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# Amazon API Gateway

## Developer Guide

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# Amazon API Gateway: Developer Guide

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# What is Amazon API Gateway?

Amazon API Gateway is an Amazon service for creating, publishing, maintaining, monitoring, and securing REST, HTTP, and WebSocket APIs at any scale. API developers can create APIs that access Amazon or other web services, as well as data stored in the [Amazon Cloud](#). As an API Gateway API developer, you can create APIs for use in your own client applications. Or you can make your APIs available to third-party app developers. For more information, see [the section called “Who uses API Gateway?” \(p. 4\)](#).

API Gateway creates RESTful APIs that:

- Are HTTP-based.
- Enable stateless client-server communication.
- Implement standard HTTP methods such as GET, POST, PUT, PATCH, and DELETE.

For more information about API Gateway REST APIs and HTTP APIs, see [the section called “Choosing HTTP API or REST API ” \(p. 9\)](#), [Working with HTTP APIs \(p. 148\)](#), [the section called “Use API Gateway to create REST APIs” \(p. 3\)](#), and [the section called “Create and configure” \(p. 205\)](#).

API Gateway creates WebSocket APIs that:

- Adhere to the [WebSocket](#) protocol, which enables stateful, full-duplex communication between client and server.
- Route incoming messages based on message content.

For more information about API Gateway WebSocket APIs, see [the section called “Use API Gateway to create WebSocket APIs” \(p. 3\)](#) and [the section called “About WebSocket APIs” \(p. 624\)](#).

## Topics

- [Architecture of API Gateway \(p. 1\)](#)
- [Features of API Gateway \(p. 2\)](#)
- [API Gateway use cases \(p. 2\)](#)
- [Accessing API Gateway \(p. 4\)](#)
- [Part of Amazon serverless infrastructure \(p. 5\)](#)
- [How to get started with Amazon API Gateway \(p. 5\)](#)
- [Amazon API Gateway concepts \(p. 5\)](#)
- [Choosing between HTTP APIs and REST APIs \(p. 9\)](#)

## Architecture of API Gateway

The following diagram shows API Gateway architecture.

This diagram illustrates how the APIs you build in Amazon API Gateway provide you or your developer customers with an integrated and consistent developer experience for building Amazon serverless applications. API Gateway handles all the tasks involved in accepting and processing up to hundreds of



thousands of concurrent API calls. These tasks include traffic management, authorization and access control, monitoring, and API version management.

API Gateway acts as a "front door" for applications to access data, business logic, or functionality from your backend services, such as workloads running on Amazon Elastic Compute Cloud (Amazon EC2), code running on Amazon Lambda, any web application, or real-time communication applications.

## Features of API Gateway

Amazon API Gateway offers features such as the following:

- Support for stateful ([WebSocket \(p. 624\)](#)) and stateless ([HTTP \(p. 148\)](#) and [REST \(p. 205\)](#)) APIs.
- Powerful, flexible [authentication \(p. 236\)](#) mechanisms, such as Amazon Identity and Access Management policies, Lambda authorizer functions, and Amazon Cognito user pools.
- [Developer portal \(p. 554\)](#) for publishing your APIs.
- [Canary release deployments \(p. 451\)](#) for safely rolling out changes.
- [CloudTrail \(p. 730\)](#) logging and monitoring of API usage and API changes.
- CloudWatch access logging and execution logging, including the ability to set alarms. For more information, see [the section called "CloudWatch metrics" \(p. 605\)](#) and [the section called "Metrics" \(p. 665\)](#).
- Ability to use Amazon CloudFormation templates to enable API creation. For more information, see [Amazon API Gateway Resource Types Reference](#) and [Amazon API Gateway V2 Resource Types Reference](#).
- Support for [custom domain names \(p. 463\)](#).
- Integration with [Amazon WAF \(p. 596\)](#) for protecting your APIs against common web exploits.
- Integration with [Amazon X-Ray \(p. 615\)](#) for understanding and triaging performance latencies.

For a complete list of API Gateway feature releases, see [Document history \(p. 755\)](#).

## API Gateway use cases

### Topics

- [Use API Gateway to create HTTP APIs \(p. 2\)](#)
- [Use API Gateway to create REST APIs \(p. 3\)](#)
- [Use API Gateway to create WebSocket APIs \(p. 3\)](#)
- [Who uses API Gateway? \(p. 4\)](#)

## Use API Gateway to create HTTP APIs

HTTP APIs enable you to create RESTful APIs with lower latency and lower cost than REST APIs.

You can use HTTP APIs to send requests to Amazon Lambda functions or to any publicly routable HTTP endpoint.

For example, you can create an HTTP API that integrates with a Lambda function on the backend. When a client calls your API, API Gateway sends the request to the Lambda function and returns the function's response to the client.

HTTP APIs support [OpenID Connect](#) and [OAuth 2.0](#) authorization. They come with built-in support for cross-origin resource sharing (CORS) and automatic deployments.

To learn more, see [the section called “Choosing HTTP API or REST API ” \(p. 9\)](#).

## Use API Gateway to create REST APIs

An API Gateway REST API is made up of resources and methods. A resource is a logical entity that an app can access through a resource path. A method corresponds to a REST API request that is submitted by the user of your API and the response returned to the user.

For example, `/incomes` could be the path of a resource representing the income of the app user. A resource can have one or more operations that are defined by appropriate HTTP verbs such as GET, POST, PUT, PATCH, and DELETE. A combination of a resource path and an operation identifies a method of the API. For example, a `POST /incomes` method could add an income earned by the caller, and a `GET /expenses` method could query the reported expenses incurred by the caller.

The app doesn't need to know where the requested data is stored and fetched from on the backend. In API Gateway REST APIs, the frontend is encapsulated by *method requests* and *method responses*. The API interfaces with the backend by means of *integration requests* and *integration responses*.

For example, with DynamoDB as the backend, the API developer sets up the integration request to forward the incoming method request to the chosen backend. The setup includes specifications of an appropriate DynamoDB action, required IAM role and policies, and required input data transformation. The backend returns the result to API Gateway as an integration response.

To route the integration response to an appropriate method response (of a given HTTP status code) to the client, you can configure the integration response to map required response parameters from integration to method. You then translate the output data format of the backend to that of the frontend, if necessary. API Gateway enables you to define a schema or model for the [payload](#) to facilitate setting up the body mapping template.

API Gateway provides REST API management functionality such as the following:

- Support for generating SDKs and creating API documentation using API Gateway extensions to OpenAPI
- Throttling of HTTP requests

## Use API Gateway to create WebSocket APIs

In a WebSocket API, the client and the server can both send messages to each other at any time. Backend servers can easily push data to connected users and devices, avoiding the need to implement complex polling mechanisms.

For example, you could build a serverless application using an API Gateway WebSocket API and Amazon Lambda to send and receive messages to and from individual users or groups of users in a chat room. Or you could invoke backend services such as Amazon Lambda, Amazon Kinesis, or an HTTP endpoint based on message content.

You can use API Gateway WebSocket APIs to build secure, real-time communication applications without having to provision or manage any servers to manage connections or large-scale data exchanges. Targeted use cases include real-time applications such as the following:

- Chat applications
- Real-time dashboards such as stock tickers
- Real-time alerts and notifications

API Gateway provides WebSocket API management functionality such as the following:

- Monitoring and throttling of connections and messages
- Using Amazon X-Ray to trace messages as they travel through the APIs to backend services
- Easy integration with HTTP/HTTPS endpoints

## Who uses API Gateway?

There are two kinds of developers who use API Gateway: API developers and app developers.

An API developer creates and deploys an API to enable the required functionality in API Gateway. The API developer must be an IAM user in the Amazon account that owns the API.

An app developer builds a functioning application to call Amazon services by invoking a WebSocket or REST API created by an API developer in API Gateway.

The app developer is the customer of the API developer. The app developer doesn't need to have an Amazon account, provided that the API either doesn't require IAM permissions or supports authorization of users through third-party federated identity providers supported by [Amazon Cognito user pool identity federation](#). Such identity providers include Amazon, Amazon Cognito user pools, Facebook, and Google.

## Creating and managing an API Gateway API

An API developer works with the API Gateway service component for API management, named `apigateway`, to create, configure, and deploy an API.

As an API developer, you can create and manage an API by using the API Gateway console, described in [Getting started with API Gateway \(p. 13\)](#), or by calling the [API references \(p. 743\)](#). There are several ways to call this API. They include using the Amazon Command Line Interface (Amazon CLI), or by using an Amazon SDK. In addition, you can enable API creation with [Amazon CloudFormation templates](#) or (in the case of REST APIs and HTTP APIs) [Working with API Gateway extensions to OpenAPI \(p. 675\)](#).

For a list of Regions where API Gateway is available, as well as the associated control service endpoints, see [Amazon API Gateway Endpoints and Quotas](#).

## Calling an API Gateway API

An app developer works with the API Gateway service component for API execution, named `execute-api`, to invoke an API that was created or deployed in API Gateway. The underlying programming entities are exposed by the created API. There are several ways to call such an API. To learn more, see [Invoking a REST API in Amazon API Gateway \(p. 408\)](#) and [Invoking a WebSocket API \(p. 655\)](#).

# Accessing API Gateway

You can access Amazon API Gateway in the following ways:

- **Amazon Web Services Management Console** – The Amazon Web Services Management Console provides a web interface for creating and managing APIs. After you complete the steps in [Prerequisites \(p. 12\)](#), you can access the API Gateway console at <https://console.amazonaws.cn/apigateway>.
- **Amazon SDKs** – If you're using a programming language that Amazon provides an SDK for, you can use an SDK to access API Gateway. SDKs simplify authentication, integrate easily with your

development environment, and provide access to API Gateway commands. For more information, see [Tools for Amazon Web Services](#).

- **API Gateway V1 and V2 APIs** – If you're using a programming language that an SDK isn't available for, see the [Amazon API Gateway Version 1 API Reference](#) and [Amazon API Gateway Version 2 API Reference](#).
- **Amazon Command Line Interface** – For more information, see [Getting Set Up with the Amazon Command Line Interface](#) in the *Amazon Command Line Interface User Guide*.
- **Amazon Tools for Windows PowerShell** – For more information, see [Setting Up the Amazon Tools for Windows PowerShell](#) in the *Amazon Tools for Windows PowerShell User Guide*.

## Part of Amazon serverless infrastructure

Together with [Amazon Lambda](#), API Gateway forms the app-facing part of the Amazon serverless infrastructure.

For an app to call publicly available Amazon services, you can use Lambda to interact with required services and expose Lambda functions through API methods in API Gateway. Amazon Lambda runs your code on a highly available computing infrastructure. It performs the necessary execution and administration of computing resources. To enable serverless applications, API Gateway supports [streamlined proxy integrations \(p. 282\)](#) with Amazon Lambda and HTTP endpoints.

## How to get started with Amazon API Gateway

For an introduction to Amazon API Gateway, see the following:

- [Getting started \(p. 13\)](#), which provides a walkthrough for creating an HTTP API.
- [Serverless land](#), which provides instructional videos.

## Amazon API Gateway concepts

### API Gateway

API Gateway is an Amazon service that supports the following:

- Creating, deploying, and managing a [RESTful](#) application programming interface (API) to expose backend HTTP endpoints, Amazon Lambda functions, or other Amazon services.
- Creating, deploying, and managing a [WebSocket](#) API to expose Amazon Lambda functions or other Amazon services.
- Invoking exposed API methods through the frontend HTTP and WebSocket endpoints.

### API Gateway REST API

A collection of HTTP resources and methods that are integrated with backend HTTP endpoints, Lambda functions, or other Amazon services. You can deploy this collection in one or more stages. Typically, API resources are organized in a resource tree according to the application logic. Each API resource can expose one or more API methods that have unique HTTP verbs supported by API Gateway. For more information, see [the section called "Choosing HTTP API or REST API" \(p. 9\)](#).

### API Gateway HTTP API

A collection of routes and methods that are integrated with backend HTTP endpoints or Lambda functions. You can deploy this collection in one or more stages. Each route can expose one or more

API methods that have unique HTTP verbs supported by API Gateway. For more information, see [the section called "Choosing HTTP API or REST API" \(p. 9\)](#).

### **API Gateway WebSocket API**

A collection of WebSocket routes and route keys that are integrated with backend HTTP endpoints, Lambda functions, or other Amazon services. You can deploy this collection in one or more stages. API methods are invoked through frontend WebSocket connections that you can associate with a registered custom domain name.

### **API deployment**

A point-in-time snapshot of your API Gateway API. To be available for clients to use, the deployment must be associated with one or more API stages.

### **API developer**

Your Amazon account that owns an API Gateway deployment (for example, a service provider that also supports programmatic access).

### **API endpoint**

A hostname for an API in API Gateway that is deployed to a specific Region. The hostname is of the form `{api-id}.execute-api.{region}.amazonaws.com`. The following types of API endpoints are supported:

- [Edge-optimized API endpoint \(p. 7\)](#)
- [Private API endpoint \(p. 7\)](#)
- [Regional API endpoint \(p. 8\)](#)

### **API key**

An alphanumeric string that API Gateway uses to identify an app developer who uses your REST or WebSocket API. API Gateway can generate API keys on your behalf, or you can import them from a CSV file. You can use API keys together with [Lambda authorizers \(p. 256\)](#) or [usage plans \(p. 491\)](#) to control access to your APIs.

See [API endpoints \(p. 6\)](#).

### **API owner**

See [API developer \(p. 6\)](#).

### **API stage**

A logical reference to a lifecycle state of your API (for example, 'dev', 'prod', 'beta', 'v2'). API stages are identified by API ID and stage name.

### **App developer**

An app creator who may or may not have an Amazon account and interacts with the API that you, the API developer, have deployed. App developers are your customers. An app developer is typically identified by an [API key \(p. 6\)](#).

### **Callback URL**

When a new client is connected to through a WebSocket connection, you can call an integration in API Gateway to store the client's callback URL. You can then use that callback URL to send messages to the client from the backend system.

### **Developer portal**

An application that allows your customers to register, discover, and subscribe to your API products (API Gateway usage plans), manage their API keys, and view their usage metrics for your APIs.

### Edge-optimized API endpoint

The default hostname of an API Gateway API that is deployed to the specified Region while using a CloudFront distribution to facilitate client access typically from across Amazon Regions. API requests are routed to the nearest CloudFront Point of Presence (POP), which typically improves connection time for geographically diverse clients.

See [API endpoints \(p. 6\)](#).

### Integration request

The internal interface of a WebSocket API route or REST API method in API Gateway, in which you map the body of a route request or the parameters and body of a method request to the formats required by the backend.

### Integration response

The internal interface of a WebSocket API route or REST API method in API Gateway, in which you map the status codes, headers, and payload that are received from the backend to the response format that is returned to a client app.

### Mapping template

A script in [Velocity Template Language \(VTL\)](#) that transforms a request body from the frontend data format to the backend data format, or that transforms a response body from the backend data format to the frontend data format. Mapping templates can be specified in the integration request or in the integration response. They can reference data made available at runtime as context and stage variables.

The mapping can be as simple as an [identity transform](#) that passes the headers or body through the integration as-is from the client to the backend for a request. The same is true for a response, in which the payload is passed from the backend to the client.

### Method request

The public interface of an API method in API Gateway that defines the parameters and body that an app developer must send in requests to access the backend through the API.

### Method response

The public interface of a REST API that defines the status codes, headers, and body models that an app developer should expect in responses from the API.

### Mock integration

In a mock integration, API responses are generated from API Gateway directly, without the need for an integration backend. As an API developer, you decide how API Gateway responds to a mock integration request. For this, you configure the method's integration request and integration response to associate a response with a given status code.

### Model

A data schema specifying the data structure of a request or response payload. A model is required for generating a strongly typed SDK of an API. It is also used to validate payloads. A model is convenient for generating a sample mapping template to initiate creation of a production mapping template. Although useful, a model is not required for creating a mapping template.

### Private API

See [Private API endpoint \(p. 7\)](#).

### Private API endpoint

An API endpoint that is exposed through interface VPC endpoints and allows a client to securely access private API resources inside a VPC. Private APIs are isolated from the public internet, and they can only be accessed using VPC endpoints for API Gateway that have been granted access.

### Private integration

An API Gateway integration type for a client to access resources inside a customer's VPC through a private REST API endpoint without exposing the resources to the public internet.

### Proxy integration

A simplified API Gateway integration configuration. You can set up a proxy integration as an HTTP proxy integration or a Lambda proxy integration.

For HTTP proxy integration, API Gateway passes the entire request and response between the frontend and an HTTP backend. For Lambda proxy integration, API Gateway sends the entire request as input to a backend Lambda function. API Gateway then transforms the Lambda function output to a frontend HTTP response.

In REST APIs, proxy integration is most commonly used with a proxy resource, which is represented by a greedy path variable (for example, `{proxy+}`) combined with a catch-all `ANY` method.

### Quick create

You can use quick create to simplify creating an HTTP API. Quick create creates an API with a Lambda or HTTP integration, a default catch-all route, and a default stage that is configured to automatically deploy changes. For more information, see [the section called "Create an HTTP API by using the Amazon CLI" \(p. 149\)](#).

### Regional API endpoint

The host name of an API that is deployed to the specified Region and intended to serve clients, such as EC2 instances, in the same Amazon Region. API requests are targeted directly to the Region-specific API Gateway API without going through any CloudFront distribution. For in-Region requests, a Regional endpoint bypasses the unnecessary round trip to a CloudFront distribution.

In addition, you can apply [latency-based routing](#) on Regional endpoints to deploy an API to multiple Regions using the same Regional API endpoint configuration, set the same custom domain name for each deployed API, and configure latency-based DNS records in Route 53 to route client requests to the Region that has the lowest latency.

See [API endpoints \(p. 6\)](#).

### Route

A WebSocket route in API Gateway is used to direct incoming messages to a specific integration, such as an Amazon Lambda function, based on the content of the message. When you define your WebSocket API, you specify a route key and an integration backend. The route key is an attribute in the message body. When the route key is matched in an incoming message, the integration backend is invoked.

A default route can also be set for non-matching route keys or to specify a proxy model that passes the message through as-is to backend components that perform the routing and process the request.

### Route request

The public interface of a WebSocket API method in API Gateway that defines the body that an app developer must send in the requests to access the backend through the API.

### Route response

The public interface of a WebSocket API that defines the status codes, headers, and body models that an app developer should expect from API Gateway.

### Usage plan

A [usage plan \(p. 491\)](#) provides selected API clients with access to one or more deployed REST or WebSocket APIs. You can use a usage plan to configure throttling and quota limits, which are enforced on individual client API keys.

### WebSocket connection

API Gateway maintains a persistent connection between clients and API Gateway itself. There is no persistent connection between API Gateway and backend integrations such as Lambda functions. Backend services are invoked as needed, based on the content of messages received from clients.

## Choosing between HTTP APIs and REST APIs

HTTP APIs are designed for low-latency, cost-effective integrations with Amazon services, including Amazon Lambda, and HTTP endpoints. HTTP APIs support OIDC and OAuth 2.0 authorization, and come with built-in support for CORS and automatic deployments. Previous-generation REST APIs currently offer more features.

The following tables summarize core features that are available in HTTP APIs and REST APIs.

Authorizers	HTTP API	REST API
Amazon Lambda	✓	✓
IAM	✓	✓
Amazon Cognito	✓ *	✓
Native OpenID Connect / OAuth 2.0	✓	

\* You can use Amazon Cognito as a JWT issuer.

Integration	HTTP API	REST API
Public HTTP endpoints	✓	✓
Lambda	✓	✓
Amazon services	✓	✓
Private integrations with Application Load Balancers	✓	
Private integrations with Network Load Balancers	✓	✓
Private integrations with Amazon Cloud Map	✓	
Mock		✓

API management	HTTP API	REST API
Usage plans		✓
API keys		✓
Custom domain names	✓ *	✓



\* HTTP APIs don't support TLS 1.0.

Development	HTTP API	REST API
API caching		✓
Request parameter transformation	✓	✓
Request body transformation		✓
Request / response validation		✓
Test invocation		✓
CORS configuration	✓	✓ *
Automatic deployments	✓	
Default stage	✓	
Default route	✓	
<a href="#">Custom gateway responses (p. 376)</a>		✓
<a href="#">Canary release deployment (p. 451)</a>		✓

\* You can combine different features of REST APIs to support CORS. To learn more, see [the section called "CORS" \(p. 382\)](#).

Security	HTTP API	REST API
Mutual TLS authentication	✓	✓
<a href="#">Certificates for backend authentication (p. 569)</a>		✓
Amazon WAF		✓
Resource policies		✓

API type	HTTP API	REST API
Regional	✓	✓
Edge-optimized		✓
Private		✓

Monitoring	HTTP API	REST API
Access logs to Amazon CloudWatch Logs	✓	✓

<b>Monitoring</b>	<b>HTTP API</b>	<b>REST API</b>
Access logs to Amazon Kinesis Data Firehose		✓
Execution logs		✓
Amazon CloudWatch metrics	✓	✓
Amazon X-Ray		✓

# Prerequisites for getting started with API Gateway

To use API Gateway and other Amazon services, you need an Amazon account. If you don't have an account, visit [www.amazonaws.cn](http://www.amazonaws.cn) and choose **Create an Amazon Account**. For detailed instructions, see [Create and activate an Amazon account](#).

As a best practice, you should also create an Amazon Identity and Access Management (IAM) user with administrator permissions and use that for all work that does not require root credentials. Create a password for console access, and access keys to use command line tools. See [Creating your first IAM admin user and group](#) in the *IAM User Guide* for instructions.

# Getting started with API Gateway

In this getting started exercise, you create a serverless API. Serverless APIs let you focus on your applications, instead of spending time provisioning and managing servers. This exercise takes less than 20 minutes to complete, and is possible within the [Amazon Free Tier](#).

First, you create a Lambda function using the Amazon Lambda console. Next, you create an HTTP API using the API Gateway console. Then, you invoke your API.

When you invoke your HTTP API, API Gateway routes the request to your Lambda function. Lambda runs the Lambda function and returns a response to API Gateway. API Gateway then returns a response to you.

To complete this exercise, you need an Amazon account and an Amazon Identity and Access Management user with console access. For more information, see [Prerequisites \(p. 12\)](#).

## Topics

- [Step 1: Create a Lambda function \(p. 13\)](#)
- [Step 2: Create an HTTP API \(p. 14\)](#)
- [Step 3: Test your API \(p. 14\)](#)
- [\(Optional\) Step 4: Clean up \(p. 15\)](#)
- [Next steps \(p. 15\)](#)

## Step 1: Create a Lambda function

You use a Lambda function for the backend of your API. Lambda runs your code only when needed and scales automatically, from a few requests per day to thousands per second.

For this example, you use the default Node.js function from the Lambda console.

### To create a Lambda function

1. Sign in to the Lambda console at <https://console.amazonaws.cn/lambda>.
2. Choose **Create function**.
3. For **Function name**, enter **my-function**.
4. Choose **Create function**.

The example function returns a 200 response to clients, and the text `Hello from Lambda!`.

You can modify your Lambda function, as long as the function's response aligns with the [format that API Gateway requires \(p. 162\)](#).

The default Lambda function code should look similar to the following:

```
exports.handler = async (event) => {
  const response = {
    statusCode: 200,
    body: JSON.stringify('Hello from Lambda!'),
  };
  return response;
};
```

```
};
```

## Step 2: Create an HTTP API

Next, you create an HTTP API. API Gateway also supports REST APIs and WebSocket APIs, but an HTTP API is the best choice for this exercise. HTTP APIs have lower latency and lower cost than REST APIs. WebSocket APIs maintain persistent connections with clients for full-duplex communication, which isn't required for this example.

The HTTP API provides an HTTP endpoint for your Lambda function. API Gateway routes requests to your Lambda function, and then returns the function's response to clients.

### To create an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Do one of the following:
  - To create your first API, for **HTTP API**, choose **Build**.
  - If you've created an API before, choose **Create API**, and then choose **Build** for **HTTP API**.
3. For **Integrations**, choose **Add integration**.
4. Choose **Lambda**.
5. For **Lambda function**, enter **my-function**.
6. For **API name**, enter **my-http-api**.
7. Choose **Next**.
8. Review the *route* that API Gateway creates for you, and then choose **Next**.
9. Review the *stage* that API Gateway creates for you, and then choose **Next**.
10. Choose **Create**.

Now you've created an HTTP API with a Lambda integration that's ready to receive requests from clients.

## Step 3: Test your API

Next, you test your API to make sure that it's working. For simplicity, use a web browser to invoke your API.

### To test your API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Note your API's invoke URL.
4. Copy your API's invoke URL, and enter it in a web browser. Append the name of your Lambda function to your invoke URL to call your Lambda function. By default, the API Gateway console creates a route with the same name as your Lambda function, `my-function`.

The full URL should look like `https://abcdef123.execute-api.us-east-2.amazonaws.com/my-function`.

Your browser sends a `GET` request to the API.

5. Verify your API's response. You should see the text "Hello from Lambda!" in your browser.

## (Optional) Step 4: Clean up

To prevent unnecessary costs, delete the resources that you created as part of this getting started exercise. The following steps delete your HTTP API, your Lambda function, and associated resources.

### To delete an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. On the **APIs** page, select an API. Choose **Actions**, and then choose **Delete**.
3. Choose **Delete**.

### To delete a Lambda function

1. Sign in to the Lambda console at <https://console.amazonaws.cn/lambda>.
2. On the **Functions** page, select a function. Choose **Actions**, and then choose **Delete**.
3. Choose **Delete**.

### To delete a Lambda function's log group

1. In the Amazon CloudWatch console, open the [Log groups page](#).
2. On the **Log groups** page, select the function's log group (`/aws/lambda/my-function`). Choose **Actions**, and then choose **Delete log group**.
3. Choose **Delete**.

### To delete a Lambda function's execution role

1. In the Amazon Identity and Access Management console, open the [Roles page](#).
2. Select the function's role, for example, `my-function-31exxmpl`.
3. Choose **Delete role**.
4. Choose **Yes, delete**.

You can automate the creation and cleanup of Amazon resources by using Amazon CloudFormation or Amazon SAM. For example Amazon CloudFormation templates, see [example Amazon CloudFormation templates](#).

## Next steps

For this example, you used the Amazon Web Services Management Console to create a simple HTTP API. The HTTP API invokes a Lambda function and returns a response to clients.

The following are next steps as you continue to work with API Gateway.

- [Configure additional types of API integrations, \(p. 159\)](#) including:
  - [HTTP endpoints \(p. 163\)](#)
  - [Private resources in a VPC, such as Amazon ECS services \(p. 169\)](#)
  - [Amazon services such as Amazon Simple Queue Service, Amazon Step Functions, and Kinesis Data Streams \(p. 164\)](#)
- [Control access to your APIs \(p. 151\)](#)
- [Enable logging for your APIs \(p. 196\)](#)

- [Configure throttling for your APIs \(p. 190\)](#)
- [Configure custom domains for your APIs \(p. 186\)](#)

To get help with Amazon API Gateway from the community, see the [API Gateway Discussion Forum](#). When you enter this forum, Amazon might require you to sign in.

To get help with API Gateway directly from Amazon, see the support options on the [Amazon Support page](#).

See also our [frequently asked questions \(FAQs\)](#), or [contact us directly](#).

# Amazon API Gateway tutorials and workshops

The following tutorials and workshops provide hands-on exercises to help you learn about API Gateway.

## HTTP API tutorials

- [Tutorial: Build a CRUD API with Lambda and DynamoDB \(p. 18\)](#)
- [Tutorial: Building an HTTP API with a private integration to an Amazon ECS service \(p. 23\)](#)

## REST API tutorials

- [Build an API Gateway REST API with Lambda integration \(p. 27\)](#)
- [Tutorial: Create a REST API by importing an example \(p. 43\)](#)
- [Build an API Gateway REST API with HTTP integration \(p. 46\)](#)
- [Tutorial: Build a REST API with API Gateway private integration \(p. 71\)](#)
- [Tutorial: Build an API Gateway REST API with Amazon integration \(p. 73\)](#)
- [Tutorial: Create a Calc REST API with two Amazon service integrations and one Lambda non-proxy integration \(p. 78\)](#)
- [Tutorial: Create a REST API as an Amazon S3 proxy in API Gateway \(p. 94\)](#)
- [Tutorial: Create a REST API as an Amazon Kinesis proxy in API Gateway \(p. 111\)](#)
- [Tutorial: Building a private REST API \(p. 140\)](#)

## WebSocket API tutorials

- [Tutorial: Building a serverless chat app with a WebSocket API, Lambda and DynamoDB \(p. 144\)](#)

## Workshops

- [Build a serverless web application](#)
- [CI/CD for serverless applications](#)
- [Serverless security workshop](#)
- [Serverless identity management, authentication and authorization](#)

## Amazon API Gateway HTTP API tutorials

The following tutorials provide hands-on exercises to help you learn about API Gateway HTTP APIs.

### Topics

- [Tutorial: Build a CRUD API with Lambda and DynamoDB \(p. 18\)](#)
- [Tutorial: Building an HTTP API with a private integration to an Amazon ECS service \(p. 23\)](#)



## Tutorial: Build a CRUD API with Lambda and DynamoDB

In this tutorial, you create a serverless API that creates, reads, updates, and deletes items from a DynamoDB table. DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability. This tutorial takes approximately 30 minutes to complete, and you can do it within the [Amazon Free Tier](#).

First, you create a [DynamoDB](#) table using the DynamoDB console. Then you create a [Lambda](#) function using the Amazon Lambda console. Next, you create an HTTP API using the API Gateway console. Lastly, you test your API.

When you invoke your HTTP API, API Gateway routes the request to your Lambda function. The Lambda function interacts with DynamoDB, and returns a response to API Gateway. API Gateway then returns a response to you.

To complete this exercise, you need an Amazon account and an Amazon Identity and Access Management user with console access. For more information, see [Prerequisites \(p. 12\)](#).

In this tutorial, you use the Amazon Web Services Management Console. For an Amazon SAM template that creates this API and all related resources, see [template.yaml](#).

### Topics

- [Step 1: Create a DynamoDB table \(p. 18\)](#)
- [Step 2: Create a Lambda function \(p. 18\)](#)
- [Step 3: Create an HTTP API \(p. 20\)](#)
- [Step 4: Create routes \(p. 20\)](#)
- [Step 5: Create an integration \(p. 21\)](#)
- [Step 6: Attach your integration to routes \(p. 21\)](#)
- [Step 7: Test your API \(p. 22\)](#)
- [Step 8: Clean up \(p. 22\)](#)
- [Next steps: Automate with Amazon SAM or Amazon CloudFormation \(p. 23\)](#)

## Step 1: Create a DynamoDB table

You use a [DynamoDB](#) table to store data for your API.

Each item has a unique ID, which we use as the [partition key](#) for the table.

### To create a DynamoDB table

1. Open the DynamoDB console at <https://console.amazonaws.cn/dynamodb/>.
2. Choose **Create table**.
3. For **Table name**, enter `http-crud-tutorial-items`.
4. For **Partition key**, enter `id`.
5. Choose **Create**.

## Step 2: Create a Lambda function

You create a [Lambda](#) function for the backend of your API. This Lambda function creates, reads, updates, and deletes items from DynamoDB. The function uses [events from API Gateway \(p. 160\)](#) to determine

how to interact with DynamoDB. For simplicity this tutorial uses a single Lambda function. As a best practice, you should create separate functions for each route.

### To create a Lambda function

1. Sign in to the Lambda console at <https://console.amazonaws.cn/lambda>.
2. Choose **Create function**.
3. For **Function name**, enter **http-crud-tutorial-function**.
4. Under **Permissions** choose **Change default execution role**.
5. Select **Create a new role from Amazon policy templates**.
6. For **Role name**, enter **http-crud-tutorial-role**.
7. For **Policy templates**, choose **Simple microservice permissions**. This policy grants the Lambda function permission to interact with DynamoDB.

#### Note

This tutorial uses a managed policy for simplicity. As a best practice, you should create your own IAM policy to grant the minimum permissions required.

8. Choose **Create function**.
9. Open `index.js` in the console's code editor, and replace its contents with the following code. Choose **Deploy** to update your function.

```
const AWS = require("aws-sdk");

const dynamo = new AWS.DynamoDB.DocumentClient();

exports.handler = async (event, context) => {
  let body;
  let statusCode = 200;
  const headers = {
    "Content-Type": "application/json"
  };

  try {
    switch (event.routeKey) {
      case "DELETE /items/{id}":
        await dynamo
          .delete({
            TableName: "http-crud-tutorial-items",
            Key: {
              id: event.pathParameters.id
            }
          })
          .promise();
        body = `Deleted item ${event.pathParameters.id}`;
        break;
      case "GET /items/{id}":
        body = await dynamo
          .get({
            TableName: "http-crud-tutorial-items",
            Key: {
              id: event.pathParameters.id
            }
          })
          .promise();
        break;
      case "GET /items":
        body = await dynamo.scan({ TableName: "http-crud-tutorial-items" }).promise();
        break;
      case "PUT /items":
```

```
let requestJSON = JSON.parse(event.body);
await dynamo
  .put({
    TableName: "http-crud-tutorial-items",
    Item: {
      id: requestJSON.id,
      price: requestJSON.price,
      name: requestJSON.name
    }
  })
  .promise();
body = `Put item ${requestJSON.id}`;
break;
default:
  throw new Error(`Unsupported route: "${event.routeKey}"`);
}
} catch (err) {
  statusCode = 400;
  body = err.message;
} finally {
  body = JSON.stringify(body);
}

return {
  statusCode,
  body,
  headers
};
};
```

## Step 3: Create an HTTP API

The HTTP API provides an HTTP endpoint for your Lambda function. In this step, you create an empty API. In the following steps, you configure routes and integrations to connect your API and your Lambda function.

### To create an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**, and then for **HTTP API**, choose **Build**.
3. For **API name**, enter **http-crud-tutorial-api**.
4. Choose **Next**.
5. For **Configure routes**, choose **Next** to skip route creation. You create routes later.
6. Review the stage that API Gateway creates for you, and then choose **Next**.
7. Choose **Create**.

## Step 4: Create routes

Routes are a way to send incoming API requests to backend resources. Routes consist of two parts: an HTTP method and a resource path, for example, `GET /items`. For this example API, we create four routes:

- `GET /items/{id}`
- `GET /items`
- `PUT /items`

- `DELETE /items/{id}`

### To create routes

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Routes**.
4. Choose **Create**.
5. For **Method**, choose **GET**.
6. For the path, enter `/items/{id}`. The `{id}` at the end of the path is a path parameter that API Gateway retrieves from the request path when a client makes a request.
7. Choose **Create**.
8. Repeat steps 4-7 for `GET /items`, `DELETE /items/{id}`, and `PUT /items`.

## Step 5: Create an integration

You create an integration to connect a route to backend resources. For this example API, you create one Lambda integration that you use for all routes.

### To create an integration

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Integrations**.
4. Choose **Manage integrations** and then choose **Create**.
5. Skip **Attach this integration to a route**. You complete that in a later step.
6. For **Integration type**, choose **Lambda function**.
7. For **Lambda function**, enter `http-crud-tutorial-function`.
8. Choose **Create**.

## Step 6: Attach your integration to routes

For this example API, you use the same Lambda integration for all routes. After you attach the integration to all of the API's routes, your Lambda function is invoked when a client calls any of your routes.

### To attach integrations to routes

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Integrations**.
4. Choose a route.
5. Under **Choose an existing integration**, choose `http-crud-tutorial-function`.
6. Choose **Attach integration**.
7. Repeat steps 4-6 for all routes.

All routes show that an Amazon Lambda integration is attached.

Now that you have an HTTP API with routes and integrations, you can test your API.

## Step 7: Test your API

To make sure that your API is working, you use [curl](#).

### To get the URL to invoke your API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Note your API's invoke URL. It appears under **Invoke URL** on the **Details** page.
4. Copy your API's invoke URL.

The full URL looks like `https://abcdef123.execute-api.us-west-2.amazonaws.com`.

### To create or update an item

- Use the following command to create or update an item. The command includes a request body with the item's ID, price, and name.

```
curl -v -X "PUT" -H "Content-Type: application/json" -d "{\"id\": \"abcdef234\", \"price\": 12345, \"name\": \"myitem\"}" https://abcdef123.execute-api.us-west-2.amazonaws.com/items
```

### To get all items

- Use the following command to list all items.

```
curl -v https://abcdef123.execute-api.us-west-2.amazonaws.com/items
```

### To get an item

- Use the following command to get an item by its ID.

```
curl -v https://abcdef123.execute-api.us-west-2.amazonaws.com/items/abcdef234
```

### To delete an item

1. Use the following command to delete an item.

```
curl -v -X "DELETE" https://abcdef123.execute-api.us-west-2.amazonaws.com/items/abcdef234
```

2. Get all items to verify that the item was deleted.

```
curl -v https://abcdef123.execute-api.us-west-2.amazonaws.com/items
```

## Step 8: Clean up

To prevent unnecessary costs, delete the resources that you created as part of this getting started exercise. The following steps delete your HTTP API, your Lambda function, and associated resources.

### To delete a DynamoDB table

1. Open the DynamoDB console at <https://console.amazonaws.cn/dynamodb/>.
2. Select your table.
3. Choose **Delete table**.
4. Confirm your choice, and choose **Delete**.

### To delete an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. On the **APIs** page, select an API. Choose **Actions**, and then choose **Delete**.
3. Choose **Delete**.

### To delete a Lambda function

1. Sign in to the Lambda console at <https://console.amazonaws.cn/lambda>.
2. On the **Functions** page, select a function. Choose **Actions**, and then choose **Delete**.
3. Choose **Delete**.

### To delete a Lambda function's log group

1. In the Amazon CloudWatch console, open the [Log groups page](#).
2. On the **Log groups** page, select the function's log group (`/aws/lambda/http-crud-tutorial-function`). Choose **Actions**, and then choose **Delete log group**.
3. Choose **Delete**.

### To delete a Lambda function's execution role

1. In the Amazon Identity and Access Management console, open the [Roles page](#).
2. Select the function's role, for example, `http-crud-tutorial-role`.
3. Choose **Delete role**.
4. Choose **Yes, delete**.

## Next steps: Automate with Amazon SAM or Amazon CloudFormation

You can automate the creation and cleanup of Amazon resources by using Amazon CloudFormation or Amazon SAM. For an example Amazon SAM template for this tutorial, see [template.yaml](#).

For example Amazon CloudFormation templates, see [example Amazon CloudFormation templates](#).

## Tutorial: Building an HTTP API with a private integration to an Amazon ECS service

In this tutorial, you create a serverless API that connects to an Amazon ECS service that runs in an Amazon VPC. Clients outside of your Amazon VPC can use the API to access your Amazon ECS service.

This tutorial takes approximately an hour to complete. First, you use an Amazon CloudFormation template to create a Amazon VPC and Amazon ECS service. Then you use the API Gateway console

to create a VPC link. The VPC link allows API Gateway to access the Amazon ECS service that runs in your Amazon VPC. Next, you create an HTTP API that uses the VPC link to connect to your Amazon ECS service. Lastly, you test your API.

When you invoke your HTTP API, API Gateway routes the request to your Amazon ECS service through your VPC link, and then returns the response from the service.

To complete this tutorial, you need an Amazon account and an Amazon Identity and Access Management user with console access. For more information, see [Prerequisites \(p. 12\)](#).

In this tutorial, you use the Amazon Web Services Management Console. For an Amazon CloudFormation template that creates this API and all related resources, see [template.yaml](#).

### Topics

- [Step 1: Create an Amazon ECS service \(p. 24\)](#)
- [Step 2: Create a VPC link \(p. 24\)](#)
- [Step 3: Create an HTTP API \(p. 25\)](#)
- [Step 4: Create a route \(p. 25\)](#)
- [Step 5: Create an integration \(p. 25\)](#)
- [Step 6: Test your API \(p. 26\)](#)
- [Step 7: Clean up \(p. 26\)](#)
- [Next steps: Automate with Amazon CloudFormation \(p. 27\)](#)

## Step 1: Create an Amazon ECS service

Amazon ECS is a container management service that makes it easy to run, stop, and manage Docker containers on a cluster. In this tutorial, you run your cluster on a serverless infrastructure that's managed by Amazon ECS.

Download and unzip [this Amazon CloudFormation template](#), which creates all of the dependencies for the service, including an Amazon VPC. You use the template to create an Amazon ECS service that uses an Application Load Balancer.

### To create a Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.
2. Choose **Create stack** and then choose **With new resources (standard)**.
3. For **Specify template**, choose **Upload a template file**.
4. Select the template that you downloaded.
5. Choose **Next**.
6. For **Stack name**, enter `http-api-private-integrations-tutorial` and then choose **Next**.
7. For **Configure stack options**, choose **Next**.
8. For **Capabilities**, acknowledge that Amazon CloudFormation can create IAM resources in your account.
9. Choose **Create stack**.

Amazon CloudFormation provisions the ECS service, which can take a few minutes. When the status of your Amazon CloudFormation stack is **CREATE\_COMPLETE**, you're ready to move on to the next step.

## Step 2: Create a VPC link

A VPC link allows API Gateway to access private resources in an Amazon VPC. You use a VPC link to allow clients to access your Amazon ECS service through your HTTP API.

### To create a VPC link

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **VPC links** and then choose **Create**.
3. For **Choose a VPC link version**, select **VPC link for HTTP APIs**.
4. For **Name**, enter `private-integrations-tutorial`.
5. For **VPC**, choose the VPC that you created in step 1. The name should start with `PrivateIntegrationsStack`.
6. For **Subnets**, select the two private subnets in your VPC. Their names end with `PrivateSubnet`.
7. Choose **Create**.

After you create your VPC link, API Gateway provisions Elastic Network Interfaces to access your VPC. The process can take a few minutes. In the meantime, you can create your API.

## Step 3: Create an HTTP API

The HTTP API provides an HTTP endpoint for your Amazon ECS service. In this step, you create an empty API. In Steps 4 and 5, you configure a route and an integration to connect your API and your Amazon ECS service.

### To create an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**, and then for **HTTP API**, choose **Build**.
3. For **API name**, enter `http-private-integrations-tutorial`.
4. Choose **Next**.
5. For **Configure routes**, choose **Next** to skip route creation. You create routes later.
6. Review the stage that API Gateway creates for you. API Gateway creates a `$default` stage with automatic deployments enabled, which is the best choice for this tutorial. Choose **Next**.
7. Choose **Create**.

## Step 4: Create a route

Routes are a way to send incoming API requests to backend resources. Routes consist of two parts: an HTTP method and a resource path, for example, `GET /items`. For this example API, we create one route.

### To create a route

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Routes**.
4. Choose **Create**.
5. For **Method**, choose **ANY**.
6. For the path, enter `/proxy+`. The `{proxy+}` at the end of the path is a greedy path variable. API Gateway sends all requests to your API to this route.
7. Choose **Create**.

## Step 5: Create an integration

You create an integration to connect a route to backend resources.



### To create an integration

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Integrations**.
4. Choose **Manage integrations** and then choose **Create**.
5. For **Attach this integration to a route**, select the **ANY /{proxy+}** route that you created earlier.
6. For **Integration type**, choose **Private resource**.
7. For **Integration details**, choose **Select manually**.
8. For **Target service**, choose **ALB/NLB**.
9. For **Load balancer**, choose the load balancer that you created with the Amazon CloudFormation template in Step 1. Its name should start with **http-Priva**.
10. For **Listener**, choose **HTTP 80**.
11. For **VPC link**, choose the VPC link that you created in Step 2. Its name should be `private-integrations-tutorial`.
12. Choose **Create**.

To verify that your route and integration are set up correctly, select **Attach integrations to routes**. The console shows that you have an `ANY /{proxy+}` route with an integration to a VPC Load Balancer.

Now you're ready to test your API.

## Step 6: Test your API

Next, you test your API to make sure that it's working. For simplicity, use a web browser to invoke your API.

### To test your API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Note your API's invoke URL.
4. In a web browser, go to your API's invoke URL.

The full URL should look like `https://abcdef123.execute-api.us-east-2.amazonaws.com`.

Your browser sends a `GET` request to the API.

5. Verify that your API's response is a welcome message that tells you that your app is running on Amazon ECS.

If you see the welcome message, you successfully created an Amazon ECS service that runs in an Amazon VPC, and you used an API Gateway HTTP API with a VPC link to access the Amazon ECS service.

## Step 7: Clean up

To prevent unnecessary costs, delete the resources that you created as part of this tutorial. The following steps delete your VPC link, Amazon CloudFormation stack, and HTTP API.

### To delete an HTTP API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.

2. On the **APIs** page, select an API. Choose **Actions**, choose **Delete**, and then confirm your choice.

#### To delete a VPC link

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **VPC link**.
3. Select your VPC link, choose **Delete**, and then confirm your choice.

#### To delete an Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.
2. Select your Amazon CloudFormation stack.
3. Choose **Delete** and then confirm your choice.

## Next steps: Automate with Amazon CloudFormation

You can automate the creation and cleanup of all Amazon resources involved in this tutorial. For a full example Amazon CloudFormation template, see [template.yaml](#).

# Amazon API Gateway REST API tutorials

The following tutorials provide hands-on exercises to help you learn about API Gateway REST APIs.

#### Topics

- [Build an API Gateway REST API with Lambda integration \(p. 27\)](#)
- [Tutorial: Create a REST API by importing an example \(p. 43\)](#)
- [Build an API Gateway REST API with HTTP integration \(p. 46\)](#)
- [Tutorial: Build a REST API with API Gateway private integration \(p. 71\)](#)
- [Tutorial: Build an API Gateway REST API with Amazon integration \(p. 73\)](#)
- [Tutorial: Create a Calc REST API with two Amazon service integrations and one Lambda non-proxy integration \(p. 78\)](#)
- [Tutorial: Create a REST API as an Amazon S3 proxy in API Gateway \(p. 94\)](#)
- [Tutorial: Create a REST API as an Amazon Kinesis proxy in API Gateway \(p. 111\)](#)
- [Tutorial: Building a private REST API \(p. 140\)](#)

## Build an API Gateway REST API with Lambda integration

To build an API with Lambda integrations, you can use Lambda proxy integration or Lambda non-proxy integration.

In Lambda proxy integration, the input to the integrated Lambda function can be expressed as any combination of request headers, path variables, query string parameters, and body. In addition, the Lambda function can use API configuration settings to influence its execution logic. For an API developer, setting up a Lambda proxy integration is simple. Other than choosing a particular Lambda function in a given region, you have little else to do. API Gateway configures the integration request

and integration response for you. Once set up, the integrated API method can evolve with the backend without modifying the existing settings. This is possible because the backend Lambda function developer parses the incoming request data and responds with desired results to the client when nothing goes wrong or responds with error messages when anything goes wrong.

In Lambda non-proxy integration, you must ensure that input to the Lambda function is supplied as the integration request payload. This implies that you, as an API developer, must map any input data the client supplied as request parameters into the proper integration request body. You may also need to translate the client-supplied request body into a format recognized by the Lambda function.

#### Topics

- [Tutorial: Build a Hello World REST API with Lambda proxy integration \(p. 28\)](#)
- [Tutorial: Build an API Gateway REST API with cross-account Lambda proxy integration \(p. 33\)](#)
- [Tutorial: Build an API Gateway REST API with Lambda non-proxy integration \(p. 35\)](#)

## Tutorial: Build a Hello World REST API with Lambda proxy integration

[Lambda proxy integration \(p. 286\)](#) is a lightweight, flexible API Gateway API integration type that allows you to integrate an API method – or an entire API – with a Lambda function. The Lambda function can be written in [any language that Lambda supports](#). Because it's a proxy integration, you can change the Lambda function implementation at any time without needing to redeploy your API.

In this tutorial, you do the following:

- Create a "Hello, World!" Lambda function to be the backend for the API.
- Create and test a "Hello, World!" API with Lambda proxy integration.

#### Topics

- [Create a "Hello, World!" Lambda function \(p. 28\)](#)
- [Create a "Hello, World!" API \(p. 30\)](#)
- [Deploy and test the API \(p. 31\)](#)

## Create a "Hello, World!" Lambda function

This function returns a greeting to the caller as a JSON object in the following format:

```
{
  "greeting": "Good {time}, {name} of {city}.[ Happy {day}!]"
}
```

### Create a "Hello, World!" Lambda function in the Lambda console

1. Sign in to the Lambda console at <https://console.amazonaws.cn/lambda>.
2. On the Amazon navigation bar, choose a [region](#) (for example, US East (N. Virginia)).

#### Note

Note the region where you create the Lambda function. You'll need it when you create the API.

3. Choose **Functions** in the navigation pane.
4. Choose **Create function**.

5. Choose **Author from scratch**.
6. Under **Basic information**, do the following:
  - a. In **Function name**, enter **GetStartedLambdaProxyIntegration**.
  - b. From the **Runtime** dropdown list, choose a supported Node.js runtime.
  - c. Under **Permissions**, expand **Choose or create an execution role**. From the **Execution role** dropdown list, choose **Create new role from Amazon policy templates**.
  - d. In **Role name**, enter **GetStartedLambdaBasicExecutionRole**.
  - e. Leave the **Policy templates** field blank.
  - f. Choose **Create function**.
7. Under **Function code**, in the inline code editor, copy/paste the following code:

```
'use strict';
console.log('Loading hello world function');

exports.handler = async (event) => {
  let name = "you";
  let city = 'World';
  let time = 'day';
  let day = '';
  let responseCode = 200;
  console.log("request: " + JSON.stringify(event));

  if (event.queryStringParameters && event.queryStringParameters.name) {
    console.log("Received name: " + event.queryStringParameters.name);
    name = event.queryStringParameters.name;
  }

  if (event.queryStringParameters && event.queryStringParameters.city) {
    console.log("Received city: " + event.queryStringParameters.city);
    city = event.queryStringParameters.city;
  }

  if (event.headers && event.headers['day']) {
    console.log("Received day: " + event.headers.day);
    day = event.headers.day;
  }

  if (event.body) {
    let body = JSON.parse(event.body)
    if (body.time)
      time = body.time;
  }

  let greeting = `Good ${time}, ${name} of ${city}.`;
  if (day) greeting += ` Happy ${day}!`;

  let responseBody = {
    message: greeting,
    input: event
  };

  // The output from a Lambda proxy integration must be
  // in the following JSON object. The 'headers' property
  // is for custom response headers in addition to standard
  // ones. The 'body' property must be a JSON string. For
  // base64-encoded payload, you must also set the 'isBase64Encoded'
  // property to 'true'.
  let response = {
    statusCode: responseCode,
    headers: {
      "x-custom-header" : "my custom header value"
```

```
    },  
    body: JSON.stringify(responseBody)  
  };  
  console.log("response: " + JSON.stringify(response))  
  return response;  
};
```

8. Choose **Deploy**.

## Create a "Hello, World!" API

Now create an API for your "Hello, World!" Lambda function by using the API Gateway console.

### Build a "Hello, World!" API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

3. Create an empty API as follows:
  - a. Under **Create new API**, choose **New API**.
  - b. Under **Settings**:
    - For **API name**, enter **LambdaSimpleProxy**.
    - If desired, enter a description in the **Description** field; otherwise, leave it empty.
    - Leave **Endpoint Type** set to **Regional**.
  - c. Choose **Create API**.
4. Create the `helloworld` resource as follows:
  - a. Choose the root resource (`/`) in the **Resources** tree.
  - b. Choose **Create Resource** from the **Actions** dropdown menu.
  - c. Leave **Configure as proxy resource** unchecked.
  - d. For **Resource Name**, enter `helloworld`.
  - e. Leave **Resource Path** set to `/helloworld`.
  - f. Leave **Enable API Gateway CORS** unchecked.
  - g. Choose **Create Resource**.
5. In a proxy integration, the entire request is sent to the backend Lambda function as-is, via a catch-all **ANY** method that represents any HTTP method. The actual HTTP method is specified by the client at run time. The **ANY** method allows you to use a single API method setup for all of the supported HTTP methods: `DELETE`, `GET`, `HEAD`, `OPTIONS`, `PATCH`, `POST`, and `PUT`.

To set up the **ANY** method, do the following:

- a. In the **Resources** list, choose `/helloworld`.
- b. In the **Actions** menu, choose **Create method**.
- c. Choose **ANY** from the dropdown menu, and choose the checkmark icon
- d. Leave the **Integration type** set to **Lambda Function**.
- e. Choose **Use Lambda Proxy integration**.
- f. From the **Lambda Region** dropdown menu, choose the region where you created the `GetStartedLambdaProxyIntegration` Lambda function.
- g. In the **Lambda Function** field, type any character and choose `GetStartedLambdaProxyIntegration` from the dropdown menu.

- h. Leave **Use Default Timeout** checked.
- i. Choose **Save**.
- j. Choose **OK** when prompted with **Add Permission to Lambda Function**.

## Deploy and test the API

### Deploy the API in the API Gateway console

1. Choose **Deploy API** from the **Actions** dropdown menu.
2. For **Deployment stage**, choose **[new stage]**.
3. For **Stage name**, enter **test**.
4. If desired, enter a **Stage description**.
5. If desired, enter a **Deployment description**.
6. Choose **Deploy**.
7. Note the API's **Invoke URL**.

### Use browser and cURL to test an API with Lambda proxy integration

You can use a browser or [cURL](#) to test your API.

To test **GET** requests using only query string parameters, you can type the URL for the API's `helloworld` resource into a browser address bar. For example: **`https://r275xc9bmd.execute-api.us-east-1.amazonaws.com/test/helloworld?name=John&city=Seattle`**

For other methods, you must use more advanced REST API testing utilities, such as [POSTMAN](#) or [cURL](#). This tutorial uses cURL. The cURL command examples below assume that cURL is installed on your computer.

### To test the deployed API using cURL:

1. Open a terminal window.
2. Copy the following cURL command and paste it into the terminal window, replacing `r275xc9bmd` with your API's API ID and `us-east-1` with the region where your API is deployed.

```
curl -v -X POST \  
  'https://r275xc9bmd.execute-api.us-east-1.amazonaws.com/test/helloworld?name=John&city=Seattle' \  
  -H 'content-type: application/json' \  
  -H 'day: Thursday' \  
  -d '{"time": "evening" }'
```

#### Note

If you're running the command on Windows, use this syntax instead:

```
curl -v -X POST "https://r275xc9bmd.execute-api.us-east-1.amazonaws.com/test/helloworld?name=John&city=Seattle" -H "content-type: application/json" -H "day: Thursday" -d "{ \"time\": \"evening\" }"
```

You should get a successful response with a payload similar to the following:

```
{
```

```
"message":"Good evening, John of Seattle. Happy Thursday!",
"input":{
  "resource":"/helloworld",
  "path":"/helloworld",
  "httpMethod":"POST",
  "headers":{"Accept":"*/*",
"content-type":"application/json",
"day":"Thursday",
"Host":"r275xc9bmd.execute-api.us-east-1.amazonaws.com",
"User-Agent":"curl/7.64.0",
"X-Amzn-Trace-Id":"Root=1-1a2b3c4d-a1b2c3d4e5f6a1b2c3d4e5f6",
"X-Forwarded-For":"72.21.198.64",
"X-Forwarded-Port":"443",
"X-Forwarded-Proto":"https"},
"multiValueHeaders":{"Accept":["*/*"],
"content-type":["application/json"],
"day":["Thursday"],
"Host":["r275xc9bmd.execute-api.us-east-1.amazonaws.com"],
"User-Agent":["curl/0.0.0"],
"X-Amzn-Trace-Id":["Root=1-1a2b3c4d-a1b2c3d4e5f6a1b2c3d4e5f6"],
"X-Forwarded-For":["11.22.333.44"],
"X-Forwarded-Port":["443"],
"X-Forwarded-Proto":["https"]},
"queryStringParameters":{"city":"Seattle",
"name":"John"}
},
"multiValueQueryStringParameters":{"
  "city":["Seattle"],
  "name":["John"]
},
"pathParameters":null,
"stageVariables":null,
"requestContext":{"
  "resourceId":"3htbry",
  "resourcePath":"/helloworld",
  "httpMethod":"POST",
  "extendedRequestId":"a1b2c3d4e5f6g7h=",
  "requestTime":"20/Mar/2019:20:38:30 +0000",
  "path":"/test/helloworld",
  "accountId":"123456789012",
  "protocol":"HTTP/1.1",
  "stage":"test",
  "domainPrefix":"r275xc9bmd",
  "requestTimeEpoch":1553114310423,
  "requestId":"test-invoke-request",
  "identity":{"cognitoIdentityPoolId":null,
  "accountId":null,
  "cognitoIdentityId":null,
  "caller":null,
  "sourceIp":"test-invoke-source-ip",
  "accessKey":null,
  "cognitoAuthenticationType":null,
  "cognitoAuthenticationProvider":null,
  "userArn":null,
  "userAgent":"curl/0.0.0","user":null
  },
  "domainName":"r275xc9bmd.execute-api.us-east-1.amazonaws.com",
  "apiId":"r275xc9bmd"
},
"body":{" \"time\": \"evening\" },
"isBase64Encoded":false
}
}
```

If you change POST to PUT in the preceding method request, you should get the same response.

To test the GET method, copy the following cURL command and paste it into the terminal window, replacing `r275xc9bmd` with your API's API ID and `us-east-1` with the region where your API is deployed.

```
curl -X GET \  
  'https://r275xc9bmd.execute-api.us-east-1.amazonaws.com/test/helloworld?name=John&city=Seattle' \  
  -H 'content-type: application/json' \  
  -H 'day: Thursday'
```

You should get a response similar to the result from the preceding POST request, except that the GET request does not have any payload. So the `body` parameter will be `null`.

## Tutorial: Build an API Gateway REST API with cross-account Lambda proxy integration

You can now use an Amazon Lambda function from a different Amazon account as your API integration backend. Each account can be in any region where Amazon API Gateway is available. This makes it easy to centrally manage and share Lambda backend functions across multiple APIs.

In this section, we show how to configure cross-account Lambda proxy integration using the Amazon API Gateway console.

First, we create the example API from [the section called “Tutorial: Create a REST API by importing an example” \(p. 43\)](#) in one account. We then create a Lambda function in another account. Finally, we use cross-account Lambda integration to allow the example API to use the Lambda function we created in the second account.

### Create API for API Gateway cross-account Lambda integration

First, you'll create the example API as described in [the section called “Tutorial: Create a REST API by importing an example” \(p. 43\)](#).

#### To create the example API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

3. Under **Create new API**, choose **Example API**.
4. Choose **Import** to create the example API.

### Create Lambda integration function in another account

Now you'll create a Lambda function in a different account from the one in which you created the example API.

#### Creating a Lambda function in another account

1. Log in to the Lambda console in a different account from the one where you created your API Gateway API.
2. Choose **Create function**.



3. Choose **Author from scratch**.
4. Under **Author from scratch**, do the following:
  - a. For **Function name**, enter a name.
  - b. From the **Runtime** drop-down list, choose a supported Node.js runtime.
  - c. Under **Permissions**, expand **Choose or create an execution role**. You can create a role or choose an existing role.
  - d. Choose **Create function** to continue.
5. Scroll down to the **Function code** pane.
6. Copy-paste the Node.js function implementation from [the section called "Tutorial: Hello World API with Lambda proxy integration" \(p. 28\)](#).
7. Choose **Deploy**.
8. Note the full ARN for your function (in the upper right corner of the Lambda function pane). You'll need it when you create your cross-account Lambda integration.

## Configure cross-account Lambda integration

Once you have a Lambda integration function in a different account, you can use the API Gateway console to add it to your API in your first account.

### Note

If you are configuring a cross-region, cross-account authorizer, the `sourceArn` that is added to the target function should use the region of the function, not the region of the API.

## Configuring your cross-account Lambda integration

1. In the API Gateway console, choose your API.
2. Choose **Resources**.
3. In the **Resources** pane, choose the top-level `GET` method.
4. In the **Method Execution** pane, choose **Integration Request**.
5. For **Integration type**, choose **Lambda Function**.
6. Check **Use Lambda Proxy integration**.
7. Leave **Lambda Region** set to your account's region.
8. For **Lambda Function**, copy/paste the full ARN for the Lambda function you created in your second account and choose the checkmark.
9. You'll see a popup that says **Add Permission to Lambda Function: You have selected a Lambda function from another account. Please ensure that you have the appropriate Function Policy on this function. You can do this by running the following Amazon CLI command from account **123456789012**:**, followed by an `aws lambda add-permission` command string.
10. Copy-paste the `aws lambda add-permission` command string into an Amazon CLI window that is configured for your second account. This will grant your first account access to your second account's Lambda function.
11. In the popup from the previous step, choose **OK**.
12. To see the updated policy for your function in the Lambda console,
  - a. Choose your integration function.
  - b. Choose **Permissions**.

You should see an `Allow` policy with a `Condition` clause in which the `in the AWS:SourceArn` is the ARN for your API's `GET` method.

## Tutorial: Build an API Gateway REST API with Lambda non-proxy integration

In this walkthrough, we use the API Gateway console to build an API that enables a client to call Lambda functions through the Lambda non-proxy integration (also known as custom integration). For more information about Amazon Lambda and Lambda functions, see the [Amazon Lambda Developer Guide](#).

To facilitate learning, we chose a simple Lambda function with minimal API setup to walk you through the steps of building an API Gateway API with the Lambda custom integration. When necessary, we describe some of the logic. For a more detailed example of the Lambda custom integration, see [Tutorial: Create a Calc REST API with two Amazon service integrations and one Lambda non-proxy integration \(p. 78\)](#).

Before creating the API, set up the Lambda backend by creating a Lambda function in Amazon Lambda, described next.

### Topics

- [Create a Lambda function for Lambda non-proxy integration \(p. 35\)](#)
- [Create an API with Lambda non-proxy integration \(p. 38\)](#)
- [Test invoking the API method \(p. 40\)](#)
- [Deploy the API \(p. 42\)](#)
- [Test the API in a deployment stage \(p. 42\)](#)
- [Clean up \(p. 43\)](#)

## Create a Lambda function for Lambda non-proxy integration

### Note

Creating Lambda functions may result in charges to your Amazon account.

In this step, you create a "Hello, World!"-like Lambda function for the Lambda custom integration. Throughout this walkthrough, the function is called `GetStartedLambdaIntegration`.

The Node.js implementation of this `GetStartedLambdaIntegration` Lambda function is as follows:

```
'use strict';
var days = ['Sunday', 'Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday'];

var times = ['morning', 'afternoon', 'evening', 'night', 'day'];

console.log('Loading function');

exports.handler = function(event, context, callback) {
  // Parse the input for the name, city, time and day property values
  let name = event.name === undefined ? 'you' : event.name;
  let city = event.city === undefined ? 'World' : event.city;
  let time = times.indexOf(event.time) < 0 ? 'day' : event.time;
  let day = days.indexOf(event.day) < 0 ? null : event.day;

  // Generate a greeting
  let greeting = 'Good ' + time + ', ' + name + ' of ' + city + '. ';
  if (day) greeting += 'Happy ' + day + '!';

  // Log the greeting to CloudWatch
  console.log('Hello: ', greeting);

  // Return a greeting to the caller
  callback(null, {
    "greeting": greeting
  });
};
```

```
});  
};
```

For the Lambda custom integration, API Gateway passes the input to the Lambda function from the client as the integration request body. The `event` object of the Lambda function handler is the input.

Our Lambda function is simple. It parses the input event object for the `name`, `city`, `time`, and `day` properties. It then returns a greeting, as a JSON object of `{"message": greeting}`, to the caller. The message is in the "Good [morning|afternoon|day], [name|you] in [city|World]. Happy *day!*" pattern. It is assumed that the input to the Lambda function is of the following JSON object:

```
{  
  "city": "...",  
  "time": "...",  
  "day": "...",  
  "name" : "..."  
}
```

For more information, see the [Amazon Lambda Developer Guide](#).

In addition, the function logs its execution to Amazon CloudWatch by calling `console.log(...)`. This is helpful for tracing calls when debugging the function. To allow the `GetStartedLambdaIntegration` function to log the call, set an IAM role with appropriate policies for the Lambda function to create the CloudWatch streams and add log entries to the streams. The Lambda console guides you through to create the required IAM roles and policies.

If you set up the API without using the API Gateway console, such as when [importing an API from an OpenAPI file](#), you must explicitly create, if necessary, and set up an invocation role and policy for API Gateway to invoke the Lambda functions. For more information on how to set up Lambda invocation and execution roles for an API Gateway API, see [Control access to an API with IAM permissions \(p. 248\)](#).

Compared to `GetStartedLambdaProxyIntegration`, the Lambda function for the Lambda proxy integration, the `GetStartedLambdaIntegration` Lambda function for the Lambda custom integration only takes input from the API Gateway API integration request body. The function can return an output of any JSON object, a string, a number, a Boolean, or even a binary blob. The Lambda function for the Lambda proxy integration, in contrast, can take the input from any request data, but must return an output of a particular JSON object. The `GetStartedLambdaIntegration` function for the Lambda custom integration can have the API request parameters as input, provided that API Gateway maps the required API request parameters to the integration request body before forwarding the client request to the backend. For this to happen, the API developer must create a mapping template and configure it on the API method when creating the API.

Now, create the `GetStartedLambdaIntegration` Lambda function.

### To create the `GetStartedLambdaIntegration` Lambda function for Lambda custom integration

1. Open the Amazon Lambda console at <https://console.amazonaws.cn/lambda/>.
2. Do one of the following:
  - If the welcome page appears, choose **Get Started Now** and then choose **Create function**.
  - If the **Lambda > Functions** list page appears, choose **Create function**.
3. Choose **Author from scratch**.
4. In the **Author from scratch** pane, do the following:
  - a. For **Name**, enter `GetStartedLambdaIntegration` as the Lambda function name.
  - b. For **Runtime**, choose a supported Node.js runtime.

- c. For **Execution role**, choose **Create a new role from Amazon policy templates**.
  - d. For **Role name**, enter a name for your role (for example, **GetStartedLambdaIntegrationRole**).
  - e. For **Policy templates**, choose **Simple microservice permissions**.
  - f. Choose **Create function**.
5. In the **Configure function** pane, under **Function code** do the following:
- a. Copy the Lambda function code listed in the beginning of this section and paste it in the inline code editor.
  - b. Leave the default choices for all other fields in this section.
  - c. Choose **Deploy**.
6. To test the newly created function, choose **Configure test events** from **Select a test event...**
- a. For **Create new event**, replace any default code statements with the following, enter **HelloWorldTest** for the event name, and choose **Create**.

```
{
  "name": "Jonny",
  "city": "Seattle",
  "time": "morning",
  "day": "Wednesday"
}
```

- b. Choose **Test** to invoke the function. The **Execution result: succeeded** section is shown. Expand **Detail** and you see the following output.

```
{
  "greeting": "Good morning, Jonny of Seattle. Happy Wednesday!"
}
```

The output is also written to CloudWatch Logs.

As a side exercise, you can use the IAM console to view the IAM role (`GetStartedLambdaIntegrationRole`) that was created as part of the Lambda function creation. Attached to this IAM role are two inline policies. One stipulates the most basic permissions for Lambda execution. It permits calling the CloudWatch `CreateLogGroup` for any CloudWatch resources of your account in the region where the Lambda function is created. This policy also allows creating the CloudWatch streams and logging events for the `HelloWorldForLambdaIntegration` Lambda function.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "logs:CreateLogGroup",
      "Resource": "arn:aws:logs:region:account-id:*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogStream",
        "logs:PutLogEvents"
      ],
      "Resource": [
        "arn:aws:logs:region:account-id:log-group:/aws/lambda/GetStartedLambdaIntegration:*"
      ]
    }
  ]
}
```

```
    ]  
  }  
]  
}
```

The other policy document applies to invoking another Amazon service that is not used in this example. You can skip it for now.

Associated with the IAM role is a trusted entity, which is `lambda.amazonaws.com`. Here is the trust relationship:

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Principal": {  
        "Service": "lambda.amazonaws.com"  
      },  
      "Action": "sts:AssumeRole"  
    }  
  ]  
}
```

The combination of this trust relationship and the inline policy makes it possible for the Lambda function to invoke a `console.log()` function to log events to CloudWatch Logs.

If you did not use the Amazon Web Services Management Console to create the Lambda function, you need to follow these examples to create the required IAM role and policies and then manually attach the role to your function.

## Create an API with Lambda non-proxy integration

With the Lambda function (`GetStartedLambdaIntegration`) created and tested, you are ready to expose the function through an API Gateway API. For illustration purposes, we expose the Lambda function with a generic HTTP method. We use the request body, a URL path variable, a query string, and a header to receive required input data from the client. We turn on the API Gateway request validator for the API to ensure that all of the required data is properly defined and specified. We configure a mapping template for API Gateway to transform the client-supplied request data into the valid format as required by the backend Lambda function.

### To create an API with Lambda custom integration with a Lambda function

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

- a. Choose **New API**.
  - b. Enter a name in **API Name**.
  - c. Optionally, add a brief description in **Description**.
  - d. Choose **Create API**.
3. Choose the root resource (`/`) under **Resources**. From the **Actions** menu, choose **Create Resource**.
    - a. Type `city` for **Resource Name**.

- b. Replace **Resource Path** with `{city}`. This is an example of the templated path variable used to take input from the client. Later, we show how to map this path variable into the Lambda function input using a mapping template.
  - c. Select the **Enable API Gateway Cors** option.
  - d. Choose **Create Resource**.
4. With the newly created `/{city}` resource highlighted, choose **Create Method** from **Actions**.
    - a. Choose `ANY` from the HTTP method drop-down menu. The `ANY` HTTP verb is a placeholder for a valid HTTP method that a client submits at run time. This example shows that `ANY` method can be used for Lambda custom integration as well as for Lambda proxy integration.
    - b. To save the setting, choose the check mark.
  5. In **Method Execution**, for the `/{city}` `ANY` method, do the following:
    - a. Choose **Lambda Function** for **Integration type**.
    - b. Leave the **Use Lambda Proxy integration** box unchecked.
    - c. Choose the region where you created the Lambda function; for example, `us-west-2`.
    - d. Type the name of your Lambda function in **Lambda Function**; for example, `GetStartedLambdaIntegration`.
    - e. Leave the **Use Default timeout** box checked.
    - f. Choose **Save**.
    - g. Choose **OK** in the **Add Permission to Lambda Function** popup to have API Gateway set up the required access permissions for the API to invoke the integrated Lambda function.
  6. In this step you'll configure the following:
    - A query string parameter (`time`)
    - A header parameter (`day`)
    - A payload property (`callerName`)

At run time, the client can use these request parameters and the request body to provide time of the day, the day of the week, and the name of the caller. You already configured the `/{city}` path variable.

- a. In the **Method Execution** pane, choose **Method Request**.
- b. Expand the **URL Query String Parameters** section. Choose **Add query string**. Type `time` for **Name**. Select the **Required** option and choose the check-mark icon to save the setting. Leave **Caching** cleared to avoid an unnecessary charge for this exercise.
- c. Expand the **HTTP Request Headers** section. Choose **Add header**. Type `day` for **Name**. Select the **Required** option and choose the check-mark icon to save the setting. Leave **Caching** cleared to avoid an unnecessary charge for this exercise.
- d. To define the method request payload, do the following:
  - i. To define a model, choose **Models** under the API from the API Gateway primary navigation pane, and then choose **Create**.
  - ii. Type `GetStartedLambdaIntegrationUserInput` for **Model name**.
  - iii. Type `application/json` for **Content type**.
  - iv. Leave the **Model description** blank.
  - v. Copy the following schema definition into the **Model schema** editor:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GetStartedLambdaIntegrationInputModel",
  "type": "object",
```

```
"properties": {  
  "callerName": { "type": "string" }  
}
```

- vi. Choose **Create model** to finish defining the input model.
  - vii. Choose **Resources**, choose the `{city}` ANY method, choose **Method Request**, and expand **Request body**. Choose **Add model**. Type `application/json` for **Content type**. Choose `GetStartedLambdaIntegrationInput` for **Model name**. Choose the check-mark icon to save the setting.
7. Choose the `{city}` ANY method and choose **Integration Request** to set up a body-mapping template. In this step you'll map the previously configured method request parameter of `nameQuery` or `nameHeader` to the JSON payload, as required by the backend Lambda function:
- a. Expand the **Mapping Templates** section. Choose **Add mapping template**. Type `application/json` for **Content-Type**. Choose the check-mark icon to save the setting.
  - b. In the popup that appears, choose **Yes, secure this integration**.
  - c. Check the recommended when there are no templates defined for **Request body passthrough**.
  - d. Choose `GetStartedLambdaIntegrationUserInput` from **Generate template** to generate an initial mapping template. This option is available because you defined a model schema, without which you would need to write the mapping template from scratch.
  - e. Replace the generated mapping script in the mapping template editor with the following:

```
#set($inputRoot = $input.path('$'))  
{  
  "city": "$input.params('city')",  
  "time": "$input.params('time')",  
  "day": "$input.params('day')",  
  "name": "$inputRoot.callerName"  
}
```

- f. Choose **Save**.

## Test invoking the API method

The API Gateway console provides a testing facility for you to test invoking the API before it is deployed. You use the Test feature of the console to test the API by submitting the following request:

```
POST /Seattle?time=morning  
day:Wednesday  
  
{  
  "callerName": "John"  
}
```

In this test request, you'll set ANY to POST, set `{city}` to `Seattle`, assign `Wednesday` as the day header value, and assign `"John"` as the `callerName` value.

### To test-invoke the ANY `{city}` method

1. In **Method Execution**, choose **Test**.
2. Choose `POST` from the **Method** drop-down list.
3. In **Path**, type `Seattle`.
4. In **Query Strings**, type `time=morning`.

5. In **Headers**, type **day:Wednesday**.
6. In **Request Body**, type `{ "callerName": "John" }`.
7. Choose **Test**.
8. Verify that the returned response payload is as follows:

```
{
  "greeting": "Good morning, John of Seattle. Happy Wednesday!"
}
```

9. You can also view the logs to examine how API Gateway processes the request and response.

```
Execution log for request test-request
Thu Aug 31 01:07:25 UTC 2017 : Starting execution for request: test-invoke-request
Thu Aug 31 01:07:25 UTC 2017 : HTTP Method: POST, Resource Path: /Seattle
Thu Aug 31 01:07:25 UTC 2017 : Method request path: {city=Seattle}
Thu Aug 31 01:07:25 UTC 2017 : Method request query string: {time=morning}
Thu Aug 31 01:07:25 UTC 2017 : Method request headers: {day=Wednesday}
Thu Aug 31 01:07:25 UTC 2017 : Method request body before transformations:
  { "callerName": "John" }
Thu Aug 31 01:07:25 UTC 2017 : Request validation succeeded for content type
application/json
Thu Aug 31 01:07:25 UTC 2017 : Endpoint request URI: https://
lambda.us-west-2.amazonaws.com/2015-03-31/functions/arn:aws:lambda:us-
west-2:123456789012:function:GetStartedLambdaIntegration/invocations
Thu Aug 31 01:07:25 UTC 2017 : Endpoint request
headers: {x-amzn-lambda-integration-tag=test-request,
Authorization=*****
X-Amz-Date=20170831T010725Z, x-amzn-apigateway-api-id=beags1mnid, X-Amz-
Source-Arn=arn:aws:execute-api:us-west-2:123456789012:beags1mnid/null/POST/
{city}, Accept=application/json, User-Agent=AmazonAPIGateway_beags1mnid,
X-Amz-Security-Token=FQoDYXdzELL////////wEaDMHGzEdEOT/VvGhabiK3AzgKrJw
+3zLqJZG4PhOq12K6W21+QotY2rrZyOzqhLoiuRg3CAYNQ2eqgL5D54+63ey9bIdtwHGoyBdq8ecWxJK/
YUnT2Rau0L9HCG5p7FC05h3IvwlFfvcidQNXeYvsKJTLXI05/
yEnY3ttIANpNYLOezD9Es8rBfyruHfJfOqextKlsC8DymCcqlGkig8qLKcZ0hWJWVwiPjIFgL7laabXs
++ZhCa4hdZo4iq1G729DE4gaV1mJVdoAagIUwLmo+y4NxFDu0r7IO/
EO5nYcCrppGVVBYiGk7H4T6sXuhTkbNNqVmXtV3ch5b0lh7 [TRUNCATED]
Thu Aug 31 01:07:25 UTC 2017 : Endpoint request body after transformations: {
  "city": "Seattle",
  "time": "morning",
  "day": "Wednesday",
  "name" : "John"
}
Thu Aug 31 01:07:25 UTC 2017 : Sending request to https://lambda.us-
west-2.amazonaws.com/2015-03-31/functions/arn:aws:lambda:us-
west-2:123456789012:function:GetStartedLambdaIntegration/invocations
Thu Aug 31 01:07:25 UTC 2017 : Received response. Integration latency: 328 ms
Thu Aug 31 01:07:25 UTC 2017 : Endpoint response body before transformations:
{"greeting":"Good morning, John of Seattle. Happy Wednesday!"}
Thu Aug 31 01:07:25 UTC 2017 : Endpoint response headers: {x-amzn-Remapped-Content-
Length=0, x-amzn-RequestId=c0475a28-8de8-11e7-8d3f-4183da788f0f, Connection=keep-
alive, Content-Length=62, Date=Thu, 31 Aug 2017 01:07:25 GMT, X-Amzn-Trace-
Id=root=1-59a7614d-373151b01b0713127e646635;sampld=0, Content-Type=application/json}
Thu Aug 31 01:07:25 UTC 2017 : Method response body after transformations:
{"greeting":"Good morning, John of Seattle. Happy Wednesday!"}
Thu Aug 31 01:07:25 UTC 2017 : Method response headers: {X-Amzn-Trace-
Id=sampld=0;root=1-59a7614d-373151b01b0713127e646635, Content-Type=application/json}
Thu Aug 31 01:07:25 UTC 2017 : Successfully completed execution
Thu Aug 31 01:07:25 UTC 2017 : Method completed with status: 200
```



The logs show the incoming request before the mapping and the integration request after the mapping. When a test fails, the logs are useful for evaluating whether the original input is correct or the mapping template works correctly.

## Deploy the API

The test invocation is a simulation and has limitations. For example, it bypasses any authorization mechanism enacted on the API. To test the API execution in real time, you must deploy the API first. To deploy an API, you create a stage to create a snapshot of the API at that time. The stage name also defines the base path after the API's default host name. The API's root resource is appended after the stage name. When you modify the API, you must redeploy it to a new or existing stage before the changes take effect.

### To deploy the API to a stage

1. Choose the API from the **APIs** pane or choose a resource or method from the **Resources** pane. Choose **Deploy API** from the **Actions** drop-down menu.
2. For **Deployment stage**, choose **New Stage**.
3. For **Stage name**, type a name; for example, **test**.

#### Note

The input must be UTF-8 encoded (i.e., unlocalized) text.

4. For **Stage description**, type a description or leave it blank.
5. For **Deployment description**, type a description or leave it blank.
6. Choose **Deploy**. After the API is successfully deployed, you see the API's base URL (the default host name plus the stage name) displayed as **Invoke URL** at the top of the **Stage Editor**. The general pattern of this base URL is `https://api-id.region.amazonaws.com/stageName`. For example, the base URL of the API (beags1mnid) created in the us-west-2 region and deployed to the test stage is `https://beags1mnid.execute-api.us-west-2.amazonaws.com/test`.

## Test the API in a deployment stage

There are several ways you can test a deployed API. For GET requests using only URL path variables or query string parameters, you can type the API resource URL in a browser. For other methods, you must use more advanced REST API testing utilities, such as [POSTMAN](#) or [cURL](#).

### To test the API using cURL

1. Open a terminal window on your local computer connected to the internet.
2. To test POST /Seattle?time=evening:

Copy the following cURL command and paste it into the terminal window.

```
curl -v -X POST \  
  'https://beags1mnid.execute-api.us-west-2.amazonaws.com/test/Seattle?time=evening' \  
  -H 'content-type: application/json' \  
  -H 'day: Thursday' \  
  -H 'x-amz-docs-region: us-west-2' \  
  -d '{  
    "callerName": "John"  
  }'
```

You should get a successful response with the following payload:

```
{"greeting": "Good evening, John of Seattle. Happy Thursday!"}
```

If you change `POST` to `PUT` in this method request, you get the same response.

## Clean up

If you no longer need the Lambda functions you created for this walkthrough, you can delete them now. You can also delete the accompanying IAM resources.

### Warning

If you plan to complete the other walkthroughs in this series, do not delete the Lambda execution role or the Lambda invocation role. If you delete a Lambda function that your APIs rely on, those APIs will no longer work. Deleting a Lambda function cannot be undone. If you want to use the Lambda function again, you must re-create the function.

If you delete an IAM resource that a Lambda function relies on, that Lambda function will no longer work, and any APIs that rely on that function will no longer work. Deleting an IAM resource cannot be undone. If you want to use the IAM resource again, you must re-create the resource.

### To delete the Lambda functions

1. Sign in to the Amazon Web Services Management Console and open the Amazon Lambda console at <https://console.amazonaws.cn/lambda/>.
2. From the list of functions, choose **GetHelloWorld**, choose **Actions**, and then choose **Delete function**. When prompted, choose **Delete** again.
3. From the list of functions, choose **GetHelloWithName**, choose **Actions**, and then choose **Delete function**. When prompted, choose **Delete** again.

### To delete the associated IAM resources

1. Open the IAM console at <https://console.amazonaws.cn/iam/>.
2. From **Details**, choose **Roles**.
3. From the list of roles, choose **APIGatewayLambdaExecRole**, choose **Role Actions**, and then choose **Delete Role**. When prompted, choose **Yes, Delete**.
4. From **Details**, choose **Policies**.
5. From the list of policies, choose **APIGatewayLambdaExecPolicy**, choose **Policy Actions**, and then choose **Delete**. When prompted, choose **Delete**.

You have now reached the end of this walkthrough.

## Tutorial: Create a REST API by importing an example

You can use the Amazon API Gateway console to create and test a simple REST API with the HTTP integration for a PetStore website. The API definition is preconfigured as a OpenAPI 2.0 file. After loading the API definition into API Gateway, you can use the API Gateway console to examine the API's basic structure or simply deploy and test the API.

The PetStore example API supports the following methods for a client to access the HTTP backend website of `http://petstore-demo-endpoint.execute-api.com/petstore/pets`.

- `GET /`: for read access of the API's root resource that is not integrated with any backend endpoint. API Gateway responds with an overview of the PetStore website. This is an example of the `MOCK` integration type.

- `GET /pets`: for read access to the API's `/pets` resource that is integrated with the like-named backend `/pets` resource. The backend returns a page of available pets in the PetStore. This is an example of the `HTTP` integration type. The URL of the integration endpoint is `http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
- `POST /pets`: for write access to the API's `/pets` resource that is integrated with the backend `/petstore/pets` resource. Upon receiving a correct request, the backend adds the specified pet to the PetStore and returns the result to the caller. The integration is also `HTTP`.
- `GET /pets/{petId}`: for read access to a pet as identified by a `petId` value as specified as a path variable of the incoming request URL. This method also has the `HTTP` integration type. The backend returns the specified pet found in the PetStore. The URL of the backend `HTTP` endpoint is `http://petstore-demo-endpoint.execute-api.com/petstore/pets/n`, where `n` is an integer as the identifier of the queried pet.

The API supports CORS access via the `OPTIONS` methods of the `MOCK` integration type. API Gateway returns the required headers supporting CORS access.

The following procedure walks you through the steps to create and test an API from an example using the API Gateway Console.

### To import, build, and test the example API

1. If you haven't already done so, complete the steps in [Prerequisites \(p. 12\)](#).
2. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
3. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

4. Under **Create new API**, choose **Example API** and then choose **Import** to create the example API. For your first API, the API Gateway console starts with this option as default.

You can scroll down the OpenAPI definition for details of this example API before choosing **Import**.

5. The newly created API is shown as follows:

The **Resources** pane shows the structure of the created API as a tree of nodes. API methods defined on each resource are edges of the tree. When a resource is selected, all of its methods are listed in the **Methods** pane on the right. Displayed under each method is a brief summary of the method, including its endpoint URL, authorization type, and API Key requirement.

6. To view the details of a method, to modify its set-up, or to test the method invocation, choose the method name from either the method list or the resource tree. Here, we choose the `POST /pets` method as an illustration:

The resulting **Method Execution** pane presents a logical view of the chosen (`POST /pets`) method's structure and behaviors: **Method Request** and **Method Response** are the API's interface with the API's frontend (a client), whereas **Integration Request** and **Integration Response** are the API's interface with the backend (`http://petstore-demo-endpoint.execute-api.com/petstore/pets`). A client uses the API to access a backend feature through the **Method Request**. API Gateway translates the client request, if necessary, into the form acceptable to the backend in **Integration Request** before forwarding the incoming request to the backend. The transformed request is known as the integration request. Similarly, the backend returns the response to API Gateway in **Integration Response**. API Gateway then routes it to **Method Response** before sending it to the client. Again, if necessary, API Gateway can map the backend response data to a form expected by the client.

For the `POST` method on an API resource, the method request payload can be passed through to the integration request without modification, if the method request's payload is of the same format as the integration request's payload.

The `GET /` method request uses the `MOCK` integration type and is not tied to any real backend endpoint. The corresponding **Integration Response** is set up to return a static HTML page. When the method is called, the API Gateway simply accepts the request and immediately returns the configured integration response to the client by way of **Method Response**. You can use the mock integration to test an API without requiring a backend endpoint. You can also use it to serve a local response, generated from a response body-mapping template.

As an API developer, you control the behaviors of your API's frontend interactions by configuring the method request and a method response. You control the behaviors of your API's backend interactions by setting up the integration request and integration response. These involve data mappings between a method and its corresponding integration. We cover the method setup in [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#). For now, we focus on testing the API to provide an end-to-end user experience.

7. Choose **Test** shown on **Client** (as shown in the previous image) to start testing. For example, to test the `POST /pets` method, enter the following `{"type": "dog", "price": 249.99}` payload into the **Request Body** before choosing the **Test** button.

The input specifies the attributes of the pet that we want to add to the list of pets on the PetStore website.

8. The results display as follows:

The **Logs** entry of the output shows the state changes from the method request to the integration request, and from the integration response to the method response. This can be useful for troubleshooting any mapping errors that cause the request to fail. In this example, no mapping is applied: the method request payload is passed through the integration request to the backend and, similarly, the backend response is passed through the integration response to the method response.

To test the API using a client other than the API Gateway test-invoke-request feature, you must first deploy the API to a stage.

9. To deploy the sample API, select the **PetStore** API, and then choose **Deploy API** from the **Actions** menu.

In **Deploy API**, for **Deployment stage**, choose **[New Stage]** because this is the first deployment of the API. Type a name (e.g., `test`) in **Stage name** and, optionally, type descriptions in **Stage description** and **Deployment description**. Choose **Deploy**.

In the resulting **Stage Editor** pane, **Invoke URL** displays the URL to invoke the API's `GET /` method request.

10. On **Stage Editor**, follow the **Invoke URL** link to submit the `GET /` method request in a browser. A successful response return the result, generated from the mapping template in the integration response.
11. In the **Stages** navigation pane, expand the `test` stage, select **GET** on `/pets/{petId}`, and then copy the **Invoke URL** value of `https://api-id.execute-api.region.amazonaws.com/test/pets/{petId}`. `{petId}` stands for a path variable.

Paste the **Invoke URL** value (obtained in the previous step) into the address bar of a browser, replacing `{petId}` by, for example, `1`, and press Enter to submit the request. A 200 OK response should return with the following JSON payload:

```
{
  "id": 1,
  "type": "dog",
  "price": 249.99
}
```

Invoking the API method as shown is possible because its **Authorization** type is set to `NONE`. If the `AWS_IAM` authorization were used, you would sign the request using the [Signature Version 4 \(SigV4\)](#) protocols. For an example of such a request, see [the section called “Tutorial: Build an API with HTTP non-proxy integration” \(p. 49\)](#).

## Build an API Gateway REST API with HTTP integration

To build an API with HTTP integration, you can use either the HTTP proxy integration or the HTTP custom integration. We recommend that you use the HTTP proxy integration, whenever possible, for the streamlined API set up while providing versatile and powerful features. The HTTP custom integration can be compelling if it is necessary to transform client request data for the backend or transform the backend response data for the client.

### Topics

- [Tutorial: Build a REST API with HTTP proxy integration \(p. 46\)](#)
- [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#)

## Tutorial: Build a REST API with HTTP proxy integration

HTTP proxy integration is a simple, powerful, and versatile mechanism to build an API that allows a web application to access multiple resources or features of the integrated HTTP endpoint, for example the entire website, with a streamlined setup of a single API method. In HTTP proxy integration, API Gateway passes the client-submitted method request to the backend. The request data that is passed through includes the request headers, query string parameters, URL path variables, and payload. The backend HTTP endpoint or the web server parses the incoming request data to determine the response that it returns. HTTP proxy integration makes the client and backend interact directly with no intervention from API Gateway after the API method is set up, except for known issues such as unsupported characters, which are listed in [the section called “Important notes” \(p. 750\)](#).

With the all-encompassing proxy resource `{proxy+}`, and the catch-all `ANY` verb for the HTTP method, you can use an HTTP proxy integration to create an API of a single API method. The method exposes the entire set of the publicly accessible HTTP resources and operations of a website. When the backend web server opens more resources for public access, the client can use these new resources with the same API setup. To enable this, the website developer must communicate clearly to the client developer what the new resources are and what operations are applicable for each of them.

As a quick introduction, the following tutorial demonstrates the HTTP proxy integration. In the tutorial, we create an API using the API Gateway console to integrate with the PetStore website through a generic proxy resource `{proxy+}`, and create the HTTP method placeholder of `ANY`.

### Topics

- [Create an API with HTTP proxy integration using the API Gateway console \(p. 47\)](#)
- [Test an API with HTTP proxy integration \(p. 48\)](#)

## Create an API with HTTP proxy integration using the API Gateway console

The following procedure walks you through the steps to create and test an API with a proxy resource for an HTTP backend using the API Gateway console. The HTTP backend is the PetStore website (<http://petstore-demo-endpoint.execute-api.com/petstore/pets>) from [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#), in which screenshots are used as visual aids to illustrate the API Gateway UI elements. If you are new to using the API Gateway console to create an API, you may want to follow that section first.

### To build an API with HTTP proxy integration with the PetStore website through a proxy resource

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

- a. Choose **New API**.
- b. Enter a name in **API Name**.
- c. Optionally, add a brief description in **Description**.
- d. Choose **Create API**.

For this tutorial, use `ProxyResourceForPetStore` for the API name.

3. To create a child resource, choose a parent resource item under the **Resources** tree and then choose **Create Resource** from the **Actions** drop-down menu. Then, do the following in the **New Child Resource** pane.
  - a. Select the **Configure as proxy resource** option to create a proxy resource. Otherwise, leave it de-selected.
  - b. Type a name in the **Resource Name\*** input text field.
  - c. Type a new name or use the default name in the **Resource Path\*** input text field.
  - d. Choose **Create Resource**.
  - e. Select **Enable API Gateway CORS**, if required.

For this tutorial, select **Configure as proxy resource**. For **Resource Name**, use the default, `proxy`. For **Resource Path**, use `/ {proxy+}`. Select **Enable API Gateway CORS**.

4. To set up the `ANY` method for integration with the HTTP backend, do the following:
  - a. Choose the resource just created and then choose **Create Method** from the **Actions** drop-down menu.
  - b. Choose `ANY` from the HTTP method drop-down list and then choose the check mark icon to save the choice.
  - c. Choose **HTTP Proxy** for **Integration type**.
  - d. Type an HTTP backend resource URL in **Endpoint URL**.
  - e. Use default settings for other fields.
  - f. Choose **Save** to finish configuring the `ANY` method.

For this tutorial, use `http://petstore-demo-endpoint.execute-api.com/{proxy}` for the **Endpoint URL**.

In the API just created, the API's proxy resource path of `{proxy+}` becomes the placeholder of any of the backend endpoints under `http://petstore-demo-endpoint.execute-api.com/`. For example, it can be `petstore`, `petstore/pets`, and `petstore/pets/{petId}`. The `ANY` method serves as a placeholder for any of the supported HTTP verbs at run time.

## Test an API with HTTP proxy integration

Whether a particular client request succeeds depends on the following:

- If the backend has made the corresponding backend endpoint available and, if so, has granted the required access permissions.
- If the client supplies the correct input.

For example, the PetStore API used here does not expose the `/petstore` resource. As such, you get a `404 Resource Not Found` response containing the error message of `Cannot GET /petstore`.

In addition, the client must be able to handle the output format of the backend in order to parse the result correctly. API Gateway does not mediate to facilitate interactions between the client and backend.

### To test an API integrated with the PetStore website using HTTP proxy integration through the proxy resource

1. To use the API Gateway console to test invoking the API, do the following.
  - a. Choose **ANY** on a proxy resource in the **Resources** tree.
  - b. Choose **Test** in the **Method Execution** pane.
  - c. From the **Method** drop-down list, choose an HTTP verb supported by the backend.
  - d. Under **Path**, type a specific path for the proxy resource supporting the chosen operation.
  - e. If required, type a supported query expression for the chosen operation under the **Query Strings** heading.
  - f. If required, type one or more supported header expressions for the chosen operation under the **Headers** heading.
  - g. If configured, set the required stage variable values for the chosen operation under the **Stage Variables** heading.
  - h. If prompted and required, choose an API Gateway-generated client certificate under the **Client Certificate** heading to the operation to be authenticated by the back end.
  - i. If prompted, type an appropriate request body in the text editor under the **Request Body** heading.
  - j. Choose **Test** to test invoking the method.

For this tutorial, use `GET` for **Method** in place of `ANY`, use `petstore/pets` for **Path** in place of the proxy resource path (`{proxy}`), and `type=fish` for **Query Strings**.

Because the backend website supports the `GET /petstore/pets?type=fish` request, it returns a successful response similar to the following:

```
[
  {
    "id": 1,
    "type": "fish",
    "price": 249.99
  },
  {
    "id": 2,
    "type": "fish",
```

```
    "price": 124.99
  },
  {
    "id": 3,
    "type": "fish",
    "price": 0.99
  }
]
```

If you try to call `GET /petstore`, you get a 404 response with an error message of `Cannot GET /petstore`. This is because the backend does not support the specified operation. If you call `GET /petstore/pets/1`, you get a 200 OK response with the following payload, because the request is supported by the PetStore website.

```
{
  "id": 1,
  "type": "dog",
  "price": 249.99
}
```

2. To use a browser to call a GET method on a specific resource of the API, do the following.
  - a. If you have not done so, choose **Deploy API** from the **Actions** drop-down menu for the API you created. Follow the instructions to deploy the API to a specific stage. Note the **Invoke URL** that displays on the resulting **Stage Editor** page. This is the base URL of the API.
  - b. To submit a GET request on a specific resource, append the resource path, including possible query string expressions to the **Invoke URL** value obtained in the previous step, copy the complete URL into the address bar of a browser, and choose Enter.

For this tutorial, deploy the API to a `test` stage and append `petstore/pets?type=fish` to the API's Invoke URL. This produces a URL of `https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/petstore/pets?type=fish`.

The result should be the same as returned when you use `TestInvoke` from the API Gateway console.

## Tutorial: Build a REST API with HTTP non-proxy integration

In this tutorial, you create an API from scratch using the Amazon API Gateway console. You can think of the console as an API design studio and use it to scope the API features, to experiment with its behaviors, to build the API, and to deploy your API in stages.

### Topics

- [Create an API with HTTP custom integration \(p. 49\)](#)
- [Map request parameters for an API Gateway API \(p. 52\)](#)
- [Map response payload \(p. 60\)](#)

## Create an API with HTTP custom integration

This section walks you through the steps to create resources, expose methods on a resource, configure a method to achieve the desired API behaviors, and to test and deploy the API.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.



If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

- a. Choose **New API**.
- b. Enter a name in **API Name**.
- c. Optionally, add a brief description in **Description**.
- d. Choose **Create API**.

As a result, an empty API is created. The **Resources** tree shows the root resource (/) without any methods. In this exercise, we will build the API with the HTTP custom integration of the PetStore website (<http://petstore-demo-endpoint.execute-api.com/petstore/pets>.) For illustration purposes, we will create a /pets resource as a child of the root and expose a GET method on this resource for a client to retrieve a list of available Pets items from the PetStore website.

3. To create the /pets resource, select the root, choose **Actions** and then choose **Create Resource**.

Type `Pets` in **Resource Name**, leave the **Resource Path** value as given, choose **Enable API Gateway CORS**, and choose **Create Resource**.

4. To expose a GET method on the /pets resource, choose **Actions** and then **Create Method**.

Choose **GET** from the list under the /pets resource node and choose the check mark icon to finish creating the method.

#### Note

Other options for an API method include:

- **POST**, primarily used to create child resources.
- **PUT**, primarily used to update existing resources (and, although not recommended, can be used to create child resources).
- **DELETE**, used to delete resources.
- **PATCH**, used to update resources.
- **HEAD**, primarily used in testing scenarios. It is the same as GET but does not return the resource representation.
- **OPTIONS**, which can be used by callers to get information about available communication options for the target service.

The method created is not yet integrated with the backend. The next step sets this up.

5. In the method's **Setup** pane, select **HTTP** for **Integration type**, select **GET** from the **HTTP method** drop-down list, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets` as the **Endpoint URL** value, leave all other settings as default, and then choose **Save**.

#### Note

For the integration request's **HTTP method**, you must choose one supported by the backend. For **HTTP** or **Mock integration**, it makes sense that the method request and the integration request use the same HTTP verb. For other integration types the method request will likely use an HTTP verb different from the integration request. For example, to call a Lambda function, the integration request must use **POST** to invoke the function, whereas the method request may use any HTTP verb depending on the logic of the Lambda function.

When the method setup finishes, you are presented with the **Method Execution** pane, where you can further configure the method request to add query string or custom header parameters. You

can also update the integration request to map input data from the method request to the format required by the back end.

The PetStore website allows you to retrieve a list of Pet items by the pet type (e.g., "Dog" or "Cat") on a given page. It uses the `type` and `page` query string parameters to accept such input. As such, we must add the query string parameters to the method request and map them into the corresponding query strings of the integration request.

6. In the GET method's **Method Execution** pane, choose **Method Request**, select `AWS_IAM` for **Authorization**, expand the **URL Query String Parameters** section, and choose **Add query string** to create two query string parameters named `type` and `page`. Choose the check mark icon to save each query string parameter as you add it.

The client can now supply a pet type and a page number as query string parameters when submitting a request. These input parameters must be mapped into the integration's query string parameters to forward the input values to our PetStore website in the backend. Because the method uses `AWS_IAM`, you must sign the request to invoke the method.

7. From the method's **Integration Request** page, expand the **URL Query String Parameters** section. By default, the method request query string parameters are mapped to the like-named integration request query string parameters. This default mapping works for our demo API. We will leave them as given. To map a different method request parameter to the corresponding integration request parameter, choose the pencil icon for the parameter to edit the mapping expression, shown in the **Mapped from** column. To map a method request parameter to a different integration request parameter, first choose the delete icon to remove the existing integration request parameter, choose **Add query string** to specify a new name and the desired method request parameter mapping expression.

This completes building the simple demo API. It's time to test the API.

8. To test the API using the API Gateway console, choose **Test** on the **Method Execution** pane for the `GET /pets` method. In the **Method Test** pane, enter `Dog` and `2` for the `type` and `page` query strings, respectively, and then choose **Test**.

The result is shown as follows. (You may need to scroll down to see the test result.)

Now that the test is successful, we can deploy the API to make it publicly available.

9. To deploy the API, select the API and then choose **Deploy API** from the **Actions** drop-down menu.

In the **Deploy API** dialog, choose a stage (or `[New Stage]` for the API's first deployment); enter a name (e.g., "test", "prod", "dev", etc.) in the **Stage name** input field; optionally, provide a description in **Stage description** and/or **Deployment description**; and then choose **Deploy**.

Once deployed, you can obtain the invocation URLs (**Invoke URL**) of the API's endpoints.

If the GET method supported open access, (i.e., if the method's authorization type were set to `NONE`) you could double-click the **Invoke URL** link to invoke the method in your default browser. If needed, you could also append necessary query string parameters to the invocation URL. With the `AWS_IAM` authorization type described here, you must sign the request with an [access key ID and the corresponding secret key](#) of an IAM user of your Amazon account. To do this, you must use a client that supports the [Signature Version 4 \(SigV4\)](#) protocols. An example of such a client is an app that uses one of the Amazon SDKs or the [Postman](#) application or cURL commands. To call a POST, PUT, or PATCH method that take a payload, you also need to use such a client to handle the payload.

To invoke this API method in the Postman, append the query string parameters to the stage-specific method invocation URL (as shown in the previous image) to create the complete method request URL:

```
https://api-id.execute-api.region.amazonaws.com/test/pets?type=Dog&page=2
```

Specify this URL in the address bar of the browser. Choose **GET** as the HTTP verb. Select **Amazon Signature** for the **Type** option under the **Authorization** tab, and then specify the following required properties before sending the request:

- For **AccessKey**, type the caller's Amazon access key, as provisioned from [Amazon IAM](#).
- For **SecretKey**, type the caller's Amazon secret key, as provisioned from Amazon IAM when the access key was first created.
- For **Amazon Region**, type the API-hosting Amazon Region, as specified in the invocation URL.
- For **Service Name**, type `execute-api`, for the API Gateway execution service.

If you use an SDK to create a client, you can call the methods exposed by the SDK to sign the request. For implementation details, see the [Amazon SDK](#) of your choosing.

**Note**

When changes are made to your API, you must redeploy the API to make the new or updated features available before invoking the request URL again.

## Map request parameters for an API Gateway API

In this walkthrough, we describe how to map method request parameters to the corresponding integration request parameters for an API Gateway API. We create an example API with the HTTP custom integration and use it to demonstrate how to use API Gateway to map a method request parameter to the corresponding integration request parameter. We then access the following publicly accessible HTTP endpoint:

```
http://petstore-demo-endpoint.execute-api.com/petstore/pets
```

If you copy the above URL, paste it into the address bar of a web browser, and press **Enter** or **Return**, you get the following JSON-formatted response body:

```
[
  {
    "id": 1,
    "type": "dog",
    "price": 249.99
  },
  {
    "id": 2,
    "type": "cat",
    "price": 124.99
  },
  {
    "id": 3,
    "type": "fish",
    "price": 0.99
  }
]
```

The preceding endpoint can take two query parameters: `type` and `page`. For example, change the URL to the following:

```
http://petstore-demo-endpoint.execute-api.com/petstore/pets?type=cat&page=2
```

You receive the following JSON-formatted response payload, displaying page 2 of only the cats:

```
[
  {
    "id": 4,
    "type": "cat",
    "price": 999.99
  },
  {
    "id": 5,
    "type": "cat",
    "price": 249.99
  },
  {
    "id": 6,
    "type": "cat",
    "price": 49.97
  }
]
```

This endpoint also supports the use of an item ID, as expressed by a URL path parameter. For example, browse to the following:

```
http://petstore-demo-endpoint.execute-api.com/petstore/pets/1
```

The following JSON-formatted information about the item with an ID of 1 is displayed:

```
{
  "id": 1,
  "type": "dog",
  "price": 249.99
}
```

In addition to supporting GET operations, this endpoint takes POST requests with a payload. For example, use [Postman](#) to send a POST method request to the following:

```
http://petstore-demo-endpoint.execute-api.com/petstore/pets
```

Include the header `Content-type: application/json` and the following request body:

```
{
  "type": "dog",
  "price": 249.99
}
```

You receive the following JSON object in the response body:

```
{
  "pet": {
    "type": "dog",
    "price": 249.99
  },
  "message": "success"
}
```

We now expose these and other features by building an API Gateway API with the HTTP custom integration of this PetStore website. The tasks include the following:

- Create an API with a resource of `https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/pets` acting as a proxy to the HTTP endpoint of `http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
- Enable the API to accept two method request query parameters of `petType` and `petsPage`, map them to the `type` and `page` query parameters of the integration request, respectively, and pass the request to the HTTP endpoint.
- Support a path parameter of `{petId}` on the API's method request URL to specify an item ID, map it to the `{id}` path parameter in the integration request URL, and send the request to the HTTP endpoint.
- Enable the method request to accept the JSON payload of the format defined by the backend website, and pass the payload without modification through the integration request to the backend HTTP endpoint.

### Topics

- [Prerequisites \(p. 54\)](#)
- [Step 1: Create resources \(p. 54\)](#)
- [Step 2: Create and test the methods \(p. 55\)](#)
- [Step 3: Deploy the API \(p. 57\)](#)
- [Step 4: Test the API \(p. 58\)](#)

### Note

Pay attention to the casing used in the steps of this walkthrough. Typing a lowercase letter instead of an uppercase letter (or vice versa) can cause errors later in the walkthrough.

### Prerequisites

Before you begin this walkthrough, you should do the following:

1. Complete the steps in [Prerequisites for getting started with API Gateway \(p. 12\)](#), including assigning API Gateway access permission to the IAM user.
2. At a minimum, follow the steps in [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#) to create a new API named `MyDemoAPI` in the API Gateway console.

### Step 1: Create resources

In this step, you create three resources that enable the API to interact with the HTTP endpoint.

#### To create the first resource

1. In the **Resources** pane, select the resource root, as represented by a single forward slash (/), and then choose **Create Resource** from the **Actions** drop-down menu.
2. For **Resource Name**, type `petstorewalkthrough`.
3. For **Resource Path**, accept the default of `/petstorewalkthrough`, and then choose **Create Resource**.

#### To create the second resource

1. In the **Resources** pane, choose `/petstorewalkthrough`, and then choose **Create Resource**.
2. For **Resource Name**, type `pets`.
3. For **Resource Path**, accept the default of `/petstorewalkthrough/pets`, and then choose **Create Resource**.

### To create the third resource

1. In the **Resources** pane, choose **/petstorewalkthrough/pets**, and then choose **Create Resource**.
2. For **Resource Name**, type `petId`. This maps to the item ID in the HTTP endpoint.
3. For **Resource Path**, overwrite `petid` with `{petId}`. Use curly braces (`{ }`) around `petId` so that **/petstorewalkthrough/pets/{petId}** is displayed, and then choose **Create Resource**.

This maps to `/petstore/pets/my-item-id` in the HTTP endpoint.

### Step 2: Create and test the methods

In this step, you integrate the methods with the backend HTTP endpoints, map the GET method request parameters to the corresponding integration request parameters, and then test the methods.

### To set up and test the first GET method

This procedure demonstrates the following:

- Create and integrate the method request of `GET /petstorewalkthrough/pets` with the integration request of `GET http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
- Map the method request query parameters of `petType` and `petsPage` to the integration request query string parameters of `type` and `page`, respectively.

1. In the **Resources** pane, choose **/petstorewalkthrough/pets**, choose **Create Method** from the **Actions** menu, and then choose **GET** under **/pets** from the drop-down list of the method names.
2. In the **/petstorewalkthrough/pets - GET - Setup** pane, choose **HTTP** for **Integration type** and choose **GET** for **HTTP method**.
3. For **Endpoint URL**, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
4. Choose **Save**.
5. In the **Method Execution** pane, choose **Method Request**, and then choose the arrow next to **URL Query String Parameters**.
6. Choose **Add query string**.
7. For **Name**, type `petType`.

This specifies the `petType` query parameter in the API's method request.

8. Choose the check mark icon to finish creating the method request URL query string parameter.
9. Choose **Add query string** again.
10. For **Name**, type `petsPage`.

This specifies the `petsPage` query parameter in the API's method request.

11. Choose the check mark icon to finish creating the method request URL query string parameter.
12. Choose **Method Execution**, choose **Integration Request**, and then choose the arrow next to **URL Query String Parameters**.
13. Delete the `petType` entry mapped from `method.request.querystring.petType` and the `petsPage` entry mapped from `method.request.querystring.petsPage`. You perform this step because the endpoint requires query string parameters named `type` and `page` for the request URL, instead of the default values.
14. Choose **Add query string**.
15. For **Name**, type `type`. This creates the required query string parameter for the integration request URL.
16. For **Mapped from**, type `method.request.querystring.petType`.

This maps the method request's `petType` query parameter to the integration request's `type` query parameter.

17. Choose the check mark icon to finish creating the integration request URL query string parameter.
18. Choose **Add query string** again.
19. For **Name**, type **page**. This creates the required query string parameter for the integration request URL.
20. For **Mapped from**, type **method.request.querystring.petsPage**.

This maps the method request's `petsPage` query parameter to the integration request's `page` query parameter.

21. Choose the check mark icon to finish creating the integration request URL query string parameter.
22. Choose **Method Execution**. In the **Client** box, choose **TEST**. In the **Query Strings** area, for **petType**, type **cat**. For **petsPage**, type **2**.
23. Choose **Test**. If successful, **Response Body** displays the following:

```
[
  {
    "id": 4,
    "type": "cat",
    "price": 999.99
  },
  {
    "id": 5,
    "type": "cat",
    "price": 249.99
  },
  {
    "id": 6,
    "type": "cat",
    "price": 49.97
  }
]
```

## To set up and test the second GET method

This procedure demonstrates the following:

- Create and integrate the method request of `GET /petstorewalkthrough/pets/{petId}` with the integration request of `GET http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}`.
  - Map the method request path parameters of `petId` to the integration request path parameters of `id`.
1. In the **Resources** list, choose **/petstorewalkthrough/pets/{petId}**, choose **Create Method** from the **Actions** drop-down menu, and then choose **GET** as the HTTP verb for the method.
  2. In the **Setup** pane, choose **HTTP** for **Integration type** and choose **GET** for **HTTP method**.
  3. For **Endpoint URL**, type **http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}**.
  4. Choose **Save**.
  5. In the **Method Execution** pane, choose **Integration Request**, and then choose the arrow next to **URL Path Parameters**.
  6. Choose **Add path**.
  7. For **Name**, type **id**.
  8. For **Mapped from**, type **method.request.path.petId**.

This maps the method request's path parameter of `petId` to the integration request's path parameter of `id`.

9. Choose the check mark icon to finish creating the URL path parameter.
10. Choose **Method Execution**, and in the **Client** box, choose **TEST**. In the **Path** area, for `petId`, type `1`.
11. Choose **Test**. If successful, **Response Body** displays the following:

```
{
  "id": 1,
  "type": "dog",
  "price": 249.99
}
```

### To set up and test the POST method

This procedure demonstrates the following:

- Create and integrate the method request of `POST /petstorewalkthrough/pets` with the integration request of `POST http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
  - Pass the method request JSON payload through to the integration request payload, without modification.
1. In the **Resources** pane, choose `/petstorewalkthrough/pets`, choose **Create Method** from the **Actions** drop-down menu, and then choose **POST** as the HTTP verb for the method.
  2. In the **Setup** pane, choose **HTTP** for **Integration type** and choose **POST** for **HTTP method**.
  3. For **Endpoint URL**, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets`.
  4. Choose **Save**.
  5. In the **Method Execution** pane, in the **Client** box, choose **TEST**. Expand **Request Body**, and then type the following:

```
{
  "type": "dog",
  "price": 249.99
}
```

6. Choose **Test**. If successful, **Response Body** displays the following:

```
{
  "pet": {
    "type": "dog",
    "price": 249.99
  },
  "message": "success"
}
```

### Step 3: Deploy the API

In this step, you deploy the API so that you can begin calling it outside of the API Gateway console.

#### To deploy the API

1. In the **Resources** pane, choose **Deploy API**.



2. For **Deployment stage**, choose **test**.

**Note**

The input must be UTF-8 encoded (i.e., unlocalized) text.

3. For **Deployment description**, type **Calling HTTP endpoint walkthrough**.
4. Choose **Deploy**.

#### Step 4: Test the API

In this step, you go outside of the API Gateway console and use your API to access the HTTP endpoint.

1. In the **Stage Editor** pane, next to **Invoke URL**, copy the URL to the clipboard. It should look something like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test
```

2. Paste this URL in the address box of a new browser tab.
3. Append `/petstorewalkthrough/pets` so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/pets
```

Browse to the URL. The following information should be displayed:

```
[
  {
    "id": 1,
    "type": "dog",
    "price": 249.99
  },
  {
    "id": 2,
    "type": "cat",
    "price": 124.99
  },
  {
    "id": 3,
    "type": "fish",
    "price": 0.99
  }
]
```

4. After `petstorewalkthrough/pets`, type `?petType=cat&petsPage=2` so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/pets?
petType=cat&petsPage=2
```

5. Browse to the URL. The following information should be displayed:

```
[
  {
    "id": 4,
    "type": "cat",
    "price": 999.99
  },
  {
    "id": 5,
    "type": "cat",
    "price": 249.99
  },
]
```

```
{
  "id": 6,
  "type": "cat",
  "price": 49.97
}
```

6. After `petstorewalkthrough/pets`, replace `?petType=cat&petsPage=2` with `/1` so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/pets/1
```

7. Browse to the URL. The following information should be displayed:

```
{
  "id": 1,
  "type": "dog",
  "price": 249.99
}
```

8. Using a web debugging proxy tool or the cURL command-line tool, send a POST method request to the URL from the previous procedure. Append `/petstorewalkthrough/pets` so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/pets
```

Append the following header:

```
Content-Type: application/json
```

Add the following code to the request body:

```
{
  "type": "dog",
  "price": 249.99
}
```

For example, if you use the cURL command-line tool, run a command similar to the following:

```
curl -H "Content-Type: application/json" -X POST -d "{\"type\": \"dog\",
  \"price\": 249.99}" https://my-api-id.execute-api.region-id.amazonaws.com/test/
petstorewalkthrough/pets
```

The following information should be returned in the response body:

```
{
  "pet": {
    "type": "dog",
    "price": 249.99
  },
  "message": "success"
}
```

You have reached the end of this walkthrough.

## Map response payload

In this walkthrough, we show how to use models and mapping templates in API Gateway to transform the output of an API call from one data schema to another. This walkthrough builds on the instructions and concepts in the [Getting started with API Gateway \(p. 13\)](#) and the [Map request parameters for an API Gateway API \(p. 52\)](#). If you have not yet completed those walkthroughs, we suggest you do them first.

This walkthrough uses API Gateway to get example data from a publicly accessible HTTP endpoint and from an Amazon Lambda function you create. Both the HTTP endpoint and the Lambda function return the same example data:

```
[
  {
    "id": 1,
    "type": "dog",
    "price": 249.99
  },
  {
    "id": 2,
    "type": "cat",
    "price": 124.99
  },
  {
    "id": 3,
    "type": "fish",
    "price": 0.99
  }
]
```

You will use models and mapping templates to transform this data to one or more output formats. In API Gateway, a model defines the format, also known as the schema or shape, of some data. In API Gateway, a mapping template is used to transform some data from one format to another. For more information, see [Working with models and mapping templates \(p. 330\)](#).

The first model and mapping template is used to rename `id` to `number`, `type` to `class`, and `price` to `salesPrice`, as follows:

```
[
  {
    "number": 1,
    "class": "dog",
    "salesPrice": 249.99
  },
  {
    "number": 2,
    "class": "cat",
    "salesPrice": 124.99
  },
  {
    "number": 3,
    "class": "fish",
    "salesPrice": 0.99
  }
]
```

The second model and mapping template is used to combine `id` and `type` into `description`, and to rename `price` to `askingPrice`, as follows:

```
[
  {
    "description": "Item 1 is a dog.",
  }
]
```

```
    "askingPrice": 249.99
  },
  {
    "description": "Item 2 is a cat.",
    "askingPrice": 124.99
  },
  {
    "description": "Item 3 is a fish.",
    "askingPrice": 0.99
  }
]
```

The third model and mapping template is used to combine `id`, `type`, and `price` into a set of `listings`, as follows:

```
{
  "listings": [
    "Item 1 is a dog. The asking price is 249.99.",
    "Item 2 is a cat. The asking price is 124.99.",
    "Item 3 is a fish. The asking price is 0.99."
  ]
}
```

### Topics

- [Step 1: Create models \(p. 61\)](#)
- [Step 2: Create resources \(p. 63\)](#)
- [Step 3: Create GET methods \(p. 64\)](#)
- [Step 4: Create a Lambda function \(p. 64\)](#)
- [Step 5: Set up and test the methods \(p. 65\)](#)
- [Step 6: Deploy the API \(p. 69\)](#)
- [Step 7: Test the API \(p. 69\)](#)
- [Step 8: Clean up \(p. 70\)](#)

### Step 1: Create models

In this step, you create four models. The first three models represent the data output formats for use with the HTTP endpoint and the Lambda function. The last model represents the data input schema for use with the Lambda function.

#### To create the first output model

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If **MyDemoAPI** is displayed, choose **Models**.
3. Choose **Create**.
4. For **Model name**, type **PetsModelNoFlatten**.
5. For **Content type**, type **application/json**.
6. For **Model description**, type **Changes id to number, type to class, and price to salesPrice**.
7. For **Model schema**, type the following JSON Schema-compatible definition:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PetsModelNoFlatten",
  "type": "array",
```

```
"items": {
  "type": "object",
  "properties": {
    "number": { "type": "integer" },
    "class": { "type": "string" },
    "salesPrice": { "type": "number" }
  }
}
}
```

8. Choose **Create model**.

### To create the second output model

1. Choose **Create**.
2. For **Model name**, type **PetsModelFlattenSome**.
3. For **Content type**, type **application/json**.
4. For **Model description**, type **Combines id and type into description, and changes price to askingPrice**.
5. For **Model schema**, type the following:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PetsModelFlattenSome",
  "type": "array",
  "items": {
    "type": "object",
    "properties": {
      "description": { "type": "string" },
      "askingPrice": { "type": "number" }
    }
  }
}
```

6. Choose **Create model**.

### To create the third output model

1. Choose **Create**.
2. For **Model name**, type **PetsModelFlattenAll**.
3. For **Content type**, type **application/json**.
4. For **Model description**, type **Combines id, type, and price into a set of listings**.
5. For **Model schema**, type the following:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PetsModelFlattenAll",
  "type": "object",
  "properties": {
    "listings": {
      "type": "array",
      "items": {
        "type": "string"
      }
    }
  }
}
```

6. Choose **Create model**.

#### To create the input model

1. Choose **Create**.
2. For **Model name**, type **PetsLambdaModel**.
3. For **Content type**, type **application/json**.
4. For **Model description**, type **GetPetsInfo model**.
5. For **Model schema**, type the following:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PetsLambdaModel",
  "type": "array",
  "items": {
    "type": "object",
    "properties": {
      "id": { "type": "integer" },
      "type": { "type": "string" },
      "price": { "type": "number" }
    }
  }
}
```

6. Choose **Create model**.

#### Step 2: Create resources

In this step, you create four resources. The first three resources enable you to get the example data from the HTTP endpoint in the three output formats. The last resource enables you to get the example data from the Lambda function in the output schema that combines `id` and `type` into `description` and renames `price` to `askingPrice`.

#### To create the first resource

1. In the links list, choose **Resources**.
2. In the **Resources** pane, choose **/petstorewalkthrough**, and then choose **Create Resource**.
3. For **Resource Name**, type **NoFlatten**.
4. For **Resource Path**, accept the default of **/petstorewalkthrough/noflatten**, and then choose **Create Resource**.

#### To create the second resource

1. In the **Resources** pane, choose **/petstorewalkthrough** again, and then choose **Create Resource**.
2. For **Resource Name**, type **FlattenSome**.
3. For **Resource Path**, accept the default of **/petstorewalkthrough/flattensome**, and then choose **Create Resource**.

#### To create the third resource

1. In the **Resources** pane, choose **/petstorewalkthrough** again, and then choose **Create Resource**.
2. For **Resource Name**, type **FlattenAll**.
3. For **Resource Path**, accept the default of **/petstorewalkthrough/flattenall**, and then choose **Create Resource**.

### To create the fourth resource

1. In the **Resources** pane, choose `/petstorewalkthrough` again, and then choose **Create Resource**.
2. For **Resource Name**, type `LambdaFlattenSome`.
3. For **Resource Path**, accept the default of `/petstorewalkthrough/lambdaflattensome`, and then choose **Create Resource**.

### Step 3: Create GET methods

In this step, you create a GET method for each of the resources you created in the previous step.

#### To create the first GET method

1. In the **Resources** list, choose `/petstorewalkthrough/flattensome`, and then choose **Create Method**.
2. From the drop-down list, choose **GET**, and then choose the check mark icon to save your choice.
3. In the Setup pane, choose **HTTP** for the **Integration type** and **GET** for **HTTP method**, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets` in **Endpoint URL**, and choose **Save**.

#### To create the second GET method

1. In the **Resources** list, choose `/petstorewalkthrough/lambdaflattensome`, and then choose **Create Method**.
2. From the drop-down list, choose **GET**, and then choose the check mark to save your choice.
3. In the Setup pane, choose **Lambda Function** for the **Integration type**, choose the region where you have created the [GetPetsInfo Lambda function \(p. 64\)](#) from the **Lambda Region** drop-down list, choose **GetPetsInfo** for **Lambda Function**, and choose **Save**. Choose **OK** when prompted to add permission to the Lambda function.

#### To create the third GET method

1. In the **Resources** list, choose `/petstorewalkthrough/flattensome`, and then choose **Create Method**.
2. From the drop-down list, choose **GET**, and then choose the check mark icon to save your choice.
3. In the Setup pane, choose **HTTP** for the **Integration type** and **GET** for **HTTP method**, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets` in **Endpoint URL**, and then choose **Save**.

#### To create the fourth GET method

1. In the **Resources** list, choose `/petstorewalkthrough/noflatten`, and then choose **Actions, Create Method**.
2. From the drop-down list, choose **GET**, and then choose the check mark icon to save your choice.
3. In the Setup pane, choose **HTTP** for the **Integration type** and **GET** for **HTTP method**, type `http://petstore-demo-endpoint.execute-api.com/petstore/pets` in **Endpoint URL**, and then choose **Save**.

### Step 4: Create a Lambda function

In this step, you create a Lambda function that returns the sample data.

#### To create the Lambda function

1. Open the Amazon Lambda console at <https://console.amazonaws.cn/lambda/>.

2. Do one of the following:
  - If a welcome page appears, choose **Get Started Now**.
  - If the **Lambda: Function list** page appears, choose **Create a Lambda function**.
3. For **Name**, type **GetPetsInfo**.
4. For **Description**, type **Gets information about pets**.
5. For **Code template**, choose **None**.
6. Type the following code:

```
console.log('Loading event');

exports.handler = function(event, context, callback) {
  callback(null,
    [{"id": 1, "type": "dog", "price": 249.99},
     {"id": 2, "type": "cat", "price": 124.99},
     {"id": 3, "type": "fish", "price": 0.99}]); // SUCCESS with message
};
```

### Tip

In the preceding code, written in Node.js, `console.log` writes information to an Amazon CloudWatch log. `event` contains the input to the Lambda function. `context` contains calling context. `callback` returns the result. For more information about how to write Lambda function code, see the "Programming Model" section in [Amazon Lambda: How it Works](#) and the sample walkthroughs in the *Amazon Lambda Developer Guide*.

7. For **Handler name**, leave the default of `index.handler`.
8. For **Role**, choose the Lambda execution role, **APIGatewayLambdaExecRole**, you created in the [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).
9. Choose **Create Lambda function**.
10. In the list of functions, choose **GetPetsInfo** to show the function's details.
11. Make a note of the Amazon region where you created this function. You need it later.
12. In the pop-up list, choose **Edit or test function**.
13. For **Sample event**, replace any code that appears with the following:

```
{
}
```

### Tip

The empty curly braces mean that there are no input values for this Lambda function. This function simply returns the JSON object containing the pets information, so those key-value pairs are not required here.

14. Choose **Invoke**. **Execution result** shows `[{"id":1,"type":"dog","price":249.99}, {"id":2,"type":"cat","price":124.99}, {"id":3,"type":"fish","price":0.99}]`, which is also written to the CloudWatch Logs log files.
15. Choose **Go to function list**.

## Step 5: Set up and test the methods

In this step, you configure the method responses, integration requests, and integration responses to specify the input and output data schemas (or models) for the GET methods associated with the HTTP endpoint and the Lambda function. You also learn to test calling these methods using the API Gateway console.



### To set up the integration for the first GET method and then test it

1. From the API's **Resources** tree, choose **GET** under the **/petstorewalkthrough/flattenall** node.
2. In the **Method Execution** pane, choose **Method Response**, and then choose the arrow next to **200**.
3. In the **Response Models for 200** area, for **application/json**, choose the pencil icon to start setting up the model for the method output. For **Models**, choose **PetsModelFlattenAll**, and then choose the check mark icon to save the setting.
4. Choose **Method Execution**, choose **Integration Response**, and then choose the arrow next to **200**.
5. Expand the **Mapping Templates** section, choose **application/json** under **Content-Type**.
6. For **Generate template from model**, choose **PetsModelFlattenAll** to display a mapping template after the `PetsModelFlattenAll` model as a starting point.
7. Modify the mapping template code as follows:

```
#set($inputRoot = $input.path('$'))
{
  "listings" : [
#foreach($elem in $inputRoot)
    "Item number $elem.id is a $elem.type. The asking price is
    $elem.price."#if($foreach.hasNext),#end
#end
  ]
}
```

8. Choose **Save**.
9. Choose **Method Execution**, and in the **Client** box, choose **TEST**, and then choose **Test**. If successful, **Response Body** displays the following:

```
{
  "listings" : [
    "Item number 1 is a dog. The asking price is 249.99.",
    "Item number 2 is a cat. The asking price is 124.99.",
    "Item number 3 is a fish. The asking price is 0.99."
  ]
}
```

### To set up integration for the second GET method and then test it

1. From the API's **Resources** tree, choose **GET** under the **/petstorewalkthrough/lambdaflatten** node.
2. In **Method Execution**, choose **Method Response**. And then choose the arrow next to **200** to expand the section.
3. In the **Response Models for 200** area, choose the pencil icon on the row for the content type of **application/json**. Choose **PetsModelFlattenSome** for **Models**, and then choose the check mark icon to save the choice.
4. Go back to **Method Execution**. Choose **Integration Response**, and then choose the arrow next to **200**.
5. In the **Mapping Templates** section, choose **application/json** under **Content-Type**.
6. For **Generate template**, choose **PetsModelFlattenSome** to display the mapping script template for the output of this method.
7. Modify the code as follows, and then choose **Save**:

```
#set($inputRoot = $input.path('$'))
[
```

```
#foreach($elem in $inputRoot)
  {
    "description" : "Item $elem.id is a $elem.type.",
    "askingPrice" : $elem.price
  }#if($foreach.hasNext),#end
#end
]
```

8. Choose **Method Execution**, and in the **Client** box, choose **TEST**, and then choose **Test**. If successful, **Response Body** displays the following:

```
[
  {
    "description" : "Item 1 is a dog.",
    "askingPrice" : 249.99
  },
  {
    "description" : "Item 2 is a cat.",
    "askingPrice" : 124.99
  },
  {
    "description" : "Item 3 is a fish.",
    "askingPrice" : 0.99
  }
]
```

### To set up integration for the third GET method and then test it

1. From the API's **Resources** tree, choose **GET** under the **/petstorewalkthrough/flattensome** node.
2. In the **Method Execution** pane, choose **Method Response**.
3. Choose the arrow next to **200**.
4. In the **Response Models for 200** area, for **application/json**, choose the pencil icon. For **Models**, choose **PetsModelFlattenSome**, and then choose the check-mark icon to save the choice.
5. Go back to **Method Execution** and choose **Integration Response**.
6. Choose the arrow next to **200** to expand the section.
7. Expand the **Mapping Templates** area. Choose **application/json** for **Content-Type**. For **Generate template**, choose **PetsModelFlattenSome** to display a mapping script template for the output of this method.
8. Modify the code as follows:

```
#set($inputRoot = $input.path('$'))
[
#foreach($elem in $inputRoot)
  {
    "description": "Item $elem.id is a $elem.type.",
    "askingPrice": $elem.price
  }#if($foreach.hasNext),#end
#end
]
```

9. Choose **Save**.
10. Go back to **Method Execution** and choose **TEST** in the **Client** box. And then choose **Test**. If successful, **Response Body** displays the following:

```
[
  {
```

```
    "description": "Item 1 is a dog.",
    "askingPrice": 249.99
  },
  {
    "description": "Item 2 is a cat.",
    "askingPrice": 124.99
  },
  {
    "description": "Item 3 is a fish.",
    "askingPrice": 0.99
  }
]
```

### To set up integration for the fourth GET method and then test it

1. From the API's **Resources** tree, choose **GET** under the **/petstorewalkthrough/noflatten** node.
2. In the **Method Execution** pane, choose **Method Response**, and then expand the **200** section.
3. In the **Response Models for 200** area, for **application/json**, choose the pencil icon to update the response model for this method.
4. Choose **PetsModelNoFlatten** as the model for the content type of **application/json**, and then choose the check-mark icon to save the choice.
5. Choose **Method Execution**, choose **Integration Response**, and then choose the arrow next to **200** to expand the section.
6. Expand the **Mapping Templates** section. Choose **application/json** for **Content-Type**. For **Generate templates**, choose **PetsModelNoFlatten** to display a mapping script template for the output of this method.
7. Modify the code as follows:

```
#set($inputRoot = $input.path('$'))
[
#foreach($elem in $inputRoot)
  {
    "number": $elem.id,
    "class": "$elem.type",
    "salesPrice": $elem.price
  }#if($foreach.hasNext),#end
#end
]
```

8. Choose **Save**.
9. Go back to **Method Execution**, and in the **Client** box, choose **TEST**, and then choose **Test**. If successful, **Response Body** displays the following:

```
[
  {
    "number": 1,
    "class": "dog",
    "salesPrice": 249.99
  },
  {
    "number": 2,
    "class": "cat",
    "salesPrice": 124.99
  },
  {
    "number": 3,
    "class": "fish",
```

```
    "salesPrice": 0.99
  }
]
```

### Step 6: Deploy the API

In this step, you deploy the API so that you can begin calling it outside of the API Gateway console.

#### To deploy the API

1. In the **Resources** pane, choose **Deploy API**.
2. For **Deployment stage**, choose **test**.
3. For **Deployment description**, type **Using models and mapping templates walkthrough**.
4. Choose **Deploy**.

### Step 7: Test the API

In this step, you go outside of the API Gateway console to interact with both the HTTP endpoint and the Lambda function.

1. In the **Stage Editor** pane, next to **Invoke URL**, copy the URL to the clipboard. It should look something like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test
```

2. Paste this URL in the address box of a new browser tab.
3. Append `/petstorewalkthrough/noflatten` so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/petstorewalkthrough/noflatten
```

Browse to the URL. The following information should be displayed:

```
[
  {
    "number": 1,
    "class": "dog",
    "salesPrice": 249.99
  },
  {
    "number": 2,
    "class": "cat",
    "salesPrice": 124.99
  },
  {
    "number": 3,
    "class": "fish",
    "salesPrice": 0.99
  }
]
```

4. After `petstorewalkthrough/`, replace `noflatten` with `flattensome`.
5. Browse to the URL. The following information should be displayed:

```
[
  {
    "description": "Item 1 is a dog.",

```

```
    "askingPrice": 249.99
  },
  {
    "description": "Item 2 is a cat.",
    "askingPrice": 124.99
  },
  {
    "description": "Item 3 is a fish.",
    "askingPrice": 0.99
  }
]
```

6. After `petstorewalkthrough/`, replace `flatten` with `flattenall`.
7. Browse to the URL. The following information should be displayed:

```
{
  "listings" : [
    "Item number 1 is a dog. The asking price is 249.99.",
    "Item number 2 is a cat. The asking price is 124.99.",
    "Item number 3 is a fish. The asking price is 0.99."
  ]
}
```

8. After `petstorewalkthrough/`, replace `flattenall` with `lambdaflatten`.
9. Browse to the URL. The following information should be displayed:

```
[
  {
    "description" : "Item 1 is a dog.",
    "askingPrice" : 249.99
  },
  {
    "description" : "Item 2 is a cat.",
    "askingPrice" : 124.99
  },
  {
    "description" : "Item 3 is a fish.",
    "askingPrice" : 0.99
  }
]
```

## Step 8: Clean up

If you no longer need the Lambda function you created for this walkthrough, you can delete it now. You can also delete the accompanying IAM resources.

### Warning

If you delete a Lambda function your APIs rely on, those APIs will no longer work. Deleting a Lambda function cannot be undone. If you want to use the Lambda function again, you must re-create the function.

If you delete an IAM resource a Lambda function relies on, the Lambda function and any APIs that rely on it will no longer work. Deleting an IAM resource cannot be undone. If you want to use the IAM resource again, you must re-create the resource. If you plan to continue experimenting with the resources you created for this and the other walkthroughs, do not delete the Lambda invocation role or the Lambda execution role.

## To delete the Lambda function

1. Sign in to the Amazon Web Services Management Console and open the Amazon Lambda console at <https://console.amazonaws.cn/lambda/>.

2. On the **Lambda: Function list** page, in the list of functions, choose the button next to **GetPetsInfo**, and then choose **Actions, Delete**. When prompted, choose **Delete** again.

### To delete the associated IAM resources

1. Open the IAM console at <https://console.amazonaws.cn/iam/>.
2. In the **Details** area, choose **Roles**.
3. Select **APIGatewayLambdaExecRole**, and then choose **Role Actions, Delete Role**. When prompted, choose **Yes, Delete**.
4. In the **Details** area, choose **Policies**.
5. Select **APIGatewayLambdaExecPolicy**, and then choose **Policy Actions, Delete**. When prompted, choose **Delete**.

You have now reached the end of this walkthrough.

## Tutorial: Build a REST API with API Gateway private integration

You can create an API Gateway API with private integration to provide your customers access to HTTP/HTTPS resources within your Amazon Virtual Private Cloud (Amazon VPC). Such VPC resources are HTTP/HTTPS endpoints on an EC2 instance behind a Network Load Balancer in the VPC. The Network Load Balancer encapsulates the VPC resource and routes incoming requests to the targeted resource.

When a client calls the API, API Gateway connects to the Network Load Balancer through the pre-configured VPC link. A VPC link is encapsulated by an API Gateway resource of [VpcLink](#). It is responsible for forwarding API method requests to the VPC resources and returns backend responses to the caller. For an API developer, a `VpcLink` is functionally equivalent to an integration endpoint.

To create an API with private integration, you must create a new `VpcLink`, or choose an existing one, that is connected to a Network Load Balancer that targets the desired VPC resources. You must have [appropriate permissions \(p. 309\)](#) to create and manage a `VpcLink`. You then set up an API [method](#) and integrate it with the `VpcLink` by setting either `HTTP` or `HTTP_PROXY` as the [integration type](#), setting `VPC_LINK` as the integration [connection type](#), and setting the `VpcLink` identifier on the integration [connectionId](#).

### Note

The Network Load Balancer and API must be owned by the same Amazon account.

To quickly get started creating an API to access VPC resources, we walk through the essential steps for building an API with the private integration, using the API Gateway console. Before creating the API, do the following:

1. Create a VPC resource, create or choose a Network Load Balancer under your account in the same region, and add the EC2 instance hosting the resource as a target of the Network Load Balancer. For more information, see [Set up a Network Load Balancer for API Gateway private integrations \(p. 309\)](#).
2. Grant permissions to create the VPC links for private integrations. For more information, see [Grant permissions to create a VPC link \(p. 309\)](#).

After creating your VPC resource and your Network Load Balancer with your VPC resource configured in its target groups, follow the instructions below to create an API and integrate it with the VPC resource via a `VpcLink` in a private integration.

### To create an API with private integration using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.

2. Create a VPC link, if you have not already done so:
  - a. From the primary navigation pane, choose **VPC links** and then choose **Create**.
  - b. Choose **VPC link for REST APIs**.
  - c. Enter a name, and optionally, a description for your VPC link.
  - d. Choose a Network Load Balancer from the **Target NLB** drop-down list.

You must have the Network Load Balancer already created in the same Region as your API for the Network Load Balancer to be present in the list.

- e. Choose **Create** to start creating the VPC link.

The initial response returns a `VpcLink` resource representation with the VPC link ID and a `PENDING` status. This is because the operation is asynchronous and takes about 2-4 minutes to complete. Upon successful completion, the status is `AVAILABLE`. In the meantime, you can proceed to create the API.

3. Choose **APIs** from the primary navigation pane and then choose **Create API** to create a new API of either an edge-optimized or regional endpoint type.
4. For the root resource (`/`), choose **Create Method** from the **Actions** drop-down menu, and then choose `GET`.
5. In the **/ GET - Setup** pane, initialize the API method integration as follows:
  - a. Choose `VPC Link` for **Integration type**.
  - b. Choose **Use Proxy Integration**.
  - c. From the **Method** drop-down list, choose `GET` as the integration method.
  - d. From the **VPC Link** drop-down list, choose `[Use Stage Variables]` and type `${stageVariables.vpcLinkId}` in the text box below.

We will define the `vpcLinkId` stage variable after deploying the API to a stage and set its value to the ID of the `VpcLink` created in **Step 2**.

- e. Type a URL, for example, `http://myApi.example.com`, for **Endpoint URL**.

Here, the host name (for example, `myApi.example.com`) is used to set the `Host` header of the integration request.

**Note**

For the Network Load Balancer (NLB), be sure to use the NLB DNS name as described in [Getting Started with Network Load Balancers](#).

- f. Leave the **Use Default Timeout** selection as-is, unless you want to customize the integration timeouts.
  - g. Choose **Save** to finish setting up the integration.

With the proxy integration, the API is ready for deployment. Otherwise, you need to proceed to set up appropriate method responses and integration responses.

- h. From the **Actions** drop-down menu, choose **Deploy API** and then choose a new or existing stage to deploy the API.

Note the resulting **Invoke URL**. You need it to invoke the API. Before doing that, you must set up the `vpcLinkId` stage variable.

- i. In the **Stage Editor**, choose the **Stage Variables** tab and choose **Add Stage Variable**.
    - i. Under the **Name** column, type `vpcLinkId`.
    - ii. Under the **Value** column, type the ID of `VPC_LINK`, for example, `gix6s7`.
  - iii. Choose the check-mark icon to save this stage variable.

Using the stage variable, you can easily switch to different VPC links for the API by changing the stage variable value.

This completes creating the API. You can test invoking the API as with other integrations.

## Tutorial: Build an API Gateway REST API with Amazon integration

Both the [Tutorial: Build a Hello World REST API with Lambda proxy integration \(p. 28\)](#) and [Build an API Gateway REST API with Lambda integration \(p. 27\)](#) topics describe how to create an API Gateway API to expose the integrated Lambda function. In addition, you can create an API Gateway API to expose other Amazon services, such as Amazon SNS, Amazon S3, Amazon Kinesis, and even Amazon Lambda. This is made possible by the AWS integration. The Lambda integration or the Lambda proxy integration is a special case, where the Lambda function invocation is exposed through the API Gateway API.

All Amazon services support dedicated APIs to expose their features. However, the application protocols or programming interfaces are likely to differ from service to service. An API Gateway API with the AWS integration has the advantage of providing a consistent application protocol for your client to access different Amazon services.

In this walkthrough, we create an API to expose Amazon SNS. For more examples of integrating an API with other Amazon services, see [Amazon API Gateway tutorials and workshops \(p. 17\)](#).

Unlike the Lambda proxy integration, there is no corresponding proxy integration for other Amazon services. Hence, an API method is integrated with a single Amazon action. For more flexibility, similar to the proxy integration, you can set up a Lambda proxy integration. The Lambda function then parses and processes requests for other Amazon actions.

API Gateway does not retry when the endpoint times out. The API caller must implement retry logic to handle endpoint timeouts.

This walkthrough builds on the instructions and concepts in [Build an API Gateway REST API with Lambda integration \(p. 27\)](#). If you have not yet completed that walkthrough, we suggest that you do it first.

### Topics

- [Prerequisites \(p. 73\)](#)
- [Step 1: Create the resource \(p. 74\)](#)
- [Step 2: Create the GET method \(p. 74\)](#)
- [Step 3: Create the Amazon service proxy execution role \(p. 74\)](#)
- [Step 4: Specify method settings and test the method \(p. 76\)](#)
- [Step 5: Deploy the API \(p. 76\)](#)
- [Step 6: Test the API \(p. 77\)](#)
- [Step 7: Clean up \(p. 77\)](#)

## Prerequisites

Before you begin this walkthrough, do the following:

1. Complete the steps in [Prerequisites for getting started with API Gateway \(p. 12\)](#).



2. Ensure that the IAM user has access to create policies and roles in IAM. You need to create an IAM policy and role in this walkthrough.
3. Create a new API named `MyDemoAPI`. For more information, see [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#).
4. Deploy the API at least once to a stage named `test`. For more information, see [Deploy the API \(p. 42\)](#) in [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).
5. Complete the rest of the steps in [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).
6. Create at least one topic in Amazon Simple Notification Service (Amazon SNS). You will use the deployed API to get a list of topics in Amazon SNS that are associated with your Amazon account. To learn how to create a topic in Amazon SNS, see [Create a Topic](#). (You do not need to copy the topic ARN mentioned in step 5.)

## Step 1: Create the resource

In this step, you create a resource that enables the Amazon service proxy to interact with the Amazon service.

### To create the resource

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **MyDemoAPI**.
3. In the **Resources** pane, choose the resource root, represented by a single forward slash (/), and then choose **Create Resource**.
4. For **Resource Name**, enter `MyDemoAWSProxy`, and then choose **Create Resource**.

## Step 2: Create the GET method

In this step, you create a GET method that enables the Amazon service proxy to interact with the Amazon service.

### To create the GET method

1. In the **Resources** pane, choose `/mydemoawsproxy`, and then choose **Create Method**.
2. For the HTTP method, choose **GET**, and then save your choice.

## Step 3: Create the Amazon service proxy execution role

In this step, you create an IAM role that your Amazon service proxy uses to interact with the Amazon service. We call this IAM role an Amazon service proxy execution role. Without this role, API Gateway cannot interact with the Amazon service. In later steps, you specify this role in the settings for the GET method you just created.

### To create the Amazon service proxy execution role and its policy

1. Sign in to the Amazon Web Services Management Console and open the IAM console at <https://console.amazonaws.cn/iam/>.
2. Choose **Policies**.
3. Do one of the following:
  - If the **Welcome to Managed Policies** page appears, choose **Get Started**, and then choose **Create Policy**.

- If a list of policies appears, choose **Create policy**.
4. Choose **JSON** and then enter the following text.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Resource": [
        "*"
      ],
      "Action": [
        "sns:ListTopics"
      ]
    }
  ]
}
```

5. Choose **Review policy**.
6. Enter a name and description for the policy.
7. Choose **Create policy**.
8. Choose **Roles**.
9. Choose **Create Role**.
10. Choose **Amazon Service** under **Select type of trusted entity** and then choose **API Gateway**.
11. Choose **Next: Permissions**.
12. Choose **Next: Tags**.
13. Choose **Next: Review**.
14. For **Role Name**, enter a name for the execution role (for example, **APIGatewayAWSProxyExecRole**), optionally enter a description for this role, and then choose **Create role**.
15. In the **Roles** list, choose the role you just created. You may need to scroll down the list.
16. For the selected role, choose **Attach policies**.
17. Select the check box next to the policy you created earlier (for example, **APIGatewayAWSProxyExecPolicy**) and choose **Attach policy**.
18. The role you just created has the following trust relationship that enables API Gateway assume to role for any actions permitted by the attached policies:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

For **Role ARN**, note of the Amazon Resource Name (ARN) for the execution role. You need it later. The ARN should look similar to: `arn:aws:iam::123456789012:role/APIGatewayAWSProxyExecRole`, where 123456789012 is your Amazon account ID.

## Step 4: Specify method settings and test the method

In this step, you specify the settings for the GET method so that it can interact with an Amazon service through an Amazon service proxy. You then test the method.

### To specify settings for the GET method and then test it

1. In the API Gateway console, in the **Resources** pane for the API named `MyDemoAPI`, in `/mydemoawsproxy`, choose **GET**.
2. Choose **Integration Request**, and then choose **Amazon Service**.
3. For **Amazon Region**, choose the name of the Amazon Region where you want to get the Amazon SNS topics.
4. For **Amazon Service**, choose **SNS**.
5. For **HTTP method**, choose **GET**.
6. For **Action**, enter `ListTopics`.
7. For **Execution Role**, enter the ARN for the execution role.
8. Leave **Path Override** blank.
9. Choose **Save**.
10. In the **Method Execution** pane, in the **Client** box, choose **TEST**, and then choose **Test**. If successful, **Response Body** displays a response similar to the following:

```
{
  "ListTopicsResponse": {
    "ListTopicsResult": {
      "NextToken": null,
      "Topics": [
        {
          "TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-1"
        },
        {
          "TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-2"
        },
        ...
        {
          "TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-N"
        }
      ]
    },
    "ResponseMetadata": {
      "RequestId": "abc1de23-45fa-6789-b0c1-d2e345fa6b78"
    }
  }
}
```

## Step 5: Deploy the API

In this step, you deploy the API so that you can call it from outside of the API Gateway console.

### To deploy the API

1. In the **Resources** pane, choose **Deploy API**.
2. For **Deployment stage**, choose `test`.
3. For **Deployment description**, enter `Calling Amazon service proxy walkthrough`.
4. Choose **Deploy**.

## Step 6: Test the API

In this step, you go outside of the API Gateway console and use your Amazon service proxy to interact with the Amazon SNS service.

1. In the **Stage Editor** pane, next to **Invoke URL**, copy the URL to the clipboard. It should look like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test
```

2. Paste the URL into the address box of a new browser tab.
3. Append /mydemoawsproxy so that it looks like this:

```
https://my-api-id.execute-api.region-id.amazonaws.com/test/mydemoawsproxy
```

Browse to the URL. Information similar to the following should be displayed:

```
{"ListTopicsResponse":{"ListTopicsResult":{"NextToken": null,"Topics": [{"TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-1"}, {"TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-2"}, ... {"TopicArn": "arn:aws:sns:us-east-1:80398EXAMPLE:MySNSTopic-N"}]}, "ResponseMetadata": {"RequestId": "abc1de23-45fa-6789-b0c1-d2e345fa6b78}}}
```

## Step 7: Clean up

You can delete the IAM resources the Amazon service proxy needs to work.

### Warning

If you delete an IAM resource an Amazon service proxy relies on, that Amazon service proxy and any APIs that rely on it will no longer work. Deleting an IAM resource cannot be undone. If you want to use the IAM resource again, you must re-create it.

### To delete the associated IAM resources

1. Open the IAM console at <https://console.amazonaws.cn/iam/>.
2. In the **Details** area, choose **Roles**.
3. Select **APIGatewayAWSProxyExecRole**, and then choose **Role Actions, Delete Role**. When prompted, choose **Yes, Delete**.
4. In the **Details** area, choose **Policies**.
5. Select **APIGatewayAWSProxyExecPolicy**, and then choose **Policy Actions, Delete**. When prompted, choose **Delete**.

You have reached the end of this walkthrough. For more detailed discussions about creating API as an Amazon service proxy, see [Tutorial: Create a REST API as an Amazon S3 proxy in API Gateway \(p. 94\)](#), [Tutorial: Create a Ca1c REST API with two Amazon service integrations and one Lambda non-proxy integration \(p. 78\)](#), or [Tutorial: Create a REST API as an Amazon Kinesis proxy in API Gateway \(p. 111\)](#).

## Tutorial: Create a Calc REST API with two Amazon service integrations and one Lambda non-proxy integration

The [Getting Started non-proxy integration tutorial \(p. 35\)](#) uses `Lambda Function` integration exclusively. `Lambda Function` integration is a special case of the `Amazon Service` integration type that performs much of the integration setup for you, such as automatically adding the required resource-based permissions for invoking the Lambda function. Here, two of the three integrations use `Amazon Service` integration. In this integration type, you have more control, but you'll need to manually perform tasks like creating and specifying an IAM role containing appropriate permissions.

In this tutorial, you'll create a `Calc` Lambda function that implements basic arithmetic operations, accepting and returning JSON-formatted input and output. Then you'll create a REST API and integrate it with the Lambda function in the following ways:

1. By exposing a `GET` method on the `/calc` resource to invoke the Lambda function, supplying the input as query string parameters. (`Amazon Service` integration)
2. By exposing a `POST` method on the `/calc` resource to invoke the Lambda function, supplying the input in the method request payload. (`Amazon Service` integration)
3. By exposing a `GET` on nested `/calc/{operand1}/{operand2}/{operator}` resources to invoke the Lambda function, supplying the input as path parameters. (`Lambda Function` integration)

In addition to trying out this tutorial, you may wish to study the [OpenAPI definition file \(p. 90\)](#) for the `Calc` API, which you can import into API Gateway by following the instructions in [the section called "OpenAPI" \(p. 427\)](#).

### Topics

- [Create an Amazon account \(p. 78\)](#)
- [Create an assumable IAM role \(p. 79\)](#)
- [Create a Calc Lambda function \(p. 80\)](#)
- [Test the Calc Lambda function \(p. 80\)](#)
- [Create a Calc API \(p. 82\)](#)
- [Integration 1: Create a GET method with query parameters to call the Lambda function \(p. 83\)](#)
- [Integration 2: Create a POST method with a JSON payload to call the Lambda function \(p. 84\)](#)
- [Integration 3: Create a GET method with path parameters to call the Lambda function \(p. 87\)](#)
- [OpenAPI definitions of sample API integrated with a Lambda function \(p. 90\)](#)

## Create an Amazon account

Before you begin this tutorial, you'll need an Amazon account.

If you do not have an Amazon Web Services account, use the following procedure to create one.

### To sign up for Amazon Web Services

1. Open <http://www.amazonaws.cn/> and choose **Sign Up**.
2. Follow the on-screen instructions.

## Create an assumable IAM role

In order for your API to invoke your Calc Lambda function, you'll need to have an API Gateway assumable IAM role, which is an IAM role with the following trusted relationship:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

The role you create will need to have Lambda [InvokeFunction](#) permission. Otherwise, the API caller will receive a 500 Internal Server Error response. To give the role this permission, you'll attach the following IAM policy to it:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "lambda:InvokeFunction",
      "Resource": "*"
    }
  ]
}
```

Here's how to accomplish all this:

### Create an API Gateway assumable IAM role

1. Log in to to the IAM console.
2. Choose **Roles**.
3. Choose **Create Role**.
4. Under **Select type of trusted entity**, choose **Amazon Service**.
5. Under **Choose the service that will use this role**, choose **Lambda**.
6. Choose **Next: Permissions**.
7. Choose **Create Policy**.

A new **Create Policy** console window will open up. In that window, do the following:

- a. In the **JSON** tab, replace the existing policy with the following:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "lambda:InvokeFunction",
```

```
        "Resource": "*"
      }
    ]
  }
}
```

- b. Choose **Review policy**.
- c. Under **Review Policy**, do the following:
  - i. For **Name**, type a name such as `lambda_execute`.
  - ii. Choose **Create Policy**.
8. In the original **Create Role** console window, do the following:
  - a. Under **Attach permissions policies**, choose your `lambda_execute` policy from the dropdown list.

If you don't see your policy in the list, choose the refresh button at the top of the list. (Don't refresh the browser page!)
  - b. Choose **Next:Tags**.
  - c. Choose **Next:Review**.
  - d. For the **Role name**, type a name such as `lambda_invoke_function_assume_apigw_role`.
  - e. Choose **Create role**.
9. Choose your `lambda_invoke_function_assume_apigw_role` from the list of roles.
10. Choose the **Trust relationships** tab.
11. Choose **Edit trust relationship**.
12. Replace the existing policy with the following:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": [
          "lambda.amazonaws.com",
          "apigateway.amazonaws.com"
        ]
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

13. Choose **Update Trust Policy**.
14. Make a note of the role ARN for the role you just created. You'll need it later.

## Create a Calc Lambda function

Next you'll create a Lambda function using the Lambda console.

1. In the Lambda console, choose **Create function**.
2. Choose **Author from Scratch**.
3. For **Name**, enter `Calc`.

4. Set the **Runtime** to a supported Node.js runtime.
5. Choose **Create function**.
6. Copy the following Lambda function and paste it into the code editor in the Lambda console.

```
console.log('Loading the Calc function');

exports.handler = function(event, context, callback) {
  console.log('Received event:', JSON.stringify(event, null, 2));
  if (event.a === undefined || event.b === undefined || event.op === undefined) {
    callback("400 Invalid Input");
  }

  var res = {};
  res.a = Number(event.a);
  res.b = Number(event.b);
  res.op = event.op;

  if (isNaN(event.a) || isNaN(event.b)) {
    callback("400 Invalid Operand");
  }

  switch(event.op)
  {
    case "+":
    case "add":
      res.c = res.a + res.b;
      break;
    case "-":
    case "sub":
      res.c = res.a - res.b;
      break;
    case "*":
    case "mul":
      res.c = res.a * res.b;
      break;
    case "/":
    case "div":
      res.c = res.b===0 ? NaN : Number(event.a) / Number(event.b);
      break;
    default:
      callback("400 Invalid Operator");
      break;
  }
  callback(null, res);
};
```

7. Under Execution role, choose **Choose an existing role**.
8. Enter the role ARN for the `lambda_invoke_function_assume_apigw_role` role you created earlier.
9. Choose **Deploy**.

This function requires two operands (a and b) and an operator (op) from the event input parameter. The input is a JSON object of the following format:

```
{
  "a": "Number" | "String",
  "b": "Number" | "String",
  "op": "String"
}
```



This function returns the calculated result (c) and the input. For an invalid input, the function returns either the null value or the "Invalid op" string as the result. The output is of the following JSON format:

```
{
  "a": "Number",
  "b": "Number",
  "op": "String",
  "c": "Number" | "String"
}
```

You should test the function in the Lambda console before integrating it with the API in the next step.

## Test the Ca1c Lambda function

Here's how to test your Ca1c function in the Lambda console:

1. In the **Saved test events** dropdown menu, choose **Configure test events**.
2. For the test event name, enter **calc2plus5**.
3. Replace the test event definition with the following:

```
{
  "a": "2",
  "b": "5",
  "op": "+"
}
```

4. Choose **Save**.
5. Choose **Test**.
6. Expand **Execution result: succeeded**. You should see the following:

```
{
  "a": 2,
  "b": 5,
  "op": "+",
  "c": 7
}
```

## Create a Ca1c API

The following procedure shows how to create an API for the Ca1c Lambda function you just created. In subsequent sections, you'll add resources and methods to it.

### Create the Ca1c API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

3. Under **Create new API**, choose **New API**.

4. For **API Name**, enter `LambdaCalc`.
5. Leave the **Description** blank, and leave the **Endpoint Type** set to **Regional**.
6. Choose **Create API**.

## Integration 1: Create a GET method with query parameters to call the Lambda function

By creating a **GET** method that passes query string parameters to the Lambda function, you enable the API to be invoked from a browser. This approach can be useful, especially for APIs that allow open access.

### To set up the GET method with query string parameters

1. In the API Gateway console, under your `LambdaCalc` API's **Resources**, choose `/`.
2. In the **Actions** drop-down menu, choose **Create Resource**.
3. For **Resource Name**, enter `calc`.
4. Choose **Create Resource**.
5. Choose the `/calc` resource you just created.
6. In the **Actions** drop-down menu, choose **Create Method**.
7. In the method drop-down menu that appears, choose **GET**.
8. Choose the checkmark icon to save your choice.
9. In the **Set up** pane:
  - a. For **Integration type**, choose **Amazon Service**.
  - b. For **Amazon Region**, choose the region (e.g., `us-west-2`) where you created the Lambda function.
  - c. For **Amazon Service**, choose **Lambda**.
  - d. Leave **Amazon Subdomain** blank, because our Lambda function is not hosted on any Amazon subdomain.
  - e. For **HTTP method**, choose **POST** and choose the checkmark icon to save your choice. Lambda requires that the **POST** request be used to invoke any Lambda function. This example shows that the HTTP method in a frontend method request can be different from the integration request in the backend.
  - f. Choose `Use path override` for **Action Type**. This option allows us to specify the ARN of the **Invoke** action to execute our `Calc` function.
  - g. Enter `/2015-03-31/functions/arn:aws:lambda:region:account-id:function:Calc/invocations` in **Path override**, where `region` is the region where you created your Lambda function and `account-id` is the account number for the Amazon account.
  - h. For **Execution role**, enter the role ARN for the `lambda_invoke_function_assume_apigw_role` IAM role you created [earlier \(p. 79\)](#).
  - i. Leave **Content Handling** set to **Passthrough**, because this method will not deal with any binary data.
  - j. Leave **Use default timeout** checked.
  - k. Choose **Save**.
10. Choose **Method Request**.

Now you will set up query parameters for the **GET** method on `/calc` so it can receive input on behalf of the backend Lambda function.

- a. Choose the pencil icon next to **Request Validator** and choose **Validate query string parameters and headers** from the drop-down menu. This setting will cause an error message to return to

state the required parameters are missing if the client does not specify them. You will not get charged for the call to the backend.

- b. Choose the checkmark icon to save your changes.
  - c. Expand the **URL Query String Parameters** section.
  - d. Choose **Add query string**.
  - e. For **Name**, type **operand1**.
  - f. Choose the checkmark icon to save the parameter.
  - g. Repeat the previous steps to create parameters named **operand2** and **operator**.
  - h. Check the **Required** option for each parameter to ensure that they are validated.
11. Choose **Method Execution** and then choose **Integration Request** to set up the mapping template to translate the client-supplied query strings to the integration request payload as required by the Calc function.
- a. Expand the **Mapping Templates** section.
  - b. Choose **When no template matches the request Content-Type header for Request body passthrough**.
  - c. Under **Content-Type**, choose **Add mapping template**.
  - d. Type **application/json** and choose the checkmark icon to open the template editor.
  - e. Choose **Yes, secure this integration** to proceed.
  - f. Copy the following mapping script into the mapping template editor:

```
{
  "a": "$input.params('operand1')",
  "b": "$input.params('operand2')",
  "op": "$input.params('operator')"
}
```

This template maps the three query string parameters declared in **Method Request** into designated property values of the JSON object as the input to the backend Lambda function. The transformed JSON object will be included as the integration request payload.

- g. Choose **Save**.
12. Choose **Method Execution**.
13. You can now test your **GET** method to verify that it has been properly set up to invoke the Lambda function:
- a. For **Query Strings**, type **operand1=2&operand2=3&operator=+**.
  - b. Choose **Test**.

The results should look similar to this:

## Integration 2: Create a **POST** method with a JSON payload to call the Lambda function

By creating a **POST** method with a JSON payload to call the Lambda function, you make it so that the client must provide the necessary input to the backend function in the request body. To ensure that the client uploads the correct input data, you'll enable request validation on the payload.

### To set up the **POST** method with a JSON payload to invoke a Lambda function

1. Go to the API Gateway console.
2. Choose **APIs**.

3. Choose the **LambdaCalc** API you created previously.
4. Choose the **/calc** resource from **Resources** pane.
5. In the **Actions** menu, choose **Create Method**.
6. Choose **POST** from the method drop-down list.
7. Choose the checkmark icon to save your choice.
8. In the **Set up** pane:
  - a. For **Integration type**, choose **Amazon Service**.
  - b. For **Amazon Region**, choose the region (e.g., `us-west-2`) where you created the Lambda function.
  - c. For **Amazon Service**, choose **Lambda**.
  - d. Leave **Amazon Subdomain** blank, because our Lambda function is not hosted on any Amazon subdomain.
  - e. For **HTTP method**, choose **POST**. This example shows that the HTTP method in a frontend method request can be different from the integration request in the backend.
  - f. For **Action**, choose `Use path override` for **Action Type**. This option allows you to specify the ARN of the `Invoke` action to execute your `Calc` function.
  - g. For **Path override**, type `/2015-03-31/functions/arn:aws:lambda:region:account-id:function:Calc/invocations`, where `region` is the region where you created your Lambda function and `account-id` is the account number for the Amazon account.
  - h. For **Execution role**, enter the role ARN for the `lambda_invoke_function_assume_apigw_role` IAM role you created [earlier \(p. 79\)](#).
  - i. Leave **Content Handling** set to **Passthrough**, because this method will not deal with any binary data.
  - j. Leave **Use Default Timeout** checked.
  - k. Choose **Save**.
9. Choose **Models** under your **LambdaCalc** API in the API Gateway console's primary navigation pane to create data models for the method's input and output:
  - a. Choose **Create** in the **Models** pane. Type `Input` in **Model name**, type `application/json` in **Content type**, and copy the following schema definition into the **Model schema** box:

```
{
  "type": "object",
  "properties": {
    "a": { "type": "number" },
    "b": { "type": "number" },
    "op": { "type": "string" }
  },
  "title": "Input"
}
```

This model describes the input data structure and will be used to validate the incoming request body.

- b. Choose **Create model**.
- c. Choose **Create** in the **Models** pane. Type `Output` in **Model name**, type `application/json` in **Content type**, and copy the following schema definition into the **Model schema** box:

```
{
  "type": "object",
  "properties": {
    "c": { "type": "number" }
  },
  "title": "Output"
}
```

```
}  
}
```

This model describes the data structure of the calculated output from the backend. It can be used to map the integration response data to a different model. This tutorial relies on the passthrough behavior and does not use this model.

- d. Locate the API ID for your API at the top of the console screen and make a note of it. It will appear in parentheses after the API name.
- e. In the **Models** pane, choose **Create**.
- f. Type `Result` in **Model name**.
- g. Type `application/json` in **Content type**.
- h. Copy the following schema definition, where `restapi-id` is the REST API ID you noted earlier, into the **Model schema** box:

```
{  
  "type": "object",  
  "properties": {  
    "input": {  
      "$ref": "https://apigateway.amazonaws.com/restapis/restapi-id/models/  
Input"  
    },  
    "output": {  
      "$ref": "https://apigateway.amazonaws.com/restapis/restapi-id/models/  
Output"  
    }  
  },  
  "title": "Output"  
}
```

This model describes the data structure of the returned response data. It references both the Input and Output schemas defined in the specified API (`restapi-id`). Again, this model is not used in this tutorial because it leverages the passthrough behavior.

- i. Choose **Create model**.
10. In the main navigation pane, under your `LambdaCalc` API, choose **Resources**.
  11. In the **Resources** pane, choose the `POST` method for your API.
  12. Choose **Method Request**.
  13. In the **Method Request** configuration settings, do the following to enable request validation on the incoming request body:
    - a. Choose the pencil icon next to **Request Validator** to choose `Validate` body. Choose the checkmark icon to save your choice.
    - b. Expand the **Request Body** section, choose **Add model**
    - c. Type `application/json` in the **Content-Type** input field and choose `Input` from the drop-down list in the **Model name** column. Choose the checkmark icon to save your choice.
  14. To test your `POST` method, do the following:
    - a. Choose **Method Execution**.
    - b. Choose **Test**.
  15. Copy the following JSON payload into the **Request Body**:

```
{  
  "a": 1,  
  "b": 2,  
  "op": "+"  
}
```

16. Choose **Test**.

You should see the following output in **Response Body**:

```
{
  "a": 1,
  "b": 2,
  "op": "+",
  "c": 3
}
```

## Integration 3: Create a GET method with path parameters to call the Lambda function

Now you'll create a **GET** method on a resource specified by a sequence of path parameters to call the backend Lambda function. The path parameter values specify the input data to the Lambda function. You'll use a mapping template to map the incoming path parameter values to the required integration request payload.

This time you'll use the built-in Lambda integration support in the API Gateway console to set up the method integration.

The resulting API resource structure will look like this:

### To set up a GET method with URL path parameters

1. Go to the API Gateway console.
2. Under **APIs**, choose the **LambdaCalc** API you created previously.
3. In the API's Resources navigation pane, choose **/calc**.
4. From the **Actions** drop-down menu, choose **Create Resource**.
5. For **Resource Name**, type **{operand1}**.
6. For **Resource Path**, type **{operand1}**.
7. Choose **Create Resource**.
8. Choose the **/calc/{operand1}** resource you just created.
9. From the **Actions** drop-down menu, choose **Create Resource**.
10. For **Resource Name**, type **{operand2}**.
11. For **Resource Path**, type **{operand2}**.
12. Choose **Create Resource**.
13. Choose the **/calc/{operand1}/{operand2}** resource you just created.
14. From the **Actions** drop-down menu, choose **Create Resource**.
15. For **Resource Path**, type **{operator}**.
16. For **Resource Name**, type **{operator}**.
17. Choose **Create Resource**.
18. Choose the **/calc/{operand1}/{operand2}/{operator}** resource you just created.
19. From the **Actions** drop-down menu, choose **Create Method**.

20. From the method drop-down menu, choose `GET`.
21. In the **Setup** pane, choose `Lambda Function` for **Integration type**, to use the streamlined setup process enabled by the console.
22. Choose a region (e.g., `us-west-2`) for **Lambda Region**. This is the region where the Lambda function is hosted.
23. Choose your existing Lambda function (`Calc`) for **Lambda Function**.
24. Choose **Save** and then choose **OK** to consent to **Add Permissions to Lambda Function**.
25. Choose **Integration Request**.
26. Set up the mapping template as follows:
  - a. Expand the **Mapping Templates** section.
  - b. Leave set to **When no template matches the requested Content-Type header**.
  - c. Choose **Add mapping template**.
  - d. Type `application/json` for **Content-Type** and then choose the check mark icon to open the template editor.
  - e. Choose **Yes, secure this integration** to proceed.
  - f. Copy the following mapping script into the template editor:

```
{
  "a": "$input.params('operand1')",
  "b": "$input.params('operand2')",
  "op":
  #if($input.params('operator')=='%2F')"/"#else"$input.params('operator')"#end
}
```

This template maps the three URL path parameters, declared when the `/calc/{operand1}/{operand2}/{operator}` resource was created, into designated property values in the JSON object. Because URL paths must be URL-encoded, the division operator must be specified as `%2F` instead of `/`. This template translates the `%2F` into `'/'` before passing it to the Lambda function.

- g. Choose **Save**.

When the method is set up correctly, the settings should look more or less like this:

27. To test your `GET` function, do the following:
  - a. Choose **Method Execution**.
  - b. Choose **Test**.
  - c. Type `1`, `1` and `+` in the **{operand1}**, **{operand2}** and **{operator}** fields, respectively.
  - d. Choose **Test**.
  - e. The result should look like this:

This test result shows the original output from the backend Lambda function, as passed through the integration response without mapping, because there is no mapping template. Next, you'll model the data structure of the method response payload after the `Result` schema.

28. By default, the method response body is assigned an empty model. This will cause the integration response body to be passed through without mapping. However, when you generate an SDK for one of the strongly-type languages, such as Java or Objective-C, your SDK users will receive an empty object as the result. To ensure that both the REST client and SDK clients receive the desired result, you must model the response data using a predefined schema. Here you'll define a model for the method response body and to construct a mapping template to translate the integration response body into the method response body.

- a. Choose `/calc/{operand1}/{operand2}/{operator}`.
- b. Choose **GET**.
- c. Choose **Method Execution**.
- d. Choose **Method Response**.
- e. Expand the **200** response,
- f. Under **Response Body for 200**, choose the pencil icon next to the model for the `application/json` content type.
- g. From the **Models** drop-down list, choose `Result`.
- h. Choose the checkmark icon to save your choice.

Setting the model for the method response body ensures that the response data will be cast into the `Result` object of a given SDK. To make sure that the integration response data is mapped accordingly, you'll need a mapping template.

29. To create the mapping template, do the following:

- a. Choose **Method Execution**.
- b. Choose **Integration Response** and expand the 200 method response entry.
- c. Expand the **Mapping Templates** section.
- d. Choose `application/json` from the **Content-Type** list.
- e. Choose `Result` from the **Generate template** drop-down list to bring up the `Result` template blueprint.
- f. Change the template blueprint to the following:

```
#set($inputRoot = $input.path('$'))
{
  "input" : {
    "a" : $inputRoot.a,
    "b" : $inputRoot.b,
    "op" : "$inputRoot.op"
  },
  "output" : {
    "c" : $inputRoot.c
  }
}
```

- g. Choose **Save**.

30. To test the mapping template, do the following:

- a. Choose **Method Execution**.
- b. Choose **Test**.
- c. Type `1 2 and +` in the **operand1**, **operand2** and **operator** input fields, respectively.

The integration response from the Lambda function is now mapped to a `Result` object.

- d. Choose **Test**, and you'll see the following under **Response Body** in the console:

```
{
  "input": {
    "a": 1,
    "b": 2,
    "op": "+"
  },
  "output": {
    "c": 3
  }
}
```



```
}  
}
```

31. At this point the API can be called only via **Test Invoke** in the API Gateway console. To make it available to clients, you'll need to deploy it as follows:
  - a. Choose **Deploy API** from the **Actions** dropdown menu.
  - b. Choose **[New Stage]** from the **Deployment Stage** dropdown menu.
  - c. For **Stage Name**, enter **test**.
  - d. Choose **Deploy**.
  - e. Note the **Invoke URL** at the top of the console window. You can use this with tools such as [Postman](#) and [cURL](#) to test your API.

### Note

Always be sure to redeploy your API whenever you add, modify, or delete a resource or method, update a data mapping, or update stage settings. Otherwise, new features or updates will not be available to clients of your API.

## OpenAPI definitions of sample API integrated with a Lambda function

### OpenAPI 2.0

```
{  
  "swagger": "2.0",  
  "info": {  
    "version": "2017-04-20T04:08:08Z",  
    "title": "LambdaCalc"  
  },  
  "host": "uojnr9hd57.execute-api.us-east-1.amazonaws.com",  
  "basePath": "/test",  
  "schemes": [  
    "https"  
  ],  
  "paths": {  
    "/calc": {  
      "get": {  
        "consumes": [  
          "application/json"  
        ],  
        "produces": [  
          "application/json"  
        ],  
        "parameters": [  
          {  
            "name": "operand2",  
            "in": "query",  
            "required": true,  
            "type": "string"  
          },  
          {  
            "name": "operator",  
            "in": "query",  
            "required": true,  
            "type": "string"  
          },  
          {  
            "name": "operand1",  
            "in": "query",  
            "required": true,  
            "type": "string"  
          }  
        ]  
      }  
    }  
  }  
}
```

```
    "type": "string"
  }
],
"responses": {
  "200": {
    "description": "200 response",
    "schema": {
      "$ref": "#/definitions/Result"
    },
    "headers": {
      "operand_1": {
        "type": "string"
      },
      "operand_2": {
        "type": "string"
      },
      "operator": {
        "type": "string"
      }
    }
  }
},
"x-amazon-apigateway-request-validator": "Validate query string parameters and headers",
"x-amazon-apigateway-integration": {
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "responses": {
    "default": {
      "statusCode": "200",
      "responseParameters": {
        "method.response.header.operator": "integration.response.body.op",
        "method.response.header.operand_2": "integration.response.body.b",
        "method.response.header.operand_1": "integration.response.body.a"
      },
      "responseTemplates": {
        "application/json": "#set($res = $input.path('$'))\n{\n  \"result\":\n  \"$res.a, $res.b, $res.op => $res.c\", \n  \"a\" : \"$res.a\", \n  \"b\" : \"$res.b\", \n  \"op\" : \"$res.op\", \n  \"c\" : \"$res.c\" \n}"
      }
    }
  },
  "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/\narn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
  "passthroughBehavior": "when_no_match",
  "httpMethod": "POST",
  "requestTemplates": {
    "application/json": "{\n  \"a\": \"$input.params('operand1')\", \n  \"b\": \"$input.params('operand2')\", \n  \"op\": \"$input.params('operator')\" \n}"
  },
  "type": "aws"
},
"post": {
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "parameters": [
    {
      "in": "body",
      "name": "Input",
      "required": true,
      "schema": {
        "$ref": "#/definitions/Input"
      }
    }
  ]
}
```

```
    }
  },
  "responses": {
    "200": {
      "description": "200 response",
      "schema": {
        "$ref": "#/definitions/Result"
      }
    }
  },
  "x-amazon-apigateway-request-validator": "Validate body",
  "x-amazon-apigateway-integration": {
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "responses": {
      "default": {
        "statusCode": "200",
        "responseTemplates": {
          "application/json": "#set($inputRoot = $input.path('$'))\n{\n  \"a\n\" : $inputRoot.a,\n  \"b\n\" : $inputRoot.b,\n  \"op\n\" : $inputRoot.op,\n  \"c\n\" :\n  $inputRoot.c\n}"
        }
      }
    },
    "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/\narn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
    "passthroughBehavior": "when_no_templates",
    "httpMethod": "POST",
    "type": "aws"
  }
},
"/calc/{operand1}/{operand2}/{operator}": {
  "get": {
    "consumes": [
      "application/json"
    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "operand2",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "name": "operator",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "name": "operand1",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "schema": {
          "$ref": "#/definitions/Result"
        }
      }
    }
  }
}
```

```
    }
  },
  "x-amazon-apigateway-integration": {
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "responses": {
      "default": {
        "statusCode": "200",
        "responseTemplates": {
          "application/json": "#set($inputRoot = $input.path('$'))\n{\n
\n\"input\" : {\n  \"a\" : $inputRoot.a,\n  \"b\" : $inputRoot.b,\n  \"op\" :
\n\"$inputRoot.op\"\n },\n  \"output\" : {\n    \"c\" : $inputRoot.c\n  }\n}"
        }
      }
    },
    "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
    "passthroughBehavior": "when_no_templates",
    "httpMethod": "POST",
    "requestTemplates": {
      "application/json": "{\n  \"a\" : \"$input.params('operand1')\",\n  \"b\" :
\n\"$input.params('operand2')\",\n  \"op\" : #if($input.params('operator')='%'2F')\n/
\n\"#{else}\"$input.params('operator')\"#end\n  }\n}"
    },
    "contentType": "application/json",
    "contentHandling": "CONVERT_TO_TEXT",
    "type": "aws"
  }
}
},
"definitions": {
  "Input": {
    "type": "object",
    "required": [
      "a",
      "b",
      "op"
    ],
    "properties": {
      "a": {
        "type": "number"
      },
      "b": {
        "type": "number"
      },
      "op": {
        "type": "string",
        "description": "binary op of ['+', 'add', '-', 'sub', '*', 'mul', '%2F',
'div']"
      }
    }
  },
  "Output": {
    "type": "object",
    "properties": {
      "c": {
        "type": "number"
      }
    }
  },
  "Result": {
    "type": "object",
    "properties": {
      "input": {
        "$ref": "#/definitions/Input"
      }
    }
  }
}
```

```
    },
    "output": {
      "$ref": "#/definitions/Output"
    }
  },
  "title": "Result"
}
},
"x-amazon-apigateway-request-validators": {
  "Validate body": {
    "validateRequestParameters": false,
    "validateRequestBody": true
  },
  "Validate query string parameters and headers": {
    "validateRequestParameters": true,
    "validateRequestBody": false
  }
}
}
```

## Tutorial: Create a REST API as an Amazon S3 proxy in API Gateway

As an example to showcase using a REST API in API Gateway to proxy Amazon S3, this section describes how to create and configure a REST API to expose the following Amazon S3 operations:

- Expose GET on the API's root resource to [list all of the Amazon S3 buckets of a caller](#).
- Expose GET on a Folder resource to [view a list of all of the objects in an Amazon S3 bucket](#).
- Expose PUT on a Folder resource to [add a bucket to Amazon S3](#).
- Expose DELETE on a Folder resource to [remove a bucket from Amazon S3](#).
- Expose GET on a Folder/Item resource to [view or download an object from an Amazon S3 bucket](#).
- Expose PUT on a Folder/Item resource to [upload an object to an Amazon S3 bucket](#).
- Expose HEAD on a Folder/Item resource to [get object metadata in an Amazon S3 bucket](#).
- Expose DELETE on a Folder/Item resource to [remove an object from an Amazon S3 bucket](#).

### Note

To integrate your API Gateway API with Amazon S3, you must choose a region where both the API Gateway and Amazon S3 services are available. For region availability, see [Amazon API Gateway Endpoints and Quotas](#).

You may want to import the sample API as an Amazon S3 proxy, as shown in [OpenAPI definitions of the sample API as an Amazon S3 proxy \(p. 102\)](#). For instructions on how to import an API using the OpenAPI definition, see [Configuring a REST API using OpenAPI \(p. 427\)](#).

To use the API Gateway console to create the API, you must first sign up for an Amazon account.

If you do not have an Amazon Web Services account, use the following procedure to create one.

### To sign up for Amazon Web Services

1. Open <http://www.amazonaws.cn/> and choose **Sign Up**.
2. Follow the on-screen instructions.

### Topics

- [Set up IAM permissions for the API to invoke Amazon S3 actions \(p. 95\)](#)
- [Create API resources to represent Amazon S3 resources \(p. 96\)](#)
- [Expose an API method to list the caller's Amazon S3 buckets \(p. 97\)](#)
- [Expose API methods to access an Amazon S3 bucket \(p. 98\)](#)
- [Expose API methods to access an Amazon S3 object in a bucket \(p. 99\)](#)
- [Call the API using a REST API client \(p. 100\)](#)
- [OpenAPI definitions of the sample API as an Amazon S3 proxy \(p. 102\)](#)

## Set up IAM permissions for the API to invoke Amazon S3 actions

To allow the API to invoke required Amazon S3 actions, you must have appropriate IAM policies attached to an IAM role. The next section describes how to verify and to create, if necessary, the required IAM role and policies.

For your API to view or list Amazon S3 buckets and objects, you can use the IAM-provided `AmazonS3ReadOnlyAccess` policy in the IAM role. The ARN of this policy is `arn:aws:iam::aws:policy/AmazonS3ReadOnlyAccess`, which is as shown as follows:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "s3:Get*",
        "s3:List*"
      ],
      "Resource": "*"
    }
  ]
}
```

This policy document states that any of the Amazon S3 `Get*` and `List*` actions can be invoked on any of the Amazon S3 resources.

For your API to update Amazon S3 buckets and objects, you can use a custom policy for any of the Amazon S3 `Put*` actions as shown as follows:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "s3:Put*",
      "Resource": "*"
    }
  ]
}
```

For your API to work with Amazon S3 `Get*`, `List*` and `Put*` actions, you can add the above read-only and put-only policies to the IAM role.

For your API to invoke the Amazon S3 `Post*` actions, you must use an `Allow` policy for the `s3:Post*` actions in the IAM role. For a complete list of Amazon S3 actions, see [Specifying Amazon S3 Permissions in a Policy](#).

For your API to create, view, update, and delete buckets and objects in Amazon S3, you can use the IAM -provided `AmazonS3FullAccess` policy in the IAM role. The ARN is `arn:aws:iam::aws:policy/AmazonS3FullAccess`.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "s3:*",
      "Resource": "*"
    }
  ]
}
```

Having chosen the desired IAM policies to use, create an IAM role and attach to it the policies. The resulting IAM role must contain the following trust policy for API Gateway to assume this role at runtime.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

When using the IAM console to create the role, choose the **Amazon API Gateway** role type to ensure that this trust policy is automatically included.

## Create API resources to represent Amazon S3 resources

We will use the API's root (`/`) resource as the container of an authenticated caller's Amazon S3 buckets. We will also create a `Folder` and `Item` resources to represent a particular Amazon S3 bucket and a particular Amazon S3 object, respectively. The folder name and object key will be specified, in the form of path parameters as part of a request URL, by the caller.

### Note

When accessing objects whose object key includes `/` or any other special character, the character needs to be URL encoded. For example, `test/test.txt` should be encoded to `test%2Ftest.txt`.

### To create an API resource that exposes the Amazon S3 service features

1. In the API Gateway console, create an API named **MyS3**. This API's root resource (`/`) represents the Amazon S3 service.
2. Under the API's root resource, create a child resource named **Folder** and set the required **Resource Path** as `/{folder}`.
3. For the API's **Folder** resource, create an **Item** child resource. Set the required **Resource Path** as `/{item}`.

## Expose an API method to list the caller's Amazon S3 buckets

Getting the list of Amazon S3 buckets of the caller involves invoking the [GET Service](#) action on Amazon S3. On the API's root resource, (`/`), create the GET method. Configure the GET method to integrate with the Amazon S3, as follows.

### To create and initialize the API's `GET /` method

1. Choose **Create method** on the root node (`/`) from the **Actions** drop-down menu at the top-right corner of the **Resources** panel.
2. Choose the `GET` from the drop-down list of HTTP verbs, and choose the check-mark icon to start creating the method.
3. In the `/ - GET - Setup` pane, choose **Amazon Service** for **Integration type**.
4. From the list, choose a region (e.g., `us-west-2`) for **Amazon Region**.
5. From **Amazon Service**, choose **S3**.
6. For **Amazon Subdomain**, leave it blank.
7. From **HTTP method**, choose `GET`.
8. For **Action Type**, choose **Use path override**. With path override, API Gateway forwards the client request to Amazon S3 as the corresponding [Amazon S3 REST API path-style request](#), in which a Amazon S3 resource is expressed by the resource path of the `s3-host-name/bucket/key` pattern. API Gateway sets the `s3-host-name` and passes the client specified bucket and key from the client to Amazon S3.
9. (Optional) In **Path override** type `/`.
10. Copy the previously created IAM role's ARN (from the IAM console) and paste it into **Execution role**.
11. Leave any other settings as default.
12. Choose **Save** to finish setting up this method.

This setup integrates the frontend GET `https://your-api-host/stage/` request with the backend GET `https://your-s3-host/`.

#### Note

After the initial setup, you can modify these settings in the **Integration Request** page of the method.

To control who can call this method of our API, we turn on the method authorization flag and set it to `AWS_IAM`.

### To enable IAM to control access to the `GET /` method

1. From the **Method Execution**, choose **Method Request**.
2. Choose the pencil icon next to **Authorization**
3. Choose `AWS_IAM` from the drop-down list.
4. Choose the check-mark icon to save the setting.

For our API to return successful responses and exceptions properly to the caller, let us declare the 200, 400 and 500 responses in **Method Response**. We use the default mapping for 200 responses so that backend responses of the status code not declared here will be returned to the caller as 200 ones.

### To declare response types for the `GET /` method

1. From the **Method Execution** pane, choose the **Method Response** box. The API Gateway declares the 200 response by default.



2. Choose **Add response**, enter **400** in the input text box, and choose the check-mark to finish the declaration.
3. Repeat the above step to declare the 500 response type. The final setting is shown as follows:

Because the successful integration response from Amazon S3 returns the bucket list as an XML payload and the default method response from API Gateway returns a JSON payload, we must map the backend Content-Type header parameter value to the frontend counterpart. Otherwise, the client will receive `application/json` for the content type when the response body is actually an XML string. The following procedure shows how to set this up. In addition, we also want to display to the client other header parameters, such as Date and Content-Length.

### To set up response header mappings for the GET / method

1. In the API Gateway console, choose **Method Response**. Add the **Content-Type** header for the 200 response type.
2. In **Integration Response**, for **Content-Type**, type `integration.response.header.Content-Type` for the method response.

With the above header mappings, API Gateway will translate the Date header from the backend to the Timestamp header for the client.

3. Still in **Integration Response**, choose **Add integration response**, type an appropriate regular expression in the **HTTP status regex** text box for a remaining method response status. Repeat until all the method response status are covered.

As a good practice, let us test our API we have configured so far.

### Test the GET method on the API root resource

1. Go back to **Method Execution**, choose **Test** from the **Client** box.
2. Choose **Test** in the **GET / - Method Test** pane. An example result is shown as follows.

#### Note

To use the API Gateway console to test the API as an Amazon S3 proxy, make sure that the targeted S3 bucket is from a different region from the API's region. Otherwise, you may get a 500 Internal Server Error response. This limitation does not apply to any deployed API.

## Expose API methods to access an Amazon S3 bucket

To work with an Amazon S3 bucket, we expose the GET, PUT, and DELETE methods on the `/{folder}` resource to list objects in a bucket, create a new bucket, and delete an existing bucket. The instructions are similar to those described in [Expose an API method to list the caller's Amazon S3 buckets \(p. 97\)](#). In the following discussions, we outline the general tasks and highlight relevant differences.

### To expose GET, PUT and DELETE methods on a folder resource

1. On the `/{folder}` node from the **Resources** tree, create the DELETE, GET and PUT methods, one at a time.
2. Set up the initial integration of each created method with its corresponding Amazon S3 endpoints. The following screen shot illustrates this setting for the `PUT /{folder}` method. For the

DELETE `/{folder}` and GET `/{folder}` method, replace the PUT value of **HTTP method** by DELETE and GET, respectively.

Notice that we used the `{bucket}` path parameter in the Amazon S3 endpoint URLs to specify the bucket. We will need to map the `{folder}` path parameter of the method requests to the `{bucket}` path parameter of the integration requests.

- To map `{folder}` to `{bucket}`:
  - Choose **Method Execution** and then **Integration Request**.
  - Expand **URL Path Parameters** and choose **Add path**
  - Type `bucket` in the **Name** column and `method.request.path.folder` in the **Mapped from** column. Choose the check-mark icon to save the mapping.
- In **Method Request**, add the `Content-Type` to the **HTTP Request Headers** section.

This is mostly needed for testing, when using the API Gateway console, when you must specify `application/xml` for an XML payload.

- In **Integration Request**, set up a mapping for the `Content-Type` header to `method.request.header.Content-Type`, following the instructions in [Expose an API method to list the caller's Amazon S3 buckets \(p. 97\)](#).
- To test the PUT method, choose **Test** in the **Client** box from **Method Execution**, and enter the following as input to the testing:
  - In **folder**, type a bucket name,
  - For the **Content-Type** header, type `application/xml`.
  - In **Request Body**, provide the bucket region as the location constraint, declared in an XML fragment as the request payload. For example,

```
<CreateBucketConfiguration xmlns="http://s3.amazonaws.com/doc/2006-03-01/">
  <LocationConstraint>{region}</LocationConstraint>
</CreateBucketConfiguration>
```

- Repeat the preceding steps to create and configure the GET and DELETE method on the API's `/{folder}` resource.

The above examples illustrate how to create a new bucket in the specified region, to view the list of objects in the bucket, and to delete the bucket. Other Amazon S3 bucket operations allow you work with the metadata or properties of the bucket. For example, you can set up your API to call the Amazon S3's [PUT /?notification](#) action to set up notifications on the bucket, to call [PUT /?acl](#) to set an access control list on the bucket, etc. The API set up is similar, except for that you must append appropriate query parameters to the Amazon S3 endpoint URLs. At run time, you must provide the appropriate XML payload to the method request. The same can be said about supporting the other GET and DELETE operations on a Amazon S3 bucket. For more information on possible Amazon S3 actions on a bucket, see [Amazon S3 Operations on Buckets](#).

## Expose API methods to access an Amazon S3 object in a bucket

Amazon S3 supports GET, DELETE, HEAD, OPTIONS, POST and PUT actions to access and manage objects in a given bucket. For the complete list of supported actions, see [Amazon S3 Operations on Objects](#).

In this tutorial, we expose the [PUT Object](#) operation, the [GET Object](#) operation, [HEAD Object](#) operation, and the [DELETE Object](#) operation through the API methods of `PUT /{folder}/{item}`, `GET /{folder}/{item}`, `HEAD /{folder}/{item}` and `DELETE /{folder}/{item}`, respectively.

The API setups for the PUT, GET and DELETE methods on `/folder/item` are the similar to those on `/folder`, as prescribed in [Expose API methods to access an Amazon S3 bucket \(p. 98\)](#). One major difference is that the object-related request path has an additional path parameter of `item` and this path parameter must be mapped to the integration request path parameter of `object`.

The same is true for the GET and DELETE methods.

As an illustration, the following screen shot shows the output when testing the GET method on a `folder/item` resource using the API Gateway console. The request correctly returns the plain text of ("Welcome to README.txt") as the content of the specified file (README.txt) in the given Amazon S3 bucket (apig-demo).

To download or upload binary files, which in API Gateway is considered any thing other than utf-8 encoded JSON content, additional API settings are necessary. This is outlined as follows:

### To download or upload binary files from S3

1. Register the media types of the affected file to the API's `binaryMediaTypes`. You can do this in the console:
  - a. Choose **Settings** for the API.
  - b. Under **Binary Media Types**, choose **Add Binary Media Type**.
  - c. Enter the required media type, for example, `image/png`.
  - d. Choose **Save Changes** to save the setting.
2. Add the `Content-Type` (for upload) and/or `Accept` (for download) header to the method request to require the client to specify the required binary media type and map them to the integration request.
3. Set **Content Handling** to `Passthrough` in the integration request (for upload) and in a integration response (for download). Make sure that no mapping template is defined for the affected content type. For more information, see [Integration Passthrough Behaviors \(p. 362\)](#) and [Select VTL Mapping Templates \(p. 361\)](#).

The payload size limit is 10 MB. See [API Gateway quotas for configuring and running a REST API \(p. 747\)](#).

Make sure that files on Amazon S3 have the correct content types added as the files' metadata. For streamable media content, `Content-Disposition:inline` may also need to be added to the metadata.

For more information about the binary support in API Gateway, see [Content type conversions in API Gateway \(p. 390\)](#).

## Call the API using a REST API client

To provide an end-to-end tutorial, we now show how to call the API using [Postman](#), which supports the Amazon IAM authorization.

### To call our Amazon S3 proxy API using Postman

1. Deploy or redeploy the API. Make a note of the base URL of the API that is displayed next to **Invoke URL** at the top of the **Stage Editor**.
2. Launch Postman.
3. Choose **Authorization** and then choose `Amazon Signature`. Type your IAM user's Access Key ID and Secret Access Key into the **AccessKey** and **SecretKey** input fields, respectively. Type the Amazon region to which your API is deployed in the **Amazon Region** text box. Type `execute-api` in the **Service Name** input field.

You can create a pair of the keys from the **Security Credentials** tab from your IAM user account in the IAM Management Console.

- To add a bucket named `apig-demo-5` to your Amazon S3 account in the `{region}` region:

**Note**

Be sure that the bucket name must be globally unique.

- Choose **PUT** from the drop-down method list and type the method URL (`https://api-id.execute-api.aws-region.amazonaws.com/stage/folder-name`)
- Set the Content-Type header value as `application/xml`. You may need to delete any existing headers before setting the content type.
- Choose **Body** menu item and type the following XML fragment as the request body:

```
<CreateBucketConfiguration>
  <LocationConstraint>{region}</LocationConstraint>
</CreateBucketConfiguration>
```

- Choose **Send** to submit the request. If successful, you should receive a 200 OK response with an empty payload.
- To add a text file to a bucket, follow the instructions above. If you specify a bucket name of `apig-demo-5` for `{folder}` and a file name of `Readme.txt` for `{item}` in the URL and provide a text string of `Hello, World!` as the file contents (thereby making it the request payload), the request becomes

```
PUT /S3/apig-demo-5/Readme.txt HTTP/1.1
Host: 9gn28ca086.execute-api.{region}.amazonaws.com
Content-Type: application/xml
X-Amz-Date: 20161015T062647Z
Authorization: AWS4-HMAC-SHA256 Credential=access-key-id/20161015/{region}/execute-api/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date, Signature=ccadb877bdb0d395ca38cc47e18a0d76bb5eaf17007d11e40bf6fb63d28c705b
Cache-Control: no-cache
Postman-Token: 6135d315-9cc4-8af8-1757-90871d00847e

Hello, World!
```

If everything goes well, you should receive a 200 OK response with an empty payload.

- To get the content of the `Readme.txt` file we just added to the `apig-demo-5` bucket, do a GET request like the following one:

```
GET /S3/apig-demo-5/Readme.txt HTTP/1.1
Host: 9gn28ca086.execute-api.{region}.amazonaws.com
Content-Type: application/xml
X-Amz-Date: 20161015T063759Z
Authorization: AWS4-HMAC-SHA256 Credential=access-key-id/20161015/{region}/execute-api/aws4_request, SignedHeaders=content-type;host;x-amz-date, Signature=ba09b72b585acf0e578e6ad02555c00e24b420b59025bc7bb8d3f7aed1471339
Cache-Control: no-cache
Postman-Token: d60fcb59-d335-52f7-0025-5bd96928098a
```

If successful, you should receive a 200 OK response with the `Hello, World!` text string as the payload.

- To list items in the `apig-demo-5` bucket, submit the following request:

```
GET /S3/apig-demo-5 HTTP/1.1
Host: 9gn28ca086.execute-api.{region}.amazonaws.com
Content-Type: application/xml
```

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```
X-Amz-Date: 20161015T064324Z
Authorization: AWS4-HMAC-SHA256 Credential=access-key-id/20161015/{region}/
execute-api/aws4_request, SignedHeaders=content-type;host;x-amz-date,
Signature=4ac9bd4574a14e01568134fd16814534d9951649d3a22b3b0db9f1f5cd4dd0ac
Cache-Control: no-cache
Postman-Token: 9c43020a-966f-61e1-81af-4c49ad8d1392
```

If successful, you should receive a 200 OK response with an XML payload showing a single item in the specified bucket, unless you added more files to the bucket before submitting this request.

```
<?xml version="1.0" encoding="UTF-8"?>
<ListBucketResult xmlns="http://s3.amazonaws.com/doc/2006-03-01/">
  <Name>apig-demo-5</Name>
  <Prefix></Prefix>
  <Marker></Marker>
  <MaxKeys>1000</MaxKeys>
  <IsTruncated>>false</IsTruncated>
  <Contents>
    <Key>Readme.txt</Key>
    <LastModified>2016-10-15T06:26:48.000Z</LastModified>
    <ETag>"65a8e27d8879283831b664bd8b7f0ad4"</ETag>
    <Size>13</Size>
    <Owner>
      <ID>06e4b09e9d...603add12ee</ID>
      <DisplayName>user-name</DisplayName>
    </Owner>
    <StorageClass>STANDARD</StorageClass>
  </Contents>
</ListBucketResult>
```

#### Note

To upload or download an image, you need to set content handling to CONVERT\_TO\_BINARY.

## OpenAPI definitions of the sample API as an Amazon S3 proxy

The following OpenAPI definitions describe the sample API, referenced in this tutorial, as an Amazon S3 proxy.

#### OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "version": "2016-10-13T23:04:43Z",
    "title": "MyS3"
  },
  "host": "9gn28ca086.execute-api.{region}.amazonaws.com",
  "basePath": "/S3",
  "schemes": [
    "https"
  ],
  "paths": {
    "/": {
      "get": {
        "produces": [
          "application/json"
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "schema": {
```

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```
        "$ref": "#/definitions/Empty"
      },
      "headers": {
        "Content-Length": {
          "type": "string"
        },
        "Timestamp": {
          "type": "string"
        },
        "Content-Type": {
          "type": "string"
        }
      }
    },
    "400": {
      "description": "400 response"
    },
    "500": {
      "description": "500 response"
    }
  },
  "security": [
    {
      "sigv4": []
    }
  ],
  "x-amazon-apigateway-integration": {
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "responses": {
      "4\\d{2}": {
        "statusCode": "400"
      },
      "default": {
        "statusCode": "200",
        "responseParameters": {
          "integration.response.header.Content-Type":
            "method.response.header.Content-Type",
          "integration.response.header.Content-Length":
            "method.response.header.Content-Length",
          "integration.response.header.Timestamp": "integration.response.header.Date"
        }
      },
      "5\\d{2}": {
        "statusCode": "500"
      }
    },
    "uri": "arn:aws:apigateway:us-west-2:s3:path/",
    "passthroughBehavior": "when_no_match",
    "httpMethod": "GET",
    "type": "aws"
  }
},
"/{folder}": {
  "get": {
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "folder",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ]
  }
},
]
```

```
"responses": {
  "200": {
    "description": "200 response",
    "schema": {
      "$ref": "#/definitions/Empty"
    },
    "headers": {
      "Content-Length": {
        "type": "string"
      },
      "Date": {
        "type": "string"
      },
      "Content-Type": {
        "type": "string"
      }
    }
  },
  "400": {
    "description": "400 response"
  },
  "500": {
    "description": "500 response"
  }
},
"security": [
  {
    "sigv4": []
  }
],
"x-amazon-apigateway-integration": {
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "responses": {
    "4\\d{2}": {
      "statusCode": "400"
    },
    "default": {
      "statusCode": "200",
      "responseParameters": {
        "method.response.header.Content-Type":
"integration.response.header.Content-Type",
        "method.response.header.Date": "integration.response.header.Date",
        "method.response.header.Content-Length":
"integration.response.header.content-length"
      }
    },
    "5\\d{2}": {
      "statusCode": "500"
    }
  },
  "requestParameters": {
    "integration.request.path.bucket": "method.request.path.folder"
  },
  "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}",
  "passthroughBehavior": "when_no_match",
  "httpMethod": "GET",
  "type": "aws"
}
},
"put": {
  "produces": [
    "application/json"
  ],
  "parameters": [
    {
      "name": "Content-Type",
```

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```
        "in": "header",
        "required": false,
        "type": "string"
    },
    {
        "name": "folder",
        "in": "path",
        "required": true,
        "type": "string"
    }
],
"responses": {
    "200": {
        "description": "200 response",
        "schema": {
            "$ref": "#/definitions/Empty"
        },
        "headers": {
            "Content-Length": {
                "type": "string"
            },
            "Content-Type": {
                "type": "string"
            }
        }
    },
    "400": {
        "description": "400 response"
    },
    "500": {
        "description": "500 response"
    }
},
"security": [
    {
        "sigv4": []
    }
],
"x-amazon-apigateway-integration": {
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "responses": {
        "4\\d{2}": {
            "statusCode": "400"
        },
        "default": {
            "statusCode": "200",
            "responseParameters": {
                "method.response.header.Content-Type":
"integration.response.header.Content-Type",
                "method.response.header.Content-Length":
"integration.response.header.Content-Length"
            }
        },
        "5\\d{2}": {
            "statusCode": "500"
        }
    },
    "requestParameters": {
        "integration.request.path.bucket": "method.request.path.folder",
        "integration.request.header.Content-Type": "method.request.header.Content-
Type"
    },
    "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}",
    "passthroughBehavior": "when_no_match",
    "httpMethod": "PUT",
    "type": "aws"
}
```



```
    }
  },
  "delete": {
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "folder",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "schema": {
          "$ref": "#/definitions/Empty"
        },
        "headers": {
          "Date": {
            "type": "string"
          },
          "Content-Type": {
            "type": "string"
          }
        }
      },
      "400": {
        "description": "400 response"
      },
      "500": {
        "description": "500 response"
      }
    },
    "security": [
      {
        "sigv4": []
      }
    ],
    "x-amazon-apigateway-integration": {
      "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
      "responses": {
        "4\\d{2}": {
          "statusCode": "400"
        },
        "default": {
          "statusCode": "200",
          "responseParameters": {
            "method.response.header.Content-Type":
"integration.response.header.Content-Type",
            "method.response.header.Date": "integration.response.header.Date"
          }
        },
        "5\\d{2}": {
          "statusCode": "500"
        }
      },
      "requestParameters": {
        "integration.request.path.bucket": "method.request.path.folder"
      },
      "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "DELETE",
      "type": "aws"
    }
  }
}
```

```
    }
  },
  "/{folder}/{item}": {
    "get": {
      "produces": [
        "application/json"
      ],
      "parameters": [
        {
          "name": "item",
          "in": "path",
          "required": true,
          "type": "string"
        },
        {
          "name": "folder",
          "in": "path",
          "required": true,
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "schema": {
            "$ref": "#/definitions/Empty"
          },
          "headers": {
            "content-type": {
              "type": "string"
            },
            "Content-Type": {
              "type": "string"
            }
          }
        },
        "400": {
          "description": "400 response"
        },
        "500": {
          "description": "500 response"
        }
      },
      "security": [
        {
          "sigv4": []
        }
      ],
      "x-amazon-apigateway-integration": {
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
        "responses": {
          "4\\d{2}": {
            "statusCode": "400"
          },
          "default": {
            "statusCode": "200",
            "responseParameters": {
              "method.response.header.content-type":
"integration.response.header.content-type",
              "method.response.header.Content-Type":
"integration.response.header.Content-Type"
            }
          },
          "5\\d{2}": {
            "statusCode": "500"
          }
        }
      }
    }
  }
}
```

```
    }
  },
  "requestParameters": {
    "integration.request.path.object": "method.request.path.item",
    "integration.request.path.bucket": "method.request.path.folder"
  },
  "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}/{object}",
  "passthroughBehavior": "when_no_match",
  "httpMethod": "GET",
  "type": "aws"
}
},
"head": {
  "produces": [
    "application/json"
  ],
  "parameters": [
    {
      "name": "item",
      "in": "path",
      "required": true,
      "type": "string"
    },
    {
      "name": "folder",
      "in": "path",
      "required": true,
      "type": "string"
    }
  ],
  "responses": {
    "200": {
      "description": "200 response",
      "schema": {
        "$ref": "#/definitions/Empty"
      },
      "headers": {
        "Content-Length": {
          "type": "string"
        },
        "Content-Type": {
          "type": "string"
        }
      }
    },
    "400": {
      "description": "400 response"
    },
    "500": {
      "description": "500 response"
    }
  },
  "security": [
    {
      "sigv4": []
    }
  ],
  "x-amazon-apigateway-integration": {
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "responses": {
      "4\\d{2}": {
        "statusCode": "400"
      },
      "default": {
        "statusCode": "200",
        "responseParameters": {
```

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```
        "method.response.header.Content-Type":  
"integration.response.header.Content-Type",  
        "method.response.header.Content-Length":  
"integration.response.header.Content-Length"  
    }  
    },  
    "5\\d{2}": {  
        "statusCode": "500"  
    }  
    },  
    "requestParameters": {  
        "integration.request.path.object": "method.request.path.item",  
        "integration.request.path.bucket": "method.request.path.folder"  
    },  
    "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}/{object}",  
    "passthroughBehavior": "when_no_match",  
    "httpMethod": "HEAD",  
    "type": "aws"  
    }  
    },  
    "put": {  
        "produces": [  
            "application/json"  
        ],  
        "parameters": [  
            {  
                "name": "Content-Type",  
                "in": "header",  
                "required": false,  
                "type": "string"  
            },  
            {  
                "name": "item",  
                "in": "path",  
                "required": true,  
                "type": "string"  
            },  
            {  
                "name": "folder",  
                "in": "path",  
                "required": true,  
                "type": "string"  
            }  
        ],  
        "responses": {  
            "200": {  
                "description": "200 response",  
                "schema": {  
                    "$ref": "#/definitions/Empty"  
                },  
                "headers": {  
                    "Content-Length": {  
                        "type": "string"  
                    },  
                    "Content-Type": {  
                        "type": "string"  
                    }  
                }  
            },  
            "400": {  
                "description": "400 response"  
            },  
            "500": {  
                "description": "500 response"  
            }  
        }  
    },  
    },
```

```

    "security": [
      {
        "sigv4": []
      }
    ],
    "x-amazon-apigateway-integration": {
      "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
      "responses": {
        "4\\d{2}": {
          "statusCode": "400"
        },
        "default": {
          "statusCode": "200",
          "responseParameters": {
            "method.response.header.Content-Type":
Type"
            "integration.response.header.Content-Type",
            "method.response.header.Content-Length":
            "integration.response.header.Content-Length"
          }
        },
        "5\\d{2}": {
          "statusCode": "500"
        }
      },
      "requestParameters": {
        "integration.request.path.object": "method.request.path.item",
        "integration.request.path.bucket": "method.request.path.folder",
        "integration.request.header.Content-Type": "method.request.header.Content-
Type"
      },
      "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}/{object}",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "PUT",
      "type": "aws"
    }
  },
  "delete": {
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "item",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "name": "folder",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "schema": {
          "$ref": "#/definitions/Empty"
        },
        "headers": {
          "Content-Length": {
            "type": "string"
          },
          "Content-Type": {
            "type": "string"
          }
        }
      }
    }
  }
}

```

```
    }
  },
  "400": {
    "description": "400 response"
  },
  "500": {
    "description": "500 response"
  }
},
"security": [
  {
    "sigv4": []
  }
],
"x-amazon-apigateway-integration": {
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "responses": {
    "4\\d{2}": {
      "statusCode": "400"
    },
    "default": {
      "statusCode": "200"
    },
    "5\\d{2}": {
      "statusCode": "500"
    }
  },
  "requestParameters": {
    "integration.request.path.object": "method.request.path.item",
    "integration.request.path.bucket": "method.request.path.folder"
  },
  "uri": "arn:aws:apigateway:us-west-2:s3:path/{bucket}/{object}",
  "passthroughBehavior": "when_no_match",
  "httpMethod": "DELETE",
  "type": "aws"
}
}
},
"securityDefinitions": {
  "sigv4": {
    "type": "apiKey",
    "name": "Authorization",
    "in": "header",
    "x-amazon-apigateway-authtype": "awsSigv4"
  }
},
"definitions": {
  "Empty": {
    "type": "object",
    "title": "Empty Schema"
  }
}
}
```

## Tutorial: Create a REST API as an Amazon Kinesis proxy in API Gateway

This page describes how to create and configure a REST API with an integration of the AWS type to access Kinesis.

### Note

To integrate your API Gateway API with Kinesis, you must choose a region where both the API Gateway and Kinesis services are available. For region availability, see [Service Endpoints and Quotas](#).

For the purpose of illustration, we create an example API to enable a client to do the following:

1. List the user's available streams in Kinesis
2. Create, describe, or delete a specified stream
3. Read data records from or write data records into the specified stream

To accomplish the preceding tasks, the API exposes methods on various resources to invoke the following, respectively:

1. The `ListStreams` action in Kinesis
2. The `CreateStream`, `DescribeStream`, or `DeleteStream` action
3. The `GetRecords` or `PutRecords` (including `PutRecord`) action in Kinesis

Specifically, we build the API as follows:

- Expose an HTTP GET method on the API's `/streams` resource and integrate the method with the [ListStreams](#) action in Kinesis to list the streams in the caller's account.
- Expose an HTTP POST method on the API's `/streams/{stream-name}` resource and integrate the method with the [CreateStream](#) action in Kinesis to create a named stream in the caller's account.
- Expose an HTTP GET method on the API's `/streams/{stream-name}` resource and integrate the method with the [DescribeStream](#) action in Kinesis to describe a named stream in the caller's account.
- Expose an HTTP DELETE method on the API's `/streams/{stream-name}` resource and integrate the method with the [DeleteStream](#) action in Kinesis to delete a stream in the caller's account.
- Expose an HTTP PUT method on the API's `/streams/{stream-name}/record` resource and integrate the method with the [PutRecord](#) action in Kinesis. This enables the client to add a single data record to the named stream.
- Expose an HTTP PUT method on the API's `/streams/{stream-name}/records` resource and integrate the method with the [PutRecords](#) action in Kinesis. This enables the client to add a list of data records to the named stream.
- Expose an HTTP GET method on the API's `/streams/{stream-name}/records` resource and integrate the method with the [GetRecords](#) action in Kinesis. This enables the client to list data records in the named stream, with a specified shard iterator. A shard iterator specifies the shard position from which to start reading data records sequentially.
- Expose an HTTP GET method on the API's `/streams/{stream-name}/sharditerator` resource and integrate the method with the [GetShardIterator](#) action in Kinesis. This helper method must be supplied to the `ListStreams` action in Kinesis.

You can apply the instructions presented here to other Kinesis actions. For the complete list of the Kinesis actions, see [Amazon Kinesis API Reference](#).

Instead of using the API Gateway console to create the sample API, you can import the sample API into API Gateway using the API Gateway [Import API](#). For information on how to use the Import API, see [Configuring a REST API using OpenAPI \(p. 427\)](#).

If you do not have an Amazon Web Services account, use the following procedure to create one.

### To sign up for Amazon Web Services

1. Open <http://www.amazonaws.cn/> and choose **Sign Up**.

2. Follow the on-screen instructions.

## Create an IAM role and policy for the API to access Kinesis

To allow the API to invoke Kinesis actions, you must have appropriate IAM policies attached to an IAM role. This section explains how to verify and to create, if necessary, the required IAM role and policies.

To enable read-only access to Kinesis, you can use the `AmazonKinesisReadOnlyAccess` policy that allows the `Get*`, `List*`, and `Describe*` actions in Kinesis to be invoked.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "kinesis:Get*",
        "kinesis:List*",
        "kinesis:Describe*"
      ],
      "Resource": "*"
    }
  ]
}
```

This policy is available as an IAM-provisioned managed policy and its ARN is `arn:aws:iam::aws:policy/AmazonKinesisReadOnlyAccess`.

To enable read-write actions in Kinesis, you can use the `AmazonKinesisFullAccess` policy.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:*",
      "Resource": "*"
    }
  ]
}
```

This policy is also available as an IAM-provisioned managed policy. Its ARN is `arn:aws:iam::aws:policy/AmazonKinesisFullAccess`.

After you decide which IAM policy to use, attach it to a new or existing IAM role. Make sure that the API Gateway control service (`apigateway.amazonaws.com`) is a trusted entity of the role and is allowed to assume the execution role (`sts:AssumeRole`).

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
```



```
    "Principal": {  
      "Service": "apigateway.amazonaws.com"  
    },  
    "Action": "sts:AssumeRole"  
  }  
]  
}
```

If you create the execution role in the IAM console and choose the **Amazon API Gateway** role type, this trust policy is automatically attached.

Note the ARN of the execution role. You will need it when creating an API method and setting up its integration request.

## Start to create an API as a Kinesis proxy

Use the following steps to create the API in the API Gateway console.

### To create an API as an Amazon service proxy for Kinesis

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

3. Choose **New API**.
4. In **API name**, enter **KinesisProxy**. Leave the default values in the other fields.
5. Enter a description in **Description**, if you like.
6. Choose **Create API**.

After the API is created, the API Gateway console displays the **Resources** page, which contains only the API's root (/) resource.

## List streams in Kinesis

Kinesis supports the `ListStreams` action with the following REST API call:

```
POST /?Action=ListStreams HTTP/1.1  
Host: kinesis.<region>.<domain>  
Content-Length: <PayloadSizeBytes>  
User-Agent: <UserAgentString>  
Content-Type: application/x-amz-json-1.1  
Authorization: <AuthParams>  
X-Amz-Date: <Date>  
  
{  
  ...  
}
```

In the above REST API request, the action is specified in the `Action` query parameter. Alternatively, you can specify the action in a `X-Amz-Target` header, instead:

```
POST / HTTP/1.1  
Host: kinesis.<region>.<domain>
```

```
Content-Length: <PayloadSizeBytes>
User-Agent: <UserAgentString>
Content-Type: application/x-amz-json-1.1
Authorization: <AuthParams>
X-Amz-Date: <Date>
X-Amz-Target: Kinesis_20131202.ListStreams
{
  ...
}
```

In this tutorial, we use the query parameter to specify action.

To expose a Kinesis action in the API, add a `/streams` resource to the API's root. Then set a `GET` method on the resource and integrate the method with the `ListStreams` action of Kinesis.

The following procedure describes how to list Kinesis streams by using the API Gateway console.

### To list Kinesis streams by using the API Gateway console

1. Select the API root resource. In **Actions**, choose **Create Resource**.  
  
In **Resource Name**, type `Streams`, leave **Resource Path** and other fields as the default, and choose **Create Resource**.
2. Choose the `/Streams` resource. From **Actions**, choose **Create Method**, choose **GET** from the list, and then choose the check mark icon to finish creating the method.

#### Note

The HTTP verb for a method invoked by a client may differ from the HTTP verb for an integration required by the backend. We chose `GET` here, because listing streams is intuitively a `READ` operation.

3. In the method's **Setup** pane, choose **Amazon Service**.
  - a. For **Amazon Region**, choose a region (e.g., `us-east-1`).
  - b. For **Amazon Service**, choose **Kinesis**.
  - c. Leave **Amazon Subdomain** blank.
  - d. For **HTTP method**, choose **POST**.

#### Note

We chose `POST` here because Kinesis requires that the `ListStreams` action be invoked with it.

- e. For **Action Type**, choose **Use action name**.
  - f. For **Action**, type `ListStreams`.
  - g. For **Execution role**, type the ARN for your execution role.
  - h. Leave the default of **Passthrough** for **Content Handling**.
  - i. Choose **Save** to finish the initial setup of the method.
4. Still in the **Integration Request** pane, expand the **HTTP Headers** section:
    - a. Choose **Add header**.
    - b. In the **Name** column, type `Content-Type`.
    - c. In the **Mapped from** column, type `'application/x-amz-json-1.1'`.
    - d. Choose the check mark icon to save the setting.

We used a request parameter mapping to set the `Content-Type` header to the static value of `'application/x-amz-json-1.1'` to inform Kinesis that the input is of a specific version of JSON.

5. Expand the **Mapping Templates** section:
  - a. Choose **Add mapping template**.
  - b. For **Content-Type**, type `application/json`.
  - c. Choose the check mark icon to save the **Content-Type** setting. Choose **Yes, secure this integration in Change passthrough behavior**.
  - d. Type `{ }` in the template editor.
  - e. Choose the **Save** button to save the mapping template.

The `ListStreams` request takes a payload of the following JSON format:

```
{
  "ExclusiveStartStreamName": "string",
  "Limit": number
}
```

However, the properties are optional. To use the default values, we opted for an empty JSON payload here.

6. Test the GET method on the Streams resource to invoke the `ListStreams` action in Kinesis:

From the API Gateway console, select the `/streams/GET` entry from the **Resources** pane, choose the **Test** invocation option, and then choose **Test**.

If you already created two streams named "myStream" and "yourStream" in Kinesis, the successful test returns a 200 OK response containing the following payload:

```
{
  "HasMoreStreams": false,
  "StreamNames": [
    "myStream",
    "yourStream"
  ]
}
```

## Create, describe, and delete a stream in Kinesis

Creating, describing, and deleting a stream in Kinesis involves making the following Kinesis REST API requests, respectively:

```
POST /?Action=CreateStream HTTP/1.1
Host: kinesis.region.domain
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "ShardCount": number,
  "StreamName": "string"
}
```

```
POST /?Action=DescribeStream HTTP/1.1
Host: kinesis.region.domain
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "StreamName": "string"
}
```

```
POST /?Action>DeleteStream HTTP/1.1
Host: kinesis.region.domain
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "StreamName": "string"
}
```

We can build the API to accept the required input as a JSON payload of the method request and pass the payload through to the integration request. However, to provide more examples of data mapping between method and integration requests, and method and integration responses, we create our API somewhat differently.

We expose the GET, POST, and Delete HTTP methods on a to-be-named Stream resource. We use the {stream-name} path variable as the placeholder of the stream resource and integrate these API methods with the Kinesis' DescribeStream, CreateStream, and DeleteStream actions, respectively. We require that the client pass other input data as headers, query parameters, or the payload of a method request. We provide mapping templates to transform the data to the required integration request payload.

### To configure and test the GET method on a stream resource

1. Create a child resource with the {stream-name} path variable under the previously created /streams resource.
2. Add the POST, GET, and DELETE HTTP verbs to this resource.

After the methods are created on the resource, the structure of the API looks like the following:

3. Set up the GET /streams/{stream-name} method to call the POST /?Action=DescribeStream action in Kinesis, as shown in the following.
4. Add the following Content-Type header mapping to the integration request:

```
Content-Type: 'x-amz-json-1.1'
```

The task follows the same procedure to set up the request parameter mapping for the GET /streams method.

5. Add the following body mapping template to map data from the GET /streams/{stream-name} method request to the POST /?Action=DescribeStream integration request:

```
{
```

```
"StreamName": "$input.params('stream-name')"  
}
```

This mapping template generates the required integration request payload for the `DescribeStream` action of Kinesis from the method request's `stream-name` path parameter value.

6. Test the `GET /stream/{stream-name}` method to invoke the `DescribeStream` action in Kinesis:

From the API Gateway console, select `/streams/{stream-name}/GET` in the **Resources** pane, choose **Test** to start testing, type the name of an existing Kinesis stream in the **Path** field for `stream-name`, and choose **Test**. If the test is successful, a 200 OK response is returned with a payload similar to the following:

```
{  
  "StreamDescription": {  
    "HasMoreShards": false,  
    "RetentionPeriodHours": 24,  
    "Shards": [  
      {  
        "HashKeyRange": {  
          "EndingHashKey": "68056473384187692692674921486353642290",  
          "StartingHashKey": "0"  
        },  
        "SequenceNumberRange": {  
          "StartingSequenceNumber":  
"49559266461454070523309915164834022007924120923395850242"  
        },  
        "ShardId": "shardId-000000000000"  
      },  
      ...  
      {  
        "HashKeyRange": {  
          "EndingHashKey": "340282366920938463463374607431768211455",  
          "StartingHashKey": "272225893536750770770699685945414569164"  
        },  
        "SequenceNumberRange": {  
          "StartingSequenceNumber":  
"49559266461543273504104037657400164881014714369419771970"  
        },  
        "ShardId": "shardId-000000000004"  
      }  
    ],  
    "StreamARN": "arn:aws:kinesis:us-east-1:12345678901:stream/myStream",  
    "StreamName": "myStream",  
    "StreamStatus": "ACTIVE"  
  }  
}
```

After you deploy the API, you can make a REST request against this API method:

```
GET https://your-api-id.execute-api.region.amazonaws.com/stage/streams/myStream  
HTTP/1.1  
Host: your-api-id.execute-api.region.amazonaws.com  
Content-Type: application/json  
Authorization: ...  
X-Amz-Date: 20160323T194451Z
```

### To configure and test the POST method on a stream resource

1. Set up the `POST /streams/{stream-name}` method to call `POST /?Action=CreateStream` action in Kinesis. The task follows the same procedure to set up the `GET /streams/{stream-name}` method provided that you replace the `DescribeStream` action by `CreateStream`.
2. Add the following `Content-Type` header mapping to the integration request:

```
Content-Type: 'x-amz-json-1.1'
```

The task follows the same procedure to set up the request parameter mapping for the `GET /streams` method.

3. Add the following body mapping template to map data from the `POST /streams/{stream-name}` method request to the `POST /?Action=CreateStream` integration request:

```
{
  "ShardCount": #if($input.path('$.ShardCount') == '') 5 #else
  $input.path('$.ShardCount') #end,
  "StreamName": "$input.params('stream-name')"
}
```

In the preceding mapping template, we set `ShardCount` to a fixed value of 5 if the client does not specify a value in the method request payload.

4. Test the `POST /streams/{stream-name}` method to create a named stream in Kinesis:

From the API Gateway console, select `/streams/{stream-name}/POST` in the **Resources** pane, choose **Test** to start testing, enter the name of a new Kinesis stream in **Path** for `stream-name`, and choose **Test**. If the test is successful, a 200 OK response is returned with no data.

After you deploy the API, you can also make a REST API request against the `POST` method on a Stream resource to invoke the `CreateStream` action in Kinesis:

```
POST https://your-api-id.execute-api.region.amazonaws.com/stage/streams/yourStream
HTTP/1.1
Host: your-api-id.execute-api.region.amazonaws.com
Content-Type: application/json
Authorization: ...
X-Amz-Date: 20160323T194451Z

{
  "ShardCount": 5
}
```

### Configure and test the DELETE method on a stream resource

1. Set up the `DELETE /streams/{stream-name}` method to integrate with the `POST /?Action>DeleteStream` action in Kinesis. The task follows the same procedure to set up the `GET /streams/{stream-name}` method provided that you replace the `DescribeStream` action by `DeleteStream`.
2. Add the following `Content-Type` header mapping to the integration request:

```
Content-Type: 'x-amz-json-1.1'
```

The task follows the same procedure to set up the request parameter mapping for the `GET /streams` method.

3. Add the following body mapping template to map data from the `DELETE /streams/{stream-name}` method request to the corresponding integration request of `POST /?Action=DeleteStream`:

```
{
  "StreamName": "$input.params('stream-name')"
}
```

This mapping template generates the required input for the `DELETE /streams/{stream-name}` action from the client-supplied URL path name of `stream-name`.

4. Test the `DELETE` method to delete a named stream in Kinesis:

From the API Gateway console, select the `/streams/{stream-name}/DELETE` method node in the **Resources** pane, choose **Test** to start testing, type the name of an existing Kinesis stream in **Path** for `stream-name`, and choose **Test**. If the test is successful, a 200 OK response is returned with no data.

After you deploy the API, you can also make the following REST API request against the `DELETE` method on the Stream resource to call the `DeleteStream` action in Kinesis:

```
DELETE https://your-api-id.execute-api.region.amazonaws.com/stage/streams/yourStream
HTTP/1.1
Host: your-api-id.execute-api.region.amazonaws.com
Content-Type: application/json
Authorization: ...
X-Amz-Date: 20160323T194451Z

{}
```

## Get records from and add records to a stream in Kinesis

After you create a stream in Kinesis, you can add data records to the stream and read the data from the stream. Adding data records involves calling the [PutRecords](#) or [PutRecord](#) action in Kinesis. The former adds multiple records whereas the latter adds a single record to the stream.

```
POST /?Action=PutRecords HTTP/1.1
Host: kinesis.region.domain
Authorization: AWS4-HMAC-SHA256 Credential=..., ...
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "Records": [
    {
      "Data": blob,
      "ExplicitHashKey": "string",
      "PartitionKey": "string"
    }
  ],
  "StreamName": "string"
}
```

or

```
POST /?Action=PutRecord HTTP/1.1
Host: kinesis.region.domain
Authorization: AWS4-HMAC-SHA256 Credential=..., ...
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "Data": blob,
  "ExplicitHashKey": "string",
  "PartitionKey": "string",
  "SequenceNumberForOrdering": "string",
  "StreamName": "string"
}
```

Here, `StreamName` identifies the target stream to add records. `StreamName`, `Data`, and `PartitionKey` are required input data. In our example, we use the default values for all of the optional input data and will not explicitly specify values for them in the input to the method request.

Reading data in Kinesis amounts to calling the [GetRecords](#) action:

```
POST /?Action=GetRecords HTTP/1.1
Host: kinesis.region.domain
Authorization: AWS4-HMAC-SHA256 Credential=..., ...
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "ShardIterator": "string",
  "Limit": number
}
```

Here, the source stream from which we are getting records is specified in the required `ShardIterator` value, as is shown in the following Kinesis action to obtain a shard iterator:

```
POST /?Action=GetShardIterator HTTP/1.1
Host: kinesis.region.domain
Authorization: AWS4-HMAC-SHA256 Credential=..., ...
...
Content-Type: application/x-amz-json-1.1
Content-Length: PayloadSizeBytes

{
  "ShardId": "string",
  "ShardIteratorType": "string",
  "StartingSequenceNumber": "string",
  "StreamName": "string"
}
```

For the `GetRecords` and `PutRecords` actions, we expose the `GET` and `PUT` methods, respectively, on a `/records` resource that is appended to a named stream resource (`/{stream-name}`). Similarly, we expose the `PutRecord` action as a `PUT` method on a `/record` resource.



Because the `GetRecords` action takes as input a `ShardIterator` value, which is obtained by calling the `GetShardIterator` helper action, we expose a `GET` helper method on a `ShardIterator` resource (`/sharditerator`).

The following figure shows the API structure of resources after the methods are created:

The following four procedures describe how to set up each of the methods, how to map data from the method requests to the integration requests, and how to test the methods.

**To set up and test the `PUT /streams/{stream-name}/record` method to invoke `PutRecord` in Kinesis:**

1. Set up the `PUT` method, as shown in the following:
2. Add the following request parameter mapping to set the `Content-Type` header to an Amazon-compliant version of JSON in the integration request:

```
Content-Type: 'x-amz-json-1.1'
```

The task follows the same procedure to set up the request parameter mapping for the `GET /streams` method.

3. Add the following body mapping template to map data from the `PUT /streams/{stream-name}/record` method request to the corresponding integration request of `POST /?Action=PutRecord`:

```
{
  "StreamName": "$input.params('stream-name')",
  "Data": "$util.base64Encode($input.json('$.Data'))",
  "PartitionKey": "$input.path('$.PartitionKey')"
}
```

This mapping template assumes that the method request payload is of the following format:

```
{
  "Data": "some data",
  "PartitionKey": "some key"
}
```

This data can be modeled by the following JSON schema:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PutRecord proxy single-record payload",
  "type": "object",
  "properties": {
    "Data": { "type": "string" },
    "PartitionKey": { "type": "string" }
  }
}
```

You can create a model to include this schema and use the model to facilitate generating the mapping template. However, you can generate a mapping template without using any model.

4. To test the `PUT /streams/{stream-name}/record` method, set the `stream-name` path variable to the name of an existing stream, supply a payload of the required format, and then submit the method request. The successful result is a `200 OK` response with a payload of the following format:

```
{
  "SequenceNumber": "49559409944537880850133345460169886593573102115167928386",
  "ShardId": "shardId-000000000004"
}
```

### To set up and test the `PUT /streams/{stream-name}/records` method to invoke `PutRecords` in Kinesis

1. Set up the `PUT /streams/{stream-name}/records` method, as shown in the following:
2. Add the following request parameter mapping to set the `Content-Type` header to an Amazon-compliant version of JSON in the integration request:

```
Content-Type: 'x-amz-json-1.1'
```

The task follows the same procedure to set up the request parameter mapping for the `GET /streams` method.

3. Add the following body mapping template to map data from the `PUT /streams/{stream-name}/records` method request to the corresponding integration request of `POST /?Action=PutRecords`:

```
{
  "StreamName": "$input.params('stream-name')",
  "Records": [
    #foreach($elem in $input.path('$.records'))
    {
      "Data": "$util.base64Encode($elem.data)",
      "PartitionKey": "$elem.partition-key"
    }#if($foreach.hasNext),#end
    #end
  ]
}
```

This mapping template assumes that the method request payload can be modelled by the following JSON schema:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PutRecords proxy payload data",
  "type": "object",
  "properties": {
    "records": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "data": { "type": "string" },
          "partition-key": { "type": "string" }
        }
      }
    }
  }
}
```

You can create a model to include this schema and use the model to facilitate generating the mapping template. However, you can generate a mapping template without using any model.

In this tutorial, we used two slightly different payload formats to illustrate that an API developer can choose to expose the backend data format to the client or hide it from the client. One format is for the `PUT /streams/{stream-name}/records` method (above). Another format is used for the `PUT /streams/{stream-name}/record` method (in the previous procedure). In production environment, you should keep both formats consistent.

4. To test the `PUT /streams/{stream-name}/records` method, set the `stream-name` path variable to an existing stream, supply the following payload, and submit the method request.

```
{
  "records": [
    {
      "data": "some data",
      "partition-key": "some key"
    },
    {
      "data": "some other data",
      "partition-key": "some key"
    }
  ]
}
```

The successful result is a 200 OK response with a payload similar to the following output:

```
{
  "FailedRecordCount": 0,
  "Records": [
    {
      "SequenceNumber": "49559409944537880850133345460167468741933742152373764162",
      "ShardId": "shardId-000000000004"
    },
    {
      "SequenceNumber": "49559409944537880850133345460168677667753356781548470338",
      "ShardId": "shardId-000000000004"
    }
  ]
}
```

### To set up and test the `GET /streams/{stream-name}/sharditerator` method invoke `GetShardIterator` in Kinesis

The `GET /streams/{stream-name}/sharditerator` method is a helper method to acquire a required shard iterator before calling the `GET /streams/{stream-name}/records` method.

1. Set up integration for the `GET /streams/{stream-name}/sharditerator` method, as shown in the following:
2. The `GetShardIterator` action requires an input of a `ShardId` value. To pass a client-supplied `ShardId` value, we add a `shard-id` query parameter to the method request, as shown in the following:

In the following body-mapping template, we set the `shard-id` query parameter value to the `ShardId` property value of the JSON payload as the input to the `GetShardIterator` action in Kinesis.

3. Configure the body mapping template to generate the required input (`ShardId` and `StreamName`) to the `GetShardIterator` action from the `shard-id` and `stream-name` parameters of the method request. In addition, the mapping template also sets `ShardIteratorType` to `TRIM_HORIZON` as a default.

```
{
  "ShardId": "$input.params('shard-id')",
  "ShardIteratorType": "TRIM_HORIZON",
  "StreamName": "$input.params('stream-name')"
}
```

4. Using the **Test** option in the API Gateway console, enter an existing stream name as the `stream-name Path` variable value, set the `shard-id Query string` to an existing `ShardId` value (e.g., `shard-000000000004`), and choose **Test**.

The successful response payload is similar to the following output:

```
{
  "ShardIterator": "AAAAAAAAAFYVN3VlFy..."
}
```

Make note of the `ShardIterator` value. You need it to get records from a stream.

### To configure and test the `GET /streams/{stream-name}/records` method to invoke the `GetRecords` action in Kinesis

1. Set up the `GET /streams/{stream-name}/records` method, as shown in the following:
2. The `GetRecords` action requires an input of a `ShardIterator` value. To pass a client-supplied `ShardIterator` value, we add a `Shard-Iterator` header parameter to the method request, as shown in the following:
3. Set up the following mapping template to map the `Shard-Iterator` header parameter value to the `ShardIterator` property value of the JSON payload for the `GetRecords` action in Kinesis.

```
{
  "ShardIterator": "$input.params('Shard-Iterator')"
}
```

4. Using the **Test** option in the API Gateway console, type an existing stream name as the `stream-name Path` variable value, set the `Shard-Iterator Header` to the `ShardIterator` value obtained from the test run of the `GET /streams/{stream-name}/sharditerator` method (above), and choose **Test**.

The successful response payload is similar to the following output:

```
{
  "MillisBehindLatest": 0,
  "NextShardIterator": "AAAAAAAAAF...",
  "Records": [ ... ]
}
```

## OpenAPI definitions of a sample API as a Kinesis proxy

Following are OpenAPI definitions for the sample API as a Kinesis proxy used in this tutorial.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "title": "KinesisProxy",
    "version": "2016-03-31T18:25:32Z"
  },
  "paths": {
    "/streams/{stream-name}/sharditerator": {
      "get": {
        "parameters": [
          {
            "name": "stream-name",
            "in": "path",
            "required": true,
            "schema": {
              "type": "string"
            }
          },
          {
            "name": "shard-id",
            "in": "query",
            "schema": {
              "type": "string"
            }
          }
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/Empty"
                }
              }
            }
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "type": "aws",
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
        "uri": "arn:aws:apigateway:us-east-1:kinesis:action/GetShardIterator",
        "responses": {
          "default": {
            "statusCode": "200"
          }
        },
        "requestParameters": {
          "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
        },
        "requestTemplates": {
          "application/json": "{\n  \"ShardId\": \"${input.params('shard-id')}\",\n  \"ShardIteratorType\": \"TRIM_HORIZON\",\n  \"StreamName\": \"${input.params('stream-name')}\",\n}"
        },
        "passthroughBehavior": "when_no_match",
        "httpMethod": "POST"
      }
    }
  }
}
```

```
    }
  },
  "/streams/{stream-name}/records": {
    "get": {
      "parameters": [
        {
          "name": "stream-name",
          "in": "path",
          "required": true,
          "schema": {
            "type": "string"
          }
        },
        {
          "name": "Shard-Iterator",
          "in": "header",
          "schema": {
            "type": "string"
          }
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/Empty"
              }
            }
          }
        }
      }
    },
    "x-amazon-apigateway-integration": {
      "type": "aws",
      "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
      "uri": "arn:aws:apigateway:us-east-1:kinesis:action/GetRecords",
      "responses": {
        "default": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
      },
      "requestTemplates": {
        "application/json": "{\n  \n  \"ShardIterator\": \"\${input.params('Shard-Iterator')}\n\n}"
      },
      "passthroughBehavior": "when_no_match",
      "httpMethod": "POST"
    }
  },
  "put": {
    "parameters": [
      {
        "name": "Content-Type",
        "in": "header",
        "schema": {
          "type": "string"
        }
      },
      {
        "name": "stream-name",
        "in": "path",
        "required": true,

```

```

        "schema": {
          "type": "string"
        }
      ],
      "requestBody": {
        "content": {
          "application/json": {
            "schema": {
              "$ref": "#/components/schemas/PutRecordsMethodRequestPayload"
            }
          },
          "application/x-amz-json-1.1": {
            "schema": {
              "$ref": "#/components/schemas/PutRecordsMethodRequestPayload"
            }
          }
        },
        "required": true
      },
      "responses": {
        "200": {
          "description": "200 response",
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/Empty"
              }
            }
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "type": "aws",
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
        "uri": "arn:aws:apigateway:us-east-1:kinesis:action/PutRecords",
        "responses": {
          "default": {
            "statusCode": "200"
          }
        },
        "requestParameters": {
          "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
        },
        "requestTemplates": {
          "application/json": "{\n  \n  \"StreamName\": \"\${input.params('stream-
name')}\",\n  \n  \"Records\": [\n    {\n      \n      \"Data\":
\n    \n    \n    \"$util.base64Encode($elem.data)\",\n    \n    \n    \"PartitionKey\": \"\${elem.partition-
key}\",\n    \n    \n    }#if($foreach.hasNext),#end\n  ]\n}",
          "application/x-amz-json-1.1": "{\n  \n  \"StreamName\":
\n  \n  \"\${input.params('stream-name')}\",\n  \n  \"records\": [\n    {\n      \n      \"Data
\n    \n    \n    : \"\${elem.data}\",\n    \n    \n    \"PartitionKey\" : \"\${elem.partition-key}\",\n
\n    \n    }#if($foreach.hasNext),#end\n  ]\n}"
        },
        "passthroughBehavior": "when_no_match",
        "httpMethod": "POST"
      }
    }
  },
  "/streams/{stream-name}": {
    "get": {
      "parameters": [
        {
          "name": "stream-name",
          "in": "path",
          "required": true,

```

```
        "schema": {
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/Empty"
              }
            }
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "type": "aws",
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
        "uri": "arn:aws:apigateway:us-east-1:kinesis:action/DescribeStream",
        "responses": {
          "default": {
            "statusCode": "200"
          }
        },
        "requestTemplates": {
          "application/json": "{\n  \"StreamName\": \"\${input.params('stream-
name')}\">\n}"
        },
        "passthroughBehavior": "when_no_match",
        "httpMethod": "POST"
      }
    },
    "post": {
      "parameters": [
        {
          "name": "stream-name",
          "in": "path",
          "required": true,
          "schema": {
            "type": "string"
          }
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "content": {
            "application/json": {
              "schema": {
                "$ref": "#/components/schemas/Empty"
              }
            }
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "type": "aws",
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
        "uri": "arn:aws:apigateway:us-east-1:kinesis:action/CreateStream",
        "responses": {
          "default": {
            "statusCode": "200"
          }
        }
      }
    }
  },
}
```



```
    "requestParameters": {
      "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
      "application/json": "{\n  \\"ShardCount\": 5,\n  \\"StreamName\":\n  \\"$input.params('stream-name')\\"\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  }
},
"delete": {
  "parameters": [
    {
      "name": "stream-name",
      "in": "path",
      "required": true,
      "schema": {
        "type": "string"
      }
    }
  ],
  "responses": {
    "200": {
      "description": "200 response",
      "headers": {
        "Content-Type": {
          "schema": {
            "type": "string"
          }
        }
      },
      "content": {
        "application/json": {
          "schema": {
            "$ref": "#/components/schemas/Empty"
          }
        }
      }
    },
    "400": {
      "description": "400 response",
      "headers": {
        "Content-Type": {
          "schema": {
            "type": "string"
          }
        }
      },
      "content": {}
    },
    "500": {
      "description": "500 response",
      "headers": {
        "Content-Type": {
          "schema": {
            "type": "string"
          }
        }
      },
      "content": {}
    }
  },
  "x-amazon-apigateway-integration": {
    "type": "aws",
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
```

```
    "uri": "arn:aws:apigateway:us-east-1:kinesis:action/DeleteStream",
    "responses": {
      "4\d{2}": {
        "statusCode": "400",
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      },
      "default": {
        "statusCode": "200",
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      },
      "5\d{2}": {
        "statusCode": "500",
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      }
    },
    "requestParameters": {
      "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
      "application/json": "{\n  \n  \"StreamName\": \"\${input.params('stream-
name')}\">\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  }
},
"/streams/{stream-name}/record": {
  "put": {
    "parameters": [
      {
        "name": "stream-name",
        "in": "path",
        "required": true,
        "schema": {
          "type": "string"
        }
      }
    ]
  },
  "responses": {
    "200": {
      "description": "200 response",
      "content": {
        "application/json": {
          "schema": {
            "$ref": "#/components/schemas/Empty"
          }
        }
      }
    }
  }
},
"x-amazon-apigateway-integration": {
  "type": "aws",
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "uri": "arn:aws:apigateway:us-east-1:kinesis:action/PutRecord",
  "responses": {
    "default": {
```

```

        "statusCode": "200"
      }
    },
    "requestParameters": {
      "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
      "application/json": "{\n  \"StreamName\": \"\${input.params('stream-
name')}\",\n  \"Data\": \"\${util.base64Encode($input.json('$.Data'))}\",\n
  \"PartitionKey\": \"\${input.path('$.PartitionKey')}\",\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  }
}
},
"/streams": {
  "get": {
    "responses": {
      "200": {
        "description": "200 response",
        "content": {
          "application/json": {
            "schema": {
              "$ref": "#/components/schemas/Empty"
            }
          }
        }
      }
    }
  },
  "x-amazon-apigateway-integration": {
    "type": "aws",
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "uri": "arn:aws:apigateway:us-east-1:kinesis:action/ListStreams",
    "responses": {
      "default": {
        "statusCode": "200"
      }
    },
    "requestParameters": {
      "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
      "application/json": "{\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  }
}
},
"components": {
  "schemas": {
    "Empty": {
      "type": "object"
    },
    "PutRecordsMethodRequestPayload": {
      "type": "object",
      "properties": {
        "records": {
          "type": "array",
          "items": {
            "type": "object",
            "properties": {
              "data": {
                "type": "string"
              }
            }
          }
        }
      }
    }
  }
}
}

```

```
    },  
    "partition-key": {  
      "type": "string"  
    }  
  }  
}  
}  
}  
}  
}  
}  
}
```

## OpenAPI 2.0

```
{  
  "swagger": "2.0",  
  "info": {  
    "version": "2016-03-31T18:25:32Z",  
    "title": "KinesisProxy"  
  },  
  "basePath": "/test",  
  "schemes": [  
    "https"  
  ],  
  "paths": {  
    "/streams": {  
      "get": {  
        "consumes": [  
          "application/json"  
        ],  
        "produces": [  
          "application/json"  
        ],  
        "responses": {  
          "200": {  
            "description": "200 response",  
            "schema": {  
              "$ref": "#/definitions/Empty"  
            }  
          }  
        }  
      },  
      "x-amazon-apigateway-integration": {  
        "type": "aws",  
        "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",  
        "uri": "arn:aws:apigateway:us-east-1:kinesis:action/ListStreams",  
        "responses": {  
          "default": {  
            "statusCode": "200"  
          }  
        },  
        "requestParameters": {  
          "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"  
        },  
        "requestTemplates": {  
          "application/json": "{\n}"  
        },  
        "passthroughBehavior": "when_no_match",  
        "httpMethod": "POST"  
      }  
    },  
    "/streams/{stream-name}": {  
      "get": {  
        "consumes": [  

```

```
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "parameters": [
    {
      "name": "stream-name",
      "in": "path",
      "required": true,
      "type": "string"
    }
  ],
  "responses": {
    "200": {
      "description": "200 response",
      "schema": {
        "$ref": "#/definitions/Empty"
      }
    }
  },
  "x-amazon-apigateway-integration": {
    "type": "aws",
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "uri": "arn:aws:apigateway:us-east-1:kinesis:action/DescribeStream",
    "responses": {
      "default": {
        "statusCode": "200"
      }
    },
    "requestTemplates": {
      "application/json": "{\n  \"StreamName\": \"${input.params('stream-
name')}\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  },
  "post": {
    "consumes": [
      "application/json"
    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
    {
      "name": "stream-name",
      "in": "path",
      "required": true,
      "type": "string"
    }
  ],
  "responses": {
    "200": {
      "description": "200 response",
      "schema": {
        "$ref": "#/definitions/Empty"
      }
    }
  },
  "x-amazon-apigateway-integration": {
    "type": "aws",
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "uri": "arn:aws:apigateway:us-east-1:kinesis:action/CreateStream",
    "responses": {
```

```
        "default": {
            "statusCode": "200"
        }
    },
    "requestParameters": {
        "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
        "application/json": "{\n    \ \"ShardCount\": 5,\n    \ \"StreamName\":\n    \ \"$input.params('stream-name')\"\n    \ }"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
}
},
"delete": {
    "consumes": [
        "application/json"
    ],
    "produces": [
        "application/json"
    ],
    "parameters": [
        {
            "name": "stream-name",
            "in": "path",
            "required": true,
            "type": "string"
        }
    ],
    "responses": {
        "200": {
            "description": "200 response",
            "schema": {
                "$ref": "#/definitions/Empty"
            },
            "headers": {
                "Content-Type": {
                    "type": "string"
                }
            }
        },
        "400": {
            "description": "400 response",
            "headers": {
                "Content-Type": {
                    "type": "string"
                }
            }
        },
        "500": {
            "description": "500 response",
            "headers": {
                "Content-Type": {
                    "type": "string"
                }
            }
        }
    }
},
"x-amazon-apigateway-integration": {
    "type": "aws",
    "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
    "uri": "arn:aws:apigateway:us-east-1:kinesis:action/DeleteStream",
    "responses": {
        "4\d{2}": {
            "statusCode": "400",
```

```
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      },
      "default": {
        "statusCode": "200",
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      },
      "5\d{2}": {
        "statusCode": "500",
        "responseParameters": {
          "method.response.header.Content-Type":
"integration.response.header.Content-Type"
        }
      }
    },
    "requestParameters": {
      "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
      "application/json": "{\n  \n  \"StreamName\": \"\${input.params('stream-
name')}\n\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
  }
},
"/streams/{stream-name}/record": {
  "put": {
    "consumes": [
      "application/json"
    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "stream-name",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ]
  },
  "responses": {
    "200": {
      "description": "200 response",
      "schema": {
        "$ref": "#/definitions/Empty"
      }
    }
  }
},
"x-amazon-apigateway-integration": {
  "type": "aws",
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "uri": "arn:aws:apigateway:us-east-1:kinesis:action/PutRecord",
  "responses": {
    "default": {
      "statusCode": "200"
    }
  }
},
"requestParameters": {
```

```
        "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
    },
    "requestTemplates": {
        "application/json": "{\n    \"StreamName\": \"\${input.params('stream-
name')}\",\n    \"Data\": \"\${util.base64Encode($input.json('$$.Data'))}\",\n
    \"PartitionKey\": \"\${input.path('$$.PartitionKey')}\",\n}"
    },
    "passthroughBehavior": "when_no_match",
    "httpMethod": "POST"
}
},
"/streams/{stream-name}/records": {
    "get": {
        "consumes": [
            "application/json"
        ],
        "produces": [
            "application/json"
        ],
        "parameters": [
            {
                "name": "stream-name",
                "in": "path",
                "required": true,
                "type": "string"
            },
            {
                "name": "Shard-Iterator",
                "in": "header",
                "required": false,
                "type": "string"
            }
        ],
        "responses": {
            "200": {
                "description": "200 response",
                "schema": {
                    "$ref": "#/definitions/Empty"
                }
            }
        },
        "x-amazon-apigateway-integration": {
            "type": "aws",
            "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
            "uri": "arn:aws:apigateway:us-east-1:kinesis:action/GetRecords",
            "responses": {
                "default": {
                    "statusCode": "200"
                }
            },
            "requestParameters": {
                "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
            },
            "requestTemplates": {
                "application/json": "{\n    \"ShardIterator\": \"\${input.params('Shard-
Iterator')}\",\n}"
            },
            "passthroughBehavior": "when_no_match",
            "httpMethod": "POST"
        }
    },
    "put": {
        "consumes": [
            "application/json",
            "application/x-amz-json-1.1"
        ],

```



```

    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "Content-Type",
        "in": "header",
        "required": false,
        "type": "string"
      },
      {
        "name": "stream-name",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "in": "body",
        "name": "PutRecordsMethodRequestPayload",
        "required": true,
        "schema": {
          "$ref": "#/definitions/PutRecordsMethodRequestPayload"
        }
      },
      {
        "in": "body",
        "name": "PutRecordsMethodRequestPayload",
        "required": true,
        "schema": {
          "$ref": "#/definitions/PutRecordsMethodRequestPayload"
        }
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "schema": {
          "$ref": "#/definitions/Empty"
        }
      }
    },
    "x-amazon-apigateway-integration": {
      "type": "aws",
      "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
      "uri": "arn:aws:apigateway:us-east-1:kinesis:action/PutRecords",
      "responses": {
        "default": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
      },
      "requestTemplates": {
        "application/json": "{\n  \"StreamName\": \"\${input.params('stream-name')}\",\n  \"Records\": [\n    {\n      \"Data\": \"\${util.base64Encode($elem.data)}\", \n      \"PartitionKey\": \"\${elem.partition-key}\"\n    }#if($foreach.hasNext),#end\n  ]\n}",
        "application/x-amz-json-1.1": "{\n  \"StreamName\": \"\${input.params('stream-name')}\",\n  \"records\": [\n    {\n      \"Data\": \"\${elem.data}\",\n      \"PartitionKey\": \"\${elem.partition-key}\"\n    }#if($foreach.hasNext),#end\n  ]\n}"
      },
      "passthroughBehavior": "when_no_match",
      "httpMethod": "POST"
    }
  }
}

```

```
    }
  },
  "/streams/{stream-name}/sharditerator": {
    "get": {
      "consumes": [
        "application/json"
      ],
      "produces": [
        "application/json"
      ],
      "parameters": [
        {
          "name": "stream-name",
          "in": "path",
          "required": true,
          "type": "string"
        },
        {
          "name": "shard-id",
          "in": "query",
          "required": false,
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "schema": {
            "$ref": "#/definitions/Empty"
          }
        }
      }
    },
    "x-amazon-apigateway-integration": {
      "type": "aws",
      "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
      "uri": "arn:aws:apigateway:us-east-1:kinesis:action/GetShardIterator",
      "responses": {
        "default": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.header.Content-Type": "'application/x-amz-json-1.1'"
      },
      "requestTemplates": {
        "application/json": "{\n  \"ShardId\": \"${input.params('shard-id')}\",\n  \"ShardIteratorType\": \"TRIM_HORIZON\",\n  \"StreamName\": \"${input.params('stream-name')}\",\n}"
      },
      "passthroughBehavior": "when_no_match",
      "httpMethod": "POST"
    }
  }
},
"definitions": {
  "Empty": {
    "type": "object"
  },
  "PutRecordsMethodRequestPayload": {
    "type": "object",
    "properties": {
      "records": {
        "type": "array",
        "items": {

```

```
    "type": "object",
    "properties": {
      "data": {
        "type": "string"
      },
      "partition-key": {
        "type": "string"
      }
    }
  }
}
}
```

## Tutorial: Building a private REST API

In this tutorial, you create a private REST API. Clients can access the API only from within your Amazon VPC. The API is isolated from the public internet, which is a common security requirement.

This tutorial takes approximately 30 minutes to complete. First, you use an Amazon CloudFormation template to create an Amazon VPC, a VPC endpoint, an Amazon Lambda function, and launch an Amazon EC2 instance that you'll use to test your API. Next, you use the Amazon Web Services Management Console to create a private API and attach a resource policy that allows access only from your VPC endpoint. Lastly, you test your API.

To complete this tutorial, you need an Amazon account and an Amazon Identity and Access Management user with console access. For more information, see [Prerequisites](#) (p. 12).

In this tutorial, you use the Amazon Web Services Management Console. For an Amazon CloudFormation template that creates this API and all related resources, see [template.yaml](#).

### Topics

- [Step 1: Create dependencies](#) (p. 140)
- [Step 2: Create a private API](#) (p. 141)
- [Step 3: Create a method and integration](#) (p. 141)
- [Step 4: Attach a resource policy](#) (p. 142)
- [Step 5: Deploy your API](#) (p. 142)
- [Step 6: Verify that your API isn't publicly accessible](#) (p. 143)
- [Step 7: Connect to an instance in your VPC and invoke your API](#) (p. 143)
- [Step 8: Clean up](#) (p. 143)
- [Next steps: Automate with Amazon CloudFormation](#) (p. 144)

## Step 1: Create dependencies

Download and unzip [this Amazon CloudFormation template](#). You use the template to create all of the dependencies for your private API, including an Amazon VPC, a VPC endpoint, and a Lambda function that serves as the backend of your API. You create the private API later.

### To create an Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.

2. Choose **Create stack** and then choose **With new resources (standard)**.
3. For **Specify template**, choose **Upload a template file**.
4. Select the template that you downloaded.
5. Choose **Next**.
6. For **Stack name**, enter `private-api-tutorial` and then choose **Next**.
7. For **Configure stack options**, choose **Next**.
8. For **Capabilities**, acknowledge that Amazon CloudFormation can create IAM resources in your account.
9. Choose **Create stack**.

Amazon CloudFormation provisions the dependencies for your API, which can take a few minutes. When the status of your Amazon CloudFormation stack is **CREATE\_COMPLETE**, choose **Outputs**. Note your VPC endpoint ID. You need it for later steps in this tutorial.

## Step 2: Create a private API

You create a private API to allow only clients within your VPC to access it.

### To create a private API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**, and then for **REST API**, choose **Build**.
3. For **API name**, enter `private-api-tutorial`.
4. For **Endpoint Type**, choose **Private**.
5. For **VPC Endpoint IDs**, enter the VPC endpoint ID from the **Outputs** of your Amazon CloudFormation stack.
6. Choose **Create**.

## Step 3: Create a method and integration

You create a `GET` method and Lambda integration to handle `GET` requests to your API. When a client invokes your API, API Gateway sends the request to the Lambda function that you created in Step 1, and then returns a response to the client.

### To create a method and integration

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Actions** and then choose **Create method**.
4. Choose **GET** and then choose the check mark to confirm your choice.
5. For **Integration Type**, select **Lambda function**
6. Select **Use Lambda proxy integration**. With a Lambda proxy integration, API Gateway sends an event to Lambda with a defined structure, and transforms the response from your Lambda function to an HTTP response.
7. For **Lambda function**, choose the function that you created with the Amazon CloudFormation template in Step 1. The function's name begins with `private-api-tutorial`.
8. Choose **Save** and then choose **OK** to confirm that you grant API Gateway permission to invoke your Lambda function.

## Step 4: Attach a resource policy

You attach a [resource policy \(p. 237\)](#) to your API that allows clients to invoke your API only through your VPC endpoint. To further restrict access to your API, you can also configure a [VPC endpoint policy \(p. 254\)](#) for your VPC endpoint, but that's not necessary for this tutorial.

### To attach a resource policy

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Resource policy**.
4. Enter the following policy. Replace *vpceID* with your VPC endpoint ID from the **Outputs** of your Amazon CloudFormation stack.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "execute-api:/*",
      "Condition": {
        "StringNotEquals": {
          "aws:sourceVpce": "vpceID"
        }
      }
    },
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "execute-api:/*"
    }
  ]
}
```

5. Choose **Save**.

## Step 5: Deploy your API

Next, you deploy your API to make it available to clients in your Amazon VPC.

### To deploy an API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Actions** and then choose **Deploy API**.
4. For **Deployment stage**, choose **New Stage**.
5. For **Stage name**, enter **test**.
6. Choose **Deploy**.

Now you're ready to test your API.

## Step 6: Verify that your API isn't publicly accessible

Use `curl` to verify that you can't invoke your API from outside of your Amazon VPC.

### To test your API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Stages** and then choose the **test** stage.
4. Copy your API's URL. The URL looks like `https://abcdef123.execute-api.us-west-2.amazonaws.com/test`. The VPC endpoint that you created in Step 1 has private DNS enabled, so you can use the provided URL to invoke your API.
5. Use `curl` to attempt to invoke your API from outside of your VPC.

```
curl https://abcdef123.execute-api.us-west-2.amazonaws.com/test
```

`Curl` indicates that your API's endpoint can't be resolved. If you get a different response, go back to Step 2, and make sure that you choose **Private** for your API's endpoint type.

```
curl: (6) Could not resolve host: abcdef123.execute-api.us-west-2.amazonaws.com/test
```

Next, you connect to an Amazon EC2 instance in your VPC to invoke your API.

## Step 7: Connect to an instance in your VPC and invoke your API

Next, you test your API from within your Amazon VPC. To access your private API, you connect to an Amazon EC2 instance in your VPC and then use `curl` to invoke your API. You use Systems Manager Session Manager to connect to your instance in the browser.

### To test your API

1. Open the Amazon EC2 console at <https://console.amazonaws.cn/ec2/>.
2. Choose **Instances**.
3. Choose the instance named **private-api-tutorial** that you created with the Amazon CloudFormation template in Step 1.
4. Choose **Connect** and then choose **Session Manager**.
5. Choose **Connect** to launch a browser-based session to your instance.
6. In your Session Manager session, use `curl` to invoke your API. You can invoke your API because you're using an instance in your Amazon VPC.

```
curl https://abcdef123.execute-api.us-west-2.amazonaws.com/test
```

Verify that you get the response `Hello from Lambda!`.

You successfully created an API that's accessible only from within your Amazon VPC and then verified that it works.

## Step 8: Clean up

To prevent unnecessary costs, delete the resources that you created as part of this tutorial. The following steps delete your REST API and your Amazon CloudFormation stack.

### To delete a REST API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. On the **APIs** page, select an API. Choose **Actions**, choose **Delete**, and then confirm your choice.

### To delete an Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.
2. Select your Amazon CloudFormation stack.
3. Choose **Delete** and then confirm your choice.

## Next steps: Automate with Amazon CloudFormation

You can automate the creation and cleanup of all Amazon resources involved in this tutorial. For a full example Amazon CloudFormation template, see [template.yaml](#).

# Amazon API Gateway WebSocket API tutorials

The following tutorial provides a hands-on exercise to help you learn about API Gateway WebSocket APIs.

### Topics

- [Tutorial: Building a serverless chat app with a WebSocket API, Lambda and DynamoDB \(p. 144\)](#)

## Tutorial: Building a serverless chat app with a WebSocket API, Lambda and DynamoDB

In this tutorial, you'll create a serverless chat application with a WebSocket API. With a WebSocket API, you can support two-way communication between clients. Clients can receive messages without having to poll for updates.

This tutorial takes approximately 30 minutes to complete. First, you'll use an Amazon CloudFormation template to create Lambda functions that will handle API requests, as well as a DynamoDB table that stores your client IDs. Then, you'll use the API Gateway console to create a WebSocket API that integrates with your Lambda functions. Lastly, you'll test your API to verify that messages are sent and received.

To complete this tutorial, you need an Amazon account and an Amazon Identity and Access Management user with console access. For more information, see [Prerequisites \(p. 12\)](#).

You also need `wscat` to connect to your API. For more information, see [the section called "Use wscat to connect to a WebSocket API and send messages to it" \(p. 655\)](#).

In this tutorial, you use the Amazon Web Services Management Console. For an Amazon CloudFormation template that creates this API and all related resources, see [chat-app.yaml](#).

### Topics

- [Step 1: Create Lambda functions and a DynamoDB table \(p. 145\)](#)
- [Step 2: Create a WebSocket API \(p. 145\)](#)
- [Step 3: Test your API \(p. 146\)](#)

- [Step 4: Clean up \(p. 147\)](#)
- [Next steps: Automate with Amazon CloudFormation \(p. 147\)](#)

## Step 1: Create Lambda functions and a DynamoDB table

Download and unzip [the app creation template for Amazon CloudFormation](#). You'll use this template to create a Amazon DynamoDB table to store your app's client IDs. Each connected client has a unique ID which we will use as the table's partition key. This template also creates Lambda functions that update your client connections in DynamoDB and handle sending messages to connected clients.

### To create a Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.
2. Choose **Create stack** and then choose **With new resources (standard)**.
3. For **Specify template**, choose **Upload a template file**.
4. Select the template that you downloaded.
5. Choose **Next**.
6. For **Stack name**, enter `websocket-api-chat-app-tutorial` and then choose **Next**.
7. For **Configure stack options**, choose **Next**.
8. For **Capabilities**, acknowledge that Amazon CloudFormation can create IAM resources in your account.
9. Choose **Create stack**.

Amazon CloudFormation provisions the resources specified in the template. It can take a few minutes to finish provisioning your resources. When the status of your Amazon CloudFormation stack is **CREATE\_COMPLETE**, you're ready to move on to the next step.

## Step 2: Create a WebSocket API

You'll create a WebSocket API to handle client connections and route requests to the Lambda functions that you created in Step 1.

### To create a WebSocket API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**. Then for **WebSocket API**, choose **Build**.
3. For **API name**, enter `websocket-chat-app-tutorial`.
4. For **Route selection expression**, enter `request.body.action`. The route selection expression determines the route that API Gateway invokes when a client sends a message.
5. Choose **Next**.
6. For **Predefined routes**, choose **Add \$connect**, **Add \$disconnect**, and **Add \$default**. The **\$connect** and **\$disconnect** routes are special routes that API Gateway invokes automatically when a client connects to or disconnects from an API. API Gateway invokes the `$default` route when no other routes match a request.
7. For **Custom routes**, choose **Add custom route**. For **Route key**, enter `sendMessage`. This custom route handles messages that are sent to connected clients.
8. Choose **Next**.
9. Under **Attach integrations**, for each route and **Integration type**, choose **Lambda**.



For **Lambda**, choose the corresponding Lambda function that you created with Amazon CloudFormation in Step 1. Each function's name matches a route. For example, for the **\$connect** route, choose the function named **WsChatAppStack-ConnectHandler**.

10. Review the stage that API Gateway creates for you. By default, API Gateway creates a stage name **production** and automatically deploys your API to that stage. Choose **Next**.
11. Choose **Create and deploy**.

## Step 3: Test your API

Next, you'll test your API to make sure that it works correctly. Use the `wscat` command to connect to the API.

### To to get the invoke URL for your API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your API.
3. Choose **Stages**, and then choose **production**.
4. Note your API's **WebSocket URL**. The URL should look like `wss://abcdef123.execute-api.us-east-2.amazonaws.com/production`.

### To connect to your API

1. Use the following command to connect to your API. When you connect to your API, API Gateway invokes the `$connect` route. When this route is invoked, it calls a Lambda function that stores your connection ID in DynamoDB.

```
wscat -c wss://abcdef123.execute-api.us-west-2.amazonaws.com/production
```

```
Connected (press CTRL+C to quit)
```

2. Open a new terminal and run the `wscat` command again with the following parameters.

```
wscat -c wss://abcdef123.execute-api.us-west-2.amazonaws.com/production
```

```
Connected (press CTRL+C to quit)
```

This gives you two connected clients that can exchange messages.

### To send a message

- API Gateway determines which route to invoke based on your API's route selection expression. Your API's route selection expression is `$request.body.action`. As a result, API Gateway invokes the `sendmessage` route when you send the following message:

```
{"action": "sendmessage", "message": "hello, everyone!"}
```

The Lambda function associated with the invoked route collects the client IDs from DynamoDB. Then, the function calls the API Gateway Management API and sends the message to those clients. All connected clients receive the following message:

```
< hello, everyone!
```

### To invoke your API's \$default route

- API Gateway invokes your API's default route when a client sends a message that doesn't match your defined routes. The Lambda function associated with the \$default route uses the API Gateway Management API to send the client information about their connection.

```
test
```

```
Use the sendmessage route to send a message. Your info:
```

```
{ "ConnectedAt": "2022-01-25T18:50:04.673Z", "Identity":  
{"SourceIp": "192.0.2.1", "UserAgent": null}, "LastActiveAt": "2022-01-25T18:50:07.642Z", "connectionID":
```

### To disconnect from your API

- Press **CTRL+C** to disconnect from your API. When a client disconnects from your API, API Gateway invokes your API's \$disconnect route. The Lambda integration for your API's \$disconnect route removes the connection ID from DynamoDB.

## Step 4: Clean up

To prevent unnecessary costs, delete the resources that you created as part of this tutorial. The following steps delete your Amazon CloudFormation stack and WebSocket API.

### To delete a WebSocket API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. On the **APIs** page, select your `websocket-chat-app-tutorial` API. Choose **Actions**, choose **Delete**, and then confirm your choice.

### To delete an Amazon CloudFormation stack

1. Open the Amazon CloudFormation console at <https://console.amazonaws.cn/cloudformation>.
2. Select your Amazon CloudFormation stack.
3. Choose **Delete** and then confirm your choice.

## Next steps: Automate with Amazon CloudFormation

You can automate the creation and cleanup of all of the Amazon resources involved in this tutorial. For an example of a Amazon CloudFormation template that automates these actions, see [chat-app.yaml](#).

# Working with HTTP APIs

HTTP APIs enable you to create RESTful APIs with lower latency and lower cost than REST APIs.

You can use HTTP APIs to send requests to Amazon Lambda functions or to any routable HTTP endpoint.

For example, you can create an HTTP API that integrates with a Lambda function on the backend. When a client calls your API, API Gateway sends the request to the Lambda function and returns the function's response to the client.

HTTP APIs support [OpenID Connect](#) and [OAuth 2.0](#) authorization. They come with built-in support for cross-origin resource sharing (CORS) and automatic deployments.

You can create HTTP APIs by using the Amazon Management Console, the Amazon CLI, APIs, Amazon CloudFormation, or SDKs. HTTP APIs use API Gateway [Version 2 APIs](#), which previously supported only WebSocket APIs.

## Topics

- [Developing an HTTP API in API Gateway \(p. 148\)](#)
- [Publishing HTTP APIs for customers to invoke \(p. 184\)](#)
- [Protecting your HTTP API \(p. 190\)](#)
- [Monitoring your HTTP API \(p. 195\)](#)
- [Troubleshooting issues with HTTP APIs \(p. 202\)](#)

## Developing an HTTP API in API Gateway

This section provides details about API Gateway capabilities that you need while you're developing your API Gateway APIs.

As you're developing your API Gateway API, you decide on a number of characteristics of your API. These characteristics depend on the use case of your API. For example, you might want to only allow certain clients to call your API, or you might want it to be available to everyone. You might want an API call to execute a Lambda function, make a database query, or call an application.

## Topics

- [Creating an HTTP API \(p. 148\)](#)
- [Working with routes for HTTP APIs \(p. 149\)](#)
- [Controlling and managing access to an HTTP API in API Gateway \(p. 151\)](#)
- [Configuring integrations for HTTP APIs \(p. 159\)](#)
- [Configuring CORS for an HTTP API \(p. 172\)](#)
- [Transforming API requests and responses \(p. 173\)](#)
- [Working with OpenAPI definitions for HTTP APIs \(p. 178\)](#)

## Creating an HTTP API

To create a functional API, you must have at least one route, integration, stage, and deployment.

The following examples show how to create an API with an Amazon Lambda or HTTP integration, a route, and a default stage that is configured to automatically deploy changes.

This guide assumes that you're already familiar with API Gateway and Lambda. For a more detailed guide, see [Getting started \(p. 13\)](#).

### Topics

- [Create an HTTP API by using the Amazon Web Services Management Console \(p. 149\)](#)
- [Create an HTTP API by using the Amazon CLI \(p. 149\)](#)

## Create an HTTP API by using the Amazon Web Services Management Console

1. Open the [API Gateway console](#).
2. Choose **Create API**.
3. Under **HTTP API**, choose **Build**.
4. Choose **Add integration**, and then choose an Amazon Lambda function or enter an HTTP endpoint.
5. For **Name**, enter a name for your API.
6. Choose **Review and create**.
7. Choose **Create**.

Now your API is ready to invoke. You can test your API by entering its invoke URL in a browser, or by using Curl.

```
curl https://api-id.execute-api.us-west-2.amazonaws.com
```

## Create an HTTP API by using the Amazon CLI

You can use quick create to create an API with a Lambda or HTTP integration, a default catch-all route, and a default stage that is configured to automatically deploy changes. The following command uses quick create to create an API that integrates with a Lambda function on the backend.

### Note

To invoke a Lambda integration, API Gateway must have the required permissions. You can use a resource-based policy or an IAM role to grant API Gateway permissions to invoke a Lambda function. To learn more, see [Amazon Lambda Permissions](#) in the *Amazon Lambda Developer Guide*.

### Example

```
aws apigatewayv2 create-api --name my-api --protocol-type HTTP --target arn:aws:lambda:us-west-2:123456789012:function:function-name
```

Now your API is ready to invoke. You can test your API by entering its invoke URL in a browser, or by using Curl.

```
curl https://api-id.execute-api.us-west-2.amazonaws.com
```

## Working with routes for HTTP APIs

Routes direct incoming API requests to backend resources. Routes consist of two parts: an HTTP method and a resource path—for example, `GET /pets`. You can define specific HTTP methods for your route. Or, you can use the `ANY` method to match all methods that you haven't defined for a resource. You can create a `$default` route that acts as a catch-all for requests that don't match any other routes.

## Working with path variables

You can use path variables in HTTP API routes.

For example, the `GET /pets/{petID}` route catches a GET request that a client submits to `https://api-id.execute-api.us-east-2.amazonaws.com/pets/6`.

A *greedy path variable* catches all child resources of a route. To create a greedy path variable, add `+` to the variable name—for example, `{proxy+}`. The greedy path variable must be at the end of the resource path.

## Working with query string parameters

By default, API Gateway sends query string parameters to your backend integration if they are included in a request to an HTTP API.

For example, when a client sends a request to `https://api-id.execute-api.us-east-2.amazonaws.com/pets?id=4&type=dog`, the query string parameters `?id=4&type=dog` are sent to your integration.

## Working with the `$default` route

The `$default` route catches requests that don't explicitly match other routes in your API.

When the `$default` route receives a request, API Gateway sends the full request path to the integration. For example, you can create an API with only a `$default` route and integrate it on the `ANY` method with the `https://petstore-demo-endpoint.execute-api.com` HTTP endpoint. When you send a request to `https://api-id.execute-api.us-east-2.amazonaws.com/store/checkout`, API Gateway sends a request to `https://petstore-demo-endpoint.execute-api.com/store/checkout`.

To learn more about HTTP integrations, see [Working with HTTP proxy integrations for HTTP APIs](#) (p. 163).

## Routing API requests

When a client sends an API request, API Gateway first determines which [stage](#) to route the request to. If the request explicitly matches a stage, API Gateway sends the request to that stage. If no stage fully matches the request, API Gateway sends the request to the `$default` stage. If there's no `$default` stage, then the API returns `{"message": "Not Found"}`.

After selecting a stage, API Gateway selects a route. API Gateway selects the route with the most-specific match, using the following priorities:

1. Full match for a route and method.
2. Match for a route and method with a greedy path variable (`{proxy+}`).
3. The `$default` route.

If no routes match a request, API Gateway returns `{"message": "Not Found"}` to the client.

For example, consider an API with a `$default` stage and the following example routes:

1. `GET /pets/dog/1`
2. `GET /pets/dog/{id}`
3. `GET /pets/{proxy+}`
4. `ANY /{proxy+}`
5. `$default`

The following table summarizes how API Gateway routes requests to the example routes.

Request	Selected route	Explanation
GET https:// <i>api-id</i> .execute-api. <i>region</i> .amazonaws.com/pets/dog/1	GET /pets/dog/1	The request fully matches this static route.
GET https:// <i>api-id</i> .execute-api. <i>region</i> .amazonaws.com/pets/dog/2	GET /pets/dog/{id}	The request fully matches this route.
GET https:// <i>api-id</i> .execute-api. <i>region</i> .amazonaws.com/pets/cat/1	GET /pets/{proxy+}	The request doesn't fully match a route. The route with a GET method and a greedy path variable catches this request.
POST https:// <i>api-id</i> .execute-api. <i>region</i> .amazonaws.com/test/5	ANY /{proxy+}	The ANY method matches all methods that you haven't defined for a route. Routes with greedy path variables have higher priority than the <code>\$default</code> route.

## Controlling and managing access to an HTTP API in API Gateway

API Gateway supports multiple mechanisms for controlling and managing access to your HTTP API:

- **Lambda authorizers** use Lambda functions to control access to APIs. For more information, see [Working with Amazon Lambda authorizers for HTTP APIs \(p. 151\)](#).
- **JWT authorizers** use JSON web tokens to control access to APIs. For more information, see [Controlling access to HTTP APIs with JWT authorizers \(p. 157\)](#).
- **Standard Amazon IAM roles and policies** offer flexible and robust access controls. You can use IAM roles and policies to control who can create and manage your APIs, as well as who can invoke them. For more information, see [Using IAM authorization \(p. 159\)](#).

## Working with Amazon Lambda authorizers for HTTP APIs

You use a Lambda authorizer to use a Lambda function to control access to your HTTP API. Then, when a client calls your API, API Gateway invokes your Lambda function. API Gateway uses the response from your Lambda function to determine whether the client can access your API.

### Payload format version

The authorizer payload format version specifies the format of the data that API Gateway sends to a Lambda authorizer, and how API Gateway interprets the response from Lambda. If you don't specify a payload format version, the Amazon Web Services Management Console uses the latest version by default. If you create a Lambda authorizer by using the Amazon CLI, Amazon CloudFormation, or an SDK, you must specify an `authorizerPayloadFormatVersion`. The supported values are 1.0 and 2.0.

If you need compatibility with REST APIs, use version 1.0.

The following examples show the structure of each payload format version.

## 2.0

```
{
  "version": "2.0",
  "type": "REQUEST",
  "routeArn": "arn:aws:execute-api:us-east-1:123456789012:abcdef123/test/GET/request",
  "identitySource": ["user1", "123"],
  "routeKey": "$default",
  "rawPath": "/my/path",
  "rawQueryString": "parameter1=value1&parameter1=value2&parameter2=value",
  "cookies": ["cookie1", "cookie2"],
  "headers": {
    "Header1": "value1",
    "Header2": "value2"
  },
  "queryStringParameters": {
    "parameter1": "value1,value2",
    "parameter2": "value"
  },
  "requestContext": {
    "accountId": "123456789012",
    "apiId": "api-id",
    "authentication": {
      "clientCert": {
        "clientCertPem": "CERT_CONTENT",
        "subjectDN": "www.example.com",
        "issuerDN": "Example issuer",
        "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
        "validity": {
          "notBefore": "May 28 12:30:02 2019 GMT",
          "notAfter": "Aug  5 09:36:04 2021 GMT"
        }
      }
    }
  },
  "domainName": "id.execute-api.us-east-1.amazonaws.com",
  "domainPrefix": "id",
  "http": {
    "method": "POST",
    "path": "/my/path",
    "protocol": "HTTP/1.1",
    "sourceIp": "IP",
    "userAgent": "agent"
  },
  "requestId": "id",
  "routeKey": "$default",
  "stage": "$default",
  "time": "12/Mar/2020:19:03:58 +0000",
  "timeEpoch": 1583348638390
},
"pathParameters": { "parameter1": "value1" },
"stageVariables": { "stageVariable1": "value1", "stageVariable2": "value2" }
}
```

## 1.0

```
{
  "version": "1.0",
  "type": "REQUEST",
  "methodArn": "arn:aws:execute-api:us-east-1:123456789012:abcdef123/test/GET/request",
  "identitySource": "user1,123",
  "authorizationToken": "user1,123",
  "resource": "/request",
}
```

```

"path": "/request",
"httpMethod": "GET",
"headers": {
  "X-AMZ-Date": "20170718T062915Z",
  "Accept": "*/*",
  "HeaderAuth1": "headerValue1",
  "CloudFront-Viewer-Country": "US",
  "CloudFront-Forwarded-Proto": "https",
  "CloudFront-Is-Tablet-Viewer": "false",
  "CloudFront-Is-Mobile-Viewer": "false",
  "User-Agent": "...",
},
"queryStringParameters": {
  "QueryString1": "queryValue1"
},
"pathParameters": {},
"stageVariables": {
  "StageVar1": "stageValue1"
},
"requestContext": {
  "path": "/request",
  "accountId": "123456789012",
  "resourceId": "05c7jb",
  "stage": "test",
  "requestId": "...",
  "identity": {
    "apiKey": "...",
    "sourceIp": "...",
    "clientCert": {
      "clientCertPem": "CERT_CONTENT",
      "subjectDN": "www.example.com",
      "issuerDN": "Example issuer",
      "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
      "validity": {
        "notBefore": "May 28 12:30:02 2019 GMT",
        "notAfter": "Aug  5 09:36:04 2021 GMT"
      }
    }
  }
},
"resourcePath": "/request",
"httpMethod": "GET",
"apiId": "abcdef123"
}

```

## Lambda authorizer response format

The payload format version also determines the structure of the response that you must return from your Lambda function.

### Lambda function response for format 1.0

If you choose the 1.0 format version, Lambda authorizers must return an IAM policy that allows or denies access to your API route. You can use standard IAM policy syntax in the policy. For examples of IAM policies, see [the section called "Control access for invoking an API" \(p. 250\)](#). The context object is optional. You can pass context properties to Lambda integrations or access logs by using `$context.authorizer.property`. To learn more, see [the section called "Logging variables" \(p. 198\)](#).

#### Example

```
{
```



```

"principalId": "abcdef", // The principal user identification associated with the token
sent by the client.
"policyDocument": {
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "execute-api:Invoke",
      "Effect": "Allow|Deny",
      "Resource": "arn:aws:execute-api:{regionId}:{accountId}:{apiId}/{stage}/{httpVerb}/
[resource]/[child-resources]]"
    }
  ]
},
"context": {
  "exampleKey": "exampleValue"
}
}

```

### Lambda function response for format 2.0

If you choose the 2.0 format version, you can return a Boolean value or an IAM policy that uses standard IAM policy syntax from your Lambda function. To return a Boolean value, enable simple responses for the authorizer. The following examples demonstrate the format that you must code your Lambda function to return. The context object is optional. You can pass context properties to Lambda integrations or access logs by using `$context.authorizer.property`. To learn more, see [the section called “Logging variables” \(p. 198\)](#).

#### Simple response

```

{
  "isAuthorized": true/false,
  "context": {
    "exampleKey": "exampleValue"
  }
}

```

#### IAM policy

```

{
  "principalId": "abcdef", // The principal user identification associated with the
token sent by the client.
  "policyDocument": {
    "Version": "2012-10-17",
    "Statement": [
      {
        "Action": "execute-api:Invoke",
        "Effect": "Allow|Deny",
        "Resource": "arn:aws:execute-api:{regionId}:{accountId}:{apiId}/{stage}/
{httpVerb}/{resource}/[child-resources]]"
      }
    ]
  },
  "context": {
    "exampleKey": "exampleValue"
  }
}

```

### Example Lambda authorizer functions

The following example Node.js Lambda functions demonstrate the required response formats you need to return from your Lambda function for the 2.0 payload format version.

## Simple response

```

exports.handler = async(event) => {
  let response = {
    "isAuthorized": false,
    "context": {
      "stringKey": "value",
      "numberKey": 1,
      "booleanKey": true,
      "arrayKey": ["value1", "value2"],
      "mapKey": {"value1": "value2"}
    }
  };

  if (event.headers.authorization === "secretToken") {
    response = {
      "isAuthorized": true,
      "context": {
        "stringKey": "value",
        "numberKey": 1,
        "booleanKey": true,
        "arrayKey": ["value1", "value2"],
        "mapKey": {"value1": "value2"}
      }
    };
  }

  return response;
};

```

## IAM policy

```

exports.handler = async(event) => {
  if (event.headers.authorization == "secretToken") {
    console.log("allowed");
    return {
      "principalId": "abcdef", // The principal user identification associated with the
      token sent by the client.
      "policyDocument": {
        "Version": "2012-10-17",
        "Statement": [{
          "Action": "execute-api:Invoke",
          "Effect": "Allow",
          "Resource": event.routeArn
        }]
      },
      "context": {
        "stringKey": "value",
        "numberKey": 1,
        "booleanKey": true,
        "arrayKey": ["value1", "value2"],
        "mapKey": { "value1": "value2" }
      }
    };
  }
  else {
    console.log("denied");
    return {
      "principalId": "abcdef", // The principal user identification associated with the
      token sent by the client.
      "policyDocument": {
        "Version": "2012-10-17",
        "Statement": [{

```

```

        "Action": "execute-api:Invoke",
        "Effect": "Deny",
        "Resource": event.routeArn
    }]
},
"context": {
    "stringKey": "value",
    "numberKey": 1,
    "booleanKey": true,
    "arrayKey": ["value1", "value2"],
    "mapKey": { "value1": "value2" }
}
};
}
};

```

## Identity sources

You can optionally specify identity sources for a Lambda authorizer. Identity sources specify the location of data that's required to authorize a request. For example, you can specify header or query string values as identity sources. If you specify identity sources, clients must include them in the request. If the client's request doesn't include the identity sources, API Gateway doesn't invoke your Lambda authorizer, and the client receives a 401 error. The following identity sources are supported:

### Selection expressions

Type	Example	Notes
Header value	<code>\$request.header.<i>name</i></code>	Header names are case-insensitive.
Query string value	<code>\$request.querystring.<i>name</i></code>	Query string names are case-sensitive.
Context variable	<code>\$context.<i>variableName</i></code>	The value of a supported <a href="#">context variable (p. 198)</a> .
Stage variable	<code>\$stageVariables.<i>variableName</i></code>	The value of a <a href="#">stage variable (p. 184)</a> .

## Caching authorizer responses

You can enable caching for a Lambda authorizer by specifying an [authorizerResultTtlInSeconds](#). When caching is enabled for an authorizer, API Gateway uses the authorizer's identity sources as the cache key. If a client specifies the same parameters in identity sources within the configured TTL, API Gateway uses the cached authorizer result, rather than invoking your Lambda function.

To enable caching, your authorizer must have at least one identity source.

If you enable simple responses for an authorizer, the authorizer's response fully allows or denies all API requests that match the cached identity source values. For more granular permissions, disable simple responses and return an IAM policy.

By default, API Gateway uses the cached authorizer response for all routes of an API that use the authorizer. To cache responses per route, add `$context.routeKey` to your authorizer's identity sources.

## Create a Lambda authorizer

When you create a Lambda authorizer, you specify the Lambda function for API Gateway to use. You must grant API Gateway permission to invoke the Lambda function by using either the function's resource policy or an IAM role. For this example, we update the resource policy for the function so that it grants API Gateway permission to invoke our Lambda function.

```
aws apigatewayv2 create-authorizer \  
  --api-id abcdef123 \  
  --authorizer-type REQUEST \  
  --identity-source '$request.header.Authorization' \  
  --name lambda-authorizer \  
  --authorizer-uri 'arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/  
functions/arn:aws:lambda:us-west-2:123456789012:function:my-function/invocations' \  
  --authorizer-payload-format-version '2.0' \  
  --enable-simple-responses
```

The following command grants API Gateway permission to invoke your Lambda function. If API Gateway doesn't have permission to invoke your function, clients receive a 500 Internal Server Error.

```
aws lambda add-permission \  
  --function-name my-authorizer-function \  
  --statement-id apigateway-invoke-permissions-abc123 \  
  --action lambda:InvokeFunction \  
  --principal apigateway.amazonaws.com \  
  --source-arn "arn:aws:execute-api:us-west-2:123456789012:api-id/authorizers/authorizer-  
id"
```

After you've created an authorizer and granted API Gateway permission to invoke it, update your route to use the authorizer.

```
aws apigatewayv2 update-route \  
  --api-id abcdef123 \  
  --route-id acd123 \  
  --authorization-type CUSTOM \  
  --authorizer-id def123
```

## Troubleshooting Lambda authorizers

If API Gateway can't invoke your Lambda authorizer, or your Lambda authorizer returns a response in an invalid format, clients receive a 500 Internal Server Error.

To troubleshoot errors, [enable access logging \(p. 196\)](#) for your API stage. Include the `$context.authorizer.error` logging variable in your log format.

If the logs indicate that API Gateway doesn't have permission to invoke your function, update your function's resource policy or provide an IAM role to grant API Gateway permission to invoke your authorizer.

If the logs indicate that your Lambda function returns an invalid response, verify that your Lambda function returns a response in the [required format \(p. 153\)](#).

## Controlling access to HTTP APIs with JWT authorizers

You can use JSON Web Tokens (JWTs) as a part of [OpenID Connect \(OIDC\)](#) and [OAuth 2.0](#) frameworks to restrict client access to your APIs.

If you configure a JWT authorizer for a route of your API, API Gateway validates the JWTs that clients submit with API requests. API Gateway allows or denies requests based on token validation, and

optionally, scopes in the token. If you configure scopes for a route, the token must include at least one of the route's scopes.

You can configure distinct authorizers for each route of an API, or use the same authorizer for multiple routes.

#### Note

There is no standard mechanism to differentiate JWT access tokens from other types of JWTs, such as OpenID Connect ID tokens. Unless you require ID tokens for API authorization, we recommend that you configure your routes to require authorization scopes. You can also configure your JWT authorizers to require issuers or audiences that your identity provider uses only when issuing JWT access tokens.

## Authorizing API requests

API Gateway uses the following general workflow to authorize requests to routes that are configured to use a JWT authorizer.

1. Check the `identitySource` for a token. The `identitySource` can include only the token, or the token prefixed with `Bearer` .
2. Decode the token.
3. Check the token's algorithm and signature by using the public key that is fetched from the issuer's `jwtks_uri`. Currently, only RSA-based algorithms are supported.
4. Validate claims. API Gateway evaluates the following token claims:
  - `kid` – The token must have a header claim that matches the key in the `jwtks_uri` that signed the token.
  - `iss` – Must match the `issuer` that is configured for the authorizer.
  - `aud` or `client_id` – Must match one of the `audience` entries that is configured for the authorizer.
  - `exp` – Must be after the current time in UTC.
  - `nbf` – Must be before the current time in UTC.
  - `iat` – Must be before the current time in UTC.
  - `scope` or `scp` – The token must include at least one of the scopes in the route's `authorizationScopes`.

If any of these steps fail, API Gateway denies the API request.

After validating the JWT, API Gateway passes the claims in the token to the API route's integration. Backend resources, such as Lambda functions, can access the JWT claims. For example, if the JWT includes an identity claim `emailID`, it's available to a Lambda integration in `$event.requestContext.authorizer.jwt.claims.emailID`. For more information about the payload that API Gateway sends to Lambda integrations, see [the section called "Amazon Lambda integrations" \(p. 159\)](#).

## Create a JWT authorizer

Before you create a JWT authorizer, you must register a client application with an identity provider. You must also have created an HTTP API. For examples of creating an HTTP API, see [Creating an HTTP API \(p. 148\)](#). For an example Amazon CloudFormation template that creates an HTTP API with a JWT authorizer that uses Amazon Cognito as an identity provider, see [http-with-jwt-auth.yaml](#).

The following Amazon CLI command creates a JWT authorizer that uses Amazon Cognito as an identity provider. For `Audience`, specify the [ID of a client](#) that's associated with the user pool that you specify for `Issuer`.

```
aws apigatewayv2 create-authorizer \  
  --name authorizer-name \  
  --
```

```
--api-id api-id \  
--authorizer-type JWT \  
--identity-source '$request.header.Authorization' \  
--jwt-configuration Audience=audience,Issuer=https://cognito-idp.us-  
west-2.amazonaws.com/userPoolID
```

## Update a route to use a JWT authorizer by using the Amazon CLI

The following command updates a route to use a JWT authorizer.

```
aws apigatewayv2 update-route \  
--api-id api-id \  
--route-id route-id \  
--authorization-type JWT \  
--authorizer-id authorizer-id \  
--authorization-scopes user.id user.email
```

## Using IAM authorization

You can enable IAM authorization for HTTP API routes. When IAM authorization is enabled, clients must use [Signature Version 4](#) to sign their requests with Amazon credentials. API Gateway invokes your API route only if the client has `execute-api` permission for the route.

IAM authorization for HTTP APIs is similar to that for [REST APIs \(p. 250\)](#).

### Note

Resource policies aren't currently supported for HTTP APIs.

For examples of IAM policies that grant clients the permission to invoke APIs, see [the section called "Control access for invoking an API" \(p. 250\)](#).

## Enable IAM authorization for a route

The following Amazon CLI command enables IAM authorization for an HTTP API route.

```
aws apigatewayv2 update-route \  
--api-id abc123 \  
--route-id abcdef \  
--authorization-type AWS_IAM
```

## Configuring integrations for HTTP APIs

*Integrations* connect a route to backend resources. HTTP APIs support Lambda proxy, Amazon service, and HTTP proxy integrations. For example, you can configure a `POST` request to the `/signup` route of your API to integrate with a Lambda function that handles signing up customers.

### Topics

- [Working with Amazon Lambda proxy integrations for HTTP APIs \(p. 159\)](#)
- [Working with HTTP proxy integrations for HTTP APIs \(p. 163\)](#)
- [Working with Amazon service integrations for HTTP APIs \(p. 164\)](#)
- [Working with private integrations for HTTP APIs \(p. 169\)](#)

## Working with Amazon Lambda proxy integrations for HTTP APIs

A Lambda proxy integration enables you to integrate an API route with a Lambda function. When a client calls your API, API Gateway sends the request to the Lambda function and returns the function's response to the client. For examples of creating an HTTP API, see [Creating an HTTP API \(p. 148\)](#).

## Payload format version

The payload format version specifies the format of the data that API Gateway sends to a Lambda integration, and how API Gateway interprets the response from Lambda. If you don't specify a payload format version, the Amazon Web Services Management Console uses the latest version by default. If you create a Lambda integration by using the Amazon CLI, Amazon CloudFormation, or an SDK, you must specify a `payloadFormatVersion`. The supported values are 1.0 and 2.0.

The following examples show the structure of each payload format version.

### Note

Header names are lowercased.

Format 2.0 doesn't have `multiValueHeaders` or `multiValueQueryStringParameters` fields. Duplicate headers are combined with commas and included in the `headers` field. Duplicate query strings are combined with commas and included in the `queryStringParameters` field.

Format 2.0 includes a new `cookies` field. All cookie headers in the request are combined with commas and added to the `cookies` field. In the response to the client, each cookie becomes a `set-cookie` header.

### 2.0

```
{
  "version": "2.0",
  "routeKey": "$default",
  "rawPath": "/my/path",
  "rawQueryString": "parameter1=value1&parameter1=value2&parameter2=value",
  "cookies": [
    "cookie1",
    "cookie2"
  ],
  "headers": {
    "header1": "value1",
    "header2": "value1,value2"
  },
  "queryStringParameters": {
    "parameter1": "value1,value2",
    "parameter2": "value"
  },
  "requestContext": {
    "accountId": "123456789012",
    "apiId": "api-id",
    "authentication": {
      "clientCert": {
        "clientCertPem": "CERT_CONTENT",
        "subjectDN": "www.example.com",
        "issuerDN": "Example issuer",
        "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
        "validity": {
          "notBefore": "May 28 12:30:02 2019 GMT",
          "notAfter": "Aug  5 09:36:04 2021 GMT"
        }
      }
    }
  },
  "authorizer": {
    "jwt": {
      "claims": {
        "claim1": "value1",
        "claim2": "value2"
      },
      "scopes": [
        "scope1",
        "scope2"
      ]
    }
  }
}
```

```

    ]
  }
},
"domainName": "id.execute-api.us-east-1.amazonaws.com",
"domainPrefix": "id",
"http": {
  "method": "POST",
  "path": "/my/path",
  "protocol": "HTTP/1.1",
  "sourceIp": "IP",
  "userAgent": "agent"
},
"requestId": "id",
"routeKey": "$default",
"stage": "$default",
"time": "12/Mar/2020:19:03:58 +0000",
"timeEpoch": 1583348638390
},
"body": "Hello from Lambda",
"pathParameters": {
  "parameter1": "value1"
},
"isBase64Encoded": false,
"stageVariables": {
  "stageVariable1": "value1",
  "stageVariable2": "value2"
}
}
}

```

1.0

```

{
  "version": "1.0",
  "resource": "/my/path",
  "path": "/my/path",
  "httpMethod": "GET",
  "headers": {
    "header1": "value1",
    "header2": "value2"
  },
  "multiValueHeaders": {
    "header1": [
      "value1"
    ],
    "header2": [
      "value1",
      "value2"
    ]
  },
  "queryStringParameters": {
    "parameter1": "value1",
    "parameter2": "value"
  },
  "multiValueQueryStringParameters": {
    "parameter1": [
      "value1",
      "value2"
    ],
    "parameter2": [
      "value"
    ]
  },
  "requestContext": {
    "accountId": "123456789012",
    "apiId": "id",

```



```

"authorizer": {
  "claims": null,
  "scopes": null
},
"domainName": "id.execute-api.us-east-1.amazonaws.com",
"domainPrefix": "id",
"extendedRequestId": "request-id",
"httpMethod": "GET",
"identity": {
  "accessKey": null,
  "accountId": null,
  "caller": null,
  "cognitoAuthenticationProvider": null,
  "cognitoAuthenticationType": null,
  "cognitoIdentityId": null,
  "cognitoIdentityPoolId": null,
  "principalOrgId": null,
  "sourceIp": "IP",
  "user": null,
  "userAgent": "user-agent",
  "userArn": null,
  "clientCert": {
    "clientCertPem": "CERT_CONTENT",
    "subjectDN": "www.example.com",
    "issuerDN": "Example issuer",
    "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
    "validity": {
      "notBefore": "May 28 12:30:02 2019 GMT",
      "notAfter": "Aug  5 09:36:04 2021 GMT"
    }
  }
},
"path": "/my/path",
"protocol": "HTTP/1.1",
"requestId": "id=",
"requestTime": "04/Mar/2020:19:15:17 +0000",
"requestTimeEpoch": 1583349317135,
"resourceId": null,
"resourcePath": "/my/path",
"stage": "$default"
},
"pathParameters": null,
"stageVariables": null,
"body": "Hello from Lambda!",
"isBase64Encoded": false
}

```

## Lambda function response format

The payload format version determines the structure of the response that your Lambda function must return.

### Lambda function response for format 1.0

With the 1.0 format version, Lambda integrations must return a response in the following format.

#### Example

```

{
  "isBase64Encoded": true|false,
  "statusCode": httpStatusCode,
  "headers": { "headername": "headervalue", ... },
}

```

```
"multiValueHeaders": { "headername": ["headervalue", "headervalue2", ...], ... },
"body": "..."}
}
```

### Lambda function response for format 2.0

With the 2.0 format version, API Gateway can infer the response format for you. API Gateway makes the following assumptions if your Lambda function returns valid JSON and doesn't return a `statusCode`:

- `isBase64Encoded` is `false`.
- `statusCode` is 200.
- `content-type` is `application/json`.
- `body` is the function's response.

The following examples show the output of a Lambda function and API Gateway's interpretation.

Lambda function output	API Gateway interpretation
"Hello from Lambda!"	{ "isBase64Encoded": false, "statusCode": 200, "body": "Hello from Lambda!", "headers": { "content-type": "application/json" } }
{ "message": "Hello from Lambda!" }	{ "isBase64Encoded": false, "statusCode": 200, "body": "{ \"message\": \"Hello from Lambda!\" }", "headers": { "content-type": "application/json" } }

To customize the response, your Lambda function should return a response with the following format.

```
{
  "cookies" : ["cookie1", "cookie2"],
  "isBase64Encoded": true|false,
  "statusCode": httpStatusCode,
  "headers": { "headername": "headervalue", ... },
  "body": "Hello from Lambda!"
}
```

## Working with HTTP proxy integrations for HTTP APIs

An HTTP proxy integration enables you to connect an API route to a publicly routable HTTP endpoint. With this integration type, API Gateway passes the entire request and response between the frontend and the backend.

To create an HTTP proxy integration, provide the URL of a publicly routable HTTP endpoint.

## HTTP proxy integration with path variables

You can use path variables in HTTP API routes.

For example, the route `/pets/{petID}` catches requests to `/pets/6`. You can reference path variables in the integration URI to send the variable's contents to an integration. An example is `/pets/extendedpath/{petID}`.

You can use greedy path variables to catch all child resources of a route. To create a greedy path variable, add `+` to the variable name—for example, `{proxy+}`.

To set up a route with an HTTP proxy integration that catches all requests, create an API route with a greedy path variable (for example, `/parent/{proxy+}`). Integrate the route with an HTTP endpoint (for example, `https://petstore-demo-endpoint.execute-api.com/petstore/{proxy}`) on the `ANY` method. The greedy path variable must be at the end of the resource path.

## Working with Amazon service integrations for HTTP APIs

You can integrate your HTTP API with Amazon services by using *first-class integrations*. A first-class integration connects an HTTP API route to an Amazon service API. When a client invokes a route that's backed by a first-class integration, API Gateway invokes an Amazon service API for you. For example, you can use first-class integrations to send a message to an Amazon Simple Queue Service queue, or to start an Amazon Step Functions state machine. For supported service actions, see [the section called "Amazon service integrations reference"](#) (p. 165).

### Mapping request parameters

First-class integrations have required and optional parameters. You must configure all required parameters to create an integration. You can use static values or map parameters that are dynamically evaluated at runtime. For a full list of supported integrations and parameters, see [the section called "Amazon service integrations reference"](#) (p. 165).

#### Parameter mapping

Type	Example	Notes
Header value	<code>\$request.header.name</code>	Header names are case-insensitive. API Gateway combines multiple header values with commas, for example <code>"header1": "value1,value2"</code> .
Query string value	<code>\$request.querystring.name</code>	Query string names are case-sensitive. API Gateway combines multiple values with commas, for example <code>"querystring1": "Value1,Value2"</code> .
Path parameter	<code>\$request.path.name</code>	The value of a path parameter in the request. For example if the route is <code>/pets/{petId}</code> , you can map the <code>petId</code> parameter from the request with <code><i>\$request.path.petId</i></code> .
Request body passthrough	<code>\$request.body</code>	API Gateway passes the entire request body through.

Type	Example	Notes
Request body	<code>\$request.body.name</code>	<p>A <a href="#">JSON path expression</a>. Recursive descent (<code>\$request.body..name</code>) and filter expressions (<code>?(expression)</code>) aren't supported.</p> <p><b>Note</b> When you specify a JSON path, API Gateway truncates the request body at 100 KB and then applies the selection expression. To send payloads larger than 100 KB, specify <code>\$request.body</code>.</p>
Context variable	<code>\$context.variableName</code>	The value of a supported <a href="#">context variable</a> (p. 198).
Stage variable	<code>\$stageVariables.variableName</code>	The value of a <a href="#">stage variable</a> (p. 184).
Static value	<code>string</code>	A constant value.

## Create a first-class integration

Before you create a first-class integration, you must create an IAM role that grants API Gateway permissions to invoke the Amazon service action that you're integrating with. To learn more, see [Creating a role for an Amazon service](#).

To create a first-class integration, choose a supported Amazon service action, such as `SQS-SendMessage`, configure the request parameters, and provide a role that grants API Gateway permissions to invoke the integrated Amazon service API. Depending on the integration subtype, different request parameters are required. To learn more, see [the section called "Amazon service integrations reference"](#) (p. 165).

The following Amazon CLI command creates an integration that sends an Amazon SQS message.

```
aws apigatewayv2 create-integration \
  --api-id abcdef123 \
  --integration-subtype SQS-SendMessage \
  --integration-type AWS_PROXY \
  --payload-format-version 1.0 \
  --credentials-arn arn:aws:iam::123456789012:role/apigateway-sqs \
  --request-parameters '{"QueueUrl": "$request.header.queueUrl", "MessageBody": "$request.body.message"}'
```

## Integration subtype reference

The following [integration subtypes](#) are supported for HTTP APIs.

### Integration subtypes

- [EventBridge-PutEvents](#) (p. 166)
- [SQS-SendMessage](#) (p. 166)

- [SQS-ReceiveMessage](#) (p. 167)
- [SQS-DeleteMessage](#) (p. 167)
- [SQS-PurgeQueue](#) (p. 167)
- [AppConfig-GetConfiguration](#) (p. 168)
- [Kinesis-PutRecord](#) (p. 168)
- [StepFunctions-StartExecution](#) (p. 168)
- [StepFunctions-StartSyncExecution](#) (p. 169)
- [StepFunctions-StopExecution](#) (p. 169)

### EventBridge-PutEvents

Sends custom events to Amazon EventBridge so that they can be matched to rules.

#### EventBridge-PutEvents 1.0

Parameter	Required
Detail	True
DetailType	True
Source	True
Time	False
EventBusName	False
Resources	False
Region	False
TraceHeader	False

To learn more, see [PutEvents](#) in the *Amazon EventBridge API Reference*.

### SQS-SendMessage

Delivers a message to the specified queue.

#### SQS-SendMessage 1.0

Parameter	Required
QueueUrl	True
MessageBody	True
DelaySeconds	False
MessageAttributes	False
MessageDeduplicationId	False
MessageGroupId	False
MessageSystemAttributes	False
Region	False

To learn more, see [SendMessage](#) in the *Amazon Simple Queue Service API Reference*.

### SQS-ReceiveMessage

Retrieves one or more messages (up to 10), from the specified queue.

#### SQS-ReceiveMessage 1.0

Parameter	Required
QueueUrl	True
AttributeNames	False
MaxNumberOfMessages	False
MessageAttributeNames	False
ReceiveRequestAttemptId	False
VisibilityTimeout	False
WaitTimeSeconds	False
Region	False

To learn more, see [ReceiveMessage](#) in the *Amazon Simple Queue Service API Reference*.

### SQS-DeleteMessage

Deletes the specified message from the specified queue.

#### SQS-DeleteMessage 1.0

Parameter	Required
ReceiptHandle	True
QueueUrl	True
Region	False

To learn more, see [DeleteMessage](#) in the *Amazon Simple Queue Service API Reference*.

### SQS-PurgeQueue

Deletes all messages in the specified queue.

#### SQS-PurgeQueue 1.0

Parameter	Required
QueueUrl	True
Region	False

To learn more, see [PurgeQueue](#) in the *Amazon Simple Queue Service API Reference*.

## AppConfig-GetConfiguration

Receive information about a configuration.

### AppConfig-GetConfiguration 1.0

Parameter	Required
Application	True
Environment	True
Configuration	True
ClientId	True
ClientConfigurationVersion	False
Region	False

To learn more, see [GetConfiguration](#) in the *Amazon AppConfig API Reference*.

## Kinesis-PutRecord

Writes a single data record into an Amazon Kinesis data stream.

### Kinesis-PutRecord 1.0

Parameter	Required
StreamName	True
Data	True
PartitionKey	True
SequenceNumberForOrdering	False
ExplicitHashKey	False
Region	False

To learn more, see [PutRecord](#) in the *Amazon Kinesis Data Streams API Reference*.

## StepFunctions-StartExecution

Starts a state machine execution.

### StepFunctions-StartExecution 1.0

Parameter	Required
StateMachineArn	True
Name	False
Input	False
Region	False

To learn more, see [StartExecution](#) in the *Amazon Step Functions API Reference*.

### StepFunctions-StartSyncExecution

Starts a synchronous state machine execution.

#### StepFunctions-StartSyncExecution 1.0

Parameter	Required
StateMachineArn	True
Name	False
Input	False
Region	False
TraceHeader	False

To learn more, see [StartSyncExecution](#) in the *Amazon Step Functions API Reference*.

### StepFunctions-StopExecution

Stops an execution.

#### StepFunctions-StopExecution 1.0

Parameter	Required
ExecutionArn	True
Cause	False
Error	False
Region	False

To learn more, see [StopExecution](#) in the *Amazon Step Functions API Reference*.

## Working with private integrations for HTTP APIs

Private integrations enable you to create API integrations with private resources in a VPC, such as Application Load Balancers or Amazon ECS container-based applications.

You can expose your resources in a VPC for access by clients outside of the VPC by using private integrations. You can control access to your API by using any of the [authorization methods \(p. 151\)](#) that API Gateway supports.

To create a private integration, you must first create a VPC link. To learn more about VPC links, see [Working with VPC links for HTTP APIs \(p. 171\)](#).

After you've created a VPC link, you can set up private integrations that connect to an Application Load Balancer, Network Load Balancer, or resources registered with an Amazon Cloud Map service.

To create a private integration, all resources must be owned by the same Amazon account (including the load balancer or Amazon Cloud Map service, VPC link and HTTP API).



By default, private integration traffic uses the HTTP protocol. You can specify a `tlsConfig` if you require private integration traffic to use HTTPS.

**Note**

For private integrations, API Gateway includes the [stage \(p. 184\)](#) portion of the API endpoint in the request to your backend resources. For example, a request to the `test` stage of an API includes `test/route-path` in the request to your private integration. To remove the stage name from the request to your backend resources, use [parameter mapping \(p. 173\)](#) to overwrite the request path to `$request.path`.

## Create a private integration using an Application Load Balancer or Network Load Balancer

Before you create a private integration, you must create a VPC link. To learn more about VPC links, see [Working with VPC links for HTTP APIs \(p. 171\)](#).

To create a private integration with an Application Load Balancer or Network Load Balancer, create an HTTP proxy integration, specify the VPC link to use, and provide the listener ARN of the load balancer.

Use the following command to create a private integration that connects to a load balancer by using a VPC link.

```
aws apigatewayv2 create-integration --api-id api-id --integration-type HTTP_PROXY \
  --integration-method GET --connection-type VPC_LINK \
  --connection-id VPC-link-ID \
  --integration-uri arn:aws:elasticloadbalancing:us-west-2:123456789012:listener/app/my-load-balancer/50dc6c495c0c9188/0467ef3c8400ae65
  --payload-format-version 1.0
```

## Create a private integration using Amazon Cloud Map service discovery

Before you create a private integration, you must create a VPC link. To learn more about VPC links, see [Working with VPC links for HTTP APIs \(p. 171\)](#).

For integrations with Amazon Cloud Map, API Gateway uses `DiscoverInstances` to identify resources. You can use query parameters to target specific resources. The registered resources' attributes must include IP addresses and ports. API Gateway distributes requests across healthy resources that are returned from `DiscoverInstances`. To learn more, see [DiscoverInstances](#) in the Amazon Cloud Map API Reference.

**Note**

If you use Amazon ECS to populate entries in Amazon Cloud Map, you must configure your Amazon ECS task to use SRV records. "A" records aren't supported. To learn more, see [Configuring Your Service to Use Service Discovery](#) in the Amazon Elastic Container Service Developer Guide.

To create a private integration with Amazon Cloud Map, create an HTTP proxy integration, specify the VPC link to use, and provide the ARN of the Amazon Cloud Map service.

Use the following command to create a private integration that uses Amazon Cloud Map service discovery to identify resources.

```
aws apigatewayv2 create-integration --api-id api-id --integration-type HTTP_PROXY \
  --integration-method GET --connection-type VPC_LINK \
  --connection-id VPC-link-ID \
  --integration-uri arn:aws:servicediscovery:us-west-2:123456789012:service/srv-id?stage=prod&deployment=green_deployment
  --payload-format-version 1.0
```

## Working with VPC links for HTTP APIs

VPC links enable you to create private integrations that connect your HTTP API routes to private resources in a VPC, such as Application Load Balancers or Amazon ECS container-based applications. To learn more about creating private integrations, see [Working with private integrations for HTTP APIs \(p. 169\)](#).

A private integration uses a VPC link to encapsulate connections between API Gateway and targeted VPC resources. You can reuse VPC links across different routes and APIs.

When you create a VPC link, API Gateway creates and manages [elastic network interfaces](#) for the VPC link in your account. This process can take a few minutes. When a VPC link is ready to use, its state transitions from `PENDING` to `AVAILABLE`.

### Note

If no traffic is sent over the VPC link for 60 days, it becomes `INACTIVE`. When a VPC link is in an `INACTIVE` state, API Gateway deletes all of the VPC link's network interfaces. This causes API requests that depend on the VPC link to fail. If API requests resume, API Gateway reprovisions network interfaces. It can take a few minutes to create the network interfaces and reactivate the VPC link. You can use the VPC link status to monitor the state of your VPC link.

### Create a VPC link by using the Amazon CLI

Use the following command to create a VPC link. To create a VPC link, all resources involved must be owned by the same Amazon account.

```
aws apigatewayv2 create-vpc-link --name MyVpcLink \
  --subnet-ids subnet-aaaa subnet-bbbb \
  --security-group-ids sg1234 sg5678
```

### Note

VPC links are immutable. After you create a VPC link, you can't change its subnets or security groups.

### Delete a VPC link by using the Amazon CLI

Use the following command to delete a VPC link.

```
aws apigatewayv2 delete-vpc-link --vpc-link-id abcd123
```

### Availability by Region

VPC links for HTTP APIs are supported in the following Regions and Availability Zones:

Region name	Region	Supported Availability Zones
US East (Ohio)	us-east-2	use2-az1, use2-az2, use2-az3
US East (N. Virginia)	us-east-1	use1-az1, use1-az2, use1-az4, use1-az5, use1-az6
US West (N. California)	us-west-1	usw1-az1, usw1-az3
US West (Oregon)	us-west-2	usw2-az1, usw2-az2, usw2-az3, usw2-az4
Asia Pacific (Hong Kong)	ap-east-1	ape1-az2, ape1-az3

Region name	Region	Supported Availability Zones
Asia Pacific (Mumbai)	ap-south-1	aps1-az1, aps1-az2, aps1-az3
Asia Pacific (Seoul)	ap-northeast-2	apne2-az1, apne2-az2, apne2-az3
Asia Pacific (Singapore)	ap-southeast-1	apse1-az1, apse1-az2, apse1-az3
Asia Pacific (Sydney)	ap-southeast-2	apse2-az1, apse2-az2, apse2-az3
Asia Pacific (Tokyo)	ap-northeast-1	apne1-az1, apne1-az2, apne1-az4
Canada (Central)	ca-central-1	cac1-az1, cac1-az2
China (Beijing)	cn-north-1	cnn1-az1, cnn1-az2
China (Ningxia)	cn-northwest-1	cnnw1-az1, cnnw1-az2, cnnw1-az3
Europe (Frankfurt)	eu-central-1	euc1-az1, euc1-az2, euc1-az3
Europe (Ireland)	eu-west-1	euw1-az1, euw1-az2, euw1-az3
Europe (London)	eu-west-2	euw2-az1, euw2-az2, euw2-az3
Europe (Paris)	eu-west-3	euw3-az1, euw3-az3
Europe (Stockholm)	eu-north-1	eun1-az1, eun1-az2, eun1-az3
Middle East (Bahrain)	me-south-1	mes1-az1, mes1-az2, mes1-az3
South America (São Paulo)	sa-east-1	sae1-az1, sae1-az2, sae1-az3

## Configuring CORS for an HTTP API

[Cross-origin resource sharing \(CORS\)](#) is a browser security feature that restricts HTTP requests that are initiated from scripts running in the browser.

CORS is typically required to build web applications that access APIs hosted on a different domain or origin. You can enable CORS to allow requests to your API from a web application hosted on a different domain. For example, if your API is hosted on `https://{api_id}.execute-api.{region}.amazonaws.com/` and you want to call your API from a web application hosted on `example.com`, your API must support CORS.

If you configure CORS for an API, API Gateway automatically sends a response to preflight OPTIONS requests, even if there isn't an OPTIONS route configured for your API. For a CORS request, API Gateway adds the configured CORS headers to the response from an integration.

**Note**

If you configure CORS for an API, API Gateway ignores CORS headers returned from your backend integration.

You can specify the following parameters in a CORS configuration.

CORS headers	CORS configuration property	Example values
Access-Control-Allow-Origin	allowOrigins	<ul style="list-style-type: none"> <li>https://www.example.com</li> <li>* (allow all origins)</li> <li>https://* (allow any origin that begins with https://)</li> <li>http://* (allow any origin that begins with http://)</li> </ul>
Access-Control-Allow-Credentials	allowCredentials	true
Access-Control-Expose-Headers	exposeHeaders	Date, x-api-id
Access-Control-Max-Age	maxAge	300
Access-Control-Allow-Methods	allowMethods	GET, POST, DELETE, *
Access-Control-Allow-Headers	allowHeaders	Authorization, *

## Configuring CORS for an HTTP API with a `$default` route and JWT authorizer

You can enable CORS and configure authorization for any route of an HTTP API. When you enable CORS and authorization for the `$default` route, there are some special considerations. The `$default` route catches requests for all methods and routes that you haven't explicitly defined, including `OPTIONS` requests. To support unauthorized `OPTIONS` requests, add an `OPTIONS /{proxy+}` route to your API that doesn't require authorization. The `OPTIONS /{proxy+}` route has higher priority than the `$default` route. As a result, it enables clients to submit `OPTIONS` requests to your API without authorization. For more information about routing priorities, see [Routing API requests \(p. 150\)](#).

## Configure CORS for an HTTP API by using the Amazon CLI

You can use the following command to enable CORS requests from `https://www.example.com`.

**Example**

```
aws apigatewayv2 update-api --api-id api-id --cors-configuration AllowOrigins="https://www.example.com"
```

For more information, see [CORS](#) in the Amazon API Gateway Version 2 API Reference.

## Transforming API requests and responses

You can modify API requests from clients before they reach your backend integrations. You can also change the response from integrations before API Gateway returns the response to clients. You use *parameter mapping* to modify API requests and responses for HTTP APIs. To use parameter mapping, you specify API request or response parameters to modify, and specify how to modify those parameters.

## Transforming API requests

You use request parameters to change requests before they reach your backend integrations. You can modify headers, query strings, or the request path.

Request parameters are a key-value map. The key identifies the location of the request parameter to change, and how to change it. The value specifies the new data for the parameter.

The following table shows supported keys.

### Parameter mapping keys

Type	Syntax
Header	append overwrite  remove:header. <i>headername</i>
Query string	append overwrite  remove:querystring. <i>querystring-name</i>
Path	overwrite:path

The following table shows supported values that you can map to parameters.

### Request parameter mapping values

Type	Syntax	Notes
Header value	<code>\$request.header.name</code> or <code>\${request.header.name}</code>	Header names are case-insensitive. API Gateway combines multiple header values with commas, for example "header1": "value1,value2". Some headers are reserved. To learn more, see <a href="#">the section called "Reserved headers" (p. 176)</a> .
Query string value	<code>\$request.querystring.name</code> or <code>\${request.querystring.name}</code>	Query string names are case-sensitive. API Gateway combines multiple values with commas, for example "querystring1" "value1,value2".
Request body	<code>\$request.body.name</code> or <code>\${request.body.name}</code>	A JSON path expression. Recursive descent ( <code>\$request.body.name</code> ) and filter expressions ( <code>?(expression)</code> ) aren't supported.  <b>Note</b> When you specify a JSON path, API Gateway truncates the request body at 100 KB and then applies the selection expression. To

Type	Syntax	Notes
		send payloads larger than 100 KB, specify <code>\$request.body</code> .
Request path	<code>\$request.path</code> or <code>\${request.path}</code>	The request path, without the stage name.
Path parameter	<code>\$request.path.name</code> or <code>\${request.path.name}</code>	The value of a path parameter in the request. For example if the route is <code>/pets/{petId}</code> , you can map the <code>petId</code> parameter from the request with <code>\$request.path.petId</code> .
Context variable	<code>\$context.variableName</code> or <code>\${context.variableName}</code>	The value of a <a href="#">context variable</a> (p. 198).
Stage variable	<code>\$stageVariables.variableName</code> or <code>\${stageVariables.variableName}</code>	The value of a <a href="#">stage variable</a> (p. 184).
Static value	<i>string</i>	A constant value.

#### Note

To use multiple variables in a selection expression, enclose the variable in brackets. For example, `${request.path.name} ${request.path.id}`.

## Transforming API responses

You use response parameters to transform the HTTP response from a backend integration before returning the response to clients. You can modify headers or the status code of a response before API Gateway returns the response to clients.

You configure response parameters for each status code that your integration returns. Response parameters are a key-value map. The key identifies the location of the request parameter to change, and how to change it. The value specifies the new data for the parameter.

The following table shows supported keys.

### Response parameter mapping keys

Type	Syntax
Header	<code>append overwrite remove:header.headername</code>
Status code	<code>overwrite:statusCode</code>

The following table shows supported values that you can map to parameters.

### Response parameter mapping values

Type	Syntax	Notes
Header value	<code>\$request.header.name</code> or <code>\${request.header.name}</code>	Header names are case-insensitive. API Gateway

Type	Syntax	Notes
		combines multiple header values with commas, for example "header1": "value1,value2". Some headers are reserved. To learn more, see <a href="#">the section called "Reserved headers"</a> (p. 176).
Response body	<code>\$response.body.name</code> or <code>\${response.body.name}</code>	A JSON path expression. Recursive descent ( <code>\$response.body.name</code> ) and filter expressions ( <code>?(expression)</code> ) aren't supported.  <b>Note</b> When you specify a JSON path, API Gateway truncates the response body at 100 KB and then applies the selection expression. To send payloads larger than 100 KB, specify <code>\$response.body</code> .
Context variable	<code>\$context.variableName</code> or <code>\${context.variableName}</code>	The value of a supported <a href="#">context variable</a> (p. 198).
Stage variable	<code>\$stageVariables.variableName</code> or <code>\${stageVariables.variableName}</code>	The value of a <a href="#">stage variable</a> (p. 184).
Static value	<i>string</i>	A constant value.

**Note**

To use multiple variables in a selection expression, enclose the variable in brackets. For example, `${request.path.name} ${request.path.id}`.

## Reserved headers

The following headers are reserved. You can't configure request or response mappings for these headers.

- access-control-\*
- apigw-\*
- Authorization
- Connection
- Content-Encoding
- Content-Length
- Content-Location
- Forwarded
- Keep-Alive
- Origin

- Proxy-Authenticate
- Proxy-Authorization
- TE
- Trailers
- Transfer-Encoding
- Upgrade
- x-amz-\*
- x-amzn-\*
- X-Forwarded-For
- X-Forwarded-Host
- X-Forwarded-Proto
- Via

## Examples

The following Amazon CLI examples configure parameter mappings. For example Amazon CloudFormation templates, see [GitHub](#).

### Add a header to an API request

The following example adds a header named `header1` to an API request before it reaches your backend integration. API Gateway populates the header with the request ID.

```
aws apigatewayv2 create-integration \  
  --api-id abcdef123 \  
  --integration-type HTTP_PROXY \  
  --payload-format-version 1.0 \  
  --integration-uri 'https://api.example.com' \  
  --integration-method ANY \  
  --request-parameters '{ "append:header.header1": "$context.requestId" }'
```

### Rename a request header

The following example renames a request header from `header1` to `header2`.

```
aws apigatewayv2 create-integration \  
  --api-id abcdef123 \  
  --integration-type HTTP_PROXY \  
  --payload-format-version 1.0 \  
  --integration-uri 'https://api.example.com' \  
  --integration-method ANY \  
  --request-parameters '{ "append:header.header2": "$request.header.header1",  
  "remove:header.header1": "" }'
```

### Change the response from an integration

The following example configures response parameters for an integration. When the integration returns a 500 status code, API Gateway changes the status code to 403, and adds `header1` to the response. When the integration returns a 404 status code, API Gateway adds an `error` header to the response.

```
aws apigatewayv2 create-integration \  
  --api-id abcdef123 \  
  --integration-type HTTP_PROXY \  
  --payload-format-version 1.0 \  
  --integration-uri 'https://api.example.com' \  
  --response-parameters '{ "statusCode": "403", "headers": { "header1": "$context.status" } }'
```



```
--integration-method ANY \  
--response-parameters '{"500" : {"append:header.header1": "$context.requestId",  
"overwrite:statusCode" : "403"}, "404" : {"append:header.error" :  
"$stageVariables.environmentId"} } }
```

## Remove configured parameter mappings

The following example command removes previously configured request parameters for `append:header.header1`. It also removes previously configured response parameters for a 200 status code.

```
aws apigatewayv2 update-integration \  
--api-id abcdef123 \  
--integration-type HTTP_PROXY \  
--payload-format-version 1.0 \  
--integration-uri 'https://api.example.com' \  
--integration-method ANY \  
--request-parameters {"append:header.header1" : ""} \  
--response-parameters {"200" : {}}
```

## Working with OpenAPI definitions for HTTP APIs

You can define your HTTP API by using an OpenAPI 3.0 definition file. Then you can import the definition into API Gateway to create an API. To learn more about API Gateway extensions to OpenAPI, see [OpenAPI extensions \(p. 675\)](#).

### Importing an HTTP API

You can create an HTTP API by importing an OpenAPI 3.0 definition file.

To migrate from a REST API to an HTTP API, you can export your REST API as an OpenAPI 3.0 definition file. Then import the API definition as an HTTP API. To learn more about exporting a REST API, see [Export a REST API from API Gateway \(p. 433\)](#).

#### Note

HTTP APIs support the same Amazon variables as REST APIs. To learn more, see [Amazon variables for OpenAPI import \(p. 432\)](#).

### Import validation information

As you import an API, API Gateway provides three categories of validation information.

#### Info

A property is valid according to the OpenAPI specification, but that property isn't supported for HTTP APIs.

For example, the following OpenAPI 3.0 snippet produces info on import because HTTP APIs don't support request validation. API Gateway ignores the `requestBody` and `schema` fields.

```
"paths": {  
  "/": {  
    "get": {  
      "x-amazon-apigateway-integration": {  
        "type": "AWS_PROXY",  
        "httpMethod": "POST",  
        "uri": "arn:aws:lambda:us-west-2:123456789012:function:HelloWorld",  
        "payloadFormatVersion": "1.0"  
      },  
      "requestBody": {
```

```
        "content": {
          "application/json": {
            "schema": {
              "$ref": "#/components/schemas/Body"
            }
          }
        }
      }
    }
  },
  ...
},
"components": {
  "schemas": {
    "Body": {
      "type": "object",
      "properties": {
        "key": {
          "type": "string"
        }
      }
    }
  }
  ...
}
...
}
```

### Warning

A property or structure is invalid according to the OpenAPI specification, but it doesn't block API creation. You can specify whether API Gateway should ignore these warnings and continue creating the API, or stop creating the API on warnings.

The following OpenAPI 3.0 document produces warnings on import because HTTP APIs support only Lambda proxy and HTTP proxy integrations.

```
"x-amazon-apigateway-integration": {
  "type": "AWS",
  "httpMethod": "POST",
  "uri": "arn:aws:lambda:us-west-2:123456789012:function:HelloWorld",
  "payloadFormatVersion": "1.0"
}
```

### Error

The OpenAPI specification is invalid or malformed. API Gateway can't create any resources from the malformed document. You must fix the errors, and then try again.

The following API definition produces errors on import because HTTP APIs support only the OpenAPI 3.0 specification.

```
{
  "swagger": "2.0.0",
  "info": {
    "title": "My API",
    "description": "An Example OpenAPI definition for Errors/Warnings/ImportInfo",
    "version": "1.0"
  }
  ...
}
```

As another example, while OpenAPI allows users to define an API with multiple security requirements attached to a particular operation, API Gateway does not support this. Each operation

can have only one of IAM authorization, a Lambda authorizer, or a JWT authorizer. Attempting to model multiple security requirements results in an error.

## Import an API by using the Amazon CLI

The following command imports the OpenAPI 3.0 definition file `api-definition.json` as an HTTP API.

### Example

```
aws apigatewayv2 import-api --body file://api-definition.json
```

### Example

You can import the following example OpenAPI 3.0 definition to create an HTTP API.

```
{
  "openapi": "3.0.1",
  "info": {
    "title": "Example Pet Store",
    "description": "A Pet Store API.",
    "version": "1.0"
  },
  "paths": {
    "/pets": {
      "get": {
        "operationId": "GET HTTP",
        "parameters": [
          {
            "name": "type",
            "in": "query",
            "schema": {
              "type": "string"
            }
          },
          {
            "name": "page",
            "in": "query",
            "schema": {
              "type": "string"
            }
          }
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "headers": {
              "Access-Control-Allow-Origin": {
                "schema": {
                  "type": "string"
                }
              }
            },
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/Pets"
                }
              }
            }
          }
        }
      }
    }
  }
}
```

```

"x-amazon-apigateway-integration": {
  "type": "HTTP_PROXY",
  "httpMethod": "GET",
  "uri": "http://petstore.execute-api.us-west-1.amazonaws.com/petstore/pets",
  "payloadFormatVersion": 1.0
}
},
"post": {
  "operationId": "Create Pet",
  "requestBody": {
    "content": {
      "application/json": {
        "schema": {
          "$ref": "#/components/schemas/NewPet"
        }
      }
    },
    "required": true
  },
  "responses": {
    "200": {
      "description": "200 response",
      "headers": {
        "Access-Control-Allow-Origin": {
          "schema": {
            "type": "string"
          }
        }
      },
      "content": {
        "application/json": {
          "schema": {
            "$ref": "#/components/schemas/NewPetResponse"
          }
        }
      }
    }
  }
},
"x-amazon-apigateway-integration": {
  "type": "HTTP_PROXY",
  "httpMethod": "POST",
  "uri": "http://petstore.execute-api.us-west-1.amazonaws.com/petstore/pets",
  "payloadFormatVersion": 1.0
}
},
"/pets/{petId}": {
  "get": {
    "operationId": "Get Pet",
    "parameters": [
      {
        "name": "petId",
        "in": "path",
        "required": true,
        "schema": {
          "type": "string"
        }
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "headers": {
          "Access-Control-Allow-Origin": {
            "schema": {
              "type": "string"
            }
          }
        }
      }
    }
  }
}

```

```

        }
      },
      "content": {
        "application/json": {
          "schema": {
            "$ref": "#/components/schemas/Pet"
          }
        }
      }
    },
    "x-amazon-apigateway-integration": {
      "type": "HTTP_PROXY",
      "httpMethod": "GET",
      "uri": "http://petstore.execute-api.us-west-1.amazonaws.com/petstore/pets/
{petId}",
      "payloadFormatVersion": 1.0
    }
  },
  "x-amazon-apigateway-cors": {
    "allowOrigins": [
      "*"
    ],
    "allowMethods": [
      "GET",
      "OPTIONS",
      "POST"
    ],
    "allowHeaders": [
      "x-amzm-header",
      "x-apigateway-header",
      "x-api-key",
      "authorization",
      "x-amz-date",
      "content-type"
    ]
  },
  "components": {
    "schemas": {
      "Pets": {
        "type": "array",
        "items": {
          "$ref": "#/components/schemas/Pet"
        }
      },
      "Empty": {
        "type": "object"
      },
      "NewPetResponse": {
        "type": "object",
        "properties": {
          "pet": {
            "$ref": "#/components/schemas/Pet"
          },
          "message": {
            "type": "string"
          }
        }
      },
      "Pet": {
        "type": "object",
        "properties": {
          "id": {

```

```

        "type": "string"
      },
      "type": {
        "type": "string"
      },
      "price": {
        "type": "number"
      }
    }
  },
  "NewPet": {
    "type": "object",
    "properties": {
      "type": {
        "$ref": "#/components/schemas/PetType"
      },
      "price": {
        "type": "number"
      }
    }
  },
  "PetType": {
    "type": "string",
    "enum": [
      "dog",
      "cat",
      "fish",
      "bird",
      "gecko"
    ]
  }
}
}
}
}

```

## Exporting an HTTP API from API Gateway

After you've created an HTTP API, you can export an OpenAPI 3.0 definition of your API from API Gateway. You can either choose a stage to export, or export the latest configuration of your API. You can also import an exported API definition into API Gateway to create another, identical API. To learn more about importing API definitions, see [Importing an HTTP API \(p. 178\)](#).

### Export an OpenAPI 3.0 definition of a stage by using the Amazon CLI

The following command exports an OpenAPI definition of an API stage named `prod` to a YAML file named `stage-definition.yaml`. The exported definition file includes [API Gateway extensions \(p. 675\)](#) by default.

```

aws apigatewayv2 export-api \
  --api-id api-id \
  --output-type YAML \
  --specification OAS30 \
  --stage-name prod \
  stage-definition.yaml

```

### Export an OpenAPI 3.0 definition of your API's latest changes by using the Amazon CLI

The following command exports an OpenAPI definition of an HTTP API to a JSON file named `latest-api-definition.json`. Because the command doesn't specify a stage, API Gateway exports the latest

configuration of your API, whether it has been deployed to a stage or not. The exported definition file doesn't include [API Gateway extensions](#) (p. 675).

```
aws apigatewayv2 export-api \  
  --api-id api-id \  
  --output-type JSON \  
  --specification OAS30 \  
  --no-include-extensions \  
  latest-api-definition.json
```

For more information, see [ExportAPI](#) in the *Amazon API Gateway Version 2 API Reference*.

## Publishing HTTP APIs for customers to invoke

You can use stages and custom domain names to publish your API for clients to invoke.

An API stage is a logical reference to a lifecycle state of your API (for example, `dev`, `prod`, `beta`, or `v2`). Each stage is a named reference to a deployment of the API and is made available for client applications to call. You can configure different integrations and settings for each stage of an API.

You can use custom domain names to provide a simpler, more intuitive URL for clients to invoke your API than the default URL, `https://api-id.execute-api.region.amazonaws.com/stage`.

### Topics

- [Working with stages for HTTP APIs](#) (p. 184)
- [Setting up custom domain names for HTTP APIs](#) (p. 186)

## Working with stages for HTTP APIs

An API stage is a logical reference to a lifecycle state of your API (for example, `dev`, `prod`, `beta`, or `v2`). API stages are identified by their API ID and stage name, and they're included in the URL you use to invoke the API. Each stage is a named reference to a deployment of the API and is made available for client applications to call.

You can create a `$default` stage that is served from the base of your API's URL—for example, `https://{api_id}.execute-api.{region}.amazonaws.com/`. You use this URL to invoke an API stage.

A deployment is a snapshot of your API configuration. After you deploy an API to a stage, it's available for clients to invoke. You must deploy an API for changes to take effect. If you enable automatic deployments, changes to an API are automatically released for you.

## Stage variables

Stage variables are key-value pairs that you can define for a stage of an HTTP API. They act like environment variables and can be used in your API setup.

For example, you can define a stage variable, and then set its value as an HTTP endpoint for an HTTP proxy integration. Later, you can reference the endpoint by using the associated stage variable name. By doing this, you can use the same API setup with a different endpoint at each stage. Similarly, you can use stage variables to specify a different Amazon Lambda function integration for each stage of your API.

### Note

Stage variables are not intended to be used for sensitive data, such as credentials. To pass sensitive data to integrations, use an Amazon Lambda authorizer. You can pass sensitive data to integrations in the output of the Lambda authorizer. To learn more, see [the section called "Lambda authorizer response format"](#) (p. 153).

## Examples

To use a stage variable to customize the HTTP integration endpoint, you must first set the name and value of the stage variable (for example, `url1`) with a value of `example.com`. Next, set up an HTTP proxy integration. Instead of entering the endpoint's URL, you can tell API Gateway to use the stage variable value, `http://${stageVariables.url1}`. This value tells API Gateway to substitute your stage variable `${ }` at runtime, depending on the stage of your API.

You can reference stage variables in a similar way to specify a Lambda function name or an Amazon role ARN.

When specifying a Lambda function name as a stage variable value, you must configure the permissions on the Lambda function manually. You can use the Amazon Command Line Interface (Amazon CLI) to do this.

```
aws lambda add-permission --function-name arn:aws:lambda:XXXXXX:your-lambda-function-name
--source-arn arn:aws:execute-api:us-east-1:YOUR_ACCOUNT_ID:api_id/*/HTTP_METHOD/resource
--principal apigateway.amazonaws.com --statement-id apigateway-access --action
lambda:InvokeFunction
```

## API Gateway stage variables reference

### HTTP integration URIs

You can use a stage variable as part of an HTTP integration URI, as shown in the following examples.

- A full URI without protocol – `http://${stageVariables.<variable_name>}`
- A full domain – `http://${stageVariables.<variable_name>}/resource/operation`
- A subdomain – `http://${stageVariables.<variable_name>}.example.com/resource/operation`
- A path – `http://example.com/${stageVariables.<variable_name>}/bar`
- A query string – `http://example.com/foo?q=${stageVariables.<variable_name>}`

### Lambda functions

You can use a stage variable in place of a Lambda function name or alias, as shown in the following examples.

- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:${stageVariables.<function_variable_name>}/invocations`
- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:<function_name>:${stageVariables.<version_variable_name>}/invocations`

#### Note

To use a stage variable for a Lambda function, the function must be in the same account as the API. Stage variables don't support cross-account Lambda functions.

### Amazon integration credentials

You can use a stage variable as part of an Amazon user or role credential ARN, as shown in the following example.

- `arn:aws:iam::<account_id>:${stageVariables.<variable_name>}`



## Setting up custom domain names for HTTP APIs

*Custom domain names* are simpler and more intuitive URLs that you can provide to your API users.

After deploying your API, you (and your customers) can invoke the API using the default base URL of the following format:

```
https://api-id.execute-api.region.amazonaws.com/stage
```

where *api-id* is generated by API Gateway, *region* (Amazon Region) is specified by you when creating the API, and *stage* is specified by you when deploying the API.

The hostname portion of the URL (that is, *api-id*.execute-api.*region*.amazonaws.com) refers to an API endpoint. The default API endpoint can be difficult to recall and not user-friendly.

With custom domain names, you can set up your API's hostname, and choose a base path (for example, *myservice*) to map the alternative URL to your API. For example, a more user-friendly API base URL can become:

```
https://api.example.com/myservice
```

If you don't set any base mapping under a custom domain name, the resulting API's base URL is the same as the custom domain (for example, `https://api.example.com`). In this case, the custom domain name can't support more than one API.

### Note

A custom domain can be associated with REST APIs and HTTP APIs. You can use [API Gateway Version 2 APIs](#) to create and manage Regional custom domain names for REST APIs and HTTP APIs.

For HTTP APIs, TLS 1.2 is the only supported TLS version.

## Register a domain name

You must have a registered internet domain name in order to set up custom domain names for your APIs. If needed, you can register an internet domain using [Amazon Route 53](#) or using a third-party domain registrar of your choice. An API's custom domain name can be the name of a subdomain or the root domain (also known as "zone apex") of a registered internet domain.

After a custom domain name is created in API Gateway, you must create or update your DNS provider's resource record to map to your API endpoint. Without such a mapping, API requests bound for the custom domain name cannot reach API Gateway.

## Regional custom domain names

When you create a custom domain name for a Regional API, API Gateway creates a Regional domain name for the API. You must set up a DNS record to map the custom domain name to the Regional domain name. You must also provide a certificate for the custom domain name.

## Wildcard custom domain names

With wildcard custom domain names, you can support an almost infinite number of domain names without exceeding the [default quota](#) (p. 744). For example, you could give each of your customers their own domain name, *customername*.api.example.com.

To create a wildcard custom domain name, specify a wildcard (\*) as the first subdomain of a custom domain that represents all possible subdomains of a root domain.

For example, the wildcard custom domain name `*.example.com` results in subdomains such as `a.example.com`, `b.example.com`, and `c.example.com`, which all route to the same domain.

Wildcard custom domain names support distinct configurations from API Gateway's standard custom domain names. For example, in a single Amazon account, you can configure `*.example.com` and `a.example.com` to behave differently.

To create a wildcard custom domain name, you must provide a certificate issued by ACM that has been validated using either the DNS or the email validation method.

**Note**

You can't create a wildcard custom domain name if a different Amazon account has created a custom domain name that conflicts with the wildcard custom domain name. For example, if account A has created `a.example.com`, then account B can't create the wildcard custom domain name `*.example.com`.

If account A and account B share an owner, you can contact the [Amazon Support Center](#) to request an exception.

## Certificates for custom domain names

To provide a certificate for a custom domain name in a Region where ACM is supported, you must request a certificate from ACM. To provide a certificate for a Regional custom domain name in a Region where ACM is not supported, you must import a certificate to API Gateway in that Region.

To import an SSL/TLS certificate, you must provide the PEM-formatted SSL/TLS certificate body, its private key, and the certificate chain for the custom domain name. Each certificate stored in ACM is identified by its ARN. To use an Amazon managed certificate for a domain name, you simply reference its ARN.

ACM makes it straightforward to set up and use a custom domain name for an API. You create a certificate for the given domain name (or import a certificate), set up the domain name in API Gateway with the ARN of the certificate provided by ACM, and map a base path under the custom domain name to a deployed stage of the API. With certificates issued by ACM, you do not have to worry about exposing any sensitive certificate details, such as the private key.

For details on setting up a custom domain name, see [Getting certificates ready in Amazon Certificate Manager \(p. 466\)](#) and [Setting up a regional custom domain name in API Gateway \(p. 475\)](#).

## Working with API mappings for HTTP APIs

You use API mappings to connect API stages to a custom domain name. After you create a domain name and configure DNS records, you use API mappings to send traffic to your APIs through your custom domain name.

An API mapping specifies an API, a stage, and optionally a path to use for the mapping. For example, you can map the `production` stage of an API to `https://api.example.com/orders`.

You can map HTTP and REST API stages to the same custom domain name.

Before you create an API mapping, you must have an API, a stage, and a custom domain name. To learn more about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

### Routing API requests

You can configure API mappings with multiple levels, for example `orders/v1/items` and `orders/v2/items`.

API Gateway routes requests to the API mapping that has the longest matching path. API Gateway considers only the paths configured for API mappings, and not API routes, to select the API to invoke.

If no path matches the request, API Gateway sends the request to the API that you've mapped to the empty path (none).

For example, consider a custom domain name `https://api.example.com` with the following API mappings:

1. (none) mapped to API 1.
2. `orders/v1/items` mapped to API 2.
3. `orders/v2/items` mapped to API 3.
4. `orders/v2/items/categories` mapped to API 4.

Request	Selected API	Explanation
<code>https://api.example.com/orders/v1/items</code>	API 2	The request exactly matches this API mapping.
<code>https://api.example.com/orders/v2/items</code>	API 3	The request exactly matches this API mapping.
<code>https://api.example.com/orders/v1/items/123</code>	API 2	API Gateway chooses the mapping that has the longest matching path. The 123 at the end of the request doesn't affect the selection.
<code>https://api.example.com/orders/v2/items/categories/5</code>	API 4	API Gateway chooses the mapping that has the longest matching path.
<code>https://api.example.com/customers</code>	API 1	API Gateway uses the empty mapping as a catch-all.

## Restrictions

- In an API mapping, the custom domain name and mapped APIs must be in the same Amazon account.
- API mappings must contain only letters, numbers, and the following characters: `$-_.+!*'()/`.
- The maximum length for the path in an API mapping is 300 characters.
- You can only map HTTP APIs to a regional custom domain name with the TLS 1.2 security policy.
- You can't map WebSocket APIs to the same custom domain name as an HTTP API or REST API.

## Create an API mapping

To create an API mapping, you must first create a custom domain name, API, and stage. For information about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

For example Amazon Serverless Application Model templates that create all resources, see [Sessions With SAM](#) on GitHub.

Amazon Web Services Management Console

### To create an API mapping

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.

2. Choose **Custom domain names**.
3. Select a custom domain name that you've already created.
4. Choose **API mappings**.
5. Choose **Configure API mappings**.
6. Choose **Add new mapping**.
7. Enter an **API**, a **Stage**, and optionally a **Path**.
8. Choose **Save**.

#### Amazon CLI

The following Amazon CLI command creates an API mapping. In this example, API Gateway sends requests to `api.example.com/v1/orders` to the specified API and stage.

```
aws apigatewayv2 create-api-mapping \  
  --domain-name api.example.com \  
  --api-mapping-key v1/orders \  
  --api-id a1b2c3d4 \  
  --stage test
```

#### Amazon CloudFormation

The following Amazon CloudFormation example creates an API mapping.

```
MyApiMapping:  
  Type: 'AWS::ApiGatewayV2::ApiMapping'  
  Properties:  
    DomainName: api.example.com  
    ApiMappingKey: 'orders/v2/items'  
    ApiId: !Ref MyApi  
    Stage: !Ref MyStage
```

## Disabling the default endpoint for an HTTP API

By default, clients can invoke your API by using the `execute-api` endpoint that API Gateway generates for your API. To ensure that clients can access your API only by using a custom domain name, disable the default `execute-api` endpoint.

### Note

When you disable the default endpoint, it affects all stages of an API.

The following Amazon CLI command disables the default endpoint for an HTTP API.

```
aws apigatewayv2 update-api \  
  --api-id abcdef123 \  
  --disable-execute-api-endpoint
```

After you disable the default endpoint, you must deploy your API for the change to take effect, unless automatic deployments are enabled.

The following Amazon CLI command creates a deployment.

```
aws apigatewayv2 create-deployment \  
  --api-id abcdef123 \  
  --stage-name test
```

```
--stage-name dev
```

## Protecting your HTTP API

API Gateway provides a number of ways to protect your API from certain threats, like malicious users or spikes in traffic. You can protect your API using strategies like setting throttling targets, and enabling mutual TLS. In this section you can learn how to enable these capabilities using API Gateway.

### Topics

- [Throttling requests to your HTTP API \(p. 190\)](#)
- [Configuring mutual TLS authentication for an HTTP API \(p. 191\)](#)

## Throttling requests to your HTTP API

You can configure throttling and quotas for your APIs to help protect them from being overwhelmed by too many requests. Both throttles and quotas are applied on a best-effort basis and should be thought of as targets rather than guaranteed request ceilings.

API Gateway throttles requests to your API using the token bucket algorithm, where a token counts for a request. Specifically, API Gateway examines the rate and a burst of request submissions against all APIs in your account, per Region. In the token bucket algorithm, a burst can allow pre-defined overrun of those limits, but other factors can also cause limits to be overrun in some cases.

When request submissions exceed the steady-state request rate and burst limits, API Gateway begins to throttle requests. Clients may receive 429 `Too Many Requests` error responses at this point. Upon catching such exceptions, the client can resubmit the failed requests in a way that is rate limiting.

As an API developer, you can set the target limits for individual API stages or routes to improve overall performance across all APIs in your account.

### Account-level throttling per Region

By default, API Gateway limits the steady-state requests per second (RPS) across all APIs within an Amazon account, per Region. It also limits the burst (that is, the maximum bucket size) across all APIs within an Amazon account, per Region. In API Gateway, the burst limit represents the target maximum number of concurrent request submissions that API Gateway will fulfill before returning 429 `Too Many Requests` error responses. For more information on throttling quotas, see [Quotas and important notes \(p. 744\)](#).

Per-account limits are applied to all APIs in an account in a specified Region. The account-level rate limit can be increased upon request - higher limits are possible with APIs that have shorter timeouts and smaller payloads. To request an increase of account-level throttling limits per Region, contact the [Amazon Support Center](#). For more information, see [Quotas and important notes \(p. 744\)](#). Note that these limits can't be higher than the Amazon throttling limits.

### Route-level throttling

You can set route-level throttling to override the account-level request throttling limits for a specific stage or for individual routes in your API. The default route throttling limits can't exceed account-level rate limits.

You can configure route-level throttling by using the Amazon CLI. The following command configures custom throttling for the specified stage and route of an API.

```
aws apigatewayv2 update-stage \
```

```
--api-id a1b2c3d4 \  
--stage-name dev \  
--route-settings '{"GET /pets":  
{ "ThrottlingBurstLimit":100, "ThrottlingRateLimit":2000}}'
```

## Configuring mutual TLS authentication for an HTTP API

Mutual TLS authentication requires two-way authentication between the client and the server. With mutual TLS, clients must present X.509 certificates to verify their identity to access your API. Mutual TLS is a common requirement for Internet of Things (IoT) and business-to-business applications.

You can use mutual TLS along with other [authorization and authentication operations \(p. 236\)](#) that API Gateway supports. API Gateway forwards the certificates that clients provide to Lambda authorizers and to backend integrations.

### Important

By default, clients can invoke your API by using the `execute-api` endpoint that API Gateway generates for your API. To ensure that clients can access your API only by using a custom domain name with mutual TLS, disable the default `execute-api` endpoint. To learn more, see [the section called "Disable the default endpoint" \(p. 189\)](#).

## Prerequisites for mutual TLS

To configure mutual TLS you need:

- A custom domain name
- At least one certificate configured in Amazon Certificate Manager for your custom domain name
- A truststore configured and uploaded to Amazon S3

## Custom domain names

To enable mutual TLS for a HTTP API, you must configure a custom domain name for your API. You can enable mutual TLS for a custom domain name, and then provide the custom domain name to clients. To access an API by using a custom domain name that has mutual TLS enabled, clients must present certificates that you trust in API requests. You can find more information at [the section called "Custom domain names" \(p. 186\)](#).

### Using Amazon Certificate Manager issued certificates

You can request a publicly trusted certificate directly from ACM or import public or self-signed certificates. To setup a certificate in ACM, go to [ACM](#). If you would like to import a certificate, continue reading in the following section.

### Using an imported or Amazon Certificate Manager PCA certificate

To use a certificate imported into ACM or a certificate from Amazon Certificate Manager Private Certificate Authority with mutual TLS, API Gateway needs an `ownershipVerificationCertificate` issued by ACM. This ownership certificate is only used to verify that you have permissions to use the domain name. It is not used for the TLS handshake. If you don't already have a `ownershipVerificationCertificate`, go to <https://console.amazonaws.cn/acm/> to set one up.

You will need to keep this certificate valid for the lifetime of your domain name. If a certificate expires and auto-renew fails, all updates to the domain name will be locked. You will need to update the `ownershipVerificationCertificateArn` with a valid `ownershipVerificationCertificate` before you can make any other changes. The `ownershipVerificationCertificate` cannot be

used as a server certificate for another mutual TLS domain in API Gateway. If a certificate is directly re-imported into ACM, the issuer must stay the same.

## Configuring your truststore

Truststores are text files with a `.pem` file extension. They are a trusted list of certificates from Certificate Authorities. To use mutual TLS, create a truststore of X.509 certificates that you trust to access your API.

You must include the complete chain of trust, starting from the issuing CA certificate, up to the root CA certificate, in your truststore. API Gateway accepts client certificates issued by any CA present in the chain of trust. The certificates can be from public or private certificate authorities. Certificates can have a maximum chain length of four. You can also provide self-signed certificates. The following hashing algorithms are supported in the truststore:

- SHA-256 or stronger
- RSA-2048 or stronger
- ECDSA-256 or stronger

API Gateway validates a number of certificate properties. You can use Lambda authorizers to perform additional checks when a client invokes an API, including checking whether a certificate has been revoked. API Gateway validates the following properties:

Validation	Description
X.509 syntax	The certificate must meet X.509 syntax requirements.
Integrity	The certificate's content must not have been altered from that signed by the certificate authority from the truststore.
Validity	The certificate's validity period must be current.
Name chaining / key chaining	The names and subjects of certificates must form an unbroken chain. Certificates can have a maximum chain length of four.

## Upload the truststore to an Amazon S3 bucket in a single file

### Example `certificates.pem`

```
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
...
```

The following Amazon CLI command uploads `certificates.pem` to your Amazon S3 bucket.

```
aws s3 cp certificates.pem s3://bucket-name
```

## Configuring mutual TLS for a custom domain name

To configure mutual TLS for a HTTP API, you must use a Regional custom domain name for your API, with a minimum TLS version of 1.2. To learn more about creating and configuring a custom domain name, see [the section called “Setting up a regional custom domain name” \(p. 475\)](#).

### Note

Mutual TLS isn't supported for private APIs.

After you've uploaded your truststore to Amazon S3, you can configure your custom domain name to use mutual TLS. Paste the following (slashes included) into a terminal:

```
aws apigatewayv2 create-domain-name \  
  --domain-name api.example.com \  
  --domain-name-configurations CertificateArn=arn:aws:acm:us-  
west-2:123456789012:certificate/123456789012-1234-1234-1234-12345678 \  
  --mutual-tls-authentication TruststoreUri=s3://bucket-name/key-name
```

After you create the domain name, you must configure DNS records and basepath mappings for API operations. To learn more, see [Setting up a regional custom domain name in API Gateway \(p. 475\)](#).

## Invoke an API by using a custom domain name that requires mutual TLS

To invoke an API with mutual TLS enabled, clients must present a trusted certificate in the API request. When a client attempts to invoke your API, API Gateway looks for the client certificate's issuer in your truststore. For API Gateway to proceed with the request, the certificate's issuer and the complete chain of trust up to the root CA certificate must be in your truststore.

The following example `curl` command sends a request to `api.example.com`, that includes `my-cert.pem` in the request. `my-key.key` is the private key for the certificate.

```
curl -v --key ./my-key.key --cert ./my-cert.pem api.example.com
```

Your API is invoked only if your truststore trusts the certificate. The following conditions will cause API Gateway to fail the TLS handshake and deny the request with a 403 status code. If your certificate:

- isn't trusted
- is expired
- doesn't use a supported algorithm

### Note

API Gateway doesn't verify if a certificate has been revoked.

## Updating your truststore

To update the certificates in your truststore, upload a new certificate bundle to Amazon S3. Then, you can update your custom domain name to use the updated certificate.

Use [Amazon S3 versioning](#) to maintain multiple versions of your truststore. When you update your custom domain name to use a new truststore version, API Gateway returns warnings if certificates are invalid.

API Gateway produces certificate warnings only when you update your domain name. API Gateway doesn't notify you if a previously uploaded certificate expires.



The following Amazon CLI command updates a custom domain name to use a new truststore version.

```
aws apigatewayv2 update-domain-name \  
  --domain-name api.example.com \  
  --mutual-tls-authentication truststoreVersion='abcdef123'
```

## Disable mutual TLS

To disable mutual TLS for a custom domain name, remove the truststore from your custom domain name, as shown in the following command.

```
aws apigatewayv2 update-domain-name \  
  --domain-name api.example.com \  
  --mutual-tls-authentication truststoreUri=''
```

## Troubleshooting certificate warnings

When creating a custom domain name with mutual TLS, API Gateway returns warnings if certificates in the truststore are not valid. This can also occur when updating a custom domain name to use a new truststore. The warnings indicate the issue with the certificate and the subject of the certificate that produced the warning. Mutual TLS is still enabled for your API, but some clients might not be able to access your API.

You'll need to decode the certificates in your truststore in order to identify which certificate produced the warning. You can use tools such as `openssl` to decode the certificates and identify their subjects.

The following command displays the contents of a certificate, including its subject:

```
openssl x509 -in certificate.crt -text -noout
```

Update or remove the certificates that produced warnings, and then upload a new truststore to Amazon S3. After uploading the new truststore, update your custom domain name to use the new truststore.

## Troubleshooting domain name conflicts

The error "The certificate subject <certSubject> conflicts with an existing certificate from a different issuer." means multiple Certificate Authorities have issued a certificate for this domain. For each subject in the certificate, there can only be one issuer in API Gateway for mutual TLS domains. You will need to get all of your certificates for that subject through a single issuer. If the problem is with a certificate you don't have control of but you can prove ownership of the domain name, [contact Amazon Web Services Support](#) to open a ticket.

## Troubleshooting domain name status messages

**PENDING\_CERTIFICATE\_REIMPORT:** This means you reimported a certificate to ACM and it failed validation because the new certificate has a SAN (subject alternative name) that is not covered by the `ownershipVerificationCertificate` or the subject or SANs in the certificate don't cover the domain name. Something might be configured incorrectly or an invalid certificate was imported. You need to reimport a valid certificate into ACM. For more information about validation see [Validating domain ownership](#).

**PENDING\_OWNERSHIP\_VERIFICATION:** This means your previously verified certificate has expired and ACM was unable to auto-renew it. You will need to renew the certificate or request a new certificate. More information about certificate renewal can be found at [ACM's troubleshooting managed certificate renewal](#) guide.

## Monitoring your HTTP API

You can use CloudWatch metrics and CloudWatch Logs to monitor HTTP APIs. By combining logs and metrics, you can log errors and monitor your API's performance.

**Note**

API Gateway might not generate logs and metrics in the following cases:

- 413 Request Entity Too Large errors
- Excessive 429 Too Many Requests errors
- 400 series errors from requests sent to a custom domain that has no API mapping
- 500 series errors caused by internal failures

**Topics**

- [Working with metrics for HTTP APIs \(p. 195\)](#)
- [Configuring logging for an HTTP API \(p. 196\)](#)

## Working with metrics for HTTP APIs

You can monitor API execution by using CloudWatch, which collects and processes raw data from API Gateway into readable, near-real-time metrics. These statistics are recorded for a period of 15 months so you can access historical information and gain a better perspective on how your web application or service is performing. By default, API Gateway metric data is automatically sent to CloudWatch in one-minute periods. For more information, see [What Is Amazon CloudWatch?](#) in the *Amazon CloudWatch User Guide*.

The following metrics are supported for HTTP APIs. You can also enable detailed metrics to write route-level metrics to Amazon CloudWatch.

Metric	Description
4xx	The number of client-side errors captured in a given period.
5xx	The number of server-side errors captured in a given period.
Count	The total number API requests in a given period.
IntegrationLatency	The time between when API Gateway relays a request to the backend and when it receives a response from the backend.
Latency	The time between when API Gateway receives a request from a client and when it returns a response to the client. The latency includes the integration latency and other API Gateway overhead.

Metric	Description
DataProcessed	The amount of data processed in bytes.

You can use the dimensions in the following table to filter API Gateway metrics.

Dimension	Description
Apild	Filters API Gateway metrics for an API with the specified API ID.
Apild, Stage	Filters API Gateway metrics for an API stage with the specified API ID and stage ID.
Apild, Stage, Route	Filters API Gateway metrics for an API method with the specified API ID, stage ID, and route ID.  API Gateway will not send these metrics unless you have explicitly enabled detailed CloudWatch metrics. You can do this by calling the UpdateStage action of the API Gateway V2 REST API to update the metricsEnabled property to <code>true</code> . Enabling such metrics will incur additional charges to your account. For pricing information, see <a href="#">Amazon CloudWatch Pricing</a> .

## Configuring logging for an HTTP API

You can enable logging to write logs to CloudWatch Logs. You can use [logging variables \(p. 198\)](#) to customize the content of your logs.

To enable logging for an HTTP API, you must do the following.

1. Ensure that your IAM user has the required permissions to enable logging.
2. Create a CloudWatch Logs log group.
3. Provide the ARN of the CloudWatch Logs log group for a stage of your API.

### Permissions to enable logging

To enable logging for an API, your IAM user must have the following permissions.

#### Example

```
{
  "Version": "2012-10-17",
  "Statement": [
```

```

    {
      "Effect": "Allow",
      "Action": [
        "logs:DescribeLogGroups",
        "logs:DescribeLogStreams",
        "logs:GetLogEvents",
        "logs:FilterLogEvents"
      ],
      "Resource": "arn:aws:logs:us-west-2:123456789012:log-group:*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogDelivery",
        "logs:PutResourcePolicy",
        "logs:UpdateLogDelivery",
        "logs>DeleteLogDelivery",
        "logs:CreateLogGroup",
        "logs:DescribeResourcePolicies",
        "logs:GetLogDelivery",
        "logs:ListLogDeliveries"
      ],
      "Resource": "*"
    }
  ]
}

```

## Creating a log group

The following Amazon CLI command creates a log group.

```
aws logs create-log-group --log-group-name my-log-group
```

You need the Amazon Resource Name (ARN) for your log group to enable logging. The ARN format is `arn:aws:logs:region:account-id:log-group:log-group-name`.

## Enabling logging for a stage

The following Amazon CLI command enables logging for the `$default` stage of an HTTP API.

```
aws apigatewayv2 update-stage --api-id abcdef \
  --stage-name '$default' \
  --access-log-settings '{"DestinationArn": "arn:aws:logs:region:account-id:log-
group:log-group-name", "Format": "$context.identity.sourceIp - - [context.requestTime]
\"$context.httpMethod $context.routeKey $context.protocol\" $context.status
$context.responseLength $context.requestId"}'
```

## Example log formats

Examples of some common access log formats are available in the API Gateway console and are listed as follows.

- CLF (**C**ommon **L**og **F**ormat):

```
$context.identity.sourceIp - - [context.requestTime] "$context.httpMethod
context.routeKey context.protocol" context.status context.responseLength
context.requestId
```

- JSON:

```
{ "requestId": "$context.requestId", "ip": "$context.identity.sourceIp",
  "requestTime": "$context.requestTime",
  "httpMethod": "$context.httpMethod", "routeKey": "$context.routeKey",
  "status": "$context.status", "protocol": "$context.protocol",
  "responseLength": "$context.responseLength" }
```

- XML:

```
<request id="$context.requestId"> <ip>$context.identity.sourceIp</ip> <requestTime>
  $context.requestTime</requestTime> <httpMethod>$context.httpMethod</httpMethod>
  <routeKey>$context.routeKey</routeKey> <status>$context.status</status> <protocol>
  $context.protocol</protocol> <responseLength>$context.responseLength</responseLength> </
  request>
```

- CSV (comma-separated values):

```
$context.identity.sourceIp,$context.requestTime,$context.httpMethod,$context.routeKey,
  $context.protocol,$context.status,$context.responseLength,$context.requestId
```

## Customizing HTTP API access logs

You can use the following variables to customize HTTP API access logs. To learn more about access logs for HTTP APIs, see [Configuring logging for an HTTP API \(p. 196\)](#).

Parameter	Description
<code>\$context.accountId</code>	The API owner's Amazon account ID.
<code>\$context.apiId</code>	The identifier API Gateway assigns to your API.
<code>\$context.authorizer.claims.<i>property</i></code>	<p>A property of the claims returned from the JSON Web Token (JWT) after the method caller is successfully authenticated. For more information, see <a href="#">Controlling access to HTTP APIs with JWT authorizers (p. 157)</a>.</p> <p><b>Note</b> Calling <code>\$context.authorizer.claims</code> returns null.</p>
<code>\$context.authorizer.error</code>	The error message returned from an authorizer.
<code>\$context.authorizer.principalId</code>	The principal user identification that a Lambda authorizer returns.
<code>\$context.authorizer.<i>property</i></code>	<p>The value of the specified key-value pair of the context map returned from an API Gateway Lambda authorizer function. For example, if the authorizer returns the following context map:</p> <pre>"context" : {   "key": "value",   "numKey": 1,   "boolKey": true }</pre>

Parameter	Description
	calling <code>\$context.authorizer.key</code> returns the "value" string, calling <code>\$context.authorizer.numKey</code> returns the 1, and calling <code>\$context.authorizer.boolKey</code> returns true.
<code>\$context.awsEndpointRequestId</code>	The Amazon endpoint's request ID from the <code>x-amz-request-id</code> or <code>x-amzn-requestId</code> header.
<code>\$context.awsEndpointRequestId2</code>	The Amazon endpoint's request ID from the <code>x-amz-id-2</code> header.
<code>\$context.customDomain.basePathMatched</code>	The path for an API mapping that an incoming request matched. Applicable when a client uses a custom domain name to access an API. For example if a client sends a request to <code>https://api.example.com/v1/orders/1234</code> , and the request matches the API mapping with the path <code>v1/orders</code> , the value is <code>v1/orders</code> . To learn more, see <a href="#">the section called "API mappings" (p. 187)</a> .
<code>\$context.dataProcessed</code>	The amount of data processed in bytes.
<code>\$context.domainName</code>	The full domain name used to invoke the API. This should be the same as the incoming <code>Host</code> header.
<code>\$context.domainPrefix</code>	The first label of the <code>\$context.domainName</code> . This is often used as a caller/customer identifier.
<code>\$context.error.message</code>	A string that contains an API Gateway error message.
<code>\$context.error.messageString</code>	The quoted value of <code>\$context.error.message</code> , namely <code>"\$context.error.message"</code> .
<code>\$context.error.responseType</code>	A type of <code>GatewayResponse</code> . For more information, see <a href="#">the section called "Metrics" (p. 665)</a> and <a href="#">the section called "Setting up gateway responses to customize error responses" (p. 376)</a> .
<code>\$context.extendedRequestId</code>	Equivalent to <code>\$context.requestId</code> .
<code>\$context.httpMethod</code>	The HTTP method used. Valid values include: <code>DELETE</code> , <code>GET</code> , <code>HEAD</code> , <code>OPTIONS</code> , <code>PATCH</code> , <code>POST</code> , and <code>PUT</code> .
<code>\$context.identity.accountId</code>	The Amazon account ID associated with the request. Supported for routes that use IAM authorization.
<code>\$context.identity.caller</code>	The principal identifier of the caller that signed the request. Supported for routes that use IAM authorization.

Parameter	Description
<code>\$context.identity.cognitoAuthenticationProvider</code>	<p>A comma-separated list of the Amazon Cognito authentication providers used by the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p> <p>For example, for an identity from an Amazon Cognito user pool, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i></code>, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i>:CognitoSignIn:<i>token subject claim</i></code></p> <p>For information, see <a href="#">Using Federated Identities</a> in the <i>Amazon Cognito Developer Guide</i>.</p>
<code>\$context.identity.cognitoAuthenticationType</code>	<p>The Amazon Cognito authentication type of the caller making the request. Available only if the request was signed with Amazon Cognito credentials. Possible values include <code>authenticated</code> for authenticated identities and <code>unauthenticated</code> for unauthenticated identities.</p>
<code>\$context.identity.cognitoIdentityId</code>	<p>The Amazon Cognito identity ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p>
<code>\$context.identity.cognitoIdentityPoolId</code>	<p>The Amazon Cognito identity pool ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p>
<code>\$context.identity.principalOrgId</code>	<p>The <a href="#">Amazon organization ID</a>. Supported for routes that use IAM authorization.</p>
<code>\$context.identity.clientCert.clientCertPem</code>	<p>The PEM-encoded client certificate that the client presented during mutual TLS authentication. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.</p>
<code>\$context.identity.clientCert.subjectDN</code>	<p>The distinguished name of the subject of the certificate that a client presents. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.</p>
<code>\$context.identity.clientCert.issuerDN</code>	<p>The distinguished name of the issuer of the certificate that a client presents. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.</p>
<code>\$context.identity.clientCert.serialNumber</code>	<p>The serial number of the certificate. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.</p>

Parameter	Description
<code>\$context.identity.clientCert.validity.notBefore</code>	The date before which the certificate is invalid. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.
<code>\$context.identity.clientCert.validity.notAfter</code>	The date after which the certificate is invalid. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled.
<code>\$context.identity.sourceIp</code>	The source IP address of the immediate TCP connection making the request to API Gateway endpoint.
<code>\$context.identity.user</code>	The principal identifier of the user that will be authorized against resource access. Supported for routes that use IAM authorization.
<code>\$context.identity.userAgent</code>	The <code>User-Agent</code> header of the API caller.
<code>\$context.identity.userArn</code>	The Amazon Resource Name (ARN) of the effective user identified after authentication. Supported for routes that use IAM authorization. For more information, see <a href="https://docs.aws.amazon.com/IAM/latest/UserGuide/id_users.html">https://docs.aws.amazon.com/IAM/latest/UserGuide/id_users.html</a> .
<code>\$context.integration.error</code>	The error message returned from an integration. Equivalent to <code>\$context.integrationErrorMessage</code> .
<code>\$context.integration.integrationStatus</code>	For Lambda proxy integration, the status code returned from Amazon Lambda, not from the backend Lambda function code.
<code>\$context.integration.latency</code>	The integration latency in ms. Equivalent to <code>\$context.integrationLatency</code> .
<code>\$context.integration.requestId</code>	The Amazon endpoint's request ID. Equivalent to <code>\$context.awsEndpointRequestId</code> .
<code>\$context.integration.status</code>	The status code returned from an integration. For Lambda proxy integrations, this is the status code that your Lambda function code returns. Equivalent to <code>\$context.integrationStatus</code> .
<code>\$context.integrationErrorMessage</code>	A string that contains an integration error message.
<code>\$context.integrationLatency</code>	The integration latency in ms.
<code>\$context.integrationStatus</code>	For Lambda proxy integration, this parameter represents the status code returned from Amazon Lambda, not from the backend Lambda function.
<code>\$context.path</code>	The request path. For example, <code>/{stage}/root/child</code> .



Parameter	Description
<code>\$context.protocol</code>	The request protocol, for example, <code>HTTP/1.1</code> .
<code>\$context.requestId</code>	The ID that API Gateway assigns to the API request.
<code>\$context.requestTime</code>	The <a href="#">CLF</a> -formatted request time ( <code>dd/MMM/yyyy:HH:mm:ss +-hhmm</code> ).
<code>\$context.requestTimeEpoch</code>	The <a href="#">Epoch</a> -formatted request time.
<code>\$context.responseLatency</code>	The response latency in ms.
<code>\$context.responseLength</code>	The response payload length.
<code>\$context.routeKey</code>	The route key of the API request, for example <code>/pets</code> .
<code>\$context.stage</code>	The deployment stage of the API request (for example, <code>beta</code> or <code>prod</code> ).
<code>\$context.status</code>	The method response status.

## Troubleshooting issues with HTTP APIs

The following topics provide troubleshooting advice for errors and issues that you might encounter when using HTTP APIs.

### Topics

- [Troubleshooting issues with HTTP API Lambda integrations \(p. 202\)](#)
- [Troubleshooting issues with HTTP API JWT authorizers \(p. 204\)](#)

## Troubleshooting issues with HTTP API Lambda integrations

The following provides troubleshooting advice for errors and issues that you might encounter when using [Amazon Lambda integrations \(p. 159\)](#) with HTTP APIs.

### Issue: My API with a Lambda integration returns `{"message": "Internal Server Error"}`

To troubleshoot the internal server error, add the `$context.integrationErrorMessage` [logging variable \(p. 198\)](#) to your log format, and view your HTTP API's logs. To achieve this, do the following:

#### To create a log group by using the Amazon Web Services Management Console

1. Open the CloudWatch console at <https://console.amazonaws.cn/cloudwatch/>.
2. Choose **Log groups**.
3. Choose **Create log group**.
4. Enter a log group name, and then choose **Create**.

5. Note the Amazon Resource Name (ARN) for your log group. The ARN format is `arn:aws:logs:region:account-id:log-group:log-group-name`. You need the log group ARN to enable access logging for your HTTP API.

### To add the `$context.integrationErrorMessage` logging variable

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose your HTTP API.
3. Under **Monitor**, choose **Logging**.
4. Select a stage of your API.
5. Choose **Edit**, and then enable access logging.
6. For **Log destination**, enter the ARN of the log group that you created in the previous step.
7. For **Log format**, choose **CLF**.
8. Add `$context.integrationErrorMessage` to the end of the log format.
9. Choose **Save**.

### To view your API's logs

1. Generate logs. Use a browser or `curl` to invoke your API.

```
$curl https://api-id.execute-api.us-west-2.amazonaws.com/route
```

2. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
3. Choose your HTTP API.
4. Under **Monitor**, choose **Logging**.
5. Select the stage of your API for which you enabled logging.
6. Choose **View logs in CloudWatch**.
7. Choose the latest log stream to view your HTTP API's logs.
8. Your log entry should look similar to the following:

Because we added `$context.integrationErrorMessage` to the log format, we see an error message in our logs that summarizes the problem.

Your logs might include a different error message that indicates that there's a problem with your Lambda function code. In that case, check your Lambda function code, and verify that your Lambda function returns a response in the [required format \(p. 162\)](#). If your logs don't include an error message, add `$context.error.message` and `$context.error.responseType` to your log format for more information to help troubleshoot.

In this case, the logs show that API Gateway didn't have the required permissions to invoke the Lambda function.

When you create a Lambda integration in the API Gateway console, API Gateway automatically configures permissions to invoke the Lambda function. When you create a Lambda integration by using the Amazon CLI, Amazon CloudFormation, or an SDK, you must grant permissions for API Gateway to invoke the function. The following Amazon CLI command grants permissions for the `$default` stage and `$default` route of an HTTP API to invoke a Lambda function.

```
aws lambda add-permission \  
  --function-name my-function \  
  --statement-id apigateway-invoke-permissions \  
  --action lambda:InvokeFunction \  
  --principal apigateway.amazonaws.com
```

```
--source-arn "arn:aws:execute-api:us-west-2:123456789012:api-id/\$default/\$default"
```

Confirm the function policy in the **Permissions** tab of the Lambda console.

Try invoking your API again. You should see your Lambda function's response.

## Troubleshooting issues with HTTP API JWT authorizers

The following provides troubleshooting advice for errors and issues that you might encounter when using JSON Web Token (JWT) authorizers with HTTP APIs.

### Issue: My API returns 401 {"message": "Unauthorized"}

Check the `www-authenticate` header in the response from the API.

The following command uses `curl` to send a request to an API with a JWT authorizer that uses `$request.header.Authorization` as its identity source.

```
$curl -v -H "Authorization: token" https://api-id.execute-api.us-west-2.amazonaws.com/route
```

The response from the API includes a `www-authenticate` header.

```
...
< HTTP/1.1 401 Unauthorized
< Date: Wed, 13 May 2020 04:07:30 GMT
< Content-Length: 26
< Connection: keep-alive
< www-authenticate: Bearer scope="" error="invalid_token" error_description="the token does
  not have a valid audience"
< apigw-requestid: Mc7UVioPPHcEKPA=
<
* Connection #0 to host api-id.execute-api.us-west-2.amazonaws.com left intact
{"message": "Unauthorized"}
```

In this case, the `www-authenticate` header shows that the token wasn't issued for a valid audience. For API Gateway to authorize a request, the JWT's `aud` or `client_id` claim must match one of the audience entries that's configured for the authorizer.

You can also decode a JWT and verify that it matches the issuer, audience, and scopes that your API requires. The website [jwt.io](https://jwt.io) can debug JWTs in the browser. The OpenID Foundation maintains a [list of libraries for working with JWTs](#).

To learn more about JWT authorizers, see [Controlling access to HTTP APIs with JWT authorizers \(p. 157\)](#).

# Working with REST APIs

A REST API in API Gateway is a collection of resources and methods that are integrated with backend HTTP endpoints, Lambda functions, or other Amazon services. You can use API Gateway features to help you with all aspects of the API lifecycle, from creation through monitoring your production APIs.

API Gateway REST APIs use a request/response model where a client sends a request to a service and the service responds back synchronously. This kind of model is suitable for many different kinds of applications that depend on synchronous communication.

## Topics

- [Developing a REST API in API Gateway \(p. 205\)](#)
- [Publishing REST APIs for customers to invoke \(p. 436\)](#)
- [Optimizing performance of REST APIs \(p. 483\)](#)
- [Distributing your REST API to clients \(p. 491\)](#)
- [Protecting your REST API \(p. 564\)](#)
- [Monitoring REST APIs \(p. 605\)](#)

## Developing a REST API in API Gateway

This section provides details about API Gateway capabilities that you need while you're developing your API Gateway APIs.

As you're developing your API Gateway API, you decide on a number of characteristics of your API. These characteristics depend on the use case of your API. For example, you might want to only allow certain clients to call your API, or you might want it to be available to everyone. You might want an API call to execute a Lambda function, make a database query, or call an application.

## Topics

- [Creating a REST API in Amazon API Gateway \(p. 205\)](#)
- [Controlling and managing access to a REST API in API Gateway \(p. 236\)](#)
- [Setting up REST API integrations \(p. 277\)](#)
- [Enable request validation in API Gateway \(p. 318\)](#)
- [Setting up data transformations for REST APIs \(p. 330\)](#)
- [Gateway responses in API Gateway \(p. 376\)](#)
- [Enabling CORS for a REST API resource \(p. 382\)](#)
- [Working with binary media types for REST APIs \(p. 388\)](#)
- [Invoking a REST API in Amazon API Gateway \(p. 408\)](#)
- [Configuring a REST API using OpenAPI \(p. 427\)](#)

## Creating a REST API in Amazon API Gateway

In Amazon API Gateway, you build a REST API as a collection of programmable entities known as API Gateway [resources](#). For example, you use a [RestApi](#) resource to represent an API that can contain a collection of [Resource](#) entities. Each [Resource](#) entity can in turn have one or more [Method](#) resources. Expressed in the request parameters and body, a [Method](#) defines the application programming interface for the client to access the exposed [Resource](#) and represents an incoming request submitted by the client. You then create an [Integration](#) resource to integrate the [Method](#) with a backend

endpoint, also known as the integration endpoint, by forwarding the incoming request to a specified integration endpoint URI. If necessary, you transform request parameters or body to meet the backend requirements. For responses, you can create a [MethodResponse](#) resource to represent a request response received by the client and you create an [IntegrationResponse](#) resource to represent the request response that is returned by the backend. You can configure the integration response to transform the backend response data before returning the data to the client or to pass the backend response as-is to the client.

To help your customers understand your API, you can also provide documentation for the API, as part of the API creation or after the API is created. To enable this, add a [DocumentationPart](#) resource for a supported API entity.

To control how clients call an API, use [IAM permissions \(p. 248\)](#), a [Lambda authorizer \(p. 256\)](#), or an [Amazon Cognito user pool \(p. 270\)](#). To meter the use of your API, set up [usage plans \(p. 491\)](#) to throttle API requests. You can enable these when creating or updating the API.

You can perform these and other tasks by using the API Gateway console, the API Gateway REST API, the Amazon CLI, or one of the Amazon SDKs. We discuss how to perform these tasks next.

### Topics

- [Choose an endpoint type to set up for an API Gateway API \(p. 206\)](#)
- [Initialize REST API setup in API Gateway \(p. 208\)](#)
- [Set up REST API methods in API Gateway \(p. 224\)](#)

## Choose an endpoint type to set up for an API Gateway API

An [API endpoint \(p. 6\)](#) type refers to the hostname of the API. The API endpoint type can be *edge-optimized*, *regional*, or *private*, depending on where the majority of your API traffic originates from.

### Edge-optimized API endpoints

An [edge-optimized API endpoint \(p. 7\)](#) is best for geographically distributed clients. API requests are routed to the nearest CloudFront Point of Presence (POP). This is the default endpoint type for API Gateway REST APIs.

Edge-optimized APIs capitalize the names of [HTTP headers](#) (for example, `Cookie`).

CloudFront sorts HTTP cookies in natural order by cookie name before forwarding the request to your origin. For more information about the way CloudFront processes cookies, see [Caching Content Based on Cookies](#).

Any custom domain name that you use for an edge-optimized API applies across all regions.

### Regional API endpoints

A [regional API endpoint \(p. 8\)](#) is intended for clients in the same region. When a client running on an EC2 instance calls an API in the same region, or when an API is intended to serve a small number of clients with high demands, a regional API reduces connection overhead.

For a regional API, any custom domain name that you use is specific to the region where the API is deployed. If you deploy a regional API in multiple regions, it can have the same custom domain name in all regions. You can use custom domains together with Amazon Route 53 to perform tasks such as [latency-based routing](#). For more information, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#) and [the section called "Creating an edge-optimized custom domain name" \(p. 472\)](#).

Regional API endpoints pass all header names through as-is.

## Private API endpoints

A *private API endpoint* (p. 7) is an API endpoint that can only be accessed from your Amazon Virtual Private Cloud (VPC) using an interface VPC endpoint, which is an endpoint network interface (ENI) that you create in your VPC. For more information, see [the section called "Private APIs" \(p. 599\)](#).

Private API endpoints pass all header names through as-is.

## Change a public or private API endpoint type in API Gateway

Changing an API endpoint type requires you to update the API's configuration. You can change an existing API type using the API Gateway console, the Amazon CLI, or an Amazon SDK for API Gateway. The update operation may take up to 60 seconds to complete. During this time, your API will be available, but its endpoint type cannot be changed again until the current change is completed.

The following endpoint type changes are supported:

- From edge-optimized to regional or private
- From regional to edge-optimized or private
- From private to regional

You cannot change a private API into an edge-optimized API.

If you are changing a public API from edge-optimized to regional or vice versa, note that an edge-optimized API may have different behaviors than a regional API. For example, an edge-optimized API removes the `Content-MD5` header. Any MD5 hash value passed to the backend can be expressed in a request string parameter or a body property. However, the regional API passes this header through, although it may remap the header name to some other name. Understanding the differences helps you decide how to update an edge-optimized API to a regional one or from a regional API to an edge-optimized one.

### Topics

- [Use the API Gateway console to change an API endpoint type \(p. 207\)](#)
- [Use the Amazon CLI to change an API endpoint type \(p. 208\)](#)

## Use the API Gateway console to change an API endpoint type

To change the API endpoint type of your API, perform one of the following sets of steps:

### To convert a public endpoint from regional or edge-optimized and vice versa

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Settings**.
4. Change the **Endpoint Type** option under **Endpoint Configuration** from Edge Optimized to Regional or from Regional to Edge Optimized.
5. Choose **Save Changes** to start the update.

### To convert a private endpoint to a regional endpoint

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Edit the resource policy for your API to remove any mention of VPCs or VPC endpoints so that API calls from outside your VPC as well as inside your VPC will succeed.

4. Choose **Settings**.
5. Change the **Endpoint Type** to `Regional`.
6. Choose **Save Changes** to start the update.
7. Remove the resource policy from your API.
8. Redeploy your API so that the changes will take effect.

### Use the Amazon CLI to change an API endpoint type

To use the Amazon CLI to update an edge-optimized API whose API ID is `{api-id}`, call `update-rest-api` as follows:

```
aws apigateway update-rest-api \  
  --rest-api-id {api-id} \  
  --patch-operations op=replace,path=/endpointConfiguration/types/EDGE,value=REGIONAL
```

The successful response has a status code of `200 OK` and a payload similar to the following:

```
{  
  "createdDate": "2017-10-16T04:09:31Z",  
  "description": "Your first API with Amazon API Gateway. This is a sample API that  
  integrates via HTTP with our demo Pet Store endpoints",  
  "endpointConfiguration": {  
    "types": "REGIONAL"  
  },  
  "id": "0gsnjtjck8",  
  "name": "PetStore imported as edge-optimized"  
}
```

Conversely, update a regional API to an edge-optimized API as follows:

```
aws apigateway update-rest-api \  
  --rest-api-id {api-id} \  
  --patch-operations op=replace,path=/endpointConfiguration/types/REGIONAL,value=EDGE
```

Because `put-rest-api` is for updating API definitions, it is not applicable to updating an API endpoint type.

## Initialize REST API setup in API Gateway

For this example, we use a simplified `PetStore` API, with the HTTP integration, that exposes the `GET /pets` and `GET /pets/{petId}` methods. The methods are integrated with the two HTTP endpoints, respectively, of `http://petstore-demo-endpoint.execute-api.com/petstore/pets` and `http://petstore-demo-endpoint.execute-api.com/petstore/pets/{petId}`. The API handles `200 OK` responses. The examples focus on the essential programming tasks for creating an API in API Gateway, taking advantage of default settings when possible.

Because of the default settings, the resulting API is edge-optimized. An alternative is to [set up a regional API \(p. 222\)](#). To set up a regional API, you must set explicitly the endpoint type of the API as `REGIONAL`. To set up an edge-optimized API explicitly, you can set `EDGE` as the type of the `endpointConfiguration`.

When setting up an API, you must choose a region. When deployed, the API is region-specific. For an edge-optimized API, the base URL is of the `http[s]://{restapi-id}.execute-api.amazonaws.com/stage` format, where `{restapi-id}` is the API's `id` value generated by API Gateway. You can assign a custom domain name (for example, `apis.example.com`) as the API's host name and call the API with a base URL of the `https://apis.example.com/myApi` format.

## Topics

- [Set up an API using the API Gateway console \(p. 209\)](#)
- [Set up an edge-optimized API using Amazon CLI commands \(p. 209\)](#)
- [Set up an edge-optimized API using the Amazon SDK for Node.js \(p. 214\)](#)
- [Set up an edge-optimized API by importing OpenAPI definitions \(p. 220\)](#)
- [Set up a regional API in API Gateway \(p. 222\)](#)

## Set up an API using the API Gateway console

To set up an API Gateway API using the API Gateway console, see [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#).

You can learn how to set up an API by following an example. For more information, see [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

Alternatively, you can set up an API by using the API Gateway [Import API \(p. 427\)](#) feature to upload an external API definition, such as one expressed in [OpenAPI 2.0](#) with the [Working with API Gateway extensions to OpenAPI \(p. 675\)](#). The example provided in [Tutorial: Create a REST API by importing an example \(p. 43\)](#) uses the Import API feature.

## Set up an edge-optimized API using Amazon CLI commands

Setting up an API using the Amazon CLI requires working with the `create-rest-api`, `create-resource` or `get-resources`, `put-method`, `put-method-response`, `put-integration`, and `put-integration-response` commands. The following procedures show how to work with these Amazon CLI commands to create the simple PetStore API of the HTTP integration type.

### To create a simple PetStore API using Amazon CLI

1. Call the `create-rest-api` command to set up the `RestApi` in a specific region (`us-west-2`).

```
aws apigateway create-rest-api --name 'Simple PetStore (Amazon CLI)' --region us-west-2
```

The following is the output of this command:

```
{
  "name": "Simple PetStore (Amazon CLI)",
  "id": "vaz7da96z6",
  "createdDate": 1494572809
}
```

Note the returned `id` of the newly created `RestApi`. You need it to set up other parts of the API.

2. Call the `get-resources` command to retrieve the root resource identifier of the `RestApi`.

```
aws apigateway get-resources --rest-api-id vaz7da96z6 --region us-west-2
```

The following is the output of this command:

```
{
  "items": [
    {
      "path": "/",
      "id": "begaltmsm8"
    }
  ]
}
```



```
}
```

Note the root resource `id`. You need it to start setting the API's resource tree and configuring methods and integrations.

3. Call the `create-resource` command to append a child resource (`pets`) under the root resource (`begaltmsm8`):

```
aws apigateway create-resource --rest-api-id vaz7da96z6 \  
  --region us-west-2 \  
  --parent-id begaltmsm8 \  
  --path-part pets
```

The following is the output of this command:

```
{  
  "path": "/pets",  
  "pathPart": "pets",  
  "id": "6sxz2j",  
  "parentId": "begaltmsm8"  
}
```

To append a child resource under the root, you specify the root resource `id` as the `parentId` property value. Similarly, to append a child resource under the `pets` resource, you repeat the preceding step while replacing the `parent-id` value with the `pets` resource `id` of `6sxz2j`:

```
aws apigateway create-resource --rest-api-id vaz7da96z6 \  
  --region us-west-2 \  
  --parent-id 6sxz2j \  
  --path-part '{petId}'
```

To make a path part a path parameter, enclose it in a pair of curly brackets. If successful, this command returns the following response:

```
{  
  "path": "/pets/{petId}",  
  "pathPart": "{petId}",  
  "id": "rjkmth",  
  "parentId": "6sxz2j"  
}
```

Now that you created two resources: `/pets` (`6sxz2j`) and `/pets/{petId}` (`rjkmth`), you can proceed to set up methods on them.

4. Call the `put-method` command to add the `GET` HTTP method on the `/pets` resource. This creates an API Method of `GET /pets` with open access, referencing the `/pets` resource by its `id` value of `6sxz2j`.

```
aws apigateway put-method --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j \  
  --http-method GET \  
  --authorization-type "NONE" \  
  --region us-west-2
```

The following is the successful output of this command:

```
{  
  "apiKeyRequired": false,
```

```
"httpMethod": "GET",  
"authorizationType": "NONE"  
}
```

The method is for open access because `authorization-type` is set to `NONE`. To permit only authenticated users to call the method, you can use IAM roles and policies, a Lambda authorizer (formerly known as a custom authorizer), or an Amazon Cognito user pool. For more information, see [the section called "Access control" \(p. 236\)](#).

To enable read access to the `/pets/{petId}` resource (`rjkmth`), add the `GET` HTTP method on it to create an API Method of `GET /pets/{petId}` as follows.

```
aws apigateway put-method --rest-api-id vaz7da96z6 \  
  --resource-id rjkmth --http-method GET \  
  --authorization-type "NONE" \  
  --region us-west-2 \  
  --request-parameters method.request.path.petId=true
```

The following is the successful output of this command:

```
{  
  "apiKeyRequired": false,  
  "httpMethod": "GET",  
  "authorizationType": "NONE",  
  "requestParameters": {  
    "method.request.path.petId": true  
  }  
}
```

Note that the method request path parameter of `petId` must be specified as a required request parameter for its dynamically set value to be mapped to a corresponding integration request parameter and passed to the backend.

5. Call the `put-method-response` command to set up the 200 OK response of the `GET /pets` method, specifying the `/pets` resource by its ID value of `6sxz2j`.

```
aws apigateway put-method-response --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j --http-method GET \  
  --status-code 200 --region us-west-2
```

The following is the output of this command:

```
{  
  "statusCode": "200"  
}
```

Similarly, to set the 200 OK response of the `GET /pets/{petId}` method, do the following, specifying the `/pets/{petId}` resource by its resource ID value of `rjkmth`:

```
aws apigateway put-method-response --rest-api-id vaz7da96z6 \  
  --resource-id rjkmth --http-method GET \  
  --status-code 200 --region us-west-2
```

Having set up a simple client interface for the API, you can proceed to set up the integration of the API methods with the backend.

6. Call the `put-integration` command to set up an `Integration` with a specified HTTP endpoint for the `GET /pets` method. The `/pets` resource is identified by its resource ID `6sxz2j`:

```
aws apigateway put-integration --rest-api-id vaz7da96z6 \  
  --resource-id 6sxx2j --http-method GET --type HTTP \  
  --integration-http-method GET \  
  --uri 'http://petstore-demo-endpoint.execute-api.com/petstore/pets' \  
  --region us-west-2
```

The following is the output of this command:

```
{  
  "httpMethod": "GET",  
  "passthroughBehavior": "WHEN_NO_MATCH",  
  "cacheKeyParameters": [],  
  "type": "HTTP",  
  "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets",  
  "cacheNamespace": "6sxx2j"  
}
```

Notice that the integration uri of `http://petstore-demo-endpoint.execute-api.com/petstore/pets` specifies the integration endpoint of the `GET /pets` method.

Similarly, you create an integration request for the `GET /pets/{petId}` method as follows:

```
aws apigateway put-integration \  
  --rest-api-id vaz7da96z6 \  
  --resource-id rjkmth \  
  --http-method GET \  
  --type HTTP \  
  --integration-http-method GET \  
  --uri 'http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}' \  
  --request-parameters  
  '{"integration.request.path.id":"method.request.path.petId"}' \  
  --region us-west-2
```

Here, the integration endpoint, uri of `http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}`, also uses a path parameter (`id`). Its value is mapped from the corresponding method request path parameter of `{petId}`. The mapping is defined as part of the request-parameters. If this mapping is not defined here, the client gets an error response when trying to call the method.

The following is the output of this command:

```
{  
  "passthroughBehavior": "WHEN_NO_MATCH",  
  "cacheKeyParameters": [],  
  "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}",  
  "httpMethod": "GET",  
  "cacheNamespace": "rjkmth",  
  "type": "HTTP",  
  "requestParameters": {  
    "integration.request.path.id": "method.request.path.petId"  
  }  
}
```

7. Call the `put-integration-response` command to create an `IntegrationResponse` of the `GET /pets` method integrated with an HTTP backend.

```
aws apigateway put-integration-response --rest-api-id vaz7da96z6 \  
  --resource-id 6sxx2j --http-method GET \  
  --region us-west-2
```

```
--status-code 200 --selection-pattern "" \  
--region us-west-2
```

The following is the output of this command:

```
{  
  "selectionPattern": "",  
  "statusCode": "200"  
}
```

Similarly, call the following `put-integration-response` command to create an `IntegrationResponse` of the `GET /pets/{petId}` method:

```
aws apigateway put-integration-response --rest-api-id vaz7da96z6 \  
  --resource-id rjkmth --http-method GET  
  --status-code 200 --selection-pattern ""  
  --region us-west-2
```

With the preceding steps, you finished setting up a simple API that allows your customers to query available pets on the PetStore website and to view an individual pet of a specified identifier. To make it callable by your customer, you must deploy the API.

8. Deploy the API to a stage stage, for example, by calling `create-deployment`:

```
aws apigateway create-deployment --rest-api-id vaz7da96z6 \  
  --region us-west-2 \  
  --stage-name test \  
  --stage-description 'Test stage' \  
  --description 'First deployment'
```

You can test this API by typing the `https://vaz7da96z6.execute-api.us-west-2.amazonaws.com/test/pets` URL in a browser, and substituting `vaz7da96z6` with the identifier of your API. The expected output should be as follows:

```
[  
  {  
    "id": 1,  
    "type": "dog",  
    "price": 249.99  
  },  
  {  
    "id": 2,  
    "type": "cat",  
    "price": 124.99  
  },  
  {  
    "id": 3,  
    "type": "fish",  
    "price": 0.99  
  }  
]
```

To test the `GET /pets/{petId}` method, type `https://vaz7da96z6.execute-api.us-west-2.amazonaws.com/test/pets/3` in the browser. You should receive the following response:

```
{  
  "id": 3,  
  "type": "fish",  
}
```

```
"price": 0.99  
}
```

## Set up an edge-optimized API using the Amazon SDK for Node.js

As an illustration, we use Amazon SDK for Node.js to describe how you can use an Amazon SDK to create an API Gateway API. For more information using an Amazon SDK, including how to set up the development environment, see [Amazon SDKs](#).

Setting up an API using the Amazon SDK for Node.js involves calling the [createRestApi](#), [createResource](#) or [getResources](#), [putMethod](#), [putMethodResponse](#), [putIntegration](#), and [putIntegrationResponse](#) functions.

The following procedures walk you through the essential steps to use these SDK commands to set up a simple PetStore API supporting the `GET /pets` and `GET /pets/{petId}` methods.

### To set up a simple PetStore API using the Amazon SDK for Node.js

1. Instantiate the SDK:

```
var AWS = require('aws-sdk');  
  
AWS.config.region = 'us-west-2';  
var apig = new AWS.APIGateway({apiVersion: '2015/07/09'});
```

2. Call the `createRestApi` function to set up the `RestApi` entity.

```
apig.createRestApi({  
  name: "Simple PetStore (node.js SDK)",  
  binaryMediaTypes: [  
    '*'  
  ],  
  description: "Demo API created using the Amazon SDK for node.js",  
  version: "0.00.001"  
}, function(err, data){  
  if (!err) {  
    console.log(data);  
  } else {  
    console.log('Create API failed:\n', err);  
  }  
});
```

The function returns an output similar to the following result:

```
{  
  id: 'iuo308uaq7',  
  name: 'PetStore (node.js SDK)',  
  description: 'Demo API created using the Amazon SDK for node.js',  
  createdAt: 2017-09-05T19:32:35.000Z,  
  version: '0.00.001',  
  binaryMediaTypes: [ '*' ]  
}
```

The resulting API's identifier is `iuo308uaq7`. You need to supply this to continue the setup of the API.

3. Call the `getResources` function to retrieve the root resource identifier of the `RestApi`.

```
apig.getResources({  
  restApiId: 'iuo308uaq7'
```

```
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log('Get the root resource failed:\n', err);
  }
})
```

This function returns an output similar to the following result:

```
{
  "items": [
    {
      "path": "/",
      "id": "s4fb0trnk0"
    }
  ]
}
```

The root resource identifier is `s4fb0trnk0`. This is the starting point for you to build the API resource tree, which you do next.

4. Call the `createResource` function to set up the `/pets` resource for the API, specifying the root resource identifier (`s4fb0trnk0`) on the `parentId` property.

```
apig.createResource({
  restApiId: 'iuo308uaq7',
  parentId: 's4fb0trnk0',
  pathPart: 'pets'
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("The '/pets' resource setup failed:\n", err);
  }
})
```

The successful result is as follows:

```
{
  "path": "/pets",
  "pathPart": "pets",
  "id": "8sxa2j",
  "parentId": "s4fb0trnk0"
}
```

To set up the `/pets/{petId}` resource, call the following `createResource` function, specifying the newly created `/pets` resource (`8sxa2j`) on the `parentId` property.

```
apig.createResource({
  restApiId: 'iuo308uaq7',
  parentId: '8sxa2j',
  pathPart: '{petId}'
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("The '/pets/{petId}' resource setup failed:\n", err);
  }
})
```

The successful result returns the newly created resource id value:

```
{
  "path": "/pets/{petId}",
  "pathPart": "{petId}",
  "id": "au5df2",
  "parentId": "8sxa2j"
}
```

Throughout this procedure, you refer to the `/pets` resource by specifying its resource ID of `8sxa2j`, and the `/pets/{petId}` resource by specifying its resource ID of `au5df2`.

5. Call the `putMethod` function to add the `GET` HTTP method on the `/pets` resource (`8sxa2j`). This sets up the `GET /pets` Method with open access.

```
apig.putMethod({
  restApiId: 'iuo308uaq7',
  resourceId: '8sxa2j',
  httpMethod: 'GET',
  authorizationType: 'NONE'
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("The 'GET /pets' method setup failed:\n", err);
  }
})
```

This function returns an output similar to the following result:

```
{
  "apiKeyRequired": false,
  "httpMethod": "GET",
  "authorizationType": "NONE"
}
```

To add the `GET` HTTP method on the `/pets/{petId}` resource (`au5df2`), which sets up the API method of `GET /pets/{petId}` with open access, call the `putMethod` function as follows.

```
apig.putMethod({
  restApiId: 'iuo308uaq7',
  resourceId: 'au5df2',
  httpMethod: 'GET',
  authorizationType: 'NONE',
  requestParameters: {
    "method.request.path.petId" : true
  }
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("The 'GET /pets/{petId}' method setup failed:\n", err);
  }
})
```

This function returns an output similar to the following result:

```
{
  "apiKeyRequired": false,
```

```
"httpMethod": "GET",
"authorizationType": "NONE",
"requestParameters": {
  "method.request.path.petId": true
}
}
```

You need to set the `requestParameters` property as shown in the preceding example to map and pass the client-supplied `petId` value to the backend.

6. Call the `putMethodResponse` function to set up a method response for the `GET /pets` method.

```
apig.putMethodResponse({
  restApiId: 'iuo308uaq7',
  resourceId: "8sxa2j",
  httpMethod: 'GET',
  statusCode: '200'
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("Set up the 200 OK response for the 'GET /pets' method failed:\n", err);
  }
})
```

This function returns an output similar to the following result:

```
{
  "statusCode": "200"
}
```

To set the 200 OK response of the `GET /pets/{petId}` method, call the `putMethodResponse` function, specifying the `/pets/{petId}` resource identifier (`au5df2`) on the `resourceId` property.

```
apig.putMethodResponse({
  restApiId: 'iuo308uaq7',
  resourceId: "au5df2",
  httpMethod: 'GET',
  statusCode: '200'
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("Set up the 200 OK response for the 'GET /pets/{petId}' method failed:\n", err);
  }
})
```

7. Call the `putIntegration` function to set up the Integration with a specified HTTP endpoint for the `GET /pets` method, supplying the `/pets` resource identifier (`8sxa2j`) on the `parentId` property.

```
apig.putIntegration({
  restApiId: 'iuo308uaq7',
  resourceId: '8sxa2j',
  httpMethod: 'GET',
  type: 'HTTP',
  integrationHttpMethod: 'GET',
  uri: 'http://perstore-demo-endpoint.execute-api.com/pets'
```



```
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("Set up the integration of the 'GET /' method of the API failed:\n",
err);
  }
})
```

This function returns an output similar the following:

```
{
  "httpMethod": "GET",
  "passthroughBehavior": "WHEN_NO_MATCH",
  "cacheKeyParameters": [],
  "type": "HTTP",
  "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets",
  "cacheNamespace": "8sxa2j"
}
```

To set up the integration of the GET /pets/{petId} method with the HTTP endpoint of http://perstore-demo-endpoint.execute-api.com/pets/{id} of the backend, call the following putIntegration function, supplying the API's /pets/{petId} resource identifier (au5df2) on the parentId property.

```
apig.putIntegration({
  restApiId: 'iuo308uaq7',
  resourceId: 'au5df2',
  httpMethod: 'GET',
  type: 'HTTP',
  integrationHttpMethod: 'GET',
  uri: 'http://perstore-demo-endpoint.execute-api.com/pets/{id}',
  requestParameters: {
    "integration.request.path.id": "method.request.path.petId"
  }
}, function(err, data){
  if (!err) {
    console.log(data);
  } else {
    console.log("The 'GET /pets/{petId}' method integration setup failed:\n", err);
  }
})
```

This function returns a successful output similar to the following:

```
{
  "httpMethod": "GET",
  "passthroughBehavior": "WHEN_NO_MATCH",
  "cacheKeyParameters": [],
  "type": "HTTP",
  "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}",
  "cacheNamespace": "au5df2",
  "requestParameters": {
    "integration.request.path.id": "method.request.path.petId"
  }
}
```

8. Call the `putIntegrationResponse` function to set up the 200 OK integration response for the `GET /pets` method, specifying the API's `/pets` resource identifier (`8sxa2j`) on the `resourceId` property.

```
apig.putIntegrationResponse({
  restApiId: 'iuo308uaq7',
  resourceId: '8sxa2j',
  httpMethod: 'GET',
  statusCode: '200',
  selectionPattern: ''
}, function(err, data){
  if (!err) {
    console.log(data);
  } else
    console.log("The 'GET /pets' method integration response setup failed:\n", err);
})
```

This function will return an output similar to the following result:

```
{
  "selectionPattern": "",
  "statusCode": "200"
}
```

To set up the 200 OK integration response of the `GET /pets/{petId}` method, call the `putIntegrationResponse` function, specifying the API's `/pets/{petId}` resource identifier (`au5df2`) on the `resourceId` property.

```
apig.putIntegrationResponse({
  restApiId: 'iuo308uaq7',
  resourceId: 'au5df2',
  httpMethod: 'GET',
  statusCode: '200',
  selectionPattern: ''
}, function(err, data){
  if (!err) {
    console.log(data);
  } else
    console.log("The 'GET /pets/{petId}' method integration response setup failed:\n",
err);
})
```

9. As a good practice, test invoking the API before deploying it. To test invoking the `GET /pets` method, call the `testInvokeMethod`, specifying the `/petsresource` identifier (`8sxa2j`) on the `resourceId` property:

```
apig.testInvokeMethod({
  restApiId: 'iuo308uaq7',
  resourceId: '8sxa2j',
  httpMethod: "GET",
  pathWithQueryString: '/'
}, function(err, data){
  if (!err) {
    console.log(data)
  } else {
    console.log('Test-invoke-method on 'GET /pets' failed:\n', err);
  }
})
```

To test invoking the `GET /pets/{petId}` method, call the `testInvokeMethod`, specifying the `/pets/{petId}` resource identifier (`au5df2`) on the `resourceId` property:

```
apig.testInvokeMethod({
  restApiId: 'iuo308uaq7',
  resourceId: 'au5df2',
  httpMethod: "GET",
  pathWithQueryString: '/'
}, function(err, data){
  if (!err) {
    console.log(data)
  } else {
    console.log('Test-invoke-method on 'GET /pets/{petId}' failed:\n', err);
  }
})
```

10. Finally, you can deploy the API for your customers to call.

```
apig.createDeployment({
  restApiId: 'iuo308uaq7',
  stageName: 'test',
  stageDescription: 'test deployment',
  description: 'API deployment'
}, function(err, data){
  if (err) {
    console.log('Deploying API failed:\n', err);
  } else {
    console.log("Deploying API succeeded\n", data);
  }
})
```

## Set up an edge-optimized API by importing OpenAPI definitions

You can set up an API in API Gateway by specifying OpenAPI definitions of appropriate API Gateway API entities and importing the OpenAPI definitions into API Gateway.

The following OpenAPI definitions describe the simple API, exposing only the `GET /` method integrated with an HTTP endpoint of the PetStore website in the backend, and returning a 200 OK response.

OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "title": "Simple PetStore (OpenAPI)"
  },
  "schemes": [
    "https"
  ],
  "paths": {
    "/pets": {
      "get": {
        "responses": {
          "200": {
            "description": "200 response"
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "responses": {
```

```

        "default": {
          "statusCode": "200"
        }
      },
      "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "GET",
      "type": "http"
    }
  },
  "/pets/{petId}": {
    "get": {
      "parameters": [
        {
          "name": "petId",
          "in": "path",
          "required": true,
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response"
        }
      },
      "x-amazon-apigateway-integration": {
        "responses": {
          "default": {
            "statusCode": "200"
          }
        },
        "requestParameters": {
          "integration.request.path.id": "method.request.path.petId"
        },
        "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets/{id}",
        "passthroughBehavior": "when_no_match",
        "httpMethod": "GET",
        "type": "http"
      }
    }
  }
}

```

The following procedure describes how to import these OpenAPI definitions into API Gateway using the API Gateway console.

### To import the simple OpenAPI definitions using the API Gateway console

1. Sign in to the API Gateway console.
2. Choose **Create API**.
3. Choose **Import from OpenAPI**.
4. If you saved the preceding OpenAPI definitions in a file, choose **Select OpenAPI File**. You can also copy the OpenAPI definitions and paste them into the import text editor.
5. Choose **Import** to finish importing the OpenAPI definitions.

To import the OpenAPI definitions using the Amazon CLI, save the OpenAPI definitions into a file and then run the following command, assuming that you use the `us-west-2` region and the absolute OpenAPI file path is `file:///path/to/API_OpenAPI_template.json`:

```
aws apigateway import-rest-api --body 'file:///path/to/API_OpenAPI_template.json' --region us-west-2
```

## Set up a regional API in API Gateway

When API requests predominantly originate from an EC2 instance or services within the same region as the API is deployed, a regional API endpoint will typically lower the latency of connections and is recommended for such scenarios.

### Note

In cases where API clients are geographically dispersed, it may still make sense to use a regional API endpoint, together with your own Amazon CloudFront distribution to ensure that API Gateway does not associate the API with service-controlled CloudFront distributions. For more information about this use case, see [How do I set up API Gateway with my own CloudFront distribution?](#).

To create a regional API, you follow the steps in [creating an edge-optimized API \(p. 208\)](#), but must explicitly set `REGIONAL` type as the only option of the API's [endpointConfiguration](#).

In the following, we show how to create a regional API using the API Gateway console, Amazon CLI, and the Amazon SDK for Javascript for Node.js.

### Topics

- [Create a regional API using the API Gateway console \(p. 222\)](#)
- [Create a regional API using the Amazon CLI \(p. 222\)](#)
- [Create a regional API using the Amazon SDK for JavaScript \(p. 223\)](#)
- [Test a regional API \(p. 223\)](#)

## Create a regional API using the API Gateway console

### To create a regional API using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. If this is your first time using API Gateway, you see a page that introduces you to the features of the service. Under **REST API**, choose **Build**. When the **Create Example API** popup appears, choose **OK**.

If this is not your first time using API Gateway, choose **Create API**. Under **REST API**, choose **Build**.

- a. Choose **New API**.
- b. Enter a name in **API Name**.
- c. Optionally, add a brief description in **Description**.
- d. Choose **Create API**.

From here on, you can proceed to set up API methods and their associated integrations as described in [creating an edge optimized API \(p. 209\)](#).

## Create a regional API using the Amazon CLI

To create a regional API using the Amazon CLI, call the `create-rest-api` command:

```
aws apigateway create-rest-api \  
  --name 'Simple PetStore (Amazon CLI, Regional)' \  
  --description 'Simple regional PetStore API' \  
  --region us-west-2 \  
  --endpointConfiguration REGIONAL
```

```
--endpoint-configuration '{ "types": ["REGIONAL"] }'
```

A successful response returns a payload similar to the following:

```
{
  "createdDate": "2017-10-13T18:41:39Z",
  "description": "Simple regional PetStore API",
  "endpointConfiguration": {
    "types": "REGIONAL"
  },
  "id": "0qzs2sy7bh",
  "name": "Simple PetStore (Amazon CLI, Regional)"
}
```

From here on, you can follow the same instructions given in [the section called “Set up an edge-optimized API using Amazon CLI commands” \(p. 209\)](#) to set up methods and integrations for this API.

### Create a regional API using the Amazon SDK for JavaScript

To create a regional API, using the Amazon SDK for JavaScript:

```
apig.createRestApi({
  name: "Simple PetStore (node.js SDK, regional)",
  endpointConfiguration: {
    types: ['REGIONAL']
  },
  description: "Demo regional API created using the Amazon SDK for node.js",
  version: "0.00.001"
}, function(err, data){
  if (!err) {
    console.log('Create API succeeded:\n', data);
    restApiId = data.id;
  } else {
    console.log('Create API failed:\n', err);
  }
});
```

A successful response returns a payload similar to the following:

```
{
  "createdDate": "2017-10-13T18:41:39Z",
  "description": "Demo regional API created using the Amazon SDK for node.js",
  "endpointConfiguration": {
    "types": "REGIONAL"
  },
  "id": "0qzs2sy7bh",
  "name": "Simple PetStore (node.js SDK, regional)"
}
```

After completing the preceding steps, you can follow the instructions in [the section called “Set up an edge-optimized API using the Amazon SDK for Node.js” \(p. 214\)](#) to set up methods and integrations for this API.

### Test a regional API

Once deployed, the regional API's default URL host name is of the following format:

```
{restapi-id}.execute-api.{region}.amazonaws.com
```

The base URL to invoke the API is like the following:

```
https://{restapi-id}.execute-api.{region}.amazonaws.com/{stage}
```

Assuming you set up the `GET /pets` and `GET /pets/{petId}` methods in this example, you can test the API by typing the following URLs in a browser:

```
https://0qzs2sy7bh.execute-api.us-west-2.amazonaws.com/test/pets
```

and

```
https://0qzs2sy7bh.execute-api.us-west-2.amazonaws.com/test/pets/1
```

Alternatively, you can use cURL commands:

```
curl -X GET https://0qzs2sy7bh.execute-api.us-west-2.amazonaws.com/test/pets
```

and

```
curl -X GET https://0qzs2sy7bh.execute-api.us-west-2.amazonaws.com/test/pets/2
```

## Set up REST API methods in API Gateway

In API Gateway, an API method embodies a [method request](#) and a [method response](#). You set up an API method to define what a client should or must do to submit a request to access the service at the backend and to define the responses that the client receives in return. For input, you can choose method request parameters, or an applicable payload, for the client to provide the required or optional data at run time. For output, you determine the method response status code, headers, and applicable body as targets to map the backend response data into, before they are returned to the client. To help the client developer understand the behaviors and the input and output formats of your API, you can [document your API \(p. 503\)](#) and [provide proper error messages \(p. 376\)](#) for [invalid requests \(p. 318\)](#).

An API method request is an HTTP request. To set up the method request, you configure an HTTP method (or verb), the path to an API [resource](#), headers, applicable query string parameters. You also configure a payload when the HTTP method is `POST`, `PUT`, or `PATCH`. For example, to retrieve a pet using the [PetStore sample API \(p. 43\)](#), you define the API method request of `GET /pets/{petId}`, where `{petId}` is a path parameter that can take a number at run time.

```
GET /pets/1
Host: apigateway.us-east-1.amazonaws.com
...
```

If the client specifies an incorrect path, for example, `/pet/1` or `/pets/one` instead of `/pets/1`, an exception is thrown.

An API method response is an HTTP response with a given status code. For a non-proxy integration, you must set up method responses to specify the required or optional targets of mappings. These transform integration response headers or body to associated method response headers or body. The mapping can be as simple as an [identity transform](#) that passes the headers or body through the integration as-is. For example, the following 200 method response shows an example of passthrough of a successful integration response as-is.

```
200 OK
Content-Type: application/json
...
```

```
{  
  "id": "1",  
  "type": "dog",  
  "price": "$249.99"  
}
```

In principle, you can define a method response corresponding to a specific response from the backend. Typically, this involves any 2XX, 4XX, and 5XX responses. However, this may not be practical, because often you may not know in advance all the responses that a backend may return. In practice, you can designate one method response as the default to handle the unknown or unmapped responses from the backend. It is good practice to designate the 500 response as the default. In any case, you must set up at least one method response for non-proxy integrations. Otherwise, API Gateway returns a 500 error response to the client even when the request succeeds at the backend.

To support a strongly typed SDK, such as a Java SDK, for your API, you should define the data model for input for the method request, and define the data model for output of the method response.

### Topics

- [Set up a method request in API Gateway \(p. 225\)](#)
- [Set up method responses in API Gateway \(p. 231\)](#)
- [Set up a method using the API Gateway console \(p. 233\)](#)

## Set up a method request in API Gateway

Setting up a method request involves performing the following tasks, after creating a [RestApi](#) resource:

1. Creating a new API or choosing an existing API [Resource](#) entity.
2. Creating an API [Method](#) resource that is a specific HTTP verb on the new or chosen API [Resource](#). This task can be further divided into the following sub tasks:
  - Adding an HTTP method to the method request
  - Configuring request parameters
  - Defining a model for the request body
  - Enacting an authorization scheme
  - Enabling request validation

You can perform these tasks using the following methods:

- [API Gateway console \(p. 234\)](#)
- Amazon CLI commands ([create-resource](#) and [put-method](#))
- Amazon SDK functions (for example, in Node.js, [createResource](#) and [putMethod](#))
- API Gateway REST API ([resource:create](#) and [method:put](#)).

For examples of using these tools, see [Initialize REST API setup in API Gateway \(p. 208\)](#).

### Topics

- [Set up API resources \(p. 226\)](#)
- [Set up an HTTP method \(p. 228\)](#)
- [Set up method request parameters \(p. 228\)](#)
- [Set up method request model \(p. 229\)](#)
- [Set up method request authorization \(p. 230\)](#)
- [Set up method request validation \(p. 231\)](#)



## Set up API resources

In an API Gateway API, you expose addressable resources as a tree of API [Resources](#) entities, with the root resource (/) at the top of the hierarchy. The root resource is relative to the API's base URL, which consists of the API endpoint and a stage name. In the API Gateway console, this base URI is referred to as the **Invoke URI** and is displayed in the API's stage editor after the API is deployed.

The API endpoint can be a default host name or a custom domain name. The default host name is of the following format:

```
{api-id}.execute-api.{region}.amazonaws.com
```

In this format, the `{api-id}` represents the API identifier that is generated by API Gateway. The `{region}` variable represents the Amazon Region (for example, `us-east-1`) that you chose when creating the API. A custom domain name is any user-friendly name under a valid internet domain. For example, if you have registered an internet domain of `example.com`, any of `*.example.com` is a valid custom domain name. For more information, see [create a custom domain name \(p. 463\)](#).

For the [PetStore sample API \(p. 43\)](#), the root resource (/) exposes the pet store. The `/pets` resource represents the collection of pets available in the pet store. The `/pets/{petId}` exposes an individual pet of a given identifier (`petId`). The path parameter of `{petId}` is part of the request parameters.

To set up an API resource, you choose an existing resource as its parent and then create the child resource under this parent resource. You start with the root resource as a parent, add a resource to this parent, add another resource to this child resource as the new parent, and so on, to its parent identifier. Then you add the named resource to the parent.

With Amazon CLI, you can call the `get-resources` command to find out which resources of an API are available:

```
aws apigateway get-resources --rest-api-id <apiId> \  
--region <region>
```

The result is a list of the currently available resources of the API. For our PetStore sample API, this list looks like the following:

```
{  
  "items": [  
    {  
      "path": "/pets",  
      "resourceMethods": {  
        "GET": {}  
      },  
      "id": "6sxx2j",  
      "pathPart": "pets",  
      "parentId": "svzr2028x8"  
    },  
    {  
      "path": "/pets/{petId}",  
      "resourceMethods": {  
        "GET": {}  
      },  
      "id": "rjkmth",  
      "pathPart": "{petId}",  
      "parentId": "6sxx2j"  
    },  
    {  
      "path": "/",  
      "id": "svzr2028x8"  
    }  
  ]  
}
```

```
}
```

Each item lists the identifiers of the resource (`id`) and, except for the root resource, its immediate parent (`parentId`), as well as the resource name (`pathPart`). The root resource is special in that it does not have any parent. After choosing a resource as the parent, call the following command to add a child resource.

```
aws apigateway create-resource --rest-api-id <apiId> \  
    --region <region> \  
    --parent-id <parentId> \  
    --path-part <resourceName>
```

For example, to add pet food for sale on the PetStore website, add a `food` resource to the root (`/`) by setting `path-part` to `food` and `parent-id` to `svzr2028x8`. The result looks like the following:

```
{  
  "path": "/food",  
  "pathPart": "food",  
  "id": "xdsvhp",  
  "parentId": "svzr2028x8"  
}
```

### Use a proxy resource to streamline API setup

As business grows, the PetStore owner may decide to add food, toys, and other pet-related items for sale. To support this, you can add `/food`, `/toys`, and other resources under the root resource. Under each sale category, you may also want to add more resources, such as `/food/{type}/{item}`, `/toys/{type}/{item}`, etc. This can get tedious. If you decide to add a middle layer `{subtype}` to the resource paths to change the path hierarchy into `/food/{type}/{subtype}/{item}`, `/toys/{type}/{subtype}/{item}`, etc., the changes will break the existing API set up. To avoid this, you can use an API Gateway [proxy resource](#) (p. 282) to expose a set of API resources all at once.

API Gateway defines a proxy resource as a placeholder for a resource to be specified when the request is submitted. A proxy resource is expressed by a special path parameter of `{proxy+}`, often referred to as a greedy path parameter. The `+` sign indicates whichever child resources are appended to it. The `/parent/{proxy+}` placeholder stands for any resource matching the path pattern of `/parent/*`. The greedy path parameter name, `proxy`, can be replaced by another string in the same way you treat a regular path parameter name.

Using the Amazon CLI, you call the following command to set up a proxy resource under the root (`/` `{proxy+}`):

```
aws apigateway create-resource --rest-api-id <apiId> \  
    --region <region> \  
    --parent-id <rootResourceId> \  
    --path-part {proxy+}
```

The result is similar to the following:

```
{  
  "path": "/{proxy+}",  
  "pathPart": "{proxy+}",  
  "id": "234jdr",  
  "parentId": "svzr2028x8"  
}
```

For the PetStore API example, you can use `{proxy+}` to represent both the `/pets` and `/pets/{petId}`. This proxy resource can also reference any other (existing or to-be-added) resources, such as `/food/{type}/{item}`, `/toys/{type}/{item}`, etc., or `/food/{type}/{subtype}/{item}`, `/`

toys/{type}/{subtype}/{item}, etc. The backend developer determines the resource hierarchy and the client developer is responsible for understanding it. API Gateway simply passes whatever the client submitted to the backend.

An API can have more than one proxy resource. For example, the following proxy resources are allowed within an API.

```
/{proxy+}
/parent/{proxy+}
/parent/{child}/{proxy+}
```

When a proxy resource has non-proxy siblings, the sibling resources are excluded from the representation of the proxy resource. For the preceding examples, `/{proxy+}` refers to any resources under the root resource except for the `/parent[/*]` resources. In other words, a method request against a specific resource takes precedence over a method request against a generic resource at the same level of the resource hierarchy.

A proxy resource cannot have any child resource. Any API resource after `{proxy+}` is redundant and ambiguous. The following proxy resources are not allowed within an API.

```
/{proxy+}/child
/parent/{proxy+}/{child}
/parent/{child}/{proxy+}/{grandchild+}
```

### Set up an HTTP method

An API method request is encapsulated by the API Gateway [Method](#) resource. To set up the method request, you must first instantiate the `Method` resource, setting at least an HTTP method and an authorization type on the method.

Closely associated with the proxy resource, API Gateway supports an HTTP method of `ANY`. This `ANY` method represents any HTTP method that is to be supplied at run time. It allows you to use a single API method setup for all of the supported HTTP methods of `DELETE`, `GET`, `HEAD`, `OPTIONS`, `PATCH`, `POST`, and `PUT`.

You can set up the `ANY` method on a non-proxy resource as well. Combining the `ANY` method with a proxy resource, you get a single API method setup for all of the supported HTTP methods against any resources of an API. Furthermore, the backend can evolve without breaking the existing API setup.

Before setting up an API method, consider who can call the method. Set the authorization type according to your plan. For open access, set it to `NONE`. To use IAM permissions, set the authorization type to `AWS_IAM`. To use a Lambda authorizer function, set this property to `CUSTOM`. To use an Amazon Cognito user pool, set the authorization type to `COGNITO_USER_POOLS`.

The following Amazon CLI command shows how to create a method request of the `ANY` verb against a specified resource (`6sxx2j`), using the IAM permissions to control its access.

```
aws apigateway put-method --rest-api-id vaz7da96z6 \  
  --resource-id 6sxx2j \  
  --http-method ANY \  
  --authorization-type AWS_IAM \  
  --region us-west-2
```

To create an API method request with a different authorization type, see [the section called “Set up method request authorization”](#) (p. 230).

### Set up method request parameters

Method request parameters are a way for a client to provide input data or execution context necessary to complete the method request. A method parameter can be a path parameter, a header, or a query string

parameter. As part of method request setup, you must declare required request parameters to make them available for the client. For non-proxy integration, you can translate these request parameters to a form that is compatible with the backend requirement.

For example, for the `GET /pets/{petId}` method request, the `{petId}` path variable is a required request parameter. You can declare this path parameter when calling the `put-method` command of the Amazon CLI. This is illustrated as follows:

```
aws apigateway put-method --rest-api-id vaz7da96z6 \  
  --resource-id rjkmth \  
  --http-method GET \  
  --authorization-type "NONE" \  
  --region us-west-2 \  
  --request-parameters method.request.path.petId=true
```

If a parameter is not required, you can set it to `false` in `request-parameters`. For example, if the `GET /pets` method uses an optional query string parameter of `type`, and an optional header parameter of `breed`, you can declare them using the following CLI command, assuming that the `/pets` resource `id` is `6sxz2j`:

```
aws apigateway put-method --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j \  
  --http-method GET \  
  --authorization-type "NONE" \  
  --region us-west-2 \  
  --request-parameters  
method.request.querystring.type=false,method.request.header.breed=false
```

Instead of this abbreviated form, you can use a JSON string to set the `request-parameters` value:

```
'{"method.request.querystring.type":false,"method.request-header.breed":false}'
```

With this setup, the client can query pets by type:

```
GET /pets?type=dog
```

And the client can query dogs of the poodle breed as follows:

```
GET /pets?type=dog  
breed:poodle
```

For information on how to map method request parameters to integration request parameters, see [the section called "Integrations" \(p. 277\)](#).

## Set up method request model

For an API method that can take input data in a payload, you can use a model. A model is expressed in a [JSON schema draft 4](#) and describes the data structure of the request body. With a model, a client can determine how to construct a method request payload as input. More importantly, API Gateway uses the model to [validate a request \(p. 318\)](#), [generate an SDK \(p. 542\)](#), and initialize a mapping template for setting up the integration in the API Gateway console. For information about how to create a [model](#), see [Models and Mapping Templates \(p. 330\)](#).

Depending on the content types, a method payload can have different formats. A model is indexed against the media type of the applied payload. API Gateway uses the `Content-Type` request header to determine the content type. To set up method request models, add key-value pairs of the "`<media-`

`type`: "`<model-name>`" format to the `requestModels` map when calling the Amazon CLI `put-method` command.

To use the same model regardless of the content type, specify `$default` as the key.

For example, to set a model on the JSON payload of the `POST /pets` method request of the PetStore example API, you can call the following Amazon CLI command:

```
aws apigateway put-method \  
  --rest-api-id vaz7da96z6 \  
  --resource-id 6sxx2j \  
  --http-method POST \  
  --authorization-type "NONE" \  
  --region us-west-2 \  
  --request-models '{"application/json":"petModel"}'
```

Here, `petModel` is the name property value of a `Model` resource describing a pet. The actual schema definition is expressed as a JSON string value of the `schema` property of the `Model` resource.

In a Java, or other strongly typed SDK, of the API, the input data is cast as the `petModel` class derived from the schema definition. With the request model, the input data in the generated SDK is cast into the `Empty` class, which is derived from the default `Empty` model. In this case, the client cannot instantiate the correct data class to provide the required input.

## Set up method request authorization

To control who can call the API method, you can configure the [authorization type](#) on the method. You can use this type to enact one of the supported authorizers, including IAM roles and policies (`AWS_IAM`), an Amazon Cognito user pool (`COGNITO_USER_POOLS`), or a Lambda authorizer (`CUSTOM`).

To use IAM permissions to authorize access to the API method, set the `authorization-type` input property to `AWS_IAM`. When this option is set, API Gateway verifies the caller's signature on the request, based on the caller's IAM user's access key identifier and secret key. If the verified user has permission to call the method, the request is accepted. Otherwise, the request is rejected and the caller receives an unauthorized error response. The call to the method does not succeed unless the caller has been granted permission to invoke the API method or if the caller is allowed to assume a role that has been granted the permission. The caller has permissions to call this and any other API methods created by anyone of the same Amazon account if the caller has the following IAM policy attached to his or her IAM user:

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Action": [  
        "execute-api:Invoke"  
      ],  
      "Resource": "arn:aws:execute-api:*:*:*"  
    }  
  ]  
}
```

For more information, see [the section called "Use IAM permissions" \(p. 248\)](#).

At present, such a policy can be granted to only the IAM users of the API owner's account. Users from a different Amazon account can call the API methods if they are allowed to assume a role of the API owner account and the assumed role has the proper permissions for the `execute-api:Invoke` action. For information on cross-account permissions, see [Using IAM Roles](#).

You can use Amazon CLI, an Amazon SDK, or a REST API client, such as [Postman](#), which implements [Signature Version 4 Signing](#).

To use a Lambda authorizer to authorize access to the API method, set the `authorization-type` input property to `CUSTOM` and set the `authorizer-id` input property to the `id` property value of a Lambda authorizer that already exists. The referenced Lambda authorizer can be of the `TOKEN` or `REQUEST` type. For information about creating a Lambda authorizer, see [the section called "Use Lambda authorizers"](#) (p. 256).

To use an Amazon Cognito user pool to authorize access to the API method, set the `authorization-type` input property to `COGNITO_USER_POOLS` and set the `authorizer-id` input property to the `id` property value of the `COGNITO_USER_POOLS` authorizer that was already created. For information about creating an Amazon Cognito user pool authorizer, see [the section called "Use Amazon Cognito user pool as authorizer for a REST API"](#) (p. 270).

### Set up method request validation

You can enable request validation when setting up an API method request. You need to first to create a [request validator](#):

```
aws apigateway create-request-validator \  
  --rest-api-id 7zw9uyk9kl \  
  --name bodyOnlyValidator \  
  --validate-request-body \  
  --no-validate-request-parameters
```

This CLI command creates a body-only request validator. Example output is as follows:

```
{  
  "validateRequestParameters": true,  
  "validateRequestBody": true,  
  "id": "jgppy6",  
  "name": "bodyOnlyValidator"  
}
```

With this request validator, you can enable request validation as part of the method request setup:

```
aws apigateway put-method \  
  --rest-api-id 7zw9uyk9kl \  
  --region us-west-2 \  
  --resource-id xdsvhp \  
  --http-method PUT \  
  --authorization-type "NONE" \  
  --request-parameters '{"method.request.querystring.type": false,  
  "method.request.querystring.page":false}' \  
  --request-models '{"application/json":"petModel"}' \  
  --request-validator-id jgppy6
```

To be included in request validation, a request parameter must be declared as required. If the query string parameter for the page is used in request validation, the `request-parameters` map of the preceding example must be specified as `'{"method.request.querystring.type": false, "method.request.querystring.page":true}'`.

### Set up method responses in API Gateway

An API method response encapsulates the output of an API method request that the client will receive. The output data includes an HTTP status code, some headers, and possibly a body.

With non-proxy integrations, the specified response parameters and body can be mapped from the associated integration response data or can be assigned certain static values according to

mappings. These mappings are specified in the integration response. The mapping can be an identical transformation that passes the integration response through as-is.

With a proxy integration, API Gateway passes the backend response through to the method response automatically. There is no need for you to set up the API method response. However, with the Lambda proxy integration, the Lambda function must return a result of [this output format \(p. 295\)](#) for API Gateway to successfully map the integration response to a method response.

Programmatically, the method response setup amounts to creating a [MethodResponse](#) resource of API Gateway and setting the properties of [statusCode](#), [responseParameters](#), and [responseModels](#).

When setting status codes for an API method, you should choose one as the default to handle any integration response of an unanticipated status code. It is reasonable to set 500 as the default because this amounts to casting otherwise unmapped responses as a server-side error. For instructional reasons, the API Gateway console sets the 200 response as the default. But you can reset it to the 500 response.

To set up a method response, you must have created the method request.

### Set up method response status code

The status code of a method response defines a type of response. For example, responses of 200, 400, and 500 indicate successful, client-side error and server-side error responses, respectively.

To set up a method response status code, set the [statusCode](#) property to an HTTP status code. The following Amazon CLI command creates a method response of 200.

```
aws apigateway put-method-response \  
  --region us-west-2 \  
  --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j \  
  --http-method GET \  
  --status-code 200
```

### Set up method response parameters

Method response parameters define which headers the client receives in response to the associated method request. Response parameters also specify a target to which API Gateway maps an integration response parameter, according to mappings prescribed in the API method's integration response.

To set up the method response parameters, add to the [responseParameters](#) map of [MethodResponse](#) key-value pairs of the "{parameter-name}": "{boolean}" format. The following CLI command shows an example of setting the `my-header` header, the `petId` path variable, and the query `query` parameter as the mapping targets:

```
aws apigateway put-method-response \  
  --region us-west-2 \  
  --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j \  
  --http-method GET \  
  --status-code 200 \  
  --response-parameters method.request.header.my-  
header=false,method.request.path.petId=true,method.request.querystring.query=false
```

### Set up method response models

A method response model defines a format of the method response body. Before setting up the response model, you must first create the model in API Gateway. To do so, you can call the [create-model](#) command. The following example shows how to create a `PetStorePet` model to describe the body of the response to the `GET /pets/{petId}` method request.

```
aws apigateway create-model \  
  --region us-west-2 \  
  --rest-api-id vaz7da96z6 \  
  --content-type application/json \  
  --name PetStorePet \  
  --schema '{ \  
    "$schema": "http://json-schema.org/draft-04/schema#", \  
    "title": "PetStorePet", \  
    "type": "object", \  
    "properties": { \  
      "id": { "type": "number" }, \  
      "type": { "type": "string" }, \  
      "price": { "type": "number" } \  
    } \  
  }'
```

The result is created as an API Gateway [Model](#) resource.

To set up the method response models to define the payload format, add the "application/json":"PetStorePet" key-value pair to the [requestModels](#) map of [MethodResponse](#) resource. The following Amazon CLI command of `put-method-response` shows how this is done:

```
aws apigateway put-method-response \  
  --region us-west-2 \  
  --rest-api-id vaz7da96z6 \  
  --resource-id 6sxz2j \  
  --http-method GET \  
  --status-code 200 \  
  --response-parameters method.request.header.my-  
header=false,method.request.path.petId=true,method.request.querystring.query=false \  
  --response-models '{"application/json":"PetStorePet"}'
```

Setting up a method response model is necessary when you generate a strongly typed SDK for the API. It ensures that the output is cast into an appropriate class in Java or Objective-C. In other cases, setting a model is optional.

## Set up a method using the API Gateway console

Before setting up an API method, verify the following:

- You must have the method available in API Gateway. Follow the instructions in [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#).
- If you want the method to communicate with a Lambda function, you must have already created the Lambda invocation role and Lambda execution role in IAM. You must also have created the Lambda function with which your method will communicate in Amazon Lambda. To create the roles and function, use the instructions in [Create a Lambda function for Lambda non-proxy integration \(p. 35\)](#) of the [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).
- If you want the method to communicate with an HTTP or HTTP proxy integration, you must have already created, and have access to, the HTTP endpoint URL with which your method will communicate.
- Verify that your certificates for HTTP and HTTP proxy endpoints are supported by API Gateway. For details see [API Gateway-supported certificate authorities for HTTP and HTTP proxy integrations \(p. 572\)](#).

### Topics

- [Set up an API Gateway method request in the API Gateway console \(p. 234\)](#)
- [Set up an API Gateway method response using the API Gateway console \(p. 236\)](#)



## Set up an API Gateway method request in the API Gateway console

To use the API Gateway console to specify an API's method request/response, and to configure how the method will authorize requests, follow these instructions.

### Note

These instructions assume you have already completed the steps in [Set up an API integration request using the API Gateway console \(p. 282\)](#). They are best used to supplement the discussions given in [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).

1. With the method selected in the **Resources** pane, choose **Method Request** from the **Method Execution** pane.
2. Under **Settings**, choose the pencil icon to open the **Authorization** drop-down menu and choose one of the available authorizers.
  - a. To enable open access to the method for any user, choose `NONE`. This step can be skipped if the default setting has not been changed.
  - b. To use IAM permissions to control the client access to the method, choose `AWS_IAM`. With this choice, only users of the IAM roles with the correct IAM policy attached are allowed to call this method.

To create the IAM role, specify an access policy with a format like the following:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:Invoke"
      ],
      "Resource": [
        "resource-statement"
      ]
    }
  ]
}
```

In this access policy, `resource-statement` is the value of the **ARN** field in the **Authorization Settings** section. For more information about setting the IAM permissions, see [Control access to an API with IAM permissions \(p. 248\)](#).

To create the IAM role, you can adapt the instructions in "To create the Lambda invocation role and its policy" and "To create the Lambda execution role and its policy" in the [Create Lambda Functions \(p. 35\)](#) section of the [Build an API Gateway REST API with Lambda integration \(p. 27\)](#).

To save your choice, choose **Update**. Otherwise, choose **Cancel**.

- c. To use a Lambda authorizer, choose one under **Token authorizer**. You must have created a Lambda authorizer to have this choice displayed in the drop-down menu. For information on how to create a Lambda authorizer, see [Use API Gateway Lambda authorizers \(p. 256\)](#).
  - d. To use an Amazon Cognito user pool, choose an available user pool under **Cognito user pool authorizers**. You must have created a user pool in Amazon Cognito and an Amazon Cognito user pool authorizer in API Gateway to have this choice displayed in the drop-down menu. For information on how to create an Amazon Cognito user pool authorizer, see [Control access to a REST API using Amazon Cognito user pools as authorizer \(p. 270\)](#).
3. To enable or disable request validation, choose the pencil icon from the **Request Validator** drop-down menu and choose one of the listed options. For more information about each option, see [Enable request validation in API Gateway \(p. 318\)](#).

4. To require an API key, choose the pencil icon to open the **API Key Required** drop-down menu and choose either `true` or `false` according to your API requirements. When enabled, API keys are used in [usage plans \(p. 491\)](#) to throttle client traffic.
5. To add a query string parameter to the method, do the following:
  - a. Choose the arrow next to **URL Query String Parameters**, and then choose **Add query string**.
  - b. For **Name**, type the name of the query string parameter.
  - c. Choose the check-mark icon to save the new query string parameter name.
  - d. If the newly created query string parameter is to be used for request validation, choose the **Required** option. For more information about the request validation, see [Enable request validation in API Gateway \(p. 318\)](#).
  - e. If the newly created query string parameter is to be used as part of a caching key, check the **Caching** option. This is applicable only when caching is enabled. For more information about caching, see [Use method or integration parameters as cache keys to index cached responses \(p. 485\)](#).

**Tip**

To remove the query string parameter, choose the **x** icon associated with it and then choose **Remove this parameter and any dependent parameters** to confirm the removal.

To change the name of the query string parameter, remove it and then create a new one.

6. To add a header parameter to the method, do the following:
  - a. Choose the arrow next to **HTTP Request Headers**, and then choose **Add header**.
  - b. For **Name**, type the name of the header parameter and then choose the check-mark icon to save the settings.
  - c. If the newly created header parameter is to be used for request validation, choose the **Required** option. For more information about request validation, see [Enable request validation in API Gateway \(p. 318\)](#).
  - d. If the newly created header parameter is to be used as part of a caching key, choose the **Caching** option. This is applicable only when caching is enabled. For more information about caching, see [Use method or integration parameters as cache keys to index cached responses \(p. 485\)](#).

**Tip**

To remove the header parameter, choose the **x** icon associated with it and then choose **Remove this parameter and any dependent parameters** to confirm the removal.

To change the name of the header parameter, remove it and then create a new one.

7. To declare the payload format of a method request with the `POST`, `PUT`, or `PATCH` HTTP verb, expand **Request Body**, and do the following:
  - a. Choose **Add model**.
  - b. Type a MIME-type (for example, `application/json`) for **Content type**.
  - c. Open the **Model name** drop-down menu to choose an available model for the payload and choose the check-mark icon to save the settings.

The currently available models for the API include the default `Empty` and `Error` models as well as any models you have created and added to the [Models](#) collection of the API. For more information about creating a model, see [Create a model in API Gateway \(p. 336\)](#).

**Note**

The model is useful to inform the client of the expected data format of a payload. It is helpful to generate a skeletal mapping template. It is important to generate a strongly typed SDK of the API in such languages as Java, C#, Objective-C, and Swift. It is only required if request validation is enabled against the payload.

8. To assign an operation name in a Java SDK of this API, generated by API Gateway, expand **SDK Settings** and type a name in **Operation name**. For example, for the method request of `GET /pets/{petId}`, the corresponding Java SDK operation name is, by default, `GetPetsPetId`. This name is constructed from the method's HTTP verb (`GET`) and the resource path variable names (`Pets` and `PetId`). If you set the operation name as `getPetById`, the SDK operation name becomes `GetPetById`.

### Set up an API Gateway method response using the API Gateway console

An API method can have one or more responses. Each response is indexed by its HTTP status code. By default, the API Gateway console adds 200 response to the method responses. You can modify it, for example, to have the method return 201 instead. You can add other responses, for example, 409 for access denial and 500 for uninitialized stage variables used.

To use the API Gateway console to modify, delete, or add a response to an API method, follow these instructions.

1. Choose **Method Response** from **Method Execution** for a given method of an API resource.
2. To add a new response, choose **Add Response**.
  - a. Type an HTTP status code; for example, 200, 400, or 500) for **HTTP Status**, and then choose the check-mark icon to save the choice.

When a backend-returned response does not have a corresponding method response defined, API Gateway fails to return the response to the client. Instead, it returns a 500 `Internal server error` error response.

- b. Expand the response of the given status code.
- c. Choose **Add Header**.
- d. Type a name for **Name** under **Response Headers for {status}**, and then choose the check-mark icon to save the choice.

If you need to translate any backend-returned header to one defined in a method response, you must first add the method response header as described in this step .

- e. Choose **Add Response Model** under **Response Body for {status}**.
  - f. Type the media type of the response payload for **Content type** and choose a model from the **Models** drop-down menu.
  - g. Choose the check-mark icon to save the settings.
3. To modify an existing response, expand the response and follow Step 2 above.
  4. To remove a response, choose the x icon for the response and confirm you want to delete the response.

For every response returned from the backend, you must have a compatible response configured as the method response. However, the configuring method response headers and payload model are optional unless you map the result from the backend to the method response before returning to the client. Also, a method response payload model is important if you are generating a strongly typed SDK for your API.

## Controlling and managing access to a REST API in API Gateway

API Gateway supports multiple mechanisms for controlling and managing access to your API.

You can use the following mechanisms for authentication and authorization:

- **Resource policies** let you create resource-based policies to allow or deny access to your APIs and methods from specified source IP addresses or VPC endpoints. For more information, see [the section called “Use API Gateway resource policies”](#) (p. 237).
- **Standard Amazon IAM roles and policies** offer flexible and robust access controls that can be applied to an entire API or individual methods. IAM roles and policies can be used for controlling who can create and manage your APIs, as well as who can invoke them. For more information, see [the section called “Use IAM permissions”](#) (p. 248).
- **IAM tags** can be used together with IAM policies to control access. For more information, see [the section called “Attribute-based access control”](#) (p. 739).
- **Endpoint policies for interface VPC endpoints** allow you to attach IAM resource policies to interface VPC endpoints to improve the security of your [private APIs](#). For more information, see [the section called “Use VPC endpoint policies for private APIs”](#) (p. 254).
- **Lambda authorizers** are Lambda functions that control access to REST API methods using bearer token authentication—as well as information described by headers, paths, query strings, stage variables, or context variables request parameters. Lambda authorizers are used to control who can invoke REST API methods. For more information, see [the section called “Use Lambda authorizers”](#) (p. 256).
- **Amazon Cognito user pools** let you create customizable authentication and authorization solutions for your REST APIs. Amazon Cognito user pools are used to control who can invoke REST API methods. For more information, see [the section called “Use Amazon Cognito user pool as authorizer for a REST API”](#) (p. 270).

You can use the following mechanisms for performing other tasks related to access control:

- **Cross-origin resource sharing (CORS)** lets you control how your REST API responds to cross-domain resource requests. For more information, see [the section called “CORS”](#) (p. 382).
- **Client-side SSL certificates** can be used to verify that HTTP requests to your backend system are from API Gateway. For more information, see [the section called “Client certificates”](#) (p. 569).
- **Amazon WAF** can be used to protect your API Gateway API from common web exploits. For more information, see [the section called “Amazon WAF”](#) (p. 596).

You can use the following mechanisms for tracking and limiting the access that you have granted to authorized clients:

- **Usage plans** let you provide **API keys** to your customers—and then track and limit usage of your API stages and methods for each API key. For more information, see [the section called “Usage plans”](#) (p. 491).

## Controlling access to an API with API Gateway resource policies

Amazon API Gateway *resource policies* are JSON policy documents that you attach to an API to control whether a specified principal (typically an IAM user or role) can invoke the API. You can use API Gateway resource policies to allow your API to be securely invoked by:

- Users from a specified Amazon account.
- Specified source IP address ranges or CIDR blocks.
- Specified virtual private clouds (VPCs) or VPC endpoints (in any account).

You can use resource policies for all API endpoint types in API Gateway: private, edge-optimized, and Regional.

For [private APIs](#), you can use resource policies together with VPC endpoint policies to control which principals have access to which resources and actions. For more information, see [the section called “Use VPC endpoint policies for private APIs” \(p. 254\)](#).

You can attach a resource policy to an API by using the Amazon Web Services Management Console, Amazon CLI, or Amazon SDKs.

API Gateway resource policies are different from IAM identity-based policies. IAM identity-based policies are attached to IAM users, groups, or roles and define what actions those identities are capable of doing on which resources. API Gateway resource policies are attached to resources. For a more detailed discussion of the differences between identity-based policies and resource policies, see [Identity-Based Policies and Resource-Based Policies](#).

You can use API Gateway resource policies together with IAM policies.

### Topics

- [Access policy language overview for Amazon API Gateway \(p. 238\)](#)
- [How API Gateway resource policies affect authorization workflow \(p. 239\)](#)
- [API Gateway resource policy examples \(p. 242\)](#)
- [Create and attach an API Gateway resource policy to an API \(p. 245\)](#)
- [Amazon condition keys that can be used in API Gateway resource policies \(p. 247\)](#)

## Access policy language overview for Amazon API Gateway

This page describes the basic elements used in Amazon API Gateway resource policies.

Resource policies are specified using the same syntax as IAM policies. For complete policy language information, see [Overview of IAM Policies](#) and [Amazon Identity and Access Management Policy Reference](#) in the *IAM User Guide*.

For information about how an Amazon service decides whether a given request should be allowed or denied, see [Determining Whether a Request is Allowed or Denied](#).

### Common elements in an access policy

In its most basic sense, a resource policy contains the following elements:

- **Resources** – APIs are the Amazon API Gateway resources for which you can allow or deny permissions. In a policy, you use the Amazon Resource Name (ARN) to identify the resource. You can also use abbreviated syntax, which API Gateway automatically expands to the full ARN when you save a resource policy. To learn more, see [API Gateway resource policy examples \(p. 242\)](#).

For the format of the full Resource element, see [Resource format of permissions for executing API in API Gateway \(p. 251\)](#).

- **Actions** – For each resource, Amazon API Gateway supports a set of operations. You identify resource operations that you will allow (or deny) by using action keywords.

For example, the `execute-api:Invoke` permission will allow the user permission to invoke an API upon a client request.

For the format of the Action element, see [Action format of permissions for executing API in API Gateway \(p. 251\)](#).

- **Effect** – What the effect is when the user requests the specific action—this can be either `Allow` or `Deny`. You can also explicitly deny access to a resource, which you might do in order to make sure that a user cannot access it, even if a different policy grants access.

### Note

"Implicit deny" is the same thing as "deny by default".

An "implicit deny" is different from an "explicit deny". For more information, see [The Difference Between Denying by Default and Explicit Deny](#).

- **Principal** – The account or user who is allowed access to the actions and resources in the statement. In a resource policy, the principal is the IAM user or account who is the recipient of this permission.

The following example resource policy shows the preceding common policy elements. The policy grants access to the API under the specified *account-id* in the specified *region* to any user whose source IP address is in the address block *123.4.5.6/24*. The policy denies all access to the API if the user's source IP is not within the range.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "arn:aws:execute-api:region:account-id:*"
    },
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "arn:aws:execute-api:region:account-id:*",
      "Condition": {
        "NotIpAddress": {
          "aws:SourceIp": "123.4.5.6/24"
        }
      }
    }
  ]
}
```

## How API Gateway resource policies affect authorization workflow

When API Gateway evaluates the resource policy attached to your API, the result is affected by the authentication type that you have defined for the API, as illustrated in the flowcharts in the following sections.

### Topics

- [API Gateway resource policy only \(p. 239\)](#)
- [Lambda authorizer and resource policy \(p. 240\)](#)
- [IAM authentication and resource policy \(p. 240\)](#)
- [Amazon Cognito authentication and resource policy \(p. 241\)](#)
- [Policy evaluation outcome tables \(p. 241\)](#)

### API Gateway resource policy only

In this workflow, an API Gateway resource policy is attached to the API, but no authentication type is defined for the API. Evaluation of the policy involves seeking an explicit allow based on the inbound criteria of the caller. An implicit denial or any explicit denial results in denying the caller.

The following is an example of such a resource policy.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "arn:aws:execute-api:region:account-id:api-id/",
      "Condition": {
        "IpAddress": {
          "aws:SourceIp": [ "192.0.2.0/24", "198.51.100.0/24" ]
        }
      }
    }
  ]
}
```

### Lambda authorizer and resource policy

In this workflow, a Lambda authorizer is configured for the API in addition to a resource policy. The resource policy is evaluated in two phases. Before calling the Lambda authorizer, API Gateway first evaluates the policy and checks for any explicit denials. If found, the caller is denied access immediately. Otherwise, the Lambda authorizer is called, and it returns a [policy document \(p. 266\)](#), which is evaluated in conjunction with the resource policy. The result is determined based on [Table A \(p. 241\)](#) (near the end of this topic).

The following example resource policy allows calls only from the VPC endpoint whose VPC endpoint ID is `vpce-1a2b3c4d`. During the "pre-auth" evaluation, only the calls coming from the VPC endpoint indicated in the example are allowed to move forward and evaluate the Lambda authorizer. All remaining calls are blocked.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "arn:aws:execute-api:region:account-id:api-id/"
      ],
      "Condition": {
        "StringNotEquals": {
          "aws:SourceVpce": "vpce-1a2b3c4d"
        }
      }
    }
  ]
}
```

### IAM authentication and resource policy

In this workflow, IAM authentication is configured for the API in addition to a resource policy. After authenticating the user with the IAM service, the policies attached to the IAM user in addition to the resource policy are evaluated together. The outcome varies based on whether the caller is in the same account, or a separate Amazon account, from the API owner.

If the caller and API owner are from separate accounts, both the IAM user policies and the resource policy explicitly allow the caller to proceed. (See [Table B \(p. 241\)](#) at the end of this topic.) In contrast, if the caller and the API owner are in the same account, then either the user policies or the resource policy must explicitly allow the caller to proceed. (See [Table A \(p. 241\)](#) below.)

The following is an example of a cross-account resource policy. Assuming the IAM user policy contains an allow, this resource policy allows calls only from the VPC whose VPC ID is `vpc-2f09a348`. (See [Table B \(p. 241\)](#) at the end of this topic.)

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "",
      "Action": "execute-api:Invoke",
      "Resource": [
        "arn:aws:execute-api:region:account-id:api-id/"
      ],
      "Condition": {
        "StringEquals": {
          "aws:SourceVpc": "vpc-2f09a348"
        }
      }
    }
  ]
}
```

### Amazon Cognito authentication and resource policy

In this workflow, an [Amazon Cognito user pool \(p. 270\)](#) is configured for the API in addition to a resource policy. API Gateway first attempts to authenticate the caller through Amazon Cognito. This is typically performed through a [JWT token](#) that is provided by the caller. If authentication is successful, the resource policy is evaluated independently, and an explicit allow is required. A deny or "neither allow or deny" results in a deny. The following is an example of a resource policy that might be used together with Amazon Cognito user pools.

The following is an example of a resource policy that allows calls only from specified source IPs, assuming that the Amazon Cognito authentication token contains an allow. (See [Table A \(p. 241\)](#) near the end of this topic.)

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": "arn:aws:execute-api:region:account-id:api-id/",
      "Condition": {
        "IpAddress": {
          "aws:SourceIp": ["192.0.2.0/24", "198.51.100.0/24"]
        }
      }
    }
  ]
}
```

### Policy evaluation outcome tables

Table A lists the resulting behavior when access to an API Gateway API is controlled by an IAM policy (or a Lambda or Amazon Cognito user pools authorizer) and an API Gateway resource policy, both of which are in the same Amazon account.



**Table A: Account A Calls API Owned by Account A**

IAM user policy (or Lambda or Amazon Cognito user pools authorizer)	API Gateway resource policy	Resulting behavior
Allow	Allow	Allow
Allow	Neither Allow nor Deny	Allow
Allow	Deny	Explicit Deny
Neither Allow nor Deny	Allow	Allow
Neither Allow nor Deny	Neither Allow nor Deny	Implicit Deny
Neither Allow nor Deny	Deny	Explicit Deny
Deny	Allow	Explicit Deny
Deny	Neither Allow nor Deny	Explicit Deny
Deny	Deny	Explicit Deny

Table B lists the resulting behavior when access to an API Gateway API is controlled by an IAM policy (or a Lambda or Amazon Cognito user pools authorizer) and an API Gateway resource policy, which are in different Amazon accounts. If either is silent (neither allow nor deny), cross-account access is denied. This is because cross-account access requires that both the resource policy and the IAM policy (or a Lambda or Amazon Cognito user pools authorizer) explicitly grant access.

**Table B: Account B Calls API Owned by Account A**

IAM user policy (or Lambda or Amazon Cognito user pools authorizer)	API Gateway resource policy	Resulting behavior
Allow	Allow	Allow
Allow	Neither Allow nor Deny	Implicit Deny
Allow	Deny	Explicit Deny
Neither Allow nor Deny	Allow	Implicit Deny
Neither Allow nor Deny	Neither Allow nor Deny	Implicit Deny
Neither Allow nor Deny	Deny	Explicit Deny
Deny	Allow	Explicit Deny
Deny	Neither Allow nor Deny	Explicit Deny
Deny	Deny	Explicit Deny

## API Gateway resource policy examples

This page presents a few examples of typical use cases for API Gateway resource policies.

The following example policies use a simplified syntax to specify the API resource. This simplified syntax is an abbreviated way that you can refer to an API resource, instead of specifying the full

Amazon Resource Name (ARN). API Gateway converts the abbreviated syntax to the full ARN when you save the policy. For example, you can specify the resource `execute-api:/stage-name/GET/pets` in a resource policy. API Gateway converts the resource to `arn:aws:execute-api:us-west-2:123456789012:aabbccdde/stage-name/GET/pets` when you save the resource policy. API Gateway builds the full ARN by using the current Region, your Amazon account ID, and the ID of the REST API that the resource policy is associated with. You can use `execute-api:/*` to represent all stages, methods, and paths in the current API. For information about access policy language, see [Access policy language overview for Amazon API Gateway \(p. 238\)](#).

### Topics

- [Example: Allow users in another Amazon account to use an API \(p. 243\)](#)
- [Example: Deny API traffic based on source IP address or range \(p. 243\)](#)
- [Example: Deny API traffic based on source IP address or range when using a private API \(p. 244\)](#)
- [Example: Allow private API traffic based on source VPC or VPC endpoint \(p. 244\)](#)

### Example: Allow users in another Amazon account to use an API

The following example resource policy grants API access in one Amazon account to two users in a different Amazon account via [Signature Version 4 \(SigV4\)](#) protocols. Specifically, Alice and the root user for the Amazon account identified by `account-id-2` are granted the `execute-api:Invoke` action to execute the `GET` action on the `pets` resource (API) in your Amazon account.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "AWS": [
          "arn:aws:iam::account-id-2:user/Alice",
          "account-id-2"
        ]
      },
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api:/stage/GET/pets"
      ]
    }
  ]
}
```

### Example: Deny API traffic based on source IP address or range

The following example resource policy denies (blocks) incoming traffic to an API from two specified source IP address blocks.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api:/*"
      ]
    },
    {

```

```

    "Effect": "Deny",
    "Principal": "*",
    "Action": "execute-api:Invoke",
    "Resource": [
      "execute-api/*"
    ],
    "Condition" : {
      "IpAddress": {
        "aws:SourceIp": ["192.0.2.0/24", "198.51.100.0/24"]
      }
    }
  }
]
}

```

#### Example: Deny API traffic based on source IP address or range when using a private API

The following example resource policy denies (blocks) incoming traffic to a private API from two specified source IP address blocks. When using private APIs, the VPC endpoint for `execute-api` rewrites the original source IP address. The `aws:VpcSourceIp` condition filters the request against the original requester IP address.

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api/*"
      ]
    },
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api/*"
      ],
      "Condition" : {
        "IpAddress": {
          "aws:VpcSourceIp": ["192.0.2.0/24", "198.51.100.0/24"]
        }
      }
    }
  ]
}

```

#### Example: Allow private API traffic based on source VPC or VPC endpoint

The following example resource policies allow incoming traffic to a private API only from a specified virtual private cloud (VPC) or VPC endpoint.

This example resource policy specifies a source VPC:

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",

```

```

        "Action": "execute-api:Invoke",
        "Resource": [
            "execute-api/*"
        ]
    },
    {
        "Effect": "Deny",
        "Principal": "*",
        "Action": "execute-api:Invoke",
        "Resource": [
            "execute-api/*"
        ],
        "Condition" : {
            "StringNotEquals": {
                "aws:SourceVpc": "vpc-1a2b3c4d"
            }
        }
    }
]
}

```

This example resource policy specifies a source VPC endpoint:

```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Principal": "*",
            "Action": "execute-api:Invoke",
            "Resource": [
                "execute-api/*"
            ]
        },
        {
            "Effect": "Deny",
            "Principal": "*",
            "Action": "execute-api:Invoke",
            "Resource": [
                "execute-api/*"
            ],
            "Condition" : {
                "StringNotEquals": {
                    "aws:SourceVpce": "vpce-1a2b3c4d"
                }
            }
        }
    ]
}

```

## Create and attach an API Gateway resource policy to an API

To allow a user to access your API by calling the API execution service, you must create an API Gateway resource policy, which controls access to the API Gateway resources, and attach the policy to the API.

### Important

To update an API Gateway resource policy, you'll need to have `apigateway:UpdateRestApiPolicy` permission in addition to `apigateway:PATCH` permission.

The resource policy can be attached to the API when the API is being created, or it can be attached afterwards. For private APIs, note that until you attach the resource policy to the private API, all calls to the API will fail.

### Important

If you update the resource policy after the API is created, you'll need to deploy the API to propagate the changes after you've attached the updated policy. Updating or saving the policy alone won't change the runtime behavior of the API. For more information about deploying your API, see [Deploying a REST API in Amazon API Gateway](#) (p. 436).

Access can be controlled by IAM condition elements, including conditions on Amazon account, source VPC, source VPC endpoint, or IP range. If the `Principal` in the policy is set to "\*", other authorization types can be used alongside the resource policy. If the `Principal` is set to "AWS", authorization will fail for all resources not secured with `AWS_IAM` authorization, including unsecured resources.

The following sections describe how to create your own API Gateway resource policy and attach it to your API. Attaching a policy applies the permissions in the policy to the methods in the API.

### Important

If you use the API Gateway console to attach a resource policy to a deployed API, or if you update an existing resource policy, you'll need to redeploy the API in the console for the changes to take effect.

### Topics

- [Attaching API Gateway resource policies \(console\)](#) (p. 246)
- [Attaching API Gateway resource policies \(Amazon CLI\)](#) (p. 246)

### Attaching API Gateway resource policies (console)

You can use the Amazon Management console to attach a resource policy to an API Gateway API.

#### To attach a resource policy to an API Gateway API

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. In the left navigation pane, choose **Resource Policy**.
4. If desired, choose one of the **Examples**. In the example policies, placeholders are enclosed in double curly braces ("`{{placeholder}}`"). Replace each of the placeholders (including the curly braces) with the necessary information.

If you don't use one of the **Examples**, enter your resource policy.

5. Choose **Save**.

If the API has been deployed previously in the API Gateway console, you'll need to redeploy it for the resource policy to take effect.

### Attaching API Gateway resource policies (Amazon CLI)

To use the Amazon CLI to create a new API and attach a resource policy to it, call the `create-rest-api` command as follows:

```
aws apigateway create-rest-api \  
  --name "api-name" \  
  --policy "{\"jsonEscapedPolicyDocument\"}"
```

To use the Amazon CLI to attach a resource policy to an existing API, call the `update-rest-api` command as follows:

```
aws apigateway update-rest-api \  
  --rest-api-id api-id \  
  --policy "{\"jsonEscapedPolicyDocument\"}"
```

```
--patch-operations op=replace,path=/policy,value='{\"jsonEscapedPolicyDocument\"}'
```

## Amazon condition keys that can be used in API Gateway resource policies

The following table contains Amazon condition keys that can be used in resource policies for APIs in API Gateway for each authorization type.

For more information about Amazon condition keys, see [Amazon Global Condition Context Keys](#).

### Table of condition keys

Condition keys	Criteria	Needs AuthN?	Authorization type
<code>aws:CurrentTime</code>	None	No	All
<code>aws:EpochTime</code>	None	No	All
<code>aws:TokenIssueTime</code>	Key is present only in requests that are signed using temporary security credentials.	Yes	IAM
<code>aws:MultiFactorAuthP</code>	Key is present only in requests that are signed using temporary security credentials.	Yes	IAM
<code>aws:MultiFactorAuthA</code>	Key is present only if MFA is present in the requests.	Yes	IAM
<code>aws:PrincipalAccount</code>	None	Yes	IAM
<code>aws:PrincipalArn</code>	None	Yes	IAM
<code>aws:PrincipalOrgID</code>	This key is included in the request context only if the principal is a member of an organization.	Yes	IAM
<code>aws:PrincipalOrgPath</code>	This key is included in the request context only if the principal is a member of an organization.	Yes	IAM
<code>aws:PrincipalTag</code>	This key is included in the request context if the principal is using an IAM user with attached tags. It is included for a principal using an IAM role with attached tags or session tags.	Yes	IAM
<code>aws:PrincipalType</code>	None	Yes	IAM
<code>aws:Referer</code>	Key is present only if the value is provided by	No	All

Condition keys	Criteria	Needs AuthN?	Authorization type
	the caller in the HTTP header.		
<code>aws:SecureTransport</code>	None	No	All
<code>aws:SourceArn</code>	None	No	All
<code>aws:SourceIp</code>	None	No	All
<code>aws:SourceVpc</code>	This key can be used only for private APIs.	No	All
<code>aws:SourceVpce</code>	This key can be used only for private APIs.	No	All
<code>aws:UserAgent</code>	Key is present only if the value is provided by the caller in the HTTP header.	No	All
<code>aws:userid</code>	None	Yes	IAM
<code>aws:username</code>	None	Yes	IAM

## Control access to an API with IAM permissions

You control access to your Amazon API Gateway API with [IAM permissions](#) by controlling access to the following two API Gateway component processes:

- To create, deploy, and manage an API in API Gateway, you must grant the API developer permissions to perform the required actions supported by the API management component of API Gateway.
- To call a deployed API or to refresh the API caching, you must grant the API caller permissions to perform required IAM actions supported by the API execution component of API Gateway.

The access control for the two processes involves different permissions models, explained next.

### API Gateway permissions model for creating and managing an API

To allow an API developer to create and manage an API in API Gateway, you must [create IAM permissions policies](#) that allow a specified API developer to create, update, deploy, view, or delete required [API entities](#). You attach the permissions policy to an [IAM user](#) representing the developer, to an [IAM group](#) containing the user, or to an [IAM role](#) assumed by the user.

For more information on how to use this permissions model, see [the section called “API Gateway identity-based policies” \(p. 715\)](#).

### API Gateway permissions model for invoking an API

To allow an API caller to invoke the API or refresh its caching, you must create IAM policies that permit a specified API caller to invoke the API method for which the IAM user authentication is enabled. The API developer sets the method's `authorizationType` property to `AWS_IAM` to require that the caller submit the IAM user's access keys to be authenticated. Then, you attach the policy to an IAM user representing the API caller, to an IAM group containing the user, or to an IAM role assumed by the user.

In this IAM permissions policy statement, the IAM `Resource` element contains a list of deployed API methods identified by given HTTP verbs and API Gateway [resource paths](#). The IAM `Action` element

contains the required API Gateway API executing actions. These actions include `execute-api:Invoke` or `execute-api:InvalidationCache`, where `execute-api` designates the underlying API execution component of API Gateway.

For more information on how to use this permissions model, see [Control access for invoking an API \(p. 250\)](#).

When an API is integrated with an Amazon service (for example, Amazon Lambda) in the back end, API Gateway must also have permissions to access integrated Amazon resources (for example, invoking a Lambda function) on behalf of the API caller. To grant these permissions, create an IAM role of the **Amazon service for API Gateway** type. When you create this role in the IAM Management console, this resulting role contains the following IAM trust policy that declares API Gateway as a trusted entity permitted to assume the role:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

If you create the IAM role by calling the [create-role](#) command of CLI or a corresponding SDK method, you must supply the above trust policy as the input parameter of `assume-role-policy-document`. Do not attempt to create such a policy directly in the IAM Management console or calling Amazon CLI [create-policy](#) command or a corresponding SDK method.

For API Gateway to call the integrated Amazon service, you must also attach to this role appropriate IAM permissions policies for calling integrated Amazon services. For example, to call a Lambda function, you must include the following IAM permissions policy in the IAM role:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "lambda:InvokeFunction",
      "Resource": "*"
    }
  ]
}
```

Note that Lambda supports resource-based access policy, which combines both trust and permissions policies. When integrating an API with a Lambda function using the API Gateway console, you are not asked to set this IAM role explicitly, because the console sets the resource-based permissions on the Lambda function for you, with your consent.

#### Note

To enact access control to an Amazon service, you can use either the caller-based permissions model, where a permissions policy is directly attached to the caller's IAM user or group, or the role-based permission model, where a permissions policy is attached to an IAM role that API Gateway can assume. The permissions policies may differ in the two models. For example, the caller-based policy blocks the access while the role-based policy allows it. You can take



advantage of this to require that an IAM user access an Amazon service through an API Gateway API only.

## Control access for invoking an API

In this section you will learn how to write up IAM policy statements to control who can call a deployed API in API Gateway. Here, you will also find the policy statement reference, including the formats of `Action` and `Resource` fields related to the API execution service. You should also study the IAM section in [the section called "How resource policies affect authorization workflow" \(p. 239\)](#).

For private APIs, you should use a combination of an API Gateway resource policy and a VPC endpoint policy. For more information, see the following topics:

- [the section called "Use API Gateway resource policies" \(p. 237\)](#)
- [the section called "Use VPC endpoint policies for private APIs" \(p. 254\)](#)

## Control who can call an API Gateway API method with IAM policies

To control who can or cannot call a deployed API with IAM permissions, create an IAM policy document with required permissions. A template for such a policy document is shown as follows.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Permission",
      "Action": [
        "execute-api:Execution-operation"
      ],
      "Resource": [
        "arn:aws:execute-api:region:account-id:api-id/stage/METHOD_HTTP_VERB/Resource-path"
      ]
    }
  ]
}
```

Here, `Permission` is to be replaced by `Allow` or `Deny` depending on whether you want to grant or revoke the included permissions. `Execution-operation` is to be replaced by the operations supported by the API execution service. `METHOD_HTTP_VERB` stands for a HTTP verb supported by the specified resources. `Resource-path` is the placeholder for the URL path of a deployed API `Resource` instance supporting the said `METHOD_HTTP_VERB`. For more information, see [Statement reference of IAM policies for executing API in API Gateway \(p. 251\)](#).

### Note

For IAM policies to be effective, you must have enabled IAM authentication on API methods by setting `AWS_IAM` for the methods' `authorizationType` property. Failing to do so will make these API methods publicly accessible.

For example, to grant a user permission to view a list of pets exposed by a specified API, but to deny the user permission to add a pet to the list, you could include the following statement in the IAM policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:Invoke"
      ],

```

```
    "Resource": [
      "arn:aws:execute-api:us-east-1:account-id:api-id/*/GET/pets"
    ],
  },
  {
    "Effect": "Deny",
    "Action": [
      "execute-api:Invoke"
    ],
    "Resource": [
      "arn:aws:execute-api:us-east-1:account-id:api-id/*/POST/pets"
    ]
  }
]
```

To grant a user permission to view a specific pet exposed by an API that is configured as GET / pets/{petId}, you could include the following statement in the IAM policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:Invoke"
      ],
      "Resource": [
        "arn:aws:execute-api:us-east-1:account-id:api-id/*/GET/pets/a1b2"
      ]
    }
  ]
}
```

### Statement reference of IAM policies for executing API in API Gateway

The following information describes the Action and Resource format of IAM policy statements of access permissions for executing an API.

### Action format of permissions for executing API in API Gateway

The API-executing Action expression has the following general format:

```
execute-api:action
```

where *action* is an available API-executing action:

- \*, which represents all of the following actions.
- **Invoke**, used to invoke an API upon a client request.
- **InvalidateCache**, used to invalidate API cache upon a client request.

### Resource format of permissions for executing API in API Gateway

The API-executing Resource expression has the following general format:

```
arn:aws:execute-api:region:account-id:api-id/stage-name/HTTP-VERB/resource-path-specifier
```

where:

- *region* is the Amazon region (such as `us-east-1` or `*` for all Amazon regions) that corresponds to the deployed API for the method.
- *account-id* is the 12-digit Amazon account Id of the REST API owner.
- *api-id* is the identifier API Gateway has assigned to the API for the method.
- *stage-name* is the name of the stage associated with the method.
- *HTTP-VERB* is the HTTP verb for the method. It can be one of the following: GET, POST, PUT, DELETE, PATCH.
- *resource-path-specifier* is the path to the desired method.

Some example resource expressions include:

- `arn:aws:execute-api:*:*:*` for any resource path in any stage, for any API in any Amazon region.
- `arn:aws:execute-api:us-east-1:*:*` for any resource path in any stage, for any API in the Amazon region of `us-east-1`.
- `arn:aws:execute-api:us-east-1:*:api-id/*` for any resource path in any stage, for the API with the identifier of *api-id* in the Amazon region of `us-east-1`.
- `arn:aws:execute-api:us-east-1:*:api-id/test/*` for resource path in the stage of `test`, for the API with the identifier of *api-id* in the Amazon region of `us-east-1`.

To learn more, see [API Gateway Amazon Resource Name \(ARN\) reference \(p. 670\)](#).

## IAM policy examples for API execution permissions

For permissions model and other background information, see [Control access for invoking an API \(p. 250\)](#).

The following policy statement gives the user permission to call any POST method along the path of `mydemoresource`, in the stage of `test`, for the API with the identifier of `a123456789`, assuming the corresponding API has been deployed to the Amazon region of `us-east-1`:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:Invoke"
      ],
      "Resource": [
        "arn:aws:execute-api:us-east-1:*:a123456789/test/POST/mydemoresource/*"
      ]
    }
  ]
}
```

The following example policy statement gives the user permission to call any method on the resource path of `petstorewalkthrough/pets`, in any stage, for the API with the identifier of `a123456789`, in any Amazon region where the corresponding API has been deployed:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
```

```
    "execute-api:Invoke"
  ],
  "Resource": [
    "arn:aws:execute-api:*:*:a123456789/*/*/petstorewalkthrough/pets"
  ]
}
]
```

## Create and attach a policy to an IAM user

To enable a user to call the API managing service or the API execution service, you must create an IAM policy for an IAM user, which controls access to the API Gateway entities, and then attach the policy to the IAM user. The following steps describe how to create your IAM policy.

### To create your own IAM policy

1. Sign in to the Amazon Web Services Management Console and open the IAM console at <https://console.amazonaws.cn/iam/>.
2. Choose **Policies**, and then choose **Create Policy**. If a **Get Started** button appears, choose it, and then choose **Create Policy**.
3. Next to **Create Your Own Policy**, choose **Select**.
4. For **Policy Name**, type any value that is easy for you to refer to later. Optionally, type descriptive text in **Description**.
5. For **Policy Document**, type a policy statement with the following format, and then choose **Create Policy**:

```
{
  "Version": "2012-10-17",
  "Statement" : [
    {
      "Effect" : "Allow",
      "Action" : [
        "action-statement"
      ],
      "Resource" : [
        "resource-statement"
      ]
    },
    {
      "Effect" : "Allow",
      "Action" : [
        "action-statement"
      ],
      "Resource" : [
        "resource-statement"
      ]
    }
  ]
}
```

In this statement, substitute *action-statement* and *resource-statement* as needed, and add other statements to specify the API Gateway entities you want to allow the IAM user to manage, the API methods the IAM user can call, or both. By default, the IAM user does not have permissions unless there is an explicit corresponding Allow statement.

6. To enable the policy for a user, choose **Users**.
7. Choose the IAM user to whom you want to attach the policy.

You have just created an IAM policy. It won't have any effect until you attach it to an IAM user, to an IAM group containing the user, or to an IAM role assumed by the user.

#### To attach an IAM policy to an IAM user

1. For the chosen user, choose the **Permissions** tab, and then choose **Attach Policy**.
2. Under **Grant permissions**, choose **Attach existing policies directly**.
3. Choose the policy document just created from the displayed list and then choose **Next: Review**.
4. Under **Permissions summary**, choose **Add permissions**.

Alternatively, you can add the user to an IAM group, if the user is not already a member, and attach the policy document to the group so that the attached policies are applicable to all group members. It is helpful to manage and update policy configurations on a group of IAM users. In the following, we highlight how to attach the policy to an IAM group, assuming that you have already created the group and added the user to the group.

#### To attach an IAM policy document to an IAM group

1. Choose **Groups** from the main navigation pane.
2. Choose the **Permissions** tab under the chosen group.
3. Choose **Attach policy**.
4. Choose the policy document that you previously created, and then choose **Attach policy**.

For API Gateway to call other Amazon services on your behalf, create an IAM role of the **Amazon API Gateway** type.

#### To create an Amazon API Gateway type of role

1. Choose **Roles** from the main navigation pane.
2. Choose **Create New Role**.
3. Type a name for **Role name** and then choose **Next Step**.
4. Under **Select Role Type**, in **Amazon Service Roles**, choose **Select** next to **Amazon API Gateway**.
5. Choose an available managed IAM permissions policy, for example, **AmazonAPIGatewayPushToCloudWatchLog** if you want API Gateway to log metrics in CloudWatch, under **Attach Policy** and then choose **Next Step**.
6. Under **Trusted Entities**, verify that **apigateway.amazonaws.com** is listed as an entry, and then choose **Create Role**.
7. In the newly created role, choose the **Permissions** tab and then choose **Attach Policy**.
8. Choose the previously created custom IAM policy document and then choose **Attach Policy**.

## Use VPC endpoint policies for private APIs in API Gateway

You can improve the security of your [private APIs](#) by configuring API Gateway to use an [interface VPC endpoint](#). Interface endpoints are powered by Amazon PrivateLink, a technology that enables you to privately access Amazon services by using private IP addresses. For more information about creating VPC endpoints, see [Creating an Interface Endpoint](#).

A *VPC endpoint policy* is an IAM resource policy that you can attach to an interface VPC endpoint to control access to the endpoint. For more information, see [Controlling Access to Services with VPC Endpoints](#). You can use an endpoint policy to restrict the traffic going from your internal network to access your private APIs. You can choose to allow or disallow access to specific private APIs that can be accessed through the VPC endpoint.

VPC endpoint policies can be used together with API Gateway resource policies. The resource policy is used to specify which principals can access the API. The endpoint policy specifies which private APIs can be called via the VPC endpoint. For more information about resource policies, see [the section called "Use API Gateway resource policies" \(p. 237\)](#).

## VPC endpoint policy examples

You can create policies for Amazon Virtual Private Cloud endpoints for Amazon API Gateway in which you can specify:

- The principal that can perform actions.
- The actions that can be performed.
- The resources that can have actions performed on them.

To attach the policy to the VPC endpoint, you'll need to use the VPC console. For more information, see [Controlling Access to Services with VPC Endpoints](#).

### Example 1: VPC endpoint policy granting access to two APIs

The following example policy grants access to only two specific APIs via the VPC endpoint that the policy is attached to.

```
{
  "Statement": [
    {
      "Principal": "*",
      "Action": [
        "execute-api:Invoke"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:execute-api:us-east-1:123412341234:a1b2c3d4e5/*",
        "arn:aws:execute-api:us-east-1:123412341234:aaaaa11111/*"
      ]
    }
  ]
}
```

### Example 2: VPC endpoint policy granting access to GET methods

The following example policy grants users access to GET methods for a specific API via the VPC endpoint that the policy is attached to.

```
{
  "Statement": [
    {
      "Principal": "*",
      "Action": [
        "execute-api:Invoke"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:execute-api:us-east-1:123412341234:a1b2c3d4e5/stageName/GET/*"
      ]
    }
  ]
}
```

### Example 3: VPC endpoint policy granting a specific user access to a specific API

The following example policy grants a specific user access to a specific API via the VPC endpoint that the policy is attached to.

```
{
  "Statement": [
    {
      "Principal": {
        "AWS": [
          "arn:aws:iam::123412341234:user/MyUser"
        ]
      },
      "Action": [
        "execute-api:Invoke"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:execute-api:us-east-1:123412341234:a1b2c3d4e5/*"
      ]
    }
  ]
}
```

## Using tags to control access to a REST API in API Gateway

Permission to access REST APIs can be fine-tuned using attribute-based access control in IAM policies.

For more information, see [the section called "Attribute-based access control" \(p. 739\)](#).

## Use API Gateway Lambda authorizers

A *Lambda authorizer* (formerly known as a *custom authorizer*) is an API Gateway feature that uses a Lambda function to control access to your API.

A Lambda authorizer is useful if you want to implement a custom authorization scheme that uses a bearer token authentication strategy such as OAuth or SAML, or that uses request parameters to determine the caller's identity.

When a client makes a request to one of your API's methods, API Gateway calls your Lambda authorizer, which takes the caller's identity as input and returns an IAM policy as output.

There are two types of Lambda authorizers:

- A *token-based* Lambda authorizer (also called a `TOKEN` authorizer) receives the caller's identity in a bearer token, such as a JSON Web Token (JWT) or an OAuth token. For an example application, see [Open Banking Brazil - Authorization Samples](#) on GitHub.
- A *request parameter-based* Lambda authorizer (also called a `REQUEST` authorizer) receives the caller's identity in a combination of headers, query string parameters, [stageVariables \(p. 374\)](#), and [\\$context \(p. 363\)](#) variables.

For WebSocket APIs, only request parameter-based authorizers are supported.

It is possible to use an Amazon Lambda function from an Amazon account that is different from the one in which you created your API. For more information, see [the section called "Configure a cross-account Lambda authorizer" \(p. 268\)](#).

For example Lambda functions, see [aws-apigateway-lambda-authorizer-blueprints](#) on GitHub.

### Topics

- [Lambda authorizer Auth workflow](#) (p. 257)
- [Steps to create an API Gateway Lambda authorizer](#) (p. 257)
- [Create an API Gateway Lambda authorizer function in the Lambda console](#) (p. 258)
- [Configure a Lambda authorizer using the API Gateway console](#) (p. 262)
- [Input to an Amazon API Gateway Lambda authorizer](#) (p. 264)
- [Output from an Amazon API Gateway Lambda authorizer](#) (p. 266)
- [Call an API with API Gateway Lambda authorizers](#) (p. 267)
- [Configure a cross-account Lambda authorizer](#) (p. 268)

## Lambda authorizer Auth workflow

The following diagram illustrates the authorization workflow for Lambda authorizers.

### API Gateway Lambda authorization workflow

1. The client calls a method on an API Gateway API method, passing a bearer token or request parameters.
2. API Gateway checks whether a Lambda authorizer is configured for the method. If it is, API Gateway calls the Lambda function.
3. The Lambda function authenticates the caller by means such as the following:
  - Calling out to an OAuth provider to get an OAuth access token.
  - Calling out to a SAML provider to get a SAML assertion.
  - Generating an IAM policy based on the request parameter values.
  - Retrieving credentials from a database.
4. If the call succeeds, the Lambda function grants access by returning an output object containing at least an IAM policy and a principal identifier.
5. API Gateway evaluates the policy.
  - If access is denied, API Gateway returns a suitable HTTP status code, such as 403 `ACCESS_DENIED`.
  - If access is allowed, API Gateway executes the method. If caching is enabled in the authorizer settings, API Gateway also caches the policy so that the Lambda authorizer function doesn't need to be invoked again.

## Steps to create an API Gateway Lambda authorizer

To create a Lambda authorizer, you need to perform the following tasks:

1. Create the Lambda authorizer function in the Lambda console as described in [the section called "Create a Lambda authorizer function in the Lambda console"](#) (p. 258). You can use one of the blueprint examples as a starting point and customize the [input](#) (p. 264) and [output](#) (p. 266) as desired.
2. Configure the Lambda function as an API Gateway authorizer and configure an API method to require it, as described in [the section called "Configure a Lambda authorizer using the console"](#) (p. 262). Alternatively, if you need a cross-account Lambda authorizer, see [the section called "Configure a cross-account Lambda authorizer"](#) (p. 268).

### Note

You can also configure an authorizer by using the Amazon CLI or an Amazon SDK.

3. Test your authorizer by using [Postman](#) as described in [the section called "Call an API with Lambda authorizers"](#) (p. 267).



## Create an API Gateway Lambda authorizer function in the Lambda console

Before configuring a Lambda authorizer, you must first create the Lambda function that implements the logic to authorize and, if necessary, to authenticate the caller. The Lambda console provides a Python blueprint, which you can use by choosing **Use a blueprint** and choosing the **api-gateway-authorizer-python** blueprint. Otherwise, you'll want to use one of the blueprints in the [awslabs](#) GitHub repository as a starting point.

For the example Lambda authorizer functions in this section, which don't call other services, you can use the built-in [AWSLambdaBasicExecutionRole](#). When creating the Lambda function for your own API Gateway Lambda authorizer, you'll need to assign an IAM execution role to the Lambda function if it calls other Amazon services. To create the role, follow the instructions in [Amazon Lambda Execution Role](#).

For more example Lambda functions, see [aws-apigateway-lambda-authorizer-blueprints](#) on GitHub. For an example application, see [Open Banking Brazil - Authorization Samples](#) on GitHub.

### EXAMPLE: Create a token-based Lambda authorizer function

To create a token-based Lambda authorizer function, enter the following Node.js code in the Lambda console and test it in the API Gateway console as follows.

1. In the Lambda console, choose **Create function**.
2. Choose **Author from scratch**.
3. Enter a name for the function.
4. Choose **Create function**.
5. Copy/paste the following code into the code editor.

```
// A simple token-based authorizer example to demonstrate how to use an authorization
token
// to allow or deny a request. In this example, the caller named 'user' is allowed to
invoke
// a request if the client-supplied token value is 'allow'. The caller is not allowed
to invoke
// the request if the token value is 'deny'. If the token value is 'unauthorized' or an
empty
// string, the authorizer function returns an HTTP 401 status code. For any other token
value,
// the authorizer returns an HTTP 500 status code.
// Note that token values are case-sensitive.

exports.handler = function(event, context, callback) {
  var token = event.authorizationToken;
  switch (token) {
    case 'allow':
      callback(null, generatePolicy('user', 'Allow', event.methodArn));
      break;
    case 'deny':
      callback(null, generatePolicy('user', 'Deny', event.methodArn));
      break;
    case 'unauthorized':
      callback("Unauthorized"); // Return a 401 Unauthorized response
      break;
    default:
      callback("Error: Invalid token"); // Return a 500 Invalid token response
  }
};

// Help function to generate an IAM policy
var generatePolicy = function(principalId, effect, resource) {
  var authResponse = {};
```

```

authResponse.principalId = principalId;
if (effect && resource) {
    var policyDocument = {};
    policyDocument.Version = '2012-10-17';
    policyDocument.Statement = [];
    var statementOne = {};
    statementOne.Action = 'execute-api:Invoke';
    statementOne.Effect = effect;
    statementOne.Resource = resource;
    policyDocument.Statement[0] = statementOne;
    authResponse.policyDocument = policyDocument;
}

// Optional output with custom properties of the String, Number or Boolean type.
authResponse.context = {
    "stringKey": "stringval",
    "numberKey": 123,
    "booleanKey": true
};
return authResponse;
}

```

6. Choose **Deploy**.
7. In the API Gateway console, create a [simple API \(p. 43\)](#) if you don't already have one.
8. Choose your API from the API list.
9. Choose **Authorizers**.
10. Choose **Create New Authorizer**.
11. Enter a name for the authorizer.
12. For **Type**, choose Lambda.
13. For **Lambda Function**, choose the region where you created your Lambda authorizer function and choose the function name from the dropdown list.
14. Leave **Lambda Invoke Role** blank.
15. For **Lambda Event Payload**, choose **Token**.
16. For **Token Source**, enter **authorizationToken**.
17. Choose **Create**, and then choose **Grant & Create**.
18. Choose **Test**.
19. For the **authorizationToken** value, enter **allow**.
20. Choose **Test**.

In this example, when the API receives a method request, API Gateway passes the source token to this Lambda authorizer function in the event.`authorizationToken` attribute. The Lambda authorizer function reads the token and acts as follows:

- If the token value is 'allow', the authorizer function returns a 200 OK HTTP response and an IAM policy that looks like the following, and the method request succeeds:

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "execute-api:Invoke",
      "Effect": "Allow",
      "Resource": "arn:aws:execute-api:us-east-1:123456789012:ivdtdhp7b5/ESTestInvoke-
stage/GET/"
    }
  ]
}

```

```
]
}
```

- If the token value is 'deny', the authorizer function returns a 403 Forbidden HTTP response and a Deny IAM policy that looks like the following, and the method request fails:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "execute-api:Invoke",
      "Effect": "Deny",
      "Resource": "arn:aws:execute-api:us-east-1:123456789012:ivdtdhp7b5/ESTestInvoke-
stage/GET/"
    }
  ]
}
```

- If the token value is 'unauthorized' or an empty string, the authorizer function returns a 401 Unauthorized HTTP response, and the method call fails.
- If the token is anything else, the client receives a 500 Invalid token response, and the method call fails.

#### Note

In production code, you may need to authenticate the user before granting authorization. If so, you can add authentication logic in the Lambda function as well by calling an authentication provider as directed in the documentation for that provider.

In addition to returning an IAM policy, the Lambda authorizer function must also return the caller's principal identifier. It can also optionally return a context object containing additional information that can be passed into the integration backend. For more information, see [Output from an Amazon API Gateway Lambda authorizer \(p. 266\)](#).

#### EXAMPLE: Create a request-based Lambda authorizer function

To create a request-based Lambda authorizer function, enter the following Node.js code in the Lambda console and test it in the API Gateway console as follows.

1. In the Lambda console, choose **Create function**.
2. Choose **Author from scratch**.
3. Enter a name for the function.
4. Choose **Create function**.
5. Copy/paste the following code into the code editor.

```
exports.handler = function(event, context, callback) {
  console.log('Received event:', JSON.stringify(event, null, 2));

  // A simple request-based authorizer example to demonstrate how to use request
  // parameters to allow or deny a request. In this example, a request is
  // authorized if the client-supplied headerauth1 header, QueryString1
  // query parameter, and stage variable of StageVar1 all match
  // specified values of 'headerValue1', 'queryValue1', and 'stageValue1',
  // respectively.

  // Retrieve request parameters from the Lambda function input:
  var headers = event.headers;
  var queryStringParameters = event.queryStringParameters;
  var pathParameters = event.pathParameters;
  var stageVariables = event.stageVariables;
```

```

// Parse the input for the parameter values
var tmp = event.methodArn.split(':');
var apiGatewayArnTmp = tmp[5].split('/');
var awsAccountId = tmp[4];
var region = tmp[3];
var restApiId = apiGatewayArnTmp[0];
var stage = apiGatewayArnTmp[1];
var method = apiGatewayArnTmp[2];
var resource = '/'; // root resource
if (apiGatewayArnTmp[3]) {
    resource += apiGatewayArnTmp[3];
}

// Perform authorization to return the Allow policy for correct parameters and
// the 'Unauthorized' error, otherwise.
var authResponse = {};
var condition = {};
condition.IpAddress = {};

if (headers.headerauth1 === "headerValue1"
    && queryStringParameters.QueryString1 === "queryValue1"
    && stageVariables.StageVar1 === "stageValue1") {
    callback(null, generateAllow('me', event.methodArn));
} else {
    callback("Unauthorized");
}
}

// Help function to generate an IAM policy
var generatePolicy = function(principalId, effect, resource) {
    // Required output:
    var authResponse = {};
    authResponse.principalId = principalId;
    if (effect && resource) {
        var policyDocument = {};
        policyDocument.Version = '2012-10-17'; // default version
        policyDocument.Statement = [];
        var statementOne = {};
        statementOne.Action = 'execute-api:Invoke'; // default action
        statementOne.Effect = effect;
        statementOne.Resource = resource;
        policyDocument.Statement[0] = statementOne;
        authResponse.policyDocument = policyDocument;
    }
    // Optional output with custom properties of the String, Number or Boolean type.
    authResponse.context = {
        "stringKey": "stringval",
        "numberKey": 123,
        "booleanKey": true
    };
    return authResponse;
}

var generateAllow = function(principalId, resource) {
    return generatePolicy(principalId, 'Allow', resource);
}

var generateDeny = function(principalId, resource) {
    return generatePolicy(principalId, 'Deny', resource);
}

```

6. Choose **Deploy**.
7. In the API Gateway console, create a [simple API \(p. 43\)](#) if you don't already have one.
8. Choose your API from the API list.

9. Choose **Authorizers**.
10. Choose **Create New Authorizer**.
11. Enter a name for the authorizer.
12. For **Type**, choose Lambda.
13. For **Lambda Function**, choose the region where you created your Lambda authorizer function and choose the function name from the dropdown list.
14. Leave **Lambda Invoke Role** blank.
15. For **Lambda Event Payload**, choose **Request**.
16. Under **Identity Sources**, add a **Header** named `headerauth1`, a **Query String** named `QueryString1`, and a **Stage Variable** named `StageVar1`.
17. Choose **Create**, and then choose **Grant & Create**.
18. Choose **Test**.
19. For `headerauth1`, enter `headerValue1`. For `QueryString1`, enter `queryValue1`. For `StageVar1`, enter `stageValue1`.
20. Choose **Test**.

In this example, the Lambda authorizer function checks the input parameters and acts as follows:

- If all the required parameter values match the expected values, the authorizer function returns a 200 OK HTTP response and an IAM policy that looks like the following, and the method request succeeds:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "execute-api:Invoke",
      "Effect": "Allow",
      "Resource": "arn:aws:execute-api:us-east-1:123456789012:ivdtdhp7b5/ESTestInvoke-
stage/GET/"
    }
  ]
}
```

- Otherwise, the authorizer function returns a 401 `Unauthorized` HTTP response, and the method call fails.

### Note

In production code, you may need to authenticate the user before granting authorization. If so, you can add authentication logic in the Lambda function as well by calling an authentication provider as directed in the documentation for that provider.

In addition to returning an IAM policy, the Lambda authorizer function must also return the caller's principal identifier. It can also optionally return a `context` object containing additional information that can be passed into the integration backend. For more information, see [Output from an Amazon API Gateway Lambda authorizer \(p. 266\)](#).

## Configure a Lambda authorizer using the API Gateway console

After you create the Lambda function and verify that it works, use the following steps to configure the API Gateway Lambda authorizer (formerly known as the custom authorizer) in the API Gateway console.

### To configure a Lambda authorizer using the API Gateway console

1. Sign in to the API Gateway console.

2. Create a new or select an existing API and choose **Authorizers** under that API.
3. Choose **Create New Authorizer**.
4. For **Create Authorizer**, type an authorizer name in the **Name** input field.
5. For **Type**, choose the **Lambda** option.
6. For **Lambda Function**, choose a region and then choose an available Lambda authorizer function that's in your account.
7. Leave **Lambda Invoke Role** blank to let the API Gateway console set a resource-based policy. The policy grants API Gateway permissions to invoke the authorizer Lambda function. You can also choose to type the name of an IAM role to allow API Gateway to invoke the authorizer Lambda function. For an example of such a role, see [Create an assumable IAM role \(p. 79\)](#).

If you choose to let the API Gateway console set the resource-based policy, the **Add Permission to Lambda Function** dialog is displayed. Choose **OK**. After the Lambda authorization is created, you can test it with appropriate authorization token values to verify that it works as expected.

8. For **Lambda Event Payload**, choose either **Token** for a `TOKEN` authorizer or **Request** for a `REQUEST` authorizer. (This is the same as setting the `type` property to `TOKEN` or `REQUEST`.)
9. Depending on the choice of the previous step, do one of the following:
  - a. For the **Token** options, do the following:
    - Type the name of a header in **Token Source**. The API client must include a header of this name to send the authorization token to the Lambda authorizer.
    - Optionally, provide a RegEx statement in `Token Validation` input field. API Gateway performs initial validation of the input token against this expression and invokes the authorizer upon successful validation. This helps reduce chances of being charged for invalid tokens.
    - For **Authorization Caching**, select or clear the **Enabled** option, depending on whether you want to cache the authorization policy generated by the authorizer or not. When policy caching is enabled, you can choose to modify the **TTL** value. Setting **TTL** to zero disables policy caching. When policy caching is enabled, the header name specified in **Token Source** becomes the cache key.

**Note**

The default **TTL** value is 300 seconds. The maximum value is 3600 seconds; this limit cannot be increased.

- b. For the **Request** option, do the following:
  - For **Identity Sources**, type a request parameter name of a chosen parameter type. Supported parameter types are `Header`, `Query String`, `Stage Variable`, and `Context`. To add more identity sources, choose **Add Identity Source**.

API Gateway uses the specified identity sources as the request authorizer caching key. When caching is enabled, API Gateway calls the authorizer's Lambda function only after successfully verifying that all the specified identity sources are present at runtime. If a specified identity source is missing, null, or empty, API Gateway returns a `401 Unauthorized` response without calling the authorizer Lambda function.

When multiple identity sources are defined, they all used to derive the authorizer's cache key. Changing any of the cache key parts causes the authorizer to discard the cached policy document and generate a new one.

- For **Authorization Caching**, select or deselect the **Enabled** option, depending on whether you want to cache the authorization policy generated by the authorizer or not. When policy caching is enabled, you can choose to modify the **TTL** value from the default (300). Setting **TTL=0** disables policy caching.

When caching is disabled, it is not necessary to specify an identity source.

### Note

To enable caching, your authorizer must return a policy that is applicable to all methods across an API. To enforce method-specific policy, you can set the TTL value to zero to disable policy caching for the API.

10. Choose **Create** to create the new Lambda authorizer for the chosen API.
11. After the authorizer is created for the API, you can optionally test invoking the authorizer before it is configured on a method.

For the `TOKEN` authorizer, type a valid token in the **Identity token** input text field and then choose **Test**. The token will be passed to the Lambda function as the header you specified in the **Identity token source** setting of the authorizer.

For the `REQUEST` authorizer, type the valid request parameters corresponding to the specified identity sources and then choose **Test**.

In addition to using the API Gateway console, you can use Amazon CLI or an Amazon SDK for API Gateway to test invoking an authorizer. To do so using the Amazon CLI, see [test-invoke-authorizer](#).

### Note

Test-invoke for method executions test-invoke for authorizers are independent processes. To test invoking a method using the API Gateway console, see [Use the console to test a REST API method \(p. 408\)](#). To test invoking a method using the Amazon CLI, see [test-invoke-method](#).

To test invoking a method and a configured authorizer, deploy the API, and then use cURL or Postman to call the method, providing the required token or request parameters.

The next procedure shows how to configure an API method to use the Lambda authorizer.

### To configure an API method to use a Lambda authorizer

1. Go back to the API. Create a new method or choose an existing method. If necessary, create a new resource.
2. In **Method Execution**, choose the **Method Request** link.
3. Under **Settings**, expand the **Authorization** drop-down list to select the Lambda authorizer you just created (for example, **myTestApiAuthorizer**), and then choose the check mark icon to save the choice.
4. Optionally, while still on the **Method Request** page, choose **Add header** if you also want to pass the authorization token to the backend. In **Name**, type a header name that matches the **Token Source** name you specified when you created the Lambda authorizer for the API. Then, choose the check mark icon to save the settings. This step does not apply to `REQUEST` authorizers.
5. Choose **Deploy API** to deploy the API to a stage. Note the **Invoke URL** value. You need it when calling the API. For a `REQUEST` authorizer using stage variables, you must also define the required stage variables and specify their values while in **Stage Editor**.

### Input to an Amazon API Gateway Lambda authorizer

For a Lambda authorizer (formerly known as a custom authorizer) of the `TOKEN` type, you must specify a custom header as the **Token Source** when you configure the authorizer for your API. The API client must pass the required authorization token in that header in the incoming request. Upon receiving the incoming method request, API Gateway extracts the token from the custom header. It then passes the token as the `authorizationToken` property of the event object of the Lambda function, in addition to the method ARN as the `methodArn` property:

```
{
```

```
"type": "TOKEN",
"authorizationToken": "{caller-supplied-token}",
"methodArn": "arn:aws:execute-api:{regionId}:{accountId}:{apiId}/{stage}/{httpVerb}/
[{resource}]/[{child-resources}]"
}
```

In this example, the `type` property specifies the authorizer type, which is a `TOKEN` authorizer. The `{caller-supplied-token}` originates from the authorization header in a client request. The `methodArn` is the ARN of the incoming method request and is populated by API Gateway in accordance with the Lambda authorizer configuration.

For the example `TOKEN` authorizer Lambda function shown in the preceding section, the `{caller-supplied-token}` string is `allow`, `deny`, `unauthorized`, or any other string value. An empty string value is the same as `unauthorized`. The following shows an example of such an input to obtain an Allow policy on the `GET` method of an API (`ymy8tbxw7b`) of the Amazon account (`123456789012`) in any stage (`*`).

```
{
  "type": "TOKEN",
  "authorizationToken": "allow",
  "methodArn": "arn:aws:execute-api:us-west-2:123456789012:ymy8tbxw7b/*/GET/"
}
```

For a Lambda authorizer of the `REQUEST` type, API Gateway passes request parameters to the authorizer Lambda function as part of the `event` object. The request parameters include headers, path parameters, query string parameters, stage variables, and some of request context variables. The API caller can set the path parameters, headers, and query string parameters. The API developer must set the stage variables during the API deployment and API Gateway provides the request context at run time.

#### Note

Path parameters can be passed as request parameters to the Lambda authorizer function, but they cannot be used as identity sources.

The following example shows an input to a `REQUEST` authorizer for an API method (`GET /request`) with a proxy integration:

```
{
  "type": "REQUEST",
  "methodArn": "arn:aws:execute-api:us-east-1:123456789012:abcdef123/test/GET/request",
  "resource": "/request",
  "path": "/request",
  "httpMethod": "GET",
  "headers": {
    "X-AMZ-Date": "20170718T062915Z",
    "Accept": "*/*",
    "HeaderAuth1": "headerValue1",
    "CloudFront-Viewer-Country": "US",
    "CloudFront-Forwarded-Proto": "https",
    "CloudFront-Is-Tablet-Viewer": "false",
    "CloudFront-Is-Mobile-Viewer": "false",
    "User-Agent": "..."
  },
  "queryStringParameters": {
    "QueryString1": "queryValue1"
  },
  "pathParameters": {},
  "stageVariables": {
    "StageVar1": "stageValue1"
  },
  "requestContext": {
    "path": "/request",
    "accountId": "123456789012",

```



```

"resourceId": "05c7jb",
"stage": "test",
"requestId": "...",
"identity": {
  "apiKey": "...",
  "sourceIp": "...",
  "clientCert": {
    "clientCertPem": "CERT_CONTENT",
    "subjectDN": "www.example.com",
    "issuerDN": "Example issuer",
    "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
    "validity": {
      "notBefore": "May 28 12:30:02 2019 GMT",
      "notAfter": "Aug  5 09:36:04 2021 GMT"
    }
  }
},
"resourcePath": "/request",
"httpMethod": "GET",
"apiId": "abcdef123"
}
}

```

The `requestContext` is a map of key-value pairs and corresponds to the `$context` (p. 363) variable. Its outcome is API-dependent. API Gateway may add new keys to the map. For more information about Lambda function input in Lambda proxy integration, see [Input format of a Lambda function for proxy integration](#) (p. 293).

## Output from an Amazon API Gateway Lambda authorizer

A Lambda authorizer function's output is a dictionary-like object, which must include the principal identifier (`principalId`) and a policy document (`policyDocument`) containing a list of policy statements. The output can also include a `context` map containing key-value pairs. If the API uses a usage plan (the `apiKeySource` is set to `AUTHORIZER`), the Lambda authorizer function must return one of the usage plan's API keys as the `usageIdentifierKey` property value.

The following shows an example of this output.

```

{
  "principalId": "yyyyyyyy", // The principal user identification associated with the token
  sent by the client.
  "policyDocument": {
    "Version": "2012-10-17",
    "Statement": [
      {
        "Action": "execute-api:Invoke",
        "Effect": "Allow|Deny",
        "Resource": "arn:aws:execute-api:{regionId}:{accountId}:{apiId}/{stage}/{httpVerb}/
        [{resource}]/[{child-resources}]"
      }
    ]
  },
  "context": {
    "stringKey": "value",
    "numberKey": "1",
    "booleanKey": "true"
  },
  "usageIdentifierKey": "{api-key}"
}

```

Here, a policy statement specifies whether to allow or deny (`Effect`) the API Gateway execution service to invoke (`Action`) the specified API method (`Resource`). You can use a wild card (\*) to specify a

resource type (method). For information about setting valid policies for calling an API, see [Statement reference of IAM policies for executing API in API Gateway](#) (p. 251).

For an authorization-enabled method ARN, e.g., `arn:aws:execute-api:{regionId}:{accountId}:{apiId}/{stage}/{httpVerb}/{resource}/{child-resources}]`, the maximum length is 1600 bytes. The path parameter values, the size of which are determined at run time, can cause the ARN length to exceed the limit. When this happens, the API client will receive a 414 Request URI too long response.

In addition, the Resource ARN, as shown in the policy statement output by the authorizer, is currently limited to 512 characters long. For this reason, you must not use URI with a JWT token of a significant length in a request URI. You can safely pass the JWT token in a request header, instead.

You can access the `principalId` value in a mapping template using the `$context.authorizer.principalId` variable. This is useful if you want to pass the value to the backend. For more information, see [\\$context Variables for data models, authorizers, mapping templates, and CloudWatch access logging](#) (p. 363).

You can access the `stringKey`, `numberKey`, or `booleanKey` value (for example, "value", "1", or "true") of the context map in a mapping template by calling `$context.authorizer.stringKey`, `$context.authorizer.numberKey`, or `$context.authorizer.booleanKey`, respectively. The returned values are all stringified. Notice that you cannot set a JSON object or array as a valid value of any key in the context map.

You can use the context map to return cached credentials from the authorizer to the backend, using an integration request mapping template. This enables the backend to provide an improved user experience by using the cached credentials to reduce the need to access the secret keys and open the authorization tokens for every request.

For the Lambda proxy integration, API Gateway passes the context object from a Lambda authorizer directly to the backend Lambda function as part of the input event. You can retrieve the context key-value pairs in the Lambda function by calling `$event.requestContext.authorizer.key`.

`{api-key}` stands for an API key in the API stage's usage plan. For more information, see [the section called "Usage plans"](#) (p. 491).

The following shows example output from the example Lambda authorizer. The example output contains a policy statement to block (Deny) calls to the GET method for the dev stage of an API (ymy8tbxw7b) of an Amazon account (123456789012).

```
{
  "principalId": "user",
  "policyDocument": {
    "Version": "2012-10-17",
    "Statement": [
      {
        "Action": "execute-api:Invoke",
        "Effect": "Deny",
        "Resource": "arn:aws:execute-api:us-west-2:123456789012:ymy8tbxw7b/dev/GET/"
      }
    ]
  }
}
```

## Call an API with API Gateway Lambda authorizers

Having configured the Lambda authorizer (formerly known as the custom authorizer) and deployed the API, you should test the API with the Lambda authorizer enabled. For this, you need a REST client, such as cURL or Postman. For the following examples, we use Postman.

### Note

When calling an authorizer-enabled method, API Gateway does not log the call to CloudWatch if the required token for the `TOKEN` authorizer is not set, is null, or is invalidated by the specified **Token validation expression**. Similarly, API Gateway does not log the call to CloudWatch if any of the required identity sources for the `REQUEST` authorizer are not set, are null, or are empty.

In the following, we show how to use Postman to call or test an API with a Lambda `TOKEN` authorizer. The method can be applied to calling an API with a Lambda `REQUEST` authorizer, if you specify the required path, header, or query string parameters explicitly.

### To call an API with the custom `TOKEN` authorizer

1. Open **Postman**, choose the **GET** method, and paste the API's **Invoke URL** into the adjacent URL field.

Add the Lambda authorization token header and set the value to `allow`. Choose **Send**.

The response shows that the API Gateway Lambda authorizer returns a **200 OK** response and successfully authorizes the call to access the HTTP endpoint (`http://httpbin.org/get`) integrated with the method.

2. Still in Postman, change the Lambda authorization token header value to `deny`. Choose **Send**.

The response shows that the API Gateway Lambda authorizer returns a **403 Forbidden** response without authorizing the call to access the HTTP endpoint.

3. In Postman, change the Lambda authorization token header value to `unauthorized` and choose **Send**.

The response shows that API Gateway returns a **401 Unauthorized** response without authorizing the call to access the HTTP endpoint.

4. Now, change the Lambda authorization token header value to `fail`. Choose **Send**.

The response shows that API Gateway returns a **500 Internal Server Error** response without authorizing the call to access the HTTP endpoint.

## Configure a cross-account Lambda authorizer

You can now also use an Amazon Lambda function from a different Amazon account as your API authorizer function. Each account can be in any region where Amazon API Gateway is available. The Lambda authorizer function can use bearer token authentication strategies such as OAuth or SAML. This makes it easy to centrally manage and share a central Lambda authorizer function across multiple API Gateway APIs.

In this section, we show how to configure a cross-account Lambda authorizer function using the Amazon API Gateway console.

These instructions assume that you already have an API Gateway API in one Amazon account and a Lambda authorizer function in another account.

### Configure a cross-account Lambda authorizer using the API Gateway console

Log in to the Amazon API Gateway console in your first account (the one that has your API in it) and do the following:

1. Locate your API and choose **Authorizers**.
2. Choose **Create New Authorizer**.
3. For **Create Authorizer**, type an authorizer name in the **Name** input field.
4. For **Type**, choose the **Lambda** option.

5. For **Lambda Function**, copy-paste the full ARN for the Lambda authorizer function that you have in your second account.

**Note**

In the Lambda console, you can find the ARN for your function in the upper right corner of the console window.

6. Leave **Lambda Invoke Role** blank to let the API Gateway console set a resource-based policy. The policy grants API Gateway permissions to invoke the authorizer Lambda function. You can also choose to type the name of an IAM role to allow API Gateway to invoke the authorizer Lambda function. For an example of such a role, see [Create an assumable IAM role \(p. 79\)](#).

If you choose to let the API Gateway console set the resource-based policy, the **Add Permission to Lambda Function** dialog is displayed. Choose **OK**. After the Lambda authorization is created, you can test it with appropriate authorization token values to verify that it works as expected.

7. For **Lambda Event Payload**, choose either **Token** for a `TOKEN` authorizer or **Request** for a `REQUEST` authorizer.
8. Depending on the choice you made in the previous step, do one of the following:
  - a. For the **Token** options, do the following:
    - i. Type the name of a header in **Token Source**. The API client must include a header of this name to send the authorization token to the Lambda authorizer.
    - ii. Optionally, provide a RegEx statement in **Token Validation** input field. API Gateway performs initial validation of the input token against this expression and invokes the authorizer upon successful validation. This helps reduce chances of being charged for invalid tokens.
    - iii. For **Authorization Caching**, select or clear the **Enabled** option, depending on whether you want to cache the authorization policy generated by the authorizer or not. When policy caching is enabled, you can choose to modify the **TTL** value from the default (300). Setting `TTL=0` disables policy caching. When policy caching is enabled, the header name specified in **Token Source** becomes the cache key.
  - b. For the **Request** option, do the following:
    - i. For **Identity Sources**, type a request parameter name of a chosen parameter type. Supported parameter types are `Header`, `Query String`, `Stage Variable`, and `Context`. To add more identity sources, choose **Add Identity Source**.

API Gateway uses the specified identity sources as the request authorizer caching key. When caching is enabled, API Gateway calls the authorizer's Lambda function only after successfully verifying that all the specified identity sources are present at runtime. If a specified identify source is missing, null, or empty, API Gateway returns a `401 Unauthorized` response without calling the authorizer Lambda function.

When multiple identity sources are defined, they are all used to derive the authorizer's cache key. Changing any of the cache key parts causes the authorizer to discard the cached policy document and generate a new one.
    - ii. For **Authorization Caching**, leave the **Enabled** option selected. Leave the **TTL** value set to the default (300).
9. Choose **Create** to create the new Lambda authorizer for the chosen API.
10. You'll see a popup that says **Add Permission to Lambda Function: You have selected a Lambda function from another account. Please ensure that you have the appropriate Function Policy on this function. You can do this by running the following Amazon CLI command from account 123456789012**; followed by an `aws lambda add-permission` command string.

Copy the command and save it for later. You run the command after you create the authorizer.

11. Choose **Create Anyway**.

12. Paste the `aws lambda add-permission` command string that you copied in a previous step into an Amazon CLI window that is configured for your second account. Replace `AUTHORIZER_ID` with your authorizer's ID. This will grant your first account access to your second account's Lambda authorizer function.

## Control access to a REST API using Amazon Cognito user pools as authorizer

As an alternative to using [IAM roles and policies \(p. 248\)](#) or [Lambda authorizers \(p. 256\)](#) (formerly known as custom authorizers), you can use an [Amazon Cognito user pool](#) to control who can access your API in Amazon API Gateway.

To use an Amazon Cognito user pool with your API, you must first create an authorizer of the `COGNITO_USER_POOLS` type and then configure an API method to use that authorizer. After the API is deployed, the client must first sign the user in to the user pool, obtain an [identity or access token](#) for the user, and then call the API method with one of the tokens, which are typically set to the request's `Authorization` header. The API call succeeds only if the required token is supplied and the supplied token is valid, otherwise, the client isn't authorized to make the call because the client did not have credentials that could be authorized.

The identity token is used to authorize API calls based on identity claims of the signed-in user. The access token is used to authorize API calls based on the custom scopes of specified access-protected resources. For more information, see [Using Tokens with User Pools](#) and [Resource Server and Custom Scopes](#).

To create and configure an Amazon Cognito user pool for your API, you perform the following tasks:

- Use the Amazon Cognito console, CLI/SDK, or API to create a user pool—or use one that's owned by another Amazon account.
- Use the API Gateway console, CLI/SDK, or API to create an API Gateway authorizer with the chosen user pool.
- Use the API Gateway console, CLI/SDK, or API to enable the authorizer on selected API methods.

To call any API methods with a user pool enabled, your API clients perform the following tasks:

- Use the Amazon Cognito CLI/SDK or API to sign a user in to the chosen user pool, and obtain an identity token or access token.
- Use a client-specific framework to call the deployed API Gateway API and supply the appropriate token in the `Authorization` header.

As the API developer, you must provide your client developers with the user pool ID, a client ID, and possibly the associated client secrets that are defined as part of the user pool.

### Note

To let a user sign in using Amazon Cognito credentials and also obtain temporary credentials to use with the permissions of an IAM role, use [Amazon Cognito Federated Identities](#). For each API resource endpoint HTTP method, set the authorization type, category `Method Execution`, to `AWS_IAM`.

In this section, we describe how to create a user pool, how to integrate an API Gateway API with the user pool, and how to invoke an API that's integrated with the user pool.

### Topics

- [Obtain permissions to create Amazon Cognito user pool authorizers for a REST API \(p. 271\)](#)
- [Create an Amazon Cognito user pool for a REST API \(p. 272\)](#)

- [Integrate a REST API with an Amazon Cognito user pool \(p. 272\)](#)
- [Call a REST API integrated with an Amazon Cognito user pool \(p. 276\)](#)
- [Configure cross-account Amazon Cognito authorizer for a REST API using the API Gateway console \(p. 277\)](#)

## Obtain permissions to create Amazon Cognito user pool authorizers for a REST API

To create an authorizer with an Amazon Cognito user pool, you must have `Allow` permissions to create or update an authorizer with the chosen Amazon Cognito user pool. The following IAM policy document shows an example of such permissions:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "apigateway:POST"
      ],
      "Resource": "arn:aws:apigateway:*::/restapis/*/authorizers",
      "Condition": {
        "ArnLike": {
          "apigateway:CognitoUserPoolProviderArn": [
            "arn:aws:cognito-idp:us-east-1:123456789012:userpool/us-
east-1_aD06NqMjO",
            "arn:aws:cognito-idp:us-east-1:234567890123:userpool/us-
east-1_xJ1MQtPEN"
          ]
        }
      }
    },
    {
      "Effect": "Allow",
      "Action": [
        "apigateway:PATCH"
      ],
      "Resource": "arn:aws:apigateway:*::/restapis/*/authorizers/*",
      "Condition": {
        "ArnLike": {
          "apigateway:CognitoUserPoolProviderArn": [
            "arn:aws:cognito-idp:us-east-1:123456789012:userpool/us-
east-1_aD06NqMjO",
            "arn:aws:cognito-idp:us-east-1:234567890123:userpool/us-
east-1_xJ1MQtPEN"
          ]
        }
      }
    }
  ]
}
```

Make sure that the policy is attached to your IAM user, an IAM group that you belong to, or an IAM role that you're assigned to.

In the preceding policy document, the `apigateway:POST` action is for creating a new authorizer, and the `apigateway:PATCH` action is for updating an existing authorizer. You can restrict the policy to a specific region or a particular API by overriding the first two wildcard (\*) characters of the `Resource` values, respectively.

The `Condition` clauses that are used here are to restrict the `Allowed` permissions to the specified user pools. When a `Condition` clause is present, access to any user pools that don't match the conditions is denied. When a permission doesn't have a `Condition` clause, access to any user pool is allowed.

You have the following options to set the `Condition` clause:

- You can set an `ArnLike` or `ArnEquals` conditional expression to permit creating or updating `COGNITO_USER_POOLS` authorizers with the specified user pools only.
- You can set an `ArnNotLike` or `ArnNotEquals` conditional expression to permit creating or updating `COGNITO_USER_POOLS` authorizers with any user pool that isn't specified in the expression.
- You can omit the `Condition` clause to permit creating or updating `COGNITO_USER_POOLS` authorizers with any user pool, of any Amazon account, and in any region.

For more information on the Amazon Resource Name (ARN) conditional expressions, see Amazon [Resource Name Condition Operators](#). As shown in the example, `apigateway:CognitoUserPoolProviderArn` is a list of ARNs of the `COGNITO_USER_POOLS` user pools that can or can't be used with an API Gateway authorizer of the `COGNITO_USER_POOLS` type.

## Create an Amazon Cognito user pool for a REST API

Before integrating your API with a user pool, you must create the user pool in Amazon Cognito. For instructions on how to create a user pool, see [Setting up User Pools](#) in the *Amazon Cognito Developer Guide*.

### Note

Ensure that user-defined Amazon Cognito variables such as groups, users, and roles use only alphanumeric characters.

Note the user pool ID, client ID, and any client secret. The client must provide them to Amazon Cognito for the user to register with the user pool, to sign in to the user pool, and to obtain an identity or access token to be included in requests to call API methods that are configured with the user pool. Also, you must specify the user pool name when you configure the user pool as an authorizer in API Gateway, as described next.

If you're using access tokens to authorize API method calls, be sure to configure the app integration with the user pool to set up the custom scopes that you want on a given resource server. For more information about using tokens with Amazon Cognito user pools, see [Using Tokens with User Pools](#). For more information about resource servers, see [Defining Resource Servers for Your User Pool](#).

Note the configured resource server identifiers and custom scope names. You need them to construct the access scope full names for **OAuth Scopes**, which is used by the `COGNITO_USER_POOLS` authorizer.

## Integrate a REST API with an Amazon Cognito user pool

After creating an Amazon Cognito user pool, in API Gateway, you must then create a `COGNITO_USER_POOLS` authorizer that uses the user pool. The following procedure walks you through the steps to do this using the API Gateway console.

### Important

After performing any of the procedures below, you'll need to deploy or redeploy your API to propagate the changes. For more information about deploying your API, see [Deploying a REST API in Amazon API Gateway \(p. 436\)](#).

### To create a `COGNITO_USER_POOLS` authorizer by using the API Gateway console

1. Create a new API, or select an existing API in API Gateway.
2. From the main navigation pane, choose **Authorizers** under the specified API.

3. Under **Authorizers**, choose **Create New Authorizer**.
4. To configure the new authorizer to use a user pool, do the following:
  - a. Type an authorizer name in **Name**.
  - b. Select the **Cognito** option.
  - c. Choose a region under **Cognito User Pool**.
  - d. Select an available user pool. You must have created a user pool for the selected region in Amazon Cognito for it to show up in the drop-down list.
  - e. For **Token source**, type `Authorization` as the header name to pass the identity or access token that's returned by Amazon Cognito when a user signs in successfully.
  - f. Optionally, enter a regular expression in the **Token validation** field to validate the `aud` (audience) field of the identity token before the request is authorized with Amazon Cognito. Note that when using an access token this validation rejects the request due to the access token not containing the `aud` field.
  - g. To finish integrating the user pool with the API, choose **Create**.
5. After creating the `COGNITO_USER_POOLS` authorizer, you can optionally test invoke it by supplying an identity token that's provisioned from the user pool. You can obtain this identity token by calling the [Amazon Cognito Identity SDK](#) to perform user sign-in. Make sure to use the returned identity token, not the access token.

The preceding procedure creates a `COGNITO_USER_POOLS` authorizer that uses the newly created Amazon Cognito user pool. Depending on how you enable the authorizer on an API method, you can use either an identity token or an access token that's provisioned from the integrated user pool. The next procedure walks you through the steps to configure the authorizer on an API method.

### To configure a `COGNITO_USER_POOLS` authorizer on methods

1. Choose (or create) a method on your API.
2. Choose **Method Request**.
3. Under **Settings**, choose the pencil icon next to **Authorization**.
4. Choose one of the available **Amazon Cognito user pool authorizers** from the drop-down list.
5. To save the settings, choose the check mark icon.
6. To use an identity token, do the following:
  - a. Leave the **OAuth Scopes** option unspecified (as `NONE`).
  - b. If needed, choose **Integration Request** to add the `$context.authorizer.claims['property-name']` or `$context.authorizer.claims.property-name` expressions in a body-mapping template to pass the specified identity claims property from the user pool to the backend. For simple property names, such as `sub` or `custom-sub`, the two notations are identical. For complex property names, such as `custom:role`, you can't use the dot notation. For example, the following mapping expressions pass the claim's [standard fields](#) of `sub` and `email` to the backend:

```
{
  "context" : {
    "sub" : "$context.authorizer.claims.sub",
    "email" : "$context.authorizer.claims.email"
  }
}
```

If you declared a custom claim field when you configured a user pool, you can follow the same pattern to access the custom fields. The following example gets a custom `role` field of a claim:



```
{
  "context" : {
    "role" : "$context.authorizer.claims.role"
  }
}
```

If the custom claim field is declared as `custom:role`, use the following example to get the claim's property:

```
{
  "context" : {
    "role" : "$context.authorizer.claims['custom:role']"
  }
}
```

7. To use an access token, do the following:
  - a. Choose the pencil icon next to **OAuth Scopes**.
  - b. Type one or more full names of a scope that has been configured when the Amazon Cognito user pool was created. For example, following the example given in [Create an Amazon Cognito user pool for a REST API \(p. 272\)](#), one of the scopes is `com.hamuta.movies/drama.view`. Use a single space to separate multiple scopes.  
  
At runtime, the method call succeeds if any scope that's specified on the method in this step matches a scope that's claimed in the incoming token. Otherwise, the call fails with a 401 Unauthorized response.
  - c. To save the setting, choose the check mark icon.
8. Repeat these steps for other methods that you choose.

With the `COGNITO_USER_POOLS` authorizer, if the **OAuth Scopes** option isn't specified, API Gateway treats the supplied token as an identity token and verifies the claimed identity against the one from the user pool. Otherwise, API Gateway treats the supplied token as an access token and verifies the access scopes that are claimed in the token against the authorization scopes declared on the method.

Instead of using the API Gateway console, you can also enable an Amazon Cognito user pool on a method by specifying an OpenAPI definition file and importing the API definition into API Gateway.

### To import a `COGNITO_USER_POOLS` authorizer with an OpenAPI definition file

1. Create (or export) an OpenAPI definition file for your API.
2. Specify the `COGNITO_USER_POOLS` authorizer (`MyUserPool`) JSON definition as part of the `securitySchemes` section in OpenAPI 3.0 or the `securityDefinitions` section in Open API 2.0 as follows:

OpenAPI 3.0

```
"securitySchemes": {
  "MyUserPool": {
    "type": "apiKey",
    "name": "Authorization",
    "in": "header",
    "x-amazon-apigateway-authtype": "cognito_user_pools",
    "x-amazon-apigateway-authorizer": {
      "type": "cognito_user_pools",
      "providerARNs": [
        "arn:aws:cognito-idp:{region}:{account_id}:userpool/{user_pool_id}"
      ]
    }
  }
}
```

```
}
}
```

### OpenAPI 2.0

```
"securityDefinitions": {
  "MyUserPool": {
    "type": "apiKey",
    "name": "Authorization",
    "in": "header",
    "x-amazon-apigateway-authtype": "cognito_user_pools",
    "x-amazon-apigateway-authorizer": {
      "type": "cognito_user_pools",
      "providerARNs": [
        "arn:aws:cognito-idp:{region}:{account_id}:userpool/{user_pool_id}"
      ]
    }
  }
}
```

- To use the identity token for method authorization, add { "MyUserPool": [] } to the security definition of the method, as shown in the following GET method on the root resource.

```
"paths": {
  "/": {
    "get": {
      "consumes": [
        "application/json"
      ],
      "produces": [
        "text/html"
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "headers": {
            "Content-Type": {
              "type": "string"
            }
          }
        }
      }
    },
    "security": [
      {
        "MyUserPool": []
      }
    ],
    "x-amazon-apigateway-integration": {
      "type": "mock",
      "responses": {
        "default": {
          "statusCode": "200",
          "responseParameters": {
            "method.response.header.Content-Type": "'text/html'"
          }
        }
      },
      "requestTemplates": {
        "application/json": "{$statusCode}: 200"
      },
      "passthroughBehavior": "when_no_match"
    }
  },
  ...
}
```

```
}

```

- To use the access token for method authorization, change the above security definition to `{ "MyUserPool": [resource-server/scope, ...] }`:

```
"paths": {
  "/": {
    "get": {
      "consumes": [
        "application/json"
      ],
      "produces": [
        "text/html"
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "headers": {
            "Content-Type": {
              "type": "string"
            }
          }
        }
      }
    },
    "security": [
      {
        "MyUserPool": ["com.hamuta.movies/drama.view", "http://my.resource.com/file.read"]
      }
    ],
    "x-amazon-apigateway-integration": {
      "type": "mock",
      "responses": {
        "default": {
          "statusCode": "200",
          "responseParameters": {
            "method.response.header.Content-Type": "'text/html'"
          }
        }
      },
      "requestTemplates": {
        "application/json": "{$\"statusCode\": 200}"
      },
      "passthroughBehavior": "when_no_match"
    }
  },
  ...
}
```

- If needed, you can set other API configuration settings by using the appropriate OpenAPI definitions or extensions. For more information, see [Working with API Gateway extensions to OpenAPI \(p. 675\)](#).

## Call a REST API integrated with an Amazon Cognito user pool

To call a method with a user pool authorizer configured, the client must do the following:

- Enable the user to sign up with the user pool.
- Enable the user to sign in to the user pool.
- Obtain an identity token of the signed-in user from the user pool.

- Include the identity token in the `Authorization` header (or another header you specified when you created the authorizer).

You can use [Amazon Amplify](#) to perform these tasks. See [Integrating Amazon Cognito With Web and Mobile Apps](#) for more information.

- For Android, see [Getting Started with Amplify for Android](#).
- To use iOS see [Getting started with Amplify for iOS](#).
- To use JavaScript, see [Getting Started with Amplify for Javascript](#).

## Configure cross-account Amazon Cognito authorizer for a REST API using the API Gateway console

You can now also use a Amazon Cognito user pool from a different Amazon account as your API authorizer. Each account can be in any region where Amazon API Gateway is available. The Amazon Cognito user pool can use bearer token authentication strategies such as OAuth or SAML. This makes it easy to centrally manage and share a central Amazon Cognito user pool authorizer across multiple API Gateway APIs.

In this section, we show how to configure a cross-account Amazon Cognito user pool using the Amazon API Gateway console.

These instructions assume that you already have an API Gateway API in one Amazon account and a Amazon Cognito user pool in another account.

### Configure cross-account Amazon Cognito authorizer using the API Gateway console

Log in to the Amazon API Gateway console in your first account (the one that has your API in it) and do the following:

1. Locate your API and choose **Authorizers**.
2. Choose **Create New Authorizer**.
3. For **Create Authorizer**, type an authorizer name in the **Name** input field.
4. For **Type**, choose the **Cognito** option.
5. For **Cognito User Pool**, copy-paste the full ARN for the user pool that you have in your second account.

#### Note

In the Amazon Cognito console, you can find the ARN for your user pool in the **Pool ARN** field of the **General Settings** pane.

6. Type the name of a header in **Token Source**. The API client must include a header of this name to send the authorization token to the Amazon Cognito authorizer.
7. Optionally, provide a RegEx statement in **Token Validation** input field. API Gateway performs initial validation of the input token against this expression and invokes the authorizer upon successful validation. This helps reduce chances of being charged for invalid tokens.
8. Choose **Create** to create the new Amazon Cognito authorizer for your API.

## Setting up REST API integrations

After setting up an API method, you must integrate it with an endpoint in the backend. A backend endpoint is also referred to as an integration endpoint and can be a Lambda function, an HTTP webpage, or an Amazon service action.

As with the API method, the API integration has an integration request and an integration response. An integration request encapsulates an HTTP request received by the backend. It might or might not differ from the method request submitted by the client. An integration response is an HTTP response encapsulating the output returned by the backend.

Setting up an integration request involves the following: configuring how to pass client-submitted method requests to the backend; configuring how to transform the request data, if necessary, to the integration request data; and specifying which Lambda function to call, specifying which HTTP server to forward the incoming request to, or specifying the Amazon service action to invoke.

Setting up an integration response (applicable to non-proxy integrations only) involves the following: configuring how to pass the backend-returned result to a method response of a given status code, configuring how to transform specified integration response parameters to predefined method response parameters, and configuring how to map the integration response body to the method response body according to the specified body-mapping templates.

Programmatically, an integration request is encapsulated by the [Integration](#) resource and an integration response by the [IntegrationResponse](#) resource of API Gateway.

To set up an integration request, you create an [Integration](#) resource and use it to configure the integration endpoint URL. You then set the IAM permissions to access the backend, and specify mappings to transform the incoming request data before passing it to the backend. To set up an integration response for non-proxy integration, you create an [IntegrationResponse](#) resource and use it to set its target method response. You then configure how to map backend output to the method response.

### Topics

- [Set up an integration request in API Gateway \(p. 278\)](#)
- [Set up an integration response in API Gateway \(p. 284\)](#)
- [Set up Lambda integrations in API Gateway \(p. 285\)](#)
- [Set up HTTP integrations in API Gateway \(p. 304\)](#)
- [Set up API Gateway private integrations \(p. 308\)](#)
- [Set up mock integrations in API Gateway \(p. 315\)](#)

## Set up an integration request in API Gateway

To set up an integration request, you perform the following required and optional tasks:

1. Choose an integration type that determines how method request data is passed to the backend.
2. For non-mock integrations, specify an HTTP method and the URI of the targeted integration endpoint, except for the `MOCK` integration.
3. For integrations with Lambda functions and other Amazon service actions, set an IAM role with required permissions for API Gateway to call the backend on your behalf.
4. For non-proxy integrations, set necessary parameter mappings to map predefined method request parameters to appropriate integration request parameters.
5. For non-proxy integrations, set necessary body mappings to map the incoming method request body of a given content type according to the specified mapping template.
6. For non-proxy integrations, specify the condition under which the incoming method request data is passed through to the backend as-is.
7. Optionally, specify how to handle type conversion for a binary payload.
8. Optionally, declare a cache namespace name and cache key parameters to enable API caching.

Performing these tasks involves creating an [Integration](#) resource of API Gateway and setting appropriate property values. You can do so using the API Gateway console, Amazon CLI commands, an Amazon SDK, or the API Gateway REST API.

## Topics

- [Basic tasks of an API integration request \(p. 279\)](#)
- [Choose an API Gateway API integration type \(p. 280\)](#)
- [Set up a proxy integration with a proxy resource \(p. 282\)](#)
- [Set up an API integration request using the API Gateway console \(p. 282\)](#)

## Basic tasks of an API integration request

An integration request is an HTTP request that API Gateway submits to the backend, passing along the client-submitted request data, and transforming the data, if necessary. The HTTP method (or verb) and URI of the integration request are dictated by the backend (that is, the integration endpoint). They can be the same as or different from the method request's HTTP method and URI, respectively.

For example, when a Lambda function returns a file that is fetched from Amazon S3, you can expose this operation intuitively as a `GET` method request to the client even though the corresponding integration request requires that a `POST` request be used to invoke the Lambda function. For an HTTP endpoint, it is likely that the method request and the corresponding integration request both use the same HTTP verb. However, this is not required. You can integrate the following method request:

```
GET /{var}?query=value
Host: api.domain.net
```

With the following integration request:

```
POST /
Host: service.domain.com
Content-Type: application/json
Content-Length: ...

{
  path: "{var}'s value",
  type: "value"
}
```

As an API developer, you can use whatever HTTP verb and URI for a method request suit your requirements. But you must follow the requirements of the integration endpoint. When the method request data differs from the integration request data, you can reconcile the difference by providing mappings from the method request data to the integration request data.

In the preceding examples, the mapping translates the path variable (`{var}`) and the query parameter (`query`) values of the `GET` method request to the values of the integration request's payload properties of `path` and `type`. Other mappable request data includes request headers and body. These are described in [Set up request and response data mappings using the API Gateway console \(p. 341\)](#).

When setting up the HTTP or HTTP proxy integration request, you assign the backend HTTP endpoint URL as the integration request URI value. For example, in the PetStore API, the method request to get a page of pets has the following integration request URI:

```
http://petstore-demo-endpoint.execute-api.com/petstore/pets
```

When setting up the Lambda or Lambda proxy integration, you assign the Amazon Resource Name (ARN) for invoking the Lambda function as the integration request URI value. This ARN has the following format:

```
arn:aws:apigateway:api-region:lambda:path//2015-03-31/functions/arn:aws:lambda:lambda-region:account-id:function:lambda-function-name/invocations
```

The part after `arn:aws:apigateway:api-region:lambda:path/`, namely, `/2015-03-31/functions/arn:aws:lambda:lambda-region:account-id:function:lambda-function-name/invocations`, is the REST API URI path of the Lambda [Invoke](#) action. If you use the API Gateway console to set up the Lambda integration, API Gateway creates the ARN and assigns it to the integration URI after prompting you to choose the `lambda-function-name` from a region.

When setting up the integration request with another Amazon service action, the integration request URI is also an ARN, similar to the integration with the Lambda `Invoke` action. For example, for the integration with the [GetBucket](#) action of Amazon S3, the integration request URI is an ARN of the following format:

```
arn:aws:apigateway:api-region:s3:path/{bucket}
```

The integration request URI is of the path convention to specify the action, where `{bucket}` is the placeholder of a bucket name. Alternatively, an Amazon service action can be referenced by its name. Using the action name, the integration request URI for the `GetBucket` action of Amazon S3 becomes the following:

```
arn:aws:apigateway:api-region:s3:action/GetBucket
```

With the action-based integration request URI, the bucket name (`{bucket}`) must be specified in the integration request body (`{ Bucket: "bucket" }`), following the input format of `GetBucket` action.

For Amazon integrations, you must also configure [credentials](#) to allow API Gateway to call the integrated actions. You can create a new or choose an existing IAM role for API Gateway to call the action and then specify the role using its ARN. The following shows an example of this ARN:

```
arn:aws:iam::account-id:role/iam-role-name
```

This IAM role must contain a policy to allow the action to be executed. It must also have API Gateway declared (in the role's trust relationship) as a trusted entity to assume the role. Such permissions can be granted on the action itself. They are known as resource-based permissions. For the Lambda integration, you can call the Lambda's [addPermission](#) action to set the resource-based permissions and then set `credentials` to null in the API Gateway integration request.

We discussed the basic integration setup. Advanced settings involve mapping method request data to the integration request data. After discussing the basic setup for an integration response, we cover advanced topics in [Set up request and response data mappings using the API Gateway console \(p. 341\)](#), where we also cover passing payload through and handling content encodings.

## Choose an API Gateway API integration type

You choose an API integration type according to the types of integration endpoint you work with and how you want data to pass to and from the integration endpoint. For a Lambda function, you can have the Lambda proxy integration, or the Lambda custom integration. For an HTTP endpoint, you can have the HTTP proxy integration or the HTTP custom integration. For an Amazon service action, you have the Amazon integration of the non-proxy type only. API Gateway also supports the mock integration, where API Gateway serves as an integration endpoint to respond to a method request.

The Lambda custom integration is a special case of the Amazon integration, where the integration endpoint corresponds to the [function-invoking action](#) of the Lambda service.

Programmatically, you choose an integration type by setting the `type` property on the [Integration](#) resource. For the Lambda proxy integration, the value is `AWS_PROXY`. For the Lambda custom integration and all other Amazon integrations, it is `AWS`. For the HTTP proxy integration and HTTP integration, the value is `HTTP_PROXY` and `HTTP`, respectively. For the mock integration, the `type` value is `MOCK`.

The Lambda proxy integration supports a streamlined integration setup with a single Lambda function. The setup is simple and can evolve with the backend without having to tear down the existing setup. For these reasons, it is highly recommended for integration with a Lambda function.

In contrast, the Lambda custom integration allows for reuse of configured mapping templates for various integration endpoints that have similar requirements of the input and output data formats. The setup is more involved and is recommended for more advanced application scenarios.

Similarly, the HTTP proxy integration has a streamlined integration setup and can evolve with the backend without having to tear down the existing setup. The HTTP custom integration is more involved to set up, but allows for reuse of configured mapping templates for other integration endpoints.

The following list summarizes the supported integration types:

- **AWS:** This type of integration lets an API expose Amazon service actions. In AWS integration, you must configure both the integration request and integration response and set up necessary data mappings from the method request to the integration request, and from the integration response to the method response.
- **AWS\_PROXY:** This type of integration lets an API method be integrated with the Lambda function invocation action with a flexible, versatile, and streamlined integration setup. This integration relies on direct interactions between the client and the integrated Lambda function.

With this type of integration, also known as the Lambda proxy integration, you do not set the integration request or the integration response. API Gateway passes the incoming request from the client as the input to the backend Lambda function. The integrated Lambda function takes the [input of this format \(p. 293\)](#) and parses the input from all available sources, including request headers, URL path variables, query string parameters, and applicable body. The function returns the result following this [output format \(p. 295\)](#).

This is the preferred integration type to call a Lambda function through API Gateway and is not applicable to any other Amazon service actions, including Lambda actions other than the function-invoking action.

- **HTTP:** This type of integration lets an API expose HTTP endpoints in the backend. With the HTTP integration, also known as the HTTP custom integration, you must configure both the integration request and integration response. You must set up necessary data mappings from the method request to the integration request, and from the integration response to the method response.
- **HTTP\_PROXY:** The HTTP proxy integration allows a client to access the backend HTTP endpoints with a streamlined integration setup on single API method. You do not set the integration request or the integration response. API Gateway passes the incoming request from the client to the HTTP endpoint and passes the outgoing response from the HTTP endpoint to the client.
- **MOCK:** This type of integration lets API Gateway return a response without sending the request further to the backend. This is useful for API testing because it can be used to test the integration set up without incurring charges for using the backend and to enable collaborative development of an API.

In collaborative development, a team can isolate their development effort by setting up simulations of API components owned by other teams by using the `MOCK` integrations. It is also used to return CORS-related headers to ensure that the API method permits CORS access. In fact, the API Gateway console integrates the `OPTIONS` method to support CORS with a mock integration. [Gateway responses \(p. 376\)](#) are other examples of mock integrations.



## Set up a proxy integration with a proxy resource

To set up a proxy integration in an API Gateway API with a [proxy resource \(p. 227\)](#), you perform the following tasks:

- Create a proxy resource with a greedy path variable of `{proxy+}`.
- Set the `ANY` method on the proxy resource.
- Integrate the resource and method with a backend using the HTTP or Lambda integration type.

### Note

Greedy path variables, `ANY` methods, and proxy integration types are independent features, although they are commonly used together. You can configure a specific HTTP method on a greedy resource or apply non-proxy integration types to a proxy resource.

API Gateway enacts certain restrictions and limitations when handling methods with either a Lambda proxy integration or an HTTP proxy integration. For details, see [the section called "Important notes" \(p. 750\)](#).

### Note

When using proxy integration with a passthrough, API Gateway returns the default `Content-Type: application/json` header if the content type of a payload is unspecified.

A proxy resource is most powerful when it is integrated with a backend using either HTTP proxy integration or Lambda proxy [integration](#).

## HTTP proxy integration with a proxy resource

The HTTP proxy integration, designated by `HTTP_PROXY` in the API Gateway REST API, is for integrating a method request with a backend HTTP endpoint. With this integration type, API Gateway simply passes the entire request and response between the frontend and the backend, subject to certain [restrictions and limitations \(p. 750\)](#).

### Note

HTTP proxy integration supports multi-valued headers and query strings.

When applying the HTTP proxy integration to a proxy resource, you can set up your API to expose a portion or an entire endpoint hierarchy of the HTTP backend with a single integration setup. For example, suppose the backend of the website is organized into multiple branches of tree nodes off the root node (`/site`) as: `/site/a0/a1/.../aN`, `/site/b0/b1/.../bM`, etc. If you integrate the `ANY` method on a proxy resource of `/api/{proxy+}` with the backend endpoints with URL paths of `/site/{proxy}`, a single integration request can support any HTTP operations (`GET`, `POST`, etc.) on any of `[a0, a1, ..., aN, b0, b1, ..., bM, ...]`. If you apply a proxy integration to a specific HTTP method, for example, `GET`, instead, the resulting integration request works with the specified (that is, `GET`) operations on any of those backend nodes.

## Lambda proxy integration with a proxy resource

The Lambda proxy integration, designated by `AWS_PROXY` in the API Gateway REST API, is for integrating a method request with a Lambda function in the backend. With this integration type, API Gateway applies a default mapping template to send the entire request to the Lambda function and transforms the output from the Lambda function to HTTP responses.

Similarly, you can apply the Lambda proxy integration to a proxy resource of `/api/{proxy+}` to set up a single integration to have a backend Lambda function react individually to changes in any of the API resources under `/api`.

## Set up an API integration request using the API Gateway console

An API method setup defines the method and describes its behaviors. To set up a method, you must specify a resource, including the root (`/`), on which the method is exposed, an HTTP method (`GET`,

POST, etc.), and how it will be integrated with the targeted backend. The method request and response specify the contract with the calling app, stipulating which parameters the API can receive and what the response looks like.

The following procedure describes how to use the API Gateway console to specify method settings.

1. In the **Resources** pane, choose the method.
2. In the **Method Execution** pane, choose **Integration Request**. For **Integration type**, choose one of the following:
  - Choose **Lambda Function** if your API will be integrated with a Lambda function. At the API level, this is an `Amazon` integration type.
  - Choose **HTTP** if your API will be integrated with an HTTP endpoint. At the API level, this is the `HTTP` integration type.
  - Choose **Amazon Service** if your API will be integrated directly with an Amazon service. At the API level, this is the `Amazon` integration type. The **Lambda Function** option above is a special case of the `Amazon` integration for invoking a Lambda function and is available only in the API Gateway console. To set up an API Gateway API to create a new Lambda function in Amazon Lambda, to set a resource permission on the Lambda function, or to perform any other Lambda service actions, you must choose the **Amazon Service** option here.
  - Choose **Mock** if you want API Gateway to act as your backend to return static responses. At the API level, this is the `MOCK` integration type. Typically, you can use the `MOCK` integration when your API is not yet final, but you want to generate API responses to unblock dependent teams for testing. For the `OPTIONS` method, API Gateway sets the `MOCK` integration as default to return CORS-enabling headers for the applied API resource. If you choose this option, skip the rest of the instructions in this topic and see [Set up mock integrations in API Gateway \(p. 315\)](#).
3. If you chose **Lambda Function**, do the following:
  - a. For **Lambda Region**, choose the region identifier that corresponds to the region where you created the Lambda function. For example, if you created the Lambda function in the US East (N. Virginia) Region, choose `us-east-1`. For a list of region names and identifiers, see [Amazon Lambda](#) in the *Amazon Web Services General Reference*.
  - b. For **Lambda Function**, type the name of the Lambda function, and then choose the function's corresponding ARN.
  - c. Choose **Save**.
4. If you chose **HTTP**, do the following:
  - a. For **HTTP method**, choose the HTTP method type that most closely matches the method in the HTTP backend.
  - b. For **Endpoint URL**, type the URL of the HTTP backend you want this method to use.
  - c. Choose **Save**.
5. If you chose **Mock**, do the following:
  - Choose **Save**.
6. If you chose **Amazon Service**, do the following:
  - a. For **Amazon Region**, choose the Amazon Region you want this method to use to call the action.
  - b. For **Amazon Service**, choose the Amazon service you want this method to call.
  - c. For **Amazon Subdomain**, type the subdomain used by the Amazon service. Typically, you would leave this blank. Some Amazon services can support subdomains as part of the hosts. Consult the service documentation for the availability and, if available, details.
  - d. For **HTTP method**, choose the HTTP method type that corresponds to the action. For HTTP method type, see the API reference documentation for the Amazon service you chose for **Amazon Service**.

- e. For **Action**, type the action you want to use. For a list of available actions, see the API reference documentation for the Amazon service you chose for **Amazon Service**.
- f. For **Execution Role**, type the ARN of the IAM role that the method will use to call the action.

To create the IAM role, you can adapt the instructions in "To create the Lambda invocation role and its policies" and "To create the Lambda execution role and its policy" in the [Create Lambda Functions \(p. 35\)](#) section. Specify an access policy of the following format, with the desired number of action and resource statements:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "action-statement"
      ],
      "Resource": [
        "resource-statement"
      ]
    },
    ...
  ]
}
```

For the action and resource statement syntax, see the documentation for the Amazon service you chose for **Amazon Service**.

For the IAM role's trust relationship, specify the following, which enables API Gateway to take action on behalf of your Amazon account:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

- g. If the action you typed for **Action** provides a custom resource path that you want this method to use, for **Path Override**, type this custom resource path. For the custom resource path, see the API reference documentation for the Amazon service you chose for **Amazon Service**.
- h. Choose **Save**.

## Set up an integration response in API Gateway

For a non-proxy integration, you must set up at least one integration response, and make it the default response, to pass the result returned from the backend to the client. You can choose to pass through the result as-is or to transform the integration response data to the method response data if the two have different formats.

For a proxy integration, API Gateway automatically passes the backend output to the client as an HTTP response. You do not set either an integration response or a method response.

To set up an integration response, you perform the following required and optional tasks:

1. Specify an HTTP status code of a method response to which the integration response data is mapped. This is required.
2. Define a regular expression to select backend output to be represented by this integration response. If you leave this empty, the response is the default response that is used to catch any response not yet configured.
3. If needed, declare mappings consisting of key-value pairs to map specified integration response parameters to given method response parameters.
4. If needed, add body-mapping templates to transform given integration response payloads into specified method response payloads.
5. If needed, specify how to handle type conversion for a binary payload.

An integration response is an HTTP response encapsulating the backend response. For an HTTP endpoint, the backend response is an HTTP response. The integration response status code can take the backend-returned status code, and the integration response body is the backend-returned payload. For a Lambda endpoint, the backend response is the output returned from the Lambda function. With the Lambda integration, the Lambda function output is returned as a 200 OK response. The payload can contain the result as JSON data, including a JSON string or a JSON object, or an error message as a JSON object. You can assign a regular expression to the [selectionPattern](#) property to map an error response to an appropriate HTTP error response. For more information about the Lambda function error response, see [Handle Lambda errors in API Gateway \(p. 300\)](#). With the Lambda proxy integration, the Lambda function must return output of the following format:

```
{
  statusCode: "...",           // a valid HTTP status code
  headers: {
    custom-header: "..."     // any API-specific custom header
  },
  body: "...",                // a JSON string.
  isBase64Encoded: true|false // for binary support
}
```

There is no need to map the Lambda function response to its proper HTTP response.

To return the result to the client, set up the integration response to pass the endpoint response through as-is to the corresponding method response. Or you can map the endpoint response data to the method response data. The response data that can be mapped includes the response status code, response header parameters, and response body. If no method response is defined for the returned status code, API Gateway returns a 500 error. For more information, see [Working with models and mapping templates \(p. 330\)](#).

## Set up Lambda integrations in API Gateway

You can integrate an API method with a Lambda function using Lambda proxy integration or Lambda non-proxy (custom) integration.

In Lambda proxy integration, the required setup is simple. Set the integration's HTTP method to POST, the integration endpoint URI to the ARN of the Lambda function invocation action of a specific Lambda function, and grant API Gateway permission to call the Lambda function on your behalf.

In Lambda non-proxy integration, in addition to the proxy integration setup steps, you also specify how the incoming request data is mapped to the integration request and how the resulting integration response data is mapped to the method response.

### Topics

- [Set up Lambda proxy integrations in API Gateway \(p. 286\)](#)
- [Set up Lambda custom integrations in API Gateway \(p. 296\)](#)
- [Set up asynchronous invocation of the backend Lambda function \(p. 299\)](#)
- [Handle Lambda errors in API Gateway \(p. 300\)](#)

## Set up Lambda proxy integrations in API Gateway

### Topics

- [Understand API Gateway Lambda proxy integration \(p. 286\)](#)
- [Support for multi-value headers and query string parameters \(p. 287\)](#)
- [Set up a proxy resource with Lambda proxy integration \(p. 288\)](#)
- [Set up Lambda proxy integration using the Amazon CLI \(p. 290\)](#)
- [Input format of a Lambda function for proxy integration \(p. 293\)](#)
- [Output format of a Lambda function for proxy integration \(p. 295\)](#)

### Understand API Gateway Lambda proxy integration

Amazon API Gateway Lambda proxy integration is a simple, powerful, and nimble mechanism to build an API with a setup of a single API method. The Lambda proxy integration allows the client to call a single Lambda function in the backend. The function accesses many resources or features of other Amazon services, including calling other Lambda functions.

In Lambda proxy integration, when a client submits an API request, API Gateway passes to the integrated Lambda function the raw request as-is, except that the order of the request parameters is not preserved. This [request data \(p. 293\)](#) includes the request headers, query string parameters, URL path variables, payload, and API configuration data. The configuration data can include current deployment stage name, stage variables, user identity, or authorization context (if any). The backend Lambda function parses the incoming request data to determine the response that it returns. For API Gateway to pass the Lambda output as the API response to the client, the Lambda function must return the result in [this format \(p. 295\)](#).

Because API Gateway doesn't intervene very much between the client and the backend Lambda function for the Lambda proxy integration, the client and the integrated Lambda function can adapt to changes in each other without breaking the existing integration setup of the API. To enable this, the client must follow application protocols enacted by the backend Lambda function.

You can set up a Lambda proxy integration for any API method. But a Lambda proxy integration is more potent when it is configured for an API method involving a generic proxy resource. The generic proxy resource can be denoted by a special templated path variable of `{proxy+}`, the catch-all `ANY` method placeholder, or both. The client can pass the input to the backend Lambda function in the incoming request as request parameters or applicable payload. The request parameters include headers, URL path variables, query string parameters, and the applicable payload. The integrated Lambda function verifies all of the input sources before processing the request and responding to the client with meaningful error messages if any of the required input is missing.

When calling an API method integrated with the generic HTTP method of `ANY` and the generic resource of `{proxy+}`, the client submits a request with a particular HTTP method in place of `ANY`. The client also specifies a particular URL path instead of `{proxy+}`, and includes any required headers, query string parameters, or an applicable payload.

The following list summarizes runtime behaviors of different API methods with the Lambda proxy integration:

- `ANY /{proxy+}`: The client must choose a particular HTTP method, must set a particular resource path hierarchy, and can set any headers, query string parameters, and applicable payload to pass the data as input to the integrated Lambda function.
- `ANY /res`: The client must choose a particular HTTP method and can set any headers, query string parameters, and applicable payload to pass the data as input to the integrated Lambda function.
- `GET|POST|PUT|... /{proxy+}`: The client can set a particular resource path hierarchy, any headers, query string parameters, and applicable payload to pass the data as input to the integrated Lambda function.
- `GET|POST|PUT|... /res/{path}/...`: The client must choose a particular path segment (for the `{path}` variable) and can set any request headers, query string parameters, and applicable payload to pass input data to the integrated Lambda function.
- `GET|POST|PUT|... /res`: The client can choose any request headers, query string parameters, and applicable payload to pass input data to the integrated Lambda function.

Both the proxy resource of `{proxy+}` and the custom resource of `{custom}` are expressed as templated path variables. However `{proxy+}` can refer to any resource along a path hierarchy, while `{custom}` refers to a particular path segment only. For example, a grocery store might organize its online product inventory by department names, produce categories, and product types. The grocery store's website can then represent available products by the following templated path variables of custom resources: `/{department}/{produce-category}/{product-type}`. For example, apples are represented by `/produce/fruit/apple` and carrots by `/produce/vegetables/carrot`. It can also use `/{proxy+}` to represent any department, any produce category, or any product type that a customer can search for while shopping in the online store. For example, `/{proxy+}` can refer to any of the following items:

- `/produce`
- `/produce/fruit`
- `/produce/vegetables/carrot`

To let customers search for any available product, its produce category, and the associated store department, you can expose a single method of `GET /{proxy+}` with read-only permissions. Similarly, to allow a supervisor to update the produce department's inventory, you can set up another single method of `PUT /produce/{proxy+}` with read/write permissions. To allow a cashier to update the running total of a vegetable, you can set up a `POST /produce/vegetables/{proxy+}` method with read/write permissions. To let a store manager perform any possible action on any available product, the online store developer can expose the `ANY /{proxy+}` method with read/write permissions. In any case, at run time, the customer or the employee must select a particular product of a given type in a chosen department, a specific produce category in a chosen department, or a specific department.

For more information about setting up API Gateway proxy integrations, see [Set up a proxy integration with a proxy resource \(p. 282\)](#).

Proxy integration requires that the client have more detailed knowledge of the backend requirements. Therefore, to ensure optimal app performance and user experience, the backend developer must communicate clearly to the client developer the requirements of the backend, and provide a robust error feedback mechanism when the requirements are not met.

### Support for multi-value headers and query string parameters

API Gateway supports multiple headers and query string parameters that have the same name. Multi-value headers as well as single-value headers and parameters can be combined in the same requests and responses. For more information, see [Input format of a Lambda function for proxy integration \(p. 293\)](#) and [Output format of a Lambda function for proxy integration \(p. 295\)](#).

## Set up a proxy resource with Lambda proxy integration

To set up a proxy resource with the Lambda proxy integration type, create an API resource with a greedy path parameter (for example, `/parent/{proxy+}`) and integrate this resource with a Lambda function backend (for example, `arn:aws:lambda:us-west-2:123456789012:function:SimpleLambda4ProxyResource`) on the ANY method. The greedy path parameter must be at the end of the API resource path. As with a non-proxy resource, you can set up the proxy resource by using the API Gateway console, importing an OpenAPI definition file, or calling the API Gateway REST API directly.

The following OpenAPI API definition file shows an example of an API with a proxy resource that is integrated with a Lambda function named `SimpleLambda4ProxyResource`.

OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "version": "2016-09-12T17:50:37Z",
    "title": "ProxyIntegrationWithLambda"
  },
  "paths": {
   ("/{proxy+}": {
      "x-amazon-apigateway-any-method": {
        "parameters": [
          {
            "name": "proxy",
            "in": "path",
            "required": true,
            "schema": {
              "type": "string"
            }
          }
        ],
        "responses": {},
        "x-amazon-apigateway-integration": {
          "responses": {
            "default": {
              "statusCode": "200"
            }
          },
          "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:SimpleLambda4ProxyResource/invocations",
          "passthroughBehavior": "when_no_match",
          "httpMethod": "POST",
          "cacheNamespace": "roq9wj",
          "cacheKeyParameters": [
            "method.request.path.proxy"
          ],
          "type": "aws_proxy"
        }
      }
    }
  },
  "servers": [
    {
      "url": "https://gy415nuibc.execute-api.us-east-1.amazonaws.com/{basePath}",
      "variables": {
        "basePath": {
          "default": "/testStage"
        }
      }
    }
  ]
}
```

```
}

```

## OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "version": "2016-09-12T17:50:37Z",
    "title": "ProxyIntegrationWithLambda"
  },
  "host": "gy415nuibc.execute-api.us-east-1.amazonaws.com",
  "basePath": "/testStage",
  "schemes": [
    "https"
  ],
  "paths": {
   ("/{proxy+}"): {
      "x-amazon-apigateway-any-method": {
        "produces": [
          "application/json"
        ],
        "parameters": [
          {
            "name": "proxy",
            "in": "path",
            "required": true,
            "type": "string"
          }
        ],
        "responses": {},
        "x-amazon-apigateway-integration": {
          "responses": {
            "default": {
              "statusCode": "200"
            }
          },
          "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:SimpleLambda4ProxyResource/invocations",
          "passthroughBehavior": "when_no_match",
          "httpMethod": "POST",
          "cacheNamespace": "roq9wj",
          "cacheKeyParameters": [
            "method.request.path.proxy"
          ],
          "type": "aws_proxy"
        }
      }
    }
  }
}
```

In Lambda proxy integration, at run time, API Gateway maps an incoming request into the input event parameter of the Lambda function. The input includes the request method, path, headers, any query string parameters, any payload, associated context, and any defined stage variables. The input format is explained in [Input format of a Lambda function for proxy integration \(p. 293\)](#). For API Gateway to map the Lambda output to HTTP responses successfully, the Lambda function must output the result in the format described in [Output format of a Lambda function for proxy integration \(p. 295\)](#).

In Lambda proxy integration of a proxy resource through the `ANY` method, the single backend Lambda function serves as the event handler for all requests through the proxy resource. For example, to log traffic patterns, you can have a mobile device send its location information of state, city, street, and building by submitting a request with `/state/city/street/house` in the URL path for the proxy



resource. The backend Lambda function can then parse the URL path and insert the location tuples into a DynamoDB table.

### Set up Lambda proxy integration using the Amazon CLI

In this section, we show how to use Amazon CLI to set up an API with the Lambda proxy integration.

#### Note

For detailed instructions for using the API Gateway console to configure a proxy resource with the Lambda proxy integration, see [Tutorial: Build a Hello World REST API with Lambda proxy integration \(p. 28\)](#).

As an example, we use the following sample Lambda function as the backend of the API:

```
exports.handler = function(event, context, callback) {
  console.log('Received event:', JSON.stringify(event, null, 2));
  var res = {
    "statusCode": 200,
    "headers": {
      "Content-Type": "*/*"
    }
  };
  var greeter = 'World';
  if (event.greeter && event.greeter !== "") {
    greeter = event.greeter;
  } else if (event.body && event.body !== "") {
    var body = JSON.parse(event.body);
    if (body.greeter && body.greeter !== "") {
      greeter = body.greeter;
    }
  } else if (event.queryStringParameters && event.queryStringParameters.greeter &&
event.queryStringParameters.greeter !== "") {
    greeter = event.queryStringParameters.greeter;
  } else if (event.multiValueHeaders && event.multiValueHeaders.greeter &&
event.multiValueHeaders.greeter !== "") {
    greeter = event.multiValueHeaders.greeter.join(" and ");
  } else if (event.headers && event.headers.greeter && event.headers.greeter !== "") {
    greeter = event.headers.greeter;
  }
  res.body = "Hello, " + greeter + "!";
  callback(null, res);
};
```

Comparing this to [the Lambda custom integration setup \(p. 296\)](#), the input to this Lambda function can be expressed in the request parameters and body. You have more latitude to allow the client to pass the same input data. Here, the client can pass the greeter's name in as a query string parameter, a header, or a body property. The function can also support the Lambda custom integration. The API setup is simpler. You do not configure the method response or integration response at all.

### To set up a Lambda proxy integration using the Amazon CLI

1. Call the `create-rest-api` command to create an API:

```
aws apigateway create-rest-api --name 'HelloWorld (Amazon CLI)' --region us-west-2
```

Note the resulting API's `id` value (`te6si5ach7`) in the response:

```
{
  "name": "HelloWorldProxy (Amazon CLI)",
  "id": "te6si5ach7",
  "createdDate": 1508461860
}
```

```
}

```

You need the API id throughout this section.

2. Call the `get-resources` command to get the root resource id:

```
aws apigateway get-resources --rest-api-id te6si5ach7 --region us-west-2

```

The successful response is shown as follows:

```
{
  "items": [
    {
      "path": "/",
      "id": "krznpq9xpg"
    }
  ]
}

```

Note the root resource id value (`krznpq9xpg`). You need it in the next step and later.

3. Call `create-resource` to create an API Gateway [Resource](#) of `/greeting`:

```
aws apigateway create-resource --rest-api-id te6si5ach7 \
  --region us-west-2 \
  --parent-id krznpq9xpg \
  --path-part {proxy+}

```

The successful response is similar to the following:

```
{
  "path": "/{proxy+}",
  "pathPart": "{proxy+}",
  "id": "2jf6xt",
  "parentId": "krznpq9xpg"
}

```

Note the resulting `{proxy+}` resource's id value (`2jf6xt`). You need it to create a method on the `/ {proxy+}` resource in the next step.

4. Call `put-method` to create an ANY method request of ANY `/ {proxy+}`:

```
aws apigateway put-method --rest-api-id te6si5ach7 \
  --region us-west-2 \
  --resource-id 2jf6xt \
  --http-method ANY \
  --authorization-type "NONE"

```

The successful response is similar to the following:

```
{
  "apiKeyRequired": false,
  "httpMethod": "ANY",
  "authorizationType": "NONE"
}

```

This API method allows the client to receive or send greetings from the Lambda function at the backend.

5. Call `put-integration` to set up the integration of the ANY `/{proxy+}` method with a Lambda function, named `HelloWorld`. This function responds to the request with a message of `"Hello, {name}!"`, if the `greeter` parameter is provided, or `"Hello, World!"`, if the query string parameter is not set.

```
aws apigateway put-integration \
  --region us-west-2 \
  --rest-api-id te6si5ach7 \
  --resource-id 2jf6xt \
  --http-method ANY \
  --type AWS_PROXY \
  --integration-http-method POST \
  --uri arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:123456789012:function:HelloWorld/invocations \
  --credentials arn:aws:iam::123456789012:role/apigAwsProxyRole
```

### Important

For Lambda integrations, you must use the HTTP method of `POST` for the integration request, according to the [specification of the Lambda service action for function invocations](#). The IAM role of `apigAwsProxyRole` must have policies allowing the `apigateway` service to invoke Lambda functions. For more information about IAM permissions, see [the section called "API Gateway permissions model for invoking an API" \(p. 248\)](#).

The successful output is similar to the following:

```
{
  "passthroughBehavior": "WHEN_NO_MATCH",
  "cacheKeyParameters": [],
  "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:1234567890:function:HelloWorld/invocations",
  "httpMethod": "POST",
  "cacheNamespace": "vvom7n",
  "credentials": "arn:aws:iam::1234567890:role/apigAwsProxyRole",
  "type": "AWS_PROXY"
}
```

Instead of supplying an IAM role for `credentials`, you can call the [add-permission](#) command to add resource-based permissions. This is what the API Gateway console does.

6. Call `create-deployment` to deploy the API to a test stage:

```
aws apigateway create-deployment --rest-api-id te6si5ach7 --stage-name test
```

7. Test the API using the following cURL commands in a terminal.

Calling the API with the query string parameter of `?greeter=jane`:

```
curl -X GET 'https://te6si5ach7.execute-api.us-west-2.amazonaws.com/test/greeting?
greeter=jane' \
  -H 'authorization: AWS4-HMAC-SHA256 Credential={access_key}/20171020/us-west-2/
execute-api/aws4_request, \
  SignedHeaders=content-type;host;x-amz-date, Signature=f327...5751'
```

Calling the API with a header parameter of `greeter:jane`:

```
curl -X GET https://te6si5ach7.execute-api.us-west-2.amazonaws.com/test/hi \
```

```
-H 'authorization: AWS4-HMAC-SHA256 Credential={access_key}/20171020/us-west-2/execute-api/aws4_request, \
  SignedHeaders=content-type;host;x-amz-date, Signature=f327...5751' \
-H 'content-type: application/json' \
-H 'greeter: jane'
```

Calling the API with a body of {"greeter": "jane"}:

```
curl -X POST https://te6si5ach7.execute-api.us-west-2.amazonaws.com/test \
-H 'authorization: AWS4-HMAC-SHA256 Credential={access_key}/20171020/us-west-2/execute-api/aws4_request, \
  SignedHeaders=content-type;host;x-amz-date, Signature=f327...5751' \
-H 'content-type: application/json' \
-d '{ "greeter": "jane" }'
```

In all the cases, the output is a 200 response with the following response body:

```
Hello, jane!
```

### Input format of a Lambda function for proxy integration

In Lambda proxy integration, API Gateway maps the entire client request to the input event parameter of the backend Lambda function. The following example shows the structure of an event that API Gateway sends to a Lambda proxy integration.

```
{
  "resource": "/my/path",
  "path": "/my/path",
  "httpMethod": "GET",
  "headers": {
    "header1": "value1",
    "header2": "value2"
  },
  "multiValueHeaders": {
    "header1": [
      "value1"
    ],
    "header2": [
      "value1",
      "value2"
    ]
  },
  "queryStringParameters": {
    "parameter1": "value1",
    "parameter2": "value"
  },
  "multiValueQueryStringParameters": {
    "parameter1": [
      "value1",
      "value2"
    ],
    "parameter2": [
      "value"
    ]
  },
  "requestContext": {
    "accountId": "123456789012",
    "apiId": "id",
    "authorizer": {
      "claims": null,
      "scopes": null
    }
  }
}
```

```

    },
    "domainName": "id.execute-api.us-east-1.amazonaws.com",
    "domainPrefix": "id",
    "extendedRequestId": "request-id",
    "httpMethod": "GET",
    "identity": {
      "accessKey": null,
      "accountId": null,
      "caller": null,
      "cognitoAuthenticationProvider": null,
      "cognitoAuthenticationType": null,
      "cognitoIdentityId": null,
      "cognitoIdentityPoolId": null,
      "principalOrgId": null,
      "sourceIp": "IP",
      "user": null,
      "userAgent": "user-agent",
      "userArn": null,
      "clientCert": {
        "clientCertPem": "CERT_CONTENT",
        "subjectDN": "www.example.com",
        "issuerDN": "Example issuer",
        "serialNumber": "a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1:a1",
        "validity": {
          "notBefore": "May 28 12:30:02 2019 GMT",
          "notAfter": "Aug  5 09:36:04 2021 GMT"
        }
      }
    }
  },
  "path": "/my/path",
  "protocol": "HTTP/1.1",
  "requestId": "id=",
  "requestTime": "04/Mar/2020:19:15:17 +0000",
  "requestTimeEpoch": 1583349317135,
  "resourceId": null,
  "resourcePath": "/my/path",
  "stage": "$default"
},
"pathParameters": null,
"stageVariables": null,
"body": "Hello from Lambda!",
"isBase64Encoded": false
}

```

### Note

In the input:

- The `headers` key can only contain single-value headers.
- The `multiValueHeaders` key can contain multi-value headers as well as single-value headers.
- If you specify values for both `headers` and `multiValueHeaders`, API Gateway merges them into a single list. If the same key-value pair is specified in both, only the values from `multiValueHeaders` will appear in the merged list.

In the input to the backend Lambda function, the `requestContext` object is a map of key-value pairs. In each pair, the key is the name of a [\\$context](#) (p. 363) variable property, and the value is the value of that property. API Gateway may add new keys to the map.

Depending on the features that are enabled, the `requestContext` map may vary from API to API. For example, in the preceding example, no authorization type is specified, so no `$context.authorizer.*` or `$context.identity.*` properties are present. When an authorization type is specified,

this causes API Gateway to pass authorized user information to the integration endpoint in a `requestContext.identity` object as follows:

- When the authorization type is `AWS_IAM`, the authorized user information includes `$context.identity.*` properties.
- When the authorization type is `COGNITO_USER_POOLS` (Amazon Cognito authorizer), the authorized user information includes `$context.identity.cognito*` and `$context.authorizer.claims.*` properties.
- When the authorization type is `CUSTOM` (Lambda authorizer), the authorized user information includes `$context.authorizer.principalId` and other applicable `$context.authorizer.*` properties.

### Output format of a Lambda function for proxy integration

In Lambda proxy integration, API Gateway requires the backend Lambda function to return output according to the following JSON format:

```
{
  "isBase64Encoded": true/false,
  "statusCode": httpStatusCode,
  "headers": { "headerName": "headerValue", ... },
  "multiValueHeaders": { "headerName": ["headerValue", "headerValue2", ...], ... },
  "body": "..."}
}
```

In the output:

- The `headers` and `multiValueHeaders` keys can be unspecified if no extra response headers are to be returned.
- The `headers` key can only contain single-value headers.
- The `multiValueHeaders` key can contain multi-value headers as well as single-value headers. You can use the `multiValueHeaders` key to specify all of your extra headers, including any single-value ones.
- If you specify values for both `headers` and `multiValueHeaders`, API Gateway merges them into a single list. If the same key-value pair is specified in both, only the values from `multiValueHeaders` will appear in the merged list.

To enable CORS for the Lambda proxy integration, you must add `Access-Control-Allow-Origin: domain-name` to the output headers. `domain-name` can be `*` for any domain name. The output body is marshalled to the frontend as the method response payload. If `body` is a binary blob, you can encode it as a Base64-encoded string by setting `isBase64Encoded` to `true` and configuring `*/*` as a **Binary Media Type**. Otherwise, you can set it to `false` or leave it unspecified.

#### Note

For more information about enabling binary support, see [Enabling binary support using the API Gateway console \(p. 392\)](#). For an example Lambda function, see [Return binary media from a Lambda proxy integration \(p. 396\)](#).

If the function output is of a different format, API Gateway returns a `502 Bad Gateway` error response.

To return a response in a Lambda function in Node.js, you can use commands such as the following:

- To return a successful result, call `callback(null, {"statusCode": 200, "body": "results"})`.
- To throw an exception, call `callback(new Error('internal server error'))`.

- For a client-side error (if, for example, a required parameter is missing), you can call `callback(null, {"statusCode": 400, "body": "Missing parameters of ..."})` to return the error without throwing an exception.

In a Lambda async function in Node.js, the equivalent syntax would be:

- To return a successful result, call `return {"statusCode": 200, "body": "results"}`.
- To throw an exception, call `throw new Error("internal server error")`.
- For a client-side error (if, for example, a required parameter is missing), you can call `return {"statusCode": 400, "body": "Missing parameters of ..."}` to return the error without throwing an exception.

## Set up Lambda custom integrations in API Gateway

To show how to set up the Lambda custom integration, we create an API Gateway API to expose the `GET /greeting?greeter={name}` method to invoke a Lambda function. The function responds with a message of `"Hello, {name}!"` if the `greeter` parameter value is a non-empty string. It returns a message of `"Hello, World!"` if the `greeter` value is an empty string. The function returns an error message of `"Missing the required greeter parameter."` if the `greeter` parameter is not set in the incoming request. We name the function `HelloWorld`.

For reference, a Node.js version of the Lambda function is shown as follows:

```
exports.handler = function(event, context, callback) {
  var res = {
    "statusCode": 200,
    "headers": {
      "Content-Type": "*/*"
    }
  };
  if (event.greeter==null) {
    callback(new Error('Missing the required greeter parameter.'));
  } else if (event.greeter === "") {
    res.body = "Hello, World";
    callback(null, res);
  } else {
    res.body = "Hello, " + event.greeter + "!";
    callback(null, res);
  }
};
```

You can create it in the Lambda console or by using the Amazon CLI. In this section, we reference this function using the following ARN:

```
arn:aws:lambda:us-east-1:123456789012:function>HelloWorld
```

With the Lambda function set in the backend, proceed to set up the API.

### To set up the Lambda custom integration using the Amazon CLI

1. Call the `create-rest-api` command to create an API:

```
aws apigateway create-rest-api --name 'HelloWorld (Amazon CLI)' --region us-west-2
```

Note the resulting API's `id` value (`te6si5ach7`) in the response:

```
{
  "name": "HelloWorld (Amazon CLI)",
  "id": "te6si5ach7",
  "createdDate": 1508461860
}
```

You need the API id throughout this section.

2. Call the `get-resources` command to get the root resource id:

```
aws apigateway get-resources --rest-api-id te6si5ach7 --region us-west-2
```

The successful response is as follows:

```
{
  "items": [
    {
      "path": "/",
      "id": "krznpq9xpg"
    }
  ]
}
```

Note the root resource id value (`krznpq9xpg`). You need it in the next step and later.

3. Call `create-resource` to create an API Gateway [Resource](#) of `/greeting`:

```
aws apigateway create-resource --rest-api-id te6si5ach7 \
  --region us-west-2 \
  --parent-id krznpq9xpg \
  --path-part greeting
```

The successful response is similar to the following:

```
{
  "path": "/greeting",
  "pathPart": "greeting",
  "id": "2jf6xt",
  "parentId": "krznpq9xpg"
}
```

Note the resulting `greeting` resource's id value (`2jf6xt`). You need it to create a method on the `/greeting` resource in the next step.

4. Call `put-method` to create an API method request of `GET /greeting?greeter={name}`:

```
aws apigateway put-method --rest-api-id te6si5ach7 \
  --region us-west-2 \
  --resource-id 2jf6xt \
  --http-method GET \
  --authorization-type "NONE" \
  --request-parameters method.request.querystring.greeter=false
```

The successful response is similar to the following:

```
{
  "apiKeyRequired": false,
  "httpMethod": "GET",
}
```



```
"authorizationType": "NONE",
"requestParameters": {
  "method.request.querystring.greeter": false
}
}
```

This API method allows the client to receive a greeting from the Lambda function at the backend. The `greeter` parameter is optional because the backend should handle either an anonymous caller or a self-identified caller.

5. Call `put-method-response` to set up the 200 OK response to the method request of `GET /greeting?greeter={name}`:

```
aws apigateway put-method-response \
  --region us-west-2 \
  --rest-api-id te6si5ach7 \
  --resource-id 2jf6xt \
  --http-method GET \
  --status-code 200
```

6. Call `put-integration` to set up the integration of the `GET /greeting?greeter={name}` method with a Lambda function, named `HelloWorld`. The function responds to the request with a message of `"Hello, {name}!"`, if the `greeter` parameter is provided, or `"Hello, World!"`, if the query string parameter is not set.

```
aws apigateway put-integration \
  --region us-west-2 \
  --rest-api-id te6si5ach7 \
  --resource-id 2jf6xt \
  --http-method GET \
  --type Amazon \
  --integration-http-method POST \
  --uri arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:123456789012:function:HelloWorld/invocations \
  --request-templates file://path/to/integration-request-template.json \
  --credentials arn:aws:iam::123456789012:role/apigAwsProxyRole
```

Here, the `request-template` parameter value, `file://path/to/integration-request-template.json`, points to a JSON file, named `integration-request-template.json` in the `path/to` directory, which contains a key-value map as a JSON object. The key is a media type of the request payload and the value is a mapping template for the body of the specified content type. In this example, the JSON file contains the following JSON object:

```
{"application/json": "{\"greeter\": \"${input.params('greeter')}\"}"}
```

The mapping template supplied here translates the `greeter` query string parameter to the `greeter` property of the JSON payload. This is necessary because input to a Lambda function in the Lambda function must be expressed in the body. You could use JSON string of the map (for example, `"{\"greeter\": \"'john'\"}"`) as the `request-template` input value to the `put-integration` command. However, using the file input avoids the difficult, and sometimes impossible, quote-escaping that is required to stringify a JSON object.

### Important

For Lambda integrations, you must use the HTTP method of `POST` for the integration request, according to the [specification of the Lambda service action for function invocations](#). The `uri` parameter is the ARN of the function-invoking action.

Successful output is similar to the following:

```
{
  "passthroughBehavior": "WHEN_NO_MATCH",
  "cacheKeyParameters": [],
  "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:123456789012:function:HelloWorld/invocations",
  "httpMethod": "POST",
  "requestTemplates": {
    "application/json": "{\"greeter\":\"$input.params('greeter')\"}"
  },
  "cacheNamespace": "krznpq9xpg",
  "credentials": "arn:aws:iam::123456789012:role/apigAwsProxyRole",
  "type": "AWS"
}
```

The IAM role of `apigAwsProxyRole` must have policies that allow the `apigateway` service to invoke Lambda functions. Instead of supplying an IAM role for `credentials`, you can call the [add-permission](#) command to add resource-based permissions. This is how the API Gateway console adds these permissions.

7. Call `put-integration-response` to set up the integration response to pass the Lambda function output to the client as the 200 OK method response.

```
aws apigateway put-integration-response \
  --region us-west-2 \
  --rest-api-id te6si5ach7 \
  --resource-id 2jff6xt \
  --http-method GET \
  --status-code 200 \
  --selection-pattern ""
```

By setting the `selection-pattern` to an empty string, the 200 OK response is the default.

The successful response should be similar to the following:

```
{
  "selectionPattern": "",
  "statusCode": "200"
}
```

8. Call `create-deployment` to deploy the API to a test stage:

```
aws apigateway create-deployment --rest-api-id te6si5ach7 --stage-name test
```

9. Test the API using the following cURL command in a terminal:

```
curl -X GET 'https://te6si5ach7.execute-api.us-west-2.amazonaws.com/test/greeting?greeter=me' \
  -H 'authorization: AWS4-HMAC-SHA256 Credential={access_key}/20171020/us-west-2/execute-api/aws4_request, SignedHeaders=content-type;host;x-amz-date, Signature=f327...5751'
```

## Set up asynchronous invocation of the backend Lambda function

In Lambda non-proxy (custom) integration, the backend Lambda function is invoked synchronously by default. This is the desired behavior for most REST API operations. Some applications, however, require work to be performed asynchronously (as a batch operation or a long-latency operation), typically by a

separate backend component. In this case, the backend Lambda function is invoked asynchronously, and the front-end REST API method doesn't return the result.

You can configure the Lambda function for a Lambda non-proxy integration to be invoked asynchronously by specifying 'Event' as the [Lambda invocation type](#). This is done as follows:

### Configure Lambda asynchronous invocation in the API Gateway console

For all invocations to be asynchronous:

- In **Integration Request**, add an `X-Amz-Invocation-Type` header with a static value of 'Event'.

For clients to decide if invocations are asynchronous or synchronous:

1. In **Method Request**, add an `InvocationType` header.
2. In **Integration Request** add an `X-Amz-Invocation-Type` header with a mapping expression of `method.request.header.InvocationType`.
3. Clients can include the `InvocationType: Event` header in API requests for asynchronous invocations or `InvocationType: RequestResponse` for synchronous invocations.

## Handle Lambda errors in API Gateway

For Lambda custom integrations, you must map errors returned by Lambda in the integration response to standard HTTP error responses for your clients. Otherwise, Lambda errors are returned as 200 OK responses by default and the result is not intuitive for your API users.

There are two types of errors that Lambda can return: standard errors and custom errors. In your API, you must handle these differently.

With the Lambda proxy integration, Lambda is required to return an output of the following format:

```
{
  "isBase64Encoded" : "boolean",
  "statusCode": "number",
  "headers": { ... },
  "body": "JSON string"
}
```

In this output, `statusCode` is typically 4XX for a client error and 5XX for a server error. API Gateway handles these errors by mapping the Lambda error to an HTTP error response, according to the specified `statusCode`. For API Gateway to pass the error type (for example, `InvalidParameterException`), as part of the response to the client, the Lambda function must include a header (for example, `"X-Amzn-ErrorType": "InvalidParameterException"`) in the `headers` property.

### Topics

- [Handle standard Lambda errors in API Gateway \(p. 300\)](#)
- [Handle custom Lambda errors in API Gateway \(p. 302\)](#)

## Handle standard Lambda errors in API Gateway

A standard Amazon Lambda error has the following format:

```
{
  "errorMessage": "<replaceable>string</replaceable>",
  "errorType": "<replaceable>string</replaceable>",
  "stackTrace": [
    "<replaceable>string</replaceable>",
  ]
}
```

```
    ] ...
  }
}
```

Here, `errorMessage` is a string expression of the error. The `errorType` is a language-dependent error or exception type. The `stackTrace` is a list of string expressions showing the stack trace leading to the occurrence of the error.

For example, consider the following JavaScript (Node.js) Lambda function.

```
exports.handler = function(event, context, callback) {
  callback(new Error("Malformed input ..."));
};
```

This function returns the following standard Lambda error, containing `Malformed input ...` as the error message:

```
{
  "errorMessage": "Malformed input ...",
  "errorType": "Error",
  "stackTrace": [
    "exports.handler (/var/task/index.js:3:14)"
  ]
}
```

Similarly, consider the following Python Lambda function, which raises an `Exception` with the same `Malformed input ...` error message.

```
def lambda_handler(event, context):
    raise Exception('Malformed input ...')
```

This function returns the following standard Lambda error:

```
{
  "stackTrace": [
    [
      "/var/task/lambda_function.py",
      3,
      "lambda_handler",
      "raise Exception('Malformed input ...')"
    ]
  ],
  "errorType": "Exception",
  "errorMessage": "Malformed input ..."
}
```

Note that the `errorType` and `stackTrace` property values are language-dependent. The standard error also applies to any error object that is an extension of the `Error` object or a subclass of the `Exception` class.

To map the standard Lambda error to a method response, you must first decide on an HTTP status code for a given Lambda error. You then set a regular expression pattern on the `selectionPattern` property of the `IntegrationResponse` associated with the given HTTP status code. In the API Gateway console, this `selectionPattern` is denoted as **Lambda Error Regex** in the **Integration Response** configuration editor.

**Note**

API Gateway uses Java pattern-style regexes for response mapping. For more information, see [Pattern](#) in the Oracle documentation.

For example, to set up a new `selectionPattern` expression, using Amazon CLI, call the following [put-integration-response](#) command:

```
aws apigateway put-integration-response --rest-api-id z0vprf0mdh --resource-id x3o5ih --http-method GET --status-code 400 --selection-pattern "Invalid*" --region us-west-2
```

Make sure that you also set up the corresponding error code (400) on the [method response](#) (p. 232). Otherwise, API Gateway throws an invalid configuration error response at runtime.

#### Note

At runtime, API Gateway matches the Lambda error's `errorMessage` against the pattern of the regular expression on the `selectionPattern` property. If there is a match, API Gateway returns the Lambda error as an HTTP response of the corresponding HTTP status code. If there is no match, API Gateway returns the error as a default response or throws an invalid configuration exception if no default response is configured.

Setting the `selectionPattern` value to `.*` for a given response amounts to resetting this response as the default response. This is because such a selection pattern will match all error messages, including null, i.e., any unspecified error message. The resulting mapping overrides the default mapping.

To update an existing `selectionPattern` value using the Amazon CLI, call the [update-integration-response](#) operation to replace the `/selectionPattern` path value with the specified regex expression of the `Malformed*` pattern.

To set the `selectionPattern` expression using the API Gateway console, type the expression in the **Lambda Error Regex** text box when setting up or updating an integration response of a specified HTTP status code.

### Handle custom Lambda errors in API Gateway

Instead of the standard error described in the preceding section, Amazon Lambda allows you to return a custom error object as JSON string. The error can be any valid JSON object. For example, the following JavaScript (Node.js) Lambda function returns a custom error:

```
exports.handler = (event, context, callback) => {
  ...
  // Error caught here:
  var myErrorObj = {
    errorType : "InternalServerError",
    httpStatus : 500,
    requestId : context.awsRequestId,
    trace : {
      "function": "abc()",
      "line": 123,
      "file": "abc.js"
    }
  }
  callback(JSON.stringify(myErrorObj));
};
```

You must turn the `myErrorObj` object into a JSON string before calling `callback` to exit the function. Otherwise, the `myErrorObj` is returned as a string of `"[object Object]"`. When a method of your API is integrated with the preceding Lambda function, API Gateway receives an integration response with the following payload:

```
{
  "errorMessage": "{\"errorType\":\"InternalServerError\",\"httpStatus\":500,\"requestId\": \"e5849002-39a0-11e7-a419-5bb5807c9fb2\", \"trace\":{\"function\":\"abc()\", \"line\":123, \"file\":\"abc.js\"}}"
```

As with any integration response, you can pass through this error response as-is to the method response. Or you can have a body-mapping template to transform the payload into a different format. For example, consider the following body-mapping template for a method response of 500 status code:

```
{
  errorMessage: $input.path('$.errorMessage');
}
```

This template translates the integration response body that contains the custom error JSON string to the following method response body. This method response body contains the custom error JSON object:

```
{
  "errorMessage" : {
    errorType : "InternalServerError",
    httpStatus : 500,
    requestId : context.awsRequestId,
    trace : {
      "function": "abc()",
      "line": 123,
      "file": "abc.js"
    }
  }
};
```

Depending on your API requirements, you may need to pass some or all of the custom error properties as method response header parameters. You can achieve this by applying the custom error mappings from the integration response body to the method response headers.

For example, the following OpenAPI extension defines a mapping from the `errorMessage.errorType`, `errorMessage.httpStatus`, `errorMessage.trace.function`, and `errorMessage.trace` properties to the `error_type`, `error_status`, `error_trace_function`, and `error_trace` headers, respectively.

```
"x-amazon-apigateway-integration": {
  "responses": {
    "default": {
      "statusCode": "200",
      "responseParameters": {
        "method.response.header.error_trace_function":
        "integration.response.body.errorMessage.trace.function",
        "method.response.header.error_status":
        "integration.response.body.errorMessage.httpStatus",
        "method.response.header.error_type":
        "integration.response.body.errorMessage.errorType",
        "method.response.header.error_trace":
        "integration.response.body.errorMessage.trace"
      },
      ...
    }
  }
}
```

At runtime, API Gateway deserializes the `integration.response.body` parameter when performing header mappings. However, this deserialization applies only to body-to-header mappings for Lambda custom error responses and does not apply to body-to-body mappings using `$input.body`. With these custom-error-body-to-header mappings, the client receives the following headers as part of the method response, provided that the `error_status`, `error_trace`, `error_trace_function`, and `error_type` headers are declared in the method request.

```
"error_status": "500",
```

```
"error_trace": "{\"function\": \"abc()\", \"line\": 123, \"file\": \"abc.js\"},  
\"error_trace_function\": \"abc()\",  
\"error_type\": \"InternalServerError\"
```

The `errorMessage.trace` property of the integration response body is a complex property. It is mapped to the `error_trace` header as a JSON string.

## Set up HTTP integrations in API Gateway

You can integrate an API method with an HTTP endpoint using the HTTP proxy integration or the HTTP custom integration.

API Gateway supports the following endpoint ports: 80, 443 and 1024-65535.

With proxy integration, setup is simple. You only need to set the HTTP method and the HTTP endpoint URI, according to the backend requirements, if you are not concerned with content encoding or caching.

With custom integration, setup is more involved. In addition to the proxy integration setup steps, you need to specify how the incoming request data is mapped to the integration request and how the resulting integration response data is mapped to the method response.

### Topics

- [Set up HTTP proxy integrations in API Gateway \(p. 304\)](#)
- [Set up HTTP custom integrations in API Gateway \(p. 308\)](#)

## Set up HTTP proxy integrations in API Gateway

To set up a proxy resource with the HTTP proxy integration type, create an API resource with a greedy path parameter (for example, `/parent/{proxy+}`) and integrate this resource with an HTTP backend endpoint (for example, `https://petstore-demo-endpoint.execute-api.com/petstore/{proxy}`) on the ANY method. The greedy path parameter must be at the end of the resource path.

As with a non-proxy resource, you can set up a proxy resource with the HTTP proxy integration by using the API Gateway console, importing an OpenAPI definition file, or calling the API Gateway REST API directly. For detailed instructions about using the API Gateway console to configure a proxy resource with the HTTP integration, see [Tutorial: Build a REST API with HTTP proxy integration \(p. 46\)](#).

The following OpenAPI definition file shows an example of an API with a proxy resource that is integrated with the [PetStore](#) website.

### OpenAPI 3.0

```
{  
  "openapi": "3.0.0",  
  "info": {  
    "version": "2016-09-12T23:19:28Z",  
    "title": "PetStoreWithProxyResource"  
  },  
  "paths": {  
    "/{proxy+}": {  
      "x-amazon-apigateway-any-method": {  
        "parameters": [  
          {  
            "name": "proxy",  
            "in": "path",  
            "required": true,  
            "schema": {  
              "type": "string"  
            }  
          }  
        ]  
      }  
    }  
  }  
}
```

```

    ],
    "responses": {},
    "x-amazon-apigateway-integration": {
      "responses": {
        "default": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.path.proxy": "method.request.path.proxy"
      },
      "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/{proxy}",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "ANY",
      "cacheNamespace": "rbftud",
      "cacheKeyParameters": [
        "method.request.path.proxy"
      ],
      "type": "http_proxy"
    }
  }
},
"servers": [
  {
    "url": "https://4z9giyi2c1.execute-api.us-east-1.amazonaws.com/{basePath}",
    "variables": {
      "basePath": {
        "default": "/test"
      }
    }
  }
]
}

```

## OpenAPI 2.0

```

{
  "swagger": "2.0",
  "info": {
    "version": "2016-09-12T23:19:28Z",
    "title": "PetStoreWithProxyResource"
  },
  "host": "4z9giyi2c1.execute-api.us-east-1.amazonaws.com",
  "basePath": "/test",
  "schemes": [
    "https"
  ],
  "paths": {
   ("/{proxy+}"): {
      "x-amazon-apigateway-any-method": {
        "produces": [
          "application/json"
        ],
        "parameters": [
          {
            "name": "proxy",
            "in": "path",
            "required": true,
            "type": "string"
          }
        ]
      },
      "responses": {},
      "x-amazon-apigateway-integration": {
        "responses": {

```



```
        "default": {  
            "statusCode": "200"  
        },  
        "requestParameters": {  
            "integration.request.path.proxy": "method.request.path.proxy"  
        },  
        "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/{proxy}",  
        "passthroughBehavior": "when_no_match",  
        "httpMethod": "ANY",  
        "cacheNamespace": "rbftud",  
        "cacheKeyParameters": [  
            "method.request.path.proxy"  
        ],  
        "type": "http_proxy"  
    }  
}
```

In this example, a cache key is declared on the `method.request.path.proxy` path parameter of the proxy resource. This is the default setting when you create the API using the API Gateway console. The API's base path (`/test`, corresponding to a stage) is mapped to the website's PetStore page (`/petstore`). The single integration request mirrors the entire PetStore website using the API's greedy path variable and the catch-all `ANY` method. The following examples illustrate this mirroring.

- **Set ANY as GET and {proxy+} as pets**

Method request initiated from the frontend:

```
GET https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/pets HTTP/1.1
```

Integration request sent to the backend:

```
GET http://petstore-demo-endpoint.execute-api.com/petstore/pets HTTP/1.1
```

The run-time instances of the `ANY` method and proxy resource are both valid. The call returns a 200 OK response with the payload containing the first batch of pets, as returned from the backend.

- **Set ANY as GET and {proxy+} as pets?type=dog**

```
GET https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/pets?type=dog HTTP/1.1
```

Integration request sent to the backend:

```
GET http://petstore-demo-endpoint.execute-api.com/petstore/pets?type=dog HTTP/1.1
```

The run-time instances of the `ANY` method and proxy resource are both valid. The call returns a 200 OK response with the payload containing the first batch of specified dogs, as returned from the backend.

- **Set ANY as GET and {proxy+} as pets/{petId}**

Method request initiated from the frontend:

```
GET https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/pets/1 HTTP/1.1
```

Integration request sent to the backend:

```
GET http://petstore-demo-endpoint.execute-api.com/petstore/pets/1 HTTP/1.1
```

The run-time instances of the ANY method and proxy resource are both valid. The call returns a 200 OK response with the payload containing the specified pet, as returned from the backend.

- **Set ANY as POST and {proxy+} as pets**

Method request initiated from the frontend:

```
POST https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/pets HTTP/1.1
Content-Type: application/json
Content-Length: ...

{
  "type" : "dog",
  "price" : 1001.00
}
```

Integration request sent to the backend:

```
POST http://petstore-demo-endpoint.execute-api.com/petstore/pets HTTP/1.1
Content-Type: application/json
Content-Length: ...

{
  "type" : "dog",
  "price" : 1001.00
}
```

The run-time instances of the ANY method and proxy resource are both valid. The call returns a 200 OK response with the payload containing the newly created pet, as returned from the backend.

- **Set ANY as GET and {proxy+} as pets/cat**

Method request initiated from the frontend:

```
GET https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test/pets/cat
```

Integration request sent to the backend:

```
GET http://petstore-demo-endpoint.execute-api.com/petstore/pets/cat
```

The run-time instance of the proxy resource path does not correspond to a backend endpoint and the resulting request is invalid. As a result, a 400 Bad Request response is returned with the following error message.

```
{
  "errors": [
    {
      "key": "Pet2.type",
      "message": "Missing required field"
    },
    {
      "key": "Pet2.price",
      "message": "Missing required field"
    }
  ]
}
```

```
]
}
```

- **Set ANY as GET and {proxy+} as null**

Method request initiated from the frontend:

```
GET https://4z9giyi2c1.execute-api.us-west-2.amazonaws.com/test
```

Integration request sent to the backend:

```
GET http://petstore-demo-endpoint.execute-api.com/petstore/pets
```

The targeted resource is the parent of the proxy resource, but the run-time instance of the ANY method is not defined in the API on that resource. As a result, this GET request returns a 403 Forbidden response with the Missing Authentication Token error message as returned by API Gateway. If the API exposes the ANY or GET method on the parent resource (/), the call returns a 404 Not Found response with the Cannot GET /petstore message as returned from the backend.

For any client request, if the targeted endpoint URL is invalid or the HTTP verb is valid but not supported, the backend returns a 404 Not Found response. For an unsupported HTTP method, a 403 Forbidden response is returned.

## Set up HTTP custom integrations in API Gateway

With the HTTP custom integration, you have more control of which data to pass between an API method and an API integration and how to pass the data. You do this using data mappings.

As part of the method request setup, you set the [requestParameters](#) property on a [Method](#) resource. This declares which method request parameters, which are provisioned from the client, are to be mapped to integration request parameters or applicable body properties before being dispatched to the backend. Then, as part of the integration request setup, you set the [requestParameters](#) property on the corresponding [Integration](#) resource to specify the parameter-to-parameter mappings. You also set the [requestTemplates](#) property to specify mapping templates, one for each supported content type. The mapping templates map method request parameters, or body, to the integration request body.

Similarly, as part of the method response setup, you set the [responseParameters](#) property on the [MethodResponse](#) resource. This declares which method response parameters, to be dispatched to the client, are to be mapped from integration response parameters or certain applicable body properties that were returned from the backend. Then, as part of the integration response setup, you set the [responseParameters](#) property on the corresponding [IntegrationResponse](#) resource to specify the parameter-to-parameter mappings. You also set the [responseTemplates](#) map to specify mapping templates, one for each supported content type. The mapping templates map integration response parameters, or integration response body properties, to the method response body.

For more information about setting up mapping templates, see [Setting up data transformations for REST APIs \(p. 330\)](#).

## Set up API Gateway private integrations

The API Gateway private integration makes it simple to expose your HTTP/HTTPS resources within an Amazon VPC for access by clients outside of the VPC. To extend access to your private VPC resources beyond the VPC boundaries, you can create an API with private integration. You can control access to your API by using any of the [authorization methods \(p. 236\)](#) that API Gateway supports.

To create a private integration, you must first create a Network Load Balancer. Your Network Load Balancer must have a [listener](#) that routes requests to resources in your VPC. To improve the availability

of your API, ensure that your Network Load Balancer routes traffic to resources in more than one Availability Zone in the Amazon Web Services Region. Then, you create a VPC link that you use to connect your API and your Network Load Balancer. After you create a VPC link, you create private integrations to route traffic from your API to resources in your VPC through your VPC link and Network Load Balancer.

**Note**

The Network Load Balancer and API must be owned by the same Amazon account.

With the API Gateway private integration, you can enable access to HTTP/HTTPS resources within a VPC without detailed knowledge of private network configurations or technology-specific appliances.

**Topics**

- [Set up a Network Load Balancer for API Gateway private integrations \(p. 309\)](#)
- [Grant permissions to create a VPC link \(p. 309\)](#)
- [Set up an API Gateway API with private integrations using the API Gateway console \(p. 310\)](#)
- [Set up an API Gateway API with private integrations using the Amazon CLI \(p. 310\)](#)
- [Set up API with private integrations using OpenAPI \(p. 313\)](#)
- [API Gateway accounts used for private integrations \(p. 315\)](#)

## Set up a Network Load Balancer for API Gateway private integrations

The following procedure outlines the steps to set up a Network Load Balancer (NLB) for API Gateway private integrations using the Amazon EC2 console and provides references for detailed instructions for each step.

For each VPC you have resources in, you only need to configure one NLB and one VPCLink. The NLB supports multiple [listeners](#) and [target groups](#) per NLB. You can configure each service as a specific listener on the NLB and use a single VPCLink to connect to the NLB. When creating the private integration in API Gateway you then define each service using the specific port that is assigned for each service. For more information, see [the section called "Tutorial: Build an API with private integration" \(p. 71\)](#).

**Note**

The Network Load Balancer and API must be owned by the same Amazon account.

### To create a Network Load Balancer for private integration using the API Gateway console

1. Sign in to the Amazon Web Services Management Console and open the Amazon EC2 console at <https://console.amazonaws.cn/ec2/>.
2. Set up a web server on an Amazon EC2 instance. For an example setup, see [Installing a LAMP Web Server on Amazon Linux](#).
3. Create a Network Load Balancer, register the EC2 instance with a target group, and add the target group to a listener of the Network Load Balancer. For details, follow the instructions in [Getting Started with Network Load Balancers](#).

After the Network Load Balancer is created, note its ARN. You will need it to create a VPC link in API Gateway for integrating the API with the VPC resources behind the Network Load Balancer.

## Grant permissions to create a VPC link

For you or a user in your account to create and maintain a VPC link, you or the user must have permissions to create, delete, and view VPC endpoint service configurations, change VPC endpoint service permissions, and examine load balancers. To grant such permissions, use the following steps.

## To grant permissions to create and update a VpcLink

1. Create an IAM policy similar to the following:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "ec2:CreateVpcEndpointServiceConfiguration",
        "ec2:DeleteVpcEndpointServiceConfigurations",
        "ec2:DescribeVpcEndpointServiceConfigurations",
        "ec2:ModifyVpcEndpointServicePermissions"
      ],
      "Resource": "*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "elasticloadbalancing:DescribeLoadBalancers"
      ],
      "Resource": "*"
    }
  ]
}
```

2. Create or choose an IAM role and attach the preceding policy to the role.
3. Assign the IAM role to you or a user in your account who is creating VPC links.

## Set up an API Gateway API with private integrations using the API Gateway console

For instructions using the API Gateway Console to set up an API with private integration, see [Tutorial: Build a REST API with API Gateway private integration \(p. 71\)](#).

## Set up an API Gateway API with private integrations using the Amazon CLI

Before creating an API with the private integration, you must have your VPC resource set up and a Network Load Balancer created and configured with your VPC source as the target. If the requirements are not met, follow [Set up a Network Load Balancer for API Gateway private integrations \(p. 309\)](#) to install the VPC resource, create a Network Load Balancer, and set the VPC resource as a target of the Network Load Balancer.

### Note

The Network Load Balancer and API must be owned by the same Amazon account.

For you to be able to create and manage a `VpcLink`, you must also have the appropriate permissions configured. For more information, see [Grant permissions to create a VPC link \(p. 309\)](#).

### Note

You only need the permissions to create a `VpcLink` in your API. You do not need the permissions to use the `VpcLink`.

After the Network Load Balancer is created, note its ARN. You need it to create a VPC link for the private integration.

## To set up an API with the private integration using Amazon CLI

1. Create a `VpcLink` targeting the specified Network Load Balancer.

For this discussion, we assume the ARN of the Network Load Balancer is `arn:aws:elasticloadbalancing:us-east-1:123456789012:loadbalancer/net/my-vpclink-test-nlb/1f8df693cd094a72`.

```
aws apigateway create-vpc-link \  
  --name my-test-vpc-link \  
  --target-arns arn:aws:elasticloadbalancing:us-east-1:123456789012:loadbalancer/net/  
my-vpclink-test-nlb/1f8df693cd094a72
```

The preceding command immediately returns the following response, acknowledging the receipt of the request, and showing the `PENDING` status for the `VpcLink` being created.

```
{  
  "status": "PENDING",  
  "targetArns": [  
    "arn:aws:elasticloadbalancing:us-east-1:123456789012:loadbalancer/net/my-  
vpclink-test-nlb/1f8df693cd094a72"  
  ],  
  "id": "gim7c3",  
  "name": "my-test-vpc-link"  
}
```

It takes 2-4 minutes for API Gateway to finish creating the `VpcLink`. When the operation finishes successfully, the `status` is `AVAILABLE`. You can verify this by calling the following CLI command:

```
aws apigateway get-vpc-link --vpc-link-id gim7c3
```

If the operation fails, you get a `FAILED` status, with the `statusMessage` containing the error message. For example, if you attempt to create a `VpcLink` with a Network Load Balancer that is already associated with a VPC endpoint, you get the following on the `statusMessage` property:

```
"NLB is already associated with another VPC Endpoint Service"
```

Only after the `VpcLink` is created successfully are we ready to create the API and integrate it with the VPC resource through the `VpcLink`.

Note the `id` value of the newly created `VpcLink` (`gim7c3` in the preceding output). You need it to set up the private integration.

2. Set up an API by creating an API Gateway `RestApi` resource:

```
aws apigateway create-rest-api --name 'My VPC Link Test'
```

We have dropped the input parameters of `endpoint-url` and `region` to use the default region as specified in the Amazon configuration.

Note the `RestApi`'s `id` value in the returned result. In this example, we assume it is `abcdef123`. You need this value to perform further operations on the API, including setting up methods and integrations.

For illustration purposes, we will create an API with only a `GET` method on the root resource (`/`) and integrate the method with the `VpcLink`.

3. Set up the `GET /` method. First get the identifier of the root resource (`/`):

```
aws apigateway get-resources --rest-api-id abcdef123
```

In the output, note the `id` value of the `/` path. In this example, we assume it to be `skpp60rab7`.

Set up the method request for the API method of `GET /`:

```
aws apigateway put-method \  
  --rest-api-id abcdef123 \  
  --resource-id skpp60rab7 \  
  --http-method GET \  
  --authorization-type "NONE"
```

To use the IAM permissions, a Lambda authorizer, or an Amazon Cognito user pool to authenticate the caller, set the `authorization-type` to `AWS_IAM`, `CUSTOM`, or `COGNITO_USER_POOLS`, respectively.

If you do not use the proxy integration with the `VpcLink`, you must also set up at least a method response of the 200 status code. We will use the proxy integration here.

4. Set up the private integration of the `HTTP_PROXY` type and call the `put-integration` command as follows:

```
aws apigateway put-integration \  
  --rest-api-id abcdef123 \  
  --resource-id skpp60rab7 \  
  --uri 'http://myApi.example.com' \  
  --http-method GET \  
  --type HTTP_PROXY \  
  --integration-http-method GET \  
  --connection-type VPC_LINK \  
  --connection-id gim7c3
```

For a private integration, you must set `connection-type` to `VPC_LINK` and set `connection-id` to either your `VpcLink`'s identifier or a stage variable referencing your `VpcLink` ID. The `uri` parameter is not used for routing requests to your endpoint, but is used for setting the `Host` header and for certificate validation.

If successful, the command returns the following output:

```
{  
  "passthroughBehavior": "WHEN_NO_MATCH",  
  "timeoutInMillis": 29000,  
  "connectionId": "gim7c3",  
  "uri": "http://myApi.example.com",  
  "connectionType": "VPC_LINK",  
  "httpMethod": "GET",  
  "cacheNamespace": "skpp60rab7",  
  "type": "HTTP_PROXY",  
  "cacheKeyParameters": []  
}
```

Using a stage variable, you set the `connectionId` property when creating the integration:

```
aws apigateway put-integration \  
  --rest-api-id abcdef123 \  
  --resource-id skpp60rab7 \  
  --uri 'http://myApi.example.com' \  
  --http-method GET \  
  --type HTTP_PROXY \  
  --integration-http-method GET \  
  --connection-type VPC_LINK \  
  --connection-id $stage.VPC_LINK_ID
```

```
--connection-id "\${stageVariables.vpcLinkId}"
```

Make sure to double-quote the stage variable expression (`${stageVariables.vpcLinkId}`) and escape the `$` character.

Alternatively, you can update the integration to reset the `connectionId` value with a stage variable:

```
aws apigateway update-integration \  
  --rest-api-id abcdef123 \  
  --resource-id skpp60rab7 \  
  --http-method GET \  
  --patch-operations '[{"op":"replace","path":"/  
connectionId","value":"${stageVariables.vpcLinkId}"}]'
```

Make sure to use a stringified JSON list as the `patch-operations` parameter value.

Using a stage variable to set the `connectionId` value has the advantage of having the same API integrated with different `vpcLinks` by resetting the stage variable value. This is useful for switching your API to a different VPC link to migrate to a different Network Load Balancer or a different VPC.

Because we used the private proxy integration, the API is now ready for deployment and for test runs. With the non-proxy integration, you must also set up the method response and integration response, just as you would when setting up an [API with HTTP custom integrations \(p. 49\)](#).

5. To test the API, deploy the API. This is necessary if you have used the stage variable as a placeholder of the `vpcLink` ID. To deploy the API with a stage variable, call the `create-deployment` command as follows:

```
aws apigateway create-deployment \  
  --rest-api-id abcdef123 \  
  --stage-name test \  
  --variables vpcLinkId=gim7c3
```

To update the stage variable with a different `vpcLink` ID (e.g., `asf9d7`), call the `update-stage` command:

```
aws apigateway update-stage \  
  --rest-api-id abcdef123 \  
  --stage-name test \  
  --patch-operations op=replace,path='/variables/vpcLinkId',value='asf9d7'
```

To test the API, invoke it using the following `cURL` command:

```
curl -X GET https://abcdef123.execute-api.us-east-1.amazonaws.com/test
```

Alternatively, you can type the API's `invoke-URL` in a web browser to view the result.

When you hardcode the `connection-id` property with the `vpcLink` ID literal, you can also call `test-invoke-method` to test invoking the API before it is deployed.

## Set up API with private integrations using OpenAPI

You can set up an API with the private integration by importing the API's OpenAPI file. The settings are similar to the OpenAPI definitions of an API with HTTP integrations, with the following exceptions:

- You must explicitly set `connectionType` to `VPC_LINK`.



- You must explicitly set `connectionId` to the ID of a `VpcLink` or to a stage variable referencing the ID of a `VpcLink`.
- The `uri` parameter in the private integration points to an HTTP/HTTPS endpoint in the VPC, but is used instead to set up the integration request's `Host` header.
- The `uri` parameter in the private integration with an HTTPS endpoint in the VPC is used to verify the stated domain name against the one in the certificate installed on the VPC endpoint.

You can use a stage variable to reference the `VpcLink` ID. Or you can assign the ID value directly to `connectionId`.

The following JSON-formatted OpenAPI file shows an example of an API with a VPC link as referenced by a stage variable (`${stageVariables.vpcLinkId}`):

#### OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "version": "2017-11-17T04:40:23Z",
    "title": "MyApiWithVpcLink"
  },
  "host": "p3wocvip9a.execute-api.us-west-2.amazonaws.com",
  "basePath": "/test",
  "schemes": [
    "https"
  ],
  "paths": {
    "/": {
      "get": {
        "produces": [
          "application/json"
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "schema": {
              "$ref": "#/definitions/Empty"
            }
          }
        }
      },
      "x-amazon-apigateway-integration": {
        "responses": {
          "default": {
            "statusCode": "200"
          }
        },
        "uri": "http://myApi.example.com",
        "passthroughBehavior": "when_no_match",
        "connectionType": "VPC_LINK",
        "connectionId": "${stageVariables.vpcLinkId}",
        "httpMethod": "GET",
        "type": "http_proxy"
      }
    }
  },
  "definitions": {
    "Empty": {
      "type": "object",
      "title": "Empty Schema"
    }
  }
}
```

```
}

```

## API Gateway accounts used for private integrations

The following region-specific API Gateway account IDs are automatically added to your VPC endpoint service as `AllowedPrincipals` when you create a `VpcLink`.

Region	Account ID
cn-north-1	643738280308
cn-northwest-1	020741727910

## Set up mock integrations in API Gateway

Amazon API Gateway supports mock integrations for API methods. This feature enables API developers to generate API responses from API Gateway directly, without the need for an integration backend. As an API developer, you can use this feature to unblock dependent teams that need to work with an API before the project development is complete. You can also use this feature to provision a landing page for your API, which can provide an overview of and navigation to your API. For an example of such a landing page, see the integration request and response of the GET method on the root resource of the example API discussed in [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

As an API developer, you decide how API Gateway responds to a mock integration request. For this, you configure the method's integration request and integration response to associate a response with a given status code. For a method with the mock integration to return a 200 response, configure the integration request body mapping template to return the following.

```
{"statusCode": 200}
```

Configure a 200 integration response to have the following body mapping template, for example:

```
{
  "statusCode": 200,
  "message": "Go ahead without me."
}
```

Similarly, for the method to return, for example, a 500 error response, set up the integration request body mapping template to return the following.

```
{"statusCode": 500}
```

Set up a 500 integration response with, for example, the following mapping template:

```
{
  "statusCode": 500,
  "message": "The invoked method is not supported on the API resource."
}
```

Alternatively, you can have a method of the mock integration return the default integration response without defining the integration request mapping template. The default integration response is the one with an undefined **HTTP status regex**. Make sure appropriate passthrough behaviors are set.

### Note

Mock integrations aren't intended to support large response templates. If you need them for your use case, you should consider using a Lambda integration instead.

Using an integration request mapping template, you can inject application logic to decide which mock integration response to return based on certain conditions. For example, you could use a `scope` query parameter on the incoming request to determine whether to return a successful response or an error response:

```
{
  #if( $input.params('scope') == "internal" )
    "statusCode": 200
  #else
    "statusCode": 500
  #end
}
```

This way, the method of the mock integration lets internal calls to go through while rejecting other types of calls with an error response.

In this section, we describe how to use the API Gateway console to enable the mock integration for an API method.

### Topics

- [Enable mock integration using the API Gateway console \(p. 316\)](#)

## Enable mock integration using the API Gateway console

You must have the method available in API Gateway. Follow the instructions in [Tutorial: Build a REST API with HTTP non-proxy integration \(p. 49\)](#).

1. Choose an API resource and create a method. In the method **Setup** pane, choose **Mock** for **Integration type**, and then choose **Save**.
2. Choose **Method Request** from **Method Execution**. Expand **URL Query String Parameters**. Choose **Add query string** to add a `scope` query parameter. This determines if the caller is internal or otherwise.
3. From **Method Execution**, choose **Method Response**.
4. Under **HTTP Status**, add **500**.
5. Choose **Integration Request** from **Method Execution**. Expand **Mapping Templates**. Choose or add an **application/json** mapping template. Enter the following in the template editor:

```
{
  #if( $input.params('scope') == "internal" )
    "statusCode": 200
  #else
    "statusCode": 500
  #end
}
```

Choose **Save**.

6. Choose **Integration Response** from **Method Execution**. Expand the **200** response and then the **Mapping Templates** section. Choose or add an **application/json** mapping template and enter the following response body mapping template in the template editor.

```
{
  "statusCode": 200,
```

```
"message": "Go ahead without me"
}
```

Choose **Save**.

7. Choose **Add integration response** to add a 500 response. Enter `5\d{2}` in **HTTP status regex**. For **Method response status**, choose **500**, and then choose **Save**.
8. Expand `5\d{2}` and then expand **Mapping Templates** and choose **Add mapping template**. Enter `application/json` for **Content-Type** and then choose the check mark icon to save the setting. In the template editor, enter the following integration response body mapping template:

```
{
  "statusCode": 500,
  "message": "The invoked method is not supported on the API resource."
}
```

Choose **Save**.

9. Choose **Test** from **Method Execution**. Do the following:
  - a. Enter `scope=internal` under **Query Strings**. Choose **Test**. The test result shows:

```
Request: /?scope=internal
Status: 200
Latency: 26 ms
Response Body
{
  "statusCode": 200,
  "message": "Go ahead without me"
}
Response Headers
{"Content-Type":"application/json"}
```

- b. Enter `scope=public` under **Query Strings** or leave it blank. Choose **Test**. The test result shows:

```
Request: /
Status: 500
Latency: 16 ms
Response Body
{
  "statusCode": 500,
  "message": "The invoked method is not supported on the API resource."
}
Response Headers
{"Content-Type":"application/json"}
```

You can also return headers in a mock integration response by first adding a header to the method response and then setting up a header mapping in the integration response. In fact, this is how the API Gateway console enables CORS support by returning CORS required headers.

## Enable request validation in API Gateway

You can configure API Gateway to perform basic validation of an API request before proceeding with the integration request. When the validation fails, API Gateway immediately fails the request, returns a 400 error response to the caller, and publishes the validation results in CloudWatch Logs. This reduces unnecessary calls to the backend. More importantly, it lets you focus on the validation efforts specific to your application.

### Topics

- [Overview of basic request validation in API Gateway \(p. 318\)](#)
- [Set up basic request validation in API Gateway \(p. 318\)](#)
- [Test basic request validation in API Gateway \(p. 324\)](#)
- [OpenAPI definitions of a sample API with basic request validation \(p. 327\)](#)

## Overview of basic request validation in API Gateway

API Gateway can perform the basic validation. This enables you, the API developer, to focus on app-specific deep validation in the backend. For the basic validation, API Gateway verifies either or both of the following conditions:

- The required request parameters in the URI, query string, and headers of an incoming request are included and non-blank.
- The applicable request payload adheres to the configured [JSON schema request model \(p. 336\)](#) of the method.

To enable basic validation, you specify validation rules in a [request validator](#), add the validator to the API's [map of request validators](#), and assign the validator to individual API methods.

### Note

Request body validation and [request body passthrough \(p. 362\)](#) are two separate issues. When a request payload cannot be validated because no model schema can be matched, you can choose to passthrough or block the original payload.

For example, when you enable request validation with a mapping template for the `application/json` media type, you might want to pass an XML payload through to the backend even though the enabled request validation will fail. This might be the case if you expect to support the XML payload on the method in the future. To fail the request with an XML payload, you must explicitly choose the `NEVER` option for the content passthrough behavior.

## Set up basic request validation in API Gateway

You can set up request validators in an API's OpenAPI definition file and then import the OpenAPI definitions into API Gateway. You can also set them up in the API Gateway console or by calling the API Gateway REST API, the Amazon CLI, or one of the Amazon SDKs. Here, we show how to do this with an OpenAPI file, in the console, and using the API Gateway REST API.

### Topics

- [Set up basic request validation by importing OpenAPI definition \(p. 318\)](#)
- [Set up request validators using the API Gateway REST API \(p. 322\)](#)
- [Set up basic request validation using the API Gateway console \(p. 323\)](#)

## Set up basic request validation by importing OpenAPI definition

The following steps describe how to enable basic request validation by importing an OpenAPI file.

## To enable request validation by importing an OpenAPI file into API Gateway

1. Declare request validators in OpenAPI by specifying a set of the [x-amazon-apigateway-request-validators.requestValidator object \(p. 707\)](#) objects in the [x-amazon-apigateway-request-validators object \(p. 706\)](#) map at the API level. For example, the [sample API OpenAPI file \(p. 327\)](#) contains the `x-amazon-apigateway-request-validators` map, with the validators' names as the keys.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "title": "ReqValidation Sample",
    "version": "1.0.0"
  },
  "servers": [
    {
      "url": "{basePath}",
      "variables": {
        "basePath": {
          "default": "/v1"
        }
      }
    }
  ],
  "x-amazon-apigateway-request-validators": {
    "all": {
      "validateRequestBody": true,
      "validateRequestParameters": true
    },
    "params-only": {
      "validateRequestBody": false,
      "validateRequestParameters": true
    }
  }
}
```

### OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "title": "ReqValidation Sample",
    "version": "1.0.0"
  },
  "schemes": [
    "https"
  ],
  "basePath": "/v1",
  "produces": [
    "application/json"
  ],
  "x-amazon-apigateway-request-validators" : {
    "all" : {
      "validateRequestBody" : true,
      "validateRequestParameters" : true
    },
    "params-only" : {
      "validateRequestBody" : false,
      "validateRequestParameters" : true
    }
  }
},
...
```

```
}  
}
```

You select a validator's name when enabling the validator on the API or on a method, as shown in the next step.

2. To enable a request validator on all methods of an API, specify an `x-amazon-apigateway-request-validator` property (p. 705) property at the API level of the OpenAPI definition file. To enable a request validator on an individual method, specify the `x-amazon-apigateway-request-validator` property at the method level. For example, the following `x-amazon-apigateway-request-validator` property enables the `params-only` validator on all API methods, unless otherwise overridden.

#### OpenAPI 3.0

```
{  
  "openapi": "3.0.0",  
  "info": {  
    "title": "ReqValidation Sample",  
    "version": "1.0.0"  
  },  
  "servers": [  
    {  
      "url": "{basePath}",  
      "variables": {  
        "basePath": {  
          "default": "/v1"  
        }  
      }  
    }  
  ],  
  "x-amazon-apigateway-request-validator": "params-only",  
  ...  
}
```

#### OpenAPI 2.0

```
{  
  "swagger": "2.0",  
  "info": {  
    "title": "ReqValidation Sample",  
    "version": "1.0.0"  
  },  
  "schemes": [  
    "https"  
  ],  
  "basePath": "/v1",  
  "produces": [  
    "application/json"  
  ],  
  ...  
  "x-amazon-apigateway-request-validator" : "params-only",  
  ...  
}
```

To enable a request validator on an individual method, specify the `x-amazon-apigateway-request-validator` property at the method level. For example, the following `x-amazon-apigateway-request-validator` property enables the `all` validator on the `POST /validation` method. This overrides the `params-only` validator that is inherited from the API.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "title": "ReqValidation Sample",
    "version": "1.0.0"
  },
  "servers": [
    {
      "url": "{basePath}",
      "variables": {
        "basePath": {
          "default": "/v1"
        }
      }
    }
  ],
  "paths": {
    "/validation": {
      "post": {
        "x-amazon-apigateway-request-validator": "all",
        ...
      }
    }
  }
  ...
}
```

### OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "title": "ReqValidation Sample",
    "version": "1.0.0"
  },
  "schemes": [
    "https"
  ],
  "basePath": "/v1",
  "produces": [
    "application/json"
  ],
  ...
  "paths": {
    "/validation": {
      "post": {
        "x-amazon-apigateway-request-validator" : "all",
        ...
      },
      ...
    }
  }
  ...
}
```

3. In API Gateway, create the API with request validators enabled by importing this [sample OpenAPI definition \(p. 327\)](#):



```
POST /restapis?mode=import&failonwarning=true HTTP/1.1
Content-Type: application/json
Host: apigateway.us-east-1.amazonaws.com
X-Amz-Date: 20170306T234936Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170306/us-east-1/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature={sig4_hash}
```

*Copy the JSON object from this [sample OpenAPI definition \(p. 327\)](#) and paste it here.*

4. Deploy the newly created API (abcdef123) to a specified stage (testStage).

```
POST /restapis/abcdef123/deployments HTTP/1.1
Content-Type: application/json
Host: apigateway.us-east-1.amazonaws.com
X-Amz-Date: 20170306T234936Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170306/us-east-1/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature={sig4_hash}

{
  "stageName" : "testStage",
  "stageDescription" : "Test stage",
  "description" : "First deployment",
  "cacheClusterEnabled" : "false"
}
```

For instructions on how to test the request validation using the API Gateway REST API, see [Test basic request validation using the API Gateway REST API \(p. 324\)](#). For instructions on how to test using the API Gateway console, see [Test basic request validation using the API Gateway console \(p. 326\)](#).

## Set up request validators using the API Gateway REST API

In the API Gateway REST API, a request validator is represented by a [RequestValidator](#) resource. To have an API support the same request validators as the [Sample API \(p. 327\)](#), add to the [RequestValidators](#) collection a parameters-only validator with `params-only` as the key, and add a full validator with `all` as its key.

### To enable the basic request validation using the API Gateway REST API

We assume that you have an API similar to the [sample API \(p. 327\)](#), but have not set up the request validators. If your API already has request validators enabled, call the appropriate `requestvalidator:update` or `method:put` action instead of `requestvalidator:create` or `method:put`.

1. To set up the `params-only` request validator, call the [requestvalidator:create](#) action as follows:

```
POST /restapis/restapi-id/requestvalidators HTTP/1.1
Content-Type: application/json
Host: apigateway.region.amazonaws.com
X-Amz-Date: 20170223T172652Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170223/region/apigateway/
aws4_request, SignedHeaders=content-type;host;x-amz-date, Signature={sig4_hash}

{
  "name" : "params-only",
  "validateRequestBody" : "false",
  "validateRequestParameters" : "true"
}
```

2. To set up the all request validator, call the `requestvalidator:create` action as follows:

```
POST /restapis/restapi-id/requestvalidators HTTP/1.1
Content-Type: application/json
Host: apigateway.region.amazonaws.com
X-Amz-Date: 20170223T172652Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170223/region/apigateway/
aws4_request, SignedHeaders=content-type;host;x-amz-date, Signature={sig4_hash}

{
  "name" : "all",
  "validateRequestBody" : "true",
  "validateRequestParameters" : "true"
}
```

If the preceding validator keys already exist in the `RequestValidators` map, call the [requestvalidator:update](#) action instead to reset the validation rules.

3. To apply the all request validator to the POST method, call [method:put](#) to enable the specified validator (as identified by the `requestValidatorId` property), or call [method:update](#) to update the enabled validator.

```
PUT /restapis/restapi-id/resources/resource-id/methods/POST HTTP/1.1
Content-Type: application/json
Host: apigateway.region.amazonaws.com
X-Amz-Date: 20170223T172652Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170223/region/apigateway/
aws4_request, SignedHeaders=content-type;host;x-amz-date, Signature={sig4_hash}

{
  "authorizationType" : "NONE",
  ...,
  "requestValidatorId" : "all"
}
```

## Set up basic request validation using the API Gateway console

The API Gateway console lets you set up the basic request validation on a method using one of the three validators:

- **Validate body:** This is the body-only validator.
- **Validate query string parameters and headers:** This is the parameters-only validator.
- **Validate body, query string parameters, and headers:** This validator is for both body and parameters validation.

When you choose one of the above validators to enable it on an API method, the API Gateway console adds the validator to the API's [RequestValidators](#) map if the validator has not already been added to the validators map of the API.

### To enable a request validator on a method

1. Sign in to the API Gateway console if you're not already logged in.
2. Create a new or choose an existing API.
3. Create a new or choose an existing resource of the API.
4. Create a new or choose an existing method the resource.
5. Choose **Method Request**.

6. Choose the pencil icon of **Request Validator** under **Settings**.
7. Choose **Validate body**, **Validate query string parameters and headers**, or **Validate body, query string parameters, and headers** from the **Request Validator** drop-down list. Then choose the check mark icon to save your choice.

To test and use the request validator in the console, follow the instructions in [Test basic request validation using the API Gateway console \(p. 326\)](#).

## Test basic request validation in API Gateway

Choose one of the following topics for instructions on testing the basic request validation against the [sample API \(p. 327\)](#).

### Topics

- [Test basic request validation using the API Gateway REST API \(p. 324\)](#)
- [Test basic request validation using the API Gateway console \(p. 326\)](#)

### Test basic request validation using the API Gateway REST API

To see the invocation URL of the deployed API, you can export the API from the stage, making sure to include the `Accept: application/json` or `Accept: application/yaml` header:

```
GET /restapis/abcdef123/stages/testStage/exports/swagger?extensions=validators HTTP/1.1
Accept: application/json
Content-Type: application/json
Host: apigateway.us-east-1.amazonaws.com
X-Amz-Date: 20170306T234936Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20170306/us-east-1/apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date, Signature={sig4_hash}
```

You can ignore the `?extensions=validators` query parameter if you don't want to download the OpenAPI specifications related to the request validation.

### To test request validation using the API Gateway REST API calls

1. Call `GET /validation?q1=cat`.

```
GET /testStage/validation?q1=cat HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
```

Because the required parameter of `q1` is set and not blank, the request passes the validation. API Gateway returns the following 200 OK response:

```
[
  {
    "id": 1,
    "type": "cat",
    "price": 249.99
  },
  {
    "id": 2,
```

```
    "type": "cat",
    "price": 124.99
  },
  {
    "id": 3,
    "type": "cat",
    "price": 0.99
  }
]
```

2. Call `GET /validation`.

```
GET /testStage/validation HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
```

Because the required parameter of `q1` is not set, the request fails to pass the validation. API Gateway returns the following `400 Bad Request` response:

```
{
  "message": "Missing required request parameters: [q1]"
}
```

3. Call `GET /validation?q1=`.

```
GET /testStage/validation?q1= HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
```

Because the required parameter of `q1` is blank, the request fails to pass the validation. API Gateway returns the same `400 Bad Request` response as in the previous example.

4. Call `POST /validation`.

```
POST /testStage/validation HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
h1: v1

{
  "name" : "Marco",
  "type" : "dog",
  "price" : 260
}
```

Because the required header parameter of `h1` is set (and not blank) and the payload format adheres to the `RequestDataModel` required properties and associated constraints, the request passes the validation. API Gateway returns the following successful response.

```
{
  "pet": {
    "name": "Marco",
    "type": "dog",
    "price": 260
  },
  "message": "success"
}
```

5. Call `POST /validation`, without specifying the `h1` header or setting its value blank.

```
POST /testStage/validation HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json

{
  "name" : "Marco",
  "type" : "dog",
  "price" : 260
}
```

Because the required header parameter of `h1` is missing or set to blank, the request fails to pass the validation. API Gateway returns the following `400 Bad Request` response:

```
{
  "message": "Missing required request parameters: [h1]"
}
```

6. Call `POST /validation`, setting the `type` property of the payload to `bird`.

```
POST /testStage/validation HTTP/1.1
Host: abcdef123.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
X-Amz-Date: 20170309T000215Z
h1: v1

{
  "name" : "Molly",
  "type" : "bird",
  "price" : 269
}
```

Because the `type` property value is not a member of the enumeration of [ `"dog"`, `"cat"`, `"fish"` ], the request fails to pass the validation. API Gateway returns the following `400 Bad Request` response:

```
{
  "message": "Invalid request body"
}
```

Setting `price` to 501 violates the constraint on the property. This causes the validation to fail and the same `400 Bad Request` response is returned.

## Test basic request validation using the API Gateway console

The following steps describe how to test basic request validation in the API Gateway console.

### To test the request validation on a method using `TestInvoke` in the API Gateway console

While signed in to the API Gateway console, do the following:

1. Choose **Resources** for the API that you've configured a request validators map for.
2. Choose a method for which you have enabled the request validation with a specified request validator.
3. Under **Method Execution**, in the **Client** box, choose **Test**.

4. Try different values for required request parameter or applicable body, and then choose **Test** to see the response.

When the method call passes validation, you should get expected responses. If validation fails, the following error message returns if the payload is not the correct format:

```
{
  "message": "Invalid request body"
}
```

If the request parameters aren't valid, the following error message returns:

```
{
  "message": "Missing required request parameters: [p1]"
}
```

## OpenAPI definitions of a sample API with basic request validation

The following OpenAPI definition defines a sample API with request validation enabled. The API is a subset of the [PetStore API](#). It exposes a `POST` method to add a pet to the `pets` collection and a `GET` method to query pets by a specified type.

There are two request validators declared in the `x-amazon-apigateway-request-validators` map at the API level. The `params-only` validator is enabled on the API and inherited by the `GET` method. This validator allows API Gateway to verify that the required query parameter (`q1`) is included and not blank in the incoming request. The `all` validator is enabled on the `POST` method. This validator verifies that the required header parameter (`h1`) is set and not blank. It also verifies that the payload format adheres to the specified `RequestBodyModel` schema.

This model requires that the input JSON object contains the `name`, `type`, and `price` properties. The `name` property can be any string, `type` must be one of the specified enumeration fields (`[ "dog", "cat", "fish" ]`), and `price` must range between 25 and 500. The `id` parameter is not required.

For more information about the behavior of this API, see [Enable request validation in API Gateway \(p. 318\)](#).

### OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "title": "ReqValidators Sample",
    "version": "1.0.0"
  },
  "schemes": [
    "https"
  ],
  "basePath": "/v1",
  "produces": [
    "application/json"
  ],
  "x-amazon-apigateway-request-validators": {
    "all": {
      "validateRequestBody": true,
      "validateRequestParameters": true
    },
    "params-only": {
```

```

    "validateRequestBody" : false,
    "validateRequestParameters" : true
  }
},
"x-amazon-apigateway-request-validator" : "params-only",
"paths": {
  "/validation": {
    "post": {
      "x-amazon-apigateway-request-validator" : "all",
      "parameters": [
        {
          "in": "header",
          "name": "h1",
          "required": true
        },
        {
          "in": "body",
          "name": "RequestBodyModel",
          "required": true,
          "schema": {
            "$ref": "#/definitions/RequestBodyModel"
          }
        }
      ]
    },
    "responses": {
      "200": {
        "schema": {
          "type": "array",
          "items": {
            "$ref": "#/definitions/Error"
          }
        },
        "headers" : {
          "test-method-response-header" : {
            "type" : "string"
          }
        }
      }
    }
  },
  "security" : [{
    "api_key" : []
  }],
  "x-amazon-apigateway-auth" : {
    "type" : "none"
  },
  "x-amazon-apigateway-integration" : {
    "type" : "http",
    "uri" : "http://petstore-demo-endpoint.execute-api.com/petstore/pets",
    "httpMethod" : "POST",
    "requestParameters": {
      "integration.request.header.custom_h1": "method.request.header.h1"
    },
    "responses" : {
      "2\\d{2}" : {
        "statusCode" : "200"
      },
      "default" : {
        "statusCode" : "400",
        "responseParameters" : {
          "method.response.header.test-method-response-header" : "'static value'"
        },
        "responseTemplates" : {
          "application/json" : "json 400 response template",
          "application/xml" : "xml 400 response template"
        }
      }
    }
  }
}

```





```
    },  
    "required": ["type", "name", "price"]  
  },  
  "Error": {  
    "type": "object",  
    "properties": {  
      }  
    }  
  }  
}
```

## Setting up data transformations for REST APIs

In API Gateway, an API's method request can take a payload in a different format from the corresponding integration request payload, as required in the backend. Similarly, the backend may return an integration response payload different from the method response payload, as expected by the frontend. API Gateway lets you use mapping templates to map the payload from a method request to the corresponding integration request and from an integration response to the corresponding method response.

A *mapping template* is a script expressed in [Velocity Template Language \(VTL\)](#) and applied to the payload using [JSONPath expressions](#).

The payload can have a *data model* according to the [JSON schema draft 4](#). You must define the model in order to have API Gateway to generate a SDK or to enable basic request validation for your API. You don't have to define any model to create a mapping template. However, a model can help you create a template because API Gateway will generate a template blueprint based on a provided model.

This section explains how to map the API request and response payload using models and mapping templates.

### Topics

- [Working with models and mapping templates \(p. 330\)](#)
- [Set up request and response data mappings using the API Gateway console \(p. 341\)](#)
- [Models and mapping template examples \(p. 343\)](#)
- [Amazon API Gateway API request and response data mapping reference \(p. 359\)](#)
- [API Gateway mapping template and access logging variable reference \(p. 363\)](#)

## Working with models and mapping templates

In API Gateway, an API's method request can take a payload in a different format from the corresponding integration request payload, as required in the backend. Similarly, the backend may return an integration response payload different from the method response payload, as expected by the frontend. API Gateway lets you use mapping templates to map the payload from a method request to the corresponding integration request and from an integration response to the corresponding method response.

A *mapping template* is a script expressed in [Velocity Template Language \(VTL\)](#) and applied to the payload using [JSONPath expressions](#).

The payload can have a *data model* according to the [JSON schema draft 4](#). You must define the model in order to have API Gateway to generate a SDK or to enable basic request validation for your API. You don't have to define any model to create a mapping template. However, a model can help you create a template because API Gateway will generate a template blueprint based on a provided model.

## Topics

- [Models \(p. 331\)](#)
- [Mapping templates \(p. 334\)](#)
- [Create a model in API Gateway \(p. 336\)](#)
- [Use a mapping template to override an API's request and response parameters and status codes \(p. 337\)](#)

## Models

In API Gateway, a model defines the data structure of a payload. In API Gateway models are defined using the [JSON schema draft 4](#).

The following JSON object describes sample data that describes the fruit or vegetable inventory in the produce department of a likely supermarket.

Suppose we have an API for managing fruit and vegetable inventory in the produce department of a supermarket. When a manager queries the backend for the current inventory, the server sends back the following response payload:

```
{
  "department": "produce",
  "categories": [
    "fruit",
    "vegetables"
  ],
  "bins": [
    {
      "category": "fruit",
      "type": "apples",
      "price": 1.99,
      "unit": "pound",
      "quantity": 232
    },
    {
      "category": "fruit",
      "type": "bananas",
      "price": 0.19,
      "unit": "each",
      "quantity": 112
    },
    {
      "category": "vegetables",
      "type": "carrots",
      "price": 1.29,
      "unit": "bag",
      "quantity": 57
    }
  ]
}
```

The JSON object has three properties:

- The `department` property has a string value (`produce`).
- The `categories` property is an array of two strings: `fruit` and `vegetables`.
- The `bins` property is an array of objects that have the string or number properties of `category`, `type`, `price`, `unit`, and `quantity`.

We can use the following JSON schema to define the model for the preceding data:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GroceryStoreInputModel",
  "type": "object",
  "properties": {
    "department": { "type": "string" },
    "categories": {
      "type": "array",
      "items": { "type": "string" }
    },
    "bins": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "category": { "type": "string" },
          "type": { "type": "string" },
          "price": { "type": "number" },
          "unit": { "type": "string" },
          "quantity": { "type": "integer" }
        }
      }
    }
  }
}
```

In the preceding example model:

- The `$schema` object represents a valid JSON Schema version identifier. In this example, it refers to JSON Schema, draft v4.
- The `title` object is a human-readable identifier for the model. In this example, it is `GroceryStoreInputModel`.
- The top-level, or root, construct in the JSON data is an object.
- The root object in the JSON data contains `department`, `categories`, and `bins` properties.
- The `department` property is a string object in the JSON data.
- The `categories` property is an array in the JSON data. The array contains string values in the JSON data.
- The `bins` property is an array in the JSON data. The array contains objects in the JSON data. Each of these objects in the JSON data contains a `category` string, a `type` string, a `price` number, a `unit` string, and a `quantity` integer (a number without a fraction or exponent part).

Alternatively, you could include part of this schema (for example, the item definition of the `bins` array) in a separate section of the same file, and use the `$ref` primitive to reference this reusable definition in other parts of the schema. Using `$ref`, the preceding model definition file can be expressed as follows:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GroceryStoreInputModel",
  "type": "object",
  "properties": {
    "department": { "type": "string" },
    "categories": {
      "type": "array",
      "items": { "type": "string" }
    },
    "bins": {
      "type": "array",
      "items": {
        "$ref": "#/definitions/Bin"
      }
    }
  }
}
```

```

    }
  },
  "definitions": {
    "Bin" : {
      "type": "object",
      "properties": {
        "category": { "type": "string" },
        "type": { "type": "string" },
        "price": { "type": "number" },
        "unit": { "type": "string" },
        "quantity": { "type": "integer" }
      }
    }
  }
}

```

The definitions section contains the schema definition of the Bin item that is referenced in the bins array with "\$ref": "#/definitions/Bin". Using reusable definitions this way makes your model definition easier to read.

In addition, you can also reference another model schema defined in an external model file by setting that model's URL as the value of the \$ref property: "\$ref": "https://apigateway.amazonaws.com/restapis/{restapi\_id}/models/{model\_name}". For example, suppose you have the following full-fledged model named Bin that is created under an API with an identifier of fugvjdxttri:

```

{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GroceryStoreInputModel",
  "type": "object",
  "properties": {
    "Bin" : {
      "type": "object",
      "properties": {
        "category": { "type": "string" },
        "type": { "type": "string" },
        "price": { "type": "number" },
        "unit": { "type": "string" },
        "quantity": { "type": "integer" }
      }
    }
  }
}

```

You can then reference it from the GroceryStoreInputModel from the same API, as follows:

```

{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GroceryStoreInputModel",
  "type": "object",
  "properties": {
    "department": { "type": "string" },
    "categories": {
      "type": "array",
      "items": { "type": "string" }
    },
    "bins": {
      "type": "array",
      "items": {
        "$ref": "https://apigateway.amazonaws.com/restapis/fugvjdxttri/models/Bin"
      }
    }
  }
}

```

```
}  
}  
}
```

The referencing and referenced models must be from the same API.

The examples don't use advanced JSON schema features, such as specifying required items, minimums and maximums (for allowed string lengths, numeric values, and array item lengths), and regular expressions. For more information, see [Introducing JSON](#) and [JSON schema draft 4](#).

For more complex JSON data formats and their models, see the following examples:

- [Input model \(photos example\) \(p. 344\)](#) and [Output model \(photos example\) \(p. 346\)](#) in the [Photos example \(p. 344\)](#)
- [Input model \(news article example\) \(p. 347\)](#) and [Output model \(news article example\) \(p. 349\)](#) in the [News article example \(p. 347\)](#)
- [Input model \(sales invoice example\) \(p. 351\)](#) and [Output model \(sales invoice example\) \(p. 353\)](#) in the [Sales invoice example \(p. 350\)](#)
- [Input model \(employee record example\) \(p. 355\)](#) and [Output model \(employee record example\) \(p. 357\)](#) in the [Employee record example \(p. 354\)](#)

To experiment with models in API Gateway, follow the instructions in [Map response payload \(p. 60\)](#), specifically [Step 1: Create models \(p. 61\)](#).

## Mapping templates

When the backend returns the query results (shown in the [Models \(p. 331\)](#) section), the manager of the produce department might be interested in reading them, as follows:

```
{  
  "choices": [  
    {  
      "kind": "apples",  
      "suggestedPrice": "1.99 per pound",  
      "available": 232  
    },  
    {  
      "kind": "bananas",  
      "suggestedPrice": "0.19 per each",  
      "available": 112  
    },  
    {  
      "kind": "carrots",  
      "suggestedPrice": "1.29 per bag",  
      "available": 57  
    }  
  ]  
}
```

To enable this, we need to provide API Gateway with a mapping template to translate the data from the backend format. The following mapping template does that.

```
#set($inputRoot = $input.path('$'))  
{  
  "choices": [  
#foreach($elem in $inputRoot.bins)  
    {  
      "kind": "$elem.type",  
      "suggestedPrice": "$elem.price per $elem.unit",  
    }  
  ]  
}
```

```
        "available": $elem.quantity
      }#if($foreach.hasNext),#end
    }#end
  ]
}
```

Let us now examine some details of the preceding output mapping template:

- The `$inputRoot` variable represents the root object in the original JSON data from the previous section. The variables in an output mapping template map to the original JSON data, not the desired transformed JSON data schema.
- The `choices` array in the output mapping template is mapped from the `bins` array with the root object in the original JSON data (`$inputRoot.bins`).
- In the output mapping template, each of the objects in the `choices` array (represented by `$elem`) are mapped from the corresponding objects in the `bins` array within the root object in the original JSON data.
- In the output mapping template, for each of objects in the `choices` object, the values of the `kind` and `available` objects (represented by `$elem.type` and `$elem.quantity`) are mapped from the corresponding values of the `type` and `value` objects in each of the objects in the original JSON data's `bins` array, respectively.
- In the output mapping template, for each of objects in the `choices` object, the value of the `suggestedPrice` object is a concatenation of the corresponding value of the `price` and `unit` objects in each of the objects in the original JSON data, respectively, with each value separated by the word `per`.

For more information about the Velocity Template Language, see [Apache Velocity - VTL Reference](#). For more information about JSONPath, see [JSONPath - XPath for JSON](#).

The mapping template assumes that the underlying data is of a JSON object. It does not require that a model be defined for the data. As an API developer, you know the data formats at both the front and backends. That knowledge can guide you to define the necessary mappings without ambiguity.

To have an SDK generated for the API, the preceding data is returned as a language-specific object. For strongly typed languages, such as Java, Objective-C, or Swift, the object corresponds to a user-defined data type (UDT). API Gateway creates such a UDT if you provide it with a data model. For the preceding method response example, you can define the following payload model in the integration response:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "GroceryStoreOutputModel",
  "type": "object",
  "properties": {
    "choices": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "kind": { "type": "string" },
          "suggestedPrice": { "type": "string" },
          "available": { "type": "integer" }
        }
      }
    }
  }
}
```

In this model, the JSON schema is expressed as follows:

- The `$schema` object represents a valid JSON schema version identifier. In this example, it refers to JSON schema, draft v4.
- The `title` object is a human-readable identifier for the model. In this example, it is `GroceryStoreOutputModel`.
- The top-level, or root, construct in the JSON data is an object.
- The root object in the JSON data contains an array of objects.
- Each object in the array of objects contains a `kind` string, a `suggestedPrice` string, and an `available` integer (a number without a fraction or exponent part).

With this model, you can call an SDK to retrieve the `kind`, `suggestedPrice`, and `available` property values by reading the `GroceryStoreOutputModel[i].kind`, `GroceryStoreOutputModel[i].suggestedPrice`, and `GroceryStoreOutputModel[i].available` properties, respectively. If no model is provided, API Gateway uses the empty model to create a default UDT. In this case, you aren't able to read these properties using a strongly-typed SDK.

To explore more complex mapping templates, see the following examples:

- [Input mapping template \(photos example\) \(p. 345\)](#) and [Output mapping template \(photos example\) \(p. 346\)](#) in the [Photos example \(p. 344\)](#)
- [Input mapping template \(news article example\) \(p. 348\)](#) and [Output mapping template \(news article example\) \(p. 349\)](#) in the [News article example \(p. 347\)](#)
- [Input mapping template \(sales invoice example\) \(p. 352\)](#) and [Output mapping template \(sales invoice example\) \(p. 353\)](#) in the [Sales invoice example \(p. 350\)](#)
- [Input mapping template \(employee record example\) \(p. 356\)](#) and [Output mapping template \(employee record example\) \(p. 358\)](#) in the [Employee record example \(p. 354\)](#)

To experiment with mapping templates in API Gateway, follow the instructions in [Map response payload \(p. 60\)](#), specifically [Step 5: Set up and test the methods \(p. 65\)](#).

## Create a model in API Gateway

Use the API Gateway console to create a model for an API.

### Topics

- [Prerequisites \(p. 336\)](#)
- [Create a model with the API Gateway console \(p. 336\)](#)

### Prerequisites

- You must have an API available in API Gateway. Follow the instructions in [Creating a REST API in Amazon API Gateway \(p. 205\)](#).

### Create a model with the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Models**.
4. Choose **Create**.
5. For **Model Name**, type a name for the model.
6. For **Content Type**, type the model's content type (for example, **application/json** for JSON).
7. (Optional) For **Model description**, type a description for the model.

8. For **Model schema**, type the model's schema. For more information about model schemas, see [Models \(p. 331\)](#).
9. Choose **Create model**.

## Use a mapping template to override an API's request and response parameters and status codes

Standard API Gateway [parameter and response code mapping templates \(p. 330\)](#) allow you to map parameters one-to-one and map a family of integration response status codes (matched by a regular expression) to a single response status code. Mapping template overrides provides you with the flexibility to perform many-to-one parameter mappings; override parameters after standard API Gateway mappings have been applied; conditionally map parameters based on body content or other parameter values; programmatically create new parameters on the fly; and override status codes returned by your integration endpoint. Any type of request parameter, response header, or response status code may be overridden.

Following are example uses for a mapping template override:

- To create a new header (or overwrite an existing header) as a concatenation of two parameters
- To override the response code to a success or failure code based on the contents of the body
- To conditionally remap a parameter based on its contents or the contents of some other parameter
- To iterate over the contents of a json body and remap key value pairs to headers or query strings

To create a mapping template override, use one or more of the following [\\$context variables \(p. 363\)](#) in a [mapping template \(p. 330\)](#):

Request body mapping template	Response body mapping template
<code>\$context.requestOverride.header.<i>header_name</i></code>	<code>\$context.responseOverride.header.<i>header_name</i></code>
<code>\$context.requestOverride.path.<i>path_name</i></code>	<code>\$context.responseOverride.status</code>
<code>\$context.requestOverride.querystring.<i>querystring_name</i></code>	

### Note

Mapping template overrides cannot be used with proxy integration endpoints, which lack data mappings. For more information about integration types, see [Choose an API Gateway API integration type \(p. 280\)](#).

### Important

Overrides are final. An override may only be applied to each parameter once. Trying to override the same parameter multiple times will result in 5XX responses from Amazon API Gateway. If you must override the same parameter multiple times throughout the template, we recommend creating a variable and applying the override at the end of the template. Note that the template is applied only after the entire template is parsed. See [Tutorial: Override an API's request parameters and headers with the API Gateway console \(p. 339\)](#).

The following tutorials show how to create and test a mapping template override in the API Gateway console. These tutorials use the [PetStore sample API \(p. 43\)](#) as a starting point. Both tutorials assume that you have already created the [PetStore sample API \(p. 43\)](#).

### Topics

- [Tutorial: Override an API's response status code with the API Gateway console \(p. 338\)](#)
- [Tutorial: Override an API's request parameters and headers with the API Gateway console \(p. 339\)](#)



- [Examples: Override an API's request parameters and headers with the API Gateway CLI \(p. 340\)](#)
- [Example: Override an API's request parameters and headers using the SDK for JavaScript \(p. 340\)](#)

### Tutorial: Override an API's response status code with the API Gateway console

To retrieve a pet using the PetStore sample API, you use the API method request of `GET /pets/{petId}`, where `{petId}` is a path parameter that can take a number at run time.

In this tutorial, you'll override this `GET` method's response code by creating a mapping template that maps `$context.responseOverride.status` to 400 when an error condition is detected.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Under **APIs**, choose the PetStore API.
3. In the **Resources** column, choose the `GET` method under `/{petId}`.
4. In the **Client** box, choose **Test**.
5. Type `-1` for `{petId}` and choose **Test**.

In the results, you'll notice two things:

First, the **Response Body** indicates an out-of-range error:

```
{
  "errors": [
    {
      "key": "GetPetRequest.petId",
      "message": "The value is out of range."
    }
  ]
}
```

Second, the last line under **Logs** box ends with: `Method completed with status: 200`.

6. Go back to **Method Execution**. Choose **Integration Response**, and then choose the arrow next to **200**.
7. In the **Mapping Templates** section, choose **Add mapping template**.
8. For **Content Type**, type `application/json`, and then choose the check mark icon to save the choice.
9. Copy the following code into the template area:

```
#set($inputRoot = $input.path('$'))
$input.json("$")
#if($inputRoot.toString().contains("error"))
#set($context.responseOverride.status = 400)
#end
```

10. Choose **Save**.
11. Go back to **Method Execution**
12. In the **Client** box, choose **Test**.
13. Type `-1` for `{petId}` and choose **Test**.

In the results, the **Response Body** indicates an out-of-range error:

```
{
  "errors": [
    {
      "key": "GetPetRequest.petId",
      "message": "The value is out of range."
    }
  ]
}
```

```
}  
  ]  
}
```

However, the last line under **Logs** box now ends with: `Method completed with status: 400.`

### Tutorial: Override an API's request parameters and headers with the API Gateway console

In this tutorial, you'll override the `GET` method's request header code by creating a mapping template that maps `$context.requestOverride.header.header_name` to a new header that combines two other headers.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Under **APIs**, choose the PetStore API.
3. In the **Resources** column, choose the `GET` method under `/pets`.
4. Choose **Method Request**.
5. Create a parameter as follows:
  - a. Expand **HTTP Request Headers**.
  - b. Choose **Add header**.
  - c. Under **Name**, type `header1`.
  - d. Choose the check mark icon to save your choice.

Repeat the process to create a second header called `header2`.

6. Go back to **Method Execution**
7. Choose **Integration Request**.
8. Expand **HTTP Headers**. You'll see the two headers you created, `header1` and `header2`, along with their default mappings (under **Mapped from**).
9. Expand **Mapping Templates**.
10. Choose **Add mapping template**.
11. For **Content Type**, type `application/json`, and then choose the check mark icon to save the choice.
12. A popup will appear that says, **Note: This template can map headers and body**.

Choose **Yes, secure this integration**.

13. Copy the following code into the template area:

```
#set($header1Override = "foo")  
#set($header3Value = "$input.params('header1')$input.params('header2')")  
$input.json("$")  
#set($context.requestOverride.header.header3 = $header3Value)  
#set($context.requestOverride.header.header1 = $header1Override)  
#set($context.requestOverride.header.multivalueheader=[ $header1Override,  
  $header3Value])
```

14. Choose **Save**.
15. Go back to **Method Execution**
16. In the **Client** box, choose **Test**.
17. Under **Headers** for `{pets}`, copy the following code:

```
header1:header1Val  
header2:header2Val
```

## 18. Choose Test.

In the Logs, you should see an entry that includes this text:

```
Endpoint request headers: {header3=header1Valheader2Val,
header2=header2Val, header1=foo, x-amzn-apigateway-api-id=<api-id>,
Accept=application/json, multivalueheader=foo,header1Valheader2Val}
```

### Examples: Override an API's request parameters and headers with the API Gateway CLI

The following CLI example shows how to use the `put-integration` command to override a response code:

```
aws apigateway put-integration --rest-api-id <API_ID> --resource-id <PATH_TO_RESOURCE_ID>
--http-method <METHOD>
--type <INTEGRATION_TYPE> --request-templates <REQUEST_TEMPLATE_MAP>
```

where `<REQUEST_TEMPLATE_MAP>` is a map from content type to a string of the template to apply. The structure of that map is as follows:

```
Content_type1=template_string,Content_type2=template_string
```

or, in JSON syntax:

```
{"content_type1": "template_string"
...}
```

The following example shows how to use the `put-integration-response` command to override an API's response code:

```
aws apigateway put-integration-response --rest-api-id <API_ID> --resource-
id <PATH_TO_RESOURCE_ID> --http-method <METHOD>
--status-code <STATUS_CODE> --response-templates <RESPONSE_TEMPLATE_MAP>
```

where `<RESPONSE_TEMPLATE_MAP>` has the same format as `<REQUEST_TEMPLATE_MAP>` above.

### Example: Override an API's request parameters and headers using the SDK for JavaScript

The following example shows how to use the `put-integration` command to override a response code:

#### Request:

```
var params = {
  httpMethod: 'STRING_VALUE', /* required */
  resourceId: 'STRING_VALUE', /* required */
  restApiId: 'STRING_VALUE', /* required */
  type: HTTP | AWS | MOCK | HTTP_PROXY | AWS_PROXY, /* required */
  requestTemplates: {
    '<Content_type>': 'TEMPLATE_STRING',
    /* '<String>': ... */
  },
};
apigateway.putIntegration(params, function(err, data) {
  if (err) console.log(err, err.stack); // an error occurred
  else console.log(data); // successful response
});
```

**Response:**

```
var params = {
  httpMethod: 'STRING_VALUE', /* required */
  resourceId: 'STRING_VALUE', /* required */
  restApiId: 'STRING_VALUE', /* required */
  statusCode: 'STRING_VALUE', /* required */
  responseTemplates: {
    '<Content_type>': 'TEMPLATE_STRING',
    /* '<String>': ... */
  },
};
apigateway.putIntegrationResponse(params, function(err, data) {
  if (err) console.log(err, err.stack); // an error occurred
  else     console.log(data);           // successful response
});
```

## Set up request and response data mappings using the API Gateway console

To use the API Gateway console to define the API's integration request/response, follow these instructions.

**Note**

These instructions assume you have already completed the steps in [Set up an API integration request using the API Gateway console \(p. 282\)](#).

1. With the method selected in the **Resources** pane, in the **Method Execution** pane, choose **Integration Request**.
2. For an HTTP proxy or an Amazon service proxy, to associate a path parameter, a query string parameter, or a header parameter defined in the integration request with a corresponding path parameter, query string parameter, or header parameter in the method request of the HTTP proxy or Amazon service proxy, do the following:
  - a. Choose the arrow next to **URL Path Parameters**, **URL Query String Parameters**, or **HTTP Headers** respectively, and then choose **Add path**, **Add query string**, or **Add header**, respectively.
  - b. For **Name**, type the name of the path parameter, query string parameter, or header parameter in the HTTP proxy or Amazon service proxy.
  - c. For **Mapped from**, type the mapping value for the path parameter, query string parameter, or header parameter. Use one of the following formats:
    - **method.request.path.parameter-name** for a path parameter named *parameter-name* as defined in the **Method Request** page.
    - **method.request.querystring.parameter-name** for a query string parameter named *parameter-name* as defined in the **Method Request** page.
    - **method.request.multivaluequerystring.parameter-name** for a multi-valued query string parameter named *parameter-name* as defined in the **Method Request** page.
    - **method.request.header.parameter-name** for a header parameter named *parameter-name* as defined in the **Method Request** page.Alternatively, you can set a literal string value (enclosed by a pair of single quotes) to an integration header.
    - **method.request.multivalueheader.parameter-name** for a multi-valued header parameter named *parameter-name* as defined in the **Method Request** page.
  - d. Choose **Create**. (To delete a path parameter, query string parameter, or header parameter, choose **Cancel** or **Remove** next to the parameter you want to delete.)

3. In the **Mapping Templates** area, choose an option for **Request body passthrough** to configure how the method request body of an unmapped content type will be passed through the integration request without transformation to the Lambda function, HTTP proxy, or Amazon service proxy. There are three options:

- Choose **When no template matches the request Content-Type header** if you want the method request body to pass through the integration request to the backend without transformation when the method request content type does not match any content types associated with the mapping templates, as defined in the next step.

**Note**

When calling the API Gateway API, you choose this option by setting `WHEN_NO_MATCH` as the `passthroughBehavior` property value on the [Integration](#) resource.

- Choose **When there are no templates defined (recommended)** if you want the method request body to pass through the integration request to the backend without transformation when no mapping template is defined in the integration request. If a template is defined when this option is selected, the method request of an unmapped content type will be rejected with an HTTP 415 Unsupported Media Type response.

**Note**

When calling the API Gateway API, you choose this option by setting `WHEN_NO_TEMPLATE` as the `passthroughBehavior` property value on the [Integration](#) resource.

- Choose **Never** if you do not want the method request to pass through when either the method request content type does not match any content type associated with the mapping templates defined in the integration request or no mapping template is defined in the integration request. The method request of an unmapped content type will be rejected with an HTTP 415 Unsupported Media Type response.

**Note**

When calling the API Gateway API, you choose this option by setting `NEVER` as the `passthroughBehavior` property value on the [Integration](#) resource.

For more information about the integration passthrough behaviors, see [Integration passthrough behaviors](#) (p. 362).

4. To define a mapping template for an incoming request, choose **Add mapping template** under **Content-Type**. Type a content type (e.g., `application/json`) in the input text box and then choose the check mark icon to save the input. Then, type the mapping template manually or choose **Generate template** to create one from a model template. For more information, see [Working with models and mapping templates](#) (p. 330).
5. You can map an integration response from the backend to a method response of the API returned to the calling app. This includes returning to the client selected response headers from the available ones from the backend, transforming the data format of the backend response payload to an API-specified format. You can specify such mapping by configuring **Method Response** and **Integration Response** from the **Method Execution** page.
  - a. In the **Method Execution** pane, choose **Integration Response**. Choose either the arrow next to **200** to specify settings for a 200 HTTP response code from the method, or choose **Add integration response** to specify settings for any other HTTP response status code from the method.
  - b. For **Lambda error regex** (for a Lambda function) or **HTTP status regex** (for an HTTP proxy or Amazon service proxy), type a regular expression to specify which Lambda function error strings (for a Lambda function) or HTTP response status codes (for an HTTP proxy or Amazon service proxy) map to this output mapping. For example, to map all 2xx HTTP response status codes from an HTTP proxy to this output mapping, type `2\d{2}` for **HTTP status regex**. To return an error message containing "Invalid Request" from a Lambda function to a 400 Bad Request response, type `.*Invalid request.*` as the **Lambda error regex** expression. On

the other hand, to return 400 `Bad Request` for all unmapped error messages from Lambda, type `"(\n| . )+"` in **Lambda error regex**. This last regular expression can be used for the default error response of an API.

#### Note

API Gateway uses Java pattern-style regexes for response mapping. For more information, see [Pattern](#) in the Oracle documentation.

The error patterns are matched against the entire string of the `errorMessage` property in the Lambda response, which is populated by `callback(errorMessage)` in Node.js or by `throw new MyException(errorMessage)` in Java. Also, escaped characters are unescaped before the regular expression is applied.

If you use `.'` as the selection pattern to filter responses, be aware that it may not match a response containing a newline (`"\n"`) character.

- c. If enabled, for **Method response status**, choose the HTTP response status code you defined in the **Method Response** page.
- d. For **Header Mappings**, for each header you defined for the HTTP response status code in the **Method Response** page, specify a mapping value by choosing **Edit**. For **Mapping value**, use one of the following formats:
  - `integration.response.multivalueheaders.header-name` where *header-name* is the name of a multi-valued response header from the backend.

For example, to return the backend response's `Date` header as an API method's response's `Timestamp` header, the **Response header** column will contain a **Timestamp** entry, and the associated **Mapping value** should be set to `integration.response.multivalueheaders.Date`.

- `integration.response.header.header-name` where *header-name* is the name of a single-valued response header from the backend.

For example, to return the backend response's `Date` header as an API method's response's `Timestamp` header, the **Response header** column will contain a **Timestamp** entry, and the associated **Mapping value** should be set to `integration.response.header.Date`.

- e. In the **Template Mappings** area, next to **Content type**, choose **Add**. In the **Content type** box, type the content type of the data that will be passed from the Lambda function, HTTP proxy, or Amazon service proxy to the method. Choose **Update**.
- f. Select **Output passthrough** if you want the method to receive, but not modify, the data from the Lambda function, HTTP proxy, or Amazon service proxy.
- g. If **Output passthrough** is cleared, for **Output mapping**, specify the output mapping template you want the Lambda function, HTTP proxy, or Amazon service proxy to use to send data to the method. You can either type the mapping template manually or choose a model from **Generate template from model**.
- h. Choose **Save**.

## Models and mapping template examples

The following sections provide examples of models and mapping templates that could be used as a starting point for your own APIs in API Gateway. For more information about models and mapping templates in API Gateway, see [Working with models and mapping templates](#) (p. 330).

### Topics

- [Photos example \(API Gateway models and mapping templates\)](#) (p. 344)
- [News article example \(API Gateway models and mapping templates\)](#) (p. 347)
- [Sales invoice example \(API Gateway models and mapping templates\)](#) (p. 350)
- [Employee record example \(API Gateway models and mapping templates\)](#) (p. 354)

## Photos example (API Gateway models and mapping templates)

The following sections provide examples of models and mapping templates that could be used for a sample photo API in API Gateway. For more information about models and mapping templates in API Gateway, see [Working with models and mapping templates \(p. 330\)](#).

### Topics

- [Original data \(photos example\) \(p. 344\)](#)
- [Input model \(photos example\) \(p. 344\)](#)
- [Input mapping template \(photos example\) \(p. 345\)](#)
- [Transformed data \(photos example\) \(p. 345\)](#)
- [Output model \(photos example\) \(p. 346\)](#)
- [Output mapping template \(photos example\) \(p. 346\)](#)

### Original data (photos example)

The following is the original JSON data for the photos example:

```
{
  "photos": {
    "page": 1,
    "pages": "1234",
    "perpage": 100,
    "total": "123398",
    "photo": [
      {
        "id": "12345678901",
        "owner": "23456789@A12",
        "secret": "abc123d456",
        "server": "1234",
        "farm": 1,
        "title": "Sample photo 1",
        "ispublic": 1,
        "isfriend": 0,
        "isfamily": 0
      },
      {
        "id": "23456789012",
        "owner": "34567890@B23",
        "secret": "bcd234e567",
        "server": "2345",
        "farm": 2,
        "title": "Sample photo 2",
        "ispublic": 1,
        "isfriend": 0,
        "isfamily": 0
      }
    ]
  }
}
```

### Input model (photos example)

The following is the input model that corresponds to the original JSON data for the photos example:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PhotosInputModel",
  "type": "object",
  "properties": {
```

```

"photos": {
  "type": "object",
  "properties": {
    "page": { "type": "integer" },
    "pages": { "type": "string" },
    "perpage": { "type": "integer" },
    "total": { "type": "string" },
    "photo": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "id": { "type": "string" },
          "owner": { "type": "string" },
          "secret": { "type": "string" },
          "server": { "type": "string" },
          "farm": { "type": "integer" },
          "title": { "type": "string" },
          "ispublic": { "type": "integer" },
          "isfriend": { "type": "integer" },
          "isfamily": { "type": "integer" }
        }
      }
    }
  }
}

```

### Input mapping template (photos example)

The following is the input mapping template that corresponds to the original JSON data for the photos example:

```

#set($inputRoot = $input.path('$'))
{
  "photos": {
    "page": $inputRoot.photos.page,
    "pages": "$inputRoot.photos.pages",
    "perpage": $inputRoot.photos.perpage,
    "total": "$inputRoot.photos.total",
    "photo": [
#foreach($elem in $inputRoot.photos.photo)
      {
        "id": "$elem.id",
        "owner": "$elem.owner",
        "secret": "$elem.secret",
        "server": "$elem.server",
        "farm": $elem.farm,
        "title": "$elem.title",
        "ispublic": $elem.ispublic,
        "isfriend": $elem.isfriend,
        "isfamily": $elem.isfamily
      }#if($foreach.hasNext),#end
#end
    ]
  }
}

```

### Transformed data (photos example)

The following is one example of how the original photos example JSON data could be transformed for output:



```
{
  "photos": [
    {
      "id": "12345678901",
      "owner": "23456789@A12",
      "title": "Sample photo 1",
      "ispublic": 1,
      "isfriend": 0,
      "isfamily": 0
    },
    {
      "id": "23456789012",
      "owner": "34567890@B23",
      "title": "Sample photo 2",
      "ispublic": 1,
      "isfriend": 0,
      "isfamily": 0
    }
  ]
}
```

### Output model (photos example)

The following is the output model that corresponds to the transformed JSON data format:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "PhotosOutputModel",
  "type": "object",
  "properties": {
    "photos": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "id": { "type": "string" },
          "owner": { "type": "string" },
          "title": { "type": "string" },
          "ispublic": { "type": "integer" },
          "isfriend": { "type": "integer" },
          "isfamily": { "type": "integer" }
        }
      }
    }
  }
}
```

### Output mapping template (photos example)

The following is the output mapping template that corresponds to the transformed JSON data format. The template variables here are based on the original, not transformed, JSON data format:

```
#set($inputRoot = $input.path('$'))
{
  "photos": [
#foreach($elem in $inputRoot.photos.photo)
    {
      "id": "$elem.id",
      "owner": "$elem.owner",
      "title": "$elem.title",
      "ispublic": $elem.ispublic,
      "isfriend": $elem.isfriend,
      "isfamily": $elem.isfamily
    }
#endforeach
  ]
}
```

```
    }#if($foreach.hasNext),#end
#end
  ]
}
```

## News article example (API Gateway models and mapping templates)

The following sections provide examples of models and mapping templates that could be used for a sample news article API in API Gateway. For more information about models and mapping templates in API Gateway, see [Working with models and mapping templates](#) (p. 330).

### Topics

- [Original data \(news article example\)](#) (p. 347)
- [Input model \(news article example\)](#) (p. 347)
- [Input mapping template \(news article example\)](#) (p. 348)
- [Transformed data \(news article example\)](#) (p. 349)
- [Output model \(news article example\)](#) (p. 349)
- [Output mapping template \(news article example\)](#) (p. 349)

### Original data (news article example)

The following is the original JSON data for the news article example:

```
{
  "count": 1,
  "items": [
    {
      "last_updated_date": "2015-04-24",
      "expire_date": "2016-04-25",
      "author_first_name": "John",
      "description": "Sample Description",
      "creation_date": "2015-04-20",
      "title": "Sample Title",
      "allow_comment": "1",
      "author": {
        "last_name": "Doe",
        "email": "johndoe@example.com",
        "first_name": "John"
      },
      "body": "Sample Body",
      "publish_date": "2015-04-25",
      "version": "1",
      "author_last_name": "Doe",
      "parent_id": 2345678901,
      "article_url": "http://www.example.com/articles/3456789012"
    }
  ],
  "version": 1
}
```

### Input model (news article example)

The following is the input model that corresponds to the original JSON data for the news article example:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "NewsArticleInputModel",
}
```

```

"type": "object",
"properties": {
  "count": { "type": "integer" },
  "items": {
    "type": "array",
    "items": {
      "type": "object",
      "properties": {
        "last_updated_date": { "type": "string" },
        "expire_date": { "type": "string" },
        "author_first_name": { "type": "string" },
        "description": { "type": "string" },
        "creation_date": { "type": "string" },
        "title": { "type": "string" },
        "allow_comment": { "type": "string" },
        "author": {
          "type": "object",
          "properties": {
            "last_name": { "type": "string" },
            "email": { "type": "string" },
            "first_name": { "type": "string" }
          }
        },
        "body": { "type": "string" },
        "publish_date": { "type": "string" },
        "version": { "type": "string" },
        "author_last_name": { "type": "string" },
        "parent_id": { "type": "integer" },
        "article_url": { "type": "string" }
      }
    }
  },
  "version": { "type": "integer" }
}

```

### Input mapping template (news article example)

The following is the input mapping template that corresponds to the original JSON data for the news article example:

```

#set($inputRoot = $input.path('$'))
{
  "count": $inputRoot.count,
  "items": [
#foreach($elem in $inputRoot.items)
    {
      "last_updated_date": "$elem.last_updated_date",
      "expire_date": "$elem.expire_date",
      "author_first_name": "$elem.author_first_name",
      "description": "$elem.description",
      "creation_date": "$elem.creation_date",
      "title": "$elem.title",
      "allow_comment": "$elem.allow_comment",
      "author": {
        "last_name": "$elem.author.last_name",
        "email": "$elem.author.email",
        "first_name": "$elem.author.first_name"
      },
      "body": "$elem.body",
      "publish_date": "$elem.publish_date",
      "version": "$elem.version",
      "author_last_name": "$elem.author_last_name",
      "parent_id": $elem.parent_id,

```

```
        "article_url": "$elem.article_url"
      }#if($foreach.hasNext),#end
    #end
  ],
  "version": $inputRoot.version
}
```

### Transformed data (news article example)

The following is one example of how the original news article example JSON data could be transformed for output:

```
{
  "count": 1,
  "items": [
    {
      "creation_date": "2015-04-20",
      "title": "Sample Title",
      "author": "John Doe",
      "body": "Sample Body",
      "publish_date": "2015-04-25",
      "article_url": "http://www.example.com/articles/3456789012"
    }
  ],
  "version": 1
}
```

### Output model (news article example)

The following is the output model that corresponds to the transformed JSON data format:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "NewsArticleOutputModel",
  "type": "object",
  "properties": {
    "count": { "type": "integer" },
    "items": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "creation_date": { "type": "string" },
          "title": { "type": "string" },
          "author": { "type": "string" },
          "body": { "type": "string" },
          "publish_date": { "type": "string" },
          "article_url": { "type": "string" }
        }
      }
    },
    "version": { "type": "integer" }
  }
}
```

### Output mapping template (news article example)

The following is the output mapping template that corresponds to the transformed JSON data format. The template variables here are based on the original, not transformed, JSON data format:

```
#set($inputRoot = $input.path('$'))
```

```
{
  "count": $inputRoot.count,
  "items": [
#foreach($elem in $inputRoot.items)
    {
      "creation_date": "$elem.creation_date",
      "title": "$elem.title",
      "author": "$elem.author.first_name $elem.author.last_name",
      "body": "$elem.body",
      "publish_date": "$elem.publish_date",
      "article_url": "$elem.article_url"
    }#if($foreach.hasNext),#end
#end
  ],
  "version": $inputRoot.version
}
```

## Sales invoice example (API Gateway models and mapping templates)

The following sections provide examples of models and mapping templates that could be used for a sample sales invoice API in API Gateway. For more information about models and mapping templates in API Gateway, see [Working with models and mapping templates \(p. 330\)](#).

### Topics

- [Original data \(sales invoice example\) \(p. 350\)](#)
- [Input model \(sales invoice example\) \(p. 351\)](#)
- [Input mapping template \(sales invoice example\) \(p. 352\)](#)
- [Transformed data \(sales invoice example\) \(p. 353\)](#)
- [Output model \(sales invoice example\) \(p. 353\)](#)
- [Output mapping template \(sales invoice example\) \(p. 353\)](#)

### Original data (sales invoice example)

The following is the original JSON data for the sales invoice example:

```
{
  "DueDate": "2013-02-15",
  "Balance": 1990.19,
  "DocNumber": "SAMP001",
  "Status": "Payable",
  "Line": [
    {
      "Description": "Sample Expense",
      "Amount": 500,
      "DetailType": "ExpenseDetail",
      "ExpenseDetail": {
        "Customer": {
          "value": "ABC123",
          "name": "Sample Customer"
        },
        "Ref": {
          "value": "DEF234",
          "name": "Sample Construction"
        },
        "Account": {
          "value": "EFG345",
          "name": "Fuel"
        }
      },
      "LineStatus": "Billable"
    }
  ]
}
```

```

    }
  },
  "Vendor": {
    "value": "GHI456",
    "name": "Sample Bank"
  },
  "APRef": {
    "value": "HIJ567",
    "name": "Accounts Payable"
  },
  "TotalAmt": 1990.19
}

```

### Input model (sales invoice example)

The following is the input model that corresponds to the original JSON data for the sales invoice example:

```

{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "InvoiceInputModel",
  "type": "object",
  "properties": {
    "DueDate": { "type": "string" },
    "Balance": { "type": "number" },
    "DocNumber": { "type": "string" },
    "Status": { "type": "string" },
    "Line": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "Description": { "type": "string" },
          "Amount": { "type": "integer" },
          "DetailType": { "type": "string" },
          "ExpenseDetail": {
            "type": "object",
            "properties": {
              "Customer": {
                "type": "object",
                "properties": {
                  "value": { "type": "string" },
                  "name": { "type": "string" }
                }
              },
              "Ref": {
                "type": "object",
                "properties": {
                  "value": { "type": "string" },
                  "name": { "type": "string" }
                }
              },
              "Account": {
                "type": "object",
                "properties": {
                  "value": { "type": "string" },
                  "name": { "type": "string" }
                }
              },
              "LineStatus": { "type": "string" }
            }
          }
        }
      }
    }
  }
}

```

```

    }
  },
  "Vendor": {
    "type": "object",
    "properties": {
      "value": { "type": "string" },
      "name": { "type": "string" }
    }
  },
  "APRef": {
    "type": "object",
    "properties": {
      "value": { "type": "string" },
      "name": { "type": "string" }
    }
  },
  "TotalAmt": { "type": "number" }
}
}

```

### Input mapping template (sales invoice example)

The following is the input mapping template that corresponds to the original JSON data for the sales invoice example:

```

#set($inputRoot = $input.path('$'))
{
  "DueDate": "$inputRoot.DueDate",
  "Balance": $inputRoot.Balance,
  "DocNumber": "$inputRoot.DocNumber",
  "Status": "$inputRoot.Status",
  "Line": [
#foreach($elem in $inputRoot.Line)
    {
      "Description": "$elem.Description",
      "Amount": $elem.Amount,
      "DetailType": "$elem.DetailType",
      "ExpenseDetail": {
        "Customer": {
          "value": "$elem.ExpenseDetail.Customer.value",
          "name": "$elem.ExpenseDetail.Customer.name"
        },
        "Ref": {
          "value": "$elem.ExpenseDetail.Ref.value",
          "name": "$elem.ExpenseDetail.Ref.name"
        },
        "Account": {
          "value": "$elem.ExpenseDetail.Account.value",
          "name": "$elem.ExpenseDetail.Account.name"
        },
        "LineStatus": "$elem.ExpenseDetail.LineStatus"
      }
    }
#if($foreach.hasNext),#end
  ],
  "Vendor": {
    "value": "$inputRoot.Vendor.value",
    "name": "$inputRoot.Vendor.name"
  },
  "APRef": {
    "value": "$inputRoot.APRef.value",
    "name": "$inputRoot.APRef.name"
  },
}

```

```
"TotalAmt": $inputRoot.TotalAmt
}
```

### Transformed data (sales invoice example)

The following is one example of how the original sales invoice example JSON data could be transformed for output:

```
{
  "DueDate": "2013-02-15",
  "Balance": 1990.19,
  "DocNumber": "SAMP001",
  "Status": "Payable",
  "Line": [
    {
      "Description": "Sample Expense",
      "Amount": 500,
      "DetailType": "ExpenseDetail",
      "Customer": "ABC123 (Sample Customer)",
      "Ref": "DEF234 (Sample Construction)",
      "Account": "EFG345 (Fuel)",
      "LineStatus": "Billable"
    }
  ],
  "TotalAmt": 1990.19
}
```

### Output model (sales invoice example)

The following is the output model that corresponds to the transformed JSON data format:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "InvoiceOutputModel",
  "type": "object",
  "properties": {
    "DueDate": { "type": "string" },
    "Balance": { "type": "number" },
    "DocNumber": { "type": "string" },
    "Status": { "type": "string" },
    "Line": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "Description": { "type": "string" },
          "Amount": { "type": "integer" },
          "DetailType": { "type": "string" },
          "Customer": { "type": "string" },
          "Ref": { "type": "string" },
          "Account": { "type": "string" },
          "LineStatus": { "type": "string" }
        }
      }
    },
    "TotalAmt": { "type": "number" }
  }
}
```

### Output mapping template (sales invoice example)

The following is the output mapping template that corresponds to the transformed JSON data format. The template variables here are based on the original, not transformed, JSON data format:



```
#set($inputRoot = $input.path('$'))
{
  "DueDate": "$inputRoot.DueDate",
  "Balance": $inputRoot.Balance,
  "DocNumber": "$inputRoot.DocNumber",
  "Status": "$inputRoot.Status",
  "Line": [
#foreach($elem in $inputRoot.Line)
    {
      "Description": "$elem.Description",
      "Amount": $elem.Amount,
      "DetailType": "$elem.DetailType",
      "Customer": "$elem.ExpenseDetail.Customer.value ($elem.ExpenseDetail.Customer.name)",
      "Ref": "$elem.ExpenseDetail.Ref.value ($elem.ExpenseDetail.Ref.name)",
      "Account": "$elem.ExpenseDetail.Account.value ($elem.ExpenseDetail.Account.name)",
      "LineStatus": "$elem.ExpenseDetail.LineStatus"
    }#if($foreach.hasNext),#end
#end
  ],
  "TotalAmt": $inputRoot.TotalAmt
}
```

## Employee record example (API Gateway models and mapping templates)

The following sections provide examples of models and mapping templates that can be used for a sample employee record API in API Gateway. For more information about models and mapping templates in API Gateway, see [Working with models and mapping templates \(p. 330\)](#).

### Topics

- [Original data \(employee record example\) \(p. 354\)](#)
- [Input model \(employee record example\) \(p. 355\)](#)
- [Input mapping template \(employee record example\) \(p. 356\)](#)
- [Transformed data \(employee record example\) \(p. 356\)](#)
- [Output model \(employee record example\) \(p. 357\)](#)
- [Output mapping template \(employee record example\) \(p. 358\)](#)

### Original data (employee record example)

The following is the original JSON data for the employee record example:

```
{
  "QueryResponse": {
    "maxResults": "1",
    "startPosition": "1",
    "Employee": {
      "Organization": "false",
      "Title": "Mrs.",
      "GivenName": "Jane",
      "MiddleName": "Lane",
      "FamilyName": "Doe",
      "DisplayName": "Jane Lane Doe",
      "PrintOnCheckName": "Jane Lane Doe",
      "Active": "true",
      "PrimaryPhone": { "FreeFormNumber": "505.555.9999" },
      "PrimaryEmailAddr": { "Address": "janedoe@example.com" },
      "EmployeeType": "Regular",
      "status": "Synchronized",
      "Id": "ABC123",
      "SyncToken": "1",

```

```

    "MetaData": {
      "CreateTime": "2015-04-26T19:45:03Z",
      "LastUpdatedTime": "2015-04-27T21:48:23Z"
    },
    "PrimaryAddr": {
      "Line1": "123 Any Street",
      "City": "Any City",
      "CountrySubDivisionCode": "WA",
      "PostalCode": "01234"
    }
  }
},
"time": "2015-04-27T22:12:32.012Z"
}

```

### Input model (employee record example)

The following is the input model that corresponds to the original JSON data for the employee record example:

```

{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "EmployeeInputModel",
  "type": "object",
  "properties": {
    "QueryResponse": {
      "type": "object",
      "properties": {
        "maxResults": { "type": "string" },
        "startPosition": { "type": "string" },
        "Employee": {
          "type": "object",
          "properties": {
            "Organization": { "type": "string" },
            "Title": { "type": "string" },
            "GivenName": { "type": "string" },
            "MiddleName": { "type": "string" },
            "FamilyName": { "type": "string" },
            "DisplayName": { "type": "string" },
            "PrintOnCheckName": { "type": "string" },
            "Active": { "type": "string" },
            "PrimaryPhone": {
              "type": "object",
              "properties": {
                "FreeFormNumber": { "type": "string" }
              }
            },
            "PrimaryEmailAddr": {
              "type": "object",
              "properties": {
                "Address": { "type": "string" }
              }
            },
            "EmployeeType": { "type": "string" },
            "status": { "type": "string" },
            "Id": { "type": "string" },
            "SyncToken": { "type": "string" },
            "MetaData": {
              "type": "object",
              "properties": {
                "CreateTime": { "type": "string" },
                "LastUpdatedTime": { "type": "string" }
              }
            }
          }
        }
      }
    }
  }
}

```

```

        "PrimaryAddr": {
          "type": "object",
          "properties": {
            "Line1": { "type": "string" },
            "City": { "type": "string" },
            "CountrySubDivisionCode": { "type": "string" },
            "PostalCode": { "type": "string" }
          }
        }
      }
    },
    "time": { "type": "string" }
  }
}

```

### Input mapping template (employee record example)

The following is the input mapping template that corresponds to the original JSON data for the employee record example:

```

#set($inputRoot = $input.path('$'))
{
  "QueryResponse": {
    "maxResults": "$inputRoot.QueryResponse.maxResults",
    "startPosition": "$inputRoot.QueryResponse.startPosition",
    "Employee": {
      "Organization": "$inputRoot.QueryResponse.Employee.Organization",
      "Title": "$inputRoot.QueryResponse.Employee.Title",
      "GivenName": "$inputRoot.QueryResponse.Employee.GivenName",
      "MiddleName": "$inputRoot.QueryResponse.Employee.MiddleName",
      "FamilyName": "$inputRoot.QueryResponse.Employee.FamilyName",
      "DisplayName": "$inputRoot.QueryResponse.Employee.DisplayName",
      "PrintOnCheckName": "$inputRoot.QueryResponse.Employee.PrintOnCheckName",
      "Active": "$inputRoot.QueryResponse.Employee.Active",
      "PrimaryPhone": { "FreeFormNumber":
"$inputRoot.QueryResponse.Employee.PrimaryPhone.FreeFormNumber" },
      "PrimaryEmailAddr": { "Address":
"$inputRoot.QueryResponse.Employee.PrimaryEmailAddr.Address" },
      "EmployeeType": "$inputRoot.QueryResponse.Employee.EmployeeType",
      "status": "$inputRoot.QueryResponse.Employee.status",
      "Id": "$inputRoot.QueryResponse.Employee.Id",
      "SyncToken": "$inputRoot.QueryResponse.Employee.SyncToken",
      "MetaData": {
        "CreateTime": "$inputRoot.QueryResponse.Employee.MetaData.CreateTime",
        "LastUpdatedTime": "$inputRoot.QueryResponse.Employee.MetaData.LastUpdatedTime"
      },
      "PrimaryAddr" : {
        "Line1": "$inputRoot.QueryResponse.Employee.PrimaryAddr.Line1",
        "City": "$inputRoot.QueryResponse.Employee.PrimaryAddr.City",
        "CountrySubDivisionCode":
"$inputRoot.QueryResponse.Employee.PrimaryAddr.CountrySubDivisionCode",
        "PostalCode": "$inputRoot.QueryResponse.Employee.PrimaryAddr.PostalCode"
      }
    }
  },
  "time": "$inputRoot.time"
}

```

### Transformed data (employee record example)

The following is one example of how the original employee record example JSON data could be transformed for output:

```
{
  "QueryResponse": {
    "maxResults": "1",
    "startPosition": "1",
    "Employees": [
      {
        "Title": "Mrs.",
        "GivenName": "Jane",
        "MiddleName": "Lane",
        "FamilyName": "Doe",
        "DisplayName": "Jane Lane Doe",
        "PrintOnCheckName": "Jane Lane Doe",
        "Active": "true",
        "PrimaryPhone": "505.555.9999",
        "Email": [
          {
            "type": "primary",
            "Address": "janedoe@example.com"
          }
        ],
        "EmployeeType": "Regular",
        "PrimaryAddr": {
          "Line1": "123 Any Street",
          "City": "Any City",
          "CountrySubDivisionCode": "WA",
          "PostalCode": "01234"
        }
      }
    ]
  },
  "time": "2015-04-27T22:12:32.012Z"
}
```

### Output model (employee record example)

The following is the output model that corresponds to the transformed JSON data format:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "title": "EmployeeOutputModel",
  "type": "object",
  "properties": {
    "QueryResponse": {
      "type": "object",
      "properties": {
        "maxResults": { "type": "string" },
        "startPosition": { "type": "string" },
        "Employees": {
          "type": "array",
          "items": {
            "type": "object",
            "properties": {
              "Title": { "type": "string" },
              "GivenName": { "type": "string" },
              "MiddleName": { "type": "string" },
              "FamilyName": { "type": "string" },
              "DisplayName": { "type": "string" },
              "PrintOnCheckName": { "type": "string" },
              "Active": { "type": "string" },
              "PrimaryPhone": { "type": "string" },
              "Email": {
                "type": "array",
                "items": {
                  "type": "object",

```

```

        "properties": {
          "type": { "type": "string" },
          "Address": { "type": "string" }
        }
      },
      "EmployeeType": { "type": "string" },
      "PrimaryAddr": {
        "type": "object",
        "properties": {
          "Line1": { "type": "string" },
          "City": { "type": "string" },
          "CountrySubDivisionCode": { "type": "string" },
          "PostalCode": { "type": "string" }
        }
      }
    }
  }
},
"time": { "type": "string" }
}
}

```

### Output mapping template (employee record example)

The following is the output mapping template that corresponds to the transformed JSON data format. The template variables here are based on the original, not transformed, JSON data format:

```

#set($inputRoot = $input.path('$'))
{
  "QueryResponse": {
    "maxResults": "$inputRoot.QueryResponse.maxResults",
    "startPosition": "$inputRoot.QueryResponse.startPosition",
    "Employees": [
      {
        "Title": "$inputRoot.QueryResponse.Employee.Title",
        "GivenName": "$inputRoot.QueryResponse.Employee.GivenName",
        "MiddleName": "$inputRoot.QueryResponse.Employee.MiddleName",
        "FamilyName": "$inputRoot.QueryResponse.Employee.FamilyName",
        "DisplayName": "$inputRoot.QueryResponse.Employee.DisplayName",
        "PrintOnCheckName": "$inputRoot.QueryResponse.Employee.PrintOnCheckName",
        "Active": "$inputRoot.QueryResponse.Employee.Active",
        "PrimaryPhone": "$inputRoot.QueryResponse.Employee.PrimaryPhone.FreeFormNumber",
        "Email": [
          {
            "type": "primary",
            "Address": "$inputRoot.QueryResponse.Employee.PrimaryEmailAddr.Address"
          }
        ],
        "EmployeeType": "$inputRoot.QueryResponse.Employee.EmployeeType",
        "PrimaryAddr": {
          "Line1": "$inputRoot.QueryResponse.Employee.PrimaryAddr.Line1",
          "City": "$inputRoot.QueryResponse.Employee.PrimaryAddr.City",
          "CountrySubDivisionCode":
            "$inputRoot.QueryResponse.Employee.PrimaryAddr.CountrySubDivisionCode",
          "PostalCode": "$inputRoot.QueryResponse.Employee.PrimaryAddr.PostalCode"
        }
      }
    ]
  },
  "time": "$inputRoot.time"
}

```

## Amazon API Gateway API request and response data mapping reference

This section explains how to set up data mappings from an API's method request data, including other data stored in [context](#) (p. 363), [stage](#) (p. 374), or [util](#) (p. 374) variables, to the corresponding integration request parameters and from an integration response data, including the other data, to the method response parameters. The method request data includes request parameters (path, query string, headers) and the body. The integration response data includes response parameters (headers) and the body. For more information about using the stage variables, see [Amazon API Gateway stage variables reference](#) (p. 450).

### Topics

- [Map method request data to integration request parameters](#) (p. 359)
- [Map integration response data to method response headers](#) (p. 360)
- [Map request and response payloads between method and integration](#) (p. 361)
- [Integration passthrough behaviors](#) (p. 362)

### Map method request data to integration request parameters

Integration request parameters, in the form of path variables, query strings or headers, can be mapped from any defined method request parameters and the payload.

In the following table, *PARAM\_NAME* is the name of a method request parameter of the given parameter type. It must match the regular expression `'^[a-zA-Z0-9._$-]+$'`. It must have been defined before it can be referenced. *JSONPath\_EXPRESSION* is a JSONPath expression for a JSON field of the body of a request or response.

#### Note

The "\$" prefix is omitted in this syntax.

### Integration request data mapping expressions

Mapped data source	Mapping expression
Method request path	<code>method.request.path.<i>PARAM_NAME</i></code>
Method request query string	<code>method.request.querystring.<i>PARAM_NAME</i></code>
Multi-value method request query string	<code>method.request.multivaluequerystring.<i>PARAM_NAME</i></code>
Method request header	<code>method.request.header.<i>PARAM_NAME</i></code>
Multi-value method request header	<code>method.request.multivalueheader.<i>PARAM_NAME</i></code>
Method request body	<code>method.request.body</code>
Method request body (JsonPath)	<code>method.request.body.<i>JSONPath_EXPRESSION</i></code>
Stage variables	<code>stageVariables.<i>VARIABLE_NAME</i></code>
Context variables	<code>context.<i>VARIABLE_NAME</i></code> that must be one of the <a href="#">supported context variables</a> (p. 363).
Static value	<code>'<i>STATIC_VALUE</i>'</code> . The <i>STATIC_VALUE</i> is a string literal and must be enclosed within a pair of single quotes.

### Example Mappings from method request parameter in OpenAPI

The following example shows an OpenAPI snippet that maps:

- the method request's header, named `methodRequestHeaderParam`, into the integration request path parameter, named `integrationPathParam`
- the multi-value method request query string, named `methodRequestQueryParam`, into the integration request query string, named `integrationQueryParam`

```
...
"requestParameters" : {
    "integration.request.path.integrationPathParam" :
    "method.request.header.methodRequestHeaderParam",
    "integration.request.querystring.integrationQueryParam" :
    "method.request.multivaluequerystring.methodRequestQueryParam"
}
...
```

Integration request parameters can also be mapped from fields in the JSON request body using a [JSONPath expression](#). The following table shows the mapping expressions for a method request body and its JSON fields.

### Example Mapping from method request body in OpenAPI

The following example shows an OpenAPI snippet that maps 1) the method request body to the integration request header, named `body-header`, and 2) a JSON field of the body, as expressed by a JSON expression (`petstore.pets[0].name`, without the `$.` prefix).

```
...
"requestParameters" : {
    "integration.request.header.body-header" : "method.request.body",
    "integration.request.path.pet-name" : "method.request.body.petstore.pets[0].name",
}
...
```

## Map integration response data to method response headers

Method response header parameters can be mapped from any integration response header or integration response body, `$context` variables, or static values.

### Method response header mapping expressions

Mapped data source	Mapping expression
Integration response header	<code>integration.response.header.PARAM_NAME</code>
Integration response header	<code>integration.response.multivalueheader.PARAM_NAME</code>
Integration response body	<code>integration.response.body</code>

Mapped data source	Mapping expression
Integration response body (JsonPath)	<code>integration.response.body.JSONPath_EXPRESSION</code>
Stage variable	<code>stageVariables.VARIABLE_NAME</code>
Context variable	<code>context.VARIABLE_NAME</code> that must be one of the <a href="#">supported context variables</a> (p. 363).
Static value	' <i>STATIC_VALUE</i> '. The <i>STATIC_VALUE</i> is a string literal and must be enclosed within a pair of single quotes.

### Example Data mapping from integration response in OpenAPI

The following example shows an OpenAPI snippet that maps 1) the integration response's `redirect.url`, JSONPath field into the request response's `location` header; and 2) the integration response's `x-app-id` header to the method response's `id` header.

```
...
"responseParameters" : {
    "method.response.header.location" : "integration.response.body.redirect.url",
    "method.response.header.id" : "integration.response.header.x-app-id",
    "method.response.header.items" : "integration.response.multivaluedheader.item",
}
...
```

### Map request and response payloads between method and integration

API Gateway uses [Velocity Template Language \(VTL\)](#) engine to process body [mapping templates](#) (p. 334) for the integration request and integration response. The mapping templates translate method request payloads to the corresponding integration request payloads and translate integration response bodies to the method response bodies.

The VTL templates use JSONPath expressions, other parameters such as calling contexts and stage variables, and utility functions to process the JSON data.

If a model is defined to describe the data structure of a payload, API Gateway can use the model to generate a skeletal mapping template for an integration request or integration response. You can use the skeletal template as an aid to customize and expand the mapping VTL script. However, you can create a mapping template from scratch without defining a model for the payload's data structure.

#### Select a VTL mapping template

API Gateway uses the following logic to select a mapping template, in [Velocity Template Language \(VTL\)](#), to map the payload from a method request to the corresponding integration request or to map the payload from an integration response to the corresponding method response.

For a request payload, API Gateway uses the request's `Content-Type` header value as the key to select the mapping template for the request payload. For a response payload, API Gateway uses the incoming request's `Accept` header value as the key to select the mapping template.

When the `Content-Type` header is absent in the request, API Gateway assumes that its default value is `application/json`. For such a request, API Gateway uses `application/json` as the default key



to select the mapping template, if one is defined. When no template matches this key, API Gateway passes the payload through unmapped if the `passthroughBehavior` property is set to `WHEN_NO_MATCH` or `WHEN_NO_TEMPLATES`.

When the `Accept` header is not specified in the request, API Gateway assumes that its default value is `application/json`. In this case, API Gateway selects an existing mapping template for `application/json` to map the response payload. If no template is defined for `application/json`, API Gateway selects the first existing template and uses it as the default to map the response payload. Similarly, API Gateway uses the first existing template when the specified `Accept` header value does not match any existing template key. If no template is defined, API Gateway simply passes the response payload through unmapped.

For example, suppose that an API has a `application/json` template defined for a request payload and has a `application/xml` template defined for the response payload. If the client sets the `"Content-Type : application/json"`, and `"Accept : application/xml"` headers in the request, both the request and response payloads will be processed with the corresponding mapping templates. If the `Accept:application/xml` header is absent, the `application/xml` mapping template will be used to map the response payload. To return the response payload unmapped instead, you must set up an empty template for `application/json`.

Only the MIME type is used from the `Accept` and `Content-Type` headers when selecting a mapping template. For example, a header of `"Content-Type: application/json; charset=UTF-8"` will have a request template with the `application/json` key selected.

## Integration passthrough behaviors

With non-proxy integrations, when a method request carries a payload and either the `Content-Type` header does not match any specified mapping template or no mapping template is defined, you can choose to pass the client-supplied request payload through the integration request to the backend without transformation. The process is known as integration passthrough.

For [proxy integrations \(p. 282\)](#), API Gateway passes the entire request through to your backend, and you do not have the option to modify the passthrough behaviors.

The actual passthrough behavior of an incoming request is determined by the option you choose for a specified mapping template, during [integration request set-up \(p. 341\)](#), and the `Content Type` header that a client set in the incoming request. The following examples illustrate the possible passthrough behaviors.

Example 1: One mapping template is defined in the integration request for the `application/json` content type.

Content-type header \Selected passthrough option	WHEN_NO_MATCH	WHEN_NO_TEMPLATES	NEVER
None (default to <code>application/json</code> )	The request payload is transformed using the template.	The request payload is transformed using the template.	The request payload is transformed using the template.
<code>application/json</code>	The request payload is transformed using the template.	The request payload is transformed using the template.	The request payload is transformed using the template.
<code>application/xml</code>	The request payload is not transformed and is sent to the backend as-is.	The request is rejected with an HTTP 415 <code>Unsupported Media Type</code> response.	The request is rejected with an HTTP 415 <code>Unsupported Media Type</code> response.

Example 2: One mapping template is defined in the integration request for the `application/xml` content type.

Content-type header \Selected passthrough option	WHEN_NO_MATCH	WHEN_NO_TEMPLATES	NEVER
None (default to <code>application/json</code> )	The request payload is not transformed and is sent to the backend as-is.	The request is rejected with an HTTP 415 Unsupported Media Type response.	The request is rejected with an HTTP 415 Unsupported Media Type response.
<code>application/json</code>	The request payload is not transformed and is sent to the backend as-is.	The request is rejected with an HTTP 415 Unsupported Media Type response.	The request is rejected with an HTTP 415 Unsupported Media Type response.
<code>application/xml</code>	The request payload is transformed using the template.	The request payload is transformed using the template.	The request payload is transformed using the template.

## API Gateway mapping template and access logging variable reference

This section provides reference information for the variables and functions that Amazon API Gateway defines for use with data models, authorizers, mapping templates, and CloudWatch access logging. For detailed information about how to use these variables and functions, see [the section called “Working with models and mapping templates” \(p. 330\)](#).

### Topics

- [\\$context Variables for data models, authorizers, mapping templates, and CloudWatch access logging \(p. 363\)](#)
- [\\$context Variable template example \(p. 369\)](#)
- [\\$context Variables for access logging only \(p. 369\)](#)
- [\\$input Variables \(p. 371\)](#)
- [\\$input Variable template examples \(p. 372\)](#)
- [\\$stageVariables \(p. 374\)](#)
- [\\$util Variables \(p. 374\)](#)

### Note

For `$method` and `$integration` variables, see [the section called “Request and response data mapping reference” \(p. 359\)](#).

### \$context Variables for data models, authorizers, mapping templates, and CloudWatch access logging

The following `$context` variables can be used in data models, authorizers, mapping templates, and CloudWatch access logging.

For `$context` variables that can be used only in CloudWatch access logging, see [the section called “\\$context Variables for access logging only” \(p. 369\)](#).

Parameter	Description
<code>\$context.accountId</code>	The API owner's Amazon account ID.
<code>\$context.apiId</code>	The identifier API Gateway assigns to your API.
<code>\$context.authorizer.claims.<i>property</i></code>	<p>A property of the claims returned from the Amazon Cognito user pool after the method caller is successfully authenticated. For more information, see <a href="#">the section called "Use Amazon Cognito user pool as authorizer for a REST API" (p. 270)</a>.</p> <p><b>Note</b> Calling <code>\$context.authorizer.claims</code> returns null.</p>
<code>\$context.authorizer.principalId</code>	The principal user identification associated with the token sent by the client and returned from an API Gateway Lambda authorizer (formerly known as a custom authorizer). For more information, see <a href="#">the section called "Use Lambda authorizers" (p. 256)</a> .
<code>\$context.authorizer.<i>property</i></code>	<p>The stringified value of the specified key-value pair of the <code>context</code> map returned from an API Gateway Lambda authorizer function. For example, if the authorizer returns the following context map:</p> <pre style="border: 1px solid black; padding: 5px;">"context" : {   "key": "value",   "numKey": 1,   "boolKey": true }</pre> <p>calling <code>\$context.authorizer.key</code> returns the "value" string, calling <code>\$context.authorizer.numKey</code> returns the "1" string, and calling <code>\$context.authorizer.boolKey</code> returns the "true" string.</p> <p>For more information, see <a href="#">the section called "Use Lambda authorizers" (p. 256)</a>.</p>
<code>\$context.awsEndpointRequestId</code>	The Amazon endpoint's request ID.
<code>\$context.domainName</code>	The full domain name used to invoke the API. This should be the same as the incoming <code>Host</code> header.
<code>\$context.domainPrefix</code>	The first label of the <code>\$context.domainName</code> . This is often used as a caller/customer identifier.
<code>\$context.error.message</code>	A string containing an API Gateway error message. This variable can only be used for simple variable substitution in a <a href="#">GatewayResponse</a> body-mapping template, which is not processed by the Velocity Template Language engine, and in access

Parameter	Description
	logging. For more information, see <a href="#">the section called "Metrics" (p. 665)</a> and <a href="#">the section called "Setting up gateway responses to customize error responses" (p. 376)</a> .
<code>\$context.error.messageString</code>	The quoted value of <code>\$context.error.message</code> , namely " <code>\$context.error.message</code> ".
<code>\$context.error.responseType</code>	A <a href="#">type</a> of <a href="#">GatewayResponse</a> . This variable can only be used for simple variable substitution in a <a href="#">GatewayResponse</a> body-mapping template, which is not processed by the Velocity Template Language engine, and in access logging. For more information, see <a href="#">the section called "Metrics" (p. 665)</a> and <a href="#">the section called "Setting up gateway responses to customize error responses" (p. 376)</a> .
<code>\$context.error.validationErrorString</code>	A string containing a detailed validation error message.
<code>\$context.extendedRequestId</code>	The extended ID that API Gateway generates and assigns to the API request. The extended request ID contains useful information for debugging and troubleshooting.
<code>\$context.httpMethod</code>	The HTTP method used. Valid values include: DELETE, GET, HEAD, OPTIONS, PATCH, POST, and PUT.
<code>\$context.identity.accountId</code>	The Amazon account ID associated with the request.
<code>\$context.identity.apiKey</code>	For API methods that require an API key, this variable is the API key associated with the method request. For methods that don't require an API key, this variable is null. For more information, see <a href="#">the section called "Usage plans" (p. 491)</a> .
<code>\$context.identity.apiKeyId</code>	The API key ID associated with an API request that requires an API key.
<code>\$context.identity.caller</code>	The principal identifier of the caller that signed the request. Supported for resources that use IAM authorization.

Parameter	Description
<code>\$context.identity.cognitoAuthenticationProvider</code>	<p>A comma-separated list of the Amazon Cognito authentication providers used by the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p> <p>For example, for an identity from an Amazon Cognito user pool, <code>cognito-idp.region.amazonaws.com/user_pool_id</code>, <code>cognito-idp.region.amazonaws.com/user_pool_id:CognitoSignIn:token</code> <i>subject claim</i></p> <p>For information, see <a href="#">Using Federated Identities</a> in the <i>Amazon Cognito Developer Guide</i>.</p>
<code>\$context.identity.cognitoAuthenticationType</code>	<p>The Amazon Cognito authentication type of the caller making the request. Available only if the request was signed with Amazon Cognito credentials. Possible values include <code>authenticated</code> for authenticated identities and <code>unauthenticated</code> for unauthenticated identities.</p>
<code>\$context.identity.cognitoIdentityId</code>	<p>The Amazon Cognito identity ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p>
<code>\$context.identity.cognitoIdentityPoolId</code>	<p>The Amazon Cognito identity pool ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p>
<code>\$context.identity.principalOrgId</code>	<p>The <a href="#">Amazon organization ID</a>.</p>
<code>\$context.identity.sourceIp</code>	<p>The source IP address of the immediate TCP connection making the request to API Gateway endpoint.</p>
<code>\$context.identity.clientCert.clientCertPem</code>	<p>The PEM-encoded client certificate that the client presented during mutual TLS authentication. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.</p>
<code>\$context.identity.clientCert.subjectDN</code>	<p>The distinguished name of the subject of the certificate that a client presents. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.</p>
<code>\$context.identity.clientCert.issuerDN</code>	<p>The distinguished name of the issuer of the certificate that a client presents. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.</p>

Parameter	Description
<code>\$context.identity.clientCert.serialNumber</code>	The serial number of the certificate. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.
<code>\$context.identity.clientCert.validity.notBefore</code>	The date before which the certificate is invalid. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.
<code>\$context.identity.clientCert.validity.notAfter</code>	The date after which the certificate is invalid. Present when a client accesses an API by using a custom domain name that has mutual TLS enabled. Present only in access logs if mutual TLS authentication fails.
<code>\$context.identity.user</code>	The principal identifier of the user that will be authorized against resource access. Supported for resources that use IAM authorization.
<code>\$context.identity.userAgent</code>	The <b>User-Agent</b> header of the API caller.
<code>\$context.identity.userArn</code>	The Amazon Resource Name (ARN) of the effective user identified after authentication. For more information, see <a href="https://docs.aws.amazon.com/IAM/latest/UserGuide/id_users.html">https://docs.aws.amazon.com/IAM/latest/UserGuide/id_users.html</a> .
<code>\$context.path</code>	The request path. For example, for a non-proxy request URL of <code>https://{rest-api-id}.execute-api.{region}.amazonaws.com/{stage}/root/child</code> , the <code>\$context.path</code> value is <code>/{stage}/root/child</code> .
<code>\$context.protocol</code>	The request protocol, for example, <code>HTTP/1.1</code> .
<code>\$context.requestId</code>	An ID for the request. Clients can override this request ID. Use <code>\$context.extendedRequestId</code> for a unique request ID that API Gateway generates.
<code>\$context.requestOverride.header.header_name</code>	The request header override. If this parameter is defined, it contains the headers to be used instead of the <b>HTTP Headers</b> that are defined in the <b>Integration Request</b> pane. For more information, see <a href="#">Use a mapping template to override an API's request and response parameters and status codes (p. 337)</a> .

Parameter	Description
<code>\$context.requestOverride.path.path_name</code>	The request path override. If this parameter is defined, it contains the request path to be used instead of the <b>URL Path Parameters</b> that are defined in the <b>Integration Request</b> pane. For more information, see <a href="#">Use a mapping template to override an API's request and response parameters and status codes (p. 337)</a> .
<code>\$context.requestOverride.querystring.querystring</code>	The request query string override. If this parameter is defined, it contains the request query strings to be used instead of the <b>URL Query String Parameters</b> that are defined in the <b>Integration Request</b> pane. For more information, see <a href="#">Use a mapping template to override an API's request and response parameters and status codes (p. 337)</a> .
<code>\$context.responseOverride.header.header</code>	The response header override. If this parameter is defined, it contains the header to be returned instead of the <b>Response header</b> that is defined as the <b>Default mapping</b> in the <b>Integration Response</b> pane. For more information, see <a href="#">Use a mapping template to override an API's request and response parameters and status codes (p. 337)</a> .
<code>\$context.responseOverride.status</code>	The response status code override. If this parameter is defined, it contains the status code to be returned instead of the <b>Method response status</b> that is defined as the <b>Default mapping</b> in the <b>Integration Response</b> pane. For more information, see <a href="#">Use a mapping template to override an API's request and response parameters and status codes (p. 337)</a> .
<code>\$context.requestTime</code>	The CLF-formatted request time (dd/MMM/yyyy:HH:mm:ss +-hmm).
<code>\$context.requestTimeEpoch</code>	The Epoch-formatted request time, in milliseconds.
<code>\$context.resourceId</code>	The identifier that API Gateway assigns to your resource.
<code>\$context.resourcePath</code>	The path to your resource. For example, for the non-proxy request URI of <code>https://{rest-api-id}.execute-api.{region}.amazonaws.com/{stage}/root/child</code> , The <code>\$context.resourcePath</code> value is <code>/root/child</code> . For more information, see <a href="#">Tutorial: Build a REST API with HTTP non-proxy integration (p. 49)</a> .
<code>\$context.stage</code>	The deployment stage of the API request (for example, Beta or Prod).

Parameter	Description
<code>\$context.wafResponseCode</code>	The response received from <a href="#">Amazon WAF</a> : <code>WAF_ALLOW</code> or <code>WAF_BLOCK</code> . Will not be set if the stage is not associated with a web ACL. For more information, see <a href="#">the section called "Amazon WAF" (p. 596)</a> .
<code>\$context.webaclArn</code>	The complete ARN of the web ACL that is used to decide whether to allow or block the request. Will not be set if the stage is not associated with a web ACL. For more information, see <a href="#">the section called "Amazon WAF" (p. 596)</a> .

### `$context` Variable template example

You may want to use `$context` variables in a mapping template if your API method passes structured data to a backend that requires the data to be in a particular format.

The following example shows a mapping template that maps incoming `$context` variables to backend variables with slightly different names in an integration request payload:

#### Note

Note that one of the variables is an API key. This example assumes that the method has "require API key" enabled.

```
{
  "stage" : "$context.stage",
  "request_id" : "$context.requestId",
  "api_id" : "$context.apiId",
  "resource_path" : "$context.resourcePath",
  "resource_id" : "$context.resourceId",
  "http_method" : "$context.httpMethod",
  "source_ip" : "$context.identity.sourceIp",
  "user-agent" : "$context.identity.userAgent",
  "account_id" : "$context.identity.accountId",
  "api_key" : "$context.identity.apiKey",
  "caller" : "$context.identity.caller",
  "user" : "$context.identity.user",
  "user_arn" : "$context.identity.userArn"
}
```

### `$context` Variables for access logging only

The following `$context` variables are available only for access logging. For more information, see [the section called "CloudWatch logs" \(p. 611\)](#). (For WebSocket APIs, see [the section called "Metrics" \(p. 665\)](#).)

Parameter	Description
<code>\$context.authorize.error</code>	The authorization error message.
<code>\$context.authorize.latency</code>	The authorization latency in ms.
<code>\$context.authorize.status</code>	The status code returned from an authorization attempt.
<code>\$context.authorizer.error</code>	The error message returned from an authorizer.



Parameter	Description
<code>\$context.authorizer.integrationLatency</code>	The authorizer latency in ms.
<code>\$context.authorizer.integrationStatus</code>	The status code returned from a Lambda authorizer.
<code>\$context.authorizer.latency</code>	The authorizer latency in ms.
<code>\$context.authorizer.requestId</code>	The Amazon endpoint's request ID.
<code>\$context.authorizer.status</code>	The status code returned from an authorizer.
<code>\$context.authenticate.error</code>	The error message returned from an authentication attempt.
<code>\$context.authenticate.latency</code>	The authentication latency in ms.
<code>\$context.authenticate.status</code>	The status code returned from an authentication attempt.
<code>\$context.customDomain.basePathMatched</code>	The path for an API mapping that an incoming request matched. Applicable when a client uses a custom domain name to access an API. For example if a client sends a request to <code>https://api.example.com/v1/orders/1234</code> , and the request matches the API mapping with the path <code>v1/orders</code> , the value is <code>v1/orders</code> . To learn more, see <a href="#">the section called "API mappings" (p. 480)</a> .
<code>\$context.integration.error</code>	The error message returned from an integration. Equivalent to <code>\$context.integrationErrorMessage</code> .
<code>\$context.integration.integrationStatus</code>	For Lambda proxy integration, the status code returned from Amazon Lambda, not from the backend Lambda function code.
<code>\$context.integration.latency</code>	The integration latency in ms. Equivalent to <code>\$context.integrationLatency</code> .
<code>\$context.integration.requestId</code>	The Amazon endpoint's request ID. Equivalent to <code>\$context.awsEndpointRequestId</code> .
<code>\$context.integration.status</code>	The status code returned from an integration. For Lambda proxy integrations, this is the status code that your Lambda function code returns. Equivalent to <code>\$context.integrationStatus</code> .
<code>\$context.integrationErrorMessage</code>	A string that contains an integration error message.
<code>\$context.integrationLatency</code>	The integration latency in ms.
<code>\$context.integrationStatus</code>	For Lambda proxy integration, this parameter represents the status code returned from Amazon Lambda, not from the backend Lambda function code.

Parameter	Description
<code>\$context.responseLatency</code>	The response latency in ms.
<code>\$context.responseLength</code>	The response payload length.
<code>\$context.status</code>	The method response status.
<code>\$context.waf.error</code>	The error message returned from Amazon WAF.
<code>\$context.waf.latency</code>	The Amazon WAF latency in ms.
<code>\$context.waf.status</code>	The status code returned from Amazon WAF.
<code>\$context.xrayTraceId</code>	The trace ID for the X-Ray trace. For more information, see <a href="#">the section called "Setting up Amazon X-Ray"</a> (p. 616).

## `$input` Variables

The `$input` variable represents the method request payload and parameters to be processed by a mapping template. It provides four functions:

Variable and function	Description
<code>\$input.body</code>	Returns the raw request payload as a string.
<code>\$input.json(x)</code>	<p>This function evaluates a JSONPath expression and returns the results as a JSON string.</p> <p>For example, <code>\$input.json('\$.pets')</code> returns a JSON string representing the <code>pets</code> structure.</p> <p>For more information about JSONPath, see <a href="#">JSONPath</a> or <a href="#">JSONPath for Java</a>.</p>
<code>\$input.params()</code>	Returns a map of all the request parameters. We recommend that you use <code>\$util.escapeJavaScript</code> to sanitize the result to avoid a potential injection attack. For full control of request sanitization, use a proxy integration without a template and handle request sanitization in your integration.
<code>\$input.params(x)</code>	Returns the value of a method request parameter from the path, query string, or header value (searched in that order), given a parameter name string <code>x</code> . We recommend that you use <code>\$util.escapeJavaScript</code> to sanitize the parameter to avoid a potential injection attack. For full control of parameter sanitization, use a proxy integration without a template and handle request sanitization in your integration.
<code>\$input.path(x)</code>	Takes a JSONPath expression string ( <code>x</code> ) and returns a JSON object representation of the result. This allows you to access and manipulate

Variable and function	Description
	<p>elements of the payload natively in <a href="#">Apache Velocity Template Language (VTL)</a>.</p> <p>For example, if the expression <code>\$input.path('\$.pets')</code> returns an object like this:</p> <pre data-bbox="906 464 1468 919">[   {     "id": 1,     "type": "dog",     "price": 249.99   },   {     "id": 2,     "type": "cat",     "price": 124.99   },   {     "id": 3,     "type": "fish",     "price": 0.99   } ]</pre> <p><code>\$input.path('\$.pets').count()</code> would return "3".</p> <p>For more information about JSONPath, see <a href="#">JSONPath</a> or <a href="#">JSONPath for Java</a>.</p>

## \$input Variable template examples

### Parameter mapping template example

The following parameter-mapping example passes all parameters, including path, querystring, and header, through to the integration endpoint via a JSON payload:

```
#set($allParams = $input.params())
{
  "params" : {
    #foreach($type in $allParams.keySet())
    #set($params = $allParams.get($type))
    "$type" : {
      #foreach($paramName in $params.keySet())
      "$paramName" : "$util.escapeJavaScript($params.get($paramName))"
      #if($foreach.hasNext),#end
      #end
    }
    #if($foreach.hasNext),#end
  }
}
```

In effect, this mapping template outputs all the request parameters in the payload as outlined as follows:

```
{
```

```
"params" : {
  "path" : {
    "path_name" : "path_value",
    ...
  }
  "header" : {
    "header_name" : "header_value",
    ...
  }
  "querystring" : {
    "querystring_name" : "querystring_value",
    ...
  }
}
```

You may want to use the `$input` variable to get query strings and the request body with or without using models. You may also want to get the parameter and the payload, or a subsection of the payload, into your Lambda function. The following examples show how to do this.

### Example JSON mapping template using `$input`

The following example shows how to use a mapping to read a name from the query string and then include the entire POST body in an element:

```
{
  "name" : "$input.params('name')",
  "body" : $input.json('$')
}
```

If the JSON input contains unescaped characters that cannot be parsed by JavaScript, a 400 response may be returned. Applying `$util.escapeJavaScript($input.json('$'))` above will ensure that the JSON input can be parsed properly.

### Example mapping template using `$input`

The following example shows how to pass a JSONPath expression to the `json()` method. You could also read a specific property of your request body object by using a period (`.`), followed by your property name:

```
{
  "name" : "$input.params('name')",
  "body" : $input.json('$.mykey')
}
```

If a method request payload contains unescaped characters that cannot be parsed by JavaScript, you may get 400 response. In this case, you need to call `$util.escapeJavaScript()` function in the mapping template, as shown as follows:

```
{
  "name" : "$input.params('name')",
  "body" : $util.escapeJavaScript($input.json('$.mykey'))
}
```

### Example request and response using `$input`

Here's an example that uses all three functions:

### Request template:

```
Resource: /things/{id}

With input template:
{
  "id" : "$input.params('id')",
  "count" : "$input.path('$.things').size()",
  "things" : $util.escapeJavaScript($input.json('$.things'))
}

POST /things/abc
{
  "things" : {
    "1" : {},
    "2" : {},
    "3" : {}
  }
}
```

### Response:

```
{
  "id": "abc",
  "count": "3",
  "things": {
    "1": {},
    "2": {},
    "3": {}
  }
}
```

For more mapping examples, see [Working with models and mapping templates \(p. 330\)](#).

## \$stageVariables

Stage variables can be used in parameter mapping and mapping templates and as placeholders in ARNs and URLs used in method integrations. For more information, see [the section called “Set up stage variables” \(p. 446\)](#).

Syntax	Description
<code>\$stageVariables.&lt;variable_name&gt;</code>	<code>&lt;variable_name&gt;</code> represents a stage variable name.
<code>\$stageVariables['&lt;variable_name&gt;']</code>	<code>&lt;variable_name&gt;</code> represents any stage variable name.
<code>#{stageVariables['&lt;variable_name&gt;']}</code>	<code>&lt;variable_name&gt;</code> represents any stage variable name.

## \$util Variables

The `$util` variable contains utility functions for use in mapping templates.

### Note

Unless otherwise specified, the default character set is UTF-8.

Function	Description
<code>\$util.escapeJavaScript()</code>	<p>Escapes the characters in a string using JavaScript string rules.</p> <p><b>Note</b> This function will turn any regular single quotes (') into escaped ones (\'). However, the escaped single quotes are not valid in JSON. Thus, when the output from this function is used in a JSON property, you must turn any escaped single quotes (\') back to regular single quotes ('). This is shown in the following example:</p> <pre>\$util.escapeJavaScript(<i>data</i>).replaceAll("\',"'')</pre>
<code>\$util.parseJson()</code>	<p>Takes "stringified" JSON and returns an object representation of the result. You can use the result from this function to access and manipulate elements of the payload natively in Apache Velocity Template Language (VTL). For example, if you have the following payload:</p> <pre>{"errorMessage": {"key1": "var1", "key2": {"arr": [1, 2, 3]}}</pre> <p>and use the following mapping template</p> <pre>#set (\$errorMessageObj = \$util.parseJson(\$input.path("\$.errorMessage"))) {   "errorMessageObjKey2ArrVal" : \$errorMessageObj.key2.arr[0] }</pre> <p>You will get the following output:</p> <pre>{   "errorMessageObjKey2ArrVal" : 1 }</pre>
<code>\$util.urlEncode()</code>	Converts a string into "application/x-www-form-urlencoded" format.
<code>\$util.urlDecode()</code>	Decodes an "application/x-www-form-urlencoded" string.
<code>\$util.base64Encode()</code>	Encodes the data into a base64-encoded string.
<code>\$util.base64Decode()</code>	Decodes the data from a base64-encoded string.

## Gateway responses in API Gateway

A gateway response is identified by a response type that is defined by API Gateway. The response consists of an HTTP status code, a set of additional headers that are specified by parameter mappings, and a payload that is generated by a non-VTL mapping template.

In the API Gateway REST API, a gateway response is represented by the [GatewayResponse](#). In OpenAPI, a `GatewayResponse` instance is described by the [x-amazon-apigateway-gateway-responses.gatewayResponse](#) (p. 688) extension.

To enable a gateway response, you set up a gateway response for a [supported response type](#) (p. 379) at the API level. Whenever API Gateway returns a response of this type, the header mappings and payload mapping templates defined in the gateway response are applied to return the mapped results to the API caller.

In the following section, we show how to set up gateway responses by using the API Gateway console and the API Gateway REST API.

### Setting up gateway responses to customize error responses

If API Gateway fails to process an incoming request, it returns to the client an error response without forwarding the request to the integration backend. By default, the error response contains a short descriptive error message. For example, if you attempt to call an operation on an undefined API resource, you receive an error response with the `{ "message": "Missing Authentication Token" }` message. If you are new to API Gateway, you may find it difficult to understand what actually went wrong.

For some of the error responses, API Gateway allows customization by API developers to return the responses in different formats. For the `Missing Authentication Token` example, you can add a hint to the original response payload with the possible cause, as in this example: `{ "message": "Missing Authentication Token", "hint": "The HTTP method or resources may not be supported." }`.

When your API mediates between an external exchange and the Amazon Cloud, you use VTL mapping templates for integration request or integration response to map the payload from one format to another. However, the VTL mapping templates work only for valid requests with successful responses.

For invalid requests, API Gateway bypasses the integration altogether and returns an error response. You must use the customization to render the error responses in an exchange-compliant format. Here, the customization is rendered in a non-VTL mapping template supporting only simple variable substitutions.

Generalizing the API Gateway-generated error response to any responses generated by API Gateway, we refer to them as *gateway responses*. This distinguishes API Gateway-generated responses from the integration responses. A gateway response mapping template can access `$context` variable values and `$stageVariables` property values, as well as method request parameters, in the form of `method.request.param-position.param-name`.

For more information about `$context` variables, see [\\$context Variables for data models, authorizers, mapping templates, and CloudWatch access logging](#) (p. 363). For more information about `$stageVariables`, see [\\$stageVariables](#) (p. 374). For more information about method request parameters, see [the section called "\\$input Variables"](#) (p. 371).

#### Topics

- [Set up a gateway response for a REST API using the API Gateway console](#) (p. 377)
- [Set up a gateway response using the API Gateway REST API](#) (p. 378)
- [Set up gateway response customization in OpenAPI](#) (p. 378)
- [Gateway response types](#) (p. 379)

## Set up a gateway response for a REST API using the API Gateway console

### To customize a gateway response using the API Gateway console

1. Sign in to the API Gateway console.
2. Choose a REST API.
3. In the primary navigation pane, choose **Gateway Responses** under the API.
4. In the **Gateway Responses** pane, choose a response type. In this walkthrough, we use **Missing Authentication Token (403)** as an example.
5. You can change the API Gateway-generated **Status Code** to return a different status code that meets your API's requirements. In this example, the customization changes the status code from the default (403) to 404 because this error message occurs when a client calls an unsupported or invalid resource that can be thought of as not found.
6. To return custom headers, choose **Add Header** under **Response Headers**. For illustration purposes, we add the following custom headers:

```
Access-Control-Allow-Origin: 'a.b.c'  
x-request-id:method.request.header.x-amzn-RequestId  
x-request-path:method.request.path.petId  
x-request-query:method.request.querystring.q
```

In the preceding header mappings, a static domain name ('a.b.c') is mapped to the `Allow-Control-Allow-Origin` header to allow CORS access to the API; the input request header of `x-amzn-RequestId` is mapped to `request-id` in the response; the `petId` path variable of the incoming request is mapped to the `request-path` header in the response; and the `q` query parameter of the original request is mapped to the `request-query` header of the response.

7. Under **Mapping Templates**, keep `application/json` for **Content Type** and enter the following body mapping template in the **Body Mapping Template** editor:

```
{  
  "message": "$context.error.messageString",  
  "type": "$context.error.responseType",  
  "statusCode": "'404'",  
  "stage": "$context.stage",  
  "resourcePath": "$context.resourcePath",  
  "stageVariables.a": "$stageVariables.a"  
}
```

This example shows how to map `$context` and `$stageVariables` properties to properties of the gateway response body.

8. Choose **Save**.
9. Deploy the API to a new or existing stage.
10. Test it by calling the following CURL command, assuming the corresponding API method's invoke URL is `https://o81lxisefl.execute-api.us-east-1.amazonaws.com/custErr/pets/{petId}`:

```
curl -v -H 'x-amzn-RequestId:123344566' https://o81lxisefl.execute-api.us-east-1.amazonaws.com/custErr/pets/5/type?q=1
```

Because the extra query string parameter `q=1` isn't compatible with the API, an error is returned to trigger the specified gateway response. You should get a gateway response similar to the following:



```
> GET /custErr/pets/5?q=1 HTTP/1.1
Host: o81lxisefl.execute-api.us-east-1.amazonaws.com
User-Agent: curl/7.51.0
Accept: */*

HTTP/1.1 404 Not Found
Content-Type: application/json
Content-Length: 334
Connection: keep-alive
Date: Tue, 02 May 2017 03:15:47 GMT
x-amzn-RequestId: 123344566
Access-Control-Allow-Origin: a.b.c
x-amzn-ErrorType: MissingAuthenticationTokenException
header-1: static
x-request-query: 1
x-request-path: 5
X-Cache: Error from cloudfront
Via: 1.1 441811a054e8d055b893175754efd0c3.cloudfront.net (CloudFront)
X-Amz-Cf-Id: nNDR-fX4csbRoAgtQJ16u0rTDz9FZWT-Mk93KgoxfzD1TUh3flmzA==

{
  "message": "Missing Authentication Token",
  "type": "MISSING_AUTHENTICATION_TOKEN",
  "statusCode": "404",
  "stage": "custErr",
  "resourcePath": "/pets/{petId}",
  "stageVariables.a": "a"
}
```

The preceding example assumes that the API backend is [Pet Store](#) and the API has a stage variable, `a`, defined.

## Set up a gateway response using the API Gateway REST API

Before customizing a gateway response using the API Gateway REST API, you must have already created an API and have obtained its identifier. To retrieve the API identifier, you can follow [restapi:gateway-responses](#) link relation and examine the result.

### To customize a gateway response using the API Gateway REST API

1. To overwrite an entire [GatewayResponse](#) instance, call the [gatewayresponse:put](#) action. Specify a desired [responseType](#) in the URL path parameter, and supply in the request payload the [statusCode](#), [responseParameters](#), and [responseTemplates](#) mappings.
2. To update part of a [GatewayResponse](#) instance, call the [gatewayresponse:update](#) action. Specify a desired [responseType](#) in the URL path parameter, and supply in the request payload the individual [GatewayResponse](#) properties you want—for example, the [responseParameters](#) or the [responseTemplates](#) mapping.

## Set up gateway response customization in OpenAPI

You can use the `x-amazon-apigateway-gateway-responses` extension at the API root level to customize gateway responses in OpenAPI. The following OpenAPI definition shows an example for customizing the [GatewayResponse](#) of the `MISSING_AUTHENTICATION_TOKEN` type.

```
"x-amazon-apigateway-gateway-responses": {
  "MISSING_AUTHENTICATION_TOKEN": {
    "statusCode": 404,
```

```

"responseParameters": {
  "gatewayresponse.header.x-request-path": "method.input.params.petId",
  "gatewayresponse.header.x-request-query": "method.input.params.q",
  "gatewayresponse.header.Access-Control-Allow-Origin": "'a.b.c'",
  "gatewayresponse.header.x-request-header": "method.input.params.Accept"
},
"responseTemplates": {
  "application/json": "{\n    \"message\": $context.error.messageString,\n    \"type\": \"$context.error.responseType\",\n    \"stage\": \"$context.stage\",\n    \"resourcePath\": \"$context.resourcePath\",\n    \"stageVariables.a\": \"$stageVariables.a\",\n    \"statusCode\": \"'404'\"\n}"
}

```

In this example, the customization changes the status code from the default (403) to 404. It also adds to the gateway response four header parameters and one body mapping template for the application/json media type.

## Gateway response types

API Gateway exposes the following gateway responses for customization by API developers.

Gateway response type	Default status code	Description
ACCESS_DENIED	403	The gateway response for authorization failure—for example, when access is denied by a custom or Amazon Cognito authorizer. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.
API_CONFIGURATION_ERROR	500	The gateway response for an invalid API configuration—including when an invalid endpoint address is submitted, when base64 decoding fails on binary data when binary support is enacted, or when integration response mapping can't match any template and no default template is configured. If the response type is unspecified, this response defaults to the DEFAULT_5XX type.
AUTHORIZER_CONFIGURATION_ERROR	500	The gateway response for failing to connect to a custom or Amazon Cognito authorizer. If the response type is unspecified, this response defaults to the DEFAULT_5XX type.
AUTHORIZER_FAILURE	500	The gateway response when a custom or Amazon Cognito authorizer failed to authenticate the caller. If the response type

Gateway response type	Default status code	Description
		is unspecified, this response defaults to the <code>DEFAULT_5XX</code> type.
<code>BAD_REQUEST_PARAMETERS</code>	400	The gateway response when the request parameter cannot be validated according to an enabled request validator. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.
<code>BAD_REQUEST_BODY</code>	400	The gateway response when the request body cannot be validated according to an enabled request validator. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.
<code>DEFAULT_4XX</code>	Null	The default gateway response for an unspecified response type with the status code of <code>4XX</code> . Changing the status code of this fallback gateway response changes the status codes of all other <code>4XX</code> responses to the new value. Resetting this status code to null reverts the status codes of all other <code>4XX</code> responses to their original values.  <b>Note</b> Amazon WAF custom responses take precedence over custom gateway responses.
<code>DEFAULT_5XX</code>	Null	The default gateway response for an unspecified response type with a status code of <code>5XX</code> . Changing the status code of this fallback gateway response changes the status codes of all other <code>5XX</code> responses to the new value. Resetting this status code to null reverts the status codes of all other <code>5XX</code> responses to their original values.
<code>EXPIRED_TOKEN</code>	403	The gateway response for an Amazon authentication token expired error. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.

Gateway response type	Default status code	Description
INTEGRATION_FAILURE	504	The gateway response for an integration failed error. If the response type is unspecified, this response defaults to the DEFAULT_5XX type.
INTEGRATION_TIMEOUT	504	The gateway response for an integration timed out error. If the response type is unspecified, this response defaults to the DEFAULT_5XX type.
INVALID_API_KEY	403	The gateway response for an invalid API key submitted for a method requiring an API key. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.
INVALID_SIGNATURE	403	The gateway response for an invalid Amazon signature error. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.
MISSING_AUTHENTICATION_TOKEN	403	The gateway response for a missing authentication token error, including the cases when the client attempts to invoke an unsupported API method or resource. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.
QUOTA_EXCEEDED	429	The gateway response for the usage plan quota exceeded error. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.
REQUEST_TOO_LARGE	413	The gateway response for the request too large error. If the response type is unspecified, this response defaults to the DEFAULT_4XX type.

Gateway response type	Default status code	Description
RESOURCE_NOT_FOUND	404	The gateway response when API Gateway cannot find the specified resource after an API request passes authentication and authorization, except for API key authentication and authorization. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.
THROTTLED	429	The gateway response when usage plan-, method-, stage-, or account-level throttling limits exceeded. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.
UNAUTHORIZED	401	The gateway response when the custom or Amazon Cognito authorizer failed to authenticate the caller.
UNSUPPORTED_MEDIA_TYPE	415	The gateway response when a payload is of an unsupported media type, if strict passthrough behavior is enabled. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.
WAF_FILTERED	403	The gateway response when a request is blocked by Amazon WAF. If the response type is unspecified, this response defaults to the <code>DEFAULT_4XX</code> type.  <b>Note</b> Amazon WAF custom responses take precedence over custom gateway responses.

## Enabling CORS for a REST API resource

Cross-origin resource sharing (CORS) is a browser security feature that restricts cross-origin HTTP requests that are initiated from scripts running in the browser. If your REST API's resources receive non-simple cross-origin HTTP requests, you need to enable CORS support.

### Determining whether to enable CORS support

A *cross-origin* HTTP request is one that is made to:

- A different *domain* (for example, from `example.com` to `amazondomains.com`)
- A different *subdomain* (for example, from `example.com` to `petstore.example.com`)
- A different *port* (for example, from `example.com` to `example.com:10777`)
- A different *protocol* (for example, from `https://example.com` to `http://example.com`)

Cross-origin HTTP requests can be divided into two types: *simple* requests and *non-simple* requests.

An HTTP request is *simple* if all of the following conditions are true:

- It is issued against an API resource that allows only `GET`, `HEAD`, and `POST` requests.
- If it is a `POST` method request, it must include an `Origin` header.
- The request payload content type is `text/plain`, `multipart/form-data`, or `application/x-www-form-urlencoded`.
- The request does not contain custom headers.
- Any additional requirements that are listed in the [Mozilla CORS documentation for simple requests](#).

For simple cross-origin `POST` method requests, the response from your resource needs to include the header `Access-Control-Allow-Origin`, where the value of the header key is set to `'*'` (any origin) or is set to the origins allowed to access that resource.

All other cross-origin HTTP requests are *non-simple* requests. If your API's resources receive non-simple requests, you need to enable CORS support.

## What it means to enable CORS support

When a browser receives a non-simple HTTP request, the [CORS protocol](#) requires the browser to send a preflight request to the server and wait for approval (or a request for credentials) from the server before sending the actual request. The *preflight request* appears to your API as an HTTP request that:

- Includes an `Origin` header.
- Uses the `OPTIONS` method.
- Includes the following headers:
  - `Access-Control-Request-Method`
  - `Access-Control-Request-Headers`

To support CORS, therefore, a REST API resource needs to implement an `OPTIONS` method that can respond to the `OPTIONS` preflight request with at least the following response headers mandated by the Fetch standard:

- `Access-Control-Allow-Methods`
- `Access-Control-Allow-Headers`
- `Access-Control-Allow-Origin`

How you enable CORS support depends on your API's integration type.

## Enabling CORS support for mock integrations

For a mock integration, you enable CORS by creating an `OPTIONS` method to return the required response headers (with appropriate static values) as the method response headers. In addition, each of the actual CORS-enabled methods must also return the `Access-Control-Allow-Origin: 'request-`

`originating server addresses` header in at least its 200 response, where the value of the header key is set to `'*'` (any origin) or is set to the origins allowed to access the resource.

## Enabling CORS support for Lambda or HTTP non-proxy integrations and Amazon service integrations

For a Lambda custom (non-proxy) integration, HTTP custom (non-proxy) integration, or Amazon service integration, you can set up the required headers by using API Gateway method response and integration response settings. When you enable CORS by using the Amazon Web Services Management Console, API Gateway creates an `OPTIONS` method and attempts to add the `Access-Control-Allow-Origin` header to your existing method integration responses. This doesn't always work, and sometimes you need to manually modify the integration response to properly enable CORS. Usually this just means manually modifying the integration response to return the `Access-Control-Allow-Origin` header.

## Enabling CORS support for Lambda or HTTP proxy integrations

For a Lambda proxy integration or HTTP proxy integration, you can still set up the required `OPTIONS` response headers in API Gateway. However, your backend is responsible for returning the `Access-Control-Allow-Origin` and `Access-Control-Allow-Headers` headers, because a proxy integration doesn't return an integration response.

The following example Lambda functions return the required CORS headers:

Node.js

```
exports.handler = async (event) => {
  const response = {
    statusCode: 200,
    headers: {
      "Access-Control-Allow-Headers" : "Content-Type",
      "Access-Control-Allow-Origin": "https://www.example.com",
      "Access-Control-Allow-Methods": "OPTIONS,POST,GET"
    },
    body: JSON.stringify('Hello from Lambda!'),
  };
  return response;
};
```

Python 3

```
import json

def lambda_handler(event, context):
    return {
        'statusCode': 200,
        'headers': {
            'Access-Control-Allow-Headers': 'Content-Type',
            'Access-Control-Allow-Origin': 'https://www.example.com',
            'Access-Control-Allow-Methods': 'OPTIONS,POST,GET'
        },
        'body': json.dumps('Hello from Lambda!')
    }
```

### Topics

- [Enable CORS on a resource using the API Gateway console \(p. 385\)](#)
- [Enable CORS on a resource using the API Gateway import API \(p. 385\)](#)
- [Testing CORS \(p. 388\)](#)

## Enable CORS on a resource using the API Gateway console

You can use the API Gateway console to enable CORS support for one or all methods on a REST API resource that you have created.

### Important

Resources can contain child resources. Enabling CORS support for a resource and its methods does not recursively enable it for child resources and their methods.

### Enable CORS support on a REST API resource

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose the API from the **APIs** list.
3. Choose a resource under **Resources**. This will enable CORS for all the methods on the resource.

Alternatively, you could choose a method under the resource to enable CORS for just this method.

4. Choose **Enable CORS** from the **Actions** drop-down menu.
5. In the **Enable CORS** form, do the following:
  - a. In the **Access-Control-Allow-Headers** input field, type a static string of a comma-separated list of headers that the client must submit in the actual request of the resource. Use the console-provided header list of 'Content-Type, X-Amz-Date, Authorization, X-API-Key, X-Amz-Security-Token' or specify your own headers.
  - b. Use the console-provided value of '\*' as the **Access-Control-Allow-Origin** header value to allow access requests from all origins, or specify origins to be permitted to access the resource.
  - c. Choose **Enable CORS and replace existing CORS headers**.

### Important

When applying the above instructions to the ANY method in a proxy integration, any applicable CORS headers will not be set. Instead, your backend must return the applicable CORS headers, such as Access-Control-Allow-Origin.

6. In **Confirm method changes**, choose **Yes, overwrite existing values** to confirm the new CORS settings.

After CORS is enabled on the GET method, an OPTIONS method is added to the resource, if it is not already there. The 200 response of the OPTIONS method is automatically configured to return the three Access-Control-Allow-\* headers to fulfill preflight handshakes. In addition, the actual (GET) method is also configured by default to return the Access-Control-Allow-Origin header in its 200 response as well. For other types of responses, you will need to manually configure them to return Access-Control-Allow-Origin' header with '\*' or specific origins, if you do not want to return the Cross-origin access error.

After you enable CORS support on your resource, you must deploy or redeploy the API for the new settings to take effect. For more information, see [the section called "Deploy a REST API \(console\)"](#) (p. 438).

## Enable CORS on a resource using the API Gateway import API

If you are using the [API Gateway Import API](#) (p. 427), you can set up CORS support using an OpenAPI file. You must first define an OPTIONS method in your resource that returns the required headers.

### Note

Web browsers expect Access-Control-Allow-Headers, and Access-Control-Allow-Origin headers to be set up in each API method that accepts CORS requests. In addition, some browsers first



make an HTTP request to an `OPTIONS` method in the same resource, and then expect to receive the same headers.

The following example creates an `OPTIONS` method for a mock integration.

### OpenAPI 3.0

```

/users:
  options:
    summary: CORS support
    description: |
      Enable CORS by returning correct headers
    tags:
      - CORS
    responses:
      200:
        description: Default response for CORS method
        headers:
          Access-Control-Allow-Origin:
            schema:
              type: string
          Access-Control-Allow-Methods:
            schema:
              type: string
          Access-Control-Allow-Headers:
            schema:
              type: string
        content: {}
  x-amazon-apigateway-integration:
    type: mock
    requestTemplates:
      application/json: |
        {
          "statusCode" : 200
        }
    responses:
      default:
        statusCode: "200"
        responseParameters:
          method.response.header.Access-Control-Allow-Headers: "'Content-Type,X-Amz-Date,Authorization,X-Api-Key'"
          method.response.header.Access-Control-Allow-Methods: "'*'"
          method.response.header.Access-Control-Allow-Origin: "'*'"
        responseTemplates:
          application/json: |
            {}

```

### OpenAPI 2.0

```

/users:
  options:
    summary: CORS support
    description: |
      Enable CORS by returning correct headers
    consumes:
      - application/json
    produces:
      - application/json
    tags:
      - CORS
  x-amazon-apigateway-integration:
    type: mock
    requestTemplates:
      application/json: |

```

```

        {
          "statusCode" : 200
        }
      responses:
        "default":
          statusCode: "200"
          responseParameters:
            method.response.header.Access-Control-Allow-Headers : "'Content-Type,X-
Amz-Date,Authorization,X-API-Key'"
            method.response.header.Access-Control-Allow-Methods : "'*'"
            method.response.header.Access-Control-Allow-Origin : "'*'"
          responseTemplates:
            application/json: |
              {}
      responses:
        200:
          description: Default response for CORS method
          headers:
            Access-Control-Allow-Headers:
              type: "string"
            Access-Control-Allow-Methods:
              type: "string"
            Access-Control-Allow-Origin:
              type: "string"

```

Once you have configured the `OPTIONS` method for your resource, you can add the required headers to the other methods in the same resource that need to accept CORS requests.

1. Declare the **Access-Control-Allow-Origin** and **Headers** to the response types.

#### OpenAPI 3.0

```

responses:
  200:
    description: Default response for CORS method
    headers:
      Access-Control-Allow-Origin:
        schema:
          type: string
      Access-Control-Allow-Methods:
        schema:
          type: string
      Access-Control-Allow-Headers:
        schema:
          type: string
    content: {}

```

#### OpenAPI 2.0

```

responses:
  200:
    description: Default response for CORS method
    headers:
      Access-Control-Allow-Headers:
        type: "string"
      Access-Control-Allow-Methods:
        type: "string"
      Access-Control-Allow-Origin:
        type: "string"

```

2. In the `x-amazon-apigateway-integration` tag, set up the mapping for those headers to your static values:

#### OpenAPI 3.0

```
responses:
  default:
    statusCode: "200"
    responseParameters:
      method.response.header.Access-Control-Allow-Headers: "'Content-Type,X-Amz-Date,Authorization,X-Api-Key'"
      method.response.header.Access-Control-Allow-Methods: "'*'"
      method.response.header.Access-Control-Allow-Origin: "'*'"
    responseTemplates:
      application/json: |
        {}
```

#### OpenAPI 2.0

```
responses:
  "default":
    statusCode: "200"
    responseParameters:
      method.response.header.Access-Control-Allow-Headers : "'Content-Type,X-Amz-Date,Authorization,X-Api-Key'"
      method.response.header.Access-Control-Allow-Methods : "'*'"
      method.response.header.Access-Control-Allow-Origin : "'*'"
```

## Testing CORS

You can test your API's CORS configuration by invoking your API, and checking the CORS headers in the response. The following `curl` command sends an `OPTIONS` request to a deployed API.

```
curl -v -X OPTIONS https://{restapi_id}.execute-api.{region}.amazonaws.com/{stage_name}
```

```
< HTTP/1.1 200 OK
< Date: Tue, 19 May 2020 00:55:22 GMT
< Content-Type: application/json
< Content-Length: 0
< Connection: keep-alive
< x-amzn-RequestId: alb2c3d4-5678-90ab-cdef-abc123
< Access-Control-Allow-Origin: *
< Access-Control-Allow-Headers: Content-Type,Authorization,X-Amz-Date,X-Api-Key,X-Amz-Security-Token
< x-amz-apigw-id: Abcd=
< Access-Control-Allow-Methods: DELETE,GET,HEAD,OPTIONS,PATCH,POST,PUT
```

The `Access-Control-Allow-Origin`, `Access-Control-Allow-Headers`, and `Access-Control-Allow-Methods` headers in the response show that the API supports CORS. For more information, see [Enabling CORS for a REST API resource \(p. 382\)](#).

## Working with binary media types for REST APIs

In API Gateway, the API request and response have a text or binary payload. A text payload is a UTF-8-encoded JSON string. A binary payload is anything other than a text payload. The binary payload can be, for example, a JPEG file, a GZip file, or an XML file. The API configuration required to support binary media depends on whether your API uses proxy or non-proxy integrations.

## Amazon Lambda proxy integrations

To handle binary payloads for Amazon Lambda proxy integrations, you must base64-encode your function's response. You must also configure the `binaryMediaTypes` for your API. Your API's `binaryMediaTypes` configuration is a list of content types that your API treats as binary data. Example binary media types include `image/png` or `application/octet-stream`. You can use the wildcard character (\*) to cover multiple media types. For example, `*/*` includes all content types.

For example code, see [the section called "Return binary media from a Lambda proxy integration" \(p. 396\)](#).

## Non-proxy integrations

To handle binary payloads for non-proxy integrations, you add the media types to the `binaryMediaTypes` list of the `RestApi` resource. Your API's `binaryMediaTypes` configuration is a list of content types that your API treats as binary data. Alternatively, you can set the `contentHandling` properties on the `Integration` and the `IntegrationResponse` resources. The `contentHandling` value can be `CONVERT_TO_BINARY`, `CONVERT_TO_TEXT`, or `undefined`.

Depending on the `contentHandling` value, and whether the `Content-Type` header of the response or the `Accept` header of the incoming request matches an entry in the `binaryMediaTypes` list, API Gateway can encode the raw binary bytes as a base64-encoded string, decode a base64-encoded string back to its raw bytes, or pass the body through without modification.

You must configure the API as follows to support binary payloads for your API in API Gateway:

- Add the desired binary media types to the `binaryMediaTypes` list on the `RestApi` resource. If this property and the `contentHandling` property are not defined, the payloads are handled as UTF-8 encoded JSON strings.
- Address the `contentHandling` property of the `Integration` resource.
  - To have the request payload converted from a base64-encoded string to its binary blob, set the property to `CONVERT_TO_BINARY`.
  - To have the request payload converted from a binary blob to a base64-encoded string, set the property to `CONVERT_TO_TEXT`.
  - To pass the payload through without modification, leave the property undefined. To pass a binary payload through without modification, you must also ensure that the `Content-Type` matches one of the `binaryMediaTypes` entries, and that [passthrough behaviors \(p. 362\)](#) are enabled for the API.
- Set the `contentHandling` property of the `IntegrationResponse` resource. The `contentHandling` property, `Accept` header in client requests, and your API's `binaryMediaTypes` combined determine how API Gateway handles content type conversions. For details, see [the section called "Content type conversions in API Gateway" \(p. 390\)](#).

### Important

When a request contains multiple media types in its `Accept` header, API Gateway honors only the first `Accept` media type. If you can't control the order of the `Accept` media types and the media type of your binary content isn't the first in the list, add the first `Accept` media type in the `binaryMediaTypes` list of your API. API Gateway handles all content types in this list as binary.

For example, to send a JPEG file using an `<img>` element in a browser, the browser might send `Accept:image/webp,image/*,*/*;q=0.8` in a request. By adding `image/webp` to the `binaryMediaTypes` list, the endpoint receives the JPEG file as binary.

For detailed information about how API Gateway handles the text and binary payloads, see [Content type conversions in API Gateway \(p. 390\)](#).

## Content type conversions in API Gateway

The combination of your API's `binaryMediaTypes`, the headers in client requests, and the integration `contentHandling` property determine how API Gateway encodes payloads.

The following table shows how API Gateway converts the request payload for specific configurations of a request's `Content-Type` header, the `binaryMediaTypes` list of a [RestApi](#) resource, and the `contentHandling` property value of the [Integration](#) resource.

### API request content type conversions in API Gateway

Method request payload	Request Content-Type header	binaryMediaType	contentHandling	Integration request payload
Text data	Any data type	Undefined	Undefined	UTF8-encoded string
Text data	Any data type	Undefined	CONVERT_TO_BINARY	Base64-decoded binary blob
Text data	Any data type	Undefined	CONVERT_TO_TEXT	UTF8-encoded string
Text data	A text data type	Set with matching media types	Undefined	Text data
Text data	A text data type	Set with matching media types	CONVERT_TO_BINARY	Base64-decoded binary blob
Text data	A text data type	Set with matching media types	CONVERT_TO_TEXT	Text data
Binary data	A binary data type	Set with matching media types	Undefined	Binary data
Binary data	A binary data type	Set with matching media types	CONVERT_TO_BINARY	Binary data
Binary data	A binary data type	Set with matching media types	CONVERT_TO_TEXT	Base64-encoded string

The following table shows how API Gateway converts the response payload for specific configurations of a request's `Accept` header, the `binaryMediaTypes` list of a [RestApi](#) resource, and the `contentHandling` property value of the [IntegrationResponse](#) resource.

#### Important

When a request contains multiple media types in its `Accept` header, API Gateway honors only the first `Accept` media type. If you can't control the order of the `Accept` media types and the media type of your binary content isn't the first in the list, add the first `Accept` media type in the `binaryMediaTypes` list of your API. API Gateway handles all content types in this list as binary.

For example, to send a JPEG file using an `<img>` element in a browser, the browser might send `Accept: image/webp, image/*, */*; q=0.8` in a request. By adding `image/webp` to the `binaryMediaTypes` list, the endpoint receives the JPEG file as binary.

### API Gateway response content type conversions

Integration response payload	Request Accept header	binaryMediaType	contentHandling	Method response payload
Text or binary data	A text type	Undefined	Undefined	UTF8-encoded string
Text or binary data	A text type	Undefined	CONVERT_TO_BINARY	Base64-decoded blob
Text or binary data	A text type	Undefined	CONVERT_TO_TEXT	UTF8-encoded string
Text data	A text type	Set with matching media types	Undefined	Text data
Text data	A text type	Set with matching media types	CONVERT_TO_BINARY	Base64-decoded blob
Text data	A text type	Set with matching media types	CONVERT_TO_TEXT	UTF8-encoded string
Text data	A binary type	Set with matching media types	Undefined	Base64-decoded blob
Text data	A binary type	Set with matching media types	CONVERT_TO_BINARY	Base64-decoded blob
Text data	A binary type	Set with matching media types	CONVERT_TO_TEXT	UTF8-encoded string
Binary data	A text type	Set with matching media types	Undefined	Base64-encoded string
Binary data	A text type	Set with matching media types	CONVERT_TO_BINARY	Binary data
Binary data	A text type	Set with matching media types	CONVERT_TO_TEXT	Base64-encoded string
Binary data	A binary type	Set with matching media types	Undefined	Binary data
Binary data	A binary type	Set with matching media types	CONVERT_TO_BINARY	Binary data
Binary data	A binary type	Set with matching media types	CONVERT_TO_TEXT	Base64-encoded string

When converting a text payload to a binary blob, API Gateway assumes that the text data is a base64-encoded string and outputs the binary data as a base64-decoded blob. If the conversion fails, it returns a 500 response, which indicates an API configuration error. You don't provide a mapping template for such a conversion, although you must enable the [passthrough behaviors \(p. 362\)](#) on the API.

When converting a binary payload to a text string, API Gateway always applies a base64 encoding on the binary data. You can define a mapping template for such a payload, but can only access the base64-encoded string in the mapping template through `$input.body`, as shown in the following excerpt of an example mapping template.

```
{  
  "data": "$input.body"  
}
```

To have the binary payload passed through without modification, you must enable the [passthrough behaviors](#) (p. 362) on the API.

## Enabling binary support using the API Gateway console

The section explains how to enable binary support using the API Gateway console. As an example, we use an API that is integrated with Amazon S3. We focus on the tasks to set the supported media types and to specify how the payload should be handled. For detailed information on how to create an API integrated with Amazon S3, see [Tutorial: Create a REST API as an Amazon S3 proxy in API Gateway](#) (p. 94).

### To enable binary support by using the API Gateway console

1. Set binary media types for the API:
  - a. Create a new API or choose an existing API. For this example, we name the API `FileMan`.
  - b. Under the selected API in the primary navigation panel, choose **Settings**.
  - c. In the **Settings** pane, choose **Add Binary Media Type** in the **Binary Media Types** section.
  - d. Type a required media type, for example, `image/png`, in the input text field. If needed, repeat this step to add more media types. To support all binary media types, specify `/*/*`.
  - e. Choose **Save Changes**.
2. Set how message payloads are handled for the API method:
  - a. Create a new or choose an existing resource in the API. For this example, we use the `{folder}/{item}` resource.
  - b. Create a new or choose an existing method on the resource. As an example, we use the `GET /{folder}/{item}` method integrated with the `Object GET` action in Amazon S3.
  - c. In **Content Handling**, choose an option.

Choose **Passthrough** if you don't want to convert the body when the client and backend accepts the same binary format. Choose **Convert to text (if needed)** to convert the binary body to a base64-encoded string when, for example, the backend requires that a binary request payload is passed in as a JSON property. And choose **Convert to binary (if needed)** when the client submits a base64-encoded string and the backend requires the original binary format, or when the endpoint returns a base64-encoded string and the client accepts only the binary output.

- d. Preserve the incoming request's `Accept` header in the integration request. You should do this if you've set `contentHandling` to `passthrough` and want to override that setting at runtime.
- e. Enable the passthrough behavior on the request body.
- f. For conversion to text, define a mapping template to put the base64-encoded binary data into the required format.

The format of this mapping template depends on the endpoint requirements of the input.

## Enabling binary support using the API Gateway REST API

The following tasks show how to enable binary support using the API Gateway REST API calls.

## Topics

- [Add and update supported binary media types to an API \(p. 393\)](#)
- [Configure request payload conversions \(p. 393\)](#)
- [Configure response payload conversions \(p. 394\)](#)
- [Convert binary data to text data \(p. 394\)](#)
- [Convert text data to a binary payload \(p. 395\)](#)
- [Pass through a binary payload \(p. 395\)](#)

## Add and update supported binary media types to an API

To enable API Gateway to support a new binary media type, you must add the binary media type to the `binaryMediaTypes` list of the `RestApi` resource. For example, to have API Gateway handle JPEG images, submit a `PATCH` request to the `RestApi` resource:

```
PATCH /restapis/<restapi_id>

{
  "patchOperations" : [ {
    "op" : "add",
    "path" : "/binaryMediaTypes/image~1jpeg"
  }
]
}
```

The MIME type specification of `image/jpeg` that is part of the `path` property value is escaped as `image~1jpeg`.

To update the supported binary media types, replace or remove the media type from the `binaryMediaTypes` list of the `RestApi` resource. For example, to change binary support from JPEG files to raw bytes, submit a `PATCH` request to the `RestApi` resource, as follows:

```
PATCH /restapis/<restapi_id>

{
  "patchOperations" : [{
    "op" : "replace",
    "path" : "/binaryMediaTypes/image~1jpeg",
    "value" : "application/octet-stream"
  },
  {
    "op" : "remove",
    "path" : "/binaryMediaTypes/image~1jpeg"
  }
]
}
```

## Configure request payload conversions

If the endpoint requires a binary input, set the `contentHandling` property of the `Integration` resource to `CONVERT_TO_BINARY`. To do so, submit a `PATCH` request, as follows:

```
PATCH /restapis/<restapi_id>/resources/<resource_id>/methods/<http_method>/integration

{
  "patchOperations" : [ {
    "op" : "replace",
    "path" : "/contentHandling",
```



```
    "value" : "CONVERT_TO_BINARY"  
  }]  
}
```

## Configure response payload conversions

If the client accepts the result as a binary blob instead of a base64-encoded payload returned from the endpoint, set the `contentHandling` property of the `IntegrationResponse` resource to `CONVERT_TO_BINARY`. To do this, submit a `PATCH` request, as follows:

```
PATCH /restapis/<restapi_id>/resources/<resource_id>/methods/<http_method>/integration/  
responses/<status_code>  
  
{  
  "patchOperations" : [ {  
    "op" : "replace",  
    "path" : "/contentHandling",  
    "value" : "CONVERT_TO_BINARY"  
  }]  
}
```

## Convert binary data to text data

To send binary data as a JSON property of the input to Amazon Lambda or Kinesis through API Gateway, do the following:

1. Enable the binary payload support of the API by adding the new binary media type of `application/octet-stream` to the API's `binaryMediaTypes` list.

```
PATCH /restapis/<restapi_id>  
  
{  
  "patchOperations" : [ {  
    "op" : "add",  
    "path" : "/binaryMediaTypes/application-1octet-stream"  
  }  
]  
}
```

2. Set `CONVERT_TO_TEXT` on the `contentHandling` property of the `Integration` resource and provide a mapping template to assign the base64-encoded string of the binary data to a JSON property. In the following example, the JSON property is `body` and `$input.body` holds the base64-encoded string.

```
PATCH /restapis/<restapi_id>/resources/<resource_id>/methods/<http_method>/integration  
  
{  
  "patchOperations" : [  
    {  
      "op" : "replace",  
      "path" : "/contentHandling",  
      "value" : "CONVERT_TO_TEXT"  
    },  
    {  
      "op" : "add",  
      "path" : "/requestTemplates/application-1octet-stream",  
      "value" : "{\"body\": \"${input.body}\"}"  
    }  
  ]  
}
```

## Convert text data to a binary payload

Suppose a Lambda function returns an image file as a base64-encoded string. To pass this binary output to the client through API Gateway, do the following:

1. Update the API's `binaryMediaTypes` list by adding the binary media type of `application/octet-stream`, if it is not already in the list.

```
PATCH /restapis/<restapi_id>

{
  "patchOperations" : [ {
    "op" : "add",
    "path" : "/binaryMediaTypes/application~octet-stream",
  } ]
}
```

2. Set the `contentHandling` property on the Integration resource to `CONVERT_TO_BINARY`. Do not define a mapping template. If you don't define a mapping template, API Gateway invokes the passthrough template to return the base64-decoded binary blob as the image file to the client.

```
PATCH /restapis/<restapi_id>/resources/<resource_id>/methods/<http_method>/integration/
responses/<status_code>

{
  "patchOperations" : [
    {
      "op" : "replace",
      "path" : "/contentHandling",
      "value" : "CONVERT_TO_BINARY"
    }
  ]
}
```

## Pass through a binary payload

To store an image in an Amazon S3 bucket using API Gateway, do the following:

1. Update the API's `binaryMediaTypes` list by adding the binary media type of `application/octet-stream`, if it isn't already in the list.

```
PATCH /restapis/<restapi_id>

{
  "patchOperations" : [ {
    "op" : "add",
    "path" : "/binaryMediaTypes/application~octet-stream"
  } ]
}
```

2. On the `contentHandling` property of the Integration resource, set `CONVERT_TO_BINARY`. Set `WHEN_NO_MATCH` as the `passthroughBehavior` property value without defining a mapping template. This enables API Gateway to invoke the passthrough template.

```
PATCH /restapis/<restapi_id>/resources/<resource_id>/methods/<http_method>/integration

{
  "patchOperations" : [
```

```
{
  "op" : "replace",
  "path" : "/contentHandling",
  "value" : "CONVERT_TO_BINARY"
},
{
  "op" : "replace",
  "path" : "/passthroughBehaviors",
  "value" : "WHEN_NO_MATCH"
}
]
}
```

## Import and export content encodings

To import the `binaryMediaTypes` list on a [RestApi](#), use the following API Gateway extension to the API's OpenAPI definition file. The extension is also used to export the API settings.

- [x-amazon-apigateway-binary-media-types property \(p. 686\)](#)

To import and export the `contentHandling` property value on an `Integration` or `IntegrationResponse` resource, use the following API Gateway extensions to the OpenAPI definitions:

- [x-amazon-apigateway-integration object \(p. 691\)](#)
- [x-amazon-apigateway-integration.response object \(p. 700\)](#)

## Examples of binary support

The following examples demonstrate how to access a binary file in Amazon S3 or Amazon Lambda through an API Gateway API.

### Topics

- [Return binary media from a Lambda proxy integration \(p. 396\)](#)
- [Access binary files in Amazon S3 through an API Gateway API \(p. 397\)](#)
- [Access binary files in Lambda using an API Gateway API \(p. 402\)](#)

## Return binary media from a Lambda proxy integration

To return binary media from an [Amazon Lambda proxy integration \(p. 286\)](#), base64 encode the response from your Lambda function. You must also [configure your API's binary media types \(p. 392\)](#).

### Note

To use a web browser to invoke an API with this example integration, set your API's binary media types to `*/*`. API Gateway uses the first `Accept` header from clients to determine if a response should return binary media. To return binary media when you can't control the order of `Accept` header values, such as requests from a browser, set your API's binary media types to `*/*` (for all content types).

The following example Python 3 Lambda function can return a binary image from Amazon S3 or text to clients. The function's response includes a `Content-Type` header to indicate to the client the type of data that it returns. The function conditionally sets the `isBase64Encoded` property in its response, depending on the type of data that it returns.

```
import base64
import boto3
```

```
import json
import random

s3 = boto3.client('s3')

def lambda_handler(event, context):
    number = random.randint(0,1)
    if number == 1:
        response = s3.get_object(
            Bucket='bucket-name',
            Key='image.png',
        )
        image = response['Body'].read()
        return {
            'headers': { "Content-Type": "image/png" },
            'statusCode': 200,
            'body': base64.b64encode(image).decode('utf-8'),
            'isBase64Encoded': True
        }
    else:
        return {
            'headers': { "Content-type": "text/html" },
            'statusCode': 200,
            'body': "<h1>This is text</h1>",
        }
```

To learn more about binary media types, see [Working with binary media types for REST APIs \(p. 388\)](#).

## Access binary files in Amazon S3 through an API Gateway API

The following examples show the OpenAPI file used to access images in Amazon S3, how to download an image from Amazon S3, and how to upload an image to Amazon S3.

### Topics

- [OpenAPI file of a sample API to access images in Amazon S3 \(p. 397\)](#)
- [Download an image from Amazon S3 \(p. 401\)](#)
- [Upload an image to Amazon S3 \(p. 402\)](#)

### OpenAPI file of a sample API to access images in Amazon S3

The following OpenAPI file shows a sample API that illustrates downloading an image file from Amazon S3 and uploading an image file to Amazon S3. This API exposes the `GET /s3?key={file-name}` and `PUT /s3?key={file-name}` methods for downloading and uploading a specified image file. The `GET` method returns the image file as a base64-encoded string as part of a JSON output, following the supplied mapping template, in a 200 OK response. The `PUT` method takes a raw binary blob as input and returns a 200 OK response with an empty payload.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "version": "2016-10-21T17:26:28Z",
    "title": "ApiName"
  },
  "paths": {
    "/s3": {
      "get": {
        "parameters": [
          {
```

```

        "name": "key",
        "in": "query",
        "required": false,
        "schema": {
            "type": "string"
        }
    },
    ],
    "responses": {
        "200": {
            "description": "200 response",
            "content": {
                "application/json": {
                    "schema": {
                        "$ref": "#/components/schemas/Empty"
                    }
                }
            }
        },
        "500": {
            "description": "500 response"
        }
    },
    "x-amazon-apigateway-integration": {
        "credentials": "arn:aws:iam::123456789012:role/binarySupportRole",
        "responses": {
            "default": {
                "statusCode": "500"
            },
            "2\\d{2}": {
                "statusCode": "200"
            }
        },
        "requestParameters": {
            "integration.request.path.key": "method.request.querystring.key"
        },
        "uri": "arn:aws:apigateway:us-west-2:s3:path/{key}",
        "passthroughBehavior": "when_no_match",
        "httpMethod": "GET",
        "type": "aws"
    }
},
"put": {
    "parameters": [
        {
            "name": "key",
            "in": "query",
            "required": false,
            "schema": {
                "type": "string"
            }
        }
    ],
    "responses": {
        "200": {
            "description": "200 response",
            "content": {
                "application/json": {
                    "schema": {
                        "$ref": "#/components/schemas/Empty"
                    }
                },
                "application/octet-stream": {
                    "schema": {
                        "$ref": "#/components/schemas/Empty"
                    }
                }
            }
        }
    }
}

```

```

        }
      },
      "500": {
        "description": "500 response"
      }
    },
    "x-amazon-apigateway-integration": {
      "credentials": "arn:aws:iam::123456789012:role/binarySupportRole",
      "responses": {
        "default": {
          "statusCode": "500"
        },
        "2\\d{2}": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.path.key": "method.request.querystring.key"
      },
      "uri": "arn:aws:apigateway:us-west-2:s3:path/{key}",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "PUT",
      "type": "aws",
      "contentHandling": "CONVERT_TO_BINARY"
    }
  }
},
"x-amazon-apigateway-binary-media-types": [
  "application/octet-stream",
  "image/jpeg"
],
"servers": [
  {
    "url": "https://abcdefghi.execute-api.us-east-1.amazonaws.com/{basePath}",
    "variables": {
      "basePath": {
        "default": "/v1"
      }
    }
  }
],
"components": {
  "schemas": {
    "Empty": {
      "type": "object",
      "title": "Empty Schema"
    }
  }
}
}

```

## OpenAPI 2.0

```

{
  "swagger": "2.0",
  "info": {
    "version": "2016-10-21T17:26:28Z",
    "title": "ApiName"
  },
  "host": "abcdefghi.execute-api.us-east-1.amazonaws.com",
  "basePath": "/v1",
  "schemes": [
    "https"
  ]
}

```

```

],
"paths": {
  "/s3": {
    "get": {
      "produces": [
        "application/json"
      ],
      "parameters": [
        {
          "name": "key",
          "in": "query",
          "required": false,
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "schema": {
            "$ref": "#/definitions/Empty"
          }
        },
        "500": {
          "description": "500 response"
        }
      },
      "x-amazon-apigateway-integration": {
        "credentials": "arn:aws:iam::123456789012:role/binarySupportRole",
        "responses": {
          "default": {
            "statusCode": "500"
          },
          "2\\d{2}": {
            "statusCode": "200"
          }
        },
        "requestParameters": {
          "integration.request.path.key": "method.request.querystring.key"
        },
        "uri": "arn:aws:apigateway:us-west-2:s3:path/{key}",
        "passthroughBehavior": "when_no_match",
        "httpMethod": "GET",
        "type": "aws"
      }
    },
    "put": {
      "produces": [
        "application/json", "application/octet-stream"
      ],
      "parameters": [
        {
          "name": "key",
          "in": "query",
          "required": false,
          "type": "string"
        }
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "schema": {
            "$ref": "#/definitions/Empty"
          }
        },
        "500": {
          "description": "500 response"
        }
      }
    }
  }
}

```

```
    },
    "x-amazon-apigateway-integration": {
      "credentials": "arn:aws:iam::123456789012:role/binarySupportRole",
      "responses": {
        "default": {
          "statusCode": "500"
        },
        "2\\d{2}": {
          "statusCode": "200"
        }
      },
      "requestParameters": {
        "integration.request.path.key": "method.request.querystring.key"
      },
      "uri": "arn:aws:apigateway:us-west-2:s3:path/{key}",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "PUT",
      "type": "aws",
      "contentHandling" : "CONVERT_TO_BINARY"
    }
  }
},
"x-amazon-apigateway-binary-media-types" : ["application/octet-stream", "image/jpeg"],
"definitions": {
  "Empty": {
    "type": "object",
    "title": "Empty Schema"
  }
}
}
```

## Download an image from Amazon S3

To download an image file (image .jpg) as a binary blob from Amazon S3:

```
GET /v1/s3?key=image.jpg HTTP/1.1
Host: abcdefghi.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/octet-stream
```

The successful response looks like this:

```
200 OK HTTP/1.1
[raw bytes]
```

The raw bytes are returned because the `Accept` header is set to a binary media type of `application/octet-stream` and binary support is enabled for the API.

Alternatively, to download an image file (image .jpg) as a base64-encoded string (formatted as a JSON property) from Amazon S3, add a response template to the 200 integration response, as shown in the following bold-faced OpenAPI definition block:

```
"x-amazon-apigateway-integration": {
  "credentials": "arn:aws:iam::123456789012:role/binarySupportRole",
  "responses": {
    "default": {
      "statusCode": "500"
    },
```



```
"2\\d{2}": {
  "statusCode": "200",
  "responseTemplates": {
    "application/json": "{\n  \"image\": \"#{@input.body}\n}"
  }
},
```

The request to download the image file looks like the following:

```
GET /v1/s3?key=image.jpg HTTP/1.1
Host: abcdefghi.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json
```

The successful response looks like the following:

```
200 OK HTTP/1.1

{
  "image": "W3JhdYBieXRlc10="
}
```

### Upload an image to Amazon S3

To upload an image file (image . jpg) as a binary blob to Amazon S3:

```
PUT /v1/s3?key=image.jpg HTTP/1.1
Host: abcdefghi.execute-api.us-east-1.amazonaws.com
Content-Type: application/octet-stream
Accept: application/json

[raw bytes]
```

The successful response looks like the following:

```
200 OK HTTP/1.1
```

To upload an image file (image . jpg) as a base64-encoded string to Amazon S3:

```
PUT /v1/s3?key=image.jpg HTTP/1.1
Host: abcdefghi.execute-api.us-east-1.amazonaws.com
Content-Type: application/json
Accept: application/json

W3JhdYBieXRlc10=
```

The input payload must be a base64-encoded string because the `Content-Type` header value is set to `application/json`. The successful response looks like the following:

```
200 OK HTTP/1.1
```

### Access binary files in Lambda using an API Gateway API

The following example demonstrates how to access a binary file in Amazon Lambda through an API Gateway API. The sample API is presented in an OpenAPI file. The code example uses the API Gateway REST API calls.

## Topics

- [OpenAPI file of a sample API to access images in Lambda \(p. 403\)](#)
- [Download an image from Lambda \(p. 407\)](#)
- [Upload an image to Lambda \(p. 407\)](#)

## OpenAPI file of a sample API to access images in Lambda

The following OpenAPI file shows an example API that illustrates downloading an image file from Lambda and uploading an image file to Lambda.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "version": "2016-10-21T17:26:28Z",
    "title": "ApiName"
  },
  "paths": {
    "/lambda": {
      "get": {
        "parameters": [
          {
            "name": "key",
            "in": "query",
            "required": false,
            "schema": {
              "type": "string"
            }
          }
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/Empty"
                }
              }
            }
          },
          "500": {
            "description": "500 response"
          }
        },
        "x-amazon-apigateway-integration": {
          "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:image/invocations",
          "type": "AWS",
          "credentials": "arn:aws:iam::123456789012:role/Lambda",
          "httpMethod": "POST",
          "requestTemplates": {
            "application/json": "{\n  \"imageKey\": \"${input.params('key')}\"\n}"
          },
          "responses": {
            "default": {
              "statusCode": "500"
            },
            "2\\d{2}": {
              "statusCode": "200",
              "responseTemplates": {
```

```

        "application/json": "{\n  \"image\": \"${input.body}\n}"
      }
    }
  },
  "put": {
    "parameters": [
      {
        "name": "key",
        "in": "query",
        "required": false,
        "schema": {
          "type": "string"
        }
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "content": {
          "application/json": {
            "schema": {
              "$ref": "#/components/schemas/Empty"
            }
          },
          "application/octet-stream": {
            "schema": {
              "$ref": "#/components/schemas/Empty"
            }
          }
        }
      },
      "500": {
        "description": "500 response"
      }
    },
    "x-amazon-apigateway-integration": {
      "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:image/invocations",
      "type": "AWS",
      "credentials": "arn:aws:iam:123456789012:role/Lambda",
      "httpMethod": "POST",
      "contentHandling": "CONVERT_TO_TEXT",
      "requestTemplates": {
        "application/json": "{\n  \"imageKey\": \"${input.params('key')}\",
        \"image\": \"${input.body}\n}"
      },
      "responses": {
        "default": {
          "statusCode": "500"
        },
        "2\\d{2}": {
          "statusCode": "200"
        }
      }
    }
  }
},
"x-amazon-apigateway-binary-media-types": [
  "application/octet-stream",
  "image/jpeg"
],
"servers": [
  {

```

```
        "url": "https://abcdefghi.execute-api.us-east-1.amazonaws.com/{basePath}",
        "variables": {
            "basePath": {
                "default": "/v1"
            }
        }
    },
    ],
    "components": {
        "schemas": {
            "Empty": {
                "type": "object",
                "title": "Empty Schema"
            }
        }
    }
}
```

## OpenAPI 2.0

```
{
  "swagger": "2.0",
  "info": {
    "version": "2016-10-21T17:26:28Z",
    "title": "ApiName"
  },
  "host": "abcdefghi.execute-api.us-east-1.amazonaws.com",
  "basePath": "/v1",
  "schemes": [
    "https"
  ],
  "paths": {
    "/lambda": {
      "get": {
        "produces": [
          "application/json"
        ],
        "parameters": [
          {
            "name": "key",
            "in": "query",
            "required": false,
            "type": "string"
          }
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "schema": {
              "$ref": "#/definitions/Empty"
            }
          },
          "500": {
            "description": "500 response"
          }
        },
        "x-amazon-apigateway-integration": {
          "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:image/invocations",
          "type": "AWS",
          "credentials": "arn:aws:iam::123456789012:role/Lambda",
          "httpMethod": "POST",
          "requestTemplates": {
            "application/json": "{\n  \"imageKey\": \"${input.params('key')}\"\n}"
          }
        }
      }
    }
  }
}
```

```

        "responses": {
          "default": {
            "statusCode": "500"
          },
          "2\\d{2}": {
            "statusCode": "200",
            "responseTemplates": {
              "application/json": "{\n  \"image\": \"${input.body}\"\\n}"
            }
          }
        }
      },
      "put": {
        "produces": [
          "application/json", "application/octet-stream"
        ],
        "parameters": [
          {
            "name": "key",
            "in": "query",
            "required": false,
            "type": "string"
          }
        ],
        "responses": {
          "200": {
            "description": "200 response",
            "schema": {
              "$ref": "#/definitions/Empty"
            }
          },
          "500": {
            "description": "500 response"
          }
        },
        "x-amazon-apigateway-integration": {
          "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:image/invocations",
          "type": "AWS",
          "credentials": "arn:aws:iam::123456789012:role/Lambda",
          "httpMethod": "POST",
          "contentHandling": "CONVERT_TO_TEXT",
          "requestTemplates": {
            "application/json": "{\n  \"imageKey\": \"${input.params('key')}\", \"image\": \"${input.body}\"\\n}"
          },
          "responses": {
            "default": {
              "statusCode": "500"
            },
            "2\\d{2}": {
              "statusCode": "200"
            }
          }
        }
      }
    },
    "x-amazon-apigateway-binary-media-types" : ["application/octet-stream", "image/jpeg"],
    "definitions": {
      "Empty": {
        "type": "object",
        "title": "Empty Schema"
      }
    }
  }
}

```

```
}  
}
```

### Download an image from Lambda

To download an image file (image . jpg) as a binary blob from Lambda:

```
GET /v1/lambda?key=image.jpg HTTP/1.1  
Host: abcdefghi.execute-api.us-east-1.amazonaws.com  
Content-Type: application/json  
Accept: application/octet-stream
```

The successful response looks like the following:

```
200 OK HTTP/1.1  
  
[raw bytes]
```

To download an image file (image . jpg) as a base64-encoded string (formatted as a JSON property) from Lambda:

```
GET /v1/lambda?key=image.jpg HTTP/1.1  
Host: abcdefghi.execute-api.us-east-1.amazonaws.com  
Content-Type: application/json  
Accept: application/json
```

The successful response looks like the following:

```
200 OK HTTP/1.1  
  
{  
  "image": "W3JhdYBieXRlc10="  
}
```

### Upload an image to Lambda

To upload an image file (image . jpg) as a binary blob to Lambda:

```
PUT /v1/lambda?key=image.jpg HTTP/1.1  
Host: abcdefghi.execute-api.us-east-1.amazonaws.com  
Content-Type: application/octet-stream  
Accept: application/json  
  
[raw bytes]
```

The successful response looks like the following:

```
200 OK
```

To upload an image file (image . jpg) as a base64-encoded string to Lambda:

```
PUT /v1/lambda?key=image.jpg HTTP/1.1  
Host: abcdefghi.execute-api.us-east-1.amazonaws.com  
Content-Type: application/json  
Accept: application/json
```

```
W3JhdyBieXRlc10=
```

The successful response looks like the following:

```
200 OK
```

## Invoking a REST API in Amazon API Gateway

To call a deployed API, clients submit requests to the URL for the API Gateway component service for API execution, known as `execute-api`.

The base URL for REST APIs is in the following format:

```
https://{restapi_id}.execute-api.{region}.amazonaws.com/{stage_name}/
```

where `{restapi_id}` is the API identifier, `{region}` is the Region, and `{stage_name}` is the stage name of the API deployment.

### Important

Before you can invoke an API, you must deploy it in API Gateway. To do that, follow the instructions in [Deploying a REST API in Amazon API Gateway \(p. 436\)](#).

### Topics

- [Obtain an API's invoke URL in the API Gateway console \(p. 408\)](#)
- [Use the API Gateway console to test a REST API method \(p. 408\)](#)
- [Call REST API through generated SDKs \(p. 409\)](#)
- [How to invoke a private API \(p. 425\)](#)

## Obtain an API's invoke URL in the API Gateway console

You can find a REST API's root URL in the **Stage Editor** for the API in the API Gateway console. It's listed as the **Invoke URL** at the top. If the API's root resource exposes a `GET` method without requiring user authentication, you can call the method by clicking the **Invoke URL** link. You can also construct this root URL by combining the `host` and `basePath` fields of an exported OpenAPI definition file of the API.

If an API permits anonymous access, you can use any web browser to invoke any `GET` method calls by copying and pasting an appropriate invocation URL to the browser's address bar. For other methods or any authentication-required calls, the invocation are more involved because you must specify a payload or sign the requests. You can handle these in a script behind an HTML page or in a client application using one of the Amazon SDKs.

For testing, you can use the API Gateway console to call an API by using the API Gateway's `TestInvoke` feature, which bypasses the `Invoke URL` and allows API testing before the API is deployed. Alternatively, you can use the [Postman](#) application to test a successfully deployed API, without writing a script or a client.

### Note

Query string parameter values in an invocation URL cannot contain `%`.

## Use the API Gateway console to test a REST API method

Use the API Gateway console to test a REST API method.

## Topics

- [Prerequisites \(p. 409\)](#)
- [Test a method with the API Gateway console \(p. 409\)](#)

## Prerequisites

- You must specify the settings for the methods you want to test. Follow the instructions in [Set up REST API methods in API Gateway \(p. 224\)](#).

## Test a method with the API Gateway console

### Important

Testing methods with the API Gateway console may result in changes to resources that cannot be undone. Testing a method with the API Gateway console is the same as calling the method outside of the API Gateway console. For example, if you use the API Gateway console to call a method that deletes an API's resources, if the method call is successful, the API's resources will be deleted.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. In the **Resources** pane, choose the method you want to test.
4. In the **Method Execution** pane, in the **Client** box, choose **TEST**. Type values in any of the displayed boxes (such as **Query Strings**, **Headers**, and **Request Body**). The console includes these values in the method request in default application/json form.

For additional options you may need to specify, contact the API owner.

5. Choose **Test**. The following information will be displayed:
  - **Request** is the resource's path that was called for the method.
  - **Status** is the response's HTTP status code.
  - **Latency** is the time between the receipt of the request from the caller and the returned response.
  - **Response Body** is the HTTP response body.
  - **Response Headers** are the HTTP response headers.

### Tip

Depending on the mapping, the HTTP status code, response body, and response headers may be different from those sent from the Lambda function, HTTP proxy, or Amazon service proxy.

- **Logs** are the simulated Amazon CloudWatch Logs entries that would have been written if this method were called outside of the API Gateway console.

### Note

Although the CloudWatch Logs entries are simulated, the results of the method call are real.

In addition to using the API Gateway console, you can use Amazon CLI or an Amazon SDK for API Gateway to test invoking a method. To do so using Amazon CLI, see [test-invoke-method](#).

## Call REST API through generated SDKs

This section shows how to call an API through a generated SDK in a client app written in Java, Java for Android, JavaScript, Ruby, Objective-C and Swift.

## Topics



- [Use a Java SDK generated by API Gateway for a REST API \(p. 410\)](#)
- [Use an Android SDK generated by API Gateway for a REST API \(p. 413\)](#)
- [Use a JavaScript SDK generated by API Gateway for a REST API \(p. 415\)](#)
- [Use a Ruby SDK generated by API Gateway for a REST API \(p. 416\)](#)
- [Use iOS SDK generated by API Gateway for a REST API in Objective-C or Swift \(p. 418\)](#)

## Use a Java SDK generated by API Gateway for a REST API

In this section, we outline the steps to use a Java SDK generated by API Gateway for a REST API, by using the [Simple Calculator \(p. 549\)](#) API as an example. Before proceeding, you must complete the steps in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#).

### To install and use a Java SDK generated by API Gateway

1. Extract the contents of the API Gateway-generated .zip file that you downloaded earlier.
2. Download and install [Apache Maven](#) (must be version 3.5 or later).
3. Download and install [JDK 8](#).
4. Set the JAVA\_HOME environment variable.
5. Go to the unzipped SDK folder where the pom.xml file is located. This folder is generated-code by default. Run the **mvn install** command to install the compiled artifact files to your local Maven repository. This creates a `target` folder containing the compiled SDK library.
6. Type the following command in an empty directory to create a client project stub to call the API using the installed SDK library.

```
mvn -B archetype:generate \
    -DarchetypeGroupId=org.apache.maven.archetypes \
    -DgroupId=examples.aws.apig.simpleCalc.sdk.app \
    -DartifactId=SimpleCalc-sdkClient
```

#### Note

The separator \ in the preceding command is included for readability. The whole command should be on a single line without the separator.

This command creates an application stub. The application stub contains a `pom.xml` file and an `src` folder under the project's root directory (`SimpleCalc-sdkClient` in the preceding command). Initially, there are two source files: `src/main/java/{package-path}/App.java` and `src/test/java/{package-path}/AppTest.java`. In this example, `{package-path}` is `examples/aws/apig/simpleCalc/sdk/app`. This package path is derived from the `DarchetypeGroupId` value. You can use the `App.java` file as a template for your client application, and you can add others in the same folder if needed. You can use the `AppTest.java` file as a unit test template for your application, and you can add other test code files to the same test folder as needed.

7. Update the package dependencies in the generated `pom.xml` file to the following, substituting your project's `groupId`, `artifactId`, `version`, and `name` properties, if necessary:

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/
XMLSchema-instance" xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://
maven.apache.org/maven-v4_0_0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>examples.aws.apig.simpleCalc.sdk.app</groupId>
  <artifactId>SimpleCalc-sdkClient</artifactId>
  <packaging>jar</packaging>
  <version>1.0-SNAPSHOT</version>
  <name>SimpleCalc-sdkClient</name>
  <url>http://maven.apache.org</url>
```

```

<dependencies>
  <dependency>
    <groupId>com.amazonaws</groupId>
    <artifactId>aws-java-sdk-core</artifactId>
    <version>1.11.94</version>
  </dependency>
  <dependency>
    <groupId>my-apig-api-examples</groupId>
    <artifactId>simple-calc-sdk</artifactId>
    <version>1.0.0</version>
  </dependency>

  <dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.12</version>
    <scope>test</scope>
  </dependency>

  <dependency>
    <groupId>commons-io</groupId>
    <artifactId>commons-io</artifactId>
    <version>2.5</version>
  </dependency>
</dependencies>

<build>
  <plugins>
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-compiler-plugin</artifactId>
      <version>3.5.1</version>
      <configuration>
        <source>1.8</source>
        <target>1.8</target>
      </configuration>
    </plugin>
  </plugins>
</build>
</project>

```

### Note

When a newer version of dependent artifact of `aws-java-sdk-core` is incompatible with the version specified above (1.11.94), you must update the `<version>` tag to the new version.

- Next, we show how to call the API using the SDK by calling the `getABOp(GetABOpRequest req)`, `getApiRoot(GetApiRootRequest req)`, and `postApiRoot(PostApiRootRequest req)` methods of the SDK. These methods correspond to the `GET /{a}/{b}/{op}`, `GET /?a={x}&b={y}&op={operator}`, and `POST /` methods, with a payload of `{"a": x, "b": y, "op": "operator"}` API requests, respectively.

Update the `App.java` file as follows:

```

package examples.aws.apig.simpleCalc.sdk.app;

import java.io.IOException;

import com.amazonaws.opensdk.config.ConnectionConfiguration;
import com.amazonaws.opensdk.config.TimeoutConfiguration;

import examples.aws.apig.simpleCalc.sdk.*;
import examples.aws.apig.simpleCalc.sdk.model.*;

```

```

import examples.aws.apig.simpleCalc.sdk.SimpleCalcSdk.*;

public class App
{
    SimpleCalcSdk sdkClient;

    public App() {
        initSdk();
    }

    // The configuration settings are for illustration purposes and may not be a
    // recommended best practice.
    private void initSdk() {
        sdkClient = SimpleCalcSdk.builder()
            .connectionConfiguration(
                new ConnectionConfiguration()
                    .maxConnections(100)
                    .connectionMaxIdleMillis(1000))
            .timeoutConfiguration(
                new TimeoutConfiguration()
                    .httpRequestTimeout(3000)
                    .totalExecutionTimeout(10000)
                    .socketTimeout(2000))
            .build();
    }

    // Calling shutdown is not necessary unless you want to exert explicit control of
    // this resource.
    public void shutdown() {
        sdkClient.shutdown();
    }

    // GetABOpResult getABOp(GetABOpRequest getABOpRequest)
    public Output getResultWithPathParameters(String x, String y, String operator) {
        operator = operator.equals("+") ? "add" : operator;
        operator = operator.equals("/") ? "div" : operator;

        GetABOpResult abopResult = sdkClient.getABOp(new
        GetABOpRequest().a(x).b(y).op(operator));
        return abopResult.getResult().getOutput();
    }

    public Output getResultWithQueryParameters(String a, String b, String op) {
        GetApiRootResult rootResult = sdkClient.getApiRoot(new
        GetApiRootRequest().a(a).b(b).op(op));
        return rootResult.getResult().getOutput();
    }

    public Output getResultByPostInputBody(Double x, Double y, String o) {
        PostApiRootResult postResult = sdkClient.postApiRoot(
            new PostApiRootRequest().input(new Input().a(x).b(y).op(o)));
        return postResult.getResult().getOutput();
    }

    public static void main( String[] args )
    {
        System.out.println( "Simple calc" );
        // to begin
        App calc = new App();

        // call the SimpleCalc API
        Output res = calc.getResultWithPathParameters("1", "2", "--");
        System.out.printf("GET /1/2/-: %s\n", res.getC());

        // Use the type query parameter
        res = calc.getResultWithQueryParameters("1", "2", "+");
    }
}

```

```
System.out.printf("GET /?a=1&b=2&op=+: %s\n", res.getC());

// Call POST with an Input body.
res = calc.getResultByPostInputBody(1.0, 2.0, "");
System.out.printf("PUT /\n\n{\"a\":1, \"b\":2,\"op\": \"*\"}\n %s\n",
res.getC());

    }
}
```

In the preceding example, the configuration settings used to instantiate the SDK client are for illustration purposes and are not necessarily recommended best practice. Also, calling `sdkClient.shutdown()` is optional, especially if you need precise control on when to free up resources.

We have shown the essential patterns to call an API using a Java SDK. You can extend the instructions to calling other API methods.

## Use an Android SDK generated by API Gateway for a REST API

In this section, we will outline the steps to use an Android SDK generated by API Gateway for a REST API. Before proceeding further, you must have already completed the steps in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#).

### Note

The generated SDK is not compatible with Android 4.4 and earlier. For more information, see [the section called "Important notes" \(p. 750\)](#).

## To install and use an Android SDK generated by API Gateway

1. Extract the contents of the API Gateway-generated .zip file that you downloaded earlier.
2. Download and install [Apache Maven](#) (preferably version 3.x).
3. Download and install [JDK 8](#).
4. Set the `JAVA_HOME` environment variable.
5. Run the `mvn install` command to install the compiled artifact files to your local Maven repository. This creates a `target` folder containing the compiled SDK library.
6. Copy the SDK file (the name of which is derived from the **Artifact Id** and **Artifact Version** you specified when generating the SDK, e.g., `simple-calcsdk-1.0.0.jar`) from the `target` folder, along with all of the other libraries from the `target/lib` folder, into your project's `lib` folder.

If you use Android Studio, create a `libs` folder under your client app module and copy the required .jar file into this folder. Verify that the dependencies section in the module's gradle file contains the following.

```
compile fileTree(include: ['*.jar'], dir: 'libs')
compile fileTree(include: ['*.jar'], dir: 'app/libs')
```

Make sure no duplicated .jar files are declared.

7. Use the `ApiClientFactory` class to initialize the API Gateway-generated SDK. For example:

```
ApiClientFactory factory = new ApiClientFactory();

// Create an instance of your SDK. Here, 'SimpleCalcClient.java' is the compiled java
// class for the SDK generated by API Gateway.
final SimpleCalcClient client = factory.build(SimpleCalcClient.class);
```

```
// Invoke a method:
// For the 'GET /?a=1&b=2&op=+' method exposed by the API, you can invoke it by
// calling the following SDK method:

Result output = client.rootGet("1", "2", "+");

//     where the Result class of the SDK corresponds to the Result model of the API.
//

// For the 'GET /{a}/{b}/{op}' method exposed by the API, you can call the following
// SDK method to invoke the request,

Result output = client.aBOPGet(a, b, c);

//     where a, b, c can be "1", "2", "add", respectively.

// For the following API method:
//     POST /
//     host: ...
//     Content-Type: application/json
//
//     { "a": 1, "b": 2, "op": "+" }
// you can call invoke it by calling the rootPost method of the SDK as follows:
Input body = new Input();
input.a=1;
input.b=2;
input.op="+";
Result output = client.rootPost(body);

//     where the Input class of the SDK corresponds to the Input model of the API.

// Parse the result:
//     If the 'Result' object is { "a": 1, "b": 2, "op": "add", "c":3}, you retrieve
//     the result 'c') as

String result=output.c;
```

- To use an Amazon Cognito credentials provider to authorize calls to your API, use the `ApiClientFactory` class to pass a set of Amazon credentials by using the SDK generated by API Gateway, as shown in the following example.

```
// Use CognitoCachingCredentialsProvider to provide Amazon credentials
// for the ApiClientFactory
AWSCredentialsProvider credentialsProvider = new CognitoCachingCredentialsProvider(
    context, // activity context
    "identityPoolId", // Cognito identity pool id
    Regions.US_EAST_1 // region of Cognito identity pool
);

ApiClientFactory factory = new ApiClientFactory()
    .credentialsProvider(credentialsProvider);
```

- To set an API key by using the API Gateway- generated SDK, use code similar to the following.

```
ApiClientFactory factory = new ApiClientFactory()
    .apiKey("YOUR_API_KEY");
```

## Use a JavaScript SDK generated by API Gateway for a REST API

### Note

These instructions assume you have already completed the instructions in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#).

### Important

If your API only has ANY methods defined, the generated SDK package will not contain an `apigClient.js` file, and you will need to define the ANY methods yourself.

### To install, initiate and call a JavaScript SDK generated by API Gateway for a REST API

1. Extract the contents of the API Gateway-generated .zip file you downloaded earlier.
2. Enable cross-origin resource sharing (CORS) for all of the methods the SDK generated by API Gateway will call. For instructions, see [Enabling CORS for a REST API resource \(p. 382\)](#).
3. In your web page, include references to the following scripts.

```
<script type="text/javascript" src="lib/axios/dist/axios.standalone.js"></script>
<script type="text/javascript" src="lib/CryptoJS/rollups/hmac-sha256.js"></script>
<script type="text/javascript" src="lib/CryptoJS/rollups/sha256.js"></script>
<script type="text/javascript" src="lib/CryptoJS/components/hmac.js"></script>
<script type="text/javascript" src="lib/CryptoJS/components/enc-base64.js"></script>
<script type="text/javascript" src="lib/url-template/url-template.js"></script>
<script type="text/javascript" src="lib/apiGatewayCore/sigV4Client.js"></script>
<script type="text/javascript" src="lib/apiGatewayCore/apiGatewayClient.js"></script>
<script type="text/javascript" src="lib/apiGatewayCore/simpleHttpClient.js"></script>
<script type="text/javascript" src="lib/apiGatewayCore/utills.js"></script>
<script type="text/javascript" src="apigClient.js"></script>
```

4. In your code, initialize the SDK generated by API Gateway by using code similar to the following.

```
var apigClient = apigClientFactory.newClient();
```

To initialize the SDK generated by API Gateway with Amazon credentials, use code similar to the following. If you use Amazon credentials, all requests to the API will be signed.

```
var apigClient = apigClientFactory.newClient({
  accessKey: 'ACCESS_KEY',
  secretKey: 'SECRET_KEY',
});
```

To use an API key with the SDK generated by API Gateway, pass the API key as a parameter to the Factory object by using code similar to the following. If you use an API key, it is specified as part of the `x-api-key` header and all requests to the API will be signed. This means you must set the appropriate CORS Accept headers for each request.

```
var apigClient = apigClientFactory.newClient({
  apiKey: 'API_KEY'
});
```

5. Call the API methods in API Gateway by using code similar to the following. Each call returns a promise with a success and failure callbacks.

```
var params = {
```

```
// This is where any modeled request parameters should be added.
// The key is the parameter name, as it is defined in the API in API Gateway.
param0: '',
param1: ''
};

var body = {
  // This is where you define the body of the request,
};

var additionalParams = {
  // If there are any unmodeled query parameters or headers that must be
  // sent with the request, add them here.
  headers: {
    param0: '',
    param1: ''
  },
  queryParams: {
    param0: '',
    param1: ''
  }
};

apigClient.methodName(params, body, additionalParams)
  .then(function(result){
    // Add success callback code here.
  }).catch( function(result){
    // Add error callback code here.
  });
```

Here, the *methodName* is constructed from the method request's resource path and the HTTP verb. For the SimpleCalc API, the SDK methods for the API methods of

```
1. GET /?a=...&b=...&op=...
2. POST /

   { "a": ..., "b": ..., "op": ...}
3. GET /{a}/{b}/{op}
```

the corresponding SDK methods are as follows:

```
1. rootGet(params);      // where params={"a": ..., "b": ..., "op": ...} is resolved to
   the query parameters
2. rootPost(null, body); // where body={"a": ..., "b": ..., "op": ...}
3. aBOPGet(params);     // where params={"a": ..., "b": ..., "op": ...} is resolved to
   the path parameters
```

## Use a Ruby SDK generated by API Gateway for a REST API

### Note

These instructions assume you already completed the instructions in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#).

### To install, instantiate, and call a Ruby SDK generated by API Gateway for a REST API

1. Unzip the downloaded Ruby SDK file. The generated SDK source is shown as follows.

2. Build a Ruby Gem from the generated SDK source, using the following shell commands in a terminal window:

```
# change to /simplecalc-sdk directory
cd simplecalc-sdk

# build the generated gem
gem build simplecalc-sdk.gemspec
```

After this, **simplecalc-sdk-1.0.0.gem** becomes available.

3. Install the gem:

```
gem install simplecalc-sdk-1.0.0.gem
```

4. Create a client application. Instantiate and initialize the Ruby SDK client in the app:

```
require 'simplecalc-sdk'
client = SimpleCalc::Client.new(
  http_wire_trace: true,
  retry_limit: 5,
  http_read_timeout: 50
)
```

If the API has authorization of the `AWS_IAM` type is configured, you can include the caller's Amazon credentials by supplying `accessKey` and `secretKey` during the initialization:

```
require 'pet-sdk'
client = Pet::Client.new(
  http_wire_trace: true,
  retry_limit: 5,
  http_read_timeout: 50,
  access_key_id: 'ACCESS_KEY',
  secret_access_key: 'SECRET_KEY'
)
```

5. Make API calls through the SDK in the app.

### Tip

If you are not familiar with the SDK method call conventions, you can review the `client.rb` file in the generated SDK `lib` folder. The folder contains documentation of each supported API method call.

To discover supported operations:

```
# to show supported operations:
puts client.operation_names
```

This results in the following display, corresponding to the API methods of `GET /?`  
`a={.}&b={.}&op={.}`, `GET /{a}/{b}/{op}`, and `POST /`, plus a payload of the `{a:"...", b:"...", op:"..."}` format, respectively:

```
[:get_api_root, :get_ab_op, :post_api_root]
```

To invoke the `GET /?a=1&b=2&op=+` API method, call the following the Ruby SDK method:

```
resp = client.get_api_root({a:"1", b:"2", op:"+"})
```



To invoke the `POST / API` method with a payload of `{a: "1", b: "2", "op": "+"}`, call the following Ruby SDK method:

```
resp = client.post_api_root(input: {a:"1", b:"2", op:"+"})
```

To invoke the `GET /1/2/+ API` method, call the following Ruby SDK method:

```
resp = client.get_ab_op({a:"1", b:"2", op:"+"})
```

The successful SDK method calls return the following response:

```
resp : {
  result: {
    input: {
      a: 1,
      b: 2,
      op: "+"
    },
    output: {
      c: 3
    }
  }
}
```

## Use iOS SDK generated by API Gateway for a REST API in Objective-C or Swift

In this tutorial, we will show how to use an iOS SDK generated by API Gateway for a REST API in an Objective-C or Swift app to call the underlying API. We will use the [SimpleCalc API \(p. 548\)](#) as an example to illustrate the following topics:

- How to install the required Amazon Mobile SDK components into your Xcode project
- How to create the API client object before calling the API's methods
- How to call the API methods through the corresponding SDK methods on the API client object
- How to prepare a method input and parse its result using the corresponding model classes of the SDK

### Topics

- [Use generated iOS SDK \(Objective-C\) to call API \(p. 418\)](#)
- [Use generated iOS SDK \(Swift\) to call API \(p. 422\)](#)

### Use generated iOS SDK (Objective-C) to call API

Before beginning the following procedure, you must complete the steps in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#) for iOS in Objective-C and download the .zip file of the generated SDK.

### Install the Amazon mobile SDK and an iOS SDK generated by API Gateway in an Objective-C project

The following procedure describes how to install the SDK.

#### To install and use an iOS SDK generated by API Gateway in Objective-C

1. Extract the contents of the API Gateway-generated .zip file you downloaded earlier. Using the [SimpleCalc API \(p. 548\)](#), you may want to rename the unzipped SDK folder to something like

**sdk\_objc\_simple\_calc.** In this SDK folder there is a `README.md` file and a `Podfile` file. The `README.md` file contains the instructions to install and use the SDK. This tutorial provides details about these instructions. The installation leverages [CocoaPods](#) to import required API Gateway libraries and other dependent Amazon Mobile SDK components. You must update the `Podfile` to import the SDKs into your app's Xcode project. The unarchived SDK folder also contains a `generated-src` folder that contains the source code of the generated SDK of your API.

2. Launch Xcode and create a new iOS Objective-C project. Make a note of the project's target. You will need to set it in the `Podfile`.
3. To import the Amazon Mobile SDK for iOS into the Xcode project by using CocoaPods, do the following:
  - a. Install CocoaPods by running the following command in a terminal window:

```
sudo gem install cocoapods
pod setup
```

- b. Copy the `Podfile` file from the extracted SDK folder into the same directory containing your Xcode project file. Replace the following block:

```
target '<YourXcodeTarget>' do
  pod 'AWSAPIGateway', '~> 2.4.7'
end
```

with your project's target name:

```
target 'app_objc_simple_calc' do
  pod 'AWSAPIGateway', '~> 2.4.7'
end
```

If your Xcode project already contains a file named `Podfile`, add the following line of code to it:

```
pod 'AWSAPIGateway', '~> 2.4.7'
```

- c. Open a terminal window and run the following command:

```
pod install
```

This installs the API Gateway component and other dependent Amazon Mobile SDK components.

- d. Close the Xcode project and then open the `.xcworkspace` file to relaunch Xcode.
  - e. Add all of the `.h` and `.m` files from the extracted SDK's `generated-src` directory into your Xcode project.

To import the Amazon Mobile SDK for iOS Objective-C into your project by explicitly downloading Amazon Mobile SDK or using [Carthage](#), follow the instructions in the `README.md` file. Be sure to use only one of these options to import the Amazon Mobile SDK.

### [Call API methods using the iOS SDK generated by API Gateway in an Objective-C project](#)

When you generated the SDK with the prefix of `SIMPLE_CALC` for this [SimpleCalc API \(p. 548\)](#) with two models for input (`Input`) and output (`Result`) of the methods, in the SDK, the resulting

API client class becomes `SIMPLE_CALCSimpleCalcClient` and the corresponding data classes are `SIMPLE_CALCInput` and `SIMPLE_CALCResult`, respectively. The API requests and responses are mapped to the SDK methods as follows:

- The API request of

```
GET /?a=...&b=...&op=...
```

becomes the SDK method of

```
(AWSTask *)rootGet:(NSString *)op a:(NSString *)a b:(NSString *)b
```

The `AWSTask.result` property is of the `SIMPLE_CALCResult` type if the `Result` model was added to the method response. Otherwise, the property is of the `NSDictionary` type.

- This API request of

```
POST /  
  
{  
  "a": "Number",  
  "b": "Number",  
  "op": "String"  
}
```

becomes the SDK method of

```
(AWSTask *)rootPost:(SIMPLE_CALCInput *)body
```

- The API request of

```
GET /{a}/{b}/{op}
```

becomes the SDK method of

```
(AWSTask *)aBOPGet:(NSString *)a b:(NSString *)b op:(NSString *)op
```

The following procedure describes how to call the API methods in Objective-C app source code; for example, as part of the `viewDidLoad` delegate in a `ViewController.m` file.

### To call the API through the iOS SDK generated by API Gateway

1. Import the API client class header file to make the API client class callable in the app:

```
#import "SIMPLE_CALCSimpleCalc.h"
```

The `#import` statement also imports `SIMPLE_CALCInput.h` and `SIMPLE_CALCResult.h` for the two model classes.

2. Instantiate the API client class:

```
SIMPLE_CALCSimpleCalcClient *apiInstance = [SIMPLE_CALCSimpleCalcClient defaultClient];
```

To use Amazon Cognito with the API, set the `defaultServiceConfiguration` property on the default `AWSServiceManager` object, as shown in the following, before calling the `defaultClient` method to create the API client object (shown in the preceding example):

```
AWSCognitoCredentialsProvider *creds = [[AWSCognitoCredentialsProvider alloc]
    initWithRegionType:AWSRegionUSEast1 identityPoolId:your_cognito_pool_id];
AWSServiceConfiguration *configuration = [[AWSServiceConfiguration alloc]
    initWithRegion:AWSRegionUSEast1 credentialsProvider:creds];
AWSServiceManager.defaultServiceManager.defaultServiceConfiguration = configuration;
```

3. Call the `GET /?a=1&b=2&op=+` method to perform  $1+2$ :

```
[[apiInstance rootGet:@"+" a:@"1" b:@"2"] continueWithBlock:^id _Nullable(AWSTask *
    _Nonnull task) {
    _textField1.text = [self handleApiResponse:task];
    return nil;
}];
```

where the helper function `handleApiResponse:task` formats the result as a string to be displayed in a text field (`_textField1`).

```
- (NSString *)handleApiResponse:(AWSTask *)task {
    if (task.error != nil) {
        return [NSString stringWithFormat:@"Error: %@", task.error.description];
    } else if (task.result != nil && [task.result isKindOfClass:[SIMPLE_CALCResult
    class]]) {
        return [NSString stringWithFormat:@"%d %d %d = %d\n", task.result.input.a,
            task.result.input.op, task.result.input.b, task.result.output.c];
    }
    return nil;
}
```

The resulting display is  $1 + 2 = 3$ .

4. Call the `POST /` with a payload to perform  $1-2$ :

```
SIMPLE_CALCInput *input = [[SIMPLE_CALCInput alloc] init];
input.a = [NSNumber numberWithInt:1];
input.b = [NSNumber numberWithInt:2];
input.op = @"-";
[[apiInstance rootPost:input] continueWithBlock:^id _Nullable(AWSTask * _Nonnull
    task) {
    _textField2.text = [self handleApiResponse:task];
    return nil;
}];
```

The resulting display is  $1 - 2 = -1$ .

5. Call the `GET /{a}/{b}/{op}` to perform  $1/2$ :

```
[[apiInstance aOpGet:@"1" b:@"2" op:@"div"] continueWithBlock:^id _Nullable(AWSTask *
    _Nonnull task) {
    _textField3.text = [self handleApiResponse:task];
    return nil;
}];
```

The resulting display is  $1 \text{ div } 2 = 0.5$ . Here, `div` is used in place of `/` because the [simple Lambda function \(p. 546\)](#) in the backend does not handle URL encoded path variables.

## Use generated iOS SDK (Swift) to call API

Before beginning the following procedure, you must complete the steps in [Generate SDKs for an API using the API Gateway console \(p. 542\)](#) for iOS in Swift and download the .zip file of the generated SDK.

### Topics

- [Install Amazon mobile SDK and API Gateway-generated SDK in a Swift project \(p. 422\)](#)
- [Call API methods through the iOS SDK generated by API Gateway in a Swift project \(p. 423\)](#)

## Install Amazon mobile SDK and API Gateway-generated SDK in a Swift project

The following procedure describes how to install the SDK.

### To install and use an iOS SDK generated by API Gateway in Swift

1. Extract the contents of the API Gateway-generated .zip file you downloaded earlier. Using the [SimpleCalc API \(p. 548\)](#), you may want to rename the unzipped SDK folder to something like `sdk_swift_simple_calc`. In this SDK folder there is a `README.md` file and a `Podfile` file. The `README.md` file contains the instructions to install and use the SDK. This tutorial provides details about these instructions. The installation leverages [CocoaPods](#) to import required Amazon Mobile SDK components. You must update the `Podfile` to import the SDKs into your Swift app's Xcode project. The unarchived SDK folder also contains a `generated-src` folder that contains the source code of the generated SDK of your API.
2. Launch Xcode and create a new iOS Swift project. Make a note of the project's target. You will need to set it in the `Podfile`.
3. To import the required Amazon Mobile SDK components into the Xcode project by using CocoaPods, do the following:
  - a. If it is not installed, install CocoaPods by running the following command in a terminal window:

```
sudo gem install cocoapods
pod setup
```

- b. Copy the `Podfile` file from the extracted SDK folder into the same directory containing your Xcode project file. Replace the following block:

```
target '<YourXcodeTarget>' do
  pod 'AWSAPIGateway', '~> 2.4.7'
end
```

with your project's target name as shown:

```
target 'app_swift_simple_calc' do
  pod 'AWSAPIGateway', '~> 2.4.7'
end
```

If your Xcode project already contains a `Podfile` with the correct target, you can simply add the following line of code to the `do ... end` loop:

```
pod 'AWSAPIGateway', '~> 2.4.7'
```

- c. Open a terminal window and run the following command in the app directory:

```
pod install
```

This installs the API Gateway component and any dependent Amazon Mobile SDK components into the app's project.

- d. Close the Xcode project and then open the \*.xcworkspace file to relaunch Xcode.
- e. Add all of the SDK's header files (.h) and Swift source code files (.swift) from the extracted generated-src directory to your Xcode project.
- f. To enable calling the Objective-C libraries of the Amazon Mobile SDK from your Swift code project, set the Bridging\_Header.h file path on the **Objective-C Bridging Header** property under the **Swift Compiler - General** setting of your Xcode project configuration:

**Tip**

You can type **bridging** in the search box of Xcode to locate the **Objective-C Bridging Header** property.

- g. Build the Xcode project to verify that it is properly configured before proceeding further. If your Xcode uses a more recent version of Swift than the one supported for the Amazon Mobile SDK, you will get Swift compiler errors. In this case, set the **Use Legacy Swift Language Version** property to **Yes** under the **Swift Compiler - Version** setting:

To import the Amazon Mobile SDK for iOS in Swift into your project by explicitly downloading the Amazon Mobile SDK or using [Carthage](#), follow the instructions in the README.md file that comes with the SDK package. Be sure to use only one of these options to import the Amazon Mobile SDK.

### Call API methods through the iOS SDK generated by API Gateway in a Swift project

When you generated the SDK with the prefix of SIMPLE\_CALC for this [SimpleCalc API \(p. 548\)](#) with two models to describe the input (Input) and output (Result) of the API's requests and responses, in the SDK, the resulting API client class becomes SIMPLE\_CALCSimpleCalcClient and the corresponding data classes are SIMPLE\_CALCInput and SIMPLE\_CALCResult, respectively. The API requests and responses are mapped to the SDK methods as follows:

- The API request of

```
GET /?a=...&b=...&op=...
```

becomes the SDK method of

```
public func rootGet(op: String?, a: String?, b: String?) -> AWSTask
```

The AWSTask.result property is of the SIMPLE\_CALCResult type if the Result model was added to the method response. Otherwise, it is of the NSDictionary type.

- This API request of

```
POST /  
  
{  
  "a": "Number",  
  "b": "Number",  
  "op": "String"  
}
```

becomes the SDK method of

```
public func rootPost(body: SIMPLE_CALCInput) -> AWSTask
```

- The API request of

```
GET /{a}/{b}/{op}
```

becomes the SDK method of

```
public func aOpGet(a: String, b: String, op: String) -> AWSTask
```

The following procedure describes how to call the API methods in Swift app source code; for example, as part of the `viewDidLoad()` delegate in a `ViewController.m` file.

### To call the API through the iOS SDK generated by API Gateway

1. Instantiate the API client class:

```
let client = SIMPLE_CALCSimpleCalcClient.defaultClient()
```

To use Amazon Cognito with the API, set a default Amazon service configuration (shown following) before getting the `defaultClient` method (shown previously):

```
let credentialsProvider =
    AWSCognitoCredentialsProvider(regionType: AWSRegionType.USEast1, identityPoolId:
    "my_pool_id")
let configuration = AWSServiceConfiguration(region: AWSRegionType.USEast1,
    credentialsProvider: credentialsProvider)
AWSManager.defaultServiceManager().defaultServiceConfiguration = configuration
```

2. Call the `GET /?a=1&b=2&op=+` method to perform 1+2:

```
client.rootGet("+", a: "1", b:"2").continueWithBlock {(task: AWSTask) -> AnyObject? in
    self.showResult(task)
    return nil
}
```

where the helper function `self.showResult(task)` prints the result or error to the console; for example:

```
func showResult(task: AWSTask) {
    if let error = task.error {
        print("Error: \(error)")
    } else if let result = task.result {
        if result is SIMPLE_CALCResult {
            let res = result as! SIMPLE_CALCResult
            print(String(format:"%@ %@ %@ = %@", res.input!.a!, res.input!.op!,
            res.input!.b!, res.output!.c!))
        } else if result is NSDictionary {
            let res = result as! NSDictionary
            print("NSDictionary: \(res)")
        }
    }
}
```

In a production app, you can display the result or error in a text field. The resulting display is  $1 + 2 = 3$ .

3. Call the `POST /` with a payload to perform 1-2:

```
let body = SIMPLE_CALCInput()
body.a=1
body.b=2
body.op="-"
client.rootPost(body).continueWithBlock {(task: AWSTask) -> AnyObject? in
    self.showResult(task)
    return nil
}
```

The resultant display is  $1 - 2 = -1$ .

4. Call the `GET /{a}/{b}/{op}` to perform 1/2:

```
client.aBOPGet("1", b:"2", op:"div").continueWithBlock {(task: AWSTask) -> AnyObject?
in
    self.showResult(task)
    return nil
}
```

The resulting display is  $1 \text{ div } 2 = 0.5$ . Here, `div` is used in place of `/` because the [simple Lambda function \(p. 546\)](#) in the backend does not handle URL encoded path variables.

## How to invoke a private API

Private APIs are accessible only from within your VPCs, and the [resource policies \(p. 603\)](#) must allow access from the VPCs and VPC endpoints you have configured. How you access your private API will depend upon whether or not you have enabled private DNS on the VPC endpoint. For example, while accessing private API from on-premises network via Amazon Direct Connect, you will have private DNS enabled on the VPC endpoint. In such a case, follow the steps outlined in [Invoking Your Private API Using Endpoint-Specific Public DNS Hostnames \(p. 427\)](#).

Once you have deployed a [private API \(p. 599\)](#), you can access it via private DNS (if you've enabled private DNS naming) and via public DNS.

To get the DNS names for your private API, do the following:

1. Sign in to the Amazon Web Services Management Console and open the Amazon VPC console at <https://console.amazonaws.cn/vpc/>.
2. In the left navigation pane, choose **Endpoints** and then choose your interface VPC endpoint for API Gateway.
3. In the **Details** pane, you'll see 5 values in the **DNS names** field. The first 3 are the public DNS names for your API. The other 2 are the private DNS names for it.

## Invoking your private API using private DNS names

### Warning

When you select the Enable Private DNS Name option while creating an interface VPC endpoint for API Gateway, the VPC where the VPC Endpoint is present won't be able to access public (edge-optimized and regional) APIs. For more information, see [Why can't I connect to my public API from an API Gateway VPC endpoint?](#)

If you've enabled private DNS, you can access your private API using the private DNS names as follows:



```
{restapi-id}.execute-api.{region}.amazonaws.com
```

The base URL to invoke the API is in the following format:

```
https://{restapi-id}.execute-api.{region}.amazonaws.com/{stage}
```

For example, assuming you set up the GET /pets and GET /pets/{petId} methods in this example, and assuming that your rest API ID was 01234567ab and your region was us-west-2, you could test your API by typing the following URLs in a browser:

```
https://01234567ab.execute-api.us-west-2.amazonaws.com/test/pets
```

and

```
https://01234567ab.execute-api.us-west-2.amazonaws.com/test/pets/1
```

Alternatively, you could use the following cURL commands:

```
curl -X GET https://01234567ab.execute-api.us-west-2.amazonaws.com/test/pets
```

and

```
curl -X GET https://01234567ab.execute-api.us-west-2.amazonaws.com/test/pets/2
```

## Accessing your private API using Amazon Direct Connect

You can also use Amazon Direct Connect to establish a dedicated private connection from an on-premises network to Amazon VPC and access your private API endpoint over that connection by using public DNS names.

You can also use private DNS names to access your private API from an on-premises network by setting up an Amazon Route 53 Resolver inbound endpoint and forwarding it all DNS queries of the private DNS from your remote network. For more information, see [Forwarding inbound DNS queries to your VPCs](#) in the *Amazon Route 53 Developer Guide*.

## Accessing your private API using a Route53 alias

You can associate or disassociate a VPC endpoint with your private API by using the procedure outlined in [Associate or Disassociate a VPC Endpoint with a Private REST API \(p. 603\)](#).

Once you associate your private API's REST API ID with the VPC endpoints you'll be calling your REST API from, you can use the following format base URL to invoke the API using a Route53 alias.

The generated base URL is in the following format:

```
https://{rest-api-id}-{vpce-id}.execute-api.{region}.amazonaws.com/{stage}
```

For example, assuming you set up the GET /pets and GET /pets/{petId} methods in this example, and assuming that your API's API ID was 01234567ab, VPC Endpoint ID was vpce-01234567abcdef012, and your region was us-west-2, you can invoke your API as:

```
curl -v https://01234567ab-vpce-01234567abcdef012.execute-api.us-west-2.amazonaws.com/test/pets/
```

## Invoking your private API using endpoint-specific public DNS hostnames

You can access your private API using endpoint-specific DNS hostnames. These are public DNS hostnames containing the VPC endpoint ID or API ID for your private API.

The generated base URL is in the following format:

```
https://{public-dns-hostname}.execute-api.{region}.vpce.amazonaws.com/{stage}
```

For example, assuming you set up the `GET /pets` and `GET /pets/{petId}` methods in this example, and assuming that your API's API ID was `01234567ab`, its public DNS hostname was `vpce-01234567abcdef012-01234567`, and your region was `us-west-2`, you could test your API via its VPC ID by using the `Host` header in a cURL command, as in the following example:

```
curl -v https://vpce-01234567abcdef012-01234567.execute-api.us-east-1.vpce.amazonaws.com/test/pets -H 'Host: 01234567ab.execute-api.us-west-2.amazonaws.com'
```

Alternatively, you can access your private API via its API ID by using the `x-apigw-api-id` header in a cURL command in the following format:

```
curl -v https://{public-dns-hostname}.execute-api.{region}.vpce.amazonaws.com/test -H'x-apigw-api-id:{api-id}'
```

## Configuring a REST API using OpenAPI

You can use API Gateway to import a REST API from an external definition file into API Gateway. Currently, API Gateway supports [OpenAPI v2.0](#) and [OpenAPI v3.0](#) definition files. You can update an API by overwriting it with a new definition, or you can merge a definition with an existing API. You specify the options by using a `mode` query parameter in the request URL.

For a tutorial on using the Import API feature from the API Gateway console, see [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

### Topics

- [Import an edge-optimized API into API Gateway \(p. 427\)](#)
- [Import a regional API into API Gateway \(p. 428\)](#)
- [Import an OpenAPI file to update an existing API definition \(p. 429\)](#)
- [Set the `OpenAPIbasePath` property \(p. 430\)](#)
- [Amazon variables for OpenAPI import \(p. 432\)](#)
- [Errors and warnings during import \(p. 433\)](#)
- [Export a REST API from API Gateway \(p. 433\)](#)

## Import an edge-optimized API into API Gateway

You can import an API's OpenAPI definition file to create a new edge-optimized API by specifying the `EDGE` endpoint type as an additional input, besides the OpenAPI file, to the import operation. You can do so using the API Gateway console, Amazon CLI, or an Amazon SDK.

For a tutorial on using the Import API feature from the API Gateway console, see [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

### Topics

- [Import an edge-optimized API using the API Gateway console \(p. 428\)](#)
- [Import an edge-optimized API using the Amazon CLI \(p. 428\)](#)

## Import an edge-optimized API using the API Gateway console

To import an edge-optimized API using the API Gateway console, do the following:

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**.
3. Under **REST API**, choose **Import**.
4. Copy an API's OpenAPI definition and paste it into the code editor, or choose **Select OpenAPI File** to load an OpenAPI file from a local drive.
5. Under **Settings**, for **Endpoint Type**, choose `Edge optimized`.
6. Choose **Import** to start importing the OpenAPI definitions.

## Import an edge-optimized API using the Amazon CLI

To import an API from an OpenAPI definition file to create a new edge-optimized API using the Amazon CLI, use the `import-rest-api` command as follows:

```
aws apigateway import-rest-api \  
  --fail-on-warnings \  
  --body 'file://path/to/API_OpenAPI_template.json'
```

or with an explicit specification of the `endpointConfigurationTypes` query string parameter to `EDGE`:

```
aws apigateway import-rest-api \  
  --parameters endpointConfigurationTypes=EDGE \  
  --fail-on-warnings \  
  --body 'file://path/to/API_OpenAPI_template.json'
```

## Import a regional API into API Gateway

When importing an API, you can choose the regional endpoint configuration for the API. You can use the API Gateway console, the Amazon CLI, or an Amazon SDK.

When you export an API, the API endpoint configuration is not included in the exported API definitions.

For a tutorial on using the Import API feature from the API Gateway console, see [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

### Topics

- [Import a regional API using the API Gateway console \(p. 428\)](#)
- [Import a regional API using the Amazon CLI \(p. 429\)](#)

## Import a regional API using the API Gateway console

To import an API of a regional endpoint using the API Gateway console, do the following:

1. Sign in to the API Gateway console and choose **Create API**.
2. Select the **Import from OpenAPI** option under **Create new API**.
3. Copy an API's OpenAPI definition and paste it into the code editor, or choose **Select OpenAPI File** to load an OpenAPI file from a local drive.
4. Under **Settings**, for **Endpoint Type**, choose `Regional`.
5. Choose **Import** to start importing the OpenAPI definitions.

## Import a regional API using the Amazon CLI

To import an API from an OpenAPI definition file using the Amazon CLI, use the `import-rest-api` command:

```
aws apigateway import-rest-api \  
  --parameters endpointConfigurationTypes=REGIONAL \  
  --fail-on-warnings \  
  --body 'file://path/to/API_OpenAPI_template.json'
```

## Import an OpenAPI file to update an existing API definition

You can import API definitions only to update an existing API, without changing its endpoint configuration, as well as stages and stage variables, or references to API keys.

The `import-to-update` operation can occur in two modes: `merge` or `overwrite`.

When an API (A) is merged into another (B), the resulting API retains the definitions of both A and B if the two APIs do not share any conflicting definitions. When conflicts arise, the method definitions of the merging API (A) overrides the corresponding method definitions of the merged API (B). For example, suppose B has declared the following methods to return 200 and 206 responses:

```
GET /a  
POST /a
```

and A declares the following method to return 200 and 400 responses:

```
GET /a
```

When A is merged into B, the resulting API yields the following methods:

```
GET /a
```

which returns 200 and 400 responses, and

```
POST /a
```

which returns 200 and 206 responses.

Merging an API is useful when you have decomposed your external API definitions into multiple, smaller parts and only want to apply changes from one of those parts at a time. For example, this might occur if multiple teams are responsible for different parts of an API and have changes available at different rates. In this mode, items from the existing API that aren't specifically defined in the imported definition are left alone.

When an API (A) overwrites another API (B), the resulting API takes the definitions of the overwriting API (A). Overwriting an API is useful when an external API definition contains the complete definition of an API. In this mode, items from an existing API that aren't specifically defined in the imported definition are deleted.

To merge an API, submit a `PUT` request to `https://apigateway.<region>.amazonaws.com/restapis/<restapi_id>?mode=merge`. The `restapi_id` path parameter value specifies the API to which the supplied API definition will be merged.

The following code snippet shows an example of the `PUT` request to merge an OpenAPI API definition in JSON, as the payload, with the specified API already in API Gateway.

```
PUT /restapis/<restapi_id>?mode=merge
Host:apigateway.<region>.amazonaws.com
Content-Type: application/json
Content-Length: ...
```

[An OpenAPI API definition in JSON \(p. 90\)](#)

The merging update operation takes two complete API definitions and merges them together. For a small and incremental change, you can use the [resource update](#) operation.

To overwrite an API, submit a `PUT` request to `https://apigateway.<region>.amazonaws.com/restapis/<restapi_id>?mode=overwrite`. The `restapi_id` path parameter specifies the API that will be overwritten with the supplied API definitions.

The following code snippet shows an example of an overwriting request with the payload of a JSON-formatted OpenAPI definition:

```
PUT /restapis/<restapi_id>?mode=overwrite
Host:apigateway.<region>.amazonaws.com
Content-Type: application/json
Content-Length: ...
```

[An OpenAPI API definition in JSON \(p. 90\)](#)

When the `mode` query parameter isn't specified, merge is assumed.

#### Note

The `PUT` operations are idempotent, but not atomic. That means if a system error occurs part way through processing, the API can end up in a bad state. However, repeating the operation successfully puts the API into the same final state as if the first operation had succeeded.

## Set the `OpenAPIbasePath` property

In [OpenAPI 2.0](#), you can use the `basePath` property to provide one or more path parts that precede each path defined in the `paths` property. Because API Gateway has several ways to express a resource's path, the Import API feature provides the following options for interpreting the `basePath` property during import: ignore, prepend, and split.

In [OpenAPI 3.0](#), `basePath` is no longer a top-level property. Instead, API Gateway uses a [server variable](#) as a convention. The Import API feature provides the same options for interpreting the base path during import. The base path is identified as follows:

- If the API doesn't contain any `basePath` variables, the Import API feature checks the `server.url` string to see if it contains a path beyond `"/`. If it does, that path is used as the base path.
- If the API contains only one `basePath` variable, the Import API feature uses it as the base path, even if it's not referenced in the `server.url`.
- If the API contains multiple `basePath` variables, the Import API feature uses only the first one as the base path.

## Ignore

If the OpenAPI file has a `basePath` value of `/a/b/c` and the `paths` property contains `/e` and `/f`, the following `POST` or `PUT` request:

```
POST /restapis?mode=import&basepath=ignore
```

```
PUT /restapis/api_id?basepath=ignore
```

results in the following resources in the API:

- /
- /e
- /f

The effect is to treat the `basePath` as if it was not present, and all of the declared API resources are served relative to the host. This can be used, for example, when you have a custom domain name with an API mapping that doesn't include a *Base Path* and a *Stage* value that refers to your production stage.

**Note**

API Gateway automatically creates a root resource for you, even if it isn't explicitly declared in your definition file.

When unspecified, `basePath` takes `ignore` by default.

## Prepend

If the OpenAPI file has a `basePath` value of `/a/b/c` and the `paths` property contains `/e` and `/f`, the following `POST` or `PUT` request:

```
POST /restapis?mode=import&basepath=prepend
```

```
PUT /restapis/api_id?basepath=prepend
```

results in the following resources in the API:

- /
- /a
- /a/b
- /a/b/c
- /a/b/c/e
- /a/b/c/f

The effect is to treat the `basePath` as specifying additional resources (without methods) and to add them to the declared resource set. This can be used, for example, when different teams are responsible for different parts of an API and the `basePath` could reference the path location for each team's API part.

**Note**

API Gateway automatically creates intermediate resources for you, even if they aren't explicitly declared in your definition.

## Split

If the OpenAPI file has a `basePath` value of `/a/b/c` and the `paths` property contains `/e` and `/f`, the following `POST` or `PUT` request:

```
POST /restapis?mode=import&basepath=split
```

```
PUT /restapis/api_id?basepath=split
```

results in the following resources in the API:

- /
- /b
- /b/c
- /b/c/e
- /b/c/f

The effect is to treat top-most path part, /a, as the beginning of each resource's path, and to create additional (no method) resources within the API itself. This could, for example, be used when a is a stage name that you want to expose as part of your API.

## Amazon variables for OpenAPI import

You can use the following Amazon variables in OpenAPI definitions. API Gateway resolves the variables when the API is imported. To specify a variable, use `${ variable-name }`.

### Amazon variables

Variable name	Description	
AWS::AccountId	The Amazon account ID that imports the API—for example, 123456789012.	
AWS::Partition	The Amazon partition in which the API is imported. For standard Amazon Regions, the partition is aws.	
AWS::Region	The Amazon Region in which the API is imported—for example, us-west-2.	

### Amazon variables example

The following example uses Amazon variables to specify an Amazon Lambda function for an integration.

#### OpenAPI 3.0

```
openapi: "3.0.1"
info:
  title: "tasks-api"
  version: "v1.0"
paths:
  /:
    get:
      summary: List tasks
      description: Returns a list of tasks
      responses:
        200:
```

```

        description: "OK"
        content:
          application/json:
            schema:
              type: array
              items:
                $ref: "#/components/schemas/Task"
      500:
        description: "Internal Server Error"
        content: {}
    x-amazon-apigateway-integration:
      uri:
        arn:${AWS::Partition}:apigateway:${AWS::Region}:lambda:path/2015-03-31/
        functions/arn:${AWS::Partition}:lambda:${AWS::Region}:
        ${AWS::AccountId}:function:LambdaFunctionName/invocations
      responses:
        default:
          statusCode: "200"
          passthroughBehavior: "when_no_match"
          httpMethod: "POST"
          contentHandling: "CONVERT_TO_TEXT"
          type: "aws_proxy"
  components:
    schemas:
      Task:
        type: object
        properties:
          id:
            type: integer
          name:
            type: string
          description:
            type: string

```

## Errors and warnings during import

### Errors during import

During the import, errors can be generated for major issues like an invalid OpenAPI document. Errors are returned as exceptions (for example, `BadRequestException`) in an unsuccessful response. When an error occurs, the new API definition is discarded and no change is made to the existing API.

### Warnings during import

During the import, warnings can be generated for minor issues like a missing model reference. If a warning occurs, the operation will continue if the `failonwarnings=false` query expression is appended to the request URL. Otherwise, the updates will be rolled back. By default, `failonwarnings` is set to `false`. In such cases, warnings are returned as a field in the resulting [RestApi](#) resource. Otherwise, warnings are returned as a message in the exception.

## Export a REST API from API Gateway

Once you created and configured a REST API in API Gateway, using the API Gateway console or otherwise, you can export it to an OpenAPI file using the API Gateway Export API, which is part of the Amazon API Gateway Control Service. You have options to include the API Gateway integration extensions, as well as the [Postman](#) extensions, in the exported OpenAPI definition file.

### Note

When exporting the API using the Amazon CLI, be sure to include the `extensions` parameter as shown in the following example, to ensure that the `x-amazon-apigateway-request-validator` extension is included:



```
aws apigateway get-export --parameters extensions='apigateway' --rest-api-id  
abcdefg123 --stage-name dev --export-type swagger latestswagger2.json
```

You cannot export an API if its payloads are not of the `application/json` type. If you try, you will get an error response stating that JSON body models are not found.

## Request to export a REST API

With the Export API, you export an existing REST API by submitting a GET request, specifying the to-be-exported API as part of URL paths. The request URL is of the following format:

### OpenAPI 3.0

```
https://<host>/restapis/<restapi_id>/stages/<stage_name>/exports/oas30
```

### OpenAPI 2.0

```
https://<host>/restapis/<restapi_id>/stages/<stage_name>/exports/swagger
```

You can append the `extensions` query string to specify whether to include API Gateway extensions (with the `integration` value) or Postman extensions (with the `postman` value).

In addition, you can set the `Accept` header to `application/json` or `application/yaml` to receive the API definition output in JSON or YAML format, respectively.

For more information about submitting GET requests using the API Gateway Export API, see [Making HTTP Requests](#).

#### Note

If you define models in your API, they must be for the content type of "application/json" for API Gateway to export the model. Otherwise, API Gateway throws an exception with the "Only found non-JSON body models for ..." error message.

Models must contain properties or be defined as a particular JSONSchema type.

## Download REST API OpenAPI definition in JSON

To export and download a REST API in OpenAPI definitions in JSON format:

### OpenAPI 3.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/oas30  
Host: apigateway.<region>.amazonaws.com  
Accept: application/json
```

### OpenAPI 2.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/swagger  
Host: apigateway.<region>.amazonaws.com
```

```
Accept: application/json
```

Here, `<region>` could be, for example, `us-east-1`. For all the regions where API Gateway is available, see [Regions and Endpoints](#)

## Download REST API OpenAPI definition in YAML

To export and download a REST API in OpenAPI definitions in YAML format:

### OpenAPI 3.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/oas30
Host: apigateway.<region>.amazonaws.com
Accept: application/yaml
```

### OpenAPI 2.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/swagger
Host: apigateway.<region>.amazonaws.com
Accept: application/yaml
```

## Download REST API OpenAPI definition with Postman extensions in JSON

To export and download a REST API in OpenAPI definitions with Postman in JSON format:

### OpenAPI 3.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/oas30?extensions=postman
Host: apigateway.<region>.amazonaws.com
Accept: application/json
```

### OpenAPI 2.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/swagger?extensions=postman
Host: apigateway.<region>.amazonaws.com
Accept: application/json
```

## Download REST API OpenAPI definition with API Gateway integration in YAML

To export and download a REST API in OpenAPI definitions with API Gateway integration in YAML format:

### OpenAPI 3.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/oas30?extensions=integrations
Host: apigateway.<region>.amazonaws.com
Accept: application/yaml
```

### OpenAPI 2.0

```
GET /restapis/<restapi_id>/stages/<stage_name>/exports/swagger?extensions=integrations
Host: apigateway.<region>.amazonaws.com
Accept: application/yaml
```

## Export REST API using the API Gateway console

After [deploying your REST API to a stage](#) (p. 438), you can proceed to export the API in the stage to an OpenAPI file using the API Gateway console.

From the **stage configuration** page in the API Gateway console, choose the **Export** tab and then one of the available options (**Export as OpenAPI**, **Export as OpenAPI + API Gateway Integrations** and **Export as Postman**) to download your API's OpenAPI definition.

# Publishing REST APIs for customers to invoke

Simply creating and developing an API Gateway API doesn't automatically make it callable by your users. To make it callable, you must deploy your API to a stage. In addition, you might want to customize the URL that your users will use to access your API. You can give it a domain that is consistent with your brand or is more memorable than the default URL for your API.

In this section, you can learn how to deploy your API and customize the URL that you provide to users to access it.

### Topics

- [Deploying a REST API in Amazon API Gateway](#) (p. 436)
- [Setting up custom domain names for REST APIs](#) (p. 463)

## Deploying a REST API in Amazon API Gateway

After creating your API, you must deploy it to make it callable by your users.

To deploy an API, you create an API deployment and associate it with a stage. A stage is a logical reference to a lifecycle state of your API (for example, `dev`, `prod`, `beta`, `v2`). API stages are identified by the API ID and stage name. They're included in the URL that you use to invoke the API. Each stage is a named reference to a deployment of the API and is made available for client applications to call.

### Important

Every time you update an API, you must redeploy the API to an existing stage or to a new stage. Updating an API includes modifying routes, methods, integrations, authorizers, and anything else other than stage settings.

As your API evolves, you can continue to deploy it to different stages as different versions of the API. You can also deploy your API updates as a [canary release deployment \(p. 451\)](#). This enables your API clients to access, on the same stage, the production version through the production release, and the updated version through the canary release.

To call a deployed API, the client submits a request against an API's URL. The URL is determined by an API's protocol (HTTP(S) or (WSS)), hostname, stage name, and (for REST APIs) resource path. The hostname and the stage name determine the API's base URL.

Using the API's default domain name, the base URL of a REST API (for example) in a given stage (*{stageName}*) is in the following format:

```
https://{restapi-id}.execute-api.{region}.amazonaws.com/{stageName}
```

To make the API's default base URL more user-friendly, you can create a custom domain name (for example, `api.example.com`) to replace the default hostname of the API. To support multiple APIs under the custom domain name, you must map an API stage to a base path.

With a custom domain name of *{api.example.com}* and the API stage mapped to a base path of (*{basePath}*) under the custom domain name, the base URL of a REST API becomes the following:

```
https://{api.example.com}/{basePath}
```

For each stage, you can optimize API performance by adjusting the default account-level request throttling limits and enabling API caching. You can also enable logging for API calls to CloudTrail or CloudWatch, and can select a client certificate for the backend to authenticate the API requests. In addition, you can override stage-level settings for individual methods and define stage variables to pass stage-specific environment contexts to the API integration at runtime.

Stages enable robust version control of your API. For example, you can deploy an API to a `test` stage and a `prod` stage, and use the `test` stage as a test build and use the `prod` stage as a stable build. After the updates pass the test, you can promote the `test` stage to the `prod` stage. The promotion can be done by redeploying the API to the `prod` stage or updating a [stage variable \(p. 439\)](#) value from the stage name of `test` to that of `prod`.

In this section, we discuss how to deploy an API by using the [API Gateway console](#) or calling the [API Gateway REST API](#). To use other tools, see the documentation of the [Amazon CLI](#) or an [Amazon SDK](#).

### Topics

- [Deploy a REST API in API Gateway \(p. 437\)](#)
- [Setting up a stage for a REST API \(p. 439\)](#)
- [Set up an API Gateway canary release deployment \(p. 451\)](#)
- [Updates to a REST API that require redeployment \(p. 462\)](#)

## Deploy a REST API in API Gateway

In API Gateway, a REST API deployment is represented by a [Deployment](#) resource. It's similar to an executable of an API that is represented by a [RestApi](#) resource.

For the client to call your API, you must create a deployment and associate a stage with it. A stage is represented by a [Stage](#) resource. It represents a snapshot of the API, including methods, integrations, models, mapping templates, and Lambda authorizers (formerly known as custom authorizers). When you update the API, you can redeploy the API by associating a new stage with the existing deployment. We discuss creating a stage in [the section called "Set up a stage" \(p. 439\)](#).

### Topics

- [Create a deployment using the Amazon CLI \(p. 438\)](#)
- [Deploying a REST API from the API Gateway console \(p. 438\)](#)

## Create a deployment using the Amazon CLI

When you create a deployment, you instantiate the [Deployment](#) resource. You can use the API Gateway console, the Amazon CLI, an Amazon SDK, or the API Gateway REST API to create a deployment.

To use the CLI to create a deployment, use the create-deployment command:

```
aws apigateway create-deployment --rest-api-id <rest-api-id> --region <region>
```

The API is not callable until you associate this deployment with a stage. With an existing stage, you can do this by updating the stage's `deploymentId` property with the newly created deployment ID (`<deployment-id>`).

```
aws apigateway update-stage --region <region> \  
  --rest-api-id <rest-api-id> \  
  --stage-name <stage-name> \  
  --patch-operations op='replace',path='/deploymentId',value='<deployment-id>'
```

When deploying an API the first time, you can combine the stage creation and deployment creation at the same time:

```
aws apigateway create-deployment --region <region> \  
  --rest-api-id <rest-api-id> \  
  --stage-name <stage-name>
```

This is what is done behind the scenes in the API Gateway console when you deploy an API the first time, or when you redeploy the API to a new stage.

## Deploying a REST API from the API Gateway console

You must have created a REST API before deploying it for the first time. For more information, see [Creating a REST API in Amazon API Gateway \(p. 205\)](#).

### Topics

- [Deploy a REST API to a stage \(p. 438\)](#)
- [Redeploy a REST API to a stage \(p. 439\)](#)
- [Update the stage configuration of a REST API deployment \(p. 439\)](#)
- [Set stage variables for a REST API deployment \(p. 439\)](#)
- [Associate a stage with a different REST API deployment \(p. 439\)](#)

### Deploy a REST API to a stage

The API Gateway console lets you deploy an API by creating a deployment and associating it with a new or existing stage.

#### Note

To associate a stage in API Gateway with a different deployment, see [Associate a stage with a different REST API deployment \(p. 439\)](#) instead.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. In the **APIs** navigation pane, choose the API you want to deploy.

3. In the **Resources** navigation pane, choose **Actions**.
4. From the **Actions** drop-down menu, choose **Deploy API**.
5. In the **Deploy API** dialog, choose an entry from the **Deployment stage** dropdown list.
6. If you choose **[New Stage]**, enter a name in **Stage name** and optionally provide a description for the stage and deployment in **Stage description** and **Deployment description**. If you choose an existing stage, you might want to provide a description of the new deployment in **Deployment description**.
7. Choose **Deploy** to deploy the API to the specified stage with default stage settings.

### Redeploy a REST API to a stage

To redeploy an API, perform the same steps as in [the section called "Deploy a REST API to a stage" \(p. 438\)](#). You can reuse the same stage as many times as desired.

### Update the stage configuration of a REST API deployment

After an API is deployed, you can modify the stage settings to enable or disable the API cache, logging, or request throttling. You can also choose a client certificate for the backend to authenticate API Gateway and set stage variables to pass deployment context to the API integration at runtime. For more information, see [Update stage settings \(p. 440\)](#).

#### Important

After modifying stage settings, you must redeploy the API for the changes to take effect.

#### Note

If the updated settings, such as enabling logging, requires a new IAM role, you can add the required IAM role without redeploying the API. However, it can take a few minutes before the new IAM role takes effect. Before that happens, traces of your API calls are not logged even if you have enabled the logging option.

### Set stage variables for a REST API deployment

For a deployment, you can set or modify stage variables to pass deployment-specific data to the API integration at runtime. You can do this on the **Stage Variables** tab in the **Stage Editor**. For more information, see instructions in [Setting up stage variables for a REST API deployment \(p. 446\)](#).

### Associate a stage with a different REST API deployment

Because a deployment represents an API snapshot and a stage defines a path into a snapshot, you can choose different deployment-stage combinations to control how users call into different versions of the API. This is useful, for example, when you want to roll back API state to a previous deployment or to merge a 'private branch' of the API into the public one.

The following procedure shows how to do this using the **Stage Editor** in the API Gateway console. It is assumed that you must have deployed an API more than once.

1. If you're not already in **Stage Editor**, choose the stage that you want to update the deployment from an API's **Stages** option in the **APIs** main navigation pane.
2. On the **Deployment History** tab, choose the option button next to the deployment you want the stage to use.
3. Choose **Change Deployment**.

## Setting up a stage for a REST API

A stage is a named reference to a deployment, which is a snapshot of the API. You use a [Stage](#) to manage and optimize a particular deployment. For example, you can configure stage settings to enable caching, customize request throttling, configure logging, define stage variables, or attach a canary release for testing.

## Topics

- [Setting up a stage using the API Gateway console \(p. 440\)](#)
- [Setting up tags for an API stage in API Gateway \(p. 443\)](#)
- [Setting up stage variables for a REST API deployment \(p. 446\)](#)

## Setting up a stage using the API Gateway console

### Topics

- [Create a new stage \(p. 440\)](#)
- [Update stage settings \(p. 440\)](#)
- [Delete a stage \(p. 443\)](#)

### Create a new stage

After the initial deployment, you can add more stages and associate them with existing deployments. You can use the API Gateway console to create a new stage, or you can choose an existing stage while deploying an API. In general, you can add a new stage to an API deployment before redeploying the API. To create a new stage using the API Gateway console, follow these steps:

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. From the **APIs** navigation pane, choose **Stages** under an API.
3. From the **Stages** navigation pane, choose **Create**.
4. Under **Create Stage**, enter a stage name, for example, **prod**, for **Stage name**.

#### Note

Stage names can only contain alphanumeric characters, hyphens, and underscores. Maximum length is 128 characters.

5. Optionally, enter a stage description for **Stage description**.
6. From the **Deployment** drop-down list, choose the date and time of the existing API deployment you want to associate with this stage.
7. Choose **Create**.

### Update stage settings

After a successful deployment of an API, the stage is populated with default settings. You can use the console or the API Gateway REST API to change the stage settings, including API caching and logging. The following steps show you how to do so using the **Stage Editor** of the API Gateway console.

### Update stage settings using the API Gateway console

These steps assume that you've already deployed the API to a stage.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. In the **APIs** pane, choose the API, and then choose **Stages**.
3. In the **Stages** pane, choose the name of the stage.
4. In the **Stage Editor** pane, choose the **Settings** tab.
5. To enable API caching for the stage, select the **Enable API cache** option under the **Cache Settings** section. Then choose the desired options and associated values for **Cache capacity**, **Encrypt cache data**, **Cache time-to-live (TTL)**, as well as any requirements for per-key cache invalidation.

For more information about stage-level cache settings, see [Enabling API caching to enhance responsiveness \(p. 483\)](#).

### Important

If you enable API caching for an API stage, your Amazon account might be charged for API caching. Caching isn't eligible for the Amazon Free Tier.

### Tip

You can also override enabled stage-level cache settings for individual methods. To do so, expand the stage under the **Stages** secondary navigation pane, and choose a method. Then, in the stage editor, choose the **Override for this method** option for **Settings**. In the **Cache Settings** area, you can set or clear **Enable Method Cache**, or customize any other desired options. For more information about the method-level cache settings, see [Enabling API caching to enhance responsiveness \(p. 483\)](#).

6. To enable Amazon CloudWatch Logs for all of the methods associated with this stage of this API Gateway API, do the following:

- a. Under the **CloudWatch Settings** section, select the **Enable CloudWatch Logs** option.

### Tip

To enable method-level CloudWatch settings, expand the stage under the **Stages** secondary navigation pane, and choose each method of interest. Back in the stage editor, choose **Override for this method** for **Settings**. In the **CloudWatch Settings** area, make sure to select **Log to CloudWatch Logs** and any other desired options before choosing **Save Changes**.

### Important

Your account is charged for accessing method-level CloudWatch metrics, but not the API-level or stage-level metrics.

- b. For **Log level**, choose **ERROR** to write only error-level entries to CloudWatch Logs, or choose **INFO** to include all **ERROR** events, as well as extra informational events.
- c. To log full API call request and response information, select **Log full requests/responses data**. No sensitive data is logged unless the **Log full requests/responses data** option is selected.

### Important

Setting logs to **ERROR** and then choosing **Log full requests/responses data** results in every request being logged in detail. This is the intended behavior.

- d. To have API Gateway report to CloudWatch the API metrics of **API calls**, **Latency**, **Integration latency**, **400 errors**, and **500 errors**, choose the **Enable Detailed CloudWatch Metrics** option. For more information about CloudWatch, see the [Amazon CloudWatch User Guide](#).
- e. Choose **Save Changes**. The new settings take effect after a new deployment.

### Important

To enable CloudWatch Logs for all or only some of the methods, you must also specify the ARN of an IAM role that enables API Gateway to write information to CloudWatch Logs on behalf of your IAM user. To do so, choose **Settings** from the **APIs** main navigation pane. Then enter the ARN of an IAM role in the **CloudWatch log role ARN** text field.

For common application scenarios, the IAM role could attach the managed policy of `AmazonAPIGatewayPushToCloudWatchLogs`, which contains the following access policy statement:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:DescribeLogGroups",
```



```
        "logs:DescribeLogStreams",
        "logs:PutLogEvents",
        "logs:GetLogEvents",
        "logs:FilterLogEvents"
    ],
    "Resource": "*"
}
]
```

The IAM role must also contain the following trust relationship statement:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

For more information about CloudWatch, see the [Amazon CloudWatch User Guide](#).

7. To enable access logging to a Kinesis Data Firehose delivery stream:
  - a. Under **Custom Access Logging**, choose **Enable Access Logging**.
  - b. In **Access Log Destination ARN**, enter the ARN of a Kinesis Data Firehose delivery stream. The ARN format is `arn:aws:firehose:{region}:{account-id}:deliverystream/amazon-apigateway-{your-delivery-stream-name}`.

**Note**

The name of your Kinesis Data Firehose delivery stream must be `amazon-apigateway-{your-delivery-stream-name}`.

- c. In **Log Format**, enter a log format. To use one of the provided examples as a guide, you can choose **CLF**, **JSON**, **XML**, or **CSV**.
    - d. Choose **Save Changes**.
8. To set stage-level throttling targets for all of the methods associated with this API, do the following in the **Default Method Throttling** section:

**Note**

Throttling rates are not hard limits, and are applied on a best-effort basis. In some cases, clients can exceed the targets that you set. Don't rely on throttling to control costs or block access to an API. Consider using [Amazon Budgets](#) to monitor costs and [Amazon WAF](#) to manage API requests.

- a. Choose **Enable throttling**.
    - b. For **Rate**, enter a target rate. This stage-level rate must not be more than the [account-level \(p. 599\)](#) rate as specified in [API Gateway quotas for configuring and running a REST API \(p. 747\)](#).
    - c. For **Burst**, enter a target burst rate. This allows more requests through for a period of time than the target rate. This stage-level burst rate must not be more than the [account-level \(p. 599\)](#) burst rate as specified in [API Gateway quotas for configuring and running a REST API \(p. 747\)](#).
9. To set stage-level throttling targets for an individual method, expand the stage in the **Stages** secondary navigation pane, choose a method, and choose **Override for this method** for **Settings**. In

the **Method Throttling** section, select the appropriate options. To learn more about throttling, see [the section called "Throttling" \(p. 598\)](#).

10. To associate an Amazon WAF web ACL with the stage, choose a web ACL from the **Web ACL** dropdown list.

**Note**

If needed, choose **Create Web ACL** to open the Amazon WAF console in a new browser tab, create the web ACL, and return to the API Gateway console to associate the web ACL with the stage.

11. If desired, choose **Block API Request if WebACL cannot be evaluated (Fail- Close)**.
12. To enable [Amazon X-Ray](#) tracing for the API stage:
  - a. In the **Stage Editor** pane, choose the **Logs/Tracing** tab.
  - b. To enable X-Ray tracing, choose **Enable X-Ray Tracing** under **X-Ray Tracing**.
  - c. To set sampling rules in the X-Ray console, choose **Set X-Ray Sampling Rules**.
  - d. If desired, choose **Set X-Ray Sampling Rules** and go to the X-Ray console to [configure sampling rules](#).

For more information, see [Tracing user requests to REST APIs using X-Ray \(p. 615\)](#).

13. Choose **Save Changes**. The new settings take effect after you redeploy the API to the stage.

## Delete a stage

When you no longer need a stage, you can delete it to avoid paying for unused resources. The following steps show you how to use the API Gateway console to delete a stage.

**Warning**

Deleting a stage might cause part or all of the corresponding API to be unusable by API callers. Deleting a stage cannot be undone, but you can recreate the stage and associate it with the same deployment.

## Delete a stage using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Stages**.
4. In the **Stages** pane, choose the stage you want to delete, and then choose **Delete Stage**.
5. When you're prompted, choose **Delete**.

## Setting up tags for an API stage in API Gateway

In API Gateway, you can add a tag to an API stage, remove the tag from the stage, or view the tag. To do this, you can use the API Gateway console, the Amazon CLI/SDK, or the API Gateway REST API.

A stage can also inherit tags from its parent REST API. For more information, see [the section called "Tag inheritance in the Amazon API Gateway V1 API" \(p. 738\)](#).

For more information about tagging API Gateway resources, see [Tagging \(p. 737\)](#).

### Topics

- [Set up tags for an API stage using the API Gateway console \(p. 444\)](#)
- [Set up tags for an API stage using the API Gateway REST API \(p. 444\)](#)

## Set up tags for an API stage using the API Gateway console

The following procedure describes how to set up tags for an API stage.

### To set up tags for an API stage by using the API Gateway console

1. Sign in to the API Gateway console.
2. Choose an existing API, or create a new API that includes resources, methods, and the corresponding integrations.
3. Choose a stage or deploy the API to a new stage.
4. In the **Stage Editor**, choose the **Configure Tags** button.
5. In the **Tag Editor**, choose **Add New Tag**. Enter a tag key (for example, `Department`) in the **Key** field, and enter a tag value (for example, `Sales`) in the **Value** field. Choose the checkmark icon to save the tag.
6. If needed, repeat step 5 to add more tags to the API stage. The maximum number of tags per stage is 50.
7. To remove an existing tag from the stage, choose the trash bin icon next to the tag.
8. Choose **Save Changes** to finish setting up the stage tags.

If the API has been deployed previously in the API Gateway console, you need to redeploy it for the changes to take effect.

## Set up tags for an API stage using the API Gateway REST API

You can set up tags for an API stage using the API Gateway REST API by doing one of the following:

- Call `tags:tag` to tag an API stage.
- Call `tags:untag` to delete one or more tags from an API stage.
- Call `stage:create` to add one or more tags to an API stage that you're creating.

You can also call `tags:get` to describe tags in an API stage.

### Tag an API stage

After you deploy an API (`m5zr3vnks7`) to a stage (`test`), tag the stage by calling `tags:tag`. The required stage Amazon Resource Name (ARN) (`arn:aws:apigateway:us-east-1::/restapis/m5zr3vnks7/stages/test`) must be URL encoded (`arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftest`).

```
PUT /tags/arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftest
{
  "tags" : {
    "Department" : "Sales"
  }
}
```

You can also use the previous request to update an existing tag to a new value.

You can add tags to a stage when calling `stage:create` to create the stage:

```
POST /restapis/<restapi_id>/stages
```

```
{
  "stageName" : "test",
  "deploymentId" : "adr134",
  "description" : "test deployment",
  "cacheClusterEnabled" : "true",
  "cacheClusterSize" : "500",
  "variables" : {
    "sv1" : "vall"
  },
  "documentationVersion" : "test",

  "tags" : {
    "Department" : "Sales",
    "Division" : "Retail"
  }
}
```

### Untag an API stage

To remove the Department tag from the stage, call `tags:untag`:

```
DELETE /tags/arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftest?tagKeys=Department
Host: apigateway.us-east-1.amazonaws.com
Authorization: ...
```

To remove more than one tag, use a comma-separated list of tag keys in the query expression—for example, `?tagKeys=Department,Division,...`

### Describe tags for an API stage

To describe existing tags on a given stage, call `tags:get`:

```
GET /tags/arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftags
Host: apigateway.us-east-1.amazonaws.com
Authorization: ...
```

The successful response is similar to the following:

```
200 OK

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-tags-{rel}.html",
      "name": "tags",
      "templated": true
    },
    "tags:tag": {
      "href": "/tags/arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftags"
    },
    "tags:untag": {
      "href": "/tags/arn%3Aaws%3Aapigateway%3Aus-east-1%3A%3A%2Frestapis%2Fm5zr3vnks7%2Fstages%2Ftags{?tagKeys}",
      "templated": true
    }
  },
  "tags": {
```

```
    "Department": "Sales"  
  }  
}
```

## Setting up stage variables for a REST API deployment

Stage variables are name-value pairs that you can define as configuration attributes associated with a deployment stage of a REST API. They act like environment variables and can be used in your API setup and mapping templates.

For example, you can define a stage variable in a stage configuration, and then set its value as the URL string of an HTTP integration for a method in your REST API. Later, you can reference the URL string by using the associated stage variable name from the API setup. By doing this, you can use the same API setup with a different endpoint at each stage by resetting the stage variable value to the corresponding URLs.

You can also access stage variables in the mapping templates, or pass configuration parameters to your Amazon Lambda or HTTP backend.

For more information about mapping templates, see [API Gateway mapping template and access logging variable reference](#) (p. 363).

### Note

Stage variables are not intended to be used for sensitive data, such as credentials. To pass sensitive data to integrations, use an Amazon Lambda authorizer. You can pass sensitive data to integrations in the output of the Lambda authorizer. To learn more, see [the section called "Output from an Amazon API Gateway Lambda authorizer"](#) (p. 266).

## Use cases

With deployment stages in API Gateway, you can manage multiple release stages for each API, such as alpha, beta, and production. Using stage variables you can configure an API deployment stage to interact with different backend endpoints.

For example, your API can pass a GET request as an HTTP proxy to the backend web host (for example, `http://example.com`). In this case, the backend web host is configured in a stage variable so that when developers call your production endpoint, API Gateway calls `example.com`. When you call your beta endpoint, API Gateway uses the value configured in the stage variable for the beta stage, and calls a different web host (for example, `beta.example.com`). Similarly, stage variables can be used to specify a different Amazon Lambda function name for each stage in your API.

You can also use stage variables to pass configuration parameters to a Lambda function through your mapping templates. For example, you might want to reuse the same Lambda function for multiple stages in your API, but the function should read data from a different Amazon DynamoDB table depending on which stage is being called. In the mapping templates that generate the request for the Lambda function, you can use stage variables to pass the table name to Lambda.

## Examples

To use a stage variable to customize the HTTP integration endpoint, you must first configure a stage variable of a specified name (for example, `url`), and then assign it a value, (for example, `example.com`). Next, from your method configuration, set up an HTTP proxy integration. Instead of entering the endpoint's URL, you can tell API Gateway to use the stage variable value, `http://#{stageVariables.url}`. This value tells API Gateway to substitute your stage variable `{ }` at runtime, depending on which stage your API is running.

You can reference stage variables in a similar way to specify a Lambda function name, an Amazon Service Proxy path, or an Amazon role ARN in the credentials field.

When specifying a Lambda function name as a stage variable value, you must configure the permissions on the Lambda function manually. You can use the Amazon Command Line Interface (Amazon CLI) to do this.

```
aws lambda add-permission --function-name arn:aws:lambda:XXXXXX:your-lambda-function-
name --source-arn arn:aws:execute-api:us-east-1:YOUR_ACCOUNT_ID:api_id/*/HTTP_METHOD/
resource --principal apigateway.amazonaws.com --statement-id apigateway-access --action
lambda:InvokeFunction
```

The following example assigns API Gateway permission to invoke a Lambda function named `helloWorld` hosted in the US West (Oregon) Region of an Amazon account on behalf of the API method.

```
arn arn:aws:execute-api:us-west-2:123123123123:bmmuvptwze/*/GET/hello
```

Here is the same command using the Amazon CLI.

```
aws lambda add-permission --function-name arn:aws:lambda:us-
east-1:123123123123:function:helloWorld --source-arn arn:aws:execute-api:us-
west-2:123123123123:bmmuvptwze/*/GET/hello --principal apigateway.amazonaws.com --
statement-id apigateway-access --action lambda:InvokeFunction
```

## Setting stage variables using the Amazon API Gateway console

In this tutorial, you learn how to set stage variables for two deployment stages of a sample API by using the Amazon API Gateway console. Before you begin, make sure the following prerequisites are met:

- You must have an API available in API Gateway. Follow the instructions in [Creating a REST API in Amazon API Gateway \(p. 205\)](#).
- You must have deployed the API at least once. Follow the instructions in [Deploying a REST API in Amazon API Gateway \(p. 436\)](#).
- You must have created the first stage for a deployed API. Follow the instructions in [Create a new stage \(p. 440\)](#).

## To declare stage variables using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Create an API, create a `GET` method on the API's root resource, if you have not already done so. Set the HTTP **Endpoint URL** value as `http://${stageVariables.url}`, and then choose **Save**.
3. Choose **Deploy API**. Choose **New Stage** and enter `beta` for **Stage name**. Choose **Deploy**.
4. In the **beta Stage Editor** panel, choose the **Stage Variables** tab, and then choose **Add Stage Variable**.
5. Enter the `url` string in the **Name** field and the `httpbin.org/get` in the **Value** field. Choose the checkmark icon to save the setting for the stage variable.
6. Repeat the preceding step to add two more stage variables: `version` and `function`. Set their values as `v-beta` and `HelloWorld`, respectively.

### Note

When setting a Lambda function as the value of a stage variable, use the function's local name, possibly including its alias or version specification, as in **HelloWorld**, **HelloWorld:1** or **HelloWorld:alpha**. Do not use the function's ARN (for example, **arn:aws:lambda:us-east-1:123456789012:function:HelloWorld**). The API Gateway console assumes the stage variable value for a Lambda function as the unqualified function name and expands the given stage variable into an ARN.

7. From the **Stages** navigation pane, choose **Create**. For **Stage name**, enter **prod**. Select a recent deployment from **Deployment** and then choose **Create**.
8. As with the **beta** stage, set the same three stage variables (**url**, **version**, and **function**) to different values ("petstore-demo-endpoint.execute-api.com/petstore/pets", "v-prod", and "HelloEveryone"), respectively.

### Using Amazon API Gateway stage variables

You can use API Gateway stage variables to access the HTTP and Lambda backends for different API deployment stages. You can also use stage variables to pass stage-specific configuration metadata into an HTTP backend as a query parameter and into a Lambda function as a payload that is generated in an input mapping template.

#### Prerequisites

You must create two stages with a `url` variable set to two different HTTP endpoints: a `function` stage variable assigned to two different Lambda functions, and a `version` stage variable containing stage-specific metadata. Follow the instructions in [Setting stage variables using the Amazon API Gateway console \(p. 447\)](#).

#### Access an HTTP endpoint through an API with a stage variable

1. In the **Stages** navigation pane, choose **beta**. In **beta Stage Editor**, choose the **Invoke URL** link. This starts the **beta** stage **GET** request on the root resource of the API.

##### Note

The **Invoke URL** link points to the root resource of the API in its **beta** stage. Navigating to the URL by choosing the link calls the **beta** stage **GET** method on the root resource. If methods are defined on child resources and not on the root resource itself, choosing the **Invoke URL** link returns a {"message": "Missing Authentication Token"} error response. In this case, you must append the name of a specific child resource to the **Invoke URL** link.

2. The response you get from the **beta** stage **GET** request is shown next. You can also verify the result by using a browser to navigate to <http://httpbin.org/get>. This value was assigned to the `url` variable in the **beta** stage. The two responses are identical.
3. In the **Stages** navigation pane, choose the **prod** stage. From **prod Stage Editor**, choose the **Invoke URL** link. This starts the **prod** stage **GET** request on the root resource of the API.
4. The response you get from the **prod** stage **GET** request is shown next. You can verify the result by using a browser to navigate to <http://petstore-demo-endpoint.execute-api.com/petstore/pets>. This value was assigned to the `url` variable in the **prod** stage. The two responses are identical.

#### Pass stage-specific metadata to an HTTP backend through a stage variable in a query parameter expression

This procedure describes how to use a stage variable value in a query parameter expression to pass stage-specific metadata into an HTTP backend. We will use the `version` stage variable declared in [Setting stage variables using the Amazon API Gateway console \(p. 447\)](#).

1. In the **Resource** navigation pane, choose the **GET** method. To add a query string parameter to the method's URL, in **Method Execution**, choose **Method Request**. Enter **version** for the parameter name.
2. In **Method Execution** choose **Integration Request**. Edit the **Endpoint URL** value to append `?version=${stageVariables.version}` to the previously defined URL value, which, in this case, is also expressed with the `url` stage variable. Choose **Deploy API** to deploy these changes.
3. In the **Stages** navigation pane, choose the **beta** stage. From **beta Stage Editor**, verify that the current stage is in the most recent deployment, and then choose the **Invoke URL** link.

### Note

We use the beta stage here because the HTTP endpoint (as specified by the `url` variable "http://httpbin.org/get") accepts query parameter expressions and returns them as the `args` object in its response.

4. The response is shown next. Notice that `v-beta`, assigned to the `version` stage variable, is passed in the backend as the `version` argument.

## Call a Lambda function through an API with a stage variable

This procedure describes how to use a stage variable to call a Lambda function as a backend of your API. We will use the `function` stage variable declared earlier. For more information, see [Setting stage variables using the Amazon API Gateway console \(p. 447\)](#).

1. In the **Resources** pane, create a `/lambdasv1` child resource under the root directory, and then create a `GET` method on the child resource. Set the **Integration type** to **Lambda Function**, and in **Lambda Function**, enter `${stageVariables.function}`. Choose **Save**.

### Tip

When prompted with **Add Permission to Lambda Function**, make a note of the Amazon CLI command before choosing **OK**. You must run the command on each Lambda function that is or will be assigned to the `function` stage variable for each of the newly created API methods. For example, if the `stageVariables.function` value is `HelloWorld` and you have not added permission to this function yet, you must run the following Amazon CLI command:

```
aws lambda add-permission --function-name arn:aws:lambda:us-east-1:account-id:function:HelloWorld --source-arn arn:aws:execute-api:us-east-1:account-id:api-id/*/GET/lambdasv1 --principal apigateway.amazonaws.com --statement-id statement-id-guid --action lambda:InvokeFunction
```

Failing to do so results in a `500 Internal Server Error` response when invoking the method. Make sure to replace `${stageVariables.function}` with the Lambda function name that is assigned to the stage variable.

2. Deploy the API to available stages.
3. In the **Stages** navigation pane, choose the **beta** stage. Verify that your most recent deployment is in **beta Stage Editor**. Copy the **Invoke URL** link, paste it into the address bar of your browser, and append `/lambdasv1` to that URL. This calls the underlying Lambda function through the `GET` method on the **LambdaSv1** child resource of the API.

### Note

Your `HelloWorld` Lambda function implements the following code.

```
exports.handler = function(event, context, callback) {
  if (event.version)
    callback(null, 'Hello, World! (' + event.version + ')');
  else
    callback(null, "Hello, world! (v-unknown)");
};
```

This implementation results in the following response.

```
"Hello, world! (v-unknown)"
```



## Pass stage-specific metadata to a Lambda function through a stage variable

This procedure describes how to use a stage variable to pass stage-specific configuration metadata into a Lambda function. We will use a `POST` method and an input mapping template to generate payload using the `version` stage variable declared earlier.

1. In the **Resources** pane, choose the `/lambdasv1` child resource. Create a `POST` method on the child resource, set the **Integration type** to **Lambda Function**, and enter `${stageVariables.function}` in **Lambda Function**. Choose **Save**.

### Tip

This step is similar to the step we used to create the `GET` method. For more information, see [Call a Lambda function through an API with a stage variable \(p. 449\)](#).

2. From the **/Method Execution** pane, choose **Integration Request**. In the **Integration Request** pane, expand **Mapping Templates**, and then choose **Add mapping template** to add a template for the `application/json` content-type, as shown in the following.

### Note

In a mapping template, a stage variable must be referenced within quotes (as in `"${stageVariables.version}"` or `"${stageVariables.version}"`). In other places, it must be referenced without quotes (as in `${stageVariables.function}`).

3. Deploy the API to available stages.
4. In the **Stages** navigation pane, choose **beta**. In **beta Stage Editor**, verify that the current stage has the most recent deployment. Copy the **Invoke URL** link, paste it into the URL input field of a REST API client, append `/lambdasv1` to that URL, and then submit a `POST` request to the underlying Lambda function.

### Note

You will get the following response.

```
"Hello, world! (v-beta)"
```

## Amazon API Gateway stage variables reference

You can use API Gateway stage variables in the following cases.

### Parameter mapping expressions

A stage variable can be used in a parameter mapping expression for an API method's request or response header parameter, without any partial substitution. In the following example, the stage variable is referenced without the `$` and the enclosing `{...}`.

- `stageVariables.<variable_name>`

### Mapping templates

A stage variable can be used anywhere in a mapping template, as shown in the following examples.

- `{ "name" : "${stageVariables.<variable_name>}" }`
- `{ "name" : "${stageVariables.<variable_name>}" }`

### HTTP integration URIs

A stage variable can be used as part of an HTTP integration URL, as shown in the following examples:

- A full URI without protocol – `http://${stageVariables.<variable_name>}`
- A full domain – `http://${stageVariables.<variable_name>}/resource/operation`
- A subdomain – `http://${stageVariables.<variable_name>}.example.com/resource/operation`
- A path – `http://example.com/${stageVariables.<variable_name>}/bar`
- A query string – `http://example.com/foo?q=${stageVariables.<variable_name>}`

### Amazon integration URIs

A stage variable can be used as part of Amazon URI action or path components, as shown in the following example.

- `arn:aws:apigateway:<region>:<service>:${stageVariables.<variable_name>}`

### Amazon integration URIs (Lambda functions)

A stage variable can be used in place of a Lambda function name, or version/alias, as shown in the following examples.

- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:${stageVariables.<function_variable_name>}/invocations`
- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:<function_name>:${stageVariables.<version_variable_name>}/invocations`

#### Note

To use a stage variable for a Lambda function, the function must be in the same account as the API. Stage variables don't support cross-account Lambda functions.

### Amazon integration credentials

A stage variable can be used as part of Amazon user/role credential ARN, as shown in the following example.

- `arn:aws:iam::<account_id>:${stageVariables.<variable_name>}`

## Set up an API Gateway canary release deployment

**Canary release** is a software development strategy in which a new version of an API (as well as other software) is deployed for testing purposes, and the base version remains deployed as a production release for normal operations on the same stage. For purposes of discussion, we refer to the base version as a production release in this documentation. Although this is reasonable, you are free to apply canary release on any non-production version for testing.

In a canary release deployment, total API traffic is separated at random into a production release and a canary release with a pre-configured ratio. Typically, the canary release receives a small percentage of API traffic and the production release takes up the rest. The updated API features are only visible to API traffic through the canary. You can adjust the canary traffic percentage to optimize test coverage or performance.

By keeping canary traffic small and the selection random, most users are not adversely affected at any time by potential bugs in the new version, and no single user is adversely affected all the time.

After the test metrics pass your requirements, you can promote the canary release to the production release and disable the canary from the deployment. This makes the new features available in the production stage.

#### Topics

- [Canary release deployment in API Gateway \(p. 452\)](#)
- [Create a canary release deployment \(p. 453\)](#)
- [Update a canary release \(p. 457\)](#)
- [Promote a canary release \(p. 458\)](#)
- [Disable a canary release \(p. 461\)](#)

## Canary release deployment in API Gateway

In API Gateway, a canary release deployment uses the deployment stage for the production release of the base version of an API, and attaches to the stage a canary release for the new versions, relative to the base version, of the API. The stage is associated with the initial deployment and the canary with subsequent deployments. At the beginning, both the stage and the canary point to the same API version. We use stage and production release interchangeably and use canary and canary release interchangeably throughout this section.

To deploy an API with a canary release, you create a canary release deployment by adding [canary settings](#) to the [stage](#) of a regular [deployment](#). The canary settings describe the underlying canary release and the stage represents the production release of the API within this deployment. To add canary settings, set `canarySettings` on the deployment stage and specify the following:

- A deployment ID, initially identical to the ID of the base version deployment set on the stage.
- A [percentage of API traffic](#), between 0.0 and 100.0 inclusive, for the canary release.
- [Stage variables for the canary release](#) that can override production release stage variables.
- The [use of the stage cache](#) for canary requests, if the [useStageCache](#) is set and API caching is enabled on the stage.

After a canary release is enabled, the deployment stage cannot be associated with another non-canary release deployment until the canary release is disabled and the canary settings removed from the stage.

When you enable API execution logging, the canary release has its own logs and metrics generated for all canary requests. They are reported to a production stage CloudWatch Logs log group as well as a canary-specific CloudWatch Logs log group. The same applies to access logging. The separate canary-specific logs are helpful to validate new API changes and decide whether to accept the changes and promote the canary release to the production stage, or to discard the changes and revert the canary release from the production stage.

The production stage execution log group is named `API-Gateway-Execution-Logs/{rest-api-id}/{stage-name}` and the canary release execution log group is named `API-Gateway-Execution-Logs/{rest-api-id}/{stage-name}/Canary`. For access logging, you must create a new log group or choose an existing one. The canary release access log group name has the `/Canary` suffix appended to the selected log group name.

A canary release can use the stage cache, if enabled, to store responses and use cached entries to return results to the next canary requests, within a pre-configured time-to-live (TTL) period.

In a canary release deployment, the production release and canary release of the API can be associated with the same version or with different versions. When they are associated with different versions, responses for production and canary requests are cached separately and the stage cache returns corresponding results for production and canary requests. When the production release and canary

release are associated with the same deployment, the stage cache uses a single cache key for both types of requests and returns the same response for the same requests from the production release and canary release.

## Create a canary release deployment

You create a canary release deployment when deploying the API with [canary settings](#) as an additional input to the [deployment creation](#) operation.

You can also create a canary release deployment from an existing non-canary deployment by making a [stage:update](#) request to add the canary settings on the stage.

When creating a non-canary release deployment, you can specify a non-existing stage name. API Gateway creates one if the specified stage does not exist. However, you cannot specify any non-existing stage name when creating a canary release deployment. You will get an error and API Gateway will not create any canary release deployment.

You can create a canary release deployment in API Gateway using the API Gateway console, the Amazon CLI, or an Amazon SDK.

### Topics

- [Create a canary deployment using the API Gateway console \(p. 453\)](#)
- [Create a canary deployment using the Amazon CLI \(p. 454\)](#)

## Create a canary deployment using the API Gateway console

To use the API Gateway console to create a canary release deployment, follow the instructions below:

### To create the initial canary release deployment

1. Sign in to the API Gateway console.
2. Choose an existing API or create a new API.
3. Change the API, if necessary, or set up desired API methods and integrations.
4. Choose **Deploy API** from the **Actions** drop-down menu. Follow the on-screen instructions in **Deploy API** to deploy the API to a new stage.

So far, you have deployed the API to a production release stage. Next, you configure canary settings on the stage and, if needed, also enable caching, set stage variables, or configure API execution or access logs.

5. To enable API caching, choose the **Settings** tab in **Stage Editor** and follow the on-screen instructions. For more information, see [the section called "Cache settings" \(p. 483\)](#).
6. To set stage variables, choose the **Stage Variables** tab in **Stage Editor** and follow the on-screen instructions to add or modify stage variables. For more information, see [the section called "Set up stage variables" \(p. 446\)](#).
7. To configure execution or access logging, choose the **Logs** tab in **Stage Editor** and follow the on-screen instructions. For more information, see [Setting up CloudWatch logging for a REST API in API Gateway \(p. 611\)](#).
8. In **Stage Editor**, choose the **Canary** tab and then choose **Create Canary**.
9. Under the **Stage's Request Distribution** section, choose the pencil icon next to **Percentage of requests to Canary** and type a number (for example, 5.0) in the input text field. Choose the check mark icon to save the setting.
10. To associate an Amazon WAF web ACL with the stage, choose a web ACL from the **Web ACL** dropdown list.

### Note

If needed, choose **Create Web ACL** to open the Amazon WAF console in a new browser tab, create the web ACL, and return to the API Gateway console to associate the web ACL with the stage.

11. If desired, choose **Block API Request if WebACL cannot be evaluated (Fail- Close)**.
12. If needed, choose **Add Stage Variables** to add them under the **Canary Stage Variables** section to override existing stage variables or add new stage variables for the canary release.
13. If desired, choose **Enable use of stage cache** to enable caching for the canary release and save your choice. The cache is not available for the canary release until API caching is enabled.

After the canary release is initialized on the deployment stage, you change the API and want to test the changes. You can redeploy the API to the same stage so that both the updated version and the base version are accessible through the same stage. The following steps describe how to do that.

### To deploy the latest API version to a canary

1. With each update of the API, choose **Deploy API** from the **Actions** drop-down menu next to the **Resources** list.
2. In **Deploy API**, choose the now canary-enabled stage from the **Deployment stage** drop-down list.
3. Optionally, type a description in **Deployment description**.
4. Choose **Deploy** to push the latest API version to the canary release.
5. If desired, reconfigure the stage settings, logs, or canary settings, as describe in [To create the initial canary release deployment \(p. 453\)](#).

As a result, the canary release points to the latest version while the production release still points to the initial version of the API. The **canarySettings** now has a new **deploymentId** value, whereas the stage still has the initial **deploymentId** value. Behind the scenes, the console calls **stage:update**.

### Create a canary deployment using the Amazon CLI

First create a baseline deployment with two stage variables, but without any canary:

```
aws apigateway create-deployment
  --variables sv0=val0,sv1=val1
  --rest-api-id 4wk1k4onj3
  --stage-name prod
```

The command returns a representation of the resulting **Deployment**, similar to the following:

```
{
  "id": "du4ot1",
  "createdDate": 1511379050
}
```

The resulting deployment **id** identifies a snapshot (or version) of the API.

Now create a canary deployment on the **prod** stage:

```
aws apigateway create-deployment
  --canary-settings '{ \
    "percentTraffic":10.5, \
    "useStageCache":false, \
    "stageVariableOverrides":{ \
```

```
        "sv1": "val2", \
        "sv2": "val3" \
    } \
}' \
--rest-api-id 4wk1k4onj3 \
--stage-name prod
```

If the specified stage (`prod`) does not exist, the preceding command returns an error. Otherwise, it returns the newly created [deployment](#) resource representation similar to the following:

```
{
  "id": "a6rox0",
  "createdDate": 1511379433
}
```

The resulting deployment `id` identifies the test version of the API for the canary release. As a result, the associated stage is canary-enabled. You can view this stage representation by calling the `get-stage` command, similar to the following:

```
aws apigateway get-stage --rest-api-id 4wk1k4onj3 --stage-name prod
```

The following shows a representation of the Stage as the output of the command:

```
{
  "stageName": "prod",
  "variables": {
    "sv0": "val0",
    "sv1": "val1"
  },
  "cacheClusterEnabled": false,
  "cacheClusterStatus": "NOT_AVAILABLE",
  "deploymentId": "du4ot1",
  "lastUpdatedDate": 1511379433,
  "createdDate": 1511379050,
  "canarySettings": {
    "percentTraffic": 10.5,
    "deploymentId": "a6rox0",
    "useStageCache": false,
    "stageVariableOverrides": {
      "sv2": "val3",
      "sv1": "val2"
    }
  },
  "methodSettings": {}
}
```

In this example, the base version of the API will use the stage variables of `{"sv0": "val0", "sv1": "val1"}`, while the test version uses the stage variables of `{"sv1": "val2", "sv2": "val3"}`. Both the production release and canary release use the same stage variable of `sv1`, but with different values, `val1` and `val2`, respectively. The stage variable of `sv0` is used solely in the production release and the stage variable of `sv2` is used in the canary release only.

You can create a canary release deployment from an existing regular deployment by updating the stage to enable a canary. To demonstrate this, create a regular deployment first:

```
aws apigateway create-deployment \
  --variables sv0=val0,sv1=val1 \
  --rest-api-id 4wk1k4onj3 \
```

```
--stage-name beta
```

The command returns a representation of the base version deployment:

```
{
  "id": "cifeiw",
  "createdDate": 1511380879
}
```

The associated beta stage does not have any canary settings:

```
{
  "stageName": "beta",
  "variables": {
    "sv0": "val0",
    "sv1": "val1"
  },
  "cacheClusterEnabled": false,
  "cacheClusterStatus": "NOT_AVAILABLE",
  "deploymentId": "cifeiw",
  "lastUpdatedDate": 1511380879,
  "createdDate": 1511380879,
  "methodSettings": {}
}
```

Now, create a new canary release deployment by attaching a canary on the stage:

```
aws apigateway update-stage \
  --patch-operations ' [{ \
    "op": "replace", \
    "path": "/canarySettings/percentTraffic", \
    "value": "10.5" \
  }, { \
    "op": "replace", \
    "path": "/canarySettings/useStageCache", \
    "value": "false" \
  }, { \
    "op": "replace", \
    "path": "/canarySettings/stageVariableOverrides/sv1", \
    "value": "val2" \
  }, { \
    "op": "replace", \
    "path": "/canarySettings/stageVariableOverrides/sv2", \
    "value": "val3" \
  } ]' \
  --rest-api-id 4wklk4onj3 \
  --stage-name beta
```

A representation of the updated stage looks like this:

```
{
  "stageName": "beta",
  "variables": {
    "sv0": "val0",
    "sv1": "val1"
  },
  "cacheClusterEnabled": false,
  "cacheClusterStatus": "NOT_AVAILABLE",
  "deploymentId": "cifeiw",
  "lastUpdatedDate": 1511381930,
  "createdDate": 1511380879,
}
```

```
"canarySettings": {  
  "percentTraffic": 10.5,  
  "deploymentId": "cifeiw",  
  "useStageCache": false,  
  "stageVariableOverrides": {  
    "sv2": "val3",  
    "sv1": "val2"  
  }  
},  
"methodSettings": {}  
}
```

Because we just enabled a canary on an existing version of the API, both the production release (Stage) and canary release (`canarySettings`) point to the same deployment, i.e., the same version (`deploymentId`) of the API. After you change the API and deploy it to this stage again, the new version will be in the canary release, while the base version remains in the production release. This is manifested in the stage evolution when the `deploymentId` in the canary release is updated to the new deployment `id` and the `deploymentId` in the production release remains unchanged.

## Update a canary release

After a canary release is deployed, you may want to adjust the percentage of the canary traffic or enable or disable the use of a stage cache to optimize the test performance. You can also modify stage variables used in the canary release when the execution context is updated. To make such updates, call the [stage:update](#) operation with new values on `canarySettings`.

You can update a canary release using the API Gateway console, the Amazon CLI [update-stage](#) command or an Amazon SDK.

### Topics

- [Update a canary release using the API Gateway console \(p. 457\)](#)
- [Update a canary release using the Amazon CLI \(p. 457\)](#)

## Update a canary release using the API Gateway console

To use the API Gateway console to update existing canary settings on a stage, do the following:

1. Sign in to the API Gateway console and choose an existing API in the primary navigation pane.
2. Choose **Stages** under the API and then choose an existing stage under the **Stages** list to open the **Stage Editor**.
3. Choose the **Canary** tab in the **Stage Editor**.
4. Update **Percentage of requests directed to Canary** by increasing or decreasing the percentage number between 0.0 and 100.0, inclusive.
5. Update **Canary Stage Variables**, including adding, removing, or modifying a desired stage variable.
6. Update the **Enable use of stage cache** option by selecting or clearing the check box.
7. Save the changes.

## Update a canary release using the Amazon CLI

To use the Amazon CLI to update a canary, call the [update-stage](#) command.

To enable or disable the use of a stage cache for the canary, call the [update-stage](#) command as follows:

```
aws apigateway update-stage \
```



```
--rest-api-id {rest-api-id}      \
--stage-name '{stage-name}'      \
--patch-operations op=replace,path=/canarySettings/useStageCache,value=true
```

To adjust the canary traffic percentage, call `update-stage` to replace the `/canarySettings/percentTraffic` value on the [stage](#).

```
aws apigateway update-stage      \
--rest-api-id {rest-api-id}      \
--stage-name '{stage-name}'      \
--patch-operations op=replace,path=/canarySettings/percentTraffic,value=25.0
```

To update canary stage variables, including adding, replacing, or removing a canary stage variable:

```
aws apigateway update-stage      \
--rest-api-id {rest-api-id}      \
--stage-name '{stage-name}'      \
--patch-operations ' [{
  "op": "replace",
  "path": "/canarySettings/stageVariableOverrides/newVar"
}, {
  "op": "replace",
  "path": "/canarySettings/stageVariableOverrides/var2"
}, {
  "op": "remove",
  "path": "/canarySettings/stageVariableOverrides/var1"
}]'
```

You can update all of the above by combining the operations into a single `patch-operations` value:

```
aws apigateway update-stage      \
--rest-api-id {rest-api-id}      \
--stage-name '{stage-name}'      \
--patch-operations ' [{
  "op": "replace",
  "path": "/canary/percentTraffic",
  "value": "20.0"
}, {
  "op": "replace",
  "path": "/canary/useStageCache",
  "value": "true"
}, {
  "op": "remove",
  "path": "/canarySettings/stageVariableOverrides/var1"
}, {
  "op": "replace",
  "path": "/canarySettings/stageVariableOverrides/newVar",
  "value": "newVal"
}, {
  "op": "replace",
  "path": "/canarySettings/stageVariableOverrides/val2",
  "value": "val4"
}]'
```

## Promote a canary release

To promote a canary release makes it available in the production stage the API version under testing. The operation involves the following tasks:

- Reset the [deployment ID](#) of the stage with the [deployment ID](#) settings of the canary. This updates the API snapshot of the stage with the snapshot of the canary, making the test version the production release as well.
- Update stage variables with canary stage variables, if any. This updates the API execution context of the stage with that of the canary. Without this update, the new API version may produce unexpected results if the test version uses different stage variables or different values of existing stage variables.
- Set the percentage of canary traffic to 0.0%.

Promoting a canary release does not disable the canary on the stage. To disable a canary, you must remove the canary settings on the stage.

### Topics

- [Promote a canary release using the API Gateway console \(p. 459\)](#)
- [Promote a canary release using the Amazon CLI \(p. 459\)](#)

## Promote a canary release using the API Gateway console

To use the API Gateway console to promote a canary release deployment, do the following:

1. Sign in to the API Gateway console and choose an existing API in the primary navigation pane.
2. Choose **Stages** under the API and then choose an existing stage under the **Stages** list to open the **Stage Editor**.
3. Choose the **Canary** tab in the **Stage Editor**.
4. Choose **Promote Canary**.
5. Confirm changes to be made and choose **Update**.

After the promotion, the production release references the same API version (**deploymentId**) as the canary release. You can verify this using the Amazon CLI. For example, see [the section called “Promote a canary release using the Amazon CLI” \(p. 459\)](#).

## Promote a canary release using the Amazon CLI

To promote a canary release to the production release using the Amazon CLI commands, call the `update-stage` command to copy the canary-associated `deploymentId` to the stage-associated `deploymentId`, to reset the canary traffic percentage to zero (0.0), and, to copy any canary-bound stage variables to the corresponding stage-bound ones.

Suppose we have a canary release deployment, described by a stage similar to the following:

```
{
  "_links": {
    ...
  },
  "accessLogSettings": {
    ...
  },
  "cacheClusterEnabled": false,
  "cacheClusterStatus": "NOT_AVAILABLE",
  "canarySettings": {
    "deploymentId": "eh1sby",
    "useStageCache": false,
    "stageVariableOverrides": {
      "sv2": "val3",
      "sv1": "val2"
    }
  },
}
```

```

    "percentTraffic": 10.5
  },
  "createdDate": "2017-11-20T04:42:19Z",
  "deploymentId": "nfcn0x",
  "lastUpdatedDate": "2017-11-22T00:54:28Z",
  "methodSettings": {
    ...
  },
  "stageName": "prod",
  "variables": {
    "sv1": "val1"
  }
}

```

We call the following update-stage request to promote it:

```

aws apigateway update-stage \
  --rest-api-id {rest-api-id} \
  --stage-name '{stage-name}' \
  --patch-operations ' [{
    "op": "replace", \
    "value": "0.0" \
    "path": "/canarySettings/percentTraffic", \
  }, {
    "op": "copy", \
    "from": "/canarySettings/stageVariableOverrides", \
    "path": "/variables", \
  }, {
    "op": "copy", \
    "from": "/canarySettings/deploymentId", \
    "path": "/deploymentId" \
  } ]'

```

After the promotion, the stage now looks like this:

```

{
  "_links": {
    ...
  },
  "accessLogSettings": {
    ...
  },
  "cacheClusterEnabled": false,
  "cacheClusterStatus": "NOT_AVAILABLE",
  "canarySettings": {
    "deploymentId": "ehlsby",
    "useStageCache": false,
    "stageVariableOverrides": {
      "sv2": "val3",
      "sv1": "val2"
    }
  },
  "percentTraffic": 0
},
"createdDate": "2017-11-20T04:42:19Z",
"deploymentId": "ehlsby",
"lastUpdatedDate": "2017-11-22T05:29:47Z",
"methodSettings": {
  ...
},
"stageName": "prod",
"variables": {
  "sv2": "val3",
  "sv1": "val2"
}

```

```
}  
}
```

As you can see, promoting a canary release to the stage does not disable the canary and the deployment remains to be a canary release deployment. To make it a regular production release deployment, you must disable the canary settings. For more information about how to disable a canary release deployment, see [the section called “Disable a canary release” \(p. 461\)](#).

## Disable a canary release

To disable a canary release deployment is to set the `canarySettings` to null to remove it from the stage.

You can disable a canary release deployment using the API Gateway console, the Amazon CLI, or an Amazon SDK.

### Topics

- [Disable a canary release using the API Gateway console \(p. 461\)](#)
- [Disable a canary release using the Amazon CLI \(p. 461\)](#)

### Disable a canary release using the API Gateway console

To use the API Gateway console to disable a canary release deployment, use the following steps:

1. Sign in to the API Gateway console and choose an existing API in the primary navigation pane.
2. Choose **Stages** under the API and then choose an existing stage under the **Stages** list to open the **Stage Editor**.
3. Choose the **Canary** tab in the **Stage Editor**.
4. Choose **Delete Canary**.
5. Confirm you want to delete the canary by choosing **Delete**.

As a result, the `canarySettings` property becomes null and is removed from the deployment `stage`. You can verify this using the Amazon CLI. For example, see [the section called “Disable a canary release using the Amazon CLI” \(p. 461\)](#).

### Disable a canary release using the Amazon CLI

To use the Amazon CLI to disable a canary release deployment, call the `update-stage` command as follows:

```
aws apigateway update-stage \  
  --rest-api-id 4wklk4onj3 \  
  --stage-name canary \  
  --patch-operations '[{"op":"remove", "path":"/canarySettings}]'
```

A successful response returns a payload similar to the following:

```
{  
  "stageName": "prod",  
  "accessLogSettings": {  
    ...  
  },  
  "cacheClusterEnabled": false,  
  "cacheClusterStatus": "NOT_AVAILABLE",  
  "deploymentId": "nfcn0x",  
  "lastUpdatedDate": 1511309280,  
}
```

```

    "createdDate": 1511152939,
    "methodSettings": {
        ...
    }
}

```

As shown in the output, the `canarySettings` property is no longer present in the `stage` of a canary-disabled deployment.

## Updates to a REST API that require redeployment

Maintaining an API amounts to viewing, updating and deleting the existing API setups. You can maintain an API using the API Gateway console, Amazon CLI, an SDK or the API Gateway REST API. Updating an API involves modifying certain resource properties or configuration settings of the API. Resource updates require redeploying the API, whereas configuration updates do not.

API resources that can be updated are detailed in the following table.

### API resource updates requiring redeployment of the API

Resource	Remarks
<a href="#">ApiKey</a>	For applicable properties and supported operations, see <a href="#">apikey:update</a> . The update requires redeploying the API.
<a href="#">Authorizer</a>	For applicable properties and supported operations, see <a href="#">authorizer:update</a> . The update requires redeploying the API.
<a href="#">DocumentationPart</a>	For applicable properties and supported operations, see <a href="#">documentationpart:update</a> . The update requires redeploying the API.
<a href="#">DocumentationVersion</a>	For applicable properties and supported operations, see <a href="#">documentationversion:update</a> . The update requires redeploying the API.
<a href="#">GatewayResponse</a>	For applicable properties and supported operations, see <a href="#">gatewayresponse:update</a> . The update requires redeploying the API.
<a href="#">Integration</a>	For applicable properties and supported operations, see <a href="#">integration:update</a> . The update requires redeploying the API.
<a href="#">IntegrationResponse</a>	For applicable properties and supported operations, see <a href="#">integrationresponse:update</a> . The update requires redeploying the API.
<a href="#">Method</a>	For applicable properties and supported operations, see <a href="#">method:update</a> . The update requires redeploying the API.
<a href="#">MethodResponse</a>	For applicable properties and supported operations, see <a href="#">methodresponse:update</a> . The update requires redeploying the API.
<a href="#">Model</a>	For applicable properties and supported operations, see <a href="#">model:update</a> . The update requires redeploying the API.
<a href="#">RequestValidator</a>	For applicable properties and supported operations, see <a href="#">requestvalidator:update</a> . The update requires redeploying the API.
<a href="#">Resource</a>	For applicable properties and supported operations, see <a href="#">resource:update</a> . The update requires redeploying the API.
<a href="#">RestApi</a>	For applicable properties and supported operations, see <a href="#">restapi:update</a> . The update requires redeploying the API.

Resource	Remarks
VpcLink	For applicable properties and supported operations, see <a href="#">vpcLink:update</a> . The update requires redeploying the API.

API configurations that can be updated are detailed in the following table.

### API configuration updates without requiring redeployment of the API

Configuration	Remarks
Account	For applicable properties and supported operations, see <a href="#">account:update</a> . The update does not require redeploying the API.
Deployment	For applicable properties and supported operations, see <a href="#">deployment:update</a> .
DomainName	For applicable properties and supported operations, see <a href="#">domainname:update</a> . The update does not require redeploying the API.
BasePathMapping	For applicable properties and supported operations, see <a href="#">basepathmapping:update</a> . The update does not require redeploying the API.
Stage	For applicable properties and supported operations, see <a href="#">stage:update</a> . The update does not require redeploying the API.
Usage	For applicable properties and supported operations, see <a href="#">usage:update</a> . The update does not require redeploying the API.
UsagePlan	For applicable properties and supported operations, see <a href="#">usageplan:update</a> . The update does not require redeploying the API.

## Setting up custom domain names for REST APIs

*Custom domain names* are simpler and more intuitive URLs that you can provide to your API users.

After deploying your API, you (and your customers) can invoke the API using the default base URL of the following format:

```
https://api-id.execute-api.region.amazonaws.com/stage
```

where *api-id* is generated by API Gateway, *region* (Amazon Region) is specified by you when creating the API, and *stage* is specified by you when deploying the API.

The hostname portion of the URL (that is, *api-id*.execute-api.*region*.amazonaws.com) refers to an API endpoint. The default API endpoint can be difficult to recall and not user-friendly.

With custom domain names, you can set up your API's hostname, and choose a base path (for example, *myservice*) to map the alternative URL to your API. For example, a more user-friendly API base URL can become:

```
https://api.example.com/myservice
```

If you don't set any base mapping under a custom domain name, the resulting API's base URL is the same as the custom domain (for example, <https://api.example.com>). In this case, the custom domain name can't support more than one API.

**Note**

A Regional custom domain can be associated with REST APIs and HTTP APIs. You can use [API Gateway Version 2 APIs](#) to create and manage Regional custom domain names for REST APIs. Custom domain names are not supported for [private APIs \(p. 599\)](#).

You can choose a minimum TLS version that your REST API supports. For REST APIs, you can choose TLS 1.2 or TLS 1.0.

## Register a domain name

You must have a registered internet domain name in order to set up custom domain names for your APIs. If needed, you can register an internet domain using [Amazon Route 53](#) or using a third-party domain registrar of your choice. An API's custom domain name can be the name of a subdomain or the root domain (also known as "zone apex") of a registered internet domain.

After a custom domain name is created in API Gateway, you must create or update your DNS provider's resource record to map to your API endpoint. Without such a mapping, API requests bound for the custom domain name cannot reach API Gateway.

**Note**

An edge-optimized custom domain name is created in a specific Region and owned by a specific Amazon account. Moving such a custom domain name between Regions or Amazon accounts involves deleting the existing CloudFront distribution and creating a new one. The process may take approximately 30 minutes before the new custom domain name becomes available. For more information, see [Updating CloudFront Distributions](#).

## Edge-optimized custom domain names

When you deploy an edge-optimized API, API Gateway sets up an Amazon CloudFront distribution and a DNS record to map the API domain name to the CloudFront distribution domain name. Requests for the API are then routed to API Gateway through the mapped CloudFront distribution.

When you create a custom domain name for an edge-optimized API, API Gateway sets up a CloudFront distribution. But you must set up a DNS record to map the custom domain name to the CloudFront distribution domain name. This mapping is for API requests that are bound for the custom domain name to be routed to API Gateway through the mapped CloudFront distribution. You must also provide a certificate for the custom domain name.

To set up an edge-optimized custom domain name or to update its certificate, you must have a permission to update CloudFront distributions. You can do so by attaching the following IAM policy statement to an IAM user, group, or role in your account:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowCloudFrontUpdateDistribution",
      "Effect": "Allow",
      "Action": [
        "cloudfront:updateDistribution"
      ],
      "Resource": [
        "*"
      ]
    }
  ]
}
```

API Gateway supports edge-optimized custom domain names by leveraging Server Name Indication (SNI) on the CloudFront distribution. For more information on using custom domain names on a CloudFront

distribution, including the required certificate format and the maximum size of a certificate key length, see [Using Alternate Domain Names and HTTPS](#) in the *Amazon CloudFront Developer Guide*.

To set up a custom domain name as your API's hostname, you, as the API owner, must provide an SSL/TLS certificate for the custom domain name.

To provide a certificate for an edge-optimized custom domain name, you can request [Amazon Certificate Manager](#) (ACM) to generate a new certificate in ACM or to import into ACM one issued by a third-party certificate authority in the `us-east-1` Region (US East (N. Virginia)).

## Regional custom domain names

When you create a custom domain name for a Regional API, API Gateway creates a Regional domain name for the API. You must set up a DNS record to map the custom domain name to the Regional domain name. You must also provide a certificate for the custom domain name.

## Wildcard custom domain names

With wildcard custom domain names, you can support an almost infinite number of domain names without exceeding the [default quota](#) (p. 744). For example, you could give each of your customers their own domain name, `customername.api.example.com`.

To create a wildcard custom domain name, specify a wildcard (\*) as the first subdomain of a custom domain that represents all possible subdomains of a root domain.

For example, the wildcard custom domain name `*.example.com` results in subdomains such as `a.example.com`, `b.example.com`, and `c.example.com`, which all route to the same domain.

Wildcard custom domain names support distinct configurations from API Gateway's standard custom domain names. For example, in a single Amazon account, you can configure `*.example.com` and `a.example.com` to behave differently.

You can use the `$context.domainName` and `$context.domainPrefix` context variables to determine the domain name that a client used to call your API. To learn more about context variables, see [API Gateway mapping template and access logging variable reference](#) (p. 363).

To create a wildcard custom domain name, you must provide a certificate issued by ACM that has been validated using either the DNS or the email validation method.

### Note

You can't create a wildcard custom domain name if a different Amazon account has created a custom domain name that conflicts with the wildcard custom domain name. For example, if account A has created `a.example.com`, then account B can't create the wildcard custom domain name `*.example.com`.

If account A and account B share an owner, you can contact the [Amazon Support Center](#) to request an exception.

## Certificates for custom domain names

To provide a certificate for a custom domain name in a Region where ACM is supported, you must request a certificate from ACM. To provide a certificate for a Regional custom domain name in a Region where ACM is not supported, you must import a certificate to API Gateway in that Region.

To import an SSL/TLS certificate, you must provide the PEM-formatted SSL/TLS certificate body, its private key, and the certificate chain for the custom domain name. Each certificate stored in ACM is identified by its ARN. To use an Amazon managed certificate for a domain name, you simply reference its ARN.

ACM makes it straightforward to set up and use a custom domain name for an API. You create a certificate for the given domain name (or import a certificate), set up the domain name in API Gateway



with the ARN of the certificate provided by ACM, and map a base path under the custom domain name to a deployed stage of the API. With certificates issued by ACM, you do not have to worry about exposing any sensitive certificate details, such as the private key.

### Topics

- [Getting certificates ready in Amazon Certificate Manager \(p. 466\)](#)
- [Choosing a minimum TLS version for a custom domain in API Gateway \(p. 468\)](#)
- [Creating an edge-optimized custom domain name \(p. 472\)](#)
- [Setting up a regional custom domain name in API Gateway \(p. 475\)](#)
- [Migrating a custom domain name to a different API endpoint \(p. 478\)](#)
- [Working with API mappings for REST APIs \(p. 480\)](#)
- [Disabling the default endpoint for a REST API \(p. 483\)](#)

## Getting certificates ready in Amazon Certificate Manager

Before setting up a custom domain name for an API, you must have an SSL/TLS certificate ready in Amazon Certificate Manager. The following steps describe how to get this done. For more information, see the [Amazon Certificate Manager User Guide](#).

### Note

To use an ACM certificate with an API Gateway edge-optimized custom domain name, you must request or import the certificate in the US East (N. Virginia) (`us-east-1`) Region. For an API Gateway Regional custom domain name, you must request or import the certificate in the same Region as your API. The certificate must be signed by a publicly trusted Certificate Authority and cover the custom domain name.

First, register your internet domain, for example, `example.com`. You can use either [Amazon Route 53](#) or a third-party accredited domain registrar. For a list of such registrars, see [Accredited Registrar Directory](#) at the ICANN website.

To create in or import into ACM an SSL/TLS certificate for a domain name, do one of the following:

### To request a certificate provided by ACM for a domain name

1. Sign in to the [Amazon Certificate Manager console](#).
2. Choose **Request a certificate**.
3. Enter a custom domain name for your API, for example, `api.example.com`, in **Domain name**.
4. Optionally, choose **Add another name to this certificate**.
5. Choose **Review and request**.
6. Choose **Confirm and request**.
7. For a valid request, a registered owner of the internet domain must consent to the request before ACM issues the certificate.

### To import into ACM a certificate for a domain name

1. Get a PEM-encoded SSL/TLS certificate for your custom domain name from a certificate authority. For a partial list of such CAs, see the [Mozilla Included CA List](#)
  - a. Generate a private key for the certificate and save the output to a file, using the [OpenSSL](#) toolkit at the OpenSSL website:

```
openssl genrsa -out private-key-file 2048
```

**Note**

Amazon API Gateway leverages Amazon CloudFront to support certificates for custom domain names. As such, the requirements and constraints of a custom domain name SSL/TLS certificate are dictated by [CloudFront](#). For example, the maximum size of the public key is 2048 and the private key size can be 1024, 2048, and 4096. The public key size is determined by the certificate authority you use. Ask your certificate authority to return keys of a size different from the default length. For more information, see [Secure access to your objects](#) and [Create signed URLs and signed cookies](#).

- b. Generate a certificate signing request (CSR) with the previously generated private key, using OpenSSL:

```
openssl req -new -sha256 -key private-key-file -out CSR-file
```

- c. Submit the CSR to the certificate authority and save the resulting certificate.
- d. Download the certificate chain from the certificate authority.

**Note**

If you obtain the private key in another way and the key is encrypted, you can use the following command to decrypt the key before submitting it to API Gateway for setting up a custom domain name.

```
openssl pkcs8 -topk8 -inform pem -in MyEncryptedKey.pem -outform pem -nocrypt -out MyDecryptedKey.pem
```

2. Upload the certificate to Amazon Certificate Manager:

- a. Sign in to the [Amazon Certificate Manager console](#).
- b. Choose **Import a certificate**.
- c. For **Certificate body**, enter or paste the body of the PEM-formatted server certificate from your certificate authority. The following shows an abbreviated example of such a certificate.

```
-----BEGIN CERTIFICATE-----  
EXAMPLECA+KgAwIBAgIQJ1XxJ8Pl++gOfQtj0IBoqDANBgkqhkiG9w0BAQUFADBB  
...  
az8Cg1aicxLBQ7EaWIhhgEXAMPLE  
-----END CERTIFICATE-----
```

- d. For **Certificate private key**, enter or paste your PEM-formatted certificate's private key. The following shows an abbreviated example of such a key.

```
-----BEGIN RSA PRIVATE KEY-----  
EXAMPLEBAAKCAQEa2Qb3LDHD7StY7Wj6U2/opV6Xu37qUCCKeDWhwpZMYJ9/nETO  
...  
1qGvJ3u04vdnzaYN5WoyN5LFckr1A71+CszD1CGSqBVDWEXAMPLE  
-----END RSA PRIVATE KEY-----
```

- e. For **Certificate chain**, enter or paste the PEM-formatted intermediate certificates and, optionally, the root certificate, one after the other without any blank lines. If you include the root certificate, your certificate chain must start with intermediate certificates and end with the root certificate. Use the intermediate certificates provided by your certificate authority. Do not include any intermediaries that are not in the chain of trust path. The following shows an abbreviated example.

```
-----BEGIN CERTIFICATE-----  
EXAMPLECA4ugAwIBAgIQWrYdrB5NogYUx1U9Pamy3DANBgkqhkiG9w0BAQUFADCB  
...
```

```
8/ifB1IK3se2e4/hEfcEejX/arxbx1BJCHBv1EPNnsdw8EXAMPLE  
-----END CERTIFICATE-----
```

Here is another example.

```
-----BEGIN CERTIFICATE-----  
Intermediate certificate 2  
-----END CERTIFICATE-----  
-----BEGIN CERTIFICATE-----  
Intermediate certificate 1  
-----END CERTIFICATE-----  
-----BEGIN CERTIFICATE-----  
Optional: Root certificate  
-----END CERTIFICATE-----
```

- f. Choose **Review and import**.

After the certificate is successfully created or imported, make note of the certificate ARN. You need it when setting up the custom domain name.

## Choosing a minimum TLS version for a custom domain in API Gateway

For greater security, you can choose a minimum Transport Layer Security (TLS) protocol version to be enforced for your Amazon API Gateway custom domain by setting a security policy in the API Gateway console, Amazon CLI, or Amazon SDKs.

A *security policy* is a predefined combination of minimum TLS version and cipher suite offered by Amazon API Gateway. You can choose either a TLS version 1.2 or TLS version 1.0 security policy. The TLS protocol addresses network security problems such as tampering and eavesdropping between a client and server. When your clients establish a TLS handshake to your API through the custom domain, the security policy enforces the TLS version and cipher suite options your clients can choose to use.

In custom domain settings, a security policy determines two settings:

- The minimum TLS version that API Gateway uses to communicate with API clients
- The cipher that API Gateway uses to encrypt the content that it returns to API clients

### Topics

- [How to specify a minimum TLS protocol version for custom domains in API Gateway \(p. 468\)](#)
- [Supported security policies, TLS protocol versions, and ciphers for edge-optimized API endpoints in API Gateway \(p. 469\)](#)
- [Supported SSL/TLS protocols and ciphers for regional, private, and WebSocket API endpoints in API Gateway \(p. 470\)](#)
- [OpenSSL and RFC cipher names \(p. 471\)](#)

## How to specify a minimum TLS protocol version for custom domains in API Gateway

When you create a custom domain, you specify the security policy for it. For more information about security policies, see the tables in the following sections.

The following sections describe how to create a custom domain name, including specifying the minimum TLS version in the API Gateway console and CLI:

- [the section called “Creating an edge-optimized custom domain name” \(p. 472\)](#)
- [the section called “Setting up a regional custom domain name” \(p. 475\)](#)

You can change the security policy by updating the domain name settings. To change the minimum TLS version, use one of the following commands, specifying the new TLS version (`TLS_1_0` or `TLS_1_2`) in the `securityPolicy` parameter. Allow up to 60 minutes for the update to be completed.

- `domainname:update`
- `update-domain-name`
- `UpdateDomainName`

## Supported security policies, TLS protocol versions, and ciphers for edge-optimized API endpoints in API Gateway

The following table lists the protocols and ciphers that API Gateway can use for each security policy for edge-optimized APIs.

	Security policy	
	TLS-1-0	TLS-1-2
<b>SSL/TLS protocols supported</b>		
TLSv1.3	◆	◆
TLSv1.2	◆	◆
TLSv1.1	◆	
TLSv1	◆	
SSLv3		
<b>Ciphers supported</b>		
ECDHE-RSA-AES128-GCM-SHA256	◆	◆
ECDHE-RSA-AES128-SHA256	◆	◆
ECDHE-RSA-AES128-SHA	◆	
ECDHE-RSA-AES256-GCM-SHA384	◆	◆
ECDHE-RSA-AES256-SHA384	◆	◆
ECDHE-RSA-AES256-SHA	◆	
AES128-GCM-SHA256	◆	◆
AES256-GCM-SHA384	◆	◆
AES128-SHA256	◆	◆
AES256-SHA	◆	
AES128-SHA	◆	

	Security policy	
	TLS-1-0	TLS-1-2
<b>SSL/TLS protocols supported</b>		
DES-CBC3-SHA	◆	
RC4-MD5		

## Supported SSL/TLS protocols and ciphers for regional, private, and WebSocket API endpoints in API Gateway

The following table describes the security policies that can be specified for Regional, private, and WebSocket API endpoints.

### Note

For private and WebSocket APIs, only `TLS-1-2` can be specified.

Security policy	TLS-1-0	TLS-1-2
<b>TLS Protocols</b>		
Protocol-TLSv1	◆	
Protocol-TLSv1.1	◆	
Protocol-TLSv1.2	◆	◆
<b>TLS Ciphers</b>		
ECDHE-ECDSA-AES128-GCM-SHA256	◆	◆
ECDHE-RSA-AES128-GCM-SHA256	◆	◆
ECDHE-ECDSA-AES128-SHA256	◆	◆
ECDHE-RSA-AES128-SHA256	◆	◆
ECDHE-ECDSA-AES128-SHA	◆	
ECDHE-RSA-AES128-SHA	◆	
ECDHE-ECDSA-AES256-GCM-SHA384	◆	◆
ECDHE-RSA-AES256-GCM-SHA384	◆	◆
ECDHE-ECDSA-AES256-SHA384	◆	◆
ECDHE-RSA-AES256-SHA384	◆	◆
ECDHE-RSA-AES256-SHA	◆	
ECDHE-ECDSA-AES256-SHA	◆	
AES128-GCM-SHA256	◆	◆

Security policy	TLS-1-0	TLS-1-2
AES128-SHA256	◆	◆
AES128-SHA	◆	
AES256-GCM-SHA384	◆	◆
AES256-SHA256	◆	◆
AES256-SHA	◆	
DES-CBC3-SHA	◆	

## OpenSSL and RFC cipher names

OpenSSL and IETF RFC 5246, [The Transport Layer Security \(TLS\) Protocol Version 1.2](#), use different names for the same ciphers. The following table maps the OpenSSL name to the RFC name for each cipher.

OpenSSL cipher name	RFC cipher name
ECDHE-RSA-AES128-GCM-SHA256	TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
ECDHE-RSA-AES128-SHA256	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256
ECDHE-RSA-AES128-SHA	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA
ECDHE-RSA-AES256-GCM-SHA384	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
ECDHE-RSA-AES256-SHA384	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384
ECDHE-RSA-AES256-SHA	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA
AES128-GCM-SHA256	TLS_RSA_WITH_AES_128_GCM_SHA256
AES256-GCM-SHA384	TLS_RSA_WITH_AES_256_GCM_SHA384
AES128-SHA256	TLS_RSA_WITH_AES_128_CBC_SHA256
AES256-SHA	TLS_RSA_WITH_AES_256_CBC_SHA
AES128-SHA	TLS_RSA_WITH_AES_128_CBC_SHA
DES-CBC3-SHA	TLS_RSA_WITH_3DES_EDE_CBC_SHA
RC4-MD5	TLS_RSA_WITH_RC4_128_MD5

## Creating an edge-optimized custom domain name

### Topics

- [Set up an edge-optimized custom domain name for an API Gateway API \(p. 472\)](#)
- [Configure base path mapping of an API with a custom domain name as its hostname \(p. 473\)](#)
- [Rotate a certificate imported into ACM \(p. 474\)](#)
- [Call your API with custom domain names \(p. 475\)](#)

### Set up an edge-optimized custom domain name for an API Gateway API

The following procedure describes how to create a custom domain name for an API using the API Gateway console.

#### To create a custom domain name using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Custom domain names** from the main navigation pane.
3. Choose **Create**.
4. For **Domain name**, enter a domain name.
5. Under Configuration, choose **Edge-optimized**.
6. Choose a minimum TLS version.
7. Choose an ACM certificate.

#### Note

To use an ACM certificate with an API Gateway edge-optimized custom domain name, you must request or import the certificate in the `us-east-1` Region (US East (N. Virginia)).

8. Choose **Create domain name**.
9. After the custom domain name is created, the console displays the associated CloudFront distribution domain name, in the form of `distribution-id.cloudfront.net`, along with the certificate ARN. Note the CloudFront distribution domain name shown in the output. You need it in the next step to set the custom domain's CNAME value or A-record alias target in your DNS.

#### Note

The newly created custom domain name takes about 40 minutes to be ready. In the meantime, you can configure the DNS record alias to map the custom domain name to the associated CloudFront distribution domain name and to set up the base path mapping for the custom domain name while the custom domain name is being initialized.

10. Next, you configure DNS records with your DNS provider to map the custom domain name to the associated CloudFront distribution. For instructions for Amazon Route 53, see [Routing traffic to an Amazon API Gateway API by using your domain name](#) in the *Amazon Route 53 Developer Guide*.

For most DNS providers, a custom domain name is added to the hosted zone as a CNAME resource record set. The CNAME record name specifies the custom domain name you entered earlier in **Domain Name** (for example, `api.example.com`). The CNAME record value specifies the domain name for the CloudFront distribution. However, use of a CNAME record will not work if your custom domain is a zone apex (i.e., `example.com` instead of `api.example.com`). A zone apex is also commonly known as the root domain of your organization. For a zone apex you need to use an A-record alias, provided that is supported by your DNS provider.

With Route 53 you can create an A record alias for your custom domain name and specify the CloudFront distribution domain name as the alias target. This means that Route 53 can route your custom domain name even if it is a zone apex. For more information, see [Choosing Between Alias and Non-Alias Resource Record Sets](#) in the *Amazon Route 53 Developer Guide*.

Use of A-record aliases also eliminates exposure of the underlying CloudFront distribution domain name because the domain name mapping takes place solely within Route 53. For these reasons, we recommend that you use Route 53 A-record alias whenever possible.

In addition to using the API Gateway console, you can use the API Gateway REST API, Amazon CLI or one of the Amazon SDKs to set up the custom domain name for your APIs. As an illustration, the following procedure outlines the steps to do so using the REST API calls.

### To set up a custom domain name using the API Gateway REST API

1. Call `domainname:create`, specifying the custom domain name and the ARN of a certificate stored in Amazon Certificate Manager.

The successful API call returns a `201 Created` response containing the certificate ARN as well as the associated CloudFront distribution name in its payload.

2. Note the CloudFront distribution domain name shown in the output. You need it in the next step to set the custom domain's CNAME value or A-record alias target in your DNS.
3. Follow the previous procedure to set up an A-record alias to map the custom domain name to its CloudFront distribution name.

For code examples of this REST API call, see [domainname:create](#).

### Configure base path mapping of an API with a custom domain name as its hostname

You can use a single custom domain name as the hostname of multiple APIs. You achieve this by configuring the base path mappings on the custom domain name. With the base path mappings, an API under the custom domain is accessible through the combination of the custom domain name and the associated base path.

For example, if you created an API named `PetStore` and another API named `PetShop` and set up a custom domain name of `api.example.com` in API Gateway, you can set the `PetStore` API's URL as `https://api.example.com` or `https://api.example.com/myPetStore`. The `PetStore` API is associated with the base path of an empty string or `myPetStore` under the custom domain name of `api.example.com`. Similarly, you can assign a base path of `yourPetShop` for the `PetShop` API. The URL of `https://api.example.com/yourPetShop` is then the root URL of the `PetShop` API.

Before setting the base path for an API, complete the steps in [Set up an edge-optimized custom domain name for an API Gateway API \(p. 472\)](#).

The following procedure sets up API mappings to map paths from your custom domain name to your API stages.

### To create API mappings name using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a custom domain name.
3. Choose **Configure API mappings**.
4. Choose **Add new mapping**.
5. Specify the **API**, **Stage**, and **Path** (optional) for the mapping.
6. Choose **Save**.



In addition, you can call the API Gateway REST API, Amazon CLI, or one of the Amazon SDKs to set up the base path mapping of an API with a custom domain name as its hostname. As an illustration, the following procedure outlines the steps to do so using the REST API calls.

### To set up the base path mapping of an API using the API Gateway REST API

- Call [basepathmapping:create](#) on a specific custom domain name, specifying the `basePath`, `restApiId`, and a deployment stage property in the request payload.

The successful API call returns a `201 Created` response.

For code examples of the REST API call, see [basepathmapping:create](#).

### Rotate a certificate imported into ACM

ACM automatically handles renewal of certificates it issues. You do not need to rotate any ACM-issued certificates for your custom domain names. CloudFront handles it on your behalf.

However, if you import a certificate into ACM and use it for a custom domain name, you must rotate the certificate before it expires. This involves importing a new third-party certificate for the domain name and rotate the existing certificate to the new one. You need to repeat the process when the newly imported certificate expires. Alternatively, you can request ACM to issue a new certificate for the domain name and rotate the existing one to the new ACM-issued certificate. After that, you can leave ACM and CloudFront to handle the certificate rotation for you automatically. To create or import a new ACM certificate, follow the steps to [request or import a new ACM certificate \(p. 466\)](#) for the specified domain name.

To rotate a certificate for a domain name, you can use the API Gateway console, the API Gateway REST API, Amazon CLI, or one of the Amazon SDKs.

### To rotate an expiring certificate imported into ACM using the API Gateway console

1. Request or import a certificate in ACM.
2. Go back to the API Gateway console.
3. Choose **Custom domain names** from the API Gateway console main navigation pane.
4. Choose a custom domain name.
5. Choose **Edit**.
6. Choose the desired certificate from the **ACM certificate** dropdown list.
7. Choose **Save** to begin rotating the certificate for the custom domain name.

#### Note

It takes about 40 minutes for the process to finish. After the rotation is done, you can choose the two-way arrow icon next to **ACM Certificate** to roll back to the original certificate.

To illustrate how to programmatically rotate an imported certificate for a custom domain name, we outline the steps using the API Gateway REST API.

### Rotate an imported certificate using the API Gateway REST API

- Call [domainname:update](#) action, specifying the ARN of the new ACM certificate for the specified domain name.

## Call your API with custom domain names

Calling an API with a custom domain name is the same as calling the API with its default domain name, provided that the correct URL is used.

The following examples compare and contrast a set of default URLs and corresponding custom URLs of two APIs (udxjef and qf3duz) in a specified Region (us-east-1), and of a given custom domain name (api.example.com).

### Root URLs of APIs with default and custom domain names

API ID	Stage	Default URL	Base path	Custom URL
udxjef	pro	https:// udxjef.execute- api.us- east-1.amazonaws.com/ pro	/petstore	https:// api.example.com/ petstore
udxjef	tst	https:// udxjef.execute- api.us- east-1.amazonaws.com/ tst	/petdepot	https:// api.example.com/ petdepot
qf3duz	dev	https:// qf3duz.execute- api.us- east-1.amazonaws.com/ dev	/bookstore	https:// api.example.com/ bookstore
qf3duz	tst	https:// qf3duz.execute- api.us- east-1.amazonaws.com/ tst	/bookstand	https:// api.example.com/ bookstand

API Gateway supports custom domain names for an API by using [Server Name Indication \(SNI\)](#). You can invoke the API with a custom domain name using a browser or a client library that supports SNI.

API Gateway enforces SNI on the CloudFront distribution. For information on how CloudFront uses custom domain names, see [Amazon CloudFront Custom SSL](#).

## Setting up a regional custom domain name in API Gateway

You can create a custom domain name for a Regional API endpoint (for an Amazon Region). To create a custom domain name, you must provide a Region-specific ACM certificate. For more information about creating or uploading a custom domain name certificate, see [Getting certificates ready in Amazon Certificate Manager \(p. 466\)](#).

### Important

For an API Gateway Regional custom domain name, you must request or import the certificate in the same Region as your API.

When you create a Regional custom domain name (or migrate one) with an ACM certificate, API Gateway creates a service-linked role in your account if the role doesn't exist already. The service-linked role is required to attach your ACM certificate to your Regional endpoint. The role is named **AWSServiceRoleForAPIGateway** and will have the **APIGatewayServiceRolePolicy** managed policy attached to it. For more information about use of the service-linked role, see [Using Service-Linked Roles](#).

### Important

You must create a DNS record to point the custom domain name to the Regional domain name. This enables the traffic that is bound to the custom domain name to be routed to the API's Regional hostname. The DNS record can be the CNAME or "A" type.

### Topics

- [Set up a regional custom domain name with an ACM certificate using the API Gateway console \(p. 476\)](#)
- [Set up a regional custom domain name with an ACM certificate using Amazon CLI \(p. 476\)](#)

## Set up a regional custom domain name with an ACM certificate using the API Gateway console

To use the API Gateway console to set up a Regional custom domain name, use the following procedure.

### To set up a regional custom domain name using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Custom domain names** from the main navigation pane.
3. Choose **Create**.
4. For **Domain name**, enter a domain name.
5. Under Configuration, choose **Regional**.
6. Choose a minimum TLS version.
7. Choose an ACM certificate. The certificate must be in the same Region as the API.
8. Choose **Create**.
9. Follow the Route 53 documentation on [configuring Route 53 to route traffic to API Gateway](#).

The following procedure sets up API mappings to map paths from your custom domain name to your API stages.

### To create API mappings name using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a custom domain name.
3. Choose **Configure API mappings**.
4. Choose **Add new mapping**.
5. Specify the **API**, **Stage**, and **Path** for the mapping.
6. Choose **Save**.

To learn about setting basepath mappings for the custom domain, see [Configure base path mapping of an API with a custom domain name as its hostname \(p. 473\)](#).

## Set up a regional custom domain name with an ACM certificate using Amazon CLI

To use the Amazon CLI to set up a custom domain name for a Regional API, use the following procedure.

1. Call `create-domain-name`, specifying a custom domain name and the ARN of a Regional certificate.

```
aws apigatewayv2 create-domain-name \  
  --domain-name 'regional.example.com' \  
  --certificate-arn arn:aws:iam::123456789012:certificate/12345678-9012-3456-7890-123456789012
```

```
--domain-name-configurations CertificateArn=arn:aws:acm:us-west-2:123456789012:certificate/123456789012-1234-1234-1234-12345678
```

Note that the specified certificate is from the `us-west-2` Region and for this example, we assume that the underlying API is from the same Region.

If successful, the call returns a result similar to the following:

```
{
  "ApiMappingSelectionExpression": "$request.basepath",
  "DomainName": "regional.example.com",
  "DomainNameConfigurations": [
    {
      "ApiGatewayDomainName": "d-id.execute-api.us-west-2.amazonaws.com",
      "CertificateArn": "arn:aws:acm:us-west-2:123456789012:certificate/id",
      "DomainNameStatus": "AVAILABLE",
      "EndpointType": "REGIONAL",
      "HostedZoneId": "id",
      "SecurityPolicy": "TLS_1_2"
    }
  ]
}
```

The `DomainNameConfigurations` property value returns the Regional API's hostname. You must create a DNS record to point your custom domain name to this Regional domain name. This enables the traffic that is bound to the custom domain name to be routed to this Regional API's hostname.

2. Create a DNS record to associate the custom domain name and the Regional domain name. This enables requests that are bound to the custom domain name to be routed to the API's Regional hostname.
3. Add a base path mapping to expose the specified API (for example, `0qzs2sy7bh`) in a deployment stage (for example, `test`) under the specified custom domain name (for example, `regional.example.com`).

```
aws apigatewayv2 create-api-mapping \
  --domain-name 'regional.example.com' \
  --api-mapping-key 'myApi' \
  --api-id 0qzs2sy7bh \
  --stage 'test'
```

As a result, the base URL using the custom domain name for the API that is deployed in the stage becomes `https://regional.example.com/myAPI`.

4. Configure your DNS records to map the Regional custom domain name to its hostname of the given hosted zone ID. First create a JSON file that contains the configuration for setting up a DNS record for the Regional domain name. The following example shows how to create a DNS A record to map a Regional custom domain name (`regional.example.com`) to its Regional hostname (`d-numh1z56v6.execute-api.us-west-2.amazonaws.com`) provisioned as part of the custom domain name creation. The `DNSName` and `HostedZoneId` properties of `AliasTarget` can take the `regionalDomainName` and `regionalHostedZoneId` values, respectively, of the custom domain name. You can also get the Regional Route 53 Hosted Zone IDs in [Amazon API Gateway Endpoints and Quotas](#).

```
{
  "Changes": [
    {
      "Action": "CREATE",
      "ResourceRecordSet": {
        "Name": "regional.example.com",
        "Type": "A",
```

```
"AliasTarget": {  
  "DNSName": "d-numh1z56v6.execute-api.us-west-2.amazonaws.com",  
  "HostedZoneId": "Z2OJLYMUO9EFXC",  
  "EvaluateTargetHealth": false  
}  
}  
]  
}
```

5. Run the following CLI command:

```
aws route53 change-resource-record-sets \  
  --hosted-zone-id {your-hosted-zone-id} \  
  --change-batch file://path/to/your/setup-dns-record.json
```

where `{your-hosted-zone-id}` is the Route 53 Hosted Zone ID of the DNS record set in your account. The `change-batch` parameter value points to a JSON file (`setup-dns-record.json`) in a folder (`path/to/your`).

## Migrating a custom domain name to a different API endpoint

You can migrate your custom domain name between edge-optimized and Regional endpoints. You first add the new endpoint configuration type to the existing `endpointConfiguration.types` list for the custom domain name. Next, you set up a DNS record to point the custom domain name to the newly provisioned endpoint. An optional last step is to remove the obsolete custom domain name configuration data.

When planning the migration, remember that for an edge-optimized API's custom domain name, the required certificate provided by ACM must be from the US East (N. Virginia) Region (`us-east-1`). This certificate is distributed to all the geographic locations. However, for a Regional API, the ACM certificate for the Regional domain name must be from the same Region hosting the API. You can migrate an edge-optimized custom domain name that is not in the `us-east-1` Region to a Regional custom domain name by first requesting a new ACM certificate from the Region that is local to the API.

It may take up to 60 seconds to complete a migration between an edge-optimized custom domain name and a Regional custom domain name in API Gateway. For the newly created endpoint to become ready to accept traffic, the migration time also depends on when you update your DNS records.

### Topics

- [Migrate custom domain names using the Amazon CLI \(p. 478\)](#)

## Migrate custom domain names using the Amazon CLI

To use the Amazon CLI to migrate a custom domain name from an edge-optimized endpoint to a Regional endpoint or vice versa, call the `update-domain-name` command to add the new endpoint type and, optionally, call the `update-domain-name` command to remove the old endpoint type.

### Topics

- [Migrate an edge-optimized custom domain name to regional \(p. 478\)](#)
- [Migrate a regional custom domain name to edge-optimized \(p. 479\)](#)

## Migrate an edge-optimized custom domain name to regional

To migrate an edge-optimized custom domain name to a Regional custom domain name, call the `update-domain-name` CLI command, as follows:

```
aws apigateway update-domain-name \
  --domain-name 'api.example.com' \
  --patch-operations [ \
    { op:'add', path: '/endpointConfiguration/types',value: 'REGIONAL' }, \
    { op:'add', path: '/regionalCertificateArn', value: 'arn:aws:acm:us-
west-2:123456789012:certificate/cd833b28-58d2-407e-83e9-dce3fd852149' } \
  ]
```

The Regional certificate must be of the same Region as the Regional API.

The success response has a 200 OK status code and a body similar to the following:

```
{
  "certificateArn": "arn:aws:acm:us-east-1:123456789012:certificate/34a95aa1-77fa-427c-
aa07-3a88bd9f3c0a",
  "certificateName": "edge-cert",
  "certificateUploadDate": "2017-10-16T23:22:57Z",
  "distributionDomainName": "d1frvgze7vy1bf.cloudfront.net",
  "domainName": "api.example.com",
  "endpointConfiguration": {
    "types": [
      "EDGE",
      "REGIONAL"
    ]
  },
  "regionalCertificateArn": "arn:aws:acm:us-west-2:123456789012:certificate/
cd833b28-58d2-407e-83e9-dce3fd852149",
  "regionalDomainName": "d-fdisjghyn6.execute-api.us-west-2.amazonaws.com"
}
```

For the migrated Regional custom domain name, the resulting `regionalDomainName` property returns the Regional API hostname. You must set up a DNS record to point the Regional custom domain name to this Regional hostname. This enables the traffic that is bound to the custom domain name to be routed to the Regional host.

After the DNS record is set, you can remove the edge-optimized custom domain name by calling the [update-domain-name](#) command of Amazon CLI:

```
aws apigateway update-domain-name \
  --domain-name api.example.com \
  --patch-operations [ \
    {op:'remove', path:'/endpointConfiguration/types', value:'EDGE'}, \
    {op:'remove', path:'certificateName'}, \
    {op:'remove', path:'certificateArn'} \
  ]
```

### Migrate a regional custom domain name to edge-optimized

To migrate a Regional custom domain name to an edge-optimized custom domain name, call the `update-domain-name` command of the Amazon CLI, as follows:

```
aws apigateway update-domain-name \
  --domain-name 'api.example.com' \
  --patch-operations [ \
    { op:'add', path: '/endpointConfiguration/types',value: 'EDGE' }, \
    { op:'add', path: '/certificateName', value:'edge-cert'}, \
    { op:'add', path: '/certificateArn', value: 'arn:aws:acm:us-
east-1:123456789012:certificate/34a95aa1-77fa-427c-aa07-3a88bd9f3c0a' } \
  ]
```

The edge-optimized domain certificate must be created in the `us-east-1` Region.

The success response has a `200 OK` status code and a body similar to the following:

```
{
  "certificateArn": "arn:aws:acm:us-east-1:738575810317:certificate/34a95aa1-77fa-427c-aa07-3a88bd9f3c0a",
  "certificateName": "edge-cert",
  "certificateUploadDate": "2017-10-16T23:22:57Z",
  "distributionDomainName": "d1frvgze7vy1bf.cloudfront.net",
  "domainName": "api.example.com",
  "endpointConfiguration": {
    "types": [
      "EDGE",
      "REGIONAL"
    ]
  },
  "regionalCertificateArn": "arn:aws:acm:us-east-1:123456789012:certificate/3d881b54-851a-478a-a887-f6502760461d",
  "regionalDomainName": "d-cgkq2qwgzf.execute-api.us-east-1.amazonaws.com"
}
```

For the specified custom domain name, API Gateway returns the edge-optimized API hostname as the `distributionDomainName` property value. You must set a DNS record to point the edge-optimized custom domain name to this distribution domain name. This enables traffic that is bound to the edge-optimized custom domain name to be routed to the edge-optimized API hostname.

After the DNS record is set, you can remove the `REGIONAL` endpoint type of the custom domain name:

```
aws apigateway update-domain-name \
  --domain-name api.example.com \
  --patch-operations [ \
    {op:'remove', path:'/endpointConfiguration/types', value:'REGIONAL'}, \
    {op:'remove', path:'regionalCertificateArn'} \
  ]
```

The result of this command is similar to the following output, with only edge-optimized domain name configuration data:

```
{
  "certificateArn": "arn:aws:acm:us-east-1:738575810317:certificate/34a95aa1-77fa-427c-aa07-3a88bd9f3c0a",
  "certificateName": "edge-cert",
  "certificateUploadDate": "2017-10-16T23:22:57Z",
  "distributionDomainName": "d1frvgze7vy1bf.cloudfront.net",
  "domainName": "regional.haymuto.com",
  "endpointConfiguration": {
    "types": "EDGE"
  }
}
```

## Working with API mappings for REST APIs

You use API mappings to connect API stages to a custom domain name. After you create a domain name and configure DNS records, you use API mappings to send traffic to your APIs through your custom domain name.

An API mapping specifies an API, a stage, and optionally a path to use for the mapping. For example, you can map the production stage of an API to `https://api.example.com/orders`.

You can map HTTP and REST API stages to the same custom domain name.

Before you create an API mapping, you must have an API, a stage, and a custom domain name. To learn more about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

## Routing API requests

You can configure API mappings with multiple levels, for example `orders/v1/items` and `orders/v2/items`.

### Note

To configure API mappings with multiple levels, your custom domain name must be regional and use the TLS 1.2 security policy.

API Gateway routes requests to the API mapping that has the longest matching path. API Gateway considers only the paths configured for API mappings, and not API routes, to select the API to invoke. If no path matches the request, API Gateway sends the request to the API that you've mapped to the empty path (`none`).

For example, consider a custom domain name `https://api.example.com` with the following API mappings:

1. `(none)` mapped to API 1.
2. `orders/v1/items` mapped to API 2.
3. `orders/v2/items` mapped to API 3.
4. `orders/v2/items/categories` mapped to API 4.

Request	Selected API	Explanation
<code>https://api.example.com/orders/v1/items</code>	API 2	The request exactly matches this API mapping.
<code>https://api.example.com/orders/v2/items</code>	API 3	The request exactly matches this API mapping.
<code>https://api.example.com/orders/v1/items/123</code>	API 2	API Gateway chooses the mapping that has the longest matching path. The 123 at the end of the request doesn't affect the selection.
<code>https://api.example.com/orders/v2/items/categories/5</code>	API 4	API Gateway chooses the mapping that has the longest matching path.
<code>https://api.example.com/customers</code>	API 1	API Gateway uses the empty mapping as a catch-all.

## Restrictions

- In an API mapping, the custom domain name and mapped APIs must be in the same Amazon account.
- API mappings must contain only letters, numbers, and the following characters: `$-_.+!*'()/`.
- The maximum length for the path in an API mapping is 300 characters.



- You can only map HTTP APIs to a regional custom domain name with the TLS 1.2 security policy.
- You can't map WebSocket APIs to the same custom domain name as an HTTP API or REST API.

## Create an API mapping

To create an API mapping, you must first create a custom domain name, API, and stage. For information about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

For example Amazon Serverless Application Model templates that create all resources, see [Sessions With SAM](#) on GitHub.

Amazon Web Services Management Console

### To create an API mapping

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Custom domain names**.
3. Select a custom domain name that you've already created.
4. Choose **API mappings**.
5. Choose **Configure API mappings**.
6. Choose **Add new mapping**.
7. Enter an **API**, a **Stage**, and optionally a **Path**.
8. Choose **Save**.

Amazon CLI

The following Amazon CLI command creates an API mapping. In this example, API Gateway sends requests to `api.example.com/v1/orders` to the specified API and stage.

#### Note

To create API mappings with multiple levels, you must use `apigatewayv2`.

```
aws apigatewayv2 create-api-mapping \
  --domain-name api.example.com \
  --api-mapping-key v1/orders \
  --api-id a1b2c3d4 \
  --stage test
```

Amazon CloudFormation

The following Amazon CloudFormation example creates an API mapping.

#### Note

To create API mappings with multiple levels, you must use `AWS::ApiGatewayV2`.

```
MyApiMapping:
  Type: 'AWS::ApiGatewayV2::ApiMapping'
  Properties:
    DomainName: api.example.com
    ApiMappingKey: 'orders/v2/items'
    ApiId: !Ref MyApi
    Stage: !Ref MyStage
```

## Disabling the default endpoint for a REST API

By default, clients can invoke your API by using the `execute-api` endpoint that API Gateway generates for your API. To ensure that clients can access your API only by using a custom domain name, disable the default `execute-api` endpoint.

### Note

When you disable the default endpoint, it affects all stages of an API.

The following Amazon CLI command disables the default endpoint for a REST API.

```
aws apigateway update-rest-api \  
  --rest-api-id abcdef123 \  
  --patch-operations op=replace,path=/disableExecuteApiEndpoint,value='True'
```

After you disable the default endpoint, you must deploy your API for the change to take effect.

The following Amazon CLI command creates a deployment.

```
aws apigateway create-deployment \  
  --rest-api-id abcdef123 \  
  --stage-name dev
```

## Optimizing performance of REST APIs

After you've made your API available to be called, you might realize that it needs to be optimized to improve responsiveness. API Gateway provides a few strategies for optimizing your API, like response caching and payload compression. In this section, you can learn how to enable these capabilities.

### Topics

- [Enabling API caching to enhance responsiveness \(p. 483\)](#)
- [Enabling payload compression for an API \(p. 487\)](#)

## Enabling API caching to enhance responsiveness

You can enable API caching in Amazon API Gateway to cache your endpoint's responses. With caching, you can reduce the number of calls made to your endpoint and also improve the latency of requests to your API.

When you enable caching for a stage, API Gateway caches responses from your endpoint for a specified time-to-live (TTL) period, in seconds. API Gateway then responds to the request by looking up the endpoint response from the cache instead of making a request to your endpoint. The default TTL value for API caching is 300 seconds. The maximum TTL value is 3600 seconds. TTL=0 means caching is disabled.

The maximum size of a response that can be cached is 1048576 bytes. Cache data encryption may increase the size of the response when it is being cached.

### Important

When you enable caching for a stage, only `GET` methods have caching enabled by default. This helps to ensure the safety and availability of your API. You can enable caching for other methods by [overriding method settings \(p. 485\)](#).

### Important

Caching is charged by the hour and is not eligible for the Amazon Free Tier.

## Enable Amazon API Gateway caching

In API Gateway, you can enable caching for a specified stage.

When you enable caching, you must choose a cache capacity. In general, a larger capacity gives a better performance, but also costs more.

API Gateway enables caching by creating a dedicated cache instance. This process can take up to 4 minutes.

API Gateway changes caching capacity by removing the existing cache instance and creating a new one with a modified capacity. All existing cached data is deleted.

### Note

The cache capacity affects the CPU, memory, and network bandwidth of the cache instance. As a result, the cache capacity can affect the performance of your cache.

API Gateway recommends that you run a 10-minute load test to verify that your cache capacity is appropriate for your workload. Ensure that traffic during the load test mirrors production traffic. For example, include ramp up, constant traffic, and traffic spikes. The load test should include responses that can be served from the cache, as well as unique responses that add items to the cache. Monitor the latency, 4xx, 5xx, cache hit, and cache miss metrics during the load test. Adjust your cache capacity as needed based on these metrics.

In the API Gateway console, you configure caching in the **Settings** tab of a named **Stage Editor**.

### To configure API caching for a given stage:

1. Go to the API Gateway console.
2. Choose the API.
3. Choose **Stages**.
4. In the **Stages** list for the API, choose the stage.
5. Choose the **Settings** tab.
6. Choose **Enable API cache**.
7. Wait for the cache creation to complete.

### Note

Creating or deleting a cache takes about 4 minutes for API Gateway to complete. When a cache is created, the **Cache status** value changes from `CREATE_IN_PROGRESS` to `AVAILABLE`. When cache deletion is completed, the **Cache status** value changes from `DELETE_IN_PROGRESS` to an empty string.

When you enable caching within a stage's **Cache Settings**, only `GET` methods are cached. To ensure the safety and availability of your API, we recommend that you don't change this setting. However, you can enable caching for other methods by [overriding method settings \(p. 485\)](#).

If you would like to verify if caching is functioning as expected, you have two general options:

- Inspect the CloudWatch metrics of **CacheHitCount** and **CacheMissCount** for your API and stage.
- Put a timestamp in the response.

### Note

You should not use the `x-Cache` header from the CloudFront response to determine if your API is being served from your API Gateway cache instance.

## Override API Gateway stage-level caching for method caching

You can override stage-level cache settings by enabling or disabling caching for a specific method. By increasing or decreasing its TTL period; or by turning encryption on or off for cached responses.

If you anticipate that a method that you are caching will receive sensitive data in its responses, in **Cache Settings**, choose **Encrypt cache data**.

### To configure API caching for individual methods using the console:

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Go to the API Gateway console.
3. Choose the API.
4. Choose **Stages**.
5. In the **Stages** list for the API, expand the stage and choose a method in the API.
6. Choose **Override for this method** in **Settings**.
7. In the **Cache Settings** area, you can set or clear **Enable Method Cache** or customize any other desired options. (This section is shown only if [stage-level caching \(p. 484\)](#) is enabled.)

## Use method or integration parameters as cache keys to index cached responses

When a cached method or integration has parameters, which can take the form of custom headers, URL paths, or query strings, you can use some or all of the parameters to form cache keys. API Gateway can cache the method's responses, depending on the parameter values used.

### Note

Cache keys are required when setting up caching on a resource.

For example, suppose you have a request in the following format:

```
GET /users?type=... HTTP/1.1
host: example.com
...
```

In this request, `type` can take a value of `admin` or `regular`. If you include the `type` parameter as part of the cache key, the responses from `GET /users?type=admin` are cached separately from those from `GET /users?type=regular`.

When a method or integration request takes more than one parameter, you can choose to include some or all of the parameters to create the cache key. For example, you can include only the `type` parameter in the cache key for the following request, made in the listed order within a TTL period:

```
GET /users?type=admin&department=A HTTP/1.1
host: example.com
...
```

The response from this request is cached and is used to serve the following request:

```
GET /users?type=admin&department=B HTTP/1.1
host: example.com
...
```

To include a method or integration request parameter as part of a cache key in the API Gateway console, select **Caching** after you add the parameter.

## Flush the API stage cache in API Gateway

When API caching is enabled, you can flush your API stage's entire cache to ensure your API's clients get the most recent responses from your integration endpoints.

To flush the API stage cache, you can choose the **Flush entire cache** button under the **Cache Settings** section in the **Settings** tab in a stage editor of the API Gateway console. The cache-flushing operation takes a couple of minutes, after which the cache status is `AVAILABLE` immediately after flushing.

### Note

After the cache is flushed, responses are serviced from the integration endpoint until the cache is built up again. During this period, the number of requests sent to the integration endpoint may increase. This may temporarily increase the overall latency of your API.

## Invalidate an API Gateway cache entry

A client of your API can invalidate an existing cache entry and reload it from the integration endpoint for individual requests. The client must send a request that contains the `Cache-Control: max-age=0` header. The client receives the response directly from the integration endpoint instead of the cache, provided that the client is authorized to do so. This replaces the existing cache entry with the new response, which is fetched from the integration endpoint.

To grant permission for a client, attach a policy of the following format to an IAM execution role for the user.

### Note

Cross-account cache invalidation is not supported.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:InvalidateCache"
      ],
      "Resource": [
        "arn:aws:execute-api:region:account-id:api-id/stage-name/GET/resource-path-specifier"
      ]
    }
  ]
}
```

This policy allows the API Gateway execution service to invalidate the cache for requests on the specified resource (or resources). To specify a group of targeted resources, use a wildcard (\*) character for `account-id`, `api-id`, and other entries in the ARN value of `Resource`. For more information on how to set permissions for the API Gateway execution service, see [Control access to an API with IAM permissions \(p. 248\)](#).

If you don't impose an `InvalidateCache` policy (or choose the **Require authorization** check box in the console), any client can invalidate the API cache. If most or all of the clients invalidate the API cache, this could significantly increase the latency of your API.

When the policy is in place, caching is enabled and authorization is required. You can control how unauthorized requests are handled by choosing an option from **Handle unauthorized requests** in the API Gateway console.

The three options result in the following behaviors:

- **Fail the request with 403 status code:** returns a 403 Unauthorized response.

To set this option using the API, use `FAIL_WITH_403`.

- **Ignore cache control header; Add a warning in response header:** process the request and add a warning header in the response.

To set this option using the API, use `SUCCEED_WITH_RESPONSE_HEADER`.

- **Ignore cache control header:** process the request and do not add a warning header in the response.

To set this option using the API, use `SUCCEED_WITHOUT_RESPONSE_HEADER`.

## Enabling payload compression for an API

API Gateway allows your client to call your API with compressed payloads by using one of the [supported content codings](#) (p. 489). By default, API Gateway supports decompression of the method request payload. However, you must configure your API to enable compression of the method response payload.

To enable compression on an [API](#), set the `minimumCompressionsSize` property to a non-negative integer between 0 and 10485760 (10M bytes) when you create the API or after you've created the API. To disable compression on the API, set the `minimumCompressionSize` to null or remove it altogether. You can enable or disable compression for an API by using the API Gateway console, the Amazon CLI, or the API Gateway REST API.

If you want the compression applied on a payload of any size, set the `minimumCompressionSize` value to zero. However, compressing data of a small size might actually increase the final data size. Furthermore, compression in API Gateway and decompression in the client might increase overall latency and require more computing times. You should run test cases against your API to determine an optimal value.

The client can submit an API request with a compressed payload and an appropriate `Content-Encoding` header for API Gateway to decompress the method request payload and apply applicable mapping templates, before passing the request to the integration endpoint. After the compression is enabled and the API is deployed, the client can receive an API response with a compressed payload if it specifies an appropriate `Accept-Encoding` header in the method request.

When the integration endpoint expects and returns uncompressed JSON payloads, any mapping template that's configured for an uncompressed JSON payload is applicable to the compressed payload. For a compressed method request payload, API Gateway decompresses the payload, applies the mapping template, and passes the mapped request to the integration endpoint. For an uncompressed integration response payload, API Gateway applies the mapping template, compresses the mapped payload, and returns the compressed payload to the client.

### Topics

- [Enable payload compression for an API](#) (p. 488)
- [Call an API method with a compressed payload](#) (p. 489)
- [Receive an API response with a compressed payload](#) (p. 490)

## Enable payload compression for an API

You can enable compression for an API using the API Gateway console, the Amazon CLI, or an Amazon SDK.

For an existing API, you must deploy the API after enabling the compression in order for the change to take effect. For a new API, you can deploy the API after the API setup is complete.

### Note

The highest-priority content encoding must be one supported by API Gateway. If it is not, compression is not applied to the response payload.

### Topics

- [Enable payload compression for an API using the API Gateway console \(p. 488\)](#)
- [Enable payload compression for an API using Amazon CLI \(p. 488\)](#)
- [Content codings supported by API Gateway \(p. 489\)](#)

## Enable payload compression for an API using the API Gateway console

The following procedure describes how to enable payload compression for an API.

### To enable payload compression by using the API Gateway console

1. Sign in to the API Gateway console.
2. Choose an existing API or create a new one.
3. In the primary navigation pane, choose **Settings** under the API you chose or the one you created.
4. Under the **Content Encoding** section in the **Settings** pane, select the **Content Encoding enabled** option to enable payload compression. Enter a number for the minimum compression size (in bytes) next to **Minimum body size required for compression**. To disable the compression, clear the **Content Encoding enabled** option.
5. Choose **Save Changes**.

## Enable payload compression for an API using Amazon CLI

To use the Amazon CLI to create a new API and enable compression, call the `create-rest-api` command as follows:

```
aws apigateway create-rest-api \  
  --name "My test API" \  
  --minimum-compression-size 0
```

To use the Amazon CLI to enable compression on an existing API, call the `update-rest-api` command as follows:

```
aws apigateway update-rest-api \  
  --rest-api-id 1234567890 \  
  --patch-operations op=replace,path=/minimumCompressionSize,value=0
```

The `minimumCompressionSize` property has a non-negative integer value between 0 and 10485760 (10M bytes). It measures the compression threshold. If the payload size is smaller than this value, compression or decompression are not applied on the payload. Setting it to zero allows compression for any payload size.

To use the Amazon CLI to disable compression, call the `update-rest-api` command as follows:

```
aws apigateway update-rest-api \  
  --rest-api-id 1234567890 \  
  --patch-operations op=replace,path=/minimumCompressionSize,value=
```

You can also set `value` to an empty string `" "` or omit the `value` property altogether in the preceding call.

## Content codings supported by API Gateway

API Gateway supports the following content codings:

- `deflate`
- `gzip`
- `identity`

API Gateway also supports the following `Accept-Encoding` header format, according to the [RFC 7231](#) specification:

- `Accept-Encoding: deflate, gzip`
- `Accept-Encoding:`
- `Accept-Encoding: *`
- `Accept-Encoding: deflate; q=0.5, gzip; q=1.0`
- `Accept-Encoding: gzip; q=1.0, identity; q=0.5, *, q=0`

## Call an API method with a compressed payload

To make an API request with a compressed payload, the client must set the `Content-Encoding` header with one of the [supported content codings](#) (p. 489).

Suppose that you're an API client and want to call the PetStore API method (`POST /pets`). Don't call the method by using the following JSON output:

```
POST /pets  
Host: {petstore-api-id}.execute-api.{region}.amazonaws.com  
Content-Length: ...  
  
{  
  "type": "dog",  
  "price": 249.99  
}
```

Instead, you can call the method with the same payload compressed by using the GZIP coding:

```
POST /pets  
Host: {petstore-api-id}.execute-api.{region}.amazonaws.com  
Content-Encoding: gzip  
Content-Length: ...  
  
###RPP*#,HU#RPJ#OW##e###L,#,-y#j
```

When API Gateway receives the request, it verifies if the specified content coding is supported. Then, it attempts to decompress the payload with the specified content coding. If the decompression



is successful, it dispatches the request to the integration endpoint. If the specified coding isn't supported or the supplied payload isn't compressed with specified coding, API Gateway returns the 415 `Unsupported Media Type` error response. The error is not logged to CloudWatch Logs, if it occurs in the early phase of decompression before your API and stage are identified.

## Receive an API response with a compressed payload

When making a request on a compression-enabled API, the client can choose to receive a compressed response payload of a specific format by specifying an `Accept-Encoding` header with a [supported content coding](#) (p. 489).

API Gateway only compresses the response payload when the following conditions are satisfied:

- The incoming request has the `Accept-Encoding` header with a supported content coding and format.

### Note

If the header is not set, the default value is `*` as defined in [RFC 7231](#). In such a case, API Gateway does not compress the payload. Some browser or client may add `Accept-Encoding` (for example, `Accept-Encoding: gzip, deflate, br`) automatically to compression-enabled requests. This can trigger the payload compression in API Gateway. Without an explicit specification of supported `Accept-Encoding` header values, API Gateway does not compress the payload.

- The `minimumCompressionSize` is set on the API to enable compression.
- The integration response doesn't have a `Content-Encoding` header.
- The size of an integration response payload, after the applicable mapping template is applied, is greater than or equal to the specified `minimumCompressionSize` value.

API Gateway applies any mapping template that's configured for the integration response before compressing the payload. If the integration response contains a `Content-Encoding` header, API Gateway assumes that the integration response payload is already compressed and skips the compression processing.

An example is the PetStore API example and the following request:

```
GET /pets
Host: {petstore-api-id}.execute-api.{region}.amazonaws.com
Accept: application/json
```

The backend responds to the request with an uncompressed JSON payload that's similar to the following:

```
200 OK

[
  {
    "id": 1,
    "type": "dog",
    "price": 249.99
  },
  {
    "id": 2,
    "type": "cat",
    "price": 124.99
  },
  {
    "id": 3,
    "type": "fish",
```

```
    "price": 0.99  
  }  
]
```

To receive this output as a compressed payload, your API client can submit a request as follows:

```
GET /pets  
Host: {petstore-api-id}.execute-api.{region}.amazonaws.com  
Accept-Encoding:gzip
```

The client receives the response with a `Content-Encoding` header and GZIP-encoded payload that are similar to the following:

```
200 OK  
Content-Encoding:gzip  
...  
  
###RP#  
  
J#)JV  
#:P^IeA*#####+(#L #X#YZ#ku0L0B7!9##C##&#####Y##a####^#X
```

When the response payload is compressed, only the compressed data size is billed for data transfer.

## Distributing your REST API to clients

This section provides details about distributing your API Gateway APIs to your customers. Distributing your API includes generating SDKs for your customers to download and integrate with their client applications, documenting your API so customers know how to call it from their client applications, making your API discoverable in a developer portal, and making your API available as part of product offerings.

### Topics

- [Creating and using usage plans with API keys \(p. 491\)](#)
- [Documenting REST APIs \(p. 503\)](#)
- [Generating an SDK for a REST API in API Gateway \(p. 542\)](#)
- [Use the serverless developer portal to catalog your API Gateway APIs \(p. 554\)](#)
- [Sell your API Gateway APIs through Amazon Web Services Marketplace \(p. 561\)](#)

## Creating and using usage plans with API keys

After you create, test, and deploy your APIs, you can use API Gateway usage plans to make them available as product offerings for your customers. You can configure usage plans and API keys to allow customers to access selected APIs, and begin throttling requests to those APIs based on defined limits and quotas. These can be set at the API, or API method level.

### What are usage plans and API keys?

A *usage plan* specifies who can access one or more deployed API stages and methods—and optionally sets the target request rate to start throttling requests. The plan uses API keys to identify API clients and who can access the associated API stages for each key.

*API keys* are alphanumeric string values that you distribute to application developer customers to grant access to your API. You can use API keys together with [Lambda authorizers \(p. 256\)](#), [IAM roles \(p. 248\)](#), or [Amazon Cognito \(p. 270\)](#) to control access to your APIs. API Gateway can generate API keys on your behalf, or you can import them from a [CSV file \(p. 502\)](#). You can generate an API key in API Gateway, or import it into API Gateway from an external source. For more information, see [the section called "Set up API keys using the API Gateway console" \(p. 494\)](#).

An API key has a name and a value. (The terms "API key" and "API key value" are often used interchangeably.) The value is an alphanumeric string between 30 and 128 characters, for example, `apikey1234abcdefg hij0123456789`.

### **Important**

API key values must be unique. If you try to create two API keys with different names and the same value, API Gateway considers them to be the same API key.

An API key can be associated with more than one usage plan. A usage plan can be associated with more than one stage. However, a given API key can only be associated with one usage plan for each stage of your API.

A *throttling limit* sets the target point at which request throttling should start. This can be set at the API or API method level.

A *quota limit* sets the target maximum number of requests with a given API key that can be submitted within a specified time interval. You can configure individual API methods to require API key authorization based on usage plan configuration.

Throttling and quota limits apply to requests for individual API keys that are aggregated across all API stages within a usage plan.

### **Note**

Usage plan throttling and quotas are not hard limits, and are applied on a best-effort basis. In some cases, clients can exceed the quotas that you set. Don't rely on usage plan quotas or throttling to control costs or block access to an API. Consider using [Amazon Budgets](#) to monitor costs and [Amazon WAF](#) to manage API requests.

## Best practices for API keys and usage plans

The following are suggested best practices to follow when using API keys and usage plans.

- Don't rely on API keys as your only means of authentication and authorization for your APIs. If you have multiple APIs in a usage plan, a user with a valid API key for one API in that usage plan can access *all* APIs in that usage plan. Instead, use an IAM role, [a Lambda authorizer \(p. 256\)](#), or an [Amazon Cognito user pool \(p. 270\)](#).
- If you're using a [developer portal \(p. 554\)](#) to publish your APIs, note that all APIs in a given usage plan are subscribable, even if you haven't made them visible to your customers.
- In some cases, clients can exceed the quotas that you set. Don't rely on usage plans to control costs. Consider using [Amazon Budgets](#) to monitor costs and [Amazon WAF](#) to manage API requests.

## Steps to configure a usage plan

The following steps outline how you, as the API owner, create and configure a usage plan for your customers.

### **To configure a usage plan**

1. Create one or more APIs, configure the methods to require an API key, and deploy the APIs to stages.
2. Generate or import API keys to distribute to application developers (your customers) who will be using your API.

3. Create the usage plan with the desired throttle and quota limits.
4. Associate API stages and API keys with the usage plan.

Callers of the API must supply an assigned API key in the `x-api-key` header in requests to the API.

**Note**

To include API methods in a usage plan, you must configure individual API methods to [require an API key \(p. 494\)](#). For user authentication and authorization, don't use API keys. Use an IAM role, a [Lambda authorizer \(p. 256\)](#), or an [Amazon Cognito user pool \(p. 270\)](#).

## Choose an API key source

When you associate a usage plan with an API and enable API keys on API methods, every incoming request to the API must contain an [API key \(p. 6\)](#). API Gateway reads the key and compares it against the keys in the usage plan. If there is a match, API Gateway throttles the requests based on the plan's request limit and quota. Otherwise, it throws an `InvalidKeyParameter` exception. As a result, the caller receives a `403 Forbidden` response.

Your API Gateway API can receive API keys from one of two sources:

**HEADER**

You distribute API keys to your customers and require them to pass the API key as the `x-API-Key` header of each incoming request.

**AUTHORIZER**

You have a Lambda authorizer return the API key as part of the authorization response. For more information on the authorization response, see [the section called "Output from an Amazon API Gateway Lambda authorizer" \(p. 266\)](#).

**To choose an API key source for an API by using the API Gateway console:**

1. Sign in to the API Gateway console.
2. Choose an existing API or create a new one.
3. In the primary navigation pane, choose **Settings** under the chosen or newly created API.
4. Under the **API Key Source** section in the **Settings** pane, choose `HEADER` or `AUTHORIZER` from the drop-down list.
5. Choose **Save Changes**.

To choose an API key source for an API by using the Amazon CLI, call the `update-rest-api` command as follows:

```
aws apigateway update-rest-api --rest-api-id 1234123412 --patch-operations  
op=replace,path=/apiKeySource,value=AUTHORIZER
```

To have the client submit an API key, set the `value` to `HEADER` in the preceding CLI command.

To choose an API key source for an API by using the API Gateway REST API, call `restapi:update` as follows:

```
PATCH /restapis/fugvjdxttri/ HTTP/1.1  
Content-Type: application/json  
Host: apigateway.us-east-1.amazonaws.com
```

```
X-Amz-Date: 20160603T205348Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20160603/us-east-1/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature={sig4_hash}

{
  "patchOperations" : [
    {
      "op" : "replace",
      "path" : "/apiKeySource",
      "value" : "HEADER"
    }
  ]
}
```

To have an authorizer return an API key, set the value to `AUTHORIZER` in the previous `patchOperations` input.

Depending on the API key source type you choose, use one of the following procedures to use header-sourced API keys or authorizer-returned API keys in method invocation:

#### To use header-sourced API keys:

1. Create an API with desired API methods. And deploy the API to a stage.
2. Create a new usage plan or choose an existing one. Add the deployed API stage to the usage plan. Attach an API key to the usage plan or choose an existing API key in the plan. Note the chosen API key value.
3. Set up API methods to require an API key.
4. Redeploy the API to the same stage. If you deploy the API to a new stage, make sure to update the usage plan to attach the new API stage.

The client can now call the API methods while supplying the `x-api-key` header with the chosen API key as the header value.

#### To use authorizer-sourced API keys:

1. Create an API with desired API methods. And deploy the API to a stage.
2. Create a new usage plan or choose an existing one. Add the deployed API stage to the usage plan. Attach an API key to the usage plan or choose an existing API key in the plan. Note the chosen API key value.
3. Create a custom Lambda authorizer of the token type. Include, as a root-level property of the authorization response, `usageIdentifierKey: {api-key}`, where `{api-key}` stands for the API key value mentioned in the previous step.
4. Set up API methods to require an API key and enable the Lambda authorizer on the methods as well.
5. Redeploy the API to the same stage. If you deploy the API to a new stage, make sure to update the usage plan to attach the new API stage.

The client can now call the API key-required methods without explicitly supplying any API key. The authorizer-returned API key is used automatically.

## Set up API keys using the API Gateway console

To set up API keys, do the following:

- Configure API methods to require an API key.

- Create or import an API key for the API in a region.

Before setting up API keys, you must have created an API and deployed it to a stage.

For instructions on how to create and deploy an API by using the API Gateway console, see [Creating a REST API in Amazon API Gateway \(p. 205\)](#) and [Deploying a REST API in Amazon API Gateway \(p. 436\)](#), respectively.

### Topics

- [Require API key on a method \(p. 495\)](#)
- [Create an API key \(p. 495\)](#)
- [Import API keys \(p. 496\)](#)

## Require API key on a method

The following procedure describes how to configure an API method to require an API key.

### To configure an API method to require an API key

1. Sign in to the Amazon Web Services Management Console and open the API Gateway console at <https://console.amazonaws.cn/apigateway/>.
2. Choose a REST API.
3. In the API Gateway main navigation pane, choose **Resources**.
4. Under **Resources**, create a new method or choose an existing one.
5. Choose **Method Request**.
6. Under the **Settings** section, choose `true` for **API Key Required**.
7. Select the checkmark icon to save the settings.
8. Deploy or redeploy the API for the requirement to take effect.

If the **API Key Required** option is set to `false` and you don't execute the previous steps, any API key that's associated with an API stage isn't used for the method.

## Create an API key

If you've already created or imported API keys for use with usage plans, you can skip this and the next procedure.

### To create an API key

1. Sign in to the Amazon Web Services Management Console and open the API Gateway console at <https://console.amazonaws.cn/apigateway/>.
2. Choose a REST API.
3. In the API Gateway main navigation pane, choose **API Keys**.
4. From the **Actions** drop-down menu, choose **Create API key**.
5. In **Create API Key**, do the following:
  - a. Enter an API key name (for example, **MyFirstKey**) in the **Name** input field.
  - b. Choose **Auto Generate** to have API Gateway generate the key value, or choose **Custom** to enter the key manually.
  - c. Choose **Save**.

6. Repeat the preceding steps to create more API keys, if needed.

## Import API keys

The following procedure describes how to import API keys to use with usage plans.

### To import API keys

1. Sign in to the Amazon Web Services Management Console and open the API Gateway console at <https://console.amazonaws.cn/apigateway/>.
2. Choose a REST API.
3. In the main navigation pane, choose **API Keys**.
4. From the **Actions** drop-down menu, choose **Import API keys**.
5. To load a comma-separated key file, choose **Select CSV File**. You can also enter the keys manually. For information about the file format, see [the section called "API Gateway API key file format" \(p. 502\)](#).
6. Choose **Fail on warnings** to stop the import when there's an error, or choose **Ignore warnings** to continue to import valid key entries when there's an error.
7. To start importing the selected API keys, choose **Import**.

Now that you've set up the API key, you can proceed to [create and use a usage plan \(p. 496\)](#).

## Create, configure, and test usage plans with the API Gateway console

Before creating a usage plan, make sure that you've set up the desired API keys. For more information, see [Set up API keys using the API Gateway console \(p. 494\)](#).

This section describes how to create and use a usage plan by using the API Gateway console.

### Topics

- [Migrate your API to default usage plans \(if needed\) \(p. 496\)](#)
- [Create a usage plan \(p. 497\)](#)
- [Test a usage plan \(p. 498\)](#)
- [Maintain a usage plan \(p. 498\)](#)

## Migrate your API to default usage plans (if needed)

If you started to use API Gateway *after* the usage plans feature was rolled out on August 11, 2016, you will automatically have usage plans enabled for you in all supported Regions.

If you started to use API Gateway before that date, you might need to migrate to default usage plans. You'll be prompted with the **Enable Usage Plans** option before using usage plans for the first time in the selected Region. When you enable this option, you have default usage plans created for every unique API stage that's associated with existing API keys. In the default usage plan, no throttle or quota limits are set initially, and the associations between the API keys and API stages are copied to the usage plans. The API behaves the same as before. However, you must use the `UsagePlan apiStages` property to associate specified API stage values (`apiId` and `stage`) with included API keys (via `UsagePlanKey`), instead of using the `ApiKey stageKeys` property.

To check whether you've already migrated to default usage plans, use the `get-account` CLI command. In the command output, the `features` list includes an entry of `"UsagePlans"` when usage plans are enabled.

You can also migrate your APIs to default usage plans by using the Amazon CLI as follows:

### To migrate to default usage plans using the Amazon CLI

1. Call this CLI command: `update-account`.
2. For the `cli-input-json` parameter, use the following JSON:

```
[
  {
    "op": "add",
    "path": "/features",
    "value": "UsagePlans"
  }
]
```

## Create a usage plan

The following procedure describes how to create a usage plan.

### To create a usage plan

1. In the Amazon API Gateway main navigation pane, choose **Usage Plans**, and then choose **Create**.
2. Under **Create Usage Plan**, do the following:
  - a. For **Name**, enter a name for your plan (for example, **Plan\_A**).
  - b. For **Description**, enter a description for your plan.
  - c. Select **Enable throttling**, and set **Rate** (for example, **100**) and **Burst** (for example, **200**).
  - d. Choose **Enable quota**, and set specify a value (for example, **5000**) for a selected time interval (for example, **Month**).
  - e. Choose **Next**.
3. To add a stage to the plan, do the following in the **Associated API Stages** pane:
  - a. Choose **Add API Stage**.
  - b. Choose an API (for example, **PetStore**) from the **API** drop-down list.
  - c. Choose a stage (for example, **Stage\_1**) from the **Stage** drop-down list.
  - d. Choose the checkmark icon to save.
4. To configure method throttling, do the following:
  - a. Choose **Configure Method Throttling**.
  - b. Choose **Add Resource/Method**.
  - c. Choose the resource from the **Resource** drop-down menu.
  - d. Choose the method from the **Method** drop-down menu.
  - e. Set **Rate (requests per second)** (for example, **100**) and **Burst** (for example, **200**).
  - f. Choose the checkmark icon to save.
  - g. Choose **Close**.
5. To add a key to the plan, do the following in the **API Keys** tab:



- a. To use an existing key, choose **Add API Key to Usage Plan**.
- b. For **Name**, enter a name for the key you want to add (for example, **MyFirstKey**).
- c. Choose the checkmark icon to save.
- d. As needed, repeat the preceding steps to add other existing API keys to this usage plan.

**Note**

Alternatively, to create a new API key and add it to the usage plan, choose **Create API Key and add to Usage Plan** and follow the instructions.

**Note**

An API key can be associated with more than one usage plan. A usage plan can be associated with more than one stage. However, a given API key can only be associated with one usage plan for each stage of your API.

6. To finish creating the usage plan, choose **Done**.
7. If you want to add more API stages to the usage plan, choose **Add API Stage** to repeat the preceding steps.

## Test a usage plan

To test the usage plan, you can use an Amazon SDK, Amazon CLI, or a REST API client like Postman. For an example of using [Postman](#) to test the usage plan, see [Test usage plans \(p. 502\)](#).

## Maintain a usage plan

Maintaining a usage plan involves monitoring the used and remaining quotas over a given time period and, if needed, extending the remaining quotas by a specified amount. The following procedures describe how to monitor and extend quotas.

### To monitor used and remaining quotas

1. In the API Gateway main navigation pane, choose **Usage Plans**.
2. Choose a usage plan from the list of usage plans.
3. From within the specified plan, choose **API Keys**.
4. Choose an API key, and then choose **Usage** to view **Subscriber's Traffic** from the plan you're monitoring.
5. Optionally, choose **Export**, choose a **From** date and a **To** date, choose **JSON** or **CSV** for the exported data format, and then choose **Export**.

The following example shows an exported file.

```
{
  "thisPeriod": {
    "px1KW6...qBazOJH": [
      [
        0,
        5000
      ],
      [
        0,
        5000
      ],
      [
        0,
        10
      ]
    ]
  }
}
```

```
    ]  
  },  
  "startDate": "2016-08-01",  
  "endDate": "2016-08-03"  
}
```

The usage data in the example shows the daily usage data for an API client, as identified by the API key (px1KW6...qBaz0JH), between August 1, 2016 and August 3, 2016. Each daily usage data shows used and remaining quotas. In this example, the subscriber hasn't used any allotted quotas yet, and the API owner or administrator has reduced the remaining quota from 5000 to 10 on the third day.

### To extend the remaining quotas

1. Repeat steps 1–3 of the previous procedure.
2. In the usage plan pane, choose **Extension** from the usage plan window.
3. Enter a number for the **Remaining** request quotas.
4. Choose **Save**.

## Set up API keys using the API Gateway REST API

To set up API keys, do the following:

- Configure API methods to require an API key.
- Create or import an API key for the API in a region.

Before setting up API keys, you must have created an API and deployed it to a stage.

For the REST API calls to create and deploy an API, see [restapi:create](#) and [deployment:create](#), respectively.

### Topics

- [Require an API key on a method \(p. 499\)](#)
- [Create or import API keys \(p. 499\)](#)

## Require an API key on a method

To require an API key on a method, do one of the following:

- Call [method:put](#) to create a method. Set `apiKeyRequired` to `true` in the request payload.
- Call [method:update](#) to set `apiKeyRequired` to `true`.

## Create or import API keys

To create or import an API key, do one of the following:

- Call [apikey:create](#) to create an API key.
- Call [apikey:import](#) to import an API key from a file. For the file format, see [API Gateway API key file format \(p. 502\)](#).

With the API key created, you can now proceed to [Create, configure, and test usage plans using the API Gateway CLI and REST API \(p. 500\)](#).

## Create, configure, and test usage plans using the API Gateway CLI and REST API

Before configuring a usage plan, you must have already done the following: set up methods of a selected API to require API keys, deployed or redeployed the API to a stage, and created or imported one or more API keys. For more information, see [Set up API keys using the API Gateway REST API \(p. 499\)](#).

To configure a usage plan by using the API Gateway REST API, use the following instructions, assuming that you've already created the APIs to be added to the usage plan.

### Topics

- [Migrate to default usage plans \(p. 500\)](#)
- [Create a usage plan \(p. 500\)](#)
- [Manage a usage plan by using the Amazon CLI \(p. 501\)](#)
- [Test usage plans \(p. 502\)](#)

### Migrate to default usage plans

When creating a usage plan the first time, you can migrate existing API stages that are associated with selected API keys to a usage plan by calling `account:update` with the following body:

```
{
  "patchOperations" : [ {
    "op" : "add",
    "path" : "/features",
    "value" : "UsagePlans"
  } ]
}
```

For more information about migrating API stages associated with API keys, see [Migrate to Default Usage Plans in the API Gateway Console \(p. 496\)](#).

### Create a usage plan

The following procedure describes how to create a usage plan.

#### To create a usage plan with the REST API

1. Call `usageplan:create` to create a usage plan. In the payload, specify the name and description of the plan, associated API stages, rate limits, and quotas.

Make note of the resultant usage plan identifier. You need it in the next step.

2. Do one of the following:
  - a. Call `usageplankey:create` to add an API key to the usage plan. Specify `keyId` and `keyType` in the payload.  
  
To add more API keys to the usage plan, repeat the previous call, one API key at a time.
  - b. Call `apikey:import` to add one or more API keys directly to the specified usage plan. The request payload should contain API key values, the associated usage plan identifier, the Boolean flags to indicate that the keys are enabled for the usage plan, and, possibly, the API key names and descriptions.

The following example of the `apikey:import` request adds three API keys (as identified by `key`, `name`, and `description`) to one usage plan (as identified by `usageplanIds`):

```
POST /apikeys?mode=import&format=csv&failonwarnings=false HTTP/1.1
Host: apigateway.us-east-1.amazonaws.com
Content-Type: text/csv
Authorization: ...

key,name,description,enabled,usageplanIds
abcdef1234ghijklmnop8901234567,importedKey_1,firstone,tRuE,n371pt
abcdef1234ghijklmnop0123456789,importedKey_2,secondone,TRUE,n371pt
abcdef1234ghijklmnop9012345678,importedKey_3, ,true,n371pt
```

As a result, three `UsagePlanKey` resources are created and added to the `UsagePlan`.

You can also add API keys to more than one usage plan this way. To do this, change each `usageplanIds` column value to a comma-separated string that contains the selected usage plan identifiers, and is enclosed within a pair of quotes ("`n371pt,m282qs`" or '`n371pt,m282qs`').

#### Note

An API key can be associated with more than one usage plan. A usage plan can be associated with more than one stage. However, a given API key can only be associated with one usage plan for each stage of your API.

## Manage a usage plan by using the Amazon CLI

The following code examples show how to add, remove, or modify the method-level throttling settings in a usage plan by calling the `update-usage-plan` command.

#### Note

Be sure to change `us-east-1` to the appropriate Region value for your API.

To add or replace a rate limit for throttling an individual resource and method:

```
aws apigateway --region us-east-1 update-usage-plan --usage-plan-id <planId> --patch-operations
                                     op="replace",path="/apiStages/<apiId>:<stage>/
throttle/<resourcePath>/<httpMethod>/rateLimit",value="0.1"
```

To add or replace a burst limit for throttling an individual resource and method:

```
aws apigateway --region us-east-1 update-usage-plan --usage-plan-id <planId>
--patch-operations op="replace",path="/apiStages/<apiId>:<stage>/
throttle/<resourcePath>/<httpMethod>/burstLimit",value="1"
```

To remove the method-level throttling settings for an individual resource and method:

```
aws apigateway --region us-east-1 update-usage-plan --usage-plan-id <planId>
--patch-operations op="remove",path="/apiStages/<apiId>:<stage>/
throttle/<resourcePath>/<httpMethod>",value=""
```

To remove all method-level throttling settings for an API:

```
aws apigateway --region us-east-1 update-usage-plan --usage-plan-id <planId> --patch-operations op="remove",path="/apiStages/<apiId>:<stage>/throttle",value=""
```

Here is an example using the Pet Store sample API:

```
aws apigateway --region us-east-1 update-usage-plan --usage-plan-id <planId> --patch-operations op="replace",path="/apiStages/<apiId>:<stage>/throttle",value="{\"/pets/GET\":{\"rateLimit\":1.0,\"burstLimit\":1},\"//GET\":{\"rateLimit\":1.0,\"burstLimit\":1}}"
```

## Test usage plans

As an example, let's use the PetStore API, which was created in [Tutorial: Create a REST API by importing an example \(p. 43\)](#). Assume that the API is configured to use an API key of `Hiorr45VR...c4GJc`. The following steps describe how to test a usage plan.

### To test your usage plan

- Make a `GET` request on the Pets resource (`/pets`), with the `?type=...&page=...` query parameters, of the API (for example, `xbvxlpjch`) in a usage plan:

```
GET /testStage/pets?type=dog&page=1 HTTP/1.1
x-api-key: Hiorr45VR...c4GJc
Content-Type: application/x-www-form-urlencoded
Host: xbvxlpjch.execute-api.ap-southeast-1.amazonaws.com
X-Amz-Date: 20160803T001845Z
Authorization: AWS4-HMAC-SHA256 Credential={access_key_ID}/20160803/ap-southeast-1/execute-api/aws4_request, SignedHeaders=content-type;host;x-amz-date;x-api-key, Signature={sigv4_hash}
```

#### Note

You must submit this request to the `execute-api` component of API Gateway and provide the required API key (for example, `Hiorr45VR...c4GJc`) in the required `x-api-key` header.

The successful response returns a `200 OK` status code and a payload that contains the requested results from the backend. If you forget to set the `x-api-key` header or set it with an incorrect key, you get a `403 Forbidden` response. However, if you didn't configure the method to require an API key, you will likely get a `200 OK` response whether you set the `x-api-key` header correctly or not, and the throttle and quota limits of the usage plan are bypassed.

Occasionally, when an internal error occurs where API Gateway is unable to enforce usage plan throttling limits or quotas for the request, API Gateway serves the request without applying the throttling limits or quotas as specified in the usage plan. But, it logs an error message of `Usage Plan check failed due to an internal error` in CloudWatch. You can ignore such occasional errors.

## API Gateway API key file format

API Gateway can import API keys from external files of a comma-separated value (CSV) format, and then associate the imported keys with one or more usage plans. The imported file must contain the `Name` and `Key` columns. The column header names aren't case sensitive, and columns can be in any order, as shown in the following example:

```
Key,name
apikey1234abcdefghij0123456789,MyFirstApiKey
```

A `Key` value must be between 30 and 128 characters.

An API key file can also have the `Description`, `Enabled`, or `UsagePlanIds` column, as shown in the following example:

```
Name, key, description, Enabled, usageplanIds  
MyFirstApiKey, apikey1234abcdefg hij0123456789, An imported key, TRUE, c7y23b
```

When a key is associated with more than one usage plan, the `UsagePlanIds` value is a comma-separated string of the usage plan IDs, enclosed with a pair of double or single quotes, as shown in the following example:

```
Enabled, Name, key, UsageplanIds  
true, MyFirstApiKey, apikey1234abcdefg hij0123456789, "c7y23b, glvrsr"
```

Unrecognized columns are permitted, but are ignored. The default value is an empty string or a `true` Boolean value.

The same API key can be imported multiple times, with the most recent version overwriting the previous one. Two API keys are identical if they have the same key value.

## Documenting REST APIs

To help customers understand and use your API, you should document the API. To help you document your API, API Gateway lets you add and update the help content for individual API entities as an integral part of your API development process. API Gateway stores the source content and enables you to archive different versions of the documentation. You can associate a documentation version with an API stage, export a stage-specific documentation snapshot to an external OpenAPI file, and distribute the file as a publication of the documentation.

To document your API, you can call the [API Gateway REST API](#), use one of the [Amazon SDKs](#) or [Amazon CLIs](#) for API Gateway, or use the API Gateway console. In addition, you can import or export the documentation parts that are defined in an external OpenAPI file. Before explaining how to document your API, we show how API documentation is represented in API Gateway.

### Topics

- [Representation of API documentation in API Gateway \(p. 503\)](#)
- [Document an API using the API Gateway console \(p. 511\)](#)
- [Publish API documentation using the API Gateway console \(p. 515\)](#)
- [Document an API using the API Gateway REST API \(p. 516\)](#)
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## Representation of API documentation in API Gateway

API Gateway API documentation consists of individual documentation parts associated with specific API entities that include API, resource, method, request, response, message parameters (i.e., path, query, header), as well as authorizers and models.

In API Gateway, a documentation part is represented by a [DocumentationPart](#) resource. The API documentation as a whole is represented by the [DocumentationParts](#) collection.

Documenting an API involves creating `DocumentationPart` instances, adding them to the `DocumentationParts` collection, and maintaining versions of the documentation parts as your API evolves.

### Topics

- [Documentation parts \(p. 504\)](#)
- [Documentation versions \(p. 510\)](#)

## Documentation parts

A `DocumentationPart` resource is a JSON object that stores the documentation content applicable to an individual API entity. Its `properties` field contains the documentation content as a map of key-value pairs. Its `location` property identifies the associated API entity.

The shape of a content map is determined by you, the API developer. The value of a key-value pair can be a string, number, boolean, object, or array. The shape of the `location` object depends on the targeted entity type.

The `DocumentationPart` resource supports content inheritance: the documentation content of an API entity is applicable to children of that API entity. For more information about the definition of child entities and content inheritance, see [Inherit Content from an API Entity of More General Specification \(p. 505\)](#).

### Location of a documentation part

The `location` property of a `DocumentationPart` instance identifies an API entity to which the associated content applies. The API entity can be an API Gateway REST API resource, such as [RestApi](#), [Resource](#), [Method](#), [MethodResponse](#), [Authorizer](#), or [Model](#). The entity can also be a message parameter, such as a URL path parameter, a query string parameter, a request or response header parameter, a request or response body, or response status code.

To specify an API entity, set the `type` attribute of the `location` object to be one of `API`, `AUTHORIZER`, `MODEL`, `RESOURCE`, `METHOD`, `PATH_PARAMETER`, `QUERY_PARAMETER`, `REQUEST_HEADER`, `REQUEST_BODY`, `RESPONSE`, `RESPONSE_HEADER`, or `RESPONSE_BODY`.

Depending on the type of an API entity, you might specify other `location` attributes, including `method`, `name`, `path`, and `statusCode`. Not all of these attributes are valid for a given API entity. For example, `type`, `path`, `name`, and `statusCode` are valid attributes of the `RESPONSE` entity; only `type` and `path` are valid location attributes of the `RESOURCE` entity. It is an error to include an invalid field in the `location` of a `DocumentationPart` for a given API entity.

Not all valid `location` fields are required. For example, `type` is both the valid and required `location` field of all API entities. However, `method`, `path`, and `statusCode` are valid but not required attributes for the `RESPONSE` entity. When not explicitly specified, a valid `location` field assumes its default value. The default path value is `/`, i.e., the root resource of an API. The default value of `method`, or `statusCode` is `*`, meaning any method, or status code values, respectively.

### Content of a documentation part

The `properties` value is encoded as a JSON string. The `properties` value contains any information you choose to meet your documentation requirements. For example, the following is a valid content map:

```
{
  "info": {
    "description": "My first API with Amazon API Gateway."
  },
  "x-custom-info" : "My custom info, recognized by OpenAPI.",
  "my-info" : "My custom info not recognized by OpenAPI."
}
```

Although API Gateway accepts any valid JSON string as the content map, the content attributes are treated as two categories: those that can be recognized by OpenAPI and those that cannot. In the

preceding example, `info`, `description`, and `x-custom-info` are recognized by OpenAPI as a standard OpenAPI object, property, or extension. In contrast, `my-info` is not compliant with the OpenAPI specification. API Gateway propagates OpenAPI-compliant content attributes into the API entity definitions from the associated `DocumentationPart` instances. API Gateway does not propagate the non-compliant content attributes into the API entity definitions.

As another example, here is `DocumentationPart` targeted for a `Resource` entity:

```
{
  "location" : {
    "type" : "RESOURCE",
    "path": "/pets"
  },
  "properties" : {
    "summary" : "The /pets resource represents a collection of pets in PetStore.",
    "description": "... a child resource under the root...",
  }
}
```

Here, both `type` and `path` are valid fields to identify the target of the `RESOURCE` type. For the root resource (`/`), you can omit the `path` field.

```
{
  "location" : {
    "type" : "RESOURCE"
  },
  "properties" : {
    "description" : "The root resource with the default path specification."
  }
}
```

This is the same as the following `DocumentationPart` instance:

```
{
  "location" : {
    "type" : "RESOURCE",
    "path": "/"
  },
  "properties" : {
    "description" : "The root resource with an explicit path specification"
  }
}
```

### Inherit content from an API entity of more general specifications

The default value of an optional `location` field provides a patterned description of an API entity. Using the default value in the `location` object, you can add a general description in the `properties` map to a `DocumentationPart` instance with this type of `location` pattern. API Gateway extracts the applicable OpenAPI documentation attributes from the `DocumentationPart` of the generic API entity and injects them into a specific API entity with the `location` fields matching the general `location` pattern, or matching the exact value, unless the specific entity already has a `DocumentationPart` instance associated with it. This behavior is also known as content inheritance from an API entity of more general specifications.

Content inheritance does not apply to certain API entity types. See the table below for details.

When an API entity matches more than one `DocumentationPart`'s `location` pattern, the entity will inherit the documentation part with the `location` fields of the highest precedence and specificities. The



order of precedence is `path > statusCode`. For matching with the `path` field, API Gateway chooses the entity with the most specific path value. The following table shows this with a few examples.

Case	path	statusCode	name	Remark
1	/pets	*	id	Documentation associated with this location pattern will be inherited by entities matching the location pattern.
2	/pets	200	id	Documentation associated with this location pattern will be inherited by entities matching the location pattern when both Case 1 and Case 2 are matched, because Case 2 is more specific than Case 1.
3	/pets/ petId	*	id	Documentation associated with this location

Case	path	statusCode	name	Remark
				pattern will be inherited by entities matching the location pattern when Cases 1, 2, and 3 are matched, because Case 3 has a higher precedence than Case 2 and is more specific than Case 1.

Here is another example to contrast a more generic `DocumentationPart` instance to a more specific one. The following general error message of "Invalid request error" is injected into the OpenAPI definitions of the 400 error responses, unless overridden.

```
{
  "location" : {
    "type" : "RESPONSE",
    "statusCode": "400"
  },
  "properties" : {
    "description" : "Invalid request error."
  }
}
```

With the following overwrite, the 400 responses to any methods on the `/pets` resource has a description of "Invalid petId specified" instead.

```
{
  "location" : {
    "type" : "RESPONSE",
    "path": "/pets",
    "statusCode": "400"
  },
  "properties" : "{
```

```

    "description" : "Invalid petId specified."
  }"
}

```

### Valid location fields of `DocumentationPart`

The following table shows the valid and required fields as well as applicable default values of a `DocumentationPart` resource that is associated with a given type of API entities.

API entity	Valid location fields	Required location fields	Default field values	Inheritable content
API	<pre> {   "location": {     "type": "API"   },   ... } </pre>	type	N/A	No
Resource	<pre> {   "location": {     "type": "RESOURCE",     "path":     "<i>resource_path</i>"   },   ... } </pre>	type	The default value of path is /.	No
Method	<pre> {   "location": {     "type": "METHOD",     "path":     "<i>resource_path</i>",     "method":     "<i>http_verb</i>"   },   ... } </pre>	type	The default values of path and method are / and *, respectively.	Yes, matching path by prefix and matching method of any values.
Query parameter	<pre> {   "location": {     "type":     "QUERY_PARAMETER",     "path":     "<i>resource_path</i>",     "method":     "<i>HTTP_verb</i>",     "name":     "<i>query_parameter_name</i>"   },   ... } </pre>	type	The default values of path and method are / and *, respectively.	Yes, matching path by prefix and matching method by exact values.
Request body	<pre> {   "location": {     "type":     "REQUEST_BODY", </pre>	type	The default values of path, and method are /and *, respectively.	Yes, matching path by prefix, and matching

API entity	Valid location fields	Required location fields	Default field values	Inheritable content
	<pre> "path":   "resource_path",   "method":   "http_verb" }, ... } </pre>			method by exact values.
Request header parameter	<pre> {   "location": {     "type":     "REQUEST_HEADER",     "path":     "resource_path",     "method":     "HTTP_verb",     "name":     "header_name"   },   ... } </pre>	type, name	The default values of path and method are / and *, respectively.	Yes, matching path by prefix and matching method by exact values.
Request path parameter	<pre> {   "location": {     "type":     "PATH_PARAMETER",     "path": "resource/ {path_parameter_name}",     "method":     "HTTP_verb",     "name":     "path_parameter_name"   },   ... } </pre>	type, name	The default values of path and method are / and *, respectively.	Yes, matching path by prefix and matching method by exact values.
Response	<pre> {   "location": {     "type": "RESPONSE",     "path":     "resource_path",     "method":     "http_verb",     "statusCode":     "status_code"   },   ... } </pre>	type	The default values of path, method, and statusCode are /, * and *, respectively.	Yes, matching path by prefix and matching method and statusCode by exact values.

API entity	Valid location fields	Required location fields	Default field values	Inheritable content
Response header	<pre>{   "location": {     "type": "RESPONSE_HEADER",     "path": "resource_path",     "method": "http_verb",     "statusCode": "status_code",     "name": "header_name"   },   ... }</pre>	type, name	The default values of path, method and statusCode are /, * and *, respectively.	Yes, matching path by prefix and matching method, and statusCode by exact values.
Response body	<pre>{   "location": {     "type": "RESPONSE_BODY",     "path": "resource_path",     "method": "http_verb",     "statusCode": "status_code"   },   ... }</pre>	type	The default values of path, method and statusCode are /, * and *, respectively.	Yes, matching path by prefix and matching method, and statusCode by exact values.
Authorizer	<pre>{   "location": {     "type": "AUTHORIZER",     "name": "authorizer_name"   },   ... }</pre>	type	N/A	No
Model	<pre>{   "location": {     "type": "MODEL",     "name": "model_name"   },   ... }</pre>	type	N/A	No

## Documentation versions

A documentation version is a snapshot of the [DocumentationParts](#) collection of an API and is tagged with a version identifier. Publishing the documentation of an API involves creating a documentation version, associating it with an API stage, and exporting that stage-specific version of the API

documentation to an external OpenAPI file. In API Gateway, a documentation snapshot is represented as a [DocumentationVersion](#) resource.

As you update an API, you create new versions of the API. In API Gateway, you maintain all the documentation versions using the [DocumentationVersions](#) collection.

## Document an API using the API Gateway console

In this section, we describe how to create and maintain documentation parts of an API using the API Gateway console.

A prerequisite for creating and editing the documentation of an API is that you must have already created the API. In this section, we use the [PetStore](#) API as an example. To create an API using the API Gateway console, follow the instructions in [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

### Topics

- [Document the API entity \(p. 511\)](#)
- [Document a RESOURCE entity \(p. 512\)](#)
- [Document a METHOD entity \(p. 512\)](#)
- [Document a QUERY\\_PARAMETER entity \(p. 512\)](#)
- [Document a PATH\\_PARAMETER entity \(p. 513\)](#)
- [Document a REQUEST\\_HEADER entity \(p. 513\)](#)
- [Document a REQUEST\\_BODY entity \(p. 513\)](#)
- [Document a RESPONSE entity \(p. 513\)](#)
- [Document a RESPONSE\\_HEADER entity \(p. 514\)](#)
- [Document a RESPONSE\\_BODY entity \(p. 514\)](#)
- [Document a MODEL entity \(p. 514\)](#)
- [Document an AUTHORIZER entity \(p. 515\)](#)

### Document the API entity

To add a documentation part for the API entity, choose **Resources** from the **PetStore** API. Choose the **Actions** → **Edit API Documentation** menu item.

If a documentation part was not created for the API, you get the documentation part's `properties` map editor. Type the following `properties` map in the text editor and then choose **Save** to create the documentation part.

```
{
  "info": {
    "description": "Your first API Gateway API.",
    "contact": {
      "name": "John Doe",
      "email": "john.doe@api.com"
    }
  }
}
```

#### Note

You do not need to encode the `properties` map into a JSON string. The API Gateway console stringifies the JSON object for you.

If a documentation part has already been created, you first get the `properties` map viewer, as shown in the following.

Choosing **Edit** brings up the `properties` map editor as shown previously.

## Document a RESOURCE entity

To add or edit the documentation part for the API's root resource, choose `/` under the **Resource** tree, and then choose the **Actions** → **Edit Resource Documentation** menu item.

If no documentation part was created for this entity, you get the **Documentation** window. Type a valid `properties` map in the editor. Then choose **Save** and **Close**.

```
{
  "description": "The PetStore's root resource."
}
```

If a documentation part has already been defined for the **RESOURCE** entity, you get the documentation viewer. Choose **Edit** to open the **Documentation** editor. Modify the existing `properties` map. Choose **Save** and then choose **Close**.

If necessary, repeat these steps to add a documentation part to other **RESOURCE** entities.

## Document a METHOD entity

To add or edit documentation for a **METHOD** entity, using the **GET** method on the root resource as an example, choose **GET** under the `/` resource and then choose the **Actions** → **Edit Method Documentation** menu item.

For the new documentation part, type the following `properties` map in the **Documentation** editor in the **Documentation** window. Then choose **Save** and **Close**.

```
{
  "tags" : [ "pets" ],
  "description" : "PetStore HTML web page containing API usage information"
}
```

For the existing documentation, choose **Edit** from the **Documentation** viewer. Edit the documentation content in the **Documentation** editor and choose **Save**. Choose **Close**.

From the **Documentation** viewer, you can also delete the documentation part.

If necessary, repeat these steps to add a documentation part to other methods.

## Document a QUERY\_PARAMETER entity

To add or edit a documentation part for a request query parameter, using the **GET** `/pets?type=...&page=...` method as an example, choose **GET** under `/pets` from the **Resources** tree. Choose **Method Request** in the **Method Execution** window. Expand the **URL Query String Parameters** section. Choose the **page** query parameter, for example, and choose the book icon to open the **Documentation** viewer or editor.

Alternatively, you can choose **Documentation** under the **PetStore** API from the main navigation pane. Then choose `Query Parameter` for **Type**. For the PetStore example API, this shows the documentation parts for the `page` and `type` query parameters.

For an API with query parameters defined for other methods, you can filter your selection by specifying the `path` of the affected resource for **Path**, choosing the desired HTTP method from **Method**, or typing the query parameter name in **Name**.

For example, choose the page query parameter. Choose **Edit** to modify the existing documentation. Choose **Save** to save the change.

To add a new documentation part for a `QUERY_PARAMETER` entity, choose **Create Documentation Part**. Choose `Query Parameter` for **Type**. Type a resource path (e.g., `/pets`) in **Path**. Choose an HTTP verb (e.g., `GET`) for **Method**. Type a `properties` description in the text editor. Then choose **Save**.

If necessary, repeat these steps to add a documentation part to other request query parameters.

## Document a `PATH_PARAMETER` entity

To add or edit documentation for a path parameter, go to **Method Request** of the method on the resource specified by the path parameter. Expand the **Request Paths** section. Choose the book icon for the path parameter to open the **Documentation** viewer or editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the **PetStore** API from the main navigation pane. Choose `Path Parameter` for **Type**. Choose **Edit** on a path parameter from the list. Modify the content and then choose **Save**.

To add documentation for a path parameter not listed, choose **Create Documentation Part**. Choose **Path Parameter** for **Type**. Set a resource path in **Path**, choose a method from **Method**, and set a path parameter name in **Name**. Add the documentation's properties and choose **Save**.

If required, repeat these steps to add or edit a documentation part to other path parameters.

## Document a `REQUEST_HEADER` entity

To add or edit documentation for a request header, go to **Method Request** of the method with the header parameter. Expand the **HTTP Request Headers** section. Choose the book icon for the header to open the **Documentation** viewer or editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose `Request Header` for **Type**. Choose **Edit** on a listed request header to change the documentation. To add documentation for an unlisted request header, choose **Create Documentation Part**. Choose **Request Header** for **Type**. Specify a resource path in **Path**. Choose a method for **Method**. Type a header name in **Name**. Then add and save a `properties` map.

If required, repeat these steps to add or edit a documentation part to other request headers.

## Document a `REQUEST_BODY` entity

To add or edit documentation for a request body, go to **Method Request** for a method. Choose the book icon for **Request Body** to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose `Request Body` for **Type**. Choose **Edit** on a listed request body to change the documentation. To add documentation for an unlisted request body, choose **Create Documentation Part**. Choose `Request Body` for **Type**. Set a resource path in **Path**. Choose an HTTP verb for **Method**. Then add and save a `properties` map.

If required, repeat these steps to add or edit a documentation part to other request bodies.

## Document a `RESPONSE` entity

To add or edit documentation for a response, go to **Method Response** of a method. Choose the book icon for **Method Response** to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.



Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose **Response (status code)** for **Type**. Choose **Edit** on a listed response of a specified HTTP status code to change the documentation. To add documentation for an unlisted response body, choose **Create Documentation Part**. Choose **Response (status code)** for **Type**. Set a resource path in **Path**. Choose an HTTP verb for **Method**. Type an HTTP status code in **Status Code**. Then add and save the documentation part properties.

If required, repeat these steps to add or edit a documentation part to other responses.

### Document a RESPONSE\_HEADER entity

To add or edit documentation for a response header, go to **Method Response** of a method. Expand a response section of a given HTTP status. Choose the book icon for a response header under **Response Headers for *Status Code*** to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose **Response Header** for **Type**. Choose **Edit** on a listed response header to change the documentation. To add documentation for an unlisted response header, choose **Create Documentation Part**. Choose **Response Header** for **Type**. Set a resource path in **Path**. Choose an HTTP verb for **Method**. Type an HTTP status code in **Status Code**. Type the response header name in **Name**. Then add and save the documentation part properties.

If required, repeat these steps to add or edit a documentation part to other response headers.

### Document a RESPONSE\_BODY entity

To add or edit documentation for a response body, go to **Method Response** of a method. Expand the response section of a given HTTP status. Choose the book icon for **Response Body for *Status Code*** to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose **Response Body** for **Type**. Choose **Edit** on a listed response body to change the documentation. To add documentation for an unlisted response body, choose **Create Documentation Part**. Choose **Response Body** for **Type**. Set a resource path in **Path**. Choose an HTTP verb for **Method**. Type an HTTP status code in **Status Code**. Then add and save the documentation part properties.

If required, repeat these steps to add or edit a documentation part to other response bodies.

### Document a MODEL entity

Documenting a MODEL entity involves creating and managing `DocumentationPart` instances for the model and each of the model's `properties`. For example, for the `ERROR` model that comes with every API by default has the following schema definition,

```
{
  "$schema" : "http://json-schema.org/draft-04/schema#",
  "title" : "Error Schema",
  "type" : "object",
  "properties" : {
    "message" : { "type" : "string" }
  }
}
```

and requires two `DocumentationPart` instances, one for the `Model` and the other for its `message` property:

```
{
  "location": {
```

```
"type": "MODEL",
"name": "Error"
},
"properties": {
  "title": "Error Schema",
  "description": "A description of the Error model"
}
}
```

and

```
{
  "location": {
    "type": "MODEL",
    "name": "Error.message"
  },
  "properties": {
    "description": "An error message."
  }
}
```

When the API is exported, the `DocumentationPart`'s properties will override the values in the original schema.

To add or edit documentation for a model, go to **Models** of the API in the main navigation pane. Choose the book icon for the name of a listed model to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose `Model` for **Type**. Choose **Edit** on a listed model to change the documentation. To add documentation for an unlisted model, choose **Create Documentation Part**. Choose **Model** for **Type**. Give a name to the model in **Name**. Then add and save the documentation part properties.

If required, repeat these steps to add or edit a documentation part to other models.

## Document an AUTHORIZER entity

To add or edit documentation for an authorizer, go to **Authorizers** for the API in the main navigation pane. Choose the book icon for the listed authorizer to open the **Documentation** viewer and then editor. Add or modify the properties of the documentation part.

Alternatively, choose **Documentation** under the API from the main navigation pane. Then choose `Authorizer` for **Type**. Choose **Edit** on a listed authorizer to change the documentation. To add documentation for an unlisted authorizer, choose **Create Documentation Part**. Choose **Authorizer** for **Type**. Give a name to the authorizer in **Name**. Then add and save the documentation part properties.

If required, repeat these steps to add or edit a documentation part to other authorizers.

To add a documentation part for an authorizer, choose **Create Documentation Part**. Choose **Authorizer** for **Type**. Specify a value for the valid `location` field of **Name** for the authorizer.

Add and save the documentation content in the `properties` map editor.

If required, repeat these steps to add a documentation part to another authorizer.

## Publish API documentation using the API Gateway console

The following procedure describes how to publish a documentation version.

### To publish a documentation version using the API Gateway console

1. Choose **Documentation** for the API from the main navigation pane in the API Gateway console.

2. Choose **Publish Documentation** in the **Documentation** pane.
3. Set up the publication:
  - a. Choose an available name for **Stage**.
  - b. Type a version identifier, e.g., 1.0.0, in **Version**.
  - c. Optionally, provide a description about the publication in **Description**.
4. Choose **Publish**.

You can now proceed to download the published documentation by exporting the documentation to an external OpenAPI file. To learn more, see [the section called “Export a REST API” \(p. 433\)](#).

## Document an API using the API Gateway REST API

In this section, we describe how to create and maintain documentation parts of an API using the API Gateway REST API.

Before creating and editing the documentation of an API, first create the API. In this section, we use the [PetStore](#) API as an example. To create an API using the API Gateway console, follow the instructions in [Tutorial: Create a REST API by importing an example \(p. 43\)](#).

### Topics

- [Document the API entity \(p. 516\)](#)
- [Document a RESOURCE entity \(p. 517\)](#)
- [Document a METHOD entity \(p. 520\)](#)
- [Document a QUERY\\_PARAMETER entity \(p. 522\)](#)
- [Document a PATH\\_PARAMETER entity \(p. 523\)](#)
- [Document a REQUEST\\_BODY entity \(p. 524\)](#)
- [Document a REQUEST\\_HEADER entity \(p. 525\)](#)
- [Document a RESPONSE entity \(p. 526\)](#)
- [Document a RESPONSE\\_HEADER entity \(p. 527\)](#)
- [Document an AUTHORIZER entity \(p. 527\)](#)
- [Document a MODEL entity \(p. 528\)](#)
- [Update documentation parts \(p. 530\)](#)
- [List documentation parts \(p. 530\)](#)

## Document the API entity

To add documentation for an [API](#), add a [DocumentationPart](#) resource for the API entity:

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "API"
  },
  "properties": "{\n\t\"info\": {\n\t\t\"description\" : \"Your first API with Amazon API
Gateway.\n\t\t}\n}"
```

```
}
```

If successful, the operation returns a 201 Created response containing the newly created DocumentationPart instance in the payload. For example:

```
{
  ...
  "id": "s2e5xf",
  "location": {
    "path": null,
    "method": null,
    "name": null,
    "statusCode": null,
    "type": "API"
  },
  "properties": "{\n\t\t\"info\": {\n\t\t\t\"description\" : \"Your first API with Amazon API Gateway.\n\t\t}\n}"
}
```

If the documentation part has already been added, a 409 Conflict response returns, containing the error message of Documentation part already exists for the specified location: type 'API' . In this case, you must call the [documentationpart:update](#) operation.

```
PATCH /restapis/4wk1k4onj3/documentation/parts/part_id HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "patchOperations" : [ {
    "op" : "replace",
    "path" : "/properties",
    "value" : "{\n\t\t\"info\": {\n\t\t\t\"description\" : \"Your first API with Amazon API Gateway.\n\t\t}\n}"
  } ]
}
```

The successful response returns a 200 OK status code with the payload containing the updated DocumentationPart instance in the payload.

## Document a RESOURCE entity

To add documentation for the root resource of an API, add a [DocumentationPart](#) resource targeted for the corresponding [Resource](#) resource:

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "RESOURCE",
  },
  "properties" : "{\n\t\t\"description\" : \"The PetStore root resource.\n\t}"
}
```

```
}

```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```
{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/p76vqo"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/p76vqo"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/p76vqo"
    }
  },
  "id": "p76vqo",
  "location": {
    "path": "/",
    "method": null,
    "name": null,
    "statusCode": null,
    "type": "RESOURCE"
  },
  "properties": "{\n\t\"description\" : \"The PetStore root resource.\"\n}"
}
```

When the resource path is not specified, the resource is assumed to be the root resource. You can add `"path": "/"` to `properties` to make the specification explicit.

To create documentation for a child resource of an API, add a `DocumentationPart` resource targeted for the corresponding `Resource` resource:

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "RESOURCE",
    "path" : "/pets"
  },
  "properties": "{\n\t\"description\" : \"A child resource under the root of PetStore.
\n}"
}
```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```
{
  "_links": {
```

```

    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/qcht86"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/qcht86"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/qcht86"
    }
  },
  "id": "qcht86",
  "location": {
    "path": "/pets",
    "method": null,
    "name": null,
    "statusCode": null,
    "type": "RESOURCE"
  },
  "properties": "{\n\t\"description\" : \"A child resource under the root of PetStore.
\n}\n}"
}

```

To add documentation for a child resource specified by a path parameter, add a [DocumentationPart](#) resource targeted for the [Resource](#) resource:

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "RESOURCE",
    "path" : "/pets/{petId}"
  },
  "properties": "{\n\t\"description\" : \"A child resource specified by the petId path
parameter.\n}\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/k6fpwb"
    },
    "documentationpart:delete": {

```

```

    "href": "/restapis/4wk1k4onj3/documentation/parts/k6fpwb"
  },
  "documentationpart:update": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/k6fpwb"
  }
},
"id": "k6fpwb",
"location": {
  "path": "/pets/{petId}",
  "method": null,
  "name": null,
  "statusCode": null,
  "type": "RESOURCE"
},
"properties": "{\n\t\"description\" : \"A child resource specified by the petId path parameter.\"\n}"
}

```

### Note

The [DocumentationPart](#) instance of a RESOURCE entity cannot be inherited by any of its child resources.

## Document a METHOD entity

To add documentation for a method of an API, add a [DocumentationPart](#) resource targeted for the corresponding [Method](#) resource:

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "METHOD",
    "path" : "/pets",
    "method" : "GET"
  },
  "properties": "{\n\t\"summary\" : \"List all pets.\"\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:update": {

```

```

    "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
  }
},
"id": "o64jbj",
"location": {
  "path": "/pets",
  "method": "GET",
  "name": null,
  "statusCode": null,
  "type": "METHOD"
},
"properties": "{\n\t\"summary\" : \"List all pets.\n\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    }
  },
  "id": "o64jbj",
  "location": {
    "path": "/pets",
    "method": "GET",
    "name": null,
    "statusCode": null,
    "type": "METHOD"
  },
  "properties": "{\n\t\"summary\" : \"List all pets.\n\n}"
}

```

If the `location.method` field is not specified in the preceding request, it is assumed to be ANY method that is represented by a wild card \* character.

To update the documentation content of a `METHOD` entity, call the [documentationpart:update](#) operation, supplying a new `properties` map:

```

PATCH /restapis/4wk1k4onj3/documentation/parts/part_id HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "patchOperations" : [ {
    "op" : "replace",

```



```

    "path" : "/properties",
    "value" : "{\n\t\"tags\" : [ \"pets\" ], \n\t\"summary\" : \"List all pets.\"\n}"
  } ]
}

```

The successful response returns a 200 OK status code with the payload containing the updated `DocumentationPart` instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/o64jbj"
    }
  },
  "id": "o64jbj",
  "location": {
    "path": "/pets",
    "method": "GET",
    "name": null,
    "statusCode": null,
    "type": "METHOD"
  },
  "properties": "{\n\t\"tags\" : [ \"pets\" ], \n\t\"summary\" : \"List all pets.\"\n}"
}

```

## Document a `QUERY_PARAMETER` entity

To add documentation for a request query parameter, add a `DocumentationPart` resource targeted for the `QUERY_PARAMETER` type, with the valid fields of path and name.

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "QUERY_PARAMETER",
    "path" : "/pets",
    "method" : "GET",
    "name" : "page"
  },
  "properties": "{\n\t\"description\" : \"Page number of results to return.\"\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```
{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h9ht5w"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h9ht5w"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h9ht5w"
    }
  },
  "id": "h9ht5w",
  "location": {
    "path": "/pets",
    "method": "GET",
    "name": "page",
    "statusCode": null,
    "type": "QUERY_PARAMETER"
  },
  "properties": "{\n\t\"description\" : \"Page number of results to return.\"\n}"
}
```

The documentation part's properties map of a `QUERY_PARAMETER` entity can be inherited by one of its child `QUERY_PARAMETER` entities. For example, if you add a `treats` resource after `/pets/{petId}`, enable the `GET` method on `/pets/{petId}/treats`, and expose the page query parameter, this child query parameter inherits the `DocumentationPart`'s properties map from the like-named query parameter of the `GET /pets` method, unless you explicitly add a `DocumentationPart` resource to the page query parameter of the `GET /pets/{petId}/treats` method.

## Document a `PATH_PARAMETER` entity

To add documentation for a path parameter, add a `DocumentationPart` resource for the `PATH_PARAMETER` entity.

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "PATH_PARAMETER",
    "path" : "/pets/{petId}",
    "method" : "*",
    "name" : "petId"
  },
  "properties": "{\n\t\"description\" : \"The id of the pet to retrieve.\"\n}"
}
```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```
{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/ckpgog"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/ckpgog"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/ckpgog"
    }
  },
  "id": "ckpgog",
  "location": {
    "path": "/pets/{petId}",
    "method": "*",
    "name": "petId",
    "statusCode": null,
    "type": "PATH_PARAMETER"
  },
  "properties": "{\n  \"description\" : \"The id of the pet to retrieve\"\n}"
}
```

## Document a REQUEST\_BODY entity

To add documentation for a request body, add a [DocumentationPart](#) resource for the request body.

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "REQUEST_BODY",
    "path" : "/pets",
    "method" : "POST"
  },
  "properties": "{\n\t\"description\" : \"A Pet object to be added to PetStore.\"\n}"
}
```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```
{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
```

```

    "href": "/restapis/4wk1k4onj3/documentation/parts/kgmfr1"
  },
  "documentationpart:delete": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/kgmfr1"
  },
  "documentationpart:update": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/kgmfr1"
  }
},
"id": "kgmfr1",
"location": {
  "path": "/pets",
  "method": "POST",
  "name": null,
  "statusCode": null,
  "type": "REQUEST_BODY"
},
"properties": "{\n\t\"description\" : \"A Pet object to be added to PetStore.\"\n}"
}

```

## Document a REQUEST\_HEADER entity

To add documentation for a request header, add a [DocumentationPart](#) resource for the request header.

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "REQUEST_HEADER",
    "path" : "/pets",
    "method" : "GET",
    "name" : "x-my-token"
  },
  "properties": "{\n\t\"description\" : \"A custom token used to authorization the method
invocation.\"\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h0m3uf"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h0m3uf"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/h0m3uf"
    }
  }
}

```

```

},
"id": "h0m3uf",
"location": {
  "path": "/pets",
  "method": "GET",
  "name": "x-my-token",
  "statusCode": null,
  "type": "REQUEST_HEADER"
},
"properties": "{\n\t\"description\" : \"A custom token used to authorization the method invocation.\n\n}"
}

```

## Document a RESPONSE entity

To add documentation for a response of a status code, add a [DocumentationPart](#) resource targeted for the corresponding [MethodResponse](#) resource.

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location": {
    "path": "/",
    "method": "*",
    "name": null,
    "statusCode": "200",
    "type": "RESPONSE"
  },
  "properties": "{\n  \"description\" : \"Successful operation.\n\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```

{
  "_links": {
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/lattew"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/lattew"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/lattew"
    }
  },
  "id": "lattew",
  "location": {
    "path": "/",
    "method": "*",
    "name": null,
    "statusCode": "200",
    "type": "RESPONSE"
  },
  "properties": "{\n  \"description\" : \"Successful operation.\n\n}"
}

```

## Document a RESPONSE\_HEADER entity

To add documentation for a response header, add a [DocumentationPart](#) resource for the response header.

```
POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{"location": {
  "path": "/",
  "method": "GET",
  "name": "Content-Type",
  "statusCode": "200",
  "type": "RESPONSE_HEADER"
},
"properties": "{\n  \"description\" : \"Media type of request\"\n}"
```

If successful, the operation returns a 201 Created response containing the newly created [DocumentationPart](#) instance in the payload. For example:

```
{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/fev7j7"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/fev7j7"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/fev7j7"
    }
  },
  "id": "fev7j7",
  "location": {
    "path": "/",
    "method": "GET",
    "name": "Content-Type",
    "statusCode": "200",
    "type": "RESPONSE_HEADER"
  },
  "properties": "{\n  \"description\" : \"Media type of request\"\n}"
}
```

The documentation of this `Content-Type` response header is the default documentation for the `Content-Type` headers of any responses of the API.

## Document an AUTHORIZER entity

To add documentation for an API authorizer, add a [DocumentationPart](#) resource targeted for the specified authorizer.

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "AUTHORIZER",
    "name" : "myAuthorizer"
  },
  "properties": "{\n\t\"description\" : \"Authorizes invocations of configured methods.
\n\n}"
}

```

If successful, the operation returns a 201 Created response containing the newly created `DocumentationPart` instance in the payload. For example:

```

{
  "_links": {
    "curies": {
      "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
      "name": "documentationpart",
      "templated": true
    },
    "self": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/pw3qw3"
    },
    "documentationpart:delete": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/pw3qw3"
    },
    "documentationpart:update": {
      "href": "/restapis/4wk1k4onj3/documentation/parts/pw3qw3"
    }
  },
  "id": "pw3qw3",
  "location": {
    "path": null,
    "method": null,
    "name": "myAuthorizer",
    "statusCode": null,
    "type": "AUTHORIZER"
  },
  "properties": "{\n\t\"description\" : \"Authorizes invocations of configured methods.
\n\n}"
}

```

#### Note

The `DocumentationPart` instance of an `AUTHORIZER` entity cannot be inherited by any of its child resources.

## Document a MODEL entity

Documenting a `MODEL` entity involves creating and managing `DocumentPart` instances for the model and each of the model's properties'. For example, for the `Error` model that comes with every API by default has the following schema definition,

```

{
  "$schema" : "http://json-schema.org/draft-04/schema#",

```

```

    "title" : "Error Schema",
    "type" : "object",
    "properties" : {
      "message" : { "type" : "string" }
    }
  }
}

```

and requires two `DocumentationPart` instances, one for the `Model` and the other for its `message` property:

```

{
  "location": {
    "type": "MODEL",
    "name": "Error"
  },
  "properties": {
    "title": "Error Schema",
    "description": "A description of the Error model"
  }
}

```

and

```

{
  "location": {
    "type": "MODEL",
    "name": "Error.message"
  },
  "properties": {
    "description": "An error message."
  }
}

```

When the API is exported, the `DocumentationPart`'s properties will override the values in the original schema.

To add documentation for an API model, add a [DocumentationPart](#) resource targeted for the specified model.

```

POST /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "location" : {
    "type" : "MODEL",
    "name" : "Pet"
  },
  "properties": "{\n\t\"description\" : \"Data structure of a Pet object.\"\n}"
}

```

If successful, the operation returns a 201 `Created` response containing the newly created `DocumentationPart` instance in the payload. For example:

```

{
  "_links": {
    "curies": {

```



```

    "href": "http://docs.aws.amazon.com/apigateway/latest/developerguide/restapi-
documentationpart-{rel}.html",
    "name": "documentationpart",
    "templated": true
  },
  "self": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/lkn4uq"
  },
  "documentationpart:delete": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/lkn4uq"
  },
  "documentationpart:update": {
    "href": "/restapis/4wk1k4onj3/documentation/parts/lkn4uq"
  }
},
"id": "lkn4uq",
"location": {
  "path": null,
  "method": null,
  "name": "Pet",
  "statusCode": null,
  "type": "MODEL"
},
"properties": "{\n\t\"description\" : \"Data structure of a Pet object.\"\n}"
}

```

Repeat the same step to create a `DocumentationPart` instance for any of the model's properties.

**Note**

The `DocumentationPart` instance of a `MODEL` entity cannot be inherited by any of its child resources.

## Update documentation parts

To update the documentation parts of any type of API entities, submit a `PATCH` request on a `DocumentationPart` instance of a specified part identifier to replace the existing `properties` map with a new one.

```

PATCH /restapis/4wk1k4onj3/documentation/parts/part_id HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "patchOperations" : [ {
    "op" : "replace",
    "path" : "RESOURCE_PATH",
    "value" : "NEW_properties_VALUE_AS_JSON_STRING"
  } ]
}

```

The successful response returns a `200 OK` status code with the payload containing the updated `DocumentationPart` instance in the payload.

You can update multiple documentation parts in a single `PATCH` request.

## List documentation parts

To list the documentation parts of any type of API entities, submit a `GET` request on a `DocumentationParts` collection.

```
GET /restapis/restapi_id/documentation/parts HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret
```

The successful response returns a 200 OK status code with the payload containing the available `DocumentationPart` instances in the payload.

## Publish API documentation using the API Gateway REST API

To publish the documentation for an API, create, update, or get a documentation snapshot, and then associate the documentation snapshot with an API stage. When creating a documentation snapshot, you can also associate it with an API stage at the same time.

### Topics

- [Create a documentation snapshot and associate it with an API stage \(p. 531\)](#)
- [Create a documentation snapshot \(p. 531\)](#)
- [Update a documentation snapshot \(p. 532\)](#)
- [Get a documentation snapshot \(p. 532\)](#)
- [Associate a documentation snapshot with an API stage \(p. 532\)](#)
- [Download a documentation snapshot associated with a stage \(p. 533\)](#)

## Create a documentation snapshot and associate it with an API stage

To create a snapshot of an API's documentation parts and associate it with an API stage at the same time, submit the following POST request:

```
POST /restapis/restapi_id/documentation/versions HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "documentationVersion" : "1.0.0",
  "stageName": "prod",
  "description" : "My API Documentation v1.0.0"
}
```

If successful, the operation returns a 200 OK response, containing the newly created `DocumentationVersion` instance as the payload.

Alternatively, you can create a documentation snapshot without associating it with an API stage first and then call `restapi:update` to associate the snapshot with a specified API stage. You can also update or query an existing documentation snapshot and then update its stage association. We show the steps in the next four sections.

## Create a documentation snapshot

To create a snapshot of an API's documentation parts, create a new `DocumentationVersion` resource and add it to the `DocumentationVersions` collection of the API:

```
POST /restapis/restapi_id/documentation/versions HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "documentationVersion" : "1.0.0",
  "description" : "My API Documentation v1.0.0"
}
```

If successful, the operation returns a 200 OK response, containing the newly created `DocumentationVersion` instance as the payload.

## Update a documentation snapshot

You can only update a documentation snapshot by modifying the `description` property of the corresponding `DocumentationVersion` resource. The following example shows how to update the description of the documentation snapshot as identified by its version identifier, *version*, e.g., 1.0.0.

```
PATCH /restapis/restapi_id/documentation/versions/version HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "patchOperations": [{
    "op": "replace",
    "path": "/description",
    "value": "My API for testing purposes."
  }]
}
```

If successful, the operation returns a 200 OK response, containing the updated `DocumentationVersion` instance as the payload.

## Get a documentation snapshot

To get a documentation snapshot, submit a `GET` request against the specified `DocumentationVersion` resource. The following example shows how to get a documentation snapshot of a given version identifier, 1.0.0.

```
GET /restapis/<restapi_id>/documentation/versions/1.0.0 HTTP/1.1
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret
```

## Associate a documentation snapshot with an API stage

To publish the API documentation, associate a documentation snapshot with an API stage. You must have already created an API stage before associating the documentation version with the stage.

To associate a documentation snapshot with an API stage using the [API Gateway REST API](#), call the `stage:update` operation to set the desired documentation version on the `stage.documentationVersion` property:

```
PATCH /restapis/RESTAPI_ID/stages/STAGE_NAME
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "patchOperations": [{
    "op": "replace",
    "path": "/documentationVersion",
    "value": "VERSION_IDENTIFIER"
  }]
}
```

## Download a documentation snapshot associated with a stage

After a version of the documentation parts is associated with a stage, you can export the documentation parts together with the API entity definitions, to an external file, using the API Gateway console, the API Gateway REST API, one of its SDKs, or the Amazon CLI for API Gateway. The process is the same as for exporting the API. The exported file format can be JSON or YAML.

Using the API Gateway REST API, you can also explicitly set the `extension=documentation, integrations, authorizers` query parameter to include the API documentation parts, API integrations and authorizers in an API export. By default, documentation parts are included, but integrations and authorizers are excluded, when you export an API. The default output from an API export is suited for distribution of the documentation.

To export the API documentation in an external JSON OpenAPI file using the API Gateway REST API, submit the following `GET` request:

```
GET /restapis/restapi_id/stages/stage_name/exports/swagger?extensions=documentation
HTTP/1.1
Accept: application/json
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret
```

Here, the `x-amazon-apigateway-documentation` object contains the documentation parts and the API entity definitions contains the documentation properties supported by OpenAPI. The output does not include details of integration or Lambda authorizers (formerly known as custom authorizers). To include both details, set `extensions=integrations, authorizers, documentation`. To include details of integrations but not of authorizers, set `extensions=integrations, documentation`.

You must set the `Accept: application/json` header in the request to output the result in a JSON file. To produce the YAML output, change the request header to `Accept: application/yaml`.

As an example, we will look at an API that exposes a simple `GET` method on the root resource (`/`). This API has four API entities defined in an OpenAPI definition file, one for each of the `API`, `MODEL`, `METHOD`, and `RESPONSE` types. A documentation part has been added to each of the `API`, `METHOD`, and `RESPONSE` entities. Calling the preceding documentation-exporting command, we get the following output, with

the documentation parts listed within the `x-amazon-apigateway-documentation` object as an extension to a standard OpenAPI file.

### OpenAPI 3.0

```
{
  "openapi": "3.0.0",
  "info": {
    "description": "API info description",
    "version": "2016-11-22T22:39:14Z",
    "title": "doc",
    "x-bar": "API info x-bar"
  },
  "paths": {
    "/": {
      "get": {
        "description": "Method description.",
        "responses": {
          "200": {
            "description": "200 response",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/Empty"
                }
              }
            }
          }
        }
      },
      "x-example": "x- Method example"
    },
    "x-bar": "resource x-bar"
  }
},
"x-amazon-apigateway-documentation": {
  "version": "1.0.0",
  "createdDate": "2016-11-22T22:41:40Z",
  "documentationParts": [
    {
      "location": {
        "type": "API"
      },
      "properties": {
        "description": "API description",
        "foo": "API foo",
        "x-bar": "API x-bar",
        "info": {
          "description": "API info description",
          "version": "API info version",
          "foo": "API info foo",
          "x-bar": "API info x-bar"
        }
      }
    },
    {
      "location": {
        "type": "METHOD",
        "method": "GET"
      },
      "properties": {
        "description": "Method description.",
        "x-example": "x- Method example",
        "foo": "Method foo",
        "info": {
          "version": "method info version",

```

```

        "description": "method info description",
        "foo": "method info foo"
    }
},
{
    "location": {
        "type": "RESOURCE"
    },
    "properties": {
        "description": "resource description",
        "foo": "resource foo",
        "x-bar": "resource x-bar",
        "info": {
            "description": "resource info description",
            "version": "resource info version",
            "foo": "resource info foo",
            "x-bar": "resource info x-bar"
        }
    }
}
],
"x-bar": "API x-bar",
"servers": [
    {
        "url": "https://rznaap68yi.execute-api.ap-southeast-1.amazonaws.com/
{basePath}",
        "variables": {
            "basePath": {
                "default": "/test"
            }
        }
    }
],
"components": {
    "schemas": {
        "Empty": {
            "type": "object",
            "title": "Empty Schema"
        }
    }
}
}
}

```

## OpenAPI 2.0

```

{
    "swagger" : "2.0",
    "info" : {
        "description" : "API info description",
        "version" : "2016-11-22T22:39:14Z",
        "title" : "doc",
        "x-bar" : "API info x-bar"
    },
    "host" : "rznaap68yi.execute-api.ap-southeast-1.amazonaws.com",
    "basePath" : "/test",
    "schemes" : [ "https" ],
    "paths" : {
        "/" : {
            "get" : {
                "description" : "Method description.",
                "produces" : [ "application/json" ],
                "responses" : {
                    "200" : {

```

```

        "description" : "200 response",
        "schema" : {
            "$ref" : "#/definitions/Empty"
        }
    },
    "x-example" : "x- Method example"
},
"x-bar" : "resource x-bar"
}
},
"definitions" : {
    "Empty" : {
        "type" : "object",
        "title" : "Empty Schema"
    }
},
"x-amazon-apigateway-documentation" : {
    "version" : "1.0.0",
    "createdDate" : "2016-11-22T22:41:40Z",
    "documentationParts" : [ {
        "location" : {
            "type" : "API"
        },
        "properties" : {
            "description" : "API description",
            "foo" : "API foo",
            "x-bar" : "API x-bar",
            "info" : {
                "description" : "API info description",
                "version" : "API info version",
                "foo" : "API info foo",
                "x-bar" : "API info x-bar"
            }
        }
    }, {
        "location" : {
            "type" : "METHOD",
            "method" : "GET"
        },
        "properties" : {
            "description" : "Method description.",
            "x-example" : "x- Method example",
            "foo" : "Method foo",
            "info" : {
                "version" : "method info version",
                "description" : "method info description",
                "foo" : "method info foo"
            }
        }
    }, {
        "location" : {
            "type" : "RESOURCE"
        },
        "properties" : {
            "description" : "resource description",
            "foo" : "resource foo",
            "x-bar" : "resource x-bar",
            "info" : {
                "description" : "resource info description",
                "version" : "resource info version",
                "foo" : "resource info foo",
                "x-bar" : "resource info x-bar"
            }
        }
    }
    ]
}
} ]

```

```
  },  
  "x-bar" : "API x-bar"  
}
```

For an OpenAPI-compliant attribute defined in the `properties` map of a documentation part, API Gateway inserts the attribute into the associated API entity definition. An attribute of `x-something` is a standard OpenAPI extension. This extension gets propagated into the API entity definition. For example, see the `x-example` attribute for the `GET` method. An attribute like `foo` is not part of the OpenAPI specification and is not injected into its associated API entity definitions.

If a documentation-rendering tool (e.g., [OpenAPI UI](#)) parses the API entity definitions to extract documentation attributes, any non OpenAPI-compliant `properties` attributes of a `DocumentationPart` instance are not available for the tool. However, if a documentation-rendering tool parses the `x-amazon-apigateway-documentation` object to get content, or if the tool calls [restapi:documentation-parts](#) and [documentationpart:by-id](#) to retrieve documentation parts from API Gateway, all the documentation attributes are available for the tool to display.

To export the documentation with API entity definitions containing integration details to a JSON OpenAPI file, submit the following `GET` request:

```
GET /restapis/restapi_id/stages/stage_name/exports/swagger?  
extensions=integrations,documentation HTTP/1.1  
Accept: application/json  
Host: apigateway.region.amazonaws.com  
Content-Type: application/json  
X-Amz-Date: YYYYMMDDTtttttZ  
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/  
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,  
Signature=sigv4_secret
```

To export the documentation with API entity definitions containing details of integrations and authorizers to a YAML OpenAPI file, submit the following `GET` request:

```
GET /restapis/restapi_id/stages/stage_name/exports/swagger?  
extensions=integrations,authorizers,documentation HTTP/1.1  
Accept: application/yaml  
Host: apigateway.region.amazonaws.com  
Content-Type: application/json  
X-Amz-Date: YYYYMMDDTtttttZ  
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/  
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,  
Signature=sigv4_secret
```

To use the API Gateway console to export and download the published documentation of an API, follow the instructions in [Export REST API using the API Gateway console \(p. 436\)](#).

## Import API documentation

As with importing API entity definitions, you can import documentation parts from an external OpenAPI file into an API in API Gateway. You specify the to-be-imported documentation parts within the `x-amazon-apigateway-documentation` object (p. 686) extension in a valid OpenAPI definition file. Importing documentation does not alter the existing API entity definitions.

You have an option to merge the newly specified documentation parts into existing documentation parts in API Gateway or to overwrite the existing documentation parts. In the `MERGE` mode, a new



documentation part defined in the OpenAPI file is added to the `DocumentationParts` collection of the API. If an imported `DocumentationPart` already exists, an imported attribute replaces the existing one if the two are different. Other existing documentation attributes remain unaffected. In the `OVERWRITE` mode, the entire `DocumentationParts` collection is replaced according to the imported OpenAPI definition file.

## Importing documentation parts using the API Gateway REST API

To import API documentation using the API Gateway REST API, call the `documentationpart:import` operation. The following example shows how to overwrite existing documentation parts of an API with a single `GET /` method, returning a 200 OK response when successful.

OpenAPI 3.0

```
PUT /restapis/<restapi_id>/documentation/parts&mode=overwrite&failonwarnings=true
Host: apigateway.region.amazonaws.com
Content-Type: application/json
X-Amz-Date: YYYYMMDDTtttttZ
Authorization: AWS4-HMAC-SHA256 Credential=access_key_id/YYYYMMDD/region/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=sigv4_secret

{
  "openapi": "3.0.0",
  "info": {
    "description": "description",
    "version": "1",
    "title": "doc"
  },
  "paths": {
    "/": {
      "get": {
        "description": "Method description.",
        "responses": {
          "200": {
            "description": "200 response",
            "content": {
              "application/json": {
                "schema": {
                  "$ref": "#/components/schemas/Empty"
                }
              }
            }
          }
        }
      }
    }
  },
  "x-amazon-apigateway-documentation": {
    "version": "1.0.3",
    "documentationParts": [
      {
        "location": {
          "type": "API"
        },
        "properties": {
          "description": "API description",
          "info": {
            "description": "API info description 4",
            "version": "API info version 3"
          }
        }
      }
    ]
  }
}
```

```

        "location": {
          "type": "METHOD",
          "method": "GET"
        },
        "properties": {
          "description": "Method description."
        }
      },
      {
        "location": {
          "type": "MODEL",
          "name": "Empty"
        },
        "properties": {
          "title": "Empty Schema"
        }
      },
      {
        "location": {
          "type": "RESPONSE",
          "method": "GET",
          "statusCode": "200"
        },
        "properties": {
          "description": "200 response"
        }
      }
    ]
  },
  "servers": [
    {
      "url": "/"
    }
  ],
  "components": {
    "schemas": {
      "Empty": {
        "type": "object",
        "title": "Empty Schema"
      }
    }
  }
}

```

## OpenAPI 2.0

```

PUT /restapis/<restapi_id>/documentation/parts&mode=overwrite&failonwarnings=true
Host: apigateway.<region>.amazonaws.com
Content-Type: application/json
X-Amz-Date: <YYYYMMDD>T<TTTTT>Z
Authorization: AWS4-HMAC-SHA256 Credential=<access_key_id>/<YYYYMMDD>/<region>/
apigateway/aws4_request, SignedHeaders=content-length;content-type;host;x-amz-date,
Signature=<sigv4_secret>

{
  "swagger": "2.0",
  "info": {
    "description": "description",
    "version": "1",
    "title": "doc"
  },
  "host": "",
  "basePath": "/",
  "schemes": [
    "https"
  ]
}

```

```

],
"paths": {
  "/": {
    "get": {
      "description": "Method description.",
      "produces": [
        "application/json"
      ],
      "responses": {
        "200": {
          "description": "200 response",
          "schema": {
            "$ref": "#/definitions/Empty"
          }
        }
      }
    }
  }
},
"definitions": {
  "Empty": {
    "type": "object",
    "title": "Empty Schema"
  }
},
"x-amazon-apigateway-documentation": {
  "version": "1.0.3",
  "documentationParts": [
    {
      "location": {
        "type": "API"
      },
      "properties": {
        "description": "API description",
        "info": {
          "description": "API info description 4",
          "version": "API info version 3"
        }
      }
    },
    {
      "location": {
        "type": "METHOD",
        "method": "GET"
      },
      "properties": {
        "description": "Method description."
      }
    },
    {
      "location": {
        "type": "MODEL",
        "name": "Empty"
      },
      "properties": {
        "title": "Empty Schema"
      }
    },
    {
      "location": {
        "type": "RESPONSE",
        "method": "GET",
        "statusCode": "200"
      },
      "properties": {
        "description": "200 response"
      }
    }
  ]
}

```

```
}
  }
}
}
```

When successful, this request returns a 200 OK response containing the imported `DocumentationPartId` in the payload.

```
{
  "ids": [
    "kg3mth",
    "796rtf",
    "zhek4p",
    "5ukm9s"
  ]
}
```

In addition, you can also call [restapi:import](#) or [restapi:put](#), supplying the documentation parts in the `x-amazon-apigateway-documentation` object as part of the input OpenAPI file of the API definition. To exclude the documentation parts from the API import, set `ignore=documentation` in the request query parameters.

## Importing documentation parts using the API Gateway console

The following instructions describe how to import documentation parts.

### To use the console to import documentation parts of an API from an external file

1. Choose **Documentation** for the API from the main navigation pane on the console.
2. Choose **Import Documentation** in the **Documentation** pane.
3. Choose **Select OpenAPI File** to load a file from a drive, or copy and paste a file contents into the file view. For an example, see the payload of the example request in [Importing documentation parts using the API Gateway REST API \(p. 538\)](#).
4. Optionally, choose **Fail on warnings** or **Ignore warnings**, and choose **Merge** or **Overwrite** from **Import mode**.
5. Choose **Import**.

## Control access to API documentation

If you have a dedicated documentation team to write and edit your API documentation, you can configure separate access permissions for your developers (for API development) and for your writers or editors (for content development). This is especially appropriate when a third-party vendor is involved in creating the documentation for you.

To grant your documentation team the access to create, update, and publish your API documentation, you can assign the documentation team an IAM role with the following IAM policy, where `account_id` is the Amazon account ID of your documentation team.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "StmntDocPartsAddEditViewDelete",
```

```
    "Effect": "Allow",
    "Action": [
      "apigateway:GET",
      "apigateway:PUT",
      "apigateway:POST",
      "apigateway:PATCH",
      "apigateway:DELETE"
    ],
    "Resource": [
      "arn:aws:apigateway:::restapis/*/documentation/*"
    ]
  }
}
```

For information on setting permissions to access API Gateway resources, see [the section called “How Amazon API Gateway works with IAM” \(p. 715\)](#).

## Generating an SDK for a REST API in API Gateway

To call your REST API in a platform- or language-specific way, you must generate the platform- or language-specific SDK of the API. Currently, API Gateway supports generating an SDK for an API in Java, JavaScript, Java for Android, Objective-C or Swift for iOS, and Ruby.

This section explains how to generate an SDK of an API Gateway API. It also demonstrates how to use the generated SDK in a Java app, a Java for Android app, Objective-C and Swift for iOS apps, and a JavaScript app.

To facilitate the discussion, we use this API Gateway [API \(p. 548\)](#), which exposes this [Simple Calculator \(p. 546\)](#) Lambda function.

Before proceeding, create or import the API and deploy it at least once in API Gateway. For instructions, see [Deploying a REST API in Amazon API Gateway \(p. 436\)](#).

### Topics

- [Generate SDKs for an API using the API Gateway console \(p. 542\)](#)
- [Generate SDKs for an API using Amazon CLI commands \(p. 545\)](#)
- [Simple calculator Lambda function \(p. 546\)](#)
- [Simple calculator API in API Gateway \(p. 548\)](#)
- [Simple calculator API OpenAPI definition \(p. 549\)](#)

## Generate SDKs for an API using the API Gateway console

To generate a platform- or language-specific SDK for an API in API Gateway, you must first create, test, and deploy the API in a stage. For illustration purposes, we use the [Simple Calculator \(p. 549\)](#) API as an example to generate language-specific or platform-specific SDKs throughout this section. For instructions on how to create, test, and deploy this API, see [Create the Simple Calculator API \(p. 548\)](#).

### Topics

- [Generate the Java SDK of an API \(p. 543\)](#)
- [Generate the Android SDK of an API \(p. 543\)](#)
- [Generate the iOS SDK of an API \(p. 544\)](#)
- [Generate the JavaScript SDK of a REST API \(p. 544\)](#)
- [Generate the Ruby SDK of an API \(p. 545\)](#)

## Generate the Java SDK of an API

### To generate the Java SDK of an API in API Gateway

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Stages**.
4. In the **Stages** pane, choose the name of the stage.
5. On the **SDK Generation** tab, for **Platform**, choose **Java** and do the following:
  - a. For **Service Name**, specify the name of your SDK. For example, `SimpleCalcSdk`. This becomes the name of your SDK client class. The name corresponds to the `<name>` tag under `<project>` in the `pom.xml` file, which is in the SDK's project folder. Do not include hyphens.
  - b. For **Java Package Name**, specify a package name for your SDK. For example, `examples.aws.apig.simpleCalc.sdk`. This package name is used as the namespace of your SDK library. Do not include hyphens.
  - c. For **Java Build System**, enter `maven` or `gradle` to specify the build system.
  - d. For **Java Group Id**, enter a group identifier for your SDK project. For example, enter `my-apig-api-examples`. This identifier corresponds to the `<groupId>` tag under `<project>` in the `pom.xml` file, which is in the SDK's project folder.
  - e. For **Java Artifact Id**, enter an artifact identifier for your SDK project. For example, enter `simple-calc-sdk`. This identifier corresponds to the `<artifactId>` tag under `<project>` in the `pom.xml` file, which is in the SDK's project folder.
  - f. For **Java Artifact Version**, enter a version identifier string. For example, `1.0.0`. This version identifier corresponds to the `<version>` tag under `<project>` in the `pom.xml` file, which is in the SDK's project folder.
  - g. For **Source Code License Text**, enter the license text of your source code, if any.
6. Choose **Generate SDK**, and then follow the on-screen directions to download the SDK generated by API Gateway.
7. Follow the instructions in [Use a Java SDK generated by API Gateway for a REST API \(p. 410\)](#) to use the generated SDK.

Every time you update an API, you must redeploy the API and regenerate the SDK to have the updates included.

## Generate the Android SDK of an API

### To generate the Android SDK of an API in API Gateway

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Stages**.
4. In the **Stages** pane, choose the name of the stage.
5. On the **SDK Generation** tab, for **Platform**, choose the Android platform.
  - a. For **Group ID**, enter the unique identifier for the corresponding project. This is used in the `pom.xml` file (for example, `com.mycompany`).
  - b. For **Invoker package**, enter the namespace for the generated client classes (for example, `com.mycompany.clientsdk`).
  - c. For **Artifact ID**, enter the name of the compiled `.jar` file without the version. This is used in the `pom.xml` file (for example, `aws-apigateway-api-sdk`).

- d. For **Artifact version**, enter the artifact version number for the generated client. This is used in the `pom.xml` file and should follow a *major.minor.patch* pattern (for example, `1.0.0`).
6. Choose **Generate SDK**, and then follow the on-screen directions to download the SDK generated by API Gateway.
7. Follow the instructions in [Use an Android SDK generated by API Gateway for a REST API \(p. 413\)](#) to use the generated SDK.

Every time you update an API, you must redeploy the API and regenerate the SDK to have the updates included.

## Generate the iOS SDK of an API

### To generate the iOS SDK of an API in API Gateway

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Stages**.
4. In the **Stages** pane, choose the name of the stage.
5. On the **SDK Generation** tab, for **Platform**, choose the **iOS (Objective-C)** or **iOS (Swift)** platform.
  - Type a unique prefix in the **Prefix** box.

The effect of prefix is as follows: if you assign, for example, `SIMPLE_CALC` as the prefix for the SDK of the [SimpleCalc \(p. 548\)](#) API with `Input`, `Output`, and `Result` models, the generated SDK will contain the `SIMPLE_CALCSimpleCalcClient` class that encapsulates the API, including the method requests/responses. In addition, the generated SDK will contain the `SIMPLE_CALCInput`, `SIMPLE_CALCOutput`, and `SIMPLE_CALCResult` classes to represent the input, output, and results, respectively, to represent the request input and response output. For more information, see [Use iOS SDK generated by API Gateway for a REST API in Objective-C or Swift \(p. 418\)](#).

6. Choose **Generate SDK**, and then follow the on-screen directions to download the SDK generated by API Gateway.
7. Follow the instructions in [Use iOS SDK generated by API Gateway for a REST API in Objective-C or Swift \(p. 418\)](#) to use the generated SDK.

Every time you update an API, you must redeploy the API and regenerate the SDK to have the updates included.

## Generate the JavaScript SDK of a REST API

### To generate the JavaScript SDK of an API in API Gateway

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. In the list of APIs, choose the name of the API that you want to generate the SDK for.
3. In the pane on the left that contains the name of the API, choose **Stages**.
4. In the **Stages** pane, choose the name of the stage.
5. On the **SDK Generation** tab, for **Platform**, choose **JavaScript**.
6. Choose **Generate SDK**, and then follow the on-screen directions to download the SDK generated by API Gateway.
7. Follow the instructions in [Use a JavaScript SDK generated by API Gateway for a REST API \(p. 415\)](#) to use the generated SDK.

Every time you update an API, you must redeploy the API and regenerate the SDK to have the updates included.

## Generate the Ruby SDK of an API

### To generate the Ruby SDK of an API in API Gateway

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Stages**.
4. In the **Stages** pane, choose the name of the stage.
5. On the **SDK Generation** tab, for **Platform**, choose **Ruby**.
  - a. For **Service Name**, specify the name of your SDK. For example, `SimpleCalc`. This is used to generate the Ruby Gem namespace of your API. The name must be all letters, (a-zA-Z), without any other special characters or numbers.
  - b. For **Ruby Gem Name**, specify the name of the Ruby Gem to contain the generated SDK source code for your API. By default, it is the lower-cased service name plus the `-sdk` suffix—for example, `simplecalc-sdk`.
  - c. For **Ruby Gem Version**, specify a version number for the generated Ruby Gem. By default, it is set to `1.0.0`.
6. Choose **Generate SDK**, and then follow the on-screen directions to download the SDK generated by API Gateway.
7. Follow the instructions in [Use a Ruby SDK generated by API Gateway for a REST API \(p. 416\)](#) to use the generated SDK.

Every time you update an API, you must redeploy the API and regenerate the SDK to have the updates included.

## Generate SDKs for an API using Amazon CLI commands

You can use Amazon CLI to generate and download an SDK of an API for a supported platform by calling the `get-sdk` command. We demonstrate this for some of the supported platforms in the following.

### Topics

- [Generate and download the Java for Android SDK using the Amazon CLI \(p. 545\)](#)
- [Generate and download the JavaScript SDK using the Amazon CLI \(p. 546\)](#)
- [Generate and download the Ruby SDK using the Amazon CLI \(p. 546\)](#)

### Generate and download the Java for Android SDK using the Amazon CLI

To generate and download a Java for Android SDK generated by API Gateway of an API (`udpuvzbkc`) at a given stage (`test`), call the command as follows:

```
aws apigateway get-sdk \
  --rest-api-id udpuvzbkc \
  --stage-name test \
  --sdk-type android \
  --parameters groupId='com.mycompany',\
    invokerPackage='com.mycompany.myApiSdk',\
    artifactId='myApiSdk',\
    artifactVersion='0.0.1' \
```



```
~/apps/myApi/myApi-android-sdk.zip
```

The last input of `~/apps/myApi/myApi-android-sdk.zip` is the path to the downloaded SDK file named `myApi-android-sdk.zip`.

## Generate and download the JavaScript SDK using the Amazon CLI

To generate and download a JavaScript SDK generated by API Gateway of an API (`udpuvvzbkc`) at a given stage (`test`), call the command as follows:

```
aws apigateway get-sdk \  
  --rest-api-id udpuvvzbkc \  
  --stage-name test \  
  --sdk-type javascript \  
  ~/apps/myApi/myApi-js-sdk.zip
```

The last input of `~/apps/myApi/myApi-js-sdk.zip` is the path to the downloaded SDK file named `myApi-js-sdk.zip`.

## Generate and download the Ruby SDK using the Amazon CLI

To generate and download a Ruby SDK of an API (`udpuvvzbkc`) at a given stage (`test`), call the command as follows:

```
aws apigateway get-sdk \  
  --rest-api-id udpuvvzbkc \  
  --stage-name test \  
  --sdk-type ruby \  
  --parameters service.name=myApiRubySdk,ruby.gem-name=myApi,ruby.gem-  
version=0.01 \  
  ~/apps/myApi/myApi-ruby-sdk.zip
```

The last input of `~/apps/myApi/myApi-ruby-sdk.zip` is the path to the downloaded SDK file named `myApi-ruby-sdk.zip`.

Next, we show how to use the generated SDK to call the underlying API. For more information, see [Call REST API through generated SDKs \(p. 409\)](#).

## Simple calculator Lambda function

As an illustration, we will use a Node.js Lambda function that performs the binary operations of addition, subtraction, multiplication and division.

### Topics

- [Simple calculator Lambda function input format \(p. 546\)](#)
- [Simple calculator Lambda function output format \(p. 547\)](#)
- [Simple calculator Lambda function implementation \(p. 547\)](#)
- [Create the simple calculator Lambda function \(p. 547\)](#)

### Simple calculator Lambda function input format

This function takes an input of the following format:

```
{ "a": "Number", "b": "Number", "op": "string" }
```

where `op` can be any of (+, -, \*, /, add, sub, mul, div).

## Simple calculator Lambda function output format

When an operation succeeds, it returns the result of the following format:

```
{ "a": "Number", "b": "Number", "op": "string", "c": "Number"}
```

where `c` holds the result of the calculation.

## Simple calculator Lambda function implementation

The implementation of the Lambda function is as follows:

```
console.log('Loading the calculator function');

exports.handler = function(event, context, callback) {
  console.log('Received event:', JSON.stringify(event, null, 2));
  if (event.a === undefined || event.b === undefined || event.op === undefined) {
    callback("400 Invalid Input");
  }

  var res = {};
  res.a = Number(event.a);
  res.b = Number(event.b);
  res.op = event.op;

  if (isNaN(event.a) || isNaN(event.b)) {
    callback("400 Invalid Operand");
  }

  switch(event.op)
  {
    case "+":
    case "add":
      res.c = res.a + res.b;
      break;
    case "-":
    case "sub":
      res.c = res.a - res.b;
      break;
    case "*":
    case "mul":
      res.c = res.a * res.b;
      break;
    case "/":
    case "div":
      res.c = res.b===0 ? NaN : Number(event.a) / Number(event.b);
      break;
    default:
      callback("400 Invalid Operator");
      break;
  }
  callback(null, res);
};
```

## Create the simple calculator Lambda function

You can use the Amazon Lambda console at <https://console.amazonaws.cn/lambda/> to create the function, pasting the above code listing into the online code editor as follows.

## Simple calculator API in API Gateway

Our simple calculator API exposes three methods (GET, POST, GET) to invoke the [the section called “Simple calculator Lambda function” \(p. 546\)](#). A graphical representation of this API is shown as follows:

These three methods show different ways to supply the input for the backend Lambda function to perform the same operation:

- The `GET /?a=...&b=...&op=...` method uses the query parameters to specify the input.
- The `POST /` method uses a JSON payload of `{ "a": "Number", "b": "Number", "op": "string" }` to specify the input.
- The `GET /{a}/{b}/{op}` method uses the path parameters to specify the input.

If not defined, API Gateway generates the corresponding SDK method name by combining the HTTP method and path parts. The root path part (`/`) is referred to as `ApiRoot`. For example, the default Java SDK method name for the API method of `GET /?a=...&b=...&op=...` is `getABOp`, the default SDK method name for `POST /` is `postApiRoot`, and the default SDK method name for `GET /{a}/{b}/{op}` is `getABOp`. Individual SDKs may customize the convention. Consult the documentation in the generated SDK source for SDK specific method names.

You can, and should, override the default SDK method names by specifying the `operationName` property on each API method. You can do so when [creating the API method](#) or [updating the API method](#) using the API Gateway REST API. In the API Swagger definition, you can set the `operationId` to achieve the same result.

Before showing how to call these methods using an SDK generated by API Gateway for this API, let's recall briefly how to set them up. For detailed instructions, see [Creating a REST API in Amazon API Gateway \(p. 205\)](#). If you're new to API Gateway, see [Build an API Gateway REST API with Lambda integration \(p. 27\)](#) first.

### Create models for input and output

To specify strongly typed input in the SDK, we create an `Input` model for the API:

Similarly, to describe the response body data type, we create the following models in the API Gateway:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "type": "object",
  "properties": {
    "c": {"type": "number"}
  },
  "title": "Output"
}
```

and

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "type": "object",
  "properties": {
    "input": {
      "$ref": "https://apigateway.amazonaws.com/restapis/t7dve4zn36/models/Input"
    },
    "output": {
      "$ref": "https://apigateway.amazonaws.com/restapis/t7dve4zn36/models/Output"
    }
  }
}
```

```
    }  
  },  
  "title": "Result"  
}
```

## Set up GET / method query parameters

For the `GET /?a=..&b=..&op=..` method, the query parameters are declared in **Method Request**:

## Set up data model for the payload as input to the backend

For the `POST /` method, we create the `Input` model and add it to the method request to define the shape of input data.

With this model, your API customers can call the SDK to specify the input by instantiating an `Input` object. Without this model, your customers would be required to create dictionary object to represent the JSON input to the Lambda function.

## Set up data model for the result output from the backend

For all three methods, we create the `Result` model and add it to the method's `Method Response` to define the shape of output returned by the Lambda function.

With this model, your API customers can parse a successful output by reading properties of a `Result` object. Without this model, customers would be required to create dictionary object to represent the JSON output.

In addition, you can also create and set up the API following the Swagger API [definitions \(p. 549\)](#).

## Simple calculator API OpenAPI definition

The following is the OpenAPI definition of the simple calculator API. You can import it into your account. However, you need to reset the resource-based permissions on the [Lambda function \(p. 546\)](#) after the import. To do so, re-select the Lambda function that you created in your account from the **Integration Request** in the API Gateway console. This will cause the API Gateway console to reset the required permissions. Alternatively, you can use Amazon Command Line Interface for Lambda command of [add-permission](#).

OpenAPI 2.0

```
{  
  "swagger": "2.0",  
  "info": {  
    "version": "2016-09-29T20:27:30Z",  
    "title": "SimpleCalc"  
  },  
  "host": "t6dve4zn25.execute-api.us-west-2.amazonaws.com",  
  "basePath": "/demo",  
  "schemes": [  
    "https"  
  ],  
  "paths": {  
    "/": {  
      "get": {  
        "consumes": [  
          "application/json"  
        ],  
        "produces": [  

```

```

        "application/json"
    ],
    "parameters": [
        {
            "name": "op",
            "in": "query",
            "required": false,
            "type": "string"
        },
        {
            "name": "a",
            "in": "query",
            "required": false,
            "type": "string"
        },
        {
            "name": "b",
            "in": "query",
            "required": false,
            "type": "string"
        }
    ],
    "responses": {
        "200": {
            "description": "200 response",
            "schema": {
                "$ref": "#/definitions/Result"
            }
        }
    },
    "x-amazon-apigateway-integration": {
        "requestTemplates": {
            "application/json": "#set($inputRoot = $input.path('$'))\n{\n
            \\"a\" : $input.params('a'),\n \\"b\" : $input.params('b'),\n \\"op\" :
            \\"$input.params('op')\"}\n}"
        },
        "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/
        arn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
        "passthroughBehavior": "when_no_templates",
        "httpMethod": "POST",
        "responses": {
            "default": {
                "statusCode": "200",
                "responseTemplates": {
                    "application/json": "#set($inputRoot = $input.path('$'))\n{\n
                    \\"input\" : {\n \\"a\" : $inputRoot.a,\n \\"b\" : $inputRoot.b,\n \\"op\" :
                    \\"$inputRoot.op\" },\n \\"output\" : {\n \\"c\" : $inputRoot.c\n }\n}"
                }
            }
        },
        "type": "aws"
    }
},
"post": {
    "consumes": [
        "application/json"
    ],
    "produces": [
        "application/json"
    ],
    "parameters": [
        {
            "in": "body",
            "name": "Input",
            "required": true,
            "schema": {

```

```

        "$ref": "#/definitions/Input"
      }
    ],
    "responses": {
      "200": {
        "description": "200 response",
        "schema": {
          "$ref": "#/definitions/Result"
        }
      }
    },
    "x-amazon-apigateway-integration": {
      "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/arn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
      "passthroughBehavior": "when_no_match",
      "httpMethod": "POST",
      "responses": {
        "default": {
          "statusCode": "200",
          "responseTemplates": {
            "application/json": "#set($inputRoot = $input.path('$'))\n{\n
            \"input\": {\n      \"a\": $inputRoot.a,\n      \"b\": $inputRoot.b,\n      \"op\":\n      \"${inputRoot.op}\n    },\n    \"output\": {\n      \"c\": $inputRoot.c\n    }\n}"
          }
        }
      },
      "type": "aws"
    }
  },
  "/{a}": {
    "x-amazon-apigateway-any-method": {
      "consumes": [
        "application/json"
      ],
      "produces": [
        "application/json"
      ],
      "parameters": [
        {
          "name": "a",
          "in": "path",
          "required": true,
          "type": "string"
        }
      ],
      "responses": {
        "404": {
          "description": "404 response"
        }
      },
      "x-amazon-apigateway-integration": {
        "requestTemplates": {
          "application/json": "{$\"statusCode\": 200}"
        },
        "passthroughBehavior": "when_no_match",
        "responses": {
          "default": {
            "statusCode": "404",
            "responseTemplates": {
              "application/json": "{$ \"Message\" : \"Can't $context.httpMethod $context.resourcePath\" }"
            }
          }
        }
      }
    }
  },

```

```

    "type": "mock"
  }
},
"/{a}/{b}": {
  "x-amazon-apigateway-any-method": {
    "consumes": [
      "application/json"
    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "a",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "name": "b",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ],
    "responses": {
      "404": {
        "description": "404 response"
      }
    },
    "x-amazon-apigateway-integration": {
      "requestTemplates": {
        "application/json": "{$\"statusCode\": 200}"
      },
      "passthroughBehavior": "when_no_match",
      "responses": {
        "default": {
          "statusCode": "404",
          "responseTemplates": {
            "application/json": "{$ \"Message\" : \"Can't $context.httpMethod
$context.resourcePath\" }"
          }
        }
      },
      "type": "mock"
    }
  }
},
"/{a}/{b}/{op}": {
  "get": {
    "consumes": [
      "application/json"
    ],
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "a",
        "in": "path",
        "required": true,
        "type": "string"
      },
      {
        "name": "b",

```

```

        "in": "path",
        "required": true,
        "type": "string"
    },
    {
        "name": "op",
        "in": "path",
        "required": true,
        "type": "string"
    }
],
"responses": {
    "200": {
        "description": "200 response",
        "schema": {
            "$ref": "#/definitions/Result"
        }
    }
},
"x-amazon-apigateway-integration": {
    "requestTemplates": {
        "application/json": "#set($inputRoot = $input.path('$'))\n{\n
        \"a\" : $input.params('a'),\n  \"b\" : $input.params('b'),\n  \"op\" :
        \"$input.params('op')\"\n}"
    },
    "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-west-2:123456789012:function:Calc/invocations",
    "passthroughBehavior": "when_no_templates",
    "httpMethod": "POST",
    "responses": {
        "default": {
            "statusCode": "200",
            "responseTemplates": {
                "application/json": "#set($inputRoot = $input.path('$'))\n{\n
                \"input\" : {\n    \"a\" : $inputRoot.a,\n    \"b\" : $inputRoot.b,\n    \"op\" :
                \"$inputRoot.op\"\n  },\n  \"output\" : {\n    \"c\" : $inputRoot.c\n  }\n}"
            }
        }
    },
    "type": "aws"
}
}
},
"definitions": {
    "Input": {
        "type": "object",
        "properties": {
            "a": {
                "type": "number"
            },
            "b": {
                "type": "number"
            },
            "op": {
                "type": "string"
            }
        }
    },
    "Output": {
        "type": "object",
        "properties": {
            "c": {
                "type": "number"
            }
        }
    }
}

```



```
    },
    "title": "Output"
  },
  "Result": {
    "type": "object",
    "properties": {
      "input": {
        "$ref": "#/definitions/Input"
      },
      "output": {
        "$ref": "#/definitions/Output"
      }
    }
  },
  "title": "Result"
}
}
```

## Use the serverless developer portal to catalog your API Gateway APIs

A *developer portal* is an application that you use to make your APIs available to your customers. You can use the Serverless Developer Portal to publish API Gateway managed APIs directly from API Gateway. You can also use it to publish non-API Gateway managed APIs by uploading OpenAPI definitions for them. When you publish APIs in a developer portal, your customers can easily:

- Discover which APIs are available.
- Browse your API documentation.
- Register for—and immediately receive—their own API key that can be used to build applications.
- Try out your APIs in the developer portal UI.
- Monitor their own API usage.

Amazon API Gateway publishes a regularly updated Serverless Developer Portal application in the [Amazon Serverless Application Repository](#) and on [GitHub](#). It is released under the [Apache 2.0 license](#), which lets you customize and incorporate it into your build and deployment tools. The front end is written in React and is designed to be fully customizable. See <https://github.com/awslabs/aws-api-gateway-developer-portal/wiki/Customization>.

For more information about the Amazon Serverless Application Repository, see the [Amazon Serverless Application Repository Developer Guide](#).

### Tip

If you'd like to try out an example developer portal, see <https://developer.exampleapigateway.com/>.

### Topics

- [Create a developer portal \(p. 555\)](#)
- [Developer portal settings \(p. 556\)](#)
- [Create an admin user for your developer portal \(p. 558\)](#)
- [Manage users for your developer portal \(p. 558\)](#)
- [Publish an API Gateway managed API to your developer portal \(p. 558\)](#)
- [Update or delete an API Gateway managed API \(p. 559\)](#)
- [Remove a non-API Gateway managed API \(p. 560\)](#)
- [Publish a non-API Gateway managed API to your developer portal \(p. 560\)](#)

- [How your customers use your developer portal \(p. 560\)](#)
- [Best practices for developer portals \(p. 561\)](#)

## Create a developer portal

You can deploy the API Gateway Serverless Developer Portal as-is or customize it to fit your branding. There are two ways to deploy your developer portal:

- By using the Amazon Serverless Application Repository. Choose the **Deploy** button to launch the API Gateway Serverless Developer Portal Amazon CloudFormation stack and enter a handful of stack parameters in the Lambda console.
- By downloading the API Gateway Serverless Developer Portal from the Amazon GitHub repository and launching the API Gateway Serverless Developer Portal Amazon CloudFormation stack from the Amazon SAM CLI.

### To deploy the serverless developer portal using the Amazon Serverless Application Repository

1. Go to the [API Gateway Serverless Developer Portal](#) page in the Amazon Serverless Application Repository.
2. Choose **Deploy**.

#### Note

You might be prompted to sign into the Amazon Lambda console.

3. In the Lambda console, enter the required [developer portal stack parameters \(p. 556\)](#) under **Application settings**.

#### Note

The S3 bucket names and the Amazon Cognito domain prefix are required; the other settings are optional.

4. If you want to enable the **Got an opinion?** customer feedback button, you need to:
  - Enter an email address in the **DevPortalAdminEmail** box. When a customer submits feedback, email is sent to this address.

#### Note

If you don't supply an email address, the **Got an opinion?** doesn't appear in the developer portal.

- You can optionally enter a table name in the **DevPortalFeedbackTableName** box. The default name is **DevPortalFeedback**. When a customer submits feedback, it is stored in a DynamoDB table with this name.
5. Select the check box next to **I acknowledge that this app creates custom IAM roles and resource policies**.
  6. Choose **Deploy**.
  7. If you entered an email address in the **AdminEmail** stack parameter, an Amazon SNS subscription email is sent to that email address. This email confirms your subscription to the Amazon SNS topic that you specified in the **MarketplaceSubscriptionTopicProductCode** setting.

### To download and deploy the serverless developer portal using Amazon SAM

1. Ensure that you have the latest [Amazon CLI](#) and [Amazon SAM CLI](#) installed and configured.
2. Download or clone the [API Gateway Serverless Developer Portal](#) repository.
3. Ensure that you have a private Amazon S3 bucket where you can upload the zipped Lambda functions. If you don't have one, you can create one using the Amazon S3 console or CLI.

In the Amazon SAM CLI, run the following command from the project root, replacing `{your-lambda-artifacts-bucket-name}` with the name of your Amazon S3 bucket:

```
sam package --template-file ./cloudformation/template.yaml \  
--output-template-file ./cloudformation/packaged.yaml \  
--s3-bucket {your-lambda-artifacts-bucket-name}
```

4. For this step, see [the section called “Developer portal settings” \(p. 556\)](#) for more information about parameters (such as `CognitoDomainNameOrPrefix`) that follow `--parameter-overrides`.

#### Note

Ensure that you have a private Amazon S3 bucket where you can upload the Amazon SAM template. (Amazon CloudFormation reads the template from the bucket to deploy the developer portal.) This can be the same bucket that you specified in the previous step for uploading the zipped Lambda functions.

Run the following command from the project root, replacing:

- `{your-template-bucket-name}` with the name of your Amazon S3 bucket.
- `{custom-prefix}` with a prefix that is globally unique.
- `{cognito-domain-or-prefix}` with a unique string.

```
sam deploy --template-file ./cloudformation/packaged.yaml \  
--s3-bucket {your-template-bucket-name} \  
--stack-name "{custom-prefix}-dev-portal" \  
--capabilities CAPABILITY_NAMED_IAM \  
--parameter-overrides CognitoDomainNameOrPrefix= "{cognito-domain-or-  
prefix}" DevPortalSiteS3BucketName="{custom-prefix}-dev-portal-static-assets"  
ArtifactsS3BucketName="{custom-prefix}-dev-portal-artifacts"
```

After your developer portal has been fully deployed, you can get its URL as follows.

### To get the URL for your newly created developer portal

1. Open the Amazon CloudFormation console.
2. Choose the name of the stack (`aws-serverless-repository-api-gateway-dev-portal` is the default stack name).
3. Open the **Outputs** section. The URL for the developer portal is specified in the `websiteURL` property.

## Developer portal settings

The following are settings you need to set during and after deployment of your developer portal:

#### Note

Many of the settings below can be changed after you've deployed your developer portal, by updating the Amazon CloudFormation stack. For more information, see [Amazon CloudFormation Stack Updates](#).

#### ArtifactsS3BucketName (REQUIRED)

The deployment process creates a privately accessible Amazon S3 bucket where the catalog metadata is stored. Specify a name to assign to the bucket. This name must be globally unique.

### **CognitoDomainNameOrPrefix (REQUIRED)**

This string is used with the Amazon Cognito hosted UI for user sign-up and sign-in. Specify a unique domain name or prefix string.

### **CognitoIdentityPoolName**

The deployment process creates an Amazon Cognito identity pool. The default name for the identity pool is **DevPortalIdentityPool**.

### **CustomDomainNameAcmCertArn**

If you provided a domain name associated with an ACM certificate, then you must also specify here the ACM certificate's ARN. Leave this blank to create a developer portal without a custom domain name.

### **DevPortalAdminEmail**

Specify an email address to enable the **Got an opinion?** customer feedback button. When a customer submits feedback, email is sent to this address.

#### **Note**

If you don't supply an email address, the **Got an opinion?** button doesn't appear in the developer portal.

### **DevPortalFeedbackTableName**

If you specify an email address for **DevPortalAdminEmail**, the deployment process creates a DynamoDB table to store feedback entered by customers. The default name is **DevPortalFeedback**. You can optionally specify your own table name.

### **DevPortalCustomersTableName**

The deployment process creates a DynamoDB table where customer accounts are stored. You can optionally specify a name to assign to this table. It must be unique within your account Region. The default name of the table is **DevPortalCustomers**.

### **DevPortalSiteS3BucketName (REQUIRED)**

The deployment process creates a privately accessible Amazon S3 bucket where the web application code is stored. Specify a name to assign to this bucket. This name must be globally unique.

### **MarketplaceSubscriptionTopicProductCode**

This is the Amazon SNS topic suffix for subscribe/unsubscribe events. Enter the desired value. The default value is **DevPortalMarketplaceSubscriptionTopic**. This setting is only relevant if you're using Amazon Web Services Marketplace integration. For more information, see [SaaS customer onboarding](#).

### **StaticAssetRebuildMode**

By default, a static asset rebuild doesn't overwrite custom content. Specify **overwrite-content** to replace the custom content with your local version.

#### **Important**

If you specify **overwrite-content**, all custom changes in your Amazon S3 bucket will be lost. Don't do this unless you know what you're doing.

### **StaticAssetRebuildToken**

Provide a token different from the last deployment's token to re-upload the developer portal site's static assets. You can provide a timestamp or GUID on each deployment to always re-upload the assets.

### **UseRoute53Nameservers**

Only applicable if you're creating a custom domain name for your developer portal. If set to **true**, a Route 53 HostedZone and RecordSet are created for you. Otherwise, leave this field set to **false** and provide your own name server hosting.

## Create an admin user for your developer portal

After you deploy your developer portal, create at least one admin user. You do that by creating a new user and adding that user to the administrator group for the Amazon Cognito user pool that Amazon CloudFormation created when you deployed the developer portal.

### Create an admin user

1. In your developer portal, choose **Register**.
2. Enter an email address and password and choose **Register**.
3. In a separate browser tab, sign in to the Amazon Cognito console.
4. Choose **Manage User Pools**.
5. Choose the user pool for your developer portal that you set when you deployed the developer portal.
6. Choose the user to promote to administrator.
7. Choose **Add to group**.
8. From the dropdown menu, choose the **{stackname}-dev-portalAdminsGroup**, where **{stackname}** is the stack name from when you deployed the developer portal.
9. Choose **Add to group**.
10. In your developer portal, log out and log back in using the same credentials. You should now see an **Admin Panel** link in the upper right corner, next to **My Dashboard**.

## Manage users for your developer portal

After you sign in as an admin user, you can use the **Accounts** section of the **Admin Panel** to manage users. An admin user can invite new users, delete users, and promote existing users to admin status from the developer portal.

## Publish an API Gateway managed API to your developer portal

The following steps outline how you, as the API owner, publish an API to your developer portal so that your customers can subscribe to it.

### Step 1: Make an API Gateway managed API available for publishing

1. If you haven't already done so, [deploy the API to a stage \(p. 438\)](#).
2. If you haven't already done so, create a [usage plan \(p. 491\)](#) and associate it with the API stage for the deployed API.

#### Note

You don't need to associate API keys with the usage plan. The developer portal does this for you.

3. Sign in to the **Developer Portal** and go to the **Admin Panel**.
4. You should see the API in the **Admin Panel** API list. In the API list, APIs are grouped by usage plan. The **Not Subscribable No Usage Plan** group lists the APIs that aren't associated with a usage plan.

### Step 2: Make the API Gateway managed API visible in the developer portal

1. In the **Admin Panel** API list, check the **Displayed** value for your API. When it's first uploaded, this value is set to **False**.

2. To make the API visible in the developer portal, choose the **False** button. Its value changes to **True**, which indicates that the API is now visible.

**Tip**

To make all APIs in a usage plan visible, choose the **False** or **Partial** button in the header bar for the usage plan.

3. Navigate to the **APIs** panel to see the developer portal as your customers see it. You should see your API listed in the left navigation column.

If the API is deployed to a stage that's associated with a usage plan, you should see a **Subscribe** button for the API. This button causes the customer's API key to be associated with the usage plan that the API is associated with.

Now that the API Gateway managed API is displayed, you can enable SDK generation so that your customers are able to download an SDK for it.

### Step 3: Enable SDK generation

1. In the **Admin Panel** API list, choose the **Disabled** button. Its value changes to **Enabled**, which indicates that SDK generation is now allowed.
2. Navigate to the **APIs** panel and choose your API in the left navigation column. You should now see **Download SDK** and **Export API** buttons.

## Update or delete an API Gateway managed API

If you make changes to your API in API Gateway after you've published it, you need to redeploy it.

### To update an API Gateway managed API

1. Make the desired changes to the API in the API Gateway console, Amazon CLI, or an SDK.
2. Redeploy the API to the same stage as before.
3. In the developer portal, in the **Admin Panel** API list, choose **Update**. This updates the API that's displayed in the developer portal UI.

**Note**

The **Download SDK** button always gets the latest deployed version of your API, even if you don't update it in the developer portal.

4. Navigate to the **APIs** panel and choose your API in the left navigation column. You should see your changes.

To stop displaying an API in the developer portal API list (without revoking customers' access to it):

1. In the **Admin Panel** API list, check the **Displayed** value for your API. If the API is visible, this value is set to **True**.
2. To make the API invisible, choose the **True** button. Its value changes to **False**, which indicates that the API is now invisible.
3. Navigate to the **APIs** panel. You should no longer see your API listed in the left navigation column.

To revoke customers' access to an API without deleting it entirely, you must do one of the following in the [API Gateway console \(p. 496\)](#) or the [API Gateway CLI or REST API \(p. 500\)](#):

- Remove the API keys from the usage plan.
- Remove the API stage from the usage plan.

## Remove a non-API Gateway managed API

To stop displaying a non-API Gateway managed API and remove customers' access to it, choose **Delete**. This won't delete the API, but it will delete its OpenAPI specification file from the developer portal.

## Publish a non-API Gateway managed API to your developer portal

The following steps outline how you publish non-API Gateway managed (or "generic") APIs to your customers. You can upload OpenAPI 2.0 (Swagger) or 3.x definitions for the APIs in JSON, YAML, or YML files.

### To publish a non-API Gateway managed API in your developer portal

1. Sign in to the **Developer Portal** and go to the **Admin Panel**.
2. Under **Generic APIs**, choose **Add API**.
3. Browse to the directory where the OpenAPI files for your APIs are located, and choose the files to upload.
4. Choose **Upload**.

#### Note

If any of the files can't be parsed or don't contain an API title, you'll get a warning, and those files won't be uploaded. All other files will be uploaded. You'll need to choose the **x** icon to dismiss the dialog.

5. You should now see your API listed under **Generic APIs**. If you don't, navigate away from the **Admin Panel** and back to it again to refresh the list.

## How your customers use your developer portal

To build applications and test your APIs, your customers need to create developer accounts by registering with your developer portal.

### To create a developer account and get an API key

1. In the developer portal, choose **Register**.
2. Enter an email address and password and choose **Register**.
3. To locate the API key, choose **My Dashboard**.

A developer account gives your customer an API key, which is typically needed to use and test your APIs. It enables usage tracking for both you and your customers.

When a customer first registers, their new API key won't be tied to any of your APIs.

### To activate the API key for an API

1. Choose **APIs**.
2. Choose the API from the API list and choose **Subscribe**.

This causes the API key to be associated with the usage plan that the API is associated with.

The customer has now subscribed to the API, and they can make calls to methods on the API. Daily usage statistics for the API will be displayed in **MyDashboard**.

A customer can try out API methods in the developer portal UI without subscribing.

**Note**

If any of the API's methods require an API key, an **Authorize** button will appear above the method list. Methods that require an API key will have a black lock icon. To try out methods that require an API key, choose the **Authorize** button and enter a valid API key that's associated with the usage plan for the API stage.

You can safely ignore the **Authorize** button when it appears on APIs that you're already subscribed to.

Your customers can submit customer feedback through the developer portal.

The customer's feedback is stored in the DynamoDB table for the developer portal. The default name of this table is **DevPortalFeedback**. Also, email is sent to the email addresses that was specified in the **DevPortalAdminEmail** field. If no email address was specified when the developer portal was deployed, the **Got an opinion?** button does not appear.

**Note**

If you change the name of this table, you must use a name that is unique within your account Region.

If you've enabled SDK generation for the API in the **Admin Panel**, the customer can download an SDK for it and export the API definition. To learn more, see [Generating an SDK for a REST API in API Gateway \(p. 542\)](#) and [Export a REST API from API Gateway \(p. 433\)](#).

## Best practices for developer portals

The following are suggested best practices to follow when deploying a developer portal.

- In most cases, you'll only want to deploy one developer portal for all of your APIs. In some cases, you might choose to have separate developer portals for development and production versions of your APIs. We don't recommend using more than one developer portal for production APIs.
- When you create a usage plan and associate it with a stage, you don't need to associate any API keys with the usage plan. The developer portal does this for you.
- Note that, if any APIs in a given usage plan are visible, *all* APIs in that usage plan are subscribable, even if you haven't made them visible to your customers.

## Sell your API Gateway APIs through Amazon Web Services Marketplace

After you build, test, and deploy your APIs, you can package them in an API Gateway [usage plan \(p. 491\)](#) and sell the plan as a Software as a Service (SaaS) product through Amazon Web Services Marketplace. API buyers subscribing to your product offering are billed by Amazon Web Services Marketplace based on the number of requests made to the usage plan.

To sell your APIs on Amazon Web Services Marketplace, you must set up the sales channel to integrate Amazon Web Services Marketplace with API Gateway. Generally speaking, this involves listing your product on Amazon Web Services Marketplace, setting up an IAM role with appropriate policies to allow API Gateway to send usage metrics to Amazon Web Services Marketplace, associating an Amazon Web Services Marketplace product with an API Gateway usage plan, and associating an Amazon Web Services Marketplace buyer with an API Gateway API key. Details are discussed in the following sections.

For more information about selling your API as a SaaS product on Amazon Web Services Marketplace, see the [Amazon Web Services Marketplace User Guide](#).

### Topics



- [Initialize Amazon Web Services Marketplace integration with API Gateway \(p. 562\)](#)
- [Handle customer subscription to usage plans \(p. 563\)](#)

## Initialize Amazon Web Services Marketplace integration with API Gateway

The following tasks are for one-time initialization of Amazon Web Services Marketplace integration with API Gateway, which enables you to sell your APIs as a SaaS product.

### List a product on Amazon Web Services Marketplace

To list your usage plan as a SaaS product, submit a product load form through [Amazon Web Services Marketplace](#). The product must contain a dimension named `apigateway` of the `requests` type. This dimension defines the price-per-request and is used by API Gateway to meter requests to your APIs.

### Create the metering role

Create an IAM role named `ApiGatewayMarketplaceMeteringRole` with the following execution policy and trust policy. This role allows API Gateway to send usage metrics to Amazon Web Services Marketplace on your behalf.

#### Execution policy of the metering role

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "aws-marketplace:BatchMeterUsage",
        "aws-marketplace:ResolveCustomer"
      ],
      "Resource": "*",
      "Effect": "Allow"
    }
  ]
}
```

#### Trusted relationship policy of the metering role

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "apigateway.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

### Associate usage plan with Amazon Web Services Marketplace product

When you list a product on Amazon Web Services Marketplace, you receive an Amazon Web Services Marketplace product code. To integrate API Gateway with Amazon Web Services Marketplace, associate your usage plan with the Amazon Web Services Marketplace product code. You enable the association

by setting the API Gateway UsagePlan's `productCode` field to your Amazon Web Services Marketplace product code, using the API Gateway console, the API Gateway REST API, the Amazon CLI for API Gateway, or Amazon SDK for API Gateway. The following code example uses the API Gateway REST API:

```
PATCH /usageplans/USAGE_PLAN_ID
Host: apigateway.region.amazonaws.com
Authorization: ...

{
  "patchOperations" : [{
    "path" : "/productCode",
    "value" : "MARKETPLACE_PRODUCT_CODE",
    "op" : "replace"
  }]
}
```

## Handle customer subscription to usage plans

The following tasks are handled by your developer portal application.

When a customer subscribes to your product through Amazon Web Services Marketplace, Amazon Web Services Marketplace forwards a `POST` request to the SaaS subscriptions URL that you registered when listing your product on Amazon Web Services Marketplace. The `POST` request comes with an `x-amzn-marketplace-token` parameter containing buyer information. Follow the instructions in [SaaS customer onboarding](#) to handle this redirect in your developer portal application.

Responding to a customer's subscribing request, Amazon Web Services Marketplace sends a `subscribe-success` notification to an Amazon SNS topic that you can subscribe to. (See [SaaS customer onboarding](#)). To accept the customer subscription request, you handle the `subscribe-success` notification by creating or retrieving an API Gateway API key for the customer, associating the customer's Amazon Web Services Marketplace-provisioned `customerId` with the API keys, and then adding the API key to your usage plan.

When the customer's subscription request completes, the developer portal application should present the customer with the associated API key and inform the customer that the API key must be included in the `x-api-key` header in requests to the APIs.

When a customer cancels a subscription to a usage plan, Amazon Web Services Marketplace sends an `unsubscribe-success` notification to the SNS topic. To complete the process of unsubscribing the customer, you handle the `unsubscribe-success` notification by removing the customer's API keys from the usage plan.

## Authorize a customer to access a usage plan

To authorize access to your usage plan for a given customer, use the API Gateway API to fetch or create an API key for the customer and add the API key to the usage plan.

The following example shows how to call the API Gateway REST API to create a new API key with a specific Amazon Web Services Marketplace `customerId` value (`MARKETPLACE_CUSTOMER_ID`).

```
POST apikeys HTTP/1.1
Host: apigateway.region.amazonaws.com
Authorization: ...

{
  "name" : "my_api_key",
  "description" : "My API key",
  "enabled" : "false",
  "stageKeys" : [ {
```

```
"restApiId" : "uycl16xg9a",  
"stageName" : "prod"  
} ],  
"customerId" : "MARKETPLACE_CUSTOMER_ID"  
}
```

The following example shows how to get an API key with a specific Amazon Web Services Marketplace `customerId` value (**MARKETPLACE\_CUSTOMER\_ID**).

```
GET /apidevkeys?customerId=MARKETPLACE_CUSTOMER_ID HTTP/1.1  
Host: apigateway.region.amazonaws.com  
Authorization: ...
```

To add an API key to a usage plan, create a [UsagePlanKey](#) with the API key for the relevant usage plan. The following example shows how to accomplish this using the API Gateway REST API, where `n371pt` is the usage plan ID and `q5ugs7qjjh` is an example API `keyId` returned from the preceding examples.

```
POST /usageplans/n371pt/keys HTTP/1.1  
Host: apigateway.region.amazonaws.com  
Authorization: ...  
  
{  
  "keyId": "q5ugs7qjjh",  
  "keyType": "API_KEY"  
}
```

## Associate a customer with an API key

You must update the [ApiKey](#)'s `customerId` field to the Amazon Web Services Marketplace customer ID of the customer. This associates the API key with the Amazon Web Services Marketplace customer, which enables metering and billing for the buyer. The following code example calls the API Gateway REST API to do that.

```
PATCH /apidevkeys/q5ugs7qjjh  
Host: apigateway.region.amazonaws.com  
Authorization: ...  
  
{  
  "patchOperations" : [{  
    "path" : "/customerId",  
    "value" : "MARKETPLACE_CUSTOMER_ID",  
    "op" : "replace"  
  }]  
}
```

# Protecting your REST API

API Gateway provides a number of ways to protect your API from certain threats, like malicious users or spikes in traffic. You can protect your API using strategies like generating SSL certificates, configuring a web application firewall, setting throttling targets, and only allowing access to your API from a Virtual Private Cloud (VPC). In this section you can learn how to enable these capabilities using API Gateway.

### Topics

- [Configuring mutual TLS authentication for a REST API \(p. 565\)](#)
- [Generate and configure an SSL certificate for backend authentication \(p. 569\)](#)

- [Using Amazon WAF to protect your APIs \(p. 596\)](#)
- [Throttle API requests for better throughput \(p. 598\)](#)
- [Creating a private API in Amazon API Gateway \(p. 599\)](#)

## Configuring mutual TLS authentication for a REST API

Mutual TLS authentication requires two-way authentication between the client and the server. With mutual TLS, clients must present X.509 certificates to verify their identity to access your API. Mutual TLS is a common requirement for Internet of Things (IoT) and business-to-business applications.

You can use mutual TLS along with other [authorization and authentication operations \(p. 236\)](#) that API Gateway supports. API Gateway forwards the certificates that clients provide to Lambda authorizers and to backend integrations.

### Important

By default, clients can invoke your API by using the `execute-api` endpoint that API Gateway generates for your API. To ensure that clients can access your API only by using a custom domain name with mutual TLS, disable the default `execute-api` endpoint. To learn more, see [the section called "Disable the default endpoint" \(p. 483\)](#).

## Prerequisites for mutual TLS

To configure mutual TLS you need:

- A custom domain name
- At least one certificate configured in Amazon Certificate Manager for your custom domain name
- A truststore configured and uploaded to Amazon S3

## Custom domain names

To enable mutual TLS for a REST API, you must configure a custom domain name for your API. You can enable mutual TLS for a custom domain name, and then provide the custom domain name to clients. To access an API by using a custom domain name that has mutual TLS enabled, clients must present certificates that you trust in API requests. You can find more information at [the section called "Custom domain names" \(p. 463\)](#).

### Using Amazon Certificate Manager issued certificates

You can request a publicly trusted certificate directly from ACM or import public or self-signed certificates. To setup a certificate in ACM, go to [ACM](#). If you would like to import a certificate, continue reading in the following section.

### Using an imported or Amazon Certificate Manager PCA certificate

To use a certificate imported into ACM or a certificate from Amazon Certificate Manager Private Certificate Authority with mutual TLS, API Gateway needs an `ownershipVerificationCertificate` issued by ACM. This ownership certificate is only used to verify that you have permissions to use the domain name. It is not used for the TLS handshake. If you don't already have a `ownershipVerificationCertificate`, go to <https://console.amazonaws.cn/acm/> to set one up.

You will need to keep this certificate valid for the lifetime of your domain name. If a certificate expires and auto-renew fails, all updates to the domain name will be locked. You will need to update the

`ownershipVerificationCertificateArn` with a valid `ownershipVerificationCertificate` before you can make any other changes. The `ownershipVerificationCertificate` cannot be used as a server certificate for another mutual TLS domain in API Gateway. If a certificate is directly re-imported into ACM, the issuer must stay the same.

## Configuring your truststore

Truststores are text files with a `.pem` file extension. They are a trusted list of certificates from Certificate Authorities. To use mutual TLS, create a truststore of X.509 certificates that you trust to access your API.

You must include the complete chain of trust, starting from the issuing CA certificate, up to the root CA certificate, in your truststore. API Gateway accepts client certificates issued by any CA present in the chain of trust. The certificates can be from public or private certificate authorities. Certificates can have a maximum chain length of four. You can also provide self-signed certificates. The following hashing algorithms are supported in the truststore:

- SHA-256 or stronger
- RSA-2048 or stronger
- ECDSA-256 or stronger

API Gateway validates a number of certificate properties. You can use Lambda authorizers to perform additional checks when a client invokes an API, including checking whether a certificate has been revoked. API Gateway validates the following properties:

Validation	Description
X.509 syntax	The certificate must meet X.509 syntax requirements.
Integrity	The certificate's content must not have been altered from that signed by the certificate authority from the truststore.
Validity	The certificate's validity period must be current.
Name chaining / key chaining	The names and subjects of certificates must form an unbroken chain. Certificates can have a maximum chain length of four.

## Upload the truststore to an Amazon S3 bucket in a single file

The following is an example of what a `.pem` file might look like.

### Example certificates.pem

```
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
<Certificate contents>
-----END CERTIFICATE-----
...
```

The following Amazon CLI command uploads `certificates.pem` to your Amazon S3 bucket.

```
aws s3 cp certificates.pem s3://bucket-name
```

## Configuring mutual TLS for a custom domain name

To configure mutual TLS for a REST API, you must use a Regional custom domain name for your API, with a minimum TLS version of 1.2. To learn more about creating and configuring a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

### Note

Mutual TLS isn't supported for private APIs.

After you've uploaded your truststore to Amazon S3, you can configure your custom domain name to use mutual TLS. Paste the following (slashes included) into a terminal:

```
aws apigateway create-domain-name --region us-east-2 \  
  --domain-name api.example.com \  
  --regional-certificate-arn arn:aws:acm:us-  
east-2:123456789012:certificate/123456789012-1234-1234-1234-12345678 \  
  --endpoint-configuration types=REGIONAL \  
  --security-policy TLS_1_2 \  
  --mutual-tls-authentication truststoreUri=s3://bucket-name/key-name
```

After you create the domain name, you must configure DNS records and basepath mappings for API operations. To learn more, see [Setting up a regional custom domain name in API Gateway \(p. 475\)](#).

## Invoke an API by using a custom domain name that requires mutual TLS

To invoke an API with mutual TLS enabled, clients must present a trusted certificate in the API request. When a client attempts to invoke your API, API Gateway looks for the client certificate's issuer in your truststore. For API Gateway to proceed with the request, the certificate's issuer and the complete chain of trust up to the root CA certificate must be in your truststore.

The following example `curl` command sends a request to `api.example.com`, that includes `my-cert.pem` in the request. `my-key.key` is the private key for the certificate.

```
curl -v --key ./my-key.key --cert ./my-cert.pem api.example.com
```

Your API is invoked only if your truststore trusts the certificate. The following conditions will cause API Gateway to fail the TLS handshake and deny the request with a 403 status code. If your certificate:

- isn't trusted
- is expired
- doesn't use a supported algorithm

### Note

API Gateway doesn't verify if a certificate has been revoked.

## Updating your truststore

To update the certificates in your truststore, upload a new certificate bundle to Amazon S3. Then, you can update your custom domain name to use the updated certificate.

Use [Amazon S3 versioning](#) to maintain multiple versions of your truststore. When you update your custom domain name to use a new truststore version, API Gateway returns warnings if certificates are invalid.

API Gateway produces certificate warnings only when you update your domain name. API Gateway doesn't notify you if a previously uploaded certificate expires.

The following Amazon CLI command updates a custom domain name to use a new truststore version.

```
aws apigateway update-domain-name \  
  --domain-name api.example.com \  
  --patch-operations op='replace',path='/mutualTlsAuthentication/  
truststoreVersion',value='abcdef123'
```

## Disable mutual TLS

To disable mutual TLS for a custom domain name, remove the truststore from your custom domain name, as shown in the following command.

```
aws apigateway update-domain-name \  
  --domain-name api.example.com \  
  --patch-operations op='replace',path='/mutualTlsAuthentication/truststoreUri',value=''
```

## Troubleshooting certificate warnings

When creating a custom domain name with mutual TLS, API Gateway returns warnings if certificates in the truststore are not valid. This can also occur when updating a custom domain name to use a new truststore. The warnings indicate the issue with the certificate and the subject of the certificate that produced the warning. Mutual TLS is still enabled for your API, but some clients might not be able to access your API.

You'll need to decode the certificates in your truststore in order to identify which certificate produced the warning. You can use tools such as `openssl` to decode the certificates and identify their subjects.

The following command displays the contents of a certificate, including its subject:

```
openssl x509 -in certificate.crt -text -noout
```

Update or remove the certificates that produced warnings, and then upload a new truststore to Amazon S3. After uploading the new truststore, update your custom domain name to use the new truststore.

## Troubleshooting domain name conflicts

The error "The certificate subject <certSubject> conflicts with an existing certificate from a different issuer." means multiple Certificate Authorities have issued a certificate for this domain. For each subject in the certificate, there can only be one issuer in API Gateway for mutual TLS domains. You will need to get all of your certificates for that subject through a single issuer. If the problem is with a certificate you don't have control of but you can prove ownership of the domain name, [contact Amazon Web Services Support](#) to open a ticket.

## Troubleshooting domain name status messages

**PENDING\_CERTIFICATE\_REIMPORT:** This means you reimported a certificate to ACM and it failed validation because the new certificate has a SAN (subject alternative name) that is not covered by the `ownershipVerificationCertificate` or the subject or SANs in the certificate don't cover the

domain name. Something might be configured incorrectly or an invalid certificate was imported. You need to reimport a valid certificate into ACM. For more information about validation see [Validating domain ownership](#).

**PENDING\_OWNERSHIP\_VERIFICATION:** This means your previously verified certificate has expired and ACM was unable to auto-renew it. You will need to renew the certificate or request a new certificate. More information about certificate renewal can be found at [ACM's troubleshooting managed certificate renewal](#) guide.

## Generate and configure an SSL certificate for backend authentication

You can use API Gateway to generate an SSL certificate and then use its public key in the backend to verify that HTTP requests to your backend system are from API Gateway. This allows your HTTP backend to control and accept only requests that originate from Amazon API Gateway, even if the backend is publicly accessible.

### Note

Some backend servers might not support SSL client authentication as API Gateway does and could return an SSL certificate error. For a list of incompatible backend servers, see [the section called "Important notes" \(p. 750\)](#).

The SSL certificates that are generated by API Gateway are self-signed, and only the public key of a certificate is visible in the API Gateway console or through the APIs.

### Topics

- [Generate a client certificate using the API Gateway console \(p. 569\)](#)
- [Configure an API to use SSL certificates \(p. 569\)](#)
- [Test invoke to verify the client certificate configuration \(p. 570\)](#)
- [Configure a backend HTTPS server to verify the client certificate \(p. 570\)](#)
- [Rotate an expiring client certificate \(p. 571\)](#)
- [API Gateway-supported certificate authorities for HTTP and HTTP proxy integrations \(p. 572\)](#)

## Generate a client certificate using the API Gateway console

1. Open the API Gateway console at <https://console.amazonaws.cn/apigateway/>.
2. Choose a REST API.
3. In the main navigation pane, choose **Client Certificates**.
4. From the **Client Certificates** pane, choose **Generate Client Certificate**.
5. Optionally, for **Edit**, choose to add a descriptive title for the generated certificate and choose **Save** to save the description. API Gateway generates a new certificate and returns the new certificate GUID, along with the PEM-encoded public key.

You're now ready to configure an API to use the certificate.

## Configure an API to use SSL certificates

These instructions assume that you already completed [Generate a client certificate using the API Gateway console \(p. 569\)](#).

1. In the API Gateway console, create or open an API for which you want to use the client certificate. Make sure that the API has been deployed to a stage.



2. Choose **Stages** under the selected API and then choose a stage.
3. In the **Stage Editor** panel, select a certificate under the **Client Certificate** section.
4. To save the settings, choose **Save Changes**.

If the API has been deployed previously in the API Gateway console, you'll need to redeploy it for the changes to take effect. For more information, see [the section called "Redeploy a REST API to a stage" \(p. 439\)](#).

After a certificate is selected for the API and saved, API Gateway uses the certificate for all calls to HTTP integrations in your API.

## Test invoke to verify the client certificate configuration

1. Choose an API method. In **Client**, choose **Test**.
2. From **Client Certificate**, choose **Test** to invoke the method request.

API Gateway presents the chosen SSL certificate for the HTTP backend to authenticate the API.

## Configure a backend HTTPS server to verify the client certificate

These instructions assume that you already completed [Generate a client certificate using the API Gateway console \(p. 569\)](#) and downloaded a copy of the client certificate. You can download a client certificate by calling `clientcertificate:by-id` of the API Gateway REST API or `get-client-certificate` of Amazon CLI.

Before configuring a backend HTTPS server to verify the client SSL certificate of API Gateway, you must have obtained the PEM-encoded private key and a server-side certificate that is provided by a trusted certificate authority.

If the server domain name is `myserver.mydomain.com`, the server certificate's CNAME value must be `myserver.mydomain.com` or `*.mydomain.com`.

Supported certificate authorities include [Let's Encrypt](#) or one of [the section called "Supported certificate authorities for HTTP and HTTP proxy integration" \(p. 572\)](#).

As an example, suppose that the client certificate file is `apig-cert.pem` and the server private key and certificate files are `server-key.pem` and `server-cert.pem`, respectively. For a Node.js server in the backend, you can configure the server similar to the following:

```
var fs = require('fs');
var https = require('https');
var options = {
  key: fs.readFileSync('server-key.pem'),
  cert: fs.readFileSync('server-cert.pem'),
  ca: fs.readFileSync('apig-cert.pem'),
  requestCert: true,
  rejectUnauthorized: true
};
https.createServer(options, function (req, res) {
  res.writeHead(200);
  res.end("hello world\n");
}).listen(443);
```

For a `node-express` app, you can use the `client-certificate-auth` modules to authenticate client requests with PEM-encoded certificates.

For other HTTPS server, see the documentation for the server.

## Rotate an expiring client certificate

The client certificate generated by API Gateway is valid for 365 days. You must rotate the certificate before a client certificate on an API stage expires to avoid any downtime for the API. You can check the expiration date of certificate by calling [clientCertificate:by-id](#) of the API Gateway REST API or the Amazon CLI command of [get-client-certificate](#) and inspecting the returned [expirationDate](#) property.

To rotate a client certificate, do the following:

1. Generate a new client certificate by calling [clientcertificate:generate](#) of the API Gateway REST API or the Amazon CLI command of [generate-client-certificate](#). In this tutorial, we assume that the new client certificate ID is `ndiqef`.
2. Update the backend server to include the new client certificate. Don't remove the existing client certificate yet.

Some servers might require a restart to finish the update. Consult the server documentation to see if you must restart the server during the update.

3. Update the API stage to use the new client certificate by calling [stage:update](#) of the API Gateway REST API, with the new client certificate ID (`ndiqef`):

```
PATCH /restapis/{restapi-id}/stages/stage1 HTTP/1.1
Content-Type: application/json
Host: apigateway.us-east-1.amazonaws.com
X-Amz-Date: 20170603T200400Z
Authorization: AWS4-HMAC-SHA256 Credential=...

{
  "patchOperations" : [
    {
      "op" : "replace",
      "path" : "/clientCertificateId",
      "value" : "ndiqef"
    }
  ]
}
```

or by calling the CLI command of [update-stage](#).

4. Update the backend server to remove the old certificate.
5. Delete the old certificate from API Gateway by calling the [clientcertificate:delete](#) of the API Gateway REST API, specifying the `clientCertificateId` (`a1b2c3`) of the old certificate:

```
DELETE /clientcertificates/a1b2c3
```

or by calling the CLI command of [delete-client-certificate](#):

```
aws apigateway delete-client-certificate --client-certificate-id a1b2c3
```

To rotate a client certificate in the console for a previously deployed API, do the following:

1. In the main navigation pane, choose **Client Certificates**.
2. From the **Client Certificates** pane, choose **Generate Client Certificate**.
3. Open the API for which you want to use the client certificate.

4. Choose **Stages** under the selected API and then choose a stage.
5. In the **Stage Editor** panel, select the new certificate under the **Client Certificate** section.
6. To save the settings, choose **Save Changes**.

You need to redeploy the API for the changes to take effect. For more information, see [the section called "Redeploy a REST API to a stage" \(p. 439\)](#).

## API Gateway-supported certificate authorities for HTTP and HTTP proxy integrations

The following list shows the certificate authorities supported by API Gateway for HTTP, HTTP proxy, and private integrations.

```
Alias name: accvraiz1
  SHA1: 93:05:7A:88:15:C6:4F:CE:88:2F:FA:91:16:52:28:78:BC:53:64:17
  SHA256:
9A:6E:C0:12:E1:A7:DA:9D:BE:34:19:4D:47:8A:D7:C0:DB:18:22:FB:07:1D:F1:29:81:49:6E:D1:04:38:41:13
Alias name: acraizfnmtrcm
  SHA1: EC:50:35:07:B2:15:C4:95:62:19:E2:A8:9A:5B:42:99:2C:4C:2C:20
  SHA256:
EB:C5:57:0C:29:01:8C:4D:67:B1:AA:12:7B:AF:12:F7:03:B4:61:1E:BC:17:B7:DA:B5:57:38:94:17:9B:93:FA
Alias name: actalis
  SHA1: F3:73:B3:87:06:5A:28:84:8A:F2:F3:4A:CE:19:2B:DD:C7:8E:9C:AC
  SHA256:
55:92:60:84:EC:96:3A:64:B9:6E:2A:BE:01:CE:0B:A8:6A:64:FB:FE:BC:C7:AA:B5:AF:C1:55:B3:7F:D7:60:66
Alias name: actalisauthenticationrootca
  SHA1: F3:73:B3:87:06:5A:28:84:8A:F2:F3:4A:CE:19:2B:DD:C7:8E:9C:AC
  SHA256:
55:92:60:84:EC:96:3A:64:B9:6E:2A:BE:01:CE:0B:A8:6A:64:FB:FE:BC:C7:AA:B5:AF:C1:55:B3:7F:D7:60:66
Alias name: addtrustclass1ca
  SHA1: CC:AB:0E:A0:4C:23:01:D6:69:7B:DD:37:9F:CD:12:EB:24:E3:94:9D
  SHA256:
8C:72:09:27:9A:C0:4E:27:5E:16:D0:7F:D3:B7:75:E8:01:54:B5:96:80:46:E3:1F:52:DD:25:76:63:24:E9:A7
Alias name: addtrustexternalca
  SHA1: 02:FA:F3:E2:91:43:54:68:60:78:57:69:4D:F5:E4:5B:68:85:18:68
  SHA256:
68:7F:A4:51:38:22:78:FF:F0:C8:B1:1F:8D:43:D5:76:67:1C:6E:B2:BC:EA:B4:13:FB:83:D9:65:D0:6D:2F:F2
Alias name: addtrustqualifiedca
  SHA1: 4D:23:78:EC:91:95:39:B5:00:7F:75:8F:03:3B:21:1E:C5:4D:8B:CF
  SHA256:
80:95:21:08:05:DB:4B:BC:35:5E:44:28:D8:FD:6E:C2:CD:E3:AB:5F:B9:7A:99:42:98:8E:B8:F4:DC:D0:60:16
Alias name: affirmtrustcommercial
  SHA1: F9:B5:B6:32:45:5F:9C:BE:EC:57:5F:80:DC:E9:6E:2C:C7:B2:78:B7
  SHA256:
03:76:AB:1D:54:C5:F9:80:3C:E4:B2:E2:01:A0:EE:7E:EF:7B:57:B6:36:E8:A9:3C:9B:8D:48:60:C9:6F:5F:A7
Alias name: affirmtrustcommercialca
  SHA1: F9:B5:B6:32:45:5F:9C:BE:EC:57:5F:80:DC:E9:6E:2C:C7:B2:78:B7
  SHA256:
03:76:AB:1D:54:C5:F9:80:3C:E4:B2:E2:01:A0:EE:7E:EF:7B:57:B6:36:E8:A9:3C:9B:8D:48:60:C9:6F:5F:A7
Alias name: affirmtrustnetworking
  SHA1: 29:36:21:02:8B:20:ED:02:F5:66:C5:32:D1:D6:ED:90:9F:45:00:2F
  SHA256:
0A:81:EC:5A:92:97:77:F1:45:90:4A:F3:8D:5D:50:9F:66:B5:E2:C5:8F:CD:B5:31:05:8B:0E:17:F3:F0:B4:1B
Alias name: affirmtrustnetworkingca
  SHA1: 29:36:21:02:8B:20:ED:02:F5:66:C5:32:D1:D6:ED:90:9F:45:00:2F
  SHA256:
0A:81:EC:5A:92:97:77:F1:45:90:4A:F3:8D:5D:50:9F:66:B5:E2:C5:8F:CD:B5:31:05:8B:0E:17:F3:F0:B4:1B
Alias name: affirmtrustpremium
  SHA1: D8:A6:33:2C:E0:03:6F:B1:85:F6:63:4F:7D:6A:06:65:26:32:28:27
  SHA256:
70:A7:3F:7F:37:6B:60:07:42:48:90:45:34:B1:14:82:D5:BF:0E:69:8E:CC:49:8D:F5:25:77:EB:F2:E9:3B:9A
```

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```
Alias name: affirmtrustpremiumca
  SHA1: D8:A6:33:2C:E0:03:6F:B1:85:F6:63:4F:7D:6A:06:65:26:32:28:27
  SHA256:
70:A7:3F:7F:37:6B:60:07:42:48:90:45:34:B1:14:82:D5:BF:0E:69:8E:CC:49:8D:F5:25:77:EB:F2:E9:3B:9A
Alias name: affirmtrustpremiuecc
  SHA1: B8:23:6B:00:2F:1D:16:86:53:01:55:6C:11:A4:37:CA:EB:FF:C3:BB
  SHA256:
BD:71:FD:F6:DA:97:E4:CF:62:D1:64:7A:DD:25:81:B0:7D:79:AD:F8:39:7E:B4:EC:BA:9C:5E:84:88:82:14:23
Alias name: affirmtrustpremiueccca
  SHA1: B8:23:6B:00:2F:1D:16:86:53:01:55:6C:11:A4:37:CA:EB:FF:C3:BB
  SHA256:
BD:71:FD:F6:DA:97:E4:CF:62:D1:64:7A:DD:25:81:B0:7D:79:AD:F8:39:7E:B4:EC:BA:9C:5E:84:88:82:14:23
Alias name: amazon-ca-g4-acm1
  SHA1: F2:0D:28:B6:29:C2:2C:5E:84:05:E6:02:4D:97:FE:8F:A0:84:93:A0
  SHA256:
B0:11:A4:F7:29:6C:74:D8:2B:F5:62:DF:87:D7:28:C7:1F:B5:8C:F4:E6:73:F2:78:FC:DA:F3:FF:83:A6:8C:87
Alias name: amazon-ca-g4-acm2
  SHA1: A7:E6:45:32:1F:7A:B7:AD:C0:70:EA:73:5F:AB:ED:C3:DA:B4:D0:C8
  SHA256:
D7:A8:7C:69:95:D0:E2:04:2A:32:70:A7:E2:87:FE:A7:E8:F4:C1:70:62:F7:90:C3:EB:BB:53:F2:AC:39:26:BE
Alias name: amazon-ca-g4-acm3
  SHA1: 7A:DB:56:57:5F:D6:EE:67:85:0A:64:BB:1C:E9:E4:B0:9A:DB:9D:07
  SHA256:
6B:EB:9D:20:2E:C2:00:70:BD:D2:5E:D3:C0:C8:33:2C:B4:78:07:C5:82:94:4E:7E:23:28:22:71:A4:8E:0E:C2
Alias name: amazon-ca-g4-legacy
  SHA1: EA:E7:DE:F9:0A:BE:9F:0B:68:CE:B7:24:0D:80:74:03:BF:6E:B1:6E
  SHA256:
CD:72:C4:7F:B4:AD:28:A4:67:2B:E1:86:47:D4:40:E9:3B:16:2D:95:DB:3C:2F:94:BB:81:D9:09:F7:91:24:5E
Alias name: amazon-root-ca-ecc-384-1
  SHA1: F9:5E:4A:AB:9C:2D:57:61:63:3D:B2:57:B4:0F:24:9E:7B:E2:23:7D
  SHA256:
C6:BD:E5:66:C2:72:2A:0E:96:E9:C1:2C:BF:38:92:D9:55:4D:29:03:57:30:72:40:7F:4E:70:17:3B:3C:9B:63
Alias name: amazon-root-ca-rsa-2k-1
  SHA1: 8A:9A:AC:27:FC:86:D4:50:23:AD:D5:63:F9:1E:AE:2C:AF:63:08:6C
  SHA256:
0F:8F:33:83:FB:70:02:89:49:24:E1:AA:B0:D7:FB:5A:BF:98:DF:75:8E:0F:FE:61:86:92:BC:F0:75:35:CC:80
Alias name: amazon-root-ca-rsa-4k-1
  SHA1: EC:BD:09:61:F5:7A:B6:A8:76:BB:20:8F:14:05:ED:7E:70:ED:39:45
  SHA256:
36:AE:AD:C2:6A:60:07:90:6B:83:A3:73:2D:D1:2B:D4:00:5E:C7:F2:76:11:99:A9:D4:DA:63:2F:59:B2:8B:CF
Alias name: amazon1
  SHA1: 8D:A7:F9:65:EC:5E:FC:37:91:0F:1C:6E:59:FD:C1:CC:6A:6E:DE:16
  SHA256:
8E:CD:E6:88:4F:3D:87:B1:12:5B:A3:1A:C3:FC:B1:3D:70:16:DE:7F:57:CC:90:4F:E1:CB:97:C6:AE:98:19:6E
Alias name: amazon2
  SHA1: 5A:8C:EF:45:D7:A6:98:59:76:7A:8C:8B:44:96:B5:78:CF:47:4B:1A
  SHA256:
1B:A5:B2:AA:8C:65:40:1A:82:96:01:18:F8:0B:EC:4F:62:30:4D:83:CE:C4:71:3A:19:C3:9C:01:1E:A4:6D:B4
Alias name: amazon3
  SHA1: 0D:44:DD:8C:3C:8C:1A:1A:58:75:64:81:E9:0F:2E:2A:FF:B3:D2:6E
  SHA256:
18:CE:6C:FE:7B:F1:4E:60:B2:E3:47:B8:DF:E8:68:CB:31:D0:2E:BB:3A:DA:27:15:69:F5:03:43:B4:6D:B3:A4
Alias name: amazon4
  SHA1: F6:10:84:07:D6:F8:BB:67:98:0C:C2:E2:44:C2:EB:AE:1C:EF:63:BE
  SHA256:
E3:5D:28:41:9E:D0:20:25:CF:A6:90:38:CD:62:39:62:45:8D:A5:C6:95:FB:DE:A3:C2:2B:0B:FB:25:89:70:92
Alias name: amazonrootca1
  SHA1: 8D:A7:F9:65:EC:5E:FC:37:91:0F:1C:6E:59:FD:C1:CC:6A:6E:DE:16
  SHA256:
8E:CD:E6:88:4F:3D:87:B1:12:5B:A3:1A:C3:FC:B1:3D:70:16:DE:7F:57:CC:90:4F:E1:CB:97:C6:AE:98:19:6E
Alias name: amazonrootca2
  SHA1: 5A:8C:EF:45:D7:A6:98:59:76:7A:8C:8B:44:96:B5:78:CF:47:4B:1A
  SHA256:
1B:A5:B2:AA:8C:65:40:1A:82:96:01:18:F8:0B:EC:4F:62:30:4D:83:CE:C4:71:3A:19:C3:9C:01:1E:A4:6D:B4
Alias name: amazonrootca3
  SHA1: 0D:44:DD:8C:3C:8C:1A:1A:58:75:64:81:E9:0F:2E:2A:FF:B3:D2:6E
```

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```
SHA256:
18:CE:6C:FE:7B:F1:4E:60:B2:E3:47:B8:DF:E8:68:CB:31:D0:2E:BB:3A:DA:27:15:69:F5:03:43:B4:6D:B3:A4
Alias name: amazonrootca4
SHA1: F6:10:84:07:D6:F8:BB:67:98:0C:C2:E2:44:C2:EB:AE:1C:EF:63:BE
SHA256:
E3:5D:28:41:9E:D0:20:25:CF:A6:90:38:CD:62:39:62:45:8D:A5:C6:95:FB:DE:A3:C2:2B:0B:FB:25:89:70:92
Alias name: amzninternalinfoseccag3
SHA1: B9:B1:CA:38:F7:BF:9C:D2:D4:95:E7:B6:5E:75:32:9B:A8:78:2E:F6
SHA256:
81:03:0B:C7:E2:54:DA:7B:F8:B7:45:DB:DD:41:15:89:B5:A3:81:86:FB:4B:29:77:1F:84:0A:18:D9:67:6D:68
Alias name: amzninternalrootca
SHA1: A7:B7:F6:15:8A:FF:1E:C8:85:13:38:BC:93:EB:A2:AB:A4:09:EF:06
SHA256:
0E:DE:63:C1:DC:7A:8E:11:F1:AB:BC:05:4F:59:EE:49:9D:62:9A:2F:DE:9C:A7:16:32:A2:64:29:3E:8B:66:AA
Alias name: aolrootca1
SHA1: 39:21:C1:15:C1:5D:0E:CA:5C:CB:5B:C4:F0:7D:21:D8:05:0B:56:6A
SHA256:
77:40:73:12:C6:3A:15:3D:5B:C0:0B:4E:51:75:9C:DF:DA:C2:37:DC:2A:33:B6:79:46:E9:8E:9B:FA:68:0A:E3
Alias name: aolrootca2
SHA1: 85:B5:FF:67:9B:0C:79:96:1F:C8:6E:44:22:00:46:13:DB:17:92:84
SHA256:
7D:3B:46:5A:60:14:E5:26:C0:AF:FC:EE:21:27:D2:31:17:27:AD:81:1C:26:84:2D:00:6A:F3:73:06:CC:80:BD
Alias name: atostrustedroot2011
SHA1: 2B:B1:F5:3E:55:0C:1D:C5:F1:D4:E6:B7:6A:46:4B:55:06:02:AC:21
SHA256:
F3:56:BE:A2:44:B7:A9:1E:B3:5D:53:CA:9A:D7:86:4A:CE:01:8E:2D:35:D5:F8:F9:6D:DF:68:A6:F4:1A:A4:74
Alias name: autoridaddecertificacionfirmaprofesionalcifa62634068
SHA1: AE:C5:FB:3F:C8:E1:BF:C4:E5:4F:03:07:5A:9A:E8:00:B7:F7:B6:FA
SHA256:
04:04:80:28:BF:1F:28:64:D4:8F:9A:D4:D8:32:94:36:6A:82:88:56:55:3F:3B:14:30:3F:90:14:7F:5D:40:EF
Alias name: baltimorecodesigningca
SHA1: 30:46:D8:C8:88:FF:69:30:C3:4A:FC:CD:49:27:08:7C:60:56:7B:0D
SHA256:
A9:15:45:DB:D2:E1:9C:4C:CD:F9:09:AA:71:90:0D:18:C7:35:1C:89:B3:15:F0:F1:3D:05:C1:3A:8F:FB:46:87
Alias name: baltimorecybertrustca
SHA1: D4:DE:20:D0:5E:66:FC:53:FE:1A:50:88:2C:78:DB:28:52:CA:E4:74
SHA256:
16:AF:57:A9:F6:76:B0:AB:12:60:95:AA:5E:BA:DE:F2:2A:B3:11:19:D6:44:AC:95:CD:4B:93:DB:F3:F2:6A:EB
Alias name: baltimorecybertrustroot
SHA1: D4:DE:20:D0:5E:66:FC:53:FE:1A:50:88:2C:78:DB:28:52:CA:E4:74
SHA256:
16:AF:57:A9:F6:76:B0:AB:12:60:95:AA:5E:BA:DE:F2:2A:B3:11:19:D6:44:AC:95:CD:4B:93:DB:F3:F2:6A:EB
Alias name: buypassclass2ca
SHA1: 49:0A:75:74:DE:87:0A:47:FE:58:EE:F6:C7:6B:EB:C6:0B:12:40:99
SHA256:
9A:11:40:25:19:7C:5B:B9:5D:94:E6:3D:55:CD:43:79:08:47:B6:46:B2:3C:DF:11:AD:A4:A0:0E:FF:15:FB:48
Alias name: buypassclass2rootca
SHA1: 49:0A:75:74:DE:87:0A:47:FE:58:EE:F6:C7:6B:EB:C6:0B:12:40:99
SHA256:
9A:11:40:25:19:7C:5B:B9:5D:94:E6:3D:55:CD:43:79:08:47:B6:46:B2:3C:DF:11:AD:A4:A0:0E:FF:15:FB:48
Alias name: buypassclass3ca
SHA1: DA:FA:F7:FA:66:84:EC:06:8F:14:50:BD:C7:C2:81:A5:BC:A9:64:57
SHA256:
ED:F7:EB:BC:A2:7A:2A:38:4D:38:7B:7D:40:10:C6:66:E2:ED:B4:84:3E:4C:29:B4:AE:1D:5B:93:32:E6:B2:4D
Alias name: buypassclass3rootca
SHA1: DA:FA:F7:FA:66:84:EC:06:8F:14:50:BD:C7:C2:81:A5:BC:A9:64:57
SHA256:
ED:F7:EB:BC:A2:7A:2A:38:4D:38:7B:7D:40:10:C6:66:E2:ED:B4:84:3E:4C:29:B4:AE:1D:5B:93:32:E6:B2:4D
Alias name: cadisigrootr2
SHA1: B5:61:EB:EA:A4:DE:E4:25:4B:69:1A:98:A5:57:47:C2:34:C7:D9:71
SHA256:
E2:3D:4A:03:6D:7B:70:E9:F5:95:B1:42:20:79:D2:B9:1E:DF:BB:1F:B6:51:A0:63:3E:AA:8A:9D:C5:F8:07:03
Alias name: camerfirmachambersca
SHA1: 78:6A:74:AC:76:AB:14:7F:9C:6A:30:50:BA:9E:A8:7E:FE:9A:CE:3C
SHA256:
06:3E:4A:FA:C4:91:DF:D3:32:F3:08:9B:85:42:E9:46:17:D8:93:D7:FE:94:4E:10:A7:93:7E:E2:9D:96:93:C0
```

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```
Alias name: camerfirmachamberscommerceca
  SHA1: 6E:3A:55:A4:19:0C:19:5C:93:84:3C:C0:DB:72:2E:31:30:61:F0:B1
  SHA256:
OC:25:8A:12:A5:67:4A:EF:25:F2:8B:A7:DC:FA:EC:EE:A3:48:E5:41:E6:F5:CC:4E:E6:3B:71:B3:61:60:6A:C3
Alias name: camerfirmachambersignca
  SHA1: 4A:BD:EE:EC:95:0D:35:9C:89:AE:C7:52:A1:2C:5B:29:F6:D6:AA:0C
  SHA256:
13:63:35:43:93:34:A7:69:80:16:A0:D3:24:DE:72:28:4E:07:9D:7B:52:20:BB:8F:BD:74:78:16:EE:BE:BA:CA
Alias name: certigna
  SHA1: B1:2E:13:63:45:86:A4:6F:1A:B2:60:68:37:58:2D:C4:AC:FD:94:97
  SHA256:
E3:B6:A2:DB:2E:D7:CE:48:84:2F:7A:C5:32:41:C7:B7:1D:54:14:4B:FB:40:C1:1F:3F:1D:0B:42:F5:EE:A1:2D
Alias name: certignarootca
  SHA1: 2D:0D:52:14:FF:9E:AD:99:24:01:74:20:47:6E:6C:85:27:27:F5:43
  SHA256:
D4:8D:3D:23:EE:DB:50:A4:59:E5:51:97:60:1C:27:77:4B:9D:7B:18:C9:4D:5A:05:95:11:A1:02:50:B9:31:68
Alias name: certplusclass2primaryca
  SHA1: 74:20:74:41:72:9C:DD:92:EC:79:31:D8:23:10:8D:C2:81:92:E2:BB
  SHA256:
0F:99:3C:8A:EF:97:BA:AF:56:87:14:0E:D5:9A:D1:82:1B:B4:AF:AC:F0:AA:9A:58:B5:D5:7A:33:8A:3A:FB:CB
Alias name: certplusclass3pprimaryca
  SHA1: 21:6B:2A:29:E6:2A:00:CE:82:01:46:D8:24:41:41:B9:25:11:B2:79
  SHA256:
CC:C8:94:89:37:1B:AD:11:1C:90:61:9B:EA:24:0A:2E:6D:AD:D9:9F:9F:6E:1D:4D:41:E5:8E:D6:DE:3D:02:85
Alias name: certsigrrootca
  SHA1: FA:B7:EE:36:97:26:62:FB:2D:B0:2A:F6:BF:03:FD:E8:7C:4B:2F:9B
  SHA256:
EA:A9:62:C4:FA:4A:6B:AF:EB:E4:15:19:6D:35:1C:CD:88:8D:4F:53:F3:FA:8A:E6:D7:C4:66:A9:4E:60:42:BB
Alias name: certsigrrootcag2
  SHA1: 26:F9:93:B4:ED:3D:28:27:B0:B9:4B:A7:E9:15:1D:A3:8D:92:E5:32
  SHA256:
65:7C:FE:2F:A7:3F:AA:38:46:25:71:F3:32:A2:36:3A:46:FC:E7:02:09:51:71:07:02:CD:FB:B6:EE:DA:33:05
Alias name: certum2
  SHA1: D3:DD:48:3E:2B:BF:4C:05:E8:AF:10:F5:FA:76:26:CF:D3:DC:30:92
  SHA256:
B6:76:F2:ED:DA:E8:77:5C:D3:6C:B0:F6:3C:D1:D4:60:39:61:F4:9E:62:65:BA:01:3A:2F:03:07:B6:D0:B8:04
Alias name: certumca
  SHA1: 62:52:DC:40:F7:11:43:A2:2F:DE:9E:F7:34:8E:06:42:51:B1:81:18
  SHA256:
D8:E0:FE:BC:1D:B2:E3:8D:00:94:0F:37:D2:7D:41:34:4D:99:3E:73:4B:99:D5:65:6D:97:78:D4:D8:14:36:24
Alias name: certumtrustednetworkca
  SHA1: 07:E0:32:E0:20:B7:2C:3F:19:2F:06:28:A2:59:3A:19:A7:0F:06:9E
  SHA256:
5C:58:46:8D:55:F5:8E:49:7E:74:39:82:D2:B5:00:10:B6:D1:65:37:4A:CF:83:A7:D4:A3:2D:B7:68:C4:40:8E
Alias name: certumtrustednetworkca2
  SHA1: D3:DD:48:3E:2B:BF:4C:05:E8:AF:10:F5:FA:76:26:CF:D3:DC:30:92
  SHA256:
B6:76:F2:ED:DA:E8:77:5C:D3:6C:B0:F6:3C:D1:D4:60:39:61:F4:9E:62:65:BA:01:3A:2F:03:07:B6:D0:B8:04
Alias name: cfcaevroot
  SHA1: E2:B8:29:4B:55:84:AB:6B:58:C2:90:46:6C:AC:3F:B8:39:8F:84:83
  SHA256:
5C:C3:D7:8E:4E:1D:5E:45:54:7A:04:E6:87:3E:64:F9:0C:F9:53:6D:1C:CC:2E:F8:00:F3:55:C4:C5:FD:70:FD
Alias name: chambersofcommerceroot2008
  SHA1: 78:6A:74:AC:76:AB:14:7F:9C:6A:30:50:BA:9E:A8:7E:FE:9A:CE:3C
  SHA256:
06:3E:4A:FA:C4:91:DF:D3:32:F3:08:9B:85:42:E9:46:17:D8:93:D7:FE:94:4E:10:A7:93:7E:E2:9D:96:93:C0
Alias name: chunghwaepkirootca
  SHA1: 67:65:0D:F1:7E:8E:7E:5B:82:40:A4:F4:56:4B:CF:E2:3D:69:C6:F0
  SHA256:
C0:A6:F4:DC:63:A2:4B:FD:CF:54:EF:2A:6A:08:2A:0A:72:DE:35:80:3E:2F:F5:FF:52:7A:E5:D8:72:06:DF:D5
Alias name: cia-crt-g3-01-ca
  SHA1: 2B:EE:2C:BA:A3:1D:B5:FE:60:40:41:95:08:ED:46:82:39:4D:ED:E2
  SHA256:
20:48:AD:4C:EC:90:7F:FA:4A:15:D4:CE:45:E3:C8:E4:2C:EA:78:33:DC:C7:D3:40:48:FC:60:47:27:42:99:EC
Alias name: cia-crt-g3-02-ca
  SHA1: 96:4A:BB:A7:BD:DA:FC:97:34:C0:0A:2D:F0:05:98:F7:E6:C6:6F:09
```

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```
SHA256:
93:F1:72:FB:BA:43:31:5C:06:EE:0F:9F:04:89:B8:F6:88:BC:75:15:3C:BE:B4:80:AC:A7:14:3A:F6:FC:4A:C1
Alias name: comodo-ca
SHA1: AF:E5:D2:44:A8:D1:19:42:30:FF:47:9F:E2:F8:97:BB:CD:7A:8C:B4
SHA256:
52:F0:E1:C4:E5:8E:C6:29:29:1B:60:31:7F:07:46:71:B8:5D:7E:A8:OD:5B:07:27:34:63:53:4B:32:B4:02:34
Alias name: comodoaaaca
SHA1: D1:EB:23:A4:6D:17:D6:8F:D9:25:64:C2:F1:F1:60:17:64:D8:E3:49
SHA256:
D7:A7:A0:FB:5D:7E:27:31:D7:71:E9:48:4E:BC:DE:F7:1D:5F:0C:3E:0A:29:48:78:2B:C8:3E:E0:EA:69:9E:F4
Alias name: comodoaaaservicesroot
SHA1: D1:EB:23:A4:6D:17:D6:8F:D9:25:64:C2:F1:F1:60:17:64:D8:E3:49
SHA256:
D7:A7:A0:FB:5D:7E:27:31:D7:71:E9:48:4E:BC:DE:F7:1D:5F:0C:3E:0A:29:48:78:2B:C8:3E:E0:EA:69:9E:F4
Alias name: comodocertificationauthority
SHA1: 66:31:BF:9E:F7:4F:9E:B6:C9:D5:A6:0C:BA:6A:BE:D1:F7:BD:EF:7B
SHA256:
0C:2C:D6:3D:F7:80:6F:A3:99:ED:E8:09:11:6B:57:5B:F8:79:89:F0:65:18:F9:80:8C:86:05:03:17:8B:AF:66
Alias name: comodoecccertificationauthority
SHA1: 9F:74:4E:9F:2B:4D:BA:EC:0F:31:2C:50:B6:56:3B:8E:2D:93:C3:11
SHA256:
17:93:92:7A:06:14:54:97:89:AD:CE:2F:8F:34:F7:F0:B6:6D:0F:3A:E3:A3:B8:4D:21:EC:15:DB:BA:4F:AD:C7
Alias name: comodorsacertificationauthority
SHA1: AF:E5:D2:44:A8:D1:19:42:30:FF:47:9F:E2:F8:97:BB:CD:7A:8C:B4
SHA256:
52:F0:E1:C4:E5:8E:C6:29:29:1B:60:31:7F:07:46:71:B8:5D:7E:A8:OD:5B:07:27:34:63:53:4B:32:B4:02:34
Alias name: cybertrustglobalroot
SHA1: 5F:43:E5:B1:BF:F8:78:8C:AC:1C:C7:CA:4A:9A:C6:22:2B:CC:34:C6
SHA256:
96:0A:DF:00:63:E9:63:56:75:0C:29:65:DD:0A:08:67:DA:0B:9C:BD:6E:77:71:4A:EA:FB:23:49:AB:39:3D:A3
Alias name: deprecateditsecca
SHA1: 12:12:0B:03:0E:15:14:54:F4:DD:B3:F5:DE:13:6E:83:5A:29:72:9D
SHA256:
9A:59:DA:86:24:1A:FD:BA:A3:39:FA:9C:FD:21:6A:0B:06:69:4D:E3:7E:37:52:6B:BE:63:C8:BC:83:74:2E:CB
Alias name: deutschetelekomrootca2
SHA1: 85:A4:08:C0:9C:19:3E:5D:51:58:7D:CD:D6:13:30:FD:8C:DE:37:BF
SHA256:
B6:19:1A:50:D0:C3:97:7F:7D:A9:9B:CD:AA:C8:6A:22:7D:AE:B9:67:9E:C7:0B:A3:B0:C9:D9:22:71:C1:70:D3
Alias name: digicertassuredidrootca
SHA1: 05:63:B8:63:0D:62:D7:5A:BB:C8:AB:1E:4B:DF:B5:A8:99:B2:4D:43
SHA256:
3E:90:99:B5:01:5E:8F:48:6C:00:BC:EA:9D:11:1E:E7:21:FA:BA:35:5A:89:BC:F1:DF:69:56:1E:3D:C6:32:5C
Alias name: digicertassuredidrootg2
SHA1: A1:4B:48:D9:43:EE:0A:0E:40:90:4F:3C:E0:A4:C0:91:93:51:5D:3F
SHA256:
7D:05:EB:B6:82:33:9F:8C:94:51:EE:09:4E:EB:FE:FA:79:53:A1:14:ED:B2:F4:49:49:45:2F:AB:7D:2F:C1:85
Alias name: digicertassuredidrootg3
SHA1: F5:17:A2:4F:9A:48:C6:C9:F8:A2:00:26:9F:DC:0F:48:2C:AB:30:89
SHA256:
7E:37:CB:8B:4C:47:09:0C:AB:36:55:1B:A6:F4:5D:B8:40:68:0F:BA:16:6A:95:2D:B1:00:71:7F:43:05:3F:C2
Alias name: digicertglobalrootca
SHA1: A8:98:5D:3A:65:E5:E5:C4:B2:D7:D6:6D:40:C6:DD:2F:B1:9C:54:36
SHA256:
43:48:A0:E9:44:4C:78:CB:26:5E:05:8D:5E:89:44:B4:D8:4F:96:62:BD:26:DB:25:7F:89:34:A4:43:C7:01:61
Alias name: digicertglobalrootg2
SHA1: DF:3C:24:F9:BF:D6:66:76:1B:26:80:73:FE:06:D1:CC:8D:4F:82:A4
SHA256:
CB:3C:CB:B7:60:31:E5:E0:13:8F:8D:D3:9A:23:F9:DE:47:FF:C3:5E:43:C1:14:4C:EA:27:D4:6A:5A:B1:CB:5F
Alias name: digicertglobalrootg3
SHA1: 7E:04:DE:89:6A:3E:66:6D:00:E6:87:D3:3F:FA:D9:3B:E8:3D:34:9E
SHA256:
31:AD:66:48:F8:10:41:38:C7:38:F3:9E:A4:32:01:33:39:3E:3A:18:CC:02:29:6E:F9:7C:2A:C9:EF:67:31:D0
Alias name: digicerthighassuranceevrootca
SHA1: 5F:B7:EE:06:33:E2:59:DB:AD:0C:4C:9A:E6:D3:8F:1A:61:C7:DC:25
SHA256:
74:31:E5:F4:C3:C1:CE:46:90:77:4F:0B:61:E0:54:40:88:3B:A9:A0:1E:D0:0B:A6:AB:D7:80:6E:D3:B1:18:CF
```

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```
Alias name: digicerttrustedrootg4
  SHA1: DD:FB:16:CD:49:31:C9:73:A2:03:7D:3F:C8:3A:4D:7D:77:5D:05:E4
  SHA256:
55:2F:7B:DC:F1:A7:AF:9E:6C:E6:72:01:7F:4F:12:AB:F7:72:40:C7:8E:76:1A:C2:03:D1:D9:D2:0A:C8:99:88
Alias name: dstrootcax3
  SHA1: DA:C9:02:4F:54:D8:F6:DF:94:93:5F:B1:73:26:38:CA:6A:D7:7C:13
  SHA256:
06:87:26:03:31:A7:24:03:D9:09:F1:05:E6:9B:CF:0D:32:E1:BD:24:93:FF:C6:D9:20:6D:11:BC:D6:77:07:39
Alias name: dtrustrootclass3ca22009
  SHA1: 58:E8:AB:B0:36:15:33:FB:80:F7:9B:1B:6D:29:D3:FF:8D:5F:00:F0
  SHA256:
49:E7:A4:42:AC:FO:EA:62:87:05:00:54:B5:25:64:B6:50:E4:F4:9E:42:E3:48:D6:AA:38:E0:39:E9:57:B1:C1
Alias name: dtrustrootclass3ca2ev2009
  SHA1: 96:C9:1B:0B:95:B4:10:98:42:FA:D0:D8:22:79:FE:60:FA:B9:16:83
  SHA256:
EE:C5:49:6B:98:8C:E9:86:25:B9:34:09:2E:EC:29:08:BE:D0:B0:F3:16:C2:D4:73:0C:84:EA:F1:F3:D3:48:81
Alias name: ecacc
  SHA1: 28:90:3A:63:5B:52:80:FA:E6:77:4C:0B:6D:A7:D6:BA:A6:4A:F2:E8
  SHA256:
88:49:7F:01:60:2F:31:54:24:6A:E2:8C:4D:5A:EF:10:F1:D8:7E:BB:76:62:6F:4A:E0:B7:F9:5B:A7:96:87:99
Alias name: emsigneccrootcac3
  SHA1: B6:AF:43:C2:9B:81:53:7D:F6:EF:6B:C3:1F:1F:60:15:0C:EE:48:66
  SHA256:
BC:4D:80:9B:15:18:9D:78:DB:3E:1D:8C:F4:F9:72:6A:79:5D:A1:64:3C:A5:F1:35:8E:1D:DB:0E:DC:0D:7E:B3
Alias name: emsigneccrootcacg3
  SHA1: 30:43:FA:4F:F2:57:DC:A0:C3:80:EE:2E:58:EA:78:B2:3F:E6:BB:C1
  SHA256:
86:A1:EC:BA:08:9C:4A:8D:3B:BE:27:34:C6:12:BA:34:1D:81:3E:04:3C:F9:E8:A8:62:CD:5C:57:A3:6B:BE:6B
Alias name: emsignrootcac1
  SHA1: E7:2E:F1:DF:FC:B2:09:28:CF:5D:D4:D5:67:37:B1:51:CB:86:4F:01
  SHA256:
12:56:09:AA:30:1D:A0:A2:49:B9:7A:82:39:CB:6A:34:21:6F:44:DC:AC:9F:39:54:B1:42:92:F2:E8:C8:60:8F
Alias name: emsignrootcacg1
  SHA1: 8A:C7:AD:8F:73:AC:4E:C1:B5:75:4D:A5:40:F4:FC:CF:7C:B5:8E:8C
  SHA256:
40:F6:AF:03:46:A9:9A:A1:CD:1D:55:5A:4E:9C:CE:62:C7:F9:63:46:03:EE:40:66:15:83:3D:C8:C8:D0:03:67
Alias name: entrust2048ca
  SHA1: 50:30:06:09:1D:97:D4:F5:AE:39:F7:CB:E7:92:7D:7D:65:2D:34:31
  SHA256:
6D:C4:71:72:E0:1C:BC:B0:BF:62:58:0D:89:5F:E2:B8:AC:9A:D4:F8:73:80:1E:0C:10:B9:C8:37:D2:1E:B1:77
Alias name: entrustevca
  SHA1: B3:1E:B1:B7:40:E3:6C:84:02:DA:DC:37:D4:4D:F5:D4:67:49:52:F9
  SHA256:
73:C1:76:43:4F:1B:C6:D5:AD:F4:5B:0E:76:E7:27:28:7C:8D:E5:76:16:C1:E6:E6:14:1A:2B:2C:BC:7D:8E:4C
Alias name: entrustnetpremium2048secureserverca
  SHA1: 50:30:06:09:1D:97:D4:F5:AE:39:F7:CB:E7:92:7D:7D:65:2D:34:31
  SHA256:
6D:C4:71:72:E0:1C:BC:B0:BF:62:58:0D:89:5F:E2:B8:AC:9A:D4:F8:73:80:1E:0C:10:B9:C8:37:D2:1E:B1:77
Alias name: entrustrootcacg2
  SHA1: 8C:F4:27:FD:79:0C:3A:D1:66:06:8D:E8:1E:57:EF:BB:93:22:72:D4
  SHA256:
43:DF:57:74:B0:3E:7F:EF:5F:E4:0D:93:1A:7B:ED:F1:BB:2E:6B:42:73:8C:4E:6D:38:41:10:3D:3A:A7:F3:39
Alias name: entrustrootcertificationauthority
  SHA1: B3:1E:B1:B7:40:E3:6C:84:02:DA:DC:37:D4:4D:F5:D4:67:49:52:F9
  SHA256:
73:C1:76:43:4F:1B:C6:D5:AD:F4:5B:0E:76:E7:27:28:7C:8D:E5:76:16:C1:E6:E6:14:1A:2B:2C:BC:7D:8E:4C
Alias name: entrustrootcertificationauthorityec1
  SHA1: 20:D8:06:40:DF:9B:25:F5:12:25:3A:11:EA:F7:59:8A:EB:14:B5:47
  SHA256:
02:ED:0E:B2:8C:14:DA:45:16:5C:56:67:91:70:0D:64:51:D7:FB:56:F0:B2:AB:1D:3B:8E:B0:70:E5:6E:DF:F5
Alias name: entrustrootcertificationauthorityg2
  SHA1: 8C:F4:27:FD:79:0C:3A:D1:66:06:8D:E8:1E:57:EF:BB:93:22:72:D4
  SHA256:
43:DF:57:74:B0:3E:7F:EF:5F:E4:0D:93:1A:7B:ED:F1:BB:2E:6B:42:73:8C:4E:6D:38:41:10:3D:3A:A7:F3:39
Alias name: entrustrootcertificationauthorityg4
  SHA1: 14:88:4E:86:26:37:B0:26:AF:59:62:5C:40:77:EC:35:29:BA:96:01
```



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```
SHA256:
DB:35:17:D1:F6:73:2A:2D:5A:B9:7C:53:3E:C7:07:79:EE:32:70:A6:2F:B4:AC:42:38:37:24:60:E6:F0:1E:88
Alias name: epkirootcertificationauthority
SHA1: 67:65:0D:F1:7E:8E:7E:5B:82:40:A4:F4:56:4B:CF:E2:3D:69:C6:F0
SHA256:
C0:A6:F4:DC:63:A2:4B:FD:CF:54:EF:2A:6A:08:2A:0A:72:DE:35:80:3E:2F:F5:FF:52:7A:E5:D8:72:06:DF:D5
Alias name: equifaxsecureebusinesscal
SHA1: AE:E6:3D:70:E3:76:FB:C7:3A:EB:B0:A1:C1:D4:C4:7A:A7:40:B3:F4
SHA256:
2E:3A:2B:B5:11:25:05:83:6C:A8:96:8B:E2:CB:37:27:CE:9B:56:84:5C:6E:E9:8E:91:85:10:4A:FB:9A:F5:96
Alias name: equifaxsecureglobalebusinesscal
SHA1: 3A:74:CB:7A:47:DB:70:DE:89:1F:24:35:98:64:B8:2D:82:BD:1A:36
SHA256:
86:AB:5A:65:71:D3:32:9A:BC:D2:E4:E6:37:66:8B:A8:9C:73:1E:C2:93:B6:CB:A6:0F:71:63:40:A0:91:CE:AE
Alias name: eszignorootca2017
SHA1: 89:D4:83:03:4F:9E:9A:48:80:5F:72:37:D4:A9:A6:EF:CB:7C:1F:D1
SHA256:
BE:B0:0B:30:83:9B:9B:C3:2C:32:E4:44:79:05:95:06:41:F2:64:21:B1:5E:D0:89:19:8B:51:8A:E2:EA:1B:99
Alias name: etugracertificationauthority
SHA1: 51:C6:E7:08:49:06:6E:F3:92:D4:5C:A0:0D:6D:A3:62:8F:C3:52:39
SHA256:
B0:BF:D5:2B:B0:D7:D9:BD:92:BF:5D:4D:C1:3D:A2:55:C0:2C:54:2F:37:83:65:EA:89:39:11:F5:5E:55:F2:3C
Alias name: gd-class2-root.pem
SHA1: 27:96:BA:E6:3F:18:01:E2:77:26:1B:A0:D7:77:70:02:8F:20:EE:E4
SHA256:
C3:84:6B:F2:4B:9E:93:CA:64:27:4C:0E:C6:7C:1E:CC:5E:02:4F:FC:AC:D2:D7:40:19:35:0E:81:FE:54:6A:E4
Alias name: gd_bundle-g2.pem
SHA1: 27:AC:93:69:FA:F2:52:07:BB:26:27:CE:FA:CC:BE:4E:F9:C3:19:B8
SHA256:
97:3A:41:27:6F:FD:01:E0:27:A2:AA:D4:9E:34:C3:78:46:D3:E9:76:FF:6A:62:0B:67:12:E3:38:32:04:1A:A6
Alias name: gdcatrustauthr5root
SHA1: 0F:36:38:5B:81:1A:25:C3:9B:31:4E:83:CA:E9:34:66:70:CC:74:B4
SHA256:
BF:FF:8F:D0:44:33:48:7D:6A:8A:A6:0C:1A:29:76:7A:9F:C2:BB:B0:5E:42:0F:71:3A:13:B9:92:89:1D:38:93
Alias name: gdroot-g2.pem
SHA1: 47:BE:AB:C9:22:EA:E8:0E:78:78:34:62:A7:9F:45:C2:54:FD:E6:8B
SHA256:
45:14:0B:32:47:EB:9C:C8:C5:B4:F0:D7:B5:30:91:F7:32:92:08:9E:6E:5A:63:E2:74:9D:D3:AC:A9:19:8E:DA
Alias name: geotrustglobalca
SHA1: DE:28:F4:A4:FF:E5:B9:2F:A3:C5:03:D1:A3:49:A7:F9:96:2A:82:12
SHA256:
FF:85:6A:2D:25:1D:CD:88:D3:66:56:F4:50:12:67:98:CF:AB:AA:DE:40:79:9C:72:2D:E4:D2:B5:DB:36:A7:3A
Alias name: geotrustprimaryca
SHA1: 32:3C:11:8E:1B:F7:B8:B6:52:54:E2:E2:10:0D:D6:02:90:37:F0:96
SHA256:
37:D5:10:06:C5:12:EA:AB:62:64:21:F1:EC:8C:92:01:3F:C5:F8:2A:E9:8E:E5:33:EB:46:19:B8:DE:B4:D0:6C
Alias name: geotrustprimarycag2
SHA1: 8D:17:84:D5:37:F3:03:7D:EC:70:FE:57:8B:51:9A:99:E6:10:D7:B0
SHA256:
5E:DB:7A:C4:3B:82:A0:6A:87:61:E8:D7:BE:49:79:EB:F2:61:1F:7D:D7:9B:F9:1C:1C:6B:56:6A:21:9E:D7:66
Alias name: geotrustprimarycag3
SHA1: 03:9E:ED:B8:0B:E7:A0:3C:69:53:89:3B:20:D2:D9:32:3A:4C:2A:FD
SHA256:
B4:78:B8:12:25:0D:F8:78:63:5C:2A:A7:EC:7D:15:5E:AA:62:5E:E8:29:16:E2:CD:29:43:61:88:6C:D1:FB:D4
Alias name: geotrustprimarycertificationauthority
SHA1: 32:3C:11:8E:1B:F7:B8:B6:52:54:E2:E2:10:0D:D6:02:90:37:F0:96
SHA256:
37:D5:10:06:C5:12:EA:AB:62:64:21:F1:EC:8C:92:01:3F:C5:F8:2A:E9:8E:E5:33:EB:46:19:B8:DE:B4:D0:6C
Alias name: geotrustprimarycertificationauthorityg2
SHA1: 8D:17:84:D5:37:F3:03:7D:EC:70:FE:57:8B:51:9A:99:E6:10:D7:B0
SHA256:
5E:DB:7A:C4:3B:82:A0:6A:87:61:E8:D7:BE:49:79:EB:F2:61:1F:7D:D7:9B:F9:1C:1C:6B:56:6A:21:9E:D7:66
Alias name: geotrustprimarycertificationauthorityg3
SHA1: 03:9E:ED:B8:0B:E7:A0:3C:69:53:89:3B:20:D2:D9:32:3A:4C:2A:FD
SHA256:
B4:78:B8:12:25:0D:F8:78:63:5C:2A:A7:EC:7D:15:5E:AA:62:5E:E8:29:16:E2:CD:29:43:61:88:6C:D1:FB:D4
```

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```
Alias name: geotrustuniversalca
  SHA1: E6:21:F3:35:43:79:05:9A:4B:68:30:9D:8A:2F:74:22:15:87:EC:79
  SHA256:
A0:45:9B:9F:63:B2:25:59:F5:FA:5D:4C:6D:B3:F9:F7:2F:F1:93:42:03:35:78:F0:73:BF:1D:1B:46:CB:B9:12
Alias name: geotrustuniversalca2
  SHA1: 37:9A:19:7B:41:85:45:35:0C:A6:03:69:F3:3C:2E:AF:47:4F:20:79
  SHA256:
A0:23:4F:3B:C8:52:7C:A5:62:8E:EC:81:AD:5D:69:89:5D:A5:68:0D:C9:1D:1C:B8:47:7F:33:F8:78:B9:5B:0B
Alias name: globalchambersignroot2008
  SHA1: 4A:BD:EE:EC:95:0D:35:9C:89:AE:C7:52:A1:2C:5B:29:F6:D6:AA:0C
  SHA256:
13:63:35:43:93:34:A7:69:80:16:A0:D3:24:DE:72:28:4E:07:9D:7B:52:20:BB:8F:BD:74:78:16:EE:BE:BA:CA
Alias name: globalsignca
  SHA1: B1:BC:96:8B:D4:F4:9D:62:2A:A8:9A:81:F2:15:01:52:A4:1D:82:9C
  SHA256:
EB:D4:10:40:E4:BB:3E:C7:42:C9:E3:81:D3:1E:F2:A4:1A:48:B6:68:5C:96:E7:CE:F3:C1:DF:6C:D4:33:1C:99
Alias name: globalsigneccrootcar4
  SHA1: 69:69:56:2E:40:80:F4:24:A1:E7:19:9F:14:BA:F3:EE:58:AB:6A:BB
  SHA256:
BE:C9:49:11:C2:95:56:76:DB:6C:0A:55:09:86:D7:6E:3B:A0:05:66:7C:44:2C:97:62:B4:FB:B7:73:DE:22:8C
Alias name: globalsigneccrootcar5
  SHA1: 1F:24:C6:30:CD:A4:18:EF:20:69:FF:AD:4F:DD:5F:46:3A:1B:69:AA
  SHA256:
17:9F:BC:14:8A:3D:D0:0F:D2:4E:A1:34:58:CC:43:BF:A7:F5:9C:81:82:D7:83:A5:13:F6:EB:EC:10:0C:89:24
Alias name: globalsignr2ca
  SHA1: 75:E0:AB:B6:13:85:12:27:1C:04:F8:5F:DD:DE:38:E4:B7:24:2E:FE
  SHA256:
CA:42:DD:41:74:5F:D0:B8:1E:B9:02:36:2C:F9:D8:BF:71:9D:A1:BD:1B:1E:FC:94:6F:5B:4C:99:F4:2C:1B:9E
Alias name: globalsignr3ca
  SHA1: D6:9B:56:11:48:F0:1C:77:C5:45:78:C1:09:26:DF:5B:85:69:76:AD
  SHA256:
CB:B5:22:D7:B7:F1:27:AD:6A:01:13:86:5B:DF:1C:D4:10:2E:7D:07:59:AF:63:5A:7C:F4:72:0D:C9:63:C5:3B
Alias name: globalsignrootca
  SHA1: B1:BC:96:8B:D4:F4:9D:62:2A:A8:9A:81:F2:15:01:52:A4:1D:82:9C
  SHA256:
EB:D4:10:40:E4:BB:3E:C7:42:C9:E3:81:D3:1E:F2:A4:1A:48:B6:68:5C:96:E7:CE:F3:C1:DF:6C:D4:33:1C:99
Alias name: globalsignrootcar2
  SHA1: 75:E0:AB:B6:13:85:12:27:1C:04:F8:5F:DD:DE:38:E4:B7:24:2E:FE
  SHA256:
CA:42:DD:41:74:5F:D0:B8:1E:B9:02:36:2C:F9:D8:BF:71:9D:A1:BD:1B:1E:FC:94:6F:5B:4C:99:F4:2C:1B:9E
Alias name: globalsignrootcar3
  SHA1: D6:9B:56:11:48:F0:1C:77:C5:45:78:C1:09:26:DF:5B:85:69:76:AD
  SHA256:
CB:B5:22:D7:B7:F1:27:AD:6A:01:13:86:5B:DF:1C:D4:10:2E:7D:07:59:AF:63:5A:7C:F4:72:0D:C9:63:C5:3B
Alias name: globalsignrootcar6
  SHA1: 80:94:64:0E:B5:A7:A1:CA:11:9C:1F:DD:D5:9F:81:02:63:A7:FB:D1
  SHA256:
2C:AB:EA:FE:37:D0:6C:A2:2A:BA:73:91:C0:03:3D:25:98:29:52:C4:53:64:73:49:76:3A:3A:B5:AD:6C:CF:69
Alias name: godaddyclass2ca
  SHA1: 27:96:BA:E6:3F:18:01:E2:77:26:1B:A0:D7:77:70:02:8F:20:EE:E4
  SHA256:
C3:84:6B:F2:4B:9E:93:CA:64:27:4C:0E:C6:7C:1E:CC:5E:02:4F:FC:AC:D2:D7:40:19:35:0E:81:FE:54:6A:E4
Alias name: godaddyrootcertificateauthorityg2
  SHA1: 47:BE:AB:C9:22:EA:E8:0E:78:78:34:62:A7:9F:45:C2:54:FD:E6:8B
  SHA256:
45:14:0B:32:47:EB:9C:C8:C5:B4:F0:D7:B5:30:91:F7:32:92:08:9E:6E:5A:63:E2:74:9D:D3:AC:A9:19:8E:DA
Alias name: godaddyrootg2ca
  SHA1: 47:BE:AB:C9:22:EA:E8:0E:78:78:34:62:A7:9F:45:C2:54:FD:E6:8B
  SHA256:
45:14:0B:32:47:EB:9C:C8:C5:B4:F0:D7:B5:30:91:F7:32:92:08:9E:6E:5A:63:E2:74:9D:D3:AC:A9:19:8E:DA
Alias name: gtsrootr1
  SHA1: E1:C9:50:E6:EF:22:F8:4C:56:45:72:8B:92:20:60:D7:D5:A7:A3:E8
  SHA256:
2A:57:54:71:E3:13:40:BC:21:58:1C:BD:2C:F1:3E:15:84:63:20:3E:CE:94:BC:F9:D3:CC:19:6B:F0:9A:54:72
Alias name: gtsrootr2
  SHA1: D2:73:96:2A:2A:5E:39:9F:73:3F:E1:C7:1E:64:3F:03:38:34:FC:4D
```

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```
SHA256:  
C4:5D:7B:B0:8E:6D:67:E6:2E:42:35:11:0B:56:4E:5F:78:FD:92:EF:05:8C:84:0A:EA:4E:64:55:D7:58:5C:60  
Alias name: gtsrootr3  
SHA1: 30:D4:24:6F:07:FF:DB:91:89:8A:0B:E9:49:66:11:EB:8C:5E:46:E5  
SHA256:  
15:D5:B8:77:46:19:EA:7D:54:CE:1C:A6:D0:B0:C4:03:E0:37:A9:17:F1:31:E8:A0:4E:1E:6B:7A:71:BA:BC:E5  
Alias name: gtsrootr4  
SHA1: 2A:1D:60:27:D9:4A:B1:0A:1C:4D:91:5C:CD:33:A0:CB:3E:2D:54:CB  
SHA256:  
71:CC:A5:39:1F:9E:79:4B:04:80:25:30:B3:63:E1:21:DA:8A:30:43:BB:26:66:2F:EA:4D:CA:7F:C9:51:A4:BD  
Alias name: hellenicacademicandresearchinstitutionsseccrootca2015  
SHA1: 9F:F1:71:8D:92:D5:9A:F3:7D:74:97:B4:BC:6F:84:68:0B:BA:B6:66  
SHA256:  
44:B5:45:AA:8A:25:E6:5A:73:CA:15:DC:27:FC:36:D2:4C:1C:B9:95:3A:06:65:39:B1:15:82:DC:48:7B:48:33  
Alias name: hellenicacademicandresearchinstitutionsrootca2011  
SHA1: FE:45:65:9B:79:03:5B:98:A1:61:B5:51:2E:AC:DA:58:09:48:22:4D  
SHA256:  
BC:10:4F:15:A4:8B:E7:09:DC:A5:42:A7:E1:D4:B9:DF:6F:05:45:27:E8:02:EA:A9:2D:59:54:44:25:8A:FE:71  
Alias name: hellenicacademicandresearchinstitutionsrootca2015  
SHA1: 01:0C:06:95:A6:98:19:14:FF:BF:5F:C6:B0:B6:95:EA:29:E9:12:A6  
SHA256:  
AO:40:92:9A:02:CE:53:B4:AC:F4:F2:FF:C6:98:1C:E4:49:6F:75:5E:6D:45:FE:0B:2A:69:2B:CD:52:52:3F:36  
Alias name: hongkongpostrootca1  
SHA1: D6:DA:A8:20:8D:09:D2:15:4D:24:B5:2F:CB:34:6E:B2:58:B2:8A:58  
SHA256:  
F9:E6:7D:33:6C:51:00:2A:C0:54:C6:32:02:2D:66:DD:A2:E7:E3:FF:F1:0A:D0:61:ED:31:D8:BB:B4:10:CF:B2  
Alias name: hongkongpostrootca3  
SHA1: 58:A2:D0:EC:20:52:81:5B:C1:F3:F8:64:02:24:4E:C2:8E:02:4B:02  
SHA256:  
5A:2F:C0:3F:0C:83:B0:90:BB:FA:40:60:4B:09:88:44:6C:76:36:18:3D:F9:84:6E:17:10:1A:44:7F:B8:EF:D6  
Alias name: identrustcommercialrootca1  
SHA1: DF:71:7E:AA:4A:D9:4E:C9:55:84:99:60:2D:48:DE:5F:BC:F0:3A:25  
SHA256:  
5D:56:49:9B:E4:D2:E0:8B:CF:CA:D0:8A:3E:38:72:3D:50:50:3B:DE:70:69:48:E4:2F:55:60:30:19:E5:28:AE  
Alias name: identrustpublicsectorrootca1  
SHA1: BA:29:41:60:77:98:3F:F4:F3:EF:F2:31:05:3B:2E:EA:6D:4D:45:FD  
SHA256:  
30:D0:89:5A:9A:44:8A:26:20:91:63:55:22:D1:F5:20:10:B5:86:7A:CA:E1:2C:78:EF:95:8F:D4:F4:38:9F:2F  
Alias name: isrgrootx1  
SHA1: CA:BD:2A:79:A1:07:6A:31:F2:1D:25:36:35:CB:03:9D:43:29:A5:E8  
SHA256:  
96:BC:EC:06:26:49:76:F3:74:60:77:9A:CF:28:C5:A7:CF:E8:A3:C0:AA:E1:1A:8F:FC:EE:05:C0:BD:DF:08:C6  
Alias name: izenpecom  
SHA1: 2F:78:3D:25:52:18:A7:4A:65:39:71:B5:2C:A2:9C:45:15:6F:E9:19  
SHA256:  
25:30:CC:8E:98:32:15:02:BA:D9:6F:9B:1F:BA:1B:09:9E:2D:29:9E:0F:45:48:BB:91:4F:36:3B:C0:D4:53:1F  
Alias name: keynectisrootca  
SHA1: 9C:61:5C:4D:4D:85:10:3A:53:26:C2:4D:BA:EA:E4:A2:D2:D5:CC:97  
SHA256:  
42:10:F1:99:49:9A:9A:C3:3C:8D:E0:2B:A6:DB:AA:14:40:8B:DD:8A:6E:32:46:89:C1:92:2D:06:97:15:A3:32  
Alias name: microseceszignorootca2009  
SHA1: 89:DF:74:FE:5C:F4:0F:4A:80:F9:E3:37:7D:54:DA:91:E1:01:31:8E  
SHA256:  
3C:5F:81:FE:A5:FA:B8:2C:64:BF:A2:EA:EC:AF:CD:E8:E0:77:FC:86:20:A7:CA:E5:37:16:3D:F3:6E:DB:F3:78  
Alias name: mozillacert0.pem  
SHA1: 97:81:79:50:D8:1C:96:70:CC:34:D8:09:CF:79:44:31:36:7E:F4:74  
SHA256:  
A5:31:25:18:8D:21:10:AA:96:4B:02:C7:B7:C6:DA:32:03:17:08:94:E5:FB:71:FF:FB:66:67:D5:E6:81:0A:36  
Alias name: mozillacert1.pem  
SHA1: 23:E5:94:94:51:95:F2:41:48:03:B4:D5:64:D2:A3:A3:F5:D8:8B:8C  
SHA256:  
B4:41:0B:73:E2:E6:EA:CA:47:FB:C4:2F:8F:A4:01:8A:F4:38:1D:C5:4C:FA:A8:44:50:46:1E:ED:09:45:4D:E9  
Alias name: mozillacert10.pem  
SHA1: 5F:3A:FC:0A:8B:64:F6:86:67:34:74:DF:7E:A9:A2:FE:F9:FA:7A:51  
SHA256:  
21:DB:20:12:36:60:BB:2E:D4:18:20:5D:A1:1E:E7:A8:5A:65:E2:BC:6E:55:B5:AF:7E:78:99:C8:A2:66:D9:2E
```

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```
Alias name: mozillacert100.pem
  SHA1: 58:E8:AB:B0:36:15:33:FB:80:F7:9B:1B:6D:29:D3:FF:8D:5F:00:F0
  SHA256:
49:E7:A4:42:AC:F0:EA:62:87:05:00:54:B5:25:64:B6:50:E4:F4:9E:42:E3:48:D6:AA:38:E0:39:E9:57:B1:C1
Alias name: mozillacert101.pem
  SHA1: 99:A6:9B:E6:1A:FE:88:6B:4D:2B:82:00:7C:B8:54:FC:31:7E:15:39
  SHA256:
62:F2:40:27:8C:56:4C:4D:D8:BF:7D:9D:4F:6F:36:6E:A8:94:D2:2F:5F:34:D9:89:A9:83:AC:EC:2F:FF:ED:50
Alias name: mozillacert102.pem
  SHA1: 96:C9:1B:0B:95:B4:10:98:42:FA:D0:D8:22:79:FE:60:FA:B9:16:83
  SHA256:
EB:C5:49:6B:98:8C:E9:86:25:B9:34:09:2E:EC:29:08:BE:D0:B0:F3:16:C2:D4:73:0C:84:EA:F1:F3:D3:48:81
Alias name: mozillacert103.pem
  SHA1: 70:C1:8D:74:B4:28:81:0A:E4:FD:A5:75:D7:01:9F:99:B0:3D:50:74
  SHA256:
3C:FC:3C:14:D1:F6:84:FF:17:E3:8C:43:CA:44:0C:00:B9:67:EC:93:3E:8B:FE:06:4C:A1:D7:2C:90:F2:AD:B0
Alias name: mozillacert104.pem
  SHA1: 4F:99:AA:93:FB:2B:D1:37:26:A1:99:4A:CE:7F:F0:05:F2:93:5D:1E
  SHA256:
1C:01:C6:F4:DB:B2:FE:FC:22:55:8B:2B:CA:32:56:3F:49:84:4A:CF:C3:2B:7B:E4:B0:FF:59:9F:9E:8C:7A:F7
Alias name: mozillacert105.pem
  SHA1: 77:47:4F:C6:30:E4:0F:4C:47:64:3F:84:BA:B8:C6:95:4A:8A:41:EC
  SHA256:
F0:9B:12:2C:71:14:F4:A0:9B:D4:EA:4F:4A:99:D5:58:B4:6E:4C:25:CD:81:14:0D:29:C0:56:13:91:4C:38:41
Alias name: mozillacert106.pem
  SHA1: E7:A1:90:29:D3:D5:52:DC:0D:0F:C6:92:D3:EA:88:0D:15:2E:1A:6B
  SHA256:
D9:5F:EA:3C:A4:EE:DC:E7:4C:D7:6E:75:FC:6D:1F:F6:2C:44:1F:0F:A8:BC:77:F0:34:B1:9E:5D:B2:58:01:5D
Alias name: mozillacert107.pem
  SHA1: 8E:1C:74:F8:A6:20:B9:E5:8A:F4:61:FA:EC:2B:47:56:51:1A:52:C6
  SHA256:
F9:6F:23:F4:C3:E7:9C:07:7A:46:98:8D:5A:F5:90:06:76:A0:F0:39:CB:64:5D:D1:75:49:B2:16:C8:24:40:CE
Alias name: mozillacert108.pem
  SHA1: B1:BC:96:8B:D4:F4:9D:62:2A:A8:9A:81:F2:15:01:52:A4:1D:82:9C
  SHA256:
EB:D4:10:40:E4:BB:3E:C7:42:C9:E3:81:D3:1E:F2:A4:1A:48:B6:68:5C:96:E7:CE:F3:C1:DF:6C:D4:33:1C:99
Alias name: mozillacert109.pem
  SHA1: B5:61:EB:EA:A4:DE:E4:25:4B:69:1A:98:A5:57:47:C2:34:C7:D9:71
  SHA256:
E2:3D:4A:03:6D:7B:70:E9:F5:95:B1:42:20:79:D2:B9:1E:DF:BB:1F:B6:51:A0:63:3E:AA:8A:9D:C5:F8:07:03
Alias name: mozillacert110.pem
  SHA1: 05:63:B8:63:0D:62:D7:5A:BB:C8:AB:1E:4B:DF:B5:A8:99:B2:4D:43
  SHA256:
3E:90:99:B5:01:5E:8F:48:6C:00:BC:EA:9D:11:1E:E7:21:FA:BA:35:5A:89:BC:F1:DF:69:56:1E:3D:C6:32:5C
Alias name: mozillacert111.pem
  SHA1: 93:05:7A:88:15:C6:4F:CE:88:2F:FA:91:16:52:28:78:BC:53:64:17
  SHA256:
9A:6E:C0:12:E1:A7:DA:9D:BE:34:19:4D:47:8A:D7:C0:DB:18:22:FB:07:1D:F1:29:81:49:6E:D1:04:38:41:13
Alias name: mozillacert112.pem
  SHA1: 9C:BB:48:53:F6:A4:F6:D3:52:A4:E8:32:52:55:60:13:F5:AD:AF:65
  SHA256:
59:76:90:07:F7:68:5D:0F:CD:50:87:2F:9F:95:D5:75:5A:5B:2B:45:7D:81:F3:69:2B:61:0A:98:67:2F:0E:1B
Alias name: mozillacert113.pem
  SHA1: 43:13:BB:96:F1:D5:86:9B:C1:4E:6A:92:F6:CF:F6:34:69:87:82:37
  SHA256:
DD:69:36:FE:21:F8:F0:77:C1:23:A1:A5:21:C1:22:24:F7:22:55:B7:3E:03:A7:26:06:93:E8:A2:4B:0F:A3:89
Alias name: mozillacert114.pem
  SHA1: 50:30:06:09:1D:97:D4:F5:AE:39:F7:CB:E7:92:7D:7D:65:2D:34:31
  SHA256:
6D:C4:71:72:E0:1C:BC:B0:BF:62:58:0D:89:5F:E2:B8:AC:9A:D4:F8:73:80:1E:0C:10:B9:C8:37:D2:1E:B1:77
Alias name: mozillacert115.pem
  SHA1: 51:C6:E7:08:49:06:6E:F3:92:D4:5C:A0:0D:6D:A3:62:8F:C3:52:39
  SHA256:
B0:BF:D5:2B:B0:D7:D9:BD:92:BF:5D:4D:C1:3D:A2:55:C0:2C:54:2F:37:83:65:EA:89:39:11:F5:5E:55:F2:3C
Alias name: mozillacert116.pem
  SHA1: 59:0D:2D:7D:88:4F:40:2E:61:7E:A5:62:32:17:65:CF:17:D8:94:E9
```

```
SHA256:
91:E2:F5:78:8D:58:10:EB:A7:BA:58:73:7D:E1:54:8A:8E:CA:CD:01:45:98:BC:0B:14:3E:04:1B:17:05:25:52
Alias name: mozillacert116.pem
SHA1: 2B:B1:F5:3E:55:0C:1D:C5:F1:D4:E6:B7:6A:46:4B:55:06:02:AC:21
SHA256:
F3:56:BE:A2:44:B7:A9:1E:B3:5D:53:CA:9A:D7:86:4A:CE:01:8E:2D:35:D5:F8:F9:6D:DF:68:A6:F4:1A:A4:74
Alias name: mozillacert117.pem
SHA1: D4:DE:20:D0:5E:66:FC:53:FE:1A:50:88:2C:78:DB:28:52:CA:E4:74
SHA256:
16:AF:57:A9:F6:76:B0:AB:12:60:95:AA:5E:BA:DE:F2:2A:B3:11:19:D6:44:AC:95:CD:4B:93:DB:F3:F2:6A:EB
Alias name: mozillacert118.pem
SHA1: 7E:78:4A:10:1C:82:65:CC:2D:E1:F1:6D:47:B4:40:CA:D9:0A:19:45
SHA256:
5F:0B:62:EA:B5:E3:53:EA:65:21:65:16:58:FB:B6:53:59:F4:43:28:0A:4A:FB:D1:04:D7:7D:10:F9:F0:4C:07
Alias name: mozillacert119.pem
SHA1: 75:E0:AB:B6:13:85:12:27:1C:04:F8:5F:DD:DE:38:E4:B7:24:2E:FE
SHA256:
CA:42:DD:41:74:5F:D0:B8:1E:B9:02:36:2C:F9:D8:BF:71:9D:A1:BD:1B:1E:FC:94:6F:5B:4C:99:F4:2C:1B:9E
Alias name: mozillacert12.pem
SHA1: A8:98:5D:3A:65:E5:E5:C4:B2:D7:D6:6D:40:C6:DD:2F:B1:9C:54:36
SHA256:
43:48:A0:E9:44:4C:78:CB:26:5E:05:8D:5E:89:44:B4:D8:4F:96:62:BD:26:DB:25:7F:89:34:A4:43:C7:01:61
Alias name: mozillacert120.pem
SHA1: DA:40:18:8B:91:89:A3:ED:EE:AE:DA:97:FE:2F:9D:F5:B7:D1:8A:41
SHA256:
CF:56:FF:46:A4:A1:86:10:9D:D9:65:84:B5:EE:B5:8A:51:0C:42:75:B0:E5:F9:4F:40:BB:AE:86:5E:19:F6:73
Alias name: mozillacert121.pem
SHA1: CC:AB:0E:A0:4C:23:01:D6:69:7B:DD:37:9F:CD:12:EB:24:E3:94:9D
SHA256:
8C:72:09:27:9A:C0:4E:27:5E:16:D0:7F:D3:B7:75:E8:01:54:B5:96:80:46:E3:1F:52:DD:25:76:63:24:E9:A7
Alias name: mozillacert122.pem
SHA1: 02:FA:F3:E2:91:43:54:68:60:78:57:69:4D:F5:E4:5B:68:85:18:68
SHA256:
68:7F:A4:51:38:22:78:FF:F0:C8:B1:1F:8D:43:D5:76:67:1C:6E:B2:BC:EA:B4:13:FB:83:D9:65:D0:6D:2F:F2
Alias name: mozillacert123.pem
SHA1: 2A:B6:28:48:5E:78:FB:F3:AD:9E:79:10:DD:6B:DF:99:72:2C:96:E5
SHA256:
07:91:CA:07:49:B2:07:82:AA:D3:C7:D7:BD:0C:DF:C9:48:58:35:84:3E:B2:D7:99:60:09:CE:43:AB:6C:69:27
Alias name: mozillacert124.pem
SHA1: 4D:23:78:EC:91:95:39:B5:00:7F:75:8F:03:3B:21:1E:C5:4D:8B:CF
SHA256:
80:95:21:08:05:DB:4B:BC:35:5E:44:28:D8:FD:6E:C2:CD:E3:AB:5F:B9:7A:99:42:98:8E:B8:F4:DC:D0:60:16
Alias name: mozillacert125.pem
SHA1: B3:1E:B1:B7:40:E3:6C:84:02:DA:DC:37:D4:4D:F5:D4:67:49:52:F9
SHA256:
73:C1:76:43:4F:1B:C6:D5:AD:F4:5B:0E:76:E7:27:28:7C:8D:E5:76:16:C1:E6:E6:14:1A:2B:2C:BC:7D:8E:4C
Alias name: mozillacert126.pem
SHA1: 25:01:90:19:CF:FB:D9:99:1C:B7:68:25:74:8D:94:5F:30:93:95:42
SHA256:
AF:8B:67:62:A1:E5:28:22:81:61:A9:5D:5C:55:9E:E2:66:27:8F:75:D7:9E:83:01:89:A5:03:50:6A:BD:6B:4C
Alias name: mozillacert127.pem
SHA1: DE:28:F4:A4:FF:E5:B9:2F:A3:C5:03:D1:A3:49:A7:F9:96:2A:82:12
SHA256:
FF:85:6A:2D:25:1D:CD:88:D3:66:56:F4:50:12:67:98:CF:AB:AA:DE:40:79:9C:72:2D:E4:D2:B5:DB:36:A7:3A
Alias name: mozillacert128.pem
SHA1: A9:E9:78:08:14:37:58:88:F2:05:19:B0:6D:2B:0D:2B:60:16:90:7D
SHA256:
CA:2D:82:A0:86:77:07:2F:8A:B6:76:4F:F0:35:67:6C:FE:3E:5E:32:5E:01:21:72:DF:3F:92:09:6D:B7:9B:85
Alias name: mozillacert129.pem
SHA1: E6:21:F3:35:43:79:05:9A:4B:68:30:9D:8A:2F:74:22:15:87:EC:79
SHA256:
A0:45:9B:9F:63:B2:25:59:F5:FA:5D:4C:6D:B3:F9:F7:2F:F1:93:42:03:35:78:F0:73:BF:1D:1B:46:CB:B9:12
Alias name: mozillacert13.pem
SHA1: 06:08:3F:59:3F:15:A1:04:A0:69:A4:6B:A9:03:D0:06:B7:97:09:91
SHA256:
6C:61:DA:C3:A2:DE:F0:31:50:6B:E0:36:D2:A6:FE:40:19:94:FB:D1:3D:F9:C8:D4:66:59:92:74:C4:46:EC:98
```

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```
Alias name: mozillacert130.pem
  SHA1: E5:DF:74:3C:B6:01:C4:9B:98:43:DC:AB:8C:E8:6A:81:10:9F:E4:8E
  SHA256:
F4:C1:49:55:1A:30:13:A3:5B:C7:BF:FE:17:A7:F3:44:9B:C1:AB:5B:5A:0A:E7:4B:06:C2:3B:90:00:4C:01:04
Alias name: mozillacert131.pem
  SHA1: 37:9A:19:7B:41:85:45:35:0C:A6:03:69:F3:3C:2E:AF:47:4F:20:79
  SHA256:
A0:23:4F:3B:C8:52:7C:A5:62:8E:EC:81:AD:5D:69:89:5D:A5:68:0D:C9:1D:1C:B8:47:7F:33:F8:78:B9:5B:0B
Alias name: mozillacert132.pem
  SHA1: 39:21:C1:15:C1:5D:0E:CA:5C:CB:5B:C4:F0:7D:21:D8:05:0B:56:6A
  SHA256:
77:40:73:12:C6:3A:15:3D:5B:C0:0B:4E:51:75:9C:DF:DA:C2:37:DC:2A:33:B6:79:46:E9:8E:9B:FA:68:0A:E3
Alias name: mozillacert133.pem
  SHA1: 85:B5:FF:67:9B:0C:79:96:1F:C8:6E:44:22:00:46:13:DB:17:92:84
  SHA256:
7D:3B:46:5A:60:14:E5:26:C0:AF:FC:EE:21:27:D2:31:17:27:AD:81:1C:26:84:2D:00:6A:F3:73:06:CC:80:BD
Alias name: mozillacert134.pem
  SHA1: 70:17:9B:86:8C:00:A4:FA:60:91:52:22:3F:9F:3E:32:BD:E0:05:62
  SHA256:
69:FA:C9:BD:55:FB:0A:C7:8D:53:BB:EE:5C:F1:D5:97:98:9F:D0:AA:AB:20:A2:51:51:BD:F1:73:3E:E7:D1:22
Alias name: mozillacert135.pem
  SHA1: 62:52:DC:40:F7:11:43:A2:2F:DE:9E:F7:34:8E:06:42:51:B1:81:18
  SHA256:
D8:E0:FE:BC:1D:B2:E3:8D:00:94:0F:37:D2:7D:41:34:4D:99:3E:73:4B:99:D5:65:6D:97:78:D4:D8:14:36:24
Alias name: mozillacert136.pem
  SHA1: D1:EB:23:A4:6D:17:D6:8F:D9:25:64:C2:F1:F1:60:17:64:D8:E3:49
  SHA256:
D7:A7:A0:FB:5D:7E:27:31:D7:71:E9:48:4E:BC:DE:F7:1D:5F:0C:3E:0A:29:48:78:2B:C8:3E:E0:EA:69:9E:F4
Alias name: mozillacert137.pem
  SHA1: 4A:65:D5:F4:1D:EF:39:B8:B8:90:4A:4A:D3:64:81:33:CF:C7:A1:D1
  SHA256:
BD:81:CE:3B:4F:65:91:D1:1A:67:B5:FC:7A:47:FD:EF:25:52:1B:F9:AA:4E:18:B9:E3:DF:2E:34:A7:80:3B:E8
Alias name: mozillacert138.pem
  SHA1: E1:9F:E3:0E:8B:84:60:9E:80:9B:17:0D:72:A8:C5:BA:6E:14:09:BD
  SHA256:
3F:06:E5:56:81:D4:96:F5:BE:16:9E:B5:38:9F:9F:2B:8F:F6:1E:17:08:DF:68:81:72:48:49:CD:5D:27:CB:69
Alias name: mozillacert139.pem
  SHA1: DE:3F:40:BD:50:93:D3:9B:6C:60:F6:DA:BC:07:62:01:00:89:76:C9
  SHA256:
A4:5E:DE:3B:BB:F0:9C:8A:E1:5C:72:EF:C0:72:68:D6:93:A2:1C:99:6F:D5:1E:67:CA:07:94:60:FD:6D:88:73
Alias name: mozillacert14.pem
  SHA1: 5F:B7:EE:06:33:E2:59:DB:AD:0C:4C:9A:E6:D3:8F:1A:61:C7:DC:25
  SHA256:
74:31:E5:F4:C3:C1:CE:46:90:77:4F:0B:61:E0:54:40:88:3B:A9:A0:1E:D0:0B:A6:AB:D7:80:6E:D3:B1:18:CF
Alias name: mozillacert140.pem
  SHA1: CA:3A:FB:CF:12:40:36:4B:44:B2:16:20:88:80:48:39:19:93:7C:F7
  SHA256:
85:A0:DD:7D:D7:20:AD:B7:FF:05:F8:3D:54:2B:20:9D:C7:FF:45:28:F7:D6:77:B1:83:89:FE:A5:E5:C4:9E:86
Alias name: mozillacert141.pem
  SHA1: 31:7A:2A:D0:7F:2B:33:5E:F5:A1:C3:4E:4B:57:E8:B7:D8:F1:FC:A6
  SHA256:
58:D0:17:27:9C:D4:DC:63:AB:DD:B1:96:A6:C9:90:6C:30:C4:E0:87:83:EA:E8:C1:60:99:54:D6:93:55:59:6B
Alias name: mozillacert142.pem
  SHA1: 1F:49:14:F7:D8:74:95:1D:DD:AE:02:C0:BE:FD:3A:2D:82:75:51:85
  SHA256:
18:F1:FC:7F:20:5D:F8:AD:DD:EB:7F:E0:07:DD:57:E3:AF:37:5A:9C:4D:8D:73:54:6B:F4:F1:FE:D1:E1:8D:35
Alias name: mozillacert143.pem
  SHA1: 36:B1:2B:49:F9:81:9E:D7:4C:9E:BC:38:0F:C6:56:8F:5D:AC:B2:F7
  SHA256:
E7:5E:72:ED:9F:56:0E:EC:6E:B4:80:00:73:A4:3F:C3:AD:19:19:5A:39:22:82:01:78:95:97:4A:99:02:6B:6C
Alias name: mozillacert144.pem
  SHA1: 37:F7:6D:E6:07:7C:90:C5:B1:3E:93:1A:B7:41:10:B4:F2:E4:9A:27
  SHA256:
79:08:B4:03:14:C1:38:10:0B:51:8D:07:35:80:7F:FB:FC:F8:51:8A:00:95:33:71:05:BA:38:6B:15:3D:D9:27
Alias name: mozillacert145.pem
  SHA1: 10:1D:FA:3F:D5:0B:CB:BB:9B:B5:60:0C:19:55:A4:1A:F4:73:3A:04
```

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```
SHA256:  
D4:1D:82:9E:8C:16:59:82:2A:F9:3F:CE:62:BF:FC:DE:26:4F:C8:4E:8B:95:0C:5F:F2:75:D0:52:35:46:95:A3  
Alias name: mozillacert146.pem  
SHA1: 21:FC:BD:8E:7F:6C:AF:05:1B:D1:B3:43:EC:A8:E7:61:47:F2:0F:8A  
SHA256:  
48:98:C6:88:8C:0C:FF:B0:D3:E3:1A:CA:8A:37:D4:E3:51:5F:F7:46:D0:26:35:D8:66:46:CF:A0:A3:18:5A:E7  
Alias name: mozillacert147.pem  
SHA1: 58:11:9F:0E:12:82:87:EA:50:FD:D9:87:45:6F:4F:78:DC:FA:D6:D4  
SHA256:  
85:FB:2F:91:DD:12:27:5A:01:45:B6:36:53:4F:84:02:4A:D6:8B:69:B8:EE:88:68:4F:F7:11:37:58:05:B3:48  
Alias name: mozillacert148.pem  
SHA1: 04:83:ED:33:99:AC:36:08:05:87:22:ED:BC:5E:46:00:E3:BE:F9:D7  
SHA256:  
6E:A5:47:41:D0:04:66:7E:ED:1B:48:16:63:4A:A3:A7:9E:6E:4B:96:95:0F:82:79:DA:FC:8D:9B:D8:81:21:37  
Alias name: mozillacert149.pem  
SHA1: 6E:3A:55:A4:19:0C:19:5C:93:84:3C:CO:DB:72:2E:31:30:61:F0:B1  
SHA256:  
0C:25:8A:12:A5:67:4A:EF:25:F2:8B:A7:DC:FA:EC:EE:A3:48:E5:41:E6:F5:CC:4E:E6:3B:71:B3:61:60:6A:C3  
Alias name: mozillacert15.pem  
SHA1: 74:20:74:41:72:9C:DD:92:EC:79:31:D8:23:10:8D:C2:81:92:E2:BB  
SHA256:  
0F:99:3C:8A:EF:97:BA:AF:56:87:14:0E:D5:9A:D1:82:1B:B4:AF:AC:F0:AA:9A:58:B5:D5:7A:33:8A:3A:FB:CB  
Alias name: mozillacert150.pem  
SHA1: 33:9B:6B:14:50:24:9B:55:7A:01:87:72:84:D9:E0:2F:C3:D2:D8:E9  
SHA256:  
EF:3C:B4:17:FC:8E:BF:6F:97:87:6C:9E:4E:CE:39:DE:1E:A5:FE:64:91:41:D1:02:8B:7D:11:C0:B2:29:8C:ED  
Alias name: mozillacert151.pem  
SHA1: AC:ED:5F:65:53:FD:25:CE:01:5F:1F:7A:48:3B:6A:74:9F:61:78:C6  
SHA256:  
7F:12:CD:5F:7E:5E:29:0E:C7:D8:51:79:D5:B7:2C:20:A5:BE:75:08:FF:DB:5B:F8:1A:B9:68:4A:7F:C9:F6:67  
Alias name: mozillacert16.pem  
SHA1: DA:C9:02:4F:54:D8:F6:DF:94:93:5F:B1:73:26:38:CA:6A:D7:7C:13  
SHA256:  
06:87:26:03:31:A7:24:03:D9:09:F1:05:E6:9B:CF:0D:32:E1:BD:24:93:FF:C6:D9:20:6D:11:BC:D6:77:07:39  
Alias name: mozillacert17.pem  
SHA1: 40:54:DA:6F:1C:3F:40:74:AC:ED:0F:EC:CD:DB:79:D1:53:FB:90:1D  
SHA256:  
76:7C:95:5A:76:41:2C:89:AF:68:8E:90:A1:C7:0F:55:6C:FD:6B:60:25:DB:EA:10:41:6D:7E:B6:83:1F:8C:40  
Alias name: mozillacert18.pem  
SHA1: 79:98:A3:08:E1:4D:65:85:E6:C2:1E:15:3A:71:9F:BA:5A:D3:4A:D9  
SHA256:  
44:04:E3:3B:5E:14:0D:CF:99:80:51:FD:FC:80:28:C7:C8:16:15:C5:EE:73:7B:11:1B:58:82:33:A9:B5:35:A0  
Alias name: mozillacert19.pem  
SHA1: B4:35:D4:E1:11:9D:1C:66:90:A7:49:EB:B3:94:BD:63:7B:A7:82:B7  
SHA256:  
C4:70:CF:54:7E:23:02:B9:77:FB:29:DD:71:A8:9A:7B:6C:1F:60:77:7B:03:29:F5:60:17:F3:28:BF:4F:6B:E6  
Alias name: mozillacert2.pem  
SHA1: 22:D5:D8:DF:8F:02:31:D1:8D:F7:9D:B7:CF:8A:2D:64:C9:3F:6C:3A  
SHA256:  
69:DD:D7:EA:90:BB:57:C9:3E:13:5D:C8:5E:A6:FC:D5:48:0B:60:32:39:BD:C4:54:FC:75:8B:2A:26:CF:7F:79  
Alias name: mozillacert20.pem  
SHA1: D8:C5:38:8A:B7:30:1B:1B:6E:D4:7A:E6:45:25:3A:6F:9F:1A:27:61  
SHA256:  
62:DD:0B:E9:B9:F5:0A:16:3E:A0:F8:E7:5C:05:3B:1E:CA:57:EA:55:C8:68:8F:64:7C:68:81:F2:C8:35:7B:95  
Alias name: mozillacert21.pem  
SHA1: 9B:AA:E5:9F:56:EE:21:CB:43:5A:BE:25:93:DF:A7:F0:40:D1:1D:CB  
SHA256:  
BE:6C:4D:A2:BB:B9:BA:59:B6:F3:93:97:68:37:42:46:C3:C0:05:99:3F:A9:8F:02:0D:1D:ED:BE:D4:8A:81:D5  
Alias name: mozillacert22.pem  
SHA1: 32:3C:11:8E:1B:F7:B8:B6:52:54:E2:E2:10:0D:D6:02:90:37:F0:96  
SHA256:  
37:D5:10:06:C5:12:EA:AB:62:64:21:F1:EC:8C:92:01:3F:C5:F8:2A:E9:8E:E5:33:EB:46:19:B8:DE:B4:D0:6C  
Alias name: mozillacert23.pem  
SHA1: 91:C6:D6:EE:3E:8A:C8:63:84:E5:48:C2:99:29:5C:75:6C:81:7B:81  
SHA256:  
8D:72:2F:81:A9:C1:13:C0:79:1D:F1:36:A2:96:6D:B2:6C:95:0A:97:1D:B4:6B:41:99:F4:EA:54:B7:8B:FB:9F
```

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```
Alias name: mozillacert24.pem
  SHA1: 59:AF:82:79:91:86:C7:B4:75:07:CB:CF:03:57:46:EB:04:DD:B7:16
  SHA256:
66:8C:83:94:7D:A6:3B:72:4B:EC:E1:74:3C:31:A0:E6:AE:D0:DB:8E:C5:B3:1B:E3:77:BB:78:4F:91:B6:71:6F
Alias name: mozillacert25.pem
  SHA1: 4E:B6:D5:78:49:9B:1C:CF:5F:58:1E:AD:56:BE:3D:9B:67:44:A5:E5
  SHA256:
9A:CF:AB:7E:43:C8:D8:80:D0:6B:26:2A:94:DE:EE:E4:B4:65:99:89:C3:D0:CA:F1:9B:AF:64:05:E4:1A:B7:DF
Alias name: mozillacert26.pem
  SHA1: 87:82:C6:C3:04:35:3B:CF:D2:96:92:D2:59:3E:7D:44:D9:34:FF:11
  SHA256:
F1:C1:B5:0A:E5:A2:0D:D8:03:0E:C9:F6:BC:24:82:3D:D3:67:B5:25:57:59:B4:E7:1B:61:FC:E9:F7:37:5D:73
Alias name: mozillacert27.pem
  SHA1: 3A:44:73:5A:E5:81:90:1F:24:86:61:46:1E:3B:9C:C4:5F:F5:3A:1B
  SHA256:
42:00:F5:04:3A:C8:59:0E:BB:52:7D:20:9E:D1:50:30:29:FB:CB:D4:1C:A1:B5:06:EC:27:F1:5A:DE:7D:AC:69
Alias name: mozillacert28.pem
  SHA1: 66:31:BF:9E:F7:4F:9E:B6:C9:D5:A6:0C:BA:6A:BE:D1:F7:BD:EF:7B
  SHA256:
0C:2C:D6:3D:F7:80:6F:A3:99:ED:E8:09:11:6B:57:5B:F8:79:89:F0:65:18:F9:80:8C:86:05:03:17:8B:AF:66
Alias name: mozillacert29.pem
  SHA1: 74:F8:A3:C3:EF:E7:B3:90:06:4B:83:90:3C:21:64:60:20:E5:DF:CE
  SHA256:
15:F0:BA:00:A3:AC:7A:F3:AC:88:4C:07:2B:10:11:A0:77:BD:77:C0:97:F4:01:64:B2:F8:59:8A:BD:83:86:0C
Alias name: mozillacert30.pem
  SHA1: 87:9F:4B:EE:05:DF:98:58:3B:E3:60:D6:33:E7:0D:3F:FE:98:71:AF
  SHA256:
39:DF:7B:68:2B:7B:93:8F:84:71:54:81:CC:DE:8D:60:D8:F2:2E:C5:98:87:7D:0A:AA:C1:2B:59:18:2B:03:12
Alias name: mozillacert31.pem
  SHA1: E7:B4:F6:9D:61:EC:90:69:DB:7E:90:A7:40:1A:3C:F4:7D:4F:E8:EE
  SHA256:
A7:12:72:AE:AA:A3:CF:E8:72:7F:7F:B3:9F:0F:B3:D1:E5:42:6E:90:60:B0:6E:E6:F1:3E:9A:3C:58:33:CD:43
Alias name: mozillacert32.pem
  SHA1: 9F:74:4E:9F:2B:4D:BA:EC:0F:31:2C:50:B6:56:3B:8E:2D:93:C3:11
  SHA256:
17:93:92:7A:06:14:54:97:89:AD:CE:2F:8F:34:F7:F0:B6:6D:0F:3A:E3:A3:B8:4D:21:EC:15:DB:BA:4F:AD:C7
Alias name: mozillacert33.pem
  SHA1: 60:D6:89:74:B5:C2:65:9E:8A:0F:C1:88:7C:88:D2:46:69:1B:18:2C
  SHA256:
B9:BE:A7:86:0A:96:2E:A3:61:1D:AB:97:AB:6D:A3:E2:1C:10:68:B9:7D:55:57:5E:D0:E1:12:79:C1:1C:89:32
Alias name: mozillacert34.pem
  SHA1: FE:B8:C4:32:DC:F9:76:9A:CE:AE:3D:D8:90:8F:FD:28:86:65:64:7D
  SHA256:
A2:2D:BA:68:1E:97:37:6E:2D:39:7D:72:8A:AE:3A:9B:62:96:B9:FD:BA:60:BC:2E:11:F6:47:F2:C6:75:FB:37
Alias name: mozillacert35.pem
  SHA1: 59:22:A1:E1:5A:EA:16:35:21:F8:98:39:6A:46:46:B0:44:1B:0F:A9
  SHA256:
41:C9:23:86:6A:B4:CA:D6:B7:AD:57:80:81:58:2E:02:07:97:A6:CB:DF:4F:FF:78:CE:83:96:B3:89:37:D7:F5
Alias name: mozillacert36.pem
  SHA1: 2A:C8:D5:8B:57:CE:BF:2F:49:AF:F2:FC:76:8F:51:14:62:90:7A:41
  SHA256:
92:BF:51:19:AB:EC:CA:D0:B1:33:2D:C4:E1:D0:5F:BA:75:B5:67:90:44:EE:0C:A2:6E:93:1F:74:4F:2F:33:CF
Alias name: mozillacert37.pem
  SHA1: 23:88:C9:D3:71:CC:9E:96:3D:FF:7D:3C:A7:CE:FC:D6:25:EC:19:0D
  SHA256:
32:7A:3D:76:1A:BA:DE:A0:34:EB:99:84:06:27:5C:B1:A4:77:6E:FD:AE:2F:DF:6D:01:68:EA:1C:4F:55:67:D0
Alias name: mozillacert38.pem
  SHA1: B1:2E:13:63:45:86:A4:6F:1A:B2:60:68:37:58:2D:C4:AC:FD:94:97
  SHA256:
E3:B6:A2:DB:2E:D7:CE:48:84:2F:7A:C5:32:41:C7:B7:1D:54:14:4B:FB:40:C1:1F:3F:1D:0B:42:F5:EE:A1:2D
Alias name: mozillacert39.pem
  SHA1: CB:A1:C5:F8:B0:E3:5E:B8:B9:45:12:D3:F9:34:A2:E9:06:10:D3:36
  SHA256:
A6:C5:1E:0D:A5:CA:0A:93:09:D2:E4:C0:E4:0C:2A:F9:10:7A:AE:82:03:85:7F:E1:98:E3:E7:69:E3:43:08:5C
Alias name: mozillacert39.pem
  SHA1: AE:50:83:ED:7C:F4:5C:BC:8F:61:C6:21:FE:68:5D:79:42:21:15:6E
```



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```
SHA256:
E6:B8:F8:76:64:85:F8:07:AE:7F:8D:AC:16:70:46:1F:07:C0:A1:3E:EF:3A:1F:F7:17:53:8D:7A:BA:D3:91:B4
Alias name: mozillacert4.pem
SHA1: E3:92:51:2F:0A:CF:F5:05:DF:F6:DE:06:7F:75:37:E1:65:EA:57:4B
SHA256:
0B:5E:ED:4E:84:64:03:CF:55:E0:65:84:84:40:ED:2A:82:75:8B:F5:B9:AA:1F:25:3D:46:13:CF:A0:80:FF:3F
Alias name: mozillacert40.pem
SHA1: 80:25:EF:F4:6E:70:C8:D4:72:24:65:84:FE:40:3B:8A:8D:6A:DB:F5
SHA256:
8D:A0:84:FC:F9:9C:E0:77:22:F8:9B:32:05:93:98:06:FA:5C:B8:11:E1:C8:13:F6:A1:08:C7:D3:36:B3:40:8E
Alias name: mozillacert41.pem
SHA1: 6B:2F:34:AD:89:58:BE:62:FD:B0:6B:5C:CE:BB:9D:D9:4F:4E:39:F3
SHA256:
EB:F3:C0:2A:87:89:B1:FB:7D:51:19:95:D6:63:B7:29:06:D9:13:CE:OD:5E:10:56:8A:8A:77:E2:58:61:67:E7
Alias name: mozillacert42.pem
SHA1: 85:A4:08:C0:9C:19:3E:5D:51:58:7D:CD:D6:13:30:FD:8C:DE:37:BF
SHA256:
B6:19:1A:50:D0:C3:97:7F:7D:A9:9B:CD:AA:C8:6A:22:7D:AE:B9:67:9E:C7:0B:A3:B0:C9:D9:22:71:C1:70:D3
Alias name: mozillacert43.pem
SHA1: F9:CD:0E:2C:DA:76:24:C1:8F:BD:F0:F0:AB:B6:45:B8:F7:FE:D5:7A
SHA256:
50:79:41:C7:44:60:A0:B4:70:86:22:0D:4E:99:32:57:2A:B5:D1:B5:BB:CB:89:80:AB:1C:B1:76:51:A8:44:D2
Alias name: mozillacert44.pem
SHA1: 5F:43:E5:B1:BF:F8:78:8C:AC:1C:C7:CA:4A:9A:C6:22:2B:CC:34:C6
SHA256:
96:0A:DF:00:63:E9:63:56:75:0C:29:65:DD:0A:08:67:DA:0B:9C:BD:6E:77:71:4A:EA:FB:23:49:AB:39:3D:A3
Alias name: mozillacert45.pem
SHA1: 67:65:0D:F1:7E:8E:7E:5B:82:40:A4:F4:56:4B:CF:E2:3D:69:C6:F0
SHA256:
C0:A6:F4:DC:63:A2:4B:FD:CF:54:EF:2A:6A:08:2A:0A:72:DE:35:80:3E:2F:F5:FF:52:7A:E5:D8:72:06:DF:D5
Alias name: mozillacert46.pem
SHA1: 40:9D:4B:D9:17:B5:5C:27:B6:9B:64:CB:98:22:44:0D:CD:09:B8:89
SHA256:
EC:C3:E9:C3:40:75:03:BE:E0:91:AA:95:2F:41:34:8F:F8:8B:AA:86:3B:22:64:BE:FA:C8:07:90:15:74:E9:39
Alias name: mozillacert47.pem
SHA1: 1B:4B:39:61:26:27:6B:64:91:A2:68:6D:D7:02:43:21:2D:1F:1D:96
SHA256:
E4:C7:34:30:D7:A5:B5:09:25:DF:43:37:0A:0D:21:6E:9A:79:B9:D6:DB:83:73:A0:C6:9E:B1:CC:31:C7:C5:2A
Alias name: mozillacert48.pem
SHA1: A0:A1:AB:90:C9:FC:84:7B:3B:12:61:E8:97:7D:5F:D3:22:61:D3:CC
SHA256:
0F:4E:9C:DD:26:4B:02:55:50:D1:70:80:63:40:21:4F:E9:44:34:C9:B0:2F:69:7E:C7:10:FC:5F:EA:FB:5E:38
Alias name: mozillacert49.pem
SHA1: 61:57:3A:11:DF:0E:D8:7E:D5:92:65:22:EA:D0:56:D7:44:B3:23:71
SHA256:
B7:B1:2B:17:1F:82:1D:AA:99:0C:DO:FE:50:87:B1:28:44:8B:A8:E5:18:4F:84:C5:1E:02:B5:C8:FB:96:2B:24
Alias name: mozillacert5.pem
SHA1: B8:01:86:D1:EB:9C:86:A5:41:04:CF:30:54:F3:4C:52:B7:E5:58:C6
SHA256:
CE:CD:DC:90:50:99:D8:DA:DF:C5:B1:D2:09:B7:37:CB:E2:C1:8C:FB:2C:10:C0:FF:0B:CF:0D:32:86:FC:1A:A2
Alias name: mozillacert50.pem
SHA1: 8C:96:BA:EB:DD:2B:07:07:48:EE:30:32:66:A0:F3:98:6E:7C:AE:58
SHA256:
35:AE:5B:DD:D8:F7:AE:63:5C:FF:BA:56:82:A8:F0:0B:95:F4:84:62:C7:10:8E:E9:A0:E5:29:2B:07:4A:AF:B2
Alias name: mozillacert51.pem
SHA1: FA:B7:EE:36:97:26:62:FB:2D:B0:2A:F6:BF:03:FD:E8:7C:4B:2F:9B
SHA256:
EA:A9:62:C4:FA:4A:6B:AF:EB:E4:15:19:6D:35:1C:CD:88:8D:4F:53:F3:FA:8A:E6:D7:C4:66:A9:4E:60:42:BB
Alias name: mozillacert52.pem
SHA1: 8B:AF:4C:9B:1D:F0:2A:92:F7:DA:12:8E:B9:1B:AC:F4:98:60:4B:6F
SHA256:
E2:83:93:77:3D:A8:45:A6:79:F2:08:0C:C7:FB:44:A3:B7:A1:C3:79:2C:B7:EB:77:29:FD:CB:6A:8D:99:AE:A7
Alias name: mozillacert53.pem
SHA1: 7F:8A:B0:CF:D0:51:87:6A:66:F3:36:0F:47:C8:8D:8C:D3:35:FC:74
SHA256:
2D:47:43:7D:E1:79:51:21:5A:12:F3:C5:8E:51:C7:29:A5:80:26:EF:1F:CC:0A:5F:B3:D9:DC:01:2F:60:0D:19
```

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```
Alias name: mozillacert54.pem
  SHA1: 03:9E:ED:B8:0B:E7:A0:3C:69:53:89:3B:20:D2:D9:32:3A:4C:2A:FD
  SHA256:
B4:78:B8:12:25:0D:F8:78:63:5C:2A:A7:EC:7D:15:5E:AA:62:5E:E8:29:16:E2:CD:29:43:61:88:6C:D1:FB:D4
Alias name: mozillacert55.pem
  SHA1: AA:DB:BC:22:23:8F:C4:01:A1:27:BB:38:DD:F4:1D:DB:08:9E:F0:12
  SHA256:
A4:31:0D:50:AF:18:A6:44:71:90:37:2A:86:AF:AF:8B:95:1F:FB:43:1D:83:7F:1E:56:88:B4:59:71:ED:15:57
Alias name: mozillacert56.pem
  SHA1: F1:8B:53:8D:1B:E9:03:B6:A6:F0:56:43:5B:17:15:89:CA:F3:6B:F2
  SHA256:
4B:03:F4:58:07:AD:70:F2:1B:FC:2C:AE:71:C9:FD:E4:60:4C:06:4C:F5:FF:B6:86:BA:E5:DB:AA:D7:FD:D3:4C
Alias name: mozillacert57.pem
  SHA1: D6:DA:A8:20:8D:09:D2:15:4D:24:B5:2F:CB:34:6E:B2:58:B2:8A:58
  SHA256:
F9:E6:7D:33:6C:51:00:2A:C0:54:C6:32:02:2D:66:DD:A2:E7:E3:FF:F1:0A:D0:61:ED:31:D8:BB:B4:10:CF:B2
Alias name: mozillacert58.pem
  SHA1: 8D:17:84:D5:37:F3:03:7D:EC:70:FE:57:8B:51:9A:99:E6:10:D7:B0
  SHA256:
5E:DB:7A:C4:3B:82:A0:6A:87:61:E8:D7:BE:49:79:EB:F2:61:1F:7D:D7:9B:F9:1C:1C:6B:56:6A:21:9E:D7:66
Alias name: mozillacert59.pem
  SHA1: 36:79:CA:35:66:87:72:30:4D:30:A5:FB:87:3B:0F:A7:7B:B7:0D:54
  SHA256:
23:99:56:11:27:A5:71:25:DE:8C:EF:EA:61:0D:DF:2F:A0:78:B5:C8:06:7F:4E:82:82:90:BF:B8:60:E8:4B:3C
Alias name: mozillacert60.pem
  SHA1: 27:96:BA:E6:3F:18:01:E2:77:26:1B:A0:D7:77:70:02:8F:20:EE:E4
  SHA256:
C3:84:6B:F2:4B:9E:93:CA:64:27:4C:0E:C6:7C:1E:CC:5E:02:4F:FC:AC:D2:D7:40:19:35:0E:81:FE:54:6A:E4
Alias name: mozillacert61.pem
  SHA1: 3B:C4:9F:48:F8:F3:73:A0:9C:1E:BD:F8:5B:B1:C3:65:C7:D8:11:B3
  SHA256:
BF:0F:EE:FB:9E:3A:58:1A:D5:F9:E9:DB:75:89:98:57:43:D2:61:08:5C:4D:31:4F:6F:5D:72:59:AA:42:16:12
Alias name: mozillacert62.pem
  SHA1: E0:B4:32:2E:B2:F6:A5:68:B6:54:53:84:48:18:4A:50:36:87:43:84
  SHA256:
03:95:0F:B4:9A:53:1F:3E:19:91:94:23:98:DF:A9:E0:EA:32:D7:BA:1C:DD:9B:C8:5D:B5:7E:D9:40:0B:43:4A
Alias name: mozillacert63.pem
  SHA1: A1:DB:63:93:91:6F:17:E4:18:55:09:40:04:15:C7:02:40:B0:AE:6B
  SHA256:
A4:B6:E3:99:6F:C2:F3:06:B3:FD:86:81:BD:63:41:3D:8C:50:09:CC:4F:A3:29:C2:CC:F0:E2:FA:1B:14:03:05
Alias name: mozillacert64.pem
  SHA1: 89:DF:74:FE:5C:F4:0F:4A:80:F9:E3:37:7D:54:DA:91:E1:01:31:8E
  SHA256:
3C:5F:81:FE:A5:FA:B8:2C:64:BF:A2:EA:EC:AF:CD:E8:E0:77:FC:86:20:A7:CA:E5:37:16:3D:F3:6E:DB:F3:78
Alias name: mozillacert65.pem
  SHA1: 62:7F:8D:78:27:65:63:99:D2:7D:7F:90:44:C9:FE:B3:F3:3E:FA:9A
  SHA256:
AB:70:36:36:5C:71:54:AA:29:C2:C2:9F:5D:41:91:16:3B:16:2A:22:25:01:13:57:D5:6D:07:FF:A7:BC:1F:72
Alias name: mozillacert66.pem
  SHA1: 69:BD:8C:F4:9C:D3:00:FB:59:2E:17:93:CA:55:6A:F3:EC:AA:35:FB
  SHA256:
BC:23:F9:8A:31:3C:B9:2D:E3:BB:FC:3A:5A:9F:44:61:AC:39:49:4C:4A:E1:5A:9E:9D:F1:31:E9:9B:73:01:9A
Alias name: mozillacert67.pem
  SHA1: DD:E1:D2:A9:01:80:2E:1D:87:5E:84:B3:80:7E:4B:B1:FD:99:41:34
  SHA256:
E6:09:07:84:65:A4:19:78:0C:B6:AC:4C:1C:0B:FB:46:53:D9:D9:CC:6E:B3:94:6E:B7:F3:D6:99:97:BA:D5:98
Alias name: mozillacert68.pem
  SHA1: D6:9B:56:11:48:F0:1C:77:C5:45:78:C1:09:26:DF:5B:85:69:76:AD
  SHA256:
CB:B5:22:D7:B7:F1:27:AD:6A:01:13:86:5B:DF:1C:D4:10:2E:7D:07:59:AF:63:5A:7C:F4:72:0D:C9:63:C5:3B
Alias name: mozillacert69.pem
  SHA1: AE:C5:FB:3F:C8:E1:BF:C4:E5:4F:03:07:5A:9A:E8:00:B7:F7:B6:FA
  SHA256:
04:04:80:28:BF:1F:28:64:D4:8F:9A:D4:D8:32:94:36:6A:82:88:56:55:3F:3B:14:30:3F:90:14:7F:5D:40:EF
Alias name: mozillacert70.pem
  SHA1: 2F:78:3D:25:52:18:A7:4A:65:39:71:B5:2C:A2:9C:45:15:6F:E9:19
```

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```
SHA256:
25:30:CC:8E:98:32:15:02:BA:D9:6F:9B:1F:BA:1B:09:9E:2D:29:9E:0F:45:48:BB:91:4F:36:3B:CO:D4:53:1F
Alias name: mozillacert7.pem
SHA1: AD:7E:1C:28:B0:64:EF:8F:60:03:40:20:14:C3:D0:E3:37:0E:B5:8A
SHA256:
14:65:FA:20:53:97:B8:76:FA:A6:F0:A9:95:8E:55:90:E4:0F:CC:7F:AA:4F:B7:C2:C8:67:75:21:FB:5F:B6:58
Alias name: mozillacert70.pem
SHA1: 78:6A:74:AC:76:AB:14:7F:9C:6A:30:50:BA:9E:A8:7E:FE:9A:CE:3C
SHA256:
06:3E:4A:FA:C4:91:DF:D3:32:F3:08:9B:85:42:E9:46:17:D8:93:D7:FE:94:4E:10:A7:93:7E:E2:9D:96:93:C0
Alias name: mozillacert71.pem
SHA1: 4A:BD:EE:EC:95:0D:35:9C:89:AE:C7:52:A1:2C:5B:29:F6:D6:AA:0C
SHA256:
13:63:35:43:93:34:A7:69:80:16:A0:D3:24:DE:72:28:4E:07:9D:7B:52:20:BB:8F:BD:74:78:16:EE:BE:BA:CA
Alias name: mozillacert72.pem
SHA1: 47:BE:AB:C9:22:EA:E8:0E:78:78:34:62:A7:9F:45:C2:54:FD:E6:8B
SHA256:
45:14:0B:32:47:EB:9C:C8:C5:B4:F0:D7:B5:30:91:F7:32:92:08:9E:6E:5A:63:E2:74:9D:D3:AC:A9:19:8E:DA
Alias name: mozillacert73.pem
SHA1: B5:1C:06:7C:EE:2B:0C:3D:F8:55:AB:2D:92:F4:FE:39:D4:E7:0F:0E
SHA256:
2C:E1:CB:0B:F9:D2:F9:E1:02:99:3F:BE:21:51:52:C3:B2:DD:0C:AB:DE:1C:68:E5:31:9B:83:91:54:DB:B7:F5
Alias name: mozillacert74.pem
SHA1: 92:5A:8F:8D:2C:6D:04:E0:66:5F:59:6A:FF:22:D8:63:E8:25:6F:3F
SHA256:
56:8D:69:05:A2:C8:87:08:A4:B3:02:51:90:ED:CF:ED:B1:97:4A:60:6A:13:C6:E5:29:0F:CB:2A:E6:3E:DA:B5
Alias name: mozillacert75.pem
SHA1: D2:32:09:AD:23:D3:14:23:21:74:E4:0D:7F:9D:62:13:97:86:63:3A
SHA256:
08:29:7A:40:47:DB:A2:36:80:C7:31:DB:6E:31:76:53:CA:78:48:E1:BE:BD:3A:0B:01:79:A7:07:F9:2C:F1:78
Alias name: mozillacert76.pem
SHA1: F9:B5:B6:32:45:5F:9C:BE:EC:57:5F:80:DC:E9:6E:2C:C7:B2:78:B7
SHA256:
03:76:AB:1D:54:C5:F9:80:3C:E4:B2:E2:01:A0:EE:7E:EF:7B:57:B6:36:E8:A9:3C:9B:8D:48:60:C9:6F:5F:A7
Alias name: mozillacert77.pem
SHA1: 13:2D:0D:45:53:4B:69:97:CD:B2:D5:C3:39:E2:55:76:60:9B:5C:C6
SHA256:
EB:04:CF:5E:B1:F3:9A:FA:76:2F:2B:B1:20:F2:96:CB:A5:20:C1:B9:7D:B1:58:95:65:B8:1C:B9:A1:7B:72:44
Alias name: mozillacert78.pem
SHA1: 29:36:21:02:8B:20:ED:02:F5:66:C5:32:D1:D6:ED:90:9F:45:00:2F
SHA256:
0A:81:EC:5A:92:97:77:F1:45:90:4A:F3:8D:5D:50:9F:66:B5:E2:C5:8F:CD:B5:31:05:8B:0E:17:F3:F0:B4:1B
Alias name: mozillacert79.pem
SHA1: D8:A6:33:2C:E0:03:6F:B1:85:F6:63:4F:7D:6A:06:65:26:32:28:27
SHA256:
70:A7:3F:7F:37:6B:60:07:42:48:90:45:34:B1:14:82:D5:BF:0E:69:8E:CC:49:8D:F5:25:77:EB:F2:E9:3B:9A
Alias name: mozillacert8.pem
SHA1: 3E:2B:F7:F2:03:1B:96:F3:8C:E6:C4:D8:A8:5D:3E:2D:58:47:6A:0F
SHA256:
C7:66:A9:BE:F2:D4:07:1C:86:3A:31:AA:49:20:E8:13:B2:D1:98:60:8C:B7:B7:CF:E2:11:43:B8:36:DF:09:EA
Alias name: mozillacert80.pem
SHA1: B8:23:6B:00:2F:1D:16:86:53:01:55:6C:11:A4:37:CA:EB:FF:C3:BB
SHA256:
BD:71:FD:F6:DA:97:E4:CF:62:D1:64:7A:DD:25:81:B0:7D:79:AD:F8:39:7E:B4:EC:BA:9C:5E:84:88:82:14:23
Alias name: mozillacert81.pem
SHA1: 07:E0:32:E0:20:B7:2C:3F:19:2F:06:28:A2:59:3A:19:A7:0F:06:9E
SHA256:
5C:58:46:8D:55:F5:8E:49:7E:74:39:82:D2:B5:00:10:B6:D1:65:37:4A:CF:83:A7:D4:A3:2D:B7:68:C4:40:8E
Alias name: mozillacert82.pem
SHA1: 2E:14:DA:EC:28:F0:FA:1E:8E:38:9A:4E:AB:EB:26:C0:0A:D3:83:C3
SHA256:
FC:BF:E2:88:62:06:F7:2B:27:59:3C:8B:07:02:97:E1:2D:76:9E:D1:0E:D7:93:07:05:A8:09:8E:FF:C1:4D:17
Alias name: mozillacert83.pem
SHA1: A0:73:E5:C5:BD:43:61:0D:86:4C:21:13:0A:85:58:57:CC:9C:EA:46
SHA256:
8C:4E:DF:D0:43:48:F3:22:96:9E:7E:29:A4:CD:4D:CA:00:46:55:06:1C:16:E1:B0:76:42:2E:F3:42:AD:63:0E
```

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```
Alias name: mozillacert84.pem
  SHA1: D3:C0:63:F2:19:ED:07:3E:34:AD:5D:75:0B:32:76:29:FF:D5:9A:F2
  SHA256:
79:3C:BF:45:59:B9:FD:E3:8A:B2:2D:F1:68:69:F6:98:81:AE:14:C4:B0:13:9A:C7:88:A7:8A:1A:FC:CA:02:FB
Alias name: mozillacert85.pem
  SHA1: CF:9E:87:6D:D3:EB:FC:42:26:97:A3:B5:A3:7A:A0:76:A9:06:23:48
  SHA256:
BF:D8:8F:E1:10:1C:41:AE:3E:80:1B:F8:BE:56:35:0E:E9:BA:D1:A6:B9:BD:51:5E:DC:5C:6D:5B:87:11:AC:44
Alias name: mozillacert86.pem
  SHA1: 74:2C:31:92:E6:07:E4:24:EB:45:49:54:2B:E1:BB:C5:3E:61:74:E2
  SHA256:
E7:68:56:34:EF:AC:F6:9A:CE:93:9A:6B:25:5B:7B:4F:AB:EF:42:93:5B:50:A2:65:AC:B5:CB:60:27:E4:4E:70
Alias name: mozillacert87.pem
  SHA1: 5F:3B:8C:F2:F8:10:B3:7D:78:B4:CE:EC:19:19:C3:73:34:B9:C7:74
  SHA256:
51:3B:2C:EC:B8:10:D4:CD:E5:DD:85:39:1A:DF:C6:C2:DD:60:D8:7B:B7:36:D2:B5:21:48:4A:A4:7A:0E:BE:FE:F6
Alias name: mozillacert88.pem
  SHA1: FE:45:65:9B:79:03:5B:98:A1:61:B5:51:2E:AC:DA:58:09:48:22:4D
  SHA256:
BC:10:4F:15:A4:8B:E7:09:DC:A5:42:A7:E1:D4:B9:DF:6F:05:45:27:E8:02:EA:A9:2D:59:54:44:25:8A:FE:71
Alias name: mozillacert89.pem
  SHA1: C8:EC:8C:87:92:69:CB:4B:AB:39:E9:8D:7E:57:67:F3:14:95:73:9D
  SHA256:
E3:89:36:0D:0F:DB:AE:B3:D2:50:58:4B:47:30:31:4E:22:2F:39:C1:56:A0:20:14:4E:8D:96:05:61:79:15:06
Alias name: mozillacert9.pem
  SHA1: F4:8B:11:BF:DE:AB:BE:94:54:20:71:E6:41:DE:6B:BE:88:2B:40:B9
  SHA256:
76:00:29:5E:EF:E8:5B:9E:1F:D6:24:DB:76:06:2A:AA:AE:59:81:8A:54:D2:77:4C:D4:C0:B2:C0:11:31:E1:B3
Alias name: mozillacert90.pem
  SHA1: F3:73:B3:87:06:5A:28:84:8A:F2:F3:4A:CE:19:2B:DD:C7:8E:9C:AC
  SHA256:
55:92:60:84:EC:96:3A:64:B9:6E:2A:BE:01:CE:0B:A8:6A:64:FB:FE:BC:C7:AA:B5:AF:C1:55:B3:7F:D7:60:66
Alias name: mozillacert91.pem
  SHA1: 3B:C0:38:0B:33:C3:F6:A6:0C:86:15:22:93:D9:DF:F5:4B:81:C0:04
  SHA256:
C1:B4:82:99:AB:A5:20:8F:E9:63:0A:CE:55:CA:68:A0:3E:DA:5A:51:9C:88:02:A0:D3:A6:73:BE:8F:8E:55:7D
Alias name: mozillacert92.pem
  SHA1: A3:F1:33:3F:E2:42:BF:CF:C5:D1:4E:8F:39:42:98:40:68:10:D1:A0
  SHA256:
E1:78:90:EE:09:A3:FB:F4:F4:8B:9C:41:4A:17:D6:37:B7:A5:06:47:E9:BC:75:23:22:72:7F:CC:17:42:A9:11
Alias name: mozillacert93.pem
  SHA1: 31:F1:FD:68:22:63:20:EE:C6:3B:3F:9D:EA:4A:3E:53:7C:7C:39:17
  SHA256:
C7:BA:65:67:DE:93:A7:98:AE:1F:AA:79:1E:71:2D:37:8F:AE:1F:93:C4:39:7F:EA:44:1B:B7:CB:E6:FD:59:95
Alias name: mozillacert94.pem
  SHA1: 49:0A:75:74:DE:87:0A:47:FE:58:EE:F6:C7:6B:EB:C6:0B:12:40:99
  SHA256:
9A:11:40:25:19:7C:5B:B9:5D:94:E6:3D:55:CD:43:79:08:47:B6:46:B2:3C:DF:11:AD:A4:A0:0E:FF:15:FB:48
Alias name: mozillacert95.pem
  SHA1: DA:FA:F7:FA:66:84:EC:06:8F:14:50:BD:C7:C2:81:A5:BC:A9:64:57
  SHA256:
ED:F7:EB:BC:A2:7A:2A:38:4D:38:7B:7D:40:10:C6:66:E2:ED:B4:84:3E:4C:29:B4:AE:1D:5B:93:32:E6:B2:4D
Alias name: mozillacert96.pem
  SHA1: 55:A6:72:3E:CB:F2:EC:CD:C3:23:74:70:19:9D:2A:BE:11:E3:81:D1
  SHA256:
FD:73:DA:D3:1C:64:4F:F1:B4:3B:EF:0C:CD:DA:96:71:0B:9C:D9:87:5E:CA:7E:31:70:7A:F3:E9:6D:52:2B:BD
Alias name: mozillacert97.pem
  SHA1: 85:37:1C:A6:E5:50:14:3D:CE:28:03:47:1B:DE:3A:09:E8:F8:77:0F
  SHA256:
83:CE:3C:12:29:68:8A:59:3D:48:5F:81:97:3C:0F:91:95:43:1E:DA:37:CC:5E:36:43:0E:79:C7:A8:88:63:8B
Alias name: mozillacert98.pem
  SHA1: C9:A8:B9:E7:55:80:5E:58:E3:53:77:A7:25:EB:AF:C3:7B:27:CC:D7
  SHA256:
3E:84:BA:43:42:90:85:16:E7:75:73:C0:99:2F:09:79:CA:08:4E:46:85:68:1F:F1:95:CC:BA:8A:22:9B:8A:76
Alias name: mozillacert99.pem
  SHA1: F1:7F:6F:B6:31:DC:99:E3:A3:C8:7F:FE:1C:F1:81:10:88:D9:60:33
```

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```
SHA256:
97:8C:D9:66:F2:FA:A0:7B:A7:AA:95:00:D9:C0:2E:9D:77:F2:CD:AD:A6:AD:6B:A7:4A:F4:B9:1C:66:59:3C:50
Alias name: netlockaranyclassgoldfotanusitvany
SHA1: 06:08:3F:59:3F:15:A1:04:A0:69:A4:6B:A9:03:D0:06:B7:97:09:91
SHA256:
6C:61:DA:C3:A2:DE:F0:31:50:6B:E0:36:D2:A6:FE:40:19:94:FB:D1:3D:F9:C8:D4:66:59:92:74:C4:46:EC:98
Alias name: networksolutionscertificateauthority
SHA1: 74:F8:A3:C3:EF:E7:B3:90:06:4B:83:90:3C:21:64:60:20:E5:DF:CE
SHA256:
15:F0:BA:00:A3:AC:7A:F3:AC:88:4C:07:2B:10:11:A0:77:BD:77:C0:97:F4:01:64:B2:F8:59:8A:BD:83:86:0C
Alias name: oistewisekeyglobalrootgaca
SHA1: 59:22:A1:E1:5A:EA:16:35:21:F8:98:39:6A:46:46:B0:44:1B:0F:A9
SHA256:
41:C9:23:86:6A:B4:CA:D6:B7:AD:57:80:81:58:2E:02:07:97:A6:CB:DF:4F:FF:78:CE:83:96:B3:89:37:D7:F5
Alias name: oistewisekeyglobalrootgbca
SHA1: 0A:F9:40:76:18:D3:D7:6A:4B:98:F0:A8:35:9E:0C:FD:27:AC:CC:ED
SHA256:
6B:9C:08:E8:6E:B0:F7:67:CF:AD:65:CD:98:B6:21:49:E5:49:4A:67:F5:84:5E:7B:D1:ED:01:9F:27:B8:6B:D6
Alias name: oistewisekeyglobalrootgccca
SHA1: E0:11:84:5E:34:DE:BE:88:81:B9:9C:F6:16:26:D1:96:1F:C3:B9:31
SHA256:
85:60:F9:1C:36:24:DA:BA:95:70:B5:FE:A0:DB:E3:6F:F1:1A:83:23:BE:94:86:85:4F:B3:F3:4A:55:71:19:8D
Alias name: quovadisrootca
SHA1: DE:3F:40:BD:50:93:D3:9B:6C:60:F6:DA:BC:07:62:01:00:89:76:C9
SHA256:
A4:5E:DE:3B:BB:F0:9C:8A:E1:5C:72:EF:C0:72:68:D6:93:A2:1C:99:6F:D5:1E:67:CA:07:94:60:FD:6D:88:73
Alias name: quovadisrootca1g3
SHA1: 1B:8E:EA:57:96:29:1A:C9:39:EA:B8:0A:81:1A:73:73:C0:93:79:67
SHA256:
8A:86:6F:D1:B2:76:B5:7E:57:8E:92:1C:65:82:8A:2B:ED:58:E9:F2:F2:88:05:41:34:B7:F1:F4:BF:C9:CC:74
Alias name: quovadisrootca2
SHA1: CA:3A:FB:CF:12:40:36:4B:44:B2:16:20:88:80:48:39:19:93:7C:F7
SHA256:
85:A0:DD:7D:D7:20:AD:B7:FF:05:F8:3D:54:2B:20:9D:C7:FF:45:28:F7:D6:77:B1:83:89:FE:A5:E5:C4:9E:86
Alias name: quovadisrootca2g3
SHA1: 09:3C:61:F3:8B:8B:DC:7D:55:DF:75:38:02:05:00:E1:25:F5:C8:36
SHA256:
8F:E4:FB:0A:F9:3A:4D:0D:67:DB:0B:EB:B2:3E:37:C7:1B:F3:25:DC:BC:DD:24:0E:A0:4D:AF:58:B4:7E:18:40
Alias name: quovadisrootca3
SHA1: 1F:49:14:F7:D8:74:95:1D:DD:AE:02:C0:BE:FD:3A:2D:82:75:51:85
SHA256:
18:F1:FC:7F:20:5D:F8:AD:DD:EB:7F:E0:07:DD:57:E3:AF:37:5A:9C:4D:8D:73:54:6B:F4:F1:FE:D1:E1:8D:35
Alias name: quovadisrootca3g3
SHA1: 48:12:BD:92:3C:A8:C4:39:06:E7:30:6D:27:96:E6:A4:CF:22:2E:7D
SHA256:
88:EF:81:DE:20:2E:B0:18:45:2E:43:F8:64:72:5C:EA:5F:BD:1F:C2:D9:D2:05:73:07:09:C5:D8:B8:69:0F:46
Alias name: secomevrootca1
SHA1: FE:B8:C4:32:DC:F9:76:9A:CE:AE:3D:D8:90:8F:FD:28:86:65:64:7D
SHA256:
A2:2D:BA:68:1E:97:37:6E:2D:39:7D:72:8A:AE:3A:9B:62:96:B9:FD:BA:60:BC:2E:11:F6:47:F2:C6:75:FB:37
Alias name: secomsrootca1
SHA1: 36:B1:2B:49:F9:81:9E:D7:4C:9E:BC:38:0F:C6:56:8F:5D:AC:B2:F7
SHA256:
E7:5E:72:ED:9F:56:0E:EC:6E:B4:80:00:73:A4:3F:C3:AD:19:19:5A:39:22:82:01:78:95:97:4A:99:02:6B:6C
Alias name: secomsrootca2
SHA1: 5F:3B:8C:F2:F8:10:B3:7D:78:B4:CE:EC:19:19:C3:73:34:B9:C7:74
SHA256:
51:3B:2C:EC:B8:10:D4:CD:E5:DD:85:39:1A:DF:C6:C2:DD:60:D8:7B:B7:36:D2:B5:21:48:4A:A4:7A:0E:BE:F6
Alias name: secomvalicertclass1ca
SHA1: E5:DF:74:3C:B6:01:C4:9B:98:43:DC:AB:8C:E8:6A:81:10:9F:E4:8E
SHA256:
F4:C1:49:55:1A:30:13:A3:5B:C7:BF:FE:17:A7:F3:44:9B:C1:AB:5B:5A:0A:E7:4B:06:C2:3B:90:00:4C:01:04
Alias name: secureglobalca
SHA1: 3A:44:73:5A:E5:81:90:1F:24:86:61:46:1E:3B:9C:C4:5F:F5:3A:1B
SHA256:
42:00:F5:04:3A:C8:59:0E:BB:52:7D:20:9E:D1:50:30:29:FB:CB:D4:1C:A1:B5:06:EC:27:F1:5A:DE:7D:AC:69
```

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```
Alias name: securesignrootca11
  SHA1: 3B:C4:9F:48:F8:F3:73:A0:9C:1E:BD:F8:5B:B1:C3:65:C7:D8:11:B3
  SHA256:
BF:0F:EE:FB:9E:3A:58:1A:D5:F9:E9:DB:75:89:98:57:43:D2:61:08:5C:4D:31:4F:6F:5D:72:59:AA:42:16:12
Alias name: securetrustca
  SHA1: 87:82:C6:C3:04:35:3B:CF:D2:96:92:D2:59:3E:7D:44:D9:34:FF:11
  SHA256:
F1:C1:B5:0A:E5:A2:0D:D8:03:0E:C9:F6:BC:24:82:3D:D3:67:B5:25:57:59:B4:E7:1B:61:FC:E9:F7:37:5D:73
Alias name: securitycommunicationrootca
  SHA1: 36:B1:2B:49:F9:81:9E:D7:4C:9E:BC:38:0F:C6:56:8F:5D:AC:B2:F7
  SHA256:
E7:5E:72:ED:9F:56:0E:EC:6E:B4:80:00:73:A4:3F:C3:AD:19:19:5A:39:22:82:01:78:95:97:4A:99:02:6B:6C
Alias name: securitycommunicationrootca2
  SHA1: 5F:3B:8C:F2:F8:10:B3:7D:78:B4:CE:EC:19:19:C3:73:34:B9:C7:74
  SHA256:
51:3B:2C:EC:B8:10:D4:CD:E5:DD:85:39:1A:DF:C6:C2:DD:60:D8:7B:B7:36:D2:B5:21:48:4A:A4:7A:0E:BE:F6
Alias name: soneraclass1ca
  SHA1: 07:47:22:01:99:CE:74:B9:7C:B0:3D:79:B2:64:A2:C8:55:E9:33:FF
  SHA256:
CD:80:82:84:CF:74:6F:F2:FD:6E:B5:8A:A1:D5:9C:4A:D4:B3:CA:56:FD:C6:27:4A:89:26:A7:83:5F:32:31:3D
Alias name: soneraclass2ca
  SHA1: 37:F7:6D:E6:07:7C:90:C5:B1:3E:93:1A:B7:41:10:B4:F2:E4:9A:27
  SHA256:
79:08:B4:03:14:C1:38:10:0B:51:8D:07:35:80:7F:FB:FC:F8:51:8A:00:95:33:71:05:BA:38:6B:15:3D:D9:27
Alias name: soneraclass2rootca
  SHA1: 37:F7:6D:E6:07:7C:90:C5:B1:3E:93:1A:B7:41:10:B4:F2:E4:9A:27
  SHA256:
79:08:B4:03:14:C1:38:10:0B:51:8D:07:35:80:7F:FB:FC:F8:51:8A:00:95:33:71:05:BA:38:6B:15:3D:D9:27
Alias name: sslcomevrootcertificationauthorityecc
  SHA1: 4C:DD:51:A3:D1:F5:20:32:14:B0:C6:C5:32:23:03:91:C7:46:42:6D
  SHA256:
22:A2:C1:F7:BD:ED:70:4C:C1:E7:01:B5:F4:08:C3:10:88:0F:E9:56:B5:DE:2A:4A:44:F9:9C:87:3A:25:A7:C8
Alias name: sslcomevrootcertificationauthorityrsa2
  SHA1: 74:3A:F0:52:9B:D0:32:A0:F4:4A:83:CD:D4:BA:A9:7B:7C:2E:C4:9A
  SHA256:
2E:7B:F1:6C:C2:24:85:A7:BB:E2:AA:86:96:75:07:61:B0:AE:39:BE:3B:2F:E9:D0:CC:6D:4E:F7:34:91:42:5C
Alias name: sslcomrootcertificationauthorityecc
  SHA1: C3:19:7C:39:24:E6:54:AF:1B:C4:AB:20:95:7A:E2:C3:0E:13:02:6A
  SHA256:
34:17:BB:06:CC:60:07:DA:1B:96:1C:92:0B:8A:B4:CE:3F:AD:82:0E:4A:A3:0B:9A:CB:C4:A7:4E:BD:CE:BC:65
Alias name: sslcomrootcertificationauthorityrsa
  SHA1: B7:AB:33:08:D1:EA:44:77:BA:14:80:12:5A:6F:BD:A9:36:49:0C:BB
  SHA256:
85:66:6A:56:2E:E0:BE:5C:E9:25:C1:D8:89:0A:6F:76:A8:7E:C1:6D:4D:7D:5F:29:EA:74:19:CF:20:12:3B:69
Alias name: staatdernederlandenevrootca
  SHA1: 76:E2:7E:C1:4F:DB:82:C1:C0:A6:75:B5:05:BE:3D:29:B4:ED:DB:BB
  SHA256:
4D:24:91:41:4C:FE:95:67:46:EC:4C:EF:A6:CF:6F:72:E2:8A:13:29:43:2F:9D:8A:90:7A:C4:CB:5D:AD:C1:5A
Alias name: staatdernederlandenrootcag3
  SHA1: D8:EB:6B:41:51:92:59:E0:F3:E7:85:00:C0:3D:B6:88:97:C9:EE:FC
  SHA256:
3C:4F:B0:B9:5A:B8:B3:00:32:F4:32:B8:6F:53:5F:E1:72:C1:85:D0:FD:39:86:58:37:CF:36:18:7F:A6:F4:28
Alias name: starfieldclass2ca
  SHA1: AD:7E:1C:28:B0:64:EF:8F:60:03:40:20:14:C3:D0:E3:37:0E:B5:8A
  SHA256:
14:65:FA:20:53:97:B8:76:FA:A6:F0:A9:95:8E:55:90:E4:0F:CC:7F:AA:4F:B7:C2:C8:67:75:21:FB:5F:B6:58
Alias name: starfieldrootcertificateauthorityg2
  SHA1: B5:1C:06:7C:EE:2B:0C:3D:F8:55:AB:2D:92:F4:FE:39:D4:E7:0F:0E
  SHA256:
2C:E1:CB:0B:F9:D2:F9:E1:02:99:3F:BE:21:51:52:C3:B2:DD:0C:AB:DE:1C:68:E5:31:9B:83:91:54:DB:B7:F5
Alias name: starfieldrootg2ca
  SHA1: B5:1C:06:7C:EE:2B:0C:3D:F8:55:AB:2D:92:F4:FE:39:D4:E7:0F:0E
  SHA256:
2C:E1:CB:0B:F9:D2:F9:E1:02:99:3F:BE:21:51:52:C3:B2:DD:0C:AB:DE:1C:68:E5:31:9B:83:91:54:DB:B7:F5
Alias name: starfieldservicesrootcertificateauthorityg2
  SHA1: 92:5A:8F:8D:2C:6D:04:E0:66:5F:59:6A:FF:22:D8:63:E8:25:6F:3F
```

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```
SHA256:
56:8D:69:05:A2:C8:87:08:A4:B3:02:51:90:ED:CF:ED:B1:97:4A:60:6A:13:C6:E5:29:0F:CB:2A:E6:3E:DA:B5
Alias name: starfieldservicesrootg2ca
SHA1: 92:5A:8F:8D:2C:6D:04:E0:66:5F:59:6A:FF:22:D8:63:E8:25:6F:3F
SHA256:
56:8D:69:05:A2:C8:87:08:A4:B3:02:51:90:ED:CF:ED:B1:97:4A:60:6A:13:C6:E5:29:0F:CB:2A:E6:3E:DA:B5
Alias name: swissigngoldcag2
SHA1: D8:C5:38:8A:B7:30:1B:1B:6E:D4:7A:E6:45:25:3A:6F:9F:1A:27:61
SHA256:
62:DD:0B:E9:B9:F5:0A:16:3E:A0:F8:E7:5C:05:3B:1E:CA:57:EA:55:C8:68:8F:64:7C:68:81:F2:C8:35:7B:95
Alias name: swissigngoldg2ca
SHA1: D8:C5:38:8A:B7:30:1B:1B:6E:D4:7A:E6:45:25:3A:6F:9F:1A:27:61
SHA256:
62:DD:0B:E9:B9:F5:0A:16:3E:A0:F8:E7:5C:05:3B:1E:CA:57:EA:55:C8:68:8F:64:7C:68:81:F2:C8:35:7B:95
Alias name: swissignplatinumg2ca
SHA1: 56:E0:FA:C0:3B:8F:18:23:55:18:E5:D3:11:CA:E8:C2:43:31:AB:66
SHA256:
3B:22:2E:56:67:11:E9:92:30:0D:C0:B1:5A:B9:47:3D:AF:DE:F8:C8:4D:0C:EF:7D:33:17:B4:C1:82:1D:14:36
Alias name: swissignsilvercag2
SHA1: 9B:AA:E5:9F:56:EE:21:CB:43:5A:BE:25:93:DF:A7:F0:40:D1:1D:CB
SHA256:
BE:6C:4D:A2:BB:B9:BA:59:B6:F3:93:97:68:37:42:46:C3:C0:05:99:3F:A9:8F:02:0D:1D:ED:BE:D4:8A:81:D5
Alias name: swissignsilverg2ca
SHA1: 9B:AA:E5:9F:56:EE:21:CB:43:5A:BE:25:93:DF:A7:F0:40:D1:1D:CB
SHA256:
BE:6C:4D:A2:BB:B9:BA:59:B6:F3:93:97:68:37:42:46:C3:C0:05:99:3F:A9:8F:02:0D:1D:ED:BE:D4:8A:81:D5
Alias name: szafirrootca2
SHA1: E2:52:FA:95:3F:ED:DB:24:60:BD:6E:28:F3:9C:CC:CF:5E:B3:3F:DE
SHA256:
A1:33:9D:33:28:1A:0B:56:E5:57:D3:D3:2B:1C:E7:F9:36:7E:B0:94:BD:5F:A7:2A:7E:50:04:C8:DE:D7:CA:FE
Alias name: teliasonerarootcav1
SHA1: 43:13:BB:96:F1:D5:86:9B:C1:4E:6A:92:F6:CF:F6:34:69:87:82:37
SHA256:
DD:69:36:FE:21:F8:F0:77:C1:23:A1:A5:21:C1:22:24:F7:22:55:B7:3E:03:A7:26:06:93:E8:A2:4B:0F:A3:89
Alias name: thawtepersonalfreemailca
SHA1: E6:18:83:AE:84:CA:C1:C1:CD:52:AD:E8:E9:25:2B:45:A6:4F:B7:E2
SHA256:
5B:38:BD:12:9E:83:D5:A0:CA:D2:39:21:08:94:90:D5:0D:4A:AE:37:04:28:F8:DD:FF:FF:FA:4C:15:64:E1:84
Alias name: thawtepremiumserverca
SHA1: E0:AB:05:94:20:72:54:93:05:60:62:02:36:70:F7:CD:2E:FC:66:66
SHA256:
3F:9F:27:D5:83:20:4B:9E:09:C8:A3:D2:06:6C:4B:57:D3:A2:47:9C:36:93:65:08:80:50:56:98:10:5D:BC:E9
Alias name: thawteprimaryrootca
SHA1: 91:C6:D6:EE:3E:8A:C8:63:84:E5:48:C2:99:29:5C:75:6C:81:7B:81
SHA256:
8D:72:2F:81:A9:C1:13:C0:79:1D:F1:36:A2:96:6D:B2:6C:95:0A:97:1D:B4:6B:41:99:F4:EA:54:B7:8B:FB:9F
Alias name: thawteprimaryrootcag2
SHA1: AA:DB:BC:22:23:8F:C4:01:A1:27:BB:38:DD:F4:1D:DB:08:9E:F0:12
SHA256:
A4:31:0D:50:AF:18:A6:44:71:90:37:2A:86:AF:AF:8B:95:1F:FB:43:1D:83:7F:1E:56:88:B4:59:71:ED:15:57
Alias name: thawteprimaryrootcag3
SHA1: F1:8B:53:8D:1B:E9:03:B6:A6:F0:56:43:5B:17:15:89:CA:F3:6B:F2
SHA256:
4B:03:F4:58:07:AD:70:F2:1B:FC:2C:AE:71:C9:FD:E4:60:4C:06:4C:F5:FF:B6:86:BA:E5:DB:AA:D7:FD:D3:4C
Alias name: thawteserverca
SHA1: 9F:AD:91:A6:CE:6A:C6:C5:00:47:C4:4E:C9:D4:A5:0D:92:D8:49:79
SHA256:
87:C6:78:BF:B8:B2:5F:38:F7:E9:7B:33:69:56:BB:CF:14:4B:BA:CA:A5:36:47:E6:1A:23:25:BC:10:55:31:6B
Alias name: trustcenterclass2caii
SHA1: AE:50:83:ED:7C:F4:5C:BC:8F:61:C6:21:FE:68:5D:79:42:21:15:6E
SHA256:
E6:B8:F8:76:64:85:F8:07:AE:7F:8D:AC:16:70:46:1F:07:C0:A1:3E:EF:3A:1F:F7:17:53:8D:7A:BA:D3:91:B4
Alias name: trustcenterclass4caii
SHA1: A6:9A:91:FD:05:7F:13:6A:42:63:0B:B1:76:0D:2D:51:12:0C:16:50
SHA256:
32:66:96:7E:59:CD:68:00:8D:9D:D3:20:81:11:85:C7:04:20:5E:8D:95:FD:D8:4F:1C:7B:31:1E:67:04:FC:32
```

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```
Alias name: trustcenteruniversalcai
  SHA1: 6B:2F:34:AD:89:58:BE:62:FD:B0:6B:5C:CE:BB:9D:D9:4F:4E:39:F3
  SHA256:
EB:F3:C0:2A:87:89:B1:FB:7D:51:19:95:D6:63:B7:29:06:D9:13:CE:OD:5E:10:56:8A:8A:77:E2:58:61:67:E7
Alias name: trustcorecal
  SHA1: 58:D1:DF:95:95:67:6B:63:C0:F0:5B:1C:17:4D:8B:84:0B:C8:78:BD
  SHA256:
5A:88:5D:B1:9C:01:D9:12:C5:75:93:88:93:8C:AF:BB:DF:03:1A:B2:D4:8E:91:EE:15:58:9B:42:97:1D:03:9C
Alias name: trustcorrootcertcal
  SHA1: FF:BD:CD:E7:82:C8:43:5E:3C:6F:26:86:5C:CA:A8:3A:45:5B:C3:0A
  SHA256:
D4:0E:9C:86:CD:8F:E4:68:C1:77:69:59:F4:9E:A7:74:FA:54:86:84:B6:C4:06:F3:90:92:61:F4:DC:E2:57:5C
Alias name: trustcorrootcertca2
  SHA1: B8:BE:6D:CB:56:F1:55:B9:63:D4:12:CA:4E:06:34:C7:94:B2:1C:C0
  SHA256:
07:53:E9:40:37:8C:1B:D5:E3:83:6E:39:5D:AE:A5:CB:83:9E:50:46:F1:BD:0E:AE:19:51:CF:10:FE:C7:C9:65
Alias name: trustisfpsrootca
  SHA1: 3B:C0:38:0B:33:C3:F6:A6:0C:86:15:22:93:D9:DF:F5:4B:81:C0:04
  SHA256:
C1:B4:82:99:AB:A5:20:8F:E9:63:0A:CE:55:CA:68:A0:3E:DA:5A:51:9C:88:02:A0:D3:A6:73:BE:8F:8E:55:7D
Alias name: ttelescglobalrootclass2
  SHA1: 59:0D:2D:7D:88:4F:40:2E:61:7E:A5:62:32:17:65:CF:17:D8:94:E9
  SHA256:
91:E2:F5:78:8D:58:10:EB:A7:BA:58:73:7D:E1:54:8A:8E:CA:CD:01:45:98:BC:0B:14:3E:04:1B:17:05:25:52
Alias name: ttelescglobalrootclass2ca
  SHA1: 59:0D:2D:7D:88:4F:40:2E:61:7E:A5:62:32:17:65:CF:17:D8:94:E9
  SHA256:
91:E2:F5:78:8D:58:10:EB:A7:BA:58:73:7D:E1:54:8A:8E:CA:CD:01:45:98:BC:0B:14:3E:04:1B:17:05:25:52
Alias name: ttelescglobalrootclass3
  SHA1: 55:A6:72:3E:CB:F2:EC:CD:C3:23:74:70:19:9D:2A:BE:11:E3:81:D1
  SHA256:
FD:73:DA:D3:1C:64:4F:F1:B4:3B:EF:0C:CD:DA:96:71:0B:9C:D9:87:5E:CA:7E:31:70:7A:F3:E9:6D:52:2B:BD
Alias name: ttelescglobalrootclass3ca
  SHA1: 55:A6:72:3E:CB:F2:EC:CD:C3:23:74:70:19:9D:2A:BE:11:E3:81:D1
  SHA256:
FD:73:DA:D3:1C:64:4F:F1:B4:3B:EF:0C:CD:DA:96:71:0B:9C:D9:87:5E:CA:7E:31:70:7A:F3:E9:6D:52:2B:BD
Alias name: tubitakkamusmsslkoksertifikasisurum1
  SHA1: 31:43:64:9B:EC:CE:27:EC:ED:3A:3F:0B:8F:0D:E4:E8:91:DD:EE:CA
  SHA256:
46:ED:C3:68:90:46:D5:3A:45:3F:B3:10:4A:B8:0D:CA:EC:65:8B:26:60:EA:16:29:DD:7E:86:79:90:64:87:16
Alias name: twcaglobalrootca
  SHA1: 9C:BB:48:53:F6:A4:F6:D3:52:A4:E8:32:52:55:60:13:F5:AD:AF:65
  SHA256:
59:76:90:07:F7:68:5D:0F:CD:50:87:2F:9F:95:D5:75:5A:5B:2B:45:7D:81:F3:69:2B:61:0A:98:67:2F:0E:1B
Alias name: twcarootcertificationauthority
  SHA1: CF:9E:87:6D:D3:EB:FC:42:26:97:A3:B5:A3:7A:A0:76:A9:06:23:48
  SHA256:
BF:D8:8F:E1:10:1C:41:AE:3E:80:1B:F8:BE:56:35:0E:E9:BA:D1:A6:B9:BD:51:5E:DC:5C:6D:5B:87:11:AC:44
Alias name: ucaextendedvalidationroot
  SHA1: A3:A1:B0:6F:24:61:23:4A:E3:36:A5:C2:37:FC:A6:FF:DD:F0:D7:3A
  SHA256:
D4:3A:F9:B3:54:73:75:5C:96:84:FC:06:D7:D8:CB:70:EE:5C:28:E7:73:FB:29:4E:B4:1E:E7:17:22:92:4D:24
Alias name: ucaglobalg2root
  SHA1: 28:F9:78:16:19:7A:FF:18:25:18:AA:44:FE:C1:A0:CE:5C:B6:4C:8A
  SHA256:
9B:EA:11:C9:76:FE:01:47:64:C1:BE:56:A6:F9:14:B5:A5:60:31:7A:BD:99:88:39:33:82:E5:16:1A:A0:49:3C
Alias name: usertrustecc
  SHA1: D1:CB:CA:5D:B2:D5:2A:7F:69:3B:67:4D:E5:F0:5A:1D:0C:95:7D:F0
  SHA256:
4F:F4:60:D5:4B:9C:86:DA:BF:BC:FC:57:12:E0:40:0D:2B:ED:3F:BC:4D:4F:BD:AA:86:E0:6A:DC:D2:A9:AD:7A
Alias name: usertrustecccertificationauthority
  SHA1: D1:CB:CA:5D:B2:D5:2A:7F:69:3B:67:4D:E5:F0:5A:1D:0C:95:7D:F0
  SHA256:
4F:F4:60:D5:4B:9C:86:DA:BF:BC:FC:57:12:E0:40:0D:2B:ED:3F:BC:4D:4F:BD:AA:86:E0:6A:DC:D2:A9:AD:7A
Alias name: usertrustrsa
  SHA1: 2B:8F:1B:57:33:0D:BB:A2:D0:7A:6C:51:F7:0E:E9:0D:DA:B9:AD:8E
```



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```
SHA256:
E7:93:C9:B0:2F:D8:AA:13:E2:1C:31:22:8A:CC:B0:81:19:64:3B:74:9C:89:89:64:B1:74:6D:46:C3:D4:CB:D2
Alias name: usertrustsacertificationauthority
SHA1: 2B:8F:1B:57:33:0D:BB:A2:D0:7A:6C:51:F7:0E:E9:0D:DA:B9:AD:8E
SHA256:
E7:93:C9:B0:2F:D8:AA:13:E2:1C:31:22:8A:CC:B0:81:19:64:3B:74:9C:89:89:64:B1:74:6D:46:C3:D4:CB:D2
Alias name: utndatacorpsgccca
SHA1: 58:11:9F:0E:12:82:87:EA:50:FD:D9:87:45:6F:4F:78:DC:FA:D6:D4
SHA256:
85:FB:2F:91:DD:12:27:5A:01:45:B6:36:53:4F:84:02:4A:D6:8B:69:B8:EE:88:68:4F:F7:11:37:58:05:B3:48
Alias name: utnuserfirstclientauthemailca
SHA1: B1:72:B1:A5:6D:95:F9:1F:E5:02:87:E1:4D:37:EA:6A:44:63:76:8A
SHA256:
43:F2:57:41:2D:44:0D:62:74:76:97:4F:87:7D:A8:F1:FC:24:44:56:5A:36:7A:E6:0E:DD:C2:7A:41:25:31:AE
Alias name: utnuserfirsthardwareca
SHA1: 04:83:ED:33:99:AC:36:08:05:87:22:ED:BC:5E:46:00:E3:BE:F9:D7
SHA256:
6E:A5:47:41:D0:04:66:7E:ED:1B:48:16:63:4A:A3:A7:9E:6E:4B:96:95:0F:82:79:DA:FC:8D:9B:D8:81:21:37
Alias name: utnuserfirstobjectca
SHA1: E1:2D:FB:4B:41:D7:D9:C3:2B:30:51:4B:AC:1D:81:D8:38:5E:2D:46
SHA256:
6F:FF:78:E4:00:A7:0C:11:01:1C:D8:59:77:C4:59:FB:5A:F9:6A:3D:F0:54:08:20:D0:F4:B8:60:78:75:E5:8F
Alias name: valicertclass2ca
SHA1: 31:7A:2A:D0:7F:2B:33:5E:F5:A1:C3:4E:4B:57:E8:B7:D8:F1:FC:A6
SHA256:
58:D0:17:27:9C:D4:DC:63:AB:DD:B1:96:A6:C9:90:6C:30:C4:E0:87:83:EA:E8:C1:60:99:54:D6:93:55:59:6B
Alias name: verisignc1g1.pem
SHA1: 90:AE:A2:69:85:FF:14:80:4C:43:49:52:EC:E9:60:84:77:AF:55:6F
SHA256:
D1:7C:D8:EC:D5:86:B7:12:23:8A:48:2C:E4:6F:A5:29:39:70:74:2F:27:6D:8A:B6:A9:E4:6E:E0:28:8F:33:55
Alias name: verisignc1g2.pem
SHA1: 27:3E:E1:24:57:FD:C4:F9:0C:55:E8:2B:56:16:7F:62:F5:32:E5:47
SHA256:
34:1D:E9:8B:13:92:AB:F7:F4:AB:90:A9:60:CF:25:D4:BD:6E:C6:5B:9A:51:CE:6E:D0:67:D0:0E:C7:CE:9B:7F
Alias name: verisignc1g3.pem
SHA1: 20:42:85:DC:F7:EB:76:41:95:57:8E:13:6B:D4:B7:D1:E9:8E:46:A5
SHA256:
CB:B5:AF:18:5E:94:2A:24:02:F9:EA:CB:C0:ED:5B:B8:76:EE:A3:C1:22:36:23:D0:04:47:E4:F3:BA:55:4B:65
Alias name: verisignc1g6.pem
SHA1: 51:7F:61:1E:29:91:6B:53:82:FB:72:E7:44:D9:8D:C3:CC:53:6D:64
SHA256:
9D:19:0B:2E:31:45:66:68:5B:E8:A8:89:E2:7A:A8:C7:D7:AE:1D:8A:AD:DB:A3:C1:EC:F9:D2:48:63:CD:34:B9
Alias name: verisignc2g1.pem
SHA1: 67:82:AA:E0:ED:EE:E2:1A:58:39:D3:C0:CD:14:68:0A:4F:60:14:2A
SHA256:
BD:46:9F:F4:5F:AA:E7:C5:4C:CB:D6:9D:3F:3B:00:22:55:D9:B0:6B:10:B1:D0:FA:38:8B:F9:6B:91:8B:2C:E9
Alias name: verisignc2g2.pem
SHA1: B3:EA:C4:47:76:C9:C8:1C:EA:F2:9D:95:B6:CC:A0:08:1B:67:EC:9D
SHA256:
3A:43:E2:20:FE:7F:3E:A9:65:3D:1E:21:74:2E:AC:2B:75:C2:0F:D8:98:03:05:BC:50:2C:AF:8C:2D:9B:41:A1
Alias name: verisignc2g3.pem
SHA1: 61:EF:43:D7:7F:CA:D4:61:51:BC:98:E0:C3:59:12:AF:9F:EB:63:11
SHA256:
92:A9:D9:83:3F:E1:94:4D:B3:66:E8:BF:AE:7A:95:B6:48:0C:2D:6C:6C:2A:1B:E6:5D:42:36:B6:08:FC:A1:BB
Alias name: verisignc2g6.pem
SHA1: 40:B3:31:A0:E9:BF:E8:55:BC:39:93:CA:70:4F:4E:C2:51:D4:1D:8F
SHA256:
CB:62:7D:18:B5:8A:D5:6D:DE:33:1A:30:45:6B:C6:5C:60:1A:4E:9B:18:DE:DC:EA:08:E7:DA:AA:07:81:5F:F0
Alias name: verisignc3g1.pem
SHA1: A1:DB:63:93:91:6F:17:E4:18:55:09:40:04:15:C7:02:40:B0:AE:6B
SHA256:
A4:B6:B3:99:6F:C2:F3:06:B3:FD:86:81:BD:63:41:3D:8C:50:09:CC:4F:A3:29:C2:CC:F0:E2:FA:1B:14:03:05
Alias name: verisignc3g2.pem
SHA1: 85:37:1C:A6:E5:50:14:3D:CE:28:03:47:1B:DE:3A:09:E8:F8:77:0F
SHA256:
83:CE:3C:12:29:68:8A:59:3D:48:5F:81:97:3C:0F:91:95:43:1E:DA:37:CC:5E:36:43:0E:79:C7:A8:88:63:8B
```

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```
Alias name: verisignc3g3.pem
  SHA1: 13:2D:0D:45:53:4B:69:97:CD:B2:D5:C3:39:E2:55:76:60:9B:5C:C6
  SHA256:
EB:04:CF:5E:B1:F3:9A:FA:76:2F:2B:B1:20:F2:96:CB:A5:20:C1:B9:7D:B1:58:95:65:B8:1C:B9:A1:7B:72:44
Alias name: verisignc3g4.pem
  SHA1: 22:D5:D8:DF:8F:02:31:D1:8D:F7:9D:B7:CF:8A:2D:64:C9:3F:6C:3A
  SHA256:
69:DD:D7:EA:90:BB:57:C9:3E:13:5D:C8:5E:A6:FC:D5:48:0B:60:32:39:BD:C4:54:FC:75:8B:2A:26:CF:7F:79
Alias name: verisignc3g5.pem
  SHA1: 4E:B6:D5:78:49:9B:1C:CF:5F:58:1E:AD:56:BE:3D:9B:67:44:A5:E5
  SHA256:
9A:CF:AB:7E:43:C8:D8:80:D0:6B:26:2A:94:DE:EE:E4:B4:65:99:89:C3:D0:CA:F1:9B:AF:64:05:E4:1A:B7:DF
Alias name: verisignc4g2.pem
  SHA1: 0B:77:BE:BB:CB:7A:A2:47:05:DE:CC:0F:BD:6A:02:FC:7A:BD:9B:52
  SHA256:
44:64:0A:0A:0E:4D:00:0F:BD:57:4D:2B:8A:07:BD:B4:D1:DF:ED:3B:45:BA:AB:A7:6F:78:57:78:C7:01:19:61
Alias name: verisignc4g3.pem
  SHA1: C8:EC:8C:87:92:69:CB:4B:AB:39:E9:8D:7E:57:67:F3:14:95:73:9D
  SHA256:
E3:89:36:0D:0F:DB:AE:B3:D2:50:58:4B:47:30:31:4E:22:2F:39:C1:56:A0:20:14:4E:8D:96:05:61:79:15:06
Alias name: verisignclass1ca
  SHA1: CE:6A:64:A3:09:E4:2F:BB:D9:85:1C:45:3E:64:09:EA:E8:7D:60:F1
  SHA256:
51:84:7C:8C:BD:2E:9A:72:C9:1E:29:2D:2A:E2:47:D7:DE:1E:3F:D2:70:54:7A:20:EF:7D:61:0F:38:B8:84:2C
Alias name: verisignclass1g2ca
  SHA1: 27:3E:E1:24:57:FD:C4:F9:0C:55:E8:2B:56:16:7F:62:F5:32:E5:47
  SHA256:
34:1D:E9:8B:13:92:AB:F7:F4:AB:90:A9:60:CF:25:D4:BD:6E:C6:5B:9A:51:CE:6E:D0:67:D0:0E:C7:CE:9B:7F
Alias name: verisignclass1g3ca
  SHA1: 20:42:85:DC:F7:EB:76:41:95:57:8E:13:6B:D4:B7:D1:E9:8E:46:A5
  SHA256:
CB:B5:AF:18:5E:94:2A:24:02:F9:EA:CB:C0:ED:5B:B8:76:EE:A3:C1:22:36:23:D0:04:47:E4:F3:BA:55:4B:65
Alias name: verisignclass2g2ca
  SHA1: B3:EA:C4:47:76:C9:C8:1C:EA:F2:9D:95:B6:CC:A0:08:1B:67:EC:9D
  SHA256:
3A:43:E2:20:FE:7F:3E:A9:65:3D:1E:21:74:2E:AC:2B:75:C2:0F:D8:98:03:05:BC:50:2C:AF:8C:2D:9B:41:A1
Alias name: verisignclass2g3ca
  SHA1: 61:EF:43:D7:7F:CA:D4:61:51:BC:98:E0:C3:59:12:AF:9F:EB:63:11
  SHA256:
92:A9:D9:83:3F:E1:94:4D:B3:66:E8:BF:AE:7A:95:B6:48:0C:2D:6C:6C:2A:1B:E6:5D:42:36:B6:08:FC:A1:BB
Alias name: verisignclass3ca
  SHA1: A1:DB:63:93:91:6F:17:E4:18:55:09:40:04:15:C7:02:40:B0:AE:6B
  SHA256:
A4:B6:B3:99:6F:C2:F3:06:B3:FD:86:81:BD:63:41:3D:8C:50:09:CC:4F:A3:29:C2:CC:F0:E2:FA:1B:14:03:05
Alias name: verisignclass3g2ca
  SHA1: 85:37:1C:A6:E5:50:14:3D:CE:28:03:47:1B:DE:3A:09:E8:F8:77:0F
  SHA256:
83:CE:3C:12:29:68:8A:59:3D:48:5F:81:97:3C:0F:91:95:43:1E:DA:37:CC:5E:36:43:0E:79:C7:A8:88:63:8B
Alias name: verisignclass3g3ca
  SHA1: 13:2D:0D:45:53:4B:69:97:CD:B2:D5:C3:39:E2:55:76:60:9B:5C:C6
  SHA256:
EB:04:CF:5E:B1:F3:9A:FA:76:2F:2B:B1:20:F2:96:CB:A5:20:C1:B9:7D:B1:58:95:65:B8:1C:B9:A1:7B:72:44
Alias name: verisignclass3g4ca
  SHA1: 22:D5:D8:DF:8F:02:31:D1:8D:F7:9D:B7:CF:8A:2D:64:C9:3F:6C:3A
  SHA256:
69:DD:D7:EA:90:BB:57:C9:3E:13:5D:C8:5E:A6:FC:D5:48:0B:60:32:39:BD:C4:54:FC:75:8B:2A:26:CF:7F:79
Alias name: verisignclass3g5ca
  SHA1: 4E:B6:D5:78:49:9B:1C:CF:5F:58:1E:AD:56:BE:3D:9B:67:44:A5:E5
  SHA256:
9A:CF:AB:7E:43:C8:D8:80:D0:6B:26:2A:94:DE:EE:E4:B4:65:99:89:C3:D0:CA:F1:9B:AF:64:05:E4:1A:B7:DF
Alias name: verisignclass3publicprimarycertificationauthorityg4
  SHA1: 22:D5:D8:DF:8F:02:31:D1:8D:F7:9D:B7:CF:8A:2D:64:C9:3F:6C:3A
  SHA256:
69:DD:D7:EA:90:BB:57:C9:3E:13:5D:C8:5E:A6:FC:D5:48:0B:60:32:39:BD:C4:54:FC:75:8B:2A:26:CF:7F:79
Alias name: verisignclass3publicprimarycertificationauthorityg5
  SHA1: 4E:B6:D5:78:49:9B:1C:CF:5F:58:1E:AD:56:BE:3D:9B:67:44:A5:E5
```

```
SHA256:  
9A:CF:AB:7E:43:C8:D8:80:D0:6B:26:2A:94:DE:EE:E4:B4:65:99:89:C3:D0:CA:F1:9B:AF:64:05:E4:1A:B7:DF  
Alias name: verisignroot.pem  
SHA1: 36:79:CA:35:66:87:72:30:4D:30:A5:FB:87:3B:0F:A7:7B:B7:0D:54  
SHA256:  
23:99:56:11:27:A5:71:25:DE:8C:EF:EA:61:0D:DF:2F:A0:78:B5:C8:06:7F:4E:82:82:90:BF:B8:60:E8:4B:3C  
Alias name: verisigntsaca  
SHA1: 20:CE:B1:F0:F5:1C:0E:19:A9:F3:8D:B1:AA:8E:03:8C:AA:7A:C7:01  
SHA256:  
CB:6B:05:D9:E8:E5:7C:D8:82:B1:0B:4D:B7:0D:E4:BB:1D:E4:2B:A4:8A:7B:D0:31:8B:63:5B:F6:E7:78:1A:9D  
Alias name: verisignuniversalrootca  
SHA1: 36:79:CA:35:66:87:72:30:4D:30:A5:FB:87:3B:0F:A7:7B:B7:0D:54  
SHA256:  
23:99:56:11:27:A5:71:25:DE:8C:EF:EA:61:0D:DF:2F:A0:78:B5:C8:06:7F:4E:82:82:90:BF:B8:60:E8:4B:3C  
Alias name: verisignuniversalrootcertificationauthority  
SHA1: 36:79:CA:35:66:87:72:30:4D:30:A5:FB:87:3B:0F:A7:7B:B7:0D:54  
SHA256:  
23:99:56:11:27:A5:71:25:DE:8C:EF:EA:61:0D:DF:2F:A0:78:B5:C8:06:7F:4E:82:82:90:BF:B8:60:E8:4B:3C  
Alias name: xrampglobalca  
SHA1: B8:01:86:D1:EB:9C:86:A5:41:04:CF:30:54:F3:4C:52:B7:E5:58:C6  
SHA256:  
CE:CD:DC:90:50:99:D8:DA:DF:C5:B1:D2:09:B7:37:CB:E2:C1:8C:FB:2C:10:C0:FF:0B:CF:0D:32:86:FC:1A:A2  
Alias name: xrampglobalcaroot  
SHA1: B8:01:86:D1:EB:9C:86:A5:41:04:CF:30:54:F3:4C:52:B7:E5:58:C6  
SHA256:  
CE:CD:DC:90:50:99:D8:DA:DF:C5:B1:D2:09:B7:37:CB:E2:C1:8C:FB:2C:10:C0:FF:0B:CF:0D:32:86:FC:1A:A2
```

## Using Amazon WAF to protect your APIs

Amazon WAF is a web application firewall that helps protect web applications and APIs from attacks. It enables you to configure a set of rules (called a web access control list (web ACL)) that allow, block, or count web requests based on customizable web security rules and conditions that you define. For more information, see [How Amazon WAF Works](#).

You can use Amazon WAF to protect your API Gateway API from common web exploits, such as SQL injection and cross-site scripting (XSS) attacks. These could affect API availability and performance, compromise security, or consume excessive resources. For example, you can create rules to allow or block requests from specified IP address ranges, requests from CIDR blocks, requests that originate from a specific country or region, requests that contain malicious SQL code, or requests that contain malicious script.

You can also create rules that match a specified string or a regular expression pattern in HTTP headers, method, query string, URI, and the request body (limited to the first 8 KB). Additionally, you can create rules to block attacks from specific user agents, bad bots, and content scrapers. For example, you can use rate-based rules to specify the number of web requests that are allowed by each client IP in a trailing, continuously updated, 5-minute period.

### Important

Amazon WAF is your first line of defense against web exploits. When Amazon WAF is enabled on an API, Amazon WAF rules are evaluated before other access control features, such as [resource policies \(p. 237\)](#), [IAM policies \(p. 248\)](#), [Lambda authorizers \(p. 256\)](#), and [Amazon Cognito authorizers \(p. 270\)](#). For example, if Amazon WAF blocks access from a CIDR block that a resource policy allows, Amazon WAF takes precedence and the resource policy isn't evaluated.

To enable Amazon WAF for your API, you need to do the following:

1. Use the Amazon WAF console, Amazon SDK, or CLI to create a Regional web ACL that contains the desired combination of Amazon WAF managed rules and your own custom rules. For more information, see [Getting Started with Amazon WAF](#) and [Creating and Configuring a Web Access Control List \(Web ACL\)](#).

### Important

API Gateway requires a Regional web ACL.

2. Associate the Amazon WAF Regional web ACL with an API stage. You can do this by using the Amazon WAF console, Amazon SDK, or CLI or by using the API Gateway console, Amazon SDK, or CLI.

## To associate an Amazon WAF regional Web ACL with an API Gateway API stage using the API Gateway console

To use the API Gateway console to associate an Amazon WAF Regional web ACL with an existing API Gateway API stage, use the following steps:

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. In the **APIs** navigation pane, choose the API, and then choose **Stages**.
3. In the **Stages** pane, choose the name of the stage.
4. In the **Stage Editor** pane, choose the **Settings** tab.
5. To associate a Regional web ACL with the API stage:
  - In the Amazon WAF web ACL dropdown list, choose the Regional web ACL that you want to associate with this stage.

### Note

If the web ACL you need doesn't exist yet, choose **Create WebACL**. Then choose **Go to Amazon WAF** to open the Amazon WAF console in a new browser tab and create a Regional web ACL. Then return to the API Gateway console to associate the web ACL with the stage.

6. Choose **Save Changes**.

## Associate an Amazon WAF regional Web ACL with an API Gateway API stage using the Amazon CLI

To use the Amazon CLI to associate an Amazon WAF Regional web ACL with an existing API Gateway API stage, call the `associate-web-acl` command, as in the following example:

```
aws waf-regional associate-web-acl \
--web-acl-id 'aabc123a-fb4f-4fc6-becb-2b00831cadcf' \
--resource-arn 'arn:aws:apigateway:{region}::restapis/4wk1k4onj3/stages/prod'
```

## Associate an Amazon WAF regional web ACL with an API stage using the Amazon WAF REST API

To use the Amazon WAF REST API to associate an Amazon WAF Regional web ACL with an existing API Gateway API stage, call the `AssociateWebACL` command, as in the following example:

```
import boto3

waf = boto3.client('waf-regional')

waf.associate_web_acl(
    WebACLId='aabc123a-fb4f-4fc6-becb-2b00831cadcf',
    ResourceArn='arn:aws:apigateway:{region}::restapis/4wk1k4onj3/stages/prod'
)
```

## Throttle API requests for better throughput

You can configure throttling and quotas for your APIs to help protect them from being overwhelmed by too many requests. Both throttles and quotas are applied on a best-effort basis and should be thought of as targets rather than guaranteed request ceilings.

API Gateway throttles requests to your API using the token bucket algorithm, where a token counts for a request. Specifically, API Gateway examines the rate and a burst of request submissions against all APIs in your account, per Region. In the token bucket algorithm, a burst can allow pre-defined overrun of those limits, but other factors can also cause limits to be overrun in some cases.

When request submissions exceed the steady-state request rate and burst limits, API Gateway begins to throttle requests. Clients may receive 429 `Too Many Requests` error responses at this point. Upon catching such exceptions, the client can resubmit the failed requests in a way that is rate limiting.

As an API developer, you can set the target limits for individual API stages or methods to improve overall performance across all APIs in your account. Alternatively, you can enable usage plans to set throttles on client request submissions based on specified requests rates and quotas.

### Topics

- [How throttling limit settings are applied in API Gateway \(p. 598\)](#)
- [Account-level throttling per Region \(p. 599\)](#)
- [Configuring API-level and stage-level throttling targets in a usage plan \(p. 599\)](#)
- [Configuring method-level throttling targets in a usage plan \(p. 599\)](#)

## How throttling limit settings are applied in API Gateway

Before you configure throttle and quota settings for your API, it's useful to understand how they are applied by Amazon API Gateway.

Amazon API Gateway provides four basic types of throttling-related settings:

- *Amazon throttling limits* are applied across all accounts and clients in a region. These limit settings exist to prevent your API—and your account—from being overwhelmed by too many requests. These limits are set by Amazon and can't be changed by a customer.
- Per-account limits are applied to all APIs in an account in a specified Region. The account-level rate limit can be increased upon request - higher limits are possible with APIs that have shorter timeouts and smaller payloads. To request an increase of account-level throttling limits per Region, contact the [Amazon Support Center](#). For more information, see [Quotas and important notes \(p. 744\)](#). Note that these limits can't be higher than the Amazon throttling limits.
- Per-API, per-stage throttling limits are applied at the API method level for a stage. You can configure the same settings for all methods, or configure different throttle settings for each method. Note that these limits can't be higher than the Amazon throttling limits.
- *Per-client throttling limits* are applied to clients that use API keys associated with your usage plan as client identifier. Note that these limits can't be higher than the per-account limits.

API Gateway throttling-related settings are applied in the following order:

1. [Per-client or per-method throttling limits \(p. 599\)](#) that you set for an API stage in a [usage plan \(p. 497\)](#)
2. Per-method throttling limits that you set for an API stage.
3. [Account-level throttling per Region \(p. 599\)](#)
4. Amazon Regional throttling

## Account-level throttling per Region

By default, API Gateway limits the steady-state requests per second (RPS) across all APIs within an Amazon account, per Region. It also limits the burst (that is, the maximum bucket size) across all APIs within an Amazon account, per Region. In API Gateway, the burst limit represents the target maximum number of concurrent request submissions that API Gateway will fulfill before returning 429 Too Many Requests error responses. For more information on throttling quotas, see [Quotas and important notes](#) (p. 744).

## Configuring API-level and stage-level throttling targets in a usage plan

In a [usage plan](#) (p. 491), you can set a per-method throttling target for all methods at the API or stage level under **Create Usage Plan**.

## Configuring method-level throttling targets in a usage plan

You can set additional throttling targets at the method level in **Usage Plans** as shown in [Create a usage plan](#) (p. 497). In the API Gateway console, these are set by specifying `Resource=<resource>`, `Method=<method>` in the **Configure Method Throttling** setting. For example, for the [PetStore example](#) (p. 49), you might specify `Resource=/pets`, `Method=GET`.

## Creating a private API in Amazon API Gateway

Using Amazon API Gateway, you can create private REST APIs that can only be accessed from your virtual private cloud in Amazon VPC by using an [interface VPC endpoint](#). This is an endpoint network interface that you create in your VPC.

Using [resource policies](#) (p. 603), you can allow or deny access to your API from selected VPCs and VPC endpoints, including across Amazon accounts. Each endpoint can be used to access multiple private APIs. You can also use Amazon Direct Connect to establish a connection from an on-premises network to Amazon VPC and access your private API over that connection.

### Important

To restrict access to your private API to specific VPCs and VPC endpoints, you must add `aws:SourceVpc` and `aws:SourceVpcE` conditions to your API's resource policy. For example policies, see [the section called "Example: Allow private API traffic based on source VPC or VPC endpoint"](#) (p. 244).

In all cases, traffic to your private API uses secure connections and does not leave the Amazon network—it is isolated from the public internet.

You can [access](#) (p. 425) your private APIs through interface VPC endpoints for API Gateway as shown in the following diagram. If you have private DNS enabled, you can use private or public DNS names to access your APIs. If you have private DNS disabled, you can only use public DNS names.

### Note

API Gateway private APIs only support TLS 1.2. Earlier TLS versions are not supported.

At a high level, the steps for creating a private API are as follows:

1. First, [create an interface VPC endpoint](#) (p. 600) for the API Gateway component service for API execution, known as `execute-api`, in your VPC.
2. Create and test your private API.
  - a. Use one of the following procedures to create your API:
    - [API Gateway console](#) (p. 601)

- [API Gateway CLI \(p. 602\)](#)
  - [Amazon SDK for JavaScript \(p. 602\)](#)
- b. To grant access to your VPC endpoint, [create a resource policy and attach it to your API \(p. 603\)](#).
  - c. [Test your API \(p. 425\)](#).

#### Note

The procedures below assume you already have a fully configured VPC. For more information, and to get started with creating a VPC, see [Getting Started With Amazon VPC](#) in the Amazon VPC User Guide.

## Private API development considerations

- You can convert an existing public API (Regional or edge-optimized) to a private API, and you can convert a private API to a Regional API. You cannot convert a private API to an edge-optimized API. For more information, see [??? \(p. 207\)](#).
- To grant access to your private API to VPCs and VPC endpoints, you need to create a resource policy and attach it to the newly created (or converted) API. Until you do so, all calls to the API will fail. For more information, see [??? \(p. 603\)](#).
- [Custom domain names \(p. 463\)](#) are not supported for private APIs.
- You can use a single VPC endpoint to access multiple private APIs.
- VPC endpoints for private APIs are subject to the same limitations as other interface VPC endpoints. For more information, see [Interface Endpoint Properties and Limitations](#) in the Amazon VPC User Guide.
- You can associate or disassociate a VPC endpoint to a REST API, which gives a Route 53 alias DNS record and simplifies invoking your private API. For more information, see [Associate or Disassociate a VPC Endpoint with a Private REST API \(p. 603\)](#).

#### Topics

- [Create an interface VPC endpoint for API Gateway `execute-api` \(p. 600\)](#)
- [Create a private API using the API Gateway console \(p. 601\)](#)
- [Create a private API using the Amazon CLI \(p. 602\)](#)
- [Create a private API using the Amazon SDK for JavaScript \(p. 602\)](#)
- [Set up a resource policy for a private API \(p. 603\)](#)
- [Deploy a private API using the API Gateway console \(p. 603\)](#)
- [Associate or disassociate a VPC endpoint with a private REST API \(p. 603\)](#)

## Create an interface VPC endpoint for API Gateway `execute-api`

The API Gateway component service for API execution is called `execute-api`. To access your private API once it's deployed, you need to create an interface VPC endpoint for it in your VPC.

After you've created your VPC endpoint, you can use it to access multiple private APIs.

#### To create an interface VPC endpoint for API Gateway `execute-api`

1. Sign in to the Amazon Web Services Management Console and open the Amazon VPC console at <https://console.amazonaws.cn/vpc/>.

2. In the navigation pane, choose **Endpoints, Create Endpoint**.
3. For **Service category**, ensure that **Amazon services** is selected.
4. For **Service Name**, choose the API Gateway service endpoint, including the Amazon Region that you want to connect to. This is in the form `com.amazonaws.region.execute-api`—for example, `com.amazonaws.us-east-1.execute-api`.

For **Type**, ensure that it indicates **Interface**.

5. Complete the following information:
  - For **VPC**, choose the VPC that you want to create the endpoint in.
  - For **Subnets**, choose the subnets (Availability Zones) in which to create the endpoint network interfaces. To improve the availability of your API, choose multiple subnets.

**Note**

Not all Availability Zones may be supported for all Amazon services.

- For **Enable Private DNS Name**, leave the check box selected. Private DNS is enabled by default.

When private DNS is enabled, you're able to access your API via private or public DNS. (This setting doesn't affect who can access your API, only which DNS addresses they can use.) However, you cannot access public APIs from a VPC by using an API Gateway VPC endpoint with private DNS enabled. Note that these DNS settings don't affect the ability to call these public APIs from the VPC if you're using an edge-optimized custom domain name to access the public API. Using an edge-optimized custom domain name to access your public API (while using private DNS to access your private API) is one way to access both public and private APIs from a VPC where the endpoint has been created with private DNS enabled.

**Note**

Leaving private DNS enabled is the recommended choice. If you choose not to enable private DNS, you're only able to access your API via public DNS.

To use the private DNS option, the `enableDnsSupport` and `enableDnsHostnames` attributes of your VPC must be set to `true`. For more information, see [DNS Support in Your VPC](#) and [Updating DNS Support for Your VPC](#) in the Amazon VPC User Guide.

- For **Security group**, select the security group to associate with the VPC endpoint network interfaces.

The security group you choose must be set to allow TCP Port 443 inbound HTTPS traffic from either an IP range in your VPC or another security group in your VPC.

6. Choose **Create endpoint**.

## Create a private API using the API Gateway console

### To create a private API using the API Gateway console

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose **Create API**.
3. Under **REST API**, choose **Build**.
4. Enter a name for **API Name**.
5. For **Endpoint Type**, choose **Private**.
6. Choose **Create API**.

From here on, you can set up API methods and their associated integrations as described in steps 1-6 of [??? \(p. 49\)](#).



**Note**

Until your API has a resource policy that grants access to your [VPC or VPC endpoint \(p. 600\)](#), all API calls will fail. Before you test and deploy your API, you need to create a resource policy and attach it to the API as described in [??? \(p. 603\)](#).

## Create a private API using the Amazon CLI

To create a private API using the Amazon CLI, call the `create-rest-api` command:

```
aws apigateway create-rest-api \
  --name 'Simple PetStore (Amazon CLI, Private)' \
  --description 'Simple private PetStore API' \
  --region us-west-2 \
  --endpoint-configuration '{ "types": ["PRIVATE"] }'
```

A successful call returns output similar to the following:

```
{
  "createdAt": "2017-10-13T18:41:39Z",
  "description": "Simple private PetStore API",
  "endpointConfiguration": {
    "types": "PRIVATE"
  },
  "id": "0qzs2sy7bh",
  "name": "Simple PetStore (Amazon CLI, Private)"
}
```

From here on, you can follow the same instructions given in [the section called “Set up an edge-optimized API using Amazon CLI commands” \(p. 209\)](#) to set up methods and integrations for this API.

When you are ready to test your API, be sure to create a resource policy and attach it to the API as described in [??? \(p. 603\)](#).

## Create a private API using the Amazon SDK for JavaScript

To create a private API by using the Amazon SDK for JavaScript:

```
apig.createRestApi({
  name: "Simple PetStore (node.js SDK, private)",
  endpointConfiguration: {
    types: ['PRIVATE']
  },
  description: "Demo private API created using the Amazon SDK for node.js",
  version: "0.00.001"
}, function(err, data){
  if (!err) {
    console.log('Create API succeeded:\n', data);
    restApiId = data.id;
  } else {
    console.log('Create API failed:\n', err);
  }
});
```

A successful call returns output similar to the following:

```
{
  "createdAt": "2017-10-13T18:41:39Z",
  "description": "Demo private API created using the Amazon SDK for node.js",
  "endpointConfiguration": {
    "types": "PRIVATE"
  }
}
```

```
    },  
    "id": "0qzs2sy7bh",  
    "name": "Simple PetStore (node.js SDK, private)"  
  }  
}
```

After completing the preceding steps, you can follow the instructions in [the section called “Set up an edge-optimized API using the Amazon SDK for Node.js” \(p. 214\)](#) to set up methods and integrations for this API.

When you are ready to test your API, be sure to create a resource policy and attach it to the API as described in [??? \(p. 603\)](#).

## Set up a resource policy for a private API

Before your private API can be accessed, you need to create a resource policy and attach it to the API. This grants access to the API from your VPCs and VPC endpoints or from VPCs and VPC endpoints in other Amazon accounts that you explicitly grant access.

To do this, follow the instructions in [the section called “Create and attach an API Gateway resource policy to an API” \(p. 245\)](#). In step 4, choose the **Source VPC** example. Replace `{{vpceID}}` (including the curly braces) with your VPC endpoint ID, and then choose **Save** to save your resource policy.

You should also consider attaching an endpoint policy to the VPC endpoint to specify the access that's being granted. For more information, see [the section called “Use VPC endpoint policies for private APIs” \(p. 254\)](#).

## Deploy a private API using the API Gateway console

To deploy your private API, do the following in the API Gateway console:

1. In the left navigation pane, select the API and then choose **Deploy API** from the **Actions** drop-down menu.
2. In the **Deploy API** dialog, choose a stage (or [New Stage] for the API's first deployment). Enter a name (for example, "test", "prod", or "dev") in the **Stage name** input field. Optionally, provide a description in **Stage description** and/or **Deployment description**. Then choose **Deploy**.

## Associate or disassociate a VPC endpoint with a private REST API

When you associate a VPC endpoint with your private API, API Gateway generates a new Route 53 ALIAS DNS record. You can use this record to invoke your private APIs just as you do your edge-optimized or Regional APIs without overriding a `Host` header or passing an `x-apigw-api-id` header.

The generated base URL is in the following format:

```
https://{rest-api-id}-{vpce-id}.execute-api.{region}.amazonaws.com/{stage}
```

Associating or disassociating a VPC endpoint with a private REST API requires you to update the API's configuration. You can perform this change using the API Gateway console, the Amazon CLI, or an Amazon SDK for API Gateway. The update operation may take few minutes to complete due to DNS propagation. During this time, your API is available, but DNS propagation for the newly generated DNS URLs may still be in progress. You may try [creating a new deployment for your API \(p. 436\)](#), if even after several minutes your new URLs are not resolving in DNS.

## Use the Amazon CLI to associate VPC endpoint with a private REST API

To associate VPC endpoints at the time of API creation, use the following command:

```
aws apigateway create-rest-api \  
  --name Petstore \  
  --endpoint-configuration '{ "types": ["PRIVATE"], "vpcEndpointIds" :  
  ["vpce-0212a4ababd5b8c3e", "vpce-0393a628149c867ee"] }' \  
  --region us-west-2
```

The output will look like the following:

```
{  
  "apiKeySource": "HEADER",  
  "endpointConfiguration": {  
    "types": [  
      "PRIVATE"  
    ],  
    "vpcEndpointIds": [  
      "vpce-0212a4ababd5b8c3e",  
      "vpce-0393a628149c867ee"  
    ]  
  },  
  "id": "u67n3ov968",  
  "createdDate": 1565718256,  
  "name": "Petstore"  
}
```

To associate VPC endpoints to an already created private API, use the following CLI command:

```
aws apigateway update-rest-api \  
  --rest-api-id u67n3ov968 \  
  --patch-operations "op='add',path='/endpointConfiguration/  
vpcEndpointIds',value='vpce-01d622316a7df47f9'" \  
  --region us-west-2
```

The output will look like the following:

```
{  
  "name": "Petstore",  
  "apiKeySource": "1565718256",  
  "tags": {},  
  "createdDate": 1565718256,  
  "endpointConfiguration": {  
    "vpcEndpointIds": [  
      "vpce-0212a4ababd5b8c3e",  
      "vpce-0393a628149c867ee",  
      "vpce-01d622316a7df47f9"  
    ],  
    "types": [  
      "PRIVATE"  
    ]  
  },  
  "id": "u67n3ov968"  
}
```

## Use the Amazon CLI to disassociate VPC endpoint from a private REST API

To disassociate a VPC endpoint from a private API, use the following CLI command:

```
aws apigateway update-rest-api \  
  --rest-api-id u67n3ov968 \  
  --patch-operations "op='remove',path='/endpointConfiguration/  
vpcEndpointIds',value='vpce-0393a628149c867ee'" \  
  --region us-west-2
```

```
--region us-west-2
```

The output will look like the following:

```
{
  "name": "Petstore",
  "apiKeySource": "1565718256",
  "tags": {},
  "createdDate": 1565718256,
  "endpointConfiguration": {
    "vpceEndpointIds": [
      "vpce-0212a4ababd5b8c3e",
      "vpce-01d622316a7df47f9"
    ],
    "types": [
      "PRIVATE"
    ]
  },
  "id": "u67n3ov968"
}
```

## Monitoring REST APIs

In this section, you can learn how to monitor your API by using CloudWatch metrics, CloudWatch Logs, Kinesis Data Firehose, and Amazon X-Ray. By combining CloudWatch execution logs and CloudWatch metrics, you can log errors and execution traces, and monitor your API's performance. You might also want to log API calls to Kinesis Data Firehose. You can also use Amazon X-Ray to trace calls through the downstream services that make up your API.

### Note

API Gateway might not generate logs and metrics in the following cases:

- 413 Request Entity Too Large errors
- Excessive 429 Too Many Requests errors
- 400 series errors from requests sent to a custom domain that has no API mapping
- 500 series errors caused by internal failures

### Topics

- [Monitoring REST API execution with Amazon CloudWatch metrics \(p. 605\)](#)
- [Setting up CloudWatch logging for a REST API in API Gateway \(p. 611\)](#)
- [Logging API calls to Kinesis Data Firehose \(p. 614\)](#)
- [Tracing user requests to REST APIs using X-Ray \(p. 615\)](#)

## Monitoring REST API execution with Amazon CloudWatch metrics

You can monitor API execution by using CloudWatch, which collects and processes raw data from API Gateway into readable, near-real-time metrics. These statistics are recorded for a period of 15 months so you can access historical information and gain a better perspective on how your web application or service is performing. By default, API Gateway metric data is automatically sent to CloudWatch in one-minute periods. For more information, see [What Is Amazon CloudWatch?](#) in the *Amazon CloudWatch User Guide*.

The metrics reported by API Gateway provide information that you can analyze in different ways. The following list shows some common uses for the metrics that are suggestions to get you started:

- Monitor the **IntegrationLatency** metrics to measure the responsiveness of the backend.
- Monitor the **Latency** metrics to measure the overall responsiveness of your API calls.
- Monitor the **CacheHitCount** and **CacheMissCount** metrics to optimize cache capacities to achieve a desired performance.

#### Topics

- [Amazon API Gateway dimensions and metrics \(p. 606\)](#)
- [View CloudWatch metrics with the API dashboard in API Gateway \(p. 608\)](#)
- [View API Gateway metrics in the CloudWatch console \(p. 609\)](#)
- [View API Gateway log events in the CloudWatch console \(p. 609\)](#)
- [Monitoring tools in Amazon \(p. 610\)](#)

## Amazon API Gateway dimensions and metrics

The metrics and dimensions that API Gateway sends to Amazon CloudWatch are listed below. For more information, see [Monitoring REST API execution with Amazon CloudWatch metrics \(p. 605\)](#).

### API Gateway metrics

Amazon API Gateway sends metric data to CloudWatch every minute.

The `AWS/ApiGateway` namespace includes the following metrics.

Metric	Description
4XXError	<p>The number of client-side errors captured in a given period.</p> <p>The <code>Sum</code> statistic represents this metric, namely, the total count of the 4XXError errors in the given period. The <code>Average</code> statistic represents the 4XXError error rate, namely, the total count of the 4XXError errors divided by the total number of requests during the period. The denominator corresponds to the <code>Count</code> metric (below).</p> <p>Unit: Count</p>
5XXError	<p>The number of server-side errors captured in a given period.</p> <p>The <code>Sum</code> statistic represents this metric, namely, the total count of the 5XXError errors in the given period. The <code>Average</code> statistic represents the 5XXError error rate, namely, the total count of the 5XXError errors divided by the total number of requests during the period. The denominator corresponds to the <code>Count</code> metric (below).</p> <p>Unit: Count</p>

Metric	Description
CacheHitCount	<p>The number of requests served from the API cache in a given period.</p> <p>The <code>Sum</code> statistic represents this metric, namely, the total count of the cache hits in the given period. The <code>Average</code> statistic represents the cache hit rate, namely, the total count of the cache hits divided by the total number of requests during the period. The denominator corresponds to the <code>Count</code> metric (below).</p> <p>Unit: Count</p>
CacheMissCount	<p>The number of requests served from the backend in a given period, when API caching is enabled.</p> <p>The <code>Sum</code> statistic represents this metric, namely, the total count of the cache misses in the given period. The <code>Average</code> statistic represents the cache miss rate, namely, the total count of the cache misses divided by the total number of requests during the period. The denominator corresponds to the <code>Count</code> metric (below).</p> <p>Unit: Count</p>
Count	<p>The total number API requests in a given period.</p> <p>The <code>SampleCount</code> statistic represents this metric.</p> <p>Unit: Count</p>
IntegrationLatency	<p>The time between when API Gateway relays a request to the backend and when it receives a response from the backend.</p> <p>Unit: Millisecond</p>
Latency	<p>The time between when API Gateway receives a request from a client and when it returns a response to the client. The latency includes the integration latency and other API Gateway overhead.</p> <p>Unit: Millisecond</p>

## Dimensions for metrics

You can use the dimensions in the following table to filter API Gateway metrics.

**Note**

API Gateway removes non-ASCII characters from the `ApiName` dimension before sending metrics to CloudWatch. If the `ApiName` contains no ASCII characters, the API ID is used as the `ApiName`.

Dimension	Description
<code>ApiName</code>	Filters API Gateway metrics for the REST API with the specified API name.

Dimension	Description
ApiName, Method, Resource, Stage	<p>Filters API Gateway metrics for the API method with the specified API name, stage, resource, and method.</p> <p>API Gateway will not send these metrics unless you have explicitly enabled detailed CloudWatch metrics. You can do this in the console by selecting <b>Enable Detailed CloudWatch Metrics</b> under a stage <b>Logs/Tracing</b> tab. Alternatively, you can call the <a href="#">update-stage</a> Amazon CLI command to update the <code>metricsEnabled</code> property to <code>true</code>.</p> <p>Enabling these metrics will incur additional charges to your account. For pricing information, see <a href="#">Amazon CloudWatch Pricing</a>.</p>
ApiName, Stage	Filters API Gateway metrics for the API stage resource with the specified API name and stage.

## View CloudWatch metrics with the API dashboard in API Gateway

You can use the API dashboard in the API Gateway Console to display the CloudWatch metrics of your deployed API in API Gateway. These are shown as a summary of API activity over time.

### Topics

- [Prerequisites \(p. 608\)](#)
- [Examine API activities in the dashboard \(p. 608\)](#)

### Prerequisites

1. You must have an API created in API Gateway. Follow the instructions in [Creating a REST API in Amazon API Gateway \(p. 205\)](#).
2. You must have the API deployed at least once. Follow the instructions in [Deploying a REST API in Amazon API Gateway \(p. 436\)](#).
3. To get CloudWatch metrics for individual methods, you must have CloudWatch Logs enabled for those methods in a given stage as described in [Update stage settings \(p. 440\)](#). Your account will be charged for accessing method-level logs, but not for accessing API- or stage-level logs.

### Examine API activities in the dashboard

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose the name of the API.
3. Under the selected API, choose **Dashboard**.
4. To display a summary of API activity over time, for **Stage**, choose the desired stage.
5. Use **From** and **To** to enter the date range.
6. Refresh, if needed, and view individual metrics displayed in separate graphs titled **API Calls**, **Integration Latency**, **Latency**, **4xx Error** and **5xx Error**. The **CacheHitCount** and **CacheMissCount** graphs will be displayed only if API caching has been enabled.

**Tip**

To examine method-level CloudWatch metrics, make sure that you have enabled CloudWatch Logs on a method level. For more information about how to set up method-level logging, see [Update stage settings using the API Gateway console \(p. 440\)](#).

## View API Gateway metrics in the CloudWatch console

Metrics are grouped first by the service namespace, and then by the various dimension combinations within each namespace.

### To view API Gateway metrics using the CloudWatch console

1. Open the CloudWatch console at <https://console.amazonaws.cn/cloudwatch/>.
2. If necessary, change the region. From the navigation bar, select the region where your Amazon resources reside. For more information, see [Regions and Endpoints](#).
3. In the navigation pane, choose **Metrics**.
4. In the **All metrics** tab, choose **API Gateway**.
5. To view metrics by stage, choose the **By Stage** panel. And then select desired APIs and metric names.
6. To view metrics by specific API, choose the **By Api Name** panel. And then select desired APIs and metric names.

### To view metrics using the Amazon CLI

1. At a command prompt, use the following command to list metrics:

```
aws cloudwatch list-metrics --namespace "AWS/ApiGateway"
```

2. To view a specific statistics (for example, *Average*) over a period of time of a 5 minutes intervals, call the following command:

```
aws cloudwatch get-metric-statistics --namespace AWS/ApiGateway --metric-name Count  
--start-time 2011-10-03T23:00:00Z --end-time 2017-10-05T23:00:00Z --period 300 --  
statistics Average
```

## View API Gateway log events in the CloudWatch console

### To view logged API requests and responses using the CloudWatch console

1. Open the CloudWatch console at <https://console.amazonaws.cn/cloudwatch/>.
2. In the navigation pane, choose **Logs groups**.
3. Under the **Log Groups** table, choose a log group of the **API-Gateway-Execution-Logs\_{rest-api-id}/ {stage-name}** name.
4. Under the **Log Streams** table, choose a log stream. You can use the timestamp to help locate the log stream of your interest.
5. Choose **Text** to view raw text or choose **Row** to view the event row by row.

**Important**

CloudWatch lets you delete log groups or streams. Do not manually delete API Gateway API log groups or streams; let API Gateway manage these resources. Manually deleting log groups or



streams may cause API requests and responses not to be logged. If that happens, you can delete the entire log group for the API and redeploy the API. This is because API Gateway creates log groups or log streams for an API stage at the time when it is deployed.

## Monitoring tools in Amazon

Amazon provides various tools that you can use to monitor API Gateway. You can configure some of these tools to do the monitoring for you automatically, while other tools require manual intervention. We recommend that you automate monitoring tasks as much as possible.

### Automated monitoring tools in Amazon

You can use the following automated monitoring tools to watch API Gateway and report when something is wrong:

- **Amazon CloudWatch Alarms** – Watch a single metric over a time period that you specify, and perform one or more actions based on the value of the metric relative to a given threshold over a number of time periods. The action is a notification sent to an Amazon Simple Notification Service (Amazon SNS) topic or Amazon EC2 Auto Scaling policy. CloudWatch alarms do not invoke actions simply because they are in a particular state; the state must have changed and been maintained for a specified number of periods. For more information, see [Monitoring REST API execution with Amazon CloudWatch metrics \(p. 605\)](#).
- **Amazon CloudWatch Logs** – Monitor, store, and access your log files from Amazon CloudTrail or other sources. For more information, see [Monitoring Log Files](#) in the *Amazon CloudWatch User Guide*.
- **Amazon CloudWatch Events** – Match events and route them to one or more target functions or streams to make changes, capture state information, and take corrective action. For more information, see [What is Amazon CloudWatch Events](#) in the *Amazon CloudWatch User Guide*.
- **Amazon CloudTrail Log Monitoring** – Share log files between accounts, monitor CloudTrail log files in real time by sending them to CloudWatch Logs, write log processing applications in Java, and validate that your log files have not changed after delivery by CloudTrail. For more information, see [Working with CloudTrail Log Files](#) in the *Amazon CloudTrail User Guide*.

### Manual monitoring tools

Another important part of monitoring API Gateway involves manually monitoring those items that the CloudWatch alarms don't cover. The API Gateway, CloudWatch, and other Amazon console dashboards provide an at-a-glance view of the state of your Amazon environment. We recommend that you also check the log files on API execution.

- API Gateway dashboard shows the following statistics for a given API stage during a specified period of time:
  - **API Calls**
  - **Cache Hit**, only when API caching is enabled.
  - **Cache Miss**, only when API caching is enabled.
  - **Latency**
  - **Integration Latency**
  - **4XX Error**
  - **5XX Error**
- The CloudWatch home page shows:
  - Current alarms and status
  - Graphs of alarms and resources
  - Service health status

In addition, you can use CloudWatch to do the following:

- Create [customized dashboards](#) to monitor the services you care about
- Graph metric data to troubleshoot issues and discover trends
- Search and browse all your Amazon resource metrics
- Create and edit alarms to be notified of problems

## Creating CloudWatch alarms to monitor API Gateway

You can create a CloudWatch alarm that sends an Amazon SNS message when the alarm changes state. An alarm watches a single metric over a time period you specify, and performs one or more actions based on the value of the metric relative to a given threshold over a number of time periods. The action is a notification sent to an Amazon SNS topic or Auto Scaling policy. Alarms invoke actions for sustained state changes only. CloudWatch alarms do not invoke actions simply because they are in a particular state; the state must have changed and been maintained for a specified number of periods.

## Setting up CloudWatch logging for a REST API in API Gateway

To help debug issues related to request execution or client access to your API, you can enable Amazon CloudWatch Logs to log API calls. For more information about CloudWatch, see [the section called “CloudWatch metrics”](#) (p. 605).

## CloudWatch log formats for API Gateway

There are two types of API logging in CloudWatch: execution logging and access logging. In execution logging, API Gateway manages the CloudWatch Logs. The process includes creating log groups and log streams, and reporting to the log streams any caller's requests and responses.

The logged data includes errors or execution traces (such as request or response parameter values or payloads), data used by Lambda authorizers (formerly known as custom authorizers), whether API keys are required, whether usage plans are enabled, and so on.

When you deploy an API, API Gateway creates a log group and log streams under the log group. The log group is named following the `API-Gateway-Execution-Logs_{rest-api-id}/{stage_name}` format. Within each log group, the logs are further divided into log streams, which are ordered by **Last Event Time** as logged data is reported.

In access logging, you, as an API developer, want to log who has accessed your API and how the caller accessed the API. You can create your own log group or choose an existing log group that could be managed by API Gateway. To specify the access details, you select [\\$context](#) (p. 363) variables (expressed in a format of your choosing) and choose a log group as the destination. The access log format must include at least `$context.requestId`. As a best practice, include `$context.requestId` and `$context.extendedRequestId` in your log format. `$context.requestId` logs the value in the `x-amzn-RequestId` header. Clients can override the value in the `x-amzn-RequestId` header. API Gateway returns this request ID in the `x-amzn-RequestId` response header. `$context.extendedRequestId` is a unique ID that API Gateway generates. API Gateway returns this request ID in the `x-amz-apigw-id` response header. An API caller can't provide or override this request ID. For more information, see [the section called “\\$context Variables for data models, authorizers, mapping templates, and CloudWatch access logging”](#) (p. 363).

### Note

Only `$context` variables are supported (not `$input`, and so on).

Choose a log format that is also adopted by your analytic backend, such as [Common Log Format](#) (CLF), JSON, XML, or CSV. You can then feed the access logs to it directly to have your metrics computed and rendered. To define the log format, set the log group ARN on the `accessLogSettings/destinationArn` property on the `stage`. You can obtain a log group ARN in the CloudWatch console, provided that

the **ARN** column is selected for display. To define the access log format, set a chosen format on the [accessLogSetting/format](#) property on the [stage](#).

Examples of some commonly used access log formats are shown in the API Gateway console and are listed as follows.

- CLF ([Common Log Format](#)):

```
$context.identity.sourceIp $context.identity.caller \
$context.identity.user [$context.requestTime] \
"$context.httpMethod $context.resourcePath $context.protocol" \
$context.status $context.responseLength $context.requestId $context.extendedRequestId
```

The continuation characters (\) are meant as a visual aid. The log format must be a single line. You can add a newline character (\n) at the end of the log format to include a newline at the end of each log entry.

- JSON:

```
{ "requestId": "$context.requestId", \
  "extendedRequestId": "$context.extendedRequestId", \
  "ip": "$context.identity.sourceIp", \
  "caller": "$context.identity.caller", \
  "user": "$context.identity.user", \
  "requestTime": "$context.requestTime", \
  "httpMethod": "$context.httpMethod", \
  "resourcePath": "$context.resourcePath", \
  "status": "$context.status", \
  "protocol": "$context.protocol", \
  "responseLength": "$context.responseLength" \
}
```

The continuation characters (\) are meant as a visual aid. The log format must be a single line. You can add a newline character (\n) at the end of the log format to include a newline at the end of each log entry.

- XML:

```
<request id="$context.requestId"> \
  <extendedRequestId>$context.extendedRequestId</extendedRequestId> \
  <ip>$context.identity.sourceIp</ip> \
  <caller>$context.identity.caller</caller> \
  <user>$context.identity.user</user> \
  <requestTime>$context.requestTime</requestTime> \
  <httpMethod>$context.httpMethod</httpMethod> \
  <resourcePath>$context.resourcePath</resourcePath> \
  <status>$context.status</status> \
  <protocol>$context.protocol</protocol> \
  <responseLength>$context.responseLength</responseLength> \
</request>
```

The continuation characters (\) are meant as a visual aid. The log format must be a single line. You can add a newline character (\n) at the end of the log format to include a newline at the end of each log entry.

- CSV (comma-separated values):

```
$context.identity.sourceIp,$context.identity.caller,\
$context.identity.user,$context.requestTime,$context.httpMethod,\
$context.resourcePath,$context.protocol,$context.status,\
$context.responseLength,$context.requestId,$context.extendedRequestId
```

The continuation characters (\) are meant as a visual aid. The log format must be a single line. You can add a newline character (\n) at the end of the log format to include a newline at the end of each log entry.

## Permissions for CloudWatch logging

To enable CloudWatch Logs, you must grant API Gateway permission to read and write logs to CloudWatch for your account. The `AmazonAPIGatewayPushToCloudWatchLogs` managed policy (with an ARN of `arn:aws:iam::aws:policy/service-role/AmazonAPIGatewayPushToCloudWatchLogs`) has all the required permissions:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:DescribeLogGroups",
        "logs:DescribeLogStreams",
        "logs:PutLogEvents",
        "logs:GetLogEvents",
        "logs:FilterLogEvents"
      ],
      "Resource": "*"
    }
  ]
}
```

### Note

API Gateway calls Amazon Security Token Service in order to assume the IAM role, so make sure that Amazon STS is enabled for the Region. For more information, see [Managing Amazon STS in an Amazon Region](#).

To grant these permissions to your account, create an IAM role with `apigateway.amazonaws.com` as its trusted entity, attach the preceding policy to the IAM role, and set the IAM role ARN on the `cloudWatchRoleArn` property on your [Account](#). You must set the `cloudWatchRoleArn` property separately for each Amazon Region in which you want to enable CloudWatch Logs.

If you receive an error when setting the IAM role ARN, check your Amazon Security Token Service account settings to make sure that Amazon STS is enabled in the Region that you're using. For more information about enabling Amazon STS, see [Managing Amazon STS in an Amazon Region](#) in the *IAM User Guide*.

## Set up CloudWatch API logging using the API Gateway console

To set up CloudWatch API logging, you must have deployed the API to a stage. You must also have configured an appropriate [CloudWatch Logs role \(p. 613\)](#) ARN for your account.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. Choose a REST API.
3. Choose **Settings** from the primary navigation panel and enter an ARN of an IAM role with appropriate permissions in **CloudWatch log role ARN**. You need to do this once.
4. Do one of the following:
  - a. Choose an existing API and then choose a stage.

- b. Create an API and deploy it to a stage.
5. Choose **Logs/Tracing** in the **Stage Editor**.
6. To enable execution logging:
  - a. Choose **Enable CloudWatch Logs** under **CloudWatch Settings**.
  - b. Choose **Error** or **Info** from the dropdown menu.
  - c. If desired, choose **Log full requests/responses data** to log the full API requests and responses.

**Warning**

This can be useful to troubleshoot APIs, but can result in logging sensitive data. We recommend that you don't enable `Log full requests/responses data` for production APIs.

- d. If desired, choose **Enable Detailed CloudWatch Metrics**.

For more information about CloudWatch metrics, see [the section called "CloudWatch metrics" \(p. 605\)](#).

7. To enable access logging:
  - a. Choose **Enable Access Logging** under **Custom Access Logging**.
  - b. Enter the ARN of a log group in **Access Log Destination ARN**. The ARN format is `arn:aws:logs:{region}:{account-id}:log-group:log-group-name`.
  - c. Enter a log format in **Log Format**. You can choose **CLF**, **JSON**, **XML**, or **CSV** to use one of the provided examples as a guide.
8. Choose **Save Changes**.

**Note**

You can enable execution logging and access logging independent of each other.

API Gateway is now ready to log requests to your API. You don't need to redeploy the API when you update the stage settings, logs, or stage variables.

## Logging API calls to Kinesis Data Firehose

To help debug issues related to client access to your API, you can log API calls to Amazon Kinesis Data Firehose. For more information about Kinesis Data Firehose, see [What Is Amazon Kinesis Data Firehose?](#)

For access logging, you can only enable CloudWatch or Kinesis Data Firehose—you can't enable both. However, you can enable CloudWatch for execution logging and Kinesis Data Firehose for access logging.

**Topics**

- [Kinesis Data Firehose log formats for API Gateway \(p. 614\)](#)
- [Permissions for Kinesis Data Firehose logging \(p. 614\)](#)
- [Set up Kinesis Data Firehose access logging by using the API Gateway console \(p. 615\)](#)

## Kinesis Data Firehose log formats for API Gateway

Kinesis Data Firehose logging uses the same format as [CloudWatch logging](#).

## Permissions for Kinesis Data Firehose logging

When Kinesis Data Firehose access logging is enabled on a stage, API Gateway creates a service-linked role in your account if the role doesn't exist already. The role is named

`AWSServiceRoleForAPIGateway` and has the `APIGatewayServiceRolePolicy` managed policy attached to it. For more information about service-linked roles, see [Using Service-Linked Roles](#).

**Note**

The name of your Kinesis Data Firehose delivery stream must be `amazon-apigateway-{your-delivery-stream-name}`.

## Set up Kinesis Data Firehose access logging by using the API Gateway console

To set up API logging, you must have deployed the API to a stage. You must also have created a Kinesis Data Firehose delivery stream.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
  2. Do one of the following:
    - a. Choose an existing API and then choose a stage.
    - b. Create an API and deploy it to a stage.
  3. Choose **Logs/Tracing** in the **Stage Editor**.
  4. To enable access logging to a Kinesis Data Firehose delivery stream:
    - a. Choose **Enable Access Logging** under **Custom Access Logging**.
    - b. Enter the ARN of a Kinesis Data Firehose delivery stream in **Access Log Destination ARN**. The ARN format is `arn:aws:firehose:{region}:{account-id}:deliverystream/amazon-apigateway-{your-delivery-stream-name}`.
- Note**  
The name of your delivery stream must be `amazon-apigateway-{your-delivery-stream-name}`.
- c. Enter a log format in **Log Format**. You can choose **CLF**, **JSON**, **XML**, or **CSV** to use one of the provided examples as a guide.
5. Choose **Save Changes**.

API Gateway is now ready to log requests to your API to Kinesis Data Firehose. You don't need to redeploy the API when you update the stage settings, logs, or stage variables.

## Tracing user requests to REST APIs using X-Ray

You can use [Amazon X-Ray](#) to trace and analyze user requests as they travel through your Amazon API Gateway REST APIs to the underlying services. API Gateway supports X-Ray tracing for all API Gateway REST API endpoint types: Regional, edge-optimized, and private. You can use X-Ray with Amazon API Gateway in all Amazon Regions where X-Ray is available.

Because X-Ray gives you an end-to-end view of an entire request, you can analyze latencies in your APIs and their backend services. You can use an X-Ray service map to view the latency of an entire request and that of the downstream services that are integrated with X-Ray. You can also configure sampling rules to tell X-Ray which requests to record and at what sampling rates, according to criteria that you specify.

If you call an API Gateway API from a service that's already being traced, API Gateway passes the trace through, even if X-Ray tracing isn't enabled on the API.

You can enable X-Ray for an API stage by using the API Gateway console, or by using the API Gateway API or CLI.

### Topics

- [Setting up Amazon X-Ray with API Gateway REST APIs \(p. 616\)](#)
- [Using Amazon X-Ray service maps and trace views with API Gateway \(p. 618\)](#)
- [Configuring Amazon X-Ray sampling rules for API Gateway APIs \(p. 619\)](#)
- [Understanding Amazon X-Ray traces for Amazon API Gateway APIs \(p. 621\)](#)

## Setting up Amazon X-Ray with API Gateway REST APIs

In this section you can find detailed information on how to set up [Amazon X-Ray](#) with API Gateway REST APIs.

### Topics

- [X-Ray tracing modes for API Gateway \(p. 616\)](#)
- [Permissions for X-Ray tracing \(p. 616\)](#)
- [Enabling X-Ray tracing in the API Gateway console \(p. 616\)](#)
- [Enabling Amazon X-Ray tracing using the API Gateway CLI \(p. 617\)](#)

## X-Ray tracing modes for API Gateway

The path of a request through your application is tracked with a trace ID. A trace collects all of the segments generated by a single request, typically an HTTP `GET` or `POST` request.

There are two modes of tracing for an API Gateway API:

- **Passive:** This is the default setting if you have not enabled X-Ray tracing on an API stage. This approach means that the API Gateway API is only traced if X-Ray has been enabled on an upstream service.
- **Active:** When an API Gateway API stage has this setting, API Gateway automatically samples API invocation requests, based on the sampling algorithm specified by X-Ray.

When active tracing is enabled on a stage, API Gateway creates a service-linked role in your account, if the role does not exist already. The role is named `AWSServiceRoleForAPIGateway` and will have the `APIGatewayServiceRolePolicy` managed policy attached to it. For more information about service-linked roles, see [Using Service-Linked Roles](#).

### Note

X-Ray applies a sampling algorithm to ensure that tracing is efficient, while still providing a representative sample of the requests that your API receives. The default sampling algorithm is 1 request per second, with 5 percent of requests sampled past that limit.

You can change the tracing mode for your API by using the API Gateway management console, the API Gateway CLI, or an Amazon SDK.

## Permissions for X-Ray tracing

When you enable X-Ray tracing on a stage, API Gateway creates a service-linked role in your account, if the role does not exist already. The role is named `AWSServiceRoleForAPIGateway` and will have the `APIGatewayServiceRolePolicy` managed policy attached to it. For more information about service-linked roles, see [Using Service-Linked Roles](#).

## Enabling X-Ray tracing in the API Gateway console

You can use the Amazon API Gateway console to enable active tracing on an API stage.

These steps assume that you have already deployed the API to a stage.

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.
2. In the **APIs** pane, choose the API, and then choose **Stages**.
3. In the **Stages** pane, choose the name of the stage.
4. In the **Stage Editor** pane, choose the **Logs/Tracing** tab.
5. To enable active X-Ray tracing, choose **Enable X-Ray Tracing** under **X-Ray Tracing**.
6. If desired, choose **Set X-Ray Sampling Rules** and go to the X-Ray console to [configure sampling rules \(p. 619\)](#).

Once you've enabled X-Ray for your API stage, you can use the X-Ray management console to view the traces and service maps.

## Enabling Amazon X-Ray tracing using the API Gateway CLI

To use the Amazon CLI to enable active X-Ray tracing for an API stage when you create the stage, call the `create-stage` command as in the following example:

```
aws apigateway create-stage \  
  --rest-api-id {rest-api-id} \  
  --stage-name {stage-name} \  
  --deployment-id {deployment-id} \  
  --region {region} \  
  --tracing-enabled=true
```

Following is example output for a successful invocation:

```
{  
  "tracingEnabled": true,  
  "stageName": {stage-name},  
  "cacheClusterEnabled": false,  
  "cacheClusterStatus": "NOT_AVAILABLE",  
  "deploymentId": {deployment-id},  
  "lastUpdatedDate": 1533849811,  
  "createdDate": 1533849811,  
  "methodSettings": {}  
}
```

To use the Amazon CLI to disable active X-Ray tracing for an API stage when you create the stage, call the `create-stage` command as in the following example:

```
aws apigateway create-stage \  
  --rest-api-id {rest-api-id} \  
  --stage-name {stage-name} \  
  --deployment-id {deployment-id} \  
  --region {region} \  
  --tracing-enabled=false
```

Following is example output for a successful invocation:

```
{  
  "tracingEnabled": false,  
  "stageName": {stage-name},  
  "cacheClusterEnabled": false,  
  "cacheClusterStatus": "NOT_AVAILABLE",  
  "deploymentId": {deployment-id},  
  "lastUpdatedDate": 1533849811,  
  "createdDate": 1533849811,  
  "methodSettings": {}  
}
```



```
"methodSettings": {}  
}
```

To use the Amazon CLI to enable active X-Ray tracing for an API that's already been deployed, call the `update-stage` command as follows:

```
aws apigateway update-stage \  
  --rest-api-id {rest-api-id} \  
  --stage-name {stage-name} \  
  --patch-operations op=replace,path=/tracingEnabled,value=true
```

To use the Amazon CLI to disable active X-Ray tracing for an API that's already been deployed, call the `update-stage` command as in the following example:

```
aws apigateway update-stage \  
  --rest-api-id {rest-api-id} \  
  --stage-name {stage-name} \  
  --region {region} \  
  --patch-operations op=replace,path=/tracingEnabled,value=false
```

Following is example output for a successful invocation:

```
{  
  "tracingEnabled": false,  
  "stageName": {stage-name},  
  "cacheClusterEnabled": false,  
  "cacheClusterStatus": "NOT_AVAILABLE",  
  "deploymentId": {deployment-id},  
  "lastUpdatedDate": 1533850033,  
  "createdDate": 1533849811,  
  "methodSettings": {}  
}
```

Once you've enabled X-Ray for your API stage, use the X-Ray CLI to retrieve trace information. For more information, see [Using the Amazon X-Ray API with the Amazon CLI](#).

## Using Amazon X-Ray service maps and trace views with API Gateway

In this section you can find detailed information on how to use [Amazon X-Ray](#) service maps and trace views with API Gateway.

For detailed information about service maps and trace views, and how to interpret them, see [Amazon X-Ray Console](#).

### Topics

- [Example X-Ray service map \(p. 618\)](#)
- [Example X-Ray trace view \(p. 619\)](#)

### Example X-Ray service map

Amazon X-Ray service maps show information about your API and all of its downstream services. When X-Ray is enabled for an API stage in API Gateway, you'll see a node in the service map containing information about the overall time spent in the API Gateway service. You can get detailed information about the response status and a histogram of the API response time for the selected timeframe. For APIs

integrating with Amazon services such as Amazon Lambda and Amazon DynamoDB, you will see more nodes providing performance metrics related to those services. There will be a service map for each API stage.

The following example shows a service map for the `test` stage of an API called `xray`. This API has a Lambda integration with a Lambda authorizer function and a Lambda backend function. The nodes represent the API Gateway service, the Lambda service, and the two Lambda functions.

For a detailed explanation of service map structure, see [Viewing the Service Map](#).

From the service map, you can zoom in to see a trace view of your API stage. The trace will display in-depth information regarding your API, represented as segments and subsegments. For example, the trace for the service map shown above would include segments for the Lambda service and Lambda function. For more information, see [Lambda as an Amazon X-Ray Trace](#).

If you choose a node or edge on an X-Ray service map, the X-Ray console shows a latency distribution histogram. You can use a latency histogram to see how long it takes for a service to complete its requests. Following is a histogram of the API Gateway stage named `xray/test` in the previous service map. For a detailed explanation of latency distribution histograms, see [Using Latency Histograms in the Amazon X-Ray Console](#).

## Example X-Ray trace view

The following diagram shows a trace view generated for the example API described above, with a Lambda backend function and a Lambda authorizer function. A successful API method request is shown with a response code of 200.

For a detailed explanation of trace views, see [Viewing Traces](#).

## Configuring Amazon X-Ray sampling rules for API Gateway APIs

You can use Amazon X-Ray console or SDK to configure sampling rules for your Amazon API Gateway API. A sampling rule specifies which requests X-Ray should record for your API. By customizing sampling rules, you can control the amount of data that you record, and modify sampling behavior on the fly without modifying or redeploying your code.

Before you specify your X-Ray sampling rules, read the following topics in the X-Ray Developer Guide:

- [Configuring Sampling Rules in the Amazon X-Ray Console](#)
- [Using Sampling Rules with the X-Ray API](#)

### Topics

- [X-Ray sampling rule option values for API Gateway APIs \(p. 619\)](#)
- [X-Ray sampling rule examples \(p. 620\)](#)

## X-Ray sampling rule option values for API Gateway APIs

The following X-Ray sampling options are relevant for API Gateway. String values can use wildcards to match a single character (?) or zero or more characters (\*). For more details, including a detailed explanation of how the **Reservoir** and **Rate** settings are used, see [Configuring Sampling Rules in the Amazon X-Ray Console](#).

- **Rule name** (string) — A unique name for the rule.
- **Priority** (integer between 1 and 9999) — The priority of the sampling rule. Services evaluate rules in ascending order of priority, and make a sampling decision with the first rule that matches.

- **Reservoir** (nonnegative integer) — A fixed number of matching requests to instrument per second, before applying the fixed rate. The reservoir is not used directly by services, but applies to all services using the rule collectively.
- **Rate** (number between 0 and 100) — The percentage of matching requests to instrument, after the reservoir is exhausted.
- **Service name** (string) — API stage name, in the form `{api-name}/{stage-name}`. For example, if you were to deploy the [PetStore \(p. 43\)](#) sample API to a stage named `test`, the **Service name** value to specify in your sampling rule would be `pets/test`.
- **Service type** (string) — For an API Gateway API, either `AWS::ApiGateway::Stage` or `AWS::ApiGateway::*` can be specified.
- **Host** (string) — The hostname from the HTTP host header. Set this to `*` to match against all hostnames. Or you can specify a full or partial hostname to match, for example, `api.example.com` or `*.example.com`.
- **Resource ARN** (string) — The ARN of the API stage, for example, `arn:aws:apigateway:region::/restapis/api-id/stages/stage-name`.

The stage name can be obtained from the console or the API Gateway CLI or API. For more information about ARN formats, see the [Amazon Web Services General Reference](#).

- **HTTP method** (string) — The method to be sampled, for example, `GET`.
- **URL path** (string) — This option is not supported for API Gateway.
- (optional) **Attributes** (key and value) — Headers from the original HTTP request, for example, `Connection`, `Content-Length`, or `Content-Type`. Each attribute value can be up to 32 characters long.

## X-Ray sampling rule examples

### Sampling rule example #1

This rule samples all `GET` requests for the `testxray` API at the `test` stage.

- **Rule name** — `test-sampling`
- **Priority** — `17`
- **Reservoir size** — `10`
- **Fixed rate** — `10`
- **Service name** — `testxray/test`
- **Service type** — `AWS::ApiGateway::Stage`
- **HTTP method** — `GET`
- **Resource ARN** — `*`
- **Host** — `*`

### Sampling rule example #2

This rule samples all requests for the `testxray` API at the `prod` stage.

- **Rule name** — `prod-sampling`
- **Priority** — `478`
- **Reservoir size** — `1`
- **Fixed rate** — `60`
- **Service name** — `testxray/prod`
- **Service type** — `AWS::ApiGateway::Stage`
- **HTTP method** — `*`

- **Resource ARN** — \*
- **Host** — \*
- **Attributes** — { }

## Understanding Amazon X-Ray traces for Amazon API Gateway APIs

This section discusses Amazon X-Ray trace segments, subsegments, and other trace fields for Amazon API Gateway APIs.

Before you read this section, review the following topics in the X-Ray Developer Guide:

- [Amazon X-Ray Console](#)
- [Amazon X-Ray Segment Documents](#)
- [X-Ray Concepts](#)

### Topics

- [Examples of trace objects for an API Gateway API \(p. 621\)](#)
- [Understanding the trace \(p. 622\)](#)

## Examples of trace objects for an API Gateway API

This section discusses some of the objects you may see in a trace for an API Gateway API.

### Annotations

Annotations can appear in segments and subsegments. They are used as filtering expressions in sampling rules to filter traces. For more information, see [Configuring Sampling Rules in the Amazon X-Ray Console](#).

Following is an example of an `annotations` object, in which an API stage is identified by the API ID and the API stage name:

```
"annotations": {
  "aws:api_id": "a1b2c3d4e5",
  "aws:api_stage": "dev"
}
```

### Amazon resource data

The `aws` object appears only in segments. Following is an example of an `aws` object that matches the Default sampling rule. For an in-depth explanation of sampling rules, see [Configuring Sampling Rules in the Amazon X-Ray Console](#).

```
"aws": {
  "xray": {
    "sampling_rule_name": "Default"
  },
  "api_gateway": {
    "account_id": "123412341234",
    "rest_api_id": "a1b2c3d4e5",
    "stage": "dev",
    "request_id": "a1b2c3d4-a1b2-a1b2-a1b2-a1b2c3d4e5f6"
  }
}
```

```
}

```

## Understanding the trace

Following is a trace segment for an API Gateway stage. For a detailed explanation of the fields that make up the trace segment, see [Amazon X-Ray Segment Documents](#) in the Amazon X-Ray Developer Guide.

```

    {
      "Document": {
        "id": "a1b2c3d4a1b2c3d4",
        "name": "testxray/dev",
        "start_time": 1533928226.229,
        "end_time": 1533928226.614,
        "metadata": {
          "default": {
            "extended_request_id": "abcde12345abcde=",
            "request_id": "a1b2c3d4-a1b2-a1b2-a1b2-a1b2c3d4e5f6"
          }
        },
        "http": {
          "request": {
            "url": "https://example.com/dev?
username=demo&message=hellofromdemo/",
            "method": "GET",
            "client_ip": "192.0.2.0",
            "x_forwarded_for": true
          },
          "response": {
            "status": 200,
            "content_length": 0
          }
        },
        "aws": {
          "xray": {
            "sampling_rule_name": "Default"
          },
          "api_gateway": {
            "account_id": "123412341234",
            "rest_api_id": "a1b2c3d4e5",
            "stage": "dev",
            "request_id": "a1b2c3d4-a1b2-a1b2-a1b2-a1b2c3d4e5f6"
          }
        },
        "annotations": {
          "aws:api_id": "a1b2c3d4e5",
          "aws:api_stage": "dev"
        },
        "trace_id": "1-a1b2c3d4-a1b2c3d4a1b2c3d4a1b2c3d4",
        "origin": "AWS::ApiGateway::Stage",
        "resource_arn": "arn:aws:apigateway:us-east-1::/restapis/a1b2c3d4e5/stages/
dev",
        "subsegments": [
          {
            "id": "abcdefgh12345678",
            "name": "Lambda",
            "start_time": 1533928226.233,
            "end_time": 1533928226.6130002,
            "http": {
              "request": {
                "url": "https://example.com/2015-03-31/functions/
arn:aws:lambda:us-east-1:123412341234:function:xray123/invocations",
                "method": "GET"
              },
              "response": {

```

```
        "status": 200,  
        "content_length": 62  
    },  
    "aws": {  
        "function_name": "xray123",  
        "region": "us-east-1",  
        "operation": "Invoke",  
        "resource_names": [  
            "xray123"  
        ]  
    },  
    "namespace": "aws"  
  }  
],  
  "Id": "a1b2c3d4a1b2c3d4"  
}
```

# Working with WebSocket APIs

A WebSocket API in API Gateway is a collection of WebSocket routes that are integrated with backend HTTP endpoints, Lambda functions, or other Amazon services. You can use API Gateway features to help you with all aspects of the API lifecycle, from creation through monitoring your production APIs.

API Gateway WebSocket APIs are bidirectional. A client can send messages to a service, and services can independently send messages to clients. This bidirectional behavior enables richer client/service interactions because services can push data to clients without requiring clients to make an explicit request. WebSocket APIs are often used in real-time applications such as chat applications, collaboration platforms, multiplayer games, and financial trading platforms.

For an example app to get started with, see [simple-websockets-chat-app](#).

In this section, you can learn how to develop, publish, protect, and monitor your WebSocket APIs using API Gateway.

## Topics

- [About WebSocket APIs in API Gateway \(p. 624\)](#)
- [Developing a WebSocket API in API Gateway \(p. 633\)](#)
- [Publishing WebSocket APIs for customers to invoke \(p. 657\)](#)
- [Protecting your WebSocket API \(p. 664\)](#)
- [Monitoring WebSocket APIs \(p. 664\)](#)

## About WebSocket APIs in API Gateway

In API Gateway you can create a WebSocket API as a stateful frontend for an Amazon service (such as Lambda or DynamoDB) or for an HTTP endpoint. The WebSocket API invokes your backend based on the content of the messages it receives from client apps.

Unlike a REST API, which receives and responds to requests, a WebSocket API supports two-way communication between client apps and your backend. The backend can send callback messages to connected clients.

In your WebSocket API, incoming JSON messages are directed to backend integrations based on routes that you configure. (Non-JSON messages are directed to a `$default` route that you configure.)

A *route* includes a *route key*, which is the value that is expected once a *route selection expression* is evaluated. The `routeSelectionExpression` is an attribute defined at the API level. It specifies a JSON property that is expected to be present in the message payload. For more information about route selection expressions, see [the section called "" \(p. 635\)](#).

For example, if your JSON messages contain an `action` property, and you want to perform different actions based on this property, your route selection expression might be `${request.body.action}`. Your routing table would specify which action to perform by matching the value of the `action` property against the custom route key values that you have defined in the table.

There are three predefined routes that can be used: `$connect`, `$disconnect`, and `$default`. In addition, you can create custom routes.

- API Gateway calls the `$connect` route when a persistent connection between the client and a WebSocket API is being initiated.
- API Gateway calls the `$disconnect` route when the client or the server disconnects from the API.
- API Gateway calls a custom route after the route selection expression is evaluated against the message if a matching route is found; the match determines which integration is invoked.

- API Gateway calls the `$default` route if the route selection expression cannot be evaluated against the message or if no matching route is found.

For more information about the `$connect` and `$disconnect` routes, see [the section called “Managing connected users and client apps” \(p. 625\)](#).

For more information about the `$default` route and custom routes, see [the section called “Invoking your backend integration” \(p. 626\)](#).

Backend services can send data to connected client apps. For more information, see [the section called “Sending data from backend services to connected clients” \(p. 628\)](#).

## Managing connected users and client apps: `$connect` and `$disconnect` routes

### Topics

- [The `\$connect` route \(p. 625\)](#)
- [The `\$disconnect` route \(p. 625\)](#)

### The `$connect` route

Client apps connect to your WebSocket API by sending a WebSocket upgrade request. If the request succeeds, the `$connect` route is executed while the connection is being established.

Because the WebSocket connection is a stateful connection, you can configure authorization on the `$connect` route only. `AuthN/AuthZ` will be performed only at connection time.

Until execution of the integration associated with the `$connect` route is completed, the upgrade request is pending and the actual connection will not be established. If the `$connect` request fails (e.g., due to `AuthN/AuthZ` failure or an integration failure), the connection will not be made.

#### Note

If authorization fails on `$connect`, the connection will not be established, and the client will receive a 401 or 403 response.

Setting up an integration for `$connect` is optional. You should consider setting up a `$connect` integration if:

- You want to enable clients to specify subprotocols by using the `Sec-WebSocket-Protocol` field. For example code, see [Setting up a `\$connect` route that requires a WebSocket subprotocol \(p. 638\)](#).
- You want to be notified when clients connect and disconnect.
- You want to throttle connections or control who connects.
- You want your backend to send messages back to clients using a callback URL.
- You want to store each connection ID and other information into a database (for example, Amazon DynamoDB).

### The `$disconnect` route

The `$disconnect` route is executed after the connection is closed.

The connection can be closed by the server or by the client. As the connection is already closed when it is executed, `$disconnect` is a best-effort event. API Gateway will try its best to deliver the `$disconnect` event to your integration, but it cannot guarantee delivery.



The backend can initiate disconnection by using the `@connections` API. For more information, see [the section called "Use `@connections` commands in your backend service" \(p. 656\)](#).

## Invoking your backend integration: `$default` Route and custom routes

### Topics

- [Using routes to process messages \(p. 626\)](#)
- [The `\$default` route \(p. 627\)](#)
- [Custom routes \(p. 627\)](#)
- [Using API Gateway WebSocket API integrations to connect to your business logic \(p. 627\)](#)
- [Important differences between WebSocket APIs and REST APIs \(p. 627\)](#)

## Using routes to process messages

In API Gateway WebSocket APIs, messages can be sent from the client to your backend service and vice versa. Unlike HTTP's request/response model, in WebSocket the backend can send messages to the client without the client taking any action.

Messages can be JSON or non-JSON. However, only JSON messages can be routed to specific integrations based on message content. Non-JSON messages are passed through to the backend by the `$default` route.

### Note

API Gateway supports message payloads up to 128 KB with a maximum frame size of 32 KB. If a message exceeds 32 KB, you must split it into multiple frames, each 32 KB or smaller. If a larger message (or frame) is received, the connection is closed with code 1009.

Currently binary payloads are not supported. If a binary frame is received, the connection is closed with code 1003. However, it is possible to convert binary payloads to text. See [the section called "Binary media types" \(p. 655\)](#).

With WebSocket APIs in API Gateway, JSON messages can be routed to execute a specific backend service based on message content. When a client sends a message over its WebSocket connection, this results in a *route request* to the WebSocket API. The request will be matched to the route with the corresponding route key in API Gateway. You can set up a route request for a WebSocket API in the API Gateway console, by using the Amazon CLI, or by using an Amazon SDK.

### Note

In the Amazon CLI and Amazon SDKs, you can create routes before or after you create integrations. Currently the console does not support reuse of integrations, so you must create the route first and then create the integration for that route.

You can configure API Gateway to perform validation on a route request before proceeding with the integration request. If the validation fails, API Gateway fails the request without calling your backend, sends a "Bad request body" gateway response similar to the following to the client, and publishes the validation results in CloudWatch Logs:

```
{ "message" : "Bad request body", "connectionId": "{connectionId}", "messageId":  
  "{messageId}" }
```

This reduces unnecessary calls to your backend and lets you focus on the other requirements of your API.

You can also define a route response for your API's routes to enable two-way communication. A route response describes what data will be sent to your client upon completion of a particular route's integration. It is not necessary to define a response for a route if, for example, you want a client to send messages to your backend without receiving a response (one-way communication). However, if you don't

provide a route response, API Gateway won't send any information about the result of your integration to your clients.

## The `$default` route

Every API Gateway WebSocket API can have a `$default` route. This is a special routing value that can be used in the following ways:

- You can use it together with defined route keys, to specify a "fallback" route (for example, a generic mock integration that returns a particular error message) for incoming messages that don't match any of the defined route keys.
- You can use it without any defined route keys, to specify a proxy model that delegates routing to a backend component.
- You can use it to specify a route for non-JSON payloads.

## Custom routes

If you want to invoke a specific integration based on message content, you can do so by creating a custom route.

A custom route uses a route key and integration that you specify. When an incoming message contains a JSON property, and that property evaluates to a value that matches the route key value, API Gateway invokes the integration. (For more information, see [the section called "About WebSocket APIs" \(p. 624\)](#).)

For example, suppose you wanted to create a chat room application. You might start by creating a WebSocket API whose route selection expression is `$request.body.action`. You could then define two routes: `joinroom` and `sendmessage`. A client app might invoke the `joinroom` route by sending a message such as the following:

```
{"action":"joinroom","roomname":"developers"}
```

And it might invoke the `sendmessage` route by sending a message such as the following:

```
{"action":"sendmessage","message":"Hello everyone"}
```

## Using API Gateway WebSocket API integrations to connect to your business logic

After setting up a route for an API Gateway WebSocket API, you must specify the integration you'd like to use. As with a route, which can have a route request and a route response, an integration can have an *integration request* and an *integration response*. An *integration request* contains the information expected by your backend in order to process the request that came from your client. An *integration response* contains the data that your backend returns to API Gateway, and that may be used to construct a message to send to the client (if a route response is defined).

For more information about setting up integrations, see [the section called "Integrations" \(p. 643\)](#).

## Important differences between WebSocket APIs and REST APIs

Integrations for WebSocket APIs are similar to integrations for REST APIs, except for the following differences:

- Currently, in the API Gateway console you must create a route first and then create an integration as that route's target. However, in the API and CLI, you can create routes and integrations independently, in any order.

- You can use a single integration for multiple routes. For example, if you have a set of actions that closely relate to each other, you may want all of those routes to go to a single Lambda function. Rather than defining the details of the integration multiple times, you can specify it once and assign it to each of the related routes.

**Note**

Currently the console does not support reuse of integrations, so you must create the route first and then create the integration for that route.

In the Amazon CLI and Amazon SDKs, you can reuse an integration by setting the route's target to a value of `"integrations/{integration-id}"`, where `{integration-id}` is the unique ID of the integration to be associated with the route.

- API Gateway provides multiple [selection expressions \(p. 628\)](#) you can use in your routes and integrations. You don't need to rely on the content type to select an input template or output mapping. As with route selection expressions, you can define a selection expression to be evaluated by API Gateway to choose the right item. All of them will fall back to the `$default` template if a matching template is not found.
  - In integration requests, the template selection expression supports `$request.body.<json_path_expression>` and static values.
  - In integration responses, the template selection expression supports `$request.body.<json_path_expression>`, `$integration.response.statuscode`, and `$integration.response.header.<headerName>`.

In the HTTP protocol, in which requests and responses are sent synchronously, communication is essentially one-way. In the WebSocket protocol, communication is two-way. Responses are asynchronous and are not necessarily received by the client in the same order as the client's messages were sent. In addition, the backend can send messages to the client.

**Note**

For a route that is configured to use `AWS_PROXY` or `LAMBDA_PROXY` integration, communication is one-way, and API Gateway will not pass the backend response through to the route response automatically. For example, in the case of `LAMBDA_PROXY` integration, the body that the Lambda function returns will not be returned to the client. If you want the client to receive integration responses, you must define a route response to make two-way communication possible.

## Sending data from backend services to connected clients

API Gateway WebSocket APIs offer the following ways for you to send data from backend services to connected clients:

- An integration can send a response, which is returned to the client by a route response that you have defined.
- You can use the `@connections` API to send a POST request. For more information, see [the section called "Use @connections commands in your backend service" \(p. 656\)](#).

## WebSocket selection expressions in API Gateway

**Topics**

- [Route response selection expressions \(p. 629\)](#)
- [API key selection expressions \(p. 629\)](#)
- [API mapping selection expressions \(p. 629\)](#)
- [WebSocket selection expression summary \(p. 629\)](#)

API Gateway uses selection expressions as a way to evaluate request and response context and produce a key. The key is then used to select from a set of possible values, typically provided by you, the API developer. The exact set of supported variables will vary depending on the particular expression. Each expression is discussed in more detail below.

For all of the expressions, the language follows the same set of rules:

- A variable is prefixed with "\$".
- Curly braces can be used to explicitly define variable boundaries, e.g., "\${request.body.version}-beta".
- Multiple variables are supported, but evaluation occurs only once (no recursive evaluation).
- A dollar sign (\$) can be escaped with "\". This is most useful when defining an expression that maps to the reserved \$default key, e.g., "\\$default".
- In some cases, a pattern format is required. In this case, the expression should be wrapped with forward slashes ("/"), e.g. "/2\d\d/" to match 2XX status codes.

## Route response selection expressions

A [route response](#) (p. 637) is used for modeling a response from the backend to the client. For WebSocket APIs, a route response is optional. When defined, it signals to API Gateway that it should return a response to a client upon receiving a WebSocket message.

Evaluation of the *route response selection expression* produces a route response key. Eventually, this key will be used to choose from one of the [RouteResponses](#) associated with the API. However, currently only the \$default key is supported.

## API key selection expressions

This expression is evaluated when the service determines the given request should proceed only if the client provides a valid [API key](#) (p. 6).

Currently the only two supported values are \$request.header.x-api-key and \$context.authorizer.usageIdentifierKey.

## API mapping selection expressions

This expression is evaluated to determine which API stage is selected when a request is made using a custom domain.

Currently, the only supported value is \$request.basepath.

## WebSocket selection expression summary

The following table summarizes the use cases for selection expressions in WebSocket APIs:

Selection expression	Evaluates to key for	Notes	Example use case
Api.RouteSelectionExpression	\$defaultRouteResponseKey	\$default is supported as a catch-	Route WebSocket messages based on the context

Selection expression	Evaluates to key for	Notes	Example use case
		all route.	of a client request.
Route.ModelSelectionExpression	Key for RequestModels	Optional. If provided for non-proxy integration model validation occurs.  \$default is supported as a catch-all.	Perform request validation dynamically within the same route.
Integration.TemplateSelectionExpression	Key for RequestTemplates	Optional. May be provided for non-proxy integration to manipulate the incoming payloads.  \${request.body.jsonPath} and static values are supported.  \$default is supported as a catch-all.	Manipulate the caller's request based on dynamic properties of the request.

Selection expression	Evaluates to key for	Notes	Example use case
Integration.IntegrationResponseSelectionExpressions	IntegrationResponseSelectionExpressions	<p>Optional. May be provided for non-proxy integrations.</p> <p>Acts as a pattern match for error messages (from Lambda) or status codes (from HTTP integrations).</p> <p>\$default is required for non-proxy integrations to act as the catch-all for successful responses.</p>	<p>Manipulate the response from the backend.</p> <p>Choose the action to occur based on the dynamic response of the backend (e.g., handling certain errors distinctly).</p>

Selection expression	Evaluates to key for	Notes	Example use case
IntegrationResponse	Key for IntegrationResponseTemplates	Optional. May be provided for non-proxy integration. \$default is supported.	In some cases, a dynamic property of the response may dictate different transformations within the same route and associated integration.  <pre>       \${request.body.js}       \${integration.res       \${integration.res       \${integration.res       and       static       values       are       supported.        \$default       is       supported       as a       catch-       all.           </pre>

Selection expression	Evaluates to key for	Notes	Example use case
<code>Route.RouteResponseExpression</code>	<code>RouteResponseExpressionResponseKey</code>	Should be provided to initiate two-way communication for a WebSocket route.  Currently, this value is restricted to <code>\$default</code> only.	
<code>RouteResponse.ModelForRouteResponseRequestModels</code>	<code>KeyForRouteResponseRequestModels</code>	Currently unsupported.	

## Developing a WebSocket API in API Gateway

This section provides details about API Gateway capabilities that you need while you're developing your API Gateway APIs.

As you're developing your API Gateway API, you decide on a number of characteristics of your API. These characteristics depend on the use case of your API. For example, you might want to only allow certain clients to call your API, or you might want it to be available to everyone. You might want an API call to execute a Lambda function, make a database query, or call an application.

### Topics

- [Create a WebSocket API in API Gateway \(p. 633\)](#)
- [Working with routes for WebSocket APIs \(p. 634\)](#)
- [Controlling and managing access to a WebSocket API in API Gateway \(p. 639\)](#)
- [Setting up WebSocket API integrations \(p. 643\)](#)
- [Request validation \(p. 647\)](#)
- [Setting up data transformations for WebSocket APIs \(p. 647\)](#)
- [Working with binary media types for WebSocket APIs \(p. 655\)](#)
- [Invoking a WebSocket API \(p. 655\)](#)

## Create a WebSocket API in API Gateway

You can create a WebSocket API in the API Gateway console, by using the Amazon CLI `create-api` command, or by using the `CreateApi` command in an Amazon SDK. The following procedures show how to create a new WebSocket API.



**Note**

WebSocket APIs only support TLS 1.2. Earlier TLS versions are not supported.

## Create a WebSocket API using Amazon CLI commands

Creating a WebSocket API using the Amazon CLI requires calling the `create-api` command as shown in the following example, which creates an API with the `$request.body.action` route selection expression:

```
aws apigatewayv2 --region us-east-1 create-api --name "myWebSocketApi3" --protocol-type WEBSOCKET --route-selection-expression '$request.body.action'
```

Example output:

```
{
  "ApiKeySelectionExpression": "$request.header.x-api-key",
  "Name": "myWebSocketApi3",
  "CreateDate": "2018-11-15T06:23:51Z",
  "ProtocolType": "WEBSOCKET",
  "RouteSelectionExpression": "'$request.body.action'",
  "ApiId": "aabbccdde"
}
```

## Create a WebSocket API using the API Gateway console

You can create a WebSocket API in the console by choosing the WebSocket protocol and giving the API a name.

**Important**

Once you have created the API, you cannot change the protocol you have chosen for it. There is no way to convert a WebSocket API into a REST API or vice versa.

### To create a WebSocket API using the API Gateway console

1. Sign in to the API Gateway console and choose **Create API**.
2. Under **WebSocket API**, choose **Build**.
3. Under **Settings**, in the **API name** field, enter the name of your API, for example, **PetStore**.
4. Enter a **Route Selection Expression** for your API, for example, `$request.body.action`.

For more information about route selection expressions, see [the section called ""](#) (p. 635).

5. If desired, enter a **Description** for your API.
6. Choose **Create API**.

## Working with routes for WebSocket APIs

In your WebSocket API, incoming JSON messages are directed to backend integrations based on routes that you configure. (Non-JSON messages are directed to a `$default` route that you configure.)

A *route* includes a *route key*, which is the value that is expected once a *route selection expression* is evaluated. The `routeSelectionExpression` is an attribute defined at the API level. It specifies a JSON property that is expected to be present in the message payload. For more information about route selection expressions, see [the section called ""](#) (p. 635).

For example, if your JSON messages contain an `action` property and you want to perform different actions based on this property, your route selection expression might be `request.body.action`.

Your routing table would specify which action to perform by matching the value of the `action` property against the custom route key values that you have defined in the table.

There are three predefined routes that can be used: `$connect`, `$disconnect`, and `$default`. In addition, you can create custom routes.

- API Gateway calls the `$connect` route when a persistent connection between the client and a WebSocket API is being initiated.
- API Gateway calls the `$disconnect` route when the client or the server disconnects from the API.
- API Gateway calls a custom route after the route selection expression is evaluated against the message if a matching route is found; the match determines which integration is invoked.
- API Gateway calls the `$default` route if the route selection expression cannot be evaluated against the message or if no matching route is found.

## Route selection expressions

A *route selection expression* is evaluated when the service is selecting the route to follow for an incoming message. The service uses the route whose `routeKey` exactly matches the evaluated value. If none match and a route with the `$default` route key exists, that route is selected. If no routes match the evaluated value and there is no `$default` route, the service returns an error. For WebSocket-based APIs, the expression should be of the form `$request.body.{path_to_body_element}`.

For example, suppose you are sending the following JSON message:

```
{
  "service" : "chat",
  "action" : "join",
  "data" : {
    "room" : "room1234"
  }
}
```

You might want to select your API's behavior based on the `action` property. In that case, you might define the following route selection expression:

```
$request.body.action
```

In this example, `request.body` refers to your message's JSON payload, and `.action` is a [JSONPath](#) expression. You can use any JSON path expression after `request.body`, but keep in mind that the result will be stringified. For example, if your JSONPath expression returns an array of two elements, that will be presented as the string `"[item1, item2]"`. For this reason, it's a good practice to have your expression evaluate to a value and not an array or an object.

You can simply use a static value, or you can use multiple variables. The following table shows examples and their evaluated results against the preceding payload.

Expression	Evaluated result	Description
<code>\$request.body.action</code>	<code>join</code>	An unwrapped variable
<code>#{request.body.action}</code>	<code>join</code>	A wrapped variable

Expression	Evaluated result	Description
<code>\${request.body.service}/join</code> <code>\${request.body.action}</code>	<code>join</code>	Multiple variables with static values
<code>\${request.body.action}</code> <code>\${request.body.invalidPath}</code>	<code>join</code>	If the JSONPath is not found, the variable is resolved as "".
<code>action</code>	<code>action</code>	Static value
<code>\\$default</code>	<code>\$default</code>	Static value

The evaluated result is used to find a route. If there is a route with a matching route key, the route is selected to process the message. If no matching route is found, then API Gateway tries to find the `$default` route if available. If the `$default` route is not defined, then API Gateway returns an error.

## Set up routes for a WebSocket API in API Gateway

When you first create a new WebSocket API, there are three predefined routes: `$connect`, `$disconnect`, and `$default`. You can create them by using the console, API, or Amazon CLI. If desired, you can create custom routes. For more information, see [the section called "About WebSocket APIs" \(p. 624\)](#).

### Note

In the CLI, you can create routes before or after you create integrations, and you can reuse the same integration for multiple routes.

### Create a route using the API Gateway console

#### To create a route using the API Gateway console

1. Sign in to the API Gateway console, choose the API, and choose **Routes**.
2. To create one of the predefined routes (`$connect`, `$disconnect`, and `$default`), choose its name.
3. If desired, you can create custom routes. To do so, enter the route key name in the **New Route Key** text box and choose the checkmark icon.

### Note

When you create a custom route, do not use the `$` prefix in the route key name. This prefix is reserved for predefined routes.

### Create a route using the Amazon CLI

To create a route using the Amazon CLI, call `create-route` as shown in the following example:

```
aws apigatewayv2 --region us-east-1 create-route --api-id aabbccdde --route-key $default
```

Example output:

```
{
  "ApiKeyRequired": false,
  "AuthorizationType": "NONE",
  "RouteKey": "$default",
  "RouteId": "1122334"
}
```

### Specify route request settings for `$connect`

When you set up the `$connect` route for your API, the following optional settings are available to enable authorization for your API. For more information, see [the section called “The `\$connect` route” \(p. 625\)](#).

- **Authorization:** If no authorization is needed, you can specify `NONE`. Otherwise, you can specify:
  - `AWS_IAM` to use standard Amazon IAM policies to control access to your API.
  - `CUSTOM` to implement authorization for an API by specifying a Lambda authorizer function that you have previously created. The authorizer can reside in your own Amazon account or a different Amazon account. For more information about Lambda authorizers, see [Use API Gateway Lambda authorizers \(p. 256\)](#).

#### Note

In the API Gateway console, the `CUSTOM` setting is visible only after you have set up an authorizer function as described in [the section called “Configure a Lambda authorizer using the console” \(p. 262\)](#).

#### Important

The **Authorization** setting is applied to the entire API, not just the `$connect` route. The `$connect` route protects the other routes, because it is called on every connection.

- **API Key Required:** You can optionally require an API key for an API's `$connect` route. You can use API keys together with usage plans to control and track access to your APIs. For more information, see [the section called “Usage plans” \(p. 491\)](#).

### Set up the `$connect` route request using the API Gateway console

To set up the `$connect` route request for a WebSocket API using the API Gateway console:

1. Sign in to the API Gateway console, choose the API, and choose **Routes**.
2. Under **Routes**, choose `$connect`.
3. Choose **Route Request** in the route overview pane.
4. Under **Access Settings**, configure the route settings as follows:
  - a. To edit the **Authorization** setting, choose the pencil icon. Choose the desired setting from the dropdown menu and choose the checkmark icon to save the new setting.
  - b. To edit the **API Key Required** setting, choose the pencil icon. Choose `true` or `false` from the dropdown menu and choose the checkmark icon to save the new setting.

## Set up route responses for a WebSocket API in API Gateway

WebSocket routes can be configured for two-way or one-way communication. If a route has a route response, it is configured for two-way communication. Otherwise, it is configured for one-way communication. *Route responses* are used to enable two-way communication, in which your API can send a response back to the client in the context of the client's message.

You can configure route responses and response selection expressions by using the API Gateway console or the Amazon CLI or an Amazon SDK. For more information about route responses, see [the section called "Invoking your backend integration"](#) (p. 626).

For more information about route response selection expressions, see [the section called ""](#) (p. 629).

### Topics

- [Set up a route response using the API Gateway console](#) (p. 638)
- [Set up a route response using the Amazon CLI](#) (p. 638)

## Set up a route response using the API Gateway console

To set up a route response for a WebSocket API using the API Gateway console:

1. Sign in to the API Gateway console, choose the API.
2. Under **Routes**, choose the route.
3. Choose **Route Response** in the route overview pane.
4. Under **Response Modeling**, in the **Response Selection Expression** box, enter the desired response selection expression and choose the checkmark icon.
5. Under **Route Responses**, under **Response Key**, choose **Add Response**.

### Note

Currently only `$default` is supported in route responses for WebSocket APIs.

6. Enter the response key name and choose the checkmark icon.

## Set up a route response using the Amazon CLI

To set up a route response for a WebSocket API using the Amazon CLI, call the `create-route-response` command as shown in the following example. You can identify the API ID and route ID by calling `get-apis` and `get-routes`.

```
aws apigatewayv2 create-route-response \  
  --api-id aabbccdde \  
  --route-id 1122334 \  
  --route-response-key '$default'
```

Example output:

```
{  
  "RouteResponseId": "abcdef",  
  "RouteResponseKey": "$default"  
}
```

## Setting up a `$connect` route that requires a WebSocket subprotocol

Clients can use the `Sec-WebSocket-Protocol` field to request a [WebSocket subprotocol](#) during the connection to your WebSocket API. You can set up an integration for the `$connect` route to allow connections only if a client requests a subprotocol that your API supports.

The following example Lambda function returns the `Sec-WebSocket-Protocol` header to clients. The function establishes a connection to your API only if the client specifies the `myprotocol` subprotocol.

For an Amazon CloudFormation template that creates this example API and Lambda proxy integration, see [ws-subprotocol.yaml](#).

```
exports.handler = async (event) => {
  if (event.headers !== undefined) {
    const headers = toLowerCaseProperties(event.headers);

    if (headers['sec-websocket-protocol'] !== undefined) {
      const subprotocolHeader = headers['sec-websocket-protocol'];
      const subprotocols = subprotocolHeader.split(',');

      if (subprotocols.indexOf('myprotocol') >= 0) {
        const response = {
          statusCode: 200,
          headers: {
            "Sec-WebSocket-Protocol" : "myprotocol"
          }
        };
        return response;
      }
    }

    const response = {
      statusCode: 400
    };

    return response;
  };
};

function toLowerCaseProperties(obj) {
  var wrapper = {};
  for (var key in obj) {
    wrapper[key.toLowerCase()] = obj[key];
  }
  return wrapper;
}
```

You can use [wscat](#) to test that your API allows connections only if a client requests a subprotocol that your API supports. The following commands use the `-s` flag to specify subprotocols during the connection.

The following command attempts a connection with an unsupported subprotocol. Because the client specified the `chat1` subprotocol, the Lambda integration returns a 400 error, and the connection is unsuccessful.

```
wscat -c wss://api-id.execute-api.region.amazonaws.com/beta -s chat1
error: Unexpected server response: 400
```

The following command includes a supported subprotocol in the connection request. The Lambda integration allows the connection.

```
wscat -c wss://api-id.execute-api.region.amazonaws.com/beta -s chat1,myprotocol
connected (press CTRL+C to quit)
```

To learn more about invoking WebSocket APIs, see [Invoking a WebSocket API \(p. 655\)](#).

## Controlling and managing access to a WebSocket API in API Gateway

API Gateway supports multiple mechanisms for controlling and managing access to your WebSocket API.

You can use the following mechanisms for authentication and authorization:

- **Standard Amazon IAM roles and policies** offer flexible and robust access controls. You can use IAM roles and policies for controlling who can create and manage your APIs, as well as who can invoke them. For more information, see [Using IAM authorization \(p. 640\)](#).
- **IAM tags** can be used together with IAM policies to control access. For more information, see [Using tags to control access to API Gateway resources \(p. 739\)](#).
- **Lambda authorizers** are Lambda functions that control access to APIs. For more information, see [Creating a Lambda REQUEST authorizer function \(p. 641\)](#).

#### Topics

- [Using IAM authorization \(p. 640\)](#)
- [Creating a Lambda REQUEST authorizer function \(p. 641\)](#)

## Using IAM authorization

IAM authorization in WebSocket APIs is similar to that for [REST APIs \(p. 250\)](#), with the following exceptions:

- The `execute-api` action supports `ManageConnections` in addition to existing actions (`Invoke`, `InvalidateCache`). `ManageConnections` controls access to the `@connections` API.
- WebSocket routes use a different ARN format:

```
arn:aws:execute-api:region:account-id:api-id/stage-name/route-key
```

- The `@connections` API uses the same ARN format as REST APIs:

```
arn:aws:execute-api:region:account-id:api-id/stage-name/POST/@connections
```

For example, you could set up the following policy to the client. This example allows everyone to send a message (`Invoke`) for all routes except for a secret route in the `prod` stage and prevents everyone from sending a message back to connected clients (`ManageConnections`) for all stages.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "execute-api:Invoke"
      ],
      "Resource": [
        "arn:aws:execute-api:us-east-1:account-id:api-id/prod/*"
      ]
    },
    {
      "Effect": "Deny",
      "Action": [
        "execute-api:Invoke"
      ],
      "Resource": [
        "arn:aws:execute-api:us-east-1:account-id:api-id/prod/secret"
      ]
    },
    {
      "Effect": "Deny",

```

```

    "Action": [
      "execute-api:ManageConnections"
    ],
    "Resource": [
      "arn:aws:execute-api:us-east-1:account-id:api-id/*"
    ]
  }
]
}

```

## Creating a Lambda REQUEST authorizer function

A Lambda authorizer function in WebSocket APIs is similar to that for [REST APIs \(p. 258\)](#), with the following exceptions:

- You cannot use path variables (`event.pathParameters`), because the path is fixed.
- `event.methodArn` is different from its REST API equivalent, because it has no HTTP method. In the case of `$connect`, `methodArn` ends with `"$connect"`:

```
arn:aws:execute-api:region:account-id:api-id/stage-name/$connect
```

- The context variables in `event.requestContext` are different from those for REST APIs.

The following example Lambda authorizer function is a WebSocket version of the Lambda authorizer function for REST APIs in [the section called "Create a Lambda authorizer function in the Lambda console" \(p. 258\)](#):

```

exports.handler = function(event, context, callback) {
  console.log('Received event:', JSON.stringify(event, null, 2));

  // A simple REQUEST authorizer example to demonstrate how to use request
  // parameters to allow or deny a request. In this example, a request is
  // authorized if the client-supplied HeaderAuth1 header and QueryString1 query parameter
  // in the request context match the specified values of
  // of 'headerValue1' and 'queryValue1' respectively.

  // Retrieve request parameters from the Lambda function input:
  var headers = event.headers;
  var queryStringParameters = event.queryStringParameters;
  var stageVariables = event.stageVariables;
  var requestContext = event.requestContext;

  // Parse the input for the parameter values
  var tmp = event.methodArn.split(':');
  var apiGatewayArnTmp = tmp[5].split('/');
  var awsAccountId = tmp[4];
  var region = tmp[3];
  var ApiId = apiGatewayArnTmp[0];
  var stage = apiGatewayArnTmp[1];
  var route = apiGatewayArnTmp[2];

  // Perform authorization to return the Allow policy for correct parameters and
  // the 'Unauthorized' error, otherwise.
  var authResponse = {};
  var condition = {};
  condition.IpAddress = {};

  if (headers.HeaderAuth1 === "headerValue1"
    && queryStringParameters.QueryString1 === "queryValue1") {
    callback(null, generateAllow('me', event.methodArn));
  } else {

```



```

        callback("Unauthorized");
    }
}

// Helper function to generate an IAM policy
var generatePolicy = function(principalId, effect, resource) {
    // Required output:
    var authResponse = {};
    authResponse.principalId = principalId;
    if (effect && resource) {
        var policyDocument = {};
        policyDocument.Version = '2012-10-17'; // default version
        policyDocument.Statement = [];
        var statementOne = {};
        statementOne.Action = 'execute-api:Invoke'; // default action
        statementOne.Effect = effect;
        statementOne.Resource = resource;
        policyDocument.Statement[0] = statementOne;
        authResponse.policyDocument = policyDocument;
    }
    // Optional output with custom properties of the String, Number or Boolean type.
    authResponse.context = {
        "stringKey": "stringval",
        "numberKey": 123,
        "booleanKey": true
    };
    return authResponse;
}

var generateAllow = function(principalId, resource) {
    return generatePolicy(principalId, 'Allow', resource);
}

var generateDeny = function(principalId, resource) {
    return generatePolicy(principalId, 'Deny', resource);
}

```

To configure the preceding Lambda function as a `REQUEST` authorizer function for a WebSocket API, follow the same procedure as for [REST APIs \(p. 262\)](#).

To configure the `$connect` route to use this Lambda authorizer in the console, select or create the `$connect` route. Choose the route request and choose your authorizer in the **Authorization** dropdown menu.

To test the authorizer, you need to create a new connection. Changing authorizer in `$connect` doesn't affect the already connected client. When you connect to your WebSocket API, you need to provide values for any configured identity sources. For example, you can connect by sending a valid query string and header using `wscat` as in the following example:

```
wscat -c 'wss://myapi.execute-api.us-east-1.amazonaws.com/beta?QueryString=queryValue1' -H
HeaderAuth1:headerValue1
```

If you attempt to connect without a valid identity value, you'll receive a 401 response:

```
wscat -c wss://myapi.execute-api.us-east-1.amazonaws.com/beta
error: Unexpected server response: 401
```

## Setting up WebSocket API integrations

After setting up an API route, you must integrate it with an endpoint in the backend. A backend endpoint is also referred to as an integration endpoint and can be a Lambda function, an HTTP endpoint, or an Amazon service action. The API integration has an integration request and an integration response.

In this section, you can learn how to set up integration requests and integration responses for your WebSocket API.

### Topics

- [Setting up a WebSocket API integration request in API Gateway \(p. 643\)](#)
- [Setting up a WebSocket API integration responses in API Gateway \(p. 645\)](#)

## Setting up a WebSocket API integration request in API Gateway

Setting up an integration request involves the following:

- Choosing a route key to integrate to the backend.
- Specifying the backend endpoint to invoke, such as an Amazon service or HTTP endpoint.
- Configuring how to transform the route request data, if necessary, into integration request data by specifying one or more request templates.

### Set up a WebSocket API integration request using the API Gateway console

#### To add an integration request to a route in a WebSocket API using the API Gateway console

1. Sign in to the API Gateway console, choose the API, and choose **Routes**.
2. Under **Routes**, choose the route.
3. In the **Route Overview** pane, choose **Integration Request**.
4. For **Integration Type**, choose one of the following:
  - Choose **Lambda Function** only if your API will be integrated with an Amazon Lambda function that you have already created in this account or in another account.

To create a new Lambda function in Amazon Lambda, to set a resource permission on the Lambda function, or to perform any other Lambda service actions, choose **Amazon Service** instead.
  - Choose **HTTP** if your API will be integrated with an existing HTTP endpoint. For more information, see [Set up HTTP integrations in API Gateway \(p. 304\)](#).
  - Choose **Mock** if you want to generate API responses from API Gateway directly, without the need for an integration backend. For more information, see [Set up mock integrations in API Gateway \(p. 315\)](#).
  - Choose **Amazon Service** if your API will be integrated with an Amazon service.
  - Choose **VPC Link** if your API will use a `vpcLink` as a private integration endpoint. For more information, see [Set up API Gateway private integrations \(p. 308\)](#).
5. If you chose **Lambda Function**, do the following:
  - a. For **Lambda Region**, choose the Region identifier that corresponds to the Region where you created the Lambda function. For example, if you created the Lambda function in the US East (N. Virginia) Region, choose `us-east-1`. For a list of Region names and identifiers, see [Amazon Lambda](#) in the *Amazon Web Services General Reference*.
  - b. For **Use Lambda Proxy integration**, choose the check box if you intend to use [Lambda proxy integration \(p. 286\)](#) or [cross-account Lambda proxy integration \(p. 33\)](#).

- c. For **Lambda Function**, specify the function in one of the following ways:
  - If your Lambda function is in the same account, start typing the function name and then choose the function from the dropdown list.

**Note**

The function name can optionally include its alias or version specification, as in `HelloWorld`, `HelloWorld:1`, or `HelloWorld:alpha`.

- If the function is in a different account, enter the ARN for the function.
- d. Choose **Invoke with caller credentials** if you want API Gateway to invoke your Lambda function using credentials received in the incoming request.
  - e. For **Execution role**, enter the ARN of the Lambda invocation role that enables API Gateway to invoke your Lambda functions.
  - f. To use the default timeout value of 29 seconds, leave **Use Default Timeout** check box selected. To set a custom timeout, clear the check box, and enter a timeout value between 50 and 29000 milliseconds.
  - g. Choose **Save**.
6. If you chose **HTTP**, follow the instructions in step 4 of [the section called "Set up integration request using the console" \(p. 282\)](#).
  7. If you chose **Mock**, proceed to the **Request Templates** step.
  8. If you chose **Amazon Service**, follow the instructions in step 6 of [the section called "Set up integration request using the console" \(p. 282\)](#).
  9. If you chose **VPC Link**, do the following:
    - a. For **Use Proxy integration**, choose the check box if you want requests to be proxied to your VPCLink's endpoint.
    - b. From the **VPC Link** dropdown list, choose `[Use Stage Variables]` and enter `${stageVariables.vpcLinkId}` in the text box below the list.

We will define the `vpcLinkId` stage variable after deploying the API to a stage and set its value to the ID of the VpcLink.
    - c. For **HTTP method**, choose the HTTP method type that most closely matches the method in the HTTP backend.
    - d. For **Endpoint URL**, enter the URL of the HTTP backend you want this integration to use.
    - e. To use the default timeout value of 29 seconds, leave **Use Default Timeout** selection checked. To set a custom timeout, uncheck the box, and enter a timeout value between 50 and 29000 milliseconds.
  10. Under **Request Templates**, do the following:
    - For **Template Selection Expression**, choose the pencil icon and replace the word `template` with a template selection expression. This is an expression that API Gateway looks for in the message payload. If it is found, it is evaluated, and the result is a template key value that is used to select the data mapping template to be applied to the data in the message payload.

For information about template selection expressions, see [the section called "Template selection expressions" \(p. 648\)](#).

## Set up an integration request using the Amazon CLI

You can set up an integration request for a route in a WebSocket API by using the Amazon CLI as in the following example, which creates a mock integration:

1. Create a file named `integration-params.json`, with the following contents:

```
{ "PassthroughBehavior": "WHEN_NO_MATCH", "TimeoutInMillis": 29000, "ConnectionType":  
  "INTERNET", "RequestTemplates": {"application/json": {"statusCode": 200}},  
  "IntegrationType": "MOCK" }
```

2. Run the `create-integration` command as shown in the following example:

```
aws apigatewayv2 --region us-east-1 create-integration --api-id aabbccdde --cli-input-  
json file://integration-params.json
```

Following is sample output for this example:

```
{  
  "PassthroughBehavior": "WHEN_NO_MATCH",  
  "TimeoutInMillis": 29000,  
  "ConnectionType": "INTERNET",  
  "IntegrationResponseSelectionExpression": "${response.statuscode}",  
  "RequestTemplates": {  
    "application/json": {"statusCode": 200}  
  },  
  "IntegrationId": "0abcdef",  
  "IntegrationType": "MOCK"  
}
```

Alternatively, you can set up an integration request for a proxy integration by using the Amazon CLI as in the following example:

1. Create a Lambda function in the Lambda console and give it a basic Lambda execution role.
2. Execute the `create-integration` command as in the following example:

```
aws apigatewayv2 create-integration --api-id aabbccdde --integration-type  
AWS_PROXY --integration-method POST --integration-uri arn:aws:apigateway:us-  
east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-  
east-1:123412341234:function:simpleproxy-echo-e2e/invocations
```

Following is sample output for this example:

```
{  
  "PassthroughBehavior": "WHEN_NO_MATCH",  
  "IntegrationMethod": "POST",  
  "TimeoutInMillis": 29000,  
  "ConnectionType": "INTERNET",  
  "IntegrationUri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/  
arn:aws:lambda:us-east-1:123412341234:function:simpleproxy-echo-e2e/invocations",  
  "IntegrationId": "abcdefg",  
  "IntegrationType": "AWS_PROXY"  
}
```

## Setting up a WebSocket API integration responses in API Gateway

### Topics

- [Overview of integration responses \(p. 646\)](#)
- [Set up an integration response using the API Gateway console \(p. 646\)](#)
- [Set up an integration response using the Amazon CLI \(p. 647\)](#)

## Overview of integration responses

API Gateway's integration response is a way of modeling and manipulating the response from a backend service. There are some differences in setup of a REST API versus a WebSocket API integration response, but conceptually the behavior is the same.

WebSocket routes can be configured for two-way or one-way communication. If a route has a route response, it is configured for two-way communication. Otherwise, it is configured for one-way communication.

- When a route is configured for two-way communication, an integration response allows you to configure transformations on the returned message payload, similar to integration responses for REST APIs.
- If a route is configured for one-way communication, then regardless of any integration response configuration, no response will be returned over the WebSocket channel after the message is processed.

The remainder of this document assumes you have chosen to configure a route with two-way communication.

Integrations can be divided into *proxy* integrations and *non-proxy* integrations.

### **Important**

For *proxy integrations*, API Gateway automatically passes the backend output to the caller as the complete payload. There is no integration response.

For *non-proxy integrations*, you must set up at least one integration response:

- Ideally, one of your integration responses should act as a catch-all when no explicit choice can be made. This default case is represented by setting an integration response key of `$default`.
- In all other cases, the integration response key functions as a regular expression. It should follow a format of `"/expression/"`.

For non-proxy HTTP integrations:

- API Gateway will attempt to match the HTTP status code of the backend response. The integration response key will function as a regular expression in this case. If a match cannot be found, then `$default` is chosen as the integration response.
- The template selection expression, as described above, functions identically. For example:
  - `/2\d\d/`: Receive and transform successful responses
  - `/4\d\d/`: Receive and transform bad request errors
  - `$default`: Receive and transform all unexpected responses

For current limitations of template selection expressions, see [the section called "Template selection expressions" \(p. 648\)](#).

## Set up an integration response using the API Gateway console

To set up a route integration response for a WebSocket API using the API Gateway console:

1. Sign in to the API Gateway console, choose the API, and choose **Routes**.
2. Choose the route.
3. Choose **Integration Response**.
4. Under **Integration Responses**, enter a value in the **Response Selection Expression** text box.
5. Under **Response Key**, choose **Add Response**.

- a. To define an integration response key, enter a key name in the **New Response Key** text box and choose the checkmark icon.
- b. Choose the pencil icon next to **Template Selection Expression** and enter an expression for API Gateway to look for in your outgoing message. This expression should evaluate to an integration response key value that maps to one of your response templates.

For information about template selection expressions, see [the section called “Template selection expressions” \(p. 648\)](#).

## Set up an integration response using the Amazon CLI

To set up an integration response for a WebSocket API using the Amazon CLI call the `create-integration-response` command. The following CLI command shows an example of creating a `$default` integration response:

```
aws apigatewayv2 create-integration-response \  
  --api-id vaz7da96z6 \  
  --integration-id a1b2c3 \  
  --integration-response-key '$default'
```

## Request validation

You can configure API Gateway to perform validation on a route request before proceeding with the integration request. If the validation fails, API Gateway fails the request without calling your backend, sends a "Bad request body" gateway response to the client, and publishes the validation results in CloudWatch Logs. Using validation this way reduces unnecessary calls to your API backend.

## Model selection expressions

You can use a model selection expression to dynamically validate requests within the same route. Model validation occurs if you provide a model selection expression for either proxy or non-proxy integrations. You might need to define the `$default` model as a fallback when no matching model is found. If there is no matching model and `$default` isn't defined, the validation fails. The selection expression looks like `Route.ModelSelectionExpression` and evaluates to the key for `Route.RequestModels`.

When you define a [route \(p. 637\)](#) for a WebSocket API, you can optionally specify a *model selection expression*. This expression is evaluated to select the model to be used for body validation when a request is received. The expression evaluates to one of the entries in a route's [requestmodels](#).

A model is expressed as a [JSON schema](#) and describes the data structure of the request body. The nature of this selection expression enables you to dynamically choose the model to validate against at runtime for a particular route. For information about how to create a model, see [the section called “Working with models and mapping templates” \(p. 330\)](#).

## Setting up data transformations for WebSocket APIs

In API Gateway, a WebSocket API's method request can take a payload in a different format from the corresponding integration request payload, as required in the backend. Similarly, the backend may return an integration response payload different from the method response payload, as expected by the frontend.

API Gateway lets you use mapping templates to map the payload from a method request to the corresponding integration request and from an integration response to the corresponding method response. You specify a template selection expression to determine which template to use to perform the necessary data transformations.

You can use data mappings to map data from a [route request](#) (p. 8) to a backend integration. To learn more, see [the section called "Data mapping"](#) (p. 648).

## Mapping templates and models

A *mapping template* is a script expressed in [Velocity Template Language \(VTL\)](#) and applied to the payload using [JSONPath expressions](#). For more information about API Gateway mapping templates, see [Mapping templates](#) (p. 334).

The payload can have a *data model* according to the [JSON schema draft 4](#). You do not have to define a model to create a mapping template. However, a model can help you create a template because API Gateway generates a template blueprint based on a provided model. For more information about API Gateway models, see [Models](#) (p. 331).

## Template selection expressions

To transform a payload with a mapping template, you specify a WebSocket API template selection expression in an [integration request](#) (p. 643) or [integration response](#) (p. 645). This expression is evaluated to determine the input or output template (if any) to use to transform either the request body into the integration request body (via an input template) or the integration response body to the route response body (via an output template).

`Integration.TemplateSelectionExpression` supports `${request.body.jsonPath}` and static values.

`IntegrationResponse.TemplateSelectionExpression` supports `${request.body.jsonPath}`, `${integration.response.statuscode}`, `${integration.response.header.headerName}`, `${integration.response.multivalueheader.headerName}`, and static values.

## Integration response selection expressions

When you [set up an integration response](#) (p. 645) for a WebSocket API, you can optionally specify an integration response selection expression. This expression determines what [IntegrationResponse](#) should be selected when an integration returns. The value of this expression is currently restricted by API Gateway, as defined below. Realize that this expression is only relevant for *non-proxy integrations*; a proxy integration simply passes the response payload back to the caller without modeling or modification.

Unlike the other preceding selection expressions, this expression currently supports a *pattern-matching* format. The expression should be wrapped with forward slashes.

Currently the value is fixed depending on the `integrationType`:

- For Lambda-based integrations, it is `$integration.response.body.errorMessage`.
- For HTTP and MOCK integrations, it is `$integration.response.statuscode`.
- For HTTP\_PROXY and AWS\_PROXY, the expression isn't utilized because you're requesting that the payload pass through to the caller.

## Setting up data mapping for WebSocket APIs

*Data mapping* enables you to map data from a [route request](#) (p. 8) to a backend integration.

### Note

Data mapping for WebSocket APIs isn't supported in the Amazon Web Services Management Console. You must use the Amazon CLI, Amazon CloudFormation, or an SDK to configure data mapping.

### Topics

- [Map route request data to integration request parameters \(p. 649\)](#)
- [Examples \(p. 649\)](#)

## Map route request data to integration request parameters

Integration request parameters can be mapped from any defined route request parameters, the request body, [context or \(p. 363\) stage \(p. 374\) variables](#), and static values.

In the following table, *PARAM\_NAME* is the name of a route request parameter of the given parameter type. It must match the regular expression `^[a-zA-Z0-9._$-]+$`. *JSONPath\_EXPRESSION* is a JSONPath expression for a JSON field of the request body.

### Integration request data mapping expressions

Mapped data source	Mapping expression
Request query string (supported only for the \$connect route)	<code>route.request.querystring.PARAM_NAME</code>
Request header (supported only for the \$connect route)	<code>route.request.header.PARAM_NAME</code>
Multi-value request query string (supported only for the \$connect route)	<code>route.request.multivaluequerystring.PARAM_NAME</code>
Multi-value request header (supported only for the \$connect route)	<code>route.request.multivalueheader.PARAM_NAME</code>
Request body	<code>route.request.body.JSONPath_EXPRESSION</code>
Stage variables	<code>stageVariables.VARIABLE_NAME</code>
Context variables	<code>context.VARIABLE_NAME</code> that must be one of the <a href="#">supported context variables (p. 363)</a> .
Static value	<code>'STATIC_VALUE'</code> . The <i>STATIC_VALUE</i> is a string literal and must be enclosed in single quotes.

## Examples

The following Amazon CLI examples configure data mappings. For an example Amazon CloudFormation template, see [websocket-data-mapping.yaml](#).

### Map a client's connectionId to a header in an integration request

The following example command maps a client's `connectionId` to a `connectionId` header in the request to a backend integration.

```
aws apigatewayv2 update-integration \
  --integration-id abc123 \
  --api-id a1b2c3d4 \
  --request-parameters 'integration.request.header.connectionId='context.connectionId'
```

### Map a query string parameter to a header in an integration request

The following example commands map an `authToken` query string parameter to an `authToken` header in the integration request.

First, add the `authToken` query string parameter to the route's request parameters.



```
aws apigatewayv2 update-route --route-id 0abcdef \
  --api-id a1b2c3d4 \
  --request-parameters '{"route.request.querystring.authToken": {"Required": false}}'
```

Next, map the query string parameter to the authToken header in the request to the backend integration.

```
aws apigatewayv2 update-integration \
  --integration-id abc123 \
  --api-id a1b2c3d4 \
  --request-parameters
  'integration.request.header.authToken='route.request.querystring.authToken'
```

## API Gateway WebSocket API mapping template reference

This section summarizes the set of variables that are currently supported for WebSocket APIs in API Gateway.

Parameter	Description
<code>\$context.connectionId</code>	A unique ID for the connection that can be used to make a callback to the client.
<code>\$context.connectedAt</code>	The <a href="#">Epoch</a> -formatted connection time.
<code>\$context.domainName</code>	A domain name for the WebSocket API. This can be used to make a callback to the client (instead of a hard-coded value).
<code>\$context.eventType</code>	The event type: <code>CONNECT</code> , <code>MESSAGE</code> , or <code>DISCONNECT</code> .
<code>\$context.messageId</code>	A unique server-side ID for a message. Available only when the <code>\$context.eventType</code> is <code>MESSAGE</code> .
<code>\$context.routeKey</code>	The selected route key.
<code>\$context.requestId</code>	Same as <code>\$context.extendedRequestId</code> .
<code>\$context.extendedRequestId</code>	An automatically generated ID for the API call, which contains more useful information for debugging/troubleshooting.
<code>\$context.apiId</code>	The identifier API Gateway assigns to your API.
<code>\$context.authorizer.principalId</code>	The principal user identification associated with the token sent by the client and returned from an API Gateway Lambda authorizer (formerly known as a custom authorizer) Lambda function.
<code>\$context.authorizer.<i>property</i></code>	The stringified value of the specified key-value pair of the <code>context</code> map returned from an API Gateway Lambda authorizer function. For example, if the authorizer returns the following context map: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <pre>"context" : {</pre> </div>

Parameter	Description
	<pre>"key": "value", "numKey": 1, "boolKey": true }</pre> <p>calling <code>\$context.authorizer.key</code> returns the "value" string, calling <code>\$context.authorizer.numKey</code> returns the "1" string, and calling <code>\$context.authorizer.boolKey</code> returns the "true" string.</p>
<code>\$context.error.messageString</code>	The quoted value of <code>\$context.error.message</code> , namely " <code>\$context.error.message</code> ".
<code>\$context.error.validationErrorString</code>	A string containing a detailed validation error message.
<code>\$context.identity.accountId</code>	The Amazon account ID associated with the request.
<code>\$context.identity.apiKey</code>	The API owner key associated with key-enabled API request.
<code>\$context.identity.apiKeyId</code>	The API key ID associated with the key-enabled API request
<code>\$context.identity.caller</code>	The principal identifier of the caller making the request.
<code>\$context.identity.cognitoAuthenticationProvider</code>	<p>A comma-separated list of the Amazon Cognito authentication providers used by the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p> <p>For example, for an identity from an Amazon Cognito user pool, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i></code>, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i>:CognitoSignIn:<i>token</i></code> <i>subject claim</i></p> <p>For information, see <a href="#">Using Federated Identities</a> in the <i>Amazon Cognito Developer Guide</i>.</p>
<code>\$context.identity.cognitoAuthenticationType</code>	The Amazon Cognito authentication type of the caller making the request. Available only if the request was signed with Amazon Cognito credentials. Possible values include <code>authenticated</code> for authenticated identities and <code>unauthenticated</code> for unauthenticated identities.
<code>\$context.identity.cognitoIdentityId</code>	The Amazon Cognito identity ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.

Parameter	Description
<code>\$context.identity.cognitoIdentityPoolId</code>	The Amazon Cognito identity pool ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.
<code>\$context.identity.sourceIp</code>	The source IP address of the immediate TCP connection making the request to API Gateway endpoint.
<code>\$context.identity.user</code>	The principal identifier of the user making the request.
<code>\$context.identity.userAgent</code>	The User Agent of the API caller.
<code>\$context.identity.userArn</code>	The Amazon Resource Name (ARN) of the effective user identified after authentication.
<code>\$context.requestTime</code>	The <a href="#">CLF</a> -formatted request time (dd/MMM/yyyy:HH:mm:ss +-hhmm).
<code>\$context.requestTimeEpoch</code>	The <a href="#">Epoch</a> -formatted request time, in milliseconds.
<code>\$context.stage</code>	The deployment stage of the API call (for example, Beta or Prod).
<code>\$context.status</code>	The response status.
<code>\$input.body</code>	Returns the raw payload as a string.
<code>\$input.json(x)</code>	<p>This function evaluates a JSONPath expression and returns the results as a JSON string.</p> <p>For example, <code>\$input.json('\$.pets')</code> will return a JSON string representing the pets structure.</p> <p>For more information about JSONPath, see <a href="#">JSONPath</a> or <a href="#">JSONPath for Java</a>.</p>

Parameter	Description
<code>\$input.path(x)</code>	<p>Takes a JSONPath expression string (x) and returns a JSON object representation of the result. This allows you to access and manipulate elements of the payload natively in <a href="#">Apache Velocity Template Language (VTL)</a>.</p> <p>For example, if the expression <code>\$input.path('\$.pets')</code> returns an object like this:</p> <pre>[   {     "id": 1,     "type": "dog",     "price": 249.99   },   {     "id": 2,     "type": "cat",     "price": 124.99   },   {     "id": 3,     "type": "fish",     "price": 0.99   } ]</pre> <p><code>\$input.path('\$.pets').count()</code> would return "3".</p> <p>For more information about JSONPath, see <a href="#">JSONPath</a> or <a href="#">JSONPath for Java</a>.</p>
<code>\$stageVariables.&lt;variable_name&gt;</code>	<code>&lt;variable_name&gt;</code> represents a stage variable name.
<code>\$stageVariables['&lt;variable_name&gt;']</code>	<code>&lt;variable_name&gt;</code> represents any stage variable name.
<code>\${stageVariables['&lt;variable_name&gt;']}</code>	<code>&lt;variable_name&gt;</code> represents any stage variable name.

Parameter	Description
<code>\$util.escapeJavaScript()</code>	<p>Escapes the characters in a string using JavaScript string rules.</p> <p><b>Note</b> This function will turn any regular single quotes (') into escaped ones (\'). However, the escaped single quotes are not valid in JSON. Thus, when the output from this function is used in a JSON property, you must turn any escaped single quotes (\') back to regular single quotes ('). This is shown in the following example:</p> <pre>\$util.escapeJavaScript(data).replaceAll("\',"'")</pre>
<code>\$util.parseJson()</code>	<p>Takes "stringified" JSON and returns an object representation of the result. You can use the result from this function to access and manipulate elements of the payload natively in Apache Velocity Template Language (VTL). For example, if you have the following payload:</p> <pre>{"errorMessage": {"key1": "var1", "key2": {"arr": [1, 2, 3]}}</pre> <p>and use the following mapping template</p> <pre>#set (\$errorMessageObj = \$util.parseJson(\$input.path("\$.errorMessage"))) {   "errorMessageObjKey2ArrVal" :   \$errorMessageObj.key2.arr[0] }</pre> <p>You will get the following output:</p> <pre>{   "errorMessageObjKey2ArrVal" : 1 }</pre>
<code>\$util.urlEncode()</code>	Converts a string into "application/x-www-form-urlencoded" format.
<code>\$util.urlDecode()</code>	Decodes an "application/x-www-form-urlencoded" string.
<code>\$util.base64Encode()</code>	Encodes the data into a base64-encoded string.
<code>\$util.base64Decode()</code>	Decodes the data from a base64-encoded string.

## Working with binary media types for WebSocket APIs

API Gateway WebSocket APIs don't currently support binary frames in incoming message payloads. If a client app sends a binary frame, API Gateway rejects it and disconnects the client with code 1003.

There is a workaround for this behavior. If the client sends a text-encoded binary data (e.g., base64) as a text frame, you can set the integration's `contentHandlingStrategy` property to `CONVERT_TO_BINARY` to convert the payload from base64-encoded string to binary.

To return a route response for a binary payload in non-proxy integrations, you can set the integration response's `contentHandlingStrategy` property to `CONVERT_TO_TEXT` to convert the payload from binary to base64-encoded string.

## Invoking a WebSocket API

After you've deployed your WebSocket API, client applications can connect to it and send messages to it—and your backend service can send messages to connected client applications:

- You can use `wscat` to connect to your WebSocket API and send messages to it to simulate client behavior. See [the section called “Use `wscat` to connect to a WebSocket API and send messages to it” \(p. 655\)](#).
- You can use the `@connections` API from your backend service to send a callback message to a connected client, get connection information, or disconnect the client. See [the section called “Use `@connections` commands in your backend service” \(p. 656\)](#).
- A client application can use its own WebSocket library to invoke your WebSocket API.

## Use `wscat` to connect to a WebSocket API and send messages to it

The `wscat` utility is a convenient tool for testing a WebSocket API that you have created and deployed in API Gateway. You can install and use `wscat` as follows:

1. Download `wscat` from <https://www.npmjs.com/package/wscat>.
2. Install `wscat` by running the following command:

```
npm install -g wscat
```

3. To connect to your API, run the `wscat` command as shown in the following example. Note that this example assumes that the `Authorization` setting is `NONE`.

```
wscat -c wss://aabbccdde.execute-api.us-east-1.amazonaws.com/test/
```

You need to replace *aabbccdde* with the actual API ID, which is displayed in the API Gateway console or returned by the Amazon CLI `create-api` command.

In addition, if your API is in a Region other than `us-east-1`, you need to substitute the correct Region.

4. To test your API, enter a message such as the following while connected:

```
{ "{jsonpath-expression}" : "{route-key}" }
```

where *{jsonpath-expression}* is a JSONPath expression and *{route-key}* is a route key for the API. For example:

```
{"action": "action1"}  
{"message": "test response body"}
```

For more information about JSONPath, see [JSONPath](#) or [JSONPath for Java](#).

5. To disconnect from your API, enter `ctrl-C`.

## Use `@connections` commands in your backend service

Your backend service can use the following WebSocket connection HTTP requests to send a callback message to a connected client, get connection information, or disconnect the client.

### Important

These requests use [IAM authorization \(p. 640\)](#), so you must sign them with [Signature Version 4 \(SigV4\)](#). To do this, you can use the API Gateway Management API. For more information, see [ApiGatewayManagementApi](#).

In the following command, you need to replace `{api-id}` with the actual API ID, which is displayed in the API Gateway console or returned by the Amazon CLI `create-api` command. In addition, if your API is in a Region other than `us-east-1`, you need to substitute the correct Region.

To send a callback message to the client, use:

```
POST https://{api-id}.execute-api.us-east-1.amazonaws.com/{stage}/  
@connections/{connection_id}
```

You can test this request by using [Postman](#) or by calling `awscurl` as in the following example:

```
awscurl --service execute-api -X POST -d "hello world" https://{prefix}.execute-api.us-  
east-1.amazonaws.com/{stage}/@connections/{connection_id}
```

You need to URL-encode the command as in the following example:

```
awscurl --service execute-api -X POST -d "hello world" https://{aabbccdde}.execute-api.us-  
east-1.amazonaws.com/prod/%40connections/R0oXAdfD0kwCH6w%3D
```

To get the latest connection status of the client, use:

```
GET https://{api-id}.execute-api.us-east-1.amazonaws.com/{stage}/  
@connections/{connection_id}
```

To disconnect the client, use:

```
DELETE https://{api-id}.execute-api.us-east-1.amazonaws.com/{stage}/  
@connections/{connection_id}
```

You can dynamically build a callback URL by using the `$context` variables in your integration. For example, if you use Lambda proxy integration with a `Node.js` Lambda function, you can build the URL as follows:

```
exports.handler = function(event, context, callback) {  
  var domain = event.requestContext.domainName;  
  var stage = event.requestContext.stage;  
  var connectionId = event.requestContext.connectionId;
```

```
var callbackUrl = util.format(util.format('https://%s/%s/@connections/%s', domain, stage,
connectionId));
// Do a SigV4 and then make the call
}
```

## Publishing WebSocket APIs for customers to invoke

Simply creating and developing an API Gateway API doesn't automatically make it callable by your users. To make it callable, you must deploy your API to a stage. In addition, you might want to customize the URL that your users will use to access your API. You can give it a domain that is consistent with your brand or is more memorable than the default URL for your API.

In this section, you can learn how to deploy your API and customize the URL that you provide to users to access it.

### Topics

- [Working with stages for WebSocket APIs \(p. 657\)](#)
- [Deploy a WebSocket API in API Gateway \(p. 658\)](#)
- [Setting up custom domain names for WebSocket APIs \(p. 660\)](#)

## Working with stages for WebSocket APIs

An API stage is a logical reference to a lifecycle state of your API (for example, `dev`, `prod`, `beta`, or `v2`). API stages are identified by their API ID and stage name, and they're included in the URL you use to invoke the API. Each stage is a named reference to a deployment of the API and is made available for client applications to call.

A deployment is a snapshot of your API configuration. After you deploy an API to a stage, it's available for clients to invoke. You must deploy an API for changes to take effect.

## Stage variables

Stage variables are key-value pairs that you can define for a stage of a WebSocket API. They act like environment variables and can be used in your API setup.

For example, you can define a stage variable, and then set its value as an HTTP endpoint for an HTTP proxy integration. Later, you can reference the endpoint by using the associated stage variable name. By doing this, you can use the same API setup with a different endpoint at each stage. Similarly, you can use stage variables to specify a different Amazon Lambda function integration for each stage of your API.

### Note

Stage variables are not intended to be used for sensitive data, such as credentials. To pass sensitive data to integrations, use an Amazon Lambda authorizer. You can pass sensitive data to integrations in the output of the Lambda authorizer. To learn more, see [the section called "Lambda authorizer response format" \(p. 153\)](#).

## Examples

To use a stage variable to customize the HTTP integration endpoint, you must first set the name and value of the stage variable (for example, `url1`) with a value of `example.com`. Next, set up an HTTP proxy integration. Instead of entering the endpoint's URL, you can tell API Gateway to use the stage



variable value, `http://${stageVariables.url}`. This value tells API Gateway to substitute your stage variable `${ }` at runtime, depending on the stage of your API.

You can reference stage variables in a similar way to specify a Lambda function name or an Amazon role ARN.

When specifying a Lambda function name as a stage variable value, you must configure the permissions on the Lambda function manually. You can use the Amazon Command Line Interface (Amazon CLI) to do this.

```
aws lambda add-permission --function-name arn:aws:lambda:XXXXXX:your-lambda-function-
name --source-arn arn:aws:execute-api:us-east-1:YOUR_ACCOUNT_ID:api_id/*/HTTP_METHOD/
resource --principal apigateway.amazonaws.com --statement-id apigateway-access --action
lambda:InvokeFunction
```

## API Gateway stage variables reference

### HTTP integration URIs

You can use a stage variable as part of an HTTP integration URI, as shown in the following examples.

- A full URI without protocol – `http://${stageVariables.<variable_name>}`
- A full domain – `http://${stageVariables.<variable_name>}/resource/operation`
- A subdomain – `http://${stageVariables.<variable_name>}.example.com/resource/operation`
- A path – `http://example.com/${stageVariables.<variable_name>}/bar`
- A query string – `http://example.com/foo?q=${stageVariables.<variable_name>}`

### Lambda functions

You can use a stage variable in place of a Lambda function name or alias, as shown in the following examples.

- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:${stageVariables.<function_variable_name>}/invocations`
- `arn:aws:apigateway:<region>:lambda:path/2015-03-31/functions/arn:aws:lambda:<region>:<account_id>:function:<function_name>:${stageVariables.<version_variable_name>}/invocations`

#### Note

To use a stage variable for a Lambda function, the function must be in the same account as the API. Stage variables don't support cross-account Lambda functions.

### Amazon integration credentials

You can use a stage variable as part of an Amazon user or role credential ARN, as shown in the following example.

- `arn:aws:iam::<account_id>:${stageVariables.<variable_name>}`

## Deploy a WebSocket API in API Gateway

After creating your WebSocket API, you must deploy it to make it available for your users to invoke.

To deploy an API, you create an [API deployment \(p. 6\)](#) and associate it with a [stage \(p. 6\)](#). Each stage is a snapshot of the API and is made available for client apps to call.

### Important

Every time you update an API, which includes modification of routes, methods, integrations, authorizers, and anything else other than stage settings, you must redeploy the API to an existing stage or to a new stage.

By default you are limited to 10 stages per API, so it is good practice to reuse them.

To call a deployed WebSocket API, the client sends a message to the API's URL. The URL is determined by the API's hostname and stage name.

### Note

API Gateway will support payloads up to 128 KB with a maximum frame size of 32 KB. If a message exceeds 32 KB, it must be split into multiple frames, each 32 KB or smaller.

Using the API's default domain name, the URL of (for example) a WebSocket API in a given stage (*{stageName}*) is in the following format:

```
wss://{api-id}.execute-api.{region}.amazonaws.com/{stageName}
```

To make the WebSocket API's URL more user-friendly, you can create a custom domain name (e.g., `api.example.com`) to replace the default host name of the API. The configuration process is the same as for REST APIs. For more information, see [the section called "Custom domain names" \(p. 463\)](#).

Stages enable robust version control of your API. For example, you can deploy an API to a `test` stage and a `prod` stage, and use the `test` stage as a test build and use the `prod` stage as a stable build. After the updates pass the test, you can promote the `test` stage to the `prod` stage. The promotion can be done by redeploying the API to the `prod` stage. For more details about stages, see [the section called "Set up a stage" \(p. 439\)](#).

### Topics

- [Create a WebSocket API deployment using the Amazon CLI \(p. 659\)](#)
- [Create a WebSocket API deployment using the API Gateway console \(p. 660\)](#)

## Create a WebSocket API deployment using the Amazon CLI

To use Amazon CLI to create a deployment, use the `create-deployment` command as shown in the following example:

```
aws apigatewayv2 --region us-east-1 create-deployment --api-id aabbccdde
```

Example output:

```
{
  "DeploymentId": "fedcba",
  "DeploymentStatus": "DEPLOYED",
  "CreateDate": "2018-11-15T06:49:09Z"
}
```

The deployed API is not callable until you associate the deployment with a stage. You can create a new stage or reuse a stage that you have previously created.

To create a new stage and associate it with the deployment, use the `create-stage` command as shown in the following example:

```
aws apigatewayv2 --region us-east-1 create-stage --api-id aabbccdde --deployment-id fedcba --stage-name test
```

Example output:

```
{
  "StageName": "test",
  "CreateDate": "2018-11-15T06:50:28Z",
  "DeploymentId": "fedcba",
  "DefaultRouteSettings": {
    "MetricsEnabled": false,
    "ThrottlingBurstLimit": 5000,
    "DataTraceEnabled": false,
    "ThrottlingRateLimit": 10000.0
  },
  "LastUpdatedDate": "2018-11-15T06:50:28Z",
  "StageVariables": {},
  "RouteSettings": {}
}
```

To reuse an existing stage, update the stage's `deploymentId` property with the newly created deployment ID (`{deployment-id}`) by using the `update-stage` command.

```
aws apigatewayv2 update-stage --region {region} \
  --api-id {api-id} \
  --stage-name {stage-name} \
  --deployment-id {deployment-id}
```

## Create a WebSocket API deployment using the API Gateway console

To use the API Gateway console to create a deployment for a WebSocket API:

1. Sign in to the API Gateway console and choose the API.
2. From the **Actions** dropdown menu, choose **Deploy API**.
3. Choose the desired stage from the dropdown list or enter the name of a new stage.

## Setting up custom domain names for WebSocket APIs

*Custom domain names* are simpler and more intuitive URLs that you can provide to your API users.

After deploying your API, you (and your customers) can invoke the API using the default base URL of the following format:

```
https://api-id.execute-api.region.amazonaws.com/stage
```

where `api-id` is generated by API Gateway, `region` (Amazon Region) is specified by you when creating the API, and `stage` is specified by you when deploying the API.

The hostname portion of the URL (that is, `api-id.execute-api.region.amazonaws.com`) refers to an API endpoint. The default API endpoint can be difficult to recall and not user-friendly.

With custom domain names, you can set up your API's hostname, and choose a base path (for example, `myservice`) to map the alternative URL to your API. For example, a more user-friendly API base URL can become:

```
https://api.example.com/myservice
```

If you don't set any base mapping under a custom domain name, the resulting API's base URL is the same as the custom domain (for example, `https://api.example.com`). In this case, the custom domain name can't support more than one API.

**Note**

A custom domain name for a WebSocket API can't be mapped to REST APIs or HTTP APIs. For WebSocket APIs, TLS 1.2 is the only supported TLS version.

## Register a domain name

You must have a registered internet domain name in order to set up custom domain names for your APIs. If needed, you can register an internet domain using [Amazon Route 53](#) or using a third-party domain registrar of your choice. An API's custom domain name can be the name of a subdomain or the root domain (also known as "zone apex") of a registered internet domain.

After a custom domain name is created in API Gateway, you must create or update your DNS provider's resource record to map to your API endpoint. Without such a mapping, API requests bound for the custom domain name cannot reach API Gateway.

## Regional custom domain names

When you create a custom domain name for a Regional API, API Gateway creates a Regional domain name for the API. You must set up a DNS record to map the custom domain name to the Regional domain name. You must also provide a certificate for the custom domain name.

## Wildcard custom domain names

With wildcard custom domain names, you can support an almost infinite number of domain names without exceeding the [default quota \(p. 744\)](#). For example, you could give each of your customers their own domain name, `customername.api.example.com`.

To create a wildcard custom domain name, specify a wildcard (\*) as the first subdomain of a custom domain that represents all possible subdomains of a root domain.

For example, the wildcard custom domain name `*.example.com` results in subdomains such as `a.example.com`, `b.example.com`, and `c.example.com`, which all route to the same domain.

Wildcard custom domain names support distinct configurations from API Gateway's standard custom domain names. For example, in a single Amazon account, you can configure `*.example.com` and `a.example.com` to behave differently.

You can use the `$context.domainName` and `$context.domainPrefix` context variables to determine the domain name that a client used to call your API. To learn more about context variables, see [API Gateway mapping template and access logging variable reference \(p. 363\)](#).

To create a wildcard custom domain name, you must provide a certificate issued by ACM that has been validated using either the DNS or the email validation method.

**Note**

You can't create a wildcard custom domain name if a different Amazon account has created a custom domain name that conflicts with the wildcard custom domain name. For example,

if account A has created `a.example.com`, then account B can't create the wildcard custom domain name `*.example.com`.

If account A and account B share an owner, you can contact the [Amazon Support Center](#) to request an exception.

## Certificates for custom domain names

To provide a certificate for a custom domain name in a Region where ACM is supported, you must request a certificate from ACM. To provide a certificate for a Regional custom domain name in a Region where ACM is not supported, you must import a certificate to API Gateway in that Region.

To import an SSL/TLS certificate, you must provide the PEM-formatted SSL/TLS certificate body, its private key, and the certificate chain for the custom domain name. Each certificate stored in ACM is identified by its ARN. To use an Amazon managed certificate for a domain name, you simply reference its ARN.

ACM makes it straightforward to set up and use a custom domain name for an API. You create a certificate for the given domain name (or import a certificate), set up the domain name in API Gateway with the ARN of the certificate provided by ACM, and map a base path under the custom domain name to a deployed stage of the API. With certificates issued by ACM, you do not have to worry about exposing any sensitive certificate details, such as the private key.

For details on setting up a custom domain name, see [Getting certificates ready in Amazon Certificate Manager \(p. 466\)](#) and [Setting up a regional custom domain name in API Gateway \(p. 475\)](#).

## Working with API mappings for WebSocket APIs

You use API mappings to connect API stages to a custom domain name. After you create a domain name and configure DNS records, you use API mappings to send traffic to your APIs through your custom domain name.

An API mapping specifies an API, a stage, and optionally a path to use for the mapping. For example, you can map the `production` stage of an API to `wss://api.example.com/orders`.

Before you create an API mapping, you must have an API, a stage, and a custom domain name. To learn more about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

### Restrictions

- In an API mapping, the custom domain name and mapped APIs must be in the same Amazon account.
- API mappings must contain only letters, numbers, and the following characters: `$-_.+!*'()`.
- The maximum length for the path in an API mapping is 300 characters.
- You can't map WebSocket APIs to the same custom domain name as an HTTP API or REST API.

## Create an API mapping

To create an API mapping, you must first create a custom domain name, API, and stage. For information about creating a custom domain name, see [the section called "Setting up a regional custom domain name" \(p. 475\)](#).

Amazon Web Services Management Console

### To create an API mapping

1. Sign in to the API Gateway console at <https://console.amazonaws.cn/apigateway>.

2. Choose **Custom domain names**.
3. Select a custom domain name that you've already created.
4. Choose **API mappings**.
5. Choose **Configure API mappings**.
6. Choose **Add new mapping**.
7. Enter an **API**, a **Stage**, and optionally a **Path**.
8. Choose **Save**.

#### Amazon CLI

The following Amazon CLI command creates an API mapping. In this example, API Gateway sends requests to `api.example.com/v1` to the specified API and stage.

```
aws apigatewayv2 create-api-mapping \  
  --domain-name api.example.com \  
  --api-mapping-key v1 \  
  --api-id a1b2c3d4 \  
  --stage test
```

#### Amazon CloudFormation

The following Amazon CloudFormation example creates an API mapping.

```
MyApiMapping:  
  Type: 'AWS::ApiGatewayV2::ApiMapping'  
  Properties:  
    DomainName: api.example.com  
    ApiMappingKey: 'v1'  
    ApiId: !Ref MyApi  
    Stage: !Ref MyStage
```

## Disabling the default endpoint for a WebSocket API

By default, clients can invoke your API by using the `execute-api` endpoint that API Gateway generates for your API. To ensure that clients can access your API only by using a custom domain name, disable the default `execute-api` endpoint.

#### Note

When you disable the default endpoint, it affects all stages of an API.

The following Amazon CLI command disables the default endpoint for a WebSocket API.

```
aws apigatewayv2 update-api \  
  --api-id abcdef123 \  
  --disable-execute-api-endpoint
```

After you disable the default endpoint, you must deploy your API for the change to take effect.

The following Amazon CLI command creates a deployment.

```
aws apigatewayv2 create-deployment \  
  --api-id abcdef123 \  
  --stage-name dev
```

## Protecting your WebSocket API

You can configure throttling and quotas for your APIs to help protect them from being overwhelmed by too many requests. Both throttles and quotas are applied on a best-effort basis and should be thought of as targets rather than guaranteed request ceilings.

API Gateway throttles requests to your API using the token bucket algorithm, where a token counts for a request. Specifically, API Gateway examines the rate and a burst of request submissions against all APIs in your account, per Region. In the token bucket algorithm, a burst can allow pre-defined overrun of those limits, but other factors can also cause limits to be overrun in some cases.

When request submissions exceed the steady-state request rate and burst limits, API Gateway begins to throttle requests. Clients may receive 429 `Too Many Requests` error responses at this point. Upon catching such exceptions, the client can resubmit the failed requests in a way that is rate limiting.

As an API developer, you can set the target limits for individual API stages or routes to improve overall performance across all APIs in your account.

### Account-level throttling per Region

By default, API Gateway limits the steady-state requests per second (RPS) across all APIs within an Amazon account, per Region. It also limits the burst (that is, the maximum bucket size) across all APIs within an Amazon account, per Region. In API Gateway, the burst limit represents the target maximum number of concurrent request submissions that API Gateway will fulfill before returning 429 `Too Many Requests` error responses. For more information on throttling quotas, see [Quotas and important notes](#) (p. 744).

Per-account limits are applied to all APIs in an account in a specified Region. The account-level rate limit can be increased upon request - higher limits are possible with APIs that have shorter timeouts and smaller payloads. To request an increase of account-level throttling limits per Region, contact the [Amazon Support Center](#). For more information, see [Quotas and important notes](#) (p. 744). Note that these limits can't be higher than the Amazon throttling limits.

### Route-level throttling

You can set route-level throttling to override the account-level request throttling limits for a specific stage or for individual routes in your API. The default route throttling limits can't exceed account-level rate limits.

## Monitoring WebSocket APIs

You can use CloudWatch metrics and CloudWatch Logs to monitor WebSocket APIs. By combining logs and metrics, you can log errors and monitor your API's performance.

#### Note

API Gateway might not generate logs and metrics in the following cases:

- 413 Request Entity Too Large errors
- Excessive 429 Too Many Requests errors
- 400 series errors from requests sent to a custom domain that has no API mapping
- 500 series errors caused by internal failures

#### Topics

- [Monitoring WebSocket API execution with CloudWatch metrics](#) (p. 665)

- [Configuring logging for a WebSocket API \(p. 666\)](#)

## Monitoring WebSocket API execution with CloudWatch metrics

You can use [Amazon CloudWatch](#) metrics to monitor WebSocket APIs. The configuration is similar to that used for REST APIs. For more information, see [Monitoring REST API execution with Amazon CloudWatch metrics \(p. 605\)](#).

The following metrics are supported for WebSocket APIs:

Metric	Description
ConnectCount	The number of messages sent to the <code>\$connect</code> route integration.
MessageCount	The number of messages sent to the WebSocket API, either from or to the client.
IntegrationError	The number of requests that return a 4XX/5XX response from the integration.
ClientError	The number of requests that have a 4XX response returned by API Gateway before the integration is invoked.
ExecutionError	Errors that occurred when calling the integration.
IntegrationLatency	The time difference between API Gateway sending the request to the integration and API Gateway receiving the response from the integration. Suppressed for callbacks and mock integrations.

You can use the dimensions in the following table to filter API Gateway metrics.

Dimension	Description
Apild	Filters API Gateway metrics for an API with the specified API ID.
Apild, Stage	Filters API Gateway metrics for an API stage with the specified API ID and stage ID.
Apild, Stage, Route	Filters API Gateway metrics for an API method with the specified API ID, stage ID, and route ID.



Dimension	Description
	API Gateway will not send these metrics unless you have explicitly enabled detailed CloudWatch metrics. You can do this by calling the UpdateStage action of the API Gateway V2 REST API to update the metricsEnabled property to true. Enabling such metrics will incur additional charges to your account. For pricing information, see <a href="#">Amazon CloudWatch Pricing</a> .

## Configuring logging for a WebSocket API

You can enable logging to write logs to CloudWatch Logs. You can use logging variables to customize the content of your logs.

For instructions on how to set up CloudWatch logging, see [the section called “Set up CloudWatch API logging using the API Gateway console” \(p. 613\)](#).

When you specify the **Log Format**, you can choose which context variables to log. The following variables are supported.

Parameter	Description
<code>\$context.apiId</code>	The identifier API Gateway assigns to your API.
<code>\$context.authorize.error</code>	The authorization error message.
<code>\$context.authorize.latency</code>	The authorization latency in ms.
<code>\$context.authorize.status</code>	The status code returned from an authorization attempt.
<code>\$context.authorizer.error</code>	The error message returned from an authorizer.
<code>\$context.authorizer.integrationLatency</code>	The Lambda authorizer latency in ms.
<code>\$context.authorizer.integrationStatus</code>	The status code returned from a Lambda authorizer.
<code>\$context.authorizer.latency</code>	The authorizer latency in ms.
<code>\$context.authorizer.requestId</code>	The Amazon endpoint's request ID.
<code>\$context.authorizer.status</code>	The status code returned from an authorizer.
<code>\$context.authorizer.principalId</code>	The principal user identification that is associated with the token sent by the client and returned from an API Gateway Lambda authorizer Lambda function. (A Lambda authorizer was formerly known as a custom authorizer.)
<code>\$context.authorizer.<i>property</i></code>	The stringified value of the specified key-value pair of the context map returned from an

Parameter	Description
	<p>API Gateway Lambda authorizer function. For example, if the authorizer returns the following context map:</p> <pre>"context" : {     "key": "value",     "numKey": 1,     "boolKey": true }</pre> <p>calling <code>\$context.authorizer.key</code> returns the "value" string, calling <code>\$context.authorizer.numKey</code> returns the "1" string, and calling <code>\$context.authorizer.boolKey</code> returns the "true" string.</p>
<code>\$context.authenticate.error</code>	The error message returned from an authentication attempt.
<code>\$context.authenticate.latency</code>	The authentication latency in ms.
<code>\$context.authenticate.status</code>	The status code returned from an authentication attempt.
<code>\$context.connectedAt</code>	The <a href="#">Epoch</a> -formatted connection time.
<code>\$context.connectionId</code>	A unique ID for the connection that can be used to make a callback to the client.
<code>\$context.domainName</code>	A domain name for the WebSocket API. This can be used to make a callback to the client (instead of a hardcoded value).
<code>\$context.error.message</code>	A string that contains an API Gateway error message.
<code>\$context.error.messageString</code>	The quoted value of <code>\$context.error.message</code> , namely <code>"\$context.error.message"</code> .
<code>\$context.error.responseType</code>	The error response type.
<code>\$context.error.validationErrorString</code>	A string that contains a detailed validation error message.
<code>\$context.eventType</code>	The event type: <code>CONNECT</code> , <code>MESSAGE</code> , or <code>DISCONNECT</code> .
<code>\$context.extendedRequestId</code>	Equivalent to <code>\$context.requestId</code> .
<code>\$context.identity.accountId</code>	The Amazon account ID associated with the request.
<code>\$context.identity.apiKey</code>	The API owner key associated with key-enabled API request.
<code>\$context.identity.apiKeyId</code>	The API key ID associated with the key-enabled API request

Parameter	Description
<code>\$context.identity.caller</code>	The principal identifier of the caller that signed the request. Supported for routes that use IAM authorization.
<code>\$context.identity.cognitoAuthenticationProvider</code>	<p>A comma-separated list of the Amazon Cognito authentication providers used by the caller making the request. Available only if the request was signed with Amazon Cognito credentials.</p> <p>For example, for an identity from an Amazon Cognito user pool, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i></code>, <code>cognito-idp.<i>region</i>.amazonaws.com/<i>user_pool_id</i>:CognitoSignIn:<i>token</i></code>, and <code><i>subject claim</i></code></p> <p>For information, see <a href="#">Using Federated Identities</a> in the <i>Amazon Cognito Developer Guide</i>.</p>
<code>\$context.identity.cognitoAuthenticationType</code>	The Amazon Cognito authentication type of the caller making the request. Available only if the request was signed with Amazon Cognito credentials. Possible values include <code>authenticated</code> for authenticated identities and <code>unauthenticated</code> for unauthenticated identities.
<code>\$context.identity.cognitoIdentityId</code>	The Amazon Cognito identity ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.
<code>\$context.identity.cognitoIdentityPoolId</code>	The Amazon Cognito identity pool ID of the caller making the request. Available only if the request was signed with Amazon Cognito credentials.
<code>\$context.identity.principalOrgId</code>	The <a href="#">Amazon organization ID</a> . Supported for routes that use IAM authorization.
<code>\$context.identity.sourceIp</code>	The source IP address of the TCP connection making the request to API Gateway.
<code>\$context.identity.user</code>	The principal identifier of the user that will be authorized against resource access. Supported for routes that use IAM authorization.
<code>\$context.identity.userAgent</code>	The user agent of the API caller.
<code>\$context.identity.userArn</code>	The Amazon Resource Name (ARN) of the effective user identified after authentication.
<code>\$context.integration.error</code>	The error message returned from an integration. Equivalent to <code>\$context.integrationErrorMessage</code> .

Parameter	Description
<code>\$context.integration.integrationStatus</code>	For Lambda proxy integration, the status code returned from Amazon Lambda, not from the backend Lambda function code.
<code>\$context.integration.latency</code>	The integration latency in ms. Equivalent to <code>\$context.integrationLatency</code> .
<code>\$context.integration.requestId</code>	The Amazon endpoint's request ID. Equivalent to <code>\$context.awsEndpointRequestId</code> .
<code>\$context.integration.status</code>	The status code returned from an integration. For Lambda proxy integrations, this is the status code that your Lambda function code returns. Equivalent to <code>\$context.integrationStatus</code> .
<code>\$context.integrationLatency</code>	The integration latency in ms, available for access logging only.
<code>\$context.messageId</code>	A unique server-side ID for a message. Available only when the <code>\$context.eventType</code> is <code>MESSAGE</code> .
<code>\$context.requestId</code>	Same as <code>\$context.extendedRequestId</code> .
<code>\$context.requestTime</code>	The <a href="#">CLF</a> -formatted request time (dd/MMM/yyyy:HH:mm:ss +-hhmm).
<code>\$context.requestTimeEpoch</code>	The <a href="#">Epoch</a> -formatted request time, in milliseconds.
<code>\$context.routeKey</code>	The selected route key.
<code>\$context.stage</code>	The deployment stage of the API call (for example, beta or prod).
<code>\$context.status</code>	The response status.
<code>\$context.waf.error</code>	The error message returned from Amazon WAF.
<code>\$context.waf.latency</code>	The Amazon WAF latency in ms.
<code>\$context.waf.status</code>	The status code returned from Amazon WAF.

# API Gateway Amazon Resource Name (ARN) reference

The following tables list the Amazon Resource Names (ARNs) for API Gateway resources. To learn more about using ARNs in Amazon Identity and Access Management policies, see [How Amazon API Gateway works with IAM](#) (p. 715) and [Control access to an API with IAM permissions](#) (p. 248).

## HTTP API and WebSocket API resources

Resource	ARN
AccessLogSettings	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /stages/ <i>stage-name</i> /accesslogsettings
Api	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i>
Apis	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis
ApiMapping	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i> /apimappings/ <i>id</i>
ApiMappings	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i> /apimappings
Authorizer	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /authorizers/ <i>id</i>
Authorizers	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /authorizers
Cors	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /cors
Deployment	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /deployments/ <i>id</i>
Deployments	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /deployments
DomainName	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i>
DomainNames	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames
ExportedAPI	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /exports/ <i>specification</i>
Integration	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /integrations/ <i>integration-id</i>

Resource	ARN
Integrations	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /integrations
IntegrationResponse	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /integrationresponses/ <i>integration-response</i>
IntegrationResponses	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /integrationresponses
Model	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /models/ <i>id</i>
Models	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /models
ModelTemplate	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /models/ <i>id</i> /template
Route	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /routes/ <i>id</i>
Routes	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /routes
RouteRequestParameter	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /routes/ <i>id</i> /requestparameters/ <i>key</i>
RouteResponse	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /routes/ <i>id</i> /routeresponses/ <i>id</i>
RouteResponses	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /routes/ <i>id</i> /routeresponses
RouteSettings	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /stages/ <i>stage-name</i> /routesettings/ <i>route-key</i>
Stage	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /stages/ <i>stage-name</i>
Stages	arn: <i>partition</i> :apigateway: <i>region</i> ::/apis/ <i>api-id</i> /stages
VpcLink	arn: <i>partition</i> :apigateway: <i>region</i> ::/vpclinks/ <i>vpclink-id</i>
VpcLinks	arn: <i>partition</i> :apigateway: <i>region</i> ::/vpclinks

## REST API resources

Resource	ARN
Account	arn: <i>partition</i> :apigateway: <i>region</i> ::/account
ApiKey	arn: <i>partition</i> :apigateway: <i>region</i> ::/apikeys/ <i>id</i>
ApiKeys	arn: <i>partition</i> :apigateway: <i>region</i> ::/apikeys
Authorizer	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /authorizers/ <i>id</i>
Authorizers	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /authorizers
BasePathMapping	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i> /basepathmappings/ <i>basepath</i>
BasePathMappings	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i> /basepathmappings
ClientCertificate	arn: <i>partition</i> :apigateway: <i>region</i> ::/clientcertificates/ <i>id</i>
ClientCertificates	arn: <i>partition</i> :apigateway: <i>region</i> ::/clientcertificates
Deployment	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /deployments/ <i>id</i>
Deployments	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /deployments
DocumentationPart	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /documentation/parts/ <i>id</i>
DocumentationParts	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /documentation/parts
DocumentationVersion	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /documentation/versions/ <i>version</i>
DocumentationVersions	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /documentation/versions
DomainName	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames/ <i>domain-name</i>
DomainNames	arn: <i>partition</i> :apigateway: <i>region</i> ::/domainnames

Resource	ARN
GatewayResponse	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /gatewayresponses/ <i>response-type</i>
GatewayResponses	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /gatewayresponses
Integration	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources/ <i>resource-id</i> /methods/ <i>http-method</i> /integration
IntegrationResponse	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources/ <i>resource-id</i> /methods/ <i>http-method</i> /integration/responses/ <i>status-code</i>
Method	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources/ <i>resource-id</i> /methods/ <i>http-method</i>
MethodResponse	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources/ <i>resource-id</i> /methods/ <i>http-method</i> /responses/ <i>status-code</i>
Model	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /models/ <i>model-name</i>
Models	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /models
RequestValidator	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /requestvalidators/ <i>id</i>
RequestValidators	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /requestvalidators
Resource	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources/ <i>id</i>
Resources	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /resources
RestApi	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i>
RestApis	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis
Stage	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /stages/ <i>stage-name</i>
Stages	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/ <i>api-id</i> /stages
Template	arn: <i>partition</i> :apigateway: <i>region</i> ::/restapis/models/ <i>model-name</i> /template



Resource	ARN
UsagePlan	arn: <i>partition</i> :apigateway: <i>region</i> ::/usageplans/ <i>usageplan-id</i>
UsagePlans	arn: <i>partition</i> :apigateway: <i>region</i> ::/usageplans
UsagePlanKey	arn: <i>partition</i> :apigateway: <i>region</i> ::/usageplans/ <i>usageplan-id</i> /keys/ <i>id</i>
UsagePlanKeys	arn: <i>partition</i> :apigateway: <i>region</i> ::/usageplans/ <i>usageplan-id</i> /keys
VpcLink	arn: <i>partition</i> :apigateway: <i>region</i> ::/vpclinks/ <i>vpclink-id</i>
VpcLinks	arn: <i>partition</i> :apigateway: <i>region</i> ::/vpclinks

## execute-api (HTTP APIs, WebSocket APIs, and REST APIs)

Resource	ARN
WebSocket API endpoint	arn: <i>partition</i> :execute-api: <i>region</i> : <i>account-id</i> : <i>api-id</i> / <i>stage</i> / <i>route-key</i>
HTTP API and REST API endpoint	arn: <i>partition</i> :execute-api: <i>region</i> : <i>account-id</i> : <i>api-id</i> / <i>stage</i> / <i>http-method</i> / <i>resource-path</i>
Lambda authorizer *	arn: <i>partition</i> :execute-api: <i>region</i> : <i>account-id</i> : <i>api-id</i> /authorizers/ <i>authorizer-id</i>

\* This ARN is applicable only when setting the SourceArn condition in the [resource policy](#) for a Lambda authorizer function. For an example, see [the section called "Create a Lambda authorizer"](#) (p. 157).

# Working with API Gateway extensions to OpenAPI

The API Gateway extensions support the Amazon-specific authorization and API Gateway-specific API integrations for REST APIs and HTTP APIs. In this section, we describe the API Gateway extensions to the OpenAPI specification.

**Tip**

To understand how the API Gateway extensions are used in an application, you can use the API Gateway console to create a REST API or HTTP API and export it to an OpenAPI definition file. For more information on how to export an API, see [Export a REST API from API Gateway \(p. 433\)](#) and [Exporting an HTTP API from API Gateway \(p. 183\)](#).

**Topics**

- [x-amazon-apigateway-any-method object \(p. 676\)](#)
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## x-amazon-apigateway-any-method object

Specifies the [OpenAPI Operation Object](#) for the API Gateway catch-all ANY method in an [OpenAPI Path Item Object](#). This object can exist alongside other Operation objects and will catch any HTTP method that wasn't explicitly declared.

The following table lists the properties extended by API Gateway. For the other OpenAPI Operation properties, see the OpenAPI specification.

### Properties

Property name	Type	Description
isDefaultRoute	Boolean	Specifies whether a route is the <code>\$default</code> route. Supported only for HTTP APIs. To learn more, see <a href="#">Working with routes for HTTP APIs (p. 149)</a> .
x-amazon-apigateway-integration	<a href="#">x-amazon-apigateway-integration object (p. 691)</a>	Specifies the integration of the method with the backend. This is an extended property of the <a href="#">OpenAPI Operation object</a> . The integration can be of type <code>AWS</code> , <code>AWS_PROXY</code> , <code>HTTP</code> , <code>HTTP_PROXY</code> , or <code>MOCK</code> .

## x-amazon-apigateway-any-method examples

The following example integrates the ANY method on a proxy resource, `{proxy+}`, with a Lambda function, `TestSimpleProxy`.

```

"/{proxy+}": {
  "x-amazon-apigateway-any-method": {
    "produces": [
      "application/json"
    ],
    "parameters": [
      {
        "name": "proxy",
        "in": "path",
        "required": true,
        "type": "string"
      }
    ],
    "responses": {},
    "x-amazon-apigateway-integration": {
      "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:123456789012:function:TestSimpleProxy/invocations",
      "httpMethod": "POST",
      "type": "aws_proxy"
    }
  }
}

```

The following example creates a `$default` route for an HTTP API that integrates with a Lambda function, `HelloWorld`.

```

"/$default": {

```

```
"x-amazon-apigateway-any-method": {
  "isDefaultRoute": true,
  "x-amazon-apigateway-integration": {
    "type": "AWS_PROXY",
    "httpMethod": "POST",
    "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:123456789012:function:HelloWorld/invocations",
    "timeoutInMillis": 1000,
    "connectionType": "INTERNET",
    "payloadFormatVersion": 1.0
  }
}
```

## x-amazon-apigateway-cors object

Specifies the cross-origin resource sharing (CORS) configuration for an HTTP API. The extension applies to the root-level OpenAPI structure. To learn more, see [Configuring CORS for an HTTP API \(p. 172\)](#).

### Properties

Property name	Type	Description
allowOrigins	Array	Specifies the allowed origins.
allowCredentials	Boolean	Specifies whether credentials are included in the CORS request.
exposeHeaders	Array	Specifies the headers that are exposed.
maxAge	Integer	Specifies the number of seconds that the browser should cache preflight request results.
allowMethods	Array	Specifies the allowed HTTP methods.
allowHeaders	Array	Specifies the allowed headers.

## x-amazon-apigateway-cors example

The following is an example CORS configuration for an HTTP API.

```
"x-amazon-apigateway-cors": {
  "allowOrigins": [
    "https://www.example.com"
  ],
  "allowCredentials": true,
  "exposeHeaders": [
    "x-apigateway-header",
    "x-amz-date",
    "content-type"
  ],
  "maxAge": 3600,
  "allowMethods": [
    "GET",
    "OPTIONS",

```

```
    "POST"
  ],
  "allowHeaders": [
    "x-apigateway-header",
    "x-amz-date",
    "content-type"
  ]
}
```

## x-amazon-apigateway-api-key-source property

Specify the source to receive an API key to throttle API methods that require a key. This API-level property is a `String` type.

Specify the source of the API key for requests. Valid values are:

- `HEADER` for receiving the API key from the `X-API-Key` header of a request.
- `AUTHORIZER` for receiving the API key from the `UsageIdentifierKey` from a Lambda authorizer (formerly known as a custom authorizer).

## x-amazon-apigateway-api-key-source example

The following example sets the `X-API-Key` header as the API key source.

OpenAPI 2.0

```
{
  "swagger" : "2.0",
  "info" : {
    "title" : "Test1"
  },
  "schemes" : [ "https" ],
  "basePath" : "/import",
  "x-amazon-apigateway-api-key-source" : "HEADER",
  .
  .
  .
}
```

## x-amazon-apigateway-auth object

Defines an authorization type to be applied for authorization of method invocations in API Gateway.

### Properties

Property name	Type	Description
type	string	Specifies the authorization type. Specify <code>NONE</code> for open access. Specify <code>AWS_IAM</code> to use IAM permissions. Values are case insensitive.

## x-amazon-apigateway-auth example

The following example sets the authorization type for an API method.

OpenAPI 3.0.1

```
{
  "openapi": "3.0.1",
  "info": {
    "title": "openapi3",
    "version": "1.0"
  },
  "paths": {
    "/protected-by-iam": {
      "get": {
        "x-amazon-apigateway-auth": {
          "type": "AWS_IAM"
        }
      }
    }
  }
}
```

## x-amazon-apigateway-authorizer object

Defines a Lambda authorizer or JWT authorizer to be applied for authorization of method invocations in API Gateway. This extension applies to the security definition in [OpenAPI 2](#) and [OpenAPI 3](#).

### Properties

Property name	Type	Description
type	string	The type of the authorizer. This is a required property.  For REST APIs, specify <code>token</code> for an authorizer with the caller identity embedded in an authorization token. Specify <code>request</code> for an authorizer with the caller identity contained in request parameters.  For HTTP APIs, specify <code>request</code> for a Lambda authorizer with the caller identity contained in request parameters. Specify <code>jwt</code> for a JWT authorizer.
authorizerUri	string	The Uniform Resource Identifier (URI) of the authorizer Lambda function. The syntax is as follows:  <code>"arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-</code>

Property name	Type	Description
		east-1: <i>account-id</i> :function: <i>auth_function_name</i> /invocations"
authorizerCredentials	string	The credentials required for invoking the authorizer, if any, in the form of an ARN of an IAM execution role. For example, "arn:aws:iam:: <i>account-id</i> : <i>IAM_role</i> ".
authorizerPayloadFormatVersion	string	For HTTP APIs, specifies the format of the data that API Gateway sends to a Lambda authorizer, and how API Gateway interprets the response from Lambda. To learn more, see <a href="#">the section called "Payload format version"</a> (p. 151).
enableSimpleResponses	Boolean	For HTTP APIs, specifies whether a <code>request</code> authorizer returns a Boolean value or an IAM policy. Supported only for authorizers with an <code>authorizerPayloadFormatVersion</code> of 2.0. If enabled, the Lambda authorizer function returns a Boolean value. To learn more, see <a href="#">the section called "Lambda function response for format 2.0"</a> (p. 154).
identitySource	string	A comma-separated list of mapping expressions of the request parameters as the identity source. Applicable for the authorizer of the <code>request</code> and <code>jwt</code> type only.
jwtConfiguration	Object	Specifies the issuer and audiences for a JWT authorizer. To learn more, see <a href="#">JWTConfiguration</a> in the API Gateway Version 2 API Reference. Supported only for HTTP APIs.
identityValidationExpression	string	A regular expression for validating the token as the incoming identity. For example, " <code>^x-[a-z]+</code> ". Supported only for REST APIs.

Property name	Type	Description
authorizerResultTtlInSeconds	string	The number of seconds during which authorizer result is cached.

## x-amazon-apigateway-authorizer examples for REST APIs

The following OpenAPI security definitions example specifies a Lambda authorizer of the "token" type and named `test-authorizer`.

```
"securityDefinitions" : {
  "test-authorizer" : {
    "type" : "apiKey", // Required and the value must be "apiKey"
    for an API Gateway API.
    "name" : "Authorization", // The name of the header containing the
    authorization token.
    "in" : "header", // Required and the value must be "header"
    for an API Gateway API.
    "x-amazon-apigateway-authtype" : "oauth2", // Specifies the authorization mechanism
    for the client.
    "x-amazon-apigateway-authorizer" : { // An API Gateway Lambda authorizer
    definition
      "type" : "token", // Required property and the value must
      "token"
      "authorizerUri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:account-id:function:function-name/invocations",
      "authorizerCredentials" : "arn:aws:iam::account-id:role",
      "identityValidationExpression" : "^x-[a-z]+",
      "authorizerResultTtlInSeconds" : 60
    }
  }
}
```

The following OpenAPI operation object snippet sets the `GET /http` to use the preceding Lambda authorizer.

```
"/http" : {
  "get" : {
    "responses" : { },
    "security" : [ {
      "test-authorizer" : [ ]
    } ],
    "x-amazon-apigateway-integration" : {
      "type" : "http",
      "responses" : {
        "default" : {
          "statusCode" : "200"
        }
      },
      "httpMethod" : "GET",
      "uri" : "http://api.example.com"
    }
  }
}
```



The following OpenAPI security definitions example specifies a Lambda authorizer of the "request" type, with a single header parameter (auth) as the identity source. The securityDefinitions is named request\_authorizer\_single\_header.

```
"securityDefinitions": {
  "request_authorizer_single_header" : {
    "type" : "apiKey",
    "name" : "auth",           // The name of a single header or query parameter as
    the identity source.
    "in" : "header",         // The location of the single identity source request
    parameter. The valid value is "header" or "query"
    "x-amazon-apigateway-authtype" : "custom",
    "x-amazon-apigateway-authorizer" : {
      "type" : "request",
      "identitySource" : "method.request.header.auth", // Request parameter mapping
      expression of the identity source. In this example, it is the 'auth' header.
      "authorizerCredentials" : "arn:aws:iam::123456789012:role/AWSepIntegTest-CS-
      LambdaRole",
      "authorizerUri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
      arn:aws:lambda:us-east-1:123456789012:function:APIGateway-Request-Authorizer:vtwo/
      invocations",
      "authorizerResultTtlInSeconds" : 300
    }
  }
}
```

The following OpenAPI security definitions example specifies a Lambda authorizer of the "request" type, with one header (HeaderAuth1) and one query string parameter QueryString1 as the identity sources.

```
"securityDefinitions": {
  "request_authorizer_header_query" : {
    "type" : "apiKey",
    "name" : "Unused",       // Must be "Unused" for multiple identity sources or
    non header or query type of request parameters.
    "in" : "header",        // Must be "header" for multiple identity sources or
    non header or query type of request parameters.
    "x-amazon-apigateway-authtype" : "custom",
    "x-amazon-apigateway-authorizer" : {
      "type" : "request",
      "identitySource" : "method.request.header.HeaderAuth1,
      method.request.querystring.QueryString1", // Request parameter mapping expressions of
      the identity sources.
      "authorizerCredentials" : "arn:aws:iam::123456789012:role/AWSepIntegTest-CS-
      LambdaRole",
      "authorizerUri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
      arn:aws:lambda:us-east-1:123456789012:function:APIGateway-Request-Authorizer:vtwo/
      invocations",
      "authorizerResultTtlInSeconds" : 300
    }
  }
}
```

The following OpenAPI security definitions example specifies an API Gateway Lambda authorizer of the "request" type, with a single stage variable (stage) as the identity source.

```
"securityDefinitions": {
  "request_authorizer_single_stagevar" : {
    "type" : "apiKey",
    "name" : "Unused",       // Must be "Unused", for multiple identity sources or
    non header or query type of request parameters.
    "in" : "header",        // Must be "header", for multiple identity sources or
    non header or query type of request parameters.
  }
}
```

```
"x-amazon-apigateway-authtype" : "custom",
"x-amazon-apigateway-authorizer" : {
  "type" : "request",
  "identitySource" : "stageVariables.stage", // Request parameter mapping
  expression of the identity source. In this example, it is the stage variable.
  "authorizerCredentials" : "arn:aws:iam::123456789012:role/AWSepIntegTest-CS-
LambdaRole",
  "authorizerUri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:123456789012:function:APIGateway-Request-Authorizer:vtwo/
invocations",
  "authorizerResultTtlInSeconds" : 300
}
}
```

## x-amazon-apigateway-authorizer examples for HTTP APIs

The following OpenAPI 3.0 example creates a JWT authorizer for an HTTP API that uses Amazon Cognito as an identity provider, with the Authorization header as an identity source.

```
"securitySchemes": {
  "jwt-authorizer-oauth": {
    "type": "oauth2",
    "x-amazon-apigateway-authorizer": {
      "type": "jwt",
      "jwtConfiguration": {
        "issuer": "https://cognito-idp.region.amazonaws.com/userPoolId",
        "audience": [
          "audience1",
          "audience2"
        ]
      },
      "identitySource": "$request.header.Authorization"
    }
  }
}
```

The following OpenAPI 3.0 example produces the same JWT authorizer as the previous example. However, this example uses the OpenAPI `openIdConnectUrl` property to automatically detect the issuer. The `openIdConnectUrl` must be fully formed.

```
"securitySchemes": {
  "jwt-authorizer-autofind": {
    "type": "openIdConnect",
    "openIdConnectUrl": "https://cognito-idp.region.amazonaws.com/userPoolId/.well-known/
openid-configuration",
    "x-amazon-apigateway-authorizer": {
      "type": "jwt",
      "jwtConfiguration": {
        "audience": [
          "audience1",
          "audience2"
        ]
      },
      "identitySource": "$request.header.Authorization"
    }
  }
}
```

The following example creates a Lambda authorizer for an HTTP API. This example authorizer uses the Authorization header as its identity source. The authorizer uses the 2.0 payload format version, and returns Boolean value, because `enableSimpleResponses` is set to `true`.

```
"securitySchemes" : {
  "lambda-authorizer" : {
    "type" : "apiKey",
    "name" : "Authorization",
    "in" : "header",
    "x-amazon-apigateway-authorizer" : {
      "type" : "request",
      "identitySource" : "$request.header.Authorization",
      "authorizerUri" : "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/arn:aws:lambda:us-west-2:123456789012:function:function-name/invocations",
      "authorizerPayloadFormatVersion" : "2.0",
      "authorizerResultTtlInSeconds" : 300,
      "enableSimpleResponses" : true
    }
  }
}
```

## x-amazon-apigateway-authtype property

For REST APIs, this extension can be used to define a custom type of a Lambda authorizer. In this case, the value is free-form. For example, an API may have multiple Lambda authorizers that use different internal schemes. You can use this extension to identify the internal scheme of a Lambda authorizer.

More commonly, in HTTP APIs and REST APIs, it can also be used as a way to define IAM authorization across several operations that share the same security scheme. In this case, the term `awsSigv4` is a reserved term, along with any term prefixed by `aws`.

This extension applies to the `apiKey` type security scheme in [OpenAPI 2](#) and [OpenAPI 3](#).

## x-amazon-apigateway-authtype example

The following OpenAPI 3 example defines IAM authorization across multiple resources in a REST API or HTTP API:

```
{
  "openapi" : "3.0.1",
  "info" : {
    "title" : "openapi3",
    "version" : "1.0"
  },
  "paths" : {
    "/operation1" : {
      "get" : {
        "responses" : {
          "default" : {
            "description" : "Default response"
          }
        }
      },
      "security" : [ {
        "sigv4Reference" : [ ]
      } ]
    }
  },
  "/operation2" : {
    "get" : {
      "responses" : {
```

```
        "default" : {
            "description" : "Default response"
        }
    },
    "security" : [ {
        "sigv4Reference" : [ ]
    } ]
}
},
"components" : {
    "securitySchemes" : {
        "sigv4Reference" : {
            "type" : "apiKey",
            "name" : "Authorization",
            "in" : "header",
            "x-amazon-apigateway-authtype": "awsSigv4"
        }
    }
}
}
```

The following OpenAPI 3 example defines a Lambda authorizer with a custom scheme for a REST API:

```
{
  "openapi" : "3.0.1",
  "info" : {
    "title" : "openapi3 for REST API",
    "version" : "1.0"
  },
  "paths" : {
    "/protected-by-lambda-authorizer" : {
      "get" : {
        "responses" : {
          "200" : {
            "description" : "Default response"
          }
        },
        "security" : [ {
          "myAuthorizer" : [ ]
        } ]
      }
    }
  },
  "components" : {
    "securitySchemes" : {
      "myAuthorizer" : {
        "type" : "apiKey",
        "name" : "Authorization",
        "in" : "header",
        "x-amazon-apigateway-authorizer" : {
          "identitySource" : "method.request.header.Authorization",
          "authorizerUri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:account-id:function:function-name/invocations",
          "authorizerResultTtlInSeconds" : 300,
          "type" : "request",
          "enableSimpleResponses" : false
        },
        "x-amazon-apigateway-authtype": "Custom scheme with corporate claims"
      }
    }
  },
  "x-amazon-apigateway-importexport-version" : "1.0"
}
```

## See also

[authorizer.authType](#)

# x-amazon-apigateway-binary-media-types property

Specifies the list of binary media types to be supported by API Gateway, such as `application/octet-stream` and `image/jpeg`. This extension is a JSON array. It should be included as a top-level vendor extension to the OpenAPI document.

## x-amazon-apigateway-binary-media-types example

The following example shows the encoding lookup order of an API.

```
"x-amazon-apigateway-binary-media-types": [ "application/octet", "image/jpeg" ]
```

# x-amazon-apigateway-documentation object

Defines the documentation parts to be imported into API Gateway. This object is a JSON object containing an array of the `DocumentationPart` instances.

### Properties

Property name	Type	Description
<code>documentationParts</code>	Array	An array of the exported or imported <code>DocumentationPart</code> instances.
<code>version</code>	String	The version identifier of the snapshot of the exported documentation parts.

## x-amazon-apigateway-documentation example

The following example of the API Gateway extension to OpenAPI defines `DocumentationParts` instances to be imported to or exported from an API in API Gateway.

```
{ ...
  "x-amazon-apigateway-documentation": {
    "version": "1.0.3",
    "documentationParts": [
      {
        "location": {
          "type": "API"
        },
        "properties": {
          "description": "API description",
          "info": {
            "description": "API info description 4",
            "version": "API info version 3"
          }
        }
      }
    ]
  }
}
```

```
    }  
  },  
  {  
    ... // Another DocumentationPart instance  
  }  
]  
}
```

## x-amazon-apigateway-endpoint-configuration object

Specifies details of the endpoint configuration for an API. This extension is an extended property of the [OpenAPI Operation](#) object. This object should be present in [top-level vendor extensions](#) for Swagger 2.0. For OpenAPI 3.0, it should be present under the vendor extensions of the [Server object](#).

### Properties

Property name	Type	Description
<code>disableExecuteApiEndpoint</code>	Boolean	Specifies whether clients can invoke your API by using the default <code>execute-api</code> endpoint. By default, clients can invoke your API with the default <code>https://{api_id}.execute-api.{region}.amazonaws.com</code> endpoint. To require that clients use a custom domain name to invoke your API, specify <code>true</code> .
<code>vpcEndpointIds</code>	An array of <code>String</code>	A list of <code>VpcEndpoint</code> identifiers against which to create Route 53 alias records for a REST API. It is only supported for REST APIs the <code>PRIVATE</code> endpoint type.

## x-amazon-apigateway-endpoint-configuration examples

The following example associates specified VPC endpoints to the REST API.

```
"x-amazon-apigateway-endpoint-configuration": {  
  "vpcEndpointIds": ["vpce-0212a4ababd5b8c3e", "vpce-01d622316a7df47f9"]  
}
```

The following example disables the default endpoint for an API.

```
"x-amazon-apigateway-endpoint-configuration": {  
  "disableExecuteApiEndpoint": true  
}
```

## x-amazon-apigateway-gateway-responses object

Defines the gateway responses for an API as a string-to-[GatewayResponse](#) map of key-value pairs. The extension applies to the root-level OpenAPI structure.

### Properties

Property name	Type	Description
<i>responseType</i>	<a href="#">x-amazon-apigateway-gateway-responses.gatewayResponse</a> (p. 688)	A <a href="#">GatewayResponse</a> for the specified <i>responseType</i> .

## x-amazon-apigateway-gateway-responses example

The following API Gateway extension to OpenAPI example defines a [GatewayResponses](#) map that contains two [GatewayResponse](#) instances—one for the `DEFAULT_4XX` type and another for the `INVALID_API_KEY` type.

```
{
  "x-amazon-apigateway-gateway-responses": {
    "DEFAULT_4XX": {
      "responseParameters": {
        "gatewayresponse.header.Access-Control-Allow-Origin": "'domain.com'"
      },
      "responseTemplates": {
        "application/json": "{\"message\": test 4xx b }"
      }
    },
    "INVALID_API_KEY": {
      "statusCode": "429",
      "responseTemplates": {
        "application/json": "{\"message\": test forbidden }"
      }
    }
  }
}
```

## x-amazon-apigateway-gateway-responses.gatewayResponse object

Defines a gateway response of a given response type, including the status code, any applicable response parameters, or response templates.

### Properties

Property name	Type	Description
<i>responseParameters</i>	<a href="#">x-amazon-apigateway-gateway-responses.responseParameters</a> (p. 688)	Specifies the <a href="#">GatewayResponse</a> parameters, namely the header parameters. The parameter values can take any incoming <a href="#">request parameter</a> (p. 359) value or a static custom value.

Property name	Type	Description
<i>responseTemplates</i>	x-amazon-apigateway-gateway-responses.responseTemplates (p. 689)	Specifies the mapping templates of the gateway response. The templates are not processed by the VTL engine.
<i>statusCode</i>	string	An HTTP status code for the gateway response.

## x-amazon-apigateway-gateway-responses.gatewayResponse example

The following example of the API Gateway extension to OpenAPI defines a [GatewayResponse](#) to customize the `INVALID_API_KEY` response to return the status code of 456, the incoming request's `api-key` header value, and a "Bad api-key" message.

```
"INVALID_API_KEY": {
  "statusCode": "456",
  "responseParameters": {
    "gatewayresponse.header.api-key": "method.request.header.api-key"
  },
  "responseTemplates": {
    "application/json": "{\"message\": \"Bad api-key\" }"
  }
}
```

## x-amazon-apigateway-gateway-responses.responseParameters object

Defines a string-to-string map of key-value pairs to generate gateway response parameters from the incoming request parameters or using literal strings. Supported only for REST APIs.

### Properties

Property name	Type	Description
gatewayresponse. <i>param-position.param-name</i>	string	<i>param-position</i> can be header, path, or querystring. For more information, see <a href="#">Map method request data to integration request parameters</a> (p. 359).

## x-amazon-apigateway-gateway-responses.responseParameters example

The following OpenAPI extensions example shows a [GatewayResponse](#) response parameter mapping expression to enable CORS support for resources on the `*.example.domain` domains.



```
"responseParameters": {  
  "gatewayresponse.header.Access-Control-Allow-Origin": '*.example.domain',  
  "gatewayresponse.header.from-request-header" : method.request.header.Accept,  
  "gatewayresponse.header.from-request-path" : method.request.path.petId,  
  "gatewayresponse.header.from-request-query" : method.request.querystring.qname  
}
```

## x-amazon-apigateway-gateway- responses.responseTemplates object

Defines [GatewayResponse](#) mapping templates, as a string-to-string map of key-value pairs, for a given gateway response. For each key-value pair, the key is the content type. For example, "application/json" and the value is a stringified mapping template for simple variable substitutions. A [GatewayResponse](#) mapping template isn't processed by the [Velocity Template Language \(VTL\)](#) engine.

### Properties

Property name	Type	Description
<code>content-type</code>	string	A <a href="#">GatewayResponse</a> body mapping template supporting only simple variable substitution to customize a gateway response body.

## x-amazon-apigateway-gateway- responses.responseTemplates example

The following OpenAPI extensions example shows a [GatewayResponse](#) mapping template to customize an API Gateway-generated error response into an app-specific format.

```
"responseTemplates": {  
  "application/json": "{ \"message\": $context.error.messageString, \"type\":  
$context.error.responseType, \"statusCode\": '488' }"  
}
```

The following OpenAPI extensions example shows a [GatewayResponse](#) mapping template to override an API Gateway-generated error response with a static error message.

```
"responseTemplates": {  
  "application/json": "{ \"message\": 'API-specific errors' }"  
}
```

## x-amazon-apigateway-importexport-version

Specifies the version of the API Gateway import and export algorithm for HTTP APIs. Currently, the only supported value is 1.0. To learn more, see [exportVersion](#) in the *API Gateway Version 2 API Reference*.

## x-amazon-apigateway-importexport-version example

The following example sets the import and export version to 1.0.

```
{  
  "openapi": "3.0.1",  
  "x-amazon-apigateway-importexport-version": "1.0",  
  "info": { ...  
}
```

## x-amazon-apigateway-integration object

Specifies details of the backend integration used for this method. This extension is an extended property of the [OpenAPI Operation](#) object. The result is an [API Gateway integration](#) object.

### Properties

Property name	Type	Description
cacheKeyParameters	An array of string	A list of request parameters whose values are to be cached.
cacheNamespace	string	An API-specific tag group of related cached parameters.
connectionId	string	The ID of a <a href="#">VpcLink</a> for the private integration.
connectionType	string	The integration connection type. The valid value is "VPC_LINK" for private integration or "INTERNET", otherwise.
credentials	string	For Amazon IAM role-based credentials, specify the ARN of an appropriate IAM role. If unspecified, credentials default to resource-based permissions that must be added manually to allow the API to access the resource. For more information, see <a href="#">Granting Permissions Using a Resource Policy</a> .  Note: When using IAM credentials, make sure that <a href="#">Amazon STS Regional endpoints</a> are enabled for the Region where this API is deployed for best performance.
contentHandling	string	Request payload encoding conversion types. Valid values are 1) CONVERT_TO_TEXT, for converting a binary payload into a base64-encoded

Property name	Type	Description
		string or converting a text payload into a <code>utf-8</code> -encoded string or passing through the text payload natively without modification, and 2) <code>CONVERT_TO_BINARY</code> , for converting a text payload into a base64-decoded blob or passing through a binary payload natively without modification.
<code>httpMethod</code>	<code>string</code>	The HTTP method used in the integration request. For Lambda function invocations, the value must be <code>POST</code> .
<code>integrationSubtype</code>	<code>string</code>	Specifies the integration subtype for an Amazon service integration. Supported only for HTTP APIs. For supported integration subtypes, see <a href="#">the section called "Amazon service integrations reference" (p. 165)</a> .
<code>passthroughBehavior</code>	<code>string</code>	Specifies how a request payload of unmapped content type is passed through the integration request without modification. Supported values are <code>when_no_templates</code> , <code>when_no_match</code> , and <code>never</code> . For more information, see <a href="#">Integration.passthroughBehavior</a> .
<code>payloadFormatVersion</code>	<code>string</code>	Specifies the format of the payload sent to an integration. Required for HTTP APIs. For HTTP APIs, supported values for Lambda proxy integrations are <code>1.0</code> and <code>2.0</code> . For all other integrations, <code>1.0</code> is the only supported value. To learn more, see <a href="#">the section called "Amazon Lambda integrations" (p. 159)</a> and <a href="#">the section called "Amazon service integrations reference" (p. 165)</a> .

Property name	Type	Description
<code>requestParameters</code>	<a href="#">x-amazon-apigateway-integration.requestParameters</a> object (p. 698)	<p>For REST APIs, specifies mappings from method request parameters to integration request parameters. Supported request parameters are <code>querystring</code>, <code>path</code>, <code>header</code>, and <code>body</code>.</p> <p>For HTTP APIs, request parameters are a key-value map specifying parameters that are passed to <code>AWS_PROXY</code> integrations with a specified <code>integrationSubtype</code>. You can provide static values, or map request data, stage variables, or context variables that are evaluated at runtime. To learn more, see <a href="#">the section called "Amazon service integrations"</a> (p. 164).</p>
<code>requestTemplates</code>	<a href="#">x-amazon-apigateway-integration.requestTemplates</a> object (p. 697)	Mapping templates for a request payload of specified MIME types.
<code>responses</code>	<a href="#">x-amazon-apigateway-integration.responses</a> object (p. 699)	Defines the method's responses and specifies desired parameter mappings or payload mappings from integration responses to method responses.
<code>timeoutInMillis</code>	<code>integer</code>	Integration timeouts between 50 ms and 29,000 ms.

Property name	Type	Description
type	string	<p>The type of integration with the specified backend. Valid values are:</p> <ul style="list-style-type: none"><li>• <code>http</code> or <code>http_proxy</code>, for integration with an HTTP backend.</li><li>• <code>aws_proxy</code>, for integration with Amazon Lambda functions.</li><li>• <code>aws</code>, for integration with Amazon Lambda functions or other Amazon services, such as Amazon DynamoDB, Amazon Simple Notification Service, or Amazon Simple Queue Service.</li><li>• <code>mock</code>, for integration with API Gateway without invoking any backend.</li></ul> <p>For more information about the integration types, see <a href="#">integration:type</a>.</p>
tlsConfig	the section called “x-amazon-apigateway-integration.tlsConfig” (p. 703)	Specifies the TLS configuration for an integration.
uri	string	The endpoint URI of the backend. For integrations of the <code>aws</code> type, this is an ARN value. For the HTTP integration, this is the URL of the HTTP endpoint including the <code>https</code> or <code>http</code> scheme.

## x-amazon-apigateway-integration examples

For HTTP APIs, you can define integrations in the components section of your OpenAPI definition. To learn more, see [x-amazon-apigateway-integrations object](#) (p. 695).

```
"x-amazon-apigateway-integration": {  
  "$ref": "#/components/x-amazon-apigateway-integrations/integration1"  
}
```

The following example creates an integration with a Lambda function. For demonstration purposes, the sample mapping templates shown in `requestTemplates` and `responseTemplates` of the examples below are assumed to apply to the following JSON-formatted payload: `{ "name": "value_1", "key": "value_2", "redirect": { "url" : "..."} }` to generate a JSON output of `{ "stage": "value_1", "user-id": "value_2" }` or an XML output of `<stage>value_1</stage>`.

```

"x-amazon-apigateway-integration" : {
  "type" : "aws",
  "uri" : "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/
arn:aws:lambda:us-east-1:012345678901:function:HelloWorld/invocations",
  "httpMethod" : "POST",
  "credentials" : "arn:aws:iam::012345678901:role/apigateway-invoke-lambda-exec-role",
  "requestTemplates" : {
    "application/json" : "#set ($root=$input.path('$')) { \"stage\":
\"$root.name\", \"user-id\": \"$root.key\" }",
    "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</
stage> "
  },
  "requestParameters" : {
    "integration.request.path.stage" : "method.request.querystring.version",
    "integration.request.querystring.provider" : "method.request.querystring.vendor"
  },
  "cacheNamespace" : "cache namespace",
  "cacheKeyParameters" : [],
  "responses" : {
    "2\\d{2}" : {
      "statusCode" : "200",
      "responseParameters" : {
        "method.response.header.requestId" : "integration.response.header.cid"
      },
      "responseTemplates" : {
        "application/json" : "#set ($root=$input.path('$')) { \"stage\":
\"$root.name\", \"user-id\": \"$root.key\" }",
        "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</
stage> "
      }
    },
    "302" : {
      "statusCode" : "302",
      "responseParameters" : {
        "method.response.header.Location" :
"integration.response.body.redirect.url"
      }
    },
    "default" : {
      "statusCode" : "400",
      "responseParameters" : {
        "method.response.header.test-method-response-header" : "'static value'"
      }
    }
  }
}

```

Note that double quotes (") for the JSON string in the mapping templates must be string-escaped (\").

## x-amazon-apigateway-integrations object

Defines a collection of integrations. You can define integrations in the components section of your OpenAPI definition, and reuse the integrations for multiple routes. Supported only for HTTP APIs.

## Properties

Property name	Type	Description
<i>integration</i>	<a href="#">x-amazon-apigateway-integration object (p. 691)</a>	A collection of integration objects.

## x-amazon-apigateway-integrations example

The following example creates an HTTP API that defines two integrations, and references the integrations by using `$ref`: `"/components/x-amazon-apigateway-integrations/integration-name`.

```
{
  "openapi": "3.0.1",
  "info": {
    "title": "Integrations",
    "description": "An API that reuses integrations",
    "version": "1.0"
  },
  "servers": [
    {
      "url": "https://example.com/{basePath}",
      "description": "The production API server",
      "variables": {
        "basePath": {
          "default": "example/path"
        }
      }
    }
  ],
  "paths": {
    "/": {
      "get": {
        "x-amazon-apigateway-integration": {
          "$ref": "#/components/x-amazon-apigateway-integrations/integration1"
        }
      }
    },
    "/pets": {
      "get": {
        "x-amazon-apigateway-integration": {
          "$ref": "#/components/x-amazon-apigateway-integrations/integration1"
        }
      }
    },
    "/checkout": {
      "get": {
        "x-amazon-apigateway-integration": {

```

```
        {
          "$ref": "#/components/x-amazon-apigateway-integrations/integration2"
        }
      }
    },
    "components": {
      "x-amazon-apigateway-integrations": {
        "integration1": {
          "type": "aws_proxy",
          "httpMethod": "POST",
          "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/arn:aws:lambda:us-west-2:123456789012:function:my-function/invocations",
          "passthroughBehavior": "when_no_templates",
          "payloadFormatVersion": "1.0"
        },
        "integration2": {
          "type": "aws_proxy",
          "httpMethod": "POST",
          "uri": "arn:aws:apigateway:us-west-2:lambda:path/2015-03-31/functions/arn:aws:lambda:us-west-2:123456789012:function:example-function/invocations",
          "passthroughBehavior": "when_no_templates",
          "payloadFormatVersion": "1.0"
        }
      }
    }
  }
}
```

## x-amazon-apigateway-integration.requestTemplates object

Specifies mapping templates for a request payload of the specified MIME types.

### Properties

Property name	Type	Description
<i>MIME type</i>	string	An example of the MIME type is <code>application/json</code> . For information about creating a mapping template, see <a href="#">Mapping templates (p. 334)</a> .

## x-amazon-apigateway-integration.requestTemplates example

The following example sets mapping templates for a request payload of the `application/json` and `application/xml` MIME types.



```
"requestTemplates" : {
  "application/json" : "#set ($root=$input.path('$')) { \"stage\": \"$root.name\",
  \"user-id\": \"$root.key\" }",
  "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</stage> "
}
```

## x-amazon-apigateway-integration.requestParameters object

For REST APIs, specifies mappings from named method request parameters to integration request parameters. The method request parameters must be defined before being referenced.

For HTTP APIs, specifies parameters that are passed to `AWS_PROXY` integrations with a specified `integrationSubtype`.

### Properties

Property name	Type	Description
<code>integration.request.&lt;param-type&gt;.&lt;param-name&gt;</code>	string	For REST APIs, the value is typically a predefined method request parameter of the <code>method.request.&lt;param-type&gt;.&lt;param-name&gt;</code> format, where <code>&lt;param-type&gt;</code> can be <code>querystring</code> , <code>path</code> , <code>header</code> , or <code>body</code> . However, <code>\$context.VARIABLE_NAME</code> , <code>\$stageVariables.VARIABLE_NAME</code> , and <code>STATIC_VALUE</code> are also valid. For the body parameter, the <code>&lt;param-name&gt;</code> is a JSON path expression without the <code>\$</code> prefix.
<code>parameter</code>	string	For HTTP APIs, request parameters are a key-value map specifying parameters that are passed to <code>AWS_PROXY</code> integrations with a specified <code>integrationSubtype</code> . You can provide static values, or map request data, stage variables, or context variables that are evaluated at runtime. To learn more, see <a href="#">the section called "Amazon service integrations" (p. 164)</a> .

## x-amazon-apigateway- integration.requestParameters example

The following request parameter mappings example translates a method request's query (`version`), header (`x-user-id`), and path (`service`) parameters to the integration request's query (`stage`), header (`x-userid`), and path parameters (`op`), respectively.

### Note

If you're creating resources through OpenAPI or Amazon CloudFormation, static values should be enclosed in single quotes.

To add this value from the console, enter `application/json` in the box, without quotation marks.

```
"requestParameters" : {  
  "integration.request.querystring.stage" : "method.request.querystring.version",  
  "integration.request.header.x-userid" : "method.request.header.x-user-id",  
  "integration.request.path.op" : "method.request.path.service"  
},
```

## x-amazon-apigateway-integration.responses object

Defines the method's responses and specifies parameter mappings or payload mappings from integration responses to method responses.

### Properties

Property name	Type	Description
<i>Response status pattern</i>	<a href="#">x-amazon-apigateway-integration.response object (p. 700)</a>	Either a regular expression used to match the integration response to the method response, or <code>default</code> to catch any response that you haven't configured. For HTTP integrations, the regex applies to the integration response status code. For Lambda invocations, the regex applies to the <code>errorMessage</code> field of the error information object returned by Amazon Lambda as a failure response body when the Lambda function execution throws an exception.  <b>Note</b> The <i>Response status pattern</i> property

Property name	Type	Description
		name refers to a response status code or regular expression describing a group of response status codes. It does not correspond to any identifier of an <a href="#">IntegrationResponse</a> resource in the API Gateway REST API.

## x-amazon-apigateway-integration.responses example

The following example shows a list of responses from 2xx and 302 responses. For the 2xx response, the method response is mapped from the integration response's payload of the `application/json` or `application/xml` MIME type. This response uses the supplied mapping templates. For the 302 response, the method response returns a `Location` header whose value is derived from the `redirect.url` property on the integration response's payload.

```
"responses" : {
  "2\\d{2}" : {
    "statusCode" : "200",
    "responseTemplates" : {
      "application/json" : "#set ($root=$input.path('$')) { \"stage\": \"$root.name\", \"user-id\": \"$root.key\" }",
      "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</stage> "
    }
  },
  "302" : {
    "statusCode" : "302",
    "responseParameters" : {
      "method.response.header.Location": "integration.response.body.redirect.url"
    }
  }
}
```

## x-amazon-apigateway-integration.response object

Defines a response and specifies parameter mappings or payload mappings from the integration response to the method response.

### Properties

Property name	Type	Description
statusCode	string	HTTP status code for the method response; for example,

Property name	Type	Description
		"200". This must correspond to a matching response in the <a href="#">OpenAPI Operation</a> responses field.
responseTemplates	<a href="#">x-amazon-apigateway-integration.responseTemplates</a> object (p. 702)	Specifies MIME type-specific mapping templates for the response's payload.
responseParameters	<a href="#">x-amazon-apigateway-integration.responseParameters</a> object (p. 702)	Specifies parameter mappings for the response. Only the header and body parameters of the integration response can be mapped to the header parameters of the method.
contentHandling	string	Response payload encoding conversion types. Valid values are 1) <code>CONVERT_TO_TEXT</code> , for converting a binary payload into a base64-encoded string or converting a text payload into a <code>utf-8</code> -encoded string or passing through the text payload natively without modification, and 2) <code>CONVERT_TO_BINARY</code> , for converting a text payload into a base64-decoded blob or passing through a binary payload natively without modification.

## x-amazon-apigateway-integration.response example

The following example defines a 302 response for the method that derives a payload of the `application/json` or `application/xml` MIME type from the backend. The response uses the supplied mapping templates and returns the redirect URL from the integration response in the method's `Location` header.

```
{
  "statusCode" : "302",
  "responseTemplates" : {
    "application/json" : "#set ($root=$input.path('$')) { \"stage\": \"$root.name\",
    \"user-id\": \"$root.key\" }",
    "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</stage> "
  },
  "responseParameters" : {
    "method.response.header.Location": "integration.response.body.redirect.url"
  }
}
```

## x-amazon-apigateway-integration.responseTemplates object

Specifies mapping templates for a response payload of the specified MIME types.

### Properties

Property name	Type	Description
<i>MIME type</i>	string	Specifies a mapping template to transform the integration response body to the method response body for a given MIME type. For information about creating a mapping template, see <a href="#">Mapping templates (p. 334)</a> . An example of the <i>MIME type</i> is <code>application/json</code> .

## x-amazon-apigateway-integration.responseTemplate example

The following example sets mapping templates for a request payload of the `application/json` and `application/xml` MIME types.

```
"responseTemplates" : {  
  "application/json" : "#set ($root=$input.path('$')) { \"stage\": \"$root.name\",  
  \"user-id\": \"$root.key\" }",  
  "application/xml" : "#set ($root=$input.path('$')) <stage>$root.name</stage> "  
}
```

## x-amazon-apigateway-integration.responseParameters object

Specifies mappings from integration method response parameters to method response parameters. You can map header, body, or static values to the header type of the method response. Supported only for REST APIs.

### Properties

Property name	Type	Description
<code>method.response.header.&lt;parameter name&gt;</code>	string	The named parameter value can be derived from the header and body types of the integration response parameters.

## x-amazon-apigateway- integration.responseParameters example

The following example maps body and header parameters of the integration response to two header parameters of the method response.

```
"responseParameters" : {  
  "method.response.header.Location" : "integration.response.body.redirect.url",  
  "method.response.header.x-user-id" : "integration.response.header.x-userid"  
}
```

## x-amazon-apigateway-integration.tlsConfig object

Specifies the TLS configuration for an integration.

### Properties

Property name	Type	Description
<code>insecureSkipVerification</code>	Boolean	Supported only for REST APIs. Specifies whether or not API Gateway skips verification that the certificate for an integration endpoint is issued by a <a href="#">supported certificate authority</a> . This isn't recommended, but it enables you to use certificates that are signed by private certificate authorities, or certificates that are self-signed. If enabled, API Gateway still performs basic certificate validation, which includes checking the certificate's expiration date, hostname, and presence of a root certificate authority. Supported only for HTTP and HTTP_PROXY integrations.
<code>serverNameToVerify</code>	string	Supported only for HTTP API private integrations. If you specify a server name, API Gateway uses it to verify the hostname on the integration's certificate. The server name is also included in the TLS handshake to support Server Name Indication (SNI) or virtual hosting.

## x-amazon-apigateway-integration.tlsConfig examples

The following OpenAPI 3.0 example enables `insecureSkipVerification` for a REST API HTTP proxy integration.

```
"x-amazon-apigateway-integration": {
  "uri": "http://petstore-demo-endpoint.execute-api.com/petstore/pets",
  "responses": {
    "default": {
      "statusCode": "200"
    }
  },
  "passthroughBehavior": "when_no_match",
  "httpMethod": "ANY",
  "tlsConfig": {
    "insecureSkipVerification": true
  }
  "type": "http_proxy",
}
```

The following OpenAPI 3.0 example specifies a `serverNameToVerify` for an HTTP API private integration.

```
"x-amazon-apigateway-integration" : {
  "payloadFormatVersion" : "1.0",
  "connectionId" : "abc123",
  "type" : "http_proxy",
  "httpMethod" : "ANY",
  "uri" : "arn:aws:elasticloadbalancing:us-west-2:123456789012:listener/app/my-load-balancer/50dc6c495c0c9188/0467ef3c8400ae65",
  "connectionType" : "VPC_LINK",
  "tlsConfig" : {
    "serverNameToVerify" : "example.com"
  }
}
```

## x-amazon-apigateway-minimum-compression-size

Specifies the minimum compression size for a REST API. To enable compression, specify an integer between 0 and 10485760. To learn more, see [Enabling payload compression for an API \(p. 487\)](#).

### x-amazon-apigateway-minimum-compression-size example

The following example specifies a minimum compression size of 5242880 bytes for a REST API.

```
"x-amazon-apigateway-minimum-compression-size": 5242880
```

## x-amazon-apigateway-policy

Specifies a resource policy for a REST API. To learn more about resource policies, see [Controlling access to an API with API Gateway resource policies \(p. 237\)](#). For resource policy examples, see [API Gateway resource policy examples \(p. 242\)](#).

## x-amazon-apigateway-policy example

The following example specifies a resource policy for a REST API. The resource policy denies (blocks) incoming traffic to an API from a specified source IP address block. On import, "execute-api:/\*" is converted to arn:aws:execute-api:*region*:*account-id*:*api-id*/\*, using the current Region, your Amazon account ID, and the current REST API ID.

```
"x-amazon-apigateway-policy": {
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api:/*"
      ]
    },
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "execute-api:Invoke",
      "Resource": [
        "execute-api:/*"
      ],
      "Condition": {
        "IpAddress": {
          "aws:SourceIp": "192.0.2.0/24"
        }
      }
    }
  ]
}
```

## x-amazon-apigateway-request-validator property

Specifies a request validator, by referencing a *request\_validator\_name* of the [x-amazon-apigateway-request-validators object](#) (p. 706) map, to enable request validation on the containing API or a method. The value of this extension is a JSON string.

This extension can be specified at the API level or at the method level. The API-level validator applies to all of the methods unless it is overridden by the method-level validator.

## x-amazon-apigateway-request-validator example

The following example applies the `basic` request validator at the API level while applying the `parameter-only` request validator on the `POST /validation` request.

OpenAPI 2.0

```
{
  "swagger": "2.0",
  "x-amazon-apigateway-request-validators" : {
    "basic" : {
      "validateRequestBody" : true,
      "validateRequestParameters" : true
    }
  }
}
```



```
    },  
    "params-only" : {  
      "validateRequestBody" : false,  
      "validateRequestParameters" : true  
    }  
  },  
  "x-amazon-apigateway-request-validator" : "basic",  
  "paths": {  
    "/validation": {  
      "post": {  
        "x-amazon-apigateway-request-validator" : "params-only",  
        ...  
      }  
    }  
  }  
}
```

## x-amazon-apigateway-request-validators object

Defines the supported request validators for the containing API as a map between a validator name and the associated request validation rules. This extension applies to a REST API.

### Properties

Property name	Type	Description
<i>request_validator_name</i>	<a href="#">x-amazon-apigateway-request-validators.requestValidator</a> object (p. 707)	<p>Specifies the validation rules consisting of the named validator. For example:</p> <pre>"basic" : {   "validateRequestBody" :   true,   "validateRequestParameters" :   true },</pre> <p>To apply this validator to a specific method, reference the validator name (<a href="#">basic</a>) as the value of the <a href="#">x-amazon-apigateway-request-validator</a> property (p. 705) property.</p>

## x-amazon-apigateway-request-validators example

The following example shows a set of request validators for an API as a map between a validator name and the associated request validation rules.

OpenAPI 2.0

```
{
```

```
"swagger": "2.0",
...
"x-amazon-apigateway-request-validators" : {
  "basic" : {
    "validateRequestBody" : true,
    "validateRequestParameters" : true
  },
  "params-only" : {
    "validateRequestBody" : false,
    "validateRequestParameters" : true
  }
},
...
}
```

## x-amazon-apigateway-request-validators.requestValidator object

Specifies the validation rules of a request validator as part of the [x-amazon-apigateway-request-validators object](#) (p. 706) map definition.

### Properties

Property name	Type	Description
validateRequestBody	Boolean	Specifies whether to validate the request body ( <code>true</code> ) or not ( <code>false</code> ).
validateRequestParameters	Boolean	Specifies whether to validate the required request parameters ( <code>true</code> ) or not ( <code>false</code> ).

## x-amazon-apigateway-request-validators.requestValidator example

The following example shows a parameter-only request validator:

```
"params-only": {
  "validateRequestBody" : false,
  "validateRequestParameters" : true
}
```

## x-amazon-apigateway-tag-value property

Specifies the value of an [Amazon tag](#) for an HTTP API. You can use the `x-amazon-apigateway-tag-value` property as part of the root-level [OpenAPI tag object](#) to specify Amazon tags for an HTTP API. If you specify a tag name without the `x-amazon-apigateway-tag-value` property, API Gateway creates a tag with an empty string for a value.

To learn more about tagging, see [Tagging your API Gateway resources](#) (p. 737).

## Properties

Property name	Type	Description
name	String	Specifies the tag key.
x-amazon-apigateway-tag-value	String	Specifies the tag value.

## x-amazon-apigateway-tag-value example

The following example specifies two tags for an HTTP API:

- "Owner": "Admin"
- "Prod": ""

```
"tags": [  
  {  
    "name": "Owner",  
    "x-amazon-apigateway-tag-value": "Admin"  
  },  
  {  
    "name": "Prod"  
  }  
]
```

# Security in Amazon API Gateway

Cloud security at Amazon is the highest priority. As an Amazon customer, you benefit from a data center and network architecture that is built to meet the requirements of the most security-sensitive organizations.

Security is a shared responsibility between Amazon and you. The [shared responsibility model](#) describes this as security *of* the cloud and security *in* the cloud:

- **Security of the cloud** – Amazon is responsible for protecting the infrastructure that runs Amazon services in the Amazon Cloud. Amazon also provides you with services that you can use securely. Third-party auditors regularly test and verify the effectiveness of our security as part of the [Amazon Compliance Programs](#). To learn about the compliance programs that apply to Amazon API Gateway, see [Amazon services in scope by compliance program](#).
- **Security in the cloud** – Your responsibility is determined by the Amazon service that you use. You are also responsible for other factors including the sensitivity of your data, your company's requirements, and applicable laws and regulations.

This documentation helps you understand how to apply the shared responsibility model when using API Gateway. The following topics show you how to configure API Gateway to meet your security and compliance objectives. You also learn how to use other Amazon services that help you to monitor and secure your API Gateway resources.

## Topics

- [Data protection in Amazon API Gateway \(p. 709\)](#)
- [Identity and access management for Amazon API Gateway \(p. 711\)](#)
- [Logging and monitoring in Amazon API Gateway \(p. 729\)](#)
- [Compliance validation for Amazon API Gateway \(p. 734\)](#)
- [Resilience in Amazon API Gateway \(p. 734\)](#)
- [Infrastructure security in Amazon API Gateway \(p. 734\)](#)
- [Vulnerability analysis in Amazon API Gateway \(p. 735\)](#)
- [Security best practices in Amazon API Gateway \(p. 735\)](#)

## Data protection in Amazon API Gateway

The Amazon [shared responsibility model](#) applies to data protection in Amazon API Gateway. As described in this model, Amazon is responsible for protecting the global infrastructure that runs all of the Amazon Web Services Cloud. You are responsible for maintaining control over your content that is hosted on this infrastructure. This content includes the security configuration and management tasks for the Amazon Web Services that you use. For more information about data privacy, see the [Data Privacy FAQ](#).

For data protection purposes, we recommend that you protect Amazon Web Services account credentials and set up individual user accounts with Amazon Identity and Access Management (IAM). That way each user is given only the permissions necessary to fulfill their job duties. We also recommend that you secure your data in the following ways:

- Use multi-factor authentication (MFA) with each account.
- Use SSL/TLS to communicate with Amazon resources. We recommend TLS 1.2 or later.

- Set up API and user activity logging with Amazon CloudTrail.
- Use Amazon encryption solutions, along with all default security controls within Amazon services.
- Use advanced managed security services such as Amazon Macie, which assists in discovering and securing personal data that is stored in Amazon S3.
- If you require FIPS 140-2 validated cryptographic modules when accessing Amazon through a command line interface or an API, use a FIPS endpoint. For more information about the available FIPS endpoints, see [Federal Information Processing Standard \(FIPS\) 140-2](#).

We strongly recommend that you never put confidential or sensitive information, such as your customers' email addresses, into tags or free-form fields such as a **Name** field. This includes when you work with API Gateway or other Amazon services using the console, API, Amazon CLI, or Amazon SDKs. Any data that you enter into tags or free-form fields used for names may be used for billing or diagnostic logs. If you provide a URL to an external server, we strongly recommend that you do not include credentials information in the URL to validate your request to that server.

## Data encryption in Amazon API Gateway

Data protection refers to protecting data while in transit (as it travels to and from API Gateway) and at rest (while it is stored in Amazon).

### Data encryption at rest in Amazon API Gateway

If you choose to enable caching for a REST API, you can enable cache encryption. To learn more, see [Enabling API caching to enhance responsiveness \(p. 483\)](#).

For more information about data protection, see the [Amazon Shared Responsibility Model and GDPR](#) blog post on the *Amazon Security Blog*.

### Data encryption in transit in Amazon API Gateway

The APIs created with Amazon API Gateway expose HTTPS endpoints only. API Gateway doesn't support unencrypted (HTTP) endpoints.

For greater security, you can choose a minimum Transport Layer Security (TLS) protocol version to be enforced for your API Gateway custom domain. You can choose either a TLS version 1.2 or TLS version 1.0 security policy. WebSocket APIs and HTTP APIs support only TLS 1.2. To learn more, see [Choosing a minimum TLS version for a custom domain in API Gateway \(p. 468\)](#).

You can also set up a Amazon CloudFront distribution with a custom SSL certificate in your account and use it with Regional APIs. You can then configure the security policy for the CloudFront distribution with TLS 1.1 or higher based on your security and compliance requirements.

For more information about data protection, see [Protecting your REST API \(p. 564\)](#) and the [Amazon Shared Responsibility Model and GDPR](#) blog post on the *Amazon Security Blog*.

## Internetwork traffic privacy

Using Amazon API Gateway, you can create private REST APIs that can be accessed only from your Amazon Virtual Private Cloud (VPC). The VPC uses an [interface VPC endpoint](#), which is an endpoint network interface that you create in your VPC. Using [resource policies \(p. 603\)](#), you can allow or deny access to your API from selected VPCs and VPC endpoints, including across Amazon accounts. Each endpoint can be used to access multiple private APIs. You can also use Amazon Direct Connect to establish a connection from an on-premises network to Amazon VPC and access your private API over that connection. In all cases, traffic to your private API uses secure connections and does not leave the

Amazon network; it is isolated from the public internet. To learn more, see [the section called “Private APIs” \(p. 599\)](#).

## Identity and access management for Amazon API Gateway

Amazon Identity and Access Management (IAM) is an Amazon Web Service that helps an administrator securely control access to Amazon resources. IAM administrators control who can be *authenticated* (signed in) and *authorized* (have permissions) to use API Gateway resources. IAM is an Amazon Web Service that you can use with no additional charge.

### Topics

- [Audience \(p. 711\)](#)
- [Authenticating with identities \(p. 711\)](#)
- [Managing access using policies \(p. 713\)](#)
- [How Amazon API Gateway works with IAM \(p. 715\)](#)
- [Amazon API Gateway identity-based policy examples \(p. 718\)](#)
- [Amazon API Gateway resource-based policy examples \(p. 724\)](#)
- [Troubleshooting Amazon API Gateway identity and access \(p. 724\)](#)
- [Using service-linked roles for API Gateway \(p. 726\)](#)

## Audience

How you use Amazon Identity and Access Management (IAM) differs, depending on the work that you do in API Gateway.

**Service user** – If you use the API Gateway service to do your job, then your administrator provides you with the credentials and permissions that you need. As you use more API Gateway features to do your work, you might need additional permissions. Understanding how access is managed can help you request the right permissions from your administrator. If you cannot access a feature in API Gateway, see [Troubleshooting Amazon API Gateway identity and access \(p. 724\)](#).

**Service administrator** – If you're in charge of API Gateway resources at your company, you probably have full access to API Gateway. It's your job to determine which API Gateway features and resources your employees should access. You must then submit requests to your IAM administrator to change the permissions of your service users. Review the information on this page to understand the basic concepts of IAM. To learn more about how your company can use IAM with API Gateway, see [How Amazon API Gateway works with IAM \(p. 715\)](#).

**IAM administrator** – If you're an IAM administrator, you might want to learn details about how you can write policies to manage access to API Gateway. To view example API Gateway identity-based policies that you can use in IAM, see [Amazon API Gateway identity-based policy examples \(p. 718\)](#).

## Authenticating with identities

Authentication is how you sign in to Amazon using your identity credentials. For more information about signing in using the Amazon Web Services Management Console, see [Signing in to the Amazon Web Services Management Console as an IAM user or root user](#) in the *IAM User Guide*.

You must be *authenticated* (signed in to Amazon) as the Amazon Web Services account root user, an IAM user, or by assuming an IAM role. You can also use your company's single sign-on authentication or even

sign in using Google or Facebook. In these cases, your administrator previously set up identity federation using IAM roles. When you access Amazon using credentials from another company, you are assuming a role indirectly.

To sign in directly to the [Amazon Web Services Management Console](#), use your password with your root user email address or your IAM user name. You can access Amazon programmatically using your root user or IAM users access keys. Amazon provides SDK and command line tools to cryptographically sign your request using your credentials. If you don't use Amazon tools, you must sign the request yourself. Do this using *Signature Version 4*, a protocol for authenticating inbound API requests. For more information about authenticating requests, see [Signature Version 4 signing process](#) in the *Amazon General Reference*.

Regardless of the authentication method that you use, you might also be required to provide additional security information. For example, Amazon recommends that you use multi-factor authentication (MFA) to increase the security of your account. To learn more, see [Using multi-factor authentication \(MFA\) in Amazon](#) in the *IAM User Guide*.

## Amazon Web Services account root user

When you first create an Amazon Web Services account, you begin with a single sign-in identity that has complete access to all Amazon Web Services and resources in the account. This identity is called the Amazon Web Services account *root user* and is accessed by signing in with the email address and password that you used to create the account. We strongly recommend that you do not use the root user for your everyday tasks, even the administrative ones. Instead, adhere to the [best practice of using the root user only to create your first IAM user](#). Then securely lock away the root user credentials and use them to perform only a few account and service management tasks.

## IAM users and groups

An *IAM user* is an identity within your Amazon Web Services account that has specific permissions for a single person or application. An IAM user can have long-term credentials such as a user name and password or a set of access keys. To learn how to generate access keys, see [Managing access keys for IAM users](#) in the *IAM User Guide*. When you generate access keys for an IAM user, make sure you view and securely save the key pair. You cannot recover the secret access key in the future. Instead, you must generate a new access key pair.

An *IAM group* is an identity that specifies a collection of IAM users. You can't sign in as a group. You can use groups to specify permissions for multiple users at a time. Groups make permissions easier to manage for large sets of users. For example, you could have a group named *IAMAdmins* and give that group permissions to administer IAM resources.

Users are different from roles. A user is uniquely associated with one person or application, but a role is intended to be assumable by anyone who needs it. Users have permanent long-term credentials, but roles provide temporary credentials. To learn more, see [When to create an IAM user \(instead of a role\)](#) in the *IAM User Guide*.

## IAM roles

An *IAM role* is an identity within your Amazon Web Services account that has specific permissions. It is similar to an IAM user, but is not associated with a specific person. You can temporarily assume an IAM role in the Amazon Web Services Management Console by [switching roles](#). You can assume a role by calling an Amazon CLI or Amazon API operation or by using a custom URL. For more information about methods for using roles, see [Using IAM roles](#) in the *IAM User Guide*.

IAM roles with temporary credentials are useful in the following situations:

- **Temporary IAM user permissions** – An IAM user can assume an IAM role to temporarily take on different permissions for a specific task.

- **Federated user access** – Instead of creating an IAM user, you can use existing identities from Amazon Directory Service, your enterprise user directory, or a web identity provider. These are known as *federated users*. Amazon assigns a role to a federated user when access is requested through an [identity provider](#). For more information about federated users, see [Federated users and roles](#) in the *IAM User Guide*.
- **Cross-account access** – You can use an IAM role to allow someone (a trusted principal) in a different account to access resources in your account. Roles are the primary way to grant cross-account access. However, with some Amazon Web Services, you can attach a policy directly to a resource (instead of using a role as a proxy). To learn the difference between roles and resource-based policies for cross-account access, see [How IAM roles differ from resource-based policies](#) in the *IAM User Guide*.
- **Cross-service access** – Some Amazon Web Services use features in other Amazon Web Services. For example, when you make a call in a service, it's common for that service to run applications in Amazon EC2 or store objects in Amazon S3. A service might do this using the calling principal's permissions, using a service role, or using a service-linked role.
  - **Principal permissions** – When you use an IAM user or role to perform actions in Amazon, you are considered a principal. Policies grant permissions to a principal. When you use some services, you might perform an action that then triggers another action in a different service. In this case, you must have permissions to perform both actions. To see whether an action requires additional dependent actions in a policy, see [Actions, Resources, and Condition Keys for Amazon API Gateway](#) in the *Service Authorization Reference*.
  - **Service role** – A service role is an [IAM role](#) that a service assumes to perform actions on your behalf. An IAM administrator can create, modify, and delete a service role from within IAM. For more information, see [Creating a role to delegate permissions to an Amazon Web Service](#) in the *IAM User Guide*.
  - **Service-linked role** – A service-linked role is a type of service role that is linked to an Amazon Web Service. The service can assume the role to perform an action on your behalf. Service-linked roles appear in your IAM account and are owned by the service. An IAM administrator can view, but not edit the permissions for service-linked roles.
- **Applications running on Amazon EC2** – You can use an IAM role to manage temporary credentials for applications that are running on an EC2 instance and making Amazon CLI or Amazon API requests. This is preferable to storing access keys within the EC2 instance. To assign an Amazon role to an EC2 instance and make it available to all of its applications, you create an instance profile that is attached to the instance. An instance profile contains the role and enables programs that are running on the EC2 instance to get temporary credentials. For more information, see [Using an IAM role to grant permissions to applications running on Amazon EC2 instances](#) in the *IAM User Guide*.

To learn whether to use IAM roles or IAM users, see [When to create an IAM role \(instead of a user\)](#) in the *IAM User Guide*.

## Managing access using policies

You control access in Amazon by creating policies and attaching them to IAM identities or Amazon resources. A policy is an object in Amazon that, when associated with an identity or resource, defines their permissions. You can sign in as the root user or an IAM user, or you can assume an IAM role. When you then make a request, Amazon evaluates the related identity-based or resource-based policies. Permissions in the policies determine whether the request is allowed or denied. Most policies are stored in Amazon as JSON documents. For more information about the structure and contents of JSON policy documents, see [Overview of JSON policies](#) in the *IAM User Guide*.

Administrators can use Amazon JSON policies to specify who has access to what. That is, which **principal** can perform **actions** on what **resources**, and under what **conditions**.

Every IAM entity (user or role) starts with no permissions. In other words, by default, users can do nothing, not even change their own password. To give a user permission to do something, an administrator must attach a permissions policy to a user. Or the administrator can add the user to a



group that has the intended permissions. When an administrator gives permissions to a group, all users in that group are granted those permissions.

IAM policies define permissions for an action regardless of the method that you use to perform the operation. For example, suppose that you have a policy that allows the `iam:GetRole` action. A user with that policy can get role information from the Amazon Web Services Management Console, the Amazon CLI, or the Amazon API.

## Identity-based policies

Identity-based policies are JSON permissions policy documents that you can attach to an identity, such as an IAM user, group of users, or role. These policies control what actions users and roles can perform, on which resources, and under what conditions. To learn how to create an identity-based policy, see [Creating IAM policies](#) in the *IAM User Guide*.

Identity-based policies can be further categorized as *inline policies* or *managed policies*. Inline policies are embedded directly into a single user, group, or role. Managed policies are standalone policies that you can attach to multiple users, groups, and roles in your Amazon Web Services account. Managed policies include Amazon managed policies and customer managed policies. To learn how to choose between a managed policy or an inline policy, see [Choosing between managed policies and inline policies](#) in the *IAM User Guide*.

## Resource-based policies

Resource-based policies are JSON policy documents that you attach to a resource. Examples of resource-based policies are *IAM role trust policies* and *Amazon S3 bucket policies*. In services that support resource-based policies, service administrators can use them to control access to a specific resource. For the resource where the policy is attached, the policy defines what actions a specified principal can perform on that resource and under what conditions. You must [specify a principal](#) in a resource-based policy. Principals can include accounts, users, roles, federated users, or Amazon Web Services.

Resource-based policies are inline policies that are located in that service. You can't use Amazon managed policies from IAM in a resource-based policy.

## Access control lists (ACLs)

Access control lists (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they do not use the JSON policy document format.

Amazon S3, Amazon WAF, and Amazon VPC are examples of services that support ACLs. To learn more about ACLs, see [Access control list \(ACL\) overview](#) in the *Amazon Simple Storage Service Developer Guide*.

## Other policy types

Amazon supports additional, less-common policy types. These policy types can set the maximum permissions granted to you by the more common policy types.

- **Permissions boundaries** – A permissions boundary is an advanced feature in which you set the maximum permissions that an identity-based policy can grant to an IAM entity (IAM user or role). You can set a permissions boundary for an entity. The resulting permissions are the intersection of entity's identity-based policies and its permissions boundaries. Resource-based policies that specify the user or role in the `Principal` field are not limited by the permissions boundary. An explicit deny in any of these policies overrides the allow. For more information about permissions boundaries, see [Permissions boundaries for IAM entities](#) in the *IAM User Guide*.
- **Service control policies (SCPs)** – SCPs are JSON policies that specify the maximum permissions for an organization or organizational unit (OU) in Amazon Organizations. Amazon Organizations is a service

for grouping and centrally managing multiple Amazon Web Services accounts that your business owns. If you enable all features in an organization, then you can apply service control policies (SCPs) to any or all of your accounts. The SCP limits permissions for entities in member accounts, including each Amazon Web Services account root user. For more information about Organizations and SCPs, see [How SCPs work](#) in the *Amazon Organizations User Guide*.

- **Session policies** – Session policies are advanced policies that you pass as a parameter when you programmatically create a temporary session for a role or federated user. The resulting session's permissions are the intersection of the user or role's identity-based policies and the session policies. Permissions can also come from a resource-based policy. An explicit deny in any of these policies overrides the allow. For more information, see [Session policies](#) in the *IAM User Guide*.

## Multiple policy types

When multiple types of policies apply to a request, the resulting permissions are more complicated to understand. To learn how Amazon determines whether to allow a request when multiple policy types are involved, see [Policy evaluation logic](#) in the *IAM User Guide*.

## How Amazon API Gateway works with IAM

Before you use IAM to manage access to API Gateway, you should understand what IAM features are available to use with API Gateway. To get a high-level view of how API Gateway and other Amazon services work with IAM, see [Amazon Services That Work with IAM](#) in the *IAM User Guide*.

### Topics

- [API Gateway identity-based policies](#) (p. 715)
- [API Gateway resource-based policies](#) (p. 718)
- [Authorization based on API Gateway tags](#) (p. 718)
- [API Gateway IAM roles](#) (p. 718)

## API Gateway identity-based policies

With IAM identity-based policies, you can specify which actions and resources are allowed or denied as well as the conditions under which actions are allowed or denied. API Gateway supports specific actions, resources, and condition keys. For more information about the API Gateway-specific actions, resources, and condition keys, see [Actions, resources, and condition keys for Amazon API Gateway Management](#) and [Actions, resources, and condition keys for Amazon API Gateway Management V2](#). For information about all of the elements that you use in a JSON policy, see [IAM JSON Policy Elements Reference](#) in the *IAM User Guide*.

The following example shows an identity-based policy that allows a user to create or update only private REST APIs. For more examples, see [the section called "Identity-based policy examples" \(p. 718\)](#).

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "ScopeToPrivateApis",
      "Effect": "Allow",
      "Action": [
        "apigateway:PATCH",
        "apigateway:POST",
        "apigateway:PUT"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::/restapis",

```

```
    "arn:aws:apigateway:us-east-1::restapis/?????????"
  ],
  "Condition": {
    "ForAllValues:StringEqualsIfExists": {
      "apigateway:Request/EndpointType": "PRIVATE",
      "apigateway:Resource/EndpointType": "PRIVATE"
    }
  }
},
{
  "Sid": "AllowResourcePolicyUpdates",
  "Effect": "Allow",
  "Action": [
    "apigateway:UpdateRestApiPolicy"
  ],
  "Resource": [
    "arn:aws:apigateway:us-east-1::restapis/*"
  ]
}
]
```

## Actions

The `Action` element of a JSON policy describes the actions that you can use to allow or deny access in a policy.

Policy actions in API Gateway use the following prefix before the action: `apigateway:`. Policy statements must include either an `Action` or `NotAction` element. API Gateway defines its own set of actions that describe tasks that you can perform with this service.

The API-managing `Action` expression has the format `apigateway:action`, where `action` is one of the following API Gateway actions: **GET**, **POST**, **PUT**, **DELETE**, **PATCH** (to update resources), or **\***, which is all of the previous actions.

Some examples of the `Action` expression include:

- `apigateway:*` for all API Gateway actions.
- `apigateway:GET` for just the GET action in API Gateway.

To specify multiple actions in a single statement, separate them with commas as follows:

```
"Action": [
  "apigateway:action1",
  "apigateway:action2"
```

For information about HTTP verbs to use for specific API Gateway operations, see [Amazon API Gateway Version 1 API Reference](#) (REST APIs) and [Amazon API Gateway Version 2 API Reference](#) (WebSocket and HTTP APIs).

For more information, see [the section called “Identity-based policy examples”](#) (p. 718).

## Resources

Administrators can use Amazon JSON policies to specify who has access to what. That is, which **principal** can perform **actions** on what **resources**, and under what **conditions**.

The `Resource` JSON policy element specifies the object or objects to which the action applies. Statements must include either a `Resource` or a `NotResource` element. As a best practice, specify

a resource using its [Amazon Resource Name \(ARN\)](#). You can do this for actions that support a specific resource type, known as *resource-level permissions*.

For actions that don't support resource-level permissions, such as listing operations, use a wildcard (\*) to indicate that the statement applies to all resources.

```
"Resource": "*" 
```

API Gateway resources have the following ARN format:

```
arn:aws:apigateway:region::resource-path-specifier
```

For example, to specify a REST API with the id *api-id* and its sub-resources, such as authorizers in your statement, use the following ARN:

```
"Resource": "arn:aws:apigateway:us-west-2::/restapis/api-id/*" 
```

To specify all REST APIs and sub-resources that belong to a specific account, use the wildcard (\*):

```
"Resource": "arn:aws:apigateway:us-west-2::/restapis/*" 
```

For a list of API Gateway resource types and their ARNs, see [API Gateway Amazon Resource Name \(ARN\) reference \(p. 670\)](#).

## Condition keys

Administrators can use Amazon JSON policies to specify who has access to what. That is, which **principal** can perform **actions** on what **resources**, and under what **conditions**.

The `Condition` element (or *Condition block*) lets you specify conditions in which a statement is in effect. The `Condition` element is optional. You can create conditional expressions that use [condition operators](#), such as equals or less than, to match the condition in the policy with values in the request.

If you specify multiple `Condition` elements in a statement, or multiple keys in a single `Condition` element, Amazon evaluates them using a logical AND operation. If you specify multiple values for a single condition key, Amazon evaluates the condition using a logical OR operation. All of the conditions must be met before the statement's permissions are granted.

You can also use placeholder variables when you specify conditions. For example, you can grant an IAM user permission to access a resource only if it is tagged with their IAM user name. For more information, see [IAM policy elements: variables and tags](#) in the *IAM User Guide*.

Amazon supports global condition keys and service-specific condition keys. To see all Amazon global condition keys, see [Amazon global condition context keys](#) in the *IAM User Guide*.

API Gateway defines its own set of condition keys and also supports using some global condition keys. For a list of API Gateway condition keys, see [Condition Keys for Amazon API Gateway](#) in the *IAM User Guide*. For information about which actions and resources you can use with a condition key, see [Actions Defined by Amazon API Gateway](#).

For information about tagging, including attribute-based access control, see [Tagging \(p. 737\)](#).

## Examples

For examples of API Gateway identity-based policies, see [Amazon API Gateway identity-based policy examples \(p. 718\)](#).

## API Gateway resource-based policies

Resource-based policies are JSON policy documents that specify what actions a specified principal can perform on the API Gateway resource and under what conditions. API Gateway supports resource-based permissions policies for REST APIs. You use resource policies to control who can invoke a REST API. For more information, see [the section called "Use API Gateway resource policies" \(p. 237\)](#).

### Examples

For examples of API Gateway resource-based policies, see [API Gateway resource policy examples \(p. 242\)](#).

## Authorization based on API Gateway tags

You can attach tags to API Gateway resources or pass tags in a request to API Gateway. To control access based on tags, you provide tag information in the [condition element](#) of a policy using the `apigateway:ResourceTag/key-name`, `aws:RequestTag/key-name`, or `aws:TagKeys` condition keys. For more information about tagging API Gateway resources, see [the section called "Attribute-based access control" \(p. 739\)](#).

For an examples of identity-based policies for limiting access to a resource based on the tags on that resource, see [Using tags to control access to API Gateway resources \(p. 739\)](#).

## API Gateway IAM roles

An [IAM role](#) is an entity within your Amazon account that has specific permissions.

### Using temporary credentials with API Gateway

You can use temporary credentials to sign in with federation, assume an IAM role, or to assume a cross-account role. You obtain temporary security credentials by calling Amazon STS API operations such as [AssumeRole](#) or [GetFederationToken](#).

API Gateway supports using temporary credentials.

### Service-linked roles

[Service-linked roles](#) allow Amazon services to access resources in other services to complete an action on your behalf. Service-linked roles appear in your IAM account and are owned by the service. An IAM administrator can view but not edit the permissions for service-linked roles.

API Gateway supports service-linked roles. For information about creating or managing API Gateway service-linked roles, see [Using service-linked roles for API Gateway \(p. 726\)](#).

### Service roles

A service can assume a [service role](#) on your behalf. A service role allows the service to access resources in other services to complete an action on your behalf. Service roles appear in your IAM account and are owned by the account, so an IAM administrator can change the permissions for this role. However, doing so might break the functionality of the service.

API Gateway supports service roles.

## Amazon API Gateway identity-based policy examples

By default, IAM users and roles don't have permission to create or modify API Gateway resources. They also can't perform tasks using the Amazon Web Services Management Console, Amazon CLI, or Amazon

SDKs. An IAM administrator must create IAM policies that grant users and roles permission to perform specific API operations on the specified resources they need. The administrator must then attach those policies to the IAM users or groups that require those permissions.

For information about how to create IAM policies, see [Creating Policies on the JSON Tab](#) in the *IAM User Guide*. For information about the actions, resources, and conditions specific to API Gateway, see [Actions, resources, and condition keys for Amazon API Gateway Management](#) and [Actions, resources, and condition keys for Amazon API Gateway Management V2](#).

### Topics

- [Policy best practices \(p. 719\)](#)
- [Allow users to view their own permissions \(p. 719\)](#)
- [Simple read permissions \(p. 720\)](#)
- [Create only REQUEST or JWT authorizers \(p. 720\)](#)
- [Require that the default execute-api endpoint is disabled \(p. 721\)](#)
- [Allow users to create or update only private REST APIs \(p. 722\)](#)
- [Require that API routes have authorization \(p. 723\)](#)
- [Prevent a user from creating or updating a VPC link \(p. 723\)](#)

## Policy best practices

Identity-based policies are very powerful. They determine whether someone can create, access, or delete API Gateway resources in your account. These actions can incur costs for your Amazon Web Services account. When you create or edit identity-based policies, follow these guidelines and recommendations:

- **Get started using Amazon managed policies** – To start using API Gateway quickly, use Amazon managed policies to give your employees the permissions they need. These policies are already available in your account and are maintained and updated by Amazon. For more information, see [Get started using permissions with Amazon managed policies](#) in the *IAM User Guide*.
- **Grant least privilege** – When you create custom policies, grant only the permissions required to perform a task. Start with a minimum set of permissions and grant additional permissions as necessary. Doing so is more secure than starting with permissions that are too lenient and then trying to tighten them later. For more information, see [Grant least privilege](#) in the *IAM User Guide*.
- **Enable MFA for sensitive operations** – For extra security, require IAM users to use multi-factor authentication (MFA) to access sensitive resources or API operations. For more information, see [Using multi-factor authentication \(MFA\) in Amazon](#) in the *IAM User Guide*.
- **Use policy conditions for extra security** – To the extent that it's practical, define the conditions under which your identity-based policies allow access to a resource. For example, you can write conditions to specify a range of allowable IP addresses that a request must come from. You can also write conditions to allow requests only within a specified date or time range, or to require the use of SSL or MFA. For more information, see [IAM JSON policy elements: Condition](#) in the *IAM User Guide*.

## Allow users to view their own permissions

This example shows how you might create a policy that allows IAM users to view the inline and managed policies that are attached to their user identity. This policy includes permissions to complete this action on the console or programmatically using the Amazon CLI or Amazon API.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
```

```

        "Sid": "ViewOwnUserInfo",
        "Effect": "Allow",
        "Action": [
            "iam:GetUserPolicy",
            "iam:ListGroupsForUser",
            "iam:ListAttachedUserPolicies",
            "iam:ListUserPolicies",
            "iam:GetUser"
        ],
        "Resource": ["arn:aws-cn:iam::*:user/${aws:username}"]
    },
    {
        "Sid": "NavigateInConsole",
        "Effect": "Allow",
        "Action": [
            "iam:GetGroupPolicy",
            "iam:GetPolicyVersion",
            "iam:GetPolicy",
            "iam:ListAttachedGroupPolicies",
            "iam:ListGroupPolicies",
            "iam:ListPolicyVersions",
            "iam:ListPolicies",
            "iam:ListUsers"
        ],
        "Resource": "*"
    }
]
}

```

## Simple read permissions

This example policy gives a user permission to get information about all of the resources of an HTTP or WebSocket API with the identifier of a123456789 in the Amazon Region of us-east-1. The resource `arn:aws:apigateway:us-east-1::/apis/a123456789/*` includes all sub-resources of the API such as authorizers and deployments.

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "apigateway:GET"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::/apis/a123456789/*"
      ]
    }
  ]
}

```

## Create only REQUEST or JWT authorizers

This example policy allows a user to create APIs with only `REQUEST` or `JWT` authorizers, including through `import`. In the Resource section of the policy, `arn:aws:apigateway:us-east-1::/apis/???????????` requires that resources have a maximum of 10 characters, which excludes sub-resources of an API. This example uses `ForAllValues` in the Condition section because users can create multiple authorizers at once by importing an API.

```

{

```

```

"Version": "2012-10-17",
"Statement": [
  {
    "Sid": "OnlyAllowSomeAuthorizerTypes",
    "Effect": "Allow",
    "Action": [
      "apigateway:PUT",
      "apigateway:POST",
      "apigateway:PATCH"
    ],
    "Resource": [
      "arn:aws:apigateway:us-east-1::/apis",
      "arn:aws:apigateway:us-east-1::/apis/?????????",
      "arn:aws:apigateway:us-east-1::/apis/*/authorizers",
      "arn:aws:apigateway:us-east-1::/apis/*/authorizers/*"
    ],
    "Condition": {
      "ForAllValues:StringEqualsIfExists": {
        "apigateway:Request/AuthorizerType": [
          "REQUEST",
          "JWT"
        ]
      }
    }
  }
]
}

```

## Require that the default `execute-api` endpoint is disabled

This example policy allows users to create, update or import an API, with the requirement that `DisableExecuteApiEndpoint` is `true`. When `DisableExecuteApiEndpoint` is `true`, clients can't use the default `execute-api` endpoint to invoke an API.

We use the `BoolIfExists` condition to handle a call to update an API that doesn't have the `DisableExecuteApiEndpoint` condition key populated. When a user attempts to create or import an API, the `DisableExecuteApiEndpoint` condition key is always populated.

Because the `apis/*` resource also captures sub resources such as authorizers or methods, we explicitly scope it to just APIs with a `Deny` statement.

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "DisableExecuteApiEndpoint",
      "Effect": "Allow",
      "Action": [
        "apigateway:PATCH",
        "apigateway:POST",
        "apigateway:PUT"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::/apis",
        "arn:aws:apigateway:us-east-1::/apis/*"
      ],
      "Condition": {
        "BoolIfExists": {
          "apigateway:Request/DisableExecuteApiEndpoint": true
        }
      }
    }
  ],
  {

```



```

    "Sid": "ScopeDownToJustApis",
    "Effect": "Deny",
    "Action": [
      "apigateway:PATCH",
      "apigateway:POST",
      "apigateway:PUT"
    ],
    "Resource": [
      "arn:aws:apigateway:us-east-1::apis/*/ *"
    ]
  }
]
}

```

## Allow users to create or update only private REST APIs

This example policy uses condition keys to require that a user creates only `PRIVATE` APIs, and to prevent updates that might change an API from `PRIVATE` to another type, such as `REGIONAL`.

We use `ForAllValues` to require that every `EndpointType` added to an API is `PRIVATE`. We use a resource condition key to allow any update to an API as long as it's `PRIVATE`. `ForAllValues` applies only if a condition key is present. For create operations, a `Resource` condition key is not present. For delete operations, a `Request` key is not present.

We use the non-greedy matcher (?) to explicitly match against API IDs to prevent allowing non-API resources such as authorizers.

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "ScopeToPrivateApis",
      "Effect": "Allow",
      "Action": [
        "apigateway:DELETE",
        "apigateway:PATCH",
        "apigateway:POST",
        "apigateway:PUT"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::restapis",
        "arn:aws:apigateway:us-east-1::restapis/?????????"
      ],
      "Condition": {
        "ForAllValues:StringEqualsIfExists": {
          "apigateway:Request/EndpointType": "PRIVATE",
          "apigateway:Resource/EndpointType": "PRIVATE"
        }
      }
    },
    {
      "Sid": "AllowResourcePolicyUpdates",
      "Effect": "Allow",
      "Action": [
        "apigateway:UpdateRestApiPolicy"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::restapis/*"
      ]
    }
  ]
}

```

## Require that API routes have authorization

This policy causes attempts to create or update a route (including through [import](#)) to fail if the route has no authorization. `ForAnyValue` evaluates to false if the key is not present, such as when a route is not being created or updated. We use `ForAnyValue` because multiple routes can be created through `import`.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowUpdatesOnApisAndRoutes",
      "Effect": "Allow",
      "Action": [
        "apigateway:POST",
        "apigateway:PATCH",
        "apigateway:PUT"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::/apis",
        "arn:aws:apigateway:us-east-1::/apis/?????????",
        "arn:aws:apigateway:us-east-1::/apis/*/routes",
        "arn:aws:apigateway:us-east-1::/apis/*/routes/*"
      ]
    },
    {
      "Sid": "DenyUnauthorizedRoutes",
      "Effect": "Deny",
      "Action": [
        "apigateway:POST",
        "apigateway:PATCH",
        "apigateway:PUT"
      ],
      "Resource": [
        "arn:aws:apigateway:us-east-1::/apis",
        "arn:aws:apigateway:us-east-1::/apis/*"
      ],
      "Condition": {
        "ForAnyValue:StringEqualsIgnoreCase": {
          "apigateway:Request/RouteAuthorizationType": "NONE"
        }
      }
    }
  ]
}
```

## Prevent a user from creating or updating a VPC link

This policy prevents a user from creating or updating a VPC link. A VPC link enables you to expose resources within an Amazon VPC to clients outside of the VPC.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "DenyVPCLink",
      "Effect": "Deny",
      "Action": [
        "apigateway:POST",
        "apigateway:PUT",
        "apigateway:PATCH"
      ],
      "Resource": [
```

```
    "arn:aws:apigateway:us-east-1::/vpclinks",  
    "arn:aws:apigateway:us-east-1::/vpclinks/*"  
  ]  
}  
]  
}
```

## Amazon API Gateway resource-based policy examples

For resource-based policy examples, see [the section called “API Gateway resource policy examples” \(p. 242\)](#).

## Troubleshooting Amazon API Gateway identity and access

Use the following information to help you diagnose and fix common issues that you might encounter when working with API Gateway and IAM.

### Topics

- [I am not authorized to perform an action in API Gateway \(p. 724\)](#)
- [I am not authorized to perform iam:PassRole \(p. 724\)](#)
- [I want to view my access keys \(p. 725\)](#)
- [I'm an administrator and want to allow others to access API Gateway \(p. 725\)](#)
- [I want to allow people outside of my Amazon account to access my API Gateway resources \(p. 725\)](#)

### I am not authorized to perform an action in API Gateway

If the Amazon Web Services Management Console tells you that you're not authorized to perform an action, then you must contact your administrator for assistance. Your administrator is the person that provided you with your user name and password.

The following example error occurs when the `mateojackson` IAM user tries to use the console to view details about an API but does not have `apigateway:GET` permissions.

```
User: arn:aws-cn:iam::123456789012:user/mateojackson is not authorized to perform:  
apigateway:GET on resource: arn:aws:apigateway:us-west-2::/apis/api-id
```

In this case, Mateo asks his administrator to update his policies to allow him to access the API resource using the `apigateway:GET` action.

### I am not authorized to perform iam:PassRole

If you receive an error that you're not authorized to perform the `iam:PassRole` action, then you must contact your administrator for assistance. Your administrator is the person that provided you with your user name and password. Ask that person to update your policies to allow you to pass a role to API Gateway.

Some Amazon Web Services allow you to pass an existing role to that service, instead of creating a new service role or service-linked role. To do this, you must have permissions to pass the role to the service.

The following example error occurs when an IAM user named `marymajor` tries to use the console to perform an action in API Gateway. However, the action requires the service to have permissions granted by a service role. Mary does not have permissions to pass the role to the service.

```
User: arn:aws-cn:iam::123456789012:user/marymajor is not authorized to perform:  
iam:PassRole
```

In this case, Mary asks her administrator to update her policies to allow her to perform the `iam:PassRole` action.

## I want to view my access keys

After you create your IAM user access keys, you can view your access key ID at any time. However, you can't view your secret access key again. If you lose your secret key, you must create a new access key pair.

Access keys consist of two parts: an access key ID (for example, `AKIAIOSFODNN7EXAMPLE`) and a secret access key (for example, `wJalrXUtnFEMI/K7MDENG/bPxrFiCYEXAMPLEKEY`). Like a user name and password, you must use both the access key ID and secret access key together to authenticate your requests. Manage your access keys as securely as you do your user name and password.

### Important

Do not provide your access keys to a third party, even to help [find your canonical user ID](#). By doing this, you might give someone permanent access to your account.

When you create an access key pair, you are prompted to save the access key ID and secret access key in a secure location. The secret access key is available only at the time you create it. If you lose your secret access key, you must add new access keys to your IAM user. You can have a maximum of two access keys. If you already have two, you must delete one key pair before creating a new one. To view instructions, see [Managing access keys](#) in the *IAM User Guide*.

## I'm an administrator and want to allow others to access API Gateway

To allow others to access API Gateway, you must create an IAM entity (user or role) for the person or application that needs access. They will use the credentials for that entity to access Amazon. You must then attach a policy to the entity that grants them the correct permissions in API Gateway.

To get started right away, see [Creating your first IAM delegated user and group](#) in the *IAM User Guide*.

## I want to allow people outside of my Amazon account to access my API Gateway resources

You can create a role that users in other accounts or people outside of your organization can use to access your resources. You can specify who is trusted to assume the role. For services that support resource-based policies or access control lists (ACLs), you can use those policies to grant people access to your resources.

To learn more, consult the following:

- To learn whether API Gateway supports these features, see [How Amazon API Gateway works with IAM \(p. 715\)](#).
- To learn how to provide access to your resources across Amazon Web Services accounts that you own, see [Providing access to an IAM user in another Amazon Web Services account that you own](#) in the *IAM User Guide*.
- To learn how to provide access to your resources to third-party Amazon Web Services accounts, see [Providing access to Amazon Web Services accounts owned by third parties](#) in the *IAM User Guide*.
- To learn how to provide access through identity federation, see [Providing access to externally authenticated users \(identity federation\)](#) in the *IAM User Guide*.
- To learn the difference between using roles and resource-based policies for cross-account access, see [How IAM roles differ from resource-based policies](#) in the *IAM User Guide*.

## Using service-linked roles for API Gateway

Amazon API Gateway uses Amazon Identity and Access Management (IAM) [service-linked roles](#). A service-linked role is a unique type of IAM role that is linked directly to API Gateway. Service-linked roles are predefined by API Gateway and include all the permissions that the service requires to call other Amazon services on your behalf.

A service-linked role makes setting up API Gateway easier because you don't have to manually add the necessary permissions. API Gateway defines the permissions of its service-linked roles, and unless defined otherwise, only API Gateway can assume its roles. The defined permissions include the trust policy and the permissions policy, and that permissions policy cannot be attached to any other IAM entity.

You can delete a service-linked role only after first deleting the related resources. This protects your API Gateway resources because you can't inadvertently remove permission to access the resources.

For information about other services that support service-linked roles, see [Amazon Services That Work with IAM](#) and look for the services that have **Yes** in the **Service-Linked Role** column. Choose a **Yes** with a link to view the service-linked role documentation for that service.

## Service-linked role permissions for API Gateway

API Gateway uses the service-linked role named **AWSServiceRoleForAPIGateway** – Allows API Gateway to access Elastic Load Balancing, Amazon Kinesis Data Firehose, and other service resources on your behalf.

The AWSServiceRoleForAPIGateway service-linked role trusts the following services to assume the role:

- ops.apigateway.amazonaws.com

The role permissions policy allows API Gateway to complete the following actions on the specified resources:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "elasticloadbalancing:AddListenerCertificates",
        "elasticloadbalancing:RemoveListenerCertificates",
        "elasticloadbalancing:ModifyListener",
        "elasticloadbalancing:DescribeListeners",
        "elasticloadbalancing:DescribeLoadBalancers",
        "xray:PutTraceSegments",
        "xray:PutTelemetryRecords",
        "xray:GetSamplingTargets",
        "xray:GetSamplingRules",
        "logs:CreateLogDelivery",
        "logs:GetLogDelivery",
        "logs:UpdateLogDelivery",
        "logs>DeleteLogDelivery",
        "logs:ListLogDeliveries",
        "servicediscovery:DiscoverInstances"
      ],
      "Resource": [
        "*"
      ]
    }
  ],
}
```

```

{
  "Effect": "Allow",
  "Action": [
    "firehose:DescribeDeliveryStream",
    "firehose:PutRecord",
    "firehose:PutRecordBatch"
  ],
  "Resource": "arn:aws:firehose:*:*:deliverystream/amazon-apigateway-*"
},
{
  "Effect": "Allow",
  "Action": [
    "acm:DescribeCertificate",
    "acm:GetCertificate"
  ],
  "Resource": "arn:aws:acm:*:*:certificate/*"
},
{
  "Effect": "Allow",
  "Action": "ec2:CreateNetworkInterfacePermission",
  "Resource": "arn:aws:ec2:*:*:network-interface/*"
},
{
  "Effect": "Allow",
  "Action": "ec2:CreateTags",
  "Resource": "arn:aws:ec2:*:*:network-interface/*",
  "Condition": {
    "ForAllValues:StringEquals": {
      "aws:TagKeys": [
        "Owner",
        "VpcLinkId"
      ]
    }
  }
},
{
  "Effect": "Allow",
  "Action": [
    "ec2:ModifyNetworkInterfaceAttribute",
    "ec2>DeleteNetworkInterface",
    "ec2:AssignPrivateIpAddresses",
    "ec2:CreateNetworkInterface",
    "ec2>DeleteNetworkInterfacePermission",
    "ec2:DescribeNetworkInterfaces",
    "ec2:DescribeAvailabilityZones",
    "ec2:DescribeNetworkInterfaceAttribute",
    "ec2:DescribeVpcs",
    "ec2:DescribeNetworkInterfacePermissions",
    "ec2:UnassignPrivateIpAddresses",
    "ec2:DescribeSubnets",
    "ec2:DescribeRouteTables",
    "ec2:DescribeSecurityGroups"
  ],
  "Resource": "*"
},
{
  "Effect": "Allow",
  "Action": "servicediscovery:GetNamespace",
  "Resource": "arn:aws:servicediscovery:*:*:namespace/*"
},
{
  "Effect": "Allow",
  "Action": "servicediscovery:GetService",
  "Resource": "arn:aws:servicediscovery:*:*:service/*"
}
]

```

```
}
```

You must configure permissions to allow an IAM entity (such as a user, group, or role) to create, edit, or delete a service-linked role. For more information, see [Service-Linked Role Permissions](#) in the *IAM User Guide*.

## Creating a service-linked role for API Gateway

You don't need to manually create a service-linked role. When you create an API, custom domain name, or VPC link in the Amazon Web Services Management Console, the Amazon CLI, or the Amazon API, API Gateway creates the service-linked role for you.

If you delete this service-linked role, and then need to create it again, you can use the same process to recreate the role in your account. When you create an API, custom domain name, or VPC link, API Gateway creates the service-linked role for you again.

## Editing a service-linked role for API Gateway

API Gateway does not allow you to edit the `AWSServiceRoleForAPIGateway` service-linked role. After you create a service-linked role, you can't change the name of the role because various entities might reference the role. However, you can edit the description of the role using IAM. For more information, see [Editing a Service-Linked Role](#) in the *IAM User Guide*.

## Deleting a service-linked role for API Gateway

If you no longer need to use a feature or service that requires a service-linked role, we recommend that you delete that role. That way you don't have an unused entity that is not actively monitored or maintained. However, you must clean up the resources for your service-linked role before you can manually delete it.

### Note

If the API Gateway service is using the role when you try to delete the resources, then the deletion might fail. If that happens, wait for a few minutes and try the operation again.

### To delete API Gateway resources used by the `AWSServiceRoleForAPIGateway`

1. Open the API Gateway console at <https://console.amazonaws.cn/apigateway/>.
2. Navigate to the API, custom domain name, or VPC link that uses the service-linked role.
3. Use the console to delete the resource.
4. Repeat the procedure to delete all APIs, custom domain names, or VPC links that use the service-linked role.

### To manually delete the service-linked role using IAM

Use the IAM console, the Amazon CLI, or the Amazon API to delete the `AWSServiceRoleForAPIGateway` service-linked role. For more information, see [Deleting a Service-Linked Role](#) in the *IAM User Guide*.

## Supported Regions for API Gateway service-linked roles

API Gateway supports using service-linked roles in all of the Regions where the service is available. For more information, see [Amazon Service Endpoints](#).

## API Gateway updates to Amazon managed policies

View details about updates to Amazon managed policies for API Gateway since this service began tracking these changes. For automatic alerts about changes to this page, subscribe to the RSS feed on the API Gateway [Document history \(p. 755\)](#) page.

Change	Description	Date
Added <code>acm:GetCertificate</code> support to the <code>AWSServiceRoleForAPIGateway</code> policy.	The <code>AWSServiceRoleForAPIGateway</code> policy now includes permission to call the ACM <code>GetCertificate</code> API action.	July 12, 2021
API Gateway started tracking changes	API Gateway started tracking changes for its Amazon managed policies.	July 12, 2021

## Logging and monitoring in Amazon API Gateway

Monitoring is an important part of maintaining the reliability, availability, and performance of API Gateway and your Amazon solutions. You should collect monitoring data from all of the parts of your Amazon solution so that you can more easily debug a multi-point failure if one occurs. Amazon provides several tools for monitoring your API Gateway resources and responding to potential incidents:

### Amazon CloudWatch Logs

To help debug issues related to request execution or client access to your API, you can enable CloudWatch Logs to log API calls. For more information, see [the section called "CloudWatch logs" \(p. 611\)](#).

### Amazon CloudWatch Alarms

Using CloudWatch alarms, you watch a single metric over a time period that you specify. If the metric exceeds a given threshold, a notification is sent to an Amazon Simple Notification Service topic or Amazon Auto Scaling policy. CloudWatch alarms do not invoke actions when a metric is in a particular state. Rather the state must have changed and been maintained for a specified number of periods. For more information, see [the section called "CloudWatch metrics" \(p. 605\)](#).

### Access Logging to Kinesis Data Firehose

To help debug issues related to client access to your API, you can enable Kinesis Data Firehose to log API calls. For more information, see [the section called "Kinesis Data Firehose" \(p. 614\)](#).

### Amazon CloudTrail

CloudTrail provides a record of actions taken by a user, role, or an Amazon service in API Gateway. Using the information collected by CloudTrail, you can determine the request that was made to API Gateway, the IP address from which the request was made, who made the request, when it was made, and additional details. For more information, see [the section called "Working with Amazon CloudTrail" \(p. 730\)](#).

### Amazon X-Ray

X-Ray is an Amazon service that gathers data about the requests that your application serves, and uses it to construct a service map that you can use to identify issues with your application and opportunities for optimization. For more information, see [the section called "Setting up Amazon X-Ray" \(p. 616\)](#).

### Amazon Config

Amazon Config provides a detailed view of the configuration of Amazon resources in your account. You can see how resources are related, get a history of configuration changes, and see how relationships and configurations change over time. You can use Amazon Config to define rules that evaluate resource configurations for data compliance. Amazon Config rules represent the ideal configuration settings for your API Gateway resources. If a resource violates a rule and is flagged as



noncompliant, Amazon Config can alert you using an Amazon Simple Notification Service (Amazon SNS) topic. For details, see [the section called “Working with Amazon Config” \(p. 731\)](#).

## Logging calls to Amazon API Gateway APIs with Amazon CloudTrail

Amazon API Gateway is integrated with Amazon CloudTrail, a service that provides a record of actions taken by a user, a role, or an Amazon service in API Gateway. CloudTrail captures all REST API calls for API Gateway service APIs as events, including calls from the API Gateway console and from code calls to the API Gateway service APIs.

### Note

[TestInvokeAuthorizer](#) and [TestInvokeMethod](#) are not logged in CloudTrail.

If you create a trail, you can enable continuous delivery of CloudTrail events to an Amazon S3 bucket, including events for API Gateway. If you don't configure a trail, you can still view the most recent events in the CloudTrail console in **Event history**.

Using the information collected by CloudTrail, you can determine the request that was made to API Gateway, the IP address from which the request was made, who made the request, when it was made, and additional details.

To learn more about CloudTrail, see the [Amazon CloudTrail User Guide](#).

## API Gateway information in CloudTrail

CloudTrail is enabled on your Amazon account when you create the account. When activity occurs in Amazon API Gateway, that activity is recorded in a CloudTrail event along with other Amazon service events in **Event history**. You can view, search, and download recent events in your Amazon account. For more information, see [Viewing Events with CloudTrail Event History](#).

For an ongoing record of events in your Amazon account, including events for API Gateway, create a trail. A trail enables CloudTrail to deliver log files to an Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all Amazon Regions. The trail logs events from all Regions in the Amazon partition and delivers the log files to the Amazon S3 bucket that you specify. Additionally, you can configure other Amazon services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see:

- [Overview for Creating a Trail](#)
- [CloudTrail Supported Services and Integrations](#)
- [Configuring Amazon SNS Notifications for CloudTrail](#)
- [Receiving CloudTrail Log Files from Multiple Regions](#) and [Receiving CloudTrail Log Files from Multiple Accounts](#)

All Amazon API Gateway actions are logged by CloudTrail and are documented in the [API references \(p. 743\)](#). For example, calls to create a new API, resource, or method in API Gateway generate entries in CloudTrail log files.

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root or IAM user credentials.
- Whether the request was made with temporary security credentials for a role or federated user.
- Whether the request was made by another Amazon service.

For more information, see the [CloudTrail userIdentity Element](#).

## Understanding API Gateway log file entries

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files are not an ordered stack trace of the public API calls, so they do not appear in any specific order.

The following example shows a CloudTrail log entry that demonstrates the API Gateway `GetResource` action:

```
{
  Records: [
    {
      eventVersion: "1.03",
      userIdentity: {
        type: "Root",
        principalId: "AKIAI44QH8DHBEXAMPLE",
        arn: "arn:aws:iam::123456789012:root",
        accountId: "123456789012",
        accessKeyId: "AKIAIOSFODNN7EXAMPLE",
        sessionContext: {
          attributes: {
            mfaAuthenticated: "false",
            creationDate: "2015-06-16T23:37:58Z"
          }
        }
      },
      eventTime: "2015-06-17T00:47:28Z",
      eventSource: "apigateway.amazonaws.com",
      eventName: "GetResource",
      awsRegion: "us-east-1",
      sourceIPAddress: "203.0.113.11",
      userAgent: "example-user-agent-string",
      requestParameters: {
        restApiId: "3rbEXAMPLE",
        resourceId: "5tfEXAMPLE",
        template: false
      },
      responseElements: null,
      requestID: "6d9c4bfc-148a-11e5-81b6-7577cEXAMPLE",
      eventID: "4d293154-a15b-4c33-9e0a-ff5eeEXAMPLE",
      readOnly: true,
      eventType: "AwsApiCall",
      recipientAccountId: "123456789012"
    },
    ... additional entries ...
  ]
}
```

## Monitoring API Gateway API configuration with Amazon Config

You can use [Amazon Config](#) to record configuration changes made to your API Gateway API resources and send notifications based on resource changes. Maintaining a configuration change history for API Gateway resources is useful for operational troubleshooting, audit, and compliance use cases.

Amazon Config can track changes to:

- **API stage configuration**, such as:
  - cache cluster settings
  - throttle settings
  - access log settings
  - the active deployment set on the stage
- **API configuration**, such as:
  - endpoint configuration
  - version
  - protocol
  - tags

In addition, the Amazon Config Rules feature enables you to define configuration rules and automatically detect, track, and alert violations to these rules. By tracking changes to these resource configuration properties, you can also author change-triggered Amazon Config rules for your API Gateway resources, and test your resource configurations against best practices.

You can enable Amazon Config in your account by using the Amazon Config console or the Amazon CLI. Select the resource types for which you want to track changes. If you previously configured Amazon Config to record all resource types, then these API Gateway resources will be automatically recorded in your account. Support for Amazon API Gateway in Amazon Config is available in all Amazon public regions and Amazon GovCloud (US). For the full list of supported Regions, see [Amazon API Gateway Endpoints and Quotas](#) in the Amazon General Reference.

### Topics

- [Supported resource types \(p. 732\)](#)
- [Setting up Amazon Config \(p. 733\)](#)
- [Configuring Amazon Config to record API Gateway resources \(p. 733\)](#)
- [Viewing API Gateway configuration details in the Amazon Config console \(p. 733\)](#)
- [Evaluating API Gateway resources using Amazon Config rules \(p. 733\)](#)

## Supported resource types

The following API Gateway resource types are integrated with Amazon Config and are documented in [Amazon Config Supported Amazon Resource Types and Resource Relationships](#):

- `AWS::ApiGatewayV2::Api` (WebSocket and HTTP API)
- `AWS::ApiGateway::RestApi` (REST API)
- `AWS::ApiGatewayV2::Stage` (WebSocket and HTTP API stage)
- `AWS::ApiGateway::Stage` (REST API stage)

For more information about Amazon Config, see the [Amazon Config Developer Guide](#). For pricing information, see the [Amazon Config pricing information page](#).

### Important

If you change any of the following API properties after the API is deployed, you *must* [redeploy \(p. 436\)](#) the API to propagate the changes. Otherwise, you'll see the attribute changes in the Amazon Config console, but the previous property settings will still be in effect; the API's runtime behavior will be unchanged.

- **`AWS::ApiGateway::RestApi`** – `binaryMediaTypes`, `minimumCompressionSize`, `apiKeySource`

- `AWS::ApiGatewayV2::Api` – `apiKeySelectionExpression`

## Setting up Amazon Config

To initially set up Amazon Config, see the following topics in the [Amazon Config Developer Guide](#).

- [Setting Up Amazon Config with the Console](#)
- [Setting Up Amazon Config with the Amazon CLI](#)

## Configuring Amazon Config to record API Gateway resources

By default, Amazon Config records configuration changes for all supported types of regional resources that it discovers in the region in which your environment is running. You can customize Amazon Config to record changes only for specific resource types, or changes to global resources.

To learn about regional vs. global resources and learn how to customize your Amazon Config configuration, see [Selecting which Resources Amazon Config Records](#).

## Viewing API Gateway configuration details in the Amazon Config console

You can use the Amazon Config console to look for API Gateway resources and get current and historical details about their configurations. The following procedure shows how to find information about an API Gateway API.

### To find an API Gateway resource in the Amazon config console

1. Open the [Amazon Config console](#).
2. Choose **Resources**.
3. On the **Resource** inventory page, choose **Resources**.
4. Open the **Resource type** menu, scroll to APIGateway or APIGatewayV2, and then choose one or more of the API Gateway resource types.
5. Choose **Look up**.
6. Choose a resource ID in the list of resources that Amazon Config displays. Amazon Config displays configuration details and other information about the resource you selected.
7. To see the full details of the recorded configuration, choose **View Details**.

To learn more ways to find a resource and view information on this page, see [Viewing Amazon Resource Configurations and History](#) in the Amazon Config Developer Guide.

## Evaluating API Gateway resources using Amazon Config rules

You can create Amazon Config rules, which represent the ideal configuration settings for your API Gateway resources. You can use predefined [Amazon Config Managed Rules](#), or define custom rules. Amazon Config continuously tracks changes to the configuration of your resources to determine whether those changes violate any of the conditions in your rules. The Amazon Config console shows the compliance status of your rules and resources.

If a resource violates a rule and is flagged as noncompliant, Amazon Config can alert you using an [Amazon Simple Notification Service Developer Guide](#) (Amazon SNS) topic. To programmatically consume the data in these Amazon Config alerts, use an Amazon Simple Queue Service (Amazon SQS) queue as the notification endpoint for the Amazon SNS topic.

To learn more about setting up and using rules, see [Evaluating Resources with Rules](#) in the [Amazon Config Developer Guide](#).

## Compliance validation for Amazon API Gateway

Third-party auditors assess the security and compliance of Amazon API Gateway as part of multiple Amazon compliance programs. These include SOC, PCI, FedRAMP, HIPAA, and others.

For a list of Amazon services in scope of specific compliance programs, see [Amazon Services in Scope by Compliance Program](#). For general information, see [Amazon Compliance Programs](#).

You can download third-party audit reports using Amazon Artifact. For more information, see [Downloading Reports in Amazon Artifact](#).

Your compliance responsibility when using API Gateway is determined by the sensitivity of your data, your company's compliance objectives, and applicable laws and regulations. Amazon provides the following resources to help with compliance:

- [Security and Compliance Quick Start Guides](#) – These deployment guides discuss architectural considerations and provide steps for deploying security- and compliance-focused baseline environments on Amazon.
- [Architecting for HIPAA Security and Compliance Whitepaper](#) – This whitepaper describes how companies can use Amazon to create HIPAA-compliant applications.
- [Amazon Compliance Resources](#) – This collection of workbooks and guides might apply to your industry and location.
- [Evaluating Resources with Rules](#) in the *Amazon Config Developer Guide* – The Amazon Config service assesses how well your resource configurations comply with internal practices, industry guidelines, and regulations.
- [Amazon Security Hub](#) – This Amazon service provides a comprehensive view of your security state within Amazon that helps you check your compliance with security industry standards and best practices.

## Resilience in Amazon API Gateway

The Amazon global infrastructure is built around Amazon Regions and Availability Zones. Amazon Regions provide multiple physically separated and isolated Availability Zones, which are connected with low-latency, high-throughput, and highly redundant networking. With Availability Zones, you can design and operate applications and databases that automatically fail over between zones without interruption. Availability Zones are more highly available, fault tolerant, and scalable than traditional single or multiple data center infrastructures.

For more information about Amazon Regions and Availability Zones, see [Amazon Global Infrastructure](#).

To prevent your APIs from being overwhelmed by too many requests, API Gateway throttles requests to your APIs. Specifically, API Gateway sets a limit on a steady-state rate and a burst of request submissions against all APIs in your account. You can configure custom throttling for your APIs. To learn more, see [Throttle API requests for better throughput \(p. 598\)](#).

## Infrastructure security in Amazon API Gateway

As a managed service, Amazon API Gateway is protected by the Amazon global network security procedures that are described in the [Amazon Web Services: Overview of Security Processes](#) whitepaper.

You use Amazon published API calls to access API Gateway through the network. Clients must support Transport Layer Security (TLS) 1.0 or later. We recommend TLS 1.2 or later. Clients must also support cipher suites with perfect forward secrecy (PFS) such as Ephemeral Diffie-Hellman (DHE) or Elliptic Curve Ephemeral Diffie-Hellman (ECDHE). Most modern systems such as Java 7 and later support these modes.

Additionally, requests must be signed by using an access key ID and a secret access key that is associated with an IAM principal. Or you can use the [Amazon Security Token Service](#) (Amazon STS) to generate temporary security credentials to sign requests.

You can call these API operations from any network location, but API Gateway does support resource-based access policies, which can include restrictions based on the source IP address. You can also use resource-based policies to control access from specific Amazon Virtual Private Cloud (Amazon VPC) endpoints or specific VPCs. Effectively, this isolates network access to a given API Gateway resource from only the specific VPC within the Amazon network.

## Vulnerability analysis in Amazon API Gateway

Configuration and IT controls are a shared responsibility between Amazon and you, our customer. For more information, see the Amazon [shared responsibility model](#).

## Security best practices in Amazon API Gateway

API Gateway provides a number of security features to consider as you develop and implement your own security policies. The following best practices are general guidelines and don't represent a complete security solution. Because these best practices might not be appropriate or sufficient for your environment, treat them as helpful considerations rather than prescriptions.

### Implement least privilege access

Use IAM policies to implement least privilege access for creating, reading, updating, or deleting API Gateway APIs. To learn more, see [Identity and access management for Amazon API Gateway](#) (p. 711). API Gateway offers several options to control access to APIs that you create. To learn more, see [Controlling and managing access to a REST API in API Gateway](#) (p. 236), [Controlling and managing access to a WebSocket API in API Gateway](#) (p. 639), and [Controlling access to HTTP APIs with JWT authorizers](#) (p. 157).

### Implement logging

Use CloudWatch Logs or Amazon Kinesis Data Firehose to log requests to your APIs. To learn more, see [Monitoring REST APIs](#) (p. 605), [Configuring logging for a WebSocket API](#) (p. 666), and [Configuring logging for an HTTP API](#) (p. 196).

### Implement Amazon CloudWatch alarms

Using CloudWatch alarms, you watch a single metric over a time period that you specify. If the metric exceeds a given threshold, a notification is sent to an Amazon Simple Notification Service topic or Amazon Auto Scaling policy. CloudWatch alarms do not invoke actions when a metric is in a particular state. Rather, the state must have changed and been maintained for a specified number of periods. For more information, see [the section called "CloudWatch metrics"](#) (p. 605).

### Enable Amazon CloudTrail

CloudTrail provides a record of actions taken by a user, role, or an Amazon service in API Gateway. Using the information collected by CloudTrail, you can determine the request that was made to API Gateway, the IP address from which the request was made, who made the request, when it was made, and additional details. For more information, see [the section called "Working with Amazon CloudTrail"](#) (p. 730).

### **Enable Amazon Config**

Amazon Config provides a detailed view of the configuration of Amazon resources in your account. You can see how resources are related, get a history of configuration changes, and see how relationships and configurations change over time. You can use Amazon Config to define rules that evaluate resource configurations for data compliance. Amazon Config rules represent the ideal configuration settings for your API Gateway resources. If a resource violates a rule and is flagged as noncompliant, Amazon Config can alert you using an Amazon Simple Notification Service (Amazon SNS) topic. For details, see [the section called “Working with Amazon Config” \(p. 731\)](#).

# Tagging your API Gateway resources

A *tag* is a metadata label that you assign or that Amazon assigns to an Amazon resource. Each tag has two parts:

- A *tag key* (for example, `CostCenter`, `Environment`, or `Project`). Tag keys are case sensitive.
- An optional field known as a *tag value* (for example, `111122223333` or `Production`). Omitting the tag value is the same as using an empty string. Like tag keys, tag values are case-sensitive.

Tags help you do the following:

- Control access to your resources based on the tags that are assigned to them. You control access by specifying tag keys and values in the conditions for an Amazon Identity and Access Management (IAM) policy. For more information about tag-based access control, see [Controlling Access Using Tags](#) in the *IAM User Guide*.
- Track your Amazon costs. You activate these tags on the Amazon Billing and Cost Management dashboard. Amazon uses the tags to categorize your costs and deliver a monthly cost allocation report to you. For more information, see [Use Cost Allocation Tags](#) in the *Amazon Billing User Guide*.
- Identify and organize your Amazon resources. Many Amazon services support tagging, so you can assign the same tag to resources from different services to indicate that the resources are related. For example, you could assign the same tag to an API Gateway stage that you assign to a CloudWatch Events rule.

For tips on using tags, see the [Amazon Tagging Strategies](#) post on the *Amazon Answers* blog.

The following sections provide more information about tags for Amazon API Gateway.

## Topics

- [API Gateway resources that can be tagged \(p. 737\)](#)
- [Using tags to control access to API Gateway resources \(p. 739\)](#)

## API Gateway resources that can be tagged

Tags can be set on the following HTTP API or WebSocket API resources in the [Amazon API Gateway V2 API](#):

- `Api`
- `DomainName`
- `Stage`
- `VpcLink`

In addition, tags can be set on the following REST API resources in the [Amazon API Gateway V1 API](#):

- `ApiKey`
- `ClientCertificate`
- `DomainName`



- RestApi
- Stage
- UsagePlan
- VpcLink

Tags cannot be set directly on other resources. However, in the [Amazon API Gateway V1 API](#), child resources inherit the tags that are set on parent resources. For example:

- If a tag is set on a RestApi resource, that tag is inherited by the following child resources of that RestApi for [Attribute-based access control](#):
  - Authorizer
  - Deployment
  - Documentation
  - GatewayResponse
  - Integration
  - Method
  - Model
  - Resource
  - ResourcePolicy
  - Setting
  - Stage
- If a tag is set on a DomainName, that tag is inherited by any BasePathMapping resources under it.
- If a tag is set on a UsagePlan, that tag is inherited by any UsagePlanKey resources under it.

**Note**

Tag inheritance applies only to [attribute-based access control](#). For example, you can't use inherited tags to monitor costs in Amazon Cost Explorer. API Gateway doesn't return inherited tags when you call [GetTags](#) for a resource.

## Tag inheritance in the Amazon API Gateway V1 API

Previously it was only possible to set tags on stages. Now that you can also set them on other resources, a Stage can receive a tag two ways:

- The tag can be set directly on the Stage.
- The stage can inherit the tag from its parent RestApi.

If a stage receives a tag both ways, the tag that was set directly on the stage takes precedence. For example, suppose a stage inherits the following tags from its parent REST API:

```
{
  'foo': 'bar',
  'x': 'y'
}
```

Suppose it also has the following tags set on it directly:

```
{
  'foo': 'bar2',
  'hello': 'world'
}
```

```
}
```

The net effect would be for the stage to have the following tags, with the following values:

```
{  
  'foo': 'bar2',  
  'hello': 'world'  
  'x': 'y'  
}
```

## Tag restrictions and usage conventions

The following restrictions and usage conventions apply to using tags with API Gateway resources:

- Each resource can have a maximum of 50 tags.
- For each resource, each tag key must be unique, and each tag key can have only one value.
- The maximum tag key length is 128 Unicode characters in UTF-8.
- The maximum tag value length is 256 Unicode characters in UTF-8.
- Allowed characters for keys and values are letters, numbers, spaces representable in UTF-8, and the following characters: . : \* = @ \_ / - (hyphen). Amazon EC2 resources allow any characters.
- Tag keys and values are case-sensitive. As a best practice, decide on a strategy for capitalizing tags, and consistently implement that strategy across all resource types. For example, decide whether to use `Costcenter`, `costcenter`, or `CostCenter`, and use the same convention for all tags. Avoid using similar tags with inconsistent case treatment.
- The `aws:` prefix is prohibited for tags; it's reserved for Amazon use. You can't edit or delete tag keys or values with this prefix. Tags with this prefix do not count against your tags per resource limit.

## Using tags to control access to API Gateway resources

Conditions in Amazon Identity and Access Management policies are part of the syntax that you use to specify permissions to API Gateway resources. For details about specifying IAM policies, see [the section called "Use IAM permissions" \(p. 248\)](#). In API Gateway, resources can have tags, and some actions can include tags. When you create an IAM policy, you can use tag condition keys to control:

- Which users can perform actions on an API Gateway resource, based on tags that the resource already has.
- Which tags can be passed in an action's request.
- Whether specific tag keys can be used in a request.

Using tags for attribute-based access control can allow for finer control than API-level control, as well as more dynamic control than resource-based access control. IAM policies can be created that allow or disallow an operation based on tags provided in the request (request tags), or tags on the resource that is being operated on (resource tags). In general, resource tags are for resources that already exist. Request tags are for when you're creating new resources.

For the complete syntax and semantics of tag condition keys, see [Controlling Access Using Tags](#) in the *IAM User Guide*.

The following examples demonstrate how to specify tag conditions in policies for API Gateway users.

## Example 1: Limit actions based on resource tags

The following example policy grants users permission to perform `GET` actions on all resources. In addition, if a resource has a tag named `iamrole` with a value of `readWrite`, the policy grants users permission to perform all actions on the resource.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "apigateway:GET",
      "Resource": "*"
    },
    {
      "Effect": "Allow",
      "Action": "apigateway:*",
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "aws:ResourceTag/iamrole": "readWrite"
        }
      }
    }
  ]
}
```

## Example 2: Limit actions based on tags in the request

The following example policy specifies that:

- When the user creates a new stage, the request to create the stage must contain a tag named `stage`.
- The value of the `stage` tag must be `beta`, `gamma`, or `prod`. Otherwise, the request to create the stage is denied.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "apigateway:*"
      ],
      "Resource": [
        "*"
      ]
    },
    {
      "Effect": "Deny",
      "Action": "apigateway:POST",
      "Resource": "arn:aws:apigateway:*::/restapis/*/stages",
      "Condition": {
        "Null": {
          "aws:RequestTag/stage": "true"
        }
      }
    }
  ]
}
```

```
"Action": "apigateway:POST",
"Resource": "arn:aws:apigateway:*::/restapis/*/stages",
"Condition": {
  "ForAnyValue:StringNotEquals": {
    "aws:RequestTag/stage": [
      "beta",
      "gamma",
      "prod"
    ]
  }
}
```

## Example 3: Deny actions based on resource tags

The following example policy allows users to perform all actions on API Gateway resources by default. If a resource has a tag named `stage` with a value of `prod`, users are denied permission to perform modifications (`PATCH`, `PUT`, `POST`, `DELETE`) on the resource.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "apigateway:*",
      "Resource": "*"
    },
    {
      "Effect": "Deny",
      "Action": [
        "apigateway:PATCH",
        "apigateway:PUT",
        "apigateway:POST",
        "apigateway:DELETE"
      ],
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "aws:ResourceTag/stage": "prod"
        }
      }
    }
  ]
}
```

## Example 4: Allow actions based on resource tags

The following example policy allows users to perform all actions on all API Gateway resources by default. If a resource has a tag named `environment` whose value is `prod`, users aren't allowed to perform any operations on the resource.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "apigateway:*",
      "Resource": "*"
    }
  ]
}
```

```
    },
    {
      "Effect": "Deny",
      "Action": [
        "apigateway:*"
      ],
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "aws:ResourceTag/environment": "prod"
        }
      }
    }
  ]
}
```

## Example 5: Allow actions based on resource tag keys

The following example policy allows users to perform all actions on all API Gateway resources by default. If a resource has a tag named `prod` with any value, including an empty string, users aren't allowed to perform operations that modify the resource.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "apigateway:*",
      "Resource": "*"
    },
    {
      "Effect": "Deny",
      "Action": [
        "apigateway:PATCH",
        "apigateway:PUT",
        "apigateway:POST",
        "apigateway:DELETE"
      ],
      "Resource": "*",
      "Condition": {
        "Null": {
          "aws:ResourceTag/prod": "false"
        }
      }
    }
  ]
}
```

# API references

Amazon API Gateway provides APIs for creating and deploying your own HTTP and WebSocket APIs. In addition, API Gateway APIs are available in standard Amazon SDKs.

If you are using a language for which an Amazon SDK exists, you may prefer to use the SDK rather than using the API Gateway REST APIs directly. The SDKs make authentication simpler, integrate easily with your development environment, and provide easy access to API Gateway commands.

Here's where to find the Amazon SDKs and API Gateway REST API reference documentation:

- [Tools for Amazon Web Services](#)
- [Amazon API Gateway Version 1 API Reference](#) (REST APIs)
- [Amazon API Gateway Version 2 API Reference](#) (WebSocket and HTTP APIs)

# Amazon API Gateway quotas and important notes

## Topics

- [API Gateway account-level quotas, per Region \(p. 744\)](#)
- [HTTP API quotas \(p. 745\)](#)
- [API Gateway quotas for configuring and running a WebSocket API \(p. 746\)](#)
- [API Gateway quotas for configuring and running a REST API \(p. 747\)](#)
- [API Gateway quotas for creating, deploying and managing an API \(p. 749\)](#)
- [Amazon API Gateway important notes \(p. 750\)](#)

Unless noted otherwise, the quotas can be increased upon request. To request a quota increase, you can use [Service Quotas](#) or contact the [Amazon Support Center](#).

When authorization is enabled on a method, the maximum length of the method's ARN (for example, `arn:aws:execute-api:{region-id}:{account-id}:{api-id}/{stage-id}/{method}/{resource}/{path}`) is 1600 bytes. The path parameter values (whose size is determined at runtime) can cause the ARN length to exceed the limit. When this happens, the API client receives a `414 Request URI too long` response.

## Note

This limits URI length when resource policies are used. In the case of private APIs where a resource policy is required, this limits the URI length of all private APIs.

## API Gateway account-level quotas, per Region

The following quotas apply per account, per Region in Amazon API Gateway.

Resource or operation	Default quota	Can be increased
Throttle quota per account, per Region across HTTP APIs, REST APIs, WebSocket APIs, and WebSocket callback APIs	10,000 requests per second (RPS) with an additional burst capacity provided by the <a href="#">token bucket algorithm</a> , using a maximum bucket capacity of 5,000 requests. *  <b>Note</b> The burst quota is determined by the API Gateway service team based on the overall RPS quota for the account in the Region. It is not a quota that a customer can control or request changes to.	Yes
Regional APIs	600	No
Edge-optimized APIs	120	No

\* For the Africa (Cape Town) and Europe (Milan) Regions, the default throttle quota is 2500 RPS and the default burst quota is 1250 RPS.

## HTTP API quotas

The following quotas apply to configuring and running an HTTP API in API Gateway.

Resource or operation	Default quota	Can be increased
Routes per API	300	Yes
Integrations per API	300	No
Maximum integration timeout	30 seconds	No
Stages per API	10	Yes
Tags per stage	50	No
Total combined size of request line and header values	10240 bytes	No
Payload size	10 MB	No
Custom domains per account per Region	120	Yes
Access log template size	3 KB	No
Amazon CloudWatch Logs log entry	1 MB	No
Authorizers per API	10	Yes
Audiences per authorizer	50	No
Scopes per route	10	No
Timeout for JSON Web Key Set endpoint	1500 ms	No
Response size from JSON Web Key Set endpoint	150000 bytes	No
Timeout for OpenID Connect discovery endpoint	1500 ms	No
VPC links per account per Region	10	Yes
Subnets per VPC link	10	Yes



Resource or operation	Default quota	Can be increased
Stage variables per stage	100	No

## API Gateway quotas for configuring and running a WebSocket API

The following quotas apply to configuring and running a WebSocket API in Amazon API Gateway.

Resource or operation	Default quota	Can be increased
New connections per second per account (across all WebSocket APIs) per Region	500	Yes
Concurrent connections	Not applicable *	Not applicable
Amazon Lambda authorizers per API	10	Yes
Amazon Lambda authorizer result size	8 KB	No
Routes per API	300	Yes
Integrations per API	300	Yes
Stages per API	10	Yes
WebSocket frame size	32 KB	No
Message payload size	128 KB **	No
Connection duration for WebSocket API	2 hours	No
Idle Connection Timeout	10 minutes	No

\* API Gateway doesn't enforce a quota on concurrent connections. The maximum number of concurrent connections is determined by the rate of new connections per second and maximum connection duration of two hours. For example, with the default quota of 500 new connections per second, if clients connect at the maximum rate over two hours, API Gateway can serve up to 3,600,000 concurrent connections.

\*\* Because of the WebSocket frame-size quota of 32 KB, a message larger than 32 KB must be split into multiple frames, each 32 KB or smaller. If a larger message (or larger frame size) is received, the connection is closed with code 1009.

## API Gateway quotas for configuring and running a REST API

The following quotas apply to configuring and running a REST API in Amazon API Gateway.

Resource or operation	Default quota	Can be increased
Custom domain names per account per Region	120	Yes
Length, in characters, of the URL for an edge-optimized API	8192	No
Length, in characters, of the URL for a regional API	10240	No
Private APIs per account per Region	600	No
Length, in characters, of API Gateway resource policy	8192	Yes
API keys per account per Region	10000	No
Client certificates per account per Region	60	Yes
Authorizers per API (Amazon Lambda and Amazon Cognito)	10	Yes
Documentation parts per API	2000	Yes
Resources per API	300	Yes
Stages per API	10	Yes
Stage variables per stage	100	No
Length, in characters, of the key in a stage variable	64	No

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Resource or operation	Default quota	Can be increased
Length, in characters, of the value in a stage variable	512	No
Usage plans per account per Region	300	Yes
Usage plans per API key	10	Yes
VPC links per account per Region	20	Yes
API caching TTL	300 seconds by default and configurable between 0 and 3600 by an API owner.	Not for the upper bound (3600)
Cached response size	1048576 Bytes. Cache data encryption may increase the size of the item that is being cached.	No
Integration timeout	50 milliseconds - 29 seconds for all integration types, including Lambda, Lambda proxy, HTTP, HTTP proxy, and Amazon integrations.	Not for the lower or upper bounds.
Total combined size of all header values	10240 Bytes	No
Payload size	10 MB	No
Tags per stage	50	No
Number of iterations in a <code>#foreach ... #end</code> loop in mapping templates	1000	No
ARN length of a method with authorization	1600 bytes	No
Method-level throttling settings for a stage in a usage plan	20	Yes

For `restapi:import` or `restapi:put`, the maximum size of the API definition file is 6 MB.

All of the per-API quotas can only be increased on specific APIs.

## API Gateway quotas for creating, deploying and managing an API

The following fixed quotas apply to creating, deploying, and managing an API in API Gateway, using the Amazon CLI, the API Gateway console, or the API Gateway REST API and its SDKs. These quotas can't be increased.

Action	Default quota	Can be increased
<a href="#">CreateApiKey</a>	5 requests per second per account	No
<a href="#">CreateDeployment</a>	1 request every 5 seconds per account	No
<a href="#">CreateDocumentationVersion</a>	1 request every 20 seconds per account	No
<a href="#">CreateDomainName</a>	1 request every 30 seconds per account	No
<a href="#">CreateResource</a>	5 requests per second per account	No
<a href="#">CreateRestApi</a>	<p><b>Regional or private API</b></p> <ul style="list-style-type: none"> <li>1 request every 3 seconds per account</li> </ul> <p><b>Edge-optimized API</b></p> <ul style="list-style-type: none"> <li>1 request every 30 seconds per account</li> </ul>	No
<a href="#">CreateVpclink (V2)</a>	1 request every 15 seconds per account	No
<a href="#">DeleteApiKey</a>	5 requests per second per account	No
<a href="#">DeleteDomainName</a>	1 request every 30 seconds per account	No
<a href="#">DeleteResource</a>	5 requests per second per account	No
<a href="#">DeleteRestApi</a>	1 request every 30 seconds per account	No
<a href="#">GetResources</a>	5 requests every 2 seconds per account	No
<a href="#">DeleteVpclink (V2)</a>	1 request every 30 seconds per account	No
<a href="#">ImportDocumentationParts</a>	1 request every 30 seconds per account	No

Action	Default quota	Can be increased
<a href="#">ImportRestApi</a>	<p><b>Regional or private API</b></p> <ul style="list-style-type: none"> <li>1 request every 3 seconds per account</li> </ul> <p><b>Edge-optimized API</b></p> <ul style="list-style-type: none"> <li>1 request every 30 seconds per account</li> </ul>	No
<a href="#">PutRestApi</a>	1 request per second per account	No
<a href="#">UpdateAccount</a>	1 request every 20 seconds per account	No
<a href="#">UpdateDomainName</a>	1 request every 30 seconds per account	No
<a href="#">UpdateUsagePlan</a>	1 request every 20 seconds per account	No
Other operations	No quota up to the total account quota.	No
Total operations	10 requests per second with a burst quota of 40 requests per second.	No

## Amazon API Gateway important notes

### Topics

- [Amazon API Gateway important notes for REST and WebSocket APIs \(p. 750\)](#)
- [Amazon API Gateway important notes for WebSocket APIs \(p. 751\)](#)
- [Amazon API Gateway important notes for REST APIs \(p. 751\)](#)

## Amazon API Gateway important notes for REST and WebSocket APIs

- API Gateway does not support sharing a custom domain name across REST and WebSocket APIs.
- Stage names can only contain alphanumeric characters, hyphens, and underscores. Maximum length is 128 characters.
- The `/ping` and `/sping` paths are reserved for the service health check. Use of these for API root-level resources with custom domains will fail to produce the expected result.
- API Gateway currently limits log events to 1024 bytes. Log events larger than 1024 bytes, such as request and response bodies, will be truncated by API Gateway before submission to CloudWatch Logs.
- CloudWatch Metrics currently limits dimension names and values to 255 valid XML characters. (For more information, see the [CloudWatch User Guide](#).) Dimension values are a function of user-defined

names, including API name, label (stage) name, and resource name. When choosing these names, be careful not to exceed CloudWatch Metrics limits.

- The maximum size of a mapping template is 300 KB.

## Amazon API Gateway important notes for WebSocket APIs

- API Gateway supports message payloads up to 128 KB with a maximum frame size of 32 KB. If a message exceeds 32 KB, you must split it into multiple frames, each 32 KB or smaller. If a larger message is received, the connection is closed with code 1009.

## Amazon API Gateway important notes for REST APIs

- The plain text pipe character (|) is not supported for any request URL query string and must be URL-encoded.
- The semicolon character (;) is not supported for any request URL query string and results in the data being split.
- When using the API Gateway console to test an API, you may get an "unknown endpoint errors" response if a self-signed certificate is presented to the backend, the intermediate certificate is missing from the certificate chain, or any other unrecognizable certificate-related exceptions thrown by the backend.
- For an API [Resource](#) or [Method](#) entity with a private integration, you should delete it after removing any hard-coded reference of a [VpcLink](#). Otherwise, you have a dangling integration and receive an error stating that the VPC link is still in use even when the [Resource](#) or [Method](#) entity is deleted. This behavior does not apply when the private integration references [VpcLink](#) through a stage variable.
- The following backends may not support SSL client authentication in a way that's compatible with API Gateway:
  - [NGINX](#)
  - [Heroku](#)
- API Gateway supports most of the [OpenAPI 2.0 specification](#) and the [OpenAPI 3.0 specification](#), with the following exceptions:
  - Path segments can only contain alphanumeric characters, hyphens, periods, commas, colons, and curly braces. Path parameters must be separate path segments. For example, "resource/{path\_parameter\_name}" is valid; "resource{path\_parameter\_name}" is not.
  - Model names can only contain alphanumeric characters.
  - For input parameters, only the following attributes are supported: name, in, required, type, description. Other attributes are ignored.
  - The securitySchemes type, if used, must be apiKey. However, OAuth 2 and HTTP Basic authentication are supported via [Lambda authorizers \(p. 256\)](#); the OpenAPI configuration is achieved via [vendor extensions \(p. 679\)](#).
  - The deprecated field is not supported and is dropped in exported APIs.
  - API Gateway models are defined using [JSON schema draft 4](#), instead of the JSON schema used by OpenAPI.
  - The discriminator parameter is not supported in any schema object.
  - The example tag is not supported.
  - exclusiveMinimum is not supported by API Gateway.
  - The maxItems and minItems tags are not included in simple request validation. To work around this, update the model after import before doing validation.

- `oneOf` is not supported by API Gateway.
- The `readOnly` field is not supported.
- Response definitions of the `"500": { "$ref": "#/responses/UnexpectedError" }` form is not supported in the OpenAPI document root. To work around this, replace the reference by the inline schema.
- Numbers of the `Int32` or `Int64` type are not supported. An example is shown as follows:

```
"elementId": {
  "description": "Working Element Id",
  "format": "int32",
  "type": "number"
}
```

- Decimal number format type (`"format": "decimal"`) is not supported in a schema definition.
- In method responses, schema definition must be of an object type and cannot be of primitive types. For example, `"schema": { "type": "string" }` is not supported. However, you can work around this using the following object type:

```
"schema": {
  "$ref": "#/definitions/StringResponse"
}

"definitions": {
  "StringResponse": {
    "type": "string"
  }
}
```

- API Gateway doesn't use root level security defined in the OpenAPI specification. Hence security needs to be defined at an operation level to be appropriately applied.
- The default keyword is not supported.
- API Gateway enacts the following restrictions and limitations when handling methods with either Lambda integration or HTTP integration.
  - Header names and query parameters are processed in a case-sensitive way.
  - The following table lists the headers that may be dropped, remapped, or otherwise modified when sent to your integration endpoint or sent back by your integration endpoint. In this table:
    - Remapped means that the header name is changed from `<string>` to `X-Amzn-Remapped-<string>`.

Remapped Overwritten means that the header name is changed from `<string>` to `X-Amzn-Remapped-<string>` and the value is overwritten.

Header name	Request (http/http_proxy/lambda)	Response (http/http_proxy/lambda)
Age	Passthrough	Passthrough
Accept	Passthrough	Dropped/ Passthrough/ Passthrough
Accept-Charset	Passthrough	Passthrough
Accept-Encoding	Passthrough	Passthrough

Header name	Request (http/http_proxy/lambda)	Response (http/http_proxy/lambda)
Authorization	Passthrough *	Remapped
Connection	Passthrough/Passthrough/Dropped	Remapped
Content-Encoding	Passthrough/Dropped/Passthrough	Passthrough
Content-Length	Passthrough (generated based on body)	Passthrough
Content-MD5	Dropped	Remapped
Content-Type	Passthrough	Passthrough
Date	Passthrough	Remapped Overwritten
Expect	Dropped	Dropped
Host	Overwritten to the integration endpoint	Dropped
Max-Forwards	Dropped	Remapped
Pragma	Passthrough	Passthrough
Proxy-Authenticate	Dropped	Dropped
Range	Passthrough	Passthrough
Referer	Passthrough	Passthrough
Server	Dropped	Remapped Overwritten
TE	Dropped	Dropped
Transfer-Encoding	Dropped/Dropped/Exception	Dropped
Trailer	Dropped	Dropped
Upgrade	Dropped	Dropped
User-Agent	Passthrough	Remapped
Via	Dropped/Dropped/Passthrough	Passthrough/ Dropped/ Dropped
Warn	Passthrough	Passthrough
WWW-Authenticate	Dropped	Remapped

\* The Authorization header is dropped if it contains a [Signature Version 4](#) signature.



- The Android SDK of an API generated by API Gateway uses the `java.net.HttpURLConnection` class. This class will throw an unhandled exception, on devices running Android 4.4 and earlier, for a 401 response resulted from remapping of the `WWW-Authenticate` header to `X-Amzn-Remapped-WWW-Authenticate`.
- Unlike API Gateway-generated Java, Android and iOS SDKs of an API, the JavaScript SDK of an API generated by API Gateway does not support retries for 500-level errors.
- The test invocation of a method uses the default content type of `application/json` and ignores specifications of any other content types.
- When sending requests to an API by passing the `X-HTTP-Method-Override` header, API Gateway overrides the method. So in order to pass the header to the backend, the header needs to be added to the integration request.
- When a request contains multiple media types in its `Accept` header, API Gateway only honors the first `Accept` media type. In the situation where you cannot control the order of the `Accept` media types and the media type of your binary content is not the first in the list, you can add the first `Accept` media type in the `binaryMediaTypes` list of your API, API Gateway will return your content as binary. For example, to send a JPEG file using an `<img>` element in a browser, the browser might send `Accept:image/webp,image/*,*/*;q=0.8` in a request. By adding `image/webp` to the `binaryMediaTypes` list, the endpoint will receive the JPEG file as binary.
- Customizing the default gateway response for 413 `REQUEST_TOO_LARGE` isn't currently supported.

# Document history

The following table describes the important changes to the documentation since the last release of Amazon API Gateway. For notification about updates to this documentation, you can subscribe to an RSS feed by choosing the RSS button in the top menu panel.

- **Latest documentation update:** July 12, 2021

update-history-change	update-history-description	update-history-date
<a href="#">Managed policy update (p. 755)</a>	Added <code>acm:GetCertificate</code> support to the <code>AWSServiceRoleForAPIGateway</code> policy. For more information, see <a href="#">Using service-linked roles for API Gateway</a> .	July 12, 2021
<a href="#">Parameter mapping for HTTP APIs (p. 755)</a>	Added support for parameter mapping for HTTP APIs. For more information, see <a href="#">Transforming API requests and responses</a> .	January 7, 2021
<a href="#">Disable the default endpoint for a REST API (p. 755)</a>	Added support for disabling the default endpoint for REST APIs. For more information, see <a href="#">Disabling the default endpoint for a REST API</a> .	October 29, 2020
<a href="#">Mutual TLS authentication (p. 755)</a>	Added support for mutual TLS authentication for REST APIs and HTTP APIs. For more information, see <a href="#">Configuring mutual TLS authentication for a REST API</a> and <a href="#">Configuring mutual TLS authentication for an HTTP API</a> .	September 17, 2020
<a href="#">HTTP API Amazon Lambda authorizers (p. 755)</a>	Added support for Amazon Lambda authorizers for HTTP APIs. For more information, see <a href="#">Working with Amazon Lambda authorizers for HTTP APIs</a> .	September 9, 2020
<a href="#">HTTP API Amazon service integrations (p. 755)</a>	Added support for Amazon service integrations for HTTP APIs. For more information, see <a href="#">Working with Amazon service integrations for HTTP APIs</a> .	August 20, 2020
<a href="#">HTTP API wildcard custom domains (p. 755)</a>	Added support for wildcard custom domain names for HTTP APIs. For more information, see <a href="#">Wildcard custom domain names</a> .	August 10, 2020

<a href="#">Serverless developer portal improvements (p. 755)</a>	Added user management to the administrator panel and support for exporting API definitions. For more information, see <a href="#">Use the serverless developer portal to catalog your API Gateway APIs</a> .	June 25, 2020
<a href="#">WebSocket API Sec-WebSocket-Protocol support (p. 755)</a>	Added support for the Sec-WebSocket-Protocol field. For more information, see <a href="#">Setting up a \$connect route that requires a WebSocket subprotocol</a> .	June 16, 2020
<a href="#">HTTP API export (p. 755)</a>	Added support for exporting OpenAPI 3.0 definitions of HTTP APIs. For more information, see <a href="#">Exporting an HTTP API from API Gateway</a> .	April 20, 2020
<a href="#">Security documentation (p. 755)</a>	Added security documentation. For more information, see <a href="#">Security in Amazon API Gateway</a> .	March 31, 2020
<a href="#">Reorganized documentation (p. 755)</a>	Reorganized the developer guide.	March 12, 2020
<a href="#">HTTP API general availability (p. 755)</a>	Released HTTP APIs in general availability. For more information, see <a href="#">Working with HTTP APIs</a> .	March 12, 2020
<a href="#">Amazon variables for OpenAPI import (p. 755)</a>	Added support for Amazon variables in OpenAPI definitions. For more information, see <a href="#">Amazon Variables for OpenAPI Import</a> .	February 17, 2020
<a href="#">Wildcard custom domain names (p. 755)</a>	Added support for wildcard custom domain names. For more information, see <a href="#">Wildcard Custom Domain Names</a> .	October 21, 2019
<a href="#">Amazon Kinesis Data Firehose logging (p. 755)</a>	Added support for Amazon Kinesis Data Firehose as a destination for access logging data. For more information, see <a href="#">Using Amazon Kinesis Data Firehose as a Destination for API Gateway Access Logging</a> .	October 15, 2019
<a href="#">Route53 aliases for invoking private APIs (p. 755)</a>	Added support for additional Route53 alias DNS records for invoking private APIs. For more information, see <a href="#">Accessing Your Private API Using Route53 Alias</a> .	September 18, 2019

<a href="#">Tag-based access control for WebSocket APIs (p. 755)</a>	Added support for tag-based access control for WebSocket APIs. For more information, see <a href="#">API Gateway Resources That Can Be Tagged</a> .	June 27, 2019
<a href="#">TLS version selection for custom domains (p. 755)</a>	Added support for Transport Layer Security (TLS) version selection for APIs that are deployed to custom domains. See the note in <a href="#">Choose a Minimum TLS Version for a Custom Domain in API Gateway</a> .	June 20, 2019
<a href="#">VPC endpoint policies for private APIs (p. 755)</a>	Added support for improving the security of private APIs by attaching endpoint policies to interface VPC endpoints. For more information, see <a href="#">Use VPC Endpoint Policies for Private APIs in API Gateway</a> .	June 4, 2019
<a href="#">Documentation updated (p. 755)</a>	Rewrote <a href="#">Getting Started with Amazon API Gateway</a> . Moved tutorials to <a href="#">Amazon API Gateway Tutorials</a> .	May 29, 2019
<a href="#">Tag-based access control for REST APIs (p. 755)</a>	Added support for tag-based access control for REST APIs. For more information, see <a href="#">Using Tags with IAM Policies to Control Access to API Gateway Resources</a> .	May 23, 2019
<a href="#">Documentation updated (p. 755)</a>	Rewrote 6 topics: <a href="#">What Is Amazon API Gateway?</a> , <a href="#">Tutorial: Build an API with HTTP Proxy Integration</a> , <a href="#">Tutorial: Create a Calc REST API with Three Non-Proxy Integrations</a> , <a href="#">API Gateway Mapping Template and Access Logging Variable Reference</a> , <a href="#">Use API Gateway Lambda Authorizers</a> , and <a href="#">Enable CORS for an API Gateway REST API Resource</a> .	April 5, 2019
<a href="#">Serverless developer portal improvements (p. 755)</a>	Added administrator panel and other improvements to make it easier to publish APIs in the Amazon API Gateway developer portal. For more information, see <a href="#">Use a Developer Portal to Catalog Your APIs</a> .	March 28, 2019

<a href="#">Support for Amazon Config (p. 755)</a>	Added support for Amazon Config. For more information, see <a href="#">Monitoring API Gateway API Configuration with Amazon Config</a> .	March 20, 2019
<a href="#">Support for Amazon CloudFormation (p. 755)</a>	Added API Gateway V2 API to the Amazon CloudFormation template reference. For more information, see <a href="#">Amazon API Gateway V2 Resource Types Reference</a> .	February 7, 2019
<a href="#">Support for WebSocket APIs (p. 755)</a>	Added support for WebSocket APIs. For more information, see <a href="#">Creating a WebSocket API in Amazon API Gateway</a> .	December 18, 2018
<a href="#">Serverless developer portal available through Amazon Serverless Application Repository (p. 755)</a>	The Amazon API Gateway developer portal serverless application is now available from the <a href="#">Amazon Serverless Application Repository</a> (in addition to <a href="#">GitHub</a> ). For more information, see <a href="#">Use a Developer Portal to Catalog Your API Gateway APIs</a> .	November 16, 2018
<a href="#">Support for Amazon WAF (p. 755)</a>	Added support for <a href="#">Amazon WAF</a> (Web Application Firewall). For more information, see <a href="#">Control Access to an API Using Amazon WAF</a> .	November 5, 2018
<a href="#">Serverless developer portal (p. 755)</a>	Amazon API Gateway now provides a fully customizable developer portal as a serverless application that you can deploy for publishing your API Gateway APIs. For more information, see <a href="#">Use a Developer Portal to Catalog Your API Gateway APIs</a> .	October 29, 2018
<a href="#">Support for multi-value headers and query string parameters (p. 755)</a>	Amazon API Gateway now supports multiple headers and query string parameters that have the same name. For more information, see <a href="#">Support for Multi-Value Headers and Query String Parameters</a> .	October 4, 2018
<a href="#">OpenAPI support (p. 755)</a>	Amazon API Gateway now supports OpenAPI 3.0 as well as OpenAPI (Swagger) 2.0.	September 27, 2018
<a href="#">Documentation updated (p. 755)</a>	Added a new topic: <a href="#">How Amazon API Gateway Resource Policies Affect Authorization Workflow</a> .	September 27, 2018

<a href="#">Active Amazon X-Ray integration (p. 755)</a>	You can now use Amazon X-Ray to trace and analyze latencies in user requests as they travel through your APIs to the underlying services. For more information, see <a href="#">Trace API Gateway API Execution with Amazon X-Ray</a> .	September 6, 2018
<a href="#">Caching improvements (p. 755)</a>	Only GET methods will have caching enabled by default when you enable caching for an API stage. This helps to ensure the safety of your API. You can enable caching for other methods by overriding method settings. For more information, see <a href="#">Enable API Caching to Enhance Responsiveness</a> .	August 20, 2018
<a href="#">Service limits revised (p. 755)</a>	Several limits have been revised: Increased number of APIs per account. Increased API rate limits for Create/Import/Deploy APIs. Corrected some rates from per minute to per second. For more information, see <a href="#">Limits</a> .	July 13, 2018
<a href="#">Overriding API request and response parameters and headers (p. 755)</a>	Added support for overriding request headers, query strings, and paths, as well as response headers and status codes. For more information, see <a href="#">Use a Mapping Template to Override an API's Request and Response Parameters and Headers</a> .	July 12, 2018
<a href="#">Method-level throttling for usage plans (p. 755)</a>	Added support for setting default per-method throttling limits, as well as setting throttling limits for individual API methods in usage plan settings. These settings are in addition to the existing account-level throttling and default method-level throttling limits that you can set in stage settings. For more information, see <a href="#">Throttle API Requests for Better Throughput</a> .	July 11, 2018

[API Gateway Developer Guide update notifications now available through RSS \(p. 755\)](#)

The HTML version of the API Gateway Developer Guide now supports an RSS feed of updates that are documented on this **Document History** page. The RSS feed includes updates made June 27, 2018, and later. Previously announced updates are still available on this page. Use the RSS button in the top menu panel to subscribe to the feed.

June 27, 2018

## Earlier updates

The following table describes important changes in each release of the *API Gateway Developer Guide* before June 27, 2018.

Change	Description	Date changed
Private APIs	Added support for <a href="#">private APIs (p. 599)</a> , which you expose via <a href="#">interface VPC endpoints</a> . Traffic to your private APIs does not leave the Amazon network; it is isolated from the public internet.	June 14, 2018
Cross-Account Lambda Authorizers and Integrations and Cross-Account Amazon Cognito User Pool Authorizers	Use an Amazon Lambda function from a different Amazon account as a Lambda authorizer function or as an API integration backend. Or use an Amazon Cognito user pool as an authorizer. The other account can be in any region where Amazon API Gateway is available. For more information, see <a href="#">the section called "Configure a cross-account Lambda authorizer" (p. 268)</a> , <a href="#">the section called "Tutorial: Build an API with cross-account Lambda proxy integration" (p. 33)</a> , and <a href="#">the section called "Configure cross-account Amazon Cognito authorizer for a REST API" (p. 277)</a> .	April 2, 2018
Resource Policies for APIs	Use API Gateway resource policies to enable users from a different Amazon account to securely access your API or to allow the API to be invoked only from specified source IP address ranges or CIDR blocks. For more information, see <a href="#">the section called "Use API Gateway resource policies" (p. 237)</a> .	April 2, 2018
Tagging for API Gateway resources	Tag an API stage with up to 50 tags for cost allocation of API requests and caching in API Gateway. For more information see <a href="#">the section called "Set up tags" (p. 443)</a> .	December 19, 2017
Payload compression and decompression	Enable calling your API with compressed payloads using one of the supported content codings. The compressed payloads are subject to mapping if a body-mapping template is specified. For more information, see <a href="#">the section called "Content encoding" (p. 487)</a> .	December 19, 2017
API key sourced from a custom authorizer	Return an API key from a custom authorizer to API Gateway to apply a usage plan for API methods that require the key. For	December 19, 2017

Change	Description	Date changed
	more information, see <a href="#">the section called "Choose an API key source"</a> (p. 493).	
Authorization with OAuth 2 scopes	Enable authorization of method invocation by using OAuth 2 scopes with the COGNITO_USER_POOLS authorizer. For more information, see <a href="#">the section called "Use Amazon Cognito user pool as authorizer for a REST API"</a> (p. 270).	December 14, 2017
Private Integration and VPC Link	Create an API with the API Gateway private integration to provide clients with access to HTTP/HTTPS resources in an Amazon VPC from outside of the VPC through a <a href="#">VpLink</a> resource. For more information, see <a href="#">the section called "Tutorial: Build an API with private integration"</a> (p. 71) and <a href="#">the section called "Private integration"</a> (p. 308).	November 30, 2017
Deploy a Canary for API testing	Add a canary release to an existing API deployment to test a newer version of the API while keeping the current version in operation on the same stage. You can set a percentage of stage traffic for the canary release and enable canary-specific execution and access logged in separate CloudWatch Logs logs. For more information, see <a href="#">the section called "Set up a canary release deployment"</a> (p. 451).	November 28, 2017
Access Logging	Log client access to your API with data derived from <a href="#">\$context variables</a> (p. 363) in a format of your choosing. For more information, see <a href="#">the section called "CloudWatch logs"</a> (p. 611).	November 21, 2017
Ruby SDK of an API	Generate a Ruby SDK for your API and use it to invoke your API methods. For more information, see <a href="#">the section called "Generate the Ruby SDK of an API"</a> (p. 545) and <a href="#">the section called "Use a Ruby SDK generated by API Gateway for a REST API"</a> (p. 416).	November 20, 2017
Regional API endpoint	Specify a regional API endpoint to create an API for non-mobile clients. A non-mobile client, such as an EC2 instance, runs in the same Amazon Region where the API is deployed. As with an edge-optimized API, you can create a custom domain name for a regional API. For more information, see <a href="#">the section called "Set up a regional API"</a> (p. 222) and <a href="#">the section called "Setting up a regional custom domain name"</a> (p. 475).	November 2, 2017
Custom request authorizer	Use custom request authorizer to supply user-authenticating information in request parameters to authorize API method calls. The request parameters include headers and query string parameters as well as stage and context variables. For more information, see <a href="#">Use API Gateway Lambda authorizers</a> (p. 256).	September 15, 2017



Change	Description	Date changed
Customizing gateway responses	Customize API Gateway-generated gateway responses to API requests that failed to reach the integration backend. A customized gateway message can provide the caller with API-specific custom error messages, including returning needed CORS headers, or can transform the gateway response data to a format of an external exchange. For more information, see <a href="#">Setting up gateway responses to customize error responses (p. 376)</a> .	June 6, 2017
Mapping Lambda custom error properties to method response headers	Map individual custom error properties returned from Lambda to the method response header parameters using the <code>integration.response.body</code> parameter, relying API Gateway to deserialize the stringified custom error object at run time. For more information, see <a href="#">Handle custom Lambda errors in API Gateway (p. 302)</a> .	June 6, 2017
Throttling limits increase	Increase the account-level steady-state request rate limit to 10,000 requests per second (rps) and the burst limit to 5000 concurrent requests. For more information, see <a href="#">Throttle API requests for better throughput (p. 598)</a> .	June 6, 2017
Validating method requests	Configure basic request validators on the API level or method levels so that API Gateway can validate incoming requests. API Gateway verifies that required parameters are set and not blank, and verifies that the format of applicable payloads conforms to the configured model. For more information, see <a href="#">Enable request validation in API Gateway (p. 318)</a> .	April 11, 2017
Integrating with ACM	Use ACM Certificates for your API's custom domain names. You can create a certificate in Amazon Certificate Manager or import an existing PEM-formatted certificate into ACM. You then refer to the certificate's ARN when setting a custom domain name for your APIs. For more information, see <a href="#">Setting up custom domain names for REST APIs (p. 463)</a> .	March 9, 2017
Generating and calling a Java SDK of an API	Let API Gateway generate the Java SDK for your API and use the SDK to call the API in your Java client. For more information, see <a href="#">Use a Java SDK generated by API Gateway for a REST API (p. 410)</a> .	January 13, 2017
Integrating with Amazon Web Services Marketplace	Sell your API in a usage plan as a SaaS product through Amazon Web Services Marketplace. Use Amazon Web Services Marketplace to extend the reach of your API. Rely on Amazon Web Services Marketplace for customer billing on your behalf. Let API Gateway handle user authorization and usage metering. For more information, see <a href="#">Sell your APIs as SaaS (p. 561)</a> .	December 1, 2016
Enabling Documentation Support for your API	Add documentation for API entities in <code>DocumentationPart</code> resources in API Gateway. Associate a snapshot of the collection <code>DocumentationPart</code> instances with an API stage to create a <code>DocumentationVersion</code> . Publish API documentation by exporting a documentation version to an external file, such as a Swagger file. For more information, see <a href="#">Documenting REST APIs (p. 503)</a> .	December 1, 2016

Change	Description	Date changed
Updated custom authorizer	A customer authorizer Lambda function now returns the caller's principal identifier. The function also can return other information as key-value pairs of the <code>context</code> map and an IAM policy. For more information, see <a href="#">Output from an Amazon API Gateway Lambda authorizer (p. 266)</a> .	December 1, 2016
Supporting binary payloads	Set <code>binaryMediaTypes</code> on your API to support binary payloads of a request or response. Set the <code>contentHandling</code> property on an <a href="#">Integration</a> or <a href="#">IntegrationResponse</a> to specify whether to handle a binary payload as the native binary blob, as a Base64-encoded string, or as a passthrough without modifications. For more information, see <a href="#">Working with binary media types for REST APIs (p. 388)</a> .	November 17, 2016
Enabling a proxy integration with an HTTP or Lambda backend through a proxy resource of an API.	Create a proxy resource with a greedy path parameter of the form <code>{proxy+}</code> and the catch-all <code>ANY</code> method. The proxy resource is integrated with an HTTP or Lambda backend using the HTTP or Lambda proxy integration, respectively. For more information, see <a href="#">Set up a proxy integration with a proxy resource (p. 282)</a> .	September 20, 2016
Extending selected APIs in API Gateway as product offerings for your customers by providing one or more usage plans.	Create a usage plan in API Gateway to enable selected API clients to access specified API stages at agreed-upon request rates and quotas. For more information, see <a href="#">Creating and using usage plans with API keys (p. 491)</a> .	August 11, 2016
Enabling method-level authorization with a user pool in Amazon Cognito	Create a user pool in Amazon Cognito and use it as your own identity provider. You can configure the user pool as a method-level authorizer to grant access for users who are registered with the user pool. For more information, see <a href="#">Control access to a REST API using Amazon Cognito user pools as authorizer (p. 270)</a> .	July 28, 2016
Enabling Amazon CloudWatch metrics and dimensions under the <code>AWS/ApiGateway</code> namespace.	The API Gateway metrics are now standardized under the CloudWatch namespace of <code>AWS/ApiGateway</code> . You can view them in both the API Gateway console and the Amazon CloudWatch console. For more information, see <a href="#">Amazon API Gateway dimensions and metrics (p. 606)</a> .	July 28, 2016
Enabling certificate rotation for a custom domain name	Certificate rotation allows you to upload and renew an expiring certificate for a custom domain name. For more information, see <a href="#">Rotate a certificate imported into ACM (p. 474)</a> .	April 27, 2016
Documenting changes for the updated Amazon API Gateway console.	Learn how to create and set up an API using the updated API Gateway console. For more information, see <a href="#">Tutorial: Create a REST API by importing an example (p. 43)</a> and <a href="#">Tutorial: Build a REST API with HTTP non-proxy integration (p. 49)</a> .	April 5, 2016

Change	Description	Date changed
Enabling the Import API feature to create a new or update an existing API from external API definitions.	With the Import API features, you can create a new API or update an existing one by uploading an external API definition expressed in Swagger 2.0 with the API Gateway extensions. For more information about the Import API, see <a href="#">Configuring a REST API using OpenAPI (p. 427)</a> .	April 5, 2016
Exposing the <code>\$input.body</code> variable to access the raw payload as string and the <code>\$util.parseJson()</code> function to turn a JSON string into a JSON object in a mapping template.	For more information about <code>\$input.body</code> and <code>\$util.parseJson()</code> , see <a href="#">API Gateway mapping template and access logging variable reference (p. 363)</a> .	April 5, 2016
Enabling client requests with method-level cache invalidation, and improving request throttling management.	Flush API stage-level cache and invalidate individual cache entry. For more information, see <a href="#">Flush the API stage cache in API Gateway (p. 486)</a> and <a href="#">Invalidate an API Gateway cache entry (p. 486)</a> . Improve the console experience for managing API request throttling. For more information, see <a href="#">Throttle API requests for better throughput (p. 598)</a> .	March 25, 2016
Enabling and calling API Gateway API using custom authorization	Create and configure an Amazon Lambda function to implement custom authorization. The function returns an IAM policy document that grants the Allow or Deny permissions to client requests of an API Gateway API. For more information, see <a href="#">Use API Gateway Lambda authorizers (p. 256)</a> .	February 11, 2016
Importing and exporting API Gateway API using a Swagger definition file and extensions	Create and update your API Gateway API using the Swagger specification with the API Gateway extensions. Import the Swagger definitions using the API Gateway Importer. Export an API Gateway API to a Swagger definition file using the API Gateway console or API Gateway Export API. For more information, see <a href="#">Configuring a REST API using OpenAPI (p. 427)</a> and <a href="#">Export a REST API from API Gateway (p. 433)</a> .	December 18, 2015
Mapping request or response body or body's JSON fields to request or response parameters.	Map method request body or its JSON fields into integration request's path, query string, or headers. Map integration response body or its JSON fields into request response's headers. For more information, see <a href="#">Amazon API Gateway API request and response data mapping reference (p. 359)</a> .	December 18, 2015
Working with Stage Variables in Amazon API Gateway	Learn how to associate configuration attributes with a deployment stage of an API in Amazon API Gateway. For more information, see <a href="#">Setting up stage variables for a REST API deployment (p. 446)</a> .	November 5, 2015
How to: Enable CORS for a Method	It is now easier to enable cross-origin resource sharing (CORS) for methods in Amazon API Gateway. For more information, see <a href="#">Enabling CORS for a REST API resource (p. 382)</a> .	November 3, 2015

Change	Description	Date changed
How to: Use Client Side SSL Authentication	Use Amazon API Gateway to generate SSL certificates that you can use to authenticate calls to your HTTP backend. For more information, see <a href="#">Generate and configure an SSL certificate for backend authentication (p. 569)</a> .	September 22, 2015
Mock integration of methods	Learn how to <a href="#">mock-integrate an API with Amazon API Gateway (p. 315)</a> . This feature enables developers to generate API responses from API Gateway directly without the need for a final integration backend beforehand.	September 1, 2015
Amazon Cognito Identity support	Amazon API Gateway has expanded the scope of the <code>\$context</code> variable so that it now returns information about Amazon Cognito Identity when requests are signed with Amazon Cognito credentials. In addition, we have added a <code>\$util</code> variable for escaping characters in JavaScript and encoding URLs and strings. For more information, see <a href="#">API Gateway mapping template and access logging variable reference (p. 363)</a> .	August 28, 2015
Swagger integration	Use the <a href="#">Swagger import tool on GitHub</a> to import Swagger API definitions into Amazon API Gateway. Learn more about <a href="#">Working with API Gateway extensions to OpenAPI (p. 675)</a> to create and deploy APIs and methods using the import tool. With the Swagger importer tool you can also update existing APIs.	July 21, 2015
Mapping Template Reference	Read about the <code>\$input</code> parameter and its functions in the <a href="#">API Gateway mapping template and access logging variable reference (p. 363)</a> .	July 18, 2015
Initial public release	This is the initial public release of the <i>API Gateway Developer Guide</i> .	July 9, 2015

# Amazon glossary

For the latest Amazon terminology, see the [Amazon glossary](#) in the *Amazon General Reference*.