

Reference Guide

AWS SDKs and Tools



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AWS SDKs and Tools: Reference Guide

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AWS SDKs and Tools Reference Guide

Many SDKs and tools share some common functionality, either through shared design specifications or through a shared library.

This guide includes information regarding:

- <u>Configuration</u> How to use the shared config and credentials files or environment variables to configure your AWS SDKs and tools.
- <u>Authentication and access</u> Establish how your code or tool authenticates with AWS when you
 develop with AWS services.
- <u>Settings reference</u> Reference for all standardized settings available for authentication and configuration.
- <u>AWS Common Runtime (CRT) libraries</u> Overview of the shared AWS Common Runtime (CRT) libraries that are available to almost all SDKs.
- <u>AWS SDKs and Tools maintenance policy</u> covers the maintenance policy and versioning for AWS
 Software Development Kits (SDKs) and tools, including Mobile and Internet of Things (IoT) SDKs,
 and their underlying dependencies.

This AWS SDKs and Tools Reference Guide is intended to be a base of information that is applicable to multiple SDKs and tools. The specific guide for the SDK or tool that you are using should be used in addition to any information presented here. The following are the SDK and tools which have relevant sections of material in this guide:

| If you are using: | This guide's relevant sections for you are: |
|--|---|
| Any SDK or tool | AWS SDKs and Tools maintenance policy |
| AWS Cloud9 | Configuration |
| • AWS CDK | Authentication and access |
| AWS Toolkit for Azure DevOps | |
| AWS Toolkit for JetBrains | AWS SDKs and Tools maintenance policy |
| AWS Toolkit for Visual Studio | |
| AWS Toolkit for Visual Studio Code | |
| AWS Serverless Application Model | |

| If you are using: | This guide's relevant sections for you are: |
|----------------------------------|---|
| AWS CodeArtifact | |
| AWS CodeBuild | |
| Amazon CodeCatalyst | |
| AWS CodeCommit | |
| AWS CodeDeploy | |
| AWS CodePipeline | |
| | |
| • AWS CLI | Configuration |
| • AWS SDK for C++ | Authentication and access |
| AWS SDK for Go | |
| AWS SDK for Java | Settings reference |
| AWS SDK for JavaScript | AWS Common Runtime (CRT) libraries |
| AWS SDK for Kotlin | ANC CDVs and Tools maintenance notice |
| AWS SDK for .NET | AWS SDKs and Tools maintenance policy |
| AWS SDK for PHP | AWS SDKs and Tools version support |
| • AWS SDK for Python (Boto3) | |
| AWS SDK for Ruby | |
| AWS SDK for Rust | |
| AWS SDK for Swift | |
| AWS Tools for Windows PowerShell | |

Developer resources

For an overview of tools that can help you develop applications on AWS, see <u>Tools to Build on AWS</u>. For information on support, see the AWS Knowledge Center.

Amazon Q Developer is a generative AI-powered conversational assistant that can help you to understand, build, extend, and operate AWS applications. To accelerate your building on AWS, the model that powers Amazon Q is augmented with high-quality AWS content to produce more complete, actionable, and referenced answers. For more information, see What is Amazon Q Developer? in the Amazon Q Developer User Guide.

Developer resources 2

Toolkit telemetry notification

AWS Integrated Development Environment (IDE) Toolkits are plugins and extensions that enable access to AWS services from your IDE. For detailed information about each of the IDE Toolkits, see the Toolkit User Guides in the preceding table.

AWS IDE Toolkits may collect and store client-side telemetry data to inform decisions regarding future AWS Toolkit releases. The data collected quantifies your usage of the AWS Toolkit.

To learn more about the telemetry data collected across all of the AWS IDE Toolkits, see the commonDefinitions.json document in the aws-toolkit-common Github repository.

For detailed information about the telemetry data collected by each of the AWS IDE Toolkits, reference the resource documents in the following AWS Toolkits' Github repositories:

- AWS Toolkit for Visual Studio
- AWS Toolkit for Visual Studio Code
- AWS Toolkit for JetBrains

Certain AWS services that are accessible in the AWS Toolkits may collect additional client-side telemetry data. For detailed information about the type of data collected by each individual AWS service, see the AWS Documentation topic for the specific service you're interested in.

Configuration

With AWS SDKs and other AWS developer tools, such as the AWS Command Line Interface (AWS CLI), you can interact with AWS service APIs. Before attempting that, however, you must configure the SDK or tool with the information that it needs to perform the requested operation.

This information includes the following items:

- Credentials information that identifies who is calling the API. The credentials are used to
 encrypt the request to the AWS servers. Using this information, AWS confirms your identity and
 can retrieve permissions policies associated with it. Then it can determine what actions you're
 allowed to perform.
- Other configuration details that you use to tell the AWS CLI or SDK how to process the request, where to send the request (to which AWS service endpoint), and how to interpret or display the response.

Each SDK or tool supports multiple sources that you can use to supply the required credential and configuration information. Some sources are unique to the SDK or tool, and you must refer to the documentation for that tool or SDK for the details on how to use that method.

However, most of the AWS SDKs and tools support common settings from two primary sources (beyond the code itself):

- Shared AWS config and credentials files The shared config and credentials files are the most common way that you can specify authentication and configuration to an AWS SDK or tool. Use these files to store settings that your tools and applications can use. Settings within the shared config and credentials files are associated with a specific profile. With multiple profiles, you can create different settings configurations to apply in different scenarios. When you use an AWS tool to invoke a command or use an SDK to invoke an AWS API, you can specify which profile, and thus which configuration settings, to use for that action. One of the profiles is designated as the default profile and is used automatically when you don't explicitly specify a profile to use. The settings that you can store in these files are documented in this reference quide.
- Environment variables Some of the settings can alternatively be stored in the environment variables of your operating system. Although you can have only one set of environment variables in effect at a time, they are easily modified dynamically as your program runs and your requirements change.

Additional topics in this section

- Shared config and credentials files
- Location of the shared config and credentials files
- **Environment variables support**
- JVM system properties support

Shared config and credentials files

The shared AWS config and credentials files contain a set of profiles. A profile is a set of configuration settings, in key-value pairs, that is used by the AWS Command Line Interface (AWS CLI), the AWS SDKs, and other tools. Configuration values are attached to a profile in order to configure some aspect of the SDK/tool when that profile is used. These files are "shared" in that the values take affect for any applications, processes, or SDKs on the local environment for a user.

Both the shared config and credentials files are plaintext files that contain only ASCII characters (UTF-8 encoded). They take the form of what are generally referred to as INI files.

Profiles

Settings within the shared config and credentials files are associated with a specific profile. Multiple profiles can be defined within the file to create different setting configurations to apply in different development environments.

The [default] profile contains the values that are used by an SDK or tool operation if a specific named profile is not specified. You can also create separate profiles that you can explicitly reference by name. Each profile can use different settings and values as needed by your application and scenario.



Note

[default] is simply an unnamed profile. This profile is named default because it is the default profile used by the SDK if the user does not specify a profile. It does not provide inherited default values to other profiles. If you set something in the [default] profile and you don't set it in a named profile, then the value isn't set when you use the named profile.

Set a named profile

The [default] profile and multiple named profiles can exist in the same file. Use the following setting to select which profile's settings are used by your SDK or tool when running your code. Profiles can also be selected within code, or per-command when working with the AWS CLI.

Configure this functionality by setting one of the following:

AWS_PROFILE - environment variable

When this environment variable is set to a named profile or "default", all SDK code and AWS CLI commands use the settings in that profile.

Linux/macOS example of setting environment variables via command line:

```
export AWS_PROFILE="my_default_profile_name";
```

Windows example of setting environment variables via command line:

```
setx AWS_PROFILE "my_default_profile_name"
```

aws.profile - JVM system property

For SDK for Kotlin on the JVM and the SDK for Java 2.x, you can <u>set the aws.profile system</u> <u>property</u>. When the SDK creates a service client, it uses the settings in the named profile unless the setting is overridden in code. The SDK for Java 1.x does not support this system property.

Format of the config file

The config file is organized into sections. A section is a named collection of settings, and continues until another section definition line is encountered.

The config file is a plaintext file that uses the following format:

- All entries in a section take the general form of setting-name=value.
- Lines can be commented out by starting the line with a hashtag character (#).

Format of the config file 6

Section types

A section definition is a line that applies a name to a collection of settings. Section definition lines start and end with square brackets ([]). Inside the brackets, there is a section type identifier and a custom name for the section. You can use letters, numbers, hyphens (-), and underscores (_), but no spaces.

Section type: default

Example section definition line: [default]

[default] is the only profile that does not require the profile section identifier.

The following example shows a basic config file with a [default] profile. It sets the <u>region</u> setting. All settings that follow this line, up until another section definition is encountered, are part of this profile.

```
[default]
#Full line comment, this text is ignored.
region = us-east-2
```

Section type: profile

Example section definition line: [profile dev]

The profile section definition line is a named configuration grouping that you can apply for different development scenarios. To better understand named profiles, see the preceding section on Profiles.

The following example shows a config file with a profile section definition line and a named profile called foo. All settings that follow this line, up until another section definition is encountered, are part of this named profile.

```
[profile foo]
...settings...
```

Some settings have their own nested group of subsettings, such as the s3 setting and subsettings in the following example. Associate the subsettings with the group by indenting them by one or more spaces.

```
[profile test]
```

Format of the config file

```
region = us-west-2
s3 =
    max_concurrent_requests=10
    max_queue_size=1000
```

Section type: sso-session

Example section definition line: [sso-session my-sso]

The sso-session section definition line names a group of settings that you use to configure a profile to resolve AWS credentials using AWS IAM Identity Center. For more information on configuring single sign-on authentication, see IAM Identity Center authentication for your SDK or tool. A profile is linked to a sso-session section by a key-value pair where sso-session is the key and the name of your sso-session section is the value, such as sso-session = <nameof-sso-session-section>.

The following example configures a profile that will get short-term AWS credentials for the "SampleRole" IAM role in the "111122223333" account using a token from the "my-sso". The "mysso" sso-session section is referenced in the profile section by name using the sso-session key.

```
[profile dev]
sso_session = my-sso
sso_account_id = 111122223333
sso_role_name = SampleRole
[sso-session my-sso]
sso_region = us-east-1
sso_start_url = https://my-sso-portal.awsapps.com/start
```

Section type: services

Example section definition line: [services *dev*]



Note

The services section supports service-specific endpoint customizations and is only available in SDKs and tools that include this feature. To see if this feature is available for your SDK, see Compatibility with AWS SDKs for service-specific endpoints.

Format of the config file

The services section definition line names a group of settings that configures custom endpoints for AWS service requests. A profile is linked to a services section by a key-value pair where services is the key and the name of your services section is the value, such as services = <name-of-services-section>.

The services section is further separated into subsections by <SERVICE> = lines, where <SERVICE> is the AWS service identifier key. The AWS service identifier is based on the API model's serviceId by replacing all spaces with underscores and lowercasing all letters. For a list of all service identifier keys to use in the services section, see Identifiers for service-specific endpoints. The service identifier key is followed by nested settings with each on its own line and indented by two spaces.

The following example uses a services definition to configure the endpoint to use for requests made only to the Amazon DynamoDB service. The "local-dynamodb" services section is referenced in the profile section by name using the services key. The AWS service identifier key is dynamodb. The Amazon DynamoDB service subsection begins on the line dynamodb = . Any immediately following lines that are indented are included in that subsection and apply to that service.

```
[profile dev]
services = local-dynamodb

[services local-dynamodb]
dynamodb =
  endpoint_url = http://localhost:8000
```

For more information on custom endpoint configuration, see Service-specific endpoints.

Format of the credentials file

The rules for the credentials file are generally identical to those for the config file, except that profile sections don't begin with the word profile. Use only the profile name itself between square brackets. The following example shows a credentials file with a named profile section called foo.

```
[foo]
...credential settings...
```

Format of the credentials file 9

Only the following settings that are considered "secrets" or sensitive can be stored in the credentials file: aws_access_key_id,aws_secret_access_key, and aws_session_token. Although these settings can alternatively be placed in the shared config file, we recommend that you keep these sensitive values in the separate credentials file. This way, you can provide separate permissions for each file, if necessary.

The following example shows a basic credentials file with a [default] profile. It sets the aws_access_key_id,aws_secret_access_key, and aws_session_token global settings.

```
[default]
aws_access_key_id=AKIAIOSFODNN7EXAMPLE
aws_secret_access_key=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
aws_session_token=IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZVERYLONGSTRI
```

Regardless of whether you use a named profile or "default" in your credentials file, any settings here will be combined with any settings from your config file that uses the same profile name. If there are credentials in both files for a profile sharing the same name, the keys in the credentials file take precedence.

Location of the shared config and credentials files

The shared AWS config and credentials files are plaintext files that hold configuration information for the AWS SDKs and tools. The files reside locally in your environment and used automatically by SDK code or by AWS CLI commands that you run in that environment. For example, on your own computer or when developing on an Amazon Elastic Compute Cloud instance.

When the SDK or tool runs, it checks for these files and loads any available configuration settings. If the files do not already exist, then a basic file is automatically created by the SDK or tool.

By default, the files are in a folder named .aws that is placed in your home or user folder.

| Operating system | Default location and name of files |
|------------------|------------------------------------|
| Linux and macOS | ~/.aws/config |
| | ~/.aws/credentials |

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| Operating system | Default location and name of files |
|------------------|------------------------------------|
| Windows | %USERPROFILE%\.aws\config |
| | %USERPROFILE%\.aws\credentials |

Home directory resolution

~ is only used for home directory resolution when it:

- Starts the path
- Is followed immediately by / or a platform specific separator. On windows, ~/ and ~\ both resolve to the home directory.

When determining the home directory, the following variables are checked:

- (All platforms) The HOME environment variable
- (Windows platforms) The USERPROFILE environment variable
- (Windows platforms) The concatenation of HOMEDRIVE and HOMEPATH environment variables (\$HOMEDRIVE\$HOMEPATH)
- (Optional per SDK or tool) An SDK or tool-specific home path resolution function or variable

When possible, if a user's home directory is specified at the start of the path (for example, ~username/), it is resolved to the requested user name's home directory (for example, /home/username/.aws/config).

Change the default location of these files

You can use any of the following to override where these files are loaded from by the SDK or tool.

Use environment variables

The following environment variables can be set to change the location or name of these files from the default to a custom value:

• config file environment variable: AWS_CONFIG_FILE

Home directory resolution 11

credentials file environment variable: AWS_SHARED_CREDENTIALS_FILE

Linux/macOS

You can specify an alternate location by running the following <u>export</u> commands on Linux or macOS.

```
$ export AWS_CONFIG_FILE=/some/file/path/on/the/system/config-file-name
$ export AWS_SHARED_CREDENTIALS_FILE=/some/other/file/path/on/the/system/
credentials-file-name
```

Windows

You can specify an alternate location by running the following setx commands on Windows.

```
C:\> setx AWS_CONFIG_FILE c:\some\file\path\on\the\system\config-file-name
C:\> setx AWS_SHARED_CREDENTIALS_FILE c:\some\other\file\path\on\the\system
\credentials-file-name
```

For more information on configuring your system using environment variables, see Environment variables, see Environment variables Environment variables<

Use JVM system properties

For the SDK for Kotlin running on the JVM and for SDK for Java 2.x, you can set the following JVM system properties to change the location or name of these files from the default to a custom value:

- config file JVM system property: aws.configFile
- credentials file environment variable: aws.sharedCredentialsFile

For instructions on how to set JVM system properties, see the section called "How to set JVM system properties". The SDK for Java 1.x does not support these system properties.

Environment variables support

Environment variables provide another way to specify configuration options and credentials, and can be useful for scripting or temporarily setting a named profile as the default. For the list of environment variables supported by most SDKs, see Environment variables list.

Environment variables 12

Precedence of options

• If you specify a setting by using its environment variable, it overrides any value loaded from a profile in the shared AWS config and credentials files.

• If you specify a setting by using a parameter on the AWS CLI command line, it overrides any value from either the corresponding environment variable or a profile in the configuration file.

How to set environment variables

The following examples show how you can configure environment variables for the default user.

Linux, macOS, or Unix

```
$ export AWS_ACCESS_KEY_ID=AKIAIOSFODNN7EXAMPLE
$ export AWS_SECRET_ACCESS_KEY=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
$ export
AWS_SESSION_TOKEN=AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R40lgk
$ export AWS_REGION=us-west-2
```

Setting the environment variable changes the value used until the end of your shell session, or until you set the variable to a different value. You can make the variables persistent across future sessions by setting them in your shell's startup script.

Windows Command Prompt

```
C:\> setx AWS_ACCESS_KEY_ID AKIAIOSFODNN7EXAMPLE
C:\> setx AWS_SECRET_ACCESS_KEY wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
C:\> setx
AWS_SESSION_TOKEN AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R40lgk
C:\> setx AWS_REGION us-west-2
```

Using <u>set</u> to set an environment variable changes the value used until the end of the current Command Prompt session, or until you set the variable to a different value. Using <u>setx</u> to set an environment variable changes the value used in both the current Command Prompt session and all Command Prompt sessions that you create after running the command. It does *not* affect other command shells that are already running at the time you run the command.

PowerShell

```
PS C:\> $Env:AWS_ACCESS_KEY_ID="AKIAIOSFODNN7EXAMPLE"
```

How to set environment variables 13

```
PS C:\> $Env:AWS_SECRET_ACCESS_KEY="wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY"

PS C:
\> $Env:AWS_SESSION_TOKEN="AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R401

PS C:\> $Env:AWS_REGION="us-west-2"
```

If you set an environment variable at the PowerShell prompt as shown in the previous examples, it saves the value for only the duration of the current session. To make the environment variable setting persistent across all PowerShell and Command Prompt sessions, store it by using the **System** application in **Control Panel**. Alternatively, you can set the variable for all future PowerShell sessions by adding it to your PowerShell profile. See the <u>PowerShell documentation</u> for more information about storing environment variables or persisting them across sessions.

Serverless environment variable setup

If you use a serverless architecture for development, you have other options for setting environment variables. Depending on your container, you can use different strategies for code running in those containers to see and access environment variables, similar to non-cloud environments.

For example, with AWS Lambda, you can directly set environment variables. For details, see <u>Using</u> AWS Lambda environment variables in the AWS Lambda Developer Guide.

In Serverless Framework, you can often set SDK environment variables in the serverless.yml file under the provider key under the environment setting. For information on the serverless.yml file, see General function settings in the Serverless Framework documentation.

Regardless of which mechanism you use to set container environment variables, there are some that are reserved by the container, such as those documented for Lambda at <u>Defined runtime</u> <u>environment variables</u>. Always consult the official documentation for the container that you're using to determine how environment variables are treated and whether there are any restrictions.

JVM system properties support

JVM system properties provide another way to specify configuration options and credentials for SDKs that run on the JVM such as the AWS SDK for Java and the AWS SDK for Kotlin. For a list of JVM system properties supported by SDKs, see Settings reference.

Precedence of options

 If you specify a setting by using its JVM system property, it overrides any value found in environment variables or loaded from a profile in the shared AWS config and credentials files.

• If you specify a setting by using its environment variable, it overrides any value loaded from a profile in the shared AWS config and credentials files.

How to set JVM system properties

You can set JVM system properties several ways.

On the command line

Set JVM system properties on the command-line when invoking the java command by using the – D switch. The following command configures the AWS Region globally for all service clients unless you explicitly override the value in code.

```
java -Daws.region=us-east-1 -jar <your_application.jar> <other_arguments>
```

If you need to set multiple JVM system properties, specify the -D switch multiple times.

With an environment variable

If you can't access the command line to invoke the JVM to run your application, you can use the JAVA_TOOL_OPTIONS environment variable to configure command-line options. This approach is useful in situations such as running an AWS Lambda function on the Java runtime or running code in an embedded JVM.

The following example configures the AWS Region globally for all service clients unless you explicitly override the value in code.

Linux, macOS, or Unix

```
$ export JAVA_TOOL_OPTIONS="-Daws.region=us-east-1"
```

Setting the environment variable changes the value used until the end of your shell session, or until you set the variable to a different value. You can make the variables persistent across future sessions by setting them in your shell's startup script.

Windows Command Prompt

```
C:\> setx JAVA_TOOL_OPTIONS -Daws.region=us-east-1
```

Using set to set an environment variable changes the value used until the end of the current Command Prompt session, or until you set the variable to a different value. Using setx to set an environment variable changes the value used in both the current Command Prompt session and all Command Prompt sessions that you create after running the command. It does not affect other command shells that are already running at the time you run the command.

At runtime

You can also set JVM system properties at runtime in code by using the System.setProperty method as shown in the following example.

```
System.setProperty("aws.region", "us-east-1");
```

Important

Set any JVM system properties before you initialize SDK service clients, otherwise service clients may use other values.

Authentication and access

You must establish how your code authenticates with AWS when you develop with AWS services. You can configure programmatic access to AWS resources in different ways, depending on the environment and the AWS access available to you.

Authentication options for code running locally (not in AWS)

- IAM Identity Center authentication for your SDK or tool As a security best practice, we recommend using AWS Organizations with IAM Identity Center to manage access across all your AWS accounts. You can create users in AWS IAM Identity Center, use Microsoft Active Directory, use a SAML 2.0 identity provider (IdP), or individually federate your IdP to AWS accounts. To check if your Region supports IAM Identity Center, see AWS IAM Identity Center endpoints and quotas in the Amazon Web Services General Reference.
- IAM Roles Anywhere You can use IAM Roles Anywhere to obtain temporary security credentials
 in IAM for workloads such as servers, containers, and applications that run outside of AWS. To
 use IAM Roles Anywhere, your workloads must use X.509 certificates.
- <u>Assume a role</u> You can assume an IAM role to temporarily access AWS resources that you might not have access to otherwise.
- <u>AWS access keys</u> Other options that might be less convenient or might increase the security risk to your AWS resources.

Authentication options for code running within an AWS environment

If your code runs on AWS, credentials can be made automatically available to your application. For example, if your application is hosted on Amazon Elastic Compute Cloud, and there is an IAM role associated with that resource, the credentials are automatically made available to your application. Likewise, if you use Amazon ECS or Amazon EKS containers, the credentials set for the IAM role can be automatically obtained by the code running inside the container through the SDK's credential provider chain.

- <u>Using IAM roles for Amazon EC2 instances</u> Use IAM roles to securely run your application on an Amazon EC2 instance.
- You can programmatically interact with AWS using IAM Identity Center in the following ways:
 - Use AWS CloudShell to run AWS CLI commands from the console.

 To try cloud-based collaboration space for software development teams, consider using Amazon CodeCatalyst.

Authentication through a web-based identity provider - Mobile or client-based web applications

If you are creating mobile applications or client-based web applications that require access to AWS, build your app so that it requests temporary AWS security credentials dynamically by using web identity federation.

With web identity federation, you don't need to create custom sign-in code or manage your own user identities. Instead, app users can sign in using a well-known external identity provider (IdP), such as Login with Amazon, Facebook, Google, or any other OpenID Connect (OIDC)-compatible IdP. They can receive an authentication token, and then exchange that token for temporary security credentials in AWS that map to an IAM role with permissions to use the resources in your AWS account.

To learn how to configure this for your SDK or tool, see <u>Federate with web identity or OpenID</u> Connect.

For mobile applications, consider using Amazon Cognito. Amazon Cognito acts as an identity broker and does much of the federation work for you. For more information, see <u>Using Amazon</u> Cognito for mobile apps in the *IAM User Guide*.

More information about access management

The *IAM User Guide* has the following information about securely controlling access to AWS resources:

- IAM Identities (users, user groups, and roles) Understand the basics of identities in AWS.
- <u>Security best practices in IAM</u> Security recommendations to follow when developing AWS applications according to the shared-responsibility model.

The Amazon Web Services General Reference has foundational basics on the following:

 <u>Understanding and getting your AWS credentials</u> – Access key options and management practices for both console and programmatic access.

AWS Builder ID

Your AWS Builder ID complements any AWS accounts you might already own or want to create. While an AWS account acts as a container for AWS resources you create and provides a security boundary for those resources, your AWS Builder ID represents you as an individual. You can sign in with your AWS Builder ID to access developer tools and services such as Amazon CodeWhisperer and Amazon CodeCatalyst.

- <u>Sign in with AWS Builder ID</u> in the AWS Sign-In User Guide Learn how to create and use an AWS Builder ID and learn what the Builder ID provides.
- <u>Authenticating with CodeWhisperer and AWS Toolkit Builder ID</u> in the *CodeWhisperer User Guide* Learn how CodeWhisperer uses an AWS Builder ID.
- <u>CodeCatalyst concepts AWS Builder ID</u> in the *Amazon CodeCatalyst User Guide* Learn how CodeCatalyst uses an AWS Builder ID.

IAM Identity Center authentication for your SDK or tool

AWS IAM Identity Center is the recommended method of providing AWS credentials when developing on a non-AWS compute service. For example, this would be something like your local development environment. If you are developing on an AWS resource, such as Amazon Elastic Compute Cloud (Amazon EC2) or AWS Cloud9, we recommend getting credentials from that service instead.

In this tutorial, you establish IAM Identity Center access and will configure it for your SDK or tool by using the AWS access portal and the AWS CLI.

- The AWS access portal is the web location where you manually sign in to the IAM
 Identity Center. The format of the URL is d-xxxxxxxxxxx.awsapps.com/startor
 your_subdomain.awsapps.com/start. When signed in to the AWS access portal, you can
 view AWS accounts and roles that have been configured for that user. This procedure uses the
 AWS access portal to get configuration values you need for the SDK/tool authentication process.
- The AWS CLI is used to configure your SDK or tool to use IAM Identity Center authentication for API calls made by your code. This one-time process updates your shared AWS config file, that is then used by your SDK or tool when you run your code.

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Configure programmatic access using IAM Identity Center

Step 1: Establish access and select appropriate permission set

If you haven't enabled IAM Identity Center yet, see <u>Enabling IAM Identity Center</u> in the AWS IAM Identity Center User Guide.

Choose one of the following methods to access your AWS credentials.

I do not have established access through IAM Identity Center

- 1. Add a user and add administrative permissions by following the <u>Configure user access with the</u> default IAM Identity Center directory procedure in the *AWS IAM Identity Center User Guide*.
- The AdministratorAccess permission set should not be used for regular development.
 Instead, we recommend using the predefined PowerUserAccess permission set, unless your employer has created a custom permission set for this purpose.

Follow the same <u>Configure user access with the default IAM Identity Center directory</u> procedure again, but this time:

- Instead of creating the Admin team group, create a Dev team group, and substitute this
 thereafter in the instructions.
- You can use the existing user, but the user must be added to the new *Dev team* group.
- Instead of creating the AdministratorAccess permission set, create a
 PowerUserAccess permission set, and substitute this thereafter in the instructions.

When you are done, you should have the following:

- A Dev team group.
- An attached PowerUserAccess permission set to the Dev team group.
- Your user added to the Dev team group.
- Exit the portal and sign in again to see your AWS accounts and options for Administrator or PowerUserAccess. Select PowerUserAccess when working with your tool/SDK.

I already have access to AWS through a federated identity provider managed by my employer (such as Microsoft Entra or Okta)

Sign in to AWS through your identity provider's portal. If your Cloud Administrator has granted you PowerUserAccess (developer) permissions, you see the AWS accounts that you have access to and your permission set. Next to the name of your permission set, you see options to access the accounts manually or programmatically using that permission set.

Custom implementations might result in different experiences, such as different permission set names. If you're not sure which permission set to use, contact your IT team for help.

I already have access to AWS through the AWS access portal managed by my employer

Sign in to AWS through the AWS access portal. If your Cloud Administrator has granted you PowerUserAccess (developer) permissions, you see the AWS accounts that you have access to and your permission set. Next to the name of your permission set, you see options to access the accounts manually or programmatically using that permission set.

I already have access to AWS through a federated custom identity provider managed by my employer

Contact your IT team for help.

Step 2: Configure SDKs and tools to use IAM Identity Center

- 1. On your development machine, install the latest AWS CLI.
 - a. See <u>Installing or updating the latest version of the AWS CLI</u> in the AWS Command Line Interface User Guide.
 - b. (Optional) To verify that the AWS CLI is working, open a command prompt and run the aws --version command.
- Sign in to the AWS access portal. Your employer may provide this URL or you may get it in an email following Step 1: Establish access. If not, find your AWS access portal URL on the Dashboard of https://console.aws.amazon.com/singlesignon/.
 - a. In the AWS access portal, in the Accounts tab, select the individual account to manage. The roles for your user are displayed. Choose Access keys to get credentials for command line or programmatic access for the appropriate permission set. Use the predefined PowerUserAccess permission set, or whichever permission set you or your employer has created to apply least-privilege permissions for development.

b. In the **Get credentials** dialog box, choose either **MacOS** and **Linux** or **Windows**, depending on your operating system.

- c. Choose the IAM Identity Center credentials method to get the SSO Start URL and SSO Region values that you need for the next step.
- 3. In the AWS CLI command prompt, run the aws configure sso command. When prompted, enter the configuration values that you collected in the previous step. For details on this AWS CLI command, see Configure your profile with the aws configure sso wizard.
 - For CLI profile name, we recommend entering default when you are getting started.
 For information about how to set non-default (named) profiles and their associated environment variable, see Profiles.
- 4. (Optional) In the AWS CLI command prompt, confirm the active session identity by running the aws sts get-caller-identity command. The response should show the IAM Identity Center permission set that you configured.
- 5. If you are using an AWS SDK, create an application for your SDK in your development environment.
 - a. For some SDKs, additional packages such as SSO and SSOOIDC must be added to your application before you can use IAM Identity Center authentication. For details, see your specific SDK.
 - b. If you previously configured access to AWS, review your shared AWS credentials file for any AWS access keys. You must remove any static credentials before the SDK or tool will use the IAM Identity Center credentials because of the Credential provider chain precedence.

For a deep dive into how the SDKs and tools use and refresh credentials using this configuration, see <u>Understand IAM Identity Center authentication</u>.

Depending on your configured session lengths, your access will eventually expire and the SDK or tool will encounter an authentication error. To refresh the access portal session again when needed, use the AWS CLI to run the aws sso login command.

You can extend both the IAM Identity Center access portal session duration and the permission set session duration. This lengthens the amount of time that you can run code before you need to manually sign in again with the AWS CLI. For more information, see the following topics in the AWS IAM Identity Center User Guide:

• IAM Identity Center session duration – Configure the duration of your users' AWS access portal sessions

• Permission set session duration – Set session duration

For details on all IAM Identity Center provider settings for SDKs and tools, see <u>IAM Identity Center</u> <u>credential provider</u> in this guide.

Understand IAM Identity Center authentication

Relevant IAM Identity Center terms

The following terms help you understand the process and configuration behind AWS IAM Identity Center. The documentation for AWS SDK APIs uses different names than IAM Identity Center for some of these authentication concepts. It's helpful to know both names.

The following table shows how alternative names relate to each other.

| IAM Identity Center name | SDK API name | Description |
|---|--------------|---|
| Identity Center | SSO | Although AWS Single Sign-On is renamed, the sso API namespaces will keep their original name for backward compatibility purposes. For more information, see IAM Identity Center rename in the AWS IAM Identity Center User Guide. |
| IAM Identity Center console Administrative console | | The console you use to configure single sign-on. |
| AWS access portal URL | | A URL unique to your IAM Identity Center account, like https://xxx.awsapps.com/start . You sign in to this portal using your |

| IAM Identity Center name | SDK API name | Description |
|---|-----------------------------------|--|
| | | IAM Identity Center sign-in credentials. |
| IAM Identity Center Access Portal session | Authentication session | Provides a bearer access token to the caller. |
| Permission set session | | The IAM session that the SDK uses internally to make the AWS service calls. In informal discussions, you might see this incorrectly referred to as "role session." |
| Permission set credentials | AWS credentials sigv4 credentials | The credentials the SDK actually uses for most AWS service calls (specifically, all sigv4 AWS service calls). In informal discussions, you might see this incorrectly referred to as "role credentials." |
| IAM Identity Center credentia l provider | SSO credential provider | How you get the credentials, such as the class or module providing the functionality. |

Understand SDK credential resolution for AWS services

The IAM Identity Center API exchanges bearer token credentials for sigv4 credentials. Most AWS services are sigv4 APIs, with a few exceptions like Amazon CodeWhisperer and Amazon CodeCatalyst. The following describes the credential resolution process for supporting most AWS service calls for your application code through AWS IAM Identity Center.

Start an AWS access portal session

• Start the process by signing in to the session with your credentials.

• Use the aws sso login command in the AWS Command Line Interface (AWS CLI). This starts a new IAM Identity Center session if you don't already have an active session.

- When you start a new session, you receive a refresh token and access token from IAM Identity Center. The AWS CLI also updates an SSO cache JSON file with a new access token and refresh token and makes it available for use by SDKs.
- If you already have an active session, the AWS CLI command reuses the existing session and will
 expire whenever the existing session expires. To learn how to set the length of an IAM Identity
 Center session, see Configure the duration of your users' AWS access portal sessions in the AWS
 IAM Identity Center User Guide.
 - The maximum session length has been extended to 90 days to reduce the need for frequent sign-ins.

How the SDK gets credentials for AWS service calls

SDKs provide access to AWS services when you instantiate a client object per service. When the selected profile of the shared AWS config file is configured for IAM Identity Center credential resolution, IAM Identity Center is used to resolve credentials for your application.

• The credential resolution process is completed during runtime when a client is created.

To retrieve credentials for sigv4 APIs using IAM Identity Center single sign-on, the SDK uses the IAM Identity Center access token to get an IAM session. This IAM session is called a permission set session, and it provides AWS access to the SDK by assuming an IAM role.

- The permission set session duration is set independently from the IAM Identity Center session duration.
 - To learn how to set the permission set session duration, see <u>Set session duration</u> in the *AWS IAM Identity Center User Guide*.
- Be aware that the permission set credentials are also referred to as AWS credentials and sigv4
 credentials in most AWS SDK API documentation.

The permission set credentials are returned from a call to <u>getRoleCredentials</u> of the IAM Identity Center API to the SDK. The SDK's client object uses that assumed IAM role to make calls to the AWS service, such as asking Amazon S3 to list the buckets in your account. The client object can continue to operate using those permission set credentials until the permission set session expires.

Session expiration and refresh

When using the <u>SSO token provider configuration</u>, the hourly access token obtained from IAM Identity Center is automatically refreshed using the refresh token.

- If the access token is expired when the SDK tries to use it, the SDK uses the refresh token to
 try to get a new access token. The IAM Identity Center compares the refresh token to your IAM
 Identity Center access portal session duration. If the refresh token is not expired, the IAM Identity
 Center responds with another access token.
- This access token can be used to either refresh the permission set session of existing clients, or to resolve credentials for new clients.

However, if the IAM Identity Center access portal session is expired, then no new access token is granted. Therefore, the permission set duration cannot be renewed. It will expire (and access will be lost) whenever the cached permission set session length times out for existing clients.

Any code that creates a new client will fail authentication as soon as the IAM Identity Center session expires. This is because the permission set credentials are not cached. Your code won't be able to create a new client and complete the credential resolution process until you have a valid access token.

To recap, when the SDK needs new permission set credentials, the SDK first checks for any valid, existing credentials and uses those. This applies whether the credentials are for a new client or for an existing client with expired credentials. If credentials aren't found or they're not valid, then the SDK calls the IAM Identity Center API to get new credentials. To call the API, it needs the access token. If the access token is expired, the SDK uses the refresh token to try to get a new access token from the IAM Identity Center service. This token is granted if your IAM Identity Center access portal session is not expired.

IAM Roles Anywhere

You can use IAM Roles Anywhere to get temporary security credentials in IAM for workloads such as servers, containers, and applications that run outside of AWS. To use IAM Roles Anywhere, your workloads must use X.509 certificates. Your Cloud Administrator should provide the certificate and private key needed to configure IAM Roles Anywhere as your credential provider.

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Step 1: Configure IAM Roles Anywhere

IAM Roles Anywhere provides a way to get temporary credentials for a workload or process that runs outside of AWS. A trust anchor is established with the certificate authority to get temporary credentials for the associated IAM role. The role sets the permissions your workload will have when your code authenticates with IAM Roles Anywhere.

For steps to set up the trust anchor, IAM role, and IAM Roles Anywhere profile, see Creating a trust anchor and profile in AWS Identity and Access Management Roles Anywhere in the IAM Roles Anywhere User Guide.



(i) Note

A profile in the IAM Roles Anywhere User Guide refers to a unique concept within the IAM Roles Anywhere service. It's not related to the profiles within the shared AWS config file.

Step 2: Use IAM Roles Anywhere

To get temporary security credentials from IAM Roles Anywhere, use the credential helper tool provided by IAM Roles Anywhere. The credential tool implements the signing process for IAM Roles Anywhere.

For instructions to download the credential helper tool, see Obtaining temporary security credentials from AWS Identity and Access Management Roles Anywhere in the IAM Roles Anywhere User Guide.

To use temporary security credentials from IAM Roles Anywhere with AWS SDKs and the AWS CLI, you can configure credential_process setting in the shared AWS config file. The SDKs and AWS CLI support a process credential provider that uses credential process to authenticate. The following shows the general structure to set credential_process.

```
credential_process = [path to helper tool] [command] [--parameter1 value] [--
parameter2 value] [...]
```

The credential-process command of the helper tool returns temporary credentials in a standard JSON format that is compatible with the credential_process setting. Note that the command name contains a hyphen but the setting name contains an underscore. The command requires the following parameters:

- private-key The path to the private key that signed the request.
- certificate The path to the certificate.
- role-arn The ARN of the role to get temporary credentials for.
- profile-arn The ARN of the profile that provides a mapping for the specified role.
- trust-anchor-arn The ARN of the trust anchor used to authenticate.

Your Cloud Administrator should provide the certificate and private key. All three ARN values can be copied from the AWS Management Console. The following example shows a shared config file that configures retrieving temporary credentials from the helper tool.

```
[profile dev]
credential_process = ./aws_signing_helper credential-process --certificate /
path/to/certificate --private-key /path/to/private-key --trust-anchor-
arn arn:aws:rolesanywhere:region:account:trust-anchor/TA_ID --profile-
arn arn:aws:rolesanywhere:region:account:profile/PROFILE_ID --role-
arn arn:aws:iam::account:role/ROLE_ID
```

For optional parameters and additional helper tool details, see <u>IAM Roles Anywhere Credential</u> Helper on GitHub.

For details on the SDK configuration setting itself and the process credential provider, see <u>Process</u> <u>credential provider</u> in this guide.

Assume a role

Assuming a role involves using a set of temporary security credentials to access AWS resources that you might not have access to otherwise. These temporary credentials consist of an access key ID, a secret access key, and a security token. To learn more about AWS Security Token Service (AWS STS) API requests, see Actions in the AWS Security Token Service API Reference.

To set up your SDK or tool to assume a role, you must first create or identify a specific *role* to assume. IAM roles are uniquely identified by a role Amazon Resource Name (<u>ARN</u>). Roles establish trust relationships with another entity. The trusted entity that uses the role might be an AWS service, another AWS account, a web identity provider or OIDC, or SAML federation. To learn more about IAM roles, see Using IAM roles in the *IAM User Guide*.

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After the IAM role is identified, if you are trusted by that role, you can configure your SDK or tool to use the permissions that are granted by the role. To do this, either <u>Assume an IAM role</u> or <u>Federate</u> with web identity or OpenID Connect.

Assume an IAM role

When assuming a role, AWS STS returns a set of temporary security credentials. These credentials are sourced from another profile or from the instance or container that your code is running in. Other examples of assuming a role include managing multiple AWS accounts from Amazon EC2, using AWS CodeCommit across AWS accounts, or accessing another account from AWS CodeBuild.

Step 1: Set up an IAM role

To set up your SDK or tool to assume a role, you must first create or identify a specific role to assume. IAM roles are uniquely identified using a role <u>ARN</u>. Roles establish trust relationships with another entity, typically within your account or for cross-account access. To set this up, see <u>Creating IAM roles</u> in the *IAM User Guide*.

Step 2: Configure the SDK or tool

Configure the SDK or tool to source credentials from credential_source or source_profile.

Use credential_source to source credentials from an Amazon ECS container, an Amazon EC2 instance, or from environment variables.

Use source_profile to source credentials from another profile. source_profile also supports role chaining, which is hierarchies of profiles where an assumed role is then used to assume another role.

When you specify this in a profile, the SDK or tool automatically makes the corresponding AWS STS <u>AssumeRole</u> API call for you. To retrieve and use temporary credentials by assuming a role, specify the following configuration values in the shared AWS config file. For more details on each of these settings, see the <u>Assume role credential provider settings</u> section.

- role_arn From the IAM role you created in Step 1
- Configure either source_profile or credential_source
- (Optional) duration_seconds
- (Optional) external_id

Assume an IAM role 29

- (Optional) mfa_serial
- (Optional) role_session_name

The following examples show the configuration of both assume role options in a shared config file:

```
role_arn = arn:aws:iam::123456789012:role/my-role-name
source_profile = profile-name-with-user-that-can-assume-role

role_arn = arn:aws:iam::123456789012:role/my-role-name
credential_source = Ec2InstanceMetadata
```

For details on all assume role credential provider settings, see <u>Assume role credential provider</u> in this guide.

Federate with web identity or OpenID Connect

When creating mobile applications or client-based web applications that require access to AWS, AWS STS returns a set of temporary security credentials for federated users who are authenticated through a public identity provider (IdP). Examples of public identity providers include Login with Amazon, Facebook, Google, or any OpenID Connect (OIDC)-compatible identity provider. With this method, your users don't need their own AWS or IAM identities.

If you are using Amazon Elastic Kubernetes Service, this feature provides the ability to specify different IAM roles for each one of your containers. Kubernetes provides capability to distribute OIDC tokens to your containers which are used by this credential provider to obtain temporary credentials. For more information on this Amazon EKS configuration, see IAM roles for service accounts in the Amazon EKS User Guide. However, for a simpler option, we recommend you use Amazon EKS Pod Identities instead if your SDK supports it.

Step 1: Set up an identity provider and IAM role

To configure federation with an external IdP, use an IAM identity provider to inform AWS about the external IdP and its configuration. This establishes *trust* between your AWS account and the external IdP. Before configuring the SDK to use the web identity token for authentication, you must first set up the identity provider (IdP) and the IAM role used to access it. To set these up, see Creating a role for web identity or OpenID Connect Federation (console) in the IAM User Guide.

Step 2: Configure the SDK or tool

Configure the SDK or tool to use a web identity token from AWS STS for authentication.

When you specify this in a profile, the SDK or tool automatically makes the corresponding AWS STS AssumeRoleWithWebIdentity API call for you. To retrieve and use temporary credentials using web identity federation, specify the following configuration values in the shared AWS config file. For more details on each of these settings, see the Assume role credential provider settings section.

- role_arn From the IAM role you created in Step 1
- web_identity_token_file From the external IdP
- (Optional) duration_seconds
- (Optional) role_session_name

The following is an example of a shared config file configuration to assume a role with web identity:

```
[profile web-identity]
role_arn=arn:aws:iam::123456789012:role/my-role-name
web_identity_token_file=/path/to/a/token
```

Note

For mobile applications, consider using Amazon Cognito. Amazon Cognito acts as an identity broker and does much of the federation work for you. However, the Amazon Cognito identity provider isn't included in the SDKs and tools core libraries like other identity providers. To access the Amazon Cognito API, include the Amazon Cognito service client in the build or libraries for your SDK or tool. For usage with AWS SDKs, see Code Cognito Developer Guide.

For details on all assume role credential provider settings, see <u>Assume role credential provider</u> in this guide.

AWS access keys

Use short-term credentials

We recommend configuring your SDK or tool to use IAM Identity Center authentication for your SDK or tool to use extended session duration options.

However, to set up the SDK or tool's temporary credentials directly, see Authenticate using shortterm credentials.

Use long-term credentials



Marning

To avoid security risks, don't use IAM users for authentication when developing purposebuilt software or working with real data. Instead, use federation with an identity provider such as AWS IAM Identity Center.

Manage access across AWS accounts

As a security best practice, we recommend using AWS Organizations with IAM Identity Center to manage access across all your AWS accounts. For more information, see Security best practices in IAM in the IAM User Guide.

You can create users in IAM Identity Center, use Microsoft Active Directory, use a SAML 2.0 identity provider (IdP), or individually federate your IdP to AWS accounts. Using one of these approaches, you can provide a single sign-on experience for your users. You can also enforce multi-factor authentication (MFA) and use temporary credentials for AWS account access. This differs from an IAM user, which is a long-term credential that can be shared and which might increase the security risk to your AWS resources.

Create IAM users for sandbox environments only

If you're new to AWS, you might create a test IAM user and then use it to run tutorials and explore what AWS has to offer. It's okay to use this type of credential when you're learning, but we recommend that you avoid using it outside of a sandbox environment.

For the following use cases, it might make sense to get started with IAM users in AWS:

• Getting started with your AWS SDK or tool and exploring AWS services in a sandbox environment.

 Running scheduled scripts, jobs, and other automated processes that don't support a humanattended sign-in process as part of your learning.

If you're using IAM users outside of these use cases, then transition to IAM Identity Center or federate your identity provider to AWS accounts as soon as possible. For more information, see Identity federation in AWS.

Secure IAM user access keys

You should rotate IAM user access keys regularly. Follow the guidance in <u>Rotating access keys</u> in the *IAM User Guide*. If you believe that you have accidentally shared your IAM user access keys, then rotate your access keys.

IAM user access keys should be stored in the shared AWS credentials file on the local machine. Don't store the IAM user access keys in your code. Don't include configuration files that contain your IAM user access keys inside of any source code management software. External tools, such as the open source project <u>git-secrets</u>, can help you from inadvertently committing sensitive information to a Git repository. For more information, see <u>IAM Identities</u> (users, user groups, and roles) in the *IAM User Guide*.

To set up an IAM user to get started, see Authenticate using long-term credentials.

Authenticate using short-term credentials

We recommend configuring your SDK or tool to use <u>IAM Identity Center authentication for your SDK or tool</u> with extended session duration options. However, you can copy and use temporary credentials that are available in the AWS access portal. New credentials will need to be copied when these expire. You can use the temporary credentials in a profile or use them as values for system properties and environment variables.

Best practice: Instead of manually managing access keys and a token in the credentials file, we recommend your application uses temporary credentials delivered from:

- An AWS compute service, such as running your application on Amazon Elastic Compute Cloud or in AWS Lambda.
- Another option in the credential provider chain, such as <u>IAM Identity Center authentication for</u> your SDK or tool.

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• Or use the Process credential provider to retrieve temporary credentials.

Set up a credentials file using short-term credentials retrieved from AWS access portal

- 1. Create a shared credentials file.
- 2. In the credentials file, paste the following placeholder text until you paste in working temporary credentials.

```
[default]
aws_access_key_id=<value from AWS access portal>
aws_secret_access_key=<value from AWS access portal>
aws_session_token=<value from AWS access portal>
```

- 3. Save the file. The file ~/.aws/credentials should now exist on your local development system. This file contains the [default] profile that the SDK or tool uses if a specific named profile is not specified.
- 4. Sign in to the AWS access portal.
- 5. Follow these instructions for <u>Manual credential refresh</u> to copy IAM role credentials from the AWS access portal.
 - a. For step 4 in the linked instructions, choose the IAM role name that grants access for your development needs. This role typically has a name like **PowerUserAccess** or **Developer**.
 - b. For step 7 in the linked instructions, select the **Manually add a profile to your AWS credentials file** option and copy the contents.
- 6. Paste the copied credentials into your local credentials file. The generated profile name is not needed if you are using the default profile. Your file should resemble the following.

```
[default]
aws_access_key_id=AKIAIOSFODNN7EXAMPLE
aws_secret_access_key=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
aws_session_token=IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZVERYLONG
```

Save the credentials file.

When the SDK creates a service client, it will access these temporary credentials and use them for each request. The settings for the IAM role chosen in step 5a determine how long the temporary credentials are valid. The maximum duration is twelve hours.

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After the temporary credentials expire, repeat steps 4 through 7.

Authenticate using long-term credentials



Marning

To avoid security risks, don't use IAM users for authentication when developing purposebuilt software or working with real data. Instead, use federation with an identity provider such as AWS IAM Identity Center.

If you use an IAM user to run your code, then the SDK or tool in your development environment authenticates by using long-term IAM user credentials in the shared AWS credentials file. Review the Security best practices in IAM topic and transition to IAM Identity Center or other temporary credentials as soon as possible.

Important warnings and guidance for credentials

Warnings for credentials

- **Do NOT** use your account's root credentials to access AWS resources. These credentials provide unrestricted account access and are difficult to revoke.
- Do NOT put literal access keys or credential information in your application files. If you do, you create a risk of accidentally exposing your credentials if, for example, you upload the project to a public repository.
- Do NOT include files that contain credentials in your project area.
- Be aware that any credentials stored in the shared AWS credentials file are stored in plaintext.

Additional guidance for securely managing credentials

For a general discussion of how to securely manage AWS credentials, see Best practices for managing AWS access keys in the AWS General Reference. In addition to that discussion, consider the following:

- Use IAM roles for tasks for Amazon Elastic Container Service (Amazon ECS) tasks.
- Use IAM roles for applications that are running on Amazon EC2 instances.

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Prerequisites: Create an AWS account

To use an IAM user to access AWS services, you need an AWS account and AWS credentials.

Create an account.

To create an AWS account, see <u>Getting started: Are you a first-time AWS user?</u> in the AWS Account Management Reference Guide.

2. Create an administrative user.

Avoid using your root user account (the initial account you create) to access the management console and services. Instead, create an administrative user account, as explained in <u>Create an</u> administrative user in the *IAM User Guide*.

After you create the administrative user account and record the login details, **be sure to sign out of your root user account** and sign back in using the administrative account.

Neither of these accounts are appropriate for doing development on AWS or for running applications on AWS. As a best practice, you need to create users, permission sets, or service roles that are appropriate for these tasks. For more information, see Apply least-privilege permissions in the IAM User Guide.

Step 1: Create your IAM user

- Create your IAM user by following the <u>Creating IAM users (console)</u> procedure in the *IAM User Guide*. When creating your IAM user:
 - We recommend you select Provide user access to the AWS Management Console. This
 allows you to view AWS services related to the code that you are running in a visual
 environment, such as checking AWS CloudTrail diagnostic logs or uploading files to Amazon
 Simple Storage Service, which is helpful when debugging your code.
 - For **Set permissions Permission options**, select **Attach policies directly** for how you want to assign permissions to this user.
 - Most "Getting Started" SDK tutorials use the Amazon S3 service as an example. To provide your application with full access to Amazon S3, select the AmazonS3FullAccess policy to attach to this user.
 - You can ignore the optional steps of that procedure regarding setting permission boundaries or tags.

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Step 2: Get your access keys

In the navigation pane of the IAM console, select **Users** and then select the **User name** of the user that you created previously.

- On the user's page, select the **Security credentials** page. Then, under **Access keys**, select Create access key.
- For Create access key Step 1, choose either Command Line Interface (CLI) or Local code. Both options generate the same type of key to use with both the AWS CLI and the SDKs.
- For Create access key Step 2, enter an optional tag and select Next.
- For Create access key Step 3, select Download .csv file to save a .csv file with your IAM user's access key and secret access key. You need this information for later.



Marning

Use appropriate security measures to keep these credentials safe.

Select **Done**.

Step 3: Update the shared credentials file

- Create or open the shared AWS credentials file. This file is ~/.aws/credentials on Linux and macOS systems, and %USERPROFILE%\.aws\credentials on Windows. For more information, see Location of Credentials Files.
- Add the following text to the shared credentials file. Replace the example ID value and example key value with the values in the .csv file that you downloaded earlier.

```
[default]
aws_access_key_id = AKIAIOSFODNN7EXAMPLE
aws_secret_access_key = wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
```

3. Save the file.

The shared credentials file is the most common way to store credentials. These can also be set as environment variables, see AWS access keys for environment variable names. This is a way to get you started, but we recommend you transition to IAM Identity Center or other temporary

Long-term credentials 37

credentials as soon as possible. After you transition away from using long-term credentials, remember to delete these credentials from the shared credentials file.

Using IAM roles for Amazon EC2 instances

This example covers setting up an AWS Identity and Access Management role with Amazon S3 access to use in your application deployed to an Amazon EC2 instance.

In order to run your AWS SDK application on an Amazon Elastic Compute Cloud instance, create an IAM role, and then give your Amazon EC2 instance access to that role. For more information, see IAM Roles for Amazon EC2 in the Amazon EC2 User Guide.

Create an IAM role

The AWS SDK application that you develop likely accesses at least one AWS service to perform actions. Create an IAM role that grants the required permissions necessary for your application to run.

This procedure creates a role that grants read-only access to Amazon S3 as an example. Many of the AWS SDK guides have "getting started" tutorials that read from Amazon S3.

- 1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
- 2. In the navigation pane, select **Roles**, then select **Create role**.
- 3. For **Select trusted entity**, under **Trusted entity type**, choose **AWS service**.
- 4. Under **Use case**, choose **Amazon EC2**, then select **Next**.
- 5. For **Add permissions**, select the checkbox for **Amazon S3 Read Only Access** from the policy list, then select **Next**.
- 6. Enter a name for the role, then select **Create role**. Remember this name because you'll need it when you create your Amazon EC2 instance.

Launch an Amazon EC2 instance and specify your IAM role

You can create and launch an Amazon EC2 instance using your IAM role by doing the following:

• Follow <u>Quickly launch an instance</u> in the *Amazon EC2 User Guide*. However, prior to the final submission step, also do the following:

IAM roles for EC2 instances 38

• Under Advanced details, for IAM Instance profile, choose the role that you created in the previous step.

With this IAM and Amazon EC2 setup, you can deploy your application to the Amazon EC2 instance and your application will have read access to the Amazon S3 service.

Connect to the EC2 instance

Connect to the Amazon EC2 instance so that you can transfer your application to it and then run the application. You'll need the file that contains the private portion of the key pair you used under Key pair (login) when you created your instance; that is, the PEM file.

You can do this by following the guidance for your instance type: Connect to your Linux instance or Connect to your Windows instance. When you connect, do so in such a way that you can transfer files from your development machine to your instance.



Note

On Linux or macOS terminal, you can use the secure copy command to copy your application. To use scp with a key pair, you can use the following command: scp -i path/to/key file/to/copy ec2-user@ec2-xx-xx-xxxxx.compute.amazonaws.com:~.

For more information for Windows, see Transfer files to Windows instances.

If you're using an AWS Toolkit, you can often also connect to the instance by using the Toolkit. For more information, see the specific user guide for the Toolkit you use.

Run your application on the EC2 instance

- Copy your application files from your local drive to your Amazon EC2 instance.
- 2. Start the application and verify that it runs with the same results as on your development machine.
- (Optional) Verify that the application uses the credentials provided by the IAM role.
 - a. Sign in to the AWS Management Console and open the Amazon EC2 console at https:// console.aws.amazon.com/ec2/.

Connect to the EC2 instance

- b. Select the instance.
- c. Choose Actions, Security, and then choose Modify IAM role.
- d. For IAM role, detach the IAM role by choosing No IAM Role.
- e. Choose **Update IAM role**.
- f. Run the application again and confirm that it returns an authorization error.

Settings reference

SDKs provide language-specific APIs for AWS services. They take care of some of the heavy lifting necessary in successfully making API calls, including authentication, retry behavior, and more. To do this, the SDKs have flexible strategies to obtain credentials to use for your requests, to maintain settings to use with each service, and to obtain values to use for global settings.

You can find detailed information about configuration settings in the following sections:

- <u>AWS SDKs and Tools standardized credential providers</u> Common credential providers standardized across multiple SDKs.
- <u>AWS SDKs and Tools standardized features</u> Common features standardized across multiple SDKs.

Creating service clients

To programmatically access AWS services, SDKs use a client class/object for each AWS service. For example, if your application needs to access Amazon EC2, your application creates an Amazon EC2 client object to interface with that service. You then use the service client to make requests to that AWS service. In most SDKs, a service client object is immutable, so you must create a new client for each service to which you make requests and for making requests to the same service using a different configuration.

Precedence of settings

Global settings configure features, credential providers, and other functionality that are supported by most SDKs and have a broad impact across AWS services. All SDKs have a series of places (or sources) that they check in order to find a value for global settings. The following is the setting lookup precedence:

- Any explicit setting set in the code or on a service client itself takes precedence over anything else.
 - Some settings can be set on a per-operation basis, and can be changed as needed for each
 operation that you invoke. For the AWS CLI or AWS Tools for PowerShell, these take the
 form of per-operation parameters that you enter on the command line. For an SDK, explicit

Creating service clients 41

assignments can take the form of a parameter that you set when you instantiate an AWS service client or configuration object, or sometimes when you call an individual API.

- 2. Java/Kotlin only: The JVM system property for the setting is checked. If it's set, that value is used to configure the client.
- 3. The environment variable is checked. If it's set, that value is used to configure the client.
- 4. The SDK checks the shared credentials file for the setting. If it's set, the client uses it.
- 5. The shared config file for the setting. If the setting is present, the SDK uses it.
 - The AWS_PROFILE environment variable or the aws.profile JVM system property can be used to specify which profile that the SDK loads.
- 6. Any default value provided by the SDK source code itself is used last.



Note

Some SDKs and tools might check in a different order. Also, some SDKs and tools support other methods of storing and retrieving parameters. For example, the AWS SDK for .NET supports an additional source called the SDK Store. For more information about providers that are unique to a SDK or tool, see the specific guide for the SDK or tool that you are using.

The order determines which methods take precedence and override others. For example, if you set up a profile in the shared config file, it's only found and used after the SDK or tool checks the other places first. This means that if you put a setting in the credentials file, it is used instead of one found in the config file. If you configure an environment variable with a setting and value, it would override that setting in both the credentials and config files. And finally, a setting on the individual operation (AWS CLI command-line parameter or API parameter) or in code would override all other values for that one command.

Settings pages

The pages within the **Settings reference** section of this guide detail the available settings that can be set through various mechanisms. The tables that follow list the config and credential file settings, environment variables, and (for Java and Kotlin SDKs) the JVM settings that can be used outside of your code to configure the feature. Each linked topic in each list takes you to the corresponding settings page.

Settings pages 42

- Config file settings list
- Credentials file settings list
- Environment variables list
- JVM system properties list

Each credential provider or feature has a page where the settings that are used to configure that functionality are listed. For each setting, you can often set the value either by adding the setting to a configuration file, or by setting an environment variable, or (for Java and Kotlin only) by setting a JVM system property. Each setting lists all supported methods of setting the value in a block above the details of the description. Although the precedence varies, the resulting functionality is the same regardless of how you set it.

The description will include the default value, if any, that takes effect if you do nothing. It also defines what a valid value is for that setting.

For example, let's look at a setting from the Request compression feature page.

The disable_request_compression example setting's information communicates the following:

- There are three equivalent ways to control request compression outside of your codebase. You can either:
 - Set it in your config file using disable_request_compression
 - Set it as an environment variable using AWS_DISABLE_REQUEST_COMPRESSION
 - Or, if you are using the Java or Kotlin SDK, set it as a JVM system property using aws.disableRequestCompression

Note

There might also be a way to configure the same functionality directly in your code, but this Reference does not cover this since it is unique to each SDK. If you want to set your configuration in the code itself, see your specific SDK guide or API reference.

- If you do nothing, the value will default to false.
- The only valid values for this Boolean setting are true and false.

Settings pages 43

At the bottom of each feature page there is a **Compatibility with AWS SDKs** table.

This table shows whether your SDK supports the settings that are listed on the page. The Supported column indicates the support level with the following values:

- Yes The settings are fully supported by the SDK as written.
- Partial Some of the settings are supported or the behavior deviates from the description. For Partial, an additional note indicates the deviation.
- No None of the settings are supported. This doesn't make claims as to whether the same functionality might be achieved in code; it only indicates that the listed external configuration settings are not supported.

Config file settings list

The settings listed in the following table can be assigned in the shared AWS config file. They are global and affect all AWS services. SDKs and tools may also support unique settings and environment variables. To see the settings and environment variables supported by only an individual SDK or tool, see that specific SDK or tool guide.

| Setting name | Details |
|----------------------------------|--------------------------------|
| account_i d_endpoin t_mode | Account-based endpoints |
| api_versions | General configuration settings |
| aws_acces s_key_id | AWS access keys |
| aws_account_id | Account-based endpoints |
| aws_secre t_access_key | AWS access keys |
| aws_sessi on_token | AWS access keys |

| Setting name | Details |
|--|---------------------------------|
| ca_bundle | General configuration settings |
| credentia l_process | Process credential provider |
| credentia l_source | Assume role credential provider |
| defaults_mode | Smart configuration defaults |
| <pre>disable_r equest_co mpression</pre> | Request compression |
| duration_ seconds | Assume role credential provider |
| ec2_metad ata_servi ce_endpoint | IMDS credential provider |
| ec2_metad ata_servi ce_endpoi nt_mode | IMDS credential provider |
| ec2_metad ata_v1_di sabled | IMDS credential provider |
| <pre>endpoint_ discovery _enabled</pre> | Endpoint discovery |
| endpoint_url | Service-specific endpoints |
| external_id | Assume role credential provider |

| Setting name | Details |
|--|---------------------------------|
| ignore_co nfigured_ endpoint_urls | Service-specific endpoints |
| max_attempts | Retry behavior |
| <pre>metadata_ service_n um_attempts</pre> | Amazon EC2 instance metadata |
| <pre>metadata_ service_t imeout</pre> | Amazon EC2 instance metadata |
| mfa_serial | Assume role credential provider |
| output | General configuration settings |
| <pre>parameter _validation</pre> | General configuration settings |
| region | AWS Region |
| request_m in_compre ssion_siz e_bytes | Request compression |
| retry_mode | Retry behavior |
| role_arn | Assume role credential provider |
| role_sess ion_name | Assume role credential provider |

| Setting name | Details |
|--|---|
| <pre>s3_disabl e_multire gion_acce ss_points</pre> | Amazon S3 Multi-Region Access Points |
| s3_use_ar n_region | Amazon S3 access points |
| sdk_ua_app_id | Application ID |
| source_profile | Assume role credential provider |
| sso_account_id | IAM Identity Center credential provider |
| sso_region | IAM Identity Center credential provider |
| sso_regis tration_scopes | IAM Identity Center credential provider |
| sso_role_name | IAM Identity Center credential provider |
| sso_start_url | IAM Identity Center credential provider |
| sts_regio nal_endpoints | AWS STS Regional endpoints |
| use_duals tack_endpoint | <u>Dual-stack and FIPS endpoints</u> |
| use_fips_ endpoint | <u>Dual-stack and FIPS endpoints</u> |
| <pre>web_ident ity_token_file</pre> | Assume role credential provider |

Credentials file settings list

The settings listed in the following table can be assigned in the shared AWS credentials file. They are global and affect all AWS services. SDKs and tools may also support unique settings and environment variables. To see the settings and environment variables supported by only an individual SDK or tool, see that specific SDK or tool guide.

| Setting name | Details |
|---------------------------|-----------------|
| aws_acces s_key_id | AWS access keys |
| aws_secre t_access_key | AWS access keys |
| aws_sessi on_token | AWS access keys |

Environment variables list

Environment variables supported by most SDKs are listed in the following table. They are global and affect all AWS services. SDKs and tools may also support unique settings and environment variables. To see the settings and environment variables supported by only an individual SDK or tool, see that specific SDK or tool guide.

| Setting name | Details |
|--------------------------------------|--------------------------------|
| AWS_ACCES S_KEY_ID | AWS access keys |
| AWS_ACCOUNT_ID | Account-based endpoints |
| AWS_ACCOU NT_ID_END POINT_MODE | Account-based endpoints |
| AWS_CA_BUNDLE | General configuration settings |

| Setting name | Details |
|---|---|
| AWS_CONFIG_FILE | Location of the shared config and credentials files |
| AWS_CONTA INER_AUTH ORIZATION _TOKEN | Container credential provider |
| AWS_CONTA INER_AUTH ORIZATION _TOKEN_FILE | Container credential provider |
| AWS_CONTA INER_CRED ENTIALS_F ULL_URI | Container credential provider |
| AWS_CONTA INER_CRED ENTIALS_R ELATIVE_URI | Container credential provider |
| AWS_DEFAU LTS_MODE | Smart configuration defaults |
| AWS_DISAB LE_REQUES T_COMPRESSION | Request compression |
| AWS_EC2_M ETADATA_D ISABLED | IMDS credential provider |

Environment variables list 49

| Setting name | Details |
|---|----------------------------|
| AWS_EC2_M ETADATA_S ERVICE_EN DPOINT | IMDS credential provider |
| AWS_EC2_M ETADATA_S ERVICE_EN DPOINT_MODE | IMDS credential provider |
| AWS_EC2_M ETADATA_V 1_DISABLED | IMDS credential provider |
| AWS_ENABL E_ENDPOIN T_DISCOVERY | Endpoint discovery |
| AWS_ENDPO INT_URL | Service-specific endpoints |
| AWS_ENDPO INT_URL_< SERVICE> | Service-specific endpoints |
| AWS_IGNOR E_CONFIGU RED_ENDPO INT_URLS | Service-specific endpoints |
| AWS_MAX_A TTEMPTS | Retry behavior |

Environment variables list 50

| Setting name | Details |
|--|--------------------------------------|
| AWS_METAD ATA_SERVI CE_NUM_AT TEMPTS | Amazon EC2 instance metadata |
| AWS_METAD ATA_SERVI CE_TIMEOUT | Amazon EC2 instance metadata |
| AWS_PROFILE | Shared config and credentials files |
| AWS_REGION | AWS Region |
| AWS_REQUE ST_MIN_CO MPRESSION _SIZE_BYTES | Request compression |
| AWS_RETRY_MODE | Retry behavior |
| AWS_ROLE_ARN | Assume role credential provider |
| AWS_ROLE_ SESSION_NAME | Assume role credential provider |
| AWS_S3_DI SABLE_MUL TIREGION_ ACCESS_POINTS | Amazon S3 Multi-Region Access Points |
| AWS_S3_US E_ARN_REGION | Amazon S3 access points |
| AWS_SDK_U A_APP_ID | Application ID |

Environment variables list 51

| Setting name | Details |
|-------------------------------|---|
| AWS_SECRE T_ACCESS_KEY | AWS access keys |
| AWS_SESSI ON_TOKEN | AWS access keys |
| AWS_SHARE D_CREDENT IALS_FILE | Location of the shared config and credentials files |
| AWS_STS_R EGIONAL_E NDPOINTS | AWS STS Regional endpoints |
| AWS_USE_D UALSTACK_ ENDPOINT | <u>Dual-stack and FIPS endpoints</u> |
| AWS_USE_F IPS_ENDPOINT | Dual-stack and FIPS endpoints |
| AWS_WEB_I DENTITY_T OKEN_FILE | Assume role credential provider |

JVM system properties list

You can use the following JVM system properties for the AWS SDK for Java and the AWS SDK for Kotlin (targeting the JVM). See the section called "How to set JVM system properties" for instructions on how to set JVM system properties.

| Setting name | Details | |
|-----------------|-----------------|--|
| aws.accessKeyId | AWS access keys | |

JVM system properties list 52

| Setting name | Details |
|--|---|
| aws.accountId | Account-based endpoints |
| aws.accou ntIdEndpo intMode | Account-based endpoints |
| aws.configFile | Location of the shared config and credentials files |
| aws.defau ltsMode | Smart configuration defaults |
| aws.disab leEc2Meta dataV1 | IMDS credential provider |
| aws.disab leRequest Compression | Request compression |
| aws.ec2Me tadataSer viceEndpoint | IMDS credential provider |
| aws.ec2Me tadataSer viceEndpo intMode | IMDS credential provider |
| aws.endpo intDiscov eryEnabled | Endpoint discovery |
| aws.endpointUrl | Service-specific endpoints |

JVM system properties list 53

| Setting name | Details |
|---|--------------------------------------|
| <pre>aws.endpo intUrl<se rvicename=""></se></pre> | Service-specific endpoints |
| aws.ignor eConfigur edEndpointUrls | Service-specific endpoints |
| aws.maxAttempts | Retry behavior |
| aws.profile | Shared config and credentials files |
| aws.region | AWS Region |
| <pre>aws.reque stMinComp ressionSi zeBytes</pre> | Request compression |
| aws.retryMode | Retry behavior |
| aws.roleArn | Assume role credential provider |
| aws.roleS essionName | Assume role credential provider |
| aws.s3Dis ableMulti RegionAcc essPoints | Amazon S3 Multi-Region Access Points |
| aws.s3Use ArnRegion | Amazon S3 access points |
| aws.secre tAccessKey | AWS access keys |

JVM system properties list 54

| Setting name | Details |
|---------------------------------------|---|
| aws.sessi onToken | AWS access keys |
| aws.share dCredenti alsFile | Location of the shared config and credentials files |
| aws.useDu alstackEn dpoint | Dual-stack and FIPS endpoints |
| aws.useFi psEndpoint | Dual-stack and FIPS endpoints |
| aws.userA gentAppId | Application ID |
| <pre>aws.webId entityTok enFile</pre> | Assume role credential provider |

AWS SDKs and Tools standardized credential providers

Many credential providers have been standardized to consistent defaults and to work the same way across many SDKs. This consistency increases productivity and clarity when coding across multiple SDKs. All settings can be overridden in code. For details, see your specific SDK API.



Important

Not all SDKs support all providers, or even all aspects within a provider.

Topics

- Credential provider chain
- AWS access keys

- Assume role credential provider
- Container credential provider
- IAM Identity Center credential provider
- IMDS credential provider
- Process credential provider

Credential provider chain

All SDKs have a series of places (or sources) that they check in order to find valid credentials to use to make a request to an AWS service. After valid credentials are found, the search is stopped. This systematic search is called the credential provider chain.

When using one of the standardized credential providers, the AWS SDKs always attempt to renew credentials automatically when they expire. The built-in credential provider chain provides your application with the ability to refresh your credentials regardless of which provider you are using in the chain. No additional code is required for the SDK to do this.

Although the distinct chain used by each SDK varies, they most often include sources such as the following:

| Credential provider | Description |
|--|--|
| AWS access keys | AWS access keys for an IAM user (such as AWS_ACCES S_KEY_ID , and AWS_SECRET_ACCESS_KEY). |
| Federate with web identity or OpenID Connect - Assume role credential provider | Sign in using a well-known external identity provider (IdP), such as Login with Amazon, Facebook, Google, or any other OpenID Connect (OIDC)-compatible IdP. Assume the permissions of an IAM role using a web identity token from AWS Security Token Service (AWS STS). |
| IAM Identity Center credential provider | Get credentials from AWS IAM Identity Center. |

Credential provider chain 56

| Credential provider | Description |
|---------------------------------|---|
| Assume role credential provider | Get access to other resources by assuming the permissions of an IAM role. (Retrieve and then use temporary credentials for a role). |
| Container credential provider | Amazon Elastic Container Service (Amazon ECS) and Amazon Elastic Kubernetes Service (Amazon EKS) credentials. The container credential provider fetches credentials for the customer's containerized application. |
| Process credential provider | Custom credential provider. Get your credentials from an external source or process, including IAM Roles Anywhere. |
| IMDS credential provider | Amazon Elastic Compute Cloud (Amazon EC2) instance profile credentials. Associate an IAM role with each of your EC2 instances. Temporary credentials for that role are made available to code running in the instance. The credentials are delivered through the Amazon EC2 metadata service. |

For each step in the chain, there are multiple ways to assign setting values. Setting values that are specified in code always take precedence. However, there are also Environment variables and the Shared config and credentials files. For more information, see Precedence of settings.

AWS access keys



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To avoid security risks, don't use IAM users for authentication when developing purposebuilt software or working with real data. Instead, use federation with an identity provider such as AWS IAM Identity Center.

AWS access keys for an IAM user can be used as your AWS credentials. The AWS SDK automatically uses these AWS credentials to sign API requests to AWS, so that your workloads can access

your AWS resources and data securely and conveniently. It is recommended to always use the aws session token so that the credentials are temporary and no longer valid after they expire. Using long-term credentials is not recommended.



Note

If AWS becomes unable to refresh these temporary credentials, AWS may extend the validity of the credentials so that your workloads are not impacted.

The shared AWS credentials file is the recommended location for storing credentials information because it is safely outside of application source directories and separate from the SDK-specific settings of the shared config file.

To learn more about AWS credentials and using access keys, see AWS security credentials and Managing access keys for IAM users in the IAM User Guide.

Configure this functionality by using the following:

aws_access_key_id - shared AWS config file setting, aws_access_key_id - shared AWS credentials file setting (recommended method), AWS_ACCESS_KEY_ID - environment variable, aws.accessKeyId - JVM system property: Java/Kotlin only

Specifies the AWS access key used as part of the credentials to authenticate the user.

aws_secret_access_key - shared AWS config file setting, aws_secret_access_key shared AWS credentials file setting (recommended method), AWS_SECRET_ACCESS_KEY environment variable, aws.secretAccessKey - JVM system property: Java/Kotlin only

Specifies the AWS secret key used as part of the credentials to authenticate the user.

aws_session_token - shared AWS config file setting, aws_session_token - shared AWS credentials file setting (recommended method), AWS_SESSION_TOKEN - environment variable, aws.sessionToken - JVM system property: Java/Kotlin only

Specifies an AWS session token used as part of the credentials to authenticate the user. You receive this value as part of the temporary credentials returned by successful requests to assume a role. A session token is required only if you manually specify temporary security credentials. However, we recommend you always use temporary security credentials instead of long-term credentials. For security recommendations, see Security best practices in IAM.

For instructions on how to obtain these values, see Authenticate using short-term credentials.

Example of setting these required values in the config or credentials file:

```
[default]
aws_access_key_id = AKIAIOSFODNN7EXAMPLE
aws_secret_access_key = wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
aws_session_token = AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R40lgk
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_ACCESS_KEY_ID=AKIAIOSFODNN7EXAMPLE
export AWS_SECRET_ACCESS_KEY=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
export
AWS_SESSION_TOKEN=AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R40lgk
```

Windows example of setting environment variables via command line:

```
setx AWS_ACCESS_KEY_ID AKIAIOSFODNN7EXAMPLE
setx AWS_SECRET_ACCESS_KEY wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
setx
AWS_SESSION_TOKEN AQoEXAMPLEH4aoAH0gNCAPy...truncated...zrkuWJ0gQs8IZZaIv2BXIa2R40lgk
```

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-----|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | shared config file not supported. |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |

| SDK | Si Notes or more information | |
|------------------------|--|--|
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | Yes | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes Environment variables not supported. | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes Environment variables not supported. | |

Assume role credential provider

Assuming a role involves using a set of temporary security credentials to access AWS resources that you might not have access to otherwise. These temporary credentials consist of an access key ID, a secret access key, and a security token.

To set up your SDK or tool to assume a role, you must first create or identify a specific *role* to assume. IAM roles are uniquely identified by a role Amazon Resource Name (<u>ARN</u>). Roles establish trust relationships with another entity. The trusted entity that uses the role might be an AWS service, another AWS account, a web identity provider or OIDC, or SAML federation.

After the IAM role is identified, if you are trusted by that role, you can configure your SDK or tool to use the permissions that are granted by the role. To do this, use the following settings.

For guidance on getting started using these settings, see Assume a role in this guide.

Assume role credential provider settings

Configure this functionality by using the following:

credential_source - shared AWS config file setting

Used within Amazon EC2 instances or Amazon Elastic Container Service containers to specify where the SDK or tool can find credentials that have permission to assume the role that you specify with the role_arn parameter.

Default value: None

Valid values:

- **Environment** Specifies that the SDK or tool is to retrieve source credentials from the environment variables AWS_ACCESS_KEY_ID and AWS_SECRET_ACCESS_KEY.
- **Ec2InstanceMetadata** Specifies that the SDK or tool is to use the <u>IAM role attached to the</u> EC2 instance profile to get source credentials.
- **EcsContainer** Specifies that the SDK or tool is to use the <u>IAM role attached to the ECS</u> container to get source credentials.

You cannot specify both credential_source and source_profile in the same profile.

Example of setting this in a config file to indicate that credentials should be sourced from Amazon EC2:

```
credential_source = Ec2InstanceMetadata
role_arn = arn:aws:iam::123456789012:role/my-role-name
```

duration_seconds - shared AWS config file setting

Specifies the maximum duration of the role session, in seconds.

This setting applies only when the profile specifies to assume a role.

Default value: 3600 seconds (one hour)

Valid values: The value can range from 900 seconds (15 minutes) up to the maximum session duration setting configured for the role (which can be a maximum of 43200 seconds, or 12 hours). For more information, see <u>View the Maximum Session Duration Setting for a Role</u> in the *IAM User Guide*.

Example of setting this in a config file:

```
duration_seconds = 43200
```

external_id - shared AWS config file setting

Specifies a unique identifier that is used by third parties to assume a role in their customers' accounts.

This setting applies only when the profile specifies to assume a role and the trust policy for the role requires a value for ExternalId. The value maps to the ExternalId parameter that is passed to the AssumeRole operation when the profile specifies a role.

Default value: None.

Valid values: See <u>How to use an External ID When Granting Access to Your AWS Resources to a Third Party in the *IAM User Guide*.</u>

Example of setting this in a config file:

```
external_id = unique_value_assigned_by_3rd_party
```

mfa_serial - shared AWS config file setting

Specifies the identification or serial number of a multi-factor authentication (MFA) device that the user must use when assuming a role.

Required when assuming a role where the trust policy for that role includes a condition that requires MFA authentication.

Default value: None.

Valid values: The value can be either a serial number for a hardware device (such as GAHT12345678), or an Amazon Resource Name (ARN) for a virtual MFA device. For more information about MFA, see Configuring MFA-Protected API Access in the *IAM User Guide*.

Example of setting this in a config file:

```
mfa_serial = arn:aws:iam::123456789012:mfa/my-user-name
```

role_arn - shared AWS config file setting, AWS_ROLE_ARN - environment variable, aws.roleArn - JVM system property: Java/Kotlin only

Specifies the Amazon Resource Name (ARN) of an IAM role that you want to use to perform operations requested using this profile.

Default value: None.

Valid values: The value must be the ARN of an IAM role, formatted as follows:

```
arn:aws:iam::account-id:role/role-name
```

In addition, you must also specify **one** of the following settings:

- source_profile To identify another profile to use to find credentials that have permission to assume the role in this profile.
- credential_source To use either credentials identified by the current environment variables or credentials attached to an Amazon EC2 instance profile, or an Amazon ECS container instance.
- web_identity_token_file To use public identity providers or any OpenID Connect
 (OIDC)-compatible identity provider for users who have been authenticated in a mobile or
 web application.

role_session_name - shared AWS config file setting, AWS_ROLE_SESSION_NAME environment variable, aws.roleSessionName - JVM system property: Java/Kotlin only

Specifies the name to attach to the role session. This name appears in AWS CloudTrail logs for entries associated with this session, which can be useful when auditing.

Default value: An optional parameter. If you don't provide this value, a session name is generated automatically if the profile assumes a role.

Valid values: Provided to the RoleSessionName parameter when the AWS CLI or AWS API calls the AssumeRole operation (or operations such as the AssumeRoleWithWebIdentity operation) on your behalf. The value becomes part of the assumed role user Amazon Resource Name (ARN) that you can query, and shows up as part of the CloudTrail log entries for operations invoked by this profile.

arn:aws:sts::123456789012:assumed-role/my-role-name/my-role_session_name.

Example of setting this in a config file:

```
role_session_name = my-role-session-name
```

source_profile - shared AWS config file setting

Specifies another profile whose credentials are used to assume the role specified by the role_arn setting in the original profile. To understand how profiles are used in the shared AWS config and credentials files, see Shared config and credentials files.

If you specify a profile that is also an assume role profile, each role will be assumed in sequential order to fully resolve the credentials. This chain is stopped when the SDK encounters a profile with credentials. Role chaining limits your AWS CLI or AWS API role session to a maximum of one hour and can't be increased. For more information, see Roles terms and concepts in the IAM User Guide.

Default value: None.

Valid values: A text string that consists of the name of a profile defined in the config and credentials files. You must also specify a value for role_arn in the current profile.

You cannot specify both credential_source and source_profile in the same profile.

Example of setting this in a config file:

```
[profile A]
source_profile = B
role_arn = arn:aws:iam::123456789012:role/RoleA

[profile B]
aws_access_key_id=AKIAIOSFODNN7EXAMPLE
aws_secret_access_key=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
aws_session_token=IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZ2luX2IQoJb3JpZVERYLONGS
```

In the previous example, the A profile uses the credentials in the B profile. When you specify that the SDK or tool should use the A profile, the SDK or tool automatically looks up the credentials for the linked B profile and uses them to request temporary credentials for the specified IAM role. The SDK or tool uses the sts:AssumeRole operation in the background to accomplish this. Those temporary credentials are then used by your code to access AWS resources. The specified role must have attached IAM permissions policies that allow the requested code to run, such as the command, AWS service, or API method.

web_identity_token_file - shared AWS config file setting,
AWS_WEB_IDENTITY_TOKEN_FILE - environment variable, aws.webIdentityTokenFile JVM system property: Java/Kotlin only

Specifies the path to a file that contains an access token from a <u>supported OAuth 2.0 provider</u> or OpenID Connect ID identity provider.

This setting enables authentication by using web identity federation providers, such as <u>Google</u>, <u>Facebook</u>, and <u>Amazon</u>, among many others. The SDK or developer tool loads the contents of this file and passes it as the WebIdentityToken argument when it calls the AssumeRoleWithWebIdentity operation on your behalf.

Default value: None.

Valid values: This value must be a path and file name. The file must contain an OAuth 2.0 access token or an OpenID Connect token that was provided to you by an identity provider. Relative paths are treated as relative to the working directory of the process.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-------|---|
| AWS CLI v2 | Yes | |
| SDK for C++ | Parti | <pre>credential_source not supported. duration_ seconds not supported. mfa_serial not supported.</pre> |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Parti | mfa_serial not supported. |
| SDK for Java 1.x | Parti | <pre>credential_source not supported.mfa_serial not supported. JVM system properties not supported.</pre> |

| SDK | Si Notes or more information |
|------------------------|--|
| SDK for JavaScript 3.x | Yes |
| SDK for JavaScript 2.x | Parti credential_source not supported. |
| SDK for Kotlin | Yes |
| SDK for .NET 3.x | Yes |
| SDK for PHP 3.x | Yes |
| SDK for Python (Boto3) | Yes |
| SDK for Ruby 3.x | Yes |
| SDK for Rust | Yes |
| SDK for Swift | Yes |
| Tools for PowerShell | Yes |

Container credential provider

The container credential provider fetches credentials for customer's containerized application. This credential provider is useful for Amazon Elastic Container Service (Amazon ECS) and Amazon Elastic Kubernetes Service (Amazon EKS) customers. SDKs attempt to load credentials from the specified HTTP endpoint through a GET request.

If you use Amazon ECS, we recommend you use a task IAM Role for improved credential isolation, authorization, and auditability. When configured, Amazon ECS sets the AWS_CONTAINER_CREDENTIALS_RELATIVE_URI environment variable that the SDKs and tools use to obtain credentials. To configure Amazon ECS for this functionality, see Task IAM role in the Amazon Elastic Container Service Developer Guide.

If you use Amazon EKS, we recommend you use Amazon EKS Pod Identity for improved credential isolation, least privilege, auditability, independent operation, reusability, and scalability. Both your Pod and an IAM role are associated with a Kubernetes service account to manage credentials for your applications. To learn more on Amazon EKS Pod Identities in the Amazon EKS User Guide. When

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configured, Amazon EKS sets the AWS_CONTAINER_CREDENTIALS_FULL_URI and AWS_CONTAINER_AUTHORIZATION_TOKEN_FILE environment variables that the SDKs and tools use to obtain credentials. For setup information, see Setting up the Amazon EKS Pod Identity Agent in the Amazon EKS User Guide or <a href="Amazon EKS Pod Identity simplifies IAM permissions for applications on Amazon EKS clusters at the AWS Blog website.

Configure this functionality by using the following:

AWS_CONTAINER_CREDENTIALS_FULL_URI - environment variable

Specifies the full HTTP URL endpoint for the SDK to use when making a request for credentials. This includes both the scheme and the host.

Default value: None.

Valid values: Valid URI.

Note: This setting is an alternative to AWS_CONTAINER_CREDENTIALS_RELATIVE_URI and will only be used if AWS CONTAINER CREDENTIALS RELATIVE URI is not set.

Linux/macOS example of setting environment variables via command line:

```
export AWS_CONTAINER_CREDENTIALS_FULL_URI=http://localhost/get-credentials
```

or

export AWS_CONTAINER_CREDENTIALS_FULL_URI=http://localhost:8080/get-credentials

AWS_CONTAINER_CREDENTIALS_RELATIVE_URI - environment variable

Specifies the relative HTTP URL endpoint for the SDK to use when making a request for credentials. The value is appended to the default Amazon ECS hostname of 169.254.170.2.

Default value: None.

Valid values: Valid relative URI.

Linux/macOS example of setting environment variables via command line:

export AWS_CONTAINER_CREDENTIALS_RELATIVE_URI=/get-credentials?a=1

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AWS_CONTAINER_AUTHORIZATION_TOKEN - environment variable

Specifies an authorization token in plain text. If this variable is set, the SDK will set the Authorization header on the HTTP request with the environment variable's value.

Default value: None.

Valid values: String.

Note: This setting is an alternative to AWS_CONTAINER_AUTHORIZATION_TOKEN_FILE and will only be used if AWS_CONTAINER_AUTHORIZATION_TOKEN_FILE is not set.

Linux/macOS example of setting environment variables via command line:

```
export AWS_CONTAINER_CREDENTIALS_FULL_URI=http://localhost/get-credential
export AWS_CONTAINER_AUTHORIZATION_TOKEN=Basic abcd
```

AWS_CONTAINER_AUTHORIZATION_TOKEN_FILE - environment variable

Specifies an absolute file path to a file that contains the authorization token in plain text.

Default value: None.

Valid values: String.

Linux/macOS example of setting environment variables via command line:

```
export AWS_CONTAINER_CREDENTIALS_FULL_URI=http://localhost/get-credential
export AWS_CONTAINER_AUTHORIZATION_TOKEN_FILE=/path/to/token
```

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------|-----|---------------------------|
| AWS CLI v2 | Yes | |

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| SDK | Sı | Notes or more information | |
|------------------------|-----|--|-----------------|
| SDK for C++ | Yes | | |
| SDK for Go V2 (1.x) | Yes | | |
| SDK for Go 1.x (V1) | Yes | | |
| SDK for Java 2.x | Yes | AWS_CONTAINER_CREDENTIALS_FULL_URI AWS_CONTAINER_AUTHORIZATION_TOKEN used for <u>Lambda SnapStart for Java</u> . | and are also |
| SDK for Java 1.x | Yes | AWS_CONTAINER_CREDENTIALS_FULL_URI AWS_CONTAINER_AUTHORIZATION_TOKEN used for <u>Lambda SnapStart for Java</u> . | and are also |
| SDK for JavaScript 3.x | Yes | | |
| SDK for JavaScript 2.x | Yes | | |
| SDK for Kotlin | Yes | | |
| SDK for .NET 3.x | Yes | | |
| SDK for PHP 3.x | Yes | | |
| SDK for Python (Boto3) | Yes | | |
| SDK for Ruby 3.x | Yes | | |
| SDK for Rust | Yes | | |
| SDK for Swift | Yes | | |
| Tools for PowerShell | Yes | | |

IAM Identity Center credential provider

This authentication mechanism uses AWS IAM Identity Center to get single sign-on (SSO) access to AWS services for your code.



Note

In the AWS SDK API documentation, the IAM Identity Center credential provider is called the SSO credential provider.

After you enable IAM Identity Center, you define a profile for its settings in your shared AWS config file. This profile is used to connect to the IAM Identity Center access portal. When a user successfully authenticates with IAM Identity Center, the portal returns short-term credentials for the IAM role associated with that user. To learn how the SDK gets temporary credentials from the configuration and uses them for AWS service requests, see Understand IAM Identity Center authentication.

There are two ways to configure IAM Identity Center through the config file:

- (Recommended) SSO token provider configuration Extended session durations. Includes support for custom session durations.
- Legacy non-refreshable configuration Uses a fixed, eight-hour session.

In both configurations, you need to sign in again when your session expires.

The following two guides contain additional information about IAM Identity Center:

- AWS IAM Identity Center User Guide
- AWS IAM Identity Center Portal API Reference

For a deep dive on how the SDKs and tools use and refresh credentials using this configuration, see Understand IAM Identity Center authentication.

Prerequisites

You must first enable IAM Identity Center. For details about enabling IAM Identity Center authentication, see Enabling AWS IAM Identity Center in the AWS IAM Identity Center User Guide.



Note

Alternatively, for complete prerequisites and the necessary shared config file configuration that is detailed on this page, see the guided instructions for setting up IAM Identity Center authentication for your SDK or tool.

SSO token provider configuration

When you use the SSO token provider configuration, your AWS SDK or tool automatically refreshes your session up to your extended session period. For more information on session duration and maximum duration, see Configure the session duration of the AWS access portal and IAM Identity Center integrated applications in the AWS IAM Identity Center User Guide.

The sso-session section of the config file is used to group configuration variables for acquiring SSO access tokens, which can then be used to acquire AWS credentials. For more details on this section within a config file, see Format of the config file.

The following shared config file example configures the SDK or tool using a dev profile to request IAM Identity Center credentials.

```
[profile dev]
sso_session = my-sso
sso_account_id = 111122223333
sso_role_name = SampleRole
[sso-session my-sso]
sso_region = us-east-1
sso_start_url = https://my-sso-portal.awsapps.com/start
sso_registration_scopes = sso:account:access
```

The previous examples shows that you define an sso-session section and associate it to a profile. Typically, sso_account_id and sso_role_name must be set in the profile section so that the SDK can request AWS credentials. sso_region, sso_start_url, and sso_registration_scopes must be set within the sso-session section.

sso_account_id and sso_role_name aren't required for all scenarios of SSO token configuration. If your application only uses AWS services that support bearer authentication, then traditional AWS credentials are not needed. Bearer authentication is an HTTP authentication scheme that uses security tokens called bearer tokens. In this scenario, sso_account_id and

sso_role_name aren't required. See the individual AWS service guide to determine if the service supports bearer token authorization.

Registration scopes are configured as part of an sso-session. Scope is a mechanism in OAuth 2.0 to limit an application's access to a user's account. The previous example sets sso_registration_scopes to provide necessary access for listing accounts and roles.

The following example shows how you can reuse the same sso-session configuration across multiple profiles.

```
[profile dev]
sso_session = my-sso
sso_account_id = 11112223333
sso_role_name = SampleRole

[profile prod]
sso_session = my-sso
sso_account_id = 11112223333
sso_role_name = SampleRole2

[sso-session my-sso]
sso_region = us-east-1
sso_start_url = https://my-sso-portal.awsapps.com/start
sso_registration_scopes = sso:account:access
```

The authentication token is cached to disk under the ~/.aws/sso/cache directory with a file name based on the session name.

Legacy non-refreshable configuration

Automated token refresh isn't supported using the legacy non-refreshable configuration. We recommend using the SSO token provider configuration instead.

To use the legacy non-refreshable configuration, you must specify the following settings within your profile:

- sso_start_url
- sso_region
- sso_account_id
- sso_role_name

You specify the user portal for a profile with the sso_start_url and sso_region settings. You specify permissions with the sso_account_id and sso_role_name settings.

The following example sets the four required values in the config file.

```
[profile my-sso-profile]
sso_start_url = https://my-sso-portal.awsapps.com/start
sso_region = us-west-2
sso_account_id = 111122223333
sso_role_name = SSOReadOnlyRole
```

The authentication token is cached to disk under the ~/.aws/sso/cache directory with a file name based on the sso_start_url.

IAM Identity Center credential provider settings

Configure this functionality by using the following:

sso_start_url - shared AWS config file setting

The URL that points to your organization's IAM Identity Center access portal. For more information on the IAM Identity Center access portal, see <u>Using the AWS access portal</u> in the *AWS IAM Identity Center User Guide*.

To find this value, open the <u>IAM Identity Center console</u>, view the **Dashboard**, and find **AWS** access portal URL.

sso_region - shared AWS config file setting

The AWS Region that contains your IAM Identity Center portal host; that is, the Region you selected before enabling IAM Identity Center. This is independent from your default AWS Region, and can be different.

For a complete list of the AWS Regions and their codes, see <u>Regional Endpoints</u> in the *Amazon Web Services General Reference*. To find this value, open the <u>IAM Identity Center console</u>, view the **Dashboard**, and find **Region**.

sso_account_id - shared AWS config file setting

The numeric ID of the AWS account that was added through the AWS Organizations service to use for authentication.

To see the list of available accounts, go to the <u>IAM Identity Center console</u> and open the **AWS** accounts page. You can also see the list of available accounts using the <u>ListAccounts</u> API method in the *AWS IAM Identity Center Portal API Reference*. For example, you can call the AWS CLI method list-accounts.

sso_role_name - shared AWS config file setting

The name of a permission set provisioned as an IAM role that defines the user's resulting permissions. The role must exist in the AWS account specified by sso_account_id. Use the role name, not the role Amazon Resource Name (ARN).

Permission sets have IAM policies and custom permissions policies attached to them and define the level of access that users have to their assigned AWS accounts.

To see the list of available permission sets per AWS account, go to the <u>IAM Identity Center</u> <u>console</u> and open the **AWS accounts** page. Choose the correct permission set name listed in the AWS accounts table. You can also see the list of available permission sets using the <u>ListAccountRoles</u> API method in the *AWS IAM Identity Center Portal API Reference*. For example, you can call the AWS CLI method <u>list-account-roles</u>.

sso_registration_scopes - shared AWS config file setting

A comma-delimited list of valid scope strings to be authorized for the sso-session. An application can request one or more scopes, and the access token issued to the application is limited to the scopes granted. A minimum scope of sso:account:access must be granted to get a refresh token back from the IAM Identity Center service. For the list of available access scope options, see Access scopes in the AWS IAM Identity Center User Guide.

These scopes define the permissions requested to be authorized for the registered OIDC client and access tokens retrieved by the client. Scopes authorize access to IAM Identity Center bearer token authorized endpoints.

This setting doesn't apply to the legacy non-refreshable configuration. Tokens issued using the legacy configuration are limited to scope sso: account: access implicitly.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-------|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | Configuration values also supported in credentials file. |
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Parti | Legacy non-refreshable configuration only. |
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes | |

IMDS credential provider

Instance Metadata Service (IMDS) provides data about your instance that you can use to configure or manage the running instance. For more information about the data available, see Work with instance metadata in the Amazon EC2 User Guide. Amazon EC2 provides a local endpoint available

to instances that can provide various bits of information to the instance. If the instance has a role attached, it can provide a set of credentials that are valid for that role. The SDKs can use that endpoint to resolve credentials as part of their default credential provider chain. Instance Metadata Service Version 2 (IMDSv2), a more secure version of IMDS that uses a session token, is used by default. If that fails due to a non-retryable condition (HTTP error codes 403, 404, 405), IMDSv1 is used as a fallback.

Configure this functionality by using the following:

AWS_EC2_METADATA_DISABLED - environment variable

Whether or not to attempt to use Amazon EC2 Instance Metadata Service (IMDS) to obtain credentials.

Default value: false.

Valid values:

- true Do not use IMDS to obtain credentials.
- false Use IMDS to obtain credentials.

ec2_metadata_v1_disabled - shared AWS config file setting, AWS_EC2_METADATA_V1_DISABLED - environment variable, aws.disableEc2MetadataV1 -JVM system property: Java/Kotlin only

Whether or not to use Instance Metadata Service Version 1 (IMDSv1) as a fallback if IMDSv2 fails.



Note

New SDKs don't support IMDSv1 and, thus, don't support this setting. For details, see table Compatibility with AWS SDKs.

Default value: false.

Valid values:

- true Do not use IMDSv1 as a fallback.
- false Use IMDSv1 as a fallback.

ec2_metadata_service_endpoint - shared AWS config file setting,

AWS_EC2_METADATA_SERVICE_ENDPOINT - environment variable,

aws.ec2MetadataServiceEndpoint - JVM system property: Java/Kotlin only

The endpoint of IMDS.

Default value: If ec2_metadata_service_endpoint_mode equals IPv4, then default endpoint is http://169.254.169.254. If ec2_metadata_service_endpoint_mode equals IPv6, then default endpoint is http://[fd00:ec2::254].

Valid values: Valid URI.

ec2_metadata_service_endpoint_mode - shared AWS config file setting,

AWS_EC2_METADATA_SERVICE_ENDPOINT_MODE - environment variable,

aws.ec2MetadataServiceEndpointMode - JVM system property: Java/Kotlin only

The endpoint mode of IMDS.

Default value: IPv4.

Valid values: IPv4, IPv6.



The IMDS credential provider is a part of the <u>Credential provider chain</u>. However, the IMDS credential provider is only checked after several other providers that are in this series. Therefore, if you want your program use this provider's credentials, you must remove other valid credential providers from your configuration or use a different profile. Alternatively, instead of relying on the credential provider chain to automatically discover which provider returns valid credentials, specify the use of the IMDS credential provider in code. You can specify credential sources directly when you create service clients.

Security for IMDS credentials

By default, when the AWS SDK is not configured with valid credentials the SDK will attempt to use the Amazon EC2 Instance Metadata Service (IMDS) to retrieve credentials for an AWS role. This behavior can be disabled by setting the AWS_EC2_METADATA_DISABLED environment variable to true. This prevents unnecessary network activity and enhances security on untrusted networks where the Amazon EC2 Instance Metadata Service may be impersonated.



Note

AWS SDK clients configured with valid credentials will never use IMDS to retrieve credentials, regardless of any of these settings.

Disabling use of Amazon EC2 IMDS credentials

How you set this environment variable depends on what operating system is in use as well as whether or not you want the change to be persistent.

Linux and macOS

Customers using Linux or macOS can set this environment variable with the following command:

```
$ export AWS_EC2_METADATA_DISABLED=true
```

If you want this setting to be persistent across multiple shell sessions and system restarts, you can add the above command to your shell profile file, such as .bash_profile, .zsh_profile, or .profile.

Windows

Customers using Windows can set this environment variable with the following command:

```
$ set AWS_EC2_METADATA_DISABLED=true
```

If you want this setting to be persistent across multiple shell sessions and system restarts can use the following command instead:

```
$ setx AWS_EC2_METADATA_DISABLED=true
```



Note

The **setx** command does not apply the value to the current shell session, so you will need to reload or reopen the shell for the change to take effect.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-------|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | Parti | JVM system properties: Use com.amazonaws.sdk. disableEc2MetadataV1 instead of aws.disab leEc2MetadataV1 ; aws.ec2MetadataSer viceEndpoint and aws.ec2MetadataSer viceEndpointMode not supported. |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | Does not use IMDSv1 fallback. |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | Does not use IMDSv1 fallback. |

| SDK | Sı | Notes or more information |
|----------------------|-----|--|
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes | You can disable IMDSv1 fallback explicitly in code using [Amazon.Util.EC2InstanceMetadata]::E C2MetadataV1Disabled = \$true . |

Process credential provider

SDKs provide a way to extend the credential provider chain for custom use cases. This provider can be used to provide custom implementations, such as retrieving credentials from an on-premises credentials store or integrating with your on-premises identify provider.

For example, IAM Roles Anywhere uses credential_process to get temporary credentials on behalf of your application. To configure credential_process for this use, see IAM Roles Anywhere.

Note

The following describes a method of sourcing credentials from an external process and might be used if you are running software outside of AWS. If you are building on an AWS compute resource, use other credential providers. If using this option, you should make sure that the config file is as locked down as possible using security best practices for your operating system. Confirm that your custom credential tool does not write any secret information to StdErr, because the SDKs and AWS CLI can capture and log such information, potentially exposing it to unauthorized users.

Configure this functionality by using the following:

credential_process - shared AWS config file setting

Specifies an external command that the SDK or tool runs on your behalf to generate or retrieve authentication credentials to use. The setting specifies the name of a program/command that the SDK will invoke. When the SDK invokes the process, it waits for the process to write JSON data to stdout. The custom provider must return information in a specific format. That information contains the credentials that the SDK or tool can use to authenticate you.



Note

The process credential provider is a part of the Credential provider chain. However, the process credential provider is only checked after several other providers that are in this series. Therefore, if you want your program use this provider's credentials, you must remove other valid credential providers from your configuration or use a different profile. Alternatively, instead of relying on the credential provider chain to automatically discover which provider returns valid credentials, specify the use of the process credential provider in code. You can specify credential sources directly when you create service clients.

Specifying the path to the credentials program

The setting's value is a string that contains a path to a program that the SDK or development tool runs on your behalf:

- The path and file name can consist of only these characters: A-Z, a-z, 0-9, hyphen (), underscore (_), period (.), forward slash (/), backslash (\), and space.
- If the path or file name contains a space, surround the complete path and file name with doublequotation marks (" ").
- If a parameter name or a parameter value contains a space, surround that element with doublequotation marks (" "). Surround only the name or value, not the pair.
- Don't include any environment variables in the strings. For example, don't include \$HOME or %USERPROFILE%.
- Don't specify the home folder as ~. * You must specify either the full path or a base file name. If there is a base file name, the system attempts to find the program within folders specified by the PATH environment variable. The path varies depending on the operating system:

The following example shows setting credential_process in the shared config file on Linux/ macOS.

```
credential_process = "/path/to/credentials.sh" parameterWithoutSpaces "parameter with
spaces"
```

The following example shows setting credential_process in the shared config file on Windows.

```
credential_process = "C:\Path\To\credentials.cmd" parameterWithoutSpaces "parameter
with spaces"
```

Can be specified within a dedicated profile:

```
[profile cred_process]
credential_process = /Users/username/process.sh
region = us-east-1
```

Valid output from the credentials program

The SDK runs the command as specified in the profile and then reads data from the standard output stream. The command you specify, whether a script or binary program, must generate JSON output on STDOUT that matches the following syntax.

```
"Version": 1,
   "AccessKeyId": "an AWS access key",
   "SecretAccessKey": "your AWS secret access key",
   "SessionToken": "the AWS session token for temporary credentials",
   "Expiration": "RFC3339 timestamp for when the credentials expire"
}
```

Note

As of this writing, the Version key must be set to 1. This might increment over time as the structure evolves.

The Expiration key is an RFC3339 formatted timestamp. If the Expiration key isn't present in the tool's output, the SDK assumes that the credentials are long-term credentials that don't refresh. Otherwise, the credentials are considered temporary credentials, and they are automatically refreshed by rerunning the credential_process command before the credentials expire.



Note

The SDK does not cache external process credentials the way it does assume-role credentials. If caching is required, you must implement it in the external process.

The external process can return a non-zero return code to indicate that an error occurred while retrieving the credentials.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-----|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | Yes | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |

| SDK | Sı | Notes or more information |
|----------------------|-----|---------------------------|
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes | |

AWS SDKs and Tools standardized features

Many features have been standardized to consistent defaults and to work the same way across many SDKs. This consistency increases productivity and clarity when coding across multiple SDKs. All settings can be overridden in code, see your specific SDK API for details.



Important

Not all SDKs support all features, or even all aspects within a feature.

Topics

- Account-based endpoints
- **Application ID**
- Amazon EC2 instance metadata
- Amazon S3 access points
- Amazon S3 Multi-Region Access Points
- **AWS Region**
- AWS STS Regional endpoints
- **Dual-stack and FIPS endpoints**
- Endpoint discovery
- General configuration settings
- IMDS client
- Retry behavior

Standardized features

- · Request compression
- Service-specific endpoints
- Smart configuration defaults

Account-based endpoints

Account-based endpoints help ensure high performance and scalability by using your AWS account ID to streamline the routing of AWS service requests for services that support this feature. When you use an AWS SDK, credential provider, and service that support account-based endpoints, the SDK will automatically construct and use an account-based endpoint rather than a regional endpoint. Account-based endpoints take the form of https://<account-id>.ddb.</account-id>.amazonaws.com, where <account-id> is replaced with your AWS account ID and <region> is replaced with your AWS Region

By default, the account ID is collected when the request is processed and used to construct an endpoint. Credential resolution also occurs when the request is processed and might change the method of endpoint resolution. Depending on what credential provider you are using, the account ID might be sourced differently.

Configure this functionality by using the following:

aws_account_id - shared AWS config file setting, AWS_ACCOUNT_ID - environment variable, aws.accountId - JVM system property: Java/Kotlin only

The AWS account ID. Used for account-based endpoint routing. An AWS account ID has a format like 111122233333.

Account-based endpoint routing provides better request performance for some services.

account_id_endpoint_mode - shared AWS config file setting,
AWS_ACCOUNT_ID_ENDPOINT_MODE - environment variable, aws.accountIdEndpointMode JVM system property: Java/Kotlin only

This setting is used to turn off account-based endpoint routing if necessary, and bypass account-based rules.

Default value: preferred

Valid values:

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- preferred The endpoint should include account ID if available.
- disabled A resolved endpoint doesn't include account ID.

• **required** – The endpoint must include account ID. If the account ID isn't available, the SDK throws an error.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Supp | Released in SDK version | Notes or more information |
|-------------------------|------|-------------------------------|---------------------------|
| AWS CLI v2 | No | | |
| SDK for C++ | No | | |
| SDK for Go V2 (1.x) | Yes | v1.35.0 | |
| SDK for Go 1.x (V1) | No | | |
| SDK for Java 2.x | Yes | v2.28.4 | |
| SDK for Java 1.x | Yes | v1.12.771 | |
| SDK for JavaScript 3.x | Yes | v3.656.0 | |
| SDK for JavaScript 2.x | No | | |
| SDK for Kotlin | Yes | v1.3.37 | |
| SDK for .NET 3.x | No | | |
| SDK for PHP 3.x | Yes | v3.318.0 | |

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| SDK | Supp | Released in SDK version | Notes or more information |
|---------------------------|------|-------------------------------|---------------------------|
| SDK for Python (Boto3) | No | | |
| SDK for Ruby 3.x | Yes | v1.123.0 | |
| SDK for Rust | No | | |
| SDK for Swift | No | | |
| Tools for PowerShel | No | | |

Application ID

A single AWS account can be used by multiple customer applications to make calls to AWS services. Application ID provides a way for customers to identify which source application made a set of calls using an AWS account. AWS SDKs and services don't use or interpret this value other than to surface it back in customer communications. For example, this value can be included in operational emails or in the AWS Health Dashboard to uniquely identify which of your applications is associated with the notification.

Configure this functionality by using the following:

sdk_ua_app_id - shared AWS config file setting, AWS_SDK_UA_APP_ID - environment
variable, aws.userAgentAppId - JVM system property: Java/Kotlin only

This setting is a unique string you assign to your application to identify which of your applications within a particular AWS account makes calls to AWS.

Default value: None

Valid values: String with maximum length of 50. Letters, numbers and the following special characters are allowed: $!,\$,\%,\&,*,+,-,..,^,_,^,_,^,_,^,$

Example of setting this value in the config file:

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```
[default]
sdk_ua_app_id=ABCDEF
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_SDK_UA_APP_ID=ABCDEF
export AWS_SDK_UA_APP_ID="ABC DEF"
```

Windows example of setting environment variables via command line:

```
setx AWS_SDK_UA_APP_ID ABCDEF
setx AWS_SDK_UA_APP_ID="ABC DEF"
```

If you include symbols that have a special meaning to the shell being used, escape the value as appropriate.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-------|---|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | shared config file not supported. |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | No | |
| SDK for Java 2.x | Parti | Shared config file setting not supported; environment variable not supported. |
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | |

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| SDK | Sı | Notes or more information |
|------------------------|-----|--------------------------------------|
| SDK for JavaScript 2.x | No | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | Environment variables not supported. |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | No | |
| Tools for PowerShell | No | |

Amazon EC2 instance metadata

Amazon EC2 provides a service on instances called the Instance Metadata Service (IMDS). To learn more about this service, see <u>Work with instance metadata</u> in the *Amazon EC2 User Guide*. When attempting to retrieve credentials on an Amazon EC2 instance that has been configured with an IAM role, the connection to the instance metadata service is adjustable.

Configure this functionality by using the following:

metadata_service_num_attempts - shared AWS config file setting, AWS_METADATA_SERVICE_NUM_ATTEMPTS - environment variable

This setting specifies the number of total attempts to make before giving up when attempting to retrieve data from the instance metadata service.

Default value: 1

Valid values: Number greater than or equal to 1.

Amazon EC2 instance metadata

metadata_service_timeout - shared AWS config file setting, AWS_METADATA_SERVICE_TIMEOUT - environment variable

Specifies the number of seconds before timing out when attempting to retrieve data from the instance metadata service.

Default value: 1

Valid values: Number greater than or equal to 1.

Example of setting these values in the config file:

```
[default]
metadata_service_num_attempts=10
metadata_service_timeout=10
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_METADATA_SERVICE_NUM_ATTEMPTS=10
export AWS_METADATA_SERVICE_TIMEOUT=10
```

Windows example of setting environment variables via command line:

```
setx AWS_METADATA_SERVICE_NUM_ATTEMPTS 10
setx AWS_METADATA_SERVICE_TIMEOUT 10
```

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-----|---------------------------|
| AWS CLI v2 | Yes | |
| SDK for C++ | No | |
| SDK for Go V2 (1.x) | No | |

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| SDK | Sı | Notes or more information | |
|------------------------|-------|-----------------------------------|---------------|
| SDK for Go 1.x (V1) | No | | |
| SDK for Java 2.x | No | | |
| SDK for Java 1.x | Parti | Only AWS_METADATA_SERVICE_TIMEOUT | is supported. |
| SDK for JavaScript 3.x | No | | |
| SDK for JavaScript 2.x | No | | |
| SDK for Kotlin | No | | |
| SDK for .NET 3.x | No | | |
| SDK for PHP 3.x | Yes | | |
| SDK for Python (Boto3) | Yes | | |
| SDK for Ruby 3.x | No | | |
| SDK for Rust | No | | |
| SDK for Swift | No | | |
| Tools for PowerShell | No | | |

Amazon S3 access points

The Amazon S3 service provides access points as an alternative way to interact with Amazon S3 buckets. Access points have unique policies and configurations that can be applied to them instead of directly to the bucket. With AWS SDKs, you can use access point Amazon Resource Names (ARNs) in the bucket field for API operations instead of specifying the bucket name explicitly. They are used for specific operations such as using an access point ARN with GetObject to fetch an object from a bucket, or using an access point ARN with PutObject to add an object to a bucket.

To learn more about Amazon S3 access points and ARNs, see <u>Using access points</u> in the *Amazon S3 User Guide*.

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Configure this functionality by using the following:

s3_use_arn_region - shared AWS config file setting, AWS_S3_USE_ARN_REGION - environment variable, aws.s3UseArnRegion - JVM system property: Java/Kotlin only, To configure value directly in code, consult your specific SDK directly.

This setting controls whether the SDK uses the access point ARN AWS Region to construct the Regional endpoint for the request. The SDK validates that the ARN AWS Region is served by the same AWS partition as the client's configured AWS Region to prevent cross-partition calls that most likely will fail. If multiply defined, the code-configured setting takes precedence, followed by the environment variable setting.

Default value: false

Valid values:

- true The SDK uses the ARN's AWS Region when constructing the endpoint instead of the client's configured AWS Region. Exception: If the client's configured AWS Region is a FIPS AWS Region, then it must match the ARN's AWS Region. Otherwise, an error will result.
- false The SDK uses the client's configured AWS Region when constructing the endpoint.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-----|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | |

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| SDK | Sı | Notes or more information |
|------------------------|-----|--|
| SDK for Java 1.x | Yes | JVM system property not supported. |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | Doesn't follow standard precedence; shared config file value takes precedence over environment variable. |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | No | |
| SDK for Swift | No | |
| Tools for PowerShell | Yes | Doesn't follow standard precedence; shared config file value takes precedence over environment variable. |

Amazon S3 Multi-Region Access Points

Amazon S3 Multi-Region Access Points provide a global endpoint that applications can use to fulfill requests from Amazon S3 buckets located in multiple AWS Regions. You can use Multi-Region Access Points to build multi-Region applications with the same architecture used in a single Region, and then run those applications anywhere in the world.

To learn more about Multi-Region Access Points, see <u>Multi-Region Access Points in Amazon S3</u> in the *Amazon S3 User Guide*.

To learn more about Multi-Region Access Point Amazon Resource Names (ARNs), see Making requests using a Multi-Region Access Point in the Amazon S3 User Guide.

To learn more about creating Multi-Region Access Points, see Managing Multi-Region Access Points in the Amazon S3 User Guide.

The SigV4A algorithm is the signing implementation used to sign the global Region requests. This algorithm is obtained by the SDK through a dependency on the <u>AWS Common Runtime (CRT)</u> libraries.

Configure this functionality by using the following:

s3_disable_multiregion_access_points - shared AWS config file setting,
AWS_S3_DISABLE_MULTIREGION_ACCESS_POINTS - environment variable,
aws.s3DisableMultiRegionAccessPoints - JVM system property: Java/Kotlin only, To
configure value directly in code, consult your specific SDK directly.

This setting controls whether the SDK potentially attempts cross-Region requests. If multiply defined, the code-configured setting takes precedence, followed by the environment variable setting.

Default value: false

Valid values:

- true Stops the use of cross-Region requests.
- false Enables cross-Region requests using Multi-Region Access Points.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Si Notes or more information |
|---------------------|------------------------------|
| AWS CLI v2 | Yes |
| SDK for C++ | Yes |
| SDK for Go V2 (1.x) | Yes |
| SDK for Go 1.x (V1) | No |

| SDK | Si Notes or more information |
|------------------------|------------------------------|
| SDK for Java 2.x | Yes |
| SDK for Java 1.x | No |
| SDK for JavaScript 3.x | Yes |
| SDK for JavaScript 2.x | No |
| SDK for Kotlin | Yes |
| SDK for .NET 3.x | Yes |
| SDK for PHP 3.x | Yes |
| SDK for Python (Boto3) | Yes |
| SDK for Ruby 3.x | Yes |
| SDK for Rust | Yes |
| SDK for Swift | No |
| Tools for PowerShell | Yes |

AWS Region

AWS Regions are an important concept to understand when working with AWS services.

With AWS Regions, you can access AWS services that physically reside in a specific geographic area. This can be useful to keep your data and applications running close to where you and your users will access them. Regions provide fault tolerance, stability, and resilience, and can also reduce latency. With Regions, you can create redundant resources that remain available and unaffected by a Regional outage.

Most AWS service requests are associated with a particular geographic region. The resources that you create in one Region do not exist in any other Region unless you explicitly use a replication feature offered by an AWS service. For example, Amazon S3 and Amazon EC2 support cross-Region replication. Some services, such as IAM, do not have Regional resources.

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The AWS General Reference contains information on the following:

 To understand the relationship between Regions and endpoints, and to view a list of existing Regional endpoints, see AWS service endpoints.

• To view the current list of all supported Regions and endpoints for each AWS service, see <u>Service</u> endpoints and quotas.

Creating service clients

To programmatically access AWS services, SDKs use a client class/object for each AWS service. If your application needs to access Amazon EC2, for example, your application would create an Amazon EC2 client object to interface with that service.

If no Region is explicitly specified for the client, the client defaults to using the Region set through the following region setting. However, the active Region for a client can be explicitly set for any individual client object. Setting the Region in this way takes precedence over any global setting for that particular service client. The alternative Region is specified during instantiation of that client, specific to your SDK (check your specific SDK Guide or your SDK's code base).

Configure this functionality by using the following:

region - shared AWS config file setting, AWS_REGION - environment variable, aws.region - JVM system property: Java/Kotlin only

Specifies the default AWS Region to use for AWS requests. This Region is used for SDK service requests that aren't provided with a specific Region to use.

Default value: None. You must specify this value explicitly.

Valid values:

- Any of the Region codes available for the chosen service, as listed in <u>AWS service endpoints</u> in the AWS General Reference. For example, the value us-east-1 sets the endpoint to the AWS Region US East (N. Virginia).
- aws-global specifies the global endpoint for services that support a separate global endpoint in addition to Regional endpoints, such as AWS Security Token Service (AWS STS) and Amazon Simple Storage Service (Amazon S3).

Example of setting this value in the config file:

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```
[default]
region = us-west-2
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_REGION=us-west-2
```

Windows example of setting environment variables via command line:

```
setx AWS_REGION us-west-2
```

Most SDKs have a "configuration" object that is available for setting the default Region from within the application code. For details, see your specific AWS SDK developer guide.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-----|--|
| AWS CLI v2 | Yes | AWS CLI v2 uses any value in AWS_REGION before any value in AWS_DEFAULT_REGION (both variables are checked). |
| AWS CLI v1 | Yes | AWS CLI v1 uses environment variable named AWS_DEFAU LT_REGION for this purpose. |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | Yes | |

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| SDK | Si Notes or more information |
|------------------------|--|
| SDK for JavaScript 3.x | Yes |
| SDK for JavaScript 2.x | Yes |
| SDK for Kotlin | Yes |
| SDK for .NET 3.x | Yes |
| SDK for PHP 3.x | Yes |
| SDK for Python (Boto3) | Yes This SDK uses environment variable named AWS_DEFAU LT_REGION for this purpose. |
| SDK for Ruby 3.x | Yes |
| SDK for Rust | Yes |
| SDK for Swift | Yes |
| Tools for PowerShell | Yes |

AWS STS Regional endpoints

AWS Security Token Service (AWS STS) is available both as a global and as a Regional service. Some of AWS SDKs and CLIs use the global service endpoint (https://sts.amazonaws.com) by default, while some use the Regional service endpoints (https://sts.{region_identifier}.{partition_domain}). Global requests map to the US East (N. Virginia) Region. For more information on AWS STS endpoints, see Endpoints in the AWS Security Token Service API Reference.

It is an AWS best practice to use Regional endpoints whenever possible and to configure your <u>AWS</u> <u>Region</u>. Customers in <u>partitions</u> other than commercial must use Regional endpoints. Not all SDKs and tools support this setting, but all have defined behavior around global and Regional endpoints. See the following section for more information.

For SDKs and tools that support this setting, customers can configure the functionality by using the following:

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sts_regional_endpoints - shared AWS config file setting, AWS_STS_REGIONAL_ENDPOINTS - environment variable

This setting specifies how the SDK or tool determines the AWS service endpoint that it uses to talk to the AWS Security Token Service (AWS STS).

Default value: legacy



Note

All new SDK major versions releasing after July 2022 will default to regional. New SDK major versions might remove this setting and use regional behavior. To reduce future impact regarding this change, we recommend you start using regional in your application when possible.

Valid values: (Recommended value: regional)

- legacy Uses the global AWS STS endpoint, sts.amazonaws.com.
- regional The SDK or tool always uses the AWS STS endpoint for the currently configured Region. For example, if the client is configured to use us-west-2, all calls to AWS STS are made to the Regional endpoint sts.us-west-2.amazonaws.com, instead of the global sts.amazonaws.com endpoint. To send a request to the global endpoint while this setting is enabled, you can set the Region to aws-global.

Example of setting these values in the config file:

```
[default]
sts_regional_endpoints = regional
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_STS_REGIONAL_ENDPOINTS=regional
```

Windows example of setting environment variables via command line:

```
setx AWS_STS_REGIONAL_ENDPOINTS regional
```

AWS STS Regional endpoints

Compatibility with AWS SDKs



Note

It is an AWS best practice to use Regional endpoints whenever possible and to configure your AWS Region.

The table that follows summarizes, for your SDK or tool:

- Supports setting: Whether the shared config file variable and environment variable for STS Regional endpoints are supported.
- **Default setting value**: The default value of the setting if it is supported.
- Default service client target STS Endpoint: What default endpoint is used by the client even if the setting to change it is not available.
- Service client fallback behavior: What the SDK does when it is supposed to use a Regional endpoint but no Region has been configured. This is the behavior regardless of if it is using a Regional endpoint because of a default or because regional has been selected by the setting.

The table also uses the following values:

- Global endpoint: https://sts.amazonaws.com.
- Regional endpoint: Based on the configured AWS Region used by your application.
- us-east-1 (Regional): Uses the us-east-1 Region endpoint but with longer session tokens than typical global requests.

| SDK | Default setting value | Default service client target STS Endpoint | Service client fallback behavior | Notes or more information |
|------------|-----------------------------|--|---|---------------------------|
| AWS CLI v2 | N N/A | Regional endpoint | Global endpoint | |

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| SDK | Default setting value | Default service client target STS Endpoint | Service client fallback behavior | Notes or more information |
|------------------------|-----------------------------|--|---|---|
| AWS CLI v1 | Y∈ legacy | Global endpoint | Global endpoint | |
| SDK for C++ | N N/A | Regional endpoint | us-east-1 (Regional) | |
| SDK for Go V2 (1.x) | N N/A | Regional endpoint | Request failure | |
| SDK for Go 1.x (V1) | Y∈ legacy | Global endpoint | Global endpoint | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | N N/A | Regional endpoint | Request failure | If no Region is configure d, the AssumeRole and AssumeRoleWithWebI dentity will use the global STS endpoint |
| SDK for Java 1.x | Y∈ legacy | Global endpoint | Global endpoint | |
| SDK for JavaScript 3.x | N N/A | Regional endpoint | Request failure | |
| SDK for JavaScript 2.x | Y∈ legacy | Global endpoint | Global endpoint | |

| SDK | : | Default setting value | Default service client target STS Endpoint | Service client fallback behavior | Notes or more information |
|------------------------------|----|-----------------------------|--|---|---------------------------|
| SDK for Kotlin | N | N/A | Regional endpoint | Global endpoint | |
| SDK for .NET 3.x | Υє | legacy | Global endpoint | Global endpoint | |
| SDK for PHP 3.x | Υє | legacy | Global endpoint | Request failure | |
| SDK for Python (Boto3) | Υє | legacy | Global endpoint | Global endpoint | |
| SDK for Ruby 3.x | Υє | regional | Regional endpoint | Request failure | |
| SDK for Rust | N | N/A | Regional endpoint | Request failure | |
| SDK for Swift | N | N/A | Regional endpoint | Request failure | |
| Tools for PowerShell | Υє | legacy | Global endpoint | Global endpoint | |

Dual-stack and FIPS endpoints

Configure this functionality by using the following:

use_dualstack_endpoint - shared AWS config file setting,
AWS_USE_DUALSTACK_ENDPOINT - environment variable, aws.useDualstackEndpoint - JVM
system property: Java/Kotlin only

Turns on or off whether the SDK will send requests to dual-stack endpoints. To learn more about dual-stack endpoints, which support both IPv4 and IPv6 traffic, see <u>Using Amazon S3 dual-stack endpoints</u> in the *Amazon Simple Storage Service User Guide*. Dual-stack endpoints are available for some services in some regions.

Default value: false

Valid values:

- true The SDK or tool will attempt to use dual-stack endpoints to make network requests. If
 a dual-stack endpoint does not exist for the service and/or AWS Region, the request will fail.
- false The SDK or tool will not use dual-stack endpoints to make network requests.

use_fips_endpoint - shared AWS config file setting, AWS_USE_FIPS_ENDPOINT environment variable, aws.useFipsEndpoint - JVM system property: Java/Kotlin only

Turns on or off whether the SDK or tool will send requests to FIPS-compliant endpoints. The Federal Information Processing Standards (FIPS) are a set of US Government security requirements for data and its encryption. Government agencies, partners, and those wanting to do business with the federal government are required to adhere to FIPS guidelines. Unlike standard AWS endpoints, FIPS endpoints use a TLS software library that complies with FIPS 140-2. If this setting is enabled and a FIPS endpoint does not exist for the service in your AWS Region, the AWS call may fail. Service-specific endpoints and the --endpoint-url option for the AWS Command Line Interface override this setting.

To learn more about other ways to specify FIPS endpoints by AWS Region, see <u>FIPS Endpoints</u> by <u>Service</u>. For more information on Amazon Elastic Compute Cloud service endpoints, see <u>Dual-stack</u> (IPv4 and IPv6) endpoints in the *Amazon EC2 API Reference*.

Default value: false

Valid values:

- true The SDK or tool will send requests to FIPS-compliant endpoints.
- false The SDK or tool will not send requests to FIPS-compliant endpoints.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-----|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes | |

Endpoint discovery

SDKs use endpoint discovery to access service endpoints (URLs to access various resources), while still maintaining flexibility for AWS to alter URLs as needed. This way, your code can automatically detect new endpoints. There are no fixed endpoints for some services. Instead, you get the available endpoints during runtime by making a request to get the endpoints first. After retrieving the available endpoints, the code then uses the endpoint to access other operations. For example, for Amazon Timestream, the SDK makes a DescribeEndpoints request to retrieve the available endpoints, and then uses those endpoints to complete specific operations such as CreateDatabase or CreateTable.

Configure this functionality by using the following:

endpoint_discovery_enabled - shared AWS config file setting,

AWS_ENABLE_ENDPOINT_DISCOVERY - environment variable,

aws.endpointDiscoveryEnabled - JVM system property: Java/Kotlin only, To configure

value directly in code, consult your specific SDK directly.

Turns on or off endpoint discovery for DynamoDB.

Endpoint discovery is required in Timestream and optional in Amazon DynamoDB. This setting defaults to either true or false depending on whether the service requires endpoint discovery. Timestream requests default to true, and Amazon DynamoDB requests default to false.

Valid values:

- **true** The SDK should automatically attempt to discover an endpoint for services where endpoint discovery is optional.
- **false** The SDK should not automatically attempt to discover an endpoint for services where endpoint discovery is optional.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

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| SDK | Sı | Notes or more information |
|------------------------|-------|--|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | Yes | To use shared config file settings, you must turn on loading from the config file; see <u>Sessions</u> . |
| SDK for Java 2.x | Yes | The SDK for Java 2.x uses AWS_ENDPOINT_DISCO VERY_ENABLED for the environment variable name. |
| SDK for Java 1.x | Parti | JVM system property not supported. |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Parti | Supported for Timestream only. |
| SDK for Swift | No | |
| Tools for PowerShell | Yes | |

General configuration settings

SDKs support some general settings that configure overall SDK behaviors.

Configure this functionality by using the following:

api_versions - shared AWS config file setting

Some AWS services maintain multiple API versions to support backward compatibility. By default, SDK and AWS CLI operations use the latest available API version. To require a specific API version to use for your requests, include the api_versions setting in your profile.

Default value: None. (Latest API version is used by the SDK.)

Valid values: This is a nested setting that's followed by one or more indented lines that each identify one AWS service and the API version to use. See the documentation for the AWS service to understand which API versions are available.

The example sets a specific API version for two AWS services in the config file. These API versions are used only for commands that run under the profile that contains these settings. Commands for any other service use the latest version of that service's API.

```
api_versions =
ec2 = 2015-03-01
cloudfront = 2015-09-017
```

ca_bundle - shared AWS config file setting, AWS_CA_BUNDLE - environment variable

Specifies the path to a custom certificate bundle (a file with a .pem extension) to use when establishing SSL/TLS connections.

Default value: none

Valid values: Specify either the full path or a base file name. If there is a base file name, the system attempts to find the program within folders specified by the PATH environment variable.

Example of setting this value in the config file:

```
[default]
ca_bundle = dev/apps/ca-certs/cabundle-2019mar05.pem
```

Due to differences in how operating systems handle paths and escaping of path characters, the following is an example of setting this value in the config file on Windows:

```
[default]
```

```
ca_bundle = C:\\Users\\username\\.aws\\aws-custom-bundle.pem
```

Linux/macOS example of setting environment variables via command line:

```
export AWS_CA_BUNDLE=/dev/apps/ca-certs/cabundle-2019mar05.pem
```

Windows example of setting environment variables via command line:

```
setx AWS_CA_BUNDLE C:\dev\apps\ca-certs\cabundle-2019mar05.pem
```

output - shared AWS config file setting

Specifies how results are formatted in the AWS CLI and other AWS SDKs and tools.

Default value: json

Valid values:

- json The output is formatted as a <u>JSON</u> string.
- yaml The output is formatted as a YAML string.
- yaml-stream The output is streamed and formatted as a YAML string. Streaming allows for faster handling of large data types.
- <u>text</u> The output is formatted as multiple lines of tab-separated string values. This can be useful to pass the output to a text processor, like grep, sed, or awk.
- <u>table</u> The output is formatted as a table using the characters +|- to form the cell borders. It typically presents the information in a "human-friendly" format that is much easier to read than the others, but not as programmatically useful.

parameter_validation - shared AWS config file setting

Specifies whether the SDK or tool attempts to validate command line parameters before sending them to the AWS service endpoint.

Default value: true

Valid values:

 true – The default. The SDK or tool performs client-side validation of command line parameters. This helps the SDK or tool confirm that parameters are valid, and catches some errors. The SDK or tool can reject requests that aren't valid before sending requests to the AWS service endpoint.

• **false** – The SDK or tool doesn't validate command line parameters before sending them to the AWS service endpoint. The AWS service endpoint is responsible for validating all requests and rejecting requests that aren't valid.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-------|---|
| AWS CLI v2 | Parti | api_versions not supported. |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Parti | <pre>api_versions and parameter_validation not supported.</pre> |
| SDK for Go 1.x (V1) | Parti | api_versions and parameter_validation not supported. To use shared config file settings, you must turn on loading from the config file; see Sessions . |
| SDK for Java 2.x | No | |
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | Yes | |
| SDK for Kotlin | No | |
| SDK for .NET 3.x | No | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |

| SDK | Sı | Notes or more information |
|----------------------|----|---------------------------|
| SDK for Rust | No | |
| SDK for Swift | No | |
| Tools for PowerShell | No | |

IMDS client

SDKs implement an Instance Metadata Service Version 2 (IMDSv2) client using session-oriented requests. For more information on IMDSv2, see <u>Use IMDSv2</u> in the *Amazon EC2 User Guide*. The IMDS client is configurable via a client configuration object available in the SDK code base.

Configure this functionality by using the following:

retries - client configuration object member

The number of additional retry attempts for any failed request.

Default value: 3

Valid values: Number greater than 0.

port - client configuration object member

The port for the endpoint.

Default value: 80

Valid values: Number.

token_ttl - client configuration object member

The TTL of the token.

Default value: 21,600 seconds (6 hours, the maximum time allotted).

Valid values: Number.

endpoint - client configuration object member

The endpoint of IMDS.

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Default value: If endpoint_mode equals IPv4, then default endpoint is

http://169.254.169.254. If endpoint_mode equals IPv6, then default endpoint is

http://[fd00:ec2::254].

Valid values: Valid URI.

The following options are supported by most SDKs. See your specific SDK code base for details.

endpoint_mode - client configuration object member

The endpoint mode of IMDS.

Default value: IPv4

Valid values: IPv4, IPv6

http_open_timeout - client configuration object member (name may vary)

The number of seconds to wait for the connection to open.

Default value: 1 second.

Valid values: Number greater than 0.

http_read_timeout - client configuration object member (name may vary)

The number of seconds for one chunk of data to be read.

Default value: 1 second.

Valid values: Number greater than 0.

http_debug_output - client configuration object member (name may vary)

Sets an output stream for debugging.

Default value: None.

Valid values: A valid I/O stream, like STDOUT.

backoff - client configuration object member (name may vary)

The number of seconds to sleep in between retries or a customer provided backoff function to call. This overrides the default exponential backoff strategy.

Default value: Varies by SDK.

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Valid values: Varies by SDK. Can be either a numeric value or a call out to a custom function.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Su Notes or more information | on |
|------------------------|------------------------------|--|
| AWS CLI v2 | es | |
| SDK for C++ | o IMDSv2 used internally or | nly. See <u>IMDS credential provider</u> . |
| SDK for Go V2 (1.x) | 2 S | |
| SDK for Go 1.x (V1) | es | |
| SDK for Java 2.x | 2 S | |
| SDK for Java 1.x | 2 S | |
| SDK for JavaScript 3.x | 2 S | |
| SDK for JavaScript 2.x | 2 S | |
| SDK for Kotlin | 2 S | |
| SDK for .NET 3.x | 2 S | |
| SDK for PHP 3.x | 2 S | |
| SDK for Python (Boto3) | 2 S | |
| SDK for Ruby 3.x | 2 S | |
| SDK for Rust | es | |
| SDK for Swift | es | |
| Tools for PowerShell | es | |

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Retry behavior

Retry behavior includes settings regarding how the SDKs attempt to recover from failures resulting from requests made to AWS services.

Configure this functionality by using the following:

retry_mode - shared AWS config file setting, AWS_RETRY_MODE - environment variable, aws.retryMode - JVM system property: Java/Kotlin only

Specifies how the SDK or developer tool attempts retries.

Default value: This value is specific to your SDK. Check your specific SDK guide or your SDK's code base for its default retry_mode.

Valid values:

- standard (Recommended) The recommended set of retry rules across AWS SDKs. This
 mode includes a standard set of errors that are retried, and automatically adjusts the number
 of retries to maximize availability and stability. This mode is safe for use in multi-tenant
 applications. The default maximum number of attempts with this mode is three, unless
 max_attempts is explicitly configured.
- adaptive A retry mode, appropriate only for specialized use-cases, that includes the
 functionality of standard mode as well as automatic client-side rate limiting. This retry mode
 is not recommended for multi-tenant applications, unless you take care to isolate application
 tenants. See Choosing between standard and adaptive retry modes for more information.
 This mode is experimental and it might change behavior in the future.
- legacy (Not Recommended) Specific to your SDK (check your specific SDK guide or your SDK's code base).

max_attempts - shared AWS config file setting, AWS_MAX_ATTEMPTS - environment variable, aws.maxAttempts - JVM system property: Java/Kotlin only

Specifies the maximum number attempts to make on a request.

Default value: If this value is not specified, its default depends on the value of the retry_mode setting:

• If retry_mode is legacy – Uses a default value specific to your SDK (check your specific SDK guide or your SDK's code base for max_attempts default).

- If retry_mode is standard Makes three attempts.
- If retry_mode is adaptive Makes three attempts.

Valid values: Number greater than 0.

Choosing between standard and adaptive retry modes

We recommend you use the standard retry mode unless you are certain that your usage is better suited for adaptive.



Note

The adaptive mode assumes that you are pooling clients based on the scope at which the backend service may throttle requests. If you don't do this, throttles in one resource could delay requests for an unrelated resource if you are using the same client for both resources.

| Standard | Adaptive |
|--|--|
| Application use-cases: All. | Application use-cases: Not sensitive to latency. Client only accesses a single resource, or, you are providing logic to pool your clients separately by the service resource that is being accessed. |
| Supports circuit-breaking to prevent the SDK from retrying during outages. | Supports circuit-breaking to prevent the SDK from retrying during outages. |
| Uses jittered exponential backoff in the event of failures. | Uses dynamic backoff durations to attempt to minimize the number of failed requests, in exchange for the potential for increased latency. |
| Never delays the first request attempt, only the retries. | Can throttle or delay the initial request attempt. |

If you choose to use adaptive mode, your application must construct clients that are designed around each resource that might be throttled. A resource, in this case, is finer-tuned than just thinking of each AWS service. AWS services can have additional dimensions that they use to throttle requests. Let's use the Amazon DynamoDB service as an example. DynamoDB uses AWS Region plus the table being accessed to throttle requests. This means that one table that your code is accessing might be throttled more than others. If your code used the same client to access all the tables, and requests to one of those tables is throttled, then adaptive retry mode will reduce the request rate for all tables. Your code should be designed to have one client per Region-and-table pair. If you experience unexpected latency when using adaptive mode, see the specific AWS documentation guide for the service you are using.

Retry mode implementation details

The AWS SDKs make use of <u>token buckets</u> to decide whether a request should be retried and (in the case of the adaptive retry mode) how quickly requests should be sent. Two token buckets are used by the SDK: a retry token bucket and a request rate token bucket.

- The retry token bucket is used to determine whether the SDK should temporarily disable retries in order to protect the upstream and downstream services during outages. Tokens are acquired from the bucket before retries are attempted, and tokens are returned to the bucket when requests succeed. If the bucket is empty when a retry is attempted, the SDK will not retry the request.
- The request rate token bucket is used only in the adaptive retry mode to determine the rate at which to send requests. Tokens are acquired from the bucket before a request is sent, and tokens are returned to the bucket at a dynamically-determined rate based on throttling responses returned by the service.

Following is the high-level pseudocode for both the standard and adaptive retry modes:

```
MakeSDKRequest() {
  attempts = 0
  loop {
    GetSendToken()
    response = SendHTTPRequest()
    RequestBookkeeping(response)
    if not Retryable(response)
      return response
  attempts += 1
    if attempts >= MAX_ATTEMPTS:
```

```
return response
if not HasRetryQuota(response)
    return response
    delay = ExponentialBackoff(attempts)
    sleep(delay)
}
```

Following are more details about the components used in the pseudocode:

GetSendToken:

This step is only used in adaptive retry mode. This step acquires a token from the request rate token bucket. If a token is not available, it will wait for one to become available. Your SDK might have configuration options available to fail the request instead of wait. Tokens in the bucket are refilled at a rate that is determined dynamically, based on the number of throttling responses received by the client.

SendHTTPRequest:

This step sends the request to AWS. Most AWS SDKs use an HTTP library that uses connection pools to reuse an existing connection when making an HTTP request. Generally, connections are reused if a request failed due to throttling errors but not if a request fails due to a transient error.

RequestBookkeeping:

Tokens are added to the token bucket if the request is successful. For adaptive retry mode only, the fill rate of the request rate token bucket is updated based on the type of response received.

Retryable:

This step determines whether a response can be retried based on the following:

- The HTTP status code.
- The error code returned from the service.
- Connection errors, defined as any error received by the SDK in which an HTTP response from the service is not received.

Transient errors (HTTP status codes 400, 408, 500, 502, 503, and 504) and throttling errors (HTTP status codes 400, 403, 429, 502, 503, and 509) can all potentially be retried. SDK retry behavior is determined in combination with error codes or other data from the service.

MAX_ATTEMPTS:

The default number of maximum attempts is set by the retry_mode setting, unless overridden by the max_attempts setting.

HasRetryQuota

This step acquires a token from the retry token bucket. If the retry token bucket is empty, the request will not be retried.

ExponentialBackoff

For an error that can be retried, the retry delay is calculated using truncated exponential backoff. The SDKs use truncated binary exponential backoff with jitter. The following algorithm shows how the amount of time to sleep, in seconds, is defined for a response for request i:

```
seconds_to_sleep_i = min(b*r^i, MAX_BACKOFF)
```

In the preceding algorithm, the following values apply:

```
b = random number within the range of: 0 <= b <= 1
 r = 2
```

MAX_BACKOFF = 20 seconds for most SDKs. See your specific SDK guide or source code for confirmation.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|---------------------|-----|---------------------------|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |

| SDK | Sı | Notes or more information |
|------------------------|-----|---|
| SDK for Go 1.x (V1) | No | |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | Yes | JVM system properties: use com.amazonaws.sdk. maxAttempts instead of aws.maxAttempts; use com.amazonaws.sdk.retryMode instead of aws.retryMode. |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | No | Supports a maximum number of retries, exponential backoff with jitter, and an option for a custom method for retry backoff. |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | Yes | |
| Tools for PowerShell | Yes | |

Request compression



Note

For help in understanding the layout of settings pages, or in interpreting the Compatibility with AWS SDKs table that follows, see Settings pages.

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AWS SDKs and tools can automatically compress payloads when sending requests to AWS services that support receiving compressed payloads. Compressing the payload on the client prior to sending it to a service may reduce the overall number of requests and bandwidth required to send data to the service, as well as reduce unsuccessful requests due to service limitations on the payload size. For compression, the SDK or tool selects an encoding algorithm that is supported by both the service and the SDK. However, the current list of possible encodings consists only of gzip, but it may expand in the future.

Request compression can be especially useful if your application is using <u>Amazon CloudWatch</u>. CloudWatch is a monitoring and observability service that collects monitoring and operational data in the form of logs, metrics, and events. One example of a service operation that supports compression is CloudWatch's <u>PutMetricDataAPI</u> method.

Configure this functionality by using the following:

disable_request_compression - shared AWS config file setting,
AWS_DISABLE_REQUEST_COMPRESSION - environment variable,
aws.disableRequestCompression - JVM system property: Java/Kotlin only

Turns on or off whether the SDK or tool will compress a payload prior to sending a request.

Default value: false

Valid values:

- true Turn off request compression.
- false Use request compression when possible.

request_min_compression_size_bytes - shared AWS config file setting,
AWS_REQUEST_MIN_COMPRESSION_SIZE_BYTES - environment variable,
aws.requestMinCompressionSizeBytes - JVM system property: Java/Kotlin only

Sets the minimum size in bytes of the request body that the SDK or tool should compress. Small payloads may become longer when compressed, thus, there is a lower limit where it makes sense to perform compression. This value is inclusive, a request size greater than or equal to the value is compressed.

Default value: 10240 bytes

Valid values: Integer value between 0 and 10485760 bytes inclusive.

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Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Sı | Notes or more information |
|------------------------|-----|---------------------------|
| AWS CLI v2 | Yes | |
| SDK for C++ | Yes | |
| SDK for Go V2 (1.x) | Yes | |
| SDK for Go 1.x (V1) | No | |
| SDK for Java 2.x | Yes | |
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | |
| SDK for JavaScript 2.x | No | |
| SDK for Kotlin | Yes | |
| SDK for .NET 3.x | Yes | |
| SDK for PHP 3.x | Yes | |
| SDK for Python (Boto3) | Yes | |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | Yes | |
| SDK for Swift | No | |
| Tools for PowerShell | Yes | |

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Service-specific endpoints

Service-specific endpoint configuration provides the option to use an endpoint of your choosing for API requests and to have that choice persist. These settings provide flexibility to support local endpoints, VPC endpoints, and third-party local AWS development environments. Different endpoints can be used for testing and production environments. You can specify an endpoint URL for individual AWS services.

Configure this functionality by using the following:

endpoint_url - shared AWS config file setting, AWS_ENDPOINT_URL - environment variable, aws.endpointUrl - JVM system property: Java/Kotlin only

When specified directly within a profile or as an environment variable, this setting specifies the endpoint that is used for all service requests. This endpoint is overridden by any configured service-specific endpoint.

You can also use this setting within a services section of a shared AWS config file to set a custom endpoint for a specific service. For a list of all service identifier keys to use for subsections within the services section, see Identifiers for service-specific endpoints.

Default value: none

Valid values: A URL including the scheme and host for the endpoint. The URL can optionally contain a path component that contains one or more path segments.

AWS_ENDPOINT_URL_<SERVICE> - environment variable, aws.endpointUrl<ServiceName> - JVM system property: Java/Kotlin only

AWS_ENDPOINT_URL_<SERVICE>, where <SERVICE> is the AWS service identifier, sets a custom endpoint for a specific service. For a list of all service-specific environment variables, see Identifiers for service-specific endpoints.

This service-specific endpoint overrides any global endpoint set in AWS_ENDPOINT_URL.

Default value: none

Valid values: A URL including the scheme and host for the endpoint. The URL can optionally contain a path component that contains one or more path segments.

ignore_configured_endpoint_urls - shared AWS config file setting,
AWS_IGNORE_CONFIGURED_ENDPOINT_URLS - environment variable,
aws.ignoreConfiguredEndpointUrls - JVM system property: Java/Kotlin only

This setting is used to ignore all custom endpoints configurations.

Note that any explicit endpoint set in the code or on a service client itself is used regardless of this setting. For example, including the --endpoint-url command line parameter with an AWS CLI command or passing an endpoint URL into a client constructor will always take effect.

Default value: false

Valid values:

- **true** The SDK or tool does not read any custom configuration options from the shared config file or from environment variables for setting an endpoint URL.
- **false** The SDK or tool uses any available user-provided endpoints from the shared config file or from environment variables.

Configure endpoints using environment variables

To route requests for all services to a custom endpoint URL, set the AWS_ENDPOINT_URL global environment variable.

```
export AWS_ENDPOINT_URL=http://localhost:4567
```

To route requests for a specific AWS service to a custom endpoint URL, use the AWS_ENDPOINT_URL_<SERVICE> environment variable. Amazon DynamoDB has a serviceId of DynamoDB. For this service, the endpoint URL environment variable is AWS_ENDPOINT_URL_DYNAMODB. This endpoint takes precedence over the global endpoint set in AWS_ENDPOINT_URL for this service.

```
export AWS_ENDPOINT_URL_DYNAMODB=http://localhost:5678
```

As another example, AWS Elastic Beanstalk has a serviceId of <u>Elastic Beanstalk</u>. The AWS service identifier is based on the API model's serviceId by replacing all spaces with underscores and uppercasing all letters. To set the endpoint for this service, the corresponding environment variable is AWS_ENDPOINT_URL_ELASTIC_BEANSTALK. For a list of all service-specific environment variables, see <u>Identifiers</u> for service-specific endpoints.

```
export AWS_ENDPOINT_URL_ELASTIC_BEANSTALK=http://localhost:5567
```

Configure endpoints using the shared config file

In the shared config file, endpoint_url is used in different places for different functionality.

- endpoint_url specified directly within a profile makes that endpoint the global endpoint.
- endpoint_url nested under a service identifier key within a services section makes that endpoint apply to requests made only to that service. For details on defining a services section in your shared config file, see Format of the config file.

The following example uses a services definition to configure a service-specific endpoint URL to be used for Amazon S3 and a custom global endpoint to be used for all other services:

```
[profile dev-s3-specific-and-global]
endpoint_url = http://localhost:1234
services = s3-specific

[services s3-specific]
s3 =
   endpoint_url = https://play.min.io:9000
```

A single profile can configure endpoints for multiple services. This example shows how to set the service-specific endpoint URLs for Amazon S3 and AWS Elastic Beanstalk in the same profile. AWS Elastic Beanstalk has a serviceId of Elastic Beanstalk. The AWS service identifier is based on the API model's serviceId by replacing all spaces with underscores and lowercasing all letters. Thus, the service identifier key becomes elastic_beanstalk and settings for this service begin on the line elastic_beanstalk = . For a list of all service identifier keys to use in the services section, see Identifiers for service-specific endpoints.

```
[services testing-s3-and-eb]
s3 =
  endpoint_url = http://localhost:4567
elastic_beanstalk =
  endpoint_url = http://localhost:8000

[profile dev]
services = testing-s3-and-eb
```

The service configuration section can be used from multiple profiles. For example, two profiles can use the same services definition while altering other profile properties:

```
[services testing-s3]
s3 =
   endpoint_url = https://localhost:4567

[profile testing-json]
output = json
services = testing-s3

[profile testing-text]
output = text
services = testing-s3
```

Configure endpoints in profiles using role-based credentials

If your profile has role-based credentials configured through a source_profile parameter for IAM assume role functionality, the SDK only uses service configurations for the specified profile. It does not use profiles that are role chained to it. For example, using the following shared config file:

```
[profile A]
credential_source = Ec2InstanceMetadata
endpoint_url = https://profile-a-endpoint.aws/

[profile B]
source_profile = A
role_arn = arn:aws:iam::123456789012:role/roleB
services = profileB

[services profileB]
ec2 =
endpoint_url = https://profile-b-ec2-endpoint.aws
```

If you use profile B and make a call in your code to Amazon EC2, the endpoint resolves as https://profile-b-ec2-endpoint.aws. If your code makes a request to any other service, the endpoint resolution will not follow any custom logic. The endpoint does not resolve to the global endpoint defined in profile A. For a global endpoint to take effect for profile B, you would need to set endpoint_url directly within profile B. For more information on the source_profile setting, see Assume role credential provider.

Precedence of settings

The settings for this feature can be used at the same time but only one value will take priority per service. For API calls made to a given AWS service, the following order is used to select a value:

- Any explicit setting set in the code or on a service client itself takes precedence over anything else.
 - For the AWS CLI, this is the value provided by the --endpoint-url command line parameter. For an SDK, explicit assignments can take the form of a parameter that you set when you instantiate an AWS service client or configuration object.
- 2. The value provided by a service-specific environment variable such as AWS_ENDPOINT_URL_DYNAMODB.
- 3. The value provided by the AWS_ENDPOINT_URL global endpoint environment variable.
- 4. The value provided by the endpoint_url setting nested under a service identifier key within a services section of the shared config file.
- 5. The value provided by the endpoint_url setting specified directly within a profile of the shared config file.
- 6. Any default endpoint URL for the respective AWS service is used last.

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Si Notes or more information |
|---------------------|------------------------------|
| AWS CLI v2 | Yes |
| SDK for C++ | No |
| SDK for Go V2 (1.x) | Yes |
| SDK for Go 1.x (V1) | No |
| SDK for Java 2.x | Yes |

| SDK | Si Notes or more information |
|------------------------|------------------------------|
| SDK for Java 1.x | No |
| SDK for JavaScript 3.x | Yes |
| SDK for JavaScript 2.x | No |
| SDK for Kotlin | Yes |
| SDK for .NET 3.x | Yes |
| SDK for PHP 3.x | Yes |
| SDK for Python (Boto3) | Yes |
| SDK for Ruby 3.x | Yes |
| SDK for Rust | No |
| SDK for Swift | No |
| Tools for PowerShell | Yes |

Identifiers for service-specific endpoints

For information on how and where to use the identifiers in the following table, see <u>Service-specific</u> endpoints.

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fill</service> |
|-----------------------------|--|
| AccessAnalyzer | ac AWS_ENDPOINT_URL_ACCESSANALYZER 1; |
| Account | a AWS_ENDPOINT_URL_ACCOUNT |
| ACM | a AWS_ENDPOINT_URL_ACM |
| ACM PCA | a AWS_ENDPOINT_URL_ACM_PCA |
| Alexa For Business | a: AWS_ENDPOINT_URL_ALEXA_FOR_BUSINESS _! |
| amp | ar AWS_ENDPOINT_URL_AMP |
| Amplify | ar AWS_ENDPOINT_URL_AMPLIFY |
| AmplifyBackend | ar AWS_ENDPOINT_URL_AMPLIFYBACKEND |
| AmplifyUIBuilder | ar AWS_ENDPOINT_URL_AMPLIFYUIBUILDER |
| API Gateway | ar AWS_ENDPOINT_URL_API_GATEWAY ar |
| ApiGatewayManageme ntApi | ar AWS_ENDPOINT_URL_APIGATEWAYMANAGEMENTAPI yr ni |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|-----------------------------|---|
| ApiGatewayV2 | a; AWS_ENDPOINT_URL_APIGATEWAYV2 y |
| AppConfig | aı AWS_ENDPOINT_URL_APPCONFIG |
| AppConfigData | a; AWS_ENDPOINT_URL_APPCONFIGDATA |
| AppFabric | aı AWS_ENDPOINT_URL_APPFABRIC |
| Appflow | a; AWS_ENDPOINT_URL_APPFLOW |
| AppIntegrations | a; AWS_ENDPOINT_URL_APPINTEGRATIONS |
| Application Auto Scaling | a; AWS_ENDPOINT_URL_APPLICATION_AUTO_SCALING or c: |
| Application Insights | a; AWS_ENDPOINT_URL_APPLICATION_INSIGHTS or t: |
| ApplicationCostPro filer | a; AWS_ENDPOINT_URL_APPLICATIONCOSTPROFILER or f: |

| serviceId | Se AWS_ENDPOINT_URL_ <service> environment variable id r ke fo st A' Co fil</service> |
|--------------------|---|
| App Mesh | a; AWS_ENDPOINT_URL_APP_MESH |
| AppRunner | a; AWS_ENDPOINT_URL_APPRUNNER |
| AppStream | a; AWS_ENDPOINT_URL_APPSTREAM |
| AppSync | a; AWS_ENDPOINT_URL_APPSYNC |
| ARC Zonal Shift | a: AWS_ENDPOINT_URL_ARC_ZONAL_SHIFT _: |
| Artifact | a: AWS_ENDPOINT_URL_ARTIFACT |
| Athena | at AWS_ENDPOINT_URL_ATHENA |
| AuditManager | at AWS_ENDPOINT_URL_AUDITMANAGER ge |
| Auto Scaling | at AWS_ENDPOINT_URL_AUTO_SCALING |
| Auto Scaling Plans | at AWS_ENDPOINT_URL_AUTO_SCALING_PLANS in |
| b2bi | b2 AWS_ENDPOINT_URL_B2BI |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fill</service> |
|-----------------------|--|
| Backup | b: AWS_ENDPOINT_URL_BACKUP |
| Backup Gateway | b: AWS_ENDPOINT_URL_BACKUP_GATEWAY |
| BackupStorage | b: AWS_ENDPOINT_URL_BACKUPSTORAGE r: |
| Batch | b: AWS_ENDPOINT_URL_BATCH |
| BCM Data Exports | <pre>bc AWS_ENDPOINT_URL_BCM_DATA_EXPORTS e;</pre> |
| Bedrock | b. AWS_ENDPOINT_URL_BEDROCK |
| Bedrock Agent | be AWS_ENDPOINT_URL_BEDROCK_AGENT ge |
| Bedrock Agent Runtime | <pre>be AWS_ENDPOINT_URL_BEDROCK_AGENT_RUNTIME ge ir</pre> |
| Bedrock Runtime | be AWS_ENDPOINT_URL_BEDROCK_RUNTIME |
| billingconductor | b: AWS_ENDPOINT_URL_BILLINGCONDUCTOR |
| Braket | b: AWS_ENDPOINT_URL_BRAKET |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fil</service> |
|---------------------------|---|
| Budgets | bi AWS_ENDPOINT_URL_BUDGETS |
| Cost Explorer | cc AWS_ENDPOINT_URL_COST_EXPLORER o: |
| chatbot | cl AWS_ENDPOINT_URL_CHATBOT |
| Chime | cl AWS_ENDPOINT_URL_CHIME |
| Chime SDK Identity | <pre>c! AWS_ENDPOINT_URL_CHIME_SDK_IDENTITY _:</pre> |
| Chime SDK Media Pipelines | cl AWS_ENDPOINT_URL_CHIME_SDK_MEDIA_PIPELINES _r pe |
| Chime SDK Meetings | cl AWS_ENDPOINT_URL_CHIME_SDK_MEETINGS _r |
| Chime SDK Messaging | cl AWS_ENDPOINT_URL_CHIME_SDK_MESSAGING _r g |
| Chime SDK Voice | <pre>c! AWS_ENDPOINT_URL_CHIME_SDK_VOICE _'</pre> |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN ct fill</service> |
|------------------------------|--|
| CleanRooms | c: AWS_ENDPOINT_URL_CLEANROOMS s |
| CleanRoomsML | c: AWS_ENDPOINT_URL_CLEANROOMSML |
| Cloud9 | c: AWS_ENDPOINT_URL_CLOUD9 |
| CloudControl | c: AWS_ENDPOINT_URL_CLOUDCONTROL |
| CloudDirectory | c: AWS_ENDPOINT_URL_CLOUDDIRECTORY |
| CloudFormation | c: AWS_ENDPOINT_URL_CLOUDFORMATION |
| CloudFront | c: AWS_ENDPOINT_URL_CLOUDFRONT |
| CloudFront KeyValueS tore | c: AWS_ENDPOINT_URL_CLOUDFRONT_KEYVALUESTORE t. e: |
| CloudHSM | c: AWS_ENDPOINT_URL_CLOUDHSM |
| CloudHSM V2 | c: AWS_ENDPOINT_URL_CLOUDHSM_V2 |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|--------------------|---|
| CloudSearch | c: AWS_ENDPOINT_URL_CLOUDSEARCH |
| CloudSearch Domain | c: AWS_ENDPOINT_URL_CLOUDSEARCH_DOMAIN |
| CloudTrail | c: AWS_ENDPOINT_URL_CLOUDTRAIL |
| CloudTrail Data | c: AWS_ENDPOINT_URL_CLOUDTRAIL_DATA 1_ |
| CloudWatch | c: AWS_ENDPOINT_URL_CLOUDWATCH |
| codeartifact | cc AWS_ENDPOINT_URL_CODEARTIFACT |
| CodeBuild | cc AWS_ENDPOINT_URL_CODEBUILD |
| CodeCatalyst | cc AWS_ENDPOINT_URL_CODECATALYST y: |
| CodeCommit | c AWS_ENDPOINT_URL_CODECOMMIT |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|-------------------------|---|
| CodeDeploy | cc AWS_ENDPOINT_URL_CODEDEPLOY y |
| CodeGuru Reviewer | cc AWS_ENDPOINT_URL_CODEGURU_REVIEWER |
| CodeGuru Security | <pre>cc AWS_ENDPOINT_URL_CODEGURU_SECURITY se</pre> |
| CodeGuruProfiler | cc AWS_ENDPOINT_URL_CODEGURUPROFILER |
| CodePipeline | <pre>cc AWS_ENDPOINT_URL_CODEPIPELINE ir</pre> |
| CodeStar | cc AWS_ENDPOINT_URL_CODESTAR |
| CodeStar connections | <pre>cc AWS_ENDPOINT_URL_CODESTAR_CONNECTIONS cc ns</pre> |
| codestar notificat ions | cc AWS_ENDPOINT_URL_CODESTAR_NOTIFICATIONS nc ic |
| Cognito Identity | <pre>c AWS_ENDPOINT_URL_COGNITO_IDENTITY de</pre> |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' co fil</service> |
|------------------------------|---|
| Cognito Identity Provider | <pre>cc AWS_ENDPOINT_URL_COGNITO_IDENTITY_PROVIDER dc</pre> |
| Cognito Sync | cc AWS_ENDPOINT_URL_COGNITO_SYNC |
| Comprehend | cc AWS_ENDPOINT_URL_COMPREHEND d |
| ComprehendMedical | cc AWS_ENDPOINT_URL_COMPREHENDMEDICAL dr |
| Compute Optimizer | cc AWS_ENDPOINT_URL_COMPUTE_OPTIMIZER p1 |
| Config Service | cc AWS_ENDPOINT_URL_CONFIG_SERVICE |
| Connect | cc AWS_ENDPOINT_URL_CONNECT |
| Connect Contact Lens | cc AWS_ENDPOINT_URL_CONNECT_CONTACT_LENS or n: |
| ConnectCampaigns | cc AWS_ENDPOINT_URL_CONNECTCAMPAIGNS m; |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fill</service> |
|----------------------------------|--|
| ConnectCases | <pre>c(AWS_ENDPOINT_URL_CONNECTCASES s(</pre> |
| ConnectParticipant | cc AWS_ENDPOINT_URL_CONNECTPARTICIPANT |
| ControlTower | <pre>C(AWS_ENDPOINT_URL_CONTROLTOWER W(</pre> |
| Cost Optimization Hub | <pre>cc AWS_ENDPOINT_URL_COST_OPTIMIZATION_HUB m: ht</pre> |
| Cost and Usage Report Service | <pre>cc AWS_ENDPOINT_URL_COST_AND_USAGE_REPO us RT_SERVICE o: ce</pre> |
| Customer Profiles | ci AWS_ENDPOINT_URL_CUSTOMER_PROFILES p: |
| DataBrew | d: AWS_ENDPOINT_URL_DATABREW |
| DataExchange | d: AWS_ENDPOINT_URL_DATAEXCHANGE |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV CC fil</service> |
|----------------------------------|---|
| Data Pipeline | <pre>d: AWS_ENDPOINT_URL_DATA_PIPELINE 1:</pre> |
| DataSync | d: AWS_ENDPOINT_URL_DATASYNC |
| DataZone | d: AWS_ENDPOINT_URL_DATAZONE |
| DAX | d: AWS_ENDPOINT_URL_DAX |
| Detective | d: AWS_ENDPOINT_URL_DETECTIVE |
| Device Farm | d AWS_ENDPOINT_URL_DEVICE_FARM |
| DevOps Guru | de AWS_ENDPOINT_URL_DEVOPS_GURU |
| Direct Connect | d: AWS_ENDPOINT_URL_DIRECT_CONNECT |
| Application Discovery Service | a; AWS_ENDPOINT_URL_APPLICATION_DISCOVE o: RY_SERVICE e: c: |
| DLM | d: AWS_ENDPOINT_URL_DLM |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV ct fill</service> |
|-------------------------------|--|
| Database Migration Service | d; AWS_ENDPOINT_URL_DATABASE_MIGRATION_ m: SERVICE _! |
| DocDB | dc AWS_ENDPOINT_URL_DOCDB |
| DocDB Elastic | <pre>dc AWS_ENDPOINT_URL_DOCDB_ELASTIC s1</pre> |
| drs | d: AWS_ENDPOINT_URL_DRS |
| Directory Service | d: AWS_ENDPOINT_URL_DIRECTORY_SERVICE _! |
| DynamoDB | d: AWS_ENDPOINT_URL_DYNAMODB |
| DynamoDB Streams | dy AWS_ENDPOINT_URL_DYNAMODB_STREAMS |
| EBS | el AWS_ENDPOINT_URL_EBS |
| EC2 | e AWS_ENDPOINT_URL_EC2 |
| EC2 Instance Connect | ec AWS_ENDPOINT_URL_EC2_INSTANCE_CONNECT nc c1 |
| ECR | e AWS_ENDPOINT_URL_ECR |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fil</service> |
|------------------------|---|
| ECR PUBLIC | e AWS_ENDPOINT_URL_ECR_PUBLIC |
| ECS | e AWS_ENDPOINT_URL_ECS |
| EFS | e AWS_ENDPOINT_URL_EFS |
| EKS | el AWS_ENDPOINT_URL_EKS |
| EKS Auth | el AWS_ENDPOINT_URL_EKS_AUTH |
| Elastic Inference | e: AWS_ENDPOINT_URL_ELASTIC_INFERENCE |
| ElastiCache | e: AWS_ENDPOINT_URL_ELASTICACHE |
| Elastic Beanstalk | e: AWS_ENDPOINT_URL_ELASTIC_BEANSTALK e: |
| Elastic Transcoder | e: AWS_ENDPOINT_URL_ELASTIC_TRANSCODER r; |
| Elastic Load Balancing | e: AWS_ENDPOINT_URL_ELASTIC_LOAD_BALANCING o: c: |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\tag{7}</service> |
|------------------------------|--|
| Elastic Load Balancing v2 | e: AWS_ENDPOINT_URL_ELASTIC_LOAD_BALANCING_V2 o; c: |
| EMR | er AWS_ENDPOINT_URL_EMR |
| EMR containers | er AWS_ENDPOINT_URL_EMR_CONTAINERS in |
| EMR Serverless | er AWS_ENDPOINT_URL_EMR_SERVERLESS r: |
| EntityResolution | er AWS_ENDPOINT_URL_ENTITYRESOLUTION o: |
| Elasticsearch Service | e: AWS_ENDPOINT_URL_ELASTICSEARCH_SERVICE a: i(|
| EventBridge | e AWS_ENDPOINT_URL_EVENTBRIDGE ge |
| Evidently | e AWS_ENDPOINT_URL_EVIDENTLY |
| finspace | f: AWS_ENDPOINT_URL_FINSPACE |
| finspace data | f: AWS_ENDPOINT_URL_FINSPACE_DATA d: |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\Ct Ct fil</service> |
|--------------------|---|
| Firehose | f: AWS_ENDPOINT_URL_FIREHOSE |
| fis | f: AWS_ENDPOINT_URL_FIS |
| FMS | fr AWS_ENDPOINT_URL_FMS |
| forecast | fc AWS_ENDPOINT_URL_FORECAST |
| forecastquery | fc AWS_ENDPOINT_URL_FORECASTQUERY |
| FraudDetector | f: AWS_ENDPOINT_URL_FRAUDDETECTOR |
| FreeTier | f: AWS_ENDPOINT_URL_FREETIER |
| FSx | f: AWS_ENDPOINT_URL_FSX |
| GameLift | ga AWS_ENDPOINT_URL_GAMELIFT |
| Glacier | g: AWS_ENDPOINT_URL_GLACIER |
| Global Accelerator | g: AWS_ENDPOINT_URL_GLOBAL_ACCELERATOR |
| Glue | g: AWS_ENDPOINT_URL_GLUE |
| grafana | g: AWS_ENDPOINT_URL_GRAFANA |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fill</service> |
|---------------|--|
| Greengrass | g: AWS_ENDPOINT_URL_GREENGRASS s |
| GreengrassV2 | g: AWS_ENDPOINT_URL_GREENGRASSV2 |
| GroundStation | g: AWS_ENDPOINT_URL_GROUNDSTATION t: |
| GuardDuty | gi AWS_ENDPOINT_URL_GUARDDUTY |
| Health | h AWS_ENDPOINT_URL_HEALTH |
| HealthLake | he AWS_ENDPOINT_URL_HEALTHLAKE e |
| Honeycode | hc AWS_ENDPOINT_URL_HONEYCODE |
| IAM | i; AWS_ENDPOINT_URL_IAM |
| identitystore | ic AWS_ENDPOINT_URL_IDENTITYSTORE |
| imagebuilder | ir AWS_ENDPOINT_URL_IMAGEBUILDER |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|-------------------------------|---|
| ImportExport | <pre>ir AWS_ENDPOINT_URL_IMPORTEXPORT o:</pre> |
| Inspector | in AWS_ENDPOINT_URL_INSPECTOR |
| Inspector Scan | ir AWS_ENDPOINT_URL_INSPECTOR_SCAN |
| Inspector2 | in AWS_ENDPOINT_URL_INSPECTOR2 2 |
| InternetMonitor | in AWS_ENDPOINT_URL_INTERNETMONITOR |
| IoT | ic AWS_ENDPOINT_URL_IOT |
| IoT Data Plane | ic AWS_ENDPOINT_URL_IOT_DATA_PLANE p: |
| IoT Jobs Data Plane | ic AWS_ENDPOINT_URL_IOT_JOBS_DATA_PLANE date |
| IoT 1Click Devices Service | <pre>ic AWS_ENDPOINT_URL_IOT_1CLICK_DEVICES_ k_ SERVICE _!</pre> |

| serviceId | Sc AWS_ENDPOINT_URL_ <service> environment variable id r kc fo st AV co fil</service> |
|---------------------|---|
| IoT 1Click Projects | ic AWS_ENDPOINT_URL_IOT_1CLICK_PROJECTS k_ s |
| IoTAnalytics | ic AWS_ENDPOINT_URL_IOTANALYTICS |
| IotDeviceAdvisor | ic AWS_ENDPOINT_URL_IOTDEVICEADVISOR |
| IoT Events | ic AWS_ENDPOINT_URL_IOT_EVENTS s |
| IoT Events Data | ic AWS_ENDPOINT_URL_IOT_EVENTS_DATA s_ |
| IoTFleetHub | ic AWS_ENDPOINT_URL_IOTFLEETHUB |
| IoTFleetWise | ic AWS_ENDPOINT_URL_IOTFLEETWISE is |
| IoTSecureTunneling | ic AWS_ENDPOINT_URL_IOTSECURETUNNELING |
| IoTSiteWise | ic AWS_ENDPOINT_URL_IOTSITEWISE se |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fill</service> |
|----------------|--|
| IoTThingsGraph | ic AWS_ENDPOINT_URL_IOTTHINGSGRAPH g: |
| IoTTwinMaker | ic AWS_ENDPOINT_URL_IOTTWINMAKER |
| IoT Wireless | ic AWS_ENDPOINT_URL_IOT_WIRELESS es |
| ivs | iv AWS_ENDPOINT_URL_IVS |
| IVS RealTime | iv AWS_ENDPOINT_URL_IVS_REALTIME ir |
| ivschat | iv AWS_ENDPOINT_URL_IVSCHAT |
| Kafka | k; AWS_ENDPOINT_URL_KAFKA |
| KafkaConnect | k; AWS_ENDPOINT_URL_KAFKACONNECT |
| kendra | k: AWS_ENDPOINT_URL_KENDRA |
| Kendra Ranking | k AWS_ENDPOINT_URL_KENDRA_RANKING |
| Keyspaces | k AWS_ENDPOINT_URL_KEYSPACES |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|---------------------------------|---|
| Kinesis | k: AWS_ENDPOINT_URL_KINESIS |
| Kinesis Video Archived Media | k: AWS_ENDPOINT_URL_KINESIS_VIDEO_ARCHI i VED_MEDIA i a |
| Kinesis Video Media | k: AWS_ENDPOINT_URL_KINESIS_VIDEO_MEDIA ic a |
| Kinesis Video Signaling | k: AWS_ENDPOINT_URL_KINESIS_VIDEO_SIGNALING ic a: |
| Kinesis Video WebRTC Storage | k: AWS_ENDPOINT_URL_KINESIS_VIDEO_WEBRT ic C_STORAGE tc e |
| Kinesis Analytics | k: AWS_ENDPOINT_URL_KINESIS_ANALYTICS |
| Kinesis Analytics V2 | k: AWS_ENDPOINT_URL_KINESIS_ANALYTICS_V2 n; v2 |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|-------------------------------|---|
| Kinesis Video | k: AWS_ENDPOINT_URL_KINESIS_VIDEO |
| KMS | kr AWS_ENDPOINT_URL_KMS |
| LakeFormation | 1; AWS_ENDPOINT_URL_LAKEFORMATION t: |
| Lambda | 1; AWS_ENDPOINT_URL_LAMBDA |
| Launch Wizard | 1; AWS_ENDPOINT_URL_LAUNCH_WIZARD z; |
| Lex Model Building Service | <pre>1 AWS_ENDPOINT_URL_LEX_MODEL_BUILDING! SERVICE _!</pre> |
| Lex Runtime Service | <pre>1 AWS_ENDPOINT_URL_LEX_RUNTIME_SERVICE me e</pre> |
| Lex Models V2 | 1 AWS_ENDPOINT_URL_LEX_MODELS_V2 s_ |
| Lex Runtime V2 | 1: AWS_ENDPOINT_URL_LEX_RUNTIME_V2 |
| License Manager | 1: AWS_ENDPOINT_URL_LICENSE_MANAGER ar |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|--|---|
| License Manager Linux Subscriptions | 1: AWS_ENDPOINT_URL_LICENSE_MANAGER_LIN ar UX_SUBSCRIPTIONS nr r: |
| License Manager User Subscriptions | 1: AWS_ENDPOINT_URL_LICENSE_MANAGER_USE ar R_SUBSCRIPTIONS e: ir |
| Lightsail | 1: AWS_ENDPOINT_URL_LIGHTSAIL |
| Location | 1 AWS_ENDPOINT_URL_LOCATION |
| CloudWatch Logs | c: AWS_ENDPOINT_URL_CLOUDWATCH_LOGS h. |
| CloudWatch Logs | c: AWS_ENDPOINT_URL_CLOUDWATCH_LOGS h_ |
| LookoutEquipment | 1 AWS_ENDPOINT_URL_LOOKOUTEQUIPMENT u: |
| LookoutMetrics | 1 AWS_ENDPOINT_URL_LOOKOUTMETRICS t: |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|----------------------------|---|
| LookoutVision | <pre>1 AWS_ENDPOINT_URL_LOOKOUTVISION s:</pre> |
| m2 | m2 AWS_ENDPOINT_URL_M2 |
| Machine Learning | machine_Learning |
| Macie2 | ma AWS_ENDPOINT_URL_MACIE2 |
| ManagedBlockchain | m; AWS_ENDPOINT_URL_MANAGEDBLOCKCHAIN |
| ManagedBlockchain Query | m: AWS_ENDPOINT_URL_MANAGEDBLOCKCHAIN_QUERY or qr |
| Marketplace Agreement | m: AWS_ENDPOINT_URL_MARKETPLACE_AGREEMENT c: e: |
| Marketplace Catalog | m: AWS_ENDPOINT_URL_MARKETPLACE_CATALOG c: g |
| Marketplace Deploymen t | m: AWS_ENDPOINT_URL_MARKETPLACE_DEPLOYMENT C: m: |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fil</service> |
|-------------------------------------|---|
| Marketplace Entitleme nt Service | maketplace_entitle cape MENT_SERVICE er v: |
| Marketplace Commerce Analytics | maketplace_commerc color E_ANALYTICS color in |
| MediaConnect | me AWS_ENDPOINT_URL_MEDIACONNECT |
| MediaConvert | me AWS_ENDPOINT_URL_MEDIACONVERT e: |
| MediaLive | me AWS_ENDPOINT_URL_MEDIALIVE |
| MediaPackage | me AWS_ENDPOINT_URL_MEDIAPACKAGE |
| MediaPackage Vod | me AWS_ENDPOINT_URL_MEDIAPACKAGE_VOD |
| MediaPackageV2 | m∉ AWS_ENDPOINT_URL_MEDIAPACKAGEV2 |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|----------------------------------|---|
| MediaStore | me AWS_ENDPOINT_URL_MEDIASTORE e |
| MediaStore Data | me AWS_ENDPOINT_URL_MEDIASTORE_DATA e_ |
| MediaTailor | me AWS_ENDPOINT_URL_MEDIATAILOR o: |
| Medical Imaging | mac AWS_ENDPOINT_URL_MEDICAL_IMAGING |
| MemoryDB | me AWS_ENDPOINT_URL_MEMORYDB |
| Marketplace Metering | ma AWS_ENDPOINT_URL_MARKETPLACE_METERING company note |
| Migration Hub | m: AWS_ENDPOINT_URL_MIGRATION_HUB _I |
| mgn | mc AWS_ENDPOINT_URL_MGN |
| Migration Hub Refactor Spaces | m: AWS_ENDPOINT_URL_MIGRATION_HUB_REFAC _I TOR_SPACES c1 es |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fil</service> |
|------------------------------|---|
| MigrationHub Config | m: AWS_ENDPOINT_URL_MIGRATIONHUB_CONFIG hu g |
| MigrationHubOrches trator | m: AWS_ENDPOINT_URL_MIGRATIONHUBORCHESTRATOR hu t: |
| MigrationHubStrategy | m: AWS_ENDPOINT_URL_MIGRATIONHUBSTRATEGY hu g) |
| Mobile | mc AWS_ENDPOINT_URL_MOBILE |
| mq | mc AWS_ENDPOINT_URL_MQ |
| MTurk | m1 AWS_ENDPOINT_URL_MTURK |
| MWAA | m\ AWS_ENDPOINT_URL_MWAA |
| Neptune | ne AWS_ENDPOINT_URL_NEPTUNE |
| Neptune Graph | n: AWS_ENDPOINT_URL_NEPTUNE_GRAPH r: |
| neptunedata | ne AWS_ENDPOINT_URL_NEPTUNEDATA ta |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|----------------------|---|
| Network Firewall | ne AWS_ENDPOINT_URL_NETWORK_FIREWALL i: |
| NetworkManager | ne AWS_ENDPOINT_URL_NETWORKMANAGER |
| NetworkMonitor | ne AWS_ENDPOINT_URL_NETWORKMONITOR n: |
| nimble | n: AWS_ENDPOINT_URL_NIMBLE |
| OAM | o: AWS_ENDPOINT_URL_OAM |
| Omics | or AWS_ENDPOINT_URL_OMICS |
| OpenSearch | of AWS_ENDPOINT_URL_OPENSEARCH |
| OpenSearchServerless | or AWS_ENDPOINT_URL_OPENSEARCHSERVERLESS hs ss |
| 0psWorks | of AWS_ENDPOINT_URL_OPSWORKS |
| OpsWorksCM | or AWS_ENDPOINT_URL_OPSWORKSCM |
| Organizations | o: AWS_ENDPOINT_URL_ORGANIZATIONS |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV ct fill</service> |
|------------------------------|--|
| OSIS | o: AWS_ENDPOINT_URL_OSIS |
| Outposts | or AWS_ENDPOINT_URL_OUTPOSTS |
| p8data | pt AWS_ENDPOINT_URL_P8DATA |
| p8data | pt AWS_ENDPOINT_URL_P8DATA |
| Panorama | p: AWS_ENDPOINT_URL_PANORAMA |
| Payment Cryptography | <pre>p; AWS_ENDPOINT_URL_PAYMENT_CRYPTOGRAPHY ry hy</pre> |
| Payment Cryptography Data | pa AWS_ENDPOINT_URL_PAYMENT_CRYPTOGRAPHY_DATA ry hy |
| Pca Connector Ad | pc AWS_ENDPOINT_URL_PCA_CONNECTOR_AD |
| Personalize | pe AWS_ENDPOINT_URL_PERSONALIZE |
| Personalize Events | <pre>pe AWS_ENDPOINT_URL_PERSONALIZE_EVENTS ze</pre> |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|-----------------------|---|
| Personalize Runtime | <pre>pe AWS_ENDPOINT_URL_PERSONALIZE_RUNTIME ze e</pre> |
| PI | p: AWS_ENDPOINT_URL_PI |
| Pinpoint | p: AWS_ENDPOINT_URL_PINPOINT |
| Pinpoint Email | p: AWS_ENDPOINT_URL_PINPOINT_EMAIL er |
| Pinpoint SMS Voice | p: AWS_ENDPOINT_URL_PINPOINT_SMS_VOICE sr |
| Pinpoint SMS Voice V2 | <pre>p: AWS_ENDPOINT_URL_PINPOINT_SMS_VOICE_V2 sr _'</pre> |
| Pipes | p: AWS_ENDPOINT_URL_PIPES |
| Polly | pc AWS_ENDPOINT_URL_POLLY |
| Pricing | p: AWS_ENDPOINT_URL_PRICING |
| PrivateNetworks | p: AWS_ENDPOINT_URL_PRIVATENETWORKS tv |
| Proton | p: AWS_ENDPOINT_URL_PROTON |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|---------------------|---|
| QBusiness | ql AWS_ENDPOINT_URL_QBUSINESS |
| QConnect | q AWS_ENDPOINT_URL_QCONNECT |
| QLDB | q: AWS_ENDPOINT_URL_QLDB |
| QLDB Session | q: AWS_ENDPOINT_URL_QLDB_SESSION |
| QuickSight | qι AWS_ENDPOINT_URL_QUICKSIGHT |
| RAM | r: AWS_ENDPOINT_URL_RAM |
| rbin | rl AWS_ENDPOINT_URL_RBIN |
| RDS | rc AWS_ENDPOINT_URL_RDS |
| RDS Data | rc AWS_ENDPOINT_URL_RDS_DATA |
| Redshift | re AWS_ENDPOINT_URL_REDSHIFT |
| Redshift Data | re AWS_ENDPOINT_URL_REDSHIFT_DATA |
| Redshift Serverless | re AWS_ENDPOINT_URL_REDSHIFT_SERVERLESS se s |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fill</service> |
|--------------------------------|--|
| Rekognition | r AWS_ENDPOINT_URL_REKOGNITION |
| repostspace | re AWS_ENDPOINT_URL_REPOSTSPACE |
| resiliencehub | re AWS_ENDPOINT_URL_RESILIENCEHUB |
| Resource Explorer 2 | <pre>re AWS_ENDPOINT_URL_RESOURCE_EXPLORER_2 e; 2</pre> |
| Resource Groups | re AWS_ENDPOINT_URL_RESOURCE_GROUPS g: |
| Resource Groups Tagging API | re AWS_ENDPOINT_URL_RESOURCE_GROUPS_TAG g: GING_API ge |
| RoboMaker | rc AWS_ENDPOINT_URL_ROBOMAKER |
| RolesAnywhere | rc AWS_ENDPOINT_URL_ROLESANYWHERE |
| Route 53 | rc AWS_ENDPOINT_URL_ROUTE_53 |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|---------------------------------|---|
| Route53 Recovery Cluster | rc AWS_ENDPOINT_URL_ROUTE53_RECOVERY_CLUSTER ec li |
| Route53 Recovery Control Config | rc AWS_ENDPOINT_URL_ROUTE53_RECOVERY_CO ec NTROL_CONFIG or n1 |
| Route53 Recovery Readiness | rc AWS_ENDPOINT_URL_ROUTE53_RECOVERY_RE ec ADINESS ea |
| Route 53 Domains | rc AWS_ENDPOINT_URL_ROUTE_53_DOMAINS |
| Route53Resolver | rc AWS_ENDPOINT_URL_ROUTE53RESOLVER |
| RUM | rı AWS_ENDPOINT_URL_RUM |
| S3 | s: AWS_ENDPOINT_URL_S3 |
| S3 Control | s: AWS_ENDPOINT_URL_S3_CONTROL |
| S30utposts | s: AWS_ENDPOINT_URL_S30UTPOSTS s |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fil</service> |
|------------------------------------|---|
| SageMaker | s: AWS_ENDPOINT_URL_SAGEMAKER |
| SageMaker A2I Runtime | s: AWS_ENDPOINT_URL_SAGEMAKER_A2I_RUNTIME _: ir |
| Sagemaker Edge | s: AWS_ENDPOINT_URL_SAGEMAKER_EDGE |
| SageMaker FeatureSt ore Runtime | s: AWS_ENDPOINT_URL_SAGEMAKER_FEATUREST _ ORE_RUNTIME to ir |
| SageMaker Geospatial | s: AWS_ENDPOINT_URL_SAGEMAKER_GEOSPATIAL _! a: |
| SageMaker Metrics | s: AWS_ENDPOINT_URL_SAGEMAKER_METRICS _r |
| SageMaker Runtime | s: AWS_ENDPOINT_URL_SAGEMAKER_RUNTIME _: |
| savingsplans | sa AWS_ENDPOINT_URL_SAVINGSPLANS |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV ct fil</service> |
|-------------------------------------|---|
| Scheduler | s AWS_ENDPOINT_URL_SCHEDULER |
| schemas | sc AWS_ENDPOINT_URL_SCHEMAS |
| SimpleDB | s: AWS_ENDPOINT_URL_SIMPLEDB |
| Secrets Manager | se AWS_ENDPOINT_URL_SECRETS_MANAGER |
| SecurityHub | s: AWS_ENDPOINT_URL_SECURITYHUB |
| SecurityLake | se AWS_ENDPOINT_URL_SECURITYLAKE al |
| ServerlessApplicat ionRepository | st AWS_ENDPOINT_URL_SERVERLESSAPPLICATI st ONREPOSITORY it |
| Service Quotas | s AWS_ENDPOINT_URL_SERVICE_QUOTAS |
| Service Catalog | se AWS_ENDPOINT_URL_SERVICE_CATALOG |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A\ Ct fil</service> |
|-----------------------------|---|
| Service Catalog AppRegistry | st AWS_ENDPOINT_URL_SERVICE_CATALOG_APP at REGISTRY p: |
| ServiceDiscovery | se AWS_ENDPOINT_URL_SERVICEDISCOVERY |
| SES | se AWS_ENDPOINT_URL_SES |
| SESv2 | st AWS_ENDPOINT_URL_SESV2 |
| Shield | sł AWS_ENDPOINT_URL_SHIELD |
| signer | s: AWS_ENDPOINT_URL_SIGNER |
| SimSpaceWeaver | s: AWS_ENDPOINT_URL_SIMSPACEWEAVER ea |
| SMS | sr AWS_ENDPOINT_URL_SMS |
| Snow Device Managemen t | SI AWS_ENDPOINT_URL_SNOW_DEVICE_MANAGEMENT COME |
| Snowball | sr AWS_ENDPOINT_URL_SNOWBALL |
| SNS | si AWS_ENDPOINT_URL_SNS |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AV Ct fil</service> |
|-----------------|---|
| SQS | sc AWS_ENDPOINT_URL_SQS |
| SSM | s: AWS_ENDPOINT_URL_SSM |
| SSM Contacts | s: AWS_ENDPOINT_URL_SSM_CONTACTS |
| SSM Incidents | s: AWS_ENDPOINT_URL_SSM_INCIDENTS er |
| Ssm Sap | s: AWS_ENDPOINT_URL_SSM_SAP |
| SS0 | s: AWS_ENDPOINT_URL_SSO |
| SSO Admin | s: AWS_ENDPOINT_URL_SSO_ADMIN |
| SSO OIDC | s: AWS_ENDPOINT_URL_SSO_OIDC |
| SFN | st AWS_ENDPOINT_URL_SFN |
| Storage Gateway | st AWS_ENDPOINT_URL_STORAGE_GATEWAY |
| STS | st AWS_ENDPOINT_URL_STS |
| SupplyChain | si AWS_ENDPOINT_URL_SUPPLYCHAIN |
| Support | st AWS_ENDPOINT_URL_SUPPORT |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st A' Ct fil</service> |
|---------------------|---|
| Support App | st AWS_ENDPOINT_URL_SUPPORT_APP |
| SWF | si AWS_ENDPOINT_URL_SWF |
| synthetics | sy AWS_ENDPOINT_URL_SYNTHETICS s |
| Textract | t AWS_ENDPOINT_URL_TEXTRACT |
| Timestream InfluxDB | t: AWS_ENDPOINT_URL_TIMESTREAM_INFLUXDB m_ b |
| Timestream Query | t: AWS_ENDPOINT_URL_TIMESTREAM_QUERY m_ |
| Timestream Write | t: AWS_ENDPOINT_URL_TIMESTREAM_WRITE m_ |
| tnb | tr AWS_ENDPOINT_URL_TNB |
| Transcribe | t: AWS_ENDPOINT_URL_TRANSCRIBE e |
| Transfer | t: AWS_ENDPOINT_URL_TRANSFER |
| Translate | t: AWS_ENDPOINT_URL_TRANSLATE |

| serviceId | Sc AWS_ENDPOINT_URL_ <service> environment variable id r kc fo st A' CC fil</service> |
|---------------------|---|
| TrustedAdvisor | t: AWS_ENDPOINT_URL_TRUSTEDADVISOR v: |
| VerifiedPermissions | <pre>ve AWS_ENDPOINT_URL_VERIFIEDPERMISSIONS e: s</pre> |
| Voice ID | vc AWS_ENDPOINT_URL_VOICE_ID |
| VPC Lattice | V AWS_ENDPOINT_URL_VPC_LATTICE C+ |
| WAF | w: AWS_ENDPOINT_URL_WAF |
| WAF Regional | waa AWS_ENDPOINT_URL_WAF_REGIONAL |
| WAFV2 | w: AWS_ENDPOINT_URL_WAFV2 |
| WellArchitected | <pre>we AWS_ENDPOINT_URL_WELLARCHITECTED te</pre> |
| Wisdom | w: AWS_ENDPOINT_URL_WISDOM |
| WorkDocs | wc AWS_ENDPOINT_URL_WORKDOCS |
| WorkLink | wc AWS_ENDPOINT_URL_WORKLINK |
| WorkMail | wc AWS_ENDPOINT_URL_WORKMAIL |

| serviceId | St AWS_ENDPOINT_URL_ <service> environment variable id r kt fo st AN Ct fill</service> |
|---------------------------|--|
| WorkMailMessageFlow | <pre>wc AWS_ENDPOINT_URL_WORKMAILMESSAGEFLOW e: w</pre> |
| WorkSpaces | wc AWS_ENDPOINT_URL_WORKSPACES |
| WorkSpaces Thin Client | <pre>wc AWS_ENDPOINT_URL_WORKSPACES_THIN_CLIENT s_ ic</pre> |
| WorkSpaces Web | wc AWS_ENDPOINT_URL_WORKSPACES_WEB s_ |
| XRay | x: AWS_ENDPOINT_URL_XRAY |

Smart configuration defaults

With the smart configuration defaults feature, AWS SDKs can provide predefined, optimized default values for other configuration settings.

Configure this functionality by using the following:

defaults_mode - shared AWS config file setting, AWS_DEFAULTS_MODE - environment variable, aws.defaultsMode - JVM system property: Java/Kotlin only

With this setting, you can choose a mode that aligns with your application architecture, which then provides optimized default values for your application. If an AWS SDK setting has a value

explicitly set, then that value always takes precedence. If an AWS SDK setting does not have a value explicitly set, and defaults_mode is not equal to legacy, then this feature can provide different default values for various settings optimized for your application. Settings may include the following: HTTP communication settings, retry behavior, service Regional endpoint settings, and, potentially, any SDK-related configuration. Customers who use this feature can get new configuration defaults tailored to common usage scenarios. If your defaults_mode is not equal to legacy, we recommend performing tests of your application when you upgrade the SDK, because the default values provided might change as best practices evolve.

Default value: legacy

Note: New major versions of SDKs will default to standard.

Valid values:

- legacy Provides default settings that vary by SDK and existed before establishment of defaults_mode.
- standard Provides the latest recommended default values that should be safe to run in most scenarios.
- in-region Builds on the standard mode and includes optimization tailored for applications that call AWS services from within the same AWS Region.
- cross-region Builds on the standard mode and includes optimization tailored for applications that call AWS services in a different Region.
- mobile Builds on the standard mode and includes optimization tailored for mobile applications.
- auto Builds on the standard mode and includes experimental features. The SDK attempts
 to discover the runtime environment to determine the appropriate settings automatically.
 The auto detection is heuristics-based and does not provide 100% accuracy. If the runtime
 environment can't be determined, standard mode is used. The auto detection might
 query instance metadata, which might introduce latency. If startup latency is critical to your
 application, we recommend choosing an explicit defaults_mode instead.

Example of setting this value in the config file:

```
[default]
defaults_mode = standard
```

The following parameters might be optimized based on the selection of defaults_mode:

- retryMode Specifies how the SDK attempts retries. See Retry behavior.
- stsRegionalEndpoints Specifies how the SDK determines the AWS service endpoint that it uses to talk to the AWS Security Token Service (AWS STS). See <u>AWS STS Regional</u> endpoints.
- s3UsEast1RegionalEndpoints Specifies how the SDK determines the AWS service endpoint that it uses to talk to the Amazon S3 for the us-east-1 Region.
- connectTimeoutInMillis After making an initial connection attempt on a socket, the amount of time before timing out. If the client does not receive a completion of the connect handshake, the client gives up and fails the operation.
- tlsNegotiationTimeoutInMillis The maximum amount of time that a TLS handshake can take from the time the CLIENT HELLO message is sent to the time the client and server have fully negotiated ciphers and exchanged keys.

The default value for each setting changes depending on the defaults_mode selected for your application. These values are currently set as follows (subject to change):

| Parameter | standard mode | in-region mode | cross-reg ion mode | mobile mode |
|------------------------------------|---------------|-------------------|-----------------------|----------------|
| retryMode | standard | standard | standard | standard |
| stsRegion alEndpoin ts | regional | regional | regional | regional |
| s3UsEast1 RegionalE ndpoints | regional | regional | regional | regional |
| connectTi meoutInMi llis | 3100 | 1100 | 3100 | 30000 |
| tlsNegoti ationTime | 3100 | 1100 | 3100 | 30000 |

| Parameter | standard mode | in-region mode | cross-reg ion mode | mobile mode |
|-----------------|---------------|-------------------|-----------------------|----------------|
| outInMill is | | | | |

For example, if the defaults_mode you selected was standard, then the value of standard would be assigned for retry_mode (from the valid retry_mode options) and the value of regional would be assigned for stsRegionalEndpoints (from the valid stsRegionalEndpoints options).

Compatibility with AWS SDKs

The following SDKs support the features and settings described in this topic. Any partial exceptions are noted. Any JVM system property settings are supported by the AWS SDK for Java and the AWS SDK for Kotlin only.

| SDK | Supported | Notes or more information |
|---------------------|-----------|---|
| AWS CLI v2 | No | |
| SDK for C++ | Yes | Parameters not optimized: stsRegionalEndpoints , s3UsEast1RegionalE ndpoints ,tlsNegoti ationTimeoutInMill is . |
| SDK for Go V2 (1.x) | Yes | Parameters not optimized: retryMode , stsRegion alEndpoints , s3UsEast1RegionalE ndpoints . |
| SDK for Go 1.x (V1) | No | |
| SDK for Java 2.x | Yes | Parameters not optimized: stsRegionalEndpoints . |

| SDK | Supported | Notes or more information |
|------------------------|-----------|--|
| SDK for Java 1.x | No | |
| SDK for JavaScript 3.x | Yes | Parameters not optimized: stsRegionalEndpoints , s3UsEast1RegionalE ndpoints ,tlsNegoti ationTimeoutInMill is .connectTi meoutInMillis is called connectionTimeout . |
| SDK for JavaScript 2.x | No | |
| SDK for Kotlin | No | |
| SDK for .NET 3.x | Yes | Parameters not optimized :connectTimeoutInMi llis ,tlsNegoti ationTimeoutInMill is . |
| SDK for PHP 3.x | Yes | Parameters not optimized : tlsNegotiationTime outInMillis . |
| SDK for Python (Boto3) | Yes | Parameters not optimized : tlsNegotiationTime outInMillis . |
| SDK for Ruby 3.x | Yes | |
| SDK for Rust | No | |
| SDK for Swift | No | |

| SDK | Supported | Notes or more information |
|----------------------|-----------|--|
| Tools for PowerShell | Yes | Parameters not optimized :connectTimeoutInMi llis ,tlsNegoti ationTimeoutInMill is . |

AWS Common Runtime (CRT) libraries

The AWS Common Runtime (CRT) libraries are a base library of the SDKs. The CRT is a modular family of independent packages, written in C. Each package provides good performance and minimal footprint for different required functionalities. These functionalities are common and shared across all SDKs providing better code reuse, optimization, and accuracy. The packages are:

- <u>awslabs/aws-c-auth</u>: AWS client-side authentication (standard credential providers and signing (sigv4))
- <u>awslabs/aws-c-cal</u>: Cryptographic primitive types, hashes (MD5, SHA256, SHA256 HMAC), signers, AES
- <u>awslabs/aws-c-common</u>: Basic data structures, threading/synchronization primitive types, buffer management, stdlib-related functions
- awslabs/aws-c-compression: Compression algorithms (Huffman encoding/decoding)
- <u>awslabs/aws-c-event-stream</u>: Event stream message processing (headers, prelude, payload, crc/trailer), remote procedure call (RPC) implementation over event streams
- awslabs/aws-c-http: C99 implementation of the HTTP/1.1 and HTTP/2 specifications
- <u>awslabs/aws-c-io</u>: Sockets (TCP, UDP), DNS, pipes, event loops, channels, SSL/TLS
- <u>awslabs/aws-c-iot</u>: C99 implementation of AWS IoT cloud services integration with devices
- <u>awslabs/aws-c-mqtt</u>: Standard, lightweight messaging protocol for the Internet of Things (IoT)
- <u>awslabs/aws-c-s3</u>: C99 library implementation for communicating with the Amazon S3 service, designed for maximizing throughput on high bandwidth Amazon EC2 instances
- <u>awslabs/aws-c-sdkutils</u>: A utilities library for parsing and managing AWS profiles
- <u>awslabs/aws-checksums</u>: Cross-platform hardware-accelerated CRC32c and CRC32 with fallback to efficient software implementations
- <u>awslabs/aws-lc</u>: General-purpose cryptographic library maintained by the AWS Cryptography team for AWS and their customers, based on code from the Google BoringSSL project and the OpenSSL project
- awslabs/s2n: C99 implementation of the TLS/SSL protocols, designed to be small and fast with security as a priority

The CRT is available through all SDKs except Go and Rust.

CRT dependencies

The CRT libraries form a complex net of relationships and dependencies. Knowing these relationships is helpful if you need to build the CRT directly from source. However, most users access CRT functionality through their language SDK (such as AWS SDK for C++ or AWS SDK for Java) or their language IoT device SDK (such as AWS IoT SDK for C++ or AWS IoT SDK for Java). In the following diagram, the Language CRT Bindings box refers to the package wrapping the CRT libraries for a specific language SDK. This is a collection of packages of the form aws-crt-*, where '*' is an SDK language (such as aws-crt-cpp or aws-crt-java).

The following is an illustration of the hierarchical dependencies of the CRT libraries.

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AWS SDKs and Tools maintenance policy

Overview

This document outlines the maintenance policy for AWS Software Development Kits (SDKs) and Tools, including Mobile and IoT SDKs, and their underlying dependencies. AWS regularly provides the AWS SDKs and Tools with updates that may contain support for new or updated AWS APIs, new features, enhancements, bug fixes, security patches, or documentation updates. Updates may also address changes with dependencies, language runtimes, and operating systems. AWS SDK releases are published to package managers (e.g. Maven, NuGet, PyPI), and are available as source code on GitHub.

We recommend users to stay up-to-date with SDK releases to keep up with the latest features, security updates, and underlying dependencies. Continued use of an unsupported SDK version is not recommended and is done at the user's discretion.

Versioning

The AWS SDK release versions are in the form of X.Y.Z where X represents the major version. Increasing the major version of an SDK indicates that this SDK underwent significant and substantial changes to support new idioms and patterns in the language. Major versions are introduced when public interfaces (e.g. classes, methods, types, etc.), behaviors, or semantics have changed. Applications need to be updated in order for them to work with the newest SDK version. It is important to update major versions carefully and in accordance with the upgrade guidelines provided by AWS.

SDK major version lifecycle

The lifecycle for major SDKs and Tools versions consists of 5 phases, which are outlined below.

Developer Preview (Phase 0) - During this phase, SDKs are not supported, should not be used
in production environments, and are meant for early access and feedback purposes only. It is
possible for future releases to introduce breaking changes. Once AWS identifies a release to be
a stable product, it may mark it as a Release Candidate. Release Candidates are ready for GA
release unless significant bugs emerge, and will receive full AWS support.

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• General Availability (GA) (Phase 1) - During this phase, SDKs are fully supported. AWS will provide regular SDK releases that include support for new services, API updates for existing services, as well as bug and security fixes. For Tools, AWS will provide regular releases that include new feature updates and bug fixes. AWS will support the GA version of an SDK for at least 24 months.

- Maintenance Announcement (Phase 2) AWS will make a public announcement at least 6 months before an SDK enters maintenance mode. During this period, the SDK will continue to be fully supported. Typically, maintenance mode is announced at the same time as the next major version is transitioned to GA.
- Maintenance (Phase 3) During the maintenance mode, AWS limits SDK releases to address critical bug fixes and security issues only. An SDK will not receive API updates for new or existing services, or be updated to support new regions. Maintenance mode has a default duration of 12 months, unless otherwise specified.
- End-of-Support (Phase 4) When an SDK reaches end-of support, it will no longer receive updates or releases. Previously published releases will continue to be available via public package managers and the code will remain on GitHub. The GitHub repository may be archived. Use of an SDK which has reached end-of-support is done at the user's discretion. We recommend users upgrade to the new major version.

The following is a visual illustration of the SDK major version lifecycle. Please note that the timelines shown below are illustrative and not binding.

Dependency lifecycle

Most AWS SDKs have underlying dependencies, such as language runtimes, operating systems, or third party libraries and frameworks. These dependencies are typically tied to the language community or the vendor who owns that particular component. Each community or vendor publishes their own end-of-support schedule for their product.

The following terms are used to classify underlying third party dependencies:

- Operating System (OS): Examples include Amazon Linux AMI, Amazon Linux 2, Windows 2008, Windows 2012, Windows 2016, etc.
- Language Runtime: Examples include Java 7, Java 8, Java 11, .NET Core, .NET Standard, .NET PCL, etc.
- Third party Library / Framework: Examples include OpenSSL, .NET Framework 4.5, Java EE, etc.

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Our policy is to continue supporting SDK dependencies for at least 6 months after the community or vendor ends support for the dependency. This policy, however, could vary depending on the specific dependency.



Note

AWS reserves the right to stop support for an underlying dependency without increasing the major SDK version

Communication methods

Maintenance announcements are communicated in several ways:

- An email announcement is sent to affected accounts, announcing our plans to end support for the specific SDK version. The email will outline the path to end-of-support, specify the campaign timelines, and provide upgrade guidance.
- AWS SDK documentation, such as API reference documentation, user guides, SDK product marketing pages, and GitHub readme(s) are updated to indicate the campaign timeline and provide guidance on upgrading affected applications.
- An AWS blog post is published that outlines the path to end-of-support, as well as reiterates the campaign timelines.
- Deprecation warnings are added to the SDKs, outlining the path to end-of-support and linking to the SDK documentation.

To see the list of available major versions of AWS SDKs and Tools and where they are in their maintenance lifecycle, see Version support.

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AWS SDKs and Tools version support

The table below shows the list of available AWS Software Development Kit (SDK) major versions and where they are in the maintenance lifecycle with associated timelines. For detailed information on the lifecycle for the major versions of AWS SDKs and Tools and their underlying dependencies, see *Maintenance policy*.

| SDK | Major version | Current Phase | General Availability Date | Notes |
|-----------------------|---------------|--------------------------|---------------------------------|---|
| AWS CLI | 1.x | General Availabil ity | 9/2/2013 | |
| AWS CLI | 2.x | General Availabil ity | 2/10/2020 | |
| SDK for C++ | 1.x | General Availabil ity | 9/2/2015 | |
| SDK for Go V2 | V2 1.x | General Availabil ity | 1/19/2021 | |
| SDK for Go | 1.x | Maintenance | 11/19/2015 | See <u>announcem</u> <u>ent</u> for details and dates |
| SDK for Java | 1.x | Maintenance | 3/25/2010 | See <u>announcem</u> <u>ent</u> for details and dates |
| SDK for Java | 2.x | General Availabil ity | 11/20/2018 | |
| SDK for JavaScript | 1.x | End-of-Support | 5/6/2013 | |

| SDK | Major version | Current Phase | General Availability Date | Notes |
|------------------------------|---------------|--------------------------|---------------------------------|---|
| SDK for JavaScript | 2.x | Maintenance | 6/19/2014 | See <u>announcem</u> <u>ent</u> for details and dates |
| SDK for JavaScript | 3.x | General Availabil ity | 12/15/2020 | |
| SDK for Kotlin | 1.x | General Availabil ity | 11/27/2023 | |
| SDK for .NET | 1.x | End-of-Support | 11/2009 | |
| SDK for .NET | 2.x | End-of-Support | 11/8/2013 | |
| SDK for .NET | 3.x | General Availabil ity | 7/28/2015 | |
| SDK for PHP | 2.x | End-of-Support | 11/2/2012 | |
| SDK for PHP | 3.x | General Availabil ity | 5/27/2015 | |
| SDK for Python (Boto2) | 1.x | End-of-Support | 7/13/2011 | |
| SDK for Python (Boto3) | 1.x | General Availabil ity | 6/22/2015 | |
| SDK for Python (Botocore) | 1.x | General Availabil ity | 6/22/2015 | |
| SDK for Ruby | 1.x | End-of-Support | 7/14/2011 | |
| SDK for Ruby | 2.x | End-of-Support | 2/15/2015 | |

| SDK | Major version | Current Phase | General Availability Date | Notes |
|-------------------------|---------------|--------------------------|---------------------------------|-------|
| SDK for Ruby | 3.x | General Availabil ity | 8/29/2017 | |
| SDK for Rust | 1.x | General Availabil ity | 11/27/2023 | |
| SDK for Swift | 1.x | General Availabil ity | 9/17/2024 | |
| Tools for PowerShell | 2.x | End-of-Support | 11/8/2013 | |
| Tools for PowerShell | 3.x | End-of-Support | 7/29/2015 | |
| Tools for PowerShell | 4.x | General Availabil ity | 11/21/2019 | |

Searching for an SDK or tool not mentioned? Encryption SDKs, IoT Device SDKs, and Mobile SDKs, for example, are not included in this guide. To find documentation on these other tools, see <u>Tools</u> to Build on AWS.

Document history for AWS SDKs and Tools ReferenceGuide

The following table describes important additions and updates to the AWS SDKs and Tools Reference Guide. For notification about updates to this documentation, you can subscribe to the RSS feed.

| Change | Description | Date |
|--|--|--------------------|
| Adding Swift SDK to Settings reference | Adding Swift SDK support to all Setting reference Compatibility with AWS SDKs tables. | September 17, 2024 |
| SDK for Java 1.x system properties | Add details about supported JVM system configuration settings by the AWS SDK for Java 1.x. | May 30, 2024 |
| Settings updates | Add JVM system configura tion settings. | March 27, 2024 |
| Compatibility table updates | Updates to compatibility for SDK support, updates to IAM Identity Center procedures. | February 20, 2024 |
| Container credential update. IMDS update. | Adding support for Amazon EKS. Adding setting to disable IMDSv1 fallback. | December 29, 2023 |
| Request compression | Adding settings for request compression feature. | December 27, 2023 |
| Compatibility tables | Compatibility tables for SDK and tool features updated to include SDK for Kotlin, SDK | December 10, 2023 |

| | for Rust, and AWS Tools for PowerShell. | |
|--|--|--------------------|
| Authentication updates | Updates to supported methods of authentication for SDKs and tools. | July 1, 2023 |
| IAM best practices updates | Updated guide to align with the IAM best practices . For more information, see Security best practices in IAM. | February 27, 2023 |
| SSO updates | Updates to SSO credentia ls for the new SSO token configuration. | November 19, 2022 |
| Settings updates | Updates to support table for General configuration and for Amazon S3 Multi-Region Access Points. | November 17, 2022 |
| Settings updates | Updates to clarity of IMDS client and IMDS credentia ls. Updates to Environment variables. | November 4, 2022 |
| Updating welcome page | Announcing Amazon CodeWhisperer. | September 22, 2022 |
| Service name change for single sign-on | Updates to reflect that AWS SSO is now referred to as AWS IAM Identity Center. | July 26, 2022 |
| Settings update | Minor updates to config file details and to supported settings. | June 15, 2022 |
| <u>Update</u> | Massive update of almost all parts of this guide. | February 1, 2022 |

Initial release

The first release of this guide is released to the public.

March 13, 2020

AWS Glossary

For the latest AWS terminology, see the <u>AWS glossary</u> in the *AWS Glossary Reference*.