



Developer Guide

# Amazon Elastic Compute Cloud



# Amazon Elastic Compute Cloud: Developer Guide

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# Table of Contents

<b>Programmatic access to Amazon EC2 .....</b>	<b>1</b>
Service endpoints .....	1
IPv4 endpoints .....	2
Dual-stack (IPv4 and IPv6) endpoints .....	2
Service endpoints by Region .....	3
Specifying endpoints .....	8
Eventual consistency .....	10
Idempotency .....	11
Idempotency in Amazon EC2 .....	12
RunInstances idempotency .....	15
Examples .....	17
Retry recommendations for idempotent requests .....	18
API request throttling .....	19
How throttling is applied .....	20
Throttling limits .....	21
Monitor API throttling .....	28
Retries and exponential backoff .....	28
Request a limit increase .....	29
<b>Using the AWS CLI .....</b>	<b>31</b>
Learn more about the AWS CLI .....	31
<b>Using AWS CloudFormation .....</b>	<b>32</b>
Amazon EC2 and AWS CloudFormation templates .....	32
Resources for Amazon EC2 .....	32
Learn more about AWS CloudFormation .....	36
<b>Using an AWS SDK .....</b>	<b>37</b>
Code examples for the Amazon EC2 API .....	37
Learn more about the AWS SDKs .....	37
<b>Low-level API for Amazon EC2 .....</b>	<b>38</b>
<b>Console-to-Code .....</b>	<b>39</b>
How it works .....	39
Limitations .....	40
Supported Regions .....	40
Supported code formats .....	40
Retained actions .....	40

Recorded actions table .....	41
Use Console-to-Code .....	41
<b>Code examples .....</b>	<b>44</b>
Actions .....	62
AcceptVpcPeeringConnection .....	69
AllocateAddress .....	71
AllocateHosts .....	84
AssignPrivateIpAddresses .....	86
AssociateAddress .....	88
AssociateDhcpOptions .....	101
AssociateRouteTable .....	103
AttachInternetGateway .....	104
AttachNetworkInterface .....	105
AttachVolume .....	106
AttachVpnGateway .....	108
AuthorizeSecurityGroupEgress .....	109
AuthorizeSecurityGroupIngress .....	111
CancelCapacityReservation .....	133
CancelImportTask .....	134
CancelSpotFleetRequests .....	135
CancelSpotInstanceRequests .....	137
ConfirmProductInstance .....	139
CopyImage .....	140
CopySnapshot .....	142
CreateCapacityReservation .....	144
CreateCustomerGateway .....	147
CreateDhcpOptions .....	149
CreateFlowLogs .....	151
CreateImage .....	153
CreateInstanceExportTask .....	156
CreateInternetGateway .....	158
CreateKeyPair .....	159
CreateLaunchTemplate .....	176
CreateNetworkAcl .....	185
CreateNetworkAclEntry .....	186
CreateNetworkInterface .....	188

CreatePlacementGroup .....	193
CreateRoute .....	194
CreateRouteTable .....	196
CreateSecurityGroup .....	200
CreateSnapshot .....	223
CreateSpotDatafeedSubscription .....	225
CreateSubnet .....	227
CreateTags .....	234
CreateVolume .....	239
CreateVpc .....	243
CreateVpcEndpoint .....	250
CreateVpnConnection .....	254
CreateVpnConnectionRoute .....	260
CreateVpnGateway .....	261
DeleteCustomerGateway .....	263
DeleteDhcpOptions .....	264
DeleteFlowLogs .....	265
DeleteInternetGateway .....	266
DeleteKeyPair .....	267
DeleteLaunchTemplate .....	279
DeleteNetworkAcl .....	283
DeleteNetworkAclEntry .....	284
DeleteNetworkInterface .....	285
DeletePlacementGroup .....	286
DeleteRoute .....	287
DeleteRouteTable .....	288
DeleteSecurityGroup .....	290
DeleteSnapshot .....	300
DeleteSpotDatafeedSubscription .....	302
DeleteSubnet .....	303
DeleteTags .....	304
DeleteVolume .....	307
DeleteVpc .....	308
DeleteVpnConnection .....	309
DeleteVpnConnectionRoute .....	310
DeleteVpnGateway .....	311

DeregisterImage .....	312
DescribeAccountAttributes .....	313
DescribeAddresses .....	316
DescribeAvailabilityZones .....	325
DescribeBundleTasks .....	333
DescribeCapacityReservations .....	334
DescribeCustomerGateways .....	337
DescribeDhcpOptions .....	339
DescribeFlowLogs .....	343
DescribeHostReservationOfferings .....	345
DescribeHosts .....	348
DescribeIamInstanceProfileAssociations .....	350
DescribeIdFormat .....	355
DescribeIdentityIdFormat .....	356
DescribeImageAttribute .....	358
DescribeImages .....	361
DescribeImportImageTasks .....	371
DescribeImportSnapshotTasks .....	374
DescribeInstanceAttribute .....	377
DescribeInstanceState .....	381
DescribeInstanceTypes .....	384
DescribeInstances .....	399
DescribeInternetGateways .....	428
DescribeKeyPairs .....	430
DescribeNetworkAcls .....	441
DescribeNetworkInterfaceAttribute .....	445
DescribeNetworkInterfaces .....	448
DescribePlacementGroups .....	453
DescribePrefixLists .....	455
DescribeRegions .....	456
DescribeRouteTables .....	470
DescribeScheduledInstanceAvailability .....	474
DescribeScheduledInstances .....	476
DescribeSecurityGroups .....	478
DescribeSnapshotAttribute .....	495
DescribeSnapshots .....	496

DescribeSpotDatafeedSubscription .....	502
DescribeSpotFleetInstances .....	504
DescribeSpotFleetRequestHistory .....	505
DescribeSpotFleetRequests .....	507
DescribeSpotInstanceRequests .....	511
DescribeSpotPriceHistory .....	515
DescribeSubnets .....	518
DescribeTags .....	526
DescribeVolumeAttribute .....	532
DescribeVolumeStatus .....	533
DescribeVolumes .....	535
DescribeVpcAttribute .....	539
DescribeVpcClassicLink .....	541
DescribeVpcClassicLinkDnsSupport .....	543
DescribeVpcEndpointServices .....	544
DescribeVpcEndpoints .....	549
DescribeVpcs .....	553
DescribeVpnConnections .....	560
DescribeVpnGateways .....	562
DetachInternetGateway .....	564
DetachNetworkInterface .....	565
DetachVolume .....	566
DetachVpnGateway .....	568
DisableVgwRoutePropagation .....	568
DisableVpcClassicLink .....	569
DisableVpcClassicLinkDnsSupport .....	570
DisassociateAddress .....	571
DisassociateRouteTable .....	580
EnableVgwRoutePropagation .....	581
EnableVolumeIo .....	582
EnableVpcClassicLink .....	583
EnableVpcClassicLinkDnsSupport .....	584
GetConsoleOutput .....	585
GetHostReservationPurchasePreview .....	587
GetPasswordData .....	588
ImportImage .....	593

ImportKeyPair .....	595
ImportSnapshot .....	597
ModifyCapacityReservation .....	598
ModifyHosts .....	600
ModifyIdFormat .....	602
ModifyImageAttribute .....	603
ModifyInstanceAttribute .....	605
ModifyInstanceCreditSpecification .....	609
ModifyNetworkInterfaceAttribute .....	610
ModifyReservedInstances .....	612
ModifySnapshotAttribute .....	614
ModifySpotFleetRequest .....	616
ModifySubnetAttribute .....	617
ModifyVolumeAttribute .....	618
ModifyVpcAttribute .....	619
MonitorInstances .....	621
MoveAddressToVpc .....	625
PurchaseHostReservation .....	627
PurchaseScheduledInstances .....	628
RebootInstances .....	630
RegisterImage .....	642
RejectVpcPeeringConnection .....	643
ReleaseAddress .....	644
ReleaseHosts .....	656
ReplaceIamInstanceProfileAssociation .....	658
ReplaceNetworkAclAssociation .....	664
ReplaceNetworkAclEntry .....	665
ReplaceRoute .....	666
ReplaceRouteTableAssociation .....	667
ReportInstanceState .....	668
RequestSpotFleet .....	669
RequestSpotInstances .....	674
ResetImageAttribute .....	679
ResetInstanceAttribute .....	680
ResetNetworkInterfaceAttribute .....	682
ResetSnapshotAttribute .....	682

RevokeSecurityGroupEgress .....	683
RevokeSecurityGroupIngress .....	685
RunInstances .....	687
RunScheduledInstances .....	711
StartInstances .....	713
StopInstances .....	729
TerminateInstances .....	746
UnassignPrivateIpAddresses .....	759
UnmonitorInstances .....	760
Scenarios .....	764
Build and manage a resilient service .....	764
Get started with instances .....	925
<b>Monitor API requests using CloudWatch .....</b>	<b>1099</b>
Enable Amazon EC2 API metrics .....	1099
Amazon EC2 API metrics and dimensions .....	1100
Metrics .....	1100
Dimensions .....	1101
Metric data retention .....	1101
Monitoring requests made on your behalf .....	1102
Billing .....	1102
Working with Amazon CloudWatch .....	1102
Viewing CloudWatch metrics .....	1102
Creating CloudWatch alarms .....	1103

# Programmatic access to Amazon EC2

You can create and manage your Amazon EC2 resources using the AWS Management Console or a programmatic interface. For information about using the Amazon EC2 console, see the [Amazon EC2 User Guide](#).

## How it works

- [Amazon EC2 endpoints](#)
- [Eventual consistency](#)
- [Idempotency](#)
- [Request throttling](#)

## Programmatic interfaces

- [AWS Command Line Interface \(AWS CLI\)](#)
- [AWS CloudFormation](#)
- [AWS SDKs](#)
- [Low-level API](#)

## Getting started

- [Code examples](#)
- [Console-to-Code](#)

## Monitoring

- [AWS CloudTrail](#)
- [Monitor requests](#)

# Amazon EC2 service endpoints

An endpoint is a URL that serves as an entry point for an AWS web service. Amazon EC2 supports the following endpoint types:

- [IPv4 endpoints](#)
- [Dual-stack endpoints](#) (support both IPv4 and IPv6)
- [FIPS endpoints](#)

When you make a request, you can specify the endpoint to use. If you do not specify an endpoint, the IPv4 endpoint is used by default. To use a different endpoint type, you must specify it in your request. For examples of how to do this, see [Specifying endpoints](#). For a table of available endpoints, see [Service endpoints by Region](#).

## IPv4 endpoints

IPv4 endpoints support IPv4 traffic only. IPv4 endpoints are available for all Regions.

If you specify the general endpoint, `ec2.amazonaws.com`, we use the endpoint for `us-east-1`. To use a different Region, specify its associated endpoint. For example, if you specify `ec2.us-east-2.amazonaws.com` as the endpoint, we direct your request to the `us-east-2` endpoint.

IPv4 endpoint names use the following naming convention:

- `service.region.amazonaws.com`

For example, the IPv4 endpoint name for the `eu-west-1` Region is `ec2.eu-west-1.amazonaws.com`.

## Dual-stack (IPv4 and IPv6) endpoints

Dual-stack endpoints support both IPv4 and IPv6 traffic. When you make a request to a dual-stack endpoint, the endpoint URL resolves to an IPv6 or an IPv4 address, depending on the protocol used by your network and client.

Amazon EC2 supports only regional dual-stack endpoints, which means that you must specify the Region as part of the endpoint name. Dual-stack endpoint names use the following naming convention:

- `ec2.region.api.aws`

For example, the dual-stack endpoint name for the `eu-west-1` Region is `ec2.eu-west-1.api.aws`.

## Service endpoints by Region

The following are the service endpoints for Amazon EC2. For more information about Regions, see [Regions and Availability Zones](#) in the *Amazon EC2 User Guide*.

Region Name	Region	Endpoint	Protocol	
US East (Ohio)	us-east-2	ec2.us-east-2.amazonaws.com ec2-fips.us-east-2.amazonaws.com ec2.us-east-2.api.aws	HTTP and HTTPS HTTPS HTTPS	
US East (N. Virginia)	us-east-1	ec2.us-east-1.amazonaws.com ec2-fips.us-east-1.amazonaws.com ec2.us-east-1.api.aws	HTTP and HTTPS HTTPS HTTPS	
US West (N. California)	us-west-1	ec2.us-west-1.amazonaws.com ec2-fips.us-west-1.amazonaws.com ec2.us-west-1.api.aws	HTTP and HTTPS HTTPS HTTPS	
US West (Oregon)	us-west-2	ec2.us-west-2.amazonaws.com ec2-fips.us-west-2.amazonaws.com ec2.us-west-2.api.aws	HTTP and HTTPS HTTPS HTTPS	

<b>Region Name</b>	<b>Region</b>	<b>Endpoint</b>	<b>Protocol</b>
Africa (Cape Town)	af-south-1	ec2.af-south-1.amazonaws.com ec2.af-south-1.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Hong Kong)	ap-east-1	ec2.ap-east-1.amazonaws.com ec2.ap-east-1.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Hyderabad)	ap-south-2	ec2.ap-south-2.amazonaws.com	HTTPS
Asia Pacific (Jakarta)	ap-southeast-3	ec2.ap-southeast-3.amazonaws.com	HTTPS
Asia Pacific (Melbourne)	ap-southeast-4	ec2.ap-southeast-4.amazonaws.com	HTTPS
Asia Pacific (Mumbai)	ap-south-1	ec2.ap-south-1.amazonaws.com ec2.ap-south-1.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Osaka)	ap-northeast-3	ec2.ap-northeast-3.amazonaws.com	HTTP and HTTPS

<b>Region Name</b>	<b>Region</b>	<b>Endpoint</b>	<b>Protocol</b>
Asia Pacific (Seoul)	ap-northeast-2	ec2.ap-northeast-2.amazonaws.com ec2.ap-northeast-2.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Singapore)	ap-southeast-1	ec2.ap-southeast-1.amazonaws.com ec2.ap-southeast-1.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Sydney)	ap-southeast-2	ec2.ap-southeast-2.amazonaws.com ec2.ap-southeast-2.api.aws	HTTP and HTTPS HTTPS
Asia Pacific (Tokyo)	ap-northeast-1	ec2.ap-northeast-1.amazonaws.com ec2.ap-northeast-1.api.aws	HTTP and HTTPS HTTPS
Canada (Central)	ca-central-1	ec2.ca-central-1.amazonaws.com ec2-fips.ca-central-1.amazonaws.com ec2.ca-central-1.api.aws	HTTP and HTTPS HTTPS HTTPS
Canada West (Calgary)	ca-west-1	ec2.ca-west-1.amazonaws.com ec2-fips.ca-west-1.amazonaws.com	HTTPS HTTPS

<b>Region Name</b>	<b>Region</b>	<b>Endpoint</b>	<b>Protocol</b>
Europe (Frankfurt)	eu-central-1	ec2.eu-central-1.amazonaws.com ec2.eu-central-1.api.aws	HTTP and HTTPS HTTPS
Europe (Ireland)	eu-west-1	ec2.eu-west-1.amazonaws.com ec2.eu-west-1.api.aws	HTTP and HTTPS HTTPS
Europe (London)	eu-west-2	ec2.eu-west-2.amazonaws.com ec2.eu-west-2.api.aws	HTTP and HTTPS HTTPS
Europe (Milan)	eu-south-1	ec2.eu-south-1.amazonaws.com ec2.eu-south-1.api.aws	HTTP and HTTPS HTTPS
Europe (Paris)	eu-west-3	ec2.eu-west-3.amazonaws.com ec2.eu-west-3.api.aws	HTTP and HTTPS HTTPS
Europe (Spain)	eu-south-2	ec2.eu-south-2.amazonaws.com	HTTPS

<b>Region Name</b>	<b>Region</b>	<b>Endpoint</b>	<b>Protocol</b>
Europe (Stockholm)	eu-north-1	ec2.eu-north-1.amazonaws.com ec2.eu-north-1.api.aws	HTTP and HTTPS HTTPS
Europe (Zurich)	eu-central-2	ec2.eu-central-2.amazonaws.com	HTTPS
Israel (Tel Aviv)	il-central-1	ec2.il-central-1.amazonaws.com	HTTPS
Middle East (Bahrain)	me-south-1	ec2.me-south-1.amazonaws.com ec2.me-south-1.api.aws	HTTP and HTTPS HTTPS
Middle East (UAE)	me-central-1	ec2.me-central-1.amazonaws.com	HTTPS
South America (São Paulo)	sa-east-1	ec2.sa-east-1.amazonaws.com ec2.sa-east-1.api.aws	HTTP and HTTPS HTTPS
AWS GovCloud (US-East)	us-gov-east-1	ec2.us-gov-east-1.amazonaws.com ec2.us-gov-east-1.api.aws	HTTPS HTTPS
AWS GovCloud (US-West)	us-gov-west-1	ec2.us-gov-west-1.amazonaws.com ec2.us-gov-west-1.api.aws	HTTPS HTTPS

# Specifying endpoints

This section provides some examples of how to specify an endpoint when making a request.

## AWS CLI

The following examples show how to specify an endpoint for the us-east-2 Region using the AWS CLI.

- **Dual-stack**

```
aws ec2 describe-regions --region us-east-2 --endpoint-url https://ec2.us-east-2.api.aws
```

- **IPv4**

```
aws ec2 describe-regions --region us-east-2 --endpoint-url https://ec2.us-east-2.amazonaws.com
```

## AWS SDK for Java 2.x

The following examples show how to specify an endpoint for the us-east-2 Region using the AWS SDK for Java 2.x.

- **Dual-stack**

```
Ec2Client client = Ec2Client.builder()
    .region(Region.US_EAST_2)
    .endpointOverride(URI.create("https://ec2.us-east-2.api.aws"))
    .build();
```

- **IPv4**

```
Ec2Client client = Ec2Client.builder()
    .region(Region.US_EAST_2)
    .endpointOverride(URI.create("https://ec2.us-east-2.amazonaws.com"))
    .build();
```

## AWS SDK for Java 1.x

The following examples show how to specify an endpoint for the eu-west-1 Region using the AWS SDK for Java 1.x.

- **Dual-stack**

```
AmazonEC2 s3 = AmazonEC2ClientBuilder.standard()
    .withEndpointConfiguration(new EndpointConfiguration(
        "https://ec2.eu-west-1.api.aws",
        "eu-west-1"))
    .build();
```

- **IPv4**

```
AmazonEC2 s3 = AmazonEC2ClientBuilder.standard()
    .withEndpointConfiguration(new EndpointConfiguration(
        "https://ec2.eu-west-1.amazonaws.com",
        "eu-west-1"))
    .build();
```

## AWS SDK for Go

The following examples show how to specify an endpoint for the us-east-1 Region using the AWS SDK for Go.

- **Dual-stack**

```
sess := session.Must(session.NewSession())
svc := ec2.New(sess, &aws.Config{
    Region: aws.String(endpoints.UsEast1RegionID),
    Endpoint: aws.String("https://ec2.us-east-1.api.aws")
})
```

- **IPv4**

```
sess := session.Must(session.NewSession())
svc := ec2.New(sess, &aws.Config{
    Region: aws.String(endpoints.UsEast1RegionID),
    Endpoint: aws.String("https://ec2.us-east-1.amazonaws.com")
})
```

# Eventual consistency in the Amazon EC2 API

The Amazon EC2 API follows an eventual consistency model, due to the distributed nature of the system supporting the API. This means that the result of an API command you run that affects your Amazon EC2 resources might not be immediately visible to all subsequent commands you run. You should keep this in mind when you carry out an API command that immediately follows a previous API command.

Eventual consistency can affect the way you manage your resources. For example, if you run a command to create a resource, it will eventually be visible to other commands. This means that if you run a command to modify or describe the resource that you just created, its ID might not have propagated throughout the system, and you will get an error responding that the resource does not exist.

To manage eventual consistency, you can do the following:

- Confirm the state of the resource before you run a command to modify it. Run the appropriate `Describe` command using an exponential backoff algorithm to ensure that you allow enough time for the previous command to propagate through the system. To do this, run the `Describe` command repeatedly, starting with a couple of seconds of wait time, and increasing gradually up to five minutes of wait time.
- Add wait time between subsequent commands, even if a `Describe` command returns an accurate response. Apply an exponential backoff algorithm starting with a couple of seconds of wait time, and increase gradually up to about five minutes of wait time.

## Eventual consistency error examples

The following are examples of error codes you may encounter as a result of eventual consistency.

- `InvalidInstanceID.NotFound`

If you successfully run the `RunInstances` command, and then immediately run another command using the instance ID that was provided in the response of `RunInstances`, it may return an `InvalidInstanceID.NotFound` error. This does not mean the instance does not exist.

Some specific commands that may be affected are:

- `DescribeInstances`: To confirm the actual state of the instance, run this command using an exponential backoff algorithm.
- `TerminateInstances`: To confirm the state of the instance, first run the `DescribeInstances` command using an exponential backoff algorithm.

 **Important**

If you get an `InvalidInstanceID.NotFound` error after running `TerminateInstances`, this does not mean that the instance is or will be terminated. Your instance could still be running. This is why it is important to first confirm the instance's state using `DescribeInstances`.

- `InvalidGroup.NotFound`

If you successfully run the `CreateSecurityGroup` command, and then immediately run another command using the security group ID that was provided in the response of `CreateSecurityGroup`, it may return an `InvalidGroup.NotFound` error. To confirm the state of the security group, run the `DescribeSecurityGroups` command using an exponential backoff algorithm.

- `InstanceLimitExceeded`

You have requested more instances than your current instance limit allows for the specified instance type. You could reach this limit unexpectedly if you are launching and terminating instances rapidly, as terminated instances count toward your instance limit for a while after they've been terminated.

## Ensuring idempotency in Amazon EC2 API requests

When you make a mutating API request, the request typically returns a result before the operation's asynchronous workflows have completed. Operations might also time out or encounter other server issues before they complete, even though the request has already returned a result. This could make it difficult to determine whether the request succeeded or not, and could lead to multiple retries to ensure that the operation completes successfully. However, if the original request and the subsequent retries are successful, the operation is completed multiple times. This means that you might create more resources than you intended.

*Idempotency* ensures that an API request completes no more than one time. With an idempotent request, if the original request completes successfully, any subsequent retries complete successfully without performing any further actions. However, the result might contain updated information, such as the current creation status.

## Contents

- [Idempotency in Amazon EC2](#)
- [RunInstances idempotency](#)
- [Examples](#)
- [Retry recommendations for idempotent requests](#)

## Idempotency in Amazon EC2

The following API actions are idempotent by default, and do not require additional configuration. The corresponding AWS CLI commands also support idempotency by default.

### Idempotent by default

- AssociateAddress
- CreateVpnConnection
- DisassociateAddress
- ReplaceNetworkAclAssociation
- TerminateInstances

The following API actions optionally support idempotency using a *client token*. The corresponding AWS CLI commands also support idempotency using a client token. A client token is a unique, case-sensitive string of up to 64 ASCII characters. To make an idempotent API request using one of these actions, specify a client token in the request. You should not reuse the same client token for other API requests. If you retry a request that completed successfully using the same client token and the same parameters, the retry succeeds without performing any further actions. If you retry a successful request using the same client token, but one or more of the parameters are different, other than the Region or Availability Zone, the retry fails with an `IdempotentParameterMismatch` error.

## Idempotent using a client token

- AllocateHosts
- AllocatelbamPoolCidr
- AssociateClientVpnTargetNetwork
- AssociateIpamResourceDiscovery
- AttachVerifiedAccessTrustProvider
- AuthorizeClientVpnIngress
- CopyFpgalmage
- CopyImage
- CreateCapacityReservation
- CreateCapacityReservationFleet
- CreateClientVpnEndpoint
- CreateClientVpnRoute
- CreateEgressOnlyInternetGateway
- CreateFleet
- CreateFlowLogs
- CreateFpgalmage
- CreateInstanceConnectEndpoint
- Createlbam
- CreatelbamPool
- CreatelbamResourceDiscovery
- CreatelbamScope
- CreateLaunchTemplate
- CreateLaunchTemplateVersion
- CreateManagedPrefixList
- CreateNatGateway
- CreateNetworkAcl
- CreateNetworkInsightsAccessScope

- CreateNetworkInsightsPath
- CreateNetworkInterface
- CreateReplaceRootVolumeTask
- CreateReservedInstancesListing
- CreateRouteTable
- CreateTrafficMirrorFilter
- CreateTrafficMirrorFilterRule
- CreateTrafficMirrorSession
- CreateTrafficMirrorTarget
- CreateVerifiedAccessEndpoint
- CreateVerifiedAccessGroup
- CreateVerifiedAccessInstance
- CreateVerifiedAccessTrustProvider
- CreateVolume
- CreateVpcEndpoint
- CreateVpcEndpointConnectionNotification
- CreateVpcEndpointServiceConfiguration
- DeleteVerifiedAccessEndpoint
- DeleteVerifiedAccessGroup
- DeleteVerifiedAccessInstance
- DeleteVerifiedAccessTrustProvider
- DetachVerifiedAccessTrustProvider
- ExportImage
- ImportImage
- ImportSnapshot
- ModifyInstanceCreditSpecification
- ModifyLaunchTemplate
- ModifyReservedInstances

- `ModifyVerifiedAccessEndpoint`
- `ModifyVerifiedAccessEndpointPolicy`
- `ModifyVerifiedAccessGroup`
- `ModifyVerifiedAccessGroupPolicy`
- `ModifyVerifiedAccessInstance`
- `ModifyVerifiedAccessInstanceLoggingConfiguration`
- `ModifyVerifiedAccessTrustProvider`
- `ProvisionIpamPoolCidr`
- `PurchaseHostReservation`
- `RequestSpotFleet`
- `RequestSpotInstances`
- `RunInstances`
- `StartNetworkInsightsAccessScopeAnalysis`
- `StartNetworkInsightsAnalysis`

## Types of idempotency

- Regional – Requests are idempotent in each Region. However, you can use the same request, including the same client token, in a different Region.
- Zonal – Requests are idempotent in each Availability Zone in a Region. For example, if you specify the same client token in two calls to **AllocateHosts** in the same Region, the calls succeed if they specify different values for the **AvailabilityZone** parameter.

## RunInstances idempotency

The [RunInstances](#) API action uses both Regional and zonal idempotency.

The type of idempotency that is used depends on how you specify the Availability Zone in your RunInstances API request. The request uses **zonal idempotency** in the following cases:

- If you explicitly specify an Availability Zone using the **AvailabilityZone** parameter in the **Placement** data type
- If you implicitly specify an Availability Zone using the **SubnetId** parameter

If you do not explicitly or implicitly specify an Availability Zone, the request uses **Regional idempotency**.

## Zonal idempotency

Zonal idempotency ensures that a RunInstances API request is idempotent in each Availability Zone in a Region. This ensures that a request with the same client token can complete only once within each Availability Zone in a Region. However, the same client token can be used to launch instances in other Availability Zones in the Region.

For example, if you send an idempotent request to launch an instance in the us-east-1a Availability Zone, and then use the same client token in a request in the us-east-1b Availability Zone, we launch instances in each of those Availability Zones. If one or more of the parameters are different, subsequent retries with the same client token in those Availability Zones either return successfully without performing any further actions or fail with an `IdempotentParameterMismatch` error.

## Regional idempotency

Regional idempotency ensures that a RunInstances API request is idempotent in a Region. This ensures that a request with the same client token can complete only once within a Region. However, the exact same request, with the same client token, can be used to launch instances in a different Region.

For example, if you send an idempotent request to launch an instance in the us-east-1 Region, and then use the same client token in a request in the eu-west-1 Region, we launch instances in each of those Regions. If one or more of the parameters are different, subsequent retries with the same client token in those Regions either return successfully without performing any further actions or fail with an `IdempotentParameterMismatch` error.

### Tip

If one of the Availability Zones in the requested Region is not available, RunInstances requests that use regional idempotency could fail. To leverage the Availability Zone features offered by the AWS infrastructure, we recommend that you use zonal idempotency when launching instances. RunInstances requests that use zonal idempotency and target an available Availability Zone succeed even if another Availability Zone in the requested Region is not available.

## Examples

### AWS CLI command examples

To make an AWS CLI command idempotent, add the `--client-token` option.

#### Example 1: Idempotency

The following [allocate-hosts](#) command uses idempotency as it includes a client token.

```
aws ec2 allocate-hosts --instance-type m5.large --availability-zone eu-west-1a --  
auto-placement on --quantity 1 --client-token 550e8400-e29b-41d4-a716-446655440000
```

#### Example 2: run-instances regional idempotency

The following [run-instances](#) command uses regional idempotency as it includes a client token but does not explicitly or implicitly specify an Availability Zone.

```
aws ec2 run-instances --image-id ami-b232d0db --count 1 --key-name my-key-pair --  
client-token 550e8400-e29b-41d4-a716-446655440000
```

#### Example 3: run-instances zonal idempotency

The following [run-instances](#) command uses zonal idempotency as it includes a client token and an explicitly specified Availability Zone.

```
aws ec2 run-instances --placement "AvailabilityZone=us-east-1a" --image-id ami-b232d0db --count 1 --key-name my-key-pair --client-token 550e8400-e29b-41d4-a716-446655440000
```

## API request examples

To make an API request idempotent, add the `ClientToken` parameter.

#### Example 1: Idempotency

The following [AllocateHosts](#) API request uses idempotency as it includes a client token.

```
https://ec2.amazonaws.com/?Action=AllocateHosts  
&AvailabilityZone=us-east-1b  
&InstanceType=m5.large  
&Quantity=1
```

```
&AutoPlacement=off  
&ClientToken=550e8400-e29b-41d4-a716-446655440000  
&AUTHPARAMS
```

## Example 2: RunInstances regional idempotency

The following [RunInstances](#) API request uses regional idempotency as it includes a client token but does not explicitly or implicitly specify an Availability Zone.

```
https://ec2.amazonaws.com/?Action=RunInstances  
&ImageId=ami-3ac33653  
&MaxCount=1  
&MinCount=1  
&KeyName=my-key-pair  
&ClientToken=550e8400-e29b-41d4-a716-446655440000  
&AUTHPARAMS
```

## Example 3: RunInstances zonal idempotency

The following [RunInstances](#) API request uses zonal idempotency as it includes a client token and an explicitly specified Availability Zone.

```
https://ec2.amazonaws.com/?Action=RunInstances  
&Placement.AvailabilityZone=us-east-1d  
&ImageId=ami-3ac33653  
&MaxCount=1  
&MinCount=1  
&KeyName=my-key-pair  
&ClientToken=550e8400-e29b-41d4-a716-446655440000  
&AUTHPARAMS
```

## Retry recommendations for idempotent requests

The following table shows some common responses that you might get for idempotent API requests, and provides retry recommendations.

Response	Recommendation	Comments
200 (OK)	Do not retry	The original request completed successfully. Any subsequent retries return successfully.

Response	Recommendation	Comments
400-series response codes ( <a href="#">client errors</a> )	Do not retry	<p>There is a problem with the request, from among the following:</p> <ul style="list-style-type: none"> <li>• It includes a parameter or parameter combination that is not valid.</li> <li>• It uses an action or resource for which you do not have permissions.</li> <li>• It uses a resource that is in the process of changing states.</li> </ul> <p>If the request involves a resource that is in the process of changing states, retrying the request could possibly succeed.</p>
500-series response codes ( <a href="#">server errors</a> )	Retry	The error is caused by an AWS server-side issue and is generally transient. Repeat the request with an appropriate backoff strategy.

## Request throttling for the Amazon EC2 API

Amazon EC2 throttles EC2 API requests for each AWS account on a per-Region basis. We do this to help the performance of the service, and to ensure fair usage for all Amazon EC2 customers. Throttling ensures that calls to the Amazon EC2 API do not exceed the maximum allowed API request limits. API calls are subject to the request limits whether they originate from:

- A third-party application
- A command line tool
- The Amazon EC2 console

If you exceed an API throttling limit, you get the `RequestLimitExceeded` error code.

## Contents

- [How throttling is applied](#)
- [Throttling limits](#)
- [Monitor API throttling](#)
- [Retries and exponential backoff](#)
- [Request a limit increase](#)

## How throttling is applied

Amazon EC2 uses the [token bucket algorithm](#) to implement API throttling. With this algorithm, your account has a *bucket* that holds a specific number of *tokens*. The number of tokens in the bucket represents your throttling limit at any given second.

Amazon EC2 implements two types of API throttling:

### API throttling types

- [Request rate limiting](#)
- [Resource rate limiting](#)

## Request rate limiting

With request rate limiting, you are throttled on the number of API requests you make. Each request that you make removes one token from the bucket. For example, the bucket size for *non-mutating* (`Describe*`) API actions is 100 tokens, so you can make up to 100 `Describe*` requests in one second. If you exceed 100 requests in a second, you are throttled and the remaining requests within that second fail.

Buckets automatically refill at a set rate. If the bucket is below its maximum capacity, a set number of tokens is added back to it every second until it reaches its maximum capacity. If the bucket is full when refill tokens arrive, they are discarded. The bucket cannot hold more than its maximum number of tokens. For example, the bucket size for *non-mutating* (`Describe*`) API actions is 100 tokens, and the refill rate is 20 tokens per second. If you make 100 `Describe*` API requests in a second, the bucket is immediately reduced to zero (0) tokens. The bucket is then refilled by 20 tokens every second, until it reaches its maximum capacity of 100 tokens. This means that the previously empty bucket reaches its maximum capacity after 5 seconds.

You do not need to wait for the bucket to be completely full before you can make API requests. You can use tokens as they are added to the bucket. If you immediately use the refill tokens, the bucket does not reach its maximum capacity. For example, the bucket size for *console non-mutating actions* is 100 tokens, and the refill rate is 10 tokens per second. If you deplete the bucket by making 100 API requests in a second, you can continue to make 10 API requests per second. The bucket can refill to the maximum capacity only if you make fewer than 10 API requests per second.

## Resource rate limiting

Some API actions, such as `RunInstances` and `TerminateInstances`, as described in the table that follows, use resource rate limiting in addition to request rate limiting. These API actions have a separate resource token bucket that depletes based on the number of resources that are impacted by the request. Like request token buckets, resource token buckets have a bucket maximum that allows you to burst, and a refill rate that allows you to sustain a steady rate of requests for as long as needed. If you exceed a specific bucket limit for an API, including when a bucket has not yet refilled to support the next API call, the action of the API is limited even though you have not reached the total API throttle limit.

For example, the resource token bucket size for `RunInstances` is 1000 tokens, and the refill rate is two tokens per second. Therefore, you can immediately launch 1000 instances, using any number of API requests, such as one request for 1000 instances or four requests for 250 instances. After the resource token bucket is empty, you can launch up to two instances every second, using either one request for two instances or two requests for one instance.

For more information, see [Resource token bucket sizes and refill rates](#).

## Throttling limits

The following sections describe the request token bucket and resource token bucket sizes and refill rates.

### Limits

- [Request token bucket sizes and refill rates](#)
- [Resource token bucket sizes and refill rates](#)

## Request token bucket sizes and refill rates

For request rate limiting purposes, API actions are grouped into the following categories:

- **Non-mutating actions** — API actions that retrieve data about resources. This category generally includes all `Describe*` actions, such as `DescribeRouteTables`, `DescribeImages`, and `DescribeHosts`. These API actions typically have the highest API throttling limits.
- **Unfiltered and unpaginated non-mutating actions** — A specific subset of non-mutating API actions that, when called without specifying either [pagination](#) or a [filter](#), use tokens from a smaller token bucket. It is recommended that you make use of pagination and filtering so that tokens are deducted from the standard (larger) token bucket.
- **Mutating actions** — API actions that create, modify, or delete resources. This category generally includes all API actions that are not categorized as *non-mutating actions*, such as `CreateVolume`, `ModifyHosts`, and `DeleteSnapshot`. These actions have a lower throttling limit than non-mutating API calls.
- **Resource-intensive actions** — Mutating API actions that take the most time and consume the most resources to complete. These actions have an even lower throttling limit than *mutating actions*. They are throttled separately from other *mutating actions*.
- **Console non-mutating actions** — Non-mutating API actions that are called from the Amazon EC2 console. These API actions are throttled separately from other non-mutating API actions.
- **Uncategorized actions** — These API actions receive their own token bucket sizes and refill rates, even though by definition they fit in one of the other categories.

The following table shows the request token bucket sizes and refill rates for all AWS Regions.

API action category	Actions	Bucket maximum capacity	Bucket refill rate
Non-mutating actions	<ul style="list-style-type: none"> <li>• <code>Describe*</code></li> <li>• <code>Get*</code></li> </ul>	100	20
Unfiltered and unpaginated non-mutating actions	<ul style="list-style-type: none"> <li>• <code>DescribeInstances</code></li> <li>•</li> </ul>	50	10

API action category	Actions	Bucket maximum capacity	Bucket refill rate
	<p>DescribeNetworkInterfaces</p> <ul style="list-style-type: none"> <li>• DescribeVolumes</li> <li>• DescribeInstanceStatus</li> <li>• DescribeSnapshots</li> <li>• DescribeSecurityGroups</li> <li>• DescribeSpotInstanceRequests</li> </ul>		
Mutating actions	API actions that are not categorized as <i>non-mutating actions</i> .	200	5

API action category	Actions	Bucket maximum capacity	Bucket refill rate
Resource-intensive actions	<ul style="list-style-type: none"> <li>• AuthorizeSecurityGroupIngress</li> <li>• CancelSpotInstanceRequests</li> <li>• CreateKeyPair</li> <li>• RequestSpotInstances</li> <li>• RevokeSecurityGroupIngress</li> <li>• CreateVpcPeeringConnection</li> <li>• AcceptVpcPeeringConnection</li> <li>• RejectVpcPeeringConnection</li> <li>• DeleteVpcPeeringConnection</li> </ul>	50	5

API action category	Actions	Bucket maximum capacity	Bucket refill rate
Console non-mutating actions	<ul style="list-style-type: none"> <li>• <code>Describe*</code></li> <li>• <code>Get*</code></li> </ul>	100	10
Uncategorized actions	<code>RunInstances</code>	5	2
	<code>StartInstances</code>	5	2
	<code>CreateVpcEndpoint</code>	4	0.3
	<code>ModifyVpcEndpoint</code>	4	0.3
	<code>DeleteVpcEndpoints</code>	4	0.3
	<code>AcceptVpcEndpointConnections</code>	10	1
	<code>RejectVpcEndpointConnections</code>	10	1
	<code>CreateVpcEndpointServiceConfiguration</code>	10	1
	<code>ModifyVpcEndpointServiceConfiguration</code>	10	1

API action category	Actions	Bucket maximum capacity	Bucket refill rate
AWS Lambda VPC API actions	DeleteVpcEndpointServiceConfigurations	10	1
	CreateDefaultVpc	1	1
	CreateDefaultSubnet	1	1
	MoveAddressesToVpc	1	1
	RestoreAddressToClassic	1	1
	DescribeMovingAddresses	1	1
	AdvertiseByoipCidr	1	0.1
	ProvisionByoipCidr	1	0.1
	DescribeByoipCidrs	1	0.5
	DeprovisionByoipCidr	1	0.1
	WithdrawByoipCidr	1	0.1

API action category	Actions	Bucket maximum capacity	Bucket refill rate
	DescribeReservedInstancesOfferings	10	10
	PurchaseReservedInstancesOffering	5	5
	DescribeSpotFleetRequests	50	3
	DescribeSpotFleetInstances	100	5
	DescribeSpotFleetRequestHistory	100	5
	AssociateEnclaveCertificateIamRole	10	1
	DisassociateEnclaveCertificateIamRole	10	1

API action category	Actions	Bucket maximum capacity	Bucket refill rate
	GetAssociatedEnvelopeCertificateIamRoles	10	1
	GetConsoleScreenshot	5 per account 2 per instance	5 per account 1 per instance

## Resource token bucket sizes and refill rates

The following table lists the resource token bucket sizes and refill rates for API actions that use resource rate limiting.

API action	Bucket maximum capacity	Bucket refill rate
RunInstances	1000	2
TerminateInstances	1000	20
StartInstances	1000	2
StopInstances	1000	20

## Monitor API throttling

You can use Amazon CloudWatch to monitor your Amazon EC2 API calls and to collect and track metrics around API throttling. You can also create an alarm to warn you when you are close to reaching the API throttling limits. For more information, see [Monitor Amazon EC2 API requests using Amazon CloudWatch](#).

## Retries and exponential backoff

Your application might need to retry an API request. For example:

- To check for an update in the status of a resource
- To enumerate a large number of resources (for example, all your volumes)
- To retry a request after it fails with a server error (5xx) or a throttling error

However, for a client error (4xx), you must revise the request to correct the problem before trying the request again.

## Resource status changes

Before you start polling to check for status updates, give the request time to potentially complete. For example, wait a few minutes before checking whether your instance is active. When you begin polling, use an appropriate sleep interval between successive requests to lower the rate of API requests. For best results, use an increasing or variable sleep interval.

Alternatively, you can use Amazon EventBridge to notify you of the status of some resources. For example, you can use the **EC2 Instance State-change Notification** event to notify you of a state change for an instance. For more information, see [Automate Amazon EC2 using EventBridge](#).

## Retries

When you need to poll or retry an API request, we recommend using an exponential backoff algorithm to calculate the sleep interval between API calls. The idea behind exponential backoff is to use progressively longer waits between retries for consecutive error responses. You should implement a maximum delay interval, as well as a maximum number of retries. You can also use jitter (randomized delay) to prevent successive collisions. For more information, see [Timeouts, retries, and backoff with jitter](#).

Each AWS SDK implements automatic retry logic. For more information, see [Retry behavior](#) in the *AWS SDKs and Tools Reference Guide*.

## Request a limit increase

You can request an increase for API throttling limits for your AWS account.

### To request access to this feature

1. Open [AWS Support Center](#).
2. Choose **Create case**.
3. Choose **Account and billing**.

4. For **Service**, choose **General Info and Getting Started**.
5. For **Category**, choose **Using AWS & Services**.
6. Choose **Next step: Additional information**.
7. For **Subject**, enter **Request an increase in my Amazon EC2 API throttling limits**.
8. For **Description**, enter **Please increase the API throttling limits for my account. Related page: <https://docs.aws.amazon.com/AWSEC2/latest/APIReference/throttling.html>**. Also include the following information:
  - A description of your use case.
  - The Regions where you need an increase.
  - The one-hour window, in UTC, when peak throttling or usage occurred (to calculate the new throttling limit).
9. Choose **Next step: Solve now or contact us**.
10. On the **Contact us** tab, choose your preferred contact language and method of contact.
11. Choose **Submit**.

# Create Amazon EC2 resources using the AWS CLI

You can create and manage your Amazon EC2 resources using the AWS Command Line Interface (AWS CLI) in a command-line shell. The AWS CLI provides direct access to the APIs for AWS services, such as Amazon EC2.

For syntax and examples for the commands for Amazon EC2, see [ec2](#) in the *AWS CLI Command Reference*. You can also find these examples in [aws-cli/awscli/examples/ec2](#) on github.

## Learn more about the AWS CLI

To learn more about the AWS CLI, see the following resources:

- [AWS Command Line Interface](#)
- [AWS Command Line Interface User Guide for Version 2](#)
- [AWS Command Line Interface User Guide for Version 1](#)

# Create Amazon EC2 resources using AWS CloudFormation

Amazon EC2 is integrated with AWS CloudFormation, a service that helps you to model and set up your AWS resources so that you can spend less time creating and managing your resources and infrastructure. You create a template that describes the AWS resources that you need (such as instances and subnets), and AWS CloudFormation provisions and configures those resources for you.

When you use AWS CloudFormation, you can reuse your template to set up your Amazon EC2 resources consistently and repeatedly. Describe your resources once, and then provision the same resources over and over in multiple AWS accounts and Regions.

## Amazon EC2 and AWS CloudFormation templates

To provision and configure resources for Amazon EC2 and related services, you must understand [AWS CloudFormation templates](#). Templates are formatted text files in JSON or YAML. These templates describe the resources you'll provision in your AWS CloudFormation stacks. If you're unfamiliar with JSON or YAML, you can use AWS CloudFormation Designer to help you get started with AWS CloudFormation templates. For more information, see [What is AWS CloudFormation Designer?](#) in the *AWS CloudFormation User Guide*.

## Resources for Amazon EC2

### Compute resources

- [AWS::EC2::CapacityReservation](#)
- [AWS::EC2::CapacityReservationFleet](#)
- [AWS::EC2::EC2Fleet](#)
- [AWS::EC2::EC2Fleet](#)
- [AWS::EC2::Host](#)
- [AWS::EC2::Instance](#)
- [AWS::EC2::InstanceConnectEndpoint](#)
- [AWS::EC2::LaunchTemplate](#)
- [AWS::EC2::PlacementGroup](#)

- [AWS::EC2::SpotFleet](#)

## Networking resources

- [AWS::EC2::CarrierGateway](#)
- [AWS::EC2::ClientVpnAuthorizationRule](#)
- [AWS::EC2::ClientVpnEndpoint](#)
- [AWS::EC2::ClientVpnRoute](#)
- [AWS::EC2::ClientVpnTargetNetworkAssociation](#)
- [AWS::EC2::CustomerGateway](#)
- [AWS::EC2::DHCOptions](#)
- [AWS::EC2::EgressOnlyInternetGateway](#)
- [AWS::EC2::EIP](#)
- [AWS::EC2::EIPAssociation](#)
- [AWS::EC2::FlowLog](#)
- [AWS::EC2::GatewayRouteTableAssociation](#)
- [AWS::EC2::InternetGateway](#)
- [AWS::EC2::IPAM](#)
- [AWS::EC2::IPAMAllocation](#)
- [AWS::EC2::IPAMPool](#)
- [AWS::EC2::IPAMPoolCidr](#)
- [AWS::EC2::IPAMResourceDiscovery](#)
- [AWS::EC2::IPAMResourceDiscoveryAssociation](#)
- [AWS::EC2::IPAMScope](#)
- [AWS::EC2::LocalGatewayRoute](#)
- [AWS::EC2::LocalGatewayRouteTable](#)
- [AWS::EC2::LocalGatewayRouteTableVirtualInterfaceGroupAssociation](#)
- [AWS::EC2::LocalGatewayRouteTableVPCAssociation](#)
- [AWS::EC2::NatGateway](#)
- [AWS::EC2::NetworkInterface](#)
- [AWS::EC2::NetworkInsightsAccessScope](#)

- [AWS::EC2::NetworkInsightsAccessScopeAnalysis](#)
- [AWS::EC2::NetworkInsightsAnalysis](#)
- [AWS::EC2::NetworkInsightsPath](#)
- [AWS::EC2::NetworkInterfaceAttachment](#)
- [AWS::EC2::NetworkInterfacePermission](#)
- [AWS::EC2::NetworkPerformanceMetricSubscription](#)
- [AWS::EC2::PrefixList](#)
- [AWS::EC2::Route](#)
- [AWS::EC2::RouteTable](#)
- [AWS::EC2::Subnet](#)
- [AWS::EC2::SubnetCidrBlock](#)
- [AWS::EC2::SubnetNetworkAclAssociation](#)
- [AWS::EC2::SubnetRouteTableAssociation](#)
- [AWS::EC2::TrafficMirrorFilter](#)
- [AWS::EC2::TrafficMirrorFilterRule](#)
- [AWS::EC2::TrafficMirrorSession](#)
- [AWS::EC2::TrafficMirrorTarget](#)
- [AWS::EC2::TransitGateway](#)
- [AWS::EC2::TransitGatewayAttachment](#)
- [AWS::EC2::TransitGatewayConnect](#)
- [AWS::EC2::TransitGatewayMulticastDomain](#)
- [AWS::EC2::TransitGatewayMulticastDomainAssociation](#)
- [AWS::EC2::TransitGatewayMulticastGroupMember](#)
- [AWS::EC2::TransitGatewayMulticastGroupSource](#)
- [AWS::EC2::TransitGatewayPeeringAttachment](#)
- [AWS::EC2::TransitGatewayRoute](#)
- [AWS::EC2::TransitGatewayRouteTable](#)
- [AWS::EC2::TransitGatewayRouteTableAssociation](#)
- [AWS::EC2::TransitGatewayRouteTablePropagation](#)
- [AWS::EC2::TransitGatewayVpcAttachment](#)

- [AWS::EC2::VPC](#)
- [AWS::EC2::VPCCidrBlock](#)
- [AWS::EC2::VPCDHCOPTIONSAssociation](#)
- [AWS::EC2::VPCEndpoint](#)
- [AWS::EC2::VPCEndpointConnectionNotification](#)
- [AWS::EC2::VPCEndpointService](#)
- [AWS::EC2::VPCEndpointServicePermissions](#)
- [AWS::EC2::VPGatewayAttachment](#)
- [AWS::EC2::VPCPeeringConnection](#)
- [AWS::EC2::VPNConnection](#)
- [AWS::EC2::VPNConnectionRoute](#)
- [AWS::EC2::VPNGateway](#)
- [AWS::EC2::VPNGatewayRoutePropagation](#)

## Security resources

- [AWS::EC2::KeyPair](#)
- [AWS::EC2::NetworkAcl](#)
- [AWS::EC2::NetworkAclEntry](#)
- [AWS::EC2::SecurityGroup](#)
- [AWS::EC2::SecurityGroupEgress](#)
- [AWS::EC2::SecurityGroupIngress](#)
- [AWS::EC2::VerifiedAccessEndpoint](#)
- [AWS::EC2::VerifiedAccessGroup](#)
- [AWS::EC2::VerifiedAccessInstance](#)
- [AWS::EC2::VerifiedAccessTrustProvider](#)

## Storage resources

- [AWS::EC2::SnapshotBlockPublicAccess](#)
- [AWS::EC2::Volume](#)
- [AWS::EC2::VolumeAttachment](#)

## Learn more about AWS CloudFormation

To learn more about AWS CloudFormation, see the following resources:

- [AWS CloudFormation](#)
- [AWS CloudFormation User Guide](#)

# Create Amazon EC2 resources using an AWS SDK

AWS provides software development kits (SDK) for many popular programming languages. An SDK makes development more efficient by providing the following:

- Pre-built components and libraries that you can incorporate into your applications
- Language-specific tools, such as compilers and debuggers
- Cryptographic signing of service requests
- Request retries
- Error response handling

## Code examples for the Amazon EC2 API

The code examples provided by AWS show you how to use an API and accomplish specific tasks. For examples for the Amazon EC2 API, see [Code examples for Amazon EC2](#). For additional examples, see [Find code examples for the AWS SDKs](#) or [aws-doc-sdk-examples](#) on github.

## Learn more about the AWS SDKs

To learn more about the AWS SDKs, see the following resources:

- [AWS SDKs and Tools Reference Guide](#)
- [Tools to Build on AWS](#)
- [What is an SDK?](#)

# Low-level API for Amazon EC2

The low-level API for Amazon EC2 is the protocol-level interface for Amazon EC2. When using the low-level API, you must format every HTTPS request correctly and add a valid digital signature to every request. For more information, see [Making requests to the Amazon EC2 API](#) in the *Amazon EC2 API Reference*. Alternatively, you can use an AWS SDK, which constructs and signs the requests on your behalf. For more information, see [Using an AWS SDK](#).

The Amazon EC2 API consists of actions and data types for multiple services. To view the actions for each service, see the following pages in the *Amazon EC2 API Reference*.

- [AWS Client VPN actions](#)
- [Amazon EBS actions](#)
- [Amazon EC2 actions](#)
- [AWS Network Manager actions](#)
- [AWS Nitro Enclaves actions](#)
- [AWS Outposts actions](#)
- [AWS PrivateLink actions](#)
- [Recycle Bin actions](#)
- [AWS Site-to-Site VPNACTIONS](#)
- [AWS Transit Gateway actions](#)
- [AWS Verified Access actions](#)
- [VM Import/Export actions](#)
- [Amazon VPC actions](#)
- [Amazon VPC IPAM actions](#)
- [AWS Wavelength actions](#)

# Generate code for your console actions using Console-to-Code

## Note

Console-to-Code is in preview release for Amazon EC2 and is subject to change. Available only in the US East (N. Virginia) Region.

The console provides a guided path for creating resources and testing prototypes. If you want to create the same resources at scale, you'll need automation code. Console-to-Code is a feature of the Amazon EC2 console that can help you get started with your automation code. Console-to-Code records your console actions, including default values and compatible parameters. It then uses generative AI to suggest code in your preferred infrastructure-as-code (IaC) format for the actions you want. You can use the code as a starting point, customizing it to make it production-ready for your specific use case.

## Pricing

There is no additional cost for using Console-to-Code.

## How it works

Console-to-Code can help you get started with your automation code, as follows:

1. You perform actions in the console, such as launching an instance or enabling detailed monitoring.
2. Console-to-Code records all your actions, including all the default settings and compatible parameters that the console provides.
3. You choose the actions that you want to use in your automation scripts. These can be mutating or read-only (non-mutating) actions, or both types of actions.
4. Console-to-Code generates code in your desired infrastructure-as-code (IaC) format, for example, TypeScript.
5. You copy the code to use in your code development tool or download it to share.

6. You then use the code as a starting point for your automation scripts. You'll need to validate that the code meets your intent and that the parameters will configure your resources as expected. You'll need to customize the code to make it production-ready for your use case. Once you're satisfied with the code, you can use it in your automation scripts.

For the instructions on how to use Console-to-Code in the Amazon EC2 console, see [Use Console-to-Code](#).

## Limitations

The following limitations apply when using Console-to-Code.

## Supported Regions

Currently only available in the US East (N. Virginia) Region.

## Supported code formats

Console-to-Code can currently generate infrastructure-as-code (IaC) in the following code formats:

- CDK Java
- CDK Python
- CDK TypeScript
- CloudFormation JSON
- CloudFormation YAML

## Retained actions

- **Current session:** Only actions taken during the current session are displayed in the **Recorded actions** table. Actions taken during previous sessions are not retained.
- **Browser refresh:** Recorded actions are lost when you refresh the browser tab.
- **Tab isolation:** The **Recorded actions** table is specific to the browser tab in which the actions were taken. Actions performed in one tab are not visible in the **Recorded actions** table in another tab.

## Recorded actions table

The following table lists and describes the columns in the **Recorded actions** table in the Console-to-Code console.

Title	Description
<b>Console page</b>	The console page on which the action was performed.
<b>Operation</b>	The API operation.
<b>Type</b>	<p>The type of action.</p> <ul style="list-style-type: none"><li>• <b>Mutating</b> – API actions that create, modify, or delete resources.</li><li>• <b>Read only</b> – API actions that retrieve data about resources (generally all <code>Describe*</code> actions).</li></ul>
<b>CLI command</b>	Details about the action that was taken, including the parameters and values.
<b>Creation time</b>	The time the action was taken.

## Use Console-to-Code

Use the following instructions to generate code using Console-to-Code in the Amazon EC2 console.

To view an animation of these steps, see [View an animation: Generate code using Console-to-Code in the Amazon EC2 console](#).

### To generate code using Console-to-Code

1. Open the Amazon EC2 console in the US East (N. Virginia) Region at <https://console.aws.amazon.com/ec2/home?region=us-east-1>.

 **Note**

Console-to-Code is in preview release and currently only available in the US East (N. Virginia) Region. Only actions performed in this Region will be recorded.

2. Use the console to create resources and test prototypes. For example, use the console to configure and launch instances and enable detailed monitoring.

Console-to-Code records every action that you perform.

3. In the left navigation pane, choose **Console-to-Code**.
4. In the **Recorded actions** table, review your actions that were recorded, and decide which actions to include for code generation.

- Use the search field to filter the table by a specific console page or action. As you start to type, the table is filtered.
- Use the **Type** drop-down to filter by all actions, mutating actions, or read-only actions.

 **Note**

Only actions taken during the current session are listed. For more information, see [Retained actions](#).

5. Select the check box next to each action for which you require code to be generated.

 **Note**

Up to 5 actions can be selected at one time.

6. Choose the **Generate {code} code** button.

The button label defaults to the last-selected code format. To select a different code format, choose the arrow next to the button.

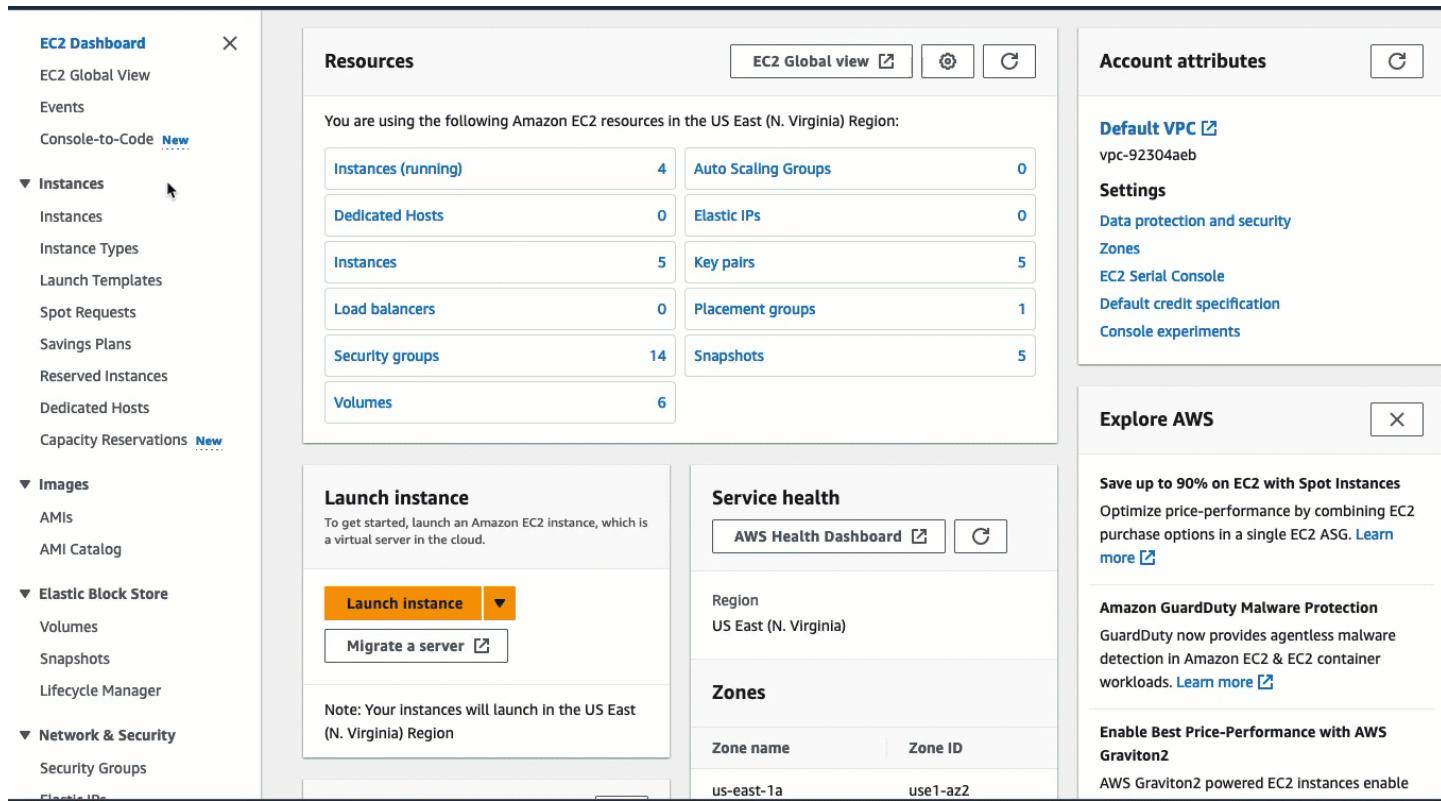
7. Under **Review code**, choose **Copy** to copy the code to use in your development tool or **Download** to download the file for sharing.
8. Use the code as a starting point for your infrastructure-as-code. You'll need to customize the code to make it production-ready for your specific use case.

### Note

If you find that the code is not production ready, please provide us with feedback on how it can be improved (see the following step 9). AWS Support can't assist you with the generated code or your customized code development.

9. (Optional) Choose the thumbs-up or thumbs-down to let us know if Console-to-Code helped. If you choose the thumbs-down, you can then choose **Provide feedback** to tell us how we can improve the code to better help you.

## View an animation: Generate code using Console-to-Code in the Amazon EC2 console



The screenshot shows the Amazon EC2 Dashboard. On the left, there's a navigation sidebar with links like EC2 Dashboard, EC2 Global View, Events, Console-to-Code (which is highlighted), Instances, Images, Elastic Block Store, Network & Security, and a few others. The main content area has three main sections: 'Resources' (listing running instances, auto scaling groups, dedicated hosts, elastic IPs, instances, key pairs, load balancers, placement groups, security groups, snapshots, and volumes), 'Launch instance' (with a prominent 'Launch instance' button and a 'Migrate a server' link), and 'Service health' (showing the AWS Health Dashboard and region information for US East (N. Virginia)). To the right, there's a 'Account attributes' section with details about the Default VPC (vpc-92304aeb) and various settings like Data protection and security, Zones, EC2 Serial Console, Default credit specification, and Console experiments. Below that is an 'Explore AWS' section with a promotion for Spot Instances and links to GuardDuty Malware Protection, Best Price-Performance with AWS Graviton2, and Graviton2 powered EC2 instances.

# Code examples for Amazon EC2 using AWS SDKs

The following code examples show how to use Amazon EC2 with an AWS software development kit (SDK).

*Actions* are code excerpts from larger programs and must be run in context. While actions show you how to call individual service functions, you can see actions in context in their related scenarios and cross-service examples.

*Scenarios* are code examples that show you how to accomplish a specific task by calling multiple functions within the same service.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Get started

### Hello Amazon EC2

The following code examples show how to get started using Amazon EC2.

#### .NET

##### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
namespace EC2Actions;

public class HelloEc2
{
    /// <summary>
    /// HelloEc2 lists the existing security groups for the default users.
}
```

```
/// </summary>
/// <param name="args">Command line arguments</param>
/// <returns>A Task object.</returns>
static async Task Main(string[] args)
{
    // Set up dependency injection for Amazon Elastic Compute Cloud (Amazon
    EC2).

    using var host =
        Microsoft.Extensions.Hosting.Host.CreateDefaultBuilder(args)
            .ConfigureServices((_, services) =>
                services.AddAWSService<IAmazonEC2>()
                    .AddTransient<EC2Wrapper>()
            )
            .Build();

    // Now the client is available for injection.
    var ec2Client = host.Services.GetRequiredService<IAmazonEC2>();

    var request = new DescribeSecurityGroupsRequest
    {
        MaxResults = 10,
    };

    // Retrieve information about up to 10 Amazon EC2 security groups.
    var response = await ec2Client.DescribeSecurityGroupsAsync(request);

    // Now print the security groups returned by the call to
    // DescribeSecurityGroupsAsync.
    Console.WriteLine("Security Groups:");
    response.SecurityGroups.ForEach(group =>
    {
        Console.WriteLine($"Security group: {group.GroupName} ID:
{group.GroupId}");
    });
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for .NET API Reference*.

## C++

## SDK for C++

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Code for the CMakeLists.txt CMake file.

```
# Set the minimum required version of CMake for this project.
cmake_minimum_required(VERSION 3.13)

# Set the AWS service components used by this project.
set(SERVICE_COMPONENTS ec2)

# Set this project's name.
project("hello_ec2")

# Set the C++ standard to use to build this target.
# At least C++ 11 is required for the AWS SDK for C++.
set(CMAKE_CXX_STANDARD 11)

# Use the MSVC variable to determine if this is a Windows build.
set(WINDOWS_BUILD ${MSVC})

if (WINDOWS_BUILD) # Set the location where CMake can find the installed
  libraries for the AWS SDK.
  string(REPLACE ";" "/aws-cpp-sdk-all;" SYSTEM_MODULE_PATH
    "${CMAKE_SYSTEM_PREFIX_PATH}/aws-cpp-sdk-all")
  list(APPEND CMAKE_PREFIX_PATH ${SYSTEM_MODULE_PATH})
endif ()

# Find the AWS SDK for C++ package.
find_package(AWSSDK REQUIRED COMPONENTS ${SERVICE_COMPONENTS})

if (WINDOWS_BUILD AND AWSSDK_INSTALL_AS_SHARED_LIBS)
  # Copy relevant AWS SDK for C++ libraries into the current binary directory
  # for running and debugging.
```

```
# set(BIN_SUB_DIR "/Debug") # If you are building from the command line, you
may need to uncomment this
                                # and set the proper subdirectory to the
executables' location.

AWSSDK_CPY_DYN_LIBS(SERVICE_COMPONENTS """
${CMAKE_CURRENT_BINARY_DIR}${BIN_SUB_DIR})
endif ()

add_executable(${PROJECT_NAME}
    hello_ec2.cpp)

target_link_libraries(${PROJECT_NAME}
    ${AWSSDK_LINK_LIBRARIES})
```

Code for the hello\_ec2.cpp source file.

```
#include <aws/core/Aws.h>
#include <aws/ec2/EC2Client.h>
#include <aws/ec2/model/DescribeInstancesRequest.h>
#include <iomanip>
#include <iostream>

/*
 * A "Hello EC2" starter application which initializes an Amazon Elastic Compute
Cloud (Amazon EC2) client and describes
 * the Amazon EC2 instances.
 *
 * main function
 *
 * Usage: 'hello_ec2'
 */
int main(int argc, char **argv) {
    (void)argc;
    (void)argv;

    Aws::SDKOptions options;
    // Optionally change the log level for debugging.
//    options.loggingOptions.logLevel = Utils::Logging::LogLevel::Debug;
    Aws::InitAPI(options); // Should only be called once.
```

```
int result = 0;
{
    Aws::Client::ClientConfiguration clientConfig;
    // Optional: Set to the AWS Region (overrides config file).
    // clientConfig.region = "us-east-1";

    Aws::EC2::EC2Client ec2Client(clientConfig);
    Aws::EC2::Model::DescribeInstancesRequest request;
    bool header = false;
    bool done = false;
    while (!done) {
        Aws::EC2::Model::DescribeInstancesOutcome outcome =
ec2Client.DescribeInstances(request);
        if (outcome.IsSuccess()) {
            if (!header) {
                std::cout << std::left <<
                    std::setw(48) << "Name" <<
                    std::setw(20) << "ID" <<
                    std::setw(25) << "Ami" <<
                    std::setw(15) << "Type" <<
                    std::setw(15) << "State" <<
                    std::setw(15) << "Monitoring" << std::endl;
                header = true;
            }
            const std::vector<Aws::EC2::Model::Reservation> &reservations =
                outcome.GetResult().GetReservations();

            for (const auto &reservation: reservations) {
                const std::vector<Aws::EC2::Model::Instance> &instances =
                    reservation.GetInstances();
                for (const auto &instance: instances) {
                    Aws::String instanceStateString =
                        Aws::EC2::Model::InstanceStateNameMapper::GetNameForInstanceStateName(
                            instance.GetState().GetName());

                    Aws::String typeString =
                        Aws::EC2::Model::InstanceTypeMapper::GetNameForInstanceType(
                            instance.GetInstanceType());

                    Aws::String monitorString =

```

```
Aws::EC2::Model::MonitoringStateMapper::GetNameForMonitoringState(
    instance.GetMonitoring().GetState());
Aws::String name = "Unknown";

const std::vector<Aws::EC2::Model::Tag> &tags =
instance.GetTags();
auto nameIter = std::find_if(tags.cbegin(), tags.cend(),
[](const
Aws::EC2::Model::Tag &tag) {
    return tag.GetKey() ==
"Name";
});
if (nameIter != tags.cend()) {
    name = nameIter->GetValue();
}
std::cout <<
    std::setw(48) << name <<
    std::setw(20) << instance.GetInstanceId() <<
    std::setw(25) << instance.GetImageId() <<
    std::setw(15) << typeString <<
    std::setw(15) << instanceStateString <<
    std::setw(15) << monitorString << std::endl;
}
}

if (!outcome.GetResult().GetNextToken().empty()) {
    request.SetNextToken(outcome.GetResult().GetNextToken());
} else {
    done = true;
}
} else {
    std::cerr << "Failed to describe EC2 instances:" <<
        outcome.GetError().GetMessage() << std::endl;
result = 1;
break;
}
}

Aws::ShutdownAPI(options); // Should only be called once.
return result;
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for C++ API Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void describeSecurityGroups(Ec2Client ec2, String groupId) {  
    try {  
        DescribeSecurityGroupsRequest request =  
DescribeSecurityGroupsRequest.builder()  
            .groupIds(groupId)  
            .build();  
  
        // Use a paginator.  
        DescribeSecurityGroupsIterable listGroups =  
ec2.describeSecurityGroupsPaginator(request);  
        listGroups.stream()  
            .flatMap(r -> r.securityGroups().stream())  
            .forEach(group -> System.out  
                .println(" Group id: " +group.groupId() + " group name = " +  
group.groupName()));  
  
    } catch (Ec2Exception e) {  
        System.err.println(e.awsErrorDetails().errorMessage());  
        System.exit(1);  
    }  
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeSecurityGroupsCommand } from "@aws-sdk/client-ec2";

import { client } from "./libs/client.js";

// Call DescribeSecurityGroups and display the result.
export const main = async () => {
  try {
    const { SecurityGroups } = await client.send(
      new DescribeSecurityGroupsCommand({}),
    );

    const securityGroupList = SecurityGroups.slice(0, 9)
      .map((sg) => ` • ${sg.GroupId}: ${sg.GroupName}`)
      .join("\n");

    console.log(
      "Hello, Amazon EC2! Let's list up to 10 of your security groups:",
    );
    console.log(securityGroupList);
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun describeEC2SecurityGroups(groupId: String) {  
    val request =  
        DescribeSecurityGroupsRequest {  
            groupIds = listOf(groupId)  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
  
        val response = ec2.describeSecurityGroups(request)  
        response.securityGroups?.forEach { group ->  
            println("Found Security Group with id ${group.groupId}, vpc id  
${group.vpcId} and description ${group.description}")  
        }  
    }  
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Kotlin API reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import boto3
```

```
def hello_ec2(ec2_resource):
    """
    Use the AWS SDK for Python (Boto3) to create an Amazon Elastic Compute Cloud
    (Amazon EC2) resource and list the security groups in your account.
    This example uses the default settings specified in your shared credentials
    and config files.

    :param ec2_resource: A Boto3 EC2 ServiceResource object. This object is a
    high-level
                           resource that wraps the low-level EC2 service API.
    """
    print("Hello, Amazon EC2! Let's list up to 10 of your security groups:")
    for sg in ec2_resource.security_groups.limit(10):
        print(f"\t{sg.id}: {sg.group_name}")

if __name__ == "__main__":
    hello_ec2(boto3.resource("ec2"))
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require 'aws-sdk-ec2'
require 'logger'

# EC2Manager is a class responsible for managing EC2 operations
# such as listing all EC2 instances in the current AWS account.
class EC2Manager
  def initialize(client)
```

```
  @client = client
  @logger = Logger.new($stdout)
end

# Lists and prints all EC2 instances in the current AWS account.
def list_instances
  @logger.info('Listing instances')

  instances = fetch_instances

  if instances.empty?
    @logger.info('You have no instances')
  else
    print_instances(instances)
  end
end

private

# Fetches all EC2 instances using pagination.
#
# @return [Array<Aws::EC2::Types::Instance>] List of EC2 instances.
def fetch_instances
  paginator = @client.describe_instances
  instances = []

  paginator.each_page do |page|
    page.reservations.each do |reservation|
      reservation.instances.each do |instance|
        instances << instance
      end
    end
  end

  instances
end

# Prints details of the given EC2 instances.
#
# @param instances [Array<Aws::EC2::Types::Instance>] List of EC2 instances to
#   print.
def print_instances(instances)
  instances.each do |instance|
    @logger.info("Instance ID: #{instance.instance_id}")
  end
end
```

```
    @logger.info("Instance Type: #{instance.instance_type}")
    @logger.info("Public IP: #{instance.public_ip_address}")
    @logger.info("Public DNS Name: #{instance.public_dns_name}")
    @logger.info("\n")
  end
end
end

if $PROGRAM_NAME == __FILE__
  ec2_client = Aws::EC2::Client.new(region: 'us-west-2')
  manager = EC2Manager.new(ec2_client)
  manager.list_instances
end
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
async fn show_security_groups(client: &aws_sdk_ec2::Client, group_ids: Vec<String>) {
    let response = client
        .describe_security_groups()
        .set_group_ids(Some(group_ids))
        .send()
        .await;

    match response {
        Ok(output) => {
            for group in output.security_groups() {
                println!(
                    "Found Security Group {} ({}), vpc id {} and description {}",
                    group.group_name().unwrap_or("unknown"),
                    group.id(),
                    group.vpc_id(),
                    group.description()
                );
            }
        }
    }
}
```

```
        group.group_id().unwrap_or("id-unknown"),
        group.vpc_id().unwrap_or("vpcid-unknown"),
        group.description().unwrap_or("(none)")
    );
}
}

Err(err) => {
    let err = err.into_service_error();
    let meta = err.meta();
    let message = meta.message().unwrap_or("unknown");
    let code = meta.code().unwrap_or("unknown");
    eprintln!("Error listing EC2 Security Groups: ({code}) {message}");
}
}
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Rust API reference*.

## Code examples

- [Actions for Amazon EC2 using AWS SDKs](#)

- [Use AcceptVpcPeeringConnection with an AWS SDK or CLI](#)
- [Use AllocateAddress with an AWS SDK or CLI](#)
- [Use AllocateHosts with an AWS SDK or CLI](#)
- [Use AssignPrivateIpAddresses with an AWS SDK or CLI](#)
- [Use AssociateAddress with an AWS SDK or CLI](#)
- [Use AssociateDhcpOptions with an AWS SDK or CLI](#)
- [Use AssociateRouteTable with an AWS SDK or CLI](#)
- [Use AttachInternetGateway with an AWS SDK or CLI](#)
- [Use AttachNetworkInterface with an AWS SDK or CLI](#)
- [Use AttachVolume with an AWS SDK or CLI](#)
- [Use AttachVpnGateway with an AWS SDK or CLI](#)
- [Use AuthorizeSecurityGroupEgress with an AWS SDK or CLI](#)
- [Use AuthorizeSecurityGroupIngress with an AWS SDK or CLI](#)
- [Use CancelCapacityReservation with an AWS SDK or CLI](#)
- [Use CancelImportTask with an AWS SDK or CLI](#)

- [Use CancelSpotFleetRequests with an AWS SDK or CLI](#)
- [Use CancelSpotInstanceRequests with an AWS SDK or CLI](#)
- [Use ConfirmProductInstance with an AWS SDK or CLI](#)
- [Use CopyImage with an AWS SDK or CLI](#)
- [Use CopySnapshot with an AWS SDK or CLI](#)
- [Use CreateCapacityReservation with an AWS SDK or CLI](#)
- [Use CreateCustomerGateway with an AWS SDK or CLI](#)
- [Use CreateDhcpOptions with an AWS SDK or CLI](#)
- [Use CreateFlowLogs with an AWS SDK or CLI](#)
- [Use CreateImage with an AWS SDK or CLI](#)
- [Use CreateInstanceExportTask with an AWS SDK or CLI](#)
- [Use CreateInternetGateway with an AWS SDK or CLI](#)
- [Use CreateKeyPair with an AWS SDK or CLI](#)
- [Use CreateLaunchTemplate with an AWS SDK or CLI](#)
- [Use CreateNetworkAcl with an AWS SDK or CLI](#)
- [Use CreateNetworkAclEntry with an AWS SDK or CLI](#)
- [Use CreateNetworkInterface with an AWS SDK or CLI](#)
- [Use CreatePlacementGroup with an AWS SDK or CLI](#)
- [Use CreateRoute with an AWS SDK or CLI](#)
- [Use CreateRouteTable with an AWS SDK or CLI](#)
- [Use CreateSecurityGroup with an AWS SDK or CLI](#)
- [Use CreateSnapshot with an AWS SDK or CLI](#)
- [Use CreateSpotDatafeedSubscription with an AWS SDK or CLI](#)
- [Use CreateSubnet with an AWS SDK or CLI](#)
- [Use CreateTags with an AWS SDK or CLI](#)
- [Use CreateVolume with an AWS SDK or CLI](#)
- [Use CreateVpc with an AWS SDK or CLI](#)
- [Use CreateVpcEndpoint with an AWS SDK or CLI](#)
- [Use CreateVpnConnection with an AWS SDK or CLI](#)
- [Use CreateVpnConnectionRoute with an AWS SDK or CLI](#)

- [Use CreateVpnGateway with an AWS SDK or CLI](#)
- [Use DeleteCustomerGateway with an AWS SDK or CLI](#)
- [Use DeleteDhcpOptions with an AWS SDK or CLI](#)
- [Use DeleteFlowLogs with an AWS SDK or CLI](#)
- [Use DeleteInternetGateway with an AWS SDK or CLI](#)
- [Use DeleteKeyPair with an AWS SDK or CLI](#)
- [Use DeleteLaunchTemplate with an AWS SDK or CLI](#)
- [Use DeleteNetworkAcl with an AWS SDK or CLI](#)
- [Use DeleteNetworkAclEntry with an AWS SDK or CLI](#)
- [Use DeleteNetworkInterface with an AWS SDK or CLI](#)
- [Use DeletePlacementGroup with an AWS SDK or CLI](#)
- [Use DeleteRoute with an AWS SDK or CLI](#)
- [Use DeleteRouteTable with an AWS SDK or CLI](#)
- [Use DeleteSecurityGroup with an AWS SDK or CLI](#)
- [Use DeleteSnapshot with an AWS SDK or CLI](#)
- [Use DeleteSpotDatafeedSubscription with an AWS SDK or CLI](#)
- [Use DeleteSubnet with an AWS SDK or CLI](#)
- [Use DeleteTags with an AWS SDK or CLI](#)
- [Use DeleteVolume with an AWS SDK or CLI](#)
- [Use DeleteVpc with an AWS SDK or CLI](#)
- [Use DeleteVpnConnection with an AWS SDK or CLI](#)
- [Use DeleteVpnConnectionRoute with an AWS SDK or CLI](#)
- [Use DeleteVpnGateway with an AWS SDK or CLI](#)
- [Use DeregisterImage with an AWS SDK or CLI](#)
- [Use DescribeAccountAttributes with an AWS SDK or CLI](#)
- [Use DescribeAddresses with an AWS SDK or CLI](#)
- [Use DescribeAvailabilityZones with an AWS SDK or CLI](#)
- [Use DescribeBundleTasks with an AWS SDK or CLI](#)
- [Use DescribeCapacityReservations with an AWS SDK or CLI](#)
- [Use DescribeCustomerGateways with an AWS SDK or CLI](#)

- [Use DescribeDhcpOptions with an AWS SDK or CLI](#)
- [Use DescribeFlowLogs with an AWS SDK or CLI](#)
- [Use DescribeHostReservationOfferings with an AWS SDK or CLI](#)
- [Use DescribeHosts with an AWS SDK or CLI](#)
- [Use DescribeIamInstanceProfileAssociations with an AWS SDK or CLI](#)
- [Use DescribeIdFormat with an AWS SDK or CLI](#)
- [Use DescribeIdentityFormat with an AWS SDK or CLI](#)
- [Use DescribeImageAttribute with an AWS SDK or CLI](#)
- [Use DescribeImages with an AWS SDK or CLI](#)
- [Use DescribeImportImageTasks with an AWS SDK or CLI](#)
- [Use DescribeImportSnapshotTasks with an AWS SDK or CLI](#)
- [Use DescribeInstanceAttribute with an AWS SDK or CLI](#)
- [Use DescribeInstanceState with an AWS SDK or CLI](#)
- [Use DescribeInstanceTypes with an AWS SDK or CLI](#)
- [Use DescribeInstances with an AWS SDK or CLI](#)
- [Use DescribeInternetGateways with an AWS SDK or CLI](#)
- [Use DescribeKeyPairs with an AWS SDK or CLI](#)
- [Use DescribeNetworkAcls with an AWS SDK or CLI](#)
- [Use DescribeNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use DescribeNetworkInterfaces with an AWS SDK or CLI](#)
- [Use DescribePlacementGroups with an AWS SDK or CLI](#)
- [Use DescribePrefixLists with an AWS SDK or CLI](#)
- [Use DescribeRegions with an AWS SDK or CLI](#)
- [Use DescribeRouteTables with an AWS SDK or CLI](#)
- [Use DescribeScheduledInstanceIdAvailability with an AWS SDK or CLI](#)
- [Use DescribeScheduledInstances with an AWS SDK or CLI](#)
- [Use DescribeSecurityGroups with an AWS SDK or CLI](#)
- [Use DescribeSnapshotAttribute with an AWS SDK or CLI](#)
- [Use DescribeSnapshots with an AWS SDK or CLI](#)
- [Use DescribeSpotDatafeedSubscription with an AWS SDK or CLI](#)

- [Use DescribeSpotFleetInstances with an AWS SDK or CLI](#)
- [Use DescribeSpotFleetRequestHistory with an AWS SDK or CLI](#)
- [Use DescribeSpotFleetRequests with an AWS SDK or CLI](#)
- [Use DescribeSpotInstanceRequests with an AWS SDK or CLI](#)
- [Use DescribeSpotPriceHistory with an AWS SDK or CLI](#)
- [Use DescribeSubnets with an AWS SDK or CLI](#)
- [Use DescribeTags with an AWS SDK or CLI](#)
- [Use DescribeVolumeAttribute with an AWS SDK or CLI](#)
- [Use DescribeVolumeStatus with an AWS SDK or CLI](#)
- [Use DescribeVolumes with an AWS SDK or CLI](#)
- [Use DescribeVpcAttribute with an AWS SDK or CLI](#)
- [Use DescribeVpcClassicLink with an AWS SDK or CLI](#)
- [Use DescribeVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use DescribeVpcEndpointServices with an AWS SDK or CLI](#)
- [Use DescribeVpcEndpoints with an AWS SDK or CLI](#)
- [Use DescribeVpcs with an AWS SDK or CLI](#)
- [Use DescribeVpnConnections with an AWS SDK or CLI](#)
- [Use DescribeVpnGateways with an AWS SDK or CLI](#)
- [Use DetachInternetGateway with an AWS SDK or CLI](#)
- [Use DetachNetworkInterface with an AWS SDK or CLI](#)
- [Use DetachVolume with an AWS SDK or CLI](#)
- [Use DetachVpnGateway with an AWS SDK or CLI](#)
- [Use DisableVgwRoutePropagation with an AWS SDK or CLI](#)
- [Use DisableVpcClassicLink with an AWS SDK or CLI](#)
- [Use DisableVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use DisassociateAddress with an AWS SDK or CLI](#)
- [Use DisassociateRouteTable with an AWS SDK or CLI](#)
- [Use EnableVgwRoutePropagation with an AWS SDK or CLI](#)
- [Use EnableVolume with an AWS SDK or CLI](#)
- [Use EnableVpcClassicLink with an AWS SDK or CLI](#)

- [Use EnableVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use GetConsoleOutput with an AWS SDK or CLI](#)
- [Use GetHostReservationPurchasePreview with an AWS SDK or CLI](#)
- [Use GetPasswordData with an AWS SDK or CLI](#)
- [Use ImportImage with an AWS SDK or CLI](#)
- [Use ImportKeyPair with an AWS SDK or CLI](#)
- [Use ImportSnapshot with an AWS SDK or CLI](#)
- [Use ModifyCapacityReservation with an AWS SDK or CLI](#)
- [Use ModifyHosts with an AWS SDK or CLI](#)
- [Use ModifyIdFormat with an AWS SDK or CLI](#)
- [Use ModifyImageAttribute with an AWS SDK or CLI](#)
- [Use ModifyInstanceAttribute with an AWS SDK or CLI](#)
- [Use ModifyInstanceStateSpecification with an AWS SDK or CLI](#)
- [Use ModifyNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use ModifyReservedInstances with an AWS SDK or CLI](#)
- [Use ModifySnapshotAttribute with an AWS SDK or CLI](#)
- [Use ModifySpotFleetRequest with an AWS SDK or CLI](#)
- [Use ModifySubnetAttribute with an AWS SDK or CLI](#)
- [Use ModifyVolumeAttribute with an AWS SDK or CLI](#)
- [Use ModifyVpcAttribute with an AWS SDK or CLI](#)
- [Use MonitorInstances with an AWS SDK or CLI](#)
- [Use MoveAddressToVpc with an AWS SDK or CLI](#)
- [Use PurchaseHostReservation with an AWS SDK or CLI](#)
- [Use PurchaseScheduledInstances with an AWS SDK or CLI](#)
- [Use RebootInstances with an AWS SDK or CLI](#)
- [Use RegisterImage with an AWS SDK or CLI](#)
- [Use RejectVpcPeeringConnection with an AWS SDK or CLI](#)
- [Use ReleaseAddress with an AWS SDK or CLI](#)
- [Use ReleaseHosts with an AWS SDK or CLI](#)
- [Use ReplaceIamInstanceProfileAssociation with an AWS SDK or CLI](#)

- [Use ReplaceNetworkAclAssociation with an AWS SDK or CLI](#)
- [Use ReplaceNetworkAclEntry with an AWS SDK or CLI](#)
- [Use ReplaceRoute with an AWS SDK or CLI](#)
- [Use ReplaceRouteTableAssociation with an AWS SDK or CLI](#)
- [Use ReportInstanceStatus with an AWS SDK or CLI](#)
- [Use RequestSpotFleet with an AWS SDK or CLI](#)
- [Use RequestSpotInstances with an AWS SDK or CLI](#)
- [Use ResetImageAttribute with an AWS SDK or CLI](#)
- [Use ResetInstanceAttribute with an AWS SDK or CLI](#)
- [Use ResetNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use ResetSnapshotAttribute with an AWS SDK or CLI](#)
- [Use RevokeSecurityGroupEgress with an AWS SDK or CLI](#)
- [Use RevokeSecurityGroupIngress with an AWS SDK or CLI](#)
- [Use RunInstances with an AWS SDK or CLI](#)
- [Use RunScheduledInstances with an AWS SDK or CLI](#)
- [Use StartInstances with an AWS SDK or CLI](#)
- [Use StopInstances with an AWS SDK or CLI](#)
- [Use TerminateInstances with an AWS SDK or CLI](#)
- [Use UnassignPrivateIpAddresses with an AWS SDK or CLI](#)
- [Use UnmonitorInstances with an AWS SDK or CLI](#)
- [Scenarios for Amazon EC2 using AWS SDKs](#)
  - [Build and manage a resilient service using an AWS SDK](#)
  - [Get started with Amazon EC2 instances using an AWS SDK](#)

## Actions for Amazon EC2 using AWS SDKs

The following code examples demonstrate how to perform individual Amazon EC2 actions with AWS SDKs. These excerpts call the Amazon EC2 API and are code excerpts from larger programs that must be run in context. Each example includes a link to GitHub, where you can find instructions for setting up and running the code.

The following examples include only the most commonly used actions. For a complete list, see the [Amazon Elastic Compute Cloud \(Amazon EC2\) API Reference](#).

## Examples

- [Use AcceptVpcPeeringConnection with an AWS SDK or CLI](#)
- [Use AllocateAddress with an AWS SDK or CLI](#)
- [Use AllocateHosts with an AWS SDK or CLI](#)
- [Use AssignPrivateIpAddresses with an AWS SDK or CLI](#)
- [Use AssociateAddress with an AWS SDK or CLI](#)
- [Use AssociateDhcpOptions with an AWS SDK or CLI](#)
- [Use AssociateRouteTable with an AWS SDK or CLI](#)
- [Use AttachInternetGateway with an AWS SDK or CLI](#)
- [Use AttachNetworkInterface with an AWS SDK or CLI](#)
- [Use AttachVolume with an AWS SDK or CLI](#)
- [Use AttachVpnGateway with an AWS SDK or CLI](#)
- [Use AuthorizeSecurityGroupEgress with an AWS SDK or CLI](#)
- [Use AuthorizeSecurityGroupIngress with an AWS SDK or CLI](#)
- [Use CancelCapacityReservation with an AWS SDK or CLI](#)
- [Use CancelImportTask with an AWS SDK or CLI](#)
- [Use CancelSpotFleetRequests with an AWS SDK or CLI](#)
- [Use CancelSpotInstanceRequests with an AWS SDK or CLI](#)
- [Use ConfirmProductInstance with an AWS SDK or CLI](#)
- [Use CopyImage with an AWS SDK or CLI](#)
- [Use CopySnapshot with an AWS SDK or CLI](#)
- [Use CreateCapacityReservation with an AWS SDK or CLI](#)
- [Use CreateCustomerGateway with an AWS SDK or CLI](#)
- [Use CreateDhcpOptions with an AWS SDK or CLI](#)
- [Use CreateFlowLogs with an AWS SDK or CLI](#)
- [Use CreateImage with an AWS SDK or CLI](#)
- [Use CreateInstanceExportTask with an AWS SDK or CLI](#)

- [Use CreateInternetGateway with an AWS SDK or CLI](#)
- [Use CreateKeyPair with an AWS SDK or CLI](#)
- [Use CreateLaunchTemplate with an AWS SDK or CLI](#)
- [Use CreateNetworkAcl with an AWS SDK or CLI](#)
- [Use CreateNetworkAclEntry with an AWS SDK or CLI](#)
- [Use CreateNetworkInterface with an AWS SDK or CLI](#)
- [Use CreatePlacementGroup with an AWS SDK or CLI](#)
- [Use CreateRoute with an AWS SDK or CLI](#)
- [Use CreateRouteTable with an AWS SDK or CLI](#)
- [Use CreateSecurityGroup with an AWS SDK or CLI](#)
- [Use CreateSnapshot with an AWS SDK or CLI](#)
- [Use CreateSpotDatafeedSubscription with an AWS SDK or CLI](#)
- [Use CreateSubnet with an AWS SDK or CLI](#)
- [Use CreateTags with an AWS SDK or CLI](#)
- [Use CreateVolume with an AWS SDK or CLI](#)
- [Use CreateVpc with an AWS SDK or CLI](#)
- [Use CreateVpcEndpoint with an AWS SDK or CLI](#)
- [Use CreateVpnConnection with an AWS SDK or CLI](#)
- [Use CreateVpnConnectionRoute with an AWS SDK or CLI](#)
- [Use CreateVpnGateway with an AWS SDK or CLI](#)
- [Use DeleteCustomerGateway with an AWS SDK or CLI](#)
- [Use DeleteDhcpOptions with an AWS SDK or CLI](#)
- [Use DeleteFlowLogs with an AWS SDK or CLI](#)
- [Use DeleteInternetGateway with an AWS SDK or CLI](#)
- [Use DeleteKeyPair with an AWS SDK or CLI](#)
- [Use DeleteLaunchTemplate with an AWS SDK or CLI](#)
- [Use DeleteNetworkAcl with an AWS SDK or CLI](#)
- [Use DeleteNetworkAclEntry with an AWS SDK or CLI](#)

- [Use DeleteNetworkInterface with an AWS SDK or CLI](#)
- [Use DeletePlacementGroup with an AWS SDK or CLI](#)
- [Use DeleteRoute with an AWS SDK or CLI](#)
- [Use DeleteRouteTable with an AWS SDK or CLI](#)
- [Use DeleteSecurityGroup with an AWS SDK or CLI](#)
- [Use DeleteSnapshot with an AWS SDK or CLI](#)
- [Use DeleteSpotDatafeedSubscription with an AWS SDK or CLI](#)
- [Use DeleteSubnet with an AWS SDK or CLI](#)
- [Use DeleteTags with an AWS SDK or CLI](#)
- [Use DeleteVolume with an AWS SDK or CLI](#)
- [Use DeleteVpc with an AWS SDK or CLI](#)
- [Use DeleteVpnConnection with an AWS SDK or CLI](#)
- [Use DeleteVpnConnectionRoute with an AWS SDK or CLI](#)
- [Use DeleteVpnGateway with an AWS SDK or CLI](#)
- [Use DeregisterImage with an AWS SDK or CLI](#)
- [Use DescribeAccountAttributes with an AWS SDK or CLI](#)
- [Use DescribeAddresses with an AWS SDK or CLI](#)
- [Use DescribeAvailabilityZones with an AWS SDK or CLI](#)
- [Use DescribeBundleTasks with an AWS SDK or CLI](#)
- [Use DescribeCapacityReservations with an AWS SDK or CLI](#)
- [Use DescribeCustomerGateways with an AWS SDK or CLI](#)
- [Use DescribeDhcpOptions with an AWS SDK or CLI](#)
- [Use DescribeFlowLogs with an AWS SDK or CLI](#)
- [Use DescribeHostReservationOfferings with an AWS SDK or CLI](#)
- [Use DescribeHosts with an AWS SDK or CLI](#)
- [Use DescribelamInstanceProfileAssociations with an AWS SDK or CLI](#)
- [Use DescribelFormat with an AWS SDK or CLI](#)
- [Use DescribelentityIdFormat with an AWS SDK or CLI](#)

- [Use DescribeImageAttribute with an AWS SDK or CLI](#)
- [Use DescribeImages with an AWS SDK or CLI](#)
- [Use DescribeImportImageTasks with an AWS SDK or CLI](#)
- [Use DescribeImportSnapshotTasks with an AWS SDK or CLI](#)
- [Use DescribeInstanceAttribute with an AWS SDK or CLI](#)
- [Use DescribeInstanceState with an AWS SDK or CLI](#)
- [Use DescribeInstanceTypes with an AWS SDK or CLI](#)
- [Use DescribeInstances with an AWS SDK or CLI](#)
- [Use DescribeInternetGateways with an AWS SDK or CLI](#)
- [Use DescribeKeyPairs with an AWS SDK or CLI](#)
- [Use DescribeNetworkAcls with an AWS SDK or CLI](#)
- [Use DescribeNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use DescribeNetworkInterfaces with an AWS SDK or CLI](#)
- [Use DescribePlacementGroups with an AWS SDK or CLI](#)
- [Use DescribePrefixLists with an AWS SDK or CLI](#)
- [Use DescribeRegions with an AWS SDK or CLI](#)
- [Use DescribeRouteTables with an AWS SDK or CLI](#)
- [Use DescribeScheduledInstanceIdAvailability with an AWS SDK or CLI](#)
- [Use DescribeScheduledInstances with an AWS SDK or CLI](#)
- [Use DescribeSecurityGroups with an AWS SDK or CLI](#)
- [Use DescribeSnapshotAttribute with an AWS SDK or CLI](#)
- [Use DescribeSnapshots with an AWS SDK or CLI](#)
- [Use DescribeSpotDatafeedSubscription with an AWS SDK or CLI](#)
- [Use DescribeSpotFleetInstances with an AWS SDK or CLI](#)
- [Use DescribeSpotFleetRequestHistory with an AWS SDK or CLI](#)
- [Use DescribeSpotFleetRequests with an AWS SDK or CLI](#)
- [Use DescribeSpotInstanceRequests with an AWS SDK or CLI](#)
- [Use DescribeSpotPriceHistory with an AWS SDK or CLI](#)

- [Use DescribeSubnets with an AWS SDK or CLI](#)
- [Use DescribeTags with an AWS SDK or CLI](#)
- [Use DescribeVolumeAttribute with an AWS SDK or CLI](#)
- [Use DescribeVolumeStatus with an AWS SDK or CLI](#)
- [Use DescribeVolumes with an AWS SDK or CLI](#)
- [Use DescribeVpcAttribute with an AWS SDK or CLI](#)
- [Use DescribeVpcClassicLink with an AWS SDK or CLI](#)
- [Use DescribeVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use DescribeVpcEndpointServices with an AWS SDK or CLI](#)
- [Use DescribeVpcEndpoints with an AWS SDK or CLI](#)
- [Use DescribeVpcs with an AWS SDK or CLI](#)
- [Use DescribeVpnConnections with an AWS SDK or CLI](#)
- [Use DescribeVpnGateways with an AWS SDK or CLI](#)
- [Use DetachInternetGateway with an AWS SDK or CLI](#)
- [Use DetachNetworkInterface with an AWS SDK or CLI](#)
- [Use DetachVolume with an AWS SDK or CLI](#)
- [Use DetachVpnGateway with an AWS SDK or CLI](#)
- [Use DisableVgwRoutePropagation with an AWS SDK or CLI](#)
- [Use DisableVpcClassicLink with an AWS SDK or CLI](#)
- [Use DisableVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use DisassociateAddress with an AWS SDK or CLI](#)
- [Use DisassociateRouteTable with an AWS SDK or CLI](#)
- [Use EnableVgwRoutePropagation with an AWS SDK or CLI](#)
- [Use EnableVolume with an AWS SDK or CLI](#)
- [Use EnableVpcClassicLink with an AWS SDK or CLI](#)
- [Use EnableVpcClassicLinkDnsSupport with an AWS SDK or CLI](#)
- [Use GetConsoleOutput with an AWS SDK or CLI](#)
- [Use GetHostReservationPurchasePreview with an AWS SDK or CLI](#)
- [Use GetPasswordData with an AWS SDK or CLI](#)

- [Use ImportImage with an AWS SDK or CLI](#)
- [Use ImportKeyPair with an AWS SDK or CLI](#)
- [Use ImportSnapshot with an AWS SDK or CLI](#)
- [Use ModifyCapacityReservation with an AWS SDK or CLI](#)
- [Use ModifyHosts with an AWS SDK or CLI](#)
- [Use ModifyIdFormat with an AWS SDK or CLI](#)
- [Use ModifyImageAttribute with an AWS SDK or CLI](#)
- [Use ModifyInstanceAttribute with an AWS SDK or CLI](#)
- [Use ModifyInstanceCreditSpecification with an AWS SDK or CLI](#)
- [Use ModifyNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use ModifyReservedInstances with an AWS SDK or CLI](#)
- [Use ModifySnapshotAttribute with an AWS SDK or CLI](#)
- [Use ModifySpotFleetRequest with an AWS SDK or CLI](#)
- [Use ModifySubnetAttribute with an AWS SDK or CLI](#)
- [Use ModifyVolumeAttribute with an AWS SDK or CLI](#)
- [Use ModifyVpcAttribute with an AWS SDK or CLI](#)
- [Use MonitorInstances with an AWS SDK or CLI](#)
- [Use MoveAddressToVpc with an AWS SDK or CLI](#)
- [Use PurchaseHostReservation with an AWS SDK or CLI](#)
- [Use PurchaseScheduledInstances with an AWS SDK or CLI](#)
- [Use RebootInstances with an AWS SDK or CLI](#)
- [Use RegisterImage with an AWS SDK or CLI](#)
- [Use RejectVpcPeeringConnection with an AWS SDK or CLI](#)
- [Use ReleaseAddress with an AWS SDK or CLI](#)
- [Use ReleaseHosts with an AWS SDK or CLI](#)
- [Use ReplaceiamInstanceProfileAssociation with an AWS SDK or CLI](#)
- [Use ReplaceNetworkAclAssociation with an AWS SDK or CLI](#)
- [Use ReplaceNetworkAclEntry with an AWS SDK or CLI](#)
- [Use ReplaceRoute with an AWS SDK or CLI](#)

- [Use ReplaceRouteTableAssociation with an AWS SDK or CLI](#)
- [Use ReportInstanceState with an AWS SDK or CLI](#)
- [Use RequestSpotFleet with an AWS SDK or CLI](#)
- [Use RequestSpotInstances with an AWS SDK or CLI](#)
- [Use ResetImageAttribute with an AWS SDK or CLI](#)
- [Use ResetInstanceAttribute with an AWS SDK or CLI](#)
- [Use ResetNetworkInterfaceAttribute with an AWS SDK or CLI](#)
- [Use ResetSnapshotAttribute with an AWS SDK or CLI](#)
- [Use RevokeSecurityGroupEgress with an AWS SDK or CLI](#)
- [Use RevokeSecurityGroupIngress with an AWS SDK or CLI](#)
- [Use RunInstances with an AWS SDK or CLI](#)
- [Use RunScheduledInstances with an AWS SDK or CLI](#)
- [Use StartInstances with an AWS SDK or CLI](#)
- [Use StopInstances with an AWS SDK or CLI](#)
- [Use TerminateInstances with an AWS SDK or CLI](#)
- [Use UnassignPrivateIpAddresses with an AWS SDK or CLI](#)
- [Use UnmonitorInstances with an AWS SDK or CLI](#)

## Use AcceptVpcPeeringConnection with an AWS SDK or CLI

The following code examples show how to use `AcceptVpcPeeringConnection`.

CLI

### AWS CLI

#### To accept a VPC peering connection

This example accepts the specified VPC peering connection request.

Command:

```
aws ec2 accept-vpc-peering-connection --vpc-peering-connection-id pcx-1a2b3c4d
```

**Output:**

```
{  
    "VpcPeeringConnection": {  
        "Status": {  
            "Message": "Provisioning",  
            "Code": "provisioning"  
        },  
        "Tags": [],  
        "AcceptorVpcInfo": {  
            "OwnerId": "444455556666",  
            "VpcId": "vpc-44455566",  
            "CidrBlock": "10.0.1.0/28"  
        },  
        "VpcPeeringConnectionId": "pcx-1a2b3c4d",  
        "RequesterVpcInfo": {  
            "OwnerId": "444455556666",  
            "VpcId": "vpc-111abc45",  
            "CidrBlock": "10.0.0.0/28"  
        }  
    }  
}
```

- For API details, see [AcceptVpcPeeringConnection](#) in *AWS CLI Command Reference*.

**PowerShell****Tools for PowerShell**

**Example 1: This example approves the requested VpcPeeringConnectionId  
pcx-1dfad234b56ff78be**

```
Approve-EC2VpcPeeringConnection -VpcPeeringConnectionId pcx-1dfad234b56ff78be
```

**Output:**

AcceptorVpcInfo	: Amazon.EC2.Model.VpcPeeringConnectionVpcInfo
ExpirationTime	: 1/1/0001 12:00:00 AM
RequesterVpcInfo	: Amazon.EC2.Model.VpcPeeringConnectionVpcInfo
Status	: Amazon.EC2.Model.VpcPeeringConnectionStateReason
Tags	: {}

```
VpcPeeringConnectionId : pcx-1dfad234b56ff78be
```

- For API details, see [AcceptVpcPeeringConnection](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AllocateAddress with an AWS SDK or CLI

The following code examples show how to use AllocateAddress.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Allocate an Elastic IP address.
/// </summary>
/// <returns>The allocation Id of the allocated address.</returns>
public async Task<string> AllocateAddress()
{
    var request = new AllocateAddressRequest();

    var response = await _amazonEC2_ALLOCATEADDRESSAsync(request);
    return response.AllocationId;
}
```

- For API details, see [AllocateAddress](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_allocate_address
#
# This function allocates an Elastic IP address for use with Amazon Elastic
# Compute Cloud (Amazon EC2) instances in a specific AWS Region.
#
# Parameters:
#     -d domain - The domain for the Elastic IP address (either 'vpc' or
# 'standard').
#
# Returns:
#     The allocated Elastic IP address, or an error message if the operation
# fails.
# And:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_allocate_address() {
    local domain response

    # Function to display usage information
    function usage() {
        echo "function ec2_allocate_address"
        echo "Allocates an Elastic IP address for use with Amazon Elastic Compute"
        echo "Cloud (Amazon EC2) instances in a specific AWS Region."
        echo "    -d domain - The domain for the Elastic IP address (either 'vpc' or"
        echo "'standard')."
    }
}
```

```
echo ""
}

# Parse the command-line arguments
while getopts "d:h" option; do
    case "${option}" in
        d) domain="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$domain" ]]; then
    errecho "ERROR: You must provide a domain with the -d parameter (either 'vpc' or 'standard')."
    return 1
fi

if [[ "$domain" != "vpc" && "$domain" != "standard" ]]; then
    errecho "ERROR: Invalid domain value. Must be either 'vpc' or 'standard'."
    return 1
fi

# Allocate the Elastic IP address
response=$(aws ec2 allocate-address \
    --domain "$domain" \
    --query "[PublicIp,AllocationId]" \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports allocate-address operation failed."
    errecho "$response"
    return 1
}

echo "$response"
```

```
    return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " An unknown error occurred."}}
```

```
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see [AllocateAddress](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Allocate an Elastic IP address and associate it with an Amazon Elastic
Compute Cloud
//! (Amazon EC2) instance.
/*!
 \param instanceID: An EC2 instance ID.
 \param[out] publicIPAddress: String to return the public IP address.
 \param[out] allocationID: String to return the allocation ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::allocateAndAssociateAddress(const Aws::String &instanceId,
                                               Aws::String &publicIPAddress,
                                               Aws::String &allocationID,
                                               const
                                               Aws::Client::ClientConfiguration &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::AllocateAddressRequest request;
    request.SetDomain(Aws::EC2::Model::DomainType::vpc);

    const Aws::EC2::Model::AllocateAddressOutcome outcome =
        ec2Client_ALLOCATEADDRESS(request);
    if (!outcome.IsSuccess()) {
```

```
        std::cerr << "Failed to allocate Elastic IP address:" <<
            outcome.GetError().GetMessage() << std::endl;
        return false;
    }
    const Aws::EC2::Model::AllocateAddressResponse &response =
outcome.GetResult();
    allocationID = response.GetAllocationId();
    publicIPAddress = response.GetPublicIp();

    return true;
}
```

- For API details, see [AllocateAddress](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To allocate an Elastic IP address from Amazon's address pool

The following `allocate-address` example allocates an Elastic IP address. Amazon EC2 selects the address from Amazon's address pool.

```
aws ec2 allocate-address
```

Output:

```
{
    "PublicIp": "70.224.234.241",
    "AllocationId": "eipalloc-01435ba59eEXAMPLE",
    "PublicIpv4Pool": "amazon",
    "NetworkBorderGroup": "us-west-2",
    "Domain": "vpc"
}
```

For more information, see [Elastic IP addresses](#) in the *Amazon EC2 User Guide*.

#### Example 2: To allocate an Elastic IP address and associate it with a network border group

The following `allocate-address` example allocates an Elastic IP address and associates it with the specified network border group.

```
aws ec2 allocate-address \
--network-border-group us-west-2-lax-1
```

Output:

```
{  
    "PublicIp": "70.224.234.241",  
    "AllocationId": "eipalloc-e03dd489ceEXAMPLE",  
    "PublicIpv4Pool": "amazon",  
    "NetworkBorderGroup": "us-west-2-lax-1",  
    "Domain": "vpc"  
}
```

For more information, see [Elastic IP addresses](#) in the *Amazon EC2 User Guide*.

### Example 3: To allocate an Elastic IP address from an address pool that you own

The following `allocate-address` example allocates an Elastic IP address from an address pool that you have brought to your Amazon Web Services account. Amazon EC2 selects the address from the address pool.

```
aws ec2 allocate-address \
--public-ipv4-pool ipv4pool-ec2-1234567890abcdef0
```

Output:

```
{  
    "AllocationId": "eipalloc-02463d08ceEXAMPLE",  
    "NetworkBorderGroup": "us-west-2",  
    "CustomerOwnedIp": "18.218.95.81",  
    "CustomerOwnedIpv4Pool": "ipv4pool-ec2-1234567890abcdef0",  
    "Domain": "vpc",  
    "NetworkBorderGroup": "us-west-2",  
}
```

For more information, see [Elastic IP addresses](#) in the *Amazon EC2 User Guide*.

- For API details, see [AllocateAddress](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static String allocateAddress(Ec2Client ec2) {
    try {
        AllocateAddressRequest allocateRequest =
            AllocateAddressRequest.builder()
                .domain(DomainType.VPC)
                .build();

        AllocateAddressResponse allocateResponse =
            ec2.allocateAddress(allocateRequest);
        return allocateResponse.allocationId();

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
    return "";
}
```

- For API details, see [AllocateAddress](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { AllocateAddressCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new AllocateAddressCommand({});

  try {
    const { AllocationId, PublicIp } = await client.send(command);
    console.log("A new IP address has been allocated to your account:");
    console.log(`ID: ${AllocationId} Public IP: ${PublicIp}`);
    console.log(
      "You can view your IP addresses in the AWS Management Console for Amazon EC2. Look under Network & Security > Elastic IPs",
    );
  } catch (err) {
    console.error(err);
  }
};


```

- For API details, see [AllocateAddress](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun getAllocateAddress(instanceIdVal: String?): String? {
  val allocateRequest =
    AllocateAddressRequest {
      domain = DomainType.Vpc
    }

  Ec2Client { region = "us-west-2" }.use { ec2 ->
    val allocateResponse = ec2.allocateAddress(allocateRequest)
  }
}
```

```
    val allocationIdVal = allocateResponse.allocationId

    val request =
        AssociateAddressRequest {
            instanceId = instanceIdVal
            allocationId = allocationIdVal
        }

    val associateResponse = ec2.associateAddress(request)
    return associateResponse.associationId
}
```

- For API details, see [AllocateAddress](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example allocates an Elastic IP address to use with an instance in a VPC.

```
New-EC2Address -Domain Vpc
```

#### Output:

AllocationId	Domain	PublicIp
eipalloc-12345678	vpc	198.51.100.2

#### Example 2: This example allocates an Elastic IP address to use with an instance in EC2-Classic.

```
New-EC2Address
```

#### Output:

AllocationId	Domain	PublicIp
	standard	203.0.113.17

- For API details, see [AllocateAddress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class ElasticIpWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) Elastic IP address  
    actions."""  
  
    def __init__(self, ec2_resource, elastic_ip=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param elastic_ip: A Boto3 VpcAddress object. This is a high-level object  
        that  
                wraps Elastic IP actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.elastic_ip = elastic_ip  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def allocate(self):  
        """  
        Allocates an Elastic IP address that can be associated with an Amazon EC2  
        instance. By using an Elastic IP address, you can keep the public IP  
        address  
                constant even when you restart the associated instance.  
        """
```

```
:return: The newly created Elastic IP object. By default, the address is
not
    associated with any instance.

"""

try:
    response =
self.ec2_resource.meta.client.allocate_address(Domain="vpc")
    self.elastic_ip =
self.ec2_resource.VpcAddress(response["AllocationId"])
except ClientError as err:
    logger.error(
        "Couldn't allocate Elastic IP. Here's why: %s: %s",
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.elastic_ip
```

- For API details, see [AllocateAddress](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
# Creates an Elastic IP address in Amazon Virtual Private Cloud (Amazon VPC).
#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @return [String] The allocation ID corresponding to the Elastic IP address.
# @example
#   puts allocate_elastic_ip_address(Aws::EC2::Client.new(region: 'us-west-2'))
def allocate_elastic_ip_address(ec2_client)
    response = ec2_client.allocate_address(domain: "vpc")
    return response.allocation_id
```

```
rescue StandardError => e
    puts "Error allocating Elastic IP address: #{e.message}"
    return "Error"
end
```

- For API details, see [AllocateAddress](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn allocate_ip_address(&self) -> Result<AllocateAddressOutput, EC2Error> {
    self.client
        .allocate_address()
        .domain(DomainType::Vpc)
        .send()
        .await
        .map_err(EC2Error::from)
}
```

- For API details, see [AllocateAddress](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.  
    oo_result = lo_ec2->allocateaddress( iv_domain = 'vpc' ).    " oo_result  
is returned for testing purposes."  
    MESSAGE 'Allocated an Elastic IP address.' TYPE 'I'.  
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
    DATA(lv_error) = |" { lo_exception->av_err_code }" - { lo_exception-  
>av_err_msg }|.  
    MESSAGE lv_error TYPE 'E'.  
ENDTRY.
```

- For API details, see [AllocateAddress](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AllocateHosts with an AWS SDK or CLI

The following code examples show how to use AllocateHosts.

CLI

### AWS CLI

#### Example 1: To allocate a Dedicated Host

The following `allocate-hosts` example allocates a single Dedicated Host in the `eu-west-1a` Availability Zone, onto which you can launch `m5.large` instances. By default, the Dedicated Host accepts only target instance launches, and does not support host recovery.

```
aws ec2 allocate-hosts \  
  --instance-type m5.large \  
  --availability-zone eu-west-1a \  
  --quantity 1
```

Output:

```
{  
  "HostIds": [  
    "h-07879acf49EXAMPLE"
```

```
    ]  
}
```

## Example 2: To allocate a Dedicated Host with auto-placement and host recovery enabled

The following `allocate-hosts` example allocates a single Dedicated Host in the `eu-west-1a` Availability Zone with auto-placement and host recovery enabled.

```
aws ec2 allocate-hosts \  
  --instance-type m5.large \  
  --availability-zone eu-west-1a \  
  --auto-placement on \  
  --host-recovery on \  
  --quantity 1
```

Output:

```
{  
  "HostIds": [  
    "h-07879acf49EXAMPLE"  
  ]  
}
```

## Example 3: To allocate a Dedicated Host with tags

The following `allocate-hosts` example allocates a single Dedicated Host and applies a tag with a key named `purpose` and a value of `production`.

```
aws ec2 allocate-hosts \  
  --instance-type m5.large \  
  --availability-zone eu-west-1a \  
  --quantity 1 \  
  --tag-specifications 'ResourceType=dedicated-host,Tags={Key=purpose,Value=production}'
```

Output:

```
{  
  "HostIds": [  
    "h-07879acf49EXAMPLE"  
  ]  
}
```

{}

For more information, see [Allocating Dedicated Hosts](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [AllocateHosts](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example allocates a Dedicated Host to your account for the given instance type and availability zone**

```
New-EC2Host -AutoPlacement on -AvailabilityZone eu-west-1b -InstanceType m4.xlarge -Quantity 1
```

#### Output:

```
h-01e23f4cd567890f3
```

- For API details, see [AllocateHosts](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AssignPrivateIpAddresses with an AWS SDK or CLI

The following code examples show how to use `AssignPrivateIpAddresses`.

### CLI

#### AWS CLI

##### To assign a specific secondary private IP address a network interface

This example assigns the specified secondary private IP address to the specified network interface. If the command succeeds, no output is returned.

Command:

```
aws ec2 assign-private-ip-addresses --network-interface-id eni-e5aa89a3 --  
private-ip-addresses 10.0.0.82
```

## To assign secondary private IP addresses that Amazon EC2 selects to a network interface

This example assigns two secondary private IP addresses to the specified network interface. Amazon EC2 automatically assigns these IP addresses from the available IP addresses in the CIDR block range of the subnet the network interface is associated with. If the command succeeds, no output is returned.

Command:

```
aws ec2 assign-private-ip-addresses --network-interface-id eni-e5aa89a3 --  
secondary-private-ip-address-count 2
```

- For API details, see [AssignPrivateIpAddresses](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example assigns the specified secondary private IP address to the specified network interface.

```
Register-EC2PrivateIpAddress -NetworkInterfaceId eni-1a2b3c4d -PrivateIpAddress  
10.0.0.82
```

#### Example 2: This example creates two secondary private IP addresses and assigns them to the specified network interface.

```
Register-EC2PrivateIpAddress -NetworkInterfaceId eni-1a2b3c4d -  
SecondaryPrivateIpAddressCount 2
```

- For API details, see [AssignPrivateIpAddresses](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use AssociateAddress with an AWS SDK or CLI

The following code examples show how to use `AssociateAddress`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Associate an Elastic IP address to an EC2 instance.
/// </summary>
/// <param name="allocationId">The allocation Id of an Elastic IP address.</param>
/// <param name="instanceId">The instance Id of the EC2 instance to
/// associate the address with.</param>
/// <returns>The association Id that represents
/// the association of the Elastic IP address with an instance.</returns>
public async Task<string> AssociateAddress(string allocationId, string
instanceId)
{
    var request = new AssociateAddressRequest
    {
        AllocationId = allocationId,
        InstanceId = instanceId
    };

    var response = await _amazonEC2.AssociateAddressAsync(request);
    return response.AssociationId;
}
```

- For API details, see [AssociateAddress](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_associate_address
#
# This function associates an Elastic IP address with an Amazon Elastic Compute
# Cloud (Amazon EC2) instance.
#
# Parameters:
#     -a allocation_id - The allocation ID of the Elastic IP address to
#     associate.
#     -i instance_id - The ID of the EC2 instance to associate the Elastic IP
#     address with.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_associate_address() {
    local allocation_id instance_id response

    # Function to display usage information
    function usage() {
        echo "function ec2_associate_address"
        echo "Associates an Elastic IP address with an Amazon Elastic Compute Cloud"
        echo "(Amazon EC2) instance."
        echo "    -a allocation_id - The allocation ID of the Elastic IP address to"
        echo "        associate."
        echo "    -i instance_id - The ID of the EC2 instance to associate the Elastic"
        echo "        IP address with."
        echo ""
    }
}
```

```
}

# Parse the command-line arguments
while getopts "a:i:h" option; do
    case "${option}" in
        a) allocation_id="${OPTARG}" ;;
        i) instance_id="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$allocation_id" ]]; then
    errecho "ERROR: You must provide an allocation ID with the -a parameter."
    return 1
fi

if [[ -z "$instance_id" ]]; then
    errecho "ERROR: You must provide an instance ID with the -i parameter."
    return 1
fi

# Associate the Elastic IP address
response=$(aws ec2 associate-address \
    --allocation-id "$allocation_id" \
    --instance-id "$instance_id" \
    --query "AssociationId" \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports associate-address operation failed."
    errecho "$response"
    return 1
}

echo "$response"
```

```
    return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " An unknown error occurred."}}
```

```
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see [AssociateAddress](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
Aws::EC2::EC2Client ec2Client(clientConfiguration);

//! Associate an Elastic IP address with an EC2 instance.
/*! \param instanceId: An EC2 instance ID.
   \param allocationId: An Elastic IP allocation ID.
   \param[out] associationID: String to receive the association ID.
   \param clientConfiguration: AWS client configuration.
   \return bool: True if the address was associated with the instance; otherwise,
false.
*/
bool AwsDoc::EC2::associateAddress(const Aws::String &instanceId, const
Aws::String &allocationId,
                                    Aws::String &associationID,
                                    const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::AssociateAddressRequest request;
    request.SetInstanceId(instanceId);
    request.SetAllocationId(allocationId);
```

```
Aws::EC2::Model::AssociateAddressOutcome outcome =
ec2Client.AssociateAddress(request);

if (!outcome.IsSuccess()) {
    std::cerr << "Failed to associate address " << allocationId <<
        " with instance " << instanceId << ":" <<
        outcome.GetError().GetMessage() << std::endl;
} else {
    std::cout << "Successfully associated address " << allocationId <<
        " with instance " << instanceId << std::endl;
    associationID = outcome.GetResult().GetAssociationId();
}

return outcome.IsSuccess();
}
```

- For API details, see [AssociateAddress](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To associate an Elastic IP addresses in EC2-Classic

This example associates an Elastic IP address with an instance in EC2-Classic. If the command succeeds, no output is returned.

Command:

```
aws ec2 associate-address --instance-id i-07ffe74c7330ebf53 --public-
ip 198.51.100.0
```

#### To associate an Elastic IP address in EC2-VPC

This example associates an Elastic IP address with an instance in a VPC.

Command:

```
aws ec2 associate-address --instance-id i-0b263919b6498b123 --allocation-
id eipalloc-64d5890a
```

## Output:

```
{  
    "AssociationId": "eipassoc-2bebb745"  
}
```

This example associates an Elastic IP address with a network interface.

## Command:

```
aws ec2 associate-address --allocation-id eipalloc-64d5890a --network-interface-  
id eni-1a2b3c4d
```

This example associates an Elastic IP with a private IP address that's associated with a network interface.

## Command:

```
aws ec2 associate-address --allocation-id eipalloc-64d5890a --network-interface-  
id eni-1a2b3c4d --private-ip-address 10.0.0.85
```

- For API details, see [AssociateAddress](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static String associateAddress(Ec2Client ec2, String instanceId,  
String allocationId) {  
    try {  
        AssociateAddressRequest associateRequest =  
AssociateAddressRequest.builder()  
            .instanceId(instanceId)  
            .allocationId(allocationId)
```

```
        .build();

        AssociateAddressResponse associateResponse =
ec2.associateAddress(associateRequest);
        return associateResponse.associationId();

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
    return "";
}
```

- For API details, see [AssociateAddress](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { AssociateAddressCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
    // You need to allocate an Elastic IP address before associating it with an
    instance.
    // You can do that with the AllocateAddressCommand.
    const allocationId = "ALLOCATION_ID";
    // You need to create an EC2 instance before an IP address can be associated
    with it.
    // You can do that with the RunInstancesCommand.
    const instanceId = "INSTANCE_ID";
    const command = new AssociateAddressCommand({
        AllocationId: allocationId,
        InstanceId: instanceId,
```

```
});  
  
try {  
    const { AssociationId } = await client.send(command);  
    console.log(  
        `Address with allocation ID ${allocationId} is now associated with instance  
        ${instanceId}.`,  
        `The association ID is ${AssociationId}.`,  
    );  
} catch (err) {  
    console.error(err);  
}  
};
```

- For API details, see [AssociateAddress](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun associateAddressSc(  
    instanceIdVal: String?,  
    allocationIdVal: String?,  
) : String? {  
    val associateRequest =  
        AssociateAddressRequest {  
            instanceId = instanceIdVal  
            allocationId = allocationIdVal  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        val associateResponse = ec2.associateAddress(associateRequest)  
        return associateResponse.associationId  
    }  
}
```

- For API details, see [AssociateAddress](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example associates the specified Elastic IP address with the specified instance in a VPC.**

```
C:\> Register-EC2Address -InstanceId i-12345678 -AllocationId eipalloc-12345678
```

#### Output:

```
eipassoc-12345678
```

**Example 2: This example associates the specified Elastic IP address with the specified instance in EC2-Classic.**

```
C:\> Register-EC2Address -InstanceId i-12345678 -PublicIp 203.0.113.17
```

- For API details, see [AssociateAddress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class ElasticIpWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) Elastic IP address  
    actions."""  
  
    def __init__(self, ec2_resource, elastic_ip=None):
```

```
"""
:param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
resource
    is used to create additional high-level objects
    that wrap low-level Amazon EC2 service actions.
:param elastic_ip: A Boto3 VpcAddress object. This is a high-level object
that
    wraps Elastic IP actions.
"""

self.ec2_resource = ec2_resource
self.elastic_ip = elastic_ip

@classmethod
def from_resource(cls):
    ec2_resource = boto3.resource("ec2")
    return cls(ec2_resource)

def associate(self, instance):
    """
    Associates an Elastic IP address with an instance. When this association
is
    created, the Elastic IP's public IP address is immediately used as the
public
    IP address of the associated instance.

    :param instance: A Boto3 Instance object. This is a high-level object
that wraps
        Amazon EC2 instance actions.
    :return: A response that contains the ID of the association.
    """
    if self.elastic_ip is None:
        logger.info("No Elastic IP to associate.")
        return

    try:
        response = self.elastic_ip.associate(InstanceId=instance.id)
    except ClientError as err:
        logger.error(
            "Couldn't associate Elastic IP %s with instance %s. Here's why:
%s: %s",
            self.elastic_ip.allocation_id,
            instance.id,
            err.response["Error"]["Code"],
```

```
        err.response["Error"]["Message"],
    )
raise
return response
```

- For API details, see [AssociateAddress](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
# Associates an Elastic IP address with an Amazon Elastic Compute Cloud
# (Amazon EC2) instance.
#
# Prerequisites:
#
# - The allocation ID corresponding to the Elastic IP address.
# - The Amazon EC2 instance.
#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @param allocation_id [String] The ID of the allocation corresponding to
#   the Elastic IP address.
# @param instance_id [String] The ID of the instance.
# @return [String] The association ID corresponding to the association of the
#   Elastic IP address to the instance.
# @example
#   puts allocate_elastic_ip_address(
#     Aws::EC2::Client.new(region: 'us-west-2'),
#     'eipalloc-04452e528a66279EX',
#     'i-033c48ef067af3dEX')
def associate_elastic_ip_address_with_instance(
  ec2_client,
  allocation_id,
  instance_id
```

```
)  
    response = ec2_client.associate_address(  
        allocation_id: allocation_id,  
        instance_id: instance_id,  
    )  
    return response.association_id  
rescue StandardError => e  
    puts "Error associating Elastic IP address with instance: #{e.message}"  
    return "Error"  
end
```

- For API details, see [AssociateAddress](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn associate_ip_address(  
    &self,  
    allocation_id: &str,  
    instance_id: &str,  
) -> Result<AssociateAddressOutput, EC2Error> {  
    let response = self  
        .client  
        .associate_address()  
        .allocation_id(allocation_id)  
        .instance_id(instance_id)  
        .send()  
        .await?;  
    Ok(response)  
}
```

- For API details, see [AssociateAddress](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.  
    oo_result = lo_ec2->associateaddress(  
        " oo_result  
        is returned for testing purposes."  
        iv_allocationid = iv_allocation_id  
        iv_instanceid = iv_instance_id  
    ).  
    MESSAGE 'Associated an Elastic IP address with an EC2 instance.' TYPE  
    'I'.  
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
        DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-  
        >av_err_msg }|.  
        MESSAGE lv_error TYPE 'E'.  
    ENDTRY.
```

- For API details, see [AssociateAddress](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AssociateDhcpOptions with an AWS SDK or CLI

The following code examples show how to use AssociateDhcpOptions.

### CLI

#### AWS CLI

##### To associate a DHCP options set with your VPC

This example associates the specified DHCP options set with the specified VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 associate-dhcp-options --dhcp-options-id dopt-d9070ebb --vpc-id vpc-a01106c2
```

### To associate the default DHCP options set with your VPC

This example associates the default DHCP options set with the specified VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 associate-dhcp-options --dhcp-options-id default --vpc-id vpc-a01106c2
```

- For API details, see [AssociateDhcpOptions](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example associates the specified DHCP options set with the specified VPC.**

```
Register-EC2DhcpOption -DhcpOptionsId dopt-1a2b3c4d -VpcId vpc-12345678
```

**Example 2: This example associates the default DHCP options set with the specified VPC.**

```
Register-EC2DhcpOption -DhcpOptionsId default -VpcId vpc-12345678
```

- For API details, see [AssociateDhcpOptions](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use AssociateRouteTable with an AWS SDK or CLI

The following code examples show how to use `AssociateRouteTable`.

CLI

## AWS CLI

### To associate a route table with a subnet

This example associates the specified route table with the specified subnet.

Command:

```
aws ec2 associate-route-table --route-table-id rtb-22574640 --subnet-id subnet-9d4a7b6c
```

Output:

```
{  
    "AssociationId": "rtbassoc-781d0d1a"  
}
```

- For API details, see [AssociateRouteTable](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

### Example 1: This example associates the specified route table with the specified subnet.

```
Register-EC2RouteTable -RouteTableId rtb-1a2b3c4d -SubnetId subnet-1a2b3c4d
```

Output:

```
rtbassoc-12345678
```

- For API details, see [AssociateRouteTable](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AttachInternetGateway with an AWS SDK or CLI

The following code examples show how to use AttachInternetGateway.

### CLI

#### AWS CLI

##### To attach an internet gateway to your VPC

The following attach-internet-gateway example attaches the specified internet gateway to the specific VPC.

```
aws ec2 attach-internet-gateway \
    --internet-gateway-id igw-0d0fb496b3EXAMPLE \
    --vpc-id vpc-0a60eb65b4EXAMPLE
```

This command produces no output.

For more information, see [Internet gateways](#) in the *Amazon VPC User Guide*.

- For API details, see [AttachInternetGateway](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

##### Example 1: This example attaches the specified Internet gateway to the specified VPC.

```
Add-EC2InternetGateway -InternetGatewayId igw-1a2b3c4d -VpcId vpc-12345678
```

##### Example 2: This example creates a VPC and an Internet gateway, and then attaches the Internet gateway to the VPC.

```
$vpc = New-EC2Vpc -CidrBlock 10.0.0.0/16
New-EC2InternetGateway | Add-EC2InternetGateway -VpcId $vpc.VpcId
```

- For API details, see [AttachInternetGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AttachNetworkInterface with an AWS SDK or CLI

The following code examples show how to use AttachNetworkInterface.

CLI

### AWS CLI

#### Example 1: To attach a network interface to an instance

The following attach-network-interface example attaches the specified network interface to the specified instance.

```
aws ec2 attach-network-interface \
    --network-interface-id eni-0dc56a8d4640ad10a \
    --instance-id i-1234567890abcdef0 \
    --device-index 1
```

Output:

```
{
    "AttachmentId": "eni-attach-01a8fc87363f07cf9"
}
```

For more information, see [Elastic network interfaces](#) in the *Amazon EC2 User Guide*.

#### Example 2: To attach a network interface to an instance with multiple network cards

The following attach-network-interface example attaches the specified network interface to the specified instance and network card.

```
aws ec2 attach-network-interface \
    --network-interface-id eni-07483b1897541ad83 \
    --instance-id i-01234567890abcdef \
    --network-card-index 1 \
    --device-index 1
```

Output:

```
{  
    "AttachmentId": "eni-attach-0fbd7ee87a88cd06c"  
}
```

For more information, see [Elastic network interfaces](#) in the *Amazon EC2 User Guide*.

- For API details, see [AttachNetworkInterface](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example attaches the specified network interface to the specified instance.**

```
Add-EC2NetworkInterface -NetworkInterfaceId eni-12345678 -InstanceId i-1a2b3c4d -  
DeviceIndex 1
```

### Output:

```
eni-attach-1a2b3c4d
```

- For API details, see [AttachNetworkInterface](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AttachVolume with an AWS SDK or CLI

The following code examples show how to use AttachVolume.

### CLI

#### AWS CLI

##### To attach a volume to an instance

This example command attaches a volume (vol-1234567890abcdef0) to an instance (i-01474ef662b89480) as /dev/sdf.

Command:

```
aws ec2 attach-volume --volume-id vol-1234567890abcdef0 --instance-id i-01474ef662b89480 --device /dev/sdf
```

Output:

```
{  
    "AttachTime": "YYYY-MM-DDTHH:MM:SS.000Z",  
    "InstanceId": "i-01474ef662b89480",  
    "VolumeId": "vol-1234567890abcdef0",  
    "State": "attaching",  
    "Device": "/dev/sdf"  
}
```

- For API details, see [AttachVolume](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example attaches the specified volume to the specified instance and exposes it with the specified device name.**

```
Add-EC2Volume -VolumeId vol-12345678 -InstanceId i-1a2b3c4d -Device /dev/sdh
```

Output:

```
AttachTime      : 12/22/2015 1:53:58 AM  
DeleteOnTermination : False  
Device          : /dev/sdh  
InstanceId       : i-1a2b3c4d  
State            : attaching  
VolumeId         : vol-12345678
```

- For API details, see [AttachVolume](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use AttachVpnGateway with an AWS SDK or CLI

The following code examples show how to use AttachVpnGateway.

CLI

## AWS CLI

### To attach a virtual private gateway to your VPC

The following attach-vpn-gateway example attaches the specified virtual private gateway to the specified VPC.

```
aws ec2 attach-vpn-gateway \
--vpn-gateway-id vgw-9a4cacf3 \
--vpc-id vpc-a01106c2
```

Output:

```
{
    "VpcAttachment": {
        "State": "attaching",
        "VpcId": "vpc-a01106c2"
    }
}
```

- For API details, see [AttachVpnGateway](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example attaches the specified virtual private gateway to the specified VPC.**

```
Add-EC2VpnGateway -VpnGatewayId vgw-1a2b3c4d -VpcId vpc-12345678
```

Output:

State	VpcId
-----	-----

```
attaching      vpc-12345678
```

- For API details, see [AttachVpnGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AuthorizeSecurityGroupEgress with an AWS SDK or CLI

The following code examples show how to use AuthorizeSecurityGroupEgress.

CLI

### AWS CLI

#### To add a rule that allows outbound traffic to a specific address range

This example command adds a rule that grants access to the specified address ranges on TCP port 80.

Command (Linux):

```
aws ec2 authorize-security-group-egress --group-id sg-1a2b3c4d --ip-permissions  
IpProtocol=tcp,FromPort=80,ToPort=80,IpRanges='[{CidrIp=10.0.0.0/16}]'
```

Command (Windows):

```
aws ec2 authorize-security-group-egress --group-id sg-1a2b3c4d --ip-  
permissions IpProtocol=tcp,FromPort=80,ToPort=80,IpRanges=[{CidrIp=10.0.0.0/16}]
```

#### To add a rule that allows outbound traffic to a specific security group

This example command adds a rule that grants access to the specified security group on TCP port 80.

Command (Linux):

```
aws ec2 authorize-security-group-egress --group-id sg-1a2b3c4d --ip-permissions  
IpProtocol=tcp,FromPort=80,ToPort=80,UserIdGroupPairs='[{GroupId=sg-4b51a32f}]'
```

Command (Windows):

```
aws ec2 authorize-security-group-egress --group-id sg-1a2b3c4d --ip-  
permissions IpProtocol=tcp,FromPort=80,ToPort=80,UserIdGroupPairs=[{GroupId=sg-4b51a32f}]
```

- For API details, see [AuthorizeSecurityGroupEgress](#) in AWS CLI Command Reference.

PowerShell

## Tools for PowerShell

**Example 1: This example defines an egress rule for the specified security group for EC2-VPC. The rule grants access to the specified IP address range on TCP port 80. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip = @{ IpProtocol="tcp"; FromPort="80"; ToPort="80";  
IpRanges="203.0.113.0/24" }  
Grant-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission $ip
```

**Example 2: With PowerShell version 2, you must use New-Object to create the IpPermission object.**

```
$ip = New-Object Amazon.EC2.Model.IpPermission  
$ip.IpProtocol = "tcp"  
$ip.FromPort = 80  
$ip.ToPort = 80  
$ip.IpRanges.Add("203.0.113.0/24")  
  
Grant-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission $ip
```

**Example 3: This example grants access to the specified source security group on TCP port 80.**

```
$ug = New-Object Amazon.EC2.Model.UserIdGroupPair  
$ug.GroupId = "sg-1a2b3c4d"  
$ug.UserId = "123456789012"  
  
Grant-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission  
@( @{ IpProtocol="tcp"; FromPort="80"; ToPort="80"; UserIdGroupPairs=$ug } )
```

- For API details, see [AuthorizeSecurityGroupEgress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use AuthorizeSecurityGroupIngress with an AWS SDK or CLI

The following code examples show how to use AuthorizeSecurityGroupIngress.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Authorize the local computer ingress to EC2 instances associated
/// with the virtual private cloud (VPC) security group.
/// </summary>
/// <param name="groupName">The name of the security group.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> AuthorizeSecurityGroupIngress(string groupName)
{
    // Get the IP address for the local computer.
    var ipAddress = await GetIpAddress();
    Console.WriteLine($"Your IP address is: {ipAddress}");
    var ipRanges = new List<IpRange> { new IpRange { CidrIp =
 $"{ipAddress}/32" } };
}
```

```
        var permission = new IpPermission
        {
            Ipv4Ranges = ipRanges,
            IpProtocol = "tcp",
            FromPort = 22,
            ToPort = 22
        };
        var permissions = new List<IpPermission> { permission };
        var response = await _amazonEC2.AuthorizeSecurityGroupIngressAsync(
            new AuthorizeSecurityGroupIngressRequest(groupName, permissions));
        return response.HttpStatusCode == HttpStatusCode.OK;
    }

    ///<summary>
    /// Authorize the local computer for ingress to
    /// the Amazon EC2 SecurityGroup.
    ///</summary>
    ///<returns>The IPv4 address of the computer running the scenario.</returns>
    private static async Task<string> GetIpAddress()
    {
        var httpClient = new HttpClient();
        var ipString = await httpClient.GetStringAsync("https://
checkip.amazonaws.com");

        // The IP address is returned with a new line
        // character on the end. Trim off the whitespace and
        // return the value to the caller.
        return ipString.Trim();
    }
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_authorize_security_group_ingress
#
# This function authorizes an ingress rule for an Amazon Elastic Compute Cloud
# (Amazon EC2) security group.
#
# Parameters:
#   -g security_group_id - The ID of the security group.
#   -i ip_address - The IP address or CIDR block to authorize.
#   -p protocol - The protocol to authorize (e.g., tcp, udp, icmp).
#   -f from_port - The start of the port range to authorize.
#   -t to_port - The end of the port range to authorize.
#
# And:
#   0 - If successful.
#   1 - If it fails.
#####
function ec2_authorize_security_group_ingress() {
    local security_group_id ip_address protocol from_port to_port response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_authorize_security_group_ingress"
        echo "Authorizes an ingress rule for an Amazon Elastic Compute Cloud (Amazon"
        echo "EC2) security group."
        echo "  -g security_group_id - The ID of the security group."
        echo "  -i ip_address - The IP address or CIDR block to authorize."
        echo "  -p protocol - The protocol to authorize (e.g., tcp, udp, icmp)."
        echo "  -f from_port - The start of the port range to authorize."
        echo "  -t to_port - The end of the port range to authorize."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopt "g:i:p:f:t:h" option; do
        case "${option}" in
            g) security_group_id="${OPTARG}" ;;
            i) ip_address="${OPTARG}" ;;
            p) protocol="${OPTARG}" ;;
            f) from_port="${OPTARG}" ;;
            t) to_port="${OPTARG}" ;;
            h)
```

```
usage
return 0
;;
\?)
echo "Invalid parameter"
usage
return 1
;;
esac
done
export OPTIND=1

if [[ -z "$security_group_id" ]]; then
    errecho "ERROR: You must provide a security group ID with the -g parameter."
    usage
    return 1
fi

if [[ -z "$ip_address" ]]; then
    errecho "ERROR: You must provide an IP address or CIDR block with the -i parameter."
    usage
    return 1
fi

if [[ -z "$protocol" ]]; then
    errecho "ERROR: You must provide a protocol with the -p parameter."
    usage
    return 1
fi

if [[ -z "$from_port" ]]; then
    errecho "ERROR: You must provide a start port with the -f parameter."
    usage
    return 1
fi

if [[ -z "$to_port" ]]; then
    errecho "ERROR: You must provide an end port with the -t parameter."
    usage
    return 1
fi

response=$(aws ec2 authorize-security-group-ingress \
```

```
--group-id "$security_group_id" \
--cidr "${ip_address}/32" \
--protocol "$protocol" \
--port "$from_port-$to_port" \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports authorize-security-group-ingress operation
failed.$response"
return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
```

```
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/bin/sh -e

//! Authorize ingress to an Amazon Elastic Compute Cloud (Amazon EC2) group.
/*!
 * \param groupID: The EC2 group ID.
 * \param clientConfiguration: The ClientConfiguration object.
 * \return bool: True if the operation was successful, false otherwise.
 */
bool
AwsDoc::EC2::authorizeSecurityGroupIngress(const Aws::String &groupID,
                                             const Aws::Client::ClientConfiguration
                                             &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
```

```
Aws::EC2::Model::AuthorizeSecurityGroupIngressRequest  
authorizeSecurityGroupIngressRequest;  
    authorizeSecurityGroupIngressRequest.SetGroupId(groupId);  
    buildSampleIngressRule(authorizeSecurityGroupIngressRequest);  
  
Aws::EC2::Model::AuthorizeSecurityGroupIngressOutcome  
authorizeSecurityGroupIngressOutcome =  
  
ec2Client.AuthorizeSecurityGroupIngress(authorizeSecurityGroupIngressRequest);  
  
if (authorizeSecurityGroupIngressOutcome.IsSuccess()) {  
    std::cout << "Successfully authorized security group ingress." <<  
std::endl;  
} else {  
    std::cerr << "Error authorizing security group ingress: "  
        << authorizeSecurityGroupIngressOutcome.GetError().GetMessage()  
<< std::endl;  
}  
  
return authorizeSecurityGroupIngressOutcome.IsSuccess();  
}
```

Utility function to build an ingress rule.

```
//! Build a sample ingress rule.  
/*!  
 \param authorize_request: An 'AuthorizeSecurityGroupIngressRequest' instance.  
 \return void:  
 */  
void buildSampleIngressRule(  
    Aws::EC2::Model::AuthorizeSecurityGroupIngressRequest &authorize_request)  
{  
    Aws::String ingressIPRange = "203.0.113.0/24"; // Configure this for your  
    allowed IP range.  
    Aws::EC2::Model::IpRange ip_range;  
    ip_range.SetCidrIp(ingressIPRange);  
  
    Aws::EC2::Model::IpPermission permission1;  
    permission1.SetIpProtocol("tcp");  
    permission1.SetToPort(80);  
    permission1.SetFromPort(80);  
    permission1.AddIpRanges(ip_range);
```

```
authorize_request.AddIpPermissions(permission1);

Aws::EC2::Model::IpPermission permission2;
permission2.SetIpProtocol("tcp");
permission2.SetToPort(22);
permission2.SetFromPort(22);
permission2.AddIpRanges(ip_range);

authorize_request.AddIpPermissions(permission2);
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To add a rule that allows inbound SSH traffic

The following authorize-security-group-ingress example adds a rule that allows inbound traffic on TCP port 22 (SSH).

```
aws ec2 authorize-security-group-ingress \
--group-id sg-1234567890abcdef0 \
--protocol tcp \
--port 22 \
--cidr 203.0.113.0/24
```

#### Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-01afa97ef3e1bedfc",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "tcp",  
            "FromPort": 22,
```

```
        "ToPort": 22,
        "CidrIpv4": "203.0.113.0/24"
    }
]
```

### Example 2: To add a rule that allows inbound HTTP traffic from another security group

The following `authorize-security-group-ingress` example adds a rule that allows inbound access on TCP port 80 from the source security group `sg-1a2b3c4d`. The source group must be in the same VPC or in a peer VPC (requires a VPC peering connection). Incoming traffic is allowed based on the private IP addresses of instances that are associated with the source security group (not the public IP address or Elastic IP address).

```
aws ec2 authorize-security-group-ingress \
--group-id sg-1234567890abcdef0 \
--protocol tcp \
--port 80 \
--source-group sg-1a2b3c4d
```

Output:

```
{
    "Return": true,
    "SecurityGroupRules": [
        {
            "SecurityGroupRuleId": "sgr-01f4be99110f638a7",
            "GroupId": "sg-1234567890abcdef0",
            "GroupOwnerId": "123456789012",
            "IsEgress": false,
            "IpProtocol": "tcp",
            "FromPort": 80,
            "ToPort": 80,
            "ReferencedGroupInfo": {
                "GroupId": "sg-1a2b3c4d",
                "UserId": "123456789012"
            }
        }
    ]
}
```

### Example 3: To add multiple rules in the same call

The following `authorize-security-group-ingress` example uses the `ip-permissions` parameter to add two inbound rules, one that enables inbound access on TCP port 3389 (RDP) and the other that enables ping/ICMP.

```
aws ec2 authorize-security-group-ingress --group-id sg-1234567890abcdef0 --ip-permissions  
IpProtocol=tcp,FromPort=3389,ToPort=3389,IpRanges="[{CidrIp=172.31.0.0/16}]"  
IpProtocol=icmp,FromPort=-1,ToPort=-1,IpRanges="[{CidrIp=172.31.0.0/16}]"
```

Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-00e06e5d3690f29f3",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "tcp",  
            "FromPort": 3389,  
            "ToPort": 3389,  
            "CidrIpv4": "172.31.0.0/16"  
        },  
        {  
            "SecurityGroupRuleId": "sgr-0a133dd4493944b87",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "tcp",  
            "FromPort": -1,  
            "ToPort": -1,  
            "CidrIpv4": "172.31.0.0/16"  
        }  
    ]  
}
```

#### Example 4: To add a rule for ICMP traffic

The following `authorize-security-group-ingress` example uses the `ip-permissions` parameter to add an inbound rule that allows the ICMP message

Destination Unreachable: Fragmentation Needed and Don't Fragment was Set (Type 3, Code 4) from anywhere.

```
aws ec2 authorize-security-group-ingress --group-id sg-1234567890abcdef0 --ip-  
permissions IpProtocol=icmp,FromPort=3,ToPort=4,IpRanges="[{CidrIp=0.0.0.0/0}]"
```

Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-0de3811019069b787",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "icmp",  
            "FromPort": 3,  
            "ToPort": 4,  
            "CidrIpv4": "0.0.0.0/0"  
        }  
    ]  
}
```

### Example 5: To add a rule for IPv6 traffic

The following `authorize-security-group-ingress` example uses the `ip-permissions` parameter to add an inbound rule that allows SSH access (port 22) from the IPv6 range `2001:db8:1234:1a00::/64`.

```
aws ec2 authorize-security-group-ingress --group-id sg-1234567890abcdef0 --ip-  
permissions  
IpProtocol=tcp,FromPort=22,ToPort=22,Ipv6Ranges="[{CidrIpv6=2001:db8:1234:1a00::/64}]"
```

Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-0455bc68b60805563",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "tcp",  
            "FromPort": 22,  
            "ToPort": 22,  
            "CidrIpv6": "2001:db8:1234:1a00::/64"  
        }  
    ]  
}
```

```
        "GroupId": "sg-1234567890abcdef0",
        "GroupOwnerId": "123456789012",
        "IsEgress": false,
        "IpProtocol": "tcp",
        "FromPort": 22,
        "ToPort": 22,
        "CidrIpv6": "2001:db8:1234:1a00::/64"
    }
]
}
```

### Example 6: To add a rule for ICMPv6 traffic

The following `authorize-security-group-ingress` example uses the `ip-permissions` parameter to add an inbound rule that allows ICMPv6 traffic from anywhere.

```
aws ec2 authorize-security-group-ingress --group-id sg-1234567890abcdef0 --ip-permissions IpProtocol=icmpv6,Ipv6Ranges="[{CidrIpv6=::/0}]"
```

Output:

```
{
    "Return": true,
    "SecurityGroupRules": [
        {
            "SecurityGroupRuleId": "sgr-04b612d9363ab6327",
            "GroupId": "sg-1234567890abcdef0",
            "GroupOwnerId": "123456789012",
            "IsEgress": false,
            "IpProtocol": "icmpv6",
            "FromPort": -1,
            "ToPort": -1,
            "CidrIpv6": "::/0"
        }
    ]
}
```

### Example 7: Add a rule with a description

The following `authorize-security-group-ingress` example uses the `ip-permissions` parameter to add an inbound rule that allows RDP traffic from the specified IPv4 address range. The rule includes a description to help you identify it later.

```
aws ec2 authorize-security-group-ingress --group-id sg-1234567890abcdef0 --ip-  
permissions  
IpProtocol=tcp,FromPort=3389,ToPort=3389,IpRanges="[{CidrIp=203.0.113.0/24,Description='RDP  
access from NY office'}]"
```

Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-0397bbcc01e974db3",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "tcp",  
            "FromPort": 3389,  
            "ToPort": 3389,  
            "CidrIpv4": "203.0.113.0/24",  
            "Description": "RDP access from NY office"  
        }  
    ]  
}
```

### Example 8: To add an inbound rule that uses a prefix list

The following `authorize-security-group-ingress` example uses the `ip-  
permissions` parameter to add an inbound rule that allows all traffic for the CIDR ranges in  
the specified prefix list.

```
aws ec2 authorize-security-group-ingress --group-id sg-04a351bfe432d4e71 --ip-  
permissions IpProtocol=all,PrefixListIds="[{PrefixListId=pl-002dc3ec097de1514}]"
```

Output:

```
{  
    "Return": true,  
    "SecurityGroupRules": [  
        {  
            "SecurityGroupRuleId": "sgr-09c74b32f677c6c7c",  
            "GroupId": "sg-1234567890abcdef0",  
            "GroupOwnerId": "123456789012",  
            "IsEgress": false,  
            "IpProtocol": "all",  
            "FromPort": null,  
            "ToPort": null,  
            "CidrIpv4": null,  
            "Description": "Allow all traffic from prefix list pl-002dc3ec097de1514"  
        }  
    ]  
}
```

```
        "GroupOwnerId": "123456789012",
        "IsEgress": false,
        "IpProtocol": "-1",
        "FromPort": -1,
        "ToPort": -1,
        "PrefixListId": "pl-0721453c7ac4ec009"
    }
]
}
```

For more information, see [Security groups](#) in the *Amazon VPC User Guide*.

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static String createSecurityGroup(Ec2Client ec2, String groupName,
String groupDesc, String vpcId,
    String myIpAddress) {
    try {
        CreateSecurityGroupRequest createRequest =
CreateSecurityGroupRequest.builder()
            .groupName(groupName)
            .description(groupDesc)
            .vpcId(vpcId)
            .build();

        CreateSecurityGroupResponse resp =
ec2.createSecurityGroup(createRequest);
        IpRange ipRange = IpRange.builder()
            .cidrIp(myIpAddress + "/0")
            .build();

        IpPermission ipPerm = IpPermission.builder()
```

```
.ipProtocol("tcp")
.toPort(80)
.fromPort(80)
.ipRanges(ipRange)
.build();

IpPermission ipPerm2 = IpPermission.builder()
.ipProtocol("tcp")
.toPort(22)
.fromPort(22)
.ipRanges(ipRange)
.build();

AuthorizeSecurityGroupIngressRequest authRequest =
AuthorizeSecurityGroupIngressRequest.builder()
.groupName(groupName)
.ipPermissions(ipPerm, ipPerm2)
.build();

ec2.authorizeSecurityGroupIngress(authRequest);
System.out.println("Successfully added ingress policy to security
group " + groupName);
return resp.groupId();

} catch (Ec2Exception e) {
System.err.println(e.awsErrorDetails().errorMessage());
System.exit(1);
}
return "";
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { AuthorizeSecurityGroupIngressCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// Grant permissions for a single IP address to ssh into instances
// within the provided security group.
export const main = async () => {
  const command = new AuthorizeSecurityGroupIngressCommand({
    // Replace with a security group ID from the AWS console or
    // the DescribeSecurityGroupsCommand.
    GroupId: "SECURITY_GROUP_ID",
    IpPermissions: [
      {
        IpProtocol: "tcp",
        FromPort: 22,
        ToPort: 22,
        // Replace 0.0.0.0 with the IP address to authorize.
        // For more information on this notation, see
        // https://en.wikipedia.org/wiki/Classless_Inter-
        Domain_Routing#CIDR_notation
        IpRanges: [{ CidrIp: "0.0.0.0/32" }],
      },
    ],
  });
}

try {
  const { SecurityGroupRules } = await client.send(command);
  console.log(JSON.stringify(SecurityGroupRules, null, 2));
} catch (err) {
  console.error(err);
}
};
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun createEC2SecurityGroupSc(  
    groupNameVal: String?,  
    groupDescVal: String?,  
    vpcIdVal: String?,  
    myIpAddress: String?,  
): String? {  
    val request =  
        CreateSecurityGroupRequest {  
            groupName = groupNameVal  
            description = groupDescVal  
            vpcId = vpcIdVal  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        val resp = ec2.createSecurityGroup(request)  
        val ipRange =  
            IpRange {  
                cidrIp = "$myIpAddress/0"  
            }  
  
        val ipPerm =  
            IpPermission {  
                ipProtocol = "tcp"  
                toPort = 80  
                fromPort = 80  
                ipRanges = listOf(ipRange)  
            }  
  
        val ipPerm2 =  
            IpPermission {  
                ipProtocol = "tcp"  
                toPort = 22  
            }  
    }  
}
```

```
        fromPort = 22
        ipRanges = listOf(ipRange)
    }

    val authRequest =
        AuthorizeSecurityGroupIngressRequest {
            groupName = groupNameVal
            ipPermissions = listOf(ipPerm, ipPerm2)
        }
    ec2.authorizeSecurityGroupIngress(authRequest)
    println("Successfully added ingress policy to Security Group
$groupNameVal")
    return resp.groupId
}
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example defines ingress rules for a security group for EC2-VPC. These rules grant access to a specific IP address for SSH (port 22) and RDC (port 3389). Note that you must identify security groups for EC2-VPC using the security group ID not the security group name. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip1 = @{ IpProtocol="tcp"; FromPort="22"; ToPort="22";
IpRanges="203.0.113.25/32" }
$ip2 = @{ IpProtocol="tcp"; FromPort="3389"; ToPort="3389";
IpRanges="203.0.113.25/32" }

Grant-EC2SecurityGroupIngress -GroupId sg-12345678 -IpPermission @($ip1, $ip2)
```

**Example 2: With PowerShell version 2, you must use New-Object to create the IpPermission objects.**

```
$ip1 = New-Object Amazon.EC2.Model.IpPermission
$ip1.IpProtocol = "tcp"
```

```
$ip1.FromPort = 22
$ip1.ToPort = 22
$ip1.IpRanges.Add("203.0.113.25/32")

$ip2 = new-object Amazon.EC2.Model.IpPermission
$ip2.IpProtocol = "tcp"
$ip2.FromPort = 3389
$ip2.ToPort = 3389
$ip2.IpRanges.Add("203.0.113.25/32")

Grant-EC2SecurityGroupIngress -GroupId sg-12345678 -IpPermission @( $ip1, $ip2 )
```

**Example 3: This example defines ingress rules for a security group for EC2-Classic. These rules grant access to a specific IP address for SSH (port 22) and RDC (port 3389). The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip1 = @{
    IpProtocol="tcp";
    FromPort="22";
    ToPort="22";
    IpRanges="203.0.113.25/32" }

$ip2 = @{
    IpProtocol="tcp";
    FromPort="3389";
    ToPort="3389";
    IpRanges="203.0.113.25/32" }

Grant-EC2SecurityGroupIngress -GroupName "my-security-group" -IpPermission
@( $ip1, $ip2 )
```

**Example 4: With PowerShell version 2, you must use New-Object to create the IpPermission objects.**

```
$ip1 = New-Object Amazon.EC2.Model.IpPermission
$ip1.IpProtocol = "tcp"
$ip1.FromPort = 22
$ip1.ToPort = 22
$ip1.IpRanges.Add("203.0.113.25/32")

$ip2 = new-object Amazon.EC2.Model.IpPermission
$ip2.IpProtocol = "tcp"
$ip2.FromPort = 3389
$ip2.ToPort = 3389
$ip2.IpRanges.Add("203.0.113.25/32")

Grant-EC2SecurityGroupIngress -GroupName "my-security-group" -IpPermission
@( $ip1, $ip2 )
```

**Example 5: This example grants TCP port 8081 access from the specified source security group (sg-1a2b3c4d) to the specified security group (sg-12345678).**

```
$ug = New-Object Amazon.EC2.Model.UserIdGroupPair  
$ug.GroupId = "sg-1a2b3c4d"  
$ug.UserId = "123456789012"  
  
Grant-EC2SecurityGroupIngress -GroupId sg-12345678 -IpPermission  
@{ IpProtocol="tcp"; FromPort="8081"; ToPort="8081"; UserIdGroupPairs=$ug } )
```

**Example 6: This example adds the CIDR 5.5.5.5/32 to the Ingress rules of security Group sg-1234abcd for TCP port 22 traffic with a description.**

```
$IpRange = New-Object -TypeName Amazon.EC2.Model.IpRange  
$IpRange.CidrIp = "5.5.5.5/32"  
$IpRange.Description = "SSH from Office"  
$IpPermission = New-Object Amazon.EC2.Model.IpPermission  
$IpPermission.IpProtocol = "tcp"  
$IpPermission.ToPort = 22  
$IpPermission.FromPort = 22  
$IpPermission.Ipv4Ranges = $IpRange  
Grant-EC2SecurityGroupIngress -GroupId sg-1234abcd -IpPermission $IpPermission
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class SecurityGroupWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) security group  
    actions."""
```

```
def __init__(self, ec2_resource, security_group=None):
    """
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
        resource
                    is used to create additional high-level objects
                    that wrap low-level Amazon EC2 service actions.
        :param security_group: A Boto3 SecurityGroup object. This is a high-level
        object
                    that wraps security group actions.
    """
    self.ec2_resource = ec2_resource
    self.security_group = security_group

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource)

    def authorize_ingress(self, ssh_ingress_ip):
        """
            Adds a rule to the security group to allow access to SSH.

            :param ssh_ingress_ip: The IP address that is granted inbound access to
            connect
                            to port 22 over TCP, used for SSH.
            :return: The response to the authorization request. The 'Return' field of
            the
                            response indicates whether the request succeeded or failed.
        """
        if self.security_group is None:
            logger.info("No security group to update.")
            return

        try:
            ip_permissions = [
                {
                    # SSH ingress open to only the specified IP address.
                    "IpProtocol": "tcp",
                    "FromPort": 22,
                    "ToPort": 22,
                    "IpRanges": [{"CidrIp": f"{ssh_ingress_ip}/32"}],
                }
            ]
        
```

```
        response = self.security_group.authorize_ingress(
            IpPermissions=ip_permissions
        )
    except ClientError as err:
        logger.error(
            "Couldn't authorize inbound rules for %s. Here's why: %s: %s",
            self.security_group.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return response
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// Add an ingress rule to a security group explicitly allowing IPv4 address
/// as {ip}/32 over TCP port 22.
pub async fn authorize_security_group_ssh_ingress(
    &self,
    group_id: &str,
    ingress_ips: Vec<Ipv4Addr>,
) -> Result<(), EC2Error> {
    tracing::info!("Authorizing ingress for security group {group_id}");
    self.client
        .authorize_security_group_ingress()
        .group_id(group_id)
        .set_ip_permissions(Some(
```

```
        ingress_ips
            .into_iter()
            .map(|ip| {
                IpPermission::builder()
                    .ip_protocol("tcp")
                    .from_port(22)
                    .to_port(22)
                    .ip_ranges(IpRange::builder().cidr_ip(format!(
                        "{}/32").build())
                        .build()
                    )
            })
            .collect(),
        ))
        .send()
        .await?;
    Ok(())
}
```

- For API details, see [AuthorizeSecurityGroupIngress](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `CancelCapacityReservation` with an AWS SDK or CLI

The following code examples show how to use `CancelCapacityReservation`.

CLI

### AWS CLI

#### To cancel a capacity reservation

The following `cancel-capacity-reservation` example cancels the specified capacity reservation.

```
aws ec2 cancel-capacity-reservation \
    --capacity-reservation-id cr-1234abcd56EXAMPLE
```

Output:

```
{  
    "Return": true  
}
```

For more information, see [Canceling a Capacity Reservation](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [CancelCapacityReservation](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example cancels the capacity reservation cr-0c1f2345db6f7cdba

```
Remove-EC2CapacityReservation -CapacityReservationId cr-0c1f2345db6f7cdba
```

#### Output:

```
Confirm  
Are you sure you want to perform this action?  
Performing the operation "Remove-EC2CapacityReservation  
(CancelCapacityReservation)" on target "cr-0c1f2345db6f7cdba".  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"): y  
True
```

- For API details, see [CancelCapacityReservation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CancelImportTask with an AWS SDK or CLI

The following code examples show how to use CancelImportTask.

## CLI

### AWS CLI

#### To cancel an import task

The following `cancel-import-task` example cancels the specified import image task.

```
aws ec2 cancel-import-task \
--import-task-id import-ami-1234567890abcdef0
```

Output:

```
{
    "ImportTaskId": "import-ami-1234567890abcdef0",
    "PreviousState": "active",
    "State": "deleting"
}
```

- For API details, see [CancelImportTask](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example cancels the specified import task (either snapshot or image import). If required, a reason can be providing using the `-CancelReason` parameter.**

```
Stop-EC2ImportTask -ImportTaskId import-ami-abcdefgfh
```

- For API details, see [CancelImportTask](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `CancelSpotFleetRequests` with an AWS SDK or CLI

The following code examples show how to use `CancelSpotFleetRequests`.

## CLI

### AWS CLI

#### Example 1: To cancel a Spot fleet request and terminate the associated instances

The following `cancel-spot-fleet-requests` example cancels a Spot Fleet request and terminates the associated On-Demand Instances and Spot Instances.

```
aws ec2 cancel-spot-fleet-requests \
    --spot-fleet-request-ids sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE \
    --terminate-instances
```

Output:

```
{  
    "SuccessfulFleetRequests": [  
        {  
            "SpotFleetRequestId": "sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE",  
            "CurrentSpotFleetRequestState": "cancelled_terminating",  
            "PreviousSpotFleetRequestState": "active"  
        }  
    ],  
    "UnsuccessfulFleetRequests": []  
}
```

For more information, see [Cancel a Spot Fleet request](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

#### Example 2: To cancel a Spot fleet request without terminating the associated instances

The following `cancel-spot-fleet-requests` example cancels a Spot Fleet request without terminating the associated On-Demand Instances and Spot Instances.

```
aws ec2 cancel-spot-fleet-requests \
    --spot-fleet-request-ids sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE \
    --no-terminate-instances
```

Output:

```
{  
    "SuccessfulFleetRequests": [
```

```
{  
    "SpotFleetRequestId": "sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE",  
    "CurrentSpotFleetRequestState": "cancelled_running",  
    "PreviousSpotFleetRequestState": "active"  
}  
,  
"UnsuccessfulFleetRequests": []  
}
```

For more information, see [Cancel a Spot Fleet request](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [CancelSpotFleetRequests](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example cancels the specified Spot fleet request and terminates the associated Spot instances.**

```
Stop-EC2SpotFleetRequest -SpotFleetRequestId sfr-73fb2ce-  
aa30-494c-8788-1cee4EXAMPLE -TerminateInstance $true
```

**Example 2: This example cancels the specified Spot fleet request without terminating the associated Spot instances.**

```
Stop-EC2SpotFleetRequest -SpotFleetRequestId sfr-73fb2ce-  
aa30-494c-8788-1cee4EXAMPLE -TerminateInstance $false
```

- For API details, see [CancelSpotFleetRequests](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CancelSpotInstanceRequests with an AWS SDK or CLI

The following code examples show how to use `CancelSpotInstanceRequests`.

## CLI

### AWS CLI

#### To cancel Spot Instance requests

This example command cancels a Spot Instance request.

Command:

```
aws ec2 cancel-spot-instance-requests --spot-instance-request-ids sir-08b93456
```

Output:

```
{  
    "CancelledSpotInstanceRequests": [  
        {  
            "State": "cancelled",  
            "SpotInstanceRequestId": "sir-08b93456"  
        }  
    ]  
}
```

- For API details, see [CancelSpotInstanceRequests](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example cancels the specified Spot instance request.

```
Stop-EC2SpotInstanceRequest -SpotInstanceId sir-12345678
```

Output:

SpotInstanceId	State
sir-12345678	cancelled

- For API details, see [CancelSpotInstanceRequests](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ConfirmProductInstance with an AWS SDK or CLI

The following code examples show how to use ConfirmProductInstance.

CLI

### AWS CLI

#### To confirm the product instance

This example determines whether the specified product code is associated with the specified instance.

Command:

```
aws ec2 confirm-product-instance --product-code 774F4FF8 --instance-id i-1234567890abcdef0
```

Output:

```
{  
    "OwnerId": "123456789012"  
}
```

- For API details, see [ConfirmProductInstance](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example determines whether the specified product code is associated with the specified instance.**

```
Confirm-EC2ProductInstance -ProductCode 774F4FF8 -InstanceId i-12345678
```

- For API details, see [ConfirmProductInstance](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CopyImage with an AWS SDK or CLI

The following code examples show how to use CopyImage.

CLI

### AWS CLI

#### Example 1: To copy an AMI to another Region

The following copy-image example command copies the specified AMI from the us-west-2 Region to the us-east-1 Region and adds a short description.

```
aws ec2 copy-image \
--region us-east-1 \
--name ami-name \
--source-region us-west-2 \
--source-image-id ami-066877671789bd71b \
--description "This is my copied image."
```

Output:

```
{
    "ImageId": "ami-0123456789abcdefg"
}
```

For more information, see [Copy an AMI](#) in the *Amazon EC2 User Guide*.

#### Example 2: To copy an AMI to another Region and encrypt the backing snapshot

The following copy-image command copies the specified AMI from the us-west-2 Region to the current Region and encrypts the backing snapshot using the specified KMS key.

```
aws ec2 copy-image \
--source-region us-west-2 \
--name ami-name \
--source-image-id ami-066877671789bd71b \
```

```
--encrypted \
--kms-key-id alias/my-kms-key
```

Output:

```
{  
    "ImageId": "ami-0123456789abcdefg"  
}
```

For more information, see [Copy an AMI](#) in the *Amazon EC2 User Guide*.

### Example 3: To include your user-defined AMI tags when copying an AMI

The following copy-image command uses the --copy-image-tags parameter to copy your user-defined AMI tags when copying the AMI.

```
aws ec2 copy-image \
--region us-east-1 \
--name ami-name \
--source-region us-west-2 \
--source-image-id ami-066877671789bd71b \
--description "This is my copied image."
--copy-image-tags
```

Output:

```
{  
    "ImageId": "ami-0123456789abcdefg"  
}
```

For more information, see [Copy an AMI](#) in the *Amazon EC2 User Guide*.

- For API details, see [CopyImage](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example copies the specified AMI in the 'EU (Ireland)' region to the 'US West (Oregon)' region. If -Region is not specified, the current default region is used as the destination region.**

```
Copy-EC2Image -SourceRegion eu-west-1 -SourceImageId ami-12345678 -Region us-west-2 -Name "Copy of ami-12345678"
```

## Output:

```
ami-87654321
```

- For API details, see [CopyImage in AWS Tools for PowerShell Cmdlet Reference](#).

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CopySnapshot with an AWS SDK or CLI

The following code examples show how to use CopySnapshot.

### CLI

#### AWS CLI

##### Example 1: To copy a snapshot to another Region

The following copy-snapshot example command copies the specified snapshot from the us-west-2 Region to the us-east-1 Region and adds a short description.

```
aws ec2 copy-snapshot \
  --region us-east-1 \
  --source-region us-west-2 \
  --source-snapshot-id snap-066877671789bd71b \
  --description "This is my copied snapshot."
```

## Output:

```
{  
    "SnapshotId": "snap-066877671789bd71b"  
}
```

For more information, see [Copy an Amazon EBS snapshot](#) in the *Amazon EC2 User Guide*.

## Example 2: To copy an unencrypted snapshot and encrypt the new snapshot

The following copy-snapshot command copies the specified unencrypted snapshot from the us-west-2 Region to the current Region and encrypts the new snapshot using the specified KMS key.

```
aws ec2 copy-snapshot \
--source-region us-west-2 \
--source-snapshot-id snap-066877671789bd71b \
--encrypted \
--kms-key-id alias/my-kms-key
```

Output:

```
{  
    "SnapshotId": "snap-066877671789bd71b"  
}
```

For more information, see [Copy an Amazon EBS snapshot](#) in the *Amazon EC2 User Guide*.

- For API details, see [CopySnapshot](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

#### Example 1: This example copies the specified snapshot from the EU (Ireland) region to the US West (Oregon) region.

```
Copy-EC2Snapshot -SourceRegion eu-west-1 -SourceSnapshotId snap-12345678 -Region  
us-west-2
```

#### Example 2: If you set a default region and omit the Region parameter, the default destination region is the default region.

```
Set-DefaultAWSRegion us-west-2  
Copy-EC2Snapshot -SourceRegion eu-west-1 -SourceSnapshotId snap-12345678
```

- For API details, see [CopySnapshot](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateCapacityReservation with an AWS SDK or CLI

The following code examples show how to use CreateCapacityReservation.

CLI

### AWS CLI

#### Example 1: To create a Capacity Reservation

The following `create-capacity-reservation` example creates a capacity reservation in the `eu-west-1a` Availability Zone, into which you can launch three `t2.medium` instances running a Linux/Unix operating system. By default, the capacity reservation is created with open instance matching criteria and no support for ephemeral storage, and it remains active until you manually cancel it.

```
aws ec2 create-capacity-reservation \
  --availability-zone eu-west-1a \
  --instance-type t2.medium \
  --instance-platform Linux/UNIX \
  --instance-count 3
```

Output:

```
{  
    "CapacityReservation": {  
        "CapacityReservationId": "cr-1234abcd56EXAMPLE ",  
        "EndDateType": "unlimited",  
        "AvailabilityZone": "eu-west-1a",  
        "InstanceMatchCriteria": "open",  
        "EphemeralStorage": false,  
        "CreateDate": "2019-08-16T09:27:35.000Z",  
        "AvailableInstanceCount": 3,  
        "InstancePlatform": "Linux/UNIX",  
        "TotalInstanceCount": 3,  
        "State": "active",  
        "Tenancy": "default",  
    }  
}
```

```
        "EbsOptimized": false,  
        "InstanceType": "t2.medium"  
    }  
}
```

## Example 2: To create a Capacity Reservation that automatically ends at a specified date/time

The following `create-capacity-reservation` example creates a capacity reservation in the `eu-west-1a` Availability Zone, into which you can launch three `m5.large` instances running a Linux/Unix operating system. This capacity reservation automatically ends on 08/31/2019 at 23:59:59.

```
aws ec2 create-capacity-reservation \  
  --availability-zone eu-west-1a \  
  --instance-type m5.large \  
  --instance-platform Linux/UNIX \  
  --instance-count 3 \  
  --end-date-type limited \  
  --end-date 2019-08-31T23:59:59Z
```

Output:

```
{  
    "CapacityReservation": {  
        "CapacityReservationId": "cr-1234abcd56EXAMPLE",  
        "EndDateType": "limited",  
        "AvailabilityZone": "eu-west-1a",  
        "EndDate": "2019-08-31T23:59:59.000Z",  
        "InstanceMatchCriteria": "open",  
        "EphemeralStorage": false,  
        "CreateDate": "2019-08-16T10:15:53.000Z",  
        "AvailableInstanceCount": 3,  
        "InstancePlatform": "Linux/UNIX",  
        "TotalInstanceCount": 3,  
        "State": "active",  
        "Tenancy": "default",  
        "EbsOptimized": false,  
        "InstanceType": "m5.large"  
    }  
}
```

### Example 3: To create a Capacity Reservation that accepts only targeted instance launches

The following `create-capacity-reservation` example creates a capacity reservation that accepts only targeted instance launches.

```
aws ec2 create-capacity-reservation \
--availability-zone eu-west-1a \
--instance-type m5.large \
--instance-platform Linux/UNIX \
--instance-count 3 \
--instance-match-criteria targeted
```

Output:

```
{
    "CapacityReservation": {
        "CapacityReservationId": "cr-1234abcd56EXAMPLE",
        "EndDateType": "unlimited",
        "AvailabilityZone": "eu-west-1a",
        "InstanceMatchCriteria": "targeted",
        "EphemeralStorage": false,
        "CreateDate": "2019-08-16T10:21:57.000Z",
        "AvailableInstanceCount": 3,
        "InstancePlatform": "Linux/UNIX",
        "TotalInstanceCount": 3,
        "State": "active",
        "Tenancy": "default",
        "EbsOptimized": false,
        "InstanceType": "m5.large"
    }
}
```

For more information, see [Creating a Capacity Reservation](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [CreateCapacityReservation](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

### Example 1: This example creates a new Capacity Reservation with the specified attributes

```
Add-EC2CapacityReservation -InstanceType m4.xlarge -InstanceCount 2 -  
AvailabilityZone eu-west-1b -EbsOptimized True -InstancePlatform Windows
```

### Output:

```
AvailabilityZone      : eu-west-1b  
AvailableInstanceCount : 2  
CapacityReservationId : cr-0c1f2345db6f7cdba  
CreateDate          : 3/28/2019 9:29:41 AM  
EbsOptimized        : True  
EndDate              : 1/1/0001 12:00:00 AM  
EndDateFormat       : unlimited  
EphemeralStorage     : False  
InstanceMatchCriteria : open  
InstancePlatform     : Windows  
InstanceType         : m4.xlarge  
State                : active  
Tags                 : {}  
Tenancy              : default  
TotalInstanceCount   : 2
```

- For API details, see [CreateCapacityReservation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateCustomerGateway with an AWS SDK or CLI

The following code examples show how to use CreateCustomerGateway.

### CLI

#### AWS CLI

##### To create a customer gateway

This example creates a customer gateway with the specified IP address for its outside interface.

Command:

```
aws ec2 create-customer-gateway --type ipsec.1 --public-ip 12.1.2.3 --bgp-asn 65534
```

Output:

```
{  
    "CustomerGateway": {  
        "CustomerGatewayId": "cgw-0e11f167",  
        "IpAddress": "12.1.2.3",  
        "State": "available",  
        "Type": "ipsec.1",  
        "BgpAsn": "65534"  
    }  
}
```

- For API details, see [CreateCustomerGateway](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates the specified customer gateway.**

```
New-EC2CustomerGateway -Type ipsec.1 -PublicIp 203.0.113.12 -BgpAsn 65534
```

Output:

```
BgpAsn      : 65534  
CustomerGatewayId : cgw-1a2b3c4d  
IpAddress     : 203.0.113.12  
State        : available  
Tags          : {}  
Type          : ipsec.1
```

- For API details, see [CreateCustomerGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateDhcpOptions with an AWS SDK or CLI

The following code examples show how to use CreateDhcpOptions.

CLI

### AWS CLI

#### To create a set of DHCP options

The following `create-dhcp-options` example creates a set of DHCP options that specifies the domain name, the domain name servers, and the NetBIOS node type.

```
aws ec2 create-dhcp-options \
  --dhcp-configuration \
    "Key=domain-name-servers,Values=10.2.5.1,10.2.5.2" \
    "Key=domain-name,Values=example.com" \
    "Key=netbios-node-type,Values=2"
```

Output:

```
{
  "DhcpOptions": {
    "DhcpConfigurations": [
      {
        "Key": "domain-name",
        "Values": [
          {
            "Value": "example.com"
          }
        ]
      },
      {
        "Key": "domain-name-servers",
        "Values": [
          {
            "Value": "10.2.5.1"
          },
          {
            "Value": "10.2.5.2"
          }
        ]
      }
    ]
  }
}
```

```
        {
            "Value": "10.2.5.2"
        }
    ],
},
{
    "Key": "netbios-node-type",
    "Values": [
        {
            "Value": "2"
        }
    ]
},
"DhcpOptionsId": "dopt-06d52773eff4c55f3"
}
}
```

- For API details, see [CreateDhcpOptions](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates the specified set of DHCP options. The syntax used by this example requires PowerShell version 3 or later.**

```
$options = @(
    @{Key="domain-name";Values=@("abc.local")},
    @{Key="domain-name-servers";Values=@("10.0.0.101","10.0.0.102")})
New-Ec2DhcpOption -DhcpConfiguration $options
```

### Output:

DhcpConfigurations	DhcpOptionsId	Tags
-----	-----	-----
{domain-name, domain-name-servers}	dopt-1a2b3c4d	{}

**Example 2: With PowerShell version 2, you must use New-Object to create each DHCP option.**

```
$option1 = New-Object Amazon.EC2.Model.DhcpConfiguration
```

```
$option1.Key = "domain-name"
$option1.Values = "abc.local"

$option2 = New-Object Amazon.EC2.Model.DhcpConfiguration
$option2.Key = "domain-name-servers"
$option2.Values = @("10.0.0.101","10.0.0.102")

New-EC2DhcpOption -DhcpConfiguration @($option1, $option2)
```

## Output:

DhcpConfigurations	DhcpOptionsId	Tags
{domain-name, domain-name-servers}	dopt-2a3b4c5d	[]

- For API details, see [CreateDhcpOptions](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateFlowLogs with an AWS SDK or CLI

The following code examples show how to use CreateFlowLogs.

### CLI

#### AWS CLI

##### Example 1: To create a flow log

The following `create-flow-logs` example creates a flow log that captures all rejected traffic for the specified network interface. The flow logs are delivered to a log group in CloudWatch Logs using the permissions in the specified IAM role.

```
aws ec2 create-flow-logs \
  --resource-type NetworkInterface \
  --resource-ids eni-11223344556677889 \
  --traffic-type REJECT \
  --log-group-name my-flow-logs \
  --deliver-logs-permission-arn arn:aws:iam::123456789101:role/publishFlowLogs
```

## Output:

```
{  
    "ClientToken": "so0eNA2uSHUNlHI0S2cJ305GuIX1CezaRdGtexample",  
    "FlowLogIds": [  
        "f1-12345678901234567"  
    ],  
    "Unsuccessful": []  
}
```

For more information, see [VPC Flow Logs](#) in the *Amazon VPC User Guide*.

### Example 2: To create a flow log with a custom format

The following `create-flow-logs` example creates a flow log that captures all traffic for the specified VPC and delivers the flow logs to an Amazon S3 bucket. The `--log-format` parameter specifies a custom format for the flow log records. To run this command on Windows, change the single quotes ('') to double quotes ("").

```
aws ec2 create-flow-logs \  
    --resource-type VPC \  
    --resource-ids vpc-00112233344556677 \  
    --traffic-type ALL \  
    --log-destination-type s3 \  

```

For more information, see [VPC Flow Logs](#) in the *Amazon VPC User Guide*.

### Example 3: To create a flow log with a one-minute maximum aggregation interval

The following `create-flow-logs` example creates a flow log that captures all traffic for the specified VPC and delivers the flow logs to an Amazon S3 bucket. The `--max-aggregation-interval` parameter specifies a maximum aggregation interval of 60 seconds (1 minute).

```
aws ec2 create-flow-logs \  
    --resource-type VPC \  
    --resource-ids vpc-00112233344556677 \  
    --traffic-type ALL \  
    --max-aggregation-interval 60
```

```
--log-destination-type s3 \
--log-destination arn:aws:s3:::flow-log-bucket/my-custom-flow-logs/ \
--max-aggregation-interval 60
```

For more information, see [VPC Flow Logs](#) in the *Amazon VPC User Guide*.

- For API details, see [CreateFlowLogs](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates EC2 flowlog for the subnet subnet-1d234567 to the cloud-watch-log named 'subnet1-log' for all 'REJECT' traffic using the permissions of the 'Admin' role**

```
New-EC2FlowLog -ResourceId "subnet-1d234567" -LogDestinationType cloud-watch-
logs -LogGroupName subnet1-log -TrafficType "REJECT" -ResourceType Subnet -
DeliverLogsPermissionArn "arn:aws:iam::98765432109:role/Admin"
```

### Output:

ClientToken	FlowLogIds	Unsuccessful
-----	-----	-----
m1VN2cxP3iB4qo//VUKl5EU6cF7gQL0xcqNefvjeTGw=	{f1-012fc34eed5678c9d}	{}

- For API details, see [CreateFlowLogs](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateImage with an AWS SDK or CLI

The following code examples show how to use CreateImage.

### CLI

#### AWS CLI

**Example 1: To create an AMI from an Amazon EBS-backed instance**

The following `create-image` example creates an AMI from the specified instance.

```
aws ec2 create-image \
--instance-id i-1234567890abcdef0 \
--name "My server" \
--description "An AMI for my server"
```

Output:

```
{  
    "ImageId": "ami-abcdef01234567890"  
}
```

For more information about specifying a block device mapping for your AMI, see [Specifying a block device mapping for an AMI](#) in the *Amazon EC2 User Guide*.

### Example 2: To create an AMI from an Amazon EBS-backed instance without reboot

The following `create-image` example creates an AMI and sets the `--no-reboot` parameter, so that the instance is not rebooted before the image is created.

```
aws ec2 create-image \
--instance-id i-1234567890abcdef0 \
--name "My server" \
--no-reboot
```

Output:

```
{  
    "ImageId": "ami-abcdef01234567890"  
}
```

For more information about specifying a block device mapping for your AMI, see [Specifying a block device mapping for an AMI](#) in the *Amazon EC2 User Guide*.

### Example 3: To tag an AMI and snapshots on creation

The following `create-image` example creates an AMI, and tags the AMI and the snapshots with the same tag `cost-center=cc123`

```
aws ec2 create-image \
--instance-id i-1234567890abcdef0 \
--name "My server" \
--tag-specifications "ResourceType=image,Tags=[{Key=cost-center,Value=cc123}]" "ResourceType=snapshot,Tags=[{Key=cost-center,Value=cc123}]"
```

Output:

```
{  
    "ImageId": "ami-abcdef01234567890"  
}
```

For more information about tagging your resources on creation, see [Add tags on resource creation](#) in the *Amazon EC2 User Guide*.

- For API details, see [CreateImage](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1:** This example creates an AMI with the specified name and description, from the specified instance. Amazon EC2 attempts to cleanly shut down the instance before creating the image, and restarts the instance on completion.

```
New-EC2Image -InstanceId i-12345678 -Name "my-web-server" -Description "My web server AMI"
```

**Example 2:** This example creates an AMI with the specified name and description, from the specified instance. Amazon EC2 creates the image without shutting down and restarting the instance; therefore, file system integrity on the created image can't be guaranteed.

```
New-EC2Image -InstanceId i-12345678 -Name "my-web-server" -Description "My web server AMI" -NoReboot $true
```

**Example 3:** This example creates an AMI with three volumes. The first volume is based on an Amazon EBS snapshot. The second volume is an empty 100 GiB Amazon EBS volume.

**The third volume is an instance store volume. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ebsBlock1 = @{SnapshotId="snap-1a2b3c4d"}  
$ebsBlock2 = @{VolumeSize=100}  
  
New-EC2Image -InstanceId i-12345678 -Name "my-web-server" -Description  
"My web server AMI" -BlockDeviceMapping @(  
@{DeviceName="/dev/sdf";Ebs=$ebsBlock1},  
@{DeviceName="/dev/sdg";Ebs=$ebsBlock2},  
@{DeviceName="/dev/  
sdc";VirtualName="ephemeral0"})
```

- For API details, see [CreateImage](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateInstanceExportTask with an AWS SDK or CLI

The following code examples show how to use CreateInstanceExportTask.

### CLI

#### AWS CLI

##### To export an instance

This example command creates a task to export the instance i-1234567890abcdef0 to the Amazon S3 bucket myexportbucket.

Command:

```
aws ec2 create-instance-export-task --description "RHEL5 instance" --  
instance-id i-1234567890abcdef0 --target-environment vmware --export-to-s3-  
task DiskImageFormat=vmddk,ContainerFormat=ova,S3Bucket=myexportbucket,S3Prefix=RHEL5
```

Output:

```
{  
    "ExportTask": {  
        "State": "active",
```

```
    "InstanceExportDetails": {  
        "InstanceId": "i-1234567890abcdef0",  
        "TargetEnvironment": "vmware"  
    },  
    "ExportToS3Task": {  
        "S3Bucket": "myexportbucket",  
        "S3Key": "RHEL5export-i-fh8sjjsq.ova",  
        "DiskImageFormat": "vmdk",  
        "ContainerFormat": "ova"  
    },  
    "Description": "RHEL5 instance",  
    "ExportTaskId": "export-i-fh8sjjsq"  
}  
}
```

- For API details, see [CreateInstanceExportTask](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1:** This example exports a stopped instance, `i-0800b00a00EXAMPLE`, as a virtual hard disk (VHD) to the S3 bucket `testbucket-export-instances-2019`. The target environment is Microsoft, and the region parameter is added because the instance is in the `us-east-1` region, while the user's default AWS Region is not `us-east-1`. To get the status of the export task, copy the `ExportTaskId` value from the results of this command, then run `Get-EC2ExportTask -ExportTaskId export_task_ID_from_results`.

```
New-EC2InstanceExportTask -InstanceId i-0800b00a00EXAMPLE -  
ExportToS3Task_DiskImageFormat VHD -ExportToS3Task_S3Bucket "testbucket-export-  
instances-2019" -TargetEnvironment Microsoft -Region us-east-1
```

### Output:

```
Description      :  
ExportTaskId   : export-i-077c73108aEXAMPLE  
ExportToS3Task  : Amazon.EC2.Model.ExportToS3Task  
InstanceExportDetails : Amazon.EC2.Model.InstanceExportDetails  
State          : active  
StatusMessage  :
```

- For API details, see [CreateInstanceExportTask](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateInternetGateway with an AWS SDK or CLI

The following code examples show how to use CreateInternetGateway.

### CLI

#### AWS CLI

##### To create an internet gateway

The following create-internet-gateway example creates an internet gateway with the tag Name=my-igw.

```
aws ec2 create-internet-gateway \
  --tag-specifications ResourceType=internet-gateway,Tags=[{Key=Name,Value=my-
  igw}]
```

Output:

```
{
  "InternetGateway": {
    "Attachments": [],
    "InternetGatewayId": "igw-0d0fb496b3994d755",
    "OwnerId": "123456789012",
    "Tags": [
      {
        "Key": "Name",
        "Value": "my-igw"
      }
    ]
  }
}
```

For more information, see [Internet gateways](#) in the *Amazon VPC User Guide*.

- For API details, see [CreateInternetGateway](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates an Internet gateway.**

```
New-EC2InternetGateway
```

#### Output:

Attachments	InternetGatewayId	Tags
-----	-----	-----
{}	igw-1a2b3c4d	{}

- For API details, see [CreateInternetGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateKeyPair with an AWS SDK or CLI

The following code examples show how to use `CreateKeyPair`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

### .NET

#### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Create an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name for the new key pair.</param>
/// <returns>The Amazon EC2 key pair created.</returns>
public async Task<KeyPair?> CreateKeyPair(string keyPairName)
{
    var request = new CreateKeyPairRequest
    {
        KeyName = keyPairName,
    };

    var response = await _amazonEC2.CreateKeyPairAsync(request);

    if (response.HttpStatusCode == HttpStatusCode.OK)
    {
        var kp = response.KeyPair;
        return kp;
    }
    else
    {
        Console.WriteLine("Could not create key pair.");
        return null;
    }
}

/// <summary>
/// Save KeyPair information to a temporary file.
/// </summary>
/// <param name="keyPair">The name of the key pair.</param>
/// <returns>The full path to the temporary file.</returns>
public string SaveKeyPair(KeyPair keyPair)
{
    var tempPath = Path.GetTempPath();
    var tempFileName = $"{tempPath}\\{Path.GetRandomFileName()}";
    var pemFileName = Path.ChangeExtension(tempFileName, "pem");

    // Save the key pair to a file in a temporary folder.
    using var stream = new FileStream(pemFileName, FileMode.Create);
    using var writer = new StreamWriter(stream);
    writer.WriteLine(keyPair.KeyMaterial);

    return pemFileName;
}
```

```
}
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_create_keypair
#
# This function creates an Amazon Elastic Compute Cloud (Amazon EC2) ED25519 or
# 2048-bit RSA key pair
# and writes it to a file.
#
# Parameters:
#     -n key_pair_name - A key pair name.
#     -f file_path - File to store the key pair.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_create_keypair() {
    local key_pair_name file_path response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_create_keypair"
        echo "Creates an Amazon Elastic Compute Cloud (Amazon EC2) ED25519 or 2048-
bit RSA key pair"
        echo " and writes it to a file."
        echo " -n key_pair_name - A key pair name."
        echo " -f file_path - File to store the key pair."
```

```
echo ""
}

# Retrieve the calling parameters.
while getopts "n:f:h" option; do
    case "${option}" in
        n) key_pair_name="${OPTARG}" ;;
        f) file_path="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?) echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key name with the -n parameter."
    usage
    return 1
fi

if [[ -z "$file_path" ]]; then
    errecho "ERROR: You must provide a file path with the -f parameter."
    usage
    return 1
fi

response=$(aws ec2 create-key-pair \
    --key-name "$key_pair_name" \
    --query 'KeyMaterial' \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports create-access-key operation failed.$response"
    return 1
}

if [[ -n "$file_path" ]]; then
    echo "$response" >"$file_path"
```

```
    fi

    return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " A command failed to execute due to a missing dependency."}}
```

```
    errecho "  The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho "  255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [CreateKeyPair](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Create an Amazon Elastic Compute Cloud (Amazon EC2) instance key pair.
/*
 * \param keyPairName: A name for a key pair.
 * \param keyFilePath: File path where the credentials are stored. Ignored if it
 * is an empty string;
 * \param clientConfiguration: AWS client configuration.
 * \return bool: Function succeeded.
 */
bool AwsDoc::EC2::createKeyPair(const Aws::String &keyPairName, const Aws::String
&keyFilePath,
                                const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::CreateKeyPairRequest request;
    request.SetKeyName(keyPairName);

    Aws::EC2::Model::CreateKeyPairOutcome outcome =
ec2Client.CreateKeyPair(request);
    if (!outcome.IsSuccess()) {
        std::cerr << "Failed to create key pair - " << keyPairName << ". " <<
outcome.GetError().GetMessage() << std::endl;
```

```
    } else {
        std::cout << "Successfully created key pair named " <<
            keyPairName << std::endl;
        if (!keyFilePath.empty()) {
            std::ofstream keyFile(keyFilePath.c_str());
            keyFile << outcome.GetResult().GetKeyMaterial();
            keyFile.close();
            std::cout << "Keys written to the file " <<
                keyFilePath << std::endl;
        }
    }

    return outcome.IsSuccess();
}
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To create a key pair

This example creates a key pair named **MyKeyPair**.

Command:

```
aws ec2 create-key-pair --key-name MyKeyPair
```

The output is an ASCII version of the private key and key fingerprint. You need to save the key to a file.

For more information, see Using Key Pairs in the *AWS Command Line Interface User Guide*.

- For API details, see [CreateKeyPair](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void createKeyPair(Ec2Client ec2, String keyName, String  
fileName) {  
    try {  
        CreateKeyPairRequest request = CreateKeyPairRequest.builder()  
            .keyName(keyName)  
            .build();  
  
        CreateKeyPairResponse response = ec2.createKeyPair(request);  
        String content = response.keyMaterial();  
        BufferedWriter writer = new BufferedWriter(new FileWriter(fileName));  
        writer.write(content);  
        writer.close();  
        System.out.println("Successfully created key pair named " + keyName);  
  
    } catch (Ec2Exception | IOException e) {  
        System.err.println(e.getMessage());  
        System.exit(1);  
    }  
}
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { CreateKeyPairCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  try {
    // Create a key pair in Amazon EC2.
    const { KeyMaterial, KeyName } = await client.send(
      // A unique name for the key pair. Up to 255 ASCII characters.
      new CreateKeyPairCommand({ KeyName: "KEY_PAIR_NAME" }),
    );
    // This logs your private key. Be sure to save it.
    console.log(KeyName);
    console.log(KeyMaterial);
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun createEC2KeyPair(keyNameVal: String) {
    val request =
        CreateKeyPairRequest {
            keyName = keyNameVal
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.createKeyPair(request)
        println("The key ID is ${response.keyPairId}")
    }
}
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a key pair and captures the PEM-encoded RSA private key in a file with the specified name. When you are using PowerShell, the encoding must be set to ascii to generate a valid key. For more information, see Create, Display, and Delete Amazon EC2 Key Pairs (<https://docs.aws.amazon.com/cli/latest/userguide/cli-services-ec2-keypairs.html>) in the AWS Command Line Interface User Guide.**

```
(New-EC2KeyPair -KeyName "my-key-pair").KeyMaterial | Out-File -Encoding ascii -  
FilePath C:\path\my-key-pair.pem
```

- For API details, see [CreateKeyPair](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class KeyPairWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) key pair  
    actions."""  
  
    def __init__(self, ec2_resource, key_file_dir, key_pair=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param key_file_dir: The folder where the private key information is  
        stored.  
                    This should be a secure folder.  
        :param key_pair: A Boto3 KeyPair object. This is a high-level object that  
                    wraps key pair actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.key_pair = key_pair  
        self.key_file_path = None  
        self.key_file_dir = key_file_dir  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource, tempfile.TemporaryDirectory())  
  
  
    def create(self, key_name):  
        """  
        Creates a key pair that can be used to securely connect to an EC2  
        instance.  
        The returned key pair contains private key information that cannot be  
        retrieved  
        again. The private key data is stored as a .pem file.  
  
        :param key_name: The name of the key pair to create.  
        :return: A Boto3 KeyPair object that represents the newly created key  
        pair.  
        """  
        try:  
            self.key_pair = self.ec2_resource.create_key_pair(KeyName=key_name)  
            self.key_file_path = os.path.join(  
                self.key_file_dir.name, f"{self.key_pair.name}.pem"
```

```
)  
    with open(self.key_file_path, "w") as key_file:  
        key_file.write(self.key_pair.key_material)  
except ClientError as err:  
    logger.error(  
        "Couldn't create key %s. Here's why: %s: %s",  
        key_name,  
        err.response["Error"]["Code"],  
        err.response["Error"]["Message"],  
    )  
    raise  
else:  
    return self.key_pair
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
# This code example does the following:  
# 1. Creates a key pair in Amazon Elastic Compute Cloud (Amazon EC2).  
# 2. Displays information about available key pairs.  
# 3. Deletes the key pair.  
  
require "aws-sdk-ec2"  
  
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.  
# @param key_pair_name [String] The name for the key pair and private  
#   key file.  
# @return [Boolean] true if the key pair and private key file were  
#   created; otherwise, false.  
# @example
```

```
#    exit 1 unless key_pair_created?(  
#      Aws::EC2::Client.new(region: 'us-west-2'),  
#      'my-key-pair'  
#    )  
def key_pair_created?(ec2_client, key_pair_name)  
  key_pair = ec2_client.create_key_pair(key_name: key_pair_name)  
  puts "Created key pair '#{key_pair.key_name}' with fingerprint " \  
    "'#{key_pair.key_fingerprint}' and ID '#{key_pair.key_pair_id}'."  
  filename = File.join(Dir.home, key_pair_name + ".pem")  
  File.open(filename, "w") { |file| file.write(key_pair.key_material) }  
  puts "Private key file saved locally as '#{filename}'."  
  return true  
rescue Aws::EC2::Errors::InvalidKeyPairDuplicate  
  puts "Error creating key pair: a key pair named '#{key_pair_name}' " \  
    "already exists."  
  return false  
rescue StandardError => e  
  puts "Error creating key pair or saving private key file: #{e.message}"  
  return false  
end  
  
# Displays information about available key pairs in  
# Amazon Elastic Compute Cloud (Amazon EC2).  
#  
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.  
# @example  
#   describe_key_pairs(Aws::EC2::Client.new(region: 'us-west-2'))  
def describe_key_pairs(ec2_client)  
  result = ec2_client.describe_key_pairs  
  if result.key_pairs.count.zero?  
    puts "No key pairs found."  
  else  
    puts "Key pair names:"  
    result.key_pairs.each do |key_pair|  
      puts key_pair.key_name  
    end  
  end  
rescue StandardError => e  
  puts "Error getting information about key pairs: #{e.message}"  
end  
  
# Deletes a key pair in Amazon Elastic Compute Cloud (Amazon EC2).  
#  
# Prerequisites:
```

```
#  
# - The key pair to delete.  
#  
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.  
# @param key_pair_name [String] The name of the key pair to delete.  
# @return [Boolean] true if the key pair was deleted; otherwise, false.  
# @example  
#   exit 1 unless key_pair_deleted?  
#     Aws::EC2::Client.new(region: 'us-west-2'),  
#     'my-key-pair'  
#   )  
def key_pair_deleted?(ec2_client, key_pair_name)  
  ec2_client.delete_key_pair(key_name: key_pair_name)  
  return true  
rescue StandardError => e  
  puts "Error deleting key pair: #{e.message}"  
  return false  
end  
  
# Example usage:  
def run_me  
  key_pair_name = ""  
  region = ""  
  # Print usage information and then stop.  
  if ARGV[0] == "--help" || ARGV[0] == "-h"  
    puts "Usage: ruby ec2-ruby-example-key-pairs.rb KEY_PAIR_NAME REGION"  
    puts "Example: ruby ec2-ruby-example-key-pairs.rb my-key-pair us-west-2"  
    exit 1  
  # If no values are specified at the command prompt, use these default values.  
  # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
  elsif ARGV.count.zero?  
    key_pair_name = "my-key-pair"  
    region = "us-west-2"  
  # Otherwise, use the values as specified at the command prompt.  
  else  
    key_pair_name = ARGV[0]  
    region = ARGV[1]  
  end  
  
  ec2_client = Aws::EC2::Client.new(region: region)  
  
  puts "Displaying existing key pair names before creating this key pair..."  
  describe_key_pairs(ec2_client)
```

```
puts "-" * 10
puts "Creating key pair..."
unless key_pair_created?(ec2_client, key_pair_name)
    puts "Stopping program."
    exit 1
end

puts "-" * 10
puts "Displaying existing key pair names after creating this key pair..."
describe_key_pairs(ec2_client)

puts "-" * 10
puts "Deleting key pair..."
unless key_pair_deleted?(ec2_client, key_pair_name)
    puts "Stopping program. You must delete the key pair yourself."
    exit 1
end
puts "Key pair deleted."

puts "-" * 10
puts "Now that the key pair is deleted, " \
    "also deleting the related private key pair file..."
filename = File.join(Dir.home, key_pair_name + ".pem")
File.delete(filename)
if File.exist?(filename)
    puts "Could not delete file at '#{filename}'. You must delete it yourself."
else
    puts "File deleted."
end

puts "-" * 10
puts "Displaying existing key pair names after deleting this key pair..."
describe_key_pairs(ec2_client)
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Rust implementation that calls the EC2 Client's `create_key_pair` and extracts the returned material.

```
pub async fn create_key_pair(&self, name: String) -> Result<(KeyPairInfo, String), EC2Error> {
    tracing::info!("Creating key pair {name}");
    let output = self.client.create_key_pair().key_name(name).send().await?;
    let info = KeyPairInfo::builder()
        .set_key_name(output.key_name)
        .set_key_fingerprint(output.key_fingerprint)
        .set_key_pair_id(output.key_pair_id)
        .build();
    let material = output
        .key_material
        .ok_or_else(|| EC2Error::new("Create Key Pair has no key material"))?;
    Ok((info, material))
}
```

A function that calls the `create_key` impl and securely saves the PEM private key.

```
/// Creates a key pair that can be used to securely connect to an EC2 instance.
/// The returned key pair contains private key information that cannot be retrieved
/// again. The private key data is stored as a .pem file.
///
/// :param key_name: The name of the key pair to create.
pub async fn create(
    &mut self,
    ec2: &EC2,
```

```
    util: &Util,
    key_name: String,
) -> Result<KeyPairInfo, EC2Error> {
    let (key_pair, material) = ec2
        .create_key_pair(key_name.clone())
        .await
        .map_err(|e| e.add_message(format!("Couldn't create key
{key_name}")))?;

    let path = self.key_file_dir.join(format!("{}.pem"));
    util.write_secure(&key_name, &path, material)?;

    self.key_file_path = Some(path);
    self.key_pair = key_pair.clone();

    Ok(key_pair)
}
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

TRY.

```
oo_result = lo_ec2->createkeypair( iv_keyname = iv_key_name ).
    " oo_result is returned for testing purposes. "
MESSAGE 'Amazon EC2 key pair created.' TYPE 'I'.
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
    DATA(lv_error) = |"{
        lo_exception->av_err_code }" - {
        lo_exception-
    >av_err_msg }|.
    MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [CreateKeyPair](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateLaunchTemplate with an AWS SDK or CLI

The following code examples show how to use CreateLaunchTemplate.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Creates an Amazon EC2 launch template to use with Amazon EC2 Auto
Scaling.
/// The launch template specifies a Bash script in its user data field that
runs after
/// the instance is started. This script installs the Python packages and
starts a Python
/// web server on the instance.
/// </summary>
/// <param name="startupScriptPath">The path to a Bash script file that is
run.</param>
/// <param name="instancePolicyPath">The path to a permissions policy to
create and attach to the profile.</param>
```

```
/// <returns>The template object.</returns>
public async Task<Amazon.EC2.Model.LaunchTemplate> CreateTemplate(string
startupScriptPath, string instancePolicyPath)
{
    await CreateKeyPair(_keyPairName);
    await CreateInstanceProfileWithNamed(_instancePolicyName,
_instanceRoleName, _instanceProfileName, instancePolicyPath);

    var startServerText = await File.ReadAllTextAsync(startupScriptPath);
    var plainTextBytes = System.Text.Encoding.UTF8.GetBytes(startServerText);

    var amiLatest = await _amazonSsm.GetParameterAsync(
        new GetParameterRequest() { Name = _amiParam });
    var amiId = amiLatest.Parameter.Value;
    var launchTemplateResponse = await _amazonEc2.CreateLaunchTemplateAsync(
        new CreateLaunchTemplateRequest()
    {
        LaunchTemplateName = _launchTemplateName,
        LaunchTemplateData = new RequestLaunchTemplateData()
    {
        InstanceType = _instanceType,
        ImageId = amiId,
        IamInstanceProfile =
            new
            LaunchTemplateIamInstanceProfileSpecificationRequest()
        {
            Name = _instanceProfileName
        },
        KeyName = _keyPairName,
        UserData = System.Convert.ToBase64String(plainTextBytes)
    }
});
    return launchTemplateResponse.LaunchTemplate;
}
```

- For API details, see [CreateLaunchTemplate](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### Example 1: To create a launch template

The following `create-launch-template` example creates a launch template that specifies the subnet in which to launch the instance , assigns a public IP address and an IPv6 address to the instance, and creates a tag for the instance.

```
aws ec2 create-launch-template \
    --launch-template-name TemplateForWebServer \
    --version-description WebVersion1 \
    --launch-template-data '{"NetworkInterfaces": [
        {"AssociatePublicIpAddress": true, "DeviceIndex": 0, "Ipv6AddressCount": 1, "SubnetId": "subnet-00000000000000000000000000000000", "Primary": true},
        {"DeviceIndex": 1, "SubnetId": "subnet-00000000000000000000000000000000", "Primary": false}
    ], "Tags": [{"Key": "purpose", "Value": "webserver"}]}]
```

Output:

```
{
    "LaunchTemplate": {
        "LatestVersionNumber": 1,
        "LaunchTemplateId": "lt-01238c059e3466abc",
        "LaunchTemplateName": "TemplateForWebServer",
        "DefaultVersionNumber": 1,
        "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
        "CreateTime": "2019-01-27T09:13:24.000Z"
    }
}
```

For more information, see [Launching an Instance from a Launch Template in the Amazon Elastic Compute Cloud User Guide](#). For information about quoting JSON-formatted parameters, see [Quoting Strings in the AWS Command Line Interface User Guide](#).

#### Example 2: To create a launch template for Amazon EC2 Auto Scaling

The following `create-launch-template` example creates a launch template with multiple tags and a block device mapping to specify an additional EBS volume when an instance launches. Specify a value for Groups that corresponds to security groups for the VPC that your Auto Scaling group will launch instances into. Specify the VPC and subnets as properties of the Auto Scaling group.

```
aws ec2 create-launch-template \
--launch-template-name TemplateForAutoScaling \
--version-description AutoScalingVersion1 \
--launch-template-data '{"NetworkInterfaces": \
[{"DeviceIndex":0,"AssociatePublicIpAddress":true,"Groups": \
["sg-7c227019,sg-903004f8"],"DeleteOnTermination":true}], "ImageId": "ami- \
b42209de", "InstanceType": "m4.large", "TagSpecifications": \
[{"ResourceType": "instance", "Tags": [{"Key": "environment", "Value": "production"}, {"Key": "purpose", "Value": "webserver"}]}, {"ResourceType": "volume", "Tags": [{"Key": "environment", "Value": "production"}, {"Key": "cost- \
center", "Value": "cc123"}]}], "BlockDeviceMappings": [{"DeviceName": "/dev/ \
sda1", "Ebs": {"VolumeSize": 100}}]}' --region us-east-1
```

Output:

```
{  
    "LaunchTemplate": {  
        "LatestVersionNumber": 1,  
        "LaunchTemplateId": "lt-0123c79c33a54e0abc",  
        "LaunchTemplateName": "TemplateForAutoScaling",  
        "DefaultVersionNumber": 1,  
        "CreatedBy": "arn:aws:iam::123456789012:user/Bob",  
        "CreateTime": "2019-04-30T18:16:06.000Z"  
    }  
}
```

For more information, see [Creating a Launch Template for an Auto Scaling Group](#) in the *Amazon EC2 Auto Scaling User Guide*. For information about quoting JSON-formatted parameters, see [Quoting Strings](#) in the *AWS Command Line Interface User Guide*.

### Example 3: To create a launch template that specifies encryption of EBS volumes

The following `create-launch-template` example creates a launch template that includes encrypted EBS volumes created from an unencrypted snapshot. It also tags the volumes during creation. If encryption by default is disabled, you must specify the "Encrypted" option as shown in the following example. If you use the "KmsKeyId" option to specify a customer managed CMK, you also must specify the "Encrypted" option even if encryption by default is enabled.

```
aws ec2 create-launch-template \
--launch-template-name TemplateForEncryption \
```

```
--launch-template-data file://config.json
```

Contents of config.json:

```
{  
    "BlockDeviceMappings": [  
        {  
            "DeviceName": "/dev/sda1",  
            "Ebs": {  
                "VolumeType": "gp2",  
                "DeleteOnTermination": true,  
                "SnapshotId": "snap-066877671789bd71b",  
                "Encrypted": true,  
                "KmsKeyId": "arn:aws:kms:us-east-1:012345678910:key/abcd1234-  
a123-456a-a12b-a123b4cd56ef"  
            }  
        }  
    ],  
    "ImageId": "ami-00068cd7555f543d5",  
    "InstanceType": "c5.large",  
    "TagSpecifications": [  
        {  
            "ResourceType": "volume",  
            "Tags": [  
                {  
                    "Key": "encrypted",  
                    "Value": "yes"  
                }  
            ]  
        }  
    ]  
}
```

Output:

```
{  
    "LaunchTemplate": {  
        "LatestVersionNumber": 1,  
        "LaunchTemplateId": "lt-0d5bd51bcf8530abc",  
        "LaunchTemplateName": "TemplateForEncryption",  
        "DefaultVersionNumber": 1,  
        "CreatedBy": "arn:aws:iam::123456789012:user/Bob",  
        "CreateTime": "2020-01-07T19:08:36.000Z"
```

```
    }  
}
```

For more information, see Restoring an Amazon EBS Volume from a Snapshot and Encryption by Default in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [CreateLaunchTemplate](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
const ssmClient = new SSMClient({});  
const { Parameter } = await ssmClient.send(  
  new GetParameterCommand({  
    Name: "/aws/service/ami-amazon-linux-latest/amzn2-ami-hvm-x86_64-gp2",  
  }),  
);  
const ec2Client = new EC2Client({});  
await ec2Client.send(  
  new CreateLaunchTemplateCommand({  
    LaunchTemplateName: NAMES.launchTemplateName,  
    LaunchTemplateData: {  
      InstanceType: "t3.micro",  
      ImageId: Parameter.Value,  
      IamInstanceProfile: { Name: NAMES.instanceProfileName },  
      UserData: readFileSync(  
        join(RESOURCES_PATH, "server_startup_script.sh"),  
      ).toString("base64"),  
      KeyName: NAMES.keyPairName,  
    },  
  }),
```

- For API details, see [CreateLaunchTemplate](#) in *AWS SDK for JavaScript API Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

This example creates a launch template that includes an instance profile that grants specific permissions to the instance, and a user data Bash script that runs on the instance after it starts.

```
class AutoScaler:  
    """  
        Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,  
        ec2_client,  
        ssm_client,  
        iam_client,  
    ):  
        """  
            :param resource_prefix: The prefix for naming AWS resources that are  
            created by this class.  
            :param inst_type: The type of EC2 instance to create, such as t3.micro.  
            :param ami_param: The Systems Manager parameter used to look up the AMI  
            that is  
                created.  
            :param autoscaling_client: A Boto3 EC2 Auto Scaling client.  
            :param ec2_client: A Boto3 EC2 client.  
            :param ssm_client: A Boto3 Systems Manager client.  
            :param iam_client: A Boto3 IAM client.  
        """  
        self.inst_type = inst_type
```

```
    self.ami_param = ami_param
    self.autoscaling_client = autoscaling_client
    self.ec2_client = ec2_client
    self.ssm_client = ssm_client
    self.iam_client = iam_client
    self.launch_template_name = f"{resource_prefix}-template"
    self.group_name = f"{resource_prefix}-group"
    self.instance_policy_name = f"{resource_prefix}-pol"
    self.instance_role_name = f"{resource_prefix}-role"
    self.instance_profile_name = f"{resource_prefix}-prof"
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
    self.key_pair_name = f"{resource_prefix}-key-pair"

    def create_template(self, server_startup_script_file, instance_policy_file):
        """
        Creates an Amazon EC2 launch template to use with Amazon EC2 Auto
        Scaling. The
            launch template specifies a Bash script in its user data field that runs
        after
            the instance is started. This script installs Python packages and starts
        a
            Python web server on the instance.

        :param server_startup_script_file: The path to a Bash script file that is
        run
                                         when an instance starts.
        :param instance_policy_file: The path to a file that defines a
        permissions policy
                                         to create and attach to the instance
        profile.
        :return: Information about the newly created template.
        """
        template = []
        try:
            self.create_key_pair(self.key_pair_name)
            self.create_instance_profile(
                instance_policy_file,
                self.instance_policy_name,
                self.instance_role_name,
                self.instance_profile_name,
            )
        
```

```
        with open(server_startup_script_file) as file:
            start_server_script = file.read()
        ami_latest = self.ssm_client.get_parameter(Name=self.ami_param)
        ami_id = ami_latest["Parameter"]["Value"]
        lt_response = self.ec2_client.create_launch_template(
            LaunchTemplateName=self.launch_template_name,
            LaunchTemplateData={
                "InstanceType": self.inst_type,
                "ImageId": ami_id,
                "IamInstanceProfile": {"Name": self.instance_profile_name},
                "UserData": base64.b64encode(
                    start_server_script.encode(encoding="utf-8")
                ).decode(encoding="utf-8"),
                "KeyName": self.key_pair_name,
            },
        )
        template = lt_response["LaunchTemplate"]
        log.info(
            "Created launch template %s for AMI %s on %s.",
            self.launch_template_name,
            ami_id,
            self.inst_type,
        )
    except ClientError as err:
        if (
            err.response["Error"]["Code"]
            == "InvalidLaunchTemplateName.AlreadyExistsException"
        ):
            log.info(
                "Launch template %s already exists, nothing to do.",
                self.launch_template_name,
            )
        else:
            raise AutoScalerError(
                f"Couldn't create launch template {self.launch_template_name}: {err}."
            )
    return template
```

- For API details, see [CreateLaunchTemplate](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateNetworkAcl with an AWS SDK or CLI

The following code examples show how to use CreateNetworkAcl.

CLI

### AWS CLI

#### To create a network ACL

This example creates a network ACL for the specified VPC.

Command:

```
aws ec2 create-network-acl --vpc-id vpc-a01106c2
```

Output:

```
{  
    "NetworkAcl": {  
        "Associations": [],  
        "NetworkAclId": "acl-5fb85d36",  
        "VpcId": "vpc-a01106c2",  
        "Tags": [],  
        "Entries": [  
            {  
                "CidrBlock": "0.0.0.0/0",  
                "RuleNumber": 32767,  
                "Protocol": "-1",  
                "Egress": true,  
                "RuleAction": "deny"  
            },  
            {  
                "CidrBlock": "0.0.0.0/0",  
                "RuleNumber": 32767,  
                "Protocol": "-1",  
                "Egress": false,  
                "RuleAction": "deny"  
            }  
        ]  
    }  
}
```

```
    ],
    "IsDefault": false
}
}
```

- For API details, see [CreateNetworkAcl](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a network ACL for the specified VPC.**

```
New-EC2NetworkAcl -VpcId vpc-12345678
```

### Output:

```
Associations : {}
Entries      : {Amazon.EC2.Model.NetworkAclEntry,
                Amazon.EC2.Model.NetworkAclEntry}
IsDefault    : False
NetworkAclId : acl-12345678
Tags         : {}
VpcId        : vpc-12345678
```

- For API details, see [CreateNetworkAcl](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateNetworkAclEntry with an AWS SDK or CLI

The following code examples show how to use CreateNetworkAclEntry.

### CLI

#### AWS CLI

##### To create a network ACL entry

This example creates an entry for the specified network ACL. The rule allows ingress traffic from any IPv4 address (0.0.0.0/0) on UDP port 53 (DNS) into any associated subnet. If the command succeeds, no output is returned.

Command:

```
aws ec2 create-network-acl-entry --network-acl-id acl-5fb85d36 --ingress --rule-number 100 --protocol udp --port-range From=53, To=53 --cidr-block 0.0.0.0/0 --rule-action allow
```

This example creates a rule for the specified network ACL that allows ingress traffic from any IPv6 address (::/0) on TCP port 80 (HTTP).

Command:

```
aws ec2 create-network-acl-entry --network-acl-id acl-5fb85d36 --ingress --rule-number 120 --protocol tcp --port-range From=80, To=80 --ipv6-cidr-block ::/0 --rule-action allow
```

- For API details, see [CreateNetworkAclEntry](#) in AWS CLI Command Reference.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates an entry for the specified network ACL. The rule allows inbound traffic from anywhere (0.0.0.0/0) on UDP port 53 (DNS) into any associated subnet.**

```
New-EC2NetworkAclEntry -NetworkAclId acl-12345678 -Egress $false -RuleNumber 100 -Protocol 17 -PortRange_From 53 -PortRange_To 53 -CidrBlock 0.0.0.0/0 -RuleAction allow
```

- For API details, see [CreateNetworkAclEntry](#) in AWS Tools for PowerShell Cmdlet Reference.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use CreateNetworkInterface with an AWS SDK or CLI

The following code examples show how to use `CreateNetworkInterface`.

CLI

## AWS CLI

### Example 1: To specify an IPv4 address for a network interface

The following `create-network-interface` example creates a network interface for the specified subnet with the specified primary IPv4 address.

```
aws ec2 create-network-interface \
    --subnet-id subnet-00a24d0d67acf6333 \
    --description "my network interface" \
    --groups sg-09dfba7ed20cda78b \
    --private-ip-address 10.0.8.17
```

Output:

```
{  
    "NetworkInterface": {  
        "AvailabilityZone": "us-west-2a",  
        "Description": "my network interface",  
        "Groups": [  
            {  
                "GroupName": "my-security-group",  
                "GroupId": "sg-09dfba7ed20cda78b"  
            }  
        ],  
        "InterfaceType": "interface",  
        "Ipv6Addresses": [],  
        "MacAddress": "06:6a:0f:9a:49:37",  
        "NetworkInterfaceId": "eni-0492b355f0cf3b3f8",  
        "OwnerId": "123456789012",  
        "PrivateDnsName": "ip-10-0-8-18.us-west-2.compute.internal",  
        "PrivateIpAddress": "10.0.8.17",  
        "PrivateIpAddresses": [  
            {  
                "Primary": true,  
                "PrivateDnsName": "ip-10-0-8-17.us-west-2.compute.internal",  
                "PrivateIpAddress": "10.0.8.17"  
            }  
        ]  
    }  
}
```

```
        "PrivateIpAddress": "10.0.8.17"
    }
],
"RequesterId": "AIDA4Z3Y7GSXTMEXAMPLE",
"RequesterManaged": false,
"SourceDestCheck": true,
"Status": "pending",
"SubnetId": "subnet-00a24d0d67acf6333",
"TagSet": [],
"VpcId": "vpc-02723a0feeeb9d57b"
}
}
```

## Example 2: To create a network interface with an IPv4 address and an IPv6 address

The following `create-network-interface` example creates a network interface for the specified subnet with an IPv4 address and an IPv6 address that are selected by Amazon EC2.

```
aws ec2 create-network-interface \
--subnet-id subnet-00a24d0d67acf6333 \
--description "my dual stack network interface" \
--ipv6-address-count 1 \
--groups sg-09dfba7ed20cda78b
```

Output:

```
{ "NetworkInterface": {
    "AvailabilityZone": "us-west-2a",
    "Description": "my dual stack network interface",
    "Groups": [
        {
            "GroupName": "my-security-group",
            "GroupId": "sg-09dfba7ed20cda78b"
        }
    ],
    "InterfaceType": "interface",
    "Ipv6Addresses": [
        {
            "Ipv6Address": "2600:1f13:cfe:3650:a1dc:237c:393a:4ba7",
            "IsPrimaryIpv6": false
        }
    ]
}}
```

```
        ],
        "MacAddress": "06:b8:68:d2:b2:2d",
        "NetworkInterfaceId": "eni-05da417453f9a84bf",
        "OwnerId": "123456789012",
        "PrivateDnsName": "ip-10-0-8-18.us-west-2.compute.internal",
        "PrivateIpAddress": "10.0.8.18",
        "PrivateIpAddresses": [
            {
                "Primary": true,
                "PrivateDnsName": "ip-10-0-8-18.us-west-2.compute.internal",
                "PrivateIpAddress": "10.0.8.18"
            }
        ],
        "RequesterId": "AIDA4Z3Y7GSXTMEXAMPLE",
        "RequesterManaged": false,
        "SourceDestCheck": true,
        "Status": "pending",
        "SubnetId": "subnet-00a24d0d67acf6333",
        "TagSet": [],
        "VpcId": "vpc-02723a0feeeb9d57b",
        "Ipv6Address": "2600:1f13:cfe:3650:a1dc:237c:393a:4ba7"
    }
}
```

### Example 3: To create a network interface with connection tracking configuration options

The following `create-network-interface` example creates a network interface and configures the idle connection tracking timeouts.

```
aws ec2 create-network-interface \
--subnet-id subnet-00a24d0d67acf6333 \
--groups sg-02e57dbcfe0331c1b \
--connection-tracking-specification TcpEstablishedTimeout=86400, UdpTimeout=60
```

Output:

```
{
    "NetworkInterface": {
        "AvailabilityZone": "us-west-2a",
        "ConnectionTrackingConfiguration": {
            "TcpEstablishedTimeout": 86400,
            "UdpTimeout": 60
    }}
```

```
        },
        "Description": "",
        "Groups": [
            {
                "GroupName": "my-security-group",
                "GroupId": "sg-02e57dbcfe0331c1b"
            }
        ],
        "InterfaceType": "interface",
        "Ipv6Addresses": [],
        "MacAddress": "06:4c:53:de:6d:91",
        "NetworkInterfaceId": "eni-0c133586e08903d0b",
        "OwnerId": "123456789012",
        "PrivateDnsName": "ip-10-0-8-94.us-west-2.compute.internal",
        "PrivateIpAddress": "10.0.8.94",
        "PrivateIpAddresses": [
            {
                "Primary": true,
                "PrivateDnsName": "ip-10-0-8-94.us-west-2.compute.internal",
                "PrivateIpAddress": "10.0.8.94"
            }
        ],
        "RequesterId": "AIDA4Z3Y7GSXTMEXAMPLE",
        "RequesterManaged": false,
        "SourceDestCheck": true,
        "Status": "pending",
        "SubnetId": "subnet-00a24d0d67acf6333",
        "TagSet": [],
        "VpcId": "vpc-02723a0feeeb9d57b"
    }
}
```

#### Example 4: To create an Elastic Fabric Adapter

The following `create-network-interface` example creates an EFA.

```
aws ec2 create-network-interface \
--interface-type efa \
--subnet-id subnet-00a24d0d67acf6333 \
--description "my efa" \
--groups sg-02e57dbcfe0331c1b
```

Output:

```
{  
    "NetworkInterface": {  
        "AvailabilityZone": "us-west-2a",  
        "Description": "my efa",  
        "Groups": [  
            {  
                "GroupName": "my-efa-sg",  
                "GroupId": "sg-02e57dbcfe0331c1b"  
            }  
        ],  
        "InterfaceType": "efa",  
        "Ipv6Addresses": [],  
        "MacAddress": "06:d7:a4:f7:4d:57",  
        "NetworkInterfaceId": "eni-034acc2885e862b65",  
        "OwnerId": "123456789012",  
        "PrivateDnsName": "ip-10-0-8-180.us-west-2.compute.internal",  
        "PrivateIpAddress": "10.0.8.180",  
        "PrivateIpAddresses": [  
            {  
                "Primary": true,  
                "PrivateDnsName": "ip-10-0-8-180.us-west-2.compute.internal",  
                "PrivateIpAddress": "10.0.8.180"  
            }  
        ],  
        "RequesterId": "AIDA4Z3Y7GSXTMEXAMPLE",  
        "RequesterManaged": false,  
        "SourceDestCheck": true,  
        "Status": "pending",  
        "SubnetId": "subnet-00a24d0d67acf6333",  
        "TagSet": [],  
        "VpcId": "vpc-02723a0feeeb9d57b"  
    }  
}
```

For more information, see [Elastic network interfaces](#) in the *Amazon EC2 User Guide*.

- For API details, see [CreateNetworkInterface](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates the specified network interface.**

```
New-EC2NetworkInterface -SubnetId subnet-1a2b3c4d -Description "my network interface" -Group sg-12345678 -PrivateIpAddress 10.0.0.17
```

## Output:

```
Association      : 
Attachment       : 
AvailabilityZone : us-west-2c
Description       : my network interface
Groups           : {my-security-group}
MacAddress        : 0a:72:bc:1a:cd:7f
NetworkInterfaceId: eni-12345678
OwnerId          : 123456789012
PrivateDnsName   : ip-10-0-0-17.us-west-2.compute.internal
PrivateIpAddress  : 10.0.0.17
PrivateIpAddresses: {}
RequesterId       : 
RequesterManaged  : False
SourceDestCheck   : True
Status            : pending
SubnetId          : subnet-1a2b3c4d
TagSet            : {}
VpcId             : vpc-12345678
```

- For API details, see [CreateNetworkInterface](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreatePlacementGroup with an AWS SDK or CLI

The following code examples show how to use CreatePlacementGroup.

### CLI

#### AWS CLI

##### To create a placement group

This example command creates a placement group with the specified name.

Command:

```
aws ec2 create-placement-group --group-name my-cluster --strategy cluster
```

### To create a partition placement group

This example command creates a partition placement group named HDFS-Group-A with five partitions.

Command:

```
aws ec2 create-placement-group --group-name HDFS-Group-A --strategy partition --  
partition-count 5
```

- For API details, see [CreatePlacementGroup](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example creates a placement group with the specified name.

```
New-EC2PlacementGroup -GroupName my-placement-group -Strategy cluster
```

- For API details, see [CreatePlacementGroup](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateRoute with an AWS SDK or CLI

The following code examples show how to use CreateRoute.

### CLI

#### AWS CLI

### To create a route

This example creates a route for the specified route table. The route matches all IPv4 traffic (`0.0.0.0/0`) and routes it to the specified Internet gateway. If the command succeeds, no output is returned.

Command:

```
aws ec2 create-route --route-table-id rtb-22574640 --destination-cidr-block 0.0.0.0/0 --gateway-id igw-c0a643a9
```

This example command creates a route in route table `rtb-g8ff4ea2`. The route matches traffic for the IPv4 CIDR block `10.0.0.0/16` and routes it to VPC peering connection, `pcx-111aaa22`. This route enables traffic to be directed to the peer VPC in the VPC peering connection. If the command succeeds, no output is returned.

Command:

```
aws ec2 create-route --route-table-id rtb-g8ff4ea2 --destination-cidr-block 10.0.0.0/16 --vpc-peering-connection-id pcx-1a2b3c4d
```

This example creates a route in the specified route table that matches all IPv6 traffic (`::/0`) and routes it to the specified egress-only Internet gateway.

Command:

```
aws ec2 create-route --route-table-id rtb-dce620b8 --destination-ipv6-cidr-block ::/0 --egress-only-internet-gateway-id eigw-01eadbd45ecd7943f
```

- For API details, see [CreateRoute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates the specified route for the specified route table. The route matches all traffic and sends it to the specified Internet gateway.**

```
New-EC2Route -RouteTableId rtb-1a2b3c4d -DestinationCidrBlock 0.0.0.0/0 -GatewayId igw-1a2b3c4d
```

### Output:

True

- For API details, see [CreateRoute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateRouteTable with an AWS SDK or CLI

The following code examples show how to use CreateRouteTable.

CLI

### AWS CLI

#### To create a route table

This example creates a route table for the specified VPC.

Command:

```
aws ec2 create-route-table --vpc-id vpc-a01106c2
```

Output:

```
{  
    "RouteTable": {  
        "Associations": [],  
        "RouteTableId": "rtb-22574640",  
        "VpcId": "vpc-a01106c2",  
        "PropagatingVgws": [],  
        "Tags": [],  
        "Routes": [  
            {  
                "GatewayId": "local",  
                "DestinationCidrBlock": "10.0.0.0/16",  
                "State": "active"  
            }  
        ]  
    }  
}
```

```
}
```

- For API details, see [CreateRouteTable](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

- Example 1: This example creates a route table for the specified VPC.**

```
New-EC2RouteTable -VpcId vpc-12345678
```

### Output:

```
Associations      : {}
PropagatingVgws : {}
Routes          : {}
RouteTableId     : rtb-1a2b3c4d
Tags            : {}
VpcId           : vpc-12345678
```

- For API details, see [CreateRouteTable](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Prerequisites:
#
# - A VPC in Amazon VPC.
# - A subnet in that VPC.
# - A gateway attached to that subnet.
```

```
#  
# @param ec2_resource [Aws::EC2::Resource] An initialized  
#   Amazon Elastic Compute Cloud (Amazon EC2) resource object.  
# @param vpc_id [String] The ID of the VPC for the route table.  
# @param subnet_id [String] The ID of the subnet for the route table.  
# @param gateway_id [String] The ID of the gateway for the route.  
# @param destination_cidr_block [String] The destination CIDR block  
#   for the route.  
# @param tag_key [String] The key portion of the tag for the route table.  
# @param tag_value [String] The value portion of the tag for the route table.  
# @return [Boolean] true if the route table was created and associated;  
#   otherwise, false.  
# @example  
#   exit 1 unless route_table_created_and_associated?  
#     Aws::EC2::Resource.new(region: 'us-west-2'),  
#     'vpc-0b6f769731EXAMPLE',  
#     'subnet-03d9303b57EXAMPLE',  
#     'igw-06ca90c011EXAMPLE',  
#     '0.0.0.0/0',  
#     'my-key',  
#     'my-value'  
#   )  
def route_table_created_and_associated?(  
  ec2_resource,  
  vpc_id,  
  subnet_id,  
  gateway_id,  
  destination_cidr_block,  
  tag_key,  
  tag_value  
)  
  route_table = ec2_resource.create_route_table(vpc_id: vpc_id)  
  puts "Created route table with ID '#{route_table.id}'."  
  route_table.create_tags(  
    tags: [  
      {  
        key: tag_key,  
        value: tag_value  
      }  
    ]  
  )  
  puts "Added tags to route table."  
  route_table.create_route(  
    destination_cidr_block: destination_cidr_block,
```

```
        gateway_id: gateway_id
    )
    puts "Created route with destination CIDR block " \
        "'#{destination_cidr_block}' and associated with gateway " \
        "with ID '#{gateway_id}'."
    route_table.associate_with_subnet(subnet_id: subnet_id)
    puts "Associated route table with subnet with ID '#{subnet_id}'."
    return true
rescue StandardError => e
    puts "Error creating or associating route table: #{e.message}"
    puts "If the route table was created but not associated, you should " \
        "clean up by deleting the route table."
    return false
end

# Example usage:
def run_me
    vpc_id = ""
    subnet_id = ""
    gateway_id = ""
    destination_cidr_block = ""
    tag_key = ""
    tag_value = ""
    region = ""
    # Print usage information and then stop.
    if ARGV[0] == "--help" || ARGV[0] == "-h"
        puts "Usage: ruby ec2-ruby-example-create-route-table.rb " \
            "VPC_ID SUBNET_ID GATEWAY_ID DESTINATION_CIDR_BLOCK " \
            "TAG_KEY TAG_VALUE REGION"
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
    puts "Example: ruby ec2-ruby-example-create-route-table.rb " \
        "vpc-0b6f769731EXAMPLE subnet-03d9303b57EXAMPLE igw-06ca90c011EXAMPLE " \
        "'0.0.0.0/0' my-key my-value us-west-2"
    exit 1
    # If no values are specified at the command prompt, use these default values.
    elsif ARGV.count.zero?
        vpc_id = "vpc-0b6f769731EXAMPLE"
        subnet_id = "subnet-03d9303b57EXAMPLE"
        gateway_id = "igw-06ca90c011EXAMPLE"
        destination_cidr_block = "0.0.0.0/0"
        tag_key = "my-key"
        tag_value = "my-value"
        # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
        region = "us-west-2"
    end
end
```

```
# Otherwise, use the values as specified at the command prompt.  
else  
    vpc_id = ARGV[0]  
    subnet_id = ARGV[1]  
    gateway_id = ARGV[2]  
    destination_cidr_block = ARGV[3]  
    tag_key = ARGV[4]  
    tag_value = ARGV[5]  
    region = ARGV[6]  
end  
  
ec2_resource = Aws::EC2::Resource.new(region: region)  
  
if route_table_created_and_associated?(  
    ec2_resource,  
    vpc_id,  
    subnet_id,  
    gateway_id,  
    destination_cidr_block,  
    tag_key,  
    tag_value  
)  
    puts "Route table created and associated."  
else  
    puts "Route table not created or not associated."  
end  
end  
  
run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [CreateRouteTable](#) in *AWS SDK for Ruby API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateSecurityGroup with an AWS SDK or CLI

The following code examples show how to use CreateSecurityGroup.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Create an Amazon EC2 security group.
/// </summary>
/// <param name="groupName">The name for the new security group.</param>
/// <param name="groupDescription">A description of the new security group.</param>
/// <returns>The group Id of the new security group.</returns>
public async Task<string> CreateSecurityGroup(string groupName, string
groupDescription)
{
    var response = await _amazonEC2.CreateSecurityGroupAsync(
        new CreateSecurityGroupRequest(groupName, groupDescription));

    return response.GroupId;
}
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_create_security_group
#
# This function creates an Amazon Elastic Compute Cloud (Amazon EC2) security
# group.
#
# Parameters:
#   -n security_group_name - The name of the security group.
#   -d security_group_description - The description of the security group.
#
# Returns:
#   The ID of the created security group, or an error message if the
#   operation fails.
# And:
#   0 - If successful.
#   1 - If it fails.
#
#####
function ec2_create_security_group() {
    local security_group_name security_group_description response

    # Function to display usage information
    function usage() {
        echo "function ec2_create_security_group"
        echo "Creates an Amazon Elastic Compute Cloud (Amazon EC2) security group."
        echo "  -n security_group_name - The name of the security group."
        echo "  -d security_group_description - The description of the security
group."
        echo ""
    }

    # Parse the command-line arguments
    # ... (arguments parsing logic)
}
```

```
while getopts "n:d:h" option; do
    case "${option}" in
        n) security_group_name="${OPTARG}" ;;
        d) security_group_description="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$security_group_name" ]]; then
    errecho "ERROR: You must provide a security group name with the -n
parameter."
    return 1
fi

if [[ -z "$security_group_description" ]]; then
    errecho "ERROR: You must provide a security group description with the -d
parameter."
    return 1
fi

# Create the security group
response=$(aws ec2 create-security-group \
    --group-name "$security_group_name" \
    --description "$security_group_description" \
    --query "GroupId" \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports create-security-group operation failed."
    errecho "$response"
    return 1
}

echo "$response"
return 0
```

```
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
```

```
    fi

    return 0
}
```

- For API details, see [CreateSecurityGroup](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Create a security group.
/*
\param groupName: A security group name.
\param description: A description.
\param vpcID: A virtual private cloud (VPC) ID.
\param[out] groupIDResult: A string to receive the group ID.
\param clientConfiguration: AWS client configuration.
\return bool: Function succeeded.
*/
bool AwsDoc::EC2::createSecurityGroup(const Aws::String &groupName,
                                       const Aws::String &description,
                                       const Aws::String &vpcID,
                                       Aws::String &groupIDResult,
                                       const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::CreateSecurityGroupRequest request;

    request.SetGroupName(groupName);
    request.SetDescription(description);
    request.SetVpcId(vpcID);

    const Aws::EC2::Model::CreateSecurityGroupOutcome outcome =
```

```
        ec2Client.CreateSecurityGroup(request);

        if (!outcome.IsSuccess()) {
            std::cerr << "Failed to create security group:" <<
                outcome.GetError().GetMessage() << std::endl;
            return false;
        }

        std::cout << "Successfully created security group named " << groupName <<
            std::endl;

        groupIDResult = outcome.GetResult().GetGroupId();

        return true;
    }
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To create a security group for EC2-Classic

This example creates a security group named MySecurityGroup.

Command:

```
aws ec2 create-security-group --group-name MySecurityGroup --description "My  
security group"
```

Output:

```
{  
    "GroupId": "sg-903004f8"  
}
```

#### To create a security group for EC2-VPC

This example creates a security group named MySecurityGroup for the specified VPC.

Command:

```
aws ec2 create-security-group --group-name MySecurityGroup --description "My security group" --vpc-id vpc-1a2b3c4d
```

Output:

```
{  
    "GroupId": "sg-903004f8"  
}
```

For more information, see *Using Security Groups in the AWS Command Line Interface User Guide*.

- For API details, see [CreateSecurityGroup](#) in *AWS CLI Command Reference*.

Java

## SDK for Java 2.x

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static String createSecurityGroup(Ec2Client ec2, String groupName,  
String groupDesc, String vpcId,  
        String myIpAddress) {  
    try {  
        CreateSecurityGroupRequest createRequest =  
CreateSecurityGroupRequest.builder()  
            .groupName(groupName)  
            .description(groupDesc)  
            .vpcId(vpcId)  
            .build();  
  
        CreateSecurityGroupResponse resp =  
ec2.createSecurityGroup(createRequest);  
        IpRange ipRange = IpRange.builder()
```

```
.cidrIp(myIpAddress + "/0")
.build();

IpPermission ipPerm = IpPermission.builder()
    .ipProtocol("tcp")
    .toPort(80)
    .fromPort(80)
    .ipRanges(ipRange)
    .build();

IpPermission ipPerm2 = IpPermission.builder()
    .ipProtocol("tcp")
    .toPort(22)
    .fromPort(22)
    .ipRanges(ipRange)
    .build();

AuthorizeSecurityGroupIngressRequest authRequest =
AuthorizeSecurityGroupIngressRequest.builder()
    .groupName(groupName)
    .ipPermissions(ipPerm, ipPerm2)
    .build();

ec2.authorizeSecurityGroupIngress(authRequest);
System.out.println("Successfully added ingress policy to security
group " + groupName);
return resp.groupId();

} catch (Ec2Exception e) {
    System.err.println(e.awsErrorDetails().errorMessage());
    System.exit(1);
}
return "";
}
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { CreateSecurityGroupCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new CreateSecurityGroupCommand({
    // Up to 255 characters in length. Cannot start with sg-.
    GroupName: "SECURITY_GROUP_NAME",
    // Up to 255 characters in length.
    Description: "DESCRIPTION",
  });

  try {
    const { GroupId } = await client.send(command);
    console.log(GroupId);
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun createEC2SecurityGroup(  
    groupNameVal: String?,  
    groupDescVal: String?,  
    vpcIdVal: String?,  
): String? {  
    val request =  
        CreateSecurityGroupRequest {  
            groupName = groupNameVal  
            description = groupDescVal  
            vpcId = vpcIdVal  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        val resp = ec2.createSecurityGroup(request)  
        val ipRange =  
            IpRange {  
                cidrIp = "0.0.0.0/0"  
            }  
  
        val ipPerm =  
            IpPermission {  
                ipProtocol = "tcp"  
                toPort = 80  
                fromPort = 80  
                ipRanges = listOf(ipRange)  
            }  
  
        val ipPerm2 =  
            IpPermission {  
                ipProtocol = "tcp"  
                toPort = 22  
                fromPort = 22  
            }  
    }  
}
```

```
        ipRanges = listOf(ipRange)
    }

    val authRequest =
        AuthorizeSecurityGroupIngressRequest {
            groupName = groupNameVal
            ipPermissions = listOf(ipPerm, ipPerm2)
        }
    ec2.authorizeSecurityGroupIngress(authRequest)
    println("Successfully added ingress policy to Security Group
$groupNameVal")
    return resp.groupId
}
}
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example creates a security group for the specified VPC.

```
New-EC2SecurityGroup -GroupName my-security-group -Description "my security
group" -VpcId vpc-12345678
```

#### Output:

```
sg-12345678
```

#### Example 2: This example creates a security group for EC2-Classic.

```
New-EC2SecurityGroup -GroupName my-security-group -Description "my security
group"
```

#### Output:

```
sg-45678901
```

- For API details, see [CreateSecurityGroup](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class SecurityGroupWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) security group  
    actions."""  
  
    def __init__(self, ec2_resource, security_group=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param security_group: A Boto3 SecurityGroup object. This is a high-level  
        object  
                that wraps security group actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.security_group = security_group  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def create(self, group_name, group_description):  
        """  
        Creates a security group in the default virtual private cloud (VPC) of  
        the  
        current account.  
          
        :param group_name: The name of the security group to create.  
        """
```

```
:param group_description: The description of the security group to
create.

:return: A Boto3 SecurityGroup object that represents the newly created
security group.

"""

try:
    self.security_group = self.ec2_resource.create_security_group(
        GroupName=group_name, Description=group_description
    )
except ClientError as err:
    logger.error(
        "Couldn't create security group %s. Here's why: %s: %s",
        group_name,
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.security_group
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
# This code example does the following:
# 1. Creates an Amazon Elastic Compute Cloud (Amazon EC2) security group.
# 2. Adds inbound rules to the security group.
# 3. Displays information about available security groups.
# 4. Deletes the security group.

require "aws-sdk-ec2"
```

```
# Creates an Amazon Elastic Compute Cloud (Amazon EC2) security group.  
#  
# Prerequisites:  
#  
# - A VPC in Amazon Virtual Private Cloud (Amazon VPC).  
#  
# @param ec2_client [Aws::EC2::Client] An initialized  
#   Amazon EC2 client.  
# @param group_name [String] A name for the security group.  
# @param description [String] A description for the security group.  
# @param vpc_id [String] The ID of the VPC for the security group.  
# @return [String] The ID of security group that was created.  
# @example  
#   puts create_security_group(  
#     Aws::EC2::Client.new(region: 'us-west-2'),  
#     'my-security-group',  
#     'This is my security group.',  
#     'vpc-6713dfEX'  
#   )  
def create_security_group(  
  ec2_client,  
  group_name,  
  description,  
  vpc_id  
)  
  security_group = ec2_client.create_security_group(  
    group_name: group_name,  
    description: description,  
    vpc_id: vpc_id  
  )  
  puts "Created security group '#{group_name}' with ID " \  
    "'#{security_group.group_id}' in VPC with ID '#{vpc_id}'."  
  return security_group.group_id  
rescue StandardError => e  
  puts "Error creating security group: #{e.message}"  
  return "Error"  
end  
  
# Adds an inbound rule to an Amazon Elastic Compute Cloud (Amazon EC2)  
# security group.  
#  
# Prerequisites:  
#
```

```
# - The security group.
#
# @param ec2_client [Aws::EC2::Client] An initialized Amazon EC2 client.
# @param security_group_id [String] The ID of the security group.
# @param ip_protocol [String] The network protocol for the inbound rule.
# @param from_port [String] The originating port for the inbound rule.
# @param to_port [String] The destination port for the inbound rule.
# @param cidr_ip_range [String] The CIDR IP range for the inbound rule.
# @return
# @example
#   exit 1 unless security_group_ingress_authorized?(

#     Aws::EC2::Client.new(region: 'us-west-2'),
#     'sg-030a858e078f1b9EX',
#     'tcp',
#     '80',
#     '80',
#     '0.0.0.0/0'
#   )
def security_group_ingress_authorized?(

  ec2_client,
  security_group_id,
  ip_protocol,
  from_port,
  to_port,
  cidr_ip_range
)
  ec2_client.authorize_security_group_ingress(
    group_id: security_group_id,
    ip_permissions: [
      {
        ip_protocol: ip_protocol,
        from_port: from_port,
        to_port: to_port,
        ip_ranges: [
          {
            cidr_ip: cidr_ip_range
          }
        ]
      }
    ]
  )
  puts "Added inbound rule to security group '#{security_group_id}' for protocol
" \
  "'#{ip_protocol}' from port '#{from_port}' to port '#{to_port}'" \

```

```
    "with CIDR IP range '#{cidr_ip_range}'."
    return true
rescue StandardError => e
    puts "Error adding inbound rule to security group: #{e.message}"
    return false
end

# Displays information about a security group's IP permissions set in
# Amazon Elastic Compute Cloud (Amazon EC2).
#
# Prerequisites:
#
# - A security group with inbound rules, outbound rules, or both.
#
# @param p [Aws::EC2::Types::IpPermission] The IP permissions set.
# @example
#   ec2_client = Aws::EC2::Client.new(region: 'us-west-2')
#   response = ec2_client.describe_security_groups
#   unless sg.ip_permissions.empty?
#     describe_security_group_permissions(
#       response.security_groups[0].ip_permissions[0]
#     )
#   end
def describe_security_group_permissions(perm)
  print "  Protocol: #{perm.ip_protocol == '-1' ? 'All' : perm.ip_protocol}"

  unless perm.from_port.nil?
    if perm.from_port == "-1" || perm.from_port == -1
      print ", From: All"
    else
      print ", From: #{perm.from_port}"
    end
  end

  unless perm.to_port.nil?
    if perm.to_port == "-1" || perm.to_port == -1
      print ", To: All"
    else
      print ", To: #{perm.to_port}"
    end
  end

  if perm.key?(:ipv_6_ranges) && perm.ipv_6_ranges.count.positive?
    print ", CIDR IPv6: #{perm.ipv_6_ranges[0].cidr_ipv_6}"
  end
end
```

```
end

if perm.key?(:ip_ranges) && perm.ip_ranges.count.positive?
  print ", CIDR IPv4: #{perm.ip_ranges[0].cidr_ip}"
end

print "\n"
end

# Displays information about available security groups in
# Amazon Elastic Compute Cloud (Amazon EC2).
#
# @param ec2_client [Aws::EC2::Client] An initialized Amazon EC2 client.
# @example
#   describe_security_groups(Aws::EC2::Client.new(region: 'us-west-2'))
def describe_security_groups(ec2_client)
  response = ec2_client.describe_security_groups

  if response.security_groups.count.positive?
    response.security_groups.each do |sg|
      puts "-" * (sg.group_name.length + 13)
      puts "Name:      #{sg.group_name}"
      puts "Description: #{sg.description}"
      puts "Group ID:   #{sg.group_id}"
      puts "Owner ID:   #{sg.owner_id}"
      puts "VPC ID:     #{sg.vpc_id}"

      if sg.tags.count.positive?
        puts "Tags:"
        sg.tags.each do |tag|
          puts "  Key: #{tag.key}, Value: #{tag.value}"
        end
      end
    end
  end

  unless sg.ip_permissions.empty?
    puts "Inbound rules:" if sg.ip_permissions.count.positive?
    sg.ip_permissions.each do |p|
      describe_security_group_permissions(p)
    end
  end

  unless sg.ip_permissions_egress.empty?
    puts "Outbound rules:" if sg.ip_permissions.count.positive?
    sg.ip_permissions_egress.each do |p|
```

```
        describe_security_group_permissions(p)
      end
    end
  end
else
  puts "No security groups found."
end
rescue StandardError => e
  puts "Error getting information about security groups: #{e.message}"
end

# Deletes an Amazon Elastic Compute Cloud (Amazon EC2)
# security group.
#
# Prerequisites:
#
# - The security group.
#
# @param ec2_client [Aws::EC2::Client] An initialized
#   Amazon EC2 client.
# @param security_group_id [String] The ID of the security group to delete.
# @return [Boolean] true if the security group was deleted; otherwise, false.
# @example
#   exit 1 unless security_group_deleted?(
#     Aws::EC2::Client.new(region: 'us-west-2'),
#     'sg-030a858e078f1b9EX'
#   )
def security_group_deleted?(ec2_client, security_group_id)
  ec2_client.delete_security_group(group_id: security_group_id)
  puts "Deleted security group '#{security_group_id}'."
  return true
rescue StandardError => e
  puts "Error deleting security group: #{e.message}"
  return false
end

# Example usage:
def run_me
  group_name = ""
  description = ""
  vpc_id = ""
  ip_protocol_http = ""
  from_port_http = ""
  to_port_http = ""
```

```
cidr_ip_range_http = ""
ip_protocol_ssh = ""
from_port_ssh = ""
to_port_ssh = ""
cidr_ip_range_ssh = ""
region = ""

# Print usage information and then stop.
if ARGV[0] == "--help" || ARGV[0] == "-h"
    puts "Usage: ruby ec2-ruby-example-security-group.rb " \
        "'GROUP_NAME DESCRIPTION VPC_ID IP_PROTOCOL_1 FROM_PORT_1 TO_PORT_1' " \
        "'CIDR_IP_RANGE_1 IP_PROTOCOL_2 FROM_PORT_2 TO_PORT_2' " \
        "'CIDR_IP_RANGE_2 REGION'"
    puts "Example: ruby ec2-ruby-example-security-group.rb " \
        "'my-security-group 'This is my security group.' vpc-6713dfEX' " \
        "'tcp 80 80 '0.0.0.0/0' tcp 22 22 '0.0.0.0/0' us-west-2'"
    exit 1

# If no values are specified at the command prompt, use these default values.
elsif ARGV.count.zero?
    group_name = "my-security-group"
    description = "This is my security group."
    vpc_id = "vpc-6713dfEX"
    ip_protocol_http = "tcp"
    from_port_http = "80"
    to_port_http = "80"
    cidr_ip_range_http = "0.0.0.0/0"
    ip_protocol_ssh = "tcp"
    from_port_ssh = "22"
    to_port_ssh = "22"
    cidr_ip_range_ssh = "0.0.0.0/0"
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
    region = "us-west-2"
# Otherwise, use the values as specified at the command prompt.
else
    group_name = ARGV[0]
    description = ARGV[1]
    vpc_id = ARGV[2]
    ip_protocol_http = ARGV[3]
    from_port_http = ARGV[4]
    to_port_http = ARGV[5]
    cidr_ip_range_http = ARGV[6]
    ip_protocol_ssh = ARGV[7]
    from_port_ssh = ARGV[8]
    to_port_ssh = ARGV[9]
    cidr_ip_range_ssh = ARGV[10]
```

```
region = ARGV[11]
end

security_group_id = ""
security_group_exists = false
ec2_client = Aws::EC2::Client.new(region: region)

puts "Attempting to create security group..."
security_group_id = create_security_group(
  ec2_client,
  group_name,
  description,
  vpc_id
)
if security_group_id == "Error"
  puts "Could not create security group. Skipping this step."
else
  security_group_exists = true
end

if security_group_exists
  puts "Attempting to add inbound rules to security group..."
  unless security_group_ingress_authorized?(
    ec2_client,
    security_group_id,
    ip_protocol_http,
    from_port_http,
    to_port_http,
    cidr_ip_range_http
  )
    puts "Could not add inbound HTTP rule to security group. " \
      "Skipping this step."
  end

  unless security_group_ingress_authorized?(
    ec2_client,
    security_group_id,
    ip_protocol_ssh,
    from_port_ssh,
    to_port_ssh,
    cidr_ip_range_ssh
  )
    puts "Could not add inbound SSH rule to security group. " \
      "Skipping this step."
  end
end
```

```
    end
  end

  puts "\nInformation about available security groups:"
  describe_security_groups(ec2_client)

  if security_group_exists
    puts "\nAttempting to delete security group..."
    unless security_group_deleted?(ec2_client, security_group_id)
      puts "Could not delete security group. You must delete it yourself."
    end
  end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn create_security_group(
  &self,
  name: &str,
  description: &str,
) -> Result<SecurityGroup, EC2Error> {
  tracing::info!("Creating security group {name}");
  let create_output = self
    .client
    .create_security_group()
    .group_name(name)
    .description(description)
    .send()
    .await
```

```
.map_err(EC2Error::from)?;

let group_id = create_output
    .group_id
    .ok_or_else(|| EC2Error::new("Missing security group id after
creation"))?;

let group = self
    .describe_security_group(&group_id)
    .await?
    .ok_or_else(|| {
        EC2Error::new(format!("Could not find security group with id
{group_id}"))
    })?;

tracing::info!("Created security group {name} as {group_id}");

Ok(group)
}
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

TRY.

```
oo_result = lo_ec2->createsecuritygroup(                                " oo_result is
returned for testing purposes. "
    iv_description = 'Security group example'
    iv_groupname = iv_security_group_name
    iv_vpcid = iv_vpc_id
).
MESSAGE 'Security group created.' TYPE 'I'.
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
```

```
DATA(lv_error) = |"{" lo_exception->av_err_code }" - { lo_exception->av_err_msg }|.
MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [CreateSecurityGroup](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateSnapshot with an AWS SDK or CLI

The following code examples show how to use CreateSnapshot.

CLI

### AWS CLI

#### To create a snapshot

This example command creates a snapshot of the volume with a volume ID of `vol-1234567890abcdef0` and a short description to identify the snapshot.

Command:

```
aws ec2 create-snapshot --volume-id vol-1234567890abcdef0 --description "This is my root volume snapshot"
```

Output:

```
{  
    "Description": "This is my root volume snapshot",  
    "Tags": [],  
    "Encrypted": false,  
    "VolumeId": "vol-1234567890abcdef0",  
    "State": "pending",  
    "VolumeSize": 8,  
    "StartTime": "2018-02-28T21:06:01.000Z",  
}
```

```
"Progress": "",  
"OwnerId": "012345678910",  
"SnapshotId": "snap-066877671789bd71b"  
}
```

## To create a snapshot with tags

This example command creates a snapshot and applies two tags: purpose=prod and costcenter=123.

Command:

```
aws ec2 create-snapshot --volume-id vol-1234567890abcdef0  
--description 'Prod backup' --tag-specifications  
'ResourceType=snapshot,Tags=[{Key=purpose,Value=prod},  
{Key=costcenter,Value=123}]'
```

Output:

```
{  
    "Description": "Prod backup",  
    "Tags": [  
        {  
            "Value": "prod",  
            "Key": "purpose"  
        },  
        {  
            "Value": "123",  
            "Key": "costcenter"  
        }  
    ],  
    "Encrypted": false,  
    "VolumeId": "vol-1234567890abcdef0",  
    "State": "pending",  
    "VolumeSize": 8,  
    "StartTime": "2018-02-28T21:06:00Z",  
    "Progress": "",  
    "OwnerId": "012345678910",  
    "SnapshotId": "snap-09ed24a70bc19bbe4"  
}
```

- For API details, see [CreateSnapshot](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a snapshot of the specified volume.**

```
New-EC2Snapshot -VolumeId vol-12345678 -Description "This is a test"
```

#### Output:

```
DataEncryptionKeyId :  
Description          : This is a test  
Encrypted            : False  
KmsKeyId             :  
OwnerAlias           :  
OwnerId              : 123456789012  
Progress              :  
SnapshotId           : snap-12345678  
StartTime            : 12/22/2015 1:28:42 AM  
State                : pending  
StateMessage         :  
Tags                 : {}  
VolumeId             : vol-12345678  
VolumeSize           : 20
```

- For API details, see [CreateSnapshot](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateSpotDatafeedSubscription with an AWS SDK or CLI

The following code examples show how to use CreateSpotDatafeedSubscription.

### CLI

#### AWS CLI

##### To create a Spot Instance data feed

The following `create-spot-datafeed-subscription` example creates a Spot Instance data feed.

```
aws ec2 create-spot-datafeed-subscription \
--bucket my-bucket \
--prefix spot-data-feed
```

Output:

```
{  
    "SpotDatafeedSubscription": {  
        "Bucket": "my-bucket",  
        "OwnerId": "123456789012",  
        "Prefix": "spot-data-feed",  
        "State": "Active"  
    }  
}
```

The data feed is stored in the Amazon S3 bucket that you specified. The file names for this data feed have the following format.

```
my-bucket.s3.amazonaws.com/spot-data-feed/123456789012.YYYY-MM-DD-
HH.n.abcd1234.gz
```

For more information, see [Spot Instance data feed](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [CreateSpotDatafeedSubscription](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a Spot instance data feed.**

```
New-EC2SpotDatafeedSubscription -Bucket my-s3-bucket -Prefix spotdata
```

**Output:**

```
Bucket : my-s3-bucket
Fault  :
```

```
OwnerId : 123456789012
Prefix : spotdata
State : Active
```

- For API details, see [CreateSpotDatafeedSubscription](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateSubnet with an AWS SDK or CLI

The following code examples show how to use CreateSubnet.

### CLI

#### AWS CLI

##### Example 1: To create a subnet with an IPv4 CIDR block only

The following `create-subnet` example creates a subnet in the specified VPC with the specified IPv4 CIDR block.

```
aws ec2 create-subnet \
--vpc-id vpc-081ec835f3EXAMPLE \
--cidr-block 10.0.0.0/24 \
--tag-specifications ResourceType=subnet,Tags=[{Key=Name,Value=my-ipv4-only-
subnet}]
```

Output:

```
{
  "Subnet": {
    "AvailabilityZone": "us-west-2a",
    "AvailabilityZoneId": "usw2-az2",
    "AvailableIpAddressCount": 251,
    "CidrBlock": "10.0.0.0/24",
    "DefaultForAz": false,
    "MapPublicIpOnLaunch": false,
    "State": "available",
    "SubnetId": "subnet-0e99b93155EXAMPLE",
    "VpcId": "vpc-081ec835f3EXAMPLE"
  }
}
```

```
"VpcId": "vpc-081ec835f3EXAMPLE",
"OwnerId": "123456789012",
"AssignIpv6AddressOnCreation": false,
"Ipv6CidrBlockAssociationSet": [],
"Tags": [
  {
    "Key": "Name",
    "Value": "my-ipv4-only-subnet"
  }
],
"SubnetArn": "arn:aws:ec2:us-west-2:123456789012:subnet/
subnet-0e99b93155EXAMPLE"
}
```

## Example 2: To create a subnet with both IPv4 and IPv6 CIDR blocks

The following create-subnet example creates a subnet in the specified VPC with the specified IPv4 and IPv6 CIDR blocks.

```
aws ec2 create-subnet \
--vpc-id vpc-081ec835f3EXAMPLE \
--cidr-block 10.0.0.0/24 \
--ipv6-cidr-block 2600:1f16:cfe:3660::/64 \
--tag-specifications ResourceType=subnet,Tags=[{Key=Name,Value=my-ipv4-ipv6-
subnet}]
```

Output:

```
{ "Subnet": { "AvailabilityZone": "us-west-2a", "AvailabilityZoneId": "usw2-az2", "AvailableIpAddressCount": 251, "CidrBlock": "10.0.0.0/24", "DefaultForAz": false, "MapPublicIpOnLaunch": false, "State": "available", "SubnetId": "subnet-0736441d38EXAMPLE", "VpcId": "vpc-081ec835f3EXAMPLE", "OwnerId": "123456789012", "AssignIpv6AddressOnCreation": false, "Ipv6CidrBlockAssociationSet": [ }
```

```
{  
    "AssociationId": "subnet-cidr-assoc-06c5f904499fcc623",  
    "Ipv6CidrBlock": "2600:1f13:cfe:3660::/64",  
    "Ipv6CidrBlockState": {  
        "State": "associating"  
    }  
},  
"Tags": [  
    {  
        "Key": "Name",  
        "Value": "my-ipv4-ipv6-subnet"  
    }  
,  
    {"SubnetArn": "arn:aws:ec2:us-west-2:123456789012:subnet/  
subnet-0736441d38EXAMPLE"}  
]  
}
```

### Example 3: To create a subnet with an IPv6 CIDR block only

The following `create-subnet` example creates a subnet in the specified VPC with the specified IPv6 CIDR block.

```
aws ec2 create-subnet \  
--vpc-id vpn-081ec835f3EXAMPLE \  
--ipv6-native \  
--ipv6-cidr-block 2600:1f16:115:200::/64 \  
--tag-specifications ResourceType=subnet,Tags=[{Key=Name,Value=my-ipv6-only-  
subnet}]
```

Output:

```
{  
    "Subnet": {  
        "AvailabilityZone": "us-west-2a",  
        "AvailabilityZoneId": "usw2-az2",  
        "AvailableIpAddressCount": 0,  
        "DefaultForAz": false,  
        "MapPublicIpOnLaunch": false,  
        "State": "available",  
        "SubnetId": "subnet-03f720e7deEXAMPLE",  
        "VpcId": "vpc-081ec835f3EXAMPLE",  
    }  
}
```

```
"OwnerId": "123456789012",
"AssignIpv6AddressOnCreation": true,
"Ipv6CidrBlockAssociationSet": [
    {
        "AssociationId": "subnet-cidr-assoc-01ef639edde556709",
        "Ipv6CidrBlock": "2600:1f13:cfe:3660::/64",
        "Ipv6CidrBlockState": {
            "State": "associating"
        }
    }
],
"Tags": [
    {
        "Key": "Name",
        "Value": "my-ipv6-only-subnet"
    }
],
"SubnetArn": "arn:aws:ec2:us-west-2:123456789012:subnet/
subnet-03f720e7deEXAMPLE"
}
```

For more information, see [VPCs and subnets](#) in the *Amazon VPC User Guide*.

- For API details, see [CreateSubnet](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example creates a subnet with the specified CIDR.

```
New-EC2Subnet -VpcId vpc-12345678 -CidrBlock 10.0.0.0/24
```

#### Output:

```
AvailabilityZone      : us-west-2c
AvailableIpAddressCount : 251
CidrBlock             : 10.0.0.0/24
DefaultForAz          : False
MapPublicIpOnLaunch   : False
State                 : pending
SubnetId              : subnet-1a2b3c4d
```

```
Tag : {}
VpcId : vpc-12345678
```

- For API details, see [CreateSubnet](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Creates a subnet within a virtual private cloud (VPC) in
# Amazon Virtual Private Cloud (Amazon VPC) and then tags
# the subnet.
#
# Prerequisites:
#
# - A VPC in Amazon VPC.
#
# @param ec2_resource [Aws::EC2::Resource] An initialized
#   Amazon Elastic Compute Cloud (Amazon EC2) resource object.
# @param vpc_id [String] The ID of the VPC for the subnet.
# @param cidr_block [String] The IPv4 CIDR block for the subnet.
# @param availability_zone [String] The ID of the Availability Zone
#   for the subnet.
# @param tag_key [String] The key portion of the tag for the subnet.
# @param tag_value [String] The value portion of the tag for the subnet.
# @return [Boolean] true if the subnet was created and tagged;
#   otherwise, false.
# @example
#   exit 1 unless subnet_created_and_tagged?(
#     Aws::EC2::Resource.new(region: 'us-west-2'),
#     'vpc-6713dfEX',
#     '10.0.0.0/24',
#     'us-west-2a',
```

```
#      'my-key',
#      'my-value'
#    )
def subnet_created_and_tagged?(  
  ec2_resource,  
  vpc_id,  
  cidr_block,  
  availability_zone,  
  tag_key,  
  tag_value  
)  
  subnet = ec2_resource.create_subnet(  
    vpc_id: vpc_id,  
    cidr_block: cidr_block,  
    availability_zone: availability_zone  
)  
  subnet.create_tags(  
    tags: [  
      {  
        key: tag_key,  
        value: tag_value  
      }  
    ]  
  )  
  puts "Subnet created with ID '#{subnet.id}' in VPC with ID '#{vpc_id}' " \  
    "and CIDR block '#{cidr_block}' in availability zone " \  
    "'#{availability_zone}' and tagged with key '#{tag_key}' and " \  
    "value '#{tag_value}'."  
  return true  
rescue StandardError => e  
  puts "Error creating or tagging subnet: #{e.message}"  
  return false  
end  
  
# Example usage:  
def run_me  
  vpc_id = ""  
  cidr_block = ""  
  availability_zone = ""  
  tag_key = ""  
  tag_value = ""  
  region = ""  
  # Print usage information and then stop.  
  if ARGV[0] == "--help" || ARGV[0] == "-h"
```

```
puts "Usage: ruby ec2-ruby-example-create-subnet.rb " \
    "VPC_ID CIDR_BLOCK AVAILABILITY_ZONE TAG_KEY TAG_VALUE REGION"
# Replace us-west-2 with the AWS Region you're using for Amazon EC2.
puts "Example: ruby ec2-ruby-example-create-subnet.rb " \
    "vpc-6713dfEX 10.0.0.0/24 us-west-2a my-key my-value us-west-2"
exit 1
# If no values are specified at the command prompt, use these default values.
elsif ARGV.count.zero?
    vpc_id = "vpc-6713dfEX"
    cidr_block = "10.0.0.0/24"
    availability_zone = "us-west-2a"
    tag_key = "my-key"
    tag_value = "my-value"
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
    region = "us-west-2"
# Otherwise, use the values as specified at the command prompt.
else
    vpc_id = ARGV[0]
    cidr_block = ARGV[1]
    availability_zone = ARGV[2]
    tag_key = ARGV[3]
    tag_value = ARGV[4]
    region = ARGV[5]
end

ec2_resource = Aws::EC2::Resource.new(region: region)

if subnet_created_and_tagged?(  

    ec2_resource,  

    vpc_id,  

    cidr_block,  

    availability_zone,  

    tag_key,  

    tag_value  

)
    puts "Subnet created and tagged."
else
    puts "Subnet not created or not tagged."
end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [CreateSubnet](#) in *AWS SDK for Ruby API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateTags with an AWS SDK or CLI

The following code examples show how to use CreateTags.

C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Add or overwrite only the specified tags for the specified Amazon Elastic
Compute Cloud (Amazon EC2) resource or resources.
/*
 * \param resources: The resources for the tags.
 * \param tags: Vector of tags.
 * \param clientConfiguration: AWS client configuration.
 * \return bool: Function succeeded.
 */
bool AwsDoc::EC2::createTags(const Aws::Vector<Aws::String> &resources,
                             const Aws::Vector<Aws::EC2::Model::Tag> &tags,
                             const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::CreateTagsRequest createTagsRequest;
    createTagsRequest.SetResources(resources);
    createTagsRequest.SetTags(tags);

    Aws::EC2::Model::CreateTagsOutcome outcome =
ec2Client.CreateTags(createTagsRequest);
```

```
if (outcome.IsSuccess()) {
    std::cout << "Successfully created tags for resources" << std::endl;
} else {
    std::cerr << "Failed to create tags for resources, " <<
outcome.GetError().GetMessage() << std::endl;
}

return outcome.IsSuccess();
}
```

- For API details, see [CreateTags in AWS SDK for C++ API Reference](#).

## CLI

### AWS CLI

#### Example 1: To add a tag to a resource

The following `create-tags` example adds the tag `Stack=production` to the specified image, or overwrites an existing tag for the AMI where the tag key is `Stack`.

```
aws ec2 create-tags \
--resources ami-1234567890abcdef0 \
--tags Key=Stack,Value=production
```

For more information, see [This is the topic title](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

#### Example 2: To add tags to multiple resources

The following `create-tags` example adds (or overwrites) two tags for an AMI and an instance. One of the tags has a key (`webserver`) but no value (value is set to an empty string). The other tag has a key (`stack`) and a value (`Production`).

```
aws ec2 create-tags \
--resources ami-1a2b3c4d i-1234567890abcdef0 \
--tags Key=webserver,Value= Key=stack,Value=Production
```

For more information, see [This is the topic title](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

### Example 3: To add tags containing special characters

The following `create-tags` example adds the tag `[Group]=test` for an instance. The square brackets ([ and ]) are special characters, and must be escaped. The following examples also use the line continuation character appropriate for each environment.

If you are using Windows, surround the element that has special characters with double quotes ("), and then precede each double quote character with a backslash (\) as follows:

```
aws ec2 create-tags ^
--resources i-1234567890abcdef0 ^
--tags Key=\"[Group]\\",Value=test
```

If you are using Windows PowerShell, surround the element the value that has special characters with double quotes ("), precede each double quote character with a backslash (\), and then surround the entire key and value structure with single quotes ('') as follows:

```
aws ec2 create-tags ^
--resources i-1234567890abcdef0 ^
--tags 'Key=\\"[Group]\\"",Value=test'
```

If you are using Linux or OS X, surround the element that has special characters with double quotes ("), and then surround the entire key and value structure with single quotes ('') as follows:

```
aws ec2 create-tags \
--resources i-1234567890abcdef0 \
--tags 'Key="\\\"[Group]\\\"",Value=test'
```

For more information, see [This is the topic title](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [CreateTags](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example adds a single tag to the specified resource. The tag key is 'myTag' and the tag value is 'myTagValue'. The syntax used by this example requires PowerShell version 3 or higher.**

```
New-EC2Tag -Resource i-12345678 -Tag @{ Key="myTag"; Value="myTagValue" }
```

**Example 2: This example updates or adds the specified tags to the specified resource. The syntax used by this example requires PowerShell version 3 or higher.**

```
New-EC2Tag -Resource i-12345678 -Tag @{ @{ Key="myTag"; Value="newTagValue" },  
@{ Key="test"; Value="anotherTagValue" } }
```

**Example 3: With PowerShell version 2, you must use New-Object to create the tag for the Tag parameter.**

```
$tag = New-Object Amazon.EC2.Model.Tag  
$tag.Key = "myTag"  
$tag.Value = "myTagValue"  
  
New-EC2Tag -Resource i-12345678 -Tag $tag
```

- For API details, see [CreateTags in AWS Tools for PowerShell Cmdlet Reference](#).

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

This example applies the Name tag After creating an instance.

```
pub async fn create_instance<'a>()
```

```
&self,
image_id: &'a str,
instance_type: InstanceType,
key_pair: &'a KeyPairInfo,
security_groups: Vec<&'a SecurityGroup>,
) -> Result<String, EC2Error> {
let run_instances = self
    .client
    .run_instances()
    .image_id(image_id)
    .instance_type(instance_type)
    .key_name(
        key_pair
            .key_name()
            .ok_or_else(|| EC2Error::new("Missing key name when launching
instance"))?,
    )
    .set_security_group_ids(Some(
        security_groups
            .iter()
            .filter_map(|sg| sg.group_id.clone())
            .collect(),
    ))
    .min_count(1)
    .max_count(1)
    .send()
    .await?;

if run_instances.instances().is_empty() {
    return Err(EC2Error::new("Failed to create instance"));
}

let instance_id = run_instances.instances()[0].instance_id().unwrap();
let response = self
    .client
    .create_tags()
    .resources(instance_id)
    .tags(
        Tag::builder()
            .key("Name")
            .value("From SDK Examples")
            .build(),
    )
    .send()
```

```
.await;

match response {
    Ok(_) => tracing::info!("Created {instance_id} and applied tags."),
    Err(err) => {
        tracing::info!("Error applying tags to {instance_id}: {err:?}",);
        return Err(err.into());
    }
}

tracing::info!("Instance is created.");

Ok(instance_id.to_string())
}
```

- For API details, see [CreateTags](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateVolume with an AWS SDK or CLI

The following code examples show how to use CreateVolume.

### CLI

#### AWS CLI

##### To create an empty General Purpose SSD (gp2) volume

The following `create-volume` example creates an 80 GiB General Purpose SSD (gp2) volume in the specified Availability Zone. Note that the current Region must be `us-east-1`, or you can add the `--region` parameter to specify the Region for the command.

```
aws ec2 create-volume \
--volume-type gp2 \
--size 80 \
--availability-zone us-east-1a
```

Output:

```
{  
    "AvailabilityZone": "us-east-1a",  
    "Tags": [],  
    "Encrypted": false,  
    "VolumeType": "gp2",  
    "VolumeId": "vol-1234567890abcdef0",  
    "State": "creating",  
    "Iops": 240,  
    "SnapshotId": "",  
    "CreateTime": "YYYY-MM-DDTHH:MM:SS.000Z",  
    "Size": 80  
}
```

If you do not specify a volume type, the default volume type is gp2.

```
aws ec2 create-volume \  
  --size 80 \  
  --availability-zone us-east-1a
```

### Example 2: To create a Provisioned IOPS SSD (io1) volume from a snapshot

The following `create-volume` example creates a Provisioned IOPS SSD (io1) volume with 1000 provisioned IOPS in the specified Availability Zone using the specified snapshot.

```
aws ec2 create-volume \  
  --volume-type io1 \  
  --iops 1000 \  
  --snapshot-id snap-066877671789bd71b \  
  --availability-zone us-east-1a
```

Output:

```
{  
    "AvailabilityZone": "us-east-1a",  
    "Tags": [],  
    "Encrypted": false,  
    "VolumeType": "io1",  
    "VolumeId": "vol-1234567890abcdef0",  
    "State": "creating",  
    "Iops": 1000,  
    "SnapshotId": "snap-066877671789bd71b",  
    "CreateTime": "YYYY-MM-DDTHH:MM:SS.000Z",
```

```
    "Size": 500  
}
```

### Example 3: To create an encrypted volume

The following `create-volume` example creates an encrypted volume using the default CMK for EBS encryption. If encryption by default is disabled, you must specify the `--encrypted` parameter as follows.

```
aws ec2 create-volume \  
  --size 80 \  
  --encrypted \  
  --availability-zone us-east-1a
```

Output:

```
{  
  "AvailabilityZone": "us-east-1a",  
  "Tags": [],  
  "Encrypted": true,  
  "VolumeType": "gp2",  
  "VolumeId": "vol-1234567890abcdef0",  
  "State": "creating",  
  "Iops": 240,  
  "SnapshotId": "",  
  "CreateTime": "YYYY-MM-DDTHH:MM:SS.000Z",  
  "Size": 80  
}
```

If encryption by default is enabled, the following example command creates an encrypted volume, even without the `--encrypted` parameter.

```
aws ec2 create-volume \  
  --size 80 \  
  --availability-zone us-east-1a
```

If you use the `--kms-key-id` parameter to specify a customer managed CMK, you must specify the `--encrypted` parameter even if encryption by default is enabled.

```
aws ec2 create-volume \  
  --volume-type gp2 \  
  --kms-key-id ARN
```

```
--size 80 \
--encrypted \
--kms-key-id 0ea3fef3-80a7-4778-9d8c-1c0c6EXAMPLE \
--availability-zone us-east-1a
```

### Example 4: To create a volume with tags

The following create-volume example creates a volume and adds two tags.

```
aws ec2 create-volume \
  --availability-zone us-east-1a \
  --volume-type gp2 \
  --size 80 \
  --tag-specifications
  'ResourceType=volume,Tags=[{Key=purpose,Value=production},{Key=cost-
center,Value=cc123}]'
```

- For API details, see [CreateVolume](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example creates the specified volume.

```
New-EC2Volume -Size 50 -AvailabilityZone us-west-2a -VolumeType gp2
```

#### Output:

```
Attachments      : {}
AvailabilityZone : us-west-2a
CreateTime       : 12/22/2015 1:42:07 AM
Encrypted        : False
Iops             : 150
KmsKeyId         :
Size             : 50
SnapshotId       :
State            : creating
Tags             : {}
VolumeId         : vol-12345678
VolumeType       : gp2
```

## Example 2: This example request creates a volume and applies a tag with a key of stack and a value of production.

```
$tag = @{ Key="stack"; Value="production" }

$tagspec = new-object Amazon.EC2.Model.TagSpecification
$tagspec.ResourceType = "volume"
$tagspec.Tags.Add($tag)

New-EC2Volume -Size 80 -AvailabilityZone "us-west-2a" -TagSpecification $tagspec
```

- For API details, see [CreateVolume](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateVpc with an AWS SDK or CLI

The following code examples show how to use CreateVpc.

### CLI

#### AWS CLI

##### Example 1: To create a VPC

The following create-vpc example creates a VPC with the specified IPv4 CIDR block and a Name tag.

```
aws ec2 create-vpc \
--cidr-block 10.0.0.0/16 \
--tag-specifications ResourceType=vpc,Tags=[{Key=Name,Value=MyVpc}]
```

Output:

```
{
    "Vpc": {
        "CidrBlock": "10.0.0.0/16",
        "DhcpOptionsId": "dopt-5EXAMPLE",
        "State": "pending",
```

```
"VpcId": "vpc-0a60eb65b4EXAMPLE",
"OwnerId": "123456789012",
"InstanceTenancy": "default",
"Ipv6CidrBlockAssociationSet": [],
"CidrBlockAssociationSet": [
    {
        "AssociationId": "vpc-cidr-assoc-07501b79ecEXAMPLE",
        "CidrBlock": "10.0.0.0/16",
        "CidrBlockState": {
            "State": "associated"
        }
    }
],
"IsDefault": false,
"Tags": [
    {
        "Key": "Name",
        "Value": MyVpc"
    }
]
}
```

## Example 2: To create a VPC with dedicated tenancy

The following `create-vpc` example creates a VPC with the specified IPv4 CIDR block and dedicated tenancy.

```
aws ec2 create-vpc \
--cidr-block 10.0.0.0/16 \
--instance-tenancy dedicated
```

Output:

```
{
    "Vpc": {
        "CidrBlock": "10.0.0.0/16",
        "DhcpOptionsId": "dopt-19edf471",
        "State": "pending",
        "VpcId": "vpc-0a53287fa4EXAMPLE",
        "OwnerId": "111122223333",
        "InstanceTenancy": "dedicated",
        "Ipv6CidrBlockAssociationSet": []
    }
}
```

```
"CidrBlockAssociationSet": [
    {
        "AssociationId": "vpc-cidr-assoc-00b24cc1c2EXAMPLE",
        "CidrBlock": "10.0.0.0/16",
        "CidrBlockState": {
            "State": "associated"
        }
    }
],
"IsDefault": false
}
```

### Example 3: To create a VPC with an IPv6 CIDR block

The following `create-vpc` example creates a VPC with an Amazon-provided IPv6 CIDR block.

```
aws ec2 create-vpc \
--cidr-block 10.0.0.0/16 \
--amazon PROVIDED-IPv6-CIDR-BLOCK
```

Output:

```
{
    "Vpc": {
        "CidrBlock": "10.0.0.0/16",
        "DhcpOptionsId": "dopt-dEXAMPLE",
        "State": "pending",
        "VpcId": "vpc-0fc5e3406bEXAMPLE",
        "OwnerId": "123456789012",
        "InstanceTenancy": "default",
        "Ipv6CidrBlockAssociationSet": [
            {
                "AssociationId": "vpc-cidr-assoc-068432c60bEXAMPLE",
                "Ipv6CidrBlock": "",
                "Ipv6CidrBlockState": {
                    "State": "associating"
                },
                "Ipv6Pool": "Amazon",
                "NetworkBorderGroup": "us-west-2"
            }
        ],
    }
}
```

```
"CidrBlockAssociationSet": [
    {
        "AssociationId": "vpc-cidr-assoc-0669f8f9f5EXAMPLE",
        "CidrBlock": "10.0.0.0/16",
        "CidrBlockState": {
            "State": "associated"
        }
    }
],
"IsDefault": false
}
```

#### Example 4: To create a VPC with a CIDR from an IPAM pool

The following `create-vpc` example creates a VPC with a CIDR from an Amazon VPC IP Address Manager (IPAM) pool.

Linux and macOS:

```
aws ec2 create-vpc \
--ipv4-ipam-pool-id ipam-pool-0533048da7d823723 \
--tag-specifications
 ResourceType=vpc,Tags='[{"Key=Environment,Value="Preprod"}, \
{Key=Owner,Value="Build Team"}]'
```

Windows:

```
aws ec2 create-vpc ^
--ipv4-ipam-pool-id ipam-pool-0533048da7d823723 ^
--tag-specifications
 ResourceType=vpc,Tags=[{"Key=Environment,Value="Preprod"},{Key=Owner,Value="Build
 Team"}]
```

Output:

```
{
    "Vpc": {
        "CidrBlock": "10.0.1.0/24",
        "DhcpOptionsId": "dopt-2afccf50",
        "State": "pending",
        "VpcId": "vpc-010e1791024eb0af9",
```

```
"OwnerId": "123456789012",
"InstanceTenancy": "default",
"Ipv6CidrBlockAssociationSet": [],
"CidrBlockAssociationSet": [
    {
        "AssociationId": "vpc-cidr-assoc-0a77de1d803226d4b",
        "CidrBlock": "10.0.1.0/24",
        "CidrBlockState": {
            "State": "associated"
        }
    }
],
"IsDefault": false,
"Tags": [
    {
        "Key": "Environment",
        "Value": "Preprod"
    },
    {
        "Key": "Owner",
        "Value": "Build Team"
    }
]
}
```

For more information, see [Create a VPC that uses an IPAM pool CIDR](#) in the *Amazon VPC IPAM User Guide*.

- For API details, see [CreateVpc](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a VPC with the specified CIDR. Amazon VPC also creates the following for the VPC: a default DHCP options set, a main route table, and a default network ACL.**

```
New-EC2VPC -CidrBlock 10.0.0.0/16
```

### Output:

```
CidrBlock      : 10.0.0.0/16
DhcpOptionsId : dopt-1a2b3c4d
InstanceTenancy : default
IsDefault      : False
State          : pending
Tags           : {}
VpcId          : vpc-12345678
```

- For API details, see [CreateVpc](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Creates a virtual private cloud (VPC) in
# Amazon Virtual Private Cloud (Amazon VPC) and then tags
# the VPC.
#
# @param ec2_resource [Aws::EC2::Resource] An initialized
#   Amazon Elastic Compute Cloud (Amazon EC2) resource object.
# @param cidr_block [String] The IPv4 CIDR block for the subnet.
# @param tag_key [String] The key portion of the tag for the VPC.
# @param tag_value [String] The value portion of the tag for the VPC.
# @return [Boolean] true if the VPC was created and tagged;
#   otherwise, false.
# @example
#   exit 1 unless vpc_created_and_tagged?(
#     Aws::EC2::Resource.new(region: 'us-west-2'),
#     '10.0.0.0/24',
#     'my-key',
#     'my-value'
#   )
```

```
def vpc_created_and_tagged?(  
    ec2_resource,  
    cidr_block,  
    tag_key,  
    tag_value  
)  
    vpc = ec2_resource.create_vpc(cidr_block: cidr_block)  
  
    # Create a public DNS by enabling DNS support and DNS hostnames.  
    vpc.modify_attribute(enable_dns_support: { value: true })  
    vpc.modify_attribute(enable_dns_hostnames: { value: true })  
  
    vpc.create_tags(tags: [{ key: tag_key, value: tag_value }])  
  
    puts "Created VPC with ID '#{vpc.id}' and tagged with key " \  
        "'#{tag_key}' and value '#{tag_value}'."  
    return true  
rescue StandardError => e  
    puts "#{e.message}"  
    return false  
end  
  
# Example usage:  
def run_me  
    cidr_block = ""  
    tag_key = ""  
    tag_value = ""  
    region = ""  
    # Print usage information and then stop.  
    if ARGV[0] == "--help" || ARGV[0] == "-h"  
        puts "Usage: ruby ec2-ruby-example-create-vpc.rb " \  
            "CIDR_BLOCK TAG_KEY TAG_VALUE REGION"  
        # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
        puts "Example: ruby ec2-ruby-example-create-vpc.rb " \  
            "10.0.0.0/24 my-key my-value us-west-2"  
        exit 1  
    # If no values are specified at the command prompt, use these default values.  
    elsif ARGV.count.zero?  
        cidr_block = "10.0.0.0/24"  
        tag_key = "my-key"  
        tag_value = "my-value"  
        # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
        region = "us-west-2"  
    # Otherwise, use the values as specified at the command prompt.  
end
```

```
else
    cidr_block = ARGV[0]
    tag_key = ARGV[1]
    tag_value = ARGV[2]
    region = ARGV[3]
end

ec2_resource = Aws::EC2::Resource.new(region: region)

if vpc_created_and_tagged?
    ec2_resource,
    cidr_block,
    tag_key,
    tag_value
)
    puts "VPC created and tagged."
else
    puts "VPC not created or not tagged."
end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [CreateVpc](#) in *AWS SDK for Ruby API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `CreateVpcEndpoint` with an AWS SDK or CLI

The following code examples show how to use `CreateVpcEndpoint`.

CLI

**AWS CLI**

### Example 1: To create a gateway endpoint

The following `create-vpc-endpoint` example creates a gateway VPC endpoint between VPC `vpc-1a2b3c4d` and Amazon S3 in the `us-east-1` region, and associates route table `rtb-11aa22bb` with the endpoint.

```
aws ec2 create-vpc-endpoint \
--vpc-id vpc-1a2b3c4d \
--service-name com.amazonaws.us-east-1.s3 \
--route-table-ids rtb-11aa22bb
```

Output:

```
{  
    "VpcEndpoint": {  
        "PolicyDocument": "{\"Version\":\"2008-10-17\"}, \"Statement\":[{\"Sid\": \"\", \"Effect\":\"Allow\", \"Principal\":\"*\", \"Action\":\"*\", \"Resource\": \"*\"}]]",  
        "VpcId": "vpc-1a2b3c4d",  
        "State": "available",  
        "ServiceName": "com.amazonaws.us-east-1.s3",  
        "RouteTableIds": [  
            "rtb-11aa22bb"  
        ],  
        "VpcEndpointId": "vpc-1a2b3c4d",  
        "CreationTimestamp": "2015-05-15T09:40:50Z"  
    }  
}
```

For more information, see [Creating a gateway endpoint](#) in the *AWS PrivateLink Guide*.

## Example 2: To create an interface endpoint

The following `create-vpc-endpoint` example creates an interface VPC endpoint between VPC `vpc-1a2b3c4d` and Amazon S3 in the `us-east-1` region. The command creates the endpoint in subnet `subnet-1a2b3c4d`, associates it with security group `sg-1a2b3c4d`, and adds a tag with a key of "Service" and a Value of "S3".

```
aws ec2 create-vpc-endpoint \
--vpc-id vpc-1a2b3c4d \
--vpc-endpoint-type Interface \
--service-name com.amazonaws.us-east-1.s3 \
--subnet-ids subnet-7b16de0c \
```

```
--security-group-id sg-1a2b3c4d \
--tag-specifications ResourceType=vpce-endpoint,Tags=[{Key=service,Value=S3}]
```

## Output:

```
{
    "VpcEndpoint": {
        "VpcEndpointId": "vpce-1a2b3c4d5e6f1a2b3",
        "VpcEndpointType": "Interface",
        "VpcId": "vpc-1a2b3c4d",
        "ServiceName": "com.amazonaws.us-east-1.s3",
        "State": "pending",
        "RouteTableIds": [],
        "SubnetIds": [
            "subnet-1a2b3c4d"
        ],
        "Groups": [
            {
                "GroupId": "sg-1a2b3c4d",
                "GroupName": "default"
            }
        ],
        "PrivateDnsEnabled": false,
        "RequesterManaged": false,
        "NetworkInterfaceIds": [
            "eni-0b16f0581c8ac6877"
        ],
        "DnsEntries": [
            {
                "DnsName": "*.vpce-1a2b3c4d5e6f1a2b3-9hnenorg.s3.us-east-1.vpce.amazonaws.com",
                "HostedZoneId": "Z7HUB22UULQXV"
            },
            {
                "DnsName": "*.vpce-1a2b3c4d5e6f1a2b3-9hnenorg-us-east-1c.s3.us-east-1.vpce.amazonaws.com",
                "HostedZoneId": "Z7HUB22UULQXV"
            }
        ],
        "CreationTimestamp": "2021-03-05T14:46:16.030000+00:00",
        "Tags": [
            {
                "Key": "service",
                "Value": "S3"
            }
        ]
    }
}
```

```
        "Value": "S3"
    }
],
"OwnerId": "123456789012"
}
}
```

For more information, see [Creating an interface endpoint](#) in the *User Guide for AWSPrivateLink*.

### Example 3: To create a Gateway Load Balancer endpoint

The following `create-vpc-endpoint` example creates a Gateway Load Balancer endpoint between VPC `vpc-111122223333aabbc` and a service that is configured using a Gateway Load Balancer.

```
aws ec2 create-vpc-endpoint \
--service-name com.amazonaws.vpce.us-east-1.vpce-svc-123123a1c43abc123 \
--vpc-endpoint-type GatewayLoadBalancer \
--vpc-id vpc-111122223333aabbc \
--subnet-ids subnet-0011aabbcc2233445
```

Output:

```
{
    "VpcEndpoint": {
        "VpcEndpointId": "vpce-aabbaabbaabbaabba",
        "VpcEndpointType": "GatewayLoadBalancer",
        "VpcId": "vpc-111122223333aabbc",
        "ServiceName": "com.amazonaws.vpce.us-east-1.vpce-svc-123123a1c43abc123",
        "State": "pending",
        "SubnetIds": [
            "subnet-0011aabbcc2233445"
        ],
        "RequesterManaged": false,
        "NetworkInterfaceIds": [
            "eni-01010120203030405"
        ],
        "CreationTimestamp": "2020-11-11T08:06:03.522Z",
        "OwnerId": "123456789012"
    }
}
```

For more information, see [Gateway Load Balancer endpoints](#) in the *User Guide for AWS PrivateLink*.

- For API details, see [CreateVpcEndpoint](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example create a new VPC Endpoint for the service com.amazonaws.eu-west-1.s3 in the VPC vpc-0fc1ff23f45b678eb**

```
New-EC2VpcEndpoint -ServiceName com.amazonaws.eu-west-1.s3 -VpcId  
vpc-0fc1ff23f45b678eb
```

### Output:

```
ClientToken VpcEndpoint  
-----  
Amazon.EC2.Model.VpcEndpoint
```

- For API details, see [CreateVpcEndpoint](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateVpnConnection with an AWS SDK or CLI

The following code examples show how to use CreateVpnConnection.

### CLI

#### AWS CLI

**Example 1: To create a VPN connection with dynamic routing**

The following `create-vpn-connection` example creates a VPN connection between the specified virtual private gateway and the specified customer gateway, and applies tags to the VPN connection. The output includes the configuration information for your customer gateway device, in XML format.

```
aws ec2 create-vpn-connection \
--type ipsec.1 \
--customer-gateway-id cgw-001122334455aabbc \
--vpn-gateway-id vgw-1a1a1a1a1a1a2b2b2 \
--tag-specification 'ResourceType=vpn-connection,Tags=[{Key=Name,Value=BGP-VPN}]'
```

Output:

```
{  
    "VpnConnection": {  
        "CustomerGatewayConfiguration": "...configuration information...",  
        "CustomerGatewayId": "cgw-001122334455aabbc",  
        "Category": "VPN",  
        "State": "pending",  
        "VpnConnectionId": "vpn-123123123123abcab",  
        "VpnGatewayId": "vgw-1a1a1a1a1a1a2b2b2",  
        "Options": {  
            "EnableAcceleration": false,  
            "StaticRoutesOnly": false,  
            "LocalIpv4NetworkCidr": "0.0.0.0/0",  
            "RemoteIpv4NetworkCidr": "0.0.0.0/0",  
            "TunnelInsideIpVersion": "ipv4",  
            "TunnelOptions": [  
                {},  
                {}  
            ]  
        },  
        "Routes": [],  
        "Tags": [  
            {  
                "Key": "Name",  
                "Value": "BGP-VPN"  
            }  
        ]  
    }  
}
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

## Example 2: To create a VPN connection with static routing

The following `create-vpn-connection` example creates a VPN connection between the specified virtual private gateway and the specified customer gateway. The options specify static routing. The output includes the configuration information for your customer gateway device, in XML format.

```
aws ec2 create-vpn-connection \
--type ipsec.1 \
--customer-gateway-id cgw-001122334455aabbc \
--vpn-gateway-id vgw-1a1a1a1a1a1a2b2b2 \
--options "{\"StaticRoutesOnly\":true}"
```

Output:

```
{
    "VpnConnection": {
        "CustomerGatewayConfiguration": "...configuration information...",
        "CustomerGatewayId": "cgw-001122334455aabbc",
        "Category": "VPN",
        "State": "pending",
        "VpnConnectionId": "vpn-123123123123abcab",
        "VpnGatewayId": "vgw-1a1a1a1a1a1a2b2b2",
        "Options": {
            "EnableAcceleration": false,
            "StaticRoutesOnly": true,
            "LocalIpv4NetworkCidr": "0.0.0.0/0",
            "RemoteIpv4NetworkCidr": "0.0.0.0/0",
            "TunnelInsideIpVersion": "ipv4",
            "TunnelOptions": [
                {},
                {}
            ],
            "Routes": [],
            "Tags": []
        }
    }
}
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

**Example 3: To create a VPN connection and specify your own inside CIDR and pre-shared key**

The following `create-vpn-connection` example creates a VPN connection and specifies the inside IP address CIDR block and a custom pre-shared key for each tunnel. The specified values are returned in the `CustomerGatewayConfiguration` information.

```
aws ec2 create-vpn-connection \
--type ipsec.1 \
--customer-gateway-id cgw-001122334455aabbc \
--vpn-gateway-id vgw-1a1a1a1a1a1a2b2b2 \
--options
TunnelOptions='[{TunnelInsideCidr=169.254.12.0/30,PreSharedKey=ExamplePreSharedKey1},
{TunnelInsideCidr=169.254.13.0/30,PreSharedKey=ExamplePreSharedKey2}]'
```

Output:

```
{
  "VpnConnection": {
    "CustomerGatewayConfiguration": "...configuration information...",
    "CustomerGatewayId": "cgw-001122334455aabbc",
    "Category": "VPN",
    "State": "pending",
    "VpnConnectionId": "vpn-123123123123abcab",
    "VpnGatewayId": "vgw-1a1a1a1a1a1a2b2b2",
    "Options": {
      "EnableAcceleration": false,
      "StaticRoutesOnly": false,
      "LocalIpv4NetworkCidr": "0.0.0.0/0",
      "RemoteIpv4NetworkCidr": "0.0.0.0/0",
      "TunnelInsideIpVersion": "ipv4",
      "TunnelOptions": [
        {
          "OutsideIpAddress": "203.0.113.3",
          "TunnelInsideCidr": "169.254.12.0/30",
          "PreSharedKey": "ExamplePreSharedKey1"
        },
        {
          "OutsideIpAddress": "203.0.113.5",
          "TunnelInsideCidr": "169.254.13.0/30",
          "PreSharedKey": "ExamplePreSharedKey2"
        }
      ]
    },
    "Routes": [],
    "Tags": []
  }
}
```

```
    }  
}
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

#### Example 4: To create a VPN connection that supports IPv6 traffic

The following `create-vpn-connection` example creates a VPN connection that supports IPv6 traffic between the specified transit gateway and specified customer gateway. The tunnel options for both tunnels specify that AWS must initiate the IKE negotiation.

```
aws ec2 create-vpn-connection \  
  --type ipsec.1 \  
  --transit-gateway-id tgw-12312312312312312 \  
  --customer-gateway-id cgw-001122334455aabbc \  
  --options TunnelInsideIpVersion=ipv6, TunnelOptions=[{StartupAction=start}, {StartupAction=start}]
```

Output:

```
{  
  "VpnConnection": {  
    "CustomerGatewayConfiguration": "...configuration information...",  
    "CustomerGatewayId": "cgw-001122334455aabbc",  
    "Category": "VPN",  
    "State": "pending",  
    "VpnConnectionId": "vpn-1111111122222222",  
    "TransitGatewayId": "tgw-12312312312312312",  
    "Options": {  
      "EnableAcceleration": false,  
      "StaticRoutesOnly": false,  
      "LocalIpv6NetworkCidr": "::/0",  
      "RemoteIpv6NetworkCidr": "::/0",  
      "TunnelInsideIpVersion": "ipv6",  
      "TunnelOptions": [  
        {  
          "OutsideIpAddress": "203.0.113.3",  
          "StartupAction": "start"  
        },  
        {  
          "OutsideIpAddress": "203.0.113.5",  
        }  
      ]  
    }  
  }  
}
```

```
        "StartupAction": "start"
    }
],
{
    "Routes": [],
    "Tags": []
}
}
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

- For API details, see [CreateVpnConnection](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a VPN connection between the specified virtual private gateway and the specified customer gateway. The output includes the configuration information that your network administrator needs, in XML format.**

```
New-EC2VpnConnection -Type ipsec.1 -CustomerGatewayId cgw-1a2b3c4d -VpnGatewayId vgw-1a2b3c4d
```

### Output:

```
CustomerGatewayConfiguration : [XML document]
CustomerGatewayId           : cgw-1a2b3c4d
Options                      :
Routes                       : {}
State                        : pending
Tags                         : {}
Type                          :
VgwTelemetry                 :
VpnConnectionId              : vpn-12345678
VpnGatewayId                 : vgw-1a2b3c4d
```

**Example 2: This example creates the VPN connection and captures the configuration in a file with the specified name.**

```
(New-EC2VpnConnection -CustomerGatewayId cgw-1a2b3c4d -VpnGatewayId vgw-1a2b3c4d).CustomerGatewayConfiguration | Out-File C:\path\vpn-configuration.xml
```

**Example 3: This example creates a VPN connection, with static routing, between the specified virtual private gateway and the specified customer gateway.**

```
New-EC2VpnConnection -Type ipsec.1 -CustomerGatewayId cgw-1a2b3c4d -VpnGatewayId vgw-1a2b3c4d -Options_StaticRoutesOnly $true
```

- For API details, see [CreateVpnConnection](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateVpnConnectionRoute with an AWS SDK or CLI

The following code examples show how to use CreateVpnConnectionRoute.

### CLI

#### AWS CLI

##### To create a static route for a VPN connection

This example creates a static route for the specified VPN connection. If the command succeeds, no output is returned.

Command:

```
aws ec2 create-vpn-connection-route --vpn-connection-id vpn-40f41529 --destination-cidr-block 11.12.0.0/16
```

- For API details, see [CreateVpnConnectionRoute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates the specified static route for the specified VPN connection.**

```
New-EC2VpnConnectionRoute -VpnConnectionId vpn-12345678 -DestinationCidrBlock  
11.12.0.0/16
```

- For API details, see [CreateVpnConnectionRoute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use CreateVpnGateway with an AWS SDK or CLI

The following code examples show how to use CreateVpnGateway.

### CLI

#### AWS CLI

##### To create a virtual private gateway

This example creates a virtual private gateway.

Command:

```
aws ec2 create-vpn-gateway --type ipsec.1
```

Output:

```
{  
    "VpnGateway": {  
        "AmazonSideAsn": 64512,  
        "State": "available",  
        "Type": "ipsec.1",  
    }  
}
```

```
        "VpnGatewayId": "vgw-9a4cacf3",
        "VpcAttachments": []
    }
}
```

## To create a virtual private gateway with a specific Amazon-side ASN

This example creates a virtual private gateway and specifies the Autonomous System Number (ASN) for the Amazon side of the BGP session.

Command:

```
aws ec2 create-vpn-gateway --type ipsec.1 --amazon-side-asn 65001
```

Output:

```
{
    "VpnGateway": {
        "AmazonSideAsn": 65001,
        "State": "available",
        "Type": "ipsec.1",
        "VpnGatewayId": "vgw-9a4cacf3",
        "VpcAttachments": []
    }
}
```

- For API details, see [CreateVpnGateway](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example creates the specified virtual private gateway.

```
New-EC2VpnGateway -Type ipsec.1
```

Output:

```
AvailabilityZone :
```

```
State      : available
Tags       : {}
Type       : ipsec.1
VpcAttachments : {}
VpnGatewayId   : vgw-1a2b3c4d
```

- For API details, see [CreateVpnGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteCustomerGateway with an AWS SDK or CLI

The following code examples show how to use DeleteCustomerGateway.

### CLI

#### AWS CLI

##### To delete a customer gateway

This example deletes the specified customer gateway. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-customer-gateway --customer-gateway-id cgw-0e11f167
```

- For API details, see [DeleteCustomerGateway](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example deletes the specified customer gateway. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2CustomerGateway -CustomerGatewayId cgw-1a2b3c4d
```

## Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2CustomerGateway (DeleteCustomerGateway)" on Target "cgw-1a2b3c4d".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteCustomerGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteDhcpOptions with an AWS SDK or CLI

The following code examples show how to use DeleteDhcpOptions.

### CLI

#### AWS CLI

##### To delete a DHCP options set

This example deletes the specified DHCP options set. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-dhcp-options --dhcp-options-id dopt-d9070ebb
```

- For API details, see [DeleteDhcpOptions](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example deletes the specified DHCP options set. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2DhcpOption -DhcpOptionsId dopt-1a2b3c4d
```

## Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2DhcpOption (DeleteDhcpOptions)" on Target  
"dopt-1a2b3c4d".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteDhcpOptions](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteFlowLogs with an AWS SDK or CLI

The following code examples show how to use DeleteFlowLogs.

### CLI

#### AWS CLI

##### To delete a flow log

The following `delete-flow-logs` example deletes the specified flow log.

```
aws ec2 delete-flow-logs --flow-log-id f1-11223344556677889
```

## Output:

```
{  
    "Unsuccessful": []  
}
```

- For API details, see [DeleteFlowLogs](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example removes the given FlowLogId fl-01a2b3456a789c01**

```
Remove-EC2FlowLog -FlowLogId fl-01a2b3456a789c01
```

#### Output:

Confirm

Are you sure you want to perform this action?

Performing the operation "Remove-EC2FlowLog (DeleteFlowLogs)" on target  
"fl-01a2b3456a789c01".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"): Y

- For API details, see [DeleteFlowLogs](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteInternetGateway with an AWS SDK or CLI

The following code examples show how to use DeleteInternetGateway.

### CLI

#### AWS CLI

##### To delete an internet gateway

The following delete-internet-gateway example deletes the specified internet gateway.

```
aws ec2 delete-internet-gateway \
--internet-gateway-id igw-0d0fb496b3EXAMPLE
```

This command produces no output.

For more information, see [Internet gateways](#) in the *Amazon VPC User Guide*.

- For API details, see [DeleteInternetGateway](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified Internet gateway. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2InternetGateway -InternetGatewayId igw-1a2b3c4d
```

#### Output:

```
Confirm
Are you sure you want to perform this action?
Performing operation "Remove-EC2InternetGateway (DeleteInternetGateway)" on
Target "igw-1a2b3c4d".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeleteInternetGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteKeyPair with an AWS SDK or CLI

The following code examples show how to use DeleteKeyPair.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

## .NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Delete an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name of the key pair to delete.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DeleteKeyPair(string keyPairName)
{
    try
    {
        await _amazonEC2.DeleteKeyPairAsync(new
DeleteKeyPairRequest(keyPairName)).ConfigureAwait(false);
        return true;
    }
    catch (Exception ex)
    {
        Console.WriteLine($"Couldn't delete the key pair because:
{ex.Message}");
        return false;
    }
}

/// <summary>
/// Delete the temporary file where the key pair information was saved.
/// </summary>
/// <param name="tempFileName">The path to the temporary file.</param>
public void DeleteTempFile(string tempFileName)
{
    if (File.Exists(tempFileName))
    {
        File.Delete(tempFileName);
    }
}
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_delete_keypair
#
# This function deletes an Amazon EC2 ED25519 or 2048-bit RSA key pair.
#
# Parameters:
#     -n key_pair_name - A key pair name.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_delete_keypair() {
    local key_pair_name response

    local option OPTARG # Required to use getopt command in a function.
    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_delete_keypair"
        echo "Deletes an Amazon EC2 ED25519 or 2048-bit RSA key pair."
        echo "  -n key_pair_name - A key pair name."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopt "n:h" option; do
        case "${option}" in
            n) key_pair_name="${OPTARG}" ;;
```

```
h)
    usage
    return 0
;;
\?) 
    echo "Invalid parameter"
    usage
    return 1
;;
esac
done
export OPTIND=1

if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key pair name with the -n parameter."
    usage
    return 1
fi

response=$(aws ec2 delete-key-pair \
--key-name "$key_pair_name") || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports delete-key-pair operation failed.$response"
    return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
```

```
#  
# This function is used to log the error messages from the AWS CLI.  
#  
# The function expects the following argument:  
#           $1 - The error code returned by the AWS CLI.  
#  
# Returns:  
#           0: - Success.  
#  
#####  
function aws_cli_error_log() {  
    local err_code=$1  
    errecho "Error code : $err_code"  
    if [ "$err_code" == 1 ]; then  
        errecho " One or more S3 transfers failed."  
    elif [ "$err_code" == 2 ]; then  
        errecho " Command line failed to parse."  
    elif [ "$err_code" == 130 ]; then  
        errecho " Process received SIGINT."  
    elif [ "$err_code" == 252 ]; then  
        errecho " Command syntax invalid."  
    elif [ "$err_code" == 253 ]; then  
        errecho " The system environment or configuration was invalid."  
    elif [ "$err_code" == 254 ]; then  
        errecho " The service returned an error."  
    elif [ "$err_code" == 255 ]; then  
        errecho " 255 is a catch-all error."  
    fi  
  
    return 0  
}
```

- For API details, see [DeleteKeyPair](#) in *AWS CLI Command Reference*.

## C++

## SDK for C++

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Delete an Amazon Elastic Compute Cloud (Amazon EC2) instance key pair.  
/*!  
 \param keyPairName: A name for a key pair.  
 \param clientConfiguration: AWS client configuration.  
 \return bool: Function succeeded.  
 */  
  
bool AwsDoc::EC2::deleteKeyPair(const Aws::String &keyPairName,  
                                 const Aws::Client::ClientConfiguration  
&clientConfiguration) {  
    Aws::EC2::EC2Client ec2Client(clientConfiguration);  
    Aws::EC2::Model::DeleteKeyPairRequest request;  
  
    request.SetKeyName(keyPairName);  
    const Aws::EC2::Model::DeleteKeyPairOutcome outcome =  
        ec2Client.DeleteKeyPair(  
            request);  
  
    if (!outcome.IsSuccess()) {  
        std::cerr << "Failed to delete key pair " << keyPairName <<  
              ":" << outcome.GetError().GetMessage() << std::endl;  
    } else {  
        std::cout << "Successfully deleted key pair named " << keyPairName <<  
              std::endl;  
    }  
  
    return outcome.IsSuccess();  
}
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To delete a key pair

The following `delete-key-pair` example deletes the specified key pair.

```
aws ec2 delete-key-pair \
--key-name my-key-pair
```

Output:

```
{  
    "Return": true,  
    "KeyId": "key-03c8d3aceb53b507"  
}
```

For more information, see [Create and delete key pairs](#) in the *AWS Command Line Interface User Guide*.

- For API details, see [DeleteKeyPair](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void deleteKeys(Ec2Client ec2, String keyPair) {  
    try {  
        DeleteKeyPairRequest request = DeleteKeyPairRequest.builder()  
            .keyName(keyPair)  
            .build();  
  
        ec2.deleteKeyPair(request);  
    } catch (AmazonServiceException e) {  
        System.out.println("Error deleting key pair: " + e.getMessage());  
    }  
}
```

```
        System.out.println("Successfully deleted key pair named " + keyPair);

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DeleteKeyPairCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new DeleteKeyPairCommand({
    KeyName: "KEY_PAIR_NAME",
  });

  try {
    await client.send(command);
    console.log("Successfully deleted key pair.");
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun deleteKeys(keyPair: String?) {
    val request =
        DeleteKeyPairRequest {
            keyName = keyPair
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.deleteKeyPair(request)
        println("Successfully deleted key pair named $keyPair")
    }
}
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified key pair. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2KeyPair -KeyName my-key-pair
```

### Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2KeyPair (DeleteKeyPair)" on Target "my-key-pair".

```
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):
```

- For API details, see [DeleteKeyPair](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class KeyPairWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) key pair  
    actions."""  
  
    def __init__(self, ec2_resource, key_file_dir, key_pair=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param key_file_dir: The folder where the private key information is  
        stored.  
                    This should be a secure folder.  
        :param key_pair: A Boto3 KeyPair object. This is a high-level object that  
                    wraps key pair actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.key_pair = key_pair  
        self.key_file_path = None  
        self.key_file_dir = key_file_dir  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource, tempfile.TemporaryDirectory())
```

```
def delete(self):
    """
    Deletes a key pair.
    """

    if self.key_pair is None:
        logger.info("No key pair to delete.")
        return

    key_name = self.key_pair.name
    try:
        self.key_pair.delete()
        self.key_pair = None
    except ClientError as err:
        logger.error(
            "Couldn't delete key %s. Here's why: %s : %s",
            key_name,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Wrapper around `delete_key` that also removes the backing private PEM key.

```
pub async fn delete(self, ec2: &EC2, util: &Util) -> Result<(), EC2Error> {
    if let Some(key_pair_id) = self.key_pair.key_pair_id() {
        ec2.delete_key_pair(key_pair_id).await?;
        if let Some(key_path) = self.key_file_path() {
            if let Err(err) = util.remove(key_path) {
```

```
        eprintln!("Failed to remove {key_path:?} ({err:?:})");
    }
}
Ok(())
}
```

```
pub async fn delete_key_pair(&self, key_pair_id: &str) -> Result<(), EC2Error> {
    let key_pair_id: String = key_pair_id.into();
    tracing::info!("Deleting key pair {key_pair_id}");
    self.client
        .delete_key_pair()
        .key_pair_id(key_pair_id)
        .send()
        .await?;
    Ok(())
}
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

TRY.

```
lo_ec2->deletekeypair( iv_keyname = iv_key_name ).
MESSAGE 'Amazon EC2 key pair deleted.' TYPE 'I'.
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
  DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception->av_err_msg }|.
  MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [DeleteKeyPair](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteLaunchTemplate with an AWS SDK or CLI

The following code examples show how to use DeleteLaunchTemplate.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Delete a launch template by name.
/// </summary>
/// <param name="templateName">The name of the template to delete.</param>
/// <returns>Async task.</returns>
public async Task DeleteTemplateByName(string templateName)
{
    try
    {
        await _amazonEc2.DeleteLaunchTemplateAsync(
            new DeleteLaunchTemplateRequest()
            {
```

```
        LaunchTemplateName = templateName
    });
}
catch (AmazonClientException)
{
    Console.WriteLine($"Unable to delete template {templateName}.");
}
}
```

- For API details, see [DeleteLaunchTemplate](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### To delete a launch template

This example deletes the specified launch template.

Command:

```
aws ec2 delete-launch-template --launch-template-id lt-0abcd290751193123
```

Output:

```
{
    "LaunchTemplate": {
        "LatestVersionNumber": 2,
        "LaunchTemplateId": "lt-0abcd290751193123",
        "LaunchTemplateName": "TestTemplate",
        "DefaultVersionNumber": 2,
        "CreatedBy": "arn:aws:iam::123456789012:root",
        "CreateTime": "2017-11-23T16:46:25.000Z"
    }
}
```

- For API details, see [DeleteLaunchTemplate](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
await client.send(  
    new DeleteLaunchTemplateCommand({  
        LaunchTemplateName: NAMES.launchTemplateName,  
    }),  
);
```

- For API details, see [DeleteLaunchTemplate](#) in *AWS SDK for JavaScript API Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:  
    """  
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,
```

```
        ec2_client,
        ssm_client,
        iam_client,
    ):
    """
    :param resource_prefix: The prefix for naming AWS resources that are
                           created by this class.
    :param inst_type: The type of EC2 instance to create, such as t3.micro.
    :param ami_param: The Systems Manager parameter used to look up the AMI
                      that is
                           created.
    :param autoscaling_client: A Boto3 EC2 Auto Scaling client.
    :param ec2_client: A Boto3 EC2 client.
    :param ssm_client: A Boto3 Systems Manager client.
    :param iam_client: A Boto3 IAM client.
    """

    self.inst_type = inst_type
    self.ami_param = ami_param
    self.autoscaling_client = autoscaling_client
    self.ec2_client = ec2_client
    self.ssm_client = ssm_client
    self.iam_client = iam_client
    self.launch_template_name = f"{resource_prefix}-template"
    self.group_name = f"{resource_prefix}-group"
    self.instance_policy_name = f"{resource_prefix}-pol"
    self.instance_role_name = f"{resource_prefix}-role"
    self.instance_profile_name = f"{resource_prefix}-prof"
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
    self.key_pair_name = f"{resource_prefix}-key-pair"

def delete_template(self):
    """
    Deletes a launch template.
    """
    try:
        self.ec2_client.delete_launch_template(
            LaunchTemplateName=self.launch_template_name
        )
        self.delete_instance_profile(
            self.instance_profile_name, self.instance_role_name
        )
    
```

```
        log.info("Launch template %s deleted.", self.launch_template_name)
    except ClientError as err:
        if (
            err.response["Error"]["Code"]
            == "InvalidLaunchTemplateName.NotFoundException"
        ):
            log.info(
                "Launch template %s does not exist, nothing to do.",
                self.launch_template_name,
            )
        else:
            raise AutoScalerError(
                f"Couldn't delete launch template
{self.launch_template_name}: {err}.""
            )
```

- For API details, see [DeleteLaunchTemplate](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteNetworkAcl with an AWS SDK or CLI

The following code examples show how to use DeleteNetworkAcl.

### CLI

#### AWS CLI

##### To delete a network ACL

This example deletes the specified network ACL. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-network-acl --network-acl-id acl-5fb85d36
```

- For API details, see [DeleteNetworkAcl](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified network ACL. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2NetworkAcl -NetworkAclId acl-12345678
```

#### Output:

```
Confirm  
Are you sure you want to perform this action?  
Performing operation "Remove-EC2NetworkAcl (DeleteNetworkAcl)" on Target  
"acl-12345678".  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"):
```

- For API details, see [DeleteNetworkAcl](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteNetworkAclEntry with an AWS SDK or CLI

The following code examples show how to use DeleteNetworkAclEntry.

### CLI

#### AWS CLI

##### To delete a network ACL entry

This example deletes ingress rule number 100 from the specified network ACL. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-network-acl-entry --network-acl-id acl-5fb85d36 --ingress --rule-number 100
```

- For API details, see [DeleteNetworkAclEntry](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example removes the specified rule from the specified network ACL. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2NetworkAclEntry -NetworkAclId acl-12345678 -Egress $false -RuleNumber  
100
```

#### Output:

```
Confirm  
Are you sure you want to perform this action?  
Performing operation "Remove-EC2NetworkAclEntry (DeleteNetworkAclEntry)" on  
Target "acl-12345678".  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"):
```

- For API details, see [DeleteNetworkAclEntry](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteNetworkInterface with an AWS SDK or CLI

The following code examples show how to use DeleteNetworkInterface.

### CLI

#### AWS CLI

##### To delete a network interface

This example deletes the specified network interface. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-network-interface --network-interface-id eni-e5aa89a3
```

- For API details, see [DeleteNetworkInterface](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example deletes the specified network interface. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2NetworkInterface -NetworkInterfaceId eni-12345678
```

Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2NetworkInterface (DeleteNetworkInterface)" on Target "eni-12345678".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteNetworkInterface](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeletePlacementGroup with an AWS SDK or CLI

The following code examples show how to use DeletePlacementGroup.

CLI

### AWS CLI

#### To delete a placement group

This example command deletes the specified placement group.

Command:

```
aws ec2 delete-placement-group --group-name my-cluster
```

- For API details, see [DeletePlacementGroup](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example deletes the specified placement group. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2PlacementGroup -GroupName my-placement-group
```

**Output:**

```
Confirm
Are you sure you want to perform this action?
Performing operation "Remove-EC2PlacementGroup (DeletePlacementGroup)" on Target
"my-placement-group".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeletePlacementGroup](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteRoute with an AWS SDK or CLI

The following code examples show how to use DeleteRoute.

CLI

### AWS CLI

#### To delete a route

This example deletes the specified route from the specified route table. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-route --route-table-id rtb-22574640 --destination-cidr-block 0.0.0.0/0
```

- For API details, see [DeleteRoute](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example deletes the specified route from the specified route table. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2Route -RouteTableId rtb-1a2b3c4d -DestinationCidrBlock 0.0.0.0/0
```

Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2Route (DeleteRoute)" on Target "rtb-1a2b3c4d".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteRoute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteRouteTable with an AWS SDK or CLI

The following code examples show how to use DeleteRouteTable.

## CLI

### AWS CLI

#### To delete a route table

This example deletes the specified route table. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-route-table --route-table-id rtb-22574640
```

- For API details, see [DeleteRouteTable](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified route table. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2RouteTable -RouteTableId rtb-1a2b3c4d
```

#### Output:

```
Confirm
Are you sure you want to perform this action?
Performing operation "Remove-EC2RouteTable (DeleteRouteTable)" on Target
"rtb-1a2b3c4d".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeleteRouteTable](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteSecurityGroup with an AWS SDK or CLI

The following code examples show how to use DeleteSecurityGroup.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Delete an Amazon EC2 security group.
/// </summary>
/// <param name="groupName">The name of the group to delete.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DeleteSecurityGroup(string groupId)
{
    var response = await _amazonEC2.DeleteSecurityGroupAsync(new
DeleteSecurityGroupRequest { GroupId = groupId });
    return response.HttpStatusCode == HttpStatusCode.OK;
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_delete_security_group
#
# This function deletes an Amazon Elastic Compute Cloud (Amazon EC2) security
group.
#
# Parameters:
#   -i security_group_id - The ID of the security group to delete.
#
# And:
#   0 - If successful.
#   1 - If it fails.
#####
function ec2_delete_security_group() {
    local security_group_id response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_delete_security_group"
        echo "Deletes an Amazon Elastic Compute Cloud (Amazon EC2) security group."
        echo " -i security_group_id - The ID of the security group to delete."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "i:h" option; do
        case "${option}" in
            i) security_group_id="${OPTARG}" ;;
            h)
                usage
                return 0
            ;;
        esac
    done
}
```

```
;;
\?)
    echo "Invalid parameter"
    usage
    return 1
;;
esac
done
export OPTIND=1

if [[ -z "$security_group_id" ]]; then
    errecho "ERROR: You must provide a security group ID with the -i parameter."
    usage
    return 1
fi

response=$(aws ec2 delete-security-group --group-id "$security_group_id" --
output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports delete-security-group operation failed.$response"
    return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
```

```
# The function expects the following argument:  
#           $1 - The error code returned by the AWS CLI.  
#  
# Returns:  
#           0: - Success.  
#  
#####  
function aws_cli_error_log() {  
    local err_code=$1  
    errecho "Error code : $err_code"  
    if [ "$err_code" == 1 ]; then  
        errecho " One or more S3 transfers failed."  
    elif [ "$err_code" == 2 ]; then  
        errecho " Command line failed to parse."  
    elif [ "$err_code" == 130 ]; then  
        errecho " Process received SIGINT."  
    elif [ "$err_code" == 252 ]; then  
        errecho " Command syntax invalid."  
    elif [ "$err_code" == 253 ]; then  
        errecho " The system environment or configuration was invalid."  
    elif [ "$err_code" == 254 ]; then  
        errecho " The service returned an error."  
    elif [ "$err_code" == 255 ]; then  
        errecho " 255 is a catch-all error."  
    fi  
  
    return 0  
}  
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Delete a security group.  
/*!  
 \param securityGroupID: A security group ID.  
 \param clientConfiguration: AWS client configuration.  
 \return bool: Function succeeded.  
 */  
bool AwsDoc::EC2::deleteSecurityGroup(const Aws::String &securityGroupID,  
                                     const Aws::Client::ClientConfiguration  
&clientConfiguration) {  
    Aws::EC2::EC2Client ec2Client(clientConfiguration);  
    Aws::EC2::Model::DeleteSecurityGroupRequest request;  
  
    request.SetGroupId(securityGroupID);  
    Aws::EC2::Model::DeleteSecurityGroupOutcome outcome =  
        ec2Client.DeleteSecurityGroup(request);  
  
    if (!outcome.IsSuccess()) {  
        std::cerr << "Failed to delete security group " << securityGroupID <<  
              ":" << outcome.GetError().GetMessage() << std::endl;  
    } else {  
        std::cout << "Successfully deleted security group " << securityGroupID <<  
              std::endl;  
    }  
  
    return outcome.IsSuccess();  
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### [EC2-Classic] To delete a security group

This example deletes the security group named MySecurityGroup. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-security-group --group-name MySecurityGroup
```

## [EC2-VPC] To delete a security group

This example deletes the security group with the ID `sg-903004f8`. Note that you can't reference a security group for EC2-VPC by name. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-security-group --group-id sg-903004f8
```

For more information, see *Using Security Groups in the AWS Command Line Interface User Guide*.

- For API details, see [DeleteSecurityGroup](#) in *AWS CLI Command Reference*.

Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void deleteEC2SecGroup(Ec2Client ec2, String groupId) {  
    try {  
        DeleteSecurityGroupRequest request =  
DeleteSecurityGroupRequest.builder()  
            .groupId(groupId)  
            .build();  
  
        ec2.deleteSecurityGroup(request);  
        System.out.println("Successfully deleted security group with Id " +  
groupId);  
  
    } catch (Ec2Exception e) {  
        System.err.println(e.awsErrorDetails().errorMessage());  
        System.exit(1);  
    }  
}
```

```
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DeleteSecurityGroupCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new DeleteSecurityGroupCommand({
    GroupId: "GROUP_ID",
  });

  try {
    await client.send(command);
    console.log("Security group deleted successfully.");
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun deleteEC2SecGroup(groupIdVal: String) {  
    val request =  
        DeleteSecurityGroupRequest {  
            groupId = groupIdVal  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        ec2.deleteSecurityGroup(request)  
        println("Successfully deleted Security Group with id $groupIdVal")  
    }  
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified security group for EC2-VPC. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2SecurityGroup -GroupId sg-12345678
```

#### Output:

Confirm  
Are you sure you want to perform this action?

```
Performing operation "Remove-EC2SecurityGroup (DeleteSecurityGroup)" on Target  
"sg-12345678".  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"):
```

## Example 2: This example deletes the specified security group for EC2-Classic.

```
Remove-EC2SecurityGroup -GroupName my-security-group -Force
```

- For API details, see [DeleteSecurityGroup](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class SecurityGroupWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) security group  
    actions."""  
  
    def __init__(self, ec2_resource, security_group=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param security_group: A Boto3 SecurityGroup object. This is a high-level  
        object  
                that wraps security group actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.security_group = security_group  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")
```

```
    return cls(ec2_resource)

def delete(self):
    """
    Deletes the security group.

    If self.security_group is None:
        logger.info("No security group to delete.")
        return

    group_id = self.security_group.id
    try:
        self.security_group.delete()
    except ClientError as err:
        logger.error(
            "Couldn't delete security group %s. Here's why: %s: %s",
            group_id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn delete_security_group(&self, group_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Deleting security group {group_id}");
    self.client
        .delete_security_group()
```

```
.group_id(group_id)
.send()
.await?;
Ok(())
}
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

TRY.

```
lo_ec2->deletesecuritygroup( iv_groupid = iv_security_group_id ).
MESSAGE 'Security group deleted.' TYPE 'I'.
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-
>av_err_msg }|.
MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [DeleteSecurityGroup](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteSnapshot with an AWS SDK or CLI

The following code examples show how to use DeleteSnapshot.

## CLI

### AWS CLI

#### To delete a snapshot

This example command deletes a snapshot with the snapshot ID of `snap-1234567890abcdef0`. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-snapshot --snapshot-id snap-1234567890abcdef0
```

- For API details, see [DeleteSnapshot](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified snapshot. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2Snapshot -SnapshotId snap-12345678
```

#### Output:

Confirm

Are you sure you want to perform this action?

Performing the operation "Remove-EC2Snapshot (DeleteSnapshot)" on target "snap-12345678".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteSnapshot](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
async fn delete_snapshot(client: &Client, id: &str) -> Result<(), Error> {
    client.delete_snapshot().snapshot_id(id).send().await?;

    println!("Deleted");

    Ok(())
}
```

- For API details, see [DeleteSnapshot](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteSpotDatafeedSubscription with an AWS SDK or CLI

The following code examples show how to use DeleteSpotDatafeedSubscription.

### CLI

#### AWS CLI

##### To cancel a Spot Instance data feed subscription

This example command deletes a Spot data feed subscription for the account. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-spot-datafeed-subscription
```

- For API details, see [DeleteSpotDatafeedSubscription](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example deletes your Spot instance data feed. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2SpotDatafeedSubscription
```

### Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2SpotDatafeedSubscription  
(DeleteSpotDatafeedSubscription)" on Target "".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteSpotDatafeedSubscription](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteSubnet with an AWS SDK or CLI

The following code examples show how to use DeleteSubnet.

CLI

### AWS CLI

#### To delete a subnet

This example deletes the specified subnet. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-subnet --subnet-id subnet-9d4a7b6c
```

- For API details, see [DeleteSubnet](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example deletes the specified subnet. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2Subnet -SubnetId subnet-1a2b3c4d
```

**Output:**

```
Confirm
Are you sure you want to perform this action?
Performing operation "Remove-EC2Subnet (DeleteSubnet)" on Target
"subnet-1a2b3c4d".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeleteSubnet](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteTags with an AWS SDK or CLI

The following code examples show how to use DeleteTags.

CLI

### AWS CLI

#### Example 1: To delete a tag from a resource

The following `delete-tags` example deletes the tag `Stack=Test` from the specified image. When you specify both a value and a key name, the tag is deleted only if the tag's value matches the specified value.

```
aws ec2 delete-tags \
--resources ami-1234567890abcdef0 \
--tags Key=Stack,Value=Test
```

It's optional to specify the value for a tag. The following `delete-tags` example deletes the tag with the key name `purpose` from the specified instance, regardless of the tag value for the tag.

```
aws ec2 delete-tags \
--resources i-1234567890abcdef0 \
--tags Key=purpose
```

If you specify the empty string as the tag value, the tag is deleted only if the tag's value is the empty string. The following `delete-tags` example specifies the empty string as the tag value for the tag to delete.

```
aws ec2 delete-tags \
--resources i-1234567890abcdef0 \
--tags Key=Name,Value=
```

## Example 2: To delete a tag from multiple resources

The following `delete-tags` example deletes the tag ```Purpose=Test``` from both an instance and an AMI. As shown in the previous example, you can omit the tag value from the command.

```
aws ec2 delete-tags \
--resources i-1234567890abcdef0 ami-1234567890abcdef0 \
--tags Key=Purpose
```

- For API details, see [DeleteTags](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example deletes the specified tag from the specified resource, regardless of the tag value. The syntax used by this example requires PowerShell version 3 or later.**

```
Remove-EC2Tag -Resource i-12345678 -Tag @{ Key="myTag" } -Force
```

**Example 2: This example deletes the specified tag from the specified resource, but only if the tag value matches. The syntax used by this example requires PowerShell version 3 or later.**

```
Remove-EC2Tag -Resource i-12345678 -Tag @{ Key="myTag";Value="myTagValue" } -Force
```

**Example 3: This example deletes the specified tag from the specified resource, regardless of the tag value.**

```
$tag = New-Object Amazon.EC2.Model.Tag  
$tag.Key = "myTag"
```

```
Remove-EC2Tag -Resource i-12345678 -Tag $tag -Force
```

**Example 4: This example deletes the specified tag from the specified resource, but only if the tag value matches.**

```
$tag = New-Object Amazon.EC2.Model.Tag  
$tag.Key = "myTag"  
$tag.Value = "myTagValue"
```

```
Remove-EC2Tag -Resource i-12345678 -Tag $tag -Force
```

- For API details, see [DeleteTags in AWS Tools for PowerShell Cmdlet Reference](#).

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use DeleteVolume with an AWS SDK or CLI

The following code examples show how to use DeleteVolume.

CLI

## AWS CLI

### To delete a volume

This example command deletes an available volume with the volume ID of vol-049df61146c4d7901. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-volume --volume-id vol-049df61146c4d7901
```

- For API details, see [DeleteVolume](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example detaches the specified volume. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2Volume -VolumeId vol-12345678
```

**Output:**

```
Confirm
Are you sure you want to perform this action?
Performing the operation "Remove-EC2Volume (DeleteVolume)" on target
"vol-12345678".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeleteVolume](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteVpc with an AWS SDK or CLI

The following code examples show how to use DeleteVpc.

### CLI

#### AWS CLI

##### To delete a VPC

This example deletes the specified VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-vpc --vpc-id vpc-a01106c2
```

- For API details, see [DeleteVpc](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example deletes the specified VPC. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2Vpc -VpcId vpc-12345678
```

**Output:**

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2Vpc (DeleteVpc)" on Target "vpc-12345678".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteVpc](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteVpnConnection with an AWS SDK or CLI

The following code examples show how to use DeleteVpnConnection.

### CLI

#### AWS CLI

##### To delete a VPN connection

This example deletes the specified VPN connection. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-vpn-connection --vpn-connection-id vpn-40f41529
```

- For API details, see [DeleteVpnConnection](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example deletes the specified VPN connection. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2VpnConnection -VpnConnectionId vpn-12345678
```

##### Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2VpnConnection (DeleteVpnConnection)" on Target "vpn-12345678".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteVpnConnection](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DeleteVpnConnectionRoute` with an AWS SDK or CLI

The following code examples show how to use `DeleteVpnConnectionRoute`.

### CLI

#### AWS CLI

##### To delete a static route from a VPN connection

This example deletes the specified static route from the specified VPN connection. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-vpn-connection-route --vpn-connection-id vpn-40f41529 --  
destination-cidr-block 11.12.0.0/16
```

- For API details, see [DeleteVpnConnectionRoute](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example removes the specified static route from the specified VPN connection. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2VpnConnectionRoute -VpnConnectionId vpn-12345678 -DestinationCidrBlock  
11.12.0.0/16
```

**Output:**

```
Confirm  
Are you sure you want to perform this action?
```

```
Performing operation "Remove-EC2VpnConnectionRoute (DeleteVpnConnectionRoute)" on
Target "vpn-12345678".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is
"Y"):
```

- For API details, see [DeleteVpnConnectionRoute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DeleteVpnGateway with an AWS SDK or CLI

The following code examples show how to use DeleteVpnGateway.

### CLI

#### AWS CLI

##### To delete a virtual private gateway

This example deletes the specified virtual private gateway. If the command succeeds, no output is returned.

Command:

```
aws ec2 delete-vpn-gateway --vpn-gateway-id vgw-9a4cacf3
```

- For API details, see [DeleteVpnGateway](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example deletes the specified virtual private gateway. You are prompted for confirmation before the operation proceeds, unless you also specify the Force parameter.**

```
Remove-EC2VpnGateway -VpnGatewayId vgw-1a2b3c4d
```

## Output:

Confirm

Are you sure you want to perform this action?

Performing operation "Remove-EC2VpnGateway (DeleteVpnGateway)" on Target  
"vgw-1a2b3c4d".

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"):

- For API details, see [DeleteVpnGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DeregisterImage` with an AWS SDK or CLI

The following code examples show how to use `DeregisterImage`.

### CLI

#### AWS CLI

##### To deregister an AMI

This example deregisters the specified AMI. If the command succeeds, no output is returned.

Command:

```
aws ec2 deregister-image --image-id ami-4fa54026
```

- For API details, see [DeregisterImage](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

##### Example 1: This example deregisters the specified AMI.

```
Unregister-EC2Image -ImageId ami-12345678
```

- For API details, see [DeregisterImage](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeAccountAttributes** with an AWS SDK or CLI

The following code examples show how to use **DescribeAccountAttributes**.

CLI

### AWS CLI

#### To describe all the attributes for your AWS account

This example describes the attributes for your AWS account.

Command:

```
aws ec2 describe-account-attributes
```

Output:

```
{  
    "AccountAttributes": [  
        {  
            "AttributeName": "vpc-max-security-groups-per-interface",  
            "AttributeValues": [  
                {  
                    "AttributeValue": "5"  
                }  
            ]  
        },  
        {  
            "AttributeName": "max-instances",  
            "AttributeValues": [  
                {  
                    "AttributeValue": "20"  
                }  
            ]  
        }  
    ]  
}
```

```
        },
        {
            "AttributeName": "supported-platforms",
            "AttributeValues": [
                {
                    "AttributeValue": "EC2"
                },
                {
                    "AttributeValue": "VPC"
                }
            ]
        },
        {
            "AttributeName": "default-vpc",
            "AttributeValues": [
                {
                    "AttributeValue": "none"
                }
            ]
        },
        {
            "AttributeName": "max-elastic-ips",
            "AttributeValues": [
                {
                    "AttributeValue": "5"
                }
            ]
        },
        {
            "AttributeName": "vpc-max-elastic-ips",
            "AttributeValues": [
                {
                    "AttributeValue": "5"
                }
            ]
        }
    ]
}
```

## To describe a single attribute for your AWS account

This example describes the supported-platforms attribute for your AWS account.

Command:

```
aws ec2 describe-account-attributes --attribute-names supported-platforms
```

Output:

```
{  
    "AccountAttributes": [  
        {  
            "AttributeName": "supported-platforms",  
            "AttributeValues": [  
                {  
                    "AttributeValue": "EC2"  
                },  
                {  
                    "AttributeValue": "VPC"  
                }  
            ]  
        }  
    ]  
}
```

- For API details, see [DescribeAccountAttributes](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes whether you can launch instances into EC2-Classic and EC2-VPC in the region, or only into EC2-VPC.**

```
(Get-EC2AccountAttribute -AttributeName supported-platforms).AttributeValues
```

Output:

```
AttributeValue  
-----  
EC2  
VPC
```

**Example 2: This example describes your default VPC, or is 'none' if you do not have a default VPC in the region.**

```
(Get-EC2AccountAttribute -AttributeName default-vpc).AttributeValues
```

**Output:**

```
AttributeValue
```

```
-----
```

```
vpc-12345678
```

**Example 3: This example describes the maximum number of On-Demand instances that you can run.**

```
(Get-EC2AccountAttribute -AttributeName max-instances).AttributeValues
```

**Output:**

```
AttributeValue
```

```
-----
```

```
20
```

- For API details, see [DescribeAccountAttributes](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeAddresses** with an AWS SDK or CLI

The following code examples show how to use **DescribeAddresses**.

C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Describe all Elastic IP addresses.
/*
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::describeAddresses(
    const Aws::Client::ClientConfiguration &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::DescribeAddressesRequest request;
    Aws::EC2::Model::DescribeAddressesOutcome outcome =
        ec2Client.DescribeAddresses(request);
    if (outcome.IsSuccess()) {
        std::cout << std::left << std::setw(20) << "InstanceId" <<
            std::setw(15) << "Public IP" << std::setw(10) << "Domain" <<
            std::setw(30) << "Allocation ID" << std::setw(25) <<
            "NIC ID" << std::endl;

        const Aws::Vector<Aws::EC2::Model::Address> &addresses =
            outcome.GetResult().GetAddresses();
        for (const auto &address: addresses) {
            Aws::String domainString =
                Aws::EC2::Model::DomainTypeMapper::GetNameForDomainType(
                    address.GetDomain());

            std::cout << std::left << std::setw(20) <<
                address.GetInstanceId() << std::setw(15) <<
                address.GetPublicIp() << std::setw(10) << domainString <<
                std::setw(30) << address.GetAllocationId() << std::setw(25) <<
                address.GetNetworkInterfaceId() << std::endl;
        }
    } else {
        std::cerr << "Failed to describe Elastic IP addresses:" <<
            outcome.GetError().GetMessage() << std::endl;
    }

    return outcome.IsSuccess();
}
```

- For API details, see [DescribeAddresses](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To retrieve details about all of your Elastic IP addresses

The following `describe_addresses` example displays details about your Elastic IP addresses.

```
aws ec2 describe-addresses
```

Output:

```
{  
    "Addresses": [  
        {  
            "InstanceId": "i-1234567890abcdef0",  
            "PublicIp": "198.51.100.0",  
            "PublicIpv4Pool": "amazon",  
            "Domain": "standard"  
        },  
        {  
            "Domain": "vpc",  
            "PublicIpv4Pool": "amazon",  
            "InstanceId": "i-1234567890abcdef0",  
            "NetworkInterfaceId": "eni-12345678",  
            "AssociationId": "eipassoc-12345678",  
            "NetworkInterfaceOwnerId": "123456789012",  
            "PublicIp": "203.0.113.0",  
            "AllocationId": "eipalloc-12345678",  
            "PrivateIpAddress": "10.0.1.241"  
        }  
    ]  
}
```

#### Example 2: To retrieve details your Elastic IP addresses for EC2-VPC

The following `describe-addresses` example displays details about your Elastic IP addresses for use with instances in a VPC.

```
aws ec2 describe-addresses \
```

```
--filters "Name=domain,Values=vpc"
```

Output:

```
{  
    "Addresses": [  
        {  
            "Domain": "vpc",  
            "PublicIpv4Pool": "amazon",  
            "InstanceId": "i-1234567890abcdef0",  
            "NetworkInterfaceId": "eni-12345678",  
            "AssociationId": "eipassoc-12345678",  
            "NetworkInterfaceOwnerId": "123456789012",  
            "PublicIp": "203.0.113.0",  
            "AllocationId": "eipalloc-12345678",  
            "PrivateIpAddress": "10.0.1.241"  
        }  
    ]  
}
```

### Example 3: To retrieve details about an Elastic IP address specified by allocation ID

The following `describe-addresses` example displays details about the Elastic IP address with the specified allocation ID, which is associated with an instance in EC2-VPC.

```
aws ec2 describe-addresses \  
  --allocation-ids eipalloc-282d9641
```

Output:

```
{  
    "Addresses": [  
        {  
            "Domain": "vpc",  
            "PublicIpv4Pool": "amazon",  
            "InstanceId": "i-1234567890abcdef0",  
            "NetworkInterfaceId": "eni-1a2b3c4d",  
            "AssociationId": "eipassoc-123abc12",  
            "NetworkInterfaceOwnerId": "123456789012",  
            "PublicIp": "203.0.113.25",  
            "AllocationId": "eipalloc-282d9641",  
            "PrivateIpAddress": "10.0.1.241"  
        }  
    ]  
}
```

```
        "PrivateIpAddress": "10.251.50.12"
    }
]
}
```

#### Example 4: To retrieve details about an Elastic IP address specified by its VPC private IP address

The following `describe-addresses` example displays details about the Elastic IP address associated with a particular private IP address in EC2-VPC.

```
aws ec2 describe-addresses \
--filters "Name=private-ip-address,Values=10.251.50.12"
```

#### Example 5: To retrieve details about Elastic IP addresses in EC2-Classic

The following `describe-addresses` example displays details about your Elastic IP addresses for use in EC2-Classic.

```
aws ec2 describe-addresses \
--filters "Name=domain,Values=standard"
```

Output:

```
{
    "Addresses": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "PublicIp": "203.0.110.25",
            "PublicIpv4Pool": "amazon",
            "Domain": "standard"
        }
    ]
}
```

#### Example 6: To retrieve details about an Elastic IP addresses specified by its public IP address

The following `describe-addresses` example displays details about the Elastic IP address with the value `203.0.110.25`, which is associated with an instance in EC2-Classic.

```
aws ec2 describe-addresses \
--public-ips 203.0.110.25
```

Output:

```
{
    "Addresses": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "PublicIp": "203.0.110.25",
            "PublicIpv4Pool": "amazon",
            "Domain": "standard"
        }
    ]
}
```

- For API details, see [DescribeAddresses](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeAddressesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
    const command = new DescribeAddressesCommand({
        // You can omit this property to show all addresses.
        AllocationIds: ["ALLOCATION_ID"],
    });

    try {
        const { Addresses } = await client.send(command);
```

```
const addressList = Addresses.map((address) => ` • ${address.PublicIp}`);
console.log("Elastic IP addresses:");
console.log(addressList.join("\n"));
} catch (err) {
  console.error(err);
}
};
```

- For API details, see [DescribeAddresses](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified Elastic IP address for instances in EC2-Classic.**

```
Get-EC2Address -AllocationId eipalloc-12345678
```

#### Output:

AllocationId	:	eipalloc-12345678
AssociationId	:	eipassoc-12345678
Domain	:	vpc
InstanceId	:	i-87654321
NetworkInterfaceId	:	eni-12345678
NetworkInterfaceOwnerId	:	12345678
PrivateIpAddress	:	10.0.2.172
PublicIp	:	198.51.100.2

**Example 2: This example describes your Elastic IP addresses for instances in a VPC. This syntax requires PowerShell version 3 or later.**

```
Get-EC2Address -Filter @{ Name="domain";Values="vpc" }
```

**Example 3: This example describes the specified Elastic IP address for instances in EC2-Classic.**

```
Get-EC2Address -PublicIp 203.0.113.17
```

**Output:**

```
AllocationId      :  
AssociationId    :  
Domain           : standard  
InstanceId       : i-12345678  
NetworkInterfaceId :  
NetworkInterfaceOwnerId :  
PrivateIpAddress   :  
PublicIp          : 203.0.113.17
```

**Example 4: This example describes your Elastic IP addresses for instances in EC2-Classic. This syntax requires PowerShell version 3 or later.**

```
Get-EC2Address -Filter @{ Name="domain";Values="standard" }
```

**Example 5: This example describes all your Elastic IP addresses.**

```
Get-EC2Address
```

**Example 6: This example returns the public and private IP for the instance id provided in filter**

```
Get-EC2Address -Region eu-west-1 -Filter @{Name="instance-id";Values="i-0c12d3f4f567ffb89"} | Select-Object PrivateIpAddress, PublicIp
```

**Output:**

```
PrivateIpAddress PublicIp  
-----  
10.0.0.99      63.36.5.227
```

**Example 7: This example retrieves all the Elastic IPs with its allocation id, association id and instance ids**

```
Get-EC2Address -Region eu-west-1 | Select-Object InstanceId, AssociationId,  
AllocationId, PublicIp
```

**Output:**

InstanceId	AssociationId	AllocationId
PublicIp		
-----	-----	-----
		eipalloc-012e3b456789e1fad
17.212.120.178		
i-0c123dfd3415bac67	eipassoc-0e123456bb7890bdb	eipalloc-01cd23ebf45f7890c
17.212.124.77		eipalloc-012345678eeabcfad
17.212.225.7		
i-0123d405c67e89a0c	eipassoc-0c123b456783966ba	eipalloc-0123cdd456a8f7892
37.216.52.173		
i-0f1bf2f34c5678d09	eipassoc-0e12934568a952d96	eipalloc-0e1c23e4d5e6789e4
37.218.222.278		
i-012e3cb4df567e8aa	eipassoc-0d1b2fa4d67d03810	eipalloc-0123f456f78a01b58
37.210.82.27		
i-0123bcf4b567890e1	eipassoc-01d2345f678903fb1	eipalloc-0e1db23cfef5c45c7
37.215.222.270		

**Example 8: This example fetches list of EC2 IP addresses matching tag key 'Category' with value 'Prod'**

```
Get-EC2Address -Filter @{Name="tag:Category";Values="Prod"}
```

### Output:

AllocationId	:	eipalloc-0123f456f81a01b58
AssociationId	:	eipassoc-0d1b23a456d103810
CustomerOwnedIp	:	
CustomerOwnedIpv4Pool	:	
Domain	:	vpc
InstanceId	:	i-012e3cb4df567e1aa
NetworkBorderGroup	:	eu-west-1
NetworkInterfaceId	:	eni-0123f41d5a60d5f40
NetworkInterfaceOwnerId	:	123456789012
PrivateIpAddress	:	192.168.1.84
PublicIp	:	34.250.81.29
PublicIpv4Pool	:	amazon
Tags	:	{Category, Name}

- For API details, see [DescribeAddresses](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.  
    oo_result = lo_ec2->describeaddresses( ) .  
    oo_result is returned for testing purposes. "  
        DATA(lt_addresses) = oo_result->get_addresses( ).  
        MESSAGE 'Retrieved information about Elastic IP addresses.' TYPE 'I'.  
        CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
        DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-  
        >av_err_msg }|.  
        MESSAGE lv_error TYPE 'E'.  
    ENDTRY.
```

- For API details, see [DescribeAddresses](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeAvailabilityZones` with an AWS SDK or CLI

The following code examples show how to use `DescribeAvailabilityZones`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

## .NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Get a list of Availability Zones in the AWS Region of the Amazon EC2
Client.
/// </summary>
/// <returns>A list of availability zones.</returns>
public async Task<List<string>> DescribeAvailabilityZones()
{
    var zoneResponse = await _amazonEc2.DescribeAvailabilityZonesAsync(
        new DescribeAvailabilityZonesRequest());
    return zoneResponse.AvailabilityZones.Select(z => z.ZoneName).ToList();
}
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS SDK for .NET API Reference*.

## C++

### SDK for C++

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! DescribeAvailabilityZones
/*
\param clientConfiguration: AWS client configuration.
\return bool: Function succeeded.
```

```
/*
int AwsDoc::EC2::describeAvailabilityZones(const Aws::Client::ClientConfiguration &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::DescribeAvailabilityZonesRequest request;
    Aws::EC2::Model::DescribeAvailabilityZonesOutcome outcome =
        ec2Client.DescribeAvailabilityZones(request);

    if (outcome.IsSuccess()) {
        std::cout << std::left <<
            std::setw(32) << "ZoneName" <<
            std::setw(20) << "State" <<
            std::setw(32) << "Region" << std::endl;

        const auto &zones =
            outcome.GetResult().GetAvailabilityZones();

        for (const auto &zone: zones) {
            Aws::String stateString =
                Aws::EC2::Model::AvailabilityZoneStateMapper::GetNameForAvailabilityZoneState(
                    zone.GetState());
            std::cout << std::left <<
                std::setw(32) << zone.GetZoneName() <<
                std::setw(20) << stateString <<
                std::setw(32) << zone.GetRegionName() << std::endl;
        }
    } else {
        std::cerr << "Failed to describe availability zones:" <<
            outcome.GetError().GetMessage() << std::endl;
    }

    return outcome.IsSuccess();
}
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To describe your Availability Zones

The following example `describe-availability-zones` displays details for the Availability Zones that are available to you. The response includes Availability Zones only for the current Region. In this example, it uses the profiles default us-west-2 (Oregon) Region.

```
aws ec2 describe-availability-zones
```

Output:

```
{  
    "AvailabilityZones": [  
        {  
            "State": "available",  
            "OptInStatus": "opt-in-not-required",  
            "Messages": [],  
            "RegionName": "us-west-2",  
            "ZoneName": "us-west-2a",  
            "ZoneId": "usw2-az1",  
            "GroupName": "us-west-2",  
            "NetworkBorderGroup": "us-west-2"  
        },  
        {  
            "State": "available",  
            "OptInStatus": "opt-in-not-required",  
            "Messages": [],  
            "RegionName": "us-west-2",  
            "ZoneName": "us-west-2b",  
            "ZoneId": "usw2-az2",  
            "GroupName": "us-west-2",  
            "NetworkBorderGroup": "us-west-2"  
        },  
        {  
            "State": "available",  
            "OptInStatus": "opt-in-not-required",  
            "Messages": [],  
            "RegionName": "us-west-2",  
            "ZoneName": "us-west-2c",  
            "ZoneId": "usw2-az3",  
            "GroupName": "us-west-2",  
            "NetworkBorderGroup": "us-west-2"  
        }  
    ]  
}
```

```
        "GroupName": "us-west-2",
        "NetworkBorderGroup": "us-west-2"
    },
    {
        "State": "available",
        "OptInStatus": "opt-in-not-required",
        "Messages": [],
        "RegionName": "us-west-2",
        "ZoneName": "us-west-2d",
        "ZoneId": "usw2-az4",
        "GroupName": "us-west-2",
        "NetworkBorderGroup": "us-west-2"
    },
    {
        "State": "available",
        "OptInStatus": "opted-in",
        "Messages": [],
        "RegionName": "us-west-2",
        "ZoneName": "us-west-2-lax-1a",
        "ZoneId": "usw2-lax1-az1",
        "GroupName": "us-west-2-lax-1",
        "NetworkBorderGroup": "us-west-2-lax-1"
    }
]
}
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the Availability Zones for the current region that are available to you.**

```
Get-EC2AvailabilityZone
```

### Output:

Messages	RegionName	State	ZoneName
-----	-----	-----	-----
{}	us-west-2	available	us-west-2a

```
{}          us-west-2      available    us-west-2b  
{}          us-west-2      available    us-west-2c
```

**Example 2: This example describes any Availability Zones that are in an impaired state.**  
**The syntax used by this example requires PowerShell version 3 or higher.**

```
Get-EC2AvailabilityZone -Filter @{ Name="state";Values="impaired" }
```

**Example 3: With PowerShell version 2, you must use New-Object to create the filter.**

```
$filter = New-Object Amazon.EC2.Model.Filter  
$filter.Name = "state"  
$filter.Values = "impaired"  
  
Get-EC2AvailabilityZone -Filter $filter
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

**Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:  
    """  
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,
```

```
        ec2_client,
        ssm_client,
        iam_client,
    ):
    """
    :param resource_prefix: The prefix for naming AWS resources that are
                           created by this class.
    :param inst_type: The type of EC2 instance to create, such as t3.micro.
    :param ami_param: The Systems Manager parameter used to look up the AMI
                      that is
                           created.
    :param autoscaling_client: A Boto3 EC2 Auto Scaling client.
    :param ec2_client: A Boto3 EC2 client.
    :param ssm_client: A Boto3 Systems Manager client.
    :param iam_client: A Boto3 IAM client.
    """

    self.inst_type = inst_type
    self.ami_param = ami_param
    self.autoscaling_client = autoscaling_client
    self.ec2_client = ec2_client
    self.ssm_client = ssm_client
    self.iam_client = iam_client
    self.launch_template_name = f"{resource_prefix}-template"
    self.group_name = f"{resource_prefix}-group"
    self.instance_policy_name = f"{resource_prefix}-pol"
    self.instance_role_name = f"{resource_prefix}-role"
    self.instance_profile_name = f"{resource_prefix}-prof"
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
    self.key_pair_name = f"{resource_prefix}-key-pair"

def get_availability_zones(self):
    """
    Gets a list of Availability Zones in the AWS Region of the Amazon EC2
    client.

    :return: The list of Availability Zones for the client Region.
    """
    try:
        response = self.ec2_client.describe_availability_zones()
        zones = [zone["ZoneName"] for zone in response["AvailabilityZones"]]
    except ClientError as err:
```

```
        raise AutoScalerError(f"Couldn't get availability zones: {err}.")  
    else:  
        return zones
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS SDK for Python (Boto3) API Reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.  
    oo_result = lo_ec2->describeavailabilityzones( ) .  
" oo_result is returned for testing purposes. "  
    DATA(lt_zones) = oo_result->get_availabilityzones( ).  
    MESSAGE 'Retrieved information about Availability Zones.' TYPE 'I'.  
  
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
        DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-  
>av_err_msg }|.  
        MESSAGE lv_error TYPE 'E'.  
    ENDTRY.
```

- For API details, see [DescribeAvailabilityZones](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `DescribeBundleTasks` with an AWS SDK or CLI

The following code examples show how to use `DescribeBundleTasks`.

CLI

## AWS CLI

### To describe your bundle tasks

This example describes all of your bundle tasks.

Command:

```
aws ec2 describe-bundle-tasks
```

Output:

```
{
  "BundleTasks": [
    {
      "UpdateTime": "2015-09-15T13:26:54.000Z",
      "InstanceId": "i-1234567890abcdef0",
      "Storage": {
        "S3": {
          "Prefix": "winami",
          "Bucket": "bundletasks"
        }
      },
      "State": "bundling",
      "StartTime": "2015-09-15T13:24:35.000Z",
      "Progress": "3%",
      "BundleId": "bun-2a4e041c"
    }
  ]
}
```

- For API details, see [DescribeBundleTasks](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified bundle task.**

```
Get-EC2BundleTask -BundleId bun-12345678
```

**Example 2: This example describes the bundle tasks whose state is either 'complete' or 'failed'.**

```
$filter = New-Object Amazon.EC2.Model.Filter  
$filter.Name = "state"  
$filter.Values = @("complete", "failed")  
  
Get-EC2BundleTask -Filter $filter
```

- For API details, see [DescribeBundleTasks](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeCapacityReservations** with an AWS SDK or CLI

The following code examples show how to use **DescribeCapacityReservations**.

### CLI

#### AWS CLI

**Example 1: To describe one or more of your capacity reservations**

The following `describe-capacity-reservations` example displays details about all of your capacity reservations in the current AWS Region.

```
aws ec2 describe-capacity-reservations
```

Output:

```
{  
    "CapacityReservations": [  
        {  
            "CapacityReservationId": "cr-1234abcd56EXAMPLE ",  
            "EndDateType": "unlimited",  
            "AvailabilityZone": "eu-west-1a",  
            "InstanceMatchCriteria": "open",  
            "Tags": [],  
            "EphemeralStorage": false,  
            "CreateDate": "2019-08-16T09:03:18.000Z",  
            "AvailableInstanceCount": 1,  
            "InstancePlatform": "Linux/UNIX",  
            "TotalInstanceCount": 1,  
            "State": "active",  
            "Tenancy": "default",  
            "EbsOptimized": true,  
            "InstanceType": "a1.medium"  
        },  
        {  
            "CapacityReservationId": "cr-abcdEXAMPLE9876ef ",  
            "EndDateType": "unlimited",  
            "AvailabilityZone": "eu-west-1a",  
            "InstanceMatchCriteria": "open",  
            "Tags": [],  
            "EphemeralStorage": false,  
            "CreateDate": "2019-08-07T11:34:19.000Z",  
            "AvailableInstanceCount": 3,  
            "InstancePlatform": "Linux/UNIX",  
            "TotalInstanceCount": 3,  
            "State": "cancelled",  
            "Tenancy": "default",  
            "EbsOptimized": true,  
            "InstanceType": "m5.large"  
        }  
    ]  
}
```

## Example 2: To describe one or more of your capacity reservations

The following `describe-capacity-reservations` example displays details about the specified capacity reservation.

```
aws ec2 describe-capacity-reservations \
```

```
--capacity-reservation-ids cr-1234abcd56EXAMPLE
```

## Output:

```
{  
    "CapacityReservations": [  
        {  
            "CapacityReservationId": "cr-1234abcd56EXAMPLE",  
            "EndDateType": "unlimited",  
            "AvailabilityZone": "eu-west-1a",  
            "InstanceMatchCriteria": "open",  
            "Tags": [],  
            "EphemeralStorage": false,  
            "CreateDate": "2019-08-16T09:03:18.000Z",  
            "AvailableInstanceCount": 1,  
            "InstancePlatform": "Linux/UNIX",  
            "TotalInstanceCount": 1,  
            "State": "active",  
            "Tenancy": "default",  
            "EbsOptimized": true,  
            "InstanceType": "a1.medium"  
        }  
    ]  
}
```

For more information, see [Viewing a Capacity Reservation](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [DescribeCapacityReservations](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes one or more of your Capacity Reservations for the region**

```
Get-EC2CapacityReservation -Region eu-west-1
```

## Output:

```
AvailabilityZone      : eu-west-1b
```

```
AvailableInstanceCount : 2
CapacityReservationId : cr-0c1f2345db6f7cdba
CreateDate           : 3/28/2019 9:29:41 AM
EbsOptimized         : True
EndDate              : 1/1/0001 12:00:00 AM
EndDateType          : unlimited
EphemeralStorage     : False
InstanceMatchCriteria: open
InstancePlatform     : Windows
InstanceType          : m4.xlarge
State                : active
Tags                : {}
Tenancy              : default
TotalInstanceCount   : 2
```

- For API details, see [DescribeCapacityReservations](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeCustomerGateways` with an AWS SDK or CLI

The following code examples show how to use `DescribeCustomerGateways`.

### CLI

#### AWS CLI

##### To describe your customer gateways

This example describes your customer gateways.

Command:

```
aws ec2 describe-customer-gateways
```

Output:

```
{
```

```
"CustomerGateways": [  
    {  
        "CustomerGatewayId": "cgw-b4dc3961",  
        "IpAddress": "203.0.113.12",  
        "State": "available",  
        "Type": "ipsec.1",  
        "BgpAsn": "65000"  
    },  
    {  
        "CustomerGatewayId": "cgw-0e11f167",  
        "IpAddress": "12.1.2.3",  
        "State": "available",  
        "Type": "ipsec.1",  
        "BgpAsn": "65534"  
    }  
]
```

## To describe a specific customer gateway

This example describes the specified customer gateway.

Command:

```
aws ec2 describe-customer-gateways --customer-gateway-ids cgw-0e11f167
```

Output:

```
{  
    "CustomerGateways": [  
        {  
            "CustomerGatewayId": "cgw-0e11f167",  
            "IpAddress": "12.1.2.3",  
            "State": "available",  
            "Type": "ipsec.1",  
            "BgpAsn": "65534"  
        }  
    ]  
}
```

- For API details, see [DescribeCustomerGateways](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified customer gateway.**

```
Get-EC2CustomerGateway -CustomerGatewayId cgw-1a2b3c4d
```

**Output:**

```
BgpAsn      : 65534
CustomerGatewayId : cgw-1a2b3c4d
IpAddress     : 203.0.113.12
State        : available
Tags         : {}
Type         : ipsec.1
```

**Example 2: This example describes any customer gateway whose state is either pending or available.**

```
$filter = New-Object Amazon.EC2.Model.Filter
$filter.Name = "state"
$filter.Values = @( "pending", "available" )

Get-EC2CustomerGateway -Filter $filter
```

**Example 3: This example describes all your customer gateways.**

```
Get-EC2CustomerGateway
```

- For API details, see [DescribeCustomerGateways](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeDhcpOptions` with an AWS SDK or CLI

The following code examples show how to use `DescribeDhcpOptions`.

## CLI

### AWS CLI

#### Example 1: To describe your DHCP options

The following `describe-dhcp-options` example retrieves details about your DHCP options.

```
aws ec2 describe-dhcp-options
```

Output:

```
{  
    "DhcpOptions": [  
        {  
            "DhcpConfigurations": [  
                {  
                    "Key": "domain-name",  
                    "Values": [  
                        {  
                            "Value": "us-east-2.compute.internal"  
                        }  
                    ]  
                },  
                {  
                    "Key": "domain-name-servers",  
                    "Values": [  
                        {  
                            "Value": "AmazonProvidedDNS"  
                        }  
                    ]  
                }  
            ],  
            "DhcpOptionsId": "dopt-19edf471",  
            "OwnerId": "111122223333"  
        },  
        {  
            "DhcpConfigurations": [  
                {  
                    "Key": "domain-name",  
                    "Values": [  
                        {  
                            "Value": "us-east-2.compute.internal"  
                        }  
                    ]  
                }  
            ]  
        }  
    ]  
}
```

```
        "Value": "us-east-2.compute.internal"
    }
]
},
{
    "Key": "domain-name-servers",
    "Values": [
        {
            "Value": "AmazonProvidedDNS"
        }
    ]
},
"DhcpOptionsId": "dopt-fEXAMPLE",
"OwnerId": "111122223333"
}
]
```

For more information, see [Working with DHCP Option Sets](#) in the *AWS VPC User Guide*.

### Example 2: To describe your DHCP options and filter the output

The following `describe-dhcp-options` example describes your DHCP options and uses a filter to return only DHCP options that have `example.com` for the domain name server. The example uses the `--query` parameter to display only the configuration information and ID in the output.

```
aws ec2 describe-dhcp-options \
--filters Name=key,Values=domain-name-servers Name=value,Values=example.com \
--query "DhcpOptions[*].[DhcpConfigurations,DhcpOptionsId]"
```

Output:

```
[
    [
        [
            {
                "Key": "domain-name",
                "Values": [
                    {
                        "Value": "example.com"
                    }
                ]
            }
        ]
    ]
]
```

```
        }
    ],
},
{
    "Key": "domain-name-servers",
    "Values": [
        {
            "Value": "172.16.16.16"
        }
    ]
},
"dopt-001122334455667ab"
]
]
```

For more information, see [Working with DHCP Option Sets](#) in the *AWS VPC User Guide*.

- For API details, see [DescribeDhcpOptions](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example lists your DHCP options sets.

```
Get-EC2DhcpOption
```

#### Output:

DhcpConfigurations	DhcpOptionsId	Tag
{domain-name, domain-name-servers}	dopt-1a2b3c4d	{}
{domain-name, domain-name-servers}	dopt-2a3b4c5d	{}
{domain-name-servers}	dopt-3a4b5c6d	{}

#### Example 2: This example gets configuration details for the specified DHCP options set.

```
(Get-EC2DhcpOption -DhcpOptionsId dopt-1a2b3c4d).DhcpConfigurations
```

#### Output:

Key	Values
---	-----
domain-name	{abc.local}
domain-name-servers	{10.0.0.101, 10.0.0.102}

- For API details, see [DescribeDhcpOptions](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeFlowLogs` with an AWS SDK or CLI

The following code examples show how to use `DescribeFlowLogs`.

### CLI

#### AWS CLI

##### Example 1: To describe all of your flow logs

The following `describe-flow-logs` example displays details for all of your flow logs.

```
aws ec2 describe-flow-logs
```

Output:

```
{
    "FlowLogs": [
        {
            "CreationTime": "2018-02-21T13:22:12.644Z",
            "DeliverLogsPermissionArn": "arn:aws:iam::123456789012:role/flow-
logs-role",
            "DeliverLogsStatus": "SUCCESS",
            "FlowLogId": "fl-aabbccdd112233445",
            "MaxAggregationInterval": 600,
            "FlowLogStatus": "ACTIVE",
            "LogGroupName": "FlowLogGroup",
            "ResourceId": "subnet-12345678901234567",
            "TrafficType": "ALL",
            "LogDestinationType": "cloud-watch-logs",
```

```
"LogFormat": "${version} ${account-id} ${interface-id} ${srcaddr}
${dstaddr} ${srcport} ${dstport} ${protocol} ${packets} ${bytes} ${start} ${end}
${action} ${log-status}"
},
{
    "CreationTime": "2020-02-04T15:22:29.986Z",
    "DeliverLogsStatus": "SUCCESS",
    "FlowLogId": "fl-01234567890123456",
    "MaxAggregationInterval": 60,
    "FlowLogStatus": "ACTIVE",
    "ResourceId": "vpc-00112233445566778",
    "TrafficType": "ACCEPT",
    "LogDestinationType": "s3",
    "LogDestination": "arn:aws:s3:::my-flow-log-bucket/custom",
    "LogFormat": "${version} ${vpc-id} ${subnet-id} ${instance-id}
${interface-id} ${account-id} ${type} ${srcaddr} ${dstaddr} ${srcport}
${dstport} ${pkt-srcaddr} ${pkt-dstaddr} ${protocol} ${bytes} ${packets}
${start} ${end} ${action} ${tcp-flags} ${log-status}"
}
]
```

## Example 2: To describe a subset of your flow logs

The following `describe-flow-logs` example uses a filter to display details for only those flow logs that are in the specified log group in Amazon CloudWatch Logs.

```
aws ec2 describe-flow-logs \
--filter "Name=log-group-name,Values=MyFlowLogs"
```

- For API details, see [DescribeFlowLogs](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes one or more flow logs with log destination type 's3'

```
Get-EC2FlowLog -Filter @{Name="log-destination-type";Values="s3"}
```

### Output:

```
CreationTime          : 2/25/2019 9:07:36 PM
DeliverLogsErrorMessage :
DeliverLogsPermissionArn :
DeliverLogsStatus      : SUCCESS
FlowLogId              : fl-01b2e3d45f67f8901
FlowLogStatus          : ACTIVE
LogDestination         : arn:aws:s3:::my-bucket-dd-tata
LogDestinationType     : s3
LogGroupName           :
ResourceId             : eni-01d2dda3456b7e890
TrafficType            : ALL
```

- For API details, see [DescribeFlowLogs](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeHostReservationOfferings** with an AWS SDK or CLI

The following code examples show how to use `DescribeHostReservationOfferings`.

### CLI

#### AWS CLI

##### To describe Dedicated Host Reservation offerings

This example describes the Dedicated Host Reservations for the M4 instance family that are available to purchase.

Command:

```
aws ec2 describe-host-reservation-offerings --filter Name=instance-
family,Values=m4
```

Output:

```
{
  "OfferingSet": [
    {
```

```
        "HourlyPrice": "1.499",
        "OfferingId": "hro-03f707bf363b6b324",
        "InstanceFamily": "m4",
        "PaymentOption": "NoUpfront",
        "UpfrontPrice": "0.000",
        "Duration": 31536000
    },
{
    "HourlyPrice": "1.045",
    "OfferingId": "hro-0ef9181cabdef7a02",
    "InstanceFamily": "m4",
    "PaymentOption": "NoUpfront",
    "UpfrontPrice": "0.000",
    "Duration": 94608000
},
{
    "HourlyPrice": "0.714",
    "OfferingId": "hro-04567a15500b92a51",
    "InstanceFamily": "m4",
    "PaymentOption": "PartialUpfront",
    "UpfrontPrice": "6254.000",
    "Duration": 31536000
},
{
    "HourlyPrice": "0.484",
    "OfferingId": "hro-0d5d7a9d23ed7fbfe",
    "InstanceFamily": "m4",
    "PaymentOption": "PartialUpfront",
    "UpfrontPrice": "12720.000",
    "Duration": 94608000
},
{
    "HourlyPrice": "0.000",
    "OfferingId": "hro-05da4108ca998c2e5",
    "InstanceFamily": "m4",
    "PaymentOption": "AllUpfront",
    "UpfrontPrice": "23913.000",
    "Duration": 94608000
},
{
    "HourlyPrice": "0.000",
    "OfferingId": "hro-0a9f9be3b95a3dc8f",
    "InstanceFamily": "m4",
    "PaymentOption": "AllUpfront",
```

```
        "UpfrontPrice": "12257.000",
        "Duration": 31536000
    }
]
```

- For API details, see [DescribeHostReservationOfferings](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the Dedicated Host reservations that are available to purchase for the given filter 'instance-family' where PaymentOption is 'NoUpfront'**

```
Get-EC2HostReservationOffering -Filter @{Name="instance-family";Values="m4"} |
Where-Object PaymentOption -eq NoUpfront
```

### Output:

```
CurrencyCode      :
Duration         : 94608000
HourlyPrice      : 1.307
InstanceFamily   : m4
OfferingId       : hro-0c1f234567890d9ab
PaymentOption    : NoUpfront
UpfrontPrice     : 0.000

CurrencyCode      :
Duration         : 31536000
HourlyPrice      : 1.830
InstanceFamily   : m4
OfferingId       : hro-04ad12aaaf34b5a67
PaymentOption    : NoUpfront
UpfrontPrice     : 0.000
```

- For API details, see [DescribeHostReservationOfferings](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeHosts` with an AWS SDK or CLI

The following code examples show how to use `DescribeHosts`.

CLI

### AWS CLI

#### To view details about Dedicated Hosts

The following `describe-hosts` example displays details for the available Dedicated Hosts in your AWS account.

```
aws ec2 describe-hosts --filter "Name=state,Values=available"
```

Output:

```
{  
    "Hosts": [  
        {  
            "HostId": "h-07879acf49EXAMPLE",  
            "Tags": [  
                {  
                    "Value": "production",  
                    "Key": "purpose"  
                }  
            ],  
            "HostProperties": {  
                "Cores": 48,  
                "TotalVCpus": 96,  
                "InstanceType": "m5.large",  
                "Sockets": 2  
            },  
            "Instances": [],  
            "State": "available",  
            "AvailabilityZone": "eu-west-1a",  
            "AvailableCapacity": {  
                "AvailableInstanceCapacity": [  
                    {  
                        "HostId": "h-07879acf49EXAMPLE",  
                        "AvailableInstances": 1  
                    }  
                ]  
            }  
        }  
    ]  
}
```

```
{  
    "AvailableCapacity": 48,  
    "InstanceType": "m5.large",  
    "TotalCapacity": 48  
}  
],  
    "AvailableVCpus": 96  
},  
    "HostRecovery": "on",  
    "AllocationTime": "2019-08-19T08:57:44.000Z",  
    "AutoPlacement": "off"  
}  
]  
}
```

For more information, see [Viewing Dedicated Hosts](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [DescribeHosts](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example returns the EC2 host details

```
Get-EC2Host
```

#### Output:

```
AllocationTime      : 3/23/2019 4:55:22 PM  
AutoPlacement      : off  
AvailabilityZone   : eu-west-1b  
AvailableCapacity  : Amazon.EC2.Model.AvailableCapacity  
ClientToken        :  
HostId             : h-01e23f4cd567890f1  
HostProperties     : Amazon.EC2.Model.HostProperties  
HostReservationId :  
Instances          : {}  
ReleaseTime        : 1/1/0001 12:00:00 AM  
State              : available  
Tags               : {}
```

## Example 2: This example queries the AvailableInstanceCapacity for the host h-01e23f4cd567899f1

```
Get-EC2Host -HostId h-01e23f4cd567899f1 | Select-Object -ExpandProperty AvailableCapacity | Select-Object -expand AvailableInstanceCapacity
```

### Output:

AvailableCapacity	InstanceType	TotalCapacity
11	m4.xlarge	11

- For API details, see [DescribeHosts](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeIamInstanceProfileAssociations** with an AWS SDK or CLI

The following code examples show how to use **DescribeIamInstanceProfileAssociations**.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
```

```
/// Get the instance profile association data for an instance.  
/// </summary>  
/// <param name="instanceId">The Id of the instance.</param>  
/// <returns>Instance profile associations data.</returns>  
public async Task<IamInstanceProfileAssociation> GetInstanceProfile(string  
instanceId)  
{  
    var response = await  
_amazonEc2.DescribeIamInstanceProfileAssociationsAsync(  
        new DescribeIamInstanceProfileAssociationsRequest()  
    {  
        Filters = new List<Amazon.EC2.Model.Filter>()  
    {  
        new ("instance-id", new List<string>() { instanceId })  
    },  
});  
return response.IamInstanceProfileAssociations[0];  
}
```

- For API details, see [DescribeIamInstanceProfileAssociations](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### To describe IAM instance profile associations

This example describes all of your IAM instance profile associations.

Command:

```
aws ec2 describe-iam-instance-profile-associations
```

Output:

```
{  
    "IamInstanceProfileAssociations": [  
        {  
            "InstanceId": "i-09eb09efa73ec1dee",  
            "State": "associated",  
            "LastUpdated": "2023-01-12T12:00:00Z",  
            "Arn": "arn:aws:iam::123456789012:instance-profile/MyProfile",  
            "CreateDate": "2023-01-12T12:00:00Z"  
        }  
    ]  
}
```

```
        "AssociationId": "iip-assoc-0db249b1f25fa24b8",
        "IamInstanceProfile": {
            "Id": "AIPAJVQN4F5WVLGCJDRGM",
            "Arn": "arn:aws:iam::123456789012:instance-profile/admin-role"
        }
    },
    {
        "InstanceId": "i-0402909a2f4dfffd14",
        "State": "associating",
        "AssociationId": "iip-assoc-0d1ec06278d29f44a",
        "IamInstanceProfile": {
            "Id": "AGJAJVQN4F5WVLGCJABCM",
            "Arn": "arn:aws:iam::123456789012:instance-profile/user1-role"
        }
    }
]
```

- For API details, see [DescribeIamInstanceProfileAssociations](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
const ec2Client = new EC2Client({});

const { IamInstanceProfileAssociations } = await ec2Client.send(
    new DescribeIamInstanceProfileAssociationsCommand({
        Filters: [
            { Name: "instance-id", Values: [state.targetInstance.InstanceId] },
        ],
    }),
);
```

- For API details, see [DescribeIamInstanceProfileAssociations](#) in *AWS SDK for JavaScript API Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:  
    """  
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,  
        ec2_client,  
        ssm_client,  
        iam_client,  
    ):  
        """  
        :param resource_prefix: The prefix for naming AWS resources that are  
        created by this class.  
        :param inst_type: The type of EC2 instance to create, such as t3.micro.  
        :param ami_param: The Systems Manager parameter used to look up the AMI  
        that is  
            created.  
        :param autoscaling_client: A Boto3 EC2 Auto Scaling client.  
        :param ec2_client: A Boto3 EC2 client.  
        :param ssm_client: A Boto3 Systems Manager client.  
        :param iam_client: A Boto3 IAM client.  
        """  
        self.inst_type = inst_type
```

```
    self.ami_param = ami_param
    self.autoscaling_client = autoscaling_client
    self.ec2_client = ec2_client
    self.ssm_client = ssm_client
    self.iam_client = iam_client
    self.launch_template_name = f"{resource_prefix}-template"
    self.group_name = f"{resource_prefix}-group"
    self.instance_policy_name = f"{resource_prefix}-pol"
    self.instance_role_name = f"{resource_prefix}-role"
    self.instance_profile_name = f"{resource_prefix}-prof"
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
    self.key_pair_name = f"{resource_prefix}-key-pair"

def get_instance_profile(self, instance_id):
    """
    Gets data about the profile associated with an instance.

    :param instance_id: The ID of the instance to look up.
    :return: The profile data.
    """

    try:
        response =
self.ec2_client.describe_iam_instance_profile_associations(
            Filters=[{"Name": "instance-id", "Values": [instance_id]}]
        )
    except ClientError as err:
        raise AutoScalerError(
            f"Couldn't get instance profile association for instance {instance_id}: {err}"
        )
    else:
        return response["IamInstanceProfileAssociations"][0]
```

- For API details, see [DescribeIamInstanceProfileAssociations](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeIdFormat` with an AWS SDK or CLI

The following code examples show how to use `DescribeIdFormat`.

CLI

### AWS CLI

#### Example 1: To describe the ID format of a resource

The following `describe-id-format` example describes the ID format for security groups.

```
aws ec2 describe-id-format \
  --resource security-group
```

In the following example output, the `Deadline` value indicates that the deadline for this resource type to permanently switch from the short ID format to the long ID format expired at 00:00 UTC on August 15, 2018.

```
{
  "Statuses": [
    {
      "Deadline": "2018-08-15T00:00:00.000Z",
      "Resource": "security-group",
      "UseLongIds": true
    }
  ]
}
```

#### Example 2: To describe the ID format for all resources

The following `describe-id-format` example describes the ID format for all resource types. All resource types that supported the short ID format were switched to use the long ID format.

```
aws ec2 describe-id-format
```

- For API details, see [DescribeIdFormat](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the ID format for the specified resource type.**

```
Get-EC2IdFormat -Resource instance
```

**Output:**

Resource	UseLongIds
-----	-----
instance	False

**Example 2: This example describes the ID formats for all resource types that support longer IDs.**

```
Get-EC2IdFormat
```

**Output:**

Resource	UseLongIds
-----	-----
reservation	False
instance	False

- For API details, see [DescribeIdFormat](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeIdentityIdFormat` with an AWS SDK or CLI

The following code examples show how to use `DescribeIdentityIdFormat`.

## CLI

### AWS CLI

#### To describe the ID format for an IAM role

The following `describe-identity-id-format` example describes the ID format received by instances created by the IAM role `EC2Role` in your AWS account.

```
aws ec2 describe-identity-id-format \
    --principal-arn arn:aws:iam::123456789012:role/my-iam-role \
    --resource instance
```

The following output indicates that instances created by this role receive IDs in long ID format.

```
{  
    "Statuses": [  
        {  
            "Deadline": "2016-12-15T00:00:00Z",  
            "Resource": "instance",  
            "UseLongIds": true  
        }  
    ]  
}
```

#### To describe the ID format for an IAM user

The following `describe-identity-id-format` example describes the ID format received by snapshots created by the IAM user `AdminUser` in your AWS account.

```
aws ec2 describe-identity-id-format \
    --principal-arn arn:aws:iam::123456789012:user/AdminUser \
    --resource snapshot
```

The output indicates that snapshots created by this user receive IDs in long ID format.

```
{  
    "Statuses": [  
        {  
            "Deadline": "2016-12-15T00:00:00Z",  
            "Resource": "snapshot",  
            "UseLongIds": true  
        }  
    ]  
}
```

```
        "UseLongIds": true
    }
]
}
```

- For API details, see [DescribeIdentityFormat](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

- Example 1: This example returns the ID format for the resource 'image' for the role given**

```
Get-EC2IdentityFormat -PrincipalArn arn:aws:iam::123456789511:role/JDBC -
Resource image
```

### Output:

Deadline	Resource	UseLongIds
-----	-----	-----
8/2/2018 11:30:00 PM	image	True

- For API details, see [DescribeIdentityFormat](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeImageAttribute** with an AWS SDK or CLI

The following code examples show how to use `DescribeImageAttribute`.

### CLI

#### AWS CLI

##### To describe the launch permissions for an AMI

This example describes the launch permissions for the specified AMI.

Command:

```
aws ec2 describe-image-attribute --image-id ami-5731123e --  
attribute launchPermission
```

Output:

```
{  
    "LaunchPermissions": [  
        {  
            "UserId": "123456789012"  
        }  
    ],  
    "ImageId": "ami-5731123e",  
}
```

## To describe the product codes for an AMI

This example describes the product codes for the specified AMI. Note that this AMI has no product codes.

Command:

```
aws ec2 describe-image-attribute --image-id ami-5731123e --attribute productCodes
```

Output:

```
{  
    "ProductCodes": [],  
    "ImageId": "ami-5731123e",  
}
```

- For API details, see [DescribeImageAttribute](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

### Example 1: This example gets the description for the specified AMI.

```
Get-EC2ImageAttribute -ImageId ami-12345678 -Attribute description
```

**Output:**

```
BlockDeviceMappings : {}
Description         : My image description
ImageId            : ami-12345678
KernelId           :
LaunchPermissions   : {}
ProductCodes        : {}
RamdiskId          :
SriovNetSupport    :
```

**Example 2: This example gets the launch permissions for the specified AMI.**

```
Get-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission
```

**Output:**

```
BlockDeviceMappings : {}
Description         :
ImageId            : ami-12345678
KernelId           :
LaunchPermissions   : {all}
ProductCodes        : {}
RamdiskId          :
SriovNetSupport    :
```

**Example 3: This example test whether enhanced networking is enabled.**

```
Get-EC2ImageAttribute -ImageId ami-12345678 -Attribute sriovNetSupport
```

**Output:**

```
BlockDeviceMappings : {}
Description         :
ImageId            : ami-12345678
KernelId           :
LaunchPermissions   : {}
ProductCodes        : {}
RamdiskId          :
SriovNetSupport    : simple
```

- For API details, see [DescribeImageAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeImages` with an AWS SDK or CLI

The following code examples show how to use `DescribeImages`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_describe_images
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# images.
#
# Parameters:
#     -i image_ids - A space-separated list of image IDs (optional).
#     -h - Display help.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_describe_images() {
```

```
local image_ids response
local option OPTARG # Required to use getopt command in a function.

# bashsupport disable=BP5008
function usage() {
    echo "function ec2_describe_images"
    echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
images."
    echo " -i image_ids - A space-separated list of image IDs (optional)."
    echo " -h - Display help."
    echo ""
}

# Retrieve the calling parameters.
while getopts "i:h" option; do
    case "${option}" in
        i) image_ids="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

local aws_cli_args=()

if [[ -n "$image_ids" ]]; then
    # shellcheck disable=SC2206
    aws_cli_args+=("--image-ids" $image_ids)
fi

response=$(aws ec2 describe-images \
"${aws_cli_args[@]}" \
--query 'Images[*.Description,Architecture,ImageId]' \
--output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports describe-images operation failed.$response"
    return 1
}
```

```
}

echo "$response"

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " Invalid file name."}
```

```
    errecho " The system environment or configuration was invalid."
elif [ "$err_code" == 254 ]; then
    errecho " The service returned an error."
elif [ "$err_code" == 255 ]; then
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see [DescribeImages](#) in *AWS CLI Command Reference*.

## CLI

### AWS CLI

#### Example 1: To describe an AMI

The following `describe-images` example describes the specified AMI in the specified Region.

```
aws ec2 describe-images \
--region us-east-1 \
--image-ids ami-1234567890EXAMPLE
```

Output:

```
{
  "Images": [
    {
      "VirtualizationType": "hvm",
      "Description": "Provided by Red Hat, Inc.",
      "PlatformDetails": "Red Hat Enterprise Linux",
      "EnaSupport": true,
      "Hypervisor": "xen",
      "State": "available",
      "SriovNetSupport": "simple",
      "ImageId": "ami-1234567890EXAMPLE",
      "UsageOperation": "RunInstances:0010",
      "BlockDeviceMappings": [
        {
          "DeviceName": "/dev/sda1",
          "VirtualName": "xvda",
          "Ebs": {
            "VolumeSize": 80,
            "DeleteOnTermination": true,
            "VolumeType": "standard"
          },
          "NoDevice": false
        }
      ]
    }
  ]
}
```

```
        "DeviceName": "/dev/sda1",
        "Ebs": {
            "SnapshotId": "snap-111222333444aaabb",
            "DeleteOnTermination": true,
            "VolumeType": "gp2",
            "VolumeSize": 10,
            "Encrypted": false
        }
    },
    "Architecture": "x86_64",
    "ImageLocation": "123456789012/RHEL-8.0.0_HVM-20190618-x86_64-1-Hourly2-GP2",
    "RootDeviceType": "ebs",
    "OwnerId": "123456789012",
    "RootDeviceName": "/dev/sda1",
    "CreationDate": "2019-05-10T13:17:12.000Z",
    "Public": true,
    "ImageType": "machine",
    "Name": "RHEL-8.0.0_HVM-20190618-x86_64-1-Hourly2-GP2"
}
]
```

For more information, see [Amazon Machine Images \(AMI\)](#) in the *Amazon EC2 User Guide*.

### Example 2: To describe AMIs based on filters

The following `describe-images` example describes Windows AMIs provided by Amazon that are backed by Amazon EBS.

```
aws ec2 describe-images \
--owners amazon \
--filters "Name=platform,Values=windows" "Name=root-device-type,Values=ebs"
```

For an example of the output for `describe-images`, see Example 1.

For additional examples using filters, see [Listing and filtering your resources](#) in the *Amazon EC2 User Guide*.

### Example 3: To describe AMIs based on tags

The following `describe-images` example describes all AMIs that have the tag `Type=Custom`. The example uses the `--query` parameter to display only the AMI IDs.

```
aws ec2 describe-images \
--filters "Name=tag:Type,Values=Custom" \
--query 'Images[*].[ImageId]' \
--output text
```

Output:

```
ami-1234567890EXAMPLE
ami-0abcdef1234567890
```

For additional examples using tag filters, see [Working with tags](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeImages](#) in AWS CLI Command Reference.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { paginateDescribeImages } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// List at least the first i386 image available for EC2 instances.
export const main = async () => {
    // The paginate function is a wrapper around the base command.
    const paginator = paginateDescribeImages(
        // Without limiting the page size, this call can take a long time. pageSize
        // is just sugar for
        // the MaxResults property in the base command.
        { client, pageSize: 25 },
        {
```

```
// There are almost 70,000 images available. Be specific with your
filtering
// to increase efficiency.
// See https://docs.aws.amazon.com/AWSJavaScriptSDK/v3/latest/clients/
client-ec2/interfaces/describeimagescommandinput.html#filters
Filters: [{ Name: "architecture", Values: ["x86_64"] }],
},
);

try {
  const arm64Images = [];
  for await (const page of paginator) {
    if (page.Images.length) {
      arm64Images.push(...page.Images);
      // Once we have at least 1 result, we can stop.
      if (arm64Images.length >= 1) {
        break;
      }
    }
  }
  console.log(arm64Images);
} catch (err) {
  console.error(err);
}
};

});
```

- For API details, see [DescribeImages](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified AMI.

```
Get-EC2Image -ImageId ami-12345678
```

#### Output:

```
Architecture      : x86_64
BlockDeviceMappings : {/dev/xvda}
CreationDate     : 2014-10-20T00:56:28.000Z
```

```
Description      : My image
Hypervisor     : xen
ImageId        : ami-12345678
ImageLocation   : 123456789012/my-image
ImageOwnerAlias :
ImageType       : machine
KernelId        :
Name           : my-image
OwnerId         : 123456789012
Platform        :
ProductCodes    : {}
Public          : False
RamdiskId       :
RootDeviceName  : /dev/xvda
RootDeviceType   : ebs
SriovNetSupport  : simple
State           : available
StateReason     :
Tags            : {Name}
VirtualizationType : hvm
```

### Example 2: This example describes the AMIs that you own.

```
Get-EC2Image -owner self
```

### Example 3: This example describes the public AMIs that run Microsoft Windows Server.

```
Get-EC2Image -Filter @{ Name="platform"; Values="windows" }
```

### Example 4: This example describes all public AMIs in the 'us-west-2' region.

```
Get-EC2Image -Region us-west-2
```

- For API details, see [DescribeImages](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance  
    actions."""  
  
    def __init__(self, ec2_resource, instance=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param instance: A Boto3 Instance object. This is a high-level object  
        that  
                    wraps instance actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.instance = instance  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
  
    def get_images(self, image_ids):  
        """  
        Gets information about Amazon Machine Images (AMIs) from a list of AMI  
        IDs.  
  
        :param image_ids: The list of AMIs to look up.  
        :return: A list of Boto3 Image objects that represent the requested AMIs.  
        """  
        try:            pass
```

```
        images = list(self.ec2_resource.images.filter(ImageIds=image_ids))
    except ClientError as err:
        logger.error(
            "Couldn't get images. Here's why: %s: %s",
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return images
```

- For API details, see [DescribeImages](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn list_images(&self, ids: Vec<Parameter>) -> Result<Vec<Image>, EC2Error> {
    let image_ids = ids.into_iter().filter_map(|p| p.value).collect();
    let output = self
        .client
        .describe_images()
        .set_image_ids(Some(image_ids))
        .send()
        .await?;

    let images = output.images.unwrap_or_default();
    if images.is_empty() {
        Err(EC2Error::new("No images for selected AMIs"))
    } else {
        Ok(images)
    }
}
```

Using the `list_images` function with SSM to limit based on your environment. For more details on SSM, see [https://docs.aws.amazon.com/systems-manager/latest/userguide/example\\_ssm\\_GetParameters\\_section.html](https://docs.aws.amazon.com/systems-manager/latest/userguide/example_ssm_GetParameters_section.html).

```
async fn find_image(&mut self) -> Result<ScenarioImage, EC2Error> {
    let params: Vec<Parameter> = self
        .ssm
        .list_path("/aws/service/ami-amazon-linux-latest")
        .await
        .map_err(|e| e.add_message("Could not find parameters for available
images"))?
        .into_iter()
        .filter(|param| param.name().is_some_and(|name|
name.contains("amzn2")))
        .collect();
    let amzn2_images: Vec<ScenarioImage> = self
        .ec2
        .list_images(params)
        .await
        .map_err(|e| e.add_message("Could not find images"))?
        .into_iter()
        .map(ScenarioImage::from)
        .collect();
    println!("We will now create an instance from an Amazon Linux 2 AMI");
    let ami = self.util.select_scenario_image(amzn2_images)?;
    Ok(ami)
}
```

- For API details, see [DescribeImages](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeImportImageTasks` with an AWS SDK or CLI

The following code examples show how to use `DescribeImportImageTasks`.

## CLI

### AWS CLI

#### To monitor an import image task

The following `describe-import-image-tasks` example checks the status of the specified import image task.

```
aws ec2 describe-import-image-tasks \
--import-task-ids import-ami-1234567890abcdef0
```

Output for an import image task that is in progress.

```
{
    "ImportImageTasks": [
        {
            "ImportTaskId": "import-ami-1234567890abcdef0",
            "Progress": "28",
            "SnapshotDetails": [
                {
                    "DiskImageSize": 705638400.0,
                    "Format": "ova",
                    "Status": "completed",
                    "UserBucket": {
                        "S3Bucket": "my-import-bucket",
                        "S3Key": "vms/my-server-vm.ova"
                    }
                }
            ],
            "Status": "active",
            "StatusMessage": "converting"
        }
    ]
}
```

Output for an import image task that is completed. The ID of the resulting AMI is provided by `ImageId`.

```
{
    "ImportImageTasks": [
        {
```

```
        "ImportTaskId": "import-ami-1234567890abcdef0",
        "ImageId": "ami-1234567890abcdef0",
        "SnapshotDetails": [
            {
                "DiskImageSize": 705638400.0,
                "Format": "ova",
                "SnapshotId": "snap-1234567890abcdef0"
                "Status": "completed",
                "UserBucket": {
                    "S3Bucket": "my-import-bucket",
                    "S3Key": "vms/my-server-vm.ova"
                }
            }
        ],
        "Status": "completed"
    }
]
```

- For API details, see [DescribeImportImageTasks](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified image import task.**

```
Get-EC2ImportImageTask -ImportTaskId import-ami-hgfedcba
```

### Output:

```
Architecture      : x86_64
Description       : Windows Image 2
Hypervisor        :
ImageId          : ami-1a2b3c4d
ImportTaskId      : import-ami-hgfedcba
LicenseType       : AWS
Platform          : Windows
Progress          :
SnapshotDetails  : {/dev/sda1}
Status            : completed
StatusMessage     :
```

## Example 2: This example describes all your image import tasks.

```
Get-EC2ImportImageTask
```

### Output:

```
Architecture      :  
Description       : Windows Image 1  
Hypervisor        :  
ImageId           :  
ImportTaskId      : import-ami-abcdefgħ  
LicenseType       : AWS  
Platform          : Windows  
Progress          :  
SnapshotDetails   : {}  
Status             : deleted  
StatusMessage     : User initiated task cancelation  
  
Architecture      : x86_64  
Description       : Windows Image 2  
Hypervisor        :  
ImageId           : ami-1a2b3c4d  
ImportTaskId      : import-ami-hgfedcba  
LicenseType       : AWS  
Platform          : Windows  
Progress          :  
SnapshotDetails   : {/dev/sda1}  
Status             : completed  
StatusMessage     :
```

- For API details, see [DescribeImportImageTasks](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeImportSnapshotTasks** with an AWS SDK or CLI

The following code examples show how to use **DescribeImportSnapshotTasks**.

## CLI

### AWS CLI

#### To monitor an import snapshot task

The following `describe-import-snapshot-tasks` example checks the status of the specified import snapshot task.

```
aws ec2 describe-import-snapshot-tasks \
--import-task-ids import-snap-1234567890abcdef0
```

Output for an import snapshot task that is in progress:

```
{
    "ImportSnapshotTasks": [
        {
            "Description": "My server VMDK",
            "ImportTaskId": "import-snap-1234567890abcdef0",
            "SnapshotTaskDetail": {
                "Description": "My server VMDK",
                "DiskImageSize": "705638400.0",
                "Format": "VMDK",
                "Progress": "42",
                "Status": "active",
                "StatusMessage": "downloading/convertig",
                "UserBucket": {
                    "S3Bucket": "my-import-bucket",
                    "S3Key": "vms/my-server-vm.vmdk"
                }
            }
        }
    ]
}
```

Output for an import snapshot task that is completed. The ID of the resulting snapshot is provided by `SnapshotId`.

```
{
    "ImportSnapshotTasks": [
        {
            "Description": "My server VMDK",
```

```
"ImportTaskId": "import-snap-1234567890abcdef0",
"SnapshotTaskDetail": [
    "Description": "My server VMDK",
    "DiskImageSize": "705638400.0",
    "Format": "VMDK",
    "SnapshotId": "snap-1234567890abcdef0"
    "Status": "completed",
    "UserBucket": {
        "S3Bucket": "my-import-bucket",
        "S3Key": "vms/my-server-vm.vmdk"
    }
]
]
```

- For API details, see [DescribeImportSnapshotTasks](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified snapshot import task.

```
Get-EC2ImportSnapshotTask -ImportTaskId import-snap-abcdefg
```

#### Output:

Description	ImportTaskId	SnapshotTaskDetail
-----	-----	-----
Disk Image Import 1	import-snap-abcdefg	Amazon.EC2.Model.SnapshotTaskDetail

#### Example 2: This example describes all your snapshot import tasks.

```
Get-EC2ImportSnapshotTask
```

#### Output:

Description	ImportTaskId	SnapshotTaskDetail
Disk Image Import 1	import-snap-abcdefg Amazon.EC2.Model.SnapshotTaskDetail	
Disk Image Import 2	import-snap-hgfedcba Amazon.EC2.Model.SnapshotTaskDetail	

- For API details, see [DescribeImportSnapshotTasks](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeInstanceAttribute** with an AWS SDK or CLI

The following code examples show how to use **DescribeInstanceAttribute**.

### CLI

#### AWS CLI

##### To describe the instance type

This example describes the instance type of the specified instance.

Command:

```
aws ec2 describe-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute instanceType
```

Output:

```
{  
    "InstanceId": "i-1234567890abcdef0"  
    "InstanceType": {  
        "Value": "t1.micro"  
    }  
}
```

```
}
```

## To describe the disableApiTermination attribute

This example describes the disableApiTermination attribute of the specified instance.

Command:

```
aws ec2 describe-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute disableApiTermination
```

Output:

```
{  
    "InstanceId": "i-1234567890abcdef0"  
    "DisableApiTermination": {  
        "Value": "false"  
    }  
}
```

## To describe the block device mapping for an instance

This example describes the blockDeviceMapping attribute of the specified instance.

Command:

```
aws ec2 describe-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute blockDeviceMapping
```

Output:

```
{  
    "InstanceId": "i-1234567890abcdef0"  
    "BlockDeviceMappings": [  
        {  
            "DeviceName": "/dev/sda1",  
            "Ebs": {  
                "Status": "attached",  
                "DeleteOnTermination": true,  
                "VolumeId": "vol-049df61146c4d7901",  
                "AttachTime": "2013-05-17T22:42:34.000Z"  
            }  
        }  
    ]
```

```
        },
        {
            "DeviceName": "/dev/sdf",
            "Ebs": {
                "Status": "attached",
                "DeleteOnTermination": false,
                "VolumeId": "vol-049df61146c4d7901",
                "AttachTime": "2013-09-10T23:07:00.000Z"
            }
        }
    ],
}
```

- For API details, see [DescribeInstanceAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the instance type of the specified instance.

```
Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute instanceType
```

#### Output:

```
InstanceType : t2.micro
```

#### Example 2: This example describes whether enhanced networking is enabled for the specified instance.

```
Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute sriovNetSupport
```

#### Output:

```
SriovNetSupport : simple
```

#### Example 3: This example describes the security groups for the specified instance.

```
(Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute groupSet).Groups
```

**Output:**

```
GroupId  
-----  
sg-12345678  
sg-45678901
```

**Example 4: This example describes whether EBS optimization is enabled for the specified instance.**

```
Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute ebsOptimized
```

**Output:**

```
EbsOptimized : False
```

**Example 5: This example describes the 'disableApiTermination' attribute of the specified instance.**

```
Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute disableApiTermination
```

**Output:**

```
DisableApiTermination : False
```

**Example 6: This example describes the 'instanceInitiatedShutdownBehavior' attribute of the specified instance.**

```
Get-EC2InstanceAttribute -InstanceId i-12345678 -Attribute  
instanceInitiatedShutdownBehavior
```

**Output:**

```
InstanceInitiatedShutdownBehavior : stop
```

- For API details, see [DescribeInstanceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeInstanceStatus` with an AWS SDK or CLI

The following code examples show how to use `DescribeInstanceStatus`.

### CLI

#### AWS CLI

##### To describe the status of an instance

The following `describe-instance-status` example describes the current status of the specified instance.

```
aws ec2 describe-instance-status \
    --instance-ids i-1234567890abcdef0
```

Output:

```
{
    "InstanceStatuses": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "InstanceState": {
                "Code": 16,
                "Name": "running"
            },
            "AvailabilityZone": "us-east-1d",
            "SystemStatus": {
                "Status": "ok",
                "Details": [
                    {
                        "Status": "passed",
                        "Name": "reachability"
                    }
                ]
            },
            "InstanceStatus": {
                "Status": "ok",
                "Details": [
                    {
                        "Status": "passed",
                        "Name": "reachability"
                    }
                ]
            }
        }
    ]
}
```

```
        "Details": [
            {
                "Status": "passed",
                "Name": "reachability"
            }
        ]
    }
}
```

For more information, see [Monitor the status of your instances](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeInstanceStatus](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the status of the specified instance.**

```
Get-EC2InstanceState -InstanceId i-12345678
```

#### Output:

```
AvailabilityZone : us-west-2a
Events          : {}
InstanceId      : i-12345678
InstanceState   : Amazon.EC2.Model.InstanceState
Status          : Amazon.EC2.Model.InstanceStatusSummary
SystemStatus    : Amazon.EC2.Model.InstanceStatusSummary
```

```
$status = Get-EC2InstanceState -InstanceId i-12345678
$status.InstanceState
```

#### Output:

Code	Name
----	----

```
16      running
```

```
$status.Status
```

## Output:

Details	Status
-----	-----
{reachability}	ok

```
$status.SystemStatus
```

## Output:

Details	Status
-----	-----
{reachability}	ok

- For API details, see [DescribeInstanceStatus](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
async fn show_all_events(client: &Client) -> Result<(), Error> {
    let resp = client.describe_regions().send().await.unwrap();

    for region in resp.regions.unwrap_or_default() {
        let reg: &'static str =
            Box::leak(Box::from(region.region_name().unwrap()));
        let region_provider =
            RegionProviderChain::default_provider().or_else(reg);
    }
}
```

```
let config = aws_config::from_env().region(region_provider).load().await;
let new_client = Client::new(&config);

let resp = new_client.describe_instance_status().send().await;

println!("Instances in region {}:", reg);
println!();

for status in resp.unwrap().instance_statuses() {
    println!(
        "  Events scheduled for instance ID: {}",
        status.instance_id().unwrap_or_default()
    );
    for event in status.events() {
        println!("    Event ID:      {}", event.instance_event_id().unwrap());
        println!("    Description:  {}", event.description().unwrap());
        println!("    Event code:   {}", event.code().unwrap().as_ref());
        println!();
    }
}
Ok(())
}
```

- For API details, see [DescribeInstanceStatus](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeInstanceTypes` with an AWS SDK or CLI

The following code examples show how to use `DescribeInstanceTypes`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

## .NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Describe the instance types available.
/// </summary>
/// <returns>A list of instance type information.</returns>
public async Task<List<InstanceTypeInfo>>
DescribeInstanceTypes(ArchitectureValues architecture)
{
    var request = new DescribeInstanceTypesRequest();

    var filters = new List<Filter>
    {
        new Filter("processor-info.supported-architecture", new
List<string> { architecture.ToString() });
    };
    filters.Add(new Filter("instance-type", new() { "*.micro", "*.small" }));

    request.Filters = filters;
    var instanceTypes = new List<InstanceTypeInfo>();

    var paginator = _amazonEC2.Paginator.DescribeInstanceTypes(request);
    await foreach (var instanceType in paginator.InstanceTypes)
    {
        instanceTypes.Add(instanceType);
    }
    return instanceTypes;
}
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# ec2_describe_instance_types
#
# This function describes EC2 instance types filtered by processor architecture
# and optionally by instance type. It takes the following arguments:
#
# -a, --architecture ARCHITECTURE Specify the processor architecture (e.g.,
# x86_64)
# -t, --type INSTANCE_TYPE           Comma-separated list of instance types (e.g.,
# t2.micro)
# -h, --help                         Show the usage help
#
# The function prints the instance type and supported architecture for each
# matching instance type.
#####
function ec2_describe_instance_types() {
    local architecture=""
    local instance_types=""

    # bashsupport disable=BP5008
    function usage() {
        echo "Usage: ec2_describe_instance_types [-a|--architecture ARCHITECTURE] [-t|--type INSTANCE_TYPE] [-h|--help]"
        echo "  -a, --architecture ARCHITECTURE Specify the processor architecture
(e.g., x86_64)"
        echo "  -t, --type INSTANCE_TYPE           Comma-separated list of instance
types (e.g., t2.micro)"
        echo "  -h, --help                         Show this help message"
    }

    while [[ $# -gt 0 ]]; do
        case "$1" in
```

```
-a | --architecture)
    architecture="$2"
    shift 2
    ;;
-t | --type)
    instance_types="$2"
    shift 2
    ;;
-h | --help)
    usage
    return 0
    ;;
*)
    echo "Unknown argument: $1"
    return 1
    ;;
esac
done

if [[ -z "$architecture" ]]; then
    errecho "Error: Architecture not specified."
    usage
    return 1
fi

if [[ -z "$instance_types" ]]; then
    errecho "Error: Instance type not specified."
    usage
    return 1
fi

local tmp_json_file="temp_ec2.json"
echo -n '['
{
    "Name": "processor-info.supported-architecture",
    "Values": ['>"$tmp_json_file"

local items
IFS=',' read -ra items <<<"$architecture"
local array_size
array_size=${#items[@]}
for i in $(seq 0 $((array_size - 1))); do
    echo -n '""'${items[$i]}""' >>"$tmp_json_file"
    if [[ $i -lt $((array_size - 1)) ]]; then
```

```
        echo -n ',' >> "$tmp_json_file"
    fi
done
echo -n ']},
{
  "Name": "instance-type",
  "Values": [' >> "$tmp_json_file"
IFS=',' read -ra items <<< "$instance_types"
local array_size
array_size=${#items[@]}
for i in $(seq 0 $((array_size - 1))); do
  echo -n '""'"${items[$i]}"""' >> "$tmp_json_file"
  if [[ $i -lt $((array_size - 1)) ]]; then
    echo -n ',' >> "$tmp_json_file"
  fi
done

echo -n ']}' ]' >> "$tmp_json_file"

local response
response=$(aws ec2 describe-instance-types --filters file:///"$tmp_json_file" \
--query 'InstanceTypes[*].[InstanceType]' --output text)

local error_code=$?

rm "$tmp_json_file"

if [[ $error_code -ne 0 ]]; then
  aws_cli_error_log $error_code
  echo "ERROR: AWS reports describe-instance-types operation failed."
  return 1
fi

echo "$response"
return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
```

```
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####

function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [DescribeInstanceTypes](#) in *AWS CLI Command Reference*.

## CLI

### AWS CLI

#### Example 1: To describe an instance type

The following `describe-instance-types` example displays details for the specified instance type.

```
aws ec2 describe-instance-types \
--instance-types t2.micro
```

Output:

```
{
    "InstanceTypes": [
        {
            "InstanceType": "t2.micro",
            "CurrentGeneration": true,
            "FreeTierEligible": true,
            "SupportedUsageClasses": [
                "on-demand",
                "spot"
            ],
            "SupportedRootDeviceTypes": [
                "ebs"
            ],
            "BareMetal": false,
            "Hypervisor": "xen",
            "ProcessorInfo": {
                "SupportedArchitectures": [
                    "i386",
                    "x86_64"
                ],
                "SustainedClockSpeedInGhz": 2.5
            },
            "VCpuInfo": {
                "DefaultVCpus": 1,
                "DefaultCores": 1,
                "DefaultThreadsPerCore": 1,
                "ValidCores": [
                    1
                ],
                "DefaultThreadsPerCore": 1
            }
        }
    ]
}
```

```
        "ValidThreadsPerCore": [
            1
        ],
        "MemoryInfo": {
            "SizeInMiB": 1024
        },
        "InstanceStorageSupported": false,
        "EbsInfo": {
            "EbsOptimizedSupport": "unsupported",
            "EncryptionSupport": "supported"
        },
        "NetworkInfo": {
            "NetworkPerformance": "Low to Moderate",
            "MaximumNetworkInterfaces": 2,
            "Ipv4AddressesPerInterface": 2,
            "Ipv6AddressesPerInterface": 2,
            "Ipv6Supported": true,
            "EnaSupport": "unsupported"
        },
        "PlacementGroupInfo": {
            "SupportedStrategies": [
                "partition",
                "spread"
            ]
        },
        "HibernationSupported": false,
        "BurstablePerformanceSupported": true,
        "DedicatedHostsSupported": false,
        "AutoRecoverySupported": true
    }
]
}
```

For more information, see [Instance Types in Amazon Elastic Compute Cloud User Guide for Linux Instances](#).

### Example 2: To filter the available instance types

You can specify a filter to scope the results to instance types that have a specific characteristic. The following `describe-instance-types` example lists the instance types that support hibernation.

```
aws ec2 describe-instance-types \
    --filters Name=hibernation-supported,Values=true --query
    'InstanceTypes[*].InstanceType'
```

Output:

```
[  
    "m5.8xlarge",  
    "r3.large",  
    "c3.8xlarge",  
    "r5.large",  
    "m4.4xlarge",  
    "c4.large",  
    "m5.xlarge",  
    "m4.xlarge",  
    "c3.large",  
    "c4.8xlarge",  
    "c4.4xlarge",  
    "c5.xlarge",  
    "c5.12xlarge",  
    "r5.4xlarge",  
    "c5.4xlarge"  
]
```

For more information, see [Instance Types in Amazon Elastic Compute Cloud User Guide for Linux Instances](#).

- For API details, see [DescribeInstanceTypes](#) in [AWS CLI Command Reference](#).

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
// Get a list of instance types.  
public static String getInstanceTypes(Ec2Client ec2) {
```

```
String instanceType;
try {
    DescribeInstanceTypesRequest typesRequest =
DescribeInstanceTypesRequest.builder()
    .maxResults(10)
    .build();

    DescribeInstanceTypesResponse response =
ec2.describeInstanceTypes(typesRequest);
    List<InstanceTypeInfo> instanceTypes = response.instanceTypes();
    for (InstanceTypeInfo type : instanceTypes) {
        System.out.println("The memory information of this type is " +
type.memoryInfo().sizeInMiB());
        System.out.println("Network information is " +
type.networkInfo().toString());
        System.out.println("Instance type is " +
type.instanceType().toString());
        instanceType = type.instanceType().toString();
        if (instanceType.compareTo("t2.2xlarge") == 0){
            return instanceType;
        }
    }
}

} catch (SsmException e) {
    System.err.println(e.getMessage());
    System.exit(1);
}
return "";
}
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import {
  paginateDescribeInstanceTypes,
  DescribeInstanceTypesCommand,
} from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// List at least the first arm64 EC2 instance type available.
export const main = async () => {
  // The paginate function is a wrapper around the underlying command.
  const paginator = paginateDescribeInstanceTypes(
    // Without limiting the page size, this call can take a long time. pageSize
    // is just sugar for
    // the MaxResults property in the underlying command.
    { client, pageSize: 25 },
    {
      Filters: [
        { Name: "processor-info.supported-architecture", Values: ["x86_64"] },
        { Name: "free-tier-eligible", Values: ["true"] },
      ],
    }
  );

  try {
    const instanceTypes = [];

    for await (const page of paginator) {
      if (page.InstanceTypes.length) {
        instanceTypes.push(...page.InstanceTypes);

        // When we have at least 1 result, we can stop.
        if (instanceTypes.length >= 1) {
          break;
        }
      }
    }
    console.log(instanceTypes);
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
// Get a list of instance types.
suspend fun getInstanceTypesSc(): String {
    var instanceType = ""
    val filterObs = ArrayList<Filter>()
    val filter =
        Filter {
            name = "processor-info.supported-architecture"
            values = listOf("arm64")
        }

    filterObs.add(filter)
    val typesRequest =
        DescribeInstanceTypesRequest {
            filters = filterObs
            maxResults = 10
        }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.describeInstanceTypes(typesRequest)
        response.instanceTypes?.forEach { type ->
            println("The memory information of this type is
${type.memoryInfo?.sizeInMib}")
            println("Maximum number of network cards is
${type.networkInfo?.maximumNetworkCards}")
            instanceType = type.instanceType.toString()
        }
        return instanceType
    }
}
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for Kotlin API reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance  
    actions."""  
  
    def __init__(self, ec2_resource, instance=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param instance: A Boto3 Instance object. This is a high-level object  
        that  
                wraps instance actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.instance = instance  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def get_instance_types(self, architecture):  
        """  
        Gets instance types that support the specified architecture and are  
        designated  
                as either 'micro' or 'small'. When an instance is created, the instance  
        type  
                you specify must support the architecture of the AMI you use.  
        """
```

```
:param architecture: The kind of architecture the instance types must
support,
                     such as 'x86_64'.
:return: A list of instance types that support the specified architecture
        and are either 'micro' or 'small'.
"""
try:
    inst_types = []
    it Paginator = self.ec2_resource.meta.client.getPaginator(
        "describe_instance_types"
    )
    for page in itPaginator.paginate(
        Filters=[
            {
                "Name": "processor-info.supported-architecture",
                "Values": [architecture],
            },
            {"Name": "instance-type", "Values": ["*.micro", "*.small"]},
        ]
    ):
        inst_types += page["InstanceTypes"]
except ClientError as err:
    logger.error(
        "Couldn't get instance types. Here's why: %s: %s",
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return inst_types
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// List instance types that match an image's architecture and are free tier eligible.
pub async fn list_instance_types(&self, image: &Image) ->
Result<Vec<InstanceType>, EC2Error> {
    let architecture = format!(
        "{}",
        image.architecture().ok_or_else(|| EC2Error::new(format!(
            "Image {:?} does not have a listed architecture",
            image.image_id()
        )))?
    );
    let free_tier_eligible_filter = Filter::builder()
        .name("free-tier-eligible")
        .values("false")
        .build();
    let supported_architecture_filter = Filter::builder()
        .name("processor-info.supported-architecture")
        .values(architecture)
        .build();
    let response = self
        .client
        .describe_instance_types()
        .filters(free_tier_eligible_filter)
        .filters(supported_architecture_filter)
        .send()
        .await?;

    Ok(response
        .instance_types
        .unwrap_or_default()
        .into_iter()
        .filter_map(|iti| iti.instance_type)
```

```
        .collect()
    }
```

- For API details, see [DescribeInstanceTypes](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeInstances` with an AWS SDK or CLI

The following code examples show how to use `DescribeInstances`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code examples:

- [Build and manage a resilient service](#)
- [Get started with instances](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Get information about existing EC2 images.
/// </summary>
/// <returns>Async task.</returns>
public async Task<DescribeInstancesResponse> DescribeInstances()
{
    // List all EC2 instances.
    await GetInstanceDescriptions();

    string tagName = "IncludeInList";
```

```
        string tagValue = "Yes";
        await GetInstanceDescriptionsFiltered(tagName, tagValue);
    }

    /// <summary>
    /// Get information for all existing Amazon EC2 instances.
    /// </summary>
    /// <returns>Async task.</returns>
    public async Task GetInstanceDescriptions()
    {
        Console.WriteLine("Showing all instances:");
        var paginator = _amazonEC2.Paginator.DescribeInstances(new
DescribeInstancesRequest());

        await foreach (var response in paginator.Responses)
        {
            foreach (var reservation in response.Reservations)
            {
                foreach (var instance in reservation.Instances)
                {
                    Console.Write($"Instance ID: {instance.InstanceId}");
                    Console.WriteLine($"\\tCurrent State: {instance.State.Name}");
                }
            }
        }
    }

    /// <summary>
    /// Get information about EC2 instances filtered by a tag name and value.
    /// </summary>
    /// <param name="tagName">The name of the tag to filter on.</param>
    /// <param name="tagValue">The value of the tag to look for.</param>
    /// <returns>Async task.</returns>
    public async Task GetInstanceDescriptionsFiltered(string tagName, string
tagValue)
    {
        // This tag filters the results of the instance list.
        var filters = new List<Filter>
        {
            new Filter
            {
                Name = $"tag:{tagName}",
                Values = new List<string>
                {

```

```
        tagValue,
    },
},
};

var request = new DescribeInstancesRequest
{
    Filters = filters,
};

Console.WriteLine("\nShowing instances with tag: \"IncludeInList\" set to
\"Yes\".");
var paginator = _amazonEC2.Paginator.DescribeInstances(request);

await foreach (var response in paginator.Responses)
{
    foreach (var reservation in response.Reservations)
    {
        foreach (var instance in reservation.Instances)
        {
            Console.Write($"Instance ID: {instance.InstanceId} ");
            Console.WriteLine($"\\tCurrent State: {instance.State.Name}");
        }
    }
}
}
```

- For API details, see [DescribeInstances](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_describe_instances
#
```

```
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.

#
# Parameters:
#     -i instance_id - The ID of the instance to describe (optional).
#     -q query - The query to filter the response (optional).
#     -h - Display help.

#
# Returns:
#     0 - If successful.
#     1 - If it fails.

#####
function ec2_describe_instances() {
    local instance_id query response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_instances"
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
instances."
        echo "  -i instance_id - The ID of the instance to describe (optional)."
        echo "  -q query - The query to filter the response (optional)."
        echo "  -h - Display help."
        echo ""
    }

    #
    # Retrieve the calling parameters.
    while getopts "i:q:h" option; do
        case "${option}" in
            i) instance_id="${OPTARG}" ;;
            q) query="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1
```

```
local aws_cli_args=()

if [[ -n "$instance_id" ]]; then
    # shellcheck disable=SC2206
    aws_cli_args+=("--instance-ids" $instance_id)
fi

local query_arg=""
if [[ -n "$query" ]]; then
    query_arg="--query '$query'"
else
    query_arg="--query Reservations[*].Instances[*].
[InstanceId,ImageId,InstanceType,KeyName,VpcId,PublicIpAddress,State.Name]"
fi

# shellcheck disable=SC2086
response=$(aws ec2 describe-instances \
"${aws_cli_args[@]}" \
$query_arg \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports describe-instances operation failed.$response"
return 1
}

echo "$response"

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}
```

```
#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [DescribeInstances](#) in *AWS CLI Command Reference*.

## C++

## SDK for C++

**Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Describe all Amazon Elastic Compute Cloud (Amazon EC2) instances associated
//! with an account.
/*
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::describeInstances(
    const Aws::Client::ClientConfiguration &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::DescribeInstancesRequest request;
    bool header = false;
    bool done = false;
    while (!done) {
        Aws::EC2::Model::DescribeInstancesOutcome outcome =
            ec2Client.DescribeInstances(request);
        if (outcome.IsSuccess()) {
            if (!header) {
                std::cout << std::left <<
                    std::setw(48) << "Name" <<
                    std::setw(20) << "ID" <<
                    std::setw(25) << "Ami" <<
                    std::setw(15) << "Type" <<
                    std::setw(15) << "State" <<
                    std::setw(15) << "Monitoring" << std::endl;
                header = true;
            }
            const std::vector<Aws::EC2::Model::Reservation> &reservations =
                outcome.GetResult().GetReservations();

            for (const auto &reservation: reservations) {
                const std::vector<Aws::EC2::Model::Instance> &instances =
```

```
        reservation.GetInstances();
    for (const auto &instance: instances) {
        Aws::String instanceStateString =
            Aws::EC2::Model::InstanceStateNameMapper::GetNameForInstanceStateName(
                instance.GetState().GetName());

        Aws::String typeString =
            Aws::EC2::Model::InstanceTypeMapper::GetNameForInstanceType(
                instance.GetInstanceType());

        Aws::String monitorString =
            Aws::EC2::Model::MonitoringStateMapper::GetNameForMonitoringState(
                instance.GetMonitoring().GetState());
        Aws::String name = "Unknown";

        const std::vector<Aws::EC2::Model::Tag> &tags =
instance.GetTags();
        auto nameIter = std::find_if(tags.cbegin(), tags.cend(),
            [] (const Aws::EC2::Model::Tag
&tag) {
                return tag.GetKey() ==
"Name";
            });
        if (nameIter != tags.cend()) {
            name = nameIter->GetValue();
        }
        std::cout <<
            std::setw(48) << name <<
            std::setw(20) << instance.GetInstanceId() <<
            std::setw(25) << instance.GetImageId() <<
            std::setw(15) << typeString <<
            std::setw(15) << instanceStateString <<
            std::setw(15) << monitorString << std::endl;
    }
}

if (!outcome.GetResult().GetNextToken().empty()) {
    request.SetNextToken(outcome.GetResult().GetNextToken());
} else {
    done = true;
}
```

```
        } else {
            std::cerr << "Failed to describe EC2 instances:" <<
                outcome.GetError().GetMessage() << std::endl;
            return false;
        }
    }

    return true;
}
```

- For API details, see [DescribeInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To describe an instance

The following describe-instances example describes the specified instance.

```
aws ec2 describe-instances \
--instance-ids i-1234567890abcdef0
```

Output:

```
{
    "Reservations": [
        {
            "Groups": [],
            "Instances": [
                {
                    "AmiLaunchIndex": 0,
                    "ImageId": "ami-0abcdef1234567890",
                    "InstanceId": "i-1234567890abcdef0",
                    "InstanceType": "t3.nano",
                    "KeyName": "my-key-pair",
                    "LaunchTime": "2022-11-15T10:48:59+00:00",
                    "Monitoring": {
                        "State": "disabled"
                    },
                    "Placement": {
                        "AvailabilityZone": "us-east-2a",

```

```
        "GroupName": "",  
        "Tenancy": "default"  
    },  
    "PrivateDnsName": "ip-10-0-0-157.us-east-2.compute.internal",  
    "PrivateIpAddress": "10-0-0-157",  
    "ProductCodes": [],  
    "PublicDnsName": "ec2-34-253-223-13.us-  
east-2.compute.amazonaws.com",  
    "PublicIpAddress": "34.253.223.13",  
    "State": {  
        "Code": 16,  
        "Name": "running"  
    },  
    "StateTransitionReason": "",  
    "SubnetId": "subnet-04a636d18e83cfacb",  
    "VpcId": "vpc-1234567890abcdef0",  
    "Architecture": "x86_64",  
    "BlockDeviceMappings": [  
        {  
            "DeviceName": "/dev/xvda",  
            "Ebs": {  
                "AttachTime": "2022-11-15T10:49:00+00:00",  
                "DeleteOnTermination": true,  
                "Status": "attached",  
                "VolumeId": "vol-02e6ccdc7de29cf2"  
            }  
        }  
    ],  
    "ClientToken": "1234abcd-1234-abcd-1234-d46a8903e9bc",  
    "EbsOptimized": true,  
    "EnaSupport": true,  
    "Hypervisor": "xen",  
    "IamInstanceProfile": {  
        "Arn": "arn:aws:iam::111111111111:instance-profile/  
AmazonSSMRoleForInstancesQuickSetup",  
        "Id": "111111111111111111111111"  
    },  
    "NetworkInterfaces": [  
        {  
            "Association": {  
                "IpOwnerId": "amazon",  
                "PublicDnsName": "ec2-34-253-223-13.us-  
east-2.compute.amazonaws.com",  
                "PublicIp": "34.253.223.13"  
            }  
        }  
    ]  
}
```

```
        },
        "Attachment": {
            "AttachTime": "2022-11-15T10:48:59+00:00",
            "AttachmentId": "eni-attach-1234567890abcdefg",
            "DeleteOnTermination": true,
            "DeviceIndex": 0,
            "Status": "attached",
            "NetworkCardIndex": 0
        },
        "Description": "",
        "Groups": [
            {
                "GroupName": "launch-wizard-146",
                "GroupId": "sg-1234567890abcdefg"
            }
        ],
        "Ipv6Addresses": [],
        "MacAddress": "00:11:22:33:44:55",
        "NetworkInterfaceId": "eni-1234567890abcdefg",
        "OwnerId": "104024344472",
        "PrivateDnsName": "ip-10-0-0-157.us-
east-2.compute.internal",
        "PrivateIpAddress": "10-0-0-157",
        "PrivateIpAddresses": [
            {
                "Association": {
                    "IpOwnerId": "amazon",
                    "PublicDnsName": "ec2-34-253-223-13.us-
east-2.compute.amazonaws.com",
                    "PublicIp": "34.253.223.13"
                },
                "Primary": true,
                "PrivateDnsName": "ip-10-0-0-157.us-
east-2.compute.internal",
                "PrivateIpAddress": "10-0-0-157"
            }
        ],
        "SourceDestCheck": true,
        "Status": "in-use",
        "SubnetId": "subnet-1234567890abcdefg",
        "VpcId": "vpc-1234567890abcdefg",
        "InterfaceType": "interface"
    }
],
]
```

```
"RootDeviceName": "/dev/xvda",
"RootDeviceType": "ebs",
"SecurityGroups": [
    {
        "GroupName": "launch-wizard-146",
        "GroupId": "sg-1234567890abcdefg"
    }
],
"SourceDestCheck": true,
"Tags": [
    {
        "Key": "Name",
        "Value": "my-instance"
    }
],
"VirtualizationType": "hvm",
"CpuOptions": {
    "CoreCount": 1,
    "ThreadsPerCore": 2
},
"CapacityReservationSpecification": {
    "CapacityReservationPreference": "open"
},
"HibernationOptions": {
    "Configured": false
},
"MetadataOptions": {
    "State": "applied",
    "HttpTokens": "optional",
    "HttpPutResponseHopLimit": 1,
    "HttpEndpoint": "enabled",
    "HttpProtocolIpv6": "disabled",
    "InstanceMetadataTags": "enabled"
},
"EnclaveOptions": {
    "Enabled": false
},
"PlatformDetails": "Linux/UNIX",
"UsageOperation": "RunInstances",
"UsageOperationUpdateTime": "2022-11-15T10:48:59+00:00",
"PrivateDnsNameOptions": {
    "HostnameType": "ip-name",
    "EnableResourceNameDnsARecord": true,
    "EnableResourceNameDnsAAAARecord": false
}
```

```
        },
        "MaintenanceOptions": {
            "AutoRecovery": "default"
        }
    ],
    "OwnerId": "111111111111",
    "ReservationId": "r-1234567890abcdefg"
}
]
```

### Example 2: To filter for instances with the specified type

The following `describe-instances` example uses filters to scope the results to instances of the specified type.

```
aws ec2 describe-instances \
--filters Name=instance-type,Values=m5.large
```

For example output, see Example 1.

For more information, see [List and filter using the CLI](#) in the *Amazon EC2 User Guide*.

### Example 3: To filter for instances with the specified type and Availability Zone

The following `describe-instances` example uses multiple filters to scope the results to instances with the specified type that are also in the specified Availability Zone.

```
aws ec2 describe-instances \
--filters Name=instance-type,Values=t2.micro,t3.micro Name=availability-
zone,Values=us-east-2c
```

For example output, see Example 1.

### Example 4: To filter for instances with the specified type and Availability Zone using a JSON file

The following `describe-instances` example uses a JSON input file to perform the same filtering as the previous example. When filters get more complicated, they can be easier to specify in a JSON file.

```
aws ec2 describe-instances \
--filters file://filters.json
```

Contents of filters.json:

```
[  
  {  
    "Name": "instance-type",  
    "Values": ["t2.micro", "t3.micro"]  
  },  
  {  
    "Name": "availability-zone",  
    "Values": ["us-east-2c"]  
  }  
]
```

For example output, see Example 1.

### Example 5: To filter for instances with the specified Owner tag

The following describe-instances example uses tag filters to scope the results to instances that have a tag with the specified tag key (Owner), regardless of the tag value.

```
aws ec2 describe-instances \
--filters "Name=tag-key,Values=Owner"
```

For example output, see Example 1.

### Example 6: To filter for instances with the specified my-team tag value

The following describe-instances example uses tag filters to scope the results to instances that have a tag with the specified tag value (my-team), regardless of the tag key.

```
aws ec2 describe-instances \
--filters "Name=tag-value,Values=my-team"
```

For example output, see Example 1.

### Example 7: To filter for instances with the specified Owner tag and my-team value

The following describe-instances example uses tag filters to scope the results to instances that have the specified tag (Owner=my-team).

```
aws ec2 describe-instances \
--filters "Name=tag:Owner,Values=my-team"
```

For example output, see Example 1.

### Example 8: To display only instance and subnet IDs for all instances

The following describe-instances examples use the --query parameter to display only the instance and subnet IDs for all instances, in JSON format.

Linux and macOS:

```
aws ec2 describe-instances \
--query 'Reservations[*].Instances[*].{Instance:InstanceId,Subnet:SubnetId}' \
\
--output json
```

Windows:

```
aws ec2 describe-instances ^
--query "Reservations[*].Instances[*].
{Instance:InstanceId,Subnet:SubnetId}" ^
--output json
```

Output:

```
[  
  {  
    "Instance": "i-057750d42936e468a",  
    "Subnet": "subnet-069beee9b12030077"  
  },  
  {  
    "Instance": "i-001efd250faaa6ffa",  
    "Subnet": "subnet-0b715c6b7db68927a"  
  },  
  {  
    "Instance": "i-027552a73f021f3bd",  
    "Subnet": "subnet-0250c25a1f4e15235"  
  }  
  ...  
]
```

## Example 9: To filter instances of the specified type and only display their instance IDs

The following describe-instances example uses filters to scope the results to instances of the specified type and the --query parameter to display only the instance IDs.

```
aws ec2 describe-instances \
--filters "Name=instance-type,Values=t2.micro" \
--query "Reservations[*].Instances[*].[InstanceId]" \
--output text
```

Output:

```
i-031c0dc19de2fb70c
i-00d8bff789a736b75
i-0b715c6b7db68927a
i-0626d4edd54f1286d
i-00b8ae04f9f99908e
i-0fc71c25d2374130c
```

## Example 10: To filter instances of the specified type and only display their instance IDs, Availability Zone, and the specified tag value

The following describe-instances examples display the instance ID, Availability Zone, and the value of the Name tag for instances that have a tag with the name tag-key, in table format.

Linux and macOS:

```
aws ec2 describe-instances \
--filters Name=tag-key,Values=Name \
--query 'Reservations[*].Instances[*].
{InstanceId:InstanceId,AZ:Placement.AvailabilityZone,Name:Tags[?Key==`Name`][
0].Value}' \
--output table
```

Windows:

```
aws ec2 describe-instances ^
--filters Name=tag-key,Values=Name ^
--query "Reservations[*].Instances[*].
{InstanceId:InstanceId,AZ:Placement.AvailabilityZone,Name:Tags[?Key==`Name`][
0].Value}" ^
```

```
--output table
```

Output:

DescribeInstances			
AZ	Instance	Name	
us-east-2b	i-057750d42936e468a	my-prod-server	
us-east-2a	i-001efd250faaa6ffa	test-server-1	
us-east-2a	i-027552a73f021f3bd	test-server-2	

### Example 11: To describe instances in a partition placement group

The following describe-instances example describes the specified instance. The output includes the placement information for the instance, which contains the placement group name and the partition number for the instance.

```
aws ec2 describe-instances \
--instance-ids i-0123a456700123456 \
--query "Reservations[*].Instances[*].Placement"
```

Output:

```
[  
 [  
 {  
     "AvailabilityZone": "us-east-1c",  
     "GroupName": "HDFS-Group-A",  
     "PartitionNumber": 3,  
     "Tenancy": "default"  
 }  
 ]  
]
```

For more information, see [Describing instances in a placement group](#) in the *Amazon EC2 User Guide*.

## Example 12: To filter to instances with the specified placement group and partition number

The following `describe-instances` example filters the results to only those instances with the specified placement group and partition number.

```
aws ec2 describe-instances \
  --filters "Name=placement-group-name,Values=HDFS-Group-A" "Name=placement-
partition-number,Values=7"
```

The following shows only the relevant information from the output.

```
"Instances": [
  {
    "InstanceId": "i-0123a456700123456",
    "InstanceType": "r4.large",
    "Placement": {
      "AvailabilityZone": "us-east-1c",
      "GroupName": "HDFS-Group-A",
      "PartitionNumber": 7,
      "Tenancy": "default"
    }
  },
  {
    "InstanceId": "i-9876a543210987654",
    "InstanceType": "r4.large",
    "Placement": {
      "AvailabilityZone": "us-east-1c",
      "GroupName": "HDFS-Group-A",
      "PartitionNumber": 7,
      "Tenancy": "default"
    }
  }
],
```

For more information, see [Describing instances in a placement group](#) in the *Amazon EC2 User Guide*.

## Example 13: To filter to instances that are configured to allow access to tags from instance metadata

The following `describe-instances` example filters the results to only those instances that are configured to allow access to instance tags from instance metadata.

```
aws ec2 describe-instances \
    --filters "Name=metadata-options.instance-metadata-tags,Values=enabled" \
    --query "Reservations[*].Instances[*].InstanceId" \
    --output text
```

The following shows the expected output.

```
i-1234567890abcdefg
i-abcdefg1234567890
i-11111111aaaaaaaaaa
i-aaaaaaaaa1111111111
```

For more information, see [Work with instance tags in instance metadata](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeInstances](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import software.amazon.awssdk.regions.Region;
import software.amazon.awssdk.services.ec2.Ec2Client;
import software.amazon.awssdk.services.ec2.model.DescribeInstancesRequest;
import software.amazon.awssdk.services.ec2.model.Ec2Exception;
import software.amazon.awssdk.services.ec2.paginators.DescribeInstancesIterable;

/**
 * Before running this Java V2 code example, set up your development
 * environment, including your credentials.
 *
 * For more information, see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-started.html

```

```
*/  
public class DescribeInstances {  
    public static void main(String[] args) {  
        Region region = Region.US_EAST_1;  
        Ec2Client ec2 = Ec2Client.builder()  
            .region(region)  
            .build();  
  
        describeEC2Instances(ec2);  
        ec2.close();  
    }  
  
    public static void describeEC2Instances(Ec2Client ec2) {  
        try {  
            DescribeInstancesRequest request = DescribeInstancesRequest.builder()  
                .maxResults(10)  
                .build();  
  
            DescribeInstancesIterable instancesIterable =  
                ec2.describeInstancesPaginator(request);  
            instancesIterable.stream()  
                .flatMap(r -> r.reservations().stream())  
                .flatMap(reservation -> reservation.instances().stream())  
                .forEach(instance -> {  
                    System.out.println("Instance Id is " +  
                        instance.instanceId());  
                    System.out.println("Image id is " + instance.imageId());  
                    System.out.println("Instance type is " +  
                        instance.instanceType());  
                    System.out.println("Instance state name is " +  
                        instance.state().name());  
                    System.out.println("Monitoring information is " +  
                        instance.monitoring().state());  
                });  
  
        } catch (Ec2Exception e) {  
            System.err.println(e.awsErrorDetails().errorCode());  
            System.exit(1);  
        }  
    }  
}
```

- For API details, see [DescribeInstances](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// List all of your EC2 instances running with x86_64 architecture that were
// launched this month.
export const main = async () => {
  const d = new Date();
  const year = d.getFullYear();
  const month = `0${d.getMonth() + 1}`.slice(-2);
  const launchTimePattern = `${year}-${month}-*`;
  const command = new DescribeInstancesCommand({
    Filters: [
      { Name: "architecture", Values: ["x86_64"] },
      { Name: "instance-state-name", Values: ["running"] },
      {
        Name: "launch-time",
        Values: [launchTimePattern],
      },
    ],
  });
}

try {
  const { Reservations } = await client.send(command);
  const instanceList = Reservations.reduce((prev, current) => {
    return prev.concat(current.Instances);
  }, []);
  console.log(instanceList);
} catch (err) {
  console.error(err);
}
```

```
};
```

- For API details, see [DescribeInstances](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun describeEC2Instances() {  
    val request =  
        DescribeInstancesRequest {  
            maxResults = 6  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        val response = ec2.describeInstances(request)  
        response.reservations?.forEach { reservation ->  
            reservation.instances?.forEach { instance ->  
                println("Instance Id is ${instance.instanceId}")  
                println("Image id is ${instance.imageId}")  
                println("Instance type is ${instance.instanceType}")  
                println("Instance state name is ${instance.state?.name}")  
                println("monitoring information is  
${instance.monitoring?.state}")  
            }  
        }  
    }  
}
```

- For API details, see [DescribeInstances](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified instance.**

```
(Get-EC2Instance -InstanceId i-12345678).Instances
```

**Output:**

```
AmiLaunchIndex      : 0
Architecture        : x86_64
BlockDeviceMappings : {/dev/sda1}
ClientToken         : TleEy1448154045270
EbsOptimized       : False
Hypervisor          : xen
IamInstanceProfile  : Amazon.EC2.Model.IamInstanceProfile
ImageId             : ami-12345678
InstanceId          : i-12345678
InstanceLifecycle   :
InstanceType         : t2.micro
KernelId            :
KeyName              : my-key-pair
LaunchTime           : 12/4/2015 4:44:40 PM
Monitoring           : Amazon.EC2.Model.Monitoring
NetworkInterfaces   : {ip-10-0-2-172.us-west-2.compute.internal}
Placement           : Amazon.EC2.Model.Placement
Platform             : Windows
PrivateDnsName      : ip-10-0-2-172.us-west-2.compute.internal
PrivateIpAddress    : 10.0.2.172
ProductCodes         : {}
PublicDnsName        :
PublicIpAddress     :
RamdiskId           :
RootDeviceName      : /dev/sda1
RootDeviceType       : ebs
SecurityGroups      : {default}
SourceDestCheck     : True
SpotInstanceRequestId :
SriovNetSupport     :
State                : Amazon.EC2.Model.InstanceState
StateReason          :
StateTransitionReason :
```

```
SubnetId      : subnet-12345678
Tags          : {Name}
VirtualizationType : hvm
VpcId         : vpc-12345678
```

**Example 2: This example describes all your instances in the current region, grouped by reservation. To see the instance details expand the Instances collection within each reservation object.**

```
Get-EC2Instance
```

**Output:**

```
GroupNames    : {}
Groups        : {}
Instances     : {}
OwnerId       : 123456789012
RequesterId   : 226008221399
ReservationId : r-c5df370c

GroupNames    : {}
Groups        : {}
Instances     : {}
OwnerId       : 123456789012
RequesterId   : 854251627541
ReservationId : r-63e65bab
...
```

**Example 3: This example illustrates using a filter to query for EC2 instances in a specific subnet of a VPC.**

```
(Get-EC2Instance -Filter @{Name="vpc-id";Values="vpc-1a2bc34d"},@{Name="subnet-id";Values="subnet-1a2b3c4d"}).Instances
```

**Output:**

InstanceId	InstanceType	Platform	PrivateIpAddress	PublicIpAddress
SecurityGroups	SubnetId	VpcId	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----

```
i-01af...82cf180e19 t2.medium    Windows  10.0.0.98      ...
    subnet-1a2b3c4d vpc-1a2b3c4d
i-0374...7e9d5b0c45 t2.xlarge    Windows  10.0.0.53      ...
    subnet-1a2b3c4d vpc-1a2b3c4d
```

- For API details, see [DescribeInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance
    actions."""

    def __init__(self, ec2_resource, instance=None):
        """
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
        resource
                           is used to create additional high-level objects
                           that wrap low-level Amazon EC2 service actions.
        :param instance: A Boto3 Instance object. This is a high-level object
        that
                           wraps instance actions.
        """
        self.ec2_resource = ec2_resource
        self.instance = instance

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource)

    def display(self, indent=1):
        """
```

```
Displays information about an instance.

:param indent: The visual indent to apply to the output.
"""

if self.instance is None:
    logger.info("No instance to display.")
    return

try:
    self.instance.load()
    ind = "\t" * indent
    print(f"{ind}ID: {self.instance.id}")
    print(f"{ind}Image ID: {self.instance.image_id}")
    print(f"{ind}Instance type: {self.instance.instance_type}")
    print(f"{ind}Key name: {self.instance.key_name}")
    print(f"{ind}VPC ID: {self.instance.vpc_id}")
    print(f"{ind}Public IP: {self.instance.public_ip_address}")
    print(f"{ind}State: {self.instance.state['Name']}")
except ClientError as err:
    logger.error(
        "Couldn't display your instance. Here's why: %s: %s",
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
```

- For API details, see [DescribeInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"
```

```
# @param ec2_resource [Aws::EC2::Resource] An initialized EC2 resource object.
# @example
#   list_instance_ids_states(Aws::EC2::Resource.new(region: 'us-west-2'))
def list_instance_ids_states(ec2_resource)
  response = ec2_resource.instances
  if response.count.zero?
    puts "No instances found."
  else
    puts "Instances -- ID, state:"
    response.each do |instance|
      puts "#{instance.id}, #{instance.state.name}"
    end
  end
rescue StandardError => e
  puts "Error getting information about instances: #{e.message}"
end

# Example usage:
def run_me
  region = ""
  # Print usage information and then stop.
  if ARGV[0] == "--help" || ARGV[0] == "-h"
    puts "Usage: ruby ec2-ruby-example-get-all-instance-info.rb REGION"
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
    puts "Example: ruby ec2-ruby-example-get-all-instance-info.rb us-west-2"
    exit 1
  # If no values are specified at the command prompt, use these default values.
  # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
  elsif ARGV.count.zero?
    region = "us-west-2"
  # Otherwise, use the values as specified at the command prompt.
  else
    region = ARGV[0]
  end
  ec2_resource = Aws::EC2::Resource.new(region: region)
  list_instance_ids_states(ec2_resource)
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [DescribeInstances](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Retrieve details for an EC2 Instance.

```
pub async fn describe_instance(&self, instance_id: &str) -> Result<Instance, EC2Error> {
    let response = self
        .client
        .describe_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    let instance = response
        .reservations()
        .first()
        .ok_or_else(|| EC2Error::new(format!("No instance reservations for {instance_id}")))?
        .instances()
        .first()
        .ok_or_else(|| {
            EC2Error::new(format!("No instances in reservation for {instance_id}"))
        })?;

    Ok(instance.clone())
}
```

After creating an EC2 instance, retrieve and store its details.

```
/// Create an EC2 instance with the given ID on a given type, using a
/// generated KeyPair and applying a list of security groups.
pub async fn create(
```

```
    &mut self,
    ec2: &EC2,
    image_id: &str,
    instance_type: InstanceType,
    key_pair: &KeyPairInfo,
    security_groups: Vec<&SecurityGroup>,
) -> Result<(), EC2Error> {
    let instance_id = ec2
        .create_instance(image_id, instance_type, key_pair, security_groups)
        .await?;
    let instance = ec2.describe_instance(&instance_id).await?;
    self.instance = Some(instance);
    Ok(())
}
```

- For API details, see [DescribeInstances](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.
  oo_result = lo_ec2->describeinstances( ) .
  "oo_result is returned for testing purposes. "

  " Retrieving details of EC2 instances. "
DATA: lv_instance_id      TYPE /aws1/ec2string,
      lv_status          TYPE /aws1/ec2instancename,
      lv_instance_type   TYPE /aws1/ec2instancetype,
      lv_image_id        TYPE /aws1/ec2string.
LOOP AT oo_result->get_reservations( ) INTO DATA(lo_reservation).
  LOOP AT lo_reservation->get_instances( ) INTO DATA(lo_instance).
    lv_instance_id = lo_instance->get_instanceid( ).
    lv_status = lo_instance->get_state( )->get_name( ).
    lv_instance_type = lo_instance->get_instancetype( ).
```

```
    lv_image_id = lo_instance->get_imageid( ).  
ENDLOOP.  
ENDLOOP.  
MESSAGE 'Retrieved information about EC2 instances.' TYPE 'I'.  
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
DATA(lv_error) = |"{" lo_exception->av_err_code }" - { lo_exception-  
>av_err_msg }|.  
MESSAGE lv_error TYPE 'E'.  
ENDTRY.
```

- For API details, see [DescribeInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeInternetGateways` with an AWS SDK or CLI

The following code examples show how to use `DescribeInternetGateways`.

### CLI

#### AWS CLI

##### To describe an internet gateway

The following `describe-internet-gateways` example describes the specified internet gateway.

```
aws ec2 describe-internet-gateways \  
--internet-gateway-ids igw-0d0fb496b3EXAMPLE
```

Output:

```
{  
    "InternetGateways": [  
        {  
            "Attachments": [  
                {  
                    "State": "available",
```

```
        "VpcId": "vpc-0a60eb65b4EXAMPLE"
    }
],
"InternetGatewayId": "igw-0d0fb496b3EXAMPLE",
"OwnerId": "123456789012",
"Tags": [
{
    "Key": "Name",
    "Value": "my-igw"
}
]
}
```

For more information, see [Internet gateways](#) in the *Amazon VPC User Guide*.

- For API details, see [DescribeInternetGateways](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified Internet gateway.**

```
Get-EC2InternetGateway -InternetGatewayId igw-1a2b3c4d
```

#### Output:

Attachments	InternetGatewayId	Tags
-----	-----	---
{vpc-1a2b3c4d}	igw-1a2b3c4d	{}

**Example 2: This example describes all your Internet gateways.**

```
Get-EC2InternetGateway
```

#### Output:

Attachments	InternetGatewayId	Tags
-----	-----	---

{vpc-1a2b3c4d}	igw-1a2b3c4d	{}
{}	igw-2a3b4c5d	{}

- For API details, see [DescribeInternetGateways](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeKeyPairs` with an AWS SDK or CLI

The following code examples show how to use `DescribeKeyPairs`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Get information about an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name of the key pair.</param>
/// <returns>A list of key pair information.</returns>
public async Task<List<KeyValuePair>> DescribeKeyPairs(string keyPairName)
{
    var request = new DescribeKeyPairsRequest();
    if (!string.IsNullOrEmpty(keyPairName))
    {
```

```
        request = new DescribeKeyPairsRequest
        {
            KeyNames = new List<string> { keyPairName }
        };
    }

    var response = await _amazonEC2.DescribeKeyPairsAsync(request);
    return response.KeyPairs.ToList();
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_describe_key_pairs
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# key pairs.
#
# Parameters:
#     -h - Display help.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_describe_key_pairs() {
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_key_pairs"
```

```
echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2) key
pairs."
echo " -h - Display help."
echo ""
}

# Retrieve the calling parameters.
while getopts "h" option; do
  case "${option}" in
    h)
      usage
      return 0
      ;;
    \?)
      echo "Invalid parameter"
      usage
      return 1
      ;;
  esac
done
export OPTIND=1

local response

response=$(aws ec2 describe-key-pairs \
  --query 'KeyPairs[*].[KeyName, KeyFingerprint]' \
  --output text) || {
  aws_cli_error_log ${?}
  errecho "ERROR: AWS reports describe-key-pairs operation failed.$response"
  return 1
}

echo "$response"

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
```

```
# This function outputs everything sent to it to STDERR (standard error output).
#####
# function errecho() {
#     printf "%s\n" "$*" 1>&2
# }

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#           $1 - The error code returned by the AWS CLI.
#
# Returns:
#           0: - Success.
#
#####

function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS CLI Command Reference*.

## C++

## SDK for C++

**Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/usr/bin/env c++  
//! Describe all Amazon Elastic Compute Cloud (Amazon EC2) instance key pairs.  
/*!  
 * \param clientConfiguration: AWS client configuration.  
 * \return bool: Function succeeded.  
 */  
bool AwsDoc::EC2::describeKeyPairs(  
    const Aws::Client::ClientConfiguration &clientConfiguration) {  
    Aws::EC2::EC2Client ec2Client(clientConfiguration);  
    Aws::EC2::Model::DescribeKeyPairsRequest request;  
  
    Aws::EC2::Model::DescribeKeyPairsOutcome outcome =  
        ec2Client.DescribeKeyPairs(request);  
    if (outcome.IsSuccess()) {  
        std::cout << std::left <<  
            std::setw(32) << "Name" <<  
            std::setw(64) << "Fingerprint" << std::endl;  
  
        const std::vector<Aws::EC2::Model::KeyPairInfo> &key_pairs =  
            outcome.GetResult().GetKeyPairs();  
        for (const auto &key_pair: key_pairs) {  
            std::cout << std::left <<  
                std::setw(32) << key_pair.GetKeyName() <<  
                std::setw(64) << key_pair.GetKeyFingerprint() << std::endl;  
        }  
    } else {  
        std::cerr << "Failed to describe key pairs:" <<  
            outcome.GetError().GetMessage() << std::endl;  
    }  
  
    return outcome.IsSuccess();  
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To display a key pair

The following `describe-key-pairs` example displays information about the specified key pair.

```
aws ec2 describe-key-pairs \
    --key-names my-key-pair
```

Output:

```
{
  "KeyPairs": [
    {
      "KeyPairId": "key-0b94643da6EXAMPLE",
      "KeyFingerprint":
        "1f:51:ae:28:bf:89:e9:d8:1f:25:5d:37:2d:7d:b8:ca:9f:f5:f1:6f",
      "KeyName": "my-key-pair",
      "KeyType": "rsa",
      "Tags": [],
      "CreateTime": "2022-05-27T21:51:16.000Z"
    }
  ]
}
```

For more information, see [Describe public keys](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeKeyPairs](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void describeKeys(Ec2Client ec2) {
    try {
        DescribeKeyPairsResponse response = ec2.describeKeyPairs();
        response.keyPairs().forEach(keyPair -> System.out.printf(
            "Found key pair with name %s " +
            "and fingerprint %s",
            keyPair.keyName(),
            keyPair.keyFingerprint()));
    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeKeyPairsCommand } from "@aws-sdk/client-ec2";
```

```
import { client } from "../libs/client.js";

export const main = async () => {
    const command = new DescribeKeyPairsCommand({});

    try {
        const { KeyPairs } = await client.send(command);
        const keyPairList = KeyPairs.map(
            (kp) => ` • ${kp.KeyPairId}: ${kp.KeyName}`,
        ).join("\n");
        console.log("The following key pairs were found in your account:");
        console.log(keyPairList);
    } catch (err) {
        console.error(err);
    }
};
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun describeEC2Keys() {
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.describeKeyPairs(DescribeKeyPairsRequest {})
        response.keyPairs?.forEach { keyPair ->
            println("Found key pair with name ${keyPair.keyName} and fingerprint
${keyPair.keyFingerprint}")
        }
    }
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified key pair.**

```
Get-EC2KeyPair -KeyName my-key-pair
```

**Output:**

KeyFingerprint	KeyName
-----	-----
1f:51:ae:28:bf:89:e9:d8:1f:25:5d:37:2d:7d:b8:ca:9f:f5:f1:6f	my-key-pair

**Example 2: This example describes all your key pairs.**

```
Get-EC2KeyPair
```

- For API details, see [DescribeKeyPairs](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class KeyPairWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) key pair  
    actions."""  
  
    def __init__(self, ec2_resource, key_file_dir, key_pair=None):  
        """
```

```
:param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
resource
    is used to create additional high-level objects
    that wrap low-level Amazon EC2 service actions.
:param key_file_dir: The folder where the private key information is
stored.
    This should be a secure folder.
:param key_pair: A Boto3 KeyPair object. This is a high-level object that
wraps key pair actions.
"""
self.ec2_resource = ec2_resource
self.key_pair = key_pair
self.key_file_path = None
self.key_file_dir = key_file_dir

@classmethod
def from_resource(cls):
    ec2_resource = boto3.resource("ec2")
    return cls(ec2_resource, tempfile.TemporaryDirectory())

def list(self, limit):
    """
    Displays a list of key pairs for the current account.

    :param limit: The maximum number of key pairs to list.
    """
    try:
        for kp in self.ec2_resource.key_pairs.limit(limit):
            print(f"Found {kp.key_type} key {kp.name} with fingerprint:")
            print(f"\t{kp.key_fingerprint}")
    except ClientError as err:
        logger.error(
            "Couldn't list key pairs. Here's why: %s: %s",
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn list_key_pair(&self) -> Result<Vec<KeyPairInfo>, EC2Error> {
    let output = self.client.describe_key_pairs().send().await?;
    Ok(output.key_pairs.unwrap_or_default())
}
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.
  oo_result = lo_ec2->describekeypairs( ) .
  " "
oo_result is returned for testing purposes. "
  DATA(lt_key_pairs) = oo_result->get_keypairs( ).
  MESSAGE 'Retrieved information about key pairs.' TYPE 'I'.
  CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
  DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-
>av_err_msg }|.
  MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [DescribeKeyPairs](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeNetworkAcls` with an AWS SDK or CLI

The following code examples show how to use `DescribeNetworkAcls`.

### CLI

#### AWS CLI

##### To describe your network ACLs

The following `describe-network-acls` example retrieves details about your network ACLs.

```
aws ec2 describe-network-acls
```

Output:

```
{  
    "NetworkAcls": [  
        {  
            "Associations": [  
                {  
                    "NetworkAclAssociationId": "aclassoc-0c1679dc41EXAMPLE",  
                    "NetworkAclId": "acl-0ea1f54ca7EXAMPLE",  
                    "SubnetId": "subnet-0931fc2fa5EXAMPLE"  
                }  
            ],  
            "Entries": [  
                {  
                    "CidrBlock": "0.0.0.0/0",  
                    "Egress": true,  
                    "Protocol": "-1",  
                    "RuleAction": "allow",  
                    "RuleNumber": 100  
                },  
                {  
                    "CidrBlock": "0.0.0.0/0",  
                    "Egress": false,  
                    "Protocol": "-1",  
                    "RuleAction": "allow",  
                    "RuleNumber": 100  
                }  
            ]  
        }  
    ]  
}
```

```
        "CidrBlock": "0.0.0.0/0",
        "Egress": true,
        "Protocol": "-1",
        "RuleAction": "deny",
        "RuleNumber": 32767
    },
    {
        "CidrBlock": "0.0.0.0/0",
        "Egress": false,
        "Protocol": "-1",
        "RuleAction": "allow",
        "RuleNumber": 100
    },
    {
        "CidrBlock": "0.0.0.0/0",
        "Egress": false,
        "Protocol": "-1",
        "RuleAction": "deny",
        "RuleNumber": 32767
    }
],
"IsDefault": true,
"NetworkAclId": "acl-0ea1f54ca7EXAMPLE",
"Tags": [],
"VpcId": "vpc-06e4ab6c6cEXAMPLE",
"OwnerId": "111122223333"
},
{
    "Associations": [],
    "Entries": [
        {
            "CidrBlock": "0.0.0.0/0",
            "Egress": true,
            "Protocol": "-1",
            "RuleAction": "allow",
            "RuleNumber": 100
        },
        {
            "Egress": true,
            "Ipv6CidrBlock": "::/0",
            "Protocol": "-1",
            "RuleAction": "allow",
            "RuleNumber": 101
        },
    ],
}
```

```
{  
    "CidrBlock": "0.0.0.0/0",  
    "Egress": true,  
    "Protocol": "-1",  
    "RuleAction": "deny",  
    "RuleNumber": 32767  
},  
{  
    "Egress": true,  
    "Ipv6CidrBlock": "::/0",  
    "Protocol": "-1",  
    "RuleAction": "deny",  
    "RuleNumber": 32768  
},  
{  
    "CidrBlock": "0.0.0.0/0",  
    "Egress": false,  
    "Protocol": "-1",  
    "RuleAction": "allow",  
    "RuleNumber": 100  
},  
{  
    "Egress": false,  
    "Ipv6CidrBlock": "::/0",  
    "Protocol": "-1",  
    "RuleAction": "allow",  
    "RuleNumber": 101  
},  
{  
    "CidrBlock": "0.0.0.0/0",  
    "Egress": false,  
    "Protocol": "-1",  
    "RuleAction": "deny",  
    "RuleNumber": 32767  
},  
{  
    "Egress": false,  
    "Ipv6CidrBlock": "::/0",  
    "Protocol": "-1",  
    "RuleAction": "deny",  
    "RuleNumber": 32768  
}  
],  
"IsDefault": true,
```

```
        "NetworkAclId": "acl-0e2a78e4e2EXAMPLE",
        "Tags": [],
        "VpcId": "vpc-03914afb3eEXAMPLE",
        "OwnerId": "111122223333"
    }
]
}
```

For more information, see [Network ACLs](#) in the *AWS VPC User Guide*.

- For API details, see [DescribeNetworkAcls](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified network ACL.

```
Get-EC2NetworkAcl -NetworkAclId acl-12345678
```

#### Output:

```
Associations : {aclassoc-1a2b3c4d}
Entries      : {Amazon.EC2.Model.NetworkAclEntry,
                Amazon.EC2.Model.NetworkAclEntry}
IsDefault    : False
NetworkAclId : acl-12345678
Tags         : {Name}
VpcId        : vpc-12345678
```

#### Example 2: This example describes the rules for the specified network ACL.

```
(Get-EC2NetworkAcl -NetworkAclId acl-12345678).Entries
```

#### Output:

```
CidrBlock    : 0.0.0.0/0
Egress       : True
IcmpTypeCode :
PortRange    :
Protocol    : -1
RuleAction   : deny
```

```
RuleNumber      : 32767
CidrBlock      : 0.0.0.0/0
Egress         : False
IcmpTypeCode   :
PortRange      :
Protocol       : -1
RuleAction     : deny
RuleNumber     : 32767
```

### Example 3: This example describes all your network ACLs.

```
Get-EC2NetworkAcl
```

- For API details, see [DescribeNetworkAcls](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeNetworkInterfaceAttribute** with an AWS SDK or CLI

The following code examples show how to use **DescribeNetworkInterfaceAttribute**.

CLI

### AWS CLI

#### To describe the attachment attribute of a network interface

This example command describes the attachment attribute of the specified network interface.

Command:

```
aws ec2 describe-network-interface-attribute --network-interface-id eni-686ea200
--attribute attachment
```

Output:

```
{
```

```
"NetworkInterfaceId": "eni-686ea200",
"Attachment": {
    "Status": "attached",
    "DeviceIndex": 0,
    "AttachTime": "2015-05-21T20:02:20.000Z",
    "InstanceId": "i-1234567890abcdef0",
    "DeleteOnTermination": true,
    "AttachmentId": "eni-attach-43348162",
    "InstanceOwnerId": "123456789012"
}
}
```

## To describe the description attribute of a network interface

This example command describes the description attribute of the specified network interface.

Command:

```
aws ec2 describe-network-interface-attribute --network-interface-id eni-686ea200
--attribute description
```

Output:

```
{
    "NetworkInterfaceId": "eni-686ea200",
    "Description": {
        "Value": "My description"
    }
}
```

## To describe the groupSet attribute of a network interface

This example command describes the groupSet attribute of the specified network interface.

Command:

```
aws ec2 describe-network-interface-attribute --network-interface-id eni-686ea200
--attribute groupSet
```

Output:

```
{  
    "NetworkInterfaceId": "eni-686ea200",  
    "Groups": [  
        {  
            "GroupName": "my-security-group",  
            "GroupId": "sg-903004f8"  
        }  
    ]  
}
```

## To describe the sourceDestCheck attribute of a network interface

This example command describes the sourceDestCheck attribute of the specified network interface.

Command:

```
aws ec2 describe-network-interface-attribute --network-interface-id eni-686ea200  
--attribute sourceDestCheck
```

Output:

```
{  
    "NetworkInterfaceId": "eni-686ea200",  
    "SourceDestCheck": {  
        "Value": true  
    }  
}
```

- For API details, see [DescribeNetworkInterfaceAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified network interface.

```
Get-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-12345678 -Attribute  
Attachment
```

Output:

Attachment : Amazon.EC2.Model.NetworkInterfaceAttachment

### Example 2: This example describes the specified network interface.

```
Get-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-12345678 -Attribute Description
```

#### Output:

Description : My description

### Example 3: This example describes the specified network interface.

```
Get-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-12345678 -Attribute GroupSet
```

#### Output:

Groups : {my-security-group}

### Example 4: This example describes the specified network interface.

```
Get-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-12345678 -Attribute SourceDestCheck
```

#### Output:

SourceDestCheck : True

- For API details, see [DescribeNetworkInterfaceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeNetworkInterfaces** with an AWS SDK or CLI

The following code examples show how to use **DescribeNetworkInterfaces**.

## CLI

### AWS CLI

#### To describe your network interfaces

This example describes all your network interfaces.

Command:

```
aws ec2 describe-network-interfaces
```

Output:

```
{
    "NetworkInterfaces": [
        {
            "Status": "in-use",
            "MacAddress": "02:2f:8f:b0:cf:75",
            "SourceDestCheck": true,
            "VpcId": "vpc-a01106c2",
            "Description": "my network interface",
            "Association": {
                "PublicIp": "203.0.113.12",
                "AssociationId": "eipassoc-0fbb766a",
                "PublicDnsName": "ec2-203-0-113-12.compute-1.amazonaws.com",
                "IpOwnerId": "123456789012"
            },
            "NetworkInterfaceId": "eni-e5aa89a3",
            "PrivateIpAddresses": [
                {
                    "PrivateDnsName": "ip-10-0-1-17.ec2.internal",
                    "Association": {
                        "PublicIp": "203.0.113.12",
                        "AssociationId": "eipassoc-0fbb766a",
                        "PublicDnsName":
                            "ec2-203-0-113-12.compute-1.amazonaws.com",
                        "IpOwnerId": "123456789012"
                    },
                    "Primary": true,
                    "PrivateIpAddress": "10.0.1.17"
                }
            ],
            "RequesterManaged": false,
        }
    ]
}
```

```
"Ipv6Addresses": [],
"PrivateDnsName": "ip-10-0-1-17.ec2.internal",
"AvailabilityZone": "us-east-1d",
"Attachment": {
    "Status": "attached",
    "DeviceIndex": 1,
    "AttachTime": "2013-11-30T23:36:42.000Z",
    "InstanceId": "i-1234567890abcdef0",
    "DeleteOnTermination": false,
    "AttachmentId": "eni-attach-66c4350a",
    "InstanceOwnerId": "123456789012"
},
"Groups": [
    {
        "GroupName": "default",
        "GroupId": "sg-8637d3e3"
    }
],
"SubnetId": "subnet-b61f49f0",
"OwnerId": "123456789012",
"TagSet": [],
"PrivateIpAddress": "10.0.1.17"
},
{
    "Status": "in-use",
    "MacAddress": "02:58:f5:ef:4b:06",
    "SourceDestCheck": true,
    "VpcId": "vpc-a01106c2",
    "Description": "Primary network interface",
    "Association": {
        "PublicIp": "198.51.100.0",
        "IpOwnerId": "amazon"
    },
    "NetworkInterfaceId": "eni-f9ba99bf",
    "PrivateIpAddresses": [
        {
            "Association": {
                "PublicIp": "198.51.100.0",
                "IpOwnerId": "amazon"
            },
            "Primary": true,
            "PrivateIpAddress": "10.0.1.149"
        }
    ],
}
```

```
"RequesterManaged": false,
"Ipv6Addresses": [],
"AvailabilityZone": "us-east-1d",
"Attachment": {
    "Status": "attached",
    "DeviceIndex": 0,
    "AttachTime": "2013-11-30T23:35:33.000Z",
    "InstanceId": "i-0598c7d356eba48d7",
    "DeleteOnTermination": true,
    "AttachmentId": "eni-attach-1b9db777",
    "InstanceOwnerId": "123456789012"
},
"Groups": [
    {
        "GroupName": "default",
        "GroupId": "sg-8637d3e3"
    }
],
"SubnetId": "subnet-b61f49f0",
"OwnerId": "123456789012",
"TagSet": [],
"PrivateIpAddress": "10.0.1.149"
}
]
}
```

This example describes network interfaces that have a tag with the key Purpose and the value Prod.

Command:

```
aws ec2 describe-network-interfaces --filters Name=tag:Purpose,Values=Prod
```

Output:

```
{
    "NetworkInterfaces": [
        {
            "Status": "available",
            "MacAddress": "12:2c:bd:f9:bf:17",
            "SourceDestCheck": true,
            "VpcId": "vpc-8941ebec",
            "Description": "ProdENI",
        }
    ]
}
```

```
"NetworkInterfaceId": "eni-b9a5ac93",
"PrivateIpAddresses": [
    {
        "PrivateDnsName": "ip-10-0-1-55.ec2.internal",
        "Primary": true,
        "PrivateIpAddress": "10.0.1.55"
    },
    {
        "PrivateDnsName": "ip-10-0-1-117.ec2.internal",
        "Primary": false,
        "PrivateIpAddress": "10.0.1.117"
    }
],
"RequesterManaged": false,
"PrivateDnsName": "ip-10-0-1-55.ec2.internal",
"AvailabilityZone": "us-east-1d",
"Ipv6Addresses": [],
"Groups": [
    {
        "GroupName": "MySG",
        "GroupId": "sg-905002f5"
    }
],
"SubnetId": "subnet-31d6c219",
"OwnerId": "123456789012",
"TagSet": [
    {
        "Value": "Prod",
        "Key": "Purpose"
    }
],
"PrivateIpAddress": "10.0.1.55"
}
]
}
```

- For API details, see [DescribeNetworkInterfaces](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified network interface.

```
Get-EC2NetworkInterface -NetworkInterfaceId eni-12345678
```

## Output:

```
Association      : 
Attachment       : Amazon.EC2.Model.NetworkInterfaceAttachment
AvailabilityZone : us-west-2c
Description       : 
Groups           : {my-security-group}
MacAddress       : 0a:e9:a6:19:4c:7f
NetworkInterfaceId : eni-12345678
OwnerId          : 123456789012
PrivateDnsName   : ip-10-0-0-107.us-west-2.compute.internal
PrivateIpAddress  : 10.0.0.107
PrivateIpAddresses: {ip-10-0-0-107.us-west-2.compute.internal}
RequesterId       : 
RequesterManaged  : False
SourceDestCheck   : True
Status            : in-use
SubnetId          : subnet-1a2b3c4d
TagSet            : {}
VpcId             : vpc-12345678
```

## Example 2: This example describes all your network interfaces.

```
Get-EC2NetworkInterface
```

- For API details, see [DescribeNetworkInterfaces](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribePlacementGroups** with an AWS SDK or CLI

The following code examples show how to use **DescribePlacementGroups**.

## CLI

### AWS CLI

#### To describe your placement groups

This example command describes all of your placement groups.

Command:

```
aws ec2 describe-placement-groups
```

Output:

```
{
    "PlacementGroups": [
        {
            "GroupName": "my-cluster",
            "State": "available",
            "Strategy": "cluster"
        },
        ...
    ]
}
```

- For API details, see [DescribePlacementGroups](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified placement group.

```
Get-EC2PlacementGroup -GroupName my-placement-group
```

Output:

GroupName	State	Strategy
-----	-----	-----
my-placement-group	available	cluster

- For API details, see [DescribePlacementGroups](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribePrefixLists** with an AWS SDK or CLI

The following code examples show how to use **DescribePrefixLists**.

CLI

### AWS CLI

#### To describe prefix lists

This example lists all available prefix lists for the region.

Command:

```
aws ec2 describe-prefix-lists
```

Output:

```
{
    "PrefixLists": [
        {
            "PrefixListName": "com.amazonaws.us-east-1.s3",
            "Cidrs": [
                "54.231.0.0/17"
            ],
            "PrefixListId": "pl-63a5400a"
        }
    ]
}
```

- For API details, see [DescribePrefixLists](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example fetches the available AWS services in a prefix list format for the region**

```
Get-EC2PrefixList
```

#### Output:

Cidrs	PrefixListId	PrefixListName
-----	-----	-----
{52.94.5.0/24, 52.119.240.0/21, 52.94.24.0/23}	pl-6fa54006	com.amazonaws.eu-west-1.dynamodb
{52.218.0.0/17, 54.231.128.0/19}	pl-6da54004	com.amazonaws.eu-west-1.s3

- For API details, see [DescribePrefixLists](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeRegions` with an AWS SDK or CLI

The following code examples show how to use `DescribeRegions`.

C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/! Describe all Amazon Elastic Compute Cloud (Amazon EC2) Regions.  
/*!
```

```
\param clientConfiguration: AWS client configuration.
\return bool: Function succeeded.
*/
bool AwsDoc::EC2::describeRegions(
    const Aws::Client::ClientConfiguration &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::DescribeRegionsRequest request;
    Aws::EC2::Model::DescribeRegionsOutcome outcome =
        ec2Client.DescribeRegions(request);
    if (outcome.IsSuccess()) {
        std::cout << std::left <<
            std::setw(32) << "RegionName" <<
            std::setw(64) << "Endpoint" << std::endl;

        const auto &regions = outcome.GetResult().GetRegions();
        for (const auto &region: regions) {
            std::cout << std::left <<
                std::setw(32) << region.GetRegionName() <<
                std::setw(64) << region.GetEndpoint() << std::endl;
        }
    } else {
        std::cerr << "Failed to describe regions:" <<
            outcome.GetError().GetMessage() << std::endl;
    }

    std::cout << std::endl;

    return outcome.IsSuccess();
}
```

- For API details, see [DescribeRegions](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To describe all of your enabled Regions

The following `describe-regions` example describes all of the Regions that are enabled for your account.

```
aws ec2 describe-regions
```

Output:

```
{  
    "Regions": [  
        {  
            "Endpoint": "ec2.eu-north-1.amazonaws.com",  
            "RegionName": "eu-north-1",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.ap-south-1.amazonaws.com",  
            "RegionName": "ap-south-1",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.eu-west-3.amazonaws.com",  
            "RegionName": "eu-west-3",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.eu-west-2.amazonaws.com",  
            "RegionName": "eu-west-2",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.eu-west-1.amazonaws.com",  
            "RegionName": "eu-west-1",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.ap-northeast-3.amazonaws.com",  
            "RegionName": "ap-northeast-3",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.ap-northeast-2.amazonaws.com",  
            "RegionName": "ap-northeast-2",  
            "OptInStatus": "opt-in-not-required"  
        },  
        {  
            "Endpoint": "ec2.ap-northeast-1.amazonaws.com",  
            "RegionName": "ap-northeast-1",  
            "OptInStatus": "opt-in-not-required"  
        }  
    ]  
}
```

```
        "RegionName": "ap-northeast-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.sa-east-1.amazonaws.com",
        "RegionName": "sa-east-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ca-central-1.amazonaws.com",
        "RegionName": "ca-central-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ap-southeast-1.amazonaws.com",
        "RegionName": "ap-southeast-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ap-southeast-2.amazonaws.com",
        "RegionName": "ap-southeast-2",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.eu-central-1.amazonaws.com",
        "RegionName": "eu-central-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.us-east-1.amazonaws.com",
        "RegionName": "us-east-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.us-east-2.amazonaws.com",
        "RegionName": "us-east-2",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.us-west-1.amazonaws.com",
        "RegionName": "us-west-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
```

```
        "Endpoint": "ec2.us-west-2.amazonaws.com",
        "RegionName": "us-west-2",
        "OptInStatus": "opt-in-not-required"
    }
]
}
```

For more information, see [Regions and Zones](#) in the *Amazon EC2 User Guide*.

### Example 2: To describe enabled Regions with an endpoint whose name contains a specific string

The following `describe-regions` example describes all Regions that you have enabled that have the string "us" in the endpoint.

```
aws ec2 describe-regions \
--filters "Name=endpoint,Values=*us*"
```

Output:

```
{
    "Regions": [
        {
            "Endpoint": "ec2.us-east-1.amazonaws.com",
            "RegionName": "us-east-1"
        },
        {
            "Endpoint": "ec2.us-east-2.amazonaws.com",
            "RegionName": "us-east-2"
        },
        {
            "Endpoint": "ec2.us-west-1.amazonaws.com",
            "RegionName": "us-west-1"
        },
        {
            "Endpoint": "ec2.us-west-2.amazonaws.com",
            "RegionName": "us-west-2"
        }
    ]
}
```

For more information, see [Regions and Zones](#) in the *Amazon EC2 User Guide*.

### Example 3: To describe all Regions

The following `describe-regions` example describes all available Regions, including Regions that are disabled.

```
aws ec2 describe-regions \
--all-regions
```

Output:

```
{
  "Regions": [
    {
      "Endpoint": "ec2.eu-north-1.amazonaws.com",
      "RegionName": "eu-north-1",
      "OptInStatus": "opt-in-not-required"
    },
    {
      "Endpoint": "ec2.ap-south-1.amazonaws.com",
      "RegionName": "ap-south-1",
      "OptInStatus": "opt-in-not-required"
    },
    {
      "Endpoint": "ec2.eu-west-3.amazonaws.com",
      "RegionName": "eu-west-3",
      "OptInStatus": "opt-in-not-required"
    },
    {
      "Endpoint": "ec2.eu-west-2.amazonaws.com",
      "RegionName": "eu-west-2",
      "OptInStatus": "opt-in-not-required"
    },
    {
      "Endpoint": "ec2.eu-west-1.amazonaws.com",
      "RegionName": "eu-west-1",
      "OptInStatus": "opt-in-not-required"
    },
    {
      "Endpoint": "ec2.ap-northeast-3.amazonaws.com",
      "RegionName": "ap-northeast-3",
      "OptInStatus": "opt-in-not-required"
    }
  ]
}
```

```
        "Endpoint": "ec2.me-south-1.amazonaws.com",
        "RegionName": "me-south-1",
        "OptInStatus": "not-opted-in"
    },
    {
        "Endpoint": "ec2.ap-northeast-2.amazonaws.com",
        "RegionName": "ap-northeast-2",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ap-northeast-1.amazonaws.com",
        "RegionName": "ap-northeast-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.sa-east-1.amazonaws.com",
        "RegionName": "sa-east-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ca-central-1.amazonaws.com",
        "RegionName": "ca-central-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ap-east-1.amazonaws.com",
        "RegionName": "ap-east-1",
        "OptInStatus": "not-opted-in"
    },
    {
        "Endpoint": "ec2.ap-southeast-1.amazonaws.com",
        "RegionName": "ap-southeast-1",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.ap-southeast-2.amazonaws.com",
        "RegionName": "ap-southeast-2",
        "OptInStatus": "opt-in-not-required"
    },
    {
        "Endpoint": "ec2.eu-central-1.amazonaws.com",
        "RegionName": "eu-central-1",
        "OptInStatus": "opt-in-not-required"
    },
}
```

```
{  
    "Endpoint": "ec2.us-east-1.amazonaws.com",  
    "RegionName": "us-east-1",  
    "OptInStatus": "opt-in-not-required"  
},  
{  
    "Endpoint": "ec2.us-east-2.amazonaws.com",  
    "RegionName": "us-east-2",  
    "OptInStatus": "opt-in-not-required"  
},  
{  
    "Endpoint": "ec2.us-west-1.amazonaws.com",  
    "RegionName": "us-west-1",  
    "OptInStatus": "opt-in-not-required"  
},  
{  
    "Endpoint": "ec2.us-west-2.amazonaws.com",  
    "RegionName": "us-west-2",  
    "OptInStatus": "opt-in-not-required"  
}  
]  
}
```

For more information, see [Regions and Zones](#) in the *Amazon EC2 User Guide*.

#### Example 4: To list the Region names only

The following describe-regions example uses the --query parameter to filter the output and return only the names of the Regions as text.

```
aws ec2 describe-regions \  
  --all-regions \  
  --query "Regions[].[Name:RegionName]" \  
  --output text
```

Output:

```
eu-north-1  
ap-south-1  
eu-west-3  
eu-west-2  
eu-west-1  
ap-northeast-3
```

```
ap-northeast-2  
me-south-1  
ap-northeast-1  
sa-east-1  
ca-central-1  
ap-east-1  
ap-southeast-1  
ap-southeast-2  
eu-central-1  
us-east-1  
us-east-2  
us-west-1  
us-west-2
```

For more information, see [Regions and Zones](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeRegions](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeRegionsCommand } from "@aws-sdk/client-ec2";  
  
import { client } from "../libs/client.js";  
  
export const main = async () => {  
    const command = new DescribeRegionsCommand({  
        // By default this command will not show regions that require you to opt-in.  
        // When AllRegions true even the regions that require opt-in will be  
        returned.  
        AllRegions: true,  
        // You can omit the Filters property if you want to get all regions.  
        Filters: [  
            {  
                Name: "region-name",  
            },  
        ],  
    });  
    const data = await command.send(client);  
    console.log(data);  
};
```

```
// You can specify multiple values for a filter.  
// You can also use '*' as a wildcard. This will return all  
// of the regions that start with `us-east-`.  
Values: ["ap-southeast-4"],  
,  
],  
});  
  
try {  
    const { Regions } = await client.send(command);  
    const regionsList = Regions.map((reg) => ` • ${reg.RegionName}`);  
    console.log("Found regions:");  
    console.log(regionsList.join("\n"));  
} catch (err) {  
    console.error(err);  
}  
};
```

- For API details, see [DescribeRegions](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the regions that are available to you.**

Get-EC2Region

### Output:

Endpoint	RegionName
-----	-----
ec2.eu-west-1.amazonaws.com	eu-west-1
ec2.ap-southeast-1.amazonaws.com	ap-southeast-1
ec2.ap-southeast-2.amazonaws.com	ap-southeast-2
ec2.eu-central-1.amazonaws.com	eu-central-1
ec2.ap-northeast-1.amazonaws.com	ap-northeast-1
ec2.us-east-1.amazonaws.com	us-east-1
ec2.sa-east-1.amazonaws.com	sa-east-1
ec2.us-west-1.amazonaws.com	us-west-1
ec2.us-west-2.amazonaws.com	us-west-2

- For API details, see [DescribeRegions](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Ruby

### SDK for Ruby

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @example
#   list_regions_endpoints(Aws::EC2::Client.new(region: 'us-west-2'))
def list_regions_endpoints(ec2_client)
    result = ec2_client.describe_regions
    # Enable pretty printing.
    max_region_string_length = 16
    max_endpoint_string_length = 33
    # Print header.
    print "Region"
    print " " * (max_region_string_length - "Region".length)
    print " Endpoint\n"
    print "-" * max_region_string_length
    print " "
    print "-" * max_endpoint_string_length
    print "\n"
    # Print Regions and their endpoints.
    result.regions.each do |region|
        print region.region_name
        print " " * (max_region_string_length - region.region_name.length)
        print " "
        print region.endpoint
        print "\n"
    end
end

# Displays a list of Amazon Elastic Compute Cloud (Amazon EC2)
```

```
# Availability Zones available to you depending on the AWS Region
# of the Amazon EC2 client.

#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @example
#   list_availability_zones(Aws::EC2::Client.new(region: 'us-west-2'))
def list_availability_zones(ec2_client)
    result = ec2_client.describe_availability_zones
    # Enable pretty printing.
    max_region_string_length = 16
    max_zone_string_length = 18
    max_state_string_length = 9
    # Print header.
    print "Region"
    print " " * (max_region_string_length - "Region".length)
    print " Zone"
    print " " * (max_zone_string_length - "Zone".length)
    print " State\n"
    print "-" * max_region_string_length
    print " "
    print "-" * max_zone_string_length
    print " "
    print "-" * max_state_string_length
    print "\n"
    # Print Regions, Availability Zones, and their states.
    result.availability_zones.each do |zone|
        print zone.region_name
        print " " * (max_region_string_length - zone.region_name.length)
        print " "
        print zone.zone_name
        print " " * (max_zone_string_length - zone.zone_name.length)
        print " "
        print zone.state
        # Print any messages for this Availability Zone.
        if zone.messages.count.positive?
            print "\n"
            puts " Messages for this zone:"
            zone.messages.each do |message|
                print "    #{message.message}\n"
            end
        end
        print "\n"
    end
end
```

```
# Example usage:  
def run_me  
  region = ""  
  # Print usage information and then stop.  
  if ARGV[0] == "--help" || ARGV[0] == "-h"  
    puts "Usage: ruby ec2-ruby-example-regions-availability-zones.rb REGION"  
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
    puts "Example: ruby ec2-ruby-example-regions-availability-zones.rb us-west-2"  
    exit 1  
  # If no values are specified at the command prompt, use these default values.  
  # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
  elsif ARGV.count.zero?  
    region = "us-west-2"  
  # Otherwise, use the values as specified at the command prompt.  
  else  
    region = ARGV[0]  
  end  
  
  ec2_client = Aws::EC2::Client.new(region: region)  
  
  puts "AWS Regions for Amazon EC2 that are available to you:"  
  list_regions_endpoints(ec2_client)  
  puts "\n\nAmazon EC2 Availability Zones that are available to you for AWS  
Region '#{region}':"  
  list_availability_zones(ec2_client)  
end  
  
run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [DescribeRegions](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
async fn show_regions(client: &Client) -> Result<(), Error> {
    let rsp = client.describe_regions().send().await?;

    println!("Regions:");
    for region in rsp.regions() {
        println!("  {}", region.region_name().unwrap());
    }

    Ok(())
}
```

- For API details, see [DescribeRegions](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.
  oo_result = lo_ec2->describeregions( ) .
  " "
oo_result is returned for testing purposes. "
  DATA(lt_regions) = oo_result->get_regions( ).
  MESSAGE 'Retrieved information about Regions.' TYPE 'I'.
  CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
    DATA(lv_error) = |"{
      lo_exception->av_err_code
    }" - {
      lo_exception-
    >av_err_msg
  }|.
    MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [DescribeRegions](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeRouteTables` with an AWS SDK or CLI

The following code examples show how to use `DescribeRouteTables`.

CLI

### AWS CLI

#### To describe your route tables

The following `describe-route-tables` example retrieves the details about your route tables

```
aws ec2 describe-route-tables
```

Output:

```
{  
    "RouteTables": [  
        {  
            "Associations": [  
                {  
                    "Main": true,  
                    "RouteTableAssociationId": "rtbassoc-0df3f54e06EXAMPLE",  
                    "RouteTableId": "rtb-09ba434c1bEXAMPLE"  
                }  
            ],  
            "PropagatingVgws": [],  
            "RouteTableId": "rtb-09ba434c1bEXAMPLE",  
            "Routes": [  
                {  
                    "DestinationCidrBlock": "10.0.0.0/16",  
                    "GatewayId": "local",  
                    "Origin": "CreateRouteTable",  
                    "State": "active"  
                },  
                {  
                    "DestinationCidrBlock": "0.0.0.0/0",  
                    "NatGatewayId": "nat-06c018cbd8EXAMPLE",  
                    "State": "active"  
                }  
            ]  
        }  
    ]  
}
```

```
        "Origin": "CreateRoute",
        "State": "blackhole"
    }
],
"Tags": [],
"VpcId": "vpc-0065acced4EXAMPLE",
"OwnerId": "111122223333"
},
{
    "Associations": [
        {
            "Main": true,
            "RouteTableAssociationId": "rtbassoc-9EXAMPLE",
            "RouteTableId": "rtb-a1eec7de"
        }
    ],
    "PropagatingVgws": [],
    "RouteTableId": "rtb-a1eec7de",
    "Routes": [
        {
            "DestinationCidrBlock": "172.31.0.0/16",
            "GatewayId": "local",
            "Origin": "CreateRouteTable",
            "State": "active"
        },
        {
            "DestinationCidrBlock": "0.0.0.0/0",
            "GatewayId": "igw-fEXAMPLE",
            "Origin": "CreateRoute",
            "State": "active"
        }
    ],
    "Tags": [],
    "VpcId": "vpc-3EXAMPLE",
    "OwnerId": "111122223333"
},
{
    "Associations": [
        {
            "Main": false,
            "RouteTableAssociationId": "rtbassoc-0b100c28b2EXAMPLE",
            "RouteTableId": "rtb-07a98f76e5EXAMPLE",
            "SubnetId": "subnet-0d3d002af8EXAMPLE"
        }
    ]
}
```

```
        ],
        "PropagatingVgws": [],
        "RouteTableId": "rtb-07a98f76e5EXAMPLE",
        "Routes": [
            {
                "DestinationCidrBlock": "10.0.0.0/16",
                "GatewayId": "local",
                "Origin": "CreateRouteTable",
                "State": "active"
            },
            {
                "DestinationCidrBlock": "0.0.0.0/0",
                "GatewayId": "igw-06cf664d80EXAMPLE",
                "Origin": "CreateRoute",
                "State": "active"
            }
        ],
        "Tags": [],
        "VpcId": "vpc-0065acced4EXAMPLE",
        "OwnerId": "111122223333"
    }
]
```

For more information, see [Working with Route Tables](#) in the *AWS VPC User Guide*.

- For API details, see [DescribeRouteTables](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes all your route tables.**

```
Get-EC2RouteTable
```

### Output:

```
DestinationCidrBlock      : 10.0.0.0/16
DestinationPrefixListId   :
GatewayId                 : local
InstanceId                :
```

```
InstanceId          :  
NetworkInterfaceId :  
Origin             : CreateRouteTable  
State              : active  
VpcPeeringConnectionId :  
  
DestinationCidrBlock   : 0.0.0.0/0  
DestinationPrefixListId :  
GatewayId           : igw-1a2b3c4d  
InstanceId          :  
InstanceOwnerId       :  
NetworkInterfaceId   :  
Origin              : CreateRoute  
State               : active  
VpcPeeringConnectionId :  

```

### Example 2: This example returns details for the specified route table.

```
Get-EC2RouteTable -RouteTableId rtb-1a2b3c4d
```

### Example 3: This example describes the route tables for the specified VPC.

```
Get-EC2RouteTable -Filter @{ Name="vpc-id"; Values="vpc-1a2b3c4d" }
```

#### Output:

```
Associations      : {rtbassoc-12345678}  
PropagatingVgws : {}  
Routes           : {, }  
RouteTableId     : rtb-1a2b3c4d  
Tags             : {}  
VpcId            : vpc-1a2b3c4d
```

- For API details, see [DescribeRouteTables](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `DescribeScheduledInstanceIdAvailability` with an AWS SDK or CLI

The following code examples show how to use `DescribeScheduledInstanceIdAvailability`.  
CLI

## AWS CLI

### To describe an available schedule

This example describes a schedule that occurs every week on Sunday, starting on the specified date.

Command:

```
aws ec2 describe-scheduled-instance-availability --  
recurrence Frequency=Weekly,Interval=1,OccurrenceDays=[1] --first-slot-start-  
time-range EarliestTime=2016-01-31T00:00:00Z,LatestTime=2016-01-31T04:00:00Z
```

Output:

```
{  
  "ScheduledInstanceIdAvailabilitySet": [  
    {  
      "AvailabilityZone": "us-west-2b",  
      "TotalScheduledInstanceIdHours": 1219,  
      "PurchaseToken": "eyJ2IjoiMSIsInMi0jEsImMi0i...",  
      "MinTermDurationInDays": 366,  
      "AvailableInstanceIdCount": 20,  
      "Recurrence": {  
        "OccurrenceDaySet": [  
          1  
        ],  
        "Interval": 1,  
        "Frequency": "Weekly",  
        "OccurrenceRelativeToEnd": false  
      },  
      "Platform": "Linux/UNIX",  
      "FirstSlotStartTime": "2016-01-31T00:00:00Z",  
      "MaxTermDurationInDays": 366,  
      "LastOccurrence": "2016-01-31T04:00:00Z",  
      "LastOccurrenceIndex": 1  
    }  
  ]  
}
```

```
        "SlotDurationInHours": 23,  
        "NetworkPlatform": "EC2-VPC",  
        "InstanceType": "c4.large",  
        "HourlyPrice": "0.095"  
    },  
    ...  
]  
}
```

To narrow the results, you can add filters that specify the operating system, network, and instance type.

Command:

```
--filters Name=platform,Values=Linux/UNIX Name=network-platform,Values=EC2-VPC  
Name=instance-type,Values=c4.large
```

- For API details, see [DescribeScheduledInstanceIdAvailability](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example describes a schedule that occurs every week on Sunday, starting on the specified date.**

```
Get-EC2ScheduledInstanceIdAvailability -Recurrence_Frequency  
    Weekly -Recurrence_Interval 1 -Recurrence_OccurrenceDay 1 -  
    FirstSlotStartTimeRange_EarliestTime 2016-01-31T00:00:00Z -  
    FirstSlotStartTimeRange_LatestTime 2016-01-31T04:00:00Z
```

**Output:**

```
AvailabilityZone          : us-west-2b  
AvailableInstanceCount   : 20  
FirstSlotStartTime       : 1/31/2016 8:00:00 AM  
HourlyPrice              : 0.095  
InstanceType              : c4.large  
MaxTermDurationInDays   : 366  
MinTermDurationInDays   : 366  
NetworkPlatform          : EC2-VPC
```

```
Platform          : Linux/UNIX
PurchaseToken    : eyJ2IjoiMSIsInMi0jEsImMi0i...
Recurrence       : Amazon.EC2.Model.ScheduledInstanceIdRecurrence
SlotDurationInHours : 23
TotalScheduledInstanceHours : 1219

...
```

## Example 2: To narrow the results, you can add filters for criteria such as operating system, network, and instance type.

```
-Filter @{ Name="platform";Values="Linux/UNIX" },@{ Name="network-
platform";Values="EC2-VPC" },@{ Name="instance-type";Values="c4.large" }
```

- For API details, see [DescribeScheduledInstanceIdAvailability](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeScheduledInstances** with an AWS SDK or CLI

The following code examples show how to use **DescribeScheduledInstances**.

CLI

### AWS CLI

#### To describe your Scheduled Instances

This example describes the specified Scheduled Instance.

Command:

```
aws ec2 describe-scheduled-instances --scheduled-instance-
ids sci-1234-1234-1234-1234-123456789012
```

Output:

```
{  
    "ScheduledInstanceSet": [  
        {  
            "AvailabilityZone": "us-west-2b",  
            "ScheduledInstanceId": "sci-1234-1234-1234-1234-123456789012",  
            "HourlyPrice": "0.095",  
            "CreateDate": "2016-01-25T21:43:38.612Z",  
            "Recurrence": {  
                "OccurrenceDaySet": [  
                    1  
                ],  
                "Interval": 1,  
                "Frequency": "Weekly",  
                "OccurrenceRelativeToEnd": false,  
                "OccurrenceUnit": ""  
            },  
            "Platform": "Linux/UNIX",  
            "TermEndDate": "2017-01-31T09:00:00Z",  
            "InstanceCount": 1,  
            "SlotDurationInHours": 32,  
            "TermStartDate": "2016-01-31T09:00:00Z",  
            "NetworkPlatform": "EC2-VPC",  
            "TotalScheduledInstanceHours": 1696,  
            "NextSlotStartTime": "2016-01-31T09:00:00Z",  
            "InstanceType": "c4.large"  
        }  
    ]  
}
```

This example describes all your Scheduled Instances.

Command:

```
aws ec2 describe-scheduled-instances
```

- For API details, see [DescribeScheduledInstances](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example describes the specified Scheduled Instance.**

```
Get-EC2ScheduledInstance -ScheduledInstanceId  
sci-1234-1234-1234-1234-123456789012
```

### Output:

```
AvailabilityZone      : us-west-2b  
CreateDate          : 1/25/2016 1:43:38 PM  
HourlyPrice         : 0.095  
InstanceCount       : 1  
InstanceType        : c4.large  
NetworkPlatform     : EC2-VPC  
NextSlotStartTime   : 1/31/2016 1:00:00 AM  
Platform            : Linux/UNIX  
PreviousSlotEndTime :  
Recurrence          : Amazon.EC2.Model.ScheduledInstanceRecurrence  
ScheduledInstanceId : sci-1234-1234-1234-1234-123456789012  
SlotDurationInHours: 32  
TermEndDate         : 1/31/2017 1:00:00 AM  
TermStartDate       : 1/31/2016 1:00:00 AM  
TotalScheduledInstanceHours : 1696
```

### Example 2: This example describes all your Scheduled Instances.

```
Get-EC2ScheduledInstance
```

- For API details, see [DescribeScheduledInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSecurityGroups** with an AWS SDK or CLI

The following code examples show how to use **DescribeSecurityGroups**.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

## .NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Retrieve information for an Amazon EC2 security group.
/// </summary>
/// <param name="groupId">The Id of the Amazon EC2 security group.</param>
/// <returns>A list of security group information.</returns>
public async Task<List<SecurityGroup>> DescribeSecurityGroups(string groupId)
{
    var request = new DescribeSecurityGroupsRequest();
    var groupIds = new List<string> { groupId };
    request.GroupIds = groupIds;

    var response = await _amazonEC2.DescribeSecurityGroupsAsync(request);
    return response.SecurityGroups;
}

/// <summary>
/// Display the information returned by the call to
/// DescribeSecurityGroupsAsync.
/// </summary>
/// <param name="securityGroup">A list of security group information.</param>
public void DisplaySecurityGroupInfoAsync(SecurityGroup securityGroup)
{
    Console.WriteLine($"{securityGroup.GroupName}");
    Console.WriteLine("Ingress permissions:");
    securityGroup.IpPermissions.ForEach(permission =>
    {
        Console.WriteLine($"    \tFromPort: {permission.FromPort}");
        Console.WriteLine($"    \tIpProtocol: {permission.IpProtocol}");

        Console.Write($"    \tIpv4Ranges: ");
        permission.Ipv4Ranges.ForEach(range =>
        {
            Console.Write($"{range.CidrIp} ");
        });
    });
}
```

```
Console.WriteLine($"\\n\\tIpv6Ranges:");
    permission.Ipv6Ranges.ForEach(range =>
{ Console.Write($"{range.CidrIpv6} "); });

    Console.WriteLine($"\\n\\tPrefixListIds: ");
    permission.PrefixListIds.ForEach(id => Console.WriteLine($"{id.Id} "));

    Console.WriteLine($"\\n\\tTo Port: {permission.ToPort}");
});

Console.WriteLine("Egress permissions:");
securityGroup.IpPermissionsEgress.ForEach(permission =>
{
    Console.WriteLine($"\\tFromPort: {permission.FromPort}");
    Console.WriteLine($"\\tIpProtocol: {permission.IpProtocol}");

    Console.WriteLine($"\\tIpv4Ranges: ");
    permission.Ipv4Ranges.ForEach(range =>
{ Console.Write($"{range.CidrIp} "); });

    Console.WriteLine($"\\n\\tIpv6Ranges:");
    permission.Ipv6Ranges.ForEach(range =>
{ Console.Write($"{range.CidrIpv6} "); });

    Console.WriteLine($"\\n\\tPrefixListIds: ");
    permission.PrefixListIds.ForEach(id => Console.WriteLine($"{id.Id} "));

    Console.WriteLine($"\\n\\tTo Port: {permission.ToPort}");
});
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_describe_security_groups
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# security groups.
#
# Parameters:
#     -g security_group_id - The ID of the security group to describe
#                           (optional).
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_describe_security_groups() {
    local security_group_id response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_security_groups"
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        echo "security groups."
        echo " -g security_group_id - The ID of the security group to describe"
        echo "(optional)."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopt "g:h" option; do
        case "${option}" in
            g) security_group_id="${OPTARG}" ;;


```

```
h)
  usage
  return 0
  ;;
\?) 
  echo "Invalid parameter"
  usage
  return 1
  ;;
esac
done
export OPTIND=1

local query="SecurityGroups[*].[GroupName, GroupId, VpcId, IpPermissions[*].
[IpProtocol, FromPort, ToPort, IpRanges[*].CidrIp]]"

if [[ -n "$security_group_id" ]]; then
  response=$(aws ec2 describe-security-groups --group-ids "$security_group_id"
--query "${query}" --output text)
else
  response=$(aws ec2 describe-security-groups --query "${query}" --output text)
fi

local error_code=${?}

if [[ $error_code -ne 0 ]]; then
  aws_cli_error_log $error_code
  errecho "ERROR: AWS reports describe-security-groups operation failed.
$response"
  return 1
fi

echo "$response"

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
```

```
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####

function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS CLI Command Reference*.

## C++

**SDK for C++****Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Describe all Amazon Elastic Compute Cloud (Amazon EC2) security groups, or a
//! specific group.
/*!
 \param groupID: A group ID, ignored if empty.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::describeSecurityGroups(const Aws::String &groupID,
                                         const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::DescribeSecurityGroupsRequest request;

    if (!groupID.empty()) {
        request.AddGroupIds(groupID);
    }

    Aws::String nextToken;
    do {
        if (!nextToken.empty()) {
            request.SetNextToken(nextToken);
        }

        Aws::EC2::Model::DescribeSecurityGroupsOutcome outcome =
ec2Client.DescribeSecurityGroups(request);
        if (outcome.IsSuccess()) {
            std::cout << std::left <<
                std::setw(32) << "Name" <<
                std::setw(30) << "GroupId" <<
                std::setw(30) << "VpcId" <<
                std::setw(64) << "Description" << std::endl;
        }
    } while (!nextToken.empty());
}
```

```
const std::vector<Aws::EC2::Model::SecurityGroup> &securityGroups =
    outcome.GetResult().GetSecurityGroups();

    for (const auto &securityGroup: securityGroups) {
        std::cout << std::left <<
            std::setw(32) << securityGroup.GetGroupName() <<
            std::setw(30) << securityGroup.GetGroupId() <<
            std::setw(30) << securityGroup.GetVpcId() <<
            std::setw(64) << securityGroup.GetDescription() <<
            std::endl;
    }
} else {
    std::cerr << "Failed to describe security groups:" <<
        outcome.GetError().GetMessage() << std::endl;
    return false;
}

nextToken = outcome.GetResult().GetNextToken();
} while (!nextToken.empty());

return true;
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To describe a security group

The following `describe-security-groups` example describes the specified security group.

```
aws ec2 describe-security-groups \
--group-ids sg-903004f8
```

Output:

```
{
    "SecurityGroups": [
```

```
{  
    "IpPermissionsEgress": [  
        {  
            "IpProtocol": "-1",  
            "IpRanges": [  
                {  
                    "CidrIp": "0.0.0.0/0"  
                }  
            ],  
            "UserIdGroupPairs": [],  
            "PrefixListIds": []  
        }  
    ],  
    "Description": "My security group",  
    "Tags": [  
        {  
            "Value": "SG1",  
            "Key": "Name"  
        }  
    ],  
    "IpPermissions": [  
        {  
            "IpProtocol": "-1",  
            "IpRanges": [],  
            "UserIdGroupPairs": [  
                {  
                    "UserId": "123456789012",  
                    "GroupId": "sg-903004f8"  
                }  
            ],  
            "PrefixListIds": []  
        },  
        {  
            "PrefixListIds": [],  
            "FromPort": 22,  
            "IpRanges": [  
                {  
                    "Description": "Access from NY office",  
                    "CidrIp": "203.0.113.0/24"  
                }  
            ],  
            "ToPort": 22,  
            "IpProtocol": "tcp",  
            "UserIdGroupPairs": []  
        }  
    ]  
}
```

```
        },
        "GroupName": "MySecurityGroup",
        "VpcId": "vpc-1a2b3c4d",
        "OwnerId": "123456789012",
        "GroupId": "sg-903004f8",
    }
]
}
```

### Example 2: To describe security groups that have specific rules

The following `describe-security-groups` example uses filters to scope the results to security groups that have a rule that allows SSH traffic (port 22) and a rule that allows traffic from all addresses (`0.0.0.0/0`). The example uses the `--query` parameter to display only the names of the security groups. Security groups must match all filters to be returned in the results; however, a single rule does not have to match all filters. For example, the output returns a security group with a rule that allows SSH traffic from a specific IP address and another rule that allows HTTP traffic from all addresses.

```
aws ec2 describe-security-groups \
  --filters Name=ip-permission.from-port,Values=22 Name=ip-permission.to-
  port,Values=22 Name=ip-permission.cidr,Values='0.0.0.0/0' \
  --query "SecurityGroups[*].[GroupName]" \
  --output text
```

Output:

```
default
my-security-group
web-servers
launch-wizard-1
```

### Example 3: To describe security groups based on tags

The following `describe-security-groups` example uses filters to scope the results to security groups that include `test` in the security group name, and that have the tag `Test=To-delete`. The example uses the `--query` parameter to display only the names and IDs of the security groups.

```
aws ec2 describe-security-groups \
```

```
--filters Name=group-name,Values=*test* Name=tag:Test,Values=To-delete \
--query "SecurityGroups[*].{Name:GroupName,ID:GroupId}"
```

Output:

```
[  
 {  
     "Name": "testfornewinstance",  
     "ID": "sg-33bb22aa"  
 },  
 {  
     "Name": "newgrouptest",  
     "ID": "sg-1a2b3c4d"  
 }  
]
```

For additional examples using tag filters, see [Working with tags](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeSecurityGroups](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void describeSecurityGroups(Ec2Client ec2, String groupId) {  
    try {  
        DescribeSecurityGroupsRequest request =  
DescribeSecurityGroupsRequest.builder()  
            .groupIds(groupId)  
            .build();  
  
        // Use a paginator.  
        DescribeSecurityGroupsIterable listGroups =  
ec2.describeSecurityGroupsPaginator(request);
```

```
        listGroups.stream()
            .flatMap(r -> r.securityGroups().stream())
            .forEach(group -> System.out
                .println(" Group id: " +group.groupId() + " group name = " +
group.groupName()));
    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DescribeSecurityGroupsCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// Log the details of a specific security group.
export const main = async () => {
    const command = new DescribeSecurityGroupsCommand({
        GroupIds: ["SECURITY_GROUP_ID"],
    });

    try {
        const { SecurityGroups } = await client.send(command);
        console.log(JSON.stringify(SecurityGroups, null, 2));
    } catch (err) {
        console.error(err);
    }
};
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun describeEC2SecurityGroups(groupId: String) {  
    val request =  
        DescribeSecurityGroupsRequest {  
            groupIds = listOf(groupId)  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
  
        val response = ec2.describeSecurityGroups(request)  
        response.securityGroups?.forEach { group ->  
            println("Found Security Group with id ${group.groupId}, vpc id  
            ${group.vpcId} and description ${group.description}")  
        }  
    }  
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified security group for a VPC. When working with security groups belonging to a VPC you must use the security group ID (-GroupId parameter), not name (-GroupName parameter), to reference the group.**

```
Get-EC2SecurityGroup -GroupId sg-12345678
```

**Output:**

```
Description      : default VPC security group
GroupId       : sg-12345678
GroupName     : default
IpPermissions  : {Amazon.EC2.Model.IpPermission}
IpPermissionsEgress : {Amazon.EC2.Model.IpPermission}
OwnerId       : 123456789012
Tags          : {}
VpcId         : vpc-12345678
```

**Example 2:** This example describes the specified security group for EC2-Classic. When working with security groups for EC2-Classic you may use either the group name (-GroupName parameter) or group ID (-GroupId parameter) to reference the security group.

```
Get-EC2SecurityGroup -GroupName my-security-group
```

**Output:**

```
Description      : my security group
GroupId       : sg-45678901
GroupName     : my-security-group
IpPermissions  : {Amazon.EC2.Model.IpPermission,
                 Amazon.EC2.Model.IpPermission}
IpPermissionsEgress : {}
OwnerId       : 123456789012
Tags          : {}
VpcId         :
```

**Example 3:** This example retrieves all the security groups for the vpc-0fc1ff23456b789eb

```
Get-EC2SecurityGroup -Filter @{Name="vpc-id";Values="vpc-0fc1ff23456b789eb"}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class SecurityGroupWrapper:
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) security group
    actions."""

    def __init__(self, ec2_resource, security_group=None):
        """
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
        resource
                is used to create additional high-level objects
                that wrap low-level Amazon EC2 service actions.
        :param security_group: A Boto3 SecurityGroup object. This is a high-level
        object
                that wraps security group actions.
        """
        self.ec2_resource = ec2_resource
        self.security_group = security_group

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource)

    def describe(self):
        """
        Displays information about the security group.
        """
        if self.security_group is None:
            logger.info("No security group to describe.")
            return

        try:
```

```
        print(f"Security group: {self.security_group.group_name}")
        print(f"\tID: {self.security_group.id}")
        print(f"\tVPC: {self.security_group.vpc_id}")
        if self.security_group.ip_permissions:
            print(f"\t\tInbound permissions:")
            pp(self.security_group.ip_permissions)
    except ClientError as err:
        logger.error(
            "Couldn't get data for security group %s. Here's why: %s: %s",
            self.security_group.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
async fn show_security_groups(client: &aws_sdk_ec2::Client, group_ids: Vec<String>) {
    let response = client
        .describe_security_groups()
        .set_group_ids(Some(group_ids))
        .send()
        .await;

    match response {
        Ok(output) => {
            for group in output.security_groups() {
                println!(
                    "Found Security Group {} ({}), vpc id {} and description {}",

```

```
        group.group_name().unwrap_or("unknown"),
        group.group_id().unwrap_or("id-unknown"),
        group.vpc_id().unwrap_or("vpcid-unknown"),
        group.description().unwrap_or("(none)")
    );
}
Err(err) => {
    let err = err.into_service_error();
    let meta = err.meta();
    let message = meta.message().unwrap_or("unknown");
    let code = meta.code().unwrap_or("unknown");
    eprintln!("Error listing EC2 Security Groups: ({code}) {message}");
}
}
}
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
TRY.
DATA lt_group_ids TYPE /aws1/
cl_ec2groupidstrlist_w=>tt_groupidstringlist.
    APPEND NEW /aws1/cl_ec2groupidstrlist_w( iv_value = iv_group_id ) TO
lt_group_ids.
    oo_result = lo_ec2->describesecuritygroups( it_groupids = lt_group_ids ).
    " oo_result is returned for testing purposes.
    DATA(lt_security_groups) = oo_result->get_securitygroups( ).
    MESSAGE 'Retrieved information about security groups.' TYPE 'I'.
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
    DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-
>av_err_msg }|.
```

```
MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [DescribeSecurityGroups](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeSnapshotAttribute` with an AWS SDK or CLI

The following code examples show how to use `DescribeSnapshotAttribute`.

CLI

### AWS CLI

#### To describe the snapshot attributes for a snapshot

The following `describe-snapshot-attribute` example lists the accounts with which a snapshot is shared.

```
aws ec2 describe-snapshot-attribute \
--snapshot-id snap-01234567890abcdef \
--attribute createVolumePermission
```

Output:

```
{
    "SnapshotId": "snap-01234567890abcdef",
    "CreateVolumePermissions": [
        {
            "UserId": "123456789012"
        }
    ]
}
```

For more information, see [Share an Amazon EBS snapshot](#) in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [DescribeSnapshotAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1:** This example describes the specified attribute of the specified snapshot.

```
Get-EC2SnapshotAttribute -SnapshotId snap-12345678 -Attribute ProductCodes
```

**Output:**

CreateVolumePermissions	ProductCodes	SnapshotId
-----	-----	-----
{}	{}	snap-12345678

**Example 2:** This example describes the specified attribute of the specified snapshot.

```
(Get-EC2SnapshotAttribute -SnapshotId snap-12345678 -Attribute CreateVolumePermission).CreateVolumePermissions
```

**Output:**

Group	UserId
-----	-----
all	

- For API details, see [DescribeSnapshotAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSchemas** with an AWS SDK or CLI

The following code examples show how to use **DescribeSchemas**.

CLI

**AWS CLI**

**Example 1:** To describe a snapshot

The following `describe-snapshots` example describes the specified snapshot.

```
aws ec2 describe-snapshots \
--snapshot-ids snap-1234567890abcdef0
```

Output:

```
{
    "Snapshots": [
        {
            "Description": "This is my snapshot",
            "Encrypted": false,
            "VolumeId": "vol-049df61146c4d7901",
            "State": "completed",
            "VolumeSize": 8,
            "StartTime": "2019-02-28T21:28:32.000Z",
            "Progress": "100%",
            "OwnerId": "012345678910",
            "SnapshotId": "snap-01234567890abcdef",
            "Tags": [
                {
                    "Key": "Stack",
                    "Value": "test"
                }
            ]
        }
    ]
}
```

For more information, see [Amazon EBS snapshots](#) in the *Amazon EC2 User Guide*.

### Example 2: To describe snapshots based on filters

The following `describe-snapshots` example uses filters to scope the results to snapshots owned by your AWS account that are in the pending state. The example uses the `--query` parameter to display only the snapshot IDs and the time the snapshot was started.

```
aws ec2 describe-snapshots \
--owner-ids self \
--filters Name=status,Values=pending \
--query "Snapshots[*].{ID:SnapshotId,Time:StartTime}"
```

**Output:**

```
[  
  {  
    "ID": "snap-1234567890abcdef0",  
    "Time": "2019-08-04T12:48:18.000Z"  
  },  
  {  
    "ID": "snap-066877671789bd71b",  
    "Time": "2019-08-04T02:45:16.000Z"  
  },  
  ...  
]
```

The following `describe-snapshots` example uses filters to scope the results to snapshots created from the specified volume. The example uses the `--query` parameter to display only the snapshot IDs.

```
aws ec2 describe-snapshots \  
  --filters Name=volume-id,Values=049df61146c4d7901 \  
  --query "Snapshots[*].[SnapshotId]" \  
  --output text
```

**Output:**

```
snap-1234567890abcdef0  
snap-08637175a712c3fb9  
...
```

For additional examples using filters, see [Listing and filtering your resources](#) in the *Amazon EC2 User Guide*.

### Example 3: To describe snapshots based on tags

The following `describe-snapshots` example uses tag filters to scope the results to snapshots that have the tag `Stack=Prod`.

```
aws ec2 describe-snapshots \  
  --filters Name>tag:Stack,Values=prod
```

For an example of the output for `describe-snapshots`, see Example 1.

For additional examples using tag filters, see [Working with tags](#) in the *Amazon EC2 User Guide*.

#### Example 4: To describe snapshots based on age

The following describe-snapshots example uses JMESPath expressions to describe all snapshots created by your AWS account before the specified date. It displays only the snapshot IDs.

```
aws ec2 describe-snapshots \
--owner-ids 012345678910 \
--query "Snapshots[?(StartTime<='2020-03-31')].[SnapshotId]"
```

For additional examples using filters, see [Listing and filtering your resources](#) in the *Amazon EC2 User Guide*.

#### Example 5: To view only archived snapshots

The following describe-snapshots example lists only snapshots that are stored in the archive tier.

```
aws ec2 describe-snapshots \
--filters "Name=storage-tier,Values=archive"
```

Output:

```
{
    "Snapshots": [
        {
            "Description": "Snap A",
            "Encrypted": false,
            "VolumeId": "vol-01234567890aaaaaaaa",
            "State": "completed",
            "VolumeSize": 8,
            "StartTime": "2021-09-07T21:00:00.000Z",
            "Progress": "100%",
            "OwnerId": "123456789012",
            "SnapshotId": "snap-01234567890aaaaaaaa",
            "StorageTier": "archive",
            "Tags": []
        },
    ]}
```

```
]  
}
```

For more information, see [View archived snapshots](#) in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [DescribeSnapshots](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified snapshot.

```
Get-EC2Snapshot -SnapshotId snap-12345678
```

#### Output:

```
DataEncryptionKeyId :  
Description          : Created by CreateImage(i-1a2b3c4d) for ami-12345678 from  
                      vol-12345678  
Encrypted           : False  
KmsKeyId            :  
OwnerAlias          :  
OwnerId              : 123456789012  
Progress             : 100%  
SnapshotId          : snap-12345678  
StartTime            : 10/23/2014 6:01:28 AM  
State                : completed  
StateMessage         :  
Tags                 : {}  
VolumeId             : vol-12345678  
VolumeSize           : 8
```

#### Example 2: This example describes the snapshots that have a 'Name' tag.

```
Get-EC2Snapshot | ? { $_.Tags.Count -gt 0 -and $_.Tags.Key -eq "Name" }
```

#### Example 3: This example describes the snapshots that have a 'Name' tag with the value 'TestValue'.

```
Get-EC2Snapshot | ? { $_.Tags.Count -gt 0 -and $_.Tags.Key -eq "Name" -and  
$_.Tags.Value -eq "TestValue" }
```

#### Example 4: This example describes all your snapshots.

```
Get-EC2Snapshot -Owner self
```

- For API details, see [DescribeSnapshots](#) in *AWS Tools for PowerShell Cmdlet Reference*.

Rust

#### SDK for Rust

##### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Shows the state of a snapshot.

```
async fn show_state(client: &Client, id: &str) -> Result<(), Error> {  
    let resp = client  
        .describe_snapshots()  
        .filters(Filter::builder().name("snapshot-id").values(id).build())  
        .send()  
        .await?  
  
    println!(  
        "State: {}",  
        resp.snapshots().first().unwrap().state().unwrap().as_ref()  
    );  
  
    Ok(())
}
```

```
async fn show_snapshots(client: &Client) -> Result<(), Error> {  
    // "self" represents your account ID.  
    // You can list the snapshots for any account by replacing
```

```
// "self" with that account ID.
let resp = client.describe_snapshots().owner_ids("self").send().await?;
let snapshots = resp.snapshots();
let length = snapshots.len();

for snapshot in snapshots {
    println!(
        "ID:      {}",
        snapshot.snapshot_id().unwrap_or_default()
    );
    println!(
        "Description: {}",
        snapshot.description().unwrap_or_default()
    );
    println!("State:      {}", snapshot.state().unwrap().as_ref());
    println!();

    println!();
    println!("Found {} snapshot(s)", length);
    println!();

    Ok(())
}
```

- For API details, see [DescribeSnapshots](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSpotDatafeedSubscription** with an AWS SDK or CLI

The following code examples show how to use `DescribeSpotDatafeedSubscription`.

CLI

### AWS CLI

#### To describe Spot Instance datafeed subscription for an account

This example command describes the data feed for the account.

Command:

```
aws ec2 describe-spot-datafeed-subscription
```

Output:

```
{  
    "SpotDatafeedSubscription": {  
        "OwnerId": "123456789012",  
        "Prefix": "spotdata",  
        "Bucket": "my-s3-bucket",  
        "State": "Active"  
    }  
}
```

- For API details, see [DescribeSpotDatafeedSubscription](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example describes your Spot instance data feed.**

```
Get-EC2SpotDatafeedSubscription
```

Output:

```
Bucket : my-s3-bucket  
Fault :  
OwnerId : 123456789012  
Prefix : spotdata  
State : Active
```

- For API details, see [DescribeSpotDatafeedSubscription](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `DescribeSpotFleetInstances` with an AWS SDK or CLI

The following code examples show how to use `DescribeSpotFleetInstances`.

CLI

## AWS CLI

### To describe the Spot Instances associated with a Spot fleet

This example command lists the Spot instances associated with the specified Spot fleet.

Command:

```
aws ec2 describe-spot-fleet-instances --spot-fleet-request-id sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE
```

Output:

```
{  
    "ActiveInstances": [  
        {  
            "InstanceId": "i-1234567890abcdef0",  
            "InstanceType": "m3.medium",  
            "SpotInstanceRequestId": "sir-08b93456"  
        },  
        ...  
    ],  
    "SpotFleetRequestId": "sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE"  
}
```

- For API details, see [DescribeSpotFleetInstances](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

### Example 1: This example describes the instances associated with the specified Spot fleet request.

```
Get-EC2SpotFleetInstance -SpotFleetRequestId sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE
```

**Output:**

InstanceId	InstanceType	SpotInstanceRequestId
i-f089262a	c3.large	sir-12345678
i-7e8b24a4	c3.large	sir-87654321

- For API details, see [DescribeSpotFleetInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSpotFleetRequestHistory** with an AWS SDK or CLI

The following code examples show how to use **DescribeSpotFleetRequestHistory**.

### CLI

#### AWS CLI

##### To describe Spot fleet history

This example command returns the history for the specified Spot fleet starting at the specified time.

Command:

```
aws ec2 describe-spot-fleet-request-history --spot-fleet-request-id sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE --start-time 2015-05-26T00:00:00Z
```

The following example output shows the successful launches of two Spot Instances for the Spot fleet.

**Output:**

```
{  
  "HistoryRecords": [  
    {  
      "Timestamp": "2015-05-26T23:17:20.697Z",  
      "Status": "Launched",  
      "InstanceId": "i-7e8b24a4",  
      "Type": "Launch",  
      "SpotInstanceRequestId": "sir-87654321",  
      "OfferType": "Standard",  
      "PricePerSecond": 0.0001  
    },  
    {  
      "Timestamp": "2015-05-26T23:17:20.697Z",  
      "Status": "Launched",  
      "InstanceId": "i-f089262a",  
      "Type": "Launch",  
      "SpotInstanceRequestId": "sir-12345678",  
      "OfferType": "Standard",  
      "PricePerSecond": 0.0001  
    }  
  ]  
}
```

```
        "EventInformation": {
            "EventSubType": "submitted"
        },
        "EventType": "fleetRequestChange"
    },
    {
        "Timestamp": "2015-05-26T23:17:20.873Z",
        "EventInformation": {
            "EventSubType": "active"
        },
        "EventType": "fleetRequestChange"
    },
    {
        "Timestamp": "2015-05-26T23:21:21.712Z",
        "EventInformation": {
            "InstanceId": "i-1234567890abcdef0",
            "EventSubType": "launched"
        },
        "EventType": "instanceChange"
    },
    {
        "Timestamp": "2015-05-26T23:21:21.816Z",
        "EventInformation": {
            "InstanceId": "i-1234567890abcdef1",
            "EventSubType": "launched"
        },
        "EventType": "instanceChange"
    }
],
"SpotFleetRequestId": "sfr-73fb02ce-aa30-494c-8788-1cee4EXAMPLE",
"NextToken": "CpHNssscimcV5oH7bSbub03CI2Qms5+ypNpNm
+53MNlR0YcXAkp0xF1fKf91yVxSExmbtma3awYxMFzNA663ZskT0AHTJ6TCb2Z8bQC2EnZgyELbymtWPfpZ1ZbauV
+P+TfGlWxWWB/Vr5dk5d4LfdgA/DRAHUUrYgxzrEXAMPLE=",
"StartTime": "2015-05-26T00:00:00Z"
}
```

- For API details, see [DescribeSpotFleetRequestHistory](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the history of the specified Spot fleet request.**

```
Get-EC2SpotFleetRequestHistory -SpotFleetRequestId sfr-73fb2ce-  
aa30-494c-8788-1cee4EXAMPLE -StartTime 2015-12-26T00:00:00Z
```

## Output:

```
HistoryRecords      : {Amazon.EC2.Model.HistoryRecord,  
Amazon.EC2.Model.HistoryRecord...}  
LastEvaluatedTime   : 12/26/2015 8:29:11 AM  
NextToken          :  
SpotFleetRequestId : sfr-088bc5f1-7e7b-451a-bd13-757f10672b93  
StartTime         : 12/25/2015 8:00:00 AM
```

```
(Get-EC2SpotFleetRequestHistory -SpotFleetRequestId sfr-73fb2ce-  
aa30-494c-8788-1cee4EXAMPLE -StartTime 2015-12-26T00:00:00Z).HistoryRecords
```

## Output:

EventInformation	EventType	Timestamp
-----	-----	-----
Amazon.EC2.Model.EventInformation	fleetRequestChange	12/26/2015 8:23:33 AM
Amazon.EC2.Model.EventInformation	fleetRequestChange	12/26/2015 8:23:33 AM
Amazon.EC2.Model.EventInformation	fleetRequestChange	12/26/2015 8:23:33 AM
Amazon.EC2.Model.EventInformation	launched	12/26/2015 8:25:34 AM
Amazon.EC2.Model.EventInformation	launched	12/26/2015 8:25:05 AM

- For API details, see [DescribeSpotFleetRequestHistory](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSpotFleetRequests** with an AWS SDK or CLI

The following code examples show how to use **DescribeSpotFleetRequests**.

## CLI

### AWS CLI

#### To describe your Spot fleet requests

This example describes all of your Spot fleet requests.

Command:

```
aws ec2 describe-spot-fleet-requests
```

Output:

```
{  
    "SpotFleetRequestConfigs": [  
        {  
            "SpotFleetRequestId": "sfr-73fbd2ce-aa30-494c-8788-1cee4EXAMPLE",  
            "SpotFleetRequestConfig": {  
                "TargetCapacity": 20,  
                "LaunchSpecifications": [  
                    {  
                        "EbsOptimized": false,  
                        "NetworkInterfaces": [  
                            {  
                                "SubnetId": "subnet-a61dafcf",  
                                "DeviceIndex": 0,  
                                "DeleteOnTermination": false,  
                                "AssociatePublicIpAddress": true,  
                                "SecondaryPrivateIpAddressCount": 0  
                            }  
                        ],  
                        "InstanceType": "cc2.8xlarge",  
                        "ImageId": "ami-1a2b3c4d"  
                    },  
                    {  
                        "EbsOptimized": false,  
                        "NetworkInterfaces": [  
                            {  
                                "SubnetId": "subnet-a61dafcf",  
                                "DeviceIndex": 0,  
                                "DeleteOnTermination": false,  
                                "AssociatePublicIpAddress": true,  
                                "SecondaryPrivateIpAddressCount": 0  
                            }  
                        ]  
                    }  
                ]  
            }  
        }  
    ]  
}
```

```
        },
      ],
      "InstanceType": "r3.8xlarge",
      "ImageId": "ami-1a2b3c4d"
    }
  ],
  "SpotPrice": "0.05",
  "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role"
},
"SpotFleetRequestState": "active"
},
{
  "SpotFleetRequestId": "sfr-306341ed-9739-402e-881b-ce47bEXAMPLE",
  "SpotFleetRequestConfig": {
    "TargetCapacity": 20,
    "LaunchSpecifications": [
      {
        "EbsOptimized": false,
        "NetworkInterfaces": [
          {
            "SubnetId": "subnet-6e7f829e",
            "DeviceIndex": 0,
            "DeleteOnTermination": false,
            "AssociatePublicIpAddress": true,
            "SecondaryPrivateIpAddressCount": 0
          }
        ],
        "InstanceType": "m3.medium",
        "ImageId": "ami-1a2b3c4d"
      }
    ],
    "SpotPrice": "0.05",
    "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role"
  },
  "SpotFleetRequestState": "active"
}
]
```

## To describe a Spot fleet request

This example describes the specified Spot fleet request.

Command:

```
aws ec2 describe-spot-fleet-requests --spot-fleet-request-ids sfr-73fdbd2ce-aa30-494c-8788-1cee4EXAMPLE
```

Output:

```
{  
    "SpotFleetRequestConfigs": [  
        {  
            "SpotFleetRequestId": "sfr-73fdbd2ce-aa30-494c-8788-1cee4EXAMPLE",  
            "SpotFleetRequestConfig": {  
                "TargetCapacity": 20,  
                "LaunchSpecifications": [  
                    {  
                        "EbsOptimized": false,  
                        "NetworkInterfaces": [  
                            {  
                                "SubnetId": "subnet-a61dafcf",  
                                "DeviceIndex": 0,  
                                "DeleteOnTermination": false,  
                                "AssociatePublicIpAddress": true,  
                                "SecondaryPrivateIpAddressCount": 0  
                            }  
,  
                            {"InstanceType": "cc2.8xlarge",  
                             "ImageId": "ami-1a2b3c4d"}  
,  
                            {  
                                "EbsOptimized": false,  
                                "NetworkInterfaces": [  
                                    {  
                                        "SubnetId": "subnet-a61dafcf",  
                                        "DeviceIndex": 0,  
                                        "DeleteOnTermination": false,  
                                        "AssociatePublicIpAddress": true,  
                                        "SecondaryPrivateIpAddressCount": 0  
                                    }  
,  
                                    {"InstanceType": "r3.8xlarge",  
                                     "ImageId": "ami-1a2b3c4d"}  
,  
                                    {"SpotPrice": "0.05",  
                                     "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role"}  
                ]  
            }  
        }  
    ]  
}
```

```
        },
        "SpotFleetRequestState": "active"
    ]
}
```

- For API details, see [DescribeSpotFleetRequests](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified Spot fleet request.

```
Get-EC2SpotFleetRequest -SpotFleetRequestId sfr-73fb2ce-
aa30-494c-8788-1cee4EXAMPLE | format-list
```

#### Output:

```
ConfigData      : Amazon.EC2.Model.SpotFleetRequestConfigData
CreateTime      : 12/26/2015 8:23:33 AM
SpotFleetRequestId : sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE
SpotFleetRequestState : active
```

#### Example 2: This example describes all your Spot fleet requests.

```
Get-EC2SpotFleetRequest
```

- For API details, see [DescribeSpotFleetRequests](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeSpotInstanceRequests` with an AWS SDK or CLI

The following code examples show how to use `DescribeSpotInstanceRequests`.

## CLI

### AWS CLI

#### Example 1: To describe a Spot Instance request

The following `describe-spot-instance-requests` example describes the specified Spot Instance request.

```
aws ec2 describe-spot-instance-requests \
--spot-instance-request-ids sir-08b93456
```

Output:

```
{
    "SpotInstanceRequests": [
        {
            "CreateTime": "2018-04-30T18:14:55.000Z",
            "InstanceId": "i-1234567890abcdef1",
            "LaunchSpecification": {
                "InstanceType": "t2.micro",
                "ImageId": "ami-003634241a8fcdec0",
                "KeyName": "my-key-pair",
                "SecurityGroups": [
                    {
                        "GroupName": "default",
                        "GroupId": "sg-e38f24a7"
                    }
                ],
                "BlockDeviceMappings": [
                    {
                        "DeviceName": "/dev/sda1",
                        "Ebs": {
                            "DeleteOnTermination": true,
                            "SnapshotId": "snap-0e54a519c999adb9bd",
                            "VolumeSize": 8,
                            "VolumeType": "standard",
                            "Encrypted": false
                        }
                    }
                ],
                "NetworkInterfaces": [
                    {

```

```
        "DeleteOnTermination": true,
        "DeviceIndex": 0,
        "SubnetId": "subnet-049df61146c4d7901"
    },
],
"Placement": {
    "AvailabilityZone": "us-east-2b",
    "Tenancy": "default"
},
"Monitoring": {
    "Enabled": false
},
"LaunchedAvailabilityZone": "us-east-2b",
"ProductDescription": "Linux/UNIX",
"SpotInstanceRequestId": "sir-08b93456",
"SpotPrice": "0.010000",
"State": "active",
"Status": {
    "Code": "fulfilled",
    "Message": "Your Spot request is fulfilled.",
    "UpdateTime": "2018-04-30T18:16:21.000Z"
},
"Tags": [],
"Type": "one-time",
"InstanceInterruptionBehavior": "terminate"
}
]
}
```

## Example 2: To describe Spot Instance requests based on filters

The following `describe-spot-instance-requests` example uses filters to scope the results to Spot Instance requests with the specified instance type in the specified Availability Zone. The example uses the `--query` parameter to display only the instance IDs.

```
aws ec2 describe-spot-instance-requests \
--filters Name=launch.instance-type,Values=m3.medium Name=launched-
availability-zone,Values=us-east-2a \
--query "SpotInstanceRequests[*].[InstanceId]" \
--output text
```

Output:

```
i-057750d42936e468a  
i-001efd250faaa6ffa  
i-027552a73f021f3bd  
...
```

For additional examples using filters, see [Listing and filtering your resources](#) in the *Amazon Elastic Compute Cloud User Guide*.

### Example 3: To describe Spot Instance requests based on tags

The following `describe-spot-instance-requests` example uses tag filters to scope the results to Spot Instance requests that have the tag `cost-center=cc123`.

```
aws ec2 describe-spot-instance-requests \  
  --filters Name=tag:cost-center,Values=cc123
```

For an example of the output for `describe-spot-instance-requests`, see Example 1.

For additional examples using tag filters, see [Working with tags](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeSpotInstanceRequests](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified Spot instance request.

```
Get-EC2SpotInstanceRequest -SpotInstanceRequestId sir-12345678
```

#### Output:

```
ActualBlockHourlyPrice      :  
AvailabilityZoneGroup       :  
BlockDurationMinutes        : 0  
CreateTime                 : 4/8/2015 2:51:33 PM  
Fault                      :  
InstanceId                 : i-12345678  
LaunchedAvailabilityZone   : us-west-2b  
LaunchGroup                :  
LaunchSpecification         : Amazon.EC2.Model.LaunchSpecification
```

ProductDescription	:	Linux/UNIX
SpotInstanceRequestId	:	sir-12345678
SpotPrice	:	0.020000
State	:	active
Status	:	Amazon.EC2.Model.SpotInstanceState
Tags	:	{Name}
Type	:	one-time

## Example 2: This example describes all your Spot instance requests.

Get-EC2SpotInstanceRequest

- For API details, see [DescribeSpotInstanceRequests](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeSpotPriceHistory** with an AWS SDK or CLI

The following code examples show how to use **DescribeSpotPriceHistory**.

### CLI

#### AWS CLI

##### To describe Spot price history

This example command returns the Spot Price history for m1.xlarge instances for a particular day in January.

Command:

```
aws ec2 describe-spot-price-history --instance-types m1.xlarge --start-time 2014-01-06T07:08:09 --end-time 2014-01-06T08:09:10
```

Output:

```
{  
    "SpotPriceHistory": [  
        {  
            "AvailabilityZone": "us-east-1a",  
            "EndPrice": 0.020000000000000002,  
            "EndTime": "2014-01-06T07:08:09.000Z",  
            "InstanceType": "m1.xlarge",  
            "Price": 0.020000000000000002,  
            "Region": "us-east-1",  
            "StartPrice": 0.020000000000000002,  
            "StartTime": "2014-01-06T07:08:09.000Z"  
        }  
    ]  
}
```

```
{  
    "Timestamp": "2014-01-06T07:10:55.000Z",  
    "ProductDescription": "SUSE Linux",  
    "InstanceType": "m1.xlarge",  
    "SpotPrice": "0.087000",  
    "AvailabilityZone": "us-west-1b"  
},  
{  
    "Timestamp": "2014-01-06T07:10:55.000Z",  
    "ProductDescription": "SUSE Linux",  
    "InstanceType": "m1.xlarge",  
    "SpotPrice": "0.087000",  
    "AvailabilityZone": "us-west-1c"  
},  
{  
    "Timestamp": "2014-01-06T05:42:36.000Z",  
    "ProductDescription": "SUSE Linux (Amazon VPC)",  
    "InstanceType": "m1.xlarge",  
    "SpotPrice": "0.087000",  
    "AvailabilityZone": "us-west-1a"  
},  
...  
}
```

## To describe Spot price history for Linux/UNIX Amazon VPC

This example command returns the Spot Price history for m1.xlarge, Linux/UNIX Amazon VPC instances for a particular day in January.

Command:

```
aws ec2 describe-spot-price-history --instance-types m1.xlarge --product-  
description "Linux/UNIX (Amazon VPC)" --start-time 2014-01-06T07:08:09 --end-  
time 2014-01-06T08:09:10
```

Output:

```
{  
    "SpotPriceHistory": [  
        {  
            "Timestamp": "2014-01-06T04:32:53.000Z",  
            "ProductDescription": "Linux/UNIX (Amazon VPC)",  
            "InstanceType": "m1.xlarge",  
            "SpotPrice": "0.087000",  
            "AvailabilityZone": "us-west-1a"  
        }  
    ]  
}
```

```
        "SpotPrice": "0.080000",
        "AvailabilityZone": "us-west-1a"
    },
    {
        "Timestamp": "2014-01-05T11:28:26.000Z",
        "ProductDescription": "Linux/UNIX (Amazon VPC)",
        "InstanceType": "m1.xlarge",
        "SpotPrice": "0.080000",
        "AvailabilityZone": "us-west-1c"
    }
]
```

- For API details, see [DescribeSpotPriceHistory](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example gets the last 10 entries in the Spot price history for the specified instance type and Availability Zone. Note that the value specified for the -AvailabilityZone parameter must be valid for the region value supplied to either the cmdlet's -Region parameter (not shown in the example) or set as default in the shell. This example command assumes a default region of 'us-west-2' has been set in the environment.**

```
Get-EC2SpotPriceHistory -InstanceType c3.large -AvailabilityZone us-west-2a -
MaxResult 10
```

### Output:

```
AvailabilityZone      : us-west-2a
InstanceType         : c3.large
Price                : 0.017300
ProductDescription   : Linux/UNIX (Amazon VPC)
Timestamp            : 12/25/2015 7:39:49 AM

AvailabilityZone      : us-west-2a
InstanceType         : c3.large
Price                : 0.017200
ProductDescription   : Linux/UNIX (Amazon VPC)
```

```
Timestamp : 12/25/2015 7:38:29 AM  
  
AvailabilityZone : us-west-2a  
InstanceType : c3.large  
Price : 0.017300  
ProductDescription : Linux/UNIX (Amazon VPC)  
Timestamp : 12/25/2015 6:57:13 AM  
...
```

- For API details, see [DescribeSpotPriceHistory](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeSubnets` with an AWS SDK or CLI

The following code examples show how to use `DescribeSubnets`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>  
/// Get all the subnets for a Vpc in a set of availability zones.  
/// </summary>  
/// <param name="vpcId">The Id of the Vpc.</param>  
/// <param name="availabilityZones">The list of availability zones.</param>
```

```
/// <returns>The collection of subnet objects.</returns>
public async Task<List<Subnet>> GetAllVpcSubnetsForZones(string vpcId,
List<string> availabilityZones)
{
    var subnets = new List<Subnet>();
    var subnetPaginator = _amazonEc2.Paginator.DescribeSubnets(
        new DescribeSubnetsRequest()
    {
        Filters = new List<Amazon.EC2.Model.Filter>()
        {
            new ("vpc-id", new List<string>() { vpcId}),
            new ("availability-zone", availabilityZones),
            new ("default-for-az", new List<string>() { "true" })
        }
    });
}

// Get the entire list using the paginator.
await foreach (var subnet in subnetPaginator.Subnets)
{
    subnets.Add(subnet);
}

return subnets;
}
```

- For API details, see [DescribeSubnets](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### Example 1: To describe all your subnets

The following describe-subnets example displays the details of your subnets.

```
aws ec2 describe-subnets
```

#### Output:

```
{
    "Subnets": [
        {

```

```
        "AvailabilityZone": "us-east-1d",
        "AvailabilityZoneId": "use1-az2",
        "AvailableIpAddressCount": 4089,
        "CidrBlock": "172.31.80.0/20",
        "DefaultForAz": true,
        "MapPublicIpOnLaunch": false,
        "MapCustomerOwnedIpOnLaunch": true,
        "State": "available",
        "SubnetId": "subnet-0bb1c79de3EXAMPLE",
        "VpcId": "vpc-0ee975135dEXAMPLE",
        "OwnerId": "111122223333",
        "AssignIpv6AddressOnCreation": false,
        "Ipv6CidrBlockAssociationSet": [],
        "CustomerOwnedIpv4Pool": "pool-2EXAMPLE",
        "SubnetArn": "arn:aws:ec2:us-east-2:111122223333:subnet/
subnet-0bb1c79de3EXAMPLE",
        "EnableDns64": false,
        "Ipv6Native": false,
        "PrivateDnsNameOptionsOnLaunch": {
            "HostnameType": "ip-name",
            "EnableResourceNameDnsARecord": false,
            "EnableResourceNameDnsAAAARecord": false
        }
    },
    {
        "AvailabilityZone": "us-east-1d",
        "AvailabilityZoneId": "use1-az2",
        "AvailableIpAddressCount": 4089,
        "CidrBlock": "172.31.80.0/20",
        "DefaultForAz": true,
        "MapPublicIpOnLaunch": true,
        "MapCustomerOwnedIpOnLaunch": false,
        "State": "available",
        "SubnetId": "subnet-8EXAMPLE",
        "VpcId": "vpc-3EXAMPLE",
        "OwnerId": "111122223333",
        "AssignIpv6AddressOnCreation": false,
        "Ipv6CidrBlockAssociationSet": [],
        "Tags": [
            {
                "Key": "Name",
                "Value": "MySubnet"
            }
        ],
    }
```

```
"SubnetArn": "arn:aws:ec2:us-east-1:111122223333:subnet/  
subnet-8EXAMPLE",  
    "EnableDns64": false,  
    "Ipv6Native": false,  
    "PrivateDnsNameOptionsOnLaunch": {  
        "HostnameType": "ip-name",  
        "EnableResourceNameDnsARecord": false,  
        "EnableResourceNameDnsAAAARecord": false  
    }  
}  
]  
}
```

For more information, see [Working with VPCs and Subnets](#) in the *AWS VPC User Guide*.

### Example 2: To describe the subnets of a specific VPC

The following `describe-subnets` example uses a filter to retrieve details for the subnets of the specified VPC.

```
aws ec2 describe-subnets \  
--filters "Name=vpc-id,Values=vpc-3EXAMPLE"
```

Output:

```
{  
    "Subnets": [  
        {  
            "AvailabilityZone": "us-east-1d",  
            "AvailabilityZoneId": "use1-az2",  
            "AvailableIpAddressCount": 4089,  
            "CidrBlock": "172.31.80.0/20",  
            "DefaultForAz": true,  
            "MapPublicIpOnLaunch": true,  
            "MapCustomerOwnedIpOnLaunch": false,  
            "State": "available",  
            "SubnetId": "subnet-8EXAMPLE",  
            "VpcId": "vpc-3EXAMPLE",  
            "OwnerId": "111122223333",  
            "AssignIpv6AddressOnCreation": false,  
            "Ipv6CidrBlockAssociationSet": [],  
            "Tags": [
```

```
{  
    "Key": "Name",  
    "Value": "MySubnet"  
}  
,  
    "SubnetArn": "arn:aws:ec2:us-east-1:111122223333:subnet/  
subnet-8EXAMPLE",  
    "EnableDns64": false,  
    "Ipv6Native": false,  
    "PrivateDnsNameOptionsOnLaunch": {  
        "HostnameType": "ip-name",  
        "EnableResourceNameDnsARecord": false,  
        "EnableResourceNameDnsAAAARecord": false  
    }  
}  
]  
}
```

For more information, see [Working with VPCs and Subnets](#) in the *AWS VPC User Guide*.

### Example 3: To describe the subnets with a specific tag

The following `describe-subnets` example uses a filter to retrieve the details of those subnets with the tag `CostCenter=123` and the `--query` parameter to display the subnet IDs of the subnets with this tag.

```
aws ec2 describe-subnets \  
--filters "Name>tag:CostCenter,Values=123" \  
--query "Subnets[*].SubnetId" \  
--output text
```

Output:

```
subnet-0987a87c8b37348ef  
subnet-02a95061c45f372ee  
subnet-03f720e7de2788d73
```

For more information, see [Working with VPCs and Subnets](#) in the *Amazon VPC User Guide*.

- For API details, see [DescribeSubnets](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
const client = new EC2Client({});  
const { Subnets } = await client.send(  
  new DescribeSubnetsCommand({  
    Filters: [  
      { Name: "vpc-id", Values: [state.defaultVpc] },  
      { Name: "availability-zone", Values: state.availabilityZoneNames },  
      { Name: "default-for-az", Values: ["true"] },  
    ],  
  }),  
);
```

- For API details, see [DescribeSubnets](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified subnet.

```
Get-EC2Subnet -SubnetId subnet-1a2b3c4d
```

#### Output:

```
AvailabilityZone      : us-west-2c  
AvailableIpAddressCount : 251  
CidrBlock            : 10.0.0.0/24  
DefaultForAz         : False  
MapPublicIpOnLaunch  : False  
State                : available  
SubnetId             : subnet-1a2b3c4d
```

```
Tags : {}
VpcId : vpc-12345678
```

## Example 2: This example describes all your subnets.

Get-EC2Subnet

- For API details, see [DescribeSubnets](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:
    """
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.
    """

    def __init__(
        self,
        resource_prefix,
        inst_type,
        ami_param,
        autoscaling_client,
        ec2_client,
        ssm_client,
        iam_client,
    ):
        """
        :param resource_prefix: The prefix for naming AWS resources that are
        created by this class.
        :param inst_type: The type of EC2 instance to create, such as t3.micro.
        :param ami_param: The Systems Manager parameter used to look up the AMI
        that is
            created.
        
```

```
:param autoscaling_client: A Boto3 EC2 Auto Scaling client.  
:param ec2_client: A Boto3 EC2 client.  
:param ssm_client: A Boto3 Systems Manager client.  
:param iam_client: A Boto3 IAM client.  
"""  
  
    self.inst_type = inst_type  
    self.ami_param = ami_param  
    self.autoscaling_client = autoscaling_client  
    self.ec2_client = ec2_client  
    self.ssm_client = ssm_client  
    self.iam_client = iam_client  
    self.launch_template_name = f"{resource_prefix}-template"  
    self.group_name = f"{resource_prefix}-group"  
    self.instance_policy_name = f"{resource_prefix}-pol"  
    self.instance_role_name = f"{resource_prefix}-role"  
    self.instance_profile_name = f"{resource_prefix}-prof"  
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"  
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"  
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"  
    self.key_pair_name = f"{resource_prefix}-key-pair"  
  
  
def get_subnets(self, vpc_id, zones):  
    """  
        Gets the default subnets in a VPC for a specified list of Availability  
        Zones.  
  
        :param vpc_id: The ID of the VPC to look up.  
        :param zones: The list of Availability Zones to look up.  
        :return: The list of subnets found.  
    """  
  
    try:  
        response = self.ec2_client.describe_subnets(  
            Filters=[  
                {"Name": "vpc-id", "Values": [vpc_id]},  
                {"Name": "availability-zone", "Values": zones},  
                {"Name": "default-for-az", "Values": ["true"]},  
            ]  
    )  
    subnets = response["Subnets"]  
    log.info("Found %s subnets for the specified zones.", len(subnets))  
except ClientError as err:  
    raise AutoScalerError(f"Couldn't get subnets: {err}")  
else:
```

```
return subnets
```

- For API details, see [DescribeSubnets](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeTags` with an AWS SDK or CLI

The following code examples show how to use `DescribeTags`.

### CLI

#### AWS CLI

##### Example 1: To describe all tags for a single resource

The following `describe-tags` example describes the tags for the specified instance.

```
aws ec2 describe-tags \
--filters "Name=resource-id,Values=i-1234567890abcdef8"
```

Output:

```
{
    "Tags": [
        {
            "ResourceType": "instance",
            "ResourceId": "i-1234567890abcdef8",
            "Value": "Test",
            "Key": "Stack"
        },
        {
            "ResourceType": "instance",
            "ResourceId": "i-1234567890abcdef8",
            "Value": "Beta Server",
            "Key": "Name"
        }
    ]
}
```

{

## Example 2: To describe all tags for a resource type

The following describe-tags example describes the tags for your volumes.

```
aws ec2 describe-tags \
--filters "Name=resource-type,Values=volume"
```

Output:

```
{
  "Tags": [
    {
      "ResourceType": "volume",
      "ResourceId": "vol-1234567890abcdef0",
      "Value": "Project1",
      "Key": "Purpose"
    },
    {
      "ResourceType": "volume",
      "ResourceId": "vol-049df61146c4d7901",
      "Value": "Logs",
      "Key": "Purpose"
    }
  ]
}
```

## Example 3: To describe all your tags

The following describe-tags example describes the tags for all your resources.

```
aws ec2 describe-tags
```

## Example 4: To describe the tags for your resources based on a tag key

The following describe-tags example describes the tags for your resources that have a tag with the key Stack.

```
aws ec2 describe-tags \
--filters Name=key,Values=Stack
```

**Output:**

```
{  
    "Tags": [  
        {  
            "ResourceType": "volume",  
            "ResourceId": "vol-027552a73f021f3b",  
            "Value": "Production",  
            "Key": "Stack"  
        },  
        {  
            "ResourceType": "instance",  
            "ResourceId": "i-1234567890abcdef8",  
            "Value": "Test",  
            "Key": "Stack"  
        }  
    ]  
}
```

**Example 5: To describe the tags for your resources based on a tag key and tag value**

The following `describe-tags` example describes the tags for your resources that have the tag `Stack=Test`.

```
aws ec2 describe-tags \  
    --filters Name=key,Values=Stack Name=value,Values=Test
```

**Output:**

```
{  
    "Tags": [  
        {  
            "ResourceType": "image",  
            "ResourceId": "ami-3ac336533f021f3bd",  
            "Value": "Test",  
            "Key": "Stack"  
        },  
        {  
            "ResourceType": "instance",  
            "ResourceId": "i-1234567890abcdef8",  
            "Value": "Test",  
            "Key": "Stack"  
        }  
    ]  
}
```

```
]  
}
```

The following `describe-tags` example uses alternate syntax to describe resources with the tag `Stack=Test`.

```
aws ec2 describe-tags \  
  --filters "Name=tag:Stack,Values=Test"
```

The following `describe-tags` example describes the tags for all your instances that have a tag with the key `Purpose` and no value.

```
aws ec2 describe-tags \  
  --filters "Name=resource-  
type,Values=instance" "Name=key,Values=Purpose" "Name=value,Values=""
```

Output:

```
{  
  "Tags": [  
    {  
      "ResourceType": "instance",  
      "ResourceId": "i-1234567890abcdef5",  
      "Value": null,  
      "Key": "Purpose"  
    }  
  ]  
}
```

- For API details, see [DescribeTags](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example fetches the tags for resource-type 'image'

```
Get-EC2Tag -Filter @{Name="resource-type";Values="image"}
```

Output:

Key	ResourceId	ResourceType	Value
---	-----	-----	-----
Name	ami-0a123b4ccb567a8ea	image	Win7-Imported
auto-delete	ami-0a123b4ccb567a8ea	image	never

**Example 2: This example fetches all the tags for all the resources and groups them by resource type**

```
Get-EC2Tag | Group-Object resourcetype
```

**Output:**

Count	Name	Group
-----	-----	-----
9	subnet	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription...}
53	instance	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription...}
3	route-table	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription}
5	security-group	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription...}
30	volume	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription...}
1	internet-gateway	{Amazon.EC2.Model.TagDescription}
3	network-interface	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription}
4	elastic-ip	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription}
1	dhcp-options	{Amazon.EC2.Model.TagDescription}
2	image	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription}
3	vpc	{Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription, Amazon.EC2.Model.TagDescription}

**Example 3: This example displays all the resources with tag 'auto-delete' with value 'no' for the given region**

```
Get-EC2Tag -Region eu-west-1 -Filter @{Name="tag:auto-delete";Values="no"}
```

### Output:

Key	ResourceId	ResourceType	Value
---	-----	-----	-----
auto-delete	i-0f1bce234d5dd678b	instance	no
auto-delete	vol-01d234aa5678901a2	volume	no
auto-delete	vol-01234bfb5def6f7b8	volume	no
auto-delete	vol-01ccb23f4c5e67890	volume	no

**Example 4:** This example obtains all the resources with tag 'auto-delete' with 'no' value and further filters in the next pipe to parse only 'instance' resource types and eventually creates 'ThisInstance' tag for each instance resources with value being the instance id itself

```
Get-EC2Tag -Region eu-west-1 -Filter @{Name="tag:auto-delete";Values="no"}  
| Where-Object ResourceType -eq "instance" | ForEach-Object {New-EC2Tag -  
ResourceId $_.ResourceId -Tag @{Key="ThisInstance";Value=$_.ResourceId}}
```

**Example 5:** This example fetches tags for all the instance resources as well as 'Name' keys and displays them in a table format

```
Get-EC2Tag -Filter @{Name="resource-  
type";Values="instance"},@{Name="key";Values="Name"} | Select-Object ResourceId,  
@{Name="Name-Tag";Expression={$PSItem.Value}} | Format-Table -AutoSize
```

### Output:

ResourceId	Name-Tag
---	-----
i-012e3cb4df567e1aa	jump1
i-01c23a45d6fc7a89f	repro-3

- For API details, see [DescribeTags](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `DescribeVolumeAttribute` with an AWS SDK or CLI

The following code examples show how to use `DescribeVolumeAttribute`.

## CLI

### AWS CLI

#### To describe a volume attribute

This example command describes the `autoEnableIo` attribute of the volume with the ID `vol-049df61146c4d7901`.

Command:

```
aws ec2 describe-volume-attribute --volume-id vol-049df61146c4d7901 --  
attribute autoEnableIO
```

Output:

```
{  
    "AutoEnableIO": {  
        "Value": false  
    },  
    "VolumeId": "vol-049df61146c4d7901"  
}
```

- For API details, see [DescribeVolumeAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified attribute of the specified volume.

```
Get-EC2VolumeAttribute -VolumeId vol-12345678 -Attribute AutoEnableIO
```

Output:

AutoEnableIO	ProductCodes	VolumeId
-----	-----	-----

False	{}	vol-12345678
-------	----	--------------

- For API details, see [DescribeVolumeAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVolumeStatus` with an AWS SDK or CLI

The following code examples show how to use `DescribeVolumeStatus`.

CLI

### AWS CLI

#### To describe the status of a single volume

This example command describes the status for the volume `vol-1234567890abcdef0`.

Command:

```
aws ec2 describe-volume-status --volume-ids vol-1234567890abcdef0
```

Output:

```
{
    "VolumeStatuses": [
        {
            "VolumeStatus": {
                "Status": "ok",
                "Details": [
                    {
                        "Status": "passed",
                        "Name": "io-enabled"
                    },
                    {
                        "Status": "not-applicable",
                        "Name": "io-performance"
                    }
                ]
            }
        }
    ]
}
```

```
        },
        "AvailabilityZone": "us-east-1a",
        "VolumeId": "vol-1234567890abcdef0",
        "Actions": [],
        "Events": []
    },
]
}
```

## To describe the status of impaired volumes

This example command describes the status for all volumes that are impaired. In this example output, there are no impaired volumes.

Command:

```
aws ec2 describe-volume-status --filters Name=volume-
status.status,Values=impaired
```

Output:

```
{
    "VolumeStatuses": []
}
```

If you have a volume with a failed status check (status is impaired), see [Working with an Impaired Volume](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeVolumeStatus](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the status of the specified volume.

```
Get-EC2VolumeStatus -VolumeId vol-12345678
```

Output:

```
Actions : {}
```

```
AvailabilityZone : us-west-2a
Events          : {}
VolumeId        : vol-12345678
VolumeStatus    : Amazon.EC2.Model.VolumeStatusInfo
```

```
(Get-EC2VolumeStatus -VolumeId vol-12345678).VolumeStatus
```

## Output:

Details	Status
-----	-----
{io-enabled, io-performance}	ok

```
(Get-EC2VolumeStatus -VolumeId vol-12345678).VolumeStatus.Details
```

## Output:

Name	Status
----	-----
io-enabled	passed
io-performance	not-applicable

- For API details, see [DescribeVolumeStatus](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeVolumes** with an AWS SDK or CLI

The following code examples show how to use **DescribeVolumes**.

### CLI

#### AWS CLI

##### Example 1: To describe a volume

The following `describe-volumes` example describes the specified volumes in the current Region.

```
aws ec2 describe-volumes \
--volume-ids vol-049df61146c4d7901 vol-1234567890abcdef0
```

Output:

```
{
    "Volumes": [
        {
            "AvailabilityZone": "us-east-1a",
            "Attachments": [
                {
                    "AttachTime": "2013-12-18T22:35:00.000Z",
                    "InstanceId": "i-1234567890abcdef0",
                    "VolumeId": "vol-049df61146c4d7901",
                    "State": "attached",
                    "DeleteOnTermination": true,
                    "Device": "/dev/sda1"
                }
            ],
            "Encrypted": true,
            "KmsKeyId": "arn:aws:kms:us-east-2a:123456789012:key/8c5b2c63-
b9bc-45a3-a87a-5513eEXAMPLE",
            "VolumeType": "gp2",
            "VolumeId": "vol-049df61146c4d7901",
            "State": "in-use",
            "Iops": 100,
            "SnapshotId": "snap-1234567890abcdef0",
            "CreateTime": "2019-12-18T22:35:00.084Z",
            "Size": 8
        },
        {
            "AvailabilityZone": "us-east-1a",
            "Attachments": [],
            "Encrypted": false,
            "VolumeType": "gp2",
            "VolumeId": "vol-1234567890abcdef0",
            "State": "available",
            "Iops": 300,
            "SnapshotId": "",
            "CreateTime": "2020-02-27T00:02:41.791Z",
            "Size": 100
        }
    ]
}
```

```
}
```

## Example 2: To describe volumes that are attached to a specific instance

The following describe-volumes example describes all volumes that are both attached to the specified instance and set to delete when the instance terminates.

```
aws ec2 describe-volumes \
  --region us-east-1 \
  --filters Name=attachment.instance-
  id,Values=i-1234567890abcdef0 Name=attachment.delete-on-termination,Values=true
```

For an example of the output for describe-volumes, see Example 1.

## Example 3: To describe available volumes in a specific Availability Zone

The following describe-volumes example describes all volumes that have a status of available and are in the specified Availability Zone.

```
aws ec2 describe-volumes \
  --filters Name=status,Values=available Name=availability-zone,Values=us-
  east-1a
```

For an example of the output for describe-volumes, see Example 1.

## Example 4: To describe volumes based on tags

The following describe-volumes example describes all volumes that have the tag key Name and a value that begins with Test. The output is then filtered with a query that displays only the tags and IDs of the volumes.

```
aws ec2 describe-volumes \
  --filters Name=tag:Name,Values=Test* \
  --query "Volumes[*].{ID:VolumeId, Tag:Tags}"
```

Output:

```
[
  {
    "Tag": [
      {
        "Value": "Test2",
```

```
        "Key": "Name"
    }
],
"ID": "vol-1234567890abcdef0"
},
{
    "Tag": [
        {
            "Value": "Test1",
            "Key": "Name"
        }
    ],
    "ID": "vol-049df61146c4d7901"
}
]
```

For additional examples using tag filters, see [Working with tags](#) in the *Amazon EC2 User Guide*.

- For API details, see [DescribeVolumes](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified EBS volume.**

```
Get-EC2Volume -VolumeId vol-12345678
```

### Output:

```
Attachments      : {}
AvailabilityZone : us-west-2c
CreateTime       : 7/17/2015 4:35:19 PM
Encrypted        : False
Iops             : 90
KmsKeyId         :
Size             : 30
SnapshotId       : snap-12345678
State            : in-use
Tags             : {}
VolumeId         : vol-12345678
```

```
VolumeType      : standard
```

**Example 2: This example describes your EBS volumes that have the status 'available'.**

```
Get-EC2Volume -Filter @{ Name="status"; Values="available" }
```

**Output:**

```
Attachments      : {}
AvailabilityZone : us-west-2c
CreateTime       : 12/21/2015 2:31:29 PM
Encrypted        : False
Iops             : 60
KmsKeyId         :
Size             : 20
SnapshotId       : snap-12345678
State            : available
Tags             : {}
VolumeId         : vol-12345678
VolumeType       : gp2
...
```

**Example 3: This example describes all your EBS volumes.**

```
Get-EC2Volume
```

- For API details, see [DescribeVolumes](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeVpcAttribute** with an AWS SDK or CLI

The following code examples show how to use **DescribeVpcAttribute**.

### CLI

#### AWS CLI

##### To describe the **enableDnsSupport** attribute

This example describes the `enableDnsSupport` attribute. This attribute indicates whether DNS resolution is enabled for the VPC. If this attribute is `true`, the Amazon DNS server resolves DNS hostnames for your instances to their corresponding IP addresses; otherwise, it does not.

Command:

```
aws ec2 describe-vpc-attribute --vpc-id vpc-a01106c2 --attribute enableDnsSupport
```

Output:

```
{  
    "VpcId": "vpc-a01106c2",  
    "EnableDnsSupport": {  
        "Value": true  
    }  
}
```

### To describe the `enableDnsHostnames` attribute

This example describes the `enableDnsHostnames` attribute. This attribute indicates whether the instances launched in the VPC get DNS hostnames. If this attribute is `true`, instances in the VPC get DNS hostnames; otherwise, they do not.

Command:

```
aws ec2 describe-vpc-attribute --vpc-id vpc-a01106c2 --  
attribute enableDnsHostnames
```

Output:

```
{  
    "VpcId": "vpc-a01106c2",  
    "EnableDnsHostnames": {  
        "Value": true  
    }  
}
```

- For API details, see [DescribeVpcAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the 'enableDnsSupport' attribute.**

```
Get-EC2VpcAttribute -VpcId vpc-12345678 -Attribute enableDnsSupport
```

**Output:**

```
EnableDnsSupport  
-----  
True
```

**Example 2: This example describes the 'enableDnsHostnames' attribute.**

```
Get-EC2VpcAttribute -VpcId vpc-12345678 -Attribute enableDnsHostnames
```

**Output:**

```
EnableDnsHostnames  
-----  
True
```

- For API details, see [DescribeVpcAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DescribeVpcClassicLink** with an AWS SDK or CLI

The following code examples show how to use `DescribeVpcClassicLink`.

CLI

### AWS CLI

#### To describe the ClassicLink status of your VPCs

This example lists the ClassicLink status of `vpc-88888888`.

Command:

```
aws ec2 describe-vpc-classic-link --vpc-id vpc-88888888
```

Output:

```
{  
    "Vpcs": [  
        {  
            "ClassicLinkEnabled": true,  
            "VpcId": "vpc-88888888",  
            "Tags": [  
                {  
                    "Value": "classiclinkvpc",  
                    "Key": "Name"  
                }  
            ]  
        }  
    ]  
}
```

This example lists only VPCs that are enabled for Classiclink (the filter value of `is-classic-link-enabled` is set to `true`).

Command:

```
aws ec2 describe-vpc-classic-link --filter "Name=is-classic-link-  
enabled,Values=true"
```

- For API details, see [DescribeVpcClassicLink](#) in AWS CLI Command Reference.

PowerShell

## Tools for PowerShell

**Example 1: Above example returns all the VPCs with their ClassicLinkEnabled state for the region**

```
Get-EC2VpcClassicLink -Region eu-west-1
```

Output:

ClassicLinkEnabled	Tags	VpcId
-----	-----	-----
False	{Name}	vpc-0fc1ff23f45b678eb
False	{}	vpc-01e23c4a5d6db78e9
False	{Name}	vpc-0123456b078b9d01f
False	{}	vpc-12cf3b4f
False	{Name}	vpc-0b12d3456a7e8901d

- For API details, see [DescribeVpcClassicLink](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVpcClassicLinkDnsSupport` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpcClassicLinkDnsSupport`.

CLI

### AWS CLI

#### To describe ClassicLink DNS support for your VPCs

This example describes the ClassicLink DNS support status of all of your VPCs.

Command:

```
aws ec2 describe-vpc-classic-link-dns-support
```

Output:

```
{
  "Vpcs": [
    {
      "VpcId": "vpc-88888888",
      "ClassicLinkDnsSupported": true
    },
    {
      "VpcId": "vpc-1a2b3c4d",
      "ClassicLinkDnsSupported": false
    }
  ]
}
```

```
    ]  
}
```

- For API details, see [DescribeVpcClassicLinkDnsSupport](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the ClassicLink DNS support status of VPCs for the region eu-west-1**

```
Get-EC2VpcClassicLinkDnsSupport -VpcId vpc-0b12d3456a7e8910d -Region eu-west-1
```

#### Output:

```
ClassicLinkDnsSupported VpcId  
-----  
False                  vpc-0b12d3456a7e8910d  
False                  vpc-12cf3b4f
```

- For API details, see [DescribeVpcClassicLinkDnsSupport](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVpcEndpointServices` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpcEndpointServices`.

### CLI

#### AWS CLI

**Example 1: To describe all VPC endpoint services**

The following "describe-vpc-endpoint-services" example lists all VPC endpoint services for an AWS Region.

```
aws ec2 describe-vpc-endpoint-services
```

Output:

```
{  
    "ServiceDetails": [  
        {  
            "ServiceType": [  
                {  
                    "ServiceType": "Gateway"  
                }  
            ],  
            "AcceptanceRequired": false,  
            "ServiceName": "com.amazonaws.us-east-1.dynamodb",  
            "VpcEndpointPolicySupported": true,  
            "Owner": "amazon",  
            "AvailabilityZones": [  
                "us-east-1a",  
                "us-east-1b",  
                "us-east-1c",  
                "us-east-1d",  
                "us-east-1e",  
                "us-east-1f"  
            ],  
            "BaseEndpointDnsNames": [  
                "dynamodb.us-east-1.amazonaws.com"  
            ]  
        },  
        {  
            "ServiceType": [  
                {  
                    "ServiceType": "Interface"  
                }  
            ],  
            "PrivateDnsName": "ec2.us-east-1.amazonaws.com",  
            "ServiceName": "com.amazonaws.us-east-1.ec2",  
            "VpcEndpointPolicySupported": false,  
            "Owner": "amazon",  
            "AvailabilityZones": [  
                "us-east-1a",  
                "us-east-1b",  
                "us-east-1c",  
                "us-east-1d",  
                "us-east-1e",  
                "us-east-1f"  
            ]  
        }  
    ]  
}
```

```
        "us-east-1e",
        "us-east-1f"
    ],
    "AcceptanceRequired": false,
    "BaseEndpointDnsNames": [
        "ec2.us-east-1.vpce.amazonaws.com"
    ]
},
{
    "ServiceType": [
        {
            "ServiceType": "Interface"
        }
    ],
    "PrivateDnsName": "ssm.us-east-1.amazonaws.com",
    "ServiceName": "com.amazonaws.us-east-1.ssm",
    "VpcEndpointPolicySupported": true,
    "Owner": "amazon",
    "AvailabilityZones": [
        "us-east-1a",
        "us-east-1b",
        "us-east-1c",
        "us-east-1d",
        "us-east-1e"
    ],
    "AcceptanceRequired": false,
    "BaseEndpointDnsNames": [
        "ssm.us-east-1.vpce.amazonaws.com"
    ]
}
],
"ServiceNames": [
    "com.amazonaws.us-east-1.dynamodb",
    "com.amazonaws.us-east-1.ec2",
    "com.amazonaws.us-east-1.ec2messages",
    "com.amazonaws.us-east-1.elasticloadbalancing",
    "com.amazonaws.us-east-1.kinesis-streams",
    "com.amazonaws.us-east-1.s3",
    "com.amazonaws.us-east-1.ssm"
]
}
```

For more information, see [View available AWS service names](#) in the *User Guide for AWSPrivateLink*.

## Example 2: To describe the details about an endpoint service

The following "describe-vpc-endpoint-services" example lists the details of the Amazon S3 interface endpoint service

```
aws ec2 describe-vpc-endpoint-services \
  --filter "Name=service-type,Values=Interface" Name=service-
  name,Values=com.amazonaws.us-east-1.s3
```

Output:

```
{
  "ServiceDetails": [
    {
      "ServiceName": "com.amazonaws.us-east-1.s3",
      "ServiceId": "vpce-svc-081d84efcdEXAMPLE",
      "ServiceType": [
        {
          "ServiceType": "Interface"
        }
      ],
      "AvailabilityZones": [
        "us-east-1a",
        "us-east-1b",
        "us-east-1c",
        "us-east-1d",
        "us-east-1e",
        "us-east-1f"
      ],
      "Owner": "amazon",
      "BaseEndpointDnsNames": [
        "s3.us-east-1.vpce.amazonaws.com"
      ],
      "VpcEndpointPolicySupported": true,
      "AcceptanceRequired": false,
      "ManagesVpcEndpoints": false,
      "Tags": []
    }
  ],
  "ServiceNames": [
```

```
        "com.amazonaws.us-east-1.s3"
    ]
}
```

For more information, see [View available AWS service names](#) in the *User Guide for AWS PrivateLink*.

- For API details, see [DescribeVpcEndpointServices](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes EC2 VPC endpoint service with the given filter, in this case com.amazonaws.eu-west-1.ecs. Further, it also expands the ServiceDetails property and displays the details**

```
Get-EC2VpcEndpointService -Region eu-west-1 -MaxResult 5 -Filter @{Name="service-name";Values="com.amazonaws.eu-west-1.ecs"} | Select-Object -ExpandProperty ServiceDetails
```

### Output:

```
AcceptanceRequired      : False
AvailabilityZones       : {eu-west-1a, eu-west-1b, eu-west-1c}
BaseEndpointDnsNames   : {ecs.eu-west-1.vpce.amazonaws.com}
Owner                  : amazon
PrivateDnsName         : ecs.eu-west-1.amazonaws.com
ServiceName             : com.amazonaws.eu-west-1.ecs
ServiceType             : {Amazon.EC2.Model.ServiceTypeDetail}
VpcEndpointPolicySupported : False
```

**Example 2: This example retrieves all the EC2 VPC Endpoint services and returns the ServiceNames matching "ssm"**

```
Get-EC2VpcEndpointService -Region eu-west-1 | Select-Object -ExpandProperty Servicenames | Where-Object { -match "ssm"}
```

### Output:

```
com.amazonaws.eu-west-1.ssm
```

```
com.amazonaws.eu-west-1.ssmmessages
```

- For API details, see [DescribeVpcEndpointServices](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVpcEndpoints` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpcEndpoints`.

CLI

### AWS CLI

#### To describe your VPC endpoints

The following `describe-vpc-endpoints` example displays details for all of your VPC endpoints.

```
aws ec2 describe-vpc-endpoints
```

Output:

```
{  
    "VpcEndpoints": [  
        {  
            "PolicyDocument": "{\"Version\":\"2008-10-17\",\"Statement\"::  
            [{\"Effect\":\"Allow\",\"Principal\":\"*\",\"Action\":\"*\",  
             \"Resource\":\"*\"}]}},  
            {"VpcId": "vpc-aabb1122",  
             "NetworkInterfaceIds": [],  
             "SubnetIds": [],  
             "PrivateDnsEnabled": true,  
             "State": "available",  
             "ServiceName": "com.amazonaws.us-east-1.dynamodb",  
             "RouteTableIds": [  
                 "rtb-3d560345"  
             ],  
             "Groups": []},
```

```
"VpcEndpointId": "vpce-032a826a",
"VpcEndpointType": "Gateway",
"CreationTimestamp": "2017-09-05T20:41:28Z",
"DnsEntries": [],
"OwnerId": "123456789012"
},
{
    "PolicyDocument": "{\n        \"Statement\": [\n            {\n                \"Action\":\n                    \"*\", \n                \"Effect\": \"Allow\", \n                \"Principal\": \"*\", \n                \"Resource\": \"*\"\n            }\n        ]\n    }",
    "VpcId": "vpc-1a2b3c4d",
    "NetworkInterfaceIds": [
        "eni-2ec2b084",
        "eni-1b4a65cf"
    ],
    "SubnetIds": [
        "subnet-d6fc当地8d",
        "subnet-7b16de0c"
    ],
    "PrivateDnsEnabled": false,
    "State": "available",
    "ServiceName": "com.amazonaws.us-east-1.elasticloadbalancing",
    "RouteTableIds": [],
    "Groups": [
        {
            "GroupName": "default",
            "GroupId": "sg-54e8bf31"
        }
    ],
    "VpcEndpointId": "vpce-0f89a33420c1931d7",
    "VpcEndpointType": "Interface",
    "CreationTimestamp": "2017-09-05T17:55:27.583Z",
    "DnsEntries": [
        {
            "HostedZoneId": "Z7HUB22UULQXV",
            "DnsName": "vpce-0f89a33420c1931d7-
bluzidnv.elasticloadbalancing.us-east-1.vpce.amazonaws.com"
        },
        {
            "HostedZoneId": "Z7HUB22UULQXV",
            "DnsName": "vpce-0f89a33420c1931d7-bluzidnv-us-
east-1b.elasticloadbalancing.us-east-1.vpce.amazonaws.com"
        },
        {

```

```
        "HostedZoneId": "Z7HUB22UULQXV",
        "DnsName": "vpce-0f89a33420c1931d7-bluzidnv-us-
east-1a.elasticloadbalancing.us-east-1.vpce.amazonaws.com"
    }
],
"OwnerId": "123456789012"
},
{
    "VpcEndpointId": "vpce-aabbaabbaabbaabba",
    "VpcEndpointType": "GatewayLoadBalancer",
    "VpcId": "vpc-111122223333aabbc",
    "ServiceName": "com.amazonaws.vpce.us-east-1.vpce-
svc-123123a1c43abc123",
    "State": "available",
    "SubnetIds": [
        "subnet-0011aabbcc2233445"
    ],
    "RequesterManaged": false,
    "NetworkInterfaceIds": [
        "eni-01010120203030405"
    ],
    "CreationTimestamp": "2020-11-11T08:06:03.522Z",
    "Tags": [],
    "OwnerId": "123456789012"
}
]
}
```

For more information, see [VPC endpoints](#) in the *Amazon VPC User Guide*.

- For API details, see [DescribeVpcEndpoints](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes one or more of your VPC endpoints for the region eu-west-1. It then pipes the output to the next command, which select the VpcEndpointId property and returns array VPC ID as string array**

```
Get-EC2VpcEndpoint -Region eu-west-1 | Select-Object -ExpandProperty
VpcEndpointId
```

**Output:**

```
vpce-01a2ab3f4f5cc6f7d  
vpce-01d2b345a6787890b  
vpce-0012e34d567890e12  
vpce-0c123db4567890123
```

**Example 2: This example describes all the vpc endpoints for the region eu-west-1 and selects VpcEndpointId, VpcId, ServiceName and PrivateDnsEnabled properties to present it in a tabular format**

```
Get-EC2VpcEndpoint -Region eu-west-1 | Select-Object VpcEndpointId, VpcId,  
ServiceName, PrivateDnsEnabled | Format-Table -AutoSize
```

**Output:**

VpcEndpointId	VpcId	ServiceName
PrivateDnsEnabled		
vpce-02a2ab2f2f2cc2f2d	vpc-0fc6ff46f65b039eb	com.amazonaws.eu-west-1.ssm
	True	
vpce-01d1b111a1114561b	vpc-0fc6ff46f65b039eb	com.amazonaws.eu-west-1.ec2
	True	
vpce-0011e23d45167e838	vpc-0fc6ff46f65b039eb	com.amazonaws.eu-west-1.ec2messages
	True	
vpce-0c123db4567890123	vpc-0fc6ff46f65b039eb	com.amazonaws.eu-west-1.ssmmessages
	True	

**Example 3: This example exports the policy document for the VPC Endpoint `vpce-01a2ab3f4f5cc6f7d` into a json file**

```
Get-EC2VpcEndpoint -Region eu-west-1 -VpcEndpointId vpce-01a2ab3f4f5cc6f7d |  
Select-Object -expand PolicyDocument | Out-File vpce_policyDocument.json
```

- For API details, see [DescribeVpcEndpoints](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVpcs` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpcs`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Get the default VPC for the account.
/// </summary>
/// <returns>The default VPC object.</returns>
public async Task<Vpc> GetDefaultVpc()
{
    var vpcResponse = await _amazonEc2.DescribeVpcsAsync(
        new DescribeVpcsRequest()
    {
        Filters = new List<Amazon.EC2.Model.Filter>()
    {
        new ("is-default", new List<string>() { "true" })
    }
});
    return vpcResponse.Vpcs[0];
}
```

- For API details, see [DescribeVpcs](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### Example 1: To describe all of your VPCs

The following `describe-vpcs` example retrieves details about your VPCs.

```
aws ec2 describe-vpcs
```

Output:

```
{  
    "Vpcs": [  
        {  
            "CidrBlock": "30.1.0.0/16",  
            "DhcpOptionsId": "dopt-19edf471",  
            "State": "available",  
            "VpcId": "vpc-0e9801d129EXAMPLE",  
            "OwnerId": "111122223333",  
            "InstanceTenancy": "default",  
            "CidrBlockAssociationSet": [  
                {  
                    "AssociationId": "vpc-cidr-assoc-062c64cfafEXAMPLE",  
                    "CidrBlock": "30.1.0.0/16",  
                    "CidrBlockState": {  
                        "State": "associated"  
                    }  
                }  
            ],  
            "IsDefault": false,  
            "Tags": [  
                {  
                    "Key": "Name",  
                    "Value": "Not Shared"  
                }  
            ]  
        },  
        {  
            "CidrBlock": "10.0.0.0/16",  
            "DhcpOptionsId": "dopt-19edf471",  
            "State": "available",  
            "VpcId": "vpc-06e4ab6c6cEXAMPLE",  
            "OwnerId": "111122223333",  
            "InstanceTenancy": "default",  
            "CidrBlockAssociationSet": [  
                {  
                    "AssociationId": "vpc-cidr-assoc-062c64cfafEXAMPLE",  
                    "CidrBlock": "10.0.0.0/16",  
                    "CidrBlockState": {  
                        "State": "associated"  
                    }  
                }  
            ]  
        }  
    ]  
}
```

```
        "OwnerId": "222222222222",
        "InstanceTenancy": "default",
        "CidrBlockAssociationSet": [
            {
                "AssociationId": "vpc-cidr-assoc-00b17b4eddEXAMPLE",
                "CidrBlock": "10.0.0.0/16",
                "CidrBlockState": {
                    "State": "associated"
                }
            }
        ],
        "IsDefault": false,
        "Tags": [
            {
                "Key": "Name",
                "Value": "Shared VPC"
            }
        ]
    }
]
```

## Example 2: To describe a specified VPC

The following `describe-vpcs` example retrieves details for the specified VPC.

```
aws ec2 describe-vpcs \
--vpc-ids vpc-06e4ab6c6cEXAMPLE
```

Output:

```
{
    "Vpcs": [
        {
            "CidrBlock": "10.0.0.0/16",
            "DhcpOptionsId": "dopt-19edf471",
            "State": "available",
            "VpcId": "vpc-06e4ab6c6cEXAMPLE",
            "OwnerId": "111122223333",
            "InstanceTenancy": "default",
            "CidrBlockAssociationSet": [
                {
                    "AssociationId": "vpc-cidr-assoc-00b17b4eddEXAMPLE",
```

```
        "CidrBlock": "10.0.0.0/16",
        "CidrBlockState": {
            "State": "associated"
        }
    ],
    "IsDefault": false,
    "Tags": [
        {
            "Key": "Name",
            "Value": "Shared VPC"
        }
    ]
}
]
```

- For API details, see [DescribeVpcs](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
const client = new EC2Client({});  
const { Vpcs } = await client.send(  
    new DescribeVpcsCommand({  
        Filters: [{ Name: "is-default", Values: ["true"] }],  
    }),  
);
```

- For API details, see [DescribeVpcs](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified VPC.**

```
Get-EC2Vpc -VpcId vpc-12345678
```

**Output:**

```
CidrBlock      : 10.0.0.0/16
DhcpOptionsId : dopt-1a2b3c4d
InstanceTenancy : default
IsDefault      : False
State          : available
Tags           : {Name}
VpcId          : vpc-12345678
```

**Example 2: This example describes the default VPC (there can be only one per region). If your account supports EC2-Classic in this region, there is no default VPC.**

```
Get-EC2Vpc -Filter @{Name="isDefault"; Values="true"}
```

**Output:**

```
CidrBlock      : 172.31.0.0/16
DhcpOptionsId : dopt-12345678
InstanceTenancy : default
IsDefault      : True
State          : available
Tags           : {}
VpcId          : vpc-45678901
```

**Example 3: This example describes the VPCs that match the specified filter (that is, have a CIDR that matches the value '10.0.0.0/16' and are in the state 'available').**

```
Get-EC2Vpc -Filter @{Name="cidr";
Values="10.0.0.0/16"},@{Name="state";Values="available"}
```

**Example 4: This example describes all your VPCs.**

## Get-EC2Vpc

- For API details, see [DescribeVpcs](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:  
    """  
        Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,  
        ec2_client,  
        ssm_client,  
        iam_client,  
    ):  
        """  
            :param resource_prefix: The prefix for naming AWS resources that are  
            created by this class.  
            :param inst_type: The type of EC2 instance to create, such as t3.micro.  
            :param ami_param: The Systems Manager parameter used to look up the AMI  
            that is  
                created.  
            :param autoscaling_client: A Boto3 EC2 Auto Scaling client.  
            :param ec2_client: A Boto3 EC2 client.  
            :param ssm_client: A Boto3 Systems Manager client.  
            :param iam_client: A Boto3 IAM client.  
        """
```

```
        self.inst_type = inst_type
        self.ami_param = ami_param
        self.autoscaling_client = autoscaling_client
        self.ec2_client = ec2_client
        self.ssm_client = ssm_client
        self.iam_client = iam_client
        self.launch_template_name = f"{resource_prefix}-template"
        self.group_name = f"{resource_prefix}-group"
        self.instance_policy_name = f"{resource_prefix}-pol"
        self.instance_role_name = f"{resource_prefix}-role"
        self.instance_profile_name = f"{resource_prefix}-prof"
        self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
        self.bad_creds_role_name = f"{resource_prefix}-bc-role"
        self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
        self.key_pair_name = f"{resource_prefix}-key-pair"

    def get_default_vpc(self):
        """
        Gets the default VPC for the account.

        :return: Data about the default VPC.
        """
        try:
            response = self.ec2_client.describe_vpcs(
                Filters=[{"Name": "is-default", "Values": ["true"]}]
            )
        except ClientError as err:
            raise AutoScalerError(f"Couldn't get default VPC: {err}")
        else:
            return response["Vpcs"][0]
```

- For API details, see [DescribeVpcs](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `DescribeVpnConnections` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpnConnections`.

CLI

## AWS CLI

### Example 1: To describe your VPN connections

The following `describe-vpn-connections` example describes all of your Site-to-Site VPN connections.

```
aws ec2 describe-vpn-connections
```

Output:

```
{
    "VpnConnections": [
        {
            "CustomerGatewayConfiguration": "...configuration information...",
            "CustomerGatewayId": "cgw-01234567abcde1234",
            "Category": "VPN",
            "State": "available",
            "Type": "ipsec.1",
            "VpnConnectionId": "vpn-1122334455aabbccd",
            "TransitGatewayId": "tgw-00112233445566aab",
            "Options": {
                "EnableAcceleration": false,
                "StaticRoutesOnly": true,
                "LocalIpv4NetworkCidr": "0.0.0.0/0",
                "RemoteIpv4NetworkCidr": "0.0.0.0/0",
                "TunnelInsideIpVersion": "ipv4"
            },
            "Routes": [],
            "Tags": [
                {
                    "Key": "Name",
                    "Value": "CanadaVPN"
                }
            ],
            "VgwTelemetry": [
                {

```

```
        "AcceptedRouteCount": 0,
        "LastStatusChange": "2020-07-29T10:35:11.000Z",
        "OutsideIpAddress": "203.0.113.3",
        "Status": "DOWN",
        "StatusMessage": ""
    },
    {
        "AcceptedRouteCount": 0,
        "LastStatusChange": "2020-09-02T09:09:33.000Z",
        "OutsideIpAddress": "203.0.113.5",
        "Status": "UP",
        "StatusMessage": ""
    }
]
}
]
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

### Example 2: To describe your available VPN connections

The following `describe-vpn-connections` example describes your Site-to-Site VPN connections with a state of available.

```
aws ec2 describe-vpn-connections \
--filters "Name=state,Values=available"
```

For more information, see [How AWS Site-to-Site VPN works](#) in the *AWS Site-to-Site VPN User Guide*.

- For API details, see [DescribeVpnConnections](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example describes the specified VPN connection.

```
Get-EC2VpnConnection -VpnConnectionId vpn-12345678
```

**Output:**

```
CustomerGatewayConfiguration : [XML document]
CustomerGatewayId          : cgw-1a2b3c4d
Options                     : Amazon.EC2.Model.VpnConnectionOptions
Routes                      : {Amazon.EC2.Model.VpnStaticRoute}
State                       : available
Tags                        : {}
Type                        : ipsec.1
VgwTelemetry                : {Amazon.EC2.Model.VgwTelemetry,
                                Amazon.EC2.Model.VgwTelemetry}
VpnConnectionId             : vpn-12345678
VpnGatewayId                : vgw-1a2b3c4d
```

**Example 2: This example describes any VPN connection whose state is either pending or available.**

```
$filter = New-Object Amazon.EC2.Model.Filter
$filter.Name = "state"
$filter.Values = @("pending", "available")

Get-EC2VpnConnection -Filter $filter
```

**Example 3: This example describes all your VPN connections.**

```
Get-EC2VpnConnection
```

- For API details, see [DescribeVpnConnections](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DescribeVpnGateways` with an AWS SDK or CLI

The following code examples show how to use `DescribeVpnGateways`.

## CLI

### AWS CLI

#### To describe your virtual private gateways

This example describes your virtual private gateways.

Command:

```
aws ec2 describe-vpn-gateways
```

Output:

```
{  
    "VpnGateways": [  
        {  
            "State": "available",  
            "Type": "ipsec.1",  
            "VpnGatewayId": "vgw-f211f09b",  
            "VpcAttachments": [  
                {  
                    "State": "attached",  
                    "VpcId": "vpc-98eb5ef5"  
                }  
            ]  
        },  
        {  
            "State": "available",  
            "Type": "ipsec.1",  
            "VpnGatewayId": "vgw-9a4cacf3",  
            "VpcAttachments": [  
                {  
                    "State": "attaching",  
                    "VpcId": "vpc-a01106c2"  
                }  
            ]  
        }  
    ]  
}
```

- For API details, see [DescribeVpnGateways](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example describes the specified virtual private gateway.**

```
Get-EC2VpnGateway -VpnGatewayId vgw-1a2b3c4d
```

**Output:**

```
AvailabilityZone :  
State           : available  
Tags            : {}  
Type            : ipsec.1  
VpcAttachments : {vpc-12345678}  
VpnGatewayId   : vgw-1a2b3c4d
```

**Example 2: This example describes any virtual private gateway whose state is either pending or available.**

```
$filter = New-Object Amazon.EC2.Model.Filter  
$filter.Name = "state"  
$filter.Values = @("pending", "available")  
  
Get-EC2VpnGateway -Filter $filter
```

**Example 3: This example describes all your virtual private gateways.**

```
Get-EC2VpnGateway
```

- For API details, see [DescribeVpnGateways](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DetachInternetGateway with an AWS SDK or CLI

The following code examples show how to use DetachInternetGateway.

## CLI

### AWS CLI

#### To detach an internet gateway from your VPC

The following `detach-internet-gateway` example detaches the specified internet gateway from the specific VPC.

```
aws ec2 detach-internet-gateway \
    --internet-gateway-id igw-0d0fb496b3EXAMPLE \
    --vpc-id vpc-0a60eb65b4EXAMPLE
```

This command produces no output.

For more information, see [Internet gateways](#) in the *Amazon VPC User Guide*.

- For API details, see [DetachInternetGateway](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example detaches the specified Internet gateway from the specified VPC.

```
Dismount-EC2InternetGateway -InternetGatewayId igw-1a2b3c4d -VpcId vpc-12345678
```

- For API details, see [DetachInternetGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DetachNetworkInterface` with an AWS SDK or CLI

The following code examples show how to use `DetachNetworkInterface`.

## CLI

### AWS CLI

#### To detach a network interface from your instance

This example detaches the specified network interface from the specified instance. If the command succeeds, no output is returned.

Command:

```
aws ec2 detach-network-interface --attachment-id eni-attach-66c4350a
```

- For API details, see [DetachNetworkInterface](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example removes the specified attachment between a network interface and an instance.**

```
Dismount-EC2NetworkInterface -AttachmentId eni-attach-1a2b3c4d -Force
```

- For API details, see [DetachNetworkInterface](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DetachVolume with an AWS SDK or CLI

The following code examples show how to use DetachVolume.

CLI

### AWS CLI

#### To detach a volume from an instance

This example command detaches the volume (vol-049df61146c4d7901) from the instance it is attached to.

Command:

```
aws ec2 detach-volume --volume-id vol-1234567890abcdef0
```

**Output:**

```
{  
    "AttachTime": "2014-02-27T19:23:06.000Z",  
    "InstanceId": "i-1234567890abcdef0",  
    "VolumeId": "vol-049df61146c4d7901",  
    "State": "detaching",  
    "Device": "/dev/sdb"  
}
```

- For API details, see [DetachVolume](#) in *AWS CLI Command Reference*.

**PowerShell****Tools for PowerShell****Example 1: This example detaches the specified volume.**

```
Dismount-EC2Volume -VolumeId vol-12345678
```

**Output:**

```
AttachTime      : 12/22/2015 1:53:58 AM  
DeleteOnTermination : False  
Device          : /dev/sdh  
InstanceId       : i-1a2b3c4d  
State            : detaching  
VolumeId         : vol-12345678
```

**Example 2: You can also specify the instance ID and device name to ensure that you are detaching the correct volume.**

```
Dismount-EC2Volume -VolumeId vol-12345678 -InstanceId i-1a2b3c4d -Device /dev/sdh
```

- For API details, see [DetachVolume](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DetachVpnGateway with an AWS SDK or CLI

The following code examples show how to use `DetachVpnGateway`.

CLI

### AWS CLI

#### To detach a virtual private gateway from your VPC

This example detaches the specified virtual private gateway from the specified VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 detach-vpn-gateway --vpn-gateway-id vgw-9a4cacf3 --vpc-id vpc-a01106c2
```

- For API details, see [DetachVpnGateway](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

#### Example 1: This example detaches the specified virtual private gateway from the specified VPC.

```
Dismount-EC2VpnGateway -VpnGatewayId vgw-1a2b3c4d -VpcId vpc-12345678
```

- For API details, see [DetachVpnGateway](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DisableVgwRoutePropagation with an AWS SDK or CLI

The following code examples show how to use `DisableVgwRoutePropagation`.

## CLI

### AWS CLI

#### To disable route propagation

This example disables the specified virtual private gateway from propagating static routes to the specified route table. If the command succeeds, no output is returned.

Command:

```
aws ec2 disable-vgw-route-propagation --route-table-id rtb-22574640 --gateway-id vgw-9a4cacf3
```

- For API details, see [DisableVgwRoutePropagation](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example disables the VGW from automatically propagating routes to the specified routing table.**

```
Disable-EC2VgwRoutePropagation -RouteTableId rtb-12345678 -GatewayId vgw-1a2b3c4d
```

- For API details, see [DisableVgwRoutePropagation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `DisableVpcClassicLink` with an AWS SDK or CLI

The following code examples show how to use `DisableVpcClassicLink`.

## CLI

### AWS CLI

#### To disable ClassicLink for a VPC

This example disables ClassicLink for vpc-8888888.

Command:

```
aws ec2 disable-vpc-classic-link --vpc-id vpc-88888888
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [DisableVpcClassicLink](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example disables EC2VpcClassicLink for the vpc-01e23c4a5d6db78e9. It returns either True or False**

```
Disable-EC2VpcClassicLink -VpcId vpc-01e23c4a5d6db78e9
```

- For API details, see [DisableVpcClassicLink](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **DisableVpcClassicLinkDnsSupport** with an AWS SDK or CLI

The following code examples show how to use `DisableVpcClassicLinkDnsSupport`.

CLI

### AWS CLI

#### To disable ClassicLink DNS support for a VPC

This example disables ClassicLink DNS support for vpc-88888888.

Command:

```
aws ec2 disable-vpc-classic-link-dns-support --vpc-id vpc-88888888
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [DisableVpcClassicLinkDnsSupport](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example disables ClassicLink DNS support for the vpc-0b12d3456a7e8910d**

```
Disable-EC2VpcClassicLinkDnsSupport -VpcId vpc-0b12d3456a7e8910d
```

- For API details, see [DisableVpcClassicLinkDnsSupport](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DisassociateAddress with an AWS SDK or CLI

The following code examples show how to use DisassociateAddress.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

## .NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Disassociate an Elastic IP address from an EC2 instance.
/// </summary>
/// <param name="associationId">The association Id.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DisassociateIp(string associationId)
{
    var response = await _amazonEC2.DisassociateAddressAsync(
        new DisassociateAddressRequest { AssociationId = associationId });
    return response.HttpStatusCode == HttpStatusCode.OK;
}
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_disassociate_address
#
# This function disassociates an Elastic IP address from an Amazon Elastic
Compute Cloud (Amazon EC2) instance.
```

```
#  
# Parameters:  
#      -a association_id - The association ID that represents the association of  
#                           the Elastic IP address with an instance.  
#  
# And:  
#      0 - If successful.  
#      1 - If it fails.  
#  
#####  
function ec2_disassociate_address() {  
    local association_id response  
  
    # Function to display usage information  
    function usage() {  
        echo "function ec2_disassociate_address"  
        echo "Disassociates an Elastic IP address from an Amazon Elastic Compute  
Cloud (Amazon EC2) instance."  
        echo " -a association_id - The association ID that represents the  
association of the Elastic IP address with an instance."  
        echo ""  
    }  
  
    # Parse the command-line arguments  
    while getopts "a:h" option; do  
        case "${option}" in  
            a) association_id="${OPTARG}" ;;  
            h)  
                usage  
                return 0  
                ;;  
            \?)  
                echo "Invalid parameter"  
                usage  
                return 1  
                ;;  
        esac  
    done  
    export OPTIND=1  
  
    # Validate the input parameters  
    if [[ -z "$association_id" ]]; then  
        errecho "ERROR: You must provide an association ID with the -a parameter."  
        return 1
```

```
fi

response=$(aws ec2 disassociate-address \
    --association-id "$association_id") || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports disassociate-address operation failed."
    errecho "$response"
    return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
```

```
    errecho " Command line failed to parse."
elif [ "$err_code" == 130 ]; then
    errecho " Process received SIGINT."
elif [ "$err_code" == 252 ]; then
    errecho " Command syntax invalid."
elif [ "$err_code" == 253 ]; then
    errecho " The system environment or configuration was invalid."
elif [ "$err_code" == 254 ]; then
    errecho " The service returned an error."
elif [ "$err_code" == 255 ]; then
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see [DisassociateAddress](#) in *AWS CLI Command Reference*.

## CLI

### AWS CLI

#### To disassociate an Elastic IP addresses in EC2-Classic

This example disassociates an Elastic IP address from an instance in EC2-Classic. If the command succeeds, no output is returned.

Command:

```
aws ec2 disassociate-address --public-ip 198.51.100.0
```

#### To disassociate an Elastic IP address in EC2-VPC

This example disassociates an Elastic IP address from an instance in a VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 disassociate-address --association-id eipassoc-2bebb745
```

- For API details, see [DisassociateAddress](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void disassociateAddress(Ec2Client ec2, String associationId) {  
    try {  
        DisassociateAddressRequest addressRequest =  
        DisassociateAddressRequest.builder()  
            .associationId(associationId)  
            .build();  
  
        ec2.disassociateAddress(addressRequest);  
        System.out.println("You successfully disassociated the address!");  
  
    } catch (Ec2Exception e) {  
        System.err.println(e.awsErrorDetails().errorMessage());  
        System.exit(1);  
    }  
}
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { DisassociateAddressCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// Disassociate an Elastic IP address from an instance.
export const main = async () => {
    const command = new DisassociateAddressCommand({
        // You can also use PublicIp, but that is for EC2 classic which is being
        // retired.
        AssociationId: "ASSOCIATION_ID",
    });

    try {
        await client.send(command);
        console.log("Successfully disassociated address");
    } catch (err) {
        console.error(err);
    }
};
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun disassociateAddressSc(associationIdVal: String?) {
    val addressRequest =
        DisassociateAddressRequest {
            associationId = associationIdVal
        }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.disassociateAddress(addressRequest)
        println("You successfully disassociated the address!")
}
```

```
    }  
}
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example disassociates the specified Elastic IP address from the specified instance in a VPC.**

```
Unregister-EC2Address -AssociationId eipassoc-12345678
```

**Example 2: This example disassociates the specified Elastic IP address from the specified instance in EC2-Classic.**

```
Unregister-EC2Address -PublicIp 203.0.113.17
```

- For API details, see [DisassociateAddress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class ElasticIpWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) Elastic IP address  
    actions."""  
  
    def __init__(self, ec2_resource, elastic_ip=None):  
        """
```

```
:param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
resource
    is used to create additional high-level objects
    that wrap low-level Amazon EC2 service actions.
:param elastic_ip: A Boto3 VpcAddress object. This is a high-level object
that
    wraps Elastic IP actions.
"""
self.ec2_resource = ec2_resource
self.elastic_ip = elastic_ip

@classmethod
def from_resource(cls):
    ec2_resource = boto3.resource("ec2")
    return cls(ec2_resource)

def disassociate(self):
    """
    Removes an association between an Elastic IP address and an instance.
When the
    association is removed, the instance is assigned a new public IP address.
    """
    if self.elastic_ip is None:
        logger.info("No Elastic IP to disassociate.")
        return

    try:
        self.elastic_ip.association.delete()
    except ClientError as err:
        logger.error(
            "Couldn't disassociate Elastic IP %s from its instance. Here's
why: %s: %s",
            self.elastic_ip.allocation_id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn disassociate_ip_address(&self, association_id: &str) ->
Result<(), EC2Error> {
    self.client
        .disassociate_address()
        .association_id(association_id)
        .send()
        .await?;
    Ok(())
}
```

- For API details, see [DisassociateAddress](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use DisassociateRouteTable with an AWS SDK or CLI

The following code examples show how to use DisassociateRouteTable.

### CLI

#### AWS CLI

##### To disassociate a route table

This example disassociates the specified route table from the specified subnet. If the command succeeds, no output is returned.

Command:

```
aws ec2 disassociate-route-table --association-id rtbassoc-781d0d1a
```

- For API details, see [DisassociateRouteTable](#) in AWS CLI Command Reference.

PowerShell

## Tools for PowerShell

**Example 1: This example removes the specified association between a route table and a subnet.**

```
Unregister-EC2RouteTable -AssociationId rtbassoc-1a2b3c4d
```

- For API details, see [DisassociateRouteTable](#) in AWS Tools for PowerShell Cmdlet Reference.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use EnableVgwRoutePropagation with an AWS SDK or CLI

The following code examples show how to use EnableVgwRoutePropagation.

CLI

### AWS CLI

#### To enable route propagation

This example enables the specified virtual private gateway to propagate static routes to the specified route table. If the command succeeds, no output is returned.

Command:

```
aws ec2 enable-vgw-route-propagation --route-table-id rtb-22574640 --gateway-id vgw-9a4cacf3
```

- For API details, see [EnableVgwRoutePropagation](#) in AWS CLI Command Reference.

## PowerShell

### Tools for PowerShell

**Example 1: This example enables the specified VGW to propagate routes automatically to the specified routing table.**

```
Enable-EC2VgwRoutePropagation -RouteTableId rtb-12345678 -GatewayId vgw-1a2b3c4d
```

- For API details, see [EnableVgwRoutePropagation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use EnableVolumeIo with an AWS SDK or CLI

The following code examples show how to use EnableVolumeIo.

### CLI

#### AWS CLI

##### To enable I/O for a volume

This example enables I/O on volume vol-1234567890abcdef0.

Command:

```
aws ec2 enable-volume-io --volume-id vol-1234567890abcdef0
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [EnableVolumeIo](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example enables I/O operations for the specified volume, if I/O operations were disabled.**

```
Enable-EC2VolumeIO -VolumeId vol-12345678
```

- For API details, see [EnableVolumelo](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use EnableVpcClassicLink with an AWS SDK or CLI

The following code examples show how to use EnableVpcClassicLink.

### CLI

#### AWS CLI

##### To enable a VPC for ClassicLink

This example enables vpc-8888888 for ClassicLink.

Command:

```
aws ec2 enable-vpc-classic-link --vpc-id vpc-88888888
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [EnableVpcClassicLink](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example enables VPC vpc-0123456b789b0d12f for ClassicLink

```
Enable-EC2VpcClassicLink -VpcId vpc-0123456b789b0d12f
```

#### Output:

```
True
```

- For API details, see [EnableVpcClassicLink](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use EnableVpcClassicLinkDnsSupport with an AWS SDK or CLI

The following code examples show how to use EnableVpcClassicLinkDnsSupport.

### CLI

#### AWS CLI

##### To enable ClassicLink DNS support for a VPC

This example enables ClassicLink DNS support for vpc-88888888.

Command:

```
aws ec2 enable-vpc-classic-link-dns-support --vpc-id vpc-88888888
```

#### Output:

```
{  
    "Return": true  
}
```

- For API details, see [EnableVpcClassicLinkDnsSupport](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example enables vpc-0b12d3456a7e8910d to support DNS hostname resolution for ClassicLink**

```
Enable-EC2VpcClassicLinkDnsSupport -VpcId vpc-0b12d3456a7e8910d -Region eu-west-1
```

- For API details, see [EnableVpcClassicLinkDnsSupport](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use GetConsoleOutput with an AWS SDK or CLI

The following code examples show how to use GetConsoleOutput.

### CLI

#### AWS CLI

**Example 1: To get the console output**

The following get-console-output example gets the console output for the specified Linux instance.

```
aws ec2 get-console-output \
--instance-id i-1234567890abcdef0
```

Output:

```
{
    "InstanceId": "i-1234567890abcdef0",
    "Timestamp": "2013-07-25T21:23:53.000Z",
    "Output": "..."
}
```

For more information, see [Instance console output](#) in the *Amazon EC2 User Guide*.

### Example 2: To get the latest console output

The following get-console-output example gets the latest console output for the specified Linux instance.

```
aws ec2 get-console-output \
--instance-id i-1234567890abcdef0 \
--latest \
--output text
```

Output:

```
i-1234567890abcdef0 [    0.000000] Command line: root=LABEL=/ console=tty1
console=ttyS0 selinux=0 nvme_core.io_timeout=4294967295
[    0.000000] x86/fpu: Supporting XSAVE feature 0x001: 'x87 floating point
registers'
[    0.000000] x86/fpu: Supporting XSAVE feature 0x002: 'SSE registers'
[    0.000000] x86/fpu: Supporting XSAVE feature 0x004: 'AVX registers'
...
Cloud-init v. 0.7.6 finished at Wed, 09 May 2018 19:01:13 +0000. Datasource
DataSourceEc2. Up 21.50 seconds
Amazon Linux AMI release 2018.03
Kernel 4.14.26-46.32.amzn1.x
```

For more information, see [Instance console output](#) in the *Amazon EC2 User Guide*.

- For API details, see [GetConsoleOutput](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example gets the console output for the specified Linux instance. The console output is encoded.**

```
Get-EC2ConsoleOutput -InstanceId i-0e19abcd47c123456
```

Output:

InstanceId	Output
------------	--------

```
-----  
i-0e194d3c47c123637 WyAgICAwLjAwMDAwMF0gQ29tbW...bGU9dHR5UzAgc2Vs
```

**Example 2: This example stores the encoded console output in a variable and then decodes it.**

```
$output_encoded = (Get-EC2ConsoleOutput -InstanceId i-0e19abcd47c123456).Output  
[System.Text.Encoding]::UTF8.GetString([System.Convert]::FromBase64String($output_encoded))
```

- For API details, see [GetConsoleOutput](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use GetHostReservationPurchasePreview with an AWS SDK or CLI

The following code examples show how to use GetHostReservationPurchasePreview.

CLI

### AWS CLI

#### To get a purchase preview for a Dedicated Host Reservation

This example provides a preview of the costs for a specified Dedicated Host Reservation for the specified Dedicated Host in your account.

Command:

```
aws ec2 get-host-reservation-purchase-preview --offering-id hro-03f707bf363b6b324  
--host-id-set h-013abcd2a00cbd123
```

Output:

```
{  
    "TotalHourlyPrice": "1.499",  
    "Purchase": [  
        {  
            "HourlyPrice": "1.499",  
            "OfferingType": "DedicatedHost",  
            "OfferingId": "hro-03f707bf363b6b324",  
            "HostId": "h-013abcd2a00cbd123",  
            "TermType": "Hourly",  
            "TermLength": 1,  
            "UsageType": "Compute",  
            "OfferingStatus": "Available",  
            "OfferingStatusReason": null  
        }  
    ]  
}
```

```
        "InstanceFamily": "m4",
        "PaymentOption": "NoUpfront",
        "HostIdSet": [
            "h-013abcd2a00cbd123"
        ],
        "UpfrontPrice": "0.000",
        "Duration": 31536000
    }
],
"TotalUpfrontPrice": "0.000"
}
```

- For API details, see [GetHostReservationPurchasePreview](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example previews a reservation purchase with configurations that match those of your Dedicated Host h-01e23f4cd567890f1**

```
Get-EC2HostReservationPurchasePreview -OfferingId hro-0c1f23456789d0ab -HostIdSet
h-01e23f4cd567890f1
```

### Output:

CurrencyCode	Purchase	TotalHourlyPrice	TotalUpfrontPrice
{} -----	1.307	0.000	

- For API details, see [GetHostReservationPurchasePreview](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use GetPasswordData with an AWS SDK or CLI

The following code examples show how to use GetPasswordData.

## CLI

### AWS CLI

#### To get the encrypted password

This example gets the encrypted password.

Command:

```
aws ec2 get-password-data --instance-id i-1234567890abcdef0
```

Output:

```
{  
    "InstanceId": "i-1234567890abcdef0",  
    "Timestamp": "2013-08-07T22:18:38.000Z",  
    "PasswordData": "gS1JFq+VpcZXqy+iktxMF6NyxD4qCrT4+gaOuN0enX1MmgXPTj7XEXAMPLE  
UQ+YeFfb+L1U4C4AKv652Ux1iRB3CPTYP7WmU3TUhsuBd+p6Lv7T21KUml60Xbk6WPW1VYYm/TRPB1  
e1DQ7PY4an/DgZT4mwcpRFigzhniQgDDe01InvSDcwoUTwNs0Y1S8ouri2W4n5GNlriM3Q0AnNVelVz/  
53TkDtzbNoU606M1gK9zUWSxqEgwvbV2j8c5rP0WCuaMWSF14ziDu4bd7q+4RSyi8NUsVWnKZ4aEZffu  
DPGzKrF5yL1f3etP2L4ZR6CvG7K1hx7VK0QVN32Dajw=="  
}
```

#### To get the decrypted password

This example gets the decrypted password.

Command:

```
aws ec2 get-password-data --instance-id i-1234567890abcdef0 --priv-launch-key C:  
\Keys\MyKeyPair.pem
```

Output:

```
{  
    "InstanceId": "i-1234567890abcdef0",  
    "Timestamp": "2013-08-30T23:18:05.000Z",  
    "PasswordData": "&ViJ652e*u"  
}
```

- For API details, see [GetPasswordData](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import software.amazon.awssdk.core.exception.SdkClientException;
import software.amazon.awssdk.core.exception.SdkServiceException;
import software.amazon.awssdk.regions.Region;
import software.amazon.awssdk.services.ec2.Ec2Client;
import software.amazon.awssdk.services.ec2.model.Ec2Exception;
import software.amazon.awssdk.services.ec2.model.GetPasswordDataRequest;
import software.amazon.awssdk.services.ec2.model.GetPasswordDataResponse;
import
software.amazon.awssdk.services.secretsmanager.model.ResourceNotFoundException;

/**
 * Before running this Java V2 code example, set up your development
 * environment, including your credentials.
 *
 * For more information, see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-started.html
 */
public class GetPasswordData {

    public static void main(String[] args) {
        final String usage = """

            Usage:
            <instanceId>

            Where:
            instanceId - An instance id from which the password is
            obtained.\s
            """;
    }
}
```

```
if (args.length != 1) {
    System.out.println(usage);
    return;
}

Region region = Region.US_EAST_1;
Ec2Client ec2 = Ec2Client.builder()
    .region(region)
    .build();

String instanceId = args[0];
getPasswordData(ec2,instanceId);
}

/**
 * Retrieves and prints the encrypted administrator password data for a
specified EC2 instance.
*
* <p>The password data is encrypted using the key pair that was specified
when the instance was launched.
* To decrypt the password data, you can use the private key of the key
pair.</p>
*
* @param ec2      The {@link Ec2Client} to use for making the request.
* @param instanceId The ID of the instance for which to get the encrypted
password data.
*/
public static void getPasswordData(Ec2Client ec2, String instanceId) {
    GetPasswordDataRequest getPasswordDataRequest =
GetPasswordDataRequest.builder()
    .instanceId(instanceId)
    .build();

    try {
        GetPasswordDataResponse getPasswordDataResponse =
ec2.getPasswordData(getPasswordDataRequest);
        String encryptedPasswordData =
getPasswordDataResponse.passwordData();
        System.out.println("Encrypted Password Data: " +
encryptedPasswordData);

    } catch (Ec2Exception e) {
        String errorCode = e.awsErrorDetails().errorCode();
        if (errorCode.matches("InvalidInstanceID.NotFound")) {
```

```
        System.err.println("Instance ID not found, unable to retrieve  
password data.");  
    } else {  
        System.err.println("There was a problem retrieving password data.  
Details:");  
        e.printStackTrace();  
    }  
}  
}  
}
```

- For API details, see [GetPasswordData](#) in *AWS SDK for Java 2.x API Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example decrypts the password that Amazon EC2 assigned to the Administrator account for the specified Windows instance. As a pem file was specified, the setting of the -Decrypt switch is automatically assumed.**

```
Get-EC2PasswordData -InstanceId i-12345678 -PemFile C:\path\my-key-pair.pem
```

#### Output:

```
mYZ(PA9?C)Q
```

**Example 2: (Windows PowerShell only) Inspects the instance to determine the name of the keypair used to launch the instance and then attempts to find the corresponding keypair data in the configuration store of the AWS Toolkit for Visual Studio. If the keypair data is found the password is decrypted.**

```
Get-EC2PasswordData -InstanceId i-12345678 -Decrypt
```

#### Output:

```
mYZ(PA9?C)Q
```

### Example 3: Returns the encrypted password data for the instance.

```
Get-EC2PasswordData -InstanceId i-12345678
```

#### Output:

```
iVz3BAK/WAXV.....dqt8WeMA==
```

- For API details, see [GetPasswordData](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ImportImage with an AWS SDK or CLI

The following code examples show how to use ImportImage.

### CLI

#### AWS CLI

##### To import a VM image file as an AMI

The following `import-image` example imports the specified OVA.

```
aws ec2 import-image \
--disk-containers Format=ova,UserBucket="{S3Bucket=my-import-bucket,S3Key=vms/
my-server-vm.ova}"
```

#### Output:

```
{
    "ImportTaskId": "import-ami-1234567890abcdef0",
    "Progress": "2",
    "SnapshotDetails": [
        {
            "DiskImageSize": 0.0,
            "Format": "ova",
```

```
        "UserBucket": {
            "S3Bucket": "my-import-bucket",
            "S3Key": "vms/my-server-vm.ova"
        }
    ],
    "Status": "active",
    "StatusMessage": "pending"
}
```

- For API details, see [ImportImage](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example imports a single-disk virtual machine image from the specified Amazon S3 bucket to Amazon EC2 with an idempotency token. The example requires that a VM Import Service Role with the default name 'vmimport' exists, with a policy allowing Amazon EC2 access to the specified bucket, as explained in the [VM Import Prerequisites topic](#). To use a custom role, specify the role name using the `-RoleName` parameter.**

```
$container = New-Object Amazon.EC2.Model.ImageDiskContainer
$container.Format="VMDK"
$container.UserBucket = New-Object Amazon.EC2.Model.UserBucket
$container.UserBucket.S3Bucket = "myVirtualMachineImages"
$container.UserBucket.S3Key = "Win_2008_Server_Standard_SP2_64-bit-disk1.vmdk"

$parms = @{
    "ClientToken"="idempotencyToken"
    "Description"="Windows 2008 Standard Image Import"
    "Platform"="Windows"
    "LicenseType"="AWS"
}

Import-EC2Image -DiskContainer $container @parms
```

### Output:

Architecture :

```
Description      : Windows 2008 Standard Image
Hypervisor     :
ImageId        :
ImportTaskId   : import-ami-abcdefg
LicenseType    : AWS
Platform       : Windows
Progress       : 2
SnapshotDetails: {}
Status         : active
StatusMessage  : pending
```

- For API details, see [ImportImage](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ImportKeyPair with an AWS SDK or CLI

The following code examples show how to use ImportKeyPair.

### CLI

#### AWS CLI

##### To import a public key

First, generate a key pair with the tool of your choice. For example, use this ssh-keygen command:

Command:

```
ssh-keygen -t rsa -C "my-key" -f ~/.ssh/my-key
```

Output:

```
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ec2-user/.ssh/my-key.
Your public key has been saved in /home/ec2-user/.ssh/my-key.pub.
```

...

This example command imports the specified public key.

Command:

```
aws ec2 import-key-pair --key-name "my-key" --public-key-material file:///~/ssh/  
my-key.pub
```

Output:

```
{  
  "KeyName": "my-key",  
  "KeyFingerprint": "1f:51:ae:28:bf:89:e9:d8:1f:25:5d:37:2d:7d:b8:ca"  
}
```

- For API details, see [ImportKeyPair](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example imports a public key to EC2. The first line stores the contents of the public key file (\*.pub) in the variable \$publickey. Next, the example converts the UTF8 format of the public key file to a Base64-encoded string, and stores the converted string in the variable \$pkbase64. In the last line, the converted public key is imported to EC2. The cmdlet returns the key fingerprint and name as results.**

```
$publickey=[Io.File]::ReadAllText("C:\Users\TestUser\.ssh\id_rsa.pub")  
$pkbase64 =  
[System.Convert]::ToBase64String([System.Text.Encoding]::UTF8.GetBytes($publickey))  
Import-EC2KeyPair -KeyName Example-user-key -PublicKey $pkbase64
```

Output:

KeyFingerprint	KeyName
-----	-----
do:d0:15:8f:79:97:12:be:00:fd:df:31:z3:b1:42:z1	Example-user-key

- For API details, see [ImportKeyPair](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ImportSnapshot with an AWS SDK or CLI

The following code examples show how to use ImportSnapshot.

CLI

### AWS CLI

#### To import a snapshot

The following import-snapshot example imports the specified disk as a snapshot.

```
aws ec2 import-snapshot \  
  --description "My server VMDK" \  
  --disk-container Format=VMDK,UserBucket={S3Bucket=my-import-bucket,S3Key=vms/  
my-server-vm.vmdk}
```

Output:

```
{  
    "Description": "My server VMDK",  
    "ImportTaskId": "import-snap-1234567890abcdef0",  
    "SnapshotTaskDetail": {  
        "Description": "My server VMDK",  
        "DiskImageSize": "0.0",  
        "Format": "VMDK",  
        "Progress": "3",  
        "Status": "active",  
        "StatusMessage": "pending"  
        "UserBucket": {  
            "S3Bucket": "my-import-bucket",  
            "S3Key": "vms/my-server-vm.vmdk"  
        }  
    }  
}
```

- For API details, see [ImportSnapshot](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example imports a VM disk image of format 'VMDK' to an Amazon EBS snapshot. The example requires a VM Import Service Role with the default name 'vmimport', with a policy allowing Amazon EC2 access to the specified bucket, as explained in the VM Import Prerequisites topic in <http://docs.aws.amazon.com/AWSEC2/latest/WindowsGuide/VMImportPrerequisites.html>. To use a custom role, specify the role name using the -RoleName parameter.**

```
$parms = @{
    "ClientToken"="idempotencyToken"
    "Description"="Disk Image Import"
    "DiskContainer_Description" = "Data disk"
    "DiskContainer_Format" = "VMDK"
    "DiskContainer_S3Bucket" = "myVirtualMachineImages"
    "DiskContainer_S3Key" = "datadiskimage.vmdk"
}

Import-EC2Snapshot @parms
```

### Output:

Description	ImportTaskId	SnapshotTaskDetail
Disk Image Import	import-snap-abcdefg	Amazon.EC2.Model.SnapshotTaskDetail

- For API details, see [ImportSnapshot](#) in AWS Tools for PowerShell Cmdlet Reference.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyCapacityReservation with an AWS SDK or CLI

The following code examples show how to use `ModifyCapacityReservation`.

## CLI

### AWS CLI

#### Example 1: To change the number of instances reserved by an existing capacity reservation

The following modify-capacity-reservation example changes the number of instances for which the capacity reservation reserves capacity.

```
aws ec2 modify-capacity-reservation \
--capacity-reservation-id cr-1234abcd56EXAMPLE \
--instance-count 5
```

Output:

```
{  
    "Return": true  
}
```

#### Example 2: To change the end date and time for an existing capacity reservation

The following modify-capacity-reservation example modifies an existing capacity reservation to end at the specified date and time.

```
aws ec2 modify-capacity-reservation \
--capacity-reservation-id cr-1234abcd56EXAMPLE \
--end-date-type Limited \
--end-date 2019-08-31T23:59:59Z
```

For more information, see [Modifying a Capacity Reservation](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [ModifyCapacityReservation](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example modifies the CapacityReservationId cr-0c1f2345db6f7cdba by changing the instance count to 1

```
Edit-EC2CapacityReservation -CapacityReservationId cr-0c1f2345db6f7cdba -  
InstanceCount 1
```

### Output:

```
True
```

- For API details, see [ModifyCapacityReservation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyHosts with an AWS SDK or CLI

The following code examples show how to use ModifyHosts.

### CLI

#### AWS CLI

##### Example 1: To enable auto-placement for a Dedicated Host

The following modify-hosts example enables auto-placement for a Dedicated Host so that it accepts any untargeted instance launches that match its instance type configuration.

```
aws ec2 modify-hosts \  
  --host-id h-06c2f189b4EXAMPLE \  
  --auto-placement on
```

### Output:

```
{  
    "Successful": [  
        "h-06c2f189b4EXAMPLE"  
    ],  
    "Unsuccessful": []  
}
```

## Example 2: To enable host recovery for a Dedicated Host

The following modify-hosts example enables host recovery for the specified Dedicated Host.

```
aws ec2 modify-hosts \
  --host-id h-06c2f189b4EXAMPLE \
  --host-recovery on
```

Output:

```
{  
  "Successful": [  
    "h-06c2f189b4EXAMPLE"  
  ],  
  "Unsuccessful": []  
}
```

For more information, see [Modifying Dedicated Host Auto-Placement](#) in the *Amazon Elastic Compute Cloud User Guide for Linux Instances*.

- For API details, see [ModifyHosts](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

### Example 1: This example modifies the AutoPlacement settings to off for the dedicated host h-01e23f4cd567890f3

```
Edit-EC2Host -HostId h-03e09f8cd681609f3 -AutoPlacement off
```

Output:

Successful	Unsuccessful
-----	-----
{h-01e23f4cd567890f3} { }	

- For API details, see [ModifyHosts](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyIdFormat with an AWS SDK or CLI

The following code examples show how to use ModifyIdFormat.

CLI

### AWS CLI

#### To enable the longer ID format for a resource

The following modify-id-format example enables the longer ID format for the instance resource type.

```
aws ec2 modify-id-format \
  --resource instance \
  --use-long-ids
```

#### To disable the longer ID format for a resource

The following modify-id-format example disables the longer ID format for the instance resource type.

```
aws ec2 modify-id-format \
  --resource instance \
  --no-use-long-ids
```

The following modify-id-format example enables the longer ID format for all supported resource types that are within their opt-in period.

```
aws ec2 modify-id-format \
  --resource all-current \
  --use-long-ids
```

- For API details, see [ModifyIdFormat](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example enables the longer ID format for the specified resource type.**

```
Edit-EC2IdFormat -Resource instance -UseLongId $true
```

**Example 2: This example disables the longer ID format for the specified resource type.**

```
Edit-EC2IdFormat -Resource instance -UseLongId $false
```

- For API details, see [ModifyIdFormat](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyImageAttribute with an AWS SDK or CLI

The following code examples show how to use ModifyImageAttribute.

### CLI

#### AWS CLI

**Example 1: To make an AMI public**

The following modify-instance-attribute example makes the specified AMI public.

```
aws ec2 modify-image-attribute \
--image-id ami-5731123e \
--launch-permission "Add=[{Group=all}]"
```

This command produces no output.

**Example 2: To make an AMI private**

The following modify-instance-attribute example makes the specified AMI private.

```
aws ec2 modify-image-attribute \
--image-id ami-5731123e \
--launch-permission "Remove=[{Group=all}]"
```

This command produces no output.

### Example 3: To grant launch permission to an AWS account

The following modify-instance-attribute example grants launch permissions to the specified AWS account.

```
aws ec2 modify-image-attribute \
--image-id ami-5731123e \
--launch-permission "Add=[{UserId=123456789012}]"
```

This command produces no output.

### Example 4: To remove launch permission from an AWS account

The following modify-instance-attribute example removes launch permissions from the specified AWS account.

```
aws ec2 modify-image-attribute \
--image-id ami-5731123e \
--launch-permission "Remove=[{UserId=123456789012}]"
```

- For API details, see [ModifyImageAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example updates the description for the specified AMI.

```
Edit-EC2ImageAttribute -ImageId ami-12345678 -Description "New description"
```

#### Example 2: This example makes the AMI public (for example, so any AWS account can use it).

```
Edit-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission -  
OperationType add -UserGroup all
```

**Example 3: This example makes the AMI private (for example, so that only you as the owner can use it).**

```
Edit-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission -  
OperationType remove -UserGroup all
```

**Example 4: This example grants launch permission to the specified AWS account.**

```
Edit-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission -  
OperationType add -UserId 111122223333
```

**Example 5: This example removes launch permission from the specified AWS account.**

```
Edit-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission -  
OperationType remove -UserId 111122223333
```

- For API details, see [ModifyImageAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyInstanceAttribute with an AWS SDK or CLI

The following code examples show how to use ModifyInstanceAttribute.

CLI

### AWS CLI

**Example 1: To modify the instance type**

The following modify-instance-attribute example modifies the instance type of the specified instance. The instance must be in the stopped state.

```
aws ec2 modify-instance-attribute \
```

```
--instance-id i-1234567890abcdef0 \
--instance-type "{\"Value\": \"m1.small\"}"
```

This command produces no output.

### Example 2: To enable enhanced networking on an instance

The following modify-instance-attribute example enables enhanced networking for the specified instance. The instance must be in the stopped state.

```
aws ec2 modify-instance-attribute \
--instance-id i-1234567890abcdef0 \
--srivd-net-support simple
```

This command produces no output.

### Example 3: To modify the sourceDestCheck attribute

The following modify-instance-attribute example sets the sourceDestCheck attribute of the specified instance to true. The instance must be in a VPC.

```
aws ec2 modify-instance-attribute --instance-id i-1234567890abcdef0 --source-
dest-check "{\"Value\": true}"
```

This command produces no output.

### Example 4: To modify the deleteOnTermination attribute of the root volume

The following modify-instance-attribute example sets the deleteOnTermination attribute for the root volume of the specified Amazon EBS-backed instance to false. By default, this attribute is true for the root volume.

Command:

```
aws ec2 modify-instance-attribute \
--instance-id i-1234567890abcdef0 \
--block-device-mappings "[{\"DeviceName\": \"/dev/sda1\", \"Ebs\": \
{\"DeleteOnTermination\": false}}]"
```

This command produces no output.

## Example 5: To modify the user data attached to an instance

The following `modify-instance-attribute` example adds the contents of the file `UserData.txt` as the `UserData` for the specified instance.

Contents of original file `UserData.txt`:

```
#!/bin/bash
yum update -y
service httpd start
chkconfig httpd on
```

The contents of the file must be base64 encoded. The first command converts the text file to base64 and saves it as a new file.

Linux/macOS version of the command:

```
base64 UserData.txt > UserData.base64.txt
```

This command produces no output.

Windows version of the command:

```
certutil -encode UserData.txt tmp.b64 && findstr /v /c:- tmp.b64 >
UserData.base64.txt
```

Output:

```
Input Length = 67
Output Length = 152
CertUtil: -encode command completed successfully.
```

Now you can reference that file in the CLI command that follows:

```
aws ec2 modify-instance-attribute \
--instance-id=i-09b5a14dbc622e76 \
--attribute userData --value file://UserData.base64.txt
```

This command produces no output.

For more information, see [User Data and the AWS CLI](#) in the *EC2 User Guide*.

- For API details, see [ModifyInstanceAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example modifies the instance type of the specified instance.**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -InstanceType m3.medium
```

**Example 2: This example enables enhanced networking for the specified instance, by specifying "simple" as the value of the single root I/O virtualization (SR-IOV) network support parameter, -SriovNetSupport..**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -SriovNetSupport "simple"
```

**Example 3: This example modifies the security groups for the specified instance. The instance must be in a VPC. You must specify the ID of each security group, not the name.**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -Group @( "sg-12345678",  
"sg-45678901" )
```

**Example 4: This example enables EBS I/O optimization for the specified instance. This feature isn't available with all instance types. Additional usage charges apply when using an EBS-optimized instance.**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -EbsOptimized $true
```

**Example 5: This example enables source/destination checking for the specified instance. For a NAT instance to perform NAT, the value must be 'false'.**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -SourceDestCheck $true
```

**Example 6: This example disables termination for the specified instance.**

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -DisableApiTermination $true
```

## Example 7: This example changes the specified instance so that it terminates when shutdown is initiated from the instance.

```
Edit-EC2InstanceAttribute -InstanceId i-12345678 -  
InstanceInitiatedShutdownBehavior terminate
```

- For API details, see [ModifyInstanceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ModifyInstanceCreditSpecification` with an AWS SDK or CLI

The following code examples show how to use `ModifyInstanceCreditSpecification`.

### CLI

#### AWS CLI

##### To modify the credit option for CPU usage of an instance

This example modifies the credit option for CPU usage of the specified instance in the specified region to "unlimited". Valid credit options are "standard" and "unlimited".

Command:

```
aws ec2 modify-instance-credit-specification --instance-credit-  
specification "InstanceId=i-1234567890abcdef0,CpuCredits=unlimited"
```

Output:

```
{  
    "SuccessfulInstanceCreditSpecifications": [  
        {  
            "InstanceId": "i-1234567890abcdef0"  
        }  
    ],  
    "UnsuccessfulInstanceCreditSpecifications": []  
}
```

- For API details, see [ModifyInstanceCreditSpecification](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This enables T2 unlimited credits for instance i-01234567890abcdef.**

```
$Credit = New-Object -TypeName Amazon.EC2.Model.InstanceCreditSpecificationRequest
$Credit.InstanceId = "i-01234567890abcdef"
$Credit.CpuCredits = "unlimited"
Edit-EC2InstanceCreditSpecification -InstanceCreditSpecification $Credit
```

- For API details, see [ModifyInstanceCreditSpecification](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ModifyNetworkInterfaceAttribute` with an AWS SDK or CLI

The following code examples show how to use `ModifyNetworkInterfaceAttribute`.

### CLI

#### AWS CLI

##### To modify the attachment attribute of a network interface

This example command modifies the attachment attribute of the specified network interface.

Command:

```
aws ec2 modify-network-interface-attribute --network-interface-id eni-686ea200 --attachment AttachmentId=eni-attach-43348162,DeleteOnTermination=false
```

##### To modify the description attribute of a network interface

This example command modifies the description attribute of the specified network interface.

Command:

```
aws ec2 modify-network-interface-attribute --network-interface-id eni-686ea200 --description "My description"
```

### To modify the groupSet attribute of a network interface

This example command modifies the groupSet attribute of the specified network interface.

Command:

```
aws ec2 modify-network-interface-attribute --network-interface-id eni-686ea200 --groups sg-903004f8 sg-1a2b3c4d
```

### To modify the sourceDestCheck attribute of a network interface

This example command modifies the sourceDestCheck attribute of the specified network interface.

Command:

```
aws ec2 modify-network-interface-attribute --network-interface-id eni-686ea200 --no-source-dest-check
```

- For API details, see [ModifyNetworkInterfaceAttribute](#) in AWS CLI Command Reference.

## PowerShell

### Tools for PowerShell

**Example 1: This example modifies the specified network interface so that the specified attachment is deleted on termination.**

```
Edit-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-1a2b3c4d -Attachment_AttachmentId eni-attach-1a2b3c4d -Attachment_DeleteOnTermination $true
```

**Example 2: This example modifies the description of the specified network interface.**

```
Edit-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-1a2b3c4d -Description "my description"
```

### Example 3: This example modifies the security group for the specified network interface.

```
Edit-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-1a2b3c4d -Groups sg-1a2b3c4d
```

### Example 4: This example disables source/destination checking for the specified network interface.

```
Edit-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-1a2b3c4d -SourceDestCheck $false
```

- For API details, see [ModifyNetworkInterfaceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ModifyReservedInstances` with an AWS SDK or CLI

The following code examples show how to use `ModifyReservedInstances`.

### CLI

#### AWS CLI

##### To modify Reserved Instances

This example command moves a Reserved Instance to another Availability Zone in the same region.

Command:

```
aws ec2 modify-reserved-instances --reserved-instance-ids b847fa93-e282-4f55-b59a-1342f5bd7c02 --target-configurations AvailabilityZone=us-west-1c,Platform=EC2-Classic,InstanceCount=10
```

Output:

```
{  
    "ReservedInstancesModificationId": "rimod-d3ed4335-b1d3-4de6-ab31-0f13aaaf46687"  
}
```

## To modify the network platform of Reserved Instances

This example command converts EC2-Classic Reserved Instances to EC2-VPC.

Command:

```
aws ec2 modify-reserved-instances --reserved-instances-ids f127bd27edb7-44c9-a0eb-0d7e09259af0 --target-configurations AvailabilityZone=us-west-1c,Platform=EC2-VPC,InstanceCount=5
```

Output:

```
{  
    "ReservedInstancesModificationId": "rimod-82fa9020-668f-4fb6-945d-61537009d291"  
}
```

For more information, see Modifying Your Reserved Instances in the *Amazon EC2 User Guide*.

## To modify the instance size of Reserved Instances

This example command modifies a Reserved Instance that has 10 m1.small Linux/UNIX instances in us-west-1c so that 8 m1.small instances become 2 m1.large instances, and the remaining 2 m1.small become 1 m1.medium instance in the same Availability Zone.

Command:

```
aws ec2 modify-reserved-instances --reserved-instances-ids 1ba8e2e3-3556-4264-949e-63ee671405a9 --target-configurations AvailabilityZone=us-west-1c,Platform=EC2-Classic,InstanceCount=2,InstanceType=m1.large AvailabilityZone=us-west-1c,Platform=EC2-Classic,InstanceCount=1,InstanceType=m1.medium
```

Output:

```
{  
    "ReservedInstancesModificationId": "rimod-acc5f240-080d-4717-b3e3-1c6b11fa00b6"
```

{}

For more information, see [Modifying the Instance Size of Your Reservations in the Amazon EC2 User Guide](#).

- For API details, see [ModifyReservedInstances](#) in [AWS CLI Command Reference](#).

## PowerShell

### Tools for PowerShell

**Example 1: This example modifies the Availability Zone, instance count, and platform for the specified Reserved instances.**

```
$config = New-Object Amazon.EC2.Model.ReservedInstancesConfiguration  
$config.AvailabilityZone = "us-west-2a"  
$config.InstanceCount = 1  
$config.Platform = "EC2-VPC"  
  
Edit-EC2ReservedInstance `  
-ReservedInstancesId @("FE32132D-70D5-4795-B400-AE435EXAMPLE",  
"0CC556F3-7AB8-4C00-B0E5-98666EXAMPLE") `  
-TargetConfiguration $config
```

- For API details, see [ModifyReservedInstances](#) in [AWS Tools for PowerShell Cmdlet Reference](#).

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ModifySnapshotAttribute` with an AWS SDK or CLI

The following code examples show how to use `ModifySnapshotAttribute`.

### CLI

#### AWS CLI

**Example 1: To modify a snapshot attribute**

The following modify-snapshot-attribute example updates the createVolumePermission attribute for the specified snapshot, removing volume permissions for the specified user.

```
aws ec2 modify-snapshot-attribute \
--snapshot-id snap-1234567890abcdef0 \
--attribute createVolumePermission \
--operation-type remove \
--user-ids 123456789012
```

### Example 2: To make a snapshot public

The following modify-snapshot-attribute example makes the specified snapshot public.

```
aws ec2 modify-snapshot-attribute \
--snapshot-id snap-1234567890abcdef0 \
--attribute createVolumePermission \
--operation-type add \
--group-names all
```

- For API details, see [ModifySnapshotAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example makes the specified snapshot public by setting its CreateVolumePermission attribute.**

```
Edit-EC2SnapshotAttribute -SnapshotId snap-12345678 -Attribute
CreateVolumePermission -OperationType Add -GroupName all
```

- For API details, see [ModifySnapshotAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use `ModifySpotFleetRequest` with an AWS SDK or CLI

The following code examples show how to use `ModifySpotFleetRequest`.

CLI

## AWS CLI

### To modify a Spot fleet request

This example command updates the target capacity of the specified Spot fleet request.

Command:

```
aws ec2 modify-spot-fleet-request --target-capacity 20 --spot-fleet-request-id sfr-73fdbd2ce-aa30-494c-8788-1cee4EXAMPLE
```

Output:

```
{  
    "Return": true  
}
```

This example command decreases the target capacity of the specified Spot fleet request without terminating any Spot Instances as a result.

Command:

```
aws ec2 modify-spot-fleet-request --target-capacity 10 --excess-capacity-termination-policy NoTermination --spot-fleet-request-ids sfr-73fdbd2ce-aa30-494c-8788-1cee4EXAMPLE
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [ModifySpotFleetRequest](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example updates the target capacity of the specified Spot fleet request.**

```
Edit-EC2SpotFleetRequest -SpotFleetRequestId sfr-73fbd2ce-  
aa30-494c-8788-1cee4EXAMPLE -TargetCapacity 10
```

#### Output:

```
True
```

- For API details, see [ModifySpotFleetRequest](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifySubnetAttribute with an AWS SDK or CLI

The following code examples show how to use ModifySubnetAttribute.

### CLI

#### AWS CLI

##### To change a subnet's public IPv4 addressing behavior

This example modifies subnet-1a2b3c4d to specify that all instances launched into this subnet are assigned a public IPv4 address. If the command succeeds, no output is returned.

Command:

```
aws ec2 modify-subnet-attribute --subnet-id subnet-1a2b3c4d --map-public-ip-on-launch
```

##### To change a subnet's IPv6 addressing behavior

This example modifies subnet-1a2b3c4d to specify that all instances launched into this subnet are assigned an IPv6 address from the range of the subnet.

Command:

```
aws ec2 modify-subnet-attribute --subnet-id subnet-1a2b3c4d --assign-ipv6-address-on-creation
```

For more information, see IP Addressing in Your VPC in the *AWS Virtual Private Cloud User Guide*.

- For API details, see [ModifySubnetAttribute](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example enables public IP addressing for the specified subnet.**

```
Edit-EC2SubnetAttribute -SubnetId subnet-1a2b3c4d -MapPublicIpOnLaunch $true
```

**Example 2: This example disables public IP addressing for the specified subnet.**

```
Edit-EC2SubnetAttribute -SubnetId subnet-1a2b3c4d -MapPublicIpOnLaunch $false
```

- For API details, see [ModifySubnetAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use **ModifyVolumeAttribute** with an AWS SDK or CLI

The following code examples show how to use **ModifyVolumeAttribute**.

CLI

### AWS CLI

#### To modify a volume attribute

This example sets the `autoEnableIo` attribute of the volume with the ID `vol-1234567890abcdef0` to true. If the command succeeds, no output is returned.

Command:

```
aws ec2 modify-volume-attribute --volume-id vol-1234567890abcdef0 --auto-enable-io
```

- For API details, see [ModifyVolumeAttribute](#) in *AWS CLI Command Reference*.

PowerShell

## Tools for PowerShell

**Example 1: This example modifies the specified attribute of the specified volume. I/O operations for the volume are automatically resumed after being suspended due to potentially inconsistent data.**

```
Edit-EC2VolumeAttribute -VolumeId vol-12345678 -AutoEnableIO $true
```

- For API details, see [ModifyVolumeAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ModifyVpcAttribute with an AWS SDK or CLI

The following code examples show how to use `ModifyVpcAttribute`.

CLI

### AWS CLI

#### To modify the enableDnsSupport attribute

This example modifies the `enableDnsSupport` attribute. This attribute indicates whether DNS resolution is enabled for the VPC. If this attribute is `true`, the Amazon DNS server resolves DNS hostnames for your instances to their corresponding IP addresses; otherwise, it does not. If the command succeeds, no output is returned.

Command:

```
aws ec2 modify-vpc-attribute --vpc-id vpc-a01106c2 --enable-dns-support "{\"Value\" : false}"
```

## To modify the enableDnsHostnames attribute

This example modifies the enableDnsHostnames attribute. This attribute indicates whether instances launched in the VPC get DNS hostnames. If this attribute is true, instances in the VPC get DNS hostnames; otherwise, they do not. If the command succeeds, no output is returned.

Command:

```
aws ec2 modify-vpc-attribute --vpc-id vpc-a01106c2 --enable-dns-hostnames  
"{\"Value\" : false}"
```

- For API details, see [ModifyVpcAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example enables support for DNS hostnames for the specified VPC.

```
Edit-EC2VpcAttribute -VpcId vpc-12345678 -EnableDnsHostnames $true
```

#### Example 2: This example disables support for DNS hostnames for the specified VPC.

```
Edit-EC2VpcAttribute -VpcId vpc-12345678 -EnableDnsHostnames $false
```

#### Example 3: This example enables support for DNS resolution for the specified VPC.

```
Edit-EC2VpcAttribute -VpcId vpc-12345678 -EnableDnsSupport $true
```

#### Example 4: This example disables support for DNS resolution for the specified VPC.

```
Edit-EC2VpcAttribute -VpcId vpc-12345678 -EnableDnsSupport $false
```

- For API details, see [ModifyVpcAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use MonitorInstances with an AWS SDK or CLI

The following code examples show how to use MonitorInstances.

C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Enable detailed monitoring for an Amazon Elastic Compute Cloud (Amazon EC2)
instance.
/*
 \param instanceId: An EC2 instance ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::enableMonitoring(const Aws::String &instanceId,
                                    const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::MonitorInstancesRequest request;
    request.AddInstanceIds(instanceId);
    request.SetDryRun(true);

    Aws::EC2::Model::MonitorInstancesOutcome dryRunOutcome =
ec2Client.MonitorInstances(request);
    if (dryRunOutcome.IsSuccess()) {
        std::cerr
            << "Failed dry run to enable monitoring on instance. A dry run
should trigger an error."
            <<
            std::endl;
    return false;
```

```
        } else if (dryRunOutcome.GetError().GetErrorType()
                   != Aws::EC2::EC2Errors::DRY_RUN_OPERATION) {
            std::cerr << "Failed dry run to enable monitoring on instance " <<
                instanceId << ":" << dryRunOutcome.GetError().GetMessage() <<
                std::endl;
            return false;
        }

        request.SetDryRun(false);
        Aws::EC2::Model::MonitorInstancesOutcome monitorInstancesOutcome =
ec2Client.MonitorInstances(request);
        if (!monitorInstancesOutcome.IsSuccess()) {
            std::cerr << "Failed to enable monitoring on instance " <<
                instanceId << ":" <<
                monitorInstancesOutcome.GetError().GetMessage() << std::endl;
        } else {
            std::cout << "Successfully enabled monitoring on instance " <<
                instanceId << std::endl;
        }

        return monitorInstancesOutcome.IsSuccess();
    }
}
```

- For API details, see [MonitorInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To enable detailed monitoring for an instance

This example command enables detailed monitoring for the specified instance.

Command:

```
aws ec2 monitor-instances --instance-ids i-1234567890abcdef0
```

Output:

```
{
    "InstanceMonitorings": [
```

```
{  
    "InstanceId": "i-1234567890abcdef0",  
    "Monitoring": {  
        "State": "pending"  
    }  
}  
]  
}
```

- For API details, see [MonitorInstances](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { MonitorInstancesCommand } from "@aws-sdk/client-ec2";  
  
import { client } from "../libs/client.js";  
  
// Turn on detailed monitoring for the selected instance.  
// By default, metrics are sent to Amazon CloudWatch every 5 minutes.  
// For a cost you can enable detailed monitoring which sends metrics every  
// minute.  
export const main = async () => {  
    const command = new MonitorInstancesCommand({  
        InstanceIds: ["INSTANCE_ID"],  
    });  
  
    try {  
        const { InstanceMonitorings } = await client.send(command);  
        const instancesBeingMonitored = InstanceMonitorings.map(  
            (im) =>  
                ` • Detailed monitoring state for ${im.InstanceId} is  
${im.Monitoring.State}.`,  
        );  
        console.log("Monitoring status:");  
    } catch (err) {  
        console.error(`Error: ${err}`);  
    }  
};
```

```
        console.log(instancesBeingMonitored.join("\n"));
    } catch (err) {
        console.error(err);
    }
};
```

- For API details, see [MonitorInstances](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example enables detailed monitoring for the specified instance.

```
Start-EC2InstanceMonitoring -InstanceId i-12345678
```

#### Output:

InstanceId	Monitoring
i-12345678	Amazon.EC2.Model.Monitoring

- For API details, see [MonitorInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
DATA lt_instance_ids TYPE /aws1/
cl_ec2instidstringlist_w=>tt_instanceidstringlist.
    APPEND NEW /aws1/cl_ec2instidstringlist_w( iv_value = iv_instance_id ) TO
lt_instance_ids.
```

```
"Perform dry run"
TRY.
  " DryRun is set to true. This checks for the required permissions to
  monitor the instance without actually making the request. "
  lo_ec2->monitorinstances(
    it_instanceids = lt_instance_ids
    iv_dryrun = abap_true
  ).
  CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
    " If the error code returned is `DryRunOperation`, then you have the
    required permissions to monitor this instance. "
    IF lo_exception->av_err_code = 'DryRunOperation'.
      MESSAGE 'Dry run to enable detailed monitoring completed.' TYPE 'I'.
      " DryRun is set to false to enable detailed monitoring. "
      lo_ec2->monitorinstances(
        it_instanceids = lt_instance_ids
        iv_dryrun = abap_false
      ).
      MESSAGE 'Detailed monitoring enabled.' TYPE 'I'.
      " If the error code returned is `UnauthorizedOperation`, then you don't
      have the required permissions to monitor this instance. "
      ELSEIF lo_exception->av_err_code = 'UnauthorizedOperation'.
        MESSAGE 'Dry run to enable detailed monitoring failed. User does not
        have the permissions to monitor the instance.' TYPE 'E'.
      ELSE.
        DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-
>av_err_msg }|.
        MESSAGE lv_error TYPE 'E'.
      ENDIF.
    ENDTRY.
```

- For API details, see [MonitorInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use MoveAddressToVpc with an AWS SDK or CLI

The following code examples show how to use MoveAddressToVpc.

## CLI

### AWS CLI

#### To move an address to EC2-VPC

This example moves Elastic IP address 54.123.4.56 to the EC2-VPC platform.

Command:

```
aws ec2 move-address-to-vpc --public-ip 54.123.4.56
```

Output:

```
{  
    "Status": "MoveInProgress"  
}
```

- For API details, see [MoveAddressToVpc](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example moves an EC2 instance with a public IP address of 12.345.67.89 to the EC2-VPC platform in the US East (Northern Virginia) region.**

```
Move-EC2AddressToVpc -PublicIp 12.345.67.89 -Region us-east-1
```

**Example 2: This example pipes the results of a Get-EC2Instance command to the Move-EC2AddressToVpc cmdlet. The Get-EC2Instance command gets an instance that is specified by instance ID, then returns the public IP address property of the instance.**

```
(Get-EC2Instance -Instance i-12345678).Instances.PublicIpAddress | Move-  
EC2AddressToVpc
```

- For API details, see [MoveAddressToVpc](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use PurchaseHostReservation with an AWS SDK or CLI

The following code examples show how to use PurchaseHostReservation.

CLI

### AWS CLI

#### To purchase a Dedicated Host Reservation

This example purchases the specified Dedicated Host Reservation offering for the specified Dedicated Host in your account.

Command:

```
aws ec2 purchase-host-reservation --offering-id hro-03f707bf363b6b324 --host-id-set h-013abcd2a00cbd123
```

Output:

```
{  
    "TotalHourlyPrice": "1.499",  
    "Purchase": [  
        {  
            "HourlyPrice": "1.499",  
            "InstanceFamily": "m4",  
            "PaymentOption": "NoUpfront",  
            "HostIdSet": [  
                "h-013abcd2a00cbd123"  
            ],  
            "HostReservationId": "hr-0d418a3a4ffc669ae",  
            "UpfrontPrice": "0.000",  
            "Duration": 31536000  
        }  
    "TotalUpfrontPrice": "0.000"  
}
```

- For API details, see [PurchaseHostReservation](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example purchases the reservation offering hro-0c1f23456789d0ab with configurations that match those of your Dedicated Host h-01e23f4cd567890f1**

```
New-EC2HostReservation -OfferingId hro-0c1f23456789d0ab HostIdSet  
h-01e23f4cd567890f1
```

### Output:

```
ClientToken      :  
CurrencyCode     :  
Purchase         : {hr-0123f4b5d67bedc89}  
TotalHourlyPrice : 1.307  
TotalUpfrontPrice : 0.000
```

- For API details, see [PurchaseHostReservation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use PurchaseScheduledInstances with an AWS SDK or CLI

The following code examples show how to use PurchaseScheduledInstances.

### CLI

#### AWS CLI

##### To purchase a Scheduled Instance

This example purchases a Scheduled Instance.

Command:

```
aws ec2 purchase-scheduled-instances --purchase-requests file://purchase-request.json
```

Purchase-request.json:

```
[  
  {  
    "PurchaseToken": "eyJ2IjoiMSIsInMi0jEsImMi0i...",  
    "InstanceCount": 1  
  }  
]
```

Output:

```
{  
  "ScheduledInstanceSet": [  
    {  
      "AvailabilityZone": "us-west-2b",  
      "ScheduledInstanceId": "sci-1234-1234-1234-123456789012",  
      "HourlyPrice": "0.095",  
      "CreateDate": "2016-01-25T21:43:38.612Z",  
      "Recurrence": {  
        "OccurrenceDaySet": [  
          1  
        ],  
        "Interval": 1,  
        "Frequency": "Weekly",  
        "OccurrenceRelativeToEnd": false,  
        "OccurrenceUnit": ""  
      },  
      "Platform": "Linux/UNIX",  
      "TermEndDate": "2017-01-31T09:00:00Z",  
      "InstanceCount": 1,  
      "SlotDurationInHours": 32,  
      "TermStartDate": "2016-01-31T09:00:00Z",  
      "NetworkPlatform": "EC2-VPC",  
      "TotalScheduledInstanceHours": 1696,  
      "NextSlotStartTime": "2016-01-31T09:00:00Z",  
      "InstanceType": "c4.large"  
    }  
  ]  
}
```

- For API details, see [PurchaseScheduledInstances](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example purchases a Scheduled Instance.

```
$request = New-Object Amazon.EC2.Model.PurchaseRequest  
$request.InstanceCount = 1  
$request.PurchaseToken = "eyJJIjoiMSIsInMi0jEsImMi0i..."  
New-EC2ScheduledInstancePurchase -PurchaseRequest $request
```

#### Output:

```
AvailabilityZone      : us-west-2b  
CreateDate          : 1/25/2016 1:43:38 PM  
HourlyPrice         : 0.095  
InstanceCount       : 1  
InstanceType        : c4.large  
NetworkPlatform     : EC2-VPC  
NextSlotStartTime   : 1/31/2016 1:00:00 AM  
Platform            : Linux/UNIX  
PreviousSlotEndTime :  
Recurrence          : Amazon.EC2.Model.ScheduledInstanceRecurrence  
ScheduledInstanceId : sci-1234-1234-1234-1234-123456789012  
SlotDurationInHours : 32  
TermEndDate         : 1/31/2017 1:00:00 AM  
TermStartDate       : 1/31/2016 1:00:00 AM  
TotalScheduledInstanceHours : 1696
```

- For API details, see [PurchaseScheduledInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RebootInstances with an AWS SDK or CLI

The following code examples show how to use RebootInstances.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Reboot EC2 instances.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the instances that will be
rebooted.</param>
/// <returns>Async task.</returns>
public async Task RebootInstances(string ec2InstanceId)
{
    var request = new RebootInstancesRequest
    {
        InstanceIds = new List<string> { ec2InstanceId },
    };

    var response = await _amazonEC2.RebootInstancesAsync(request);
    if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
    {
        Console.WriteLine("Instances successfully rebooted.");
    }
    else
    {
        Console.WriteLine("Could not reboot one or more instances.");
    }
}
```

Replace the profile for an instance, reboot, and restart a web server.

```
/// <summary>
/// Replace the profile associated with a running instance. After the profile
is replaced, the instance
/// is rebooted to ensure that it uses the new profile. When the instance is
ready, Systems Manager is
/// used to restart the Python web server.
/// </summary>
/// <param name="instanceId">The Id of the instance to update.</param>
/// <param name="credsProfileName">The name of the new profile to associate
with the specified instance.</param>
/// <param name="associationId">The Id of the existing profile association
for the instance.</param>
/// <returns>Async task.</returns>
public async Task ReplaceInstanceProfile(string instanceId, string
credsProfileName, string associationId)
{
    await _amazonEc2.ReplaceIamInstanceProfileAssociationAsync(
        new ReplaceIamInstanceProfileAssociationRequest()
    {
        AssociationId = associationId,
        IamInstanceProfile = new IamInstanceProfileSpecification()
        {
            Name = credsProfileName
        }
    });
    // Allow time before resetting.
    Thread.Sleep(25000);
    var instanceReady = false;
    var retries = 5;
    while (retries-- > 0 && !instanceReady)
    {
        await _amazonEc2.RebootInstancesAsync(
            new RebootInstancesRequest(new List<string>() { instanceId }));
        Thread.Sleep(10000);

        var instancesPaginator =
_amazonSsm.Paginator.DescribeInstanceInformation(
            new DescribeInstanceInformationRequest());
        // Get the entire list using the paginator.
        await foreach (var instance in
instancesPaginator.InstanceInformationList)
        {
            instanceReady = instance.InstanceId == instanceId;
```

```
        if (instanceReady)
        {
            break;
        }
    }

Console.WriteLine($"Sending restart command to instance {instanceId}");
await _amazonSsm.SendCommandAsync(
    new SendCommandRequest()
    {
        InstanceIds = new List<string>() { instanceId },
        DocumentName = "AWS-RunShellScript",
        Parameters = new Dictionary<string, List<string>>()
        {
            {"commands", new List<string>() { "cd / && sudo python3
server.py 80" }};
        }
    });
Console.WriteLine($"Restarted the web server on instance {instanceId}");
}
```

- For API details, see [RebootInstances](#) in *AWS SDK for .NET API Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Reboot an Amazon Elastic Compute Cloud (Amazon EC2) instance.
/*!
\param instanceID: An EC2 instance ID.
\param clientConfiguration: AWS client configuration.
\return bool: Function succeeded.
*/
bool AwsDoc::EC2::rebootInstance(const Aws::String &instanceId,
```

```
const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::RebootInstancesRequest request;
    request.AddInstanceIds(instanceId);
    request.SetDryRun(true);

    Aws::EC2::Model::RebootInstancesOutcome dry_run_outcome =
ec2Client.RebootInstances(request);
    if (dry_run_outcome.IsSuccess()) {
        std::cerr
            << "Failed dry run to reboot on instance. A dry run should
trigger an error."
            <<
            std::endl;
        return false;
    } else if (dry_run_outcome.GetError().GetErrorCode()
        != Aws::EC2::EC2Errors::DRY_RUN_OPERATION) {
        std::cout << "Failed dry run to reboot instance " << instanceId << ":" "
            << dry_run_outcome.GetError().GetMessage() << std::endl;
        return false;
    }

    request.SetDryRun(false);
    Aws::EC2::Model::RebootInstancesOutcome outcome =
ec2Client.RebootInstances(request);
    if (!outcome.IsSuccess()) {
        std::cout << "Failed to reboot instance " << instanceId << ":" "
            << outcome.GetError().GetMessage() << std::endl;
    } else {
        std::cout << "Successfully rebooted instance " << instanceId <<
            std::endl;
    }

    return outcome.IsSuccess();
}
```

- For API details, see [RebootInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To reboot an Amazon EC2 instance

This example reboots the specified instance. If the command succeeds, no output is returned.

Command:

```
aws ec2 reboot-instances --instance-ids i-1234567890abcdef5
```

For more information, see Reboot Your Instance in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [RebootInstances](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { RebootInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new RebootInstancesCommand({
    InstanceIds: ["INSTANCE_ID"],
  });

  try {
    await client.send(command);
    console.log("Instance rebooted successfully.");
  } catch (err) {
    console.error(err);
  }
}
```

```
    }  
};
```

- For API details, see [RebootInstances](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example reboots the specified instance.

```
Restart-EC2Instance -InstanceId i-12345678
```

- For API details, see [RebootInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class AutoScaler:  
    """  
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.  
    """  
  
    def __init__(  
        self,  
        resource_prefix,  
        inst_type,  
        ami_param,  
        autoscaling_client,  
        ec2_client,  
        ssm_client,  
        iam_client,  
    ):
```

```
"""
:param resource_prefix: The prefix for naming AWS resources that are
created by this class.
:param inst_type: The type of EC2 instance to create, such as t3.micro.
:param ami_param: The Systems Manager parameter used to look up the AMI
that is
    created.

:param autoscaling_client: A Boto3 EC2 Auto Scaling client.
:param ec2_client: A Boto3 EC2 client.
:param ssm_client: A Boto3 Systems Manager client.
:param iam_client: A Boto3 IAM client.
"""

self.inst_type = inst_type
self.ami_param = ami_param
self.autoscaling_client = autoscaling_client
self.ec2_client = ec2_client
self.ssm_client = ssm_client
self.iam_client = iam_client
self.launch_template_name = f"{resource_prefix}-template"
self.group_name = f"{resource_prefix}-group"
self.instance_policy_name = f"{resource_prefix}-pol"
self.instance_role_name = f"{resource_prefix}-role"
self.instance_profile_name = f"{resource_prefix}-prof"
self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
self.bad_creds_role_name = f"{resource_prefix}-bc-role"
self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
self.key_pair_name = f"{resource_prefix}-key-pair"

def replace_instance_profile(
    self, instance_id, new_instance_profile_name, profile_association_id
):
    """
    Replaces the profile associated with a running instance. After the
    profile is
        replaced, the instance is rebooted to ensure that it uses the new
    profile. When
        the instance is ready, Systems Manager is used to restart the Python web
    server.

    :param instance_id: The ID of the instance to update.
    :param new_instance_profile_name: The name of the new profile to
    associate with
        the specified instance.
    
```

```
:param profile_association_id: The ID of the existing profile association
for the
                                instance.

"""
try:
    self.ec2_client.replace_iam_instance_profile_association(
        IamInstanceProfile={"Name": new_instance_profile_name},
        AssociationId=profile_association_id,
    )
    log.info(
        "Replaced instance profile for association %s with profile %s.",
        profile_association_id,
        new_instance_profile_name,
    )
    time.sleep(5)
    inst_ready = False
    tries = 0
    while not inst_ready:
        if tries % 6 == 0:
            self.ec2_client.reboot_instances(InstanceIds=[instance_id])
            log.info(
                "Rebooting instance %s and waiting for it to be
ready.",
                instance_id,
            )
        tries += 1
        time.sleep(10)
        response = self.ssm_client.describe_instance_information()
        for info in response["InstanceInformationList"]:
            if info["InstanceId"] == instance_id:
                inst_ready = True
    self.ssm_client.send_command(
        InstanceIds=[instance_id],
        DocumentName="AWS-RunShellScript",
        Parameters={"commands": ["cd / && sudo python3 server.py 80"]},
    )
    log.info("Restarted the Python web server on instance %s.",
instance_id)
except ClientError as err:
    raise AutoScalerError(
        f"Couldn't replace instance profile for association
{profile_association_id}: {err}"
    )
```

- For API details, see [RebootInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn reboot(&self, ec2: &EC2) -> Result<(), EC2Error> {
    if self.instance.is_some() {
        ec2.reboot_instance(self.instance_id()).await?;
        ec2.wait_for_instance_stopped(self.instance_id(), None)
            .await?;
        ec2.wait_for_instance_ready(self.instance_id(), None)
            .await?;
    }
    Ok(())
}
```

```
pub async fn reboot_instance(&self, instance_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Rebooting instance {instance_id}");

    self.client
        .reboot_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    Ok(())
}
```

Waiters for instance to be in the stopped and ready states, using the Waiters API. Using the Waiters API requires `use aws\_sdk\_ec2::client::Waiters` in the rust file.

```
/// Wait for an instance to be ready and status ok (default wait 60 seconds)
pub async fn wait_for_instance_ready(
    &self,
    instance_id: &str,
    duration: Option<Duration>,
) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_status_ok()
        .instance_ids(instance_id)
        .wait(duration.unwrap_or(Duration::from_secs(60)))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to start.",
                exceeded.max_wait().as_secs()
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}

pub async fn wait_for_instance_stopped(
    &self,
    instance_id: &str,
    duration: Option<Duration>,
) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_stopped()
        .instance_ids(instance_id)
        .wait(duration.unwrap_or(Duration::from_secs(60)))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to stop.",
                exceeded.max_wait().as_secs(),
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
```

- For API details, see [RebootInstances](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
DATA lt_instance_ids TYPE /aws1/
cl_ec2instidstringlist_w=>tt_instanceidstringlist.
    APPEND NEW /aws1/cl_ec2instidstringlist_w( iv_value = iv_instance_id ) TO
lt_instance_ids.

"Perform dry run"
TRY.
    " DryRun is set to true. This checks for the required permissions to
    reboot the instance without actually making the request. "
    lo_ec2->rebootinstances(
        it_instanceids = lt_instance_ids
        iv_dryrun = abap_true
    ).
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
    " If the error code returned is `DryRunOperation`, then you have the
    required permissions to reboot this instance. "
    IF lo_exception->av_err_code = 'DryRunOperation'.
        MESSAGE 'Dry run to reboot instance completed.' TYPE 'I'.
        " DryRun is set to false to make a reboot request. "
        lo_ec2->rebootinstances(
            it_instanceids = lt_instance_ids
            iv_dryrun = abap_false
        ).
        MESSAGE 'Instance rebooted.' TYPE 'I'.
        " If the error code returned is `UnauthorizedOperation`, then you don't
        have the required permissions to reboot this instance. "
        ELSEIF lo_exception->av_err_code = 'UnauthorizedOperation'.
```

```
MESSAGE 'Dry run to reboot instance failed. User does not have  
permissions to reboot the instance.' TYPE 'E'.  
ELSE.  
    DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-  
>av_err_msg }|.  
    MESSAGE lv_error TYPE 'E'.  
ENDIF.  
ENDTRY.
```

- For API details, see [RebootInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RegisterImage with an AWS SDK or CLI

The following code examples show how to use RegisterImage.

CLI

### AWS CLI

#### Example 1: To register an AMI using a manifest file

The following register-image example registers an AMI using the specified manifest file in Amazon S3.

```
aws ec2 register-image \  
  --name my-image \  
  --image-location my-s3-bucket/myimage/image.manifest.xml
```

Output:

```
{  
    "ImageId": "ami-1234567890EXAMPLE"  
}
```

For more information, see [Amazon Machine Images \(AMI\)](#) in the *Amazon EC2 User Guide*.

## Example 2: To register an AMI using a snapshot of a root device

The following `register-image` example registers an AMI using the specified snapshot of an EBS root volume as device `/dev/xvda`. The block device mapping also includes an empty 100 GiB EBS volume as device `/dev/xvdf`.

```
aws ec2 register-image \
  --name my-image \
  --root-device-name /dev/xvda \
  --block-device-mappings DeviceName=/dev/xvda, Ebs={SnapshotId=snap-0db2cf683925d191f} DeviceName=/dev/xvdf, Ebs={VolumeSize=100}
```

Output:

```
{  
    "ImageId": "ami-1a2b3c4d5eEXAMPLE"  
}
```

For more information, see [Amazon Machine Images \(AMI\)](#) in the *Amazon EC2 User Guide*.

- For API details, see [RegisterImage](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

#### Example 1: This example registers an AMI using the specified manifest file in Amazon S3.

```
Register-EC2Image -ImageLocation my-s3-bucket/my-web-server-ami/image.manifest.xml -Name my-web-server-ami
```

- For API details, see [RegisterImage](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RejectVpcPeeringConnection with an AWS SDK or CLI

The following code examples show how to use `RejectVpcPeeringConnection`.

## CLI

### AWS CLI

#### To reject a VPC peering connection

This example rejects the specified VPC peering connection request.

Command:

```
aws ec2 reject-vpc-peering-connection --vpc-peering-connection-id pcx-1a2b3c4d
```

Output:

```
{  
    "Return": true  
}
```

- For API details, see [RejectVpcPeeringConnection](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: The above example denies the request for VpcPeering request id **pcx-01a2b3ce45fe67eb8**

```
Deny-EC2VpcPeeringConnection -VpcPeeringConnectionId pcx-01a2b3ce45fe67eb8
```

- For API details, see [RejectVpcPeeringConnection](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReleaseAddress with an AWS SDK or CLI

The following code examples show how to use ReleaseAddress.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Release an Elastic IP address.
/// </summary>
/// <param name="allocationId">The allocation Id of the Elastic IP address.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> ReleaseAddress(string allocationId)
{
    var request = new ReleaseAddressRequest
    {
        AllocationId = allocationId
    };

    var response = await _amazonEC2.ReleaseAddressAsync(request);
    return response.HttpStatusCode == HttpStatusCode.OK;
}
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_release_address
#
# This function releases an Elastic IP address from an Amazon Elastic Compute
# Cloud (Amazon EC2) instance.
#
# Parameters:
#     -a allocation_id - The allocation ID of the Elastic IP address to
# release.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_release_address() {
    local allocation_id response

    # Function to display usage information
    function usage() {
        echo "function ec2_release_address"
        echo "Releases an Elastic IP address from an Amazon Elastic Compute Cloud"
        echo "(Amazon EC2) instance."
        echo "  -a allocation_id - The allocation ID of the Elastic IP address to"
        echo "release."
        echo ""
    }

    # Parse the command-line arguments
    while getopts "a:h" option; do
        case "${option}" in
            a) allocation_id="${OPTARG}" ;;
```

```
h)
    usage
    return 0
    ;;
\?) 
    echo "Invalid parameter"
    usage
    return 1
    ;;
esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$allocation_id" ]]; then
    errecho "ERROR: You must provide an allocation ID with the -a parameter."
    return 1
fi

response=$(aws ec2 release-address \
--allocation-id "$allocation_id") || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports release-address operation failed."
errecho "$response"
return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
```

```
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [ReleaseAddress](#) in *AWS CLI Command Reference*.

## C++

**SDK for C++****Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Release an Elastic IP address.  
/*!  
 \param clientConfiguration: AWS client configuration.  
 \return bool: Function succeeded.  
 */  
bool AwsDoc::EC2::releaseAddress(const Aws::String &allocationID,  
                                 const Aws::Client::ClientConfiguration  
&clientConfiguration) {  
    Aws::EC2::EC2Client ec2(clientConfiguration);  
  
    Aws::EC2::Model::ReleaseAddressRequest request;  
    request.SetAllocationId(allocationID);  
  
    Aws::EC2::Model::ReleaseAddressOutcome outcome = ec2.ReleaseAddress(request);  
    if (!outcome.IsSuccess()) {  
        std::cerr << "Failed to release Elastic IP address " <<  
              allocationID << ":" << outcome.GetError().GetMessage() <<  
              std::endl;  
    } else {  
        std::cout << "Successfully released Elastic IP address " <<  
              allocationID << std::endl;  
    }  
  
    return outcome.IsSuccess();  
}
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To release an Elastic IP addresses for EC2-Classic

This example releases an Elastic IP address for use with instances in EC2-Classic. If the command succeeds, no output is returned.

Command:

```
aws ec2 release-address --public-ip 198.51.100.0
```

#### To release an Elastic IP address for EC2-VPC

This example releases an Elastic IP address for use with instances in a VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 release-address --allocation-id eipalloc-64d5890a
```

- For API details, see [ReleaseAddress](#) in AWS CLI Command Reference.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void releaseEC2Address(Ec2Client ec2, String allocId) {  
    try {  
        ReleaseAddressRequest request = ReleaseAddressRequest.builder()  
            .allocationId(allocId)  
            .build();  
    }  
}
```

```
        ec2.releaseAddress(request);
        System.out.println("Successfully released Elastic IP address " +
allocId);
    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { ReleaseAddressCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new ReleaseAddressCommand({
    // You can also use PublicIp, but that is for EC2 classic which is being
    // retired.
    AllocationId: "ALLOCATION_ID",
  });

  try {
    await client.send(command);
    console.log("Successfully released address.");
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun releaseEC2AddressSc(allocId: String?) {  
    val request =  
        ReleaseAddressRequest {  
            allocationId = allocId  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        ec2.releaseAddress(request)  
        println("Successfully released Elastic IP address $allocId")  
    }  
}
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example releases the specified Elastic IP address for instances in a VPC.

```
Remove-EC2Address -AllocationId eipalloc-12345678 -Force
```

#### Example 2: This example releases the specified Elastic IP address for instances in EC2-Classic.

```
Remove-EC2Address -PublicIp 198.51.100.2 -Force
```

- For API details, see [ReleaseAddress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class ElasticIpWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) Elastic IP address  
    actions."""  
  
    def __init__(self, ec2_resource, elastic_ip=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param elastic_ip: A Boto3 VpcAddress object. This is a high-level object  
        that  
                wraps Elastic IP actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.elastic_ip = elastic_ip  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def release(self):  
        """  
        Releases an Elastic IP address. After the Elastic IP address is released,  
        it can no longer be used.  
        """  
        if self.elastic_ip is None:  
            logger.info("No Elastic IP to release.")
```

```
        return

    try:
        self.elastic_ip.release()
    except ClientError as err:
        logger.error(
            "Couldn't release Elastic IP address %s. Here's why: %s: %s",
            self.elastic_ip.allocation_id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
# Releases an Elastic IP address from an
# Amazon Elastic Compute Cloud (Amazon EC2) instance.
#
# Prerequisites:
#
# - An Amazon EC2 instance with an associated Elastic IP address.
#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @param allocation_id [String] The ID of the allocation corresponding to
#   the Elastic IP address.
# @return [Boolean] true if the Elastic IP address was released;
#   otherwise, false.
# @example
#   exit 1 unless elastic_ip_address_released?(
#     Aws::EC2::Client.new(region: 'us-west-2'),
```

```
#      'eipalloc-04452e528a66279EX'
#    )
def elastic_ip_address_released?(ec2_client, allocation_id)
  ec2_client.release_address(allocation_id: allocation_id)
  return true
rescue StandardError => e
  puts("Error releasing Elastic IP address: #{e.message}")
  return false
end
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn deallocate_ip_address(&self, allocation_id: &str) -> Result<(), EC2Error> {
    self.client
        .release_address()
        .allocation_id(allocation_id)
        .send()
        .await?;
    Ok(())
}
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

TRY.

```
lo_ec2->releaseaddress( iv_allocationid = iv_allocation_id ).  
MESSAGE 'Elastic IP address released.' TYPE 'I'.  
CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
DATA(lv_error) = |"{" lo_exception->av_err_code }" - { lo_exception-  
>av_err_msg }|.  
MESSAGE lv_error TYPE 'E'.  
ENDTRY.
```

- For API details, see [ReleaseAddress](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReleaseHosts with an AWS SDK or CLI

The following code examples show how to use ReleaseHosts.

### CLI

#### AWS CLI

##### To release a Dedicated host from your account

To release a Dedicated host from your account. Instances that are on the host must be stopped or terminated before the host can be released.

Command:

```
aws ec2 release-hosts --host-id=h-0029d6e3cacf1b3da
```

### Output:

```
{  
    "Successful": [  
        "h-0029d6e3cacf1b3da"  
    ],  
    "Unsuccessful": []  
}
```

- For API details, see [ReleaseHosts](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example releases the given host ID h-0badaf1dcb2f3456

```
Remove-EC2Host -HostId h-0badaf1dcb2f3456
```

### Output:

```
Confirm  
Are you sure you want to perform this action?  
Performing the operation "Remove-EC2Host (ReleaseHosts)" on target  
"h-0badaf1dcb2f3456".  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is  
"Y"): Y  
  
Successful          Unsuccessful  
-----  
{h-0badaf1dcb2f3456} {}
```

- For API details, see [ReleaseHosts](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Use ReplaceIamInstanceProfileAssociation with an AWS SDK or CLI

The following code examples show how to use ReplaceIamInstanceProfileAssociation.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Build and manage a resilient service](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Replace the profile associated with a running instance. After the profile
is replaced, the instance
/// is rebooted to ensure that it uses the new profile. When the instance is
ready, Systems Manager is
/// used to restart the Python web server.
/// </summary>
/// <param name="instanceId">The Id of the instance to update.</param>
/// <param name="credsProfileName">The name of the new profile to associate
with the specified instance.</param>
/// <param name="associationId">The Id of the existing profile association
for the instance.</param>
/// <returns>Async task.</returns>
public async Task ReplaceInstanceProfile(string instanceId, string
credsProfileName, string associationId)
{
    await _amazonEc2.ReplaceIamInstanceProfileAssociationAsync(
        new ReplaceIamInstanceProfileAssociationRequest()
    {
        AssociationId = associationId,
        IamInstanceProfile = new IamInstanceProfileSpecification()
```

```
        {
            Name = credsProfileName
        }
    });
// Allow time before resetting.
Thread.Sleep(25000);
var instanceReady = false;
var retries = 5;
while (retries-- > 0 && !instanceReady)
{
    await _amazonEc2.RebootInstancesAsync(
        new RebootInstancesRequest(new List<string>() { instanceId }));
    Thread.Sleep(10000);

    var instancesPaginator =
_amazonSsm.Paginator.DescribeInstanceInformation(
    new DescribeInstanceInformationRequest());
    // Get the entire list using the paginator.
    await foreach (var instance in
instancesPaginator.InstanceInformationList)
    {
        instanceReady = instance.InstanceId == instanceId;
        if (instanceReady)
        {
            break;
        }
    }
}
Console.WriteLine($"Sending restart command to instance {instanceId}");
await _amazonSsm.SendCommandAsync(
    new SendCommandRequest()
{
    InstanceIds = new List<string>() { instanceId },
    DocumentName = "AWS-RunShellScript",
    Parameters = new Dictionary<string, List<string>]()
    {
        {"commands", new List<string>() { "cd / && sudo python3
server.py 80" }}
        }
    });
Console.WriteLine($"Restarted the web server on instance {instanceId}");
}
```

- For API details, see [ReplaceIamInstanceProfileAssociation](#) in *AWS SDK for .NET API Reference*.

## CLI

### AWS CLI

#### To replace an IAM instance profile for an instance

This example replaces the IAM instance profile represented by the association `iip-assoc-060bae234aac2e7fa` with the IAM instance profile named `AdminRole`.

```
aws ec2 replace-iam-instance-profile-association \
    --iam-instance-profile Name=AdminRole \
    --association-id iip-assoc-060bae234aac2e7fa
```

Output:

```
{  
    "IamInstanceProfileAssociation": {  
        "InstanceId": "i-087711ddaf98f9489",  
        "State": "associating",  
        "AssociationId": "iip-assoc-0b215292fab192820",  
        "IamInstanceProfile": {  
            "Id": "AIPAJLNLDX3AMYZNWYYAY",  
            "Arn": "arn:aws:iam::123456789012:instance-profile/AdminRole"  
        }  
    }  
}
```

- For API details, see [ReplaceIamInstanceProfileAssociation](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
await retry({ intervalInMs: 1000, maxRetries: 30 }, () =>
  ec2Client.send(
    new ReplaceIamInstanceProfileAssociationCommand({
      AssociationId: state.instanceProfileAssociationId,
      IamInstanceProfile: { Name: NAMES.ssmOnlyInstanceProfileName },
    }),
  );
);
```

- For API details, see [ReplaceIamInstanceProfileAssociation](#) in *AWS SDK for JavaScript API Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

This example replaces the instance profile of a running instance, reboots the instance, and sends a command to the instance after it starts.

```
class AutoScaler:
    """
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.
    """

    def __init__(
        self,
        resource_prefix,
        inst_type,
        ami_param,
        autoscaling_client,
        ec2_client,
        ssm_client,
        iam_client,
    ):
        pass
```

```
"""
:param resource_prefix: The prefix for naming AWS resources that are
created by this class.
:param inst_type: The type of EC2 instance to create, such as t3.micro.
:param ami_param: The Systems Manager parameter used to look up the AMI
that is
    created.

:param autoscaling_client: A Boto3 EC2 Auto Scaling client.
:param ec2_client: A Boto3 EC2 client.
:param ssm_client: A Boto3 Systems Manager client.
:param iam_client: A Boto3 IAM client.
"""

self.inst_type = inst_type
self.ami_param = ami_param
self.autoscaling_client = autoscaling_client
self.ec2_client = ec2_client
self.ssm_client = ssm_client
self.iam_client = iam_client
self.launch_template_name = f"{resource_prefix}-template"
self.group_name = f"{resource_prefix}-group"
self.instance_policy_name = f"{resource_prefix}-pol"
self.instance_role_name = f"{resource_prefix}-role"
self.instance_profile_name = f"{resource_prefix}-prof"
self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
self.bad_creds_role_name = f"{resource_prefix}-bc-role"
self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
self.key_pair_name = f"{resource_prefix}-key-pair"

def replace_instance_profile(
    self, instance_id, new_instance_profile_name, profile_association_id
):
    """
    Replaces the profile associated with a running instance. After the
    profile is
        replaced, the instance is rebooted to ensure that it uses the new
    profile. When
        the instance is ready, Systems Manager is used to restart the Python web
    server.

    :param instance_id: The ID of the instance to update.
    :param new_instance_profile_name: The name of the new profile to
associate with
                                            the specified instance.

```

```
:param profile_association_id: The ID of the existing profile association
for the
                                instance.

"""
try:
    self.ec2_client.replace_iam_instance_profile_association(
        IamInstanceProfile={"Name": new_instance_profile_name},
        AssociationId=profile_association_id,
    )
    log.info(
        "Replaced instance profile for association %s with profile %s.",
        profile_association_id,
        new_instance_profile_name,
    )
    time.sleep(5)
    inst_ready = False
    tries = 0
    while not inst_ready:
        if tries % 6 == 0:
            self.ec2_client.reboot_instances(InstanceIds=[instance_id])
            log.info(
                "Rebooting instance %s and waiting for it to be
ready.",
                instance_id,
            )
        tries += 1
        time.sleep(10)
        response = self.ssm_client.describe_instance_information()
        for info in response["InstanceInformationList"]:
            if info["InstanceId"] == instance_id:
                inst_ready = True
    self.ssm_client.send_command(
        InstanceIds=[instance_id],
        DocumentName="AWS-RunShellScript",
        Parameters={"commands": ["cd / && sudo python3 server.py 80"]},
    )
    log.info("Restarted the Python web server on instance %s.",
instance_id)
except ClientError as err:
    raise AutoScalerError(
        f"Couldn't replace instance profile for association
{profile_association_id}: {err}"
    )
```

- For API details, see [ReplaceElbInstanceProfileAssociation](#) in *AWS SDK for Python (Boto3) API Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReplaceNetworkAclAssociation with an AWS SDK or CLI

The following code examples show how to use ReplaceNetworkAclAssociation.

CLI

### AWS CLI

#### To replace the network ACL associated with a subnet

This example associates the specified network ACL with the subnet for the specified network ACL association.

Command:

```
aws ec2 replace-network-acl-association --association-id aclassoc-e5b95c8c --  
network-acl-id acl-5fb85d36
```

Output:

```
{  
    "NewAssociationId": "aclassoc-3999875b"  
}
```

- For API details, see [ReplaceNetworkAclAssociation](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

**Example 1: This example associates the specified network ACL with the subnet for the specified network ACL association.**

```
Set-EC2NetworkAclAssociation -NetworkAclId acl-12345678 -AssociationId  
aclassoc-1a2b3c4d
```

## Output:

```
aclassoc-87654321
```

- For API details, see [ReplaceNetworkAclAssociation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReplaceNetworkAclEntry with an AWS SDK or CLI

The following code examples show how to use ReplaceNetworkAclEntry.

### CLI

#### AWS CLI

##### To replace a network ACL entry

This example replaces an entry for the specified network ACL. The new rule 100 allows ingress traffic from 203.0.113.12/24 on UDP port 53 (DNS) into any associated subnet.

Command:

```
aws ec2 replace-network-acl-entry --network-acl-id acl-5fb85d36 --ingress --rule-number 100 --protocol udp --port-range From=53,To=53 --cidr-block 203.0.113.12/24  
--rule-action allow
```

- For API details, see [ReplaceNetworkAclEntry](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example replaces the specified entry for the specified network ACL. The new rule allows inbound traffic from the specified address to any associated subnet.**

```
Set-EC2NetworkAclEntry -NetworkAclId acl-12345678 -Egress $false -RuleNumber 100  
-Protocol 17 -PortRange_From 53 -PortRange_To 53 -CidrBlock 203.0.113.12/24 -  
RuleAction allow
```

- For API details, see [ReplaceNetworkAclEntry](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReplaceRoute with an AWS SDK or CLI

The following code examples show how to use ReplaceRoute.

### CLI

#### AWS CLI

##### To replace a route

This example replaces the specified route in the specified route table. The new route matches the specified CIDR and sends the traffic to the specified virtual private gateway. If the command succeeds, no output is returned.

Command:

```
aws ec2 replace-route --route-table-id rtb-22574640 --destination-cidr-  
block 10.0.0.0/16 --gateway-id vgw-9a4cacf3
```

- For API details, see [ReplaceRoute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example replaces the specified route for the specified route table. The new route sends the specified traffic to the specified virtual private gateway.**

```
Set-EC2Route -RouteTableId rtb-1a2b3c4d -DestinationCidrBlock 10.0.0.0/24 -  
GatewayId vgw-1a2b3c4d
```

- For API details, see [ReplaceRoute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReplaceRouteTableAssociation with an AWS SDK or CLI

The following code examples show how to use ReplaceRouteTableAssociation.

### CLI

#### AWS CLI

##### To replace the route table associated with a subnet

This example associates the specified route table with the subnet for the specified route table association.

Command:

```
aws ec2 replace-route-table-association --association-id rtbassoc-781d0d1a --  
route-table-id rtb-22574640
```

Output:

```
{  
    "NewAssociationId": "rtbassoc-3a1f0f58"  
}
```

- For API details, see [ReplaceRouteTableAssociation](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example associates the specified route table with the subnet for the specified route table association.**

```
Set-EC2RouteTableAssociation -RouteTableId rtb-1a2b3c4d -AssociationId  
rtbassoc-12345678
```

#### Output:

```
rtbassoc-87654321
```

- For API details, see [ReplaceRouteTableAssociation](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ReportInstanceState with an AWS SDK or CLI

The following code examples show how to use ReportInstanceState.

### CLI

#### AWS CLI

##### To report status feedback for an instance

This example command reports status feedback for the specified instance.

Command:

```
aws ec2 report-instance-status --instances i-1234567890abcdef0 --status impaired  
--reason-codes unresponsive
```

- For API details, see [ReportInstanceState](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example reports status feedback for the specified instance.**

```
Send-EC2InstanceState -Instance i-12345678 -Status impaired -ReasonCode unresponsive
```

- For API details, see [ReportInstanceState](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RequestSpotFleet with an AWS SDK or CLI

The following code examples show how to use RequestSpotFleet.

### CLI

#### AWS CLI

##### To request a Spot fleet in the subnet with the lowest price

This example command creates a Spot fleet request with two launch specifications that differ only by subnet. The Spot fleet launches the instances in the specified subnet with the lowest price. If the instances are launched in a default VPC, they receive a public IP address by default. If the instances are launched in a nondefault VPC, they do not receive a public IP address by default.

Note that you can't specify different subnets from the same Availability Zone in a Spot fleet request.

Command:

```
aws ec2 request-spot-fleet --spot-fleet-request-config file://config.json
```

Config.json:

```
{  
    "SpotPrice": "0.04",  
    "TargetCapacity": 2,  
    "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role",  
    "LaunchSpecifications": [  
        {  
            "ImageId": "ami-1a2b3c4d",  
            "KeyName": "my-key-pair",  
            "SecurityGroups": [  
                {  
                    "GroupId": "sg-1a2b3c4d"  
                }  
            ],  
            "InstanceType": "m3.medium",  
            "SubnetId": "subnet-1a2b3c4d, subnet-3c4d5e6f",  
            "IamInstanceProfile": {  
                "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
            }  
        }  
    ]  
}
```

Output:

```
{  
    "SpotFleetRequestId": "sfr-73fb2ce-aa30-494c-8788-1cee4EXAMPLE"  
}
```

## To request a Spot fleet in the Availability Zone with the lowest price

This example command creates a Spot fleet request with two launch specifications that differ only by Availability Zone. The Spot fleet launches the instances in the specified Availability Zone with the lowest price. If your account supports EC2-VPC only, Amazon EC2 launches the Spot instances in the default subnet of the Availability Zone. If your account supports EC2-Classic, Amazon EC2 launches the instances in EC2-Classic in the Availability Zone.

Command:

```
aws ec2 request-spot-fleet --spot-fleet-request-config file://config.json
```

## Config.json:

```
{  
    "SpotPrice": "0.04",  
    "TargetCapacity": 2,  
    "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role",  
    "LaunchSpecifications": [  
        {  
            "ImageId": "ami-1a2b3c4d",  
            "KeyName": "my-key-pair",  
            "SecurityGroups": [  
                {  
                    "GroupId": "sg-1a2b3c4d"  
                }  
            ],  
            "InstanceType": "m3.medium",  
            "Placement": {  
                "AvailabilityZone": "us-west-2a, us-west-2b"  
            },  
            "IamInstanceProfile": {  
                "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
            }  
        }  
    ]  
}
```

## To launch Spot instances in a subnet and assign them public IP addresses

This example command assigns public addresses to instances launched in a nondefault VPC. Note that when you specify a network interface, you must include the subnet ID and security group ID using the network interface.

## Command:

```
aws ec2 request-spot-fleet --spot-fleet-request-config file://config.json
```

## Config.json:

```
{  
    "SpotPrice": "0.04",  
    "TargetCapacity": 2,  
    "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role",  
    "LaunchSpecifications": [  
        {  
            "ImageId": "ami-1a2b3c4d",  
            "KeyName": "my-key-pair",  
            "SecurityGroups": [  
                {  
                    "GroupId": "sg-1a2b3c4d"  
                }  
            ],  
            "InstanceType": "m3.medium",  
            "Placement": {  
                "AvailabilityZone": "us-west-2a, us-west-2b"  
            },  
            "IamInstanceProfile": {  
                "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
            }  
        }  
    ]  
}
```

```
"LaunchSpecifications": [
    {
        "ImageId": "ami-1a2b3c4d",
        "KeyName": "my-key-pair",
        "InstanceType": "m3.medium",
        "NetworkInterfaces": [
            {
                "DeviceIndex": 0,
                "SubnetId": "subnet-1a2b3c4d",
                "Groups": [ "sg-1a2b3c4d" ],
                "AssociatePublicIpAddress": true
            }
        ],
        "IamInstanceProfile": {
            "Arn": "arn:aws:iam::880185128111:instance-profile/my-iam-role"
        }
    }
]
```

## To request a Spot fleet using the diversified allocation strategy

This example command creates a Spot fleet request that launches 30 instances using the diversified allocation strategy. The launch specifications differ by instance type. The Spot fleet distributes the instances across the launch specifications such that there are 10 instances of each type.

Command:

```
aws ec2 request-spot-fleet --spot-fleet-request-config file://config.json
```

Config.json:

```
{
    "SpotPrice": "0.70",
    "TargetCapacity": 30,
    "AllocationStrategy": "diversified",
    "IamFleetRole": "arn:aws:iam::123456789012:role/my-spot-fleet-role",
    "LaunchSpecifications": [
        {
            "ImageId": "ami-1a2b3c4d",
            "InstanceType": "c4.2xlarge",
            "NetworkInterfaceConfigurations": [
                {
                    "AssociatePublicIpAddress": true
                }
            ]
        }
    ]
}
```

```
        "SubnetId": "subnet-1a2b3c4d"
    },
    {
        "ImageId": "ami-1a2b3c4d",
        "InstanceType": "m3.2xlarge",
        "SubnetId": "subnet-1a2b3c4d"
    },
    {
        "ImageId": "ami-1a2b3c4d",
        "InstanceType": "r3.2xlarge",
        "SubnetId": "subnet-1a2b3c4d"
    }
]
```

For more information, see **Spot Fleet Requests** in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [RequestSpotFleet](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example creates a Spot fleet request in the Availability Zone with the lowest price for the specified instance type. If your account supports EC2-VPC only, the Spot fleet launches the instances in the lowest-priced Availability Zone that has a default subnet. If your account supports EC2-Classic, the Spot fleet launches the instances in EC2-Classic in the lowest-priced Availability Zone. Note that the price you pay will not exceed the specified Spot price for the request.**

```
$sg = New-Object Amazon.EC2.Model.GroupIdentifier
$sg.GroupId = "sg-12345678"
$lc = New-Object Amazon.EC2.Model.SpotFleetLaunchSpecification
$lc.ImageId = "ami-12345678"
$lc.InstanceType = "m3.medium"
$lc.SecurityGroups.Add($sg)
Request-EC2SpotFleet -SpotFleetRequestConfig_SpotPrice 0.04 ` 
-SpotFleetRequestConfig_TargetCapacity 2 ` 
-SpotFleetRequestConfig_IamFleetRole arn:aws:iam::123456789012:role/my-spot-
fleet-role ` 
-SpotFleetRequestConfig_LaunchSpecification $lc
```

- For API details, see [RequestSpotFleet](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RequestSpotInstances with an AWS SDK or CLI

The following code examples show how to use RequestSpotInstances.

CLI

### AWS CLI

#### To request Spot Instances

This example command creates a one-time Spot Instance request for five instances in the specified Availability Zone. If your account supports EC2-VPC only, Amazon EC2 launches the instances in the default subnet of the specified Availability Zone. If your account supports EC2-Classic, Amazon EC2 launches the instances in EC2-Classic in the specified Availability Zone.

Command:

```
aws ec2 request-spot-instances --spot-price "0.03" --instance-count 5 --  
type "one-time" --launch-specification file://specification.json
```

Specification.json:

```
{  
    "ImageId": "ami-1a2b3c4d",  
    "KeyName": "my-key-pair",  
    "SecurityGroupIds": [ "sg-1a2b3c4d" ],  
    "InstanceType": "m3.medium",  
    "Placement": {  
        "AvailabilityZone": "us-west-2a"  
    },  
    "IamInstanceProfile": {  
        "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
    }  
}
```

{

**Output:**

```
{  
    "SpotInstanceRequests": [  
        {  
            "Status": {  
                "UpdateTime": "2014-03-25T20:54:21.000Z",  
                "Code": "pending-evaluation",  
                "Message": "Your Spot request has been submitted for review, and is  
pending evaluation."  
            },  
            "ProductDescription": "Linux/UNIX",  
            "SpotInstanceRequestId": "sir-df6f405d",  
            "State": "open",  
            "LaunchSpecification": {  
                "Placement": {  
                    "AvailabilityZone": "us-west-2a"  
                },  
                "ImageId": "ami-1a2b3c4d",  
                "KeyName": "my-key-pair",  
                "SecurityGroups": [  
                    {  
                        "GroupName": "my-security-group",  
                        "GroupId": "sg-1a2b3c4d"  
                    }  
                ],  
                "Monitoring": {  
                    "Enabled": false  
                },  
                "IamInstanceProfile": {  
                    "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
                },  
                "InstanceType": "m3.medium"  
            },  
            "Type": "one-time",  
            "CreateTime": "2014-03-25T20:54:20.000Z",  
            "SpotPrice": "0.050000"  
        },  
        ...  
    ]  
}
```

This example command creates a one-time Spot Instance request for five instances in the specified subnet. Amazon EC2 launches the instances in the specified subnet. If the VPC is a nondefault VPC, the instances do not receive a public IP address by default.

### Command:

```
aws ec2 request-spot-instances --spot-price "0.050" --instance-count 5 --  
type "one-time" --launch-specification file://specification.json
```

## Specification.json:

```
{  
    "ImageId": "ami-1a2b3c4d",  
    "SecurityGroupIds": [ "sg-1a2b3c4d" ],  
    "InstanceType": "m3.medium",  
    "SubnetId": "subnet-1a2b3c4d",  
    "IamInstanceProfile": {  
        "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"  
    }  
}
```

## Output:

```
{  
  "SpotInstanceRequests": [  
    {  
      "Status": {  
        "UpdateTime": "2014-03-25T22:21:58.000Z",  
        "Code": "pending-evaluation",  
        "Message": "Your Spot request has been submitted for review, and is  
pending evaluation."  
      },  
      "ProductDescription": "Linux/UNIX",  
      "SpotInstanceRequestId": "sir-df6f405d",  
      "State": "open",  
      "LaunchSpecification": {  
        "Placement": {  
          "AvailabilityZone": "us-west-2a"  
        }  
        "ImageId": "ami-1a2b3c4d"  
        "SecurityGroups": [  
          {  
            "Group": "sg-12345678",  
            "Status": "active"  
          }  
        ]  
      }  
    }  
  ]  
}
```

```
        "GroupName": "my-security-group",
        "GroupID": "sg-1a2b3c4d"
    },
]
"SubnetId": "subnet-1a2b3c4d",
"Monitoring": {
    "Enabled": false
},
"IamInstanceProfile": {
    "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"
},
"InstanceType": "m3.medium",
},
"Type": "one-time",
"CreateTime": "2014-03-25T22:21:58.000Z",
"SpotPrice": "0.050000"
},
...
]
}
```

This example assigns a public IP address to the Spot Instances that you launch in a nondefault VPC. Note that when you specify a network interface, you must include the subnet ID and security group ID using the network interface.

Command:

```
aws ec2 request-spot-instances --spot-price "0.050" --instance-count 1 --
type "one-time" --launch-specification file://specification.json
```

Specification.json:

```
{
    "ImageId": "ami-1a2b3c4d",
    "KeyName": "my-key-pair",
    "InstanceType": "m3.medium",
    "NetworkInterfaces": [
        {
            "DeviceIndex": 0,
            "SubnetId": "subnet-1a2b3c4d",
            "Groups": [ "sg-1a2b3c4d" ],
            "AssociatePublicIpAddress": true
        }
    ]
}
```

```
        },
    ],
    "IamInstanceProfile": {
        "Arn": "arn:aws:iam::123456789012:instance-profile/my-iam-role"
    }
}
```

- For API details, see [RequestSpotInstances](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example requests a one-time Spot instance in the specified subnet. Note that the security group must be created for the VPC that contains the specified subnet, and it must be specified by ID using the network interface. When you specify a network interface, you must include the subnet ID using the network interface.**

```
$n = New-Object Amazon.EC2.Model.InstanceNetworkInterfaceSpecification
$n.DeviceIndex = 0
$n.SubnetId = "subnet-12345678"
$n.Groups.Add("sg-12345678")
Request-EC2SpotInstance -InstanceCount 1 -SpotPrice 0.050 -Type one-time ` 
-IamInstanceProfile_Arn arn:aws:iam::123456789012:instance-profile/my-iam-role ` 
-LaunchSpecification_ImageId ami-12345678 ` 
-LaunchSpecification_InstanceType m3.medium ` 
-LaunchSpecification_NetworkInterface $n
```

### Output:

```
ActualBlockHourlyPrice      :
AvailabilityZoneGroup      :
BlockDurationMinutes       : 0
CreateTime                 : 12/26/2015 7:44:10 AM
Fault                      :
InstanceId                 :
LaunchedAvailabilityZone   :
LaunchGroup                :
LaunchSpecification         : Amazon.EC2.Model.LaunchSpecification
ProductDescription          : Linux/UNIX
SpotInstanceRequestId       : sir-12345678
SpotPrice                  : 0.050000
```

State	:	open
Status	:	Amazon.EC2.Model.SpotInstanceState
Tags	:	{}
Type	:	one-time

- For API details, see [RequestSpotInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ResetImageAttribute` with an AWS SDK or CLI

The following code examples show how to use `ResetImageAttribute`.

### CLI

#### AWS CLI

##### To reset the `launchPermission` attribute

This example resets the `launchPermission` attribute for the specified AMI to its default value. By default, AMIs are private. If the command succeeds, no output is returned.

Command:

```
aws ec2 reset-image-attribute --image-id ami-5731123e --  
attribute LaunchPermission
```

- For API details, see [ResetImageAttribute](#) in *AWS CLI Command Reference*.

### PowerShell

#### Tools for PowerShell

**Example 1: This example resets the 'launchPermission' attribute to its default value. By default, AMIs are private.**

```
Reset-EC2ImageAttribute -ImageId ami-12345678 -Attribute launchPermission
```

- For API details, see [ResetImageAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `ResetInstanceAttribute` with an AWS SDK or CLI

The following code examples show how to use `ResetInstanceAttribute`.

### CLI

#### AWS CLI

##### To reset the `sourceDestCheck` attribute

This example resets the `sourceDestCheck` attribute of the specified instance. The instance must be in a VPC. If the command succeeds, no output is returned.

Command:

```
aws ec2 reset-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute sourceDestCheck
```

##### To reset the `kernel` attribute

This example resets the `kernel` attribute of the specified instance. The instance must be in the stopped state. If the command succeeds, no output is returned.

Command:

```
aws ec2 reset-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute kernel
```

##### To reset the `ramdisk` attribute

This example resets the `ramdisk` attribute of the specified instance. The instance must be in the stopped state. If the command succeeds, no output is returned.

Command:

```
aws ec2 reset-instance-attribute --instance-id i-1234567890abcdef0 --  
attribute ramdisk
```

- For API details, see [ResetInstanceAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example resets the 'srivNetSupport' attribute for the specified instance.

```
Reset-EC2InstanceAttribute -InstanceId i-12345678 -Attribute srivNetSupport
```

#### Example 2: This example resets the 'ebsOptimized' attribute for the specified instance.

```
Reset-EC2InstanceAttribute -InstanceId i-12345678 -Attribute ebsOptimized
```

#### Example 3: This example resets the 'sourceDestCheck' attribute for the specified instance.

```
Reset-EC2InstanceAttribute -InstanceId i-12345678 -Attribute sourceDestCheck
```

#### Example 4: This example resets the 'disableApiTermination' attribute for the specified instance.

```
Reset-EC2InstanceAttribute -InstanceId i-12345678 -Attribute  
disableApiTermination
```

#### Example 5: This example resets the 'instanceInitiatedShutdownBehavior' attribute for the specified instance.

```
Reset-EC2InstanceAttribute -InstanceId i-12345678 -Attribute  
instanceInitiatedShutdownBehavior
```

- For API details, see [ResetInstanceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ResetNetworkInterfaceAttribute with an AWS SDK or CLI

The following code examples show how to use ResetNetworkInterfaceAttribute.

CLI

### AWS CLI

#### To reset a network interface attribute

The following `reset-network-interface-attribute` example resets the value of the source/destination checking attribute to `true`.

```
aws ec2 reset-network-interface-attribute \
    --network-interface-id eni-686ea200 \
    --source-dest-check
```

This command produces no output.

- For API details, see [ResetNetworkInterfaceAttribute](#) in *AWS CLI Command Reference*.

PowerShell

### Tools for PowerShell

#### Example 1: This example resets source/destination checking for the specified network interface.

```
Reset-EC2NetworkInterfaceAttribute -NetworkInterfaceId eni-1a2b3c4d -  
SourceDestCheck
```

- For API details, see [ResetNetworkInterfaceAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use ResetSnapshotAttribute with an AWS SDK or CLI

The following code examples show how to use ResetSnapshotAttribute.

## CLI

### AWS CLI

#### To reset a snapshot attribute

This example resets the create volume permissions for snapshot snap-1234567890abcdef0. If the command succeeds, no output is returned.

Command:

```
aws ec2 reset-snapshot-attribute --snapshot-id snap-1234567890abcdef0 --  
attribute createVolumePermission
```

- For API details, see [ResetSnapshotAttribute](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example resets the specified attribute of the specified snapshot.

```
Reset-EC2SnapshotAttribute -SnapshotId snap-12345678 -Attribute  
CreateVolumePermission
```

- For API details, see [ResetSnapshotAttribute](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RevokeSecurityGroupEgress with an AWS SDK or CLI

The following code examples show how to use RevokeSecurityGroupEgress.

## CLI

### AWS CLI

#### Example 1: To remove the rule that allows outbound traffic to a specific address range

The following `revoke-security-group-egress` example command removes the rule that grants access to the specified address ranges on TCP port 80.

```
aws ec2 revoke-security-group-egress \
--group-id sg-026c12253ce15eff7 \
--ip-
permissions [{IpProtocol=tcp, FromPort=80, ToPort=80, IpRanges=[{CidrIp=10.0.0.0/16}]}
```

This command produces no output.

For more information, see [Security groups](#) in the *Amazon EC2 User Guide*.

### Example 2: To remove the rule that allows outbound traffic to a specific security group

The following `revoke-security-group-egress` example command removes the rule that grants access to the specified security group on TCP port 80.

```
aws ec2 revoke-security-group-egress \
--group-id sg-026c12253ce15eff7 \
--ip-permissions '[{"IpProtocol": "tcp", "FromPort": 443, "ToPort": 443, "UserIdGroupPairs": [{"GroupId": "sg-06df23a01ff2df86d"}]]'
```

This command produces no output.

For more information, see [Security groups](#) in the *Amazon EC2 User Guide*.

- For API details, see [RevokeSecurityGroupEgress](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example removes the rule for the specified security group for EC2-VPC. This revokes access to the specified IP address range on TCP port 80. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip = @{ IpProtocol="tcp"; FromPort="80"; ToPort="80";
IpRanges="203.0.113.0/24" }
Revoke-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission $ip
```

**Example 2: With PowerShell version 2, you must use New-Object to create the IpPermission object.**

```
$ip = New-Object Amazon.EC2.Model.IpPermission
$ip.IpProtocol = "tcp"
$ip.FromPort = 80
$ip.ToPort = 80
$ip.IpRanges.Add("203.0.113.0/24")
Revoke-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission $ip
```

**Example 3: This example revokes access to the specified source security group on TCP port 80.**

```
$ug = New-Object Amazon.EC2.Model.UserIdGroupPair
$ug.GroupId = "sg-1a2b3c4d"
$ug.UserId = "123456789012"
Revoke-EC2SecurityGroupEgress -GroupId sg-12345678 -IpPermission
@{ IpProtocol="tcp"; FromPort="80"; ToPort="80"; UserIdGroupPairs=$ug } )
```

- For API details, see [RevokeSecurityGroupEgress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RevokeSecurityGroupIngress with an AWS SDK or CLI

The following code examples show how to use RevokeSecurityGroupIngress.

CLI

### AWS CLI

**Example 1: To remove a rule from a security group**

The following `revoke-security-group-ingress` example removes TCP port 22 access for the `203.0.113.0/24` address range from the specified security group for a default VPC.

```
aws ec2 revoke-security-group-ingress \
--group-name mySecurityGroup
--protocol tcp \
--port 22 \
```

```
--cidr 203.0.113.0/24
```

This command produces no output if it succeeds.

For more information, see [Security groups](#) in the *Amazon EC2 User Guide*.

### Example 2: To remove a rule using the IP permissions set

The following `revoke-security-group-ingress` example uses the `ip-permissions` parameter to remove an inbound rule that allows the ICMP message Destination Unreachable: Fragmentation Needed and Don't Fragment was Set (Type 3, Code 4).

```
aws ec2 revoke-security-group-ingress \
  --group-id sg-026c12253ce15eff7 \
  --ip-
permissions IpProtocol=icmp,FromPort=3,ToPort=4,IpRanges=[{CidrIp=0.0.0.0/0}]
```

This command produces no output if it succeeds.

For more information, see [Security groups](#) in the *Amazon EC2 User Guide*.

- For API details, see [RevokeSecurityGroupIngress](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example revokes access to TCP port 22 from the specified address range for the specified security group for EC2-VPC. Note that you must identify security groups for EC2-VPC using the security group ID not the security group name. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip = @{ IpProtocol="tcp"; FromPort="22"; ToPort="22";
IpRanges="203.0.113.0/24" }
Revoke-EC2SecurityGroupIngress -GroupId sg-12345678 -IpPermission $ip
```

**Example 2: With PowerShell version 2, you must use New-Object to create the IpPermission object.**

```
$ip = New-Object Amazon.EC2.Model.IpPermission
```

```
$ip.IpProtocol = "tcp"  
$ip.FromPort = 22  
$ip.ToPort = 22  
$ip.IpRanges.Add("203.0.113.0/24")  
  
Revoke-EC2SecurityGroupIngress -GroupId sg-12345678 -IpPermission $ip
```

**Example 3: This example revokes access to TCP port 22 from the specified address range for the specified security group for EC2-Classic. The syntax used by this example requires PowerShell version 3 or higher.**

```
$ip = @{ IpProtocol="tcp"; FromPort="22"; ToPort="22";  
IpRanges="203.0.113.0/24" }  
  
Revoke-EC2SecurityGroupIngress -GroupName "my-security-group" -IpPermission $ip
```

**Example 4: With PowerShell version 2, you must use New-Object to create the IpPermission object.**

```
$ip = New-Object Amazon.EC2.Model.IpPermission  
$ip.IpProtocol = "tcp"  
$ip.FromPort = 22  
$ip.ToPort = 22  
$ip.IpRanges.Add("203.0.113.0/24")  
  
Revoke-EC2SecurityGroupIngress -GroupName "my-security-group" -IpPermission $ip
```

- For API details, see [RevokeSecurityGroupIngress](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RunInstances with an AWS SDK or CLI

The following code examples show how to use RunInstances.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Create and run an EC2 instance.
/// </summary>
/// <param name="ImageId">The image Id of the image used as a basis for the
/// EC2 instance.</param>
/// <param name="instanceType">The instance type of the EC2 instance to
create.</param>
/// <param name="keyName">The name of the key pair to associate with the
/// instance.</param>
/// <param name="groupId">The Id of the Amazon EC2 security group that will
be
/// allowed to interact with the new EC2 instance.</param>
/// <returns>The instance Id of the new EC2 instance.</returns>
public async Task<string> RunInstances(string imageId, string instanceType,
string keyName, string groupId)
{
    var request = new RunInstancesRequest
    {
        ImageId = imageId,
        InstanceType = instanceType,
        KeyName = keyName,
        MinCount = 1,
        MaxCount = 1,
        SecurityGroupIds = new List<string> { groupId }
    };
    var response = await _amazonEC2.RunInstancesAsync(request);
    return response.Reservation.Instances[0].InstanceId;
}
```

- For API details, see [RunInstances](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_run_instances
#
# This function launches one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.
#
# Parameters:
#   -i image_id - The ID of the Amazon Machine Image (AMI) to use.
#   -t instance_type - The instance type to use (e.g., t2.micro).
#   -k key_pair_name - The name of the key pair to use.
#   -s security_group_id - The ID of the security group to use.
#   -c count - The number of instances to launch (default: 1).
#   -h - Display help.
#
# Returns:
#   0 - If successful.
#   1 - If it fails.
#####
function ec2_run_instances() {
    local image_id instance_type key_pair_name security_group_id count response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_run_instances"
        echo "Launches one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        echo "instances."
        echo "  -i image_id - The ID of the Amazon Machine Image (AMI) to use."
    }
}
```

```
echo " -t instance_type - The instance type to use (e.g., t2.micro)."
echo " -k key_pair_name - The name of the key pair to use."
echo " -s security_group_id - The ID of the security group to use."
echo " -c count - The number of instances to launch (default: 1)."
echo " -h - Display help."
echo ""

}

# Retrieve the calling parameters.
while getopts "i:t:k:s:c:h" option; do
    case "${option}" in
        i) image_id="${OPTARG}" ;;
        t) instance_type="${OPTARG}" ;;
        k) key_pair_name="${OPTARG}" ;;
        s) security_group_id="${OPTARG}" ;;
        c) count="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

if [[ -z "$image_id" ]]; then
    errecho "ERROR: You must provide an Amazon Machine Image (AMI) ID with the -i parameter."
    usage
    return 1
fi

if [[ -z "$instance_type" ]]; then
    errecho "ERROR: You must provide an instance type with the -t parameter."
    usage
    return 1
fi

if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key pair name with the -k parameter."
```

```
usage
return 1
fi

if [[ -z "$security_group_id" ]]; then
    errecho "ERROR: You must provide a security group ID with the -s parameter."
    usage
    return 1
fi

if [[ -z "$count" ]]; then
    count=1
fi

response=$(aws ec2 run-instances \
--image-id "$image_id" \
--instance-type "$instance_type" \
--key-name "$key_pair_name" \
--security-group-ids "$security_group_id" \
--count "$count" \
--query 'Instances[*].[InstanceId]' \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports run-instances operation failed.$response"
return 1
}

echo "$response"

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}
```

```
#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#           $1 - The error code returned by the AWS CLI.
#
# Returns:
#           0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [RunInstances](#) in *AWS CLI Command Reference*.

## C++

**SDK for C++****Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Launch an Amazon Elastic Compute Cloud (Amazon EC2) instance.  
/*!  
 \param instanceName: A name for the EC2 instance.  
 \param amiId: An Amazon Machine Image (AMI) identifier.  
 \param[out] instanceID: String to return the instance ID.  
 \param clientConfiguration: AWS client configuration.  
 \return bool: Function succeeded.  
 */  
bool AwsDoc::EC2::runInstance(const Aws::String &instanceName,  
                               const Aws::String &amiId,  
                               Aws::String &instanceID,  
                               const Aws::Client::ClientConfiguration  
&clientConfiguration) {  
    Aws::EC2::EC2Client ec2Client(clientConfiguration);  
  
    Aws::EC2::Model::RunInstancesRequest runRequest;  
    runRequest.SetImageId(amiId);  
    runRequest.SetInstanceType(Aws::EC2::Model::InstanceType::t1_micro);  
    runRequest.SetMinCount(1);  
    runRequest.SetMaxCount(1);  
  
    Aws::EC2::Model::RunInstancesOutcome runOutcome = ec2Client.RunInstances(  
        runRequest);  
    if (!runOutcome.IsSuccess()) {  
        std::cerr << "Failed to launch EC2 instance " << instanceName <<  
              " based on ami " << amiId << ":" <<  
              runOutcome.GetError().GetMessage() << std::endl;  
        return false;  
    }  
  
    const Aws::Vector<Aws::EC2::Model::Instance> &instances =  
    runOutcome.GetResult().GetInstances();
```

```
if (instances.empty()) {
    std::cerr << "Failed to launch EC2 instance " << instanceName <<
        " based on ami " << amiId << ":" <<
        runOutcome.GetError().GetMessage() << std::endl;
    return false;
}

instanceID = instances[0].GetInstanceId();

return true;
}
```

- For API details, see [RunInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To launch an instance into a default subnet

The following `run-instances` example launches a single instance of type `t2.micro` into the default subnet for the current Region and associates it with the default subnet for the default VPC for the Region. The key pair is optional if you do not plan to connect to your instance using SSH (Linux) or RDP (Windows).

```
aws ec2 run-instances \
    --image-id ami-0abcdef1234567890 \
    --instance-type t2.micro \
    --key-name MyKeyPair
```

Output:

```
{  
    "Instances": [  
        {  
            "AmiLaunchIndex": 0,  
            "ImageId": "ami-0abcdef1234567890",  
            "InstanceId": "i-1231231230abcdef0",  
            "InstanceType": "t2.micro",  
            "KeyName": "MyKeyPair",  
            "LaunchTime": "2018-05-10T08:05:20.000Z",  
            "Placement": {  
                "AvailabilityZone": "us-west-2a",  
                "GroupName": null  
            },  
            "PrivateDns": "ip-123-123-123-0.abcde...  
            "PrivateIpAddress": "123.123.123.0",  
            "PublicDns": "ec2-123-123-123-0.compute-1...  
            "PublicIpAddress": "123.123.123.0",  
            "State": {  
                "Code": 16,  
                "Name": "running"  
            },  
            "SubnetId": "subnet-00000000",  
            "VpcId": "vpc-00000000"  
        }  
    ]  
}
```

```
"Monitoring": {
    "State": "disabled"
},
"Placement": {
    "AvailabilityZone": "us-east-2a",
    "GroupName": "",
    "Tenancy": "default"
},
"PrivateDnsName": "ip-10-0-0-157.us-east-2.compute.internal",
"PrivateIpAddress": "10.0.0.157",
"ProductCodes": [],
"PublicDnsName": "",
"State": {
    "Code": 0,
    "Name": "pending"
},
"StateTransitionReason": "",
"SubnetId": "subnet-04a636d18e83cfacb",
"VpcId": "vpc-1234567890abcdef0",
"Architecture": "x86_64",
"BlockDeviceMappings": [],
"ClientToken": "",
"EbsOptimized": false,
"Hypervisor": "xen",
"NetworkInterfaces": [
{
    "Attachment": {
        "AttachTime": "2018-05-10T08:05:20.000Z",
        "AttachmentId": "eni-attach-0e325c07e928a0405",
        "DeleteOnTermination": true,
        "DeviceIndex": 0,
        "Status": "attaching"
    },
    "Description": "",
    "Groups": [
        {
            "GroupName": "MySecurityGroup",
            "GroupId": "sg-0598c7d356eba48d7"
        }
    ],
    "Ipv6Addresses": [],
    "MacAddress": "0a:ab:58:e0:67:e2",
    "NetworkInterfaceId": "eni-0c0a29997760baee7",
    "OwnerId": "123456789012",
```

```
        "PrivateDnsName": "ip-10-0-0-157.us-east-2.compute.internal",
        "PrivateIpAddress": "10.0.0.157",
        "PrivateIpAddresses": [
            {
                "Primary": true,
                "PrivateDnsName": "ip-10-0-0-157.us-
east-2.compute.internal",
                "PrivateIpAddress": "10.0.0.157"
            }
        ],
        "SourceDestCheck": true,
        "Status": "in-use",
        "SubnetId": "subnet-04a636d18e83cfacb",
        "VpcId": "vpc-1234567890abcdef0",
        "InterfaceType": "interface"
    }
],
"RootDeviceName": "/dev/xvda",
"RootDeviceType": "ebs",
"SecurityGroups": [
{
    "GroupName": "MySecurityGroup",
    "GroupId": "sg-0598c7d356eba48d7"
}
],
"SourceDestCheck": true,
"StateReason": {
    "Code": "pending",
    "Message": "pending"
},
"Tags": [],
"VirtualizationType": "hvm",
"CpuOptions": {
    "CoreCount": 1,
    "ThreadsPerCore": 1
},
"CapacityReservationSpecification": {
    "CapacityReservationPreference": "open"
},
"MetadataOptions": {
    "State": "pending",
    "HttpTokens": "optional",
    "HttpPutResponseHopLimit": 1,
    "HttpEndpoint": "enabled"
```

```
        }
    ],
    "OwnerId": "123456789012",
    "ReservationId": "r-02a3f596d91211712"
}
```

### Example 2: To launch an instance into a non-default subnet and add a public IP address

The following `run-instances` example requests a public IP address for an instance that you're launching into a nondefault subnet. The instance is associated with the specified security group.

```
aws ec2 run-instances \
--image-id ami-0abcdef1234567890 \
--instance-type t2.micro \
--subnet-id subnet-08fc749671b2d077c \
--security-group-ids sg-0b0384b66d7d692f9 \
--associate-public-ip-address \
--key-name MyKeyPair
```

For an example of the output for `run-instances`, see Example 1.

### Example 3: To launch an instance with additional volumes

The following `run-instances` example uses a block device mapping, specified in `mapping.json`, to attach additional volumes at launch. A block device mapping can specify EBS volumes, instance store volumes, or both EBS volumes and instance store volumes.

```
aws ec2 run-instances \
--image-id ami-0abcdef1234567890 \
--instance-type t2.micro \
--subnet-id subnet-08fc749671b2d077c \
--security-group-ids sg-0b0384b66d7d692f9 \
--key-name MyKeyPair \
--block-device-mappings file://mapping.json
```

Contents of `mapping.json`. This example adds `/dev/sdh` an empty EBS volume with a size of 100 GiB.

```
[
```

```
{  
    "DeviceName": "/dev/sdh",  
    "Ebs": {  
        "VolumeSize": 100  
    }  
}  
]
```

Contents of mapping.json. This example adds ephemeral1 as an instance store volume.

```
[  
    {  
        "DeviceName": "/dev/sdc",  
        "VirtualName": "ephemeral1"  
    }  
]
```

For an example of the output for run-instances, see Example 1.

For more information about block device mappings, see [Block device mapping](#) in the *Amazon EC2 User Guide*.

#### Example 4: To launch an instance and add tags on creation

The following run-instances example adds a tag with a key of webserver and value of production to the instance. The command also applies a tag with a key of cost-center and a value of cc123 to any EBS volume that's created (in this case, the root volume).

```
aws ec2 run-instances \  
    --image-id ami-0abcdef1234567890 \  
    --instance-type t2.micro \  
    --count 1 \  
    --subnet-id subnet-08fc749671b2d077c \  
    --key-name MyKeyPair \  
    --security-group-ids sg-0b0384b66d7d692f9 \  
    --tag-specifications  
    'ResourceType=instance,Tags=[{Key=webserver,Value=production}]'  
    'ResourceType=volume,Tags=[{Key=cost-center,Value=cc123}]'
```

For an example of the output for run-instances, see Example 1.

#### Example 5: To launch an instance with user data

The following `run-instances` example passes user data in a file called `my_script.txt` that contains a configuration script for your instance. The script runs at launch.

```
aws ec2 run-instances \
--image-id ami-0abcdef1234567890 \
--instance-type t2.micro \
--count 1 \
--subnet-id subnet-08fc749671b2d077c \
--key-name MyKeyPair \
--security-group-ids sg-0b0384b66d7d692f9 \
--user-data file://my_script.txt
```

For an example of the output for `run-instances`, see Example 1.

For more information about instance user data, see [Working with instance user data](#) in the *Amazon EC2 User Guide*.

### Example 6: To launch a burstable performance instance

The following `run-instances` example launches a `t2.micro` instance with the unlimited credit option. When you launch a T2 instance, if you do not specify `--credit-specification`, the default is the standard credit option. When you launch a T3 instance, the default is the unlimited credit option.

```
aws ec2 run-instances \
--image-id ami-0abcdef1234567890 \
--instance-type t2.micro \
--count 1 \
--subnet-id subnet-08fc749671b2d077c \
--key-name MyKeyPair \
--security-group-ids sg-0b0384b66d7d692f9 \
--credit-specification CpuCredits=unlimited
```

For an example of the output for `run-instances`, see Example 1.

For more information about burstable performance instances, see [Burstable performance instances](#) in the *Amazon EC2 User Guide*.

- For API details, see [RunInstances](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import software.amazon.awssdk.regions.Region;
import software.amazon.awssdk.services.ec2.Ec2Client;
import software.amazon.awssdk.services.ec2.model.InstanceType;
import software.amazon.awssdk.services.ec2.model.RunInstancesRequest;
import software.amazon.awssdk.services.ec2.model.RunInstancesResponse;
import software.amazon.awssdk.services.ec2.model.Tag;
import software.amazon.awssdk.services.ec2.model.CreateTagsRequest;
import software.amazon.awssdk.services.ec2.model.Ec2Exception;

/**
 * Before running this Java V2 code example, set up your development
 * environment, including your credentials.
 *
 * For more information, see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-started.html
 *
 * This code example requires an AMI value. You can learn more about this value
 * by reading this documentation topic:
 *
 * https://docs.aws.amazon.com/AWSEC2/latest/WindowsGuide/AMIs.html
 */
public class CreateInstance {
    public static void main(String[] args) {
        final String usage = """
            Usage:
            <name> <amiId>

            Where:
        """;
    }
}
```

```
        name - An instance name value that you can obtain from the AWS
Console (for example, ami-xxxxxx5c8b987b1a0).\s
        amiId - An Amazon Machine Image (AMI) value that you can
obtain from the AWS Console (for example, i-xxxxxx2734106d0ab).\s
        """;

    if (args.length != 2) {
        System.out.println(usage);
        System.exit(1);
    }

    String name = args[0];
    String amiId = args[1];
    Region region = Region.US_EAST_1;
    Ec2Client ec2 = Ec2Client.builder()
        .region(region)
        .build();

    String instanceId = createEC2Instance(ec2, name, amiId);
    System.out.println("The Amazon EC2 Instance ID is " + instanceId);
    ec2.close();
}

public static String createEC2Instance(Ec2Client ec2, String name, String
amiId) {
    RunInstancesRequest runRequest = RunInstancesRequest.builder()
        .imageId(amiId)
        .instanceType(InstanceType.T1_MICRO)
        .maxCount(1)
        .minCount(1)
        .build();

    // Use a waiter to wait until the instance is running.
    System.out.println("Going to start an EC2 instance using a waiter");
    RunInstancesResponse response = ec2.runInstances(runRequest);
    String instanceIdVal = response.instances().get(0).instanceId();
    ec2.waiter().waitUntilInstanceRunning(r -> r.instanceIds(instanceIdVal));
    Tag tag = Tag.builder()
        .key("Name")
        .value(name)
        .build();

    CreateTagsRequest tagRequest = CreateTagsRequest.builder()
        .resources(instanceIdVal)
```

```
        .tags(tag)
        .build();

    try {
        ec2.createTags(tagRequest);
        System.out.printf("Successfully started EC2 Instance %s based on AMI
%s", instanceIdVal, amiId);
        return instanceIdVal;

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }

    return "";
}
}
```

- For API details, see [RunInstances](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { RunInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

// Create a new EC2 instance.
export const main = async () => {
  const command = new RunInstancesCommand({
    // Your key pair name.
    KeyName: "KEY_PAIR_NAME",
    // Your security group.
    SecurityGroupIds: ["SECURITY_GROUP_ID"],
```

```
// An x86_64 compatible image.  
ImageId: "ami-0001a0d1a04bfcc30",  
// An x86_64 compatible free-tier instance type.  
InstanceType: "t1.micro",  
// Ensure only 1 instance launches.  
MinCount: 1,  
MaxCount: 1,  
});  
  
try {  
    const response = await client.send(command);  
    console.log(response);  
} catch (err) {  
    console.error(err);  
}  
};
```

- For API details, see [RunInstances](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun createEC2Instance(  
    name: String,  
    amiId: String,  
): String? {  
    val request =  
        RunInstancesRequest {  
            imageId = amiId  
            instanceType = InstanceType.T1Micro  
            maxCount = 1  
            minCount = 1  
        }  
}
```

```
Ec2Client { region = "us-west-2" }.use { ec2 ->
    val response = ec2.runInstances(request)
    val instanceId = response.instances?.get(0)?.instanceId
    val tag =
        Tag {
            key = "Name"
            value = name
        }

    val requestTags =
        CreateTagsRequest {
            resources = listOf(instanceId.toString())
            tags = listOf(tag)
        }
    ec2.createTags(requestTags)
    println("Successfully started EC2 Instance $instanceId based on AMI
$amiId")
    return instanceId
}
}
```

- For API details, see [RunInstances](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example launches a single instance of the specified AMI in EC2-Classic or a default VPC.**

```
New-EC2Instance -ImageId ami-12345678 -MinCount 1 -MaxCount 1 -InstanceType
m3.medium -KeyName my-key-pair -SecurityGroup my-security-group
```

**Example 2: This example launches a single instance of the specified AMI in a VPC.**

```
New-EC2Instance -ImageId ami-12345678 -MinCount 1 -MaxCount 1 -SubnetId
subnet-12345678 -InstanceType t2.micro -KeyName my-key-pair -SecurityGroupId
sg-12345678
```

**Example 3: To add an EBS volume or an instance store volume, define a block device mapping and add it to the command. This example adds an instance store volume.**

```
$bdm = New-Object Amazon.EC2.Model.BlockDeviceMapping  
$bdm.VirtualName = "ephemeral0"  
$bdm.DeviceName = "/dev/sdf"  
  
New-EC2Instance -ImageId ami-12345678 -BlockDeviceMapping $bdm ...
```

**Example 4: To specify one of the current Windows AMIs, get its AMI ID using Get-EC2ImageByName. This example launches an instance from the current base AMI for Windows Server 2016.**

```
$ami = Get-EC2ImageByName WINDOWS_2016_BASE  
  
New-EC2Instance -ImageId $ami.ImageId ...
```

**Example 5: Launches an instance into the specified dedicated host environment.**

```
New-EC2Instance -ImageId ami-1a2b3c4d -InstanceType m4.large -KeyName my-key-pair  
-SecurityGroupId sg-1a2b3c4d -AvailabilityZone us-west-1a -Tenancy host -HostID  
h-1a2b3c4d5e6f1a2b3
```

**Example 6: This request launches two instances and applies a tag with a key of webserver and a value of production to the instances. The request also applies a tag with a key of cost-center and a value of cc123 to the volumes that are created (in this case, the root volume for each instance).**

```
$tag1 = @{ Key="webserver"; Value="production" }  
$tag2 = @{ Key="cost-center"; Value="cc123" }  
  
$tagspec1 = new-object Amazon.EC2.Model.TagSpecification  
$tagspec1.ResourceType = "instance"  
$tagspec1.Tags.Add($tag1)  
  
$tagspec2 = new-object Amazon.EC2.Model.TagSpecification  
$tagspec2.ResourceType = "volume"  
$tagspec2.Tags.Add($tag2)  
  
New-EC2Instance -ImageId "ami-1a2b3c4d" -KeyName "my-key-pair" -MaxCount 2 -  
InstanceType "t2.large" -SubnetId "subnet-1a2b3c4d" -TagSpecification $tagspec1,  
$tagspec2
```

- For API details, see [RunInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance  
    actions."""  
  
    def __init__(self, ec2_resource, instance=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param instance: A Boto3 Instance object. This is a high-level object  
        that  
                    wraps instance actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.instance = instance  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def create(self, image, instance_type, key_pair, security_groups=None):  
        """  
        Creates a new EC2 instance. The instance starts immediately after  
        it is created.  
  
        The instance is created in the default VPC of the current account.  
  
        :param image: A Boto3 Image object that represents an Amazon Machine  
        Image (AMI)  
        """
```

```
        that defines attributes of the instance that is created.  
The AMI  
        defines things like the kind of operating system and the  
type of  
        storage used by the instance.  
:param instance_type: The type of instance to create, such as 't2.micro'.  
        The instance type defines things like the number of  
CPUs and  
        the amount of memory.  
:param key_pair: A Boto3 KeyPair or KeyPairInfo object that represents  
the key  
        pair that is used to secure connections to the instance.  
:param security_groups: A list of Boto3 SecurityGroup objects that  
represents the  
        security groups that are used to grant access to  
the  
        instance. When no security groups are specified,  
the  
        default security group of the VPC is used.  
:return: A Boto3 Instance object that represents the newly created  
instance.  
"""  
try:  
    instance_params = {  
        "ImageId": image.id,  
        "InstanceType": instance_type,  
        "KeyName": key_pair.name,  
    }  
    if security_groups is not None:  
        instance_params["SecurityGroupIds"] = [sg.id for sg in  
security_groups]  
        self.instance = self.ec2_resource.create_instances(  
            **instance_params, MinCount=1, MaxCount=1  
        )[0]  
        self.instance.wait_until_running()  
    except ClientError as err:  
        logging.error(  
            "Couldn't create instance with image %s, instance type %s, and  
key %s."  
            "Here's why: %s: %s",  
            image.id,  
            instance_type,  
            key_pair.name,  
            err.response["Error"]["Code"],
```

```
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.instance
```

- For API details, see [RunInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn create_instance<'a>(
    &self,
    image_id: &'a str,
    instance_type: InstanceType,
    key_pair: &'a KeyPairInfo,
    security_groups: Vec<&'a SecurityGroup>,
) -> Result<String, EC2Error> {
    let run_instances = self
        .client
        .run_instances()
        .image_id(image_id)
        .instance_type(instance_type)
        .key_name(
            key_pair
                .key_name()
                .ok_or_else(|| EC2Error::new("Missing key name when launching
instance"))?,
        )
        .set_security_group_ids(Some(
            security_groups
                .iter()
                .filter_map(|sg| sg.group_id.clone())))
}
```

```
        .collect(),
    ))
    .min_count(1)
    .max_count(1)
    .send()
    .await?;

    if run_instances.instances().is_empty() {
        return Err(EC2Error::new("Failed to create instance"));
    }

    let instance_id = run_instances.instances()[0].instance_id().unwrap();
    let response = self
        .client
        .create_tags()
        .resources(instance_id)
        .tags(
            Tag::builder()
                .key("Name")
                .value("From SDK Examples")
                .build(),
        )
        .send()
        .await;

    match response {
        Ok(_) => tracing::info!("Created {instance_id} and applied tags."),
        Err(err) => {
            tracing::info!("Error applying tags to {instance_id}: {err:?}");
            return Err(err.into());
        }
    }
}

tracing::info!("Instance is created.");

Ok(instance_id.to_string())
}
```

- For API details, see [RunInstances](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
" Create tags for resource created during instance launch. "
DATA lt_tagspecifications TYPE /aws1/
cl_ec2tagspecification=>tt_tagspecificationlist.
DATA ls_tagspecifications LIKE LINE OF lt_tagspecifications.
ls_tagspecifications = NEW /aws1/cl_ec2tagspecification(
    iv_resourcetype = 'instance'
    it_tags = VALUE /aws1/cl_ec2tag=>tt_taglist(
        ( NEW /aws1/cl_ec2tag( iv_key = 'Name' iv_value = iv_tag_value ) )
    )
).
APPEND ls_tagspecifications TO lt_tagspecifications.

TRY.
    " Create/launch Amazon Elastic Compute Cloud (Amazon EC2) instance. "
    oo_result = lo_ec2->runinstances(                                     " oo_result
is returned for testing purposes. "
        iv_imageid = iv_ami_id
        iv_instancetype = 't2.micro'
        iv_maxcount = 1
        iv_mincount = 1
        it_tagspecifications = lt_tagspecifications
        iv_subnetid = iv_subnet_id
    ).
    MESSAGE 'EC2 instance created.' TYPE 'I'.
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
        DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-
>av_err_msg }|.
        MESSAGE lv_error TYPE 'E'.
ENDTRY.
```

- For API details, see [RunInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use RunScheduledInstances with an AWS SDK or CLI

The following code examples show how to use RunScheduledInstances.

CLI

### AWS CLI

#### To launch a Scheduled Instance

This example launches the specified Scheduled Instance in a VPC.

Command:

```
aws ec2 run-scheduled-instances --scheduled-instance-id sci-1234-1234-1234-123456789012 --instance-count 1 --launch-specification file://launch-specification.json
```

Launch-specification.json:

```
{  
    "ImageId": "ami-12345678",  
    "KeyName": "my-key-pair",  
    "InstanceType": "c4.large",  
    "NetworkInterfaces": [  
        {  
            "DeviceIndex": 0,  
            "SubnetId": "subnet-12345678",  
            "AssociatePublicIpAddress": true,  
            "Groups": ["sg-12345678"]  
        }  
    ],  
    "IamInstanceProfile": {  
        "Name": "my-iam-role"  
    }  
}
```

```
}
```

## Output:

```
{
    "InstanceIdSet": [
        "i-1234567890abcdef0"
    ]
}
```

This example launches the specified Scheduled Instance in EC2-Classic.

## Command:

```
aws ec2 run-scheduled-instances --scheduled-instance-
id sci-1234-1234-1234-1234-123456789012 --instance-count 1 --launch-
specification file://launch-specification.json
```

## Launch-specification.json:

```
{
    "ImageId": "ami-12345678",
    "KeyName": "my-key-pair",
    "SecurityGroupIds": ["sg-12345678"],
    "InstanceType": "c4.large",
    "Placement": {
        "AvailabilityZone": "us-west-2b"
    }
    "IamInstanceProfile": {
        "Name": "my-iam-role"
    }
}
```

## Output:

```
{
    "InstanceIdSet": [
        "i-1234567890abcdef0"
    ]
}
```

- For API details, see [RunScheduledInstances](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example launches the specified Scheduled Instance.

```
New-EC2ScheduledInstance -ScheduledInstanceId  
sci-1234-1234-1234-1234-123456789012 -InstanceCount 1  
-IamInstanceProfile_Name my-iam-role  
-LaunchSpecification_ImageId ami-12345678  
-LaunchSpecification_InstanceType c4.large  
-LaunchSpecification_SubnetId subnet-12345678  
-LaunchSpecification_SecurityGroupId sg-12345678
```

- For API details, see [RunScheduledInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use StartInstances with an AWS SDK or CLI

The following code examples show how to use StartInstances.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Start an EC2 instance.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the Amazon EC2 instance
/// to start.</param>
/// <returns>Async task.</returns>
public async Task StartInstances(string ec2InstanceId)
{
    var request = new StartInstancesRequest
    {
        InstanceIds = new List<string> { ec2InstanceId },
    };

    var response = await _amazonEC2.StartInstancesAsync(request);

    if (response.StartingInstances.Count > 0)
    {
        var instances = response.StartingInstances;
        instances.ForEach(i =>
        {
            Console.WriteLine($"Successfully started the EC2 instance with
instance ID: {i.InstanceId}.");
        });
    }
}
```

- For API details, see [StartInstances](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_start_instances
```

```
#  
# This function starts one or more Amazon Elastic Compute Cloud (Amazon EC2)  
instances.  
#  
# Parameters:  
#     -i instance_id - The ID(s) of the instance(s) to start (comma-separated).  
#     -h - Display help.  
#  
# Returns:  
#     0 - If successful.  
#     1 - If it fails.  
#####  
function ec2_start_instances() {  
    local instance_ids  
    local option OPTARG # Required to use getopt command in a function.  
  
    # bashsupport disable=BP5008  
    function usage() {  
        echo "function ec2_start_instances"  
        echo "Starts one or more Amazon Elastic Compute Cloud (Amazon EC2)  
instances."  
        echo "  -i instance_id - The ID(s) of the instance(s) to start (comma-  
separated)."  
        echo "  -h - Display help."  
        echo ""  
    }  
  
    # Retrieve the calling parameters.  
    while getopt "i:h" option; do  
        case "${option}" in  
            i) instance_ids="${OPTARG}" ;;  
            h)  
                usage  
                return 0  
                ;;  
            \?)  
                echo "Invalid parameter"  
                usage  
                return 1  
                ;;  
        esac  
    done  
    export OPTIND=1
```

```
if [[ -z "$instance_ids" ]]; then
    errecho "ERROR: You must provide one or more instance IDs with the -i
parameter."
    usage
    return 1
fi

response=$(aws ec2 start-instances \
--instance-ids "${instance_ids}") || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports start-instances operation failed with $response."
return 1
}

return 0
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
```

```
errecho "Error code : $err_code"
if [ "$err_code" == 1 ]; then
    errecho " One or more S3 transfers failed."
elif [ "$err_code" == 2 ]; then
    errecho " Command line failed to parse."
elif [ "$err_code" == 130 ]; then
    errecho " Process received SIGINT."
elif [ "$err_code" == 252 ]; then
    errecho " Command syntax invalid."
elif [ "$err_code" == 253 ]; then
    errecho " The system environment or configuration was invalid."
elif [ "$err_code" == 254 ]; then
    errecho " The service returned an error."
elif [ "$err_code" == 255 ]; then
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see [StartInstances](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Start an Amazon Elastic Compute Cloud (Amazon EC2) instance.
/*
 \param instanceID: An EC2 instance ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::startInstance(const Aws::String &instanceId,
                                 const Aws::Client::ClientConfiguration
&clientConfiguration) {
```

```
Aws::EC2::EC2Client ec2Client(clientConfiguration);

Aws::EC2::Model::StartInstancesRequest startRequest;
startRequest.AddInstanceIds(instanceId);
startRequest.SetDryRun(true);

Aws::EC2::Model::StartInstancesOutcome dryRunOutcome =
ec2Client.StartInstances(startRequest);
if (dryRunOutcome.IsSuccess()) {
    std::cerr
        << "Failed dry run to start instance. A dry run should trigger an
error."
        << std::endl;
    return false;
} else if (dryRunOutcome.GetError().GetErrorCode() !=
           Aws::EC2::EC2Errors::DRY_RUN_OPERATION) {
    std::cout << "Failed dry run to start instance " << instanceId << ":" 
              << dryRunOutcome.GetError().GetMessage() << std::endl;
    return false;
}

startRequest.SetDryRun(false);
Aws::EC2::Model::StartInstancesOutcome startInstancesOutcome =
ec2Client.StartInstances(startRequest);

if (!startInstancesOutcome.IsSuccess()) {
    std::cout << "Failed to start instance " << instanceId << ":" <<
                startInstancesOutcome.GetError().GetMessage() << std::endl;
} else {
    std::cout << "Successfully started instance " << instanceId <<
                std::endl;
}

return startInstancesOutcome.IsSuccess();
}
```

- For API details, see [StartInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To start an Amazon EC2 instance

This example starts the specified Amazon EBS-backed instance.

Command:

```
aws ec2 start-instances --instance-ids i-1234567890abcdef0
```

Output:

```
{  
    "StartingInstances": [  
        {  
            "InstanceId": "i-1234567890abcdef0",  
            "CurrentState": {  
                "Code": 0,  
                "Name": "pending"  
            },  
            "PreviousState": {  
                "Code": 80,  
                "Name": "stopped"  
            }  
        }  
    ]  
}
```

For more information, see Stop and Start Your Instance in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [StartInstances](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void startInstance(Ec2Client ec2, String instanceId) {  
    Ec2Waiter ec2Waiter = Ec2Waiter.builder()  
        .overrideConfiguration(b -> b.maxAttempts(100))  
        .client(ec2)  
        .build();  
  
    StartInstancesRequest request = StartInstancesRequest.builder()  
        .instanceIds(instanceId)  
        .build();  
  
    System.out.println("Use an Ec2Waiter to wait for the instance to run.  
This will take a few minutes.");  
    ec2.startInstances(request);  
    DescribeInstancesRequest instanceRequest =  
    DescribeInstancesRequest.builder()  
        .instanceIds(instanceId)  
        .build();  
  
    WaiterResponse<DescribeInstancesResponse> waiterResponse =  
    ec2Waiter.waitUntilInstanceRunning(instanceRequest);  
    waiterResponse.matched().response().ifPresent(System.out::println);  
    System.out.println("Successfully started instance " + instanceId);  
}
```

- For API details, see [StartInstances](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { StartInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new StartInstancesCommand({
    // Use DescribeInstancesCommand to find InstanceIds
    InstanceIds: ["INSTANCE_ID"],
  });

  try {
    const { StartingInstances } = await client.send(command);
    const instanceIdList = StartingInstances.map(
      (instance) => ` • ${instance.InstanceId}`,
    );
    console.log("Starting instances:");
    console.log(instanceIdList.join("\n"));
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [StartInstances](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun startInstanceSc(instanceId: String) {
    val request =
        StartInstancesRequest {
            instanceIds = listOf(instanceId)
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.startInstances(request)
        println("Waiting until instance $instanceId starts. This will take a few
minutes.")
        ec2.waitUntilInstanceRunning {
            // suspend call
            instanceIds = listOf(instanceId)
        }
        println("Successfully started instance $instanceId")
    }
}
```

- For API details, see [StartInstances](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example starts the specified instance.

```
Start-EC2Instance -InstanceId i-12345678
```

#### Output:

CurrentState	InstanceId	PreviousState
Amazon.EC2.Model.InstanceState	i-12345678	Amazon.EC2.Model.InstanceState

### Example 2: This example starts the specified instances.

```
@("i-12345678", "i-76543210") | Start-EC2Instance
```

**Example 3: This example starts the set of instances that are currently stopped. The Instance objects returned by Get-EC2Instance are piped to Start-EC2Instance. The syntax used by this example requires PowerShell version 3 or higher.**

```
(Get-EC2Instance -Filter @{ Name="instance-state-name"; Values="stopped"}).Instances | Start-EC2Instance
```

**Example 4: With PowerShell version 2, you must use New-Object to create the filter for the Filter parameter.**

```
$filter = New-Object Amazon.EC2.Model.Filter
$filter.Name = "instance-state-name"
$filter.Values = "stopped"

(Get-EC2Instance -Filter $filter).Instances | Start-EC2Instance
```

- For API details, see [StartInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance
    actions."""
```

```
def __init__(self, ec2_resource, instance=None):
    """
    :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
    resource
        is used to create additional high-level objects
        that wrap low-level Amazon EC2 service actions.
    :param instance: A Boto3 Instance object. This is a high-level object
    that
        wraps instance actions.
    """
    self.ec2_resource = ec2_resource
    self.instance = instance

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource)

    def start(self):
        """
        Starts an instance and waits for it to be in a running state.

        :return: The response to the start request.
        """
        if self.instance is None:
            logger.info("No instance to start.")
            return

        try:
            response = self.instance.start()
            self.instance.wait_until_running()
        except ClientError as err:
            logger.error(
                "Couldn't start instance %s. Here's why: %s: %s",
                self.instance.id,
                err.response["Error"]["Code"],
                err.response["Error"]["Message"],
            )
            raise
        else:
            return response
```

- For API details, see [StartInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Attempts to start an Amazon Elastic Compute Cloud (Amazon EC2) instance.
#
# Prerequisites:
#
# - The Amazon EC2 instance.
#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @param instance_id [String] The ID of the instance.
# @return [Boolean] true if the instance was started; otherwise, false.
# @example
#   exit 1 unless instance_started?(
#     Aws::EC2::Client.new(region: 'us-west-2'),
#     'i-123abc'
#   )
def instance_started?(ec2_client, instance_id)
  response = ec2_client.describe_instance_status(instance_ids: [instance_id])

  if response.instance_statuses.count.positive?
    state = response.instance_statuses[0].instance_state.name
    case state
    when "pending"
      puts "Error starting instance: the instance is pending. Try again later."
      return false
    when "running"
      puts "The instance is already running."
    end
  end
end
```

```
        return true
    when "terminated"
        puts "Error starting instance: " \
            "the instance is terminated, so you cannot start it."
        return false
    end
end

ec2_client.start_instances(instance_ids: [instance_id])
ec2_client.wait_until(:instance_running, instance_ids: [instance_id])
puts "Instance started."
return true
rescue StandardError => e
    puts "Error starting instance: #{e.message}"
    return false
end

# Example usage:
def run_me
    instance_id = ""
    region = ""
    # Print usage information and then stop.
    if ARGV[0] == "--help" || ARGV[0] == "-h"
        puts "Usage: ruby ec2-ruby-example-start-instance-i-123abc.rb " \
            "INSTANCE_ID REGION"
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
        puts "Example: ruby ec2-ruby-example-start-instance-i-123abc.rb " \
            "i-123abc us-west-2"
        exit 1
    # If no values are specified at the command prompt, use these default values.
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.
    elsif ARGV.count.zero?
        instance_id = "i-123abc"
        region = "us-west-2"
    # Otherwise, use the values as specified at the command prompt.
    else
        instance_id = ARGV[0]
        region = ARGV[1]
    end

    ec2_client = Aws::EC2::Client.new(region: region)

    puts "Attempting to start instance '#{instance_id}' " \
        "(this might take a few minutes)..."
```

```
unless instance_started?(ec2_client, instance_id)
    puts "Could not start instance."
end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [StartInstances](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

## Start an EC2 Instance by instance ID.

```
pub async fn start_instance(&self, instance_id: &str) -> Result<(), EC2Error>
{
    tracing::info!("Starting instance {instance_id}");

    self.client
        .start_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    tracing::info!("Started instance.");

    Ok(())
}
```

Wait for an instance to be in the ready and status ok states, using the Waiters API. Using the Waiters API requires `use aws\_sdk\_ec2::client::Waiters` in the rust file.

```
/// Wait for an instance to be ready and status ok (default wait 60 seconds)
pub async fn wait_for_instance_ready(
    &self,
    instance_id: &str,
    duration: Option<Duration>,
) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_status_ok()
        .instance_ids(instance_id)
        .wait(duration.unwrap_or(Duration::from_secs(60)))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to start.",
                exceeded.max_wait().as_secs()
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
```

- For API details, see [StartInstances](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
DATA lt_instance_ids TYPE /aws1/
cl_ec2instidstringlist_w=>tt_instanceidstringlist.
APPEND NEW /aws1/cl_ec2instidstringlist_w( iv_value = iv_instance_id ) TO
lt_instance_ids.

"Perform dry run"
```

```
TRY.  
    " DryRun is set to true. This checks for the required permissions to  
    start the instance without actually making the request."  
    lo_ec2->startinstances(  
        it_instanceids = lt_instance_ids  
        iv_dryrun = abap_true  
    ).  
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).  
        " If the error code returned is `DryRunOperation`, then you have the  
        required permissions to start this instance."  
        IF lo_exception->av_err_code = 'DryRunOperation'.  
            MESSAGE 'Dry run to start instance completed.' TYPE 'I'.  
            " DryRun is set to false to start instance."  
            oo_result = lo_ec2->startinstances(          " oo_result is returned  
            for testing purposes.  
                it_instanceids = lt_instance_ids  
                iv_dryrun = abap_false  
            ).  
            MESSAGE 'Successfully started the EC2 instance.' TYPE 'I'.  
            " If the error code returned is `UnauthorizedOperation`, then you don't  
            have the required permissions to start this instance."  
            ELSEIF lo_exception->av_err_code = 'UnauthorizedOperation'.  
                MESSAGE 'Dry run to start instance failed. User does not have  
                permissions to start the instance.' TYPE 'E'.  
            ELSE.  
                DATA(lv_error) = |"{ lo_exception->av_err_code }" - { lo_exception-  
                >av_err_msg }|.  
                MESSAGE lv_error TYPE 'E'.  
            ENDIF.  
        ENDTRY.
```

- For API details, see [StartInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use StopInstances with an AWS SDK or CLI

The following code examples show how to use StopInstances.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

## AWS SDK for .NET

### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Stop an EC2 instance.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the EC2 instance to
/// stop.</param>
/// <returns>Async task.</returns>
public async Task StopInstances(string ec2InstanceId)
{
    // In addition to the list of instance Ids, the
    // request can also include the following properties:
    // Force      When true, forces the instances to
    //             stop but you must check the integrity
    //             of the file system. Not recommended on
    //             Windows instances.
    // Hibernate  When true, hibernates the instance if the
    //             instance was enabled for hibernation when
    //             it was launched.

    var request = new StopInstancesRequest
    {
        InstanceIds = new List<string> { ec2InstanceId },
    };

    var response = await _amazonEC2.StopInstancesAsync(request);

    if (response.StoppingInstances.Count > 0)
    {
```

```
        var instances = response.StoppingInstances;
        instances.ForEach(i =>
    {
        Console.WriteLine($"Successfully stopped the EC2 Instance " +
            $"with InstanceID: {i.InstanceId}.");
    });
}
}
```

- For API details, see [StopInstances](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_stop_instances
#
# This function stops one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.
#
# Parameters:
#     -i instance_id - The ID(s) of the instance(s) to stop (comma-separated).
#     -h - Display help.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_stop_instances() {
    local instance_ids
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
```

```
echo "function ec2_stop_instances"
echo "Stops one or more Amazon Elastic Compute Cloud (Amazon EC2) instances."
echo " -i instance_id - The ID(s) of the instance(s) to stop (comma-separated)."
echo " -h - Display help."
echo ""
}

# Retrieve the calling parameters.
while getopts "i:h" option; do
    case "${option}" in
        i) instance_ids="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

if [[ -z "$instance_ids" ]]; then
    errecho "ERROR: You must provide one or more instance IDs with the -i
parameter."
    usage
    return 1
fi

response=$(aws ec2 stop-instances \
--instance-ids "${instance_ids}") || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports stop-instances operation failed with $response."
return 1
}

return 0
}
```

## The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
    fi

    return 0
}
```

- For API details, see [StopInstances](#) in *AWS CLI Command Reference*.

C++

## SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Stop an EC2 instance.
/*
 \param instanceID: An EC2 instance ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::stopInstance(const Aws::String &instanceId,
                                const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::StopInstancesRequest request;
    request.AddInstanceIds(instanceId);
    request.SetDryRun(true);

    Aws::EC2::Model::StopInstancesOutcome dryRunOutcome =
ec2Client.StopInstances(request);
    if (dryRunOutcome.IsSuccess()) {
        std::cerr
            << "Failed dry run to stop instance. A dry run should trigger an
error."
            << std::endl;
        return false;
    } else if (dryRunOutcome.GetError().GetErrorCode() !=
               Aws::EC2::EC2Errors::DRY_RUN_OPERATION) {
        std::cout << "Failed dry run to stop instance " << instanceId << ":" 
                  << dryRunOutcome.GetError().GetMessage() << std::endl;
        return false;
    }
}
```

```
request.SetDryRun(false);
Aws::EC2::Model::StopInstancesOutcome outcome =
ec2Client.StopInstances(request);
if (!outcome.IsSuccess()) {
    std::cout << "Failed to stop instance " << instanceId << ": " <<
        outcome.GetError().GetMessage() << std::endl;
} else {
    std::cout << "Successfully stopped instance " << instanceId <<
        std::endl;
}

return outcome.IsSuccess();
}

void PrintUsage() {
    std::cout << "Usage: run_start_stop_instance <instance_id> <start|stop>" <<
        std::endl;
}
```

- For API details, see [StopInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### Example 1: To stop an Amazon EC2 instance

The following stop-instances example stops the specified Amazon EBS-backed instance.

```
aws ec2 stop-instances \
--instance-ids i-1234567890abcdef0
```

Output:

```
{
    "StoppingInstances": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "CurrentState": {
                "Code": 64,
                "Name": "stopping"
            }
        }
    ]
}
```

```
        },
        "PreviousState": {
            "Code": 16,
            "Name": "running"
        }
    }
}
```

For more information, see [Stop and Start Your Instance](#) in the *Amazon Elastic Compute Cloud User Guide*.

### Example 2: To hibernate an Amazon EC2 instance

The following `stop-instances` example hibernates Amazon EBS-backed instance if the instance is enabled for hibernation and meets the hibernation prerequisites. After the instance is put into hibernation the instance is stopped.

```
aws ec2 stop-instances \
--instance-ids i-1234567890abcdef0 \
--hibernate
```

Output:

```
{
    "StoppingInstances": [
        {
            "CurrentState": {
                "Code": 64,
                "Name": "stopping"
            },
            "InstanceId": "i-1234567890abcdef0",
            "PreviousState": {
                "Code": 16,
                "Name": "running"
            }
        }
    ]
}
```

For more information, see [Hibernate your On-Demand Linux instance](#) in the *Amazon Elastic Compute Cloud User Guide*.

- For API details, see [StopInstances](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void stopInstance(Ec2Client ec2, String instanceId) {  
    Ec2Waiter ec2Waiter = Ec2Waiter.builder()  
        .overrideConfiguration(b -> b.maxAttempts(100))  
        .client(ec2)  
        .build();  
    StopInstancesRequest request = StopInstancesRequest.builder()  
        .instanceIds(instanceId)  
        .build();  
  
    System.out.println("Use an Ec2Waiter to wait for the instance to stop.  
This will take a few minutes.");  
    ec2.stopInstances(request);  
    DescribeInstancesRequest instanceRequest =  
    DescribeInstancesRequest.builder()  
        .instanceIds(instanceId)  
        .build();  
  
    WaiterResponse<DescribeInstancesResponse> waiterResponse =  
    ec2Waiter.waitUntilInstanceStopped(instanceRequest);  
    waiterResponse.matched().response().ifPresent(System.out::println);  
    System.out.println("Successfully stopped instance " + instanceId);  
}
```

- For API details, see [StopInstances](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { StopInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new StopInstancesCommand({
    // Use DescribeInstancesCommand to find InstanceIds
    InstanceIds: ["INSTANCE_ID"],
  });

  try {
    const { StoppingInstances } = await client.send(command);
    const instanceIdList = StoppingInstances.map(
      (instance) => ` • ${instance.InstanceId}`,
    );
    console.log("Stopping instances:");
    console.log(instanceIdList.join("\n"));
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [StopInstances](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun stopInstanceSc(instanceId: String) {
    val request =
        StopInstancesRequest {
            instanceIds = listOf(instanceId)
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.stopInstances(request)
        println("Waiting until instance $instanceId stops. This will take a few
minutes.")
        ec2.waitUntilInstanceStopped {
            // suspend call
            instanceIds = listOf(instanceId)
        }
        println("Successfully stopped instance $instanceId")
    }
}
```

- For API details, see [StopInstances](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

#### Example 1: This example stops the specified instance.

```
Stop-EC2Instance -InstanceId i-12345678
```

#### Output:

CurrentState	InstanceId	PreviousState
Amazon.EC2.Model.InstanceState	i-12345678	Amazon.EC2.Model.InstanceState

- For API details, see [StopInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance  
    actions."""  
  
    def __init__(self, ec2_resource, instance=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param instance: A Boto3 Instance object. This is a high-level object  
        that  
                    wraps instance actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.instance = instance  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def stop(self):  
        """
```

```
    Stops an instance and waits for it to be in a stopped state.

    :return: The response to the stop request.
    """
    if self.instance is None:
        logger.info("No instance to stop.")
        return

    try:
        response = self.instance.stop()
        self.instance.wait_until_stopped()
    except ClientError as err:
        logger.error(
            "Couldn't stop instance %s. Here's why: %s: %s",
            self.instance.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return response
```

- For API details, see [StopInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Prerequisites:
#
# - The Amazon EC2 instance.
```

```
#  
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.  
# @param instance_id [String] The ID of the instance.  
# @return [Boolean] true if the instance was stopped; otherwise, false.  
# @example  
#   exit 1 unless instance_stopped?  
#  
#     Aws::EC2::Client.new(region: 'us-west-2'),  
#     'i-123abc'  
#   )  
def instance_stopped?(ec2_client, instance_id)  
    response = ec2_client.describe_instance_status(instance_ids: [instance_id])  
  
    if response.instance_statuses.count.positive?  
        state = response.instance_statuses[0].instance_state.name  
        case state  
        when "stopping"  
            puts "The instance is already stopping."  
            return true  
        when "stopped"  
            puts "The instance is already stopped."  
            return true  
        when "terminated"  
            puts "Error stopping instance: " \  
                "the instance is terminated, so you cannot stop it."  
            return false  
        end  
    end  
  
    ec2_client.stop_instances(instance_ids: [instance_id])  
    ec2_client.wait_until(:instance_stopped, instance_ids: [instance_id])  
    puts "Instance stopped."  
    return true  
rescue StandardError => e  
    puts "Error stopping instance: #{e.message}"  
    return false  
end  
  
# Example usage:  
def run_me  
    instance_id = ""  
    region = ""  
    # Print usage information and then stop.  
    if ARGV[0] == "--help" || ARGV[0] == "-h"  
        puts "Usage: ruby ec2-ruby-example-stop-instance-i-123abc.rb " \  

```

```
    "INSTANCE_ID REGION "
# Replace us-west-2 with the AWS Region you're using for Amazon EC2.
puts "Example: ruby ec2-ruby-example-start-instance-i-123abc.rb " \
    "i-123abc us-west-2"
exit 1
# If no values are specified at the command prompt, use these default values.
# Replace us-west-2 with the AWS Region you're using for Amazon EC2.
elsif ARGV.count.zero?
    instance_id = "i-123abc"
    region = "us-west-2"
# Otherwise, use the values as specified at the command prompt.
else
    instance_id = ARGV[0]
    region = ARGV[1]
end

ec2_client = Aws::EC2::Client.new(region: region)

puts "Attempting to stop instance '#{instance_id}' " \
    "(this might take a few minutes)..."
unless instance_stopped?(ec2_client, instance_id)
    puts "Could not stop instance."
end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [StopInstances](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn stop_instance(&self, instance_id: &str) -> Result<(), EC2Error>
{
```

```
    tracing::info!("Stopping instance {instance_id}");

    self.client
        .stop_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    self.wait_for_instance_stopped(instance_id, None).await?;

    tracing::info!("Stopped instance.");

    Ok(())
}
```

Wait for an instance to be in the stopped state, using the Waiters API. Using the Waiters API requires `use aws\_sdk\_ec2::client::Waiters` in the rust file.

```
pub async fn stop_instance(&self, instance_id: &str) -> Result<(), EC2Error>
{
    tracing::info!("Stopping instance {instance_id}");

    self.client
        .stop_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    self.wait_for_instance_stopped(instance_id, None).await?;

    tracing::info!("Stopped instance.");

    Ok(())
}
```

- For API details, see [StopInstances](#) in *AWS SDK for Rust API reference*.

## SAP ABAP

### SDK for SAP ABAP

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
DATA lt_instance_ids TYPE /aws1/
cl_ec2instidstringlist_w=>tt_instanceidstringlist.
    APPEND NEW /aws1/cl_ec2instidstringlist_w( iv_value = iv_instance_id ) TO
lt_instance_ids.

    "Perform dry run"
TRY.
    " DryRun is set to true. This checks for the required permissions to stop
the instance without actually making the request. "
    lo_ec2->stopinstances(
        it_instanceids = lt_instance_ids
        iv_dryrun = abap_true
    ).
    CATCH /aws1/cx_rt_service_generic INTO DATA(lo_exception).
        " If the error code returned is `DryRunOperation`, then you have the
required permissions to stop this instance. "
        IF lo_exception->av_err_code = 'DryRunOperation'.
            MESSAGE 'Dry run to stop instance completed.' TYPE 'I'.
            " DryRun is set to false to stop instance. "
            oo_result = lo_ec2->stopinstances(           " oo_result is returned
for testing purposes. "
                it_instanceids = lt_instance_ids
                iv_dryrun = abap_false
            ).
            MESSAGE 'Successfully stopped the EC2 instance.' TYPE 'I'.
            " If the error code returned is `UnauthorizedOperation`, then you don't
have the required permissions to stop this instance. "
            ELSEIF lo_exception->av_err_code = 'UnauthorizedOperation'.
                MESSAGE 'Dry run to stop instance failed. User does not have
permissions to stop the instance.' TYPE 'E'.
            ELSE.
        ENDIF.
    ENDTRY.
```

```
DATA(lv_error) = |"{'lo_exception->av_err_code }" - { lo_exception->av_err_msg }|.
MESSAGE lv_error TYPE 'E'.
ENDIF.
ENDTRY.
```

- For API details, see [StopInstances](#) in *AWS SDK for SAP ABAP API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use `TerminateInstances` with an AWS SDK or CLI

The following code examples show how to use `TerminateInstances`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

.NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/// <summary>
/// Terminate an EC2 instance.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the EC2 instance
/// to terminate.</param>
/// <returns>Async task.</returns>
public async Task<List<InstanceStateChange>> TerminateInstances(string
ec2InstanceId)
```

```
{  
    var request = new TerminateInstancesRequest  
    {  
        InstanceIds = new List<string> { ec2InstanceId }  
    };  
  
    var response = await _amazonEC2.TerminateInstancesAsync(request);  
    return response.TerminatingInstances;  
}
```

- For API details, see [TerminateInstances](#) in *AWS SDK for .NET API Reference*.

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#####
# function ec2_terminate_instances
#
# This function terminates one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances using the AWS CLI.
#
# Parameters:
#     -i instance_ids - A space-separated list of instance IDs.
#     -h - Display help.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_terminate_instances() {
    local instance_ids response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
```

```
function usage() {
    echo "function ec2_terminate_instances"
    echo "Terminates one or more Amazon Elastic Compute Cloud (Amazon EC2)
instances."
    echo "  -i instance_ids - A space-separated list of instance IDs."
    echo "  -h - Display help."
    echo ""
}

# Retrieve the calling parameters.
while getopts "i:h" option; do
    case "${option}" in
        i) instance_ids="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?) 
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Check if instance ID is provided
if [[ -z "${instance_ids}" ]]; then
    echo "Error: Missing required instance IDs parameter."
    usage
    return 1
fi

# shellcheck disable=SC2086
response=$(aws ec2 terminate-instances \
    "--instance-ids" $instance_ids \
    --query 'TerminatingInstances[*].[InstanceId,CurrentState.Name]' \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports terminate-instances operation failed.$response"
    return 1
}

return 0
```

```
}
```

The utility functions used in this example.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
    errecho "Error code : $err_code"
    if [ "$err_code" == 1 ]; then
        errecho " One or more S3 transfers failed."
    elif [ "$err_code" == 2 ]; then
        errecho " Command line failed to parse."
    elif [ "$err_code" == 130 ]; then
        errecho " Process received SIGINT."
    elif [ "$err_code" == 252 ]; then
        errecho " Command syntax invalid."
    elif [ "$err_code" == 253 ]; then
        errecho " The system environment or configuration was invalid."
    elif [ "$err_code" == 254 ]; then
        errecho " The service returned an error."
    elif [ "$err_code" == 255 ]; then
        errecho " 255 is a catch-all error."
```

```
    fi

    return 0
}
```

- For API details, see [TerminateInstances](#) in *AWS CLI Command Reference*.

## C++

### SDK for C++

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
#!/ Terminate an Amazon Elastic Compute Cloud (Amazon EC2) instance.
/*!
 \param instanceID: An EC2 instance ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::terminateInstances(const Aws::String &instanceID,
                                      const Aws::Client::ClientConfiguration
&clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);

    Aws::EC2::Model::TerminateInstancesRequest request;
    request.SetInstanceIds({instanceID});

    Aws::EC2::Model::TerminateInstancesOutcome outcome =
        ec2Client.TerminateInstances(request);
    if (outcome.IsSuccess()) {
        std::cout << "Ec2 instance '" << instanceID <<
            "' was terminated." << std::endl;
    } else {
        std::cerr << "Failed to terminate ec2 instance " << instanceID <<
            ", " <<
            outcome.GetError().GetMessage() << std::endl;
    }
    return false;
}
```

```
    }

    return outcome.IsSuccess();
}
```

- For API details, see [TerminateInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To terminate an Amazon EC2 instance

This example terminates the specified instance.

Command:

```
aws ec2 terminate-instances --instance-ids i-1234567890abcdef0
```

Output:

```
{
    "TerminatingInstances": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "CurrentState": {
                "Code": 32,
                "Name": "shutting-down"
            },
            "PreviousState": {
                "Code": 16,
                "Name": "running"
            }
        }
    ]
}
```

For more information, see *Using Amazon EC2 Instances in the AWS Command Line Interface User Guide*.

- For API details, see [TerminateInstances](#) in *AWS CLI Command Reference*.

## Java

### SDK for Java 2.x

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
public static void terminateEC2(Ec2Client ec2, String instanceId) {
    try {
        Ec2Waiter ec2Waiter = Ec2Waiter.builder()
            .overrideConfiguration(b -> b.maxAttempts(100))
            .client(ec2)
            .build();

        TerminateInstancesRequest ti = TerminateInstancesRequest.builder()
            .instanceIds(instanceId)
            .build();

        System.out.println("Use an Ec2Waiter to wait for the instance to
terminate. This will take a few minutes.");
        ec2.terminateInstances(ti);
        DescribeInstancesRequest instanceRequest =
        DescribeInstancesRequest.builder()
            .instanceIds(instanceId)
            .build();

        WaiterResponse<DescribeInstancesResponse> waiterResponse = ec2Waiter
            .waitUntilInstanceTerminated(instanceRequest);
        waiterResponse.matched().response().ifPresent(System.out::println);
        System.out.println("Successfully started instance " + instanceId);
        System.out.println(instanceId + " is terminated!");

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

- For API details, see [TerminateInstances](#) in *AWS SDK for Java 2.x API Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { TerminateInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new TerminateInstancesCommand({
    InstanceIds: ["INSTANCE_ID"],
  });

  try {
    const { TerminatingInstances } = await client.send(command);
    const instanceList = TerminatingInstances.map(
      (instance) => ` • ${instance.InstanceId}`,
    );
    console.log("Terminating instances:");
    console.log(instanceList.join("\n"));
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [TerminateInstances](#) in *AWS SDK for JavaScript API Reference*.

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
suspend fun terminateEC2(instanceID: String) {  
    val request =  
        TerminateInstancesRequest {  
            instanceIds = listOf(instanceID)  
        }  
  
    Ec2Client { region = "us-west-2" }.use { ec2 ->  
        val response = ec2.terminateInstances(request)  
        response.terminatingInstances?.forEach { instance ->  
            println("The ID of the terminated instance is  
            ${instance.instanceId}")  
        }  
    }  
}
```

- For API details, see [TerminateInstances](#) in *AWS SDK for Kotlin API reference*.

## PowerShell

### Tools for PowerShell

**Example 1:** This example terminates the specified instance (the instance may be running or in 'stopped' state). The cmdlet will prompt for confirmation before proceeding; use the **-Force** switch to suppress the prompt.

```
Remove-EC2Instance -InstanceId i-12345678
```

### Output:

CurrentState	InstanceId	PreviousState
--------------	------------	---------------

```
----- ----- -----  
Amazon.EC2.Model.InstanceState    i-12345678    Amazon.EC2.Model.InstanceState
```

- For API details, see [TerminateInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

## Python

### SDK for Python (Boto3)

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
class InstanceWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance  
actions."""  
  
    def __init__(self, ec2_resource, instance=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
resource  
                is used to create additional high-level objects  
                that wrap low-level Amazon EC2 service actions.  
        :param instance: A Boto3 Instance object. This is a high-level object  
that  
                wraps instance actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.instance = instance  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
    def terminate(self):  
        """  
        Terminates an instance and waits for it to be in a terminated state.  
        """
```

```
if self.instance is None:
    logger.info("No instance to terminate.")
    return

instance_id = self.instance.id
try:
    self.instance.terminate()
    self.instance.wait_until_terminated()
    self.instance = None
except ClientError as err:
    logging.error(
        "Couldn't terminate instance %s. Here's why: %s: %s",
        instance_id,
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
```

- For API details, see [TerminateInstances](#) in *AWS SDK for Python (Boto3) API Reference*.

## Ruby

### SDK for Ruby

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
require "aws-sdk-ec2"

# Prerequisites:
#
# - The Amazon EC2 instance.
#
# @param ec2_client [Aws::EC2::Client] An initialized EC2 client.
# @param instance_id [String] The ID of the instance.
# @return [Boolean] true if the instance was terminated; otherwise, false.
```

```
# @example
#   exit 1 unless instance_terminated?(  
#     Aws::EC2::Client.new(region: 'us-west-2'),  
#     'i-123abc'  
#   )  
def instance_terminated?(ec2_client, instance_id)  
  response = ec2_client.describe_instance_status(instance_ids: [instance_id])  
  
  if response.instance_statuses.count.positive? &&  
    response.instance_statuses[0].instance_state.name == "terminated"  
  
    puts "The instance is already terminated."  
    return true  
  end  
  
  ec2_client.terminate_instances(instance_ids: [instance_id])  
  ec2_client.wait_until(:instance_terminated, instance_ids: [instance_id])  
  puts "Instance terminated."  
  return true  
rescue StandardError => e  
  puts "Error terminating instance: #{e.message}"  
  return false  
end  
  
# Example usage:  
def run_me  
  instance_id = ""  
  region = ""  
  # Print usage information and then stop.  
  if ARGV[0] == "--help" || ARGV[0] == "-h"  
    puts "Usage: ruby ec2-ruby-example-terminate-instance-i-123abc.rb " \  
      "INSTANCE_ID REGION"  
    # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
    puts "Example: ruby ec2-ruby-example-terminate-instance-i-123abc.rb " \  
      "i-123abc us-west-2"  
    exit 1  
  # If no values are specified at the command prompt, use these default values.  
  # Replace us-west-2 with the AWS Region you're using for Amazon EC2.  
  elsif ARGV.count.zero?  
    instance_id = "i-123abc"  
    region = "us-west-2"  
  # Otherwise, use the values as specified at the command prompt.  
  else  
    instance_id = ARGV[0]
```

```
region = ARGV[1]
end

ec2_client = Aws::EC2::Client.new(region: region)

puts "Attempting to terminate instance '#{instance_id}' " \
  "(this might take a few minutes)..."
unless instance_terminated?(ec2_client, instance_id)
  puts "Could not terminate instance."
end
end

run_me if $PROGRAM_NAME == __FILE__
```

- For API details, see [TerminateInstances](#) in *AWS SDK for Ruby API Reference*.

## Rust

### SDK for Rust

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
pub async fn delete_instance(&self, instance_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Deleting instance with id {instance_id}");
    self.stop_instance(instance_id).await?;
    self.client
        .terminate_instances()
        .instance_ids(instance_id)
        .send()
        .await?;
    self.wait_for_instance_terminated(instance_id).await?;
    tracing::info!("Terminated instance with id {instance_id}");
    Ok(())
}
```

Wait for an instance to be in the terminated state, using the Waiters API. Using the Waiters API requires `use aws\_sdk\_ec2::client::Waiters` in the rust file.

```
async fn wait_for_instance_terminated(&self, instance_id: &str) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_terminated()
        .instance_ids(instance_id)
        .wait(Duration::from_secs(60))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to terminate.",
                exceeded.max_wait().as_secs(),
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
```

- For API details, see [TerminateInstances](#) in *AWS SDK for Rust API reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use UnassignPrivateIpAddresses with an AWS SDK or CLI

The following code examples show how to use UnassignPrivateIpAddresses.

CLI

### AWS CLI

#### To unassign a secondary private IP address from a network interface

This example unassigns the specified private IP address from the specified network interface. If the command succeeds, no output is returned.

Command:

```
aws ec2 unassign-private-ip-addresses --network-interface-id eni-e5aa89a3 --  
private-ip-addresses 10.0.0.82
```

- For API details, see [UnassignPrivateIpAddresses](#) in *AWS CLI Command Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example unassigns the specified private IP address from the specified network interface.**

```
Unregister-EC2PrivateIpAddress -NetworkInterfaceId eni-1a2b3c4d -PrivateIpAddress  
10.0.0.82
```

- For API details, see [UnassignPrivateIpAddresses](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Use UnmonitorInstances with an AWS SDK or CLI

The following code examples show how to use `UnmonitorInstances`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- [Get started with instances](#)

## C++

**SDK for C++****Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
//! Disable monitoring for an EC2 instance.
/*!
 \param instanceId: An EC2 instance ID.
 \param clientConfiguration: AWS client configuration.
 \return bool: Function succeeded.
 */
bool AwsDoc::EC2::disableMonitoring(const Aws::String &instanceId,
                                     const Aws::Client::ClientConfiguration
                                     &clientConfiguration) {
    Aws::EC2::EC2Client ec2Client(clientConfiguration);
    Aws::EC2::Model::UnmonitorInstancesRequest unrequest;
    unrequest.AddInstanceIds(instanceId);
    unrequest.SetDryRun(true);

    Aws::EC2::Model::UnmonitorInstancesOutcome dryRunOutcome =
ec2Client.UnmonitorInstances(unrequest);
    if (dryRunOutcome.IsSuccess()) {
        std::cerr
            << "Failed dry run to disable monitoring on instance. A dry run
should trigger an error."
            <<
            std::endl;
        return false;
    } else if (dryRunOutcome.GetError().GetErrorCode() !=
               Aws::EC2::EC2Errors::DRY_RUN_OPERATION) {
        std::cout << "Failed dry run to disable monitoring on instance " <<
                     instanceId << ": " << dryRunOutcome.GetError().GetMessage() <<
                     std::endl;
        return false;
    }

    unrequest.SetDryRun(false);
```

```
Aws::EC2::Model::UnmonitorInstancesOutcome unmonitorInstancesOutcome =
ec2Client.UnmonitorInstances(unrequest);
if (!unmonitorInstancesOutcome.IsSuccess()) {
    std::cout << "Failed to disable monitoring on instance " << instanceId
        << ":" << unmonitorInstancesOutcome.GetError().GetMessage() <<
        std::endl;
} else {
    std::cout << "Successfully disable monitoring on instance " <<
        instanceId << std::endl;
}

return unmonitorInstancesOutcome.IsSuccess();
}
```

- For API details, see [UnmonitorInstances](#) in *AWS SDK for C++ API Reference*.

## CLI

### AWS CLI

#### To disable detailed monitoring for an instance

This example command disables detailed monitoring for the specified instance.

Command:

```
aws ec2 unmonitor-instances --instance-ids i-1234567890abcdef0
```

Output:

```
{
    "InstanceMonitorings": [
        {
            "InstanceId": "i-1234567890abcdef0",
            "Monitoring": {
                "State": "disabling"
            }
        }
    ]
}
```

- For API details, see [UnmonitorInstances](#) in *AWS CLI Command Reference*.

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
import { UnmonitorInstancesCommand } from "@aws-sdk/client-ec2";

import { client } from "../libs/client.js";

export const main = async () => {
  const command = new UnmonitorInstancesCommand({
    InstanceIds: ["i-09a3dfe7ae00e853f"],
  });

  try {
    const { InstanceMonitorings } = await client.send(command);
    const instanceMonitoringsList = InstanceMonitorings.map(
      (im) =>
        ` • Detailed monitoring state for ${im.InstanceId} is
${im.Monitoring.State}.`,
    );
    console.log("Monitoring status:");
    console.log(instanceMonitoringsList.join("\n"));
  } catch (err) {
    console.error(err);
  }
};
```

- For API details, see [UnmonitorInstances](#) in *AWS SDK for JavaScript API Reference*.

## PowerShell

### Tools for PowerShell

**Example 1: This example disables detailed monitoring for the specified instance.**

```
Stop-EC2InstanceMonitoring -InstanceId i-12345678
```

#### Output:

InstanceId	Monitoring
i-12345678	Amazon.EC2.Model.Monitoring

- For API details, see [UnmonitorInstances](#) in *AWS Tools for PowerShell Cmdlet Reference*.

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Scenarios for Amazon EC2 using AWS SDKs

The following code examples show you how to implement common scenarios in Amazon EC2 with AWS SDKs. These scenarios show you how to accomplish specific tasks by calling multiple functions within Amazon EC2. Each scenario includes a link to GitHub, where you can find instructions on how to set up and run the code.

### Examples

- [Build and manage a resilient service using an AWS SDK](#)
- [Get started with Amazon EC2 instances using an AWS SDK](#)

## Build and manage a resilient service using an AWS SDK

The following code examples show how to create a load-balanced web service that returns book, movie, and song recommendations. The example shows how the service responds to failures, and how to restructure the service for more resilience when failures occur.

- Use an Amazon EC2 Auto Scaling group to create Amazon Elastic Compute Cloud (Amazon EC2) instances based on a launch template and to keep the number of instances in a specified range.
- Handle and distribute HTTP requests with Elastic Load Balancing.
- Monitor the health of instances in an Auto Scaling group and forward requests only to healthy instances.
- Run a Python web server on each EC2 instance to handle HTTP requests. The web server responds with recommendations and health checks.
- Simulate a recommendation service with an Amazon DynamoDB table.
- Control web server response to requests and health checks by updating AWS Systems Manager parameters.

## .NET

### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run the interactive scenario at a command prompt.

```
static async Task Main(string[] args)
{
    _configuration = new ConfigurationBuilder()
        .SetBasePath(Directory.GetCurrentDirectory())
        .AddJsonFile("settings.json") // Load settings from .json file.
        .AddJsonFile("settings.local.json",
            true) // Optionally, load local settings.
        .Build();

    // Set up dependency injection for the AWS services.
    using var host = Host.CreateDefaultBuilder(args)
        .ConfigureLogging(logging =>
            logging.AddFilter("System", LogLevel.Debug)
                .AddFilter<DebugLoggerProvider>("Microsoft",
                    LogLevel.Information)
```

```
        .AddFilter<ConsoleLoggerProvider>("Microsoft",
LogLevel.Trace))
    .ConfigureServices((_, services) =>
        services.AddAWSService<IAmazonIdentityManagementService>()
            .AddAWSService<IAmazonDynamoDB>()
            .AddAWSService<IAmazonElasticLoadBalancingV2>()
            .AddAWSService<IAmazonSimpleSystemsManagement>()
            .AddAWSService<IAmazonAutoScaling>()
            .AddAWSService<IAmazonEC2>()
            .AddTransient<AutoScalerWrapper>()
            .AddTransient<ElasticLoadBalancerWrapper>()
            .AddTransient<SmParameterWrapper>()
            .AddTransient<Recommendations>()
            .AddSingleton< IConfiguration>(_configuration)
    )
    .Build();

    ServicesSetup(host);
    ResourcesSetup();

    try
    {
        Console.WriteLine(new string('-', 80));
        Console.WriteLine("Welcome to the Resilient Architecture Example Scenario.");
        Console.WriteLine(new string('-', 80));
        await Deploy(true);

        Console.WriteLine("Now let's begin the scenario.");
        Console.WriteLine(new string('-', 80));
        await Demo(true);

        Console.WriteLine(new string('-', 80));
        Console.WriteLine("Finally, let's clean up our resources.");
        Console.WriteLine(new string('-', 80));

        await DestroyResources(true);

        Console.WriteLine(new string('-', 80));
        Console.WriteLine("Resilient Architecture Example Scenario is complete.");
        Console.WriteLine(new string('-', 80));
    }
    catch (Exception ex)
```

```
{  
    Console.WriteLine(new string('-', 80));  
    Console.WriteLine($"There was a problem running the scenario:  
{ex.Message}");  
    await DestroyResources(true);  
    Console.WriteLine(new string('-', 80));  
}  
}  
  
/// <summary>  
/// Setup any common resources, also used for integration testing.  
/// </summary>  
public static void ResourcesSetup()  
{  
    _httpClient = new HttpClient();  
}  
  
/// <summary>  
/// Populate the services for use within the console application.  
/// </summary>  
/// <param name="host">The services host.</param>  
private static void ServicesSetup(IHost host)  
{  
    _elasticLoadBalancerWrapper =  
host.Services.GetRequiredService<ElasticLoadBalancerWrapper>();  
    _iamClient =  
host.Services.GetRequiredService<IAmazonIdentityManagementService>();  
    _recommendations = host.Services.GetRequiredService<Recommendations>();  
    _autoScalerWrapper =  
host.Services.GetRequiredService<AutoScalerWrapper>();  
    _smParameterWrapper =  
host.Services.GetRequiredService<SmParameterWrapper>();  
}  
  
/// <summary>  
/// Deploy necessary resources for the scenario.  
/// </summary>  
/// <param name="interactive">True to run as interactive.</param>  
/// <returns>True if successful.</returns>  
public static async Task<bool> Deploy(bool interactive)  
{  
    var protocol = "HTTP";  
    var port = 80;  
    var sshPort = 22;
```

```
Console.WriteLine(
    "\nFor this demo, we'll use the AWS SDK for .NET to create several
AWS resources\n" +
    "to set up a load-balanced web service endpoint and explore some ways
to make it resilient\n" +
    "against various kinds of failures.\n\n" +
    "Some of the resources create by this demo are:\n");

Console.WriteLine(
    "\t* A DynamoDB table that the web service depends on to provide
book, movie, and song recommendations.");
Console.WriteLine(
    "\t* An EC2 launch template that defines EC2 instances that each
contain a Python web server.");
Console.WriteLine(
    "\t* An EC2 Auto Scaling group that manages EC2 instances across
several Availability Zones.");
Console.WriteLine(
    "\t* An Elastic Load Balancing (ELB) load balancer that targets the
Auto Scaling group to distribute requests.");
Console.WriteLine(new string('-', 80));
Console.WriteLine("Press Enter when you're ready to start deploying
resources.");
if (interactive)
    Console.ReadLine();

// Create and populate the DynamoDB table.
var databaseTableName = _configuration["databaseName"];
var recommendationsPath = Path.Join(_configuration["resourcePath"],
    "recommendations_objects.json");
Console.WriteLine($"Creating and populating a DynamoDB table named
{databaseTableName}.");
await _recommendations.CreateDatabaseWithNamed(databaseTableName);
await _recommendations.PopulateDatabase(databaseTableName,
recommendationsPath);
Console.WriteLine(new string('-', 80));

// Create the EC2 Launch Template.

Console.WriteLine(
    $"Creating an EC2 launch template that runs
'server_startup_script.sh' when an instance starts.\n"
```

```
+ "\nThis script starts a Python web server defined in the
`server.py` script. The web server\n"
+ "listens to HTTP requests on port 80 and responds to requests to
'/' and to '/healthcheck'.\n"
+ "For demo purposes, this server is run as the root user. In
production, the best practice is to\n"
+ "run a web server, such as Apache, with least-privileged
credentials.");
Console.WriteLine(
    "\nThe template also defines an IAM policy that each instance uses to
assume a role that grants\n"
    + "permissions to access the DynamoDB recommendation table and
Systems Manager parameters\n"
    + "that control the flow of the demo.");

var startupScriptPath = Path.Join(_configuration["resourcePath"],
    "server_startup_script.sh");
var instancePolicyPath = Path.Join(_configuration["resourcePath"],
    "instance_policy.json");
await _autoScalerWrapper.CreateTemplate(startupScriptPath,
instancePolicyPath);
Console.WriteLine(new string('-', 80));

Console.WriteLine(
    "Creating an EC2 Auto Scaling group that maintains three EC2
instances, each in a different\n"
    + "Availability Zone.\n");
var zones = await _autoScalerWrapper.DescribeAvailabilityZones();
await _autoScalerWrapper.CreateGroupOfSize(3,
_autoScalerWrapper.GroupName, zones);
Console.WriteLine(new string('-', 80));

Console.WriteLine(
    "At this point, you have EC2 instances created. Once each instance
starts, it listens for\n"
    + "HTTP requests. You can see these instances in the console or
continue with the demo.\n");

Console.WriteLine(new string('-', 80));
Console.WriteLine("Press Enter when you're ready to continue.");
if (interactive)
    Console.ReadLine();
```

```
Console.WriteLine("Creating variables that control the flow of the demo.");
await _smParameterWrapper.Reset();

Console.WriteLine(
    "\nCreating an Elastic Load Balancing target group and load balancer.
The target group\n"
    + "defines how the load balancer connects to instances. The load
balancer provides a\n"
    + "single endpoint where clients connect and dispatches requests to
instances in the group.");

var defaultVpc = await _autoScalerWrapper.GetDefaultVpc();
var subnets = await
_autoScalerWrapper.GetAllVpcSubnetsForZones(defaultVpc.VpcId, zones);
var subnetIds = subnets.Select(s => s.SubnetId).ToList();
var targetGroup = await
_elasticLoadBalancerWrapper.CreateTargetGroupOnVpc(_elasticLoadBalancerWrapper.TargetGr
protocol, port, defaultVpc.VpcId);

await
_elasticLoadBalancerWrapper.CreateLoadBalancerAndListener(_elasticLoadBalancerWrapper.Lo
subnetIds, targetGroup);
await
_autoScalerWrapper.AttachLoadBalancerToGroup(_autoScalerWrapper.GroupName,
targetGroup.TargetGroupArn);
Console.WriteLine("\nVerifying access to the load balancer endpoint...");
var endPoint = await
_elasticLoadBalancerWrapper.GetEndpointForLoadBalancerByName(_elasticLoadBalancerWrapper
    var loadBalancerAccess = await
_elasticLoadBalancerWrapper.VerifyLoadBalancerEndpoint(endPoint);

if (!loadBalancerAccess)
{
    Console.WriteLine("\nCouldn't connect to the load balancer, verifying
that the port is open...");

    var ipString = await _httpClient.GetStringAsync("https://
checkip.amazonaws.com");
    ipString = ipString.Trim();

    var defaultSecurityGroup = await
_autoScalerWrapper.GetDefaultSecurityGroupForVpc(defaultVpc);
```

```
        var portIsOpen =
    _autoScalerWrapper.VerifyInboundPortForGroup(defaultSecurityGroup, port,
ipString);
        var sshPortIsOpen =
    _autoScalerWrapper.VerifyInboundPortForGroup(defaultSecurityGroup, sshPort,
ipString);

        if (!portIsOpen)
    {
        Console.WriteLine(
            "\nFor this example to work, the default security group for
your default VPC must\n"
            + "allows access from this computer. You can either add it
automatically from this\n"
            + "example or add it yourself using the AWS Management
Console.\n");
    }

        if (!interactive || GetYesNoResponse(
            "Do you want to add a rule to the security group to allow
inbound traffic from your computer's IP address?"))
    {
        await
    _autoScalerWrapper.OpenInboundPort(defaultSecurityGroup.GroupId, port,
ipString);
    }
}

if (!sshPortIsOpen)
{
    if (!interactive || GetYesNoResponse(
        "Do you want to add a rule to the security group to allow
inbound SSH traffic for debugging from your computer's IP address?"))
    {
        await
    _autoScalerWrapper.OpenInboundPort(defaultSecurityGroup.GroupId, sshPort,
ipString);
    }
}

loadBalancerAccess = await
_elasticLoadBalancerWrapper.VerifyLoadBalancerEndpoint(endPoint);
}

if (loadBalancerAccess)
{
```

```
        Console.WriteLine("Your load balancer is ready. You can access it by
browsing to:");
        Console.WriteLine($"\"{http://{{endPoint}}\n\"");
    }
else
{
    Console.WriteLine(
        "\nCouldn't get a successful response from the load balancer
endpoint. Troubleshoot by\n"
        + "manually verifying that your VPC and security group are
configured correctly and that\n"
        + "you can successfully make a GET request to the load balancer
endpoint:\n");
    Console.WriteLine($"\"{http://{{endPoint}}\n\"");
}
Console.WriteLine(new string('-', 80));
Console.WriteLine("Press Enter when you're ready to continue with the
demo.");
if (interactive)
    Console.ReadLine();
return true;
}

/// <summary>
/// Demonstrate the steps of the scenario.
/// </summary>
/// <param name="interactive">True to run as an interactive scenario.</param>
/// <returns>Async task.</returns>
public static async Task<bool> Demo(bool interactive)
{
    var ssmOnlyPolicy = Path.Join(_configuration["resourcePath"],
        "ssm_only_policy.json");

    Console.WriteLine(new string('-', 80));
    Console.WriteLine("Resetting parameters to starting values for demo.");
    await _smParameterWrapper.Reset();

    Console.WriteLine("\nThis part of the demonstration shows how to toggle
different parts of the system\n" +
                    "to create situations where the web service fails, and
shows how using a resilient\n" +
                    "architecture can keep the web service running in spite
of these failures.");
    Console.WriteLine(new string('-', 88));
}
```

```
Console.WriteLine("At the start, the load balancer endpoint returns recommendations and reports that all targets are healthy.");
if (interactive)
    await DemoActionChoices();

Console.WriteLine($"The web service running on the EC2 instances gets recommendations by querying a DynamoDB table.\n" +
                  $"The table name is contained in a Systems Manager parameter named '{_smParameterWrapper.TableParameter}'.\n" +
                  $"To simulate a failure of the recommendation service, let's set this parameter to name a non-existent table.\n");
await
_smParameterWrapper.PutParameterByName(_smParameterWrapper.TableParameter,
"this-is-not-a-table");
Console.WriteLine("\nNow, sending a GET request to the load balancer endpoint returns a failure code. But, the service reports as\n" +
                  "healthy to the load balancer because shallow health checks don't check for failure of the recommendation service.");
if (interactive)
    await DemoActionChoices();

Console.WriteLine("Instead of failing when the recommendation service fails, the web service can return a static response.");
Console.WriteLine("While this is not a perfect solution, it presents the customer with a somewhat better experience than failure.");

await
_smParameterWrapper.PutParameterByName(_smParameterWrapper.FailureResponseParameter,
"static");

Console.WriteLine("\nNow, sending a GET request to the load balancer endpoint returns a static response.");
Console.WriteLine("The service still reports as healthy because health checks are still shallow.");
if (interactive)
    await DemoActionChoices();

Console.WriteLine("Let's reinstate the recommendation service.\n");
await
_smParameterWrapper.PutParameterByName(_smParameterWrapper.TableParameter,
_smParameterWrapper.TableName);
Console.WriteLine(
"\nLet's also substitute bad credentials for one of the instances in the target group so that it can't\n" +
```

```
        "access the DynamoDB recommendation table.\n"
    );
    await _autoScalerWrapper.CreateInstanceProfileWithName(
        _autoScalerWrapper.BadCredsPolicyName,
        _autoScalerWrapper.BadCredsRoleName,
        _autoScalerWrapper.BadCredsProfileName,
        ssmOnlyPolicy,
        new List<string> { "AmazonSSMManagedInstanceCore" }
    );
    var instances = await
_autoScalerWrapper.GetInstancesByGroupName(_autoScalerWrapper.GroupName);
    var badInstanceId = instances.First();
    var instanceProfile = await
_autoScalerWrapper.GetInstanceProfile(badInstanceId);
    Console.WriteLine(
        $"Replacing the profile for instance {badInstanceId} with a profile
that contains\n" +
        "bad credentials...\n"
    );
    await _autoScalerWrapper.ReplaceInstanceProfile(
        badInstanceId,
        _autoScalerWrapper.BadCredsProfileName,
        instanceProfile.AssociationId
    );
    Console.WriteLine(
        "Now, sending a GET request to the load balancer endpoint returns
either a recommendation or a static response,\n" +
        "depending on which instance is selected by the load balancer.\n"
    );
    if (interactive)
        await DemoActionChoices();

    Console.WriteLine("\nLet's implement a deep health check. For this demo,
a deep health check tests whether");
    Console.WriteLine("the web service can access the DynamoDB table that it
depends on for recommendations. Note that");
    Console.WriteLine("the deep health check is only for ELB routing and not
for Auto Scaling instance health.");
    Console.WriteLine("This kind of deep health check is not recommended for
Auto Scaling instance health, because it");
    Console.WriteLine("risks accidental termination of all instances in the
Auto Scaling group when a dependent service fails.");
```

```
        Console.WriteLine("\nBy implementing deep health checks, the load
balancer can detect when one of the instances is failing");
        Console.WriteLine("and take that instance out of rotation.");

        await
_smParameterWrapper.PutParameterByName(_smParameterWrapper.HealthCheckParameter,
"deep");

        Console.WriteLine($"\\nNow, checking target health indicates that the
instance with bad credentials ({badInstanceId})");
        Console.WriteLine("is unhealthy. Note that it might take a minute or two
for the load balancer to detect the unhealthy");
        Console.WriteLine("instance. Sending a GET request to the load balancer
endpoint always returns a recommendation, because");
        Console.WriteLine("the load balancer takes unhealthy instances out of its
rotation.");

        if (interactive)
            await DemoActionChoices();

        Console.WriteLine("\nBecause the instances in this demo are controlled by
an auto scaler, the simplest way to fix an unhealthy");
        Console.WriteLine("instance is to terminate it and let the auto scaler
start a new instance to replace it.");

        await _autoScalerWrapper.TryTerminateInstanceById(badInstanceId);

        Console.WriteLine($"\\nEven while the instance is terminating and the new
instance is starting, sending a GET");
        Console.WriteLine("request to the web service continues to get a
successful recommendation response because");
        Console.WriteLine("starts and reports as healthy, it is included in the
load balancing rotation.");
        Console.WriteLine("Note that terminating and replacing an instance
typically takes several minutes, during which time you");
        Console.WriteLine("can see the changing health check status until the new
instance is running and healthy.");

        if (interactive)
            await DemoActionChoices();

        Console.WriteLine("\nIf the recommendation service fails now, deep health
checks mean all instances report as unhealthy.");
```

```
        await
_smParameterWrapper.PutParameterByName(_smParameterWrapper.TableParameter,
"this-is-not-a-table");

        Console.WriteLine($"\\nWhen all instances are unhealthy, the load balancer
continues to route requests even to");
        Console.WriteLine("unhealthy instances, allowing them to fail open and
return a static response rather than fail");
        Console.WriteLine("closed and report failure to the customer.");

        if (interactive)
            await DemoActionChoices();
        await _smParameterWrapper.Reset();

        Console.WriteLine(new string('-', 80));
        return true;
    }

/// <summary>
/// Clean up the resources from the scenario.
/// </summary>
/// <param name="interactive">True to ask the user for cleanup.</param>
/// <returns>Async task.</returns>
public static async Task<bool> DestroyResources(bool interactive)
{
    Console.WriteLine(new string('-', 80));
    Console.WriteLine(
        "To keep things tidy and to avoid unwanted charges on your account,
we can clean up all AWS resources\\n" +
        "that were created for this demo."
    );

    if (!interactive || GetYesNoResponse("Do you want to clean up all demo
resources? (y/n) "))
    {
        await
_elasticLoadBalancerWrapper.DeleteLoadBalancerByName(_elasticLoadBalancerWrapper.LoadBal
        await
_elasticLoadBalancerWrapper.DeleteTargetGroupByName(_elasticLoadBalancerWrapper.TargetGr
        await
_autoScalerWrapper.TerminateAndDeleteAutoScalingGroupWithName(_autoScalerWrapper.GroupNa
        await
_autoScalerWrapper.DeleteKeyPairByName(_autoScalerWrapper.KeyPairName);
    }
}
```

```
        await
    _autoScalerWrapper.DeleteTemplateByName(_autoScalerWrapper.LaunchTemplateName);
        await _autoScalerWrapper.DeleteInstanceProfile(
            _autoScalerWrapper.BadCredsProfileName,
            _autoScalerWrapper.BadCredsRoleName
        );
        await
    _recommendations.DestroyDatabaseByName(_recommendations.TableName);
    }
else
{
    Console.WriteLine(
        "Ok, we'll leave the resources intact.\n" +
        "Don't forget to delete them when you're done with them or you
might incur unexpected charges."
    );
}

Console.WriteLine(new string('-', 80));
return true;
}
```

Create a class that wraps Auto Scaling and Amazon EC2 actions.

```
/// <summary>
/// Encapsulates Amazon EC2 Auto Scaling and EC2 management methods.
/// </summary>
public class AutoScalerWrapper
{
    private readonly IAmazonAutoScaling _amazonAutoScaling;
    private readonly IAmazonEC2 _amazonEc2;
    private readonly IAmazonSimpleSystemsManagement _amazonSsm;
    private readonly IAmazonIdentityManagementService _amazonIam;

    private readonly string _instanceType = "";
    private readonly string _amiParam = "";
    private readonly string _launchTemplateName = "";
    private readonly string _groupName = "";
    private readonly string _instancePolicyName = "";
    private readonly string _instanceRoleName = "";
    private readonly string _instanceProfileName = "";
    private readonly string _badCredsProfileName = "";
```

```
private readonly string _badCredsRoleName = "";
private readonly string _badCredsPolicyName = "";
private readonly string _keyPairName = "";

public string GroupName => _groupName;
public string KeyPairName => _keyPairName;
public string LaunchTemplateName => _launchTemplateName;
public string InstancePolicyName => _instancePolicyName;
public string BadCredsProfileName => _badCredsProfileName;
public string BadCredsRoleName => _badCredsRoleName;
public string BadCredsPolicyName => _badCredsPolicyName;

/// <summary>
/// Constructor for the AutoScalerWrapper.
/// </summary>
/// <param name="amazonAutoScaling">The injected AutoScaling client.</param>
/// <param name="amazonEc2">The injected EC2 client.</param>
/// <param name="amazonIam">The injected IAM client.</param>
/// <param name="amazonSsm">The injected SSM client.</param>
public AutoScalerWrapper(
    IAmazonAutoScaling amazonAutoScaling,
    IAmazonEC2 amazonEc2,
    IAmazonSimpleSystemsManagement amazonSsm,
    IAmazonIdentityManagementService amazonIam,
    IConfiguration configuration)
{
    _amazonAutoScaling = amazonAutoScaling;
    _amazonEc2 = amazonEc2;
    _amazonSsm = amazonSsm;
    _amazonIam = amazonIam;

    var prefix = configuration["resourcePrefix"];
    _instanceType = configuration["instanceType"];
    _amiParam = configuration["amiParam"];

    _launchTemplateName = prefix + "-template";
    _groupName = prefix + "-group";
    _instancePolicyName = prefix + "-pol";
    _instanceRoleName = prefix + "-role";
    _instanceProfileName = prefix + "-prof";
    _badCredsPolicyName = prefix + "-bc-pol";
    _badCredsRoleName = prefix + "-bc-role";
    _badCredsProfileName = prefix + "-bc-prof";
    _keyPairName = prefix + "-key-pair";
```

```
}

    ///<summary>
    /// Create a policy, role, and profile that is associated with instances with
    a specified name.
    /// An instance's associated profile defines a role that is assumed by the
    /// instance. The role has attached policies that specify the AWS permissions
    granted to
    /// clients that run on the instance.
    /// </summary>
    ///<param name="policyName">Name to use for the policy.</param>
    ///<param name="roleName">Name to use for the role.</param>
    ///<param name="profileName">Name to use for the profile.</param>
    ///<param name="ssmOnlyPolicyFile">Path to a policy file for SSM.</param>
    ///<param name="awsManagedPolicies">AWS Managed policies to be attached to
    the role.</param>
    ///<returns>The Arn of the profile.</returns>
    public async Task<string> CreateInstanceProfileWithName(
        string policyName,
        string roleName,
        string profileName,
        string ssmOnlyPolicyFile,
        List<string>? awsManagedPolicies = null)
    {

        var assumeRoleDoc = "{" +
            "\"Version\": \"2012-10-17\", " +
            "\"Statement\": [{" +
                "\"Effect\": \"Allow\", " +
                "\"Principal\": { " +
                "\"Service\": [ " +
                    "\"ec2.amazonaws.com\"" +
                "] " +
                "}, " +
                "\"Action\": \"sts:AssumeRole\"" +
            "}] " +
        "}";

        var policyDocument = await File.ReadAllTextAsync(ssmOnlyPolicyFile);

        var policyArn = "";

        try
        {
```

```
var createPolicyResult = await _amazonIam.CreatePolicyAsync(
    new CreatePolicyRequest
    {
        PolicyName = policyName,
        PolicyDocument = policyDocument
    });
policyArn = createPolicyResult.Policy.Arn;
}
catch (EntityAlreadyExistsException)
{
    // The policy already exists, so we look it up to get the Arn.
    var policiesPaginator = _amazonIam.Paginator.ListPolicies(
        new ListPoliciesRequest()
    {
        Scope = PolicyScopeType.Local
    });
    // Get the entire list using the paginator.
    await foreach (var policy in policiesPaginator.Policies)
    {
        if (policy.PolicyName.Equals(policyName))
        {
            policyArn = policy.Arn;
        }
    }

    if (policyArn == null)
    {
        throw new InvalidOperationException("Policy not found");
    }
}

try
{
    await _amazonIam.CreateRoleAsync(new CreateRoleRequest()
    {
        RoleName = roleName,
        AssumeRolePolicyDocument = assumeRoleDoc,
    });
    await _amazonIam.AttachRolePolicyAsync(new AttachRolePolicyRequest()
    {
        RoleName = roleName,
        PolicyArn = policyArn
    });
    if (awsManagedPolicies != null)
```

```
        {
            foreach (var awsPolicy in awsManagedPolicies)
            {
                await _amazonIam.AttachRolePolicyAsync(new
AttachRolePolicyRequest()
                {
                    PolicyArn = $"arn:aws:iam::aws:policy/{awsPolicy}",
                    RoleName = roleName
                });
            }
        }
    }
catch (EntityAlreadyExistsException)
{
    Console.WriteLine("Role already exists.");
}

string profileArn = "";
try
{
    var profileCreateResponse = await
_amazonIam.CreateInstanceProfileAsync(
        new CreateInstanceProfileRequest()
    {
        InstanceProfileName = profileName
    });
    // Allow time for the profile to be ready.
    profileArn = profileCreateResponse.InstanceProfile.Arn;
    Thread.Sleep(10000);
    await _amazonIam.AddRoleToInstanceProfileAsync(
        new AddRoleToInstanceProfileRequest()
    {
        InstanceProfileName = profileName,
        RoleName = roleName
    });
}

}
catch (EntityAlreadyExistsException)
{
    Console.WriteLine("Policy already exists.");
    var profileGetResponse = await _amazonIam.GetInstanceProfileAsync(
        new GetInstanceProfileRequest()
    {
        InstanceProfileName = profileName
    });
}
```

```
        });
        profileArn = profileGetResponse.InstanceProfile.Arn;
    }
    return profileArn;
}

/// <summary>
/// Create a new key pair and save the file.
/// </summary>
/// <param name="newKeyPairName">The name of the new key pair.</param>
/// <returns>Async task.</returns>
public async Task CreateKeyPair(string newKeyPairName)
{
    try
    {
        var keyResponse = await _amazonEc2.CreateKeyPairAsync(
            new CreateKeyPairRequest() { KeyName = newKeyPairName });
        await File.WriteAllTextAsync($"{newKeyPairName}.pem",
            keyResponse.KeyPair.KeyMaterial);
        Console.WriteLine($"Created key pair {newKeyPairName}.");
    }
    catch (AlreadyExistsException)
    {
        Console.WriteLine("Key pair already exists.");
    }
}

/// <summary>
/// Delete the key pair and file by name.
/// </summary>
/// <param name="deleteKeyPairName">The key pair to delete.</param>
/// <returns>Async task.</returns>
public async Task DeleteKeyPairByName(string deleteKeyPairName)
{
    try
    {
        await _amazonEc2.DeleteKeyPairAsync(
            new DeleteKeyPairRequest() { KeyName = deleteKeyPairName });
        File.Delete($"{deleteKeyPairName}.pem");
    }
    catch (FileNotFoundException)
    {
        Console.WriteLine($"Key pair {deleteKeyPairName} not found.");
    }
}
```

```
}

/// <summary>
/// Creates an Amazon EC2 launch template to use with Amazon EC2 Auto
Scaling.
/// The launch template specifies a Bash script in its user data field that
runs after
/// the instance is started. This script installs the Python packages and
starts a Python
/// web server on the instance.
/// </summary>
/// <param name="startupScriptPath">The path to a Bash script file that is
run.</param>
/// <param name="instancePolicyPath">The path to a permissions policy to
create and attach to the profile.</param>
/// <returns>The template object.</returns>
public async Task<Amazon.EC2.Model.LaunchTemplate> CreateTemplate(string
startupScriptPath, string instancePolicyPath)
{
    await CreateKeyPair(_keyPairName);
    await CreateInstanceProfileWithNamed(_instancePolicyName,
_instanceRoleName, _instanceProfileName, instancePolicyPath);

    var startServerText = await File.ReadAllTextAsync(startupScriptPath);
    var plainTextBytes = System.Text.Encoding.UTF8.GetBytes(startServerText);

    var amiLatest = await _amazonSsm.GetParameterAsync(
        new GetParameterRequest() { Name = _amiParam });
    var amiId = amiLatest.Parameter.Value;
    var launchTemplateResponse = await _amazonEc2.CreateLaunchTemplateAsync(
        new CreateLaunchTemplateRequest()
    {
        LaunchTemplateName = _launchTemplateName,
        LaunchTemplateData = new RequestLaunchTemplateData()
    {
        InstanceType = _instanceType,
        ImageId = amiId,
        IamInstanceProfile =
            new
                LaunchTemplateIamInstanceProfileSpecificationRequest()
    {
        Name = _instanceProfileName
    },

```

```
        KeyName = _keyPairName,
        UserData = System.Convert.ToBase64String(plainTextBytes)
    }
});

return launchTemplateResponse.LaunchTemplate;

}

/// <summary>
/// Get a list of Availability Zones in the AWS Region of the Amazon EC2
Client.

/// </summary>
/// <returns>A list of availability zones.</returns>
public async Task<List<string>> DescribeAvailabilityZones()
{
    var zoneResponse = await _amazonEc2.DescribeAvailabilityZonesAsync(
        new DescribeAvailabilityZonesRequest());
    return zoneResponse.AvailabilityZones.Select(z => z.ZoneName).ToList();
}

/// <summary>
/// Create an EC2 Auto Scaling group of a specified size and name.
/// </summary>
/// <param name="groupSize">The size for the group.</param>
/// <param name="groupName">The name for the group.</param>
/// <param name="availabilityZones">The availability zones for the group.</
param>
/// <returns>Async task.</returns>
public async Task CreateGroupOfSize(int groupSize, string groupName,
List<string> availabilityZones)
{
    try
    {
        await _amazonAutoScaling.CreateAutoScalingGroupAsync(
            new CreateAutoScalingGroupRequest()
        {
            AutoScalingGroupName = groupName,
            AvailabilityZones = availabilityZones,
            LaunchTemplate =
            new
Amazon.AutoScaling.Model.LaunchTemplateSpecification()
            {
                LaunchTemplateName = _launchTemplateName,
                Version = "$Default"
            }
        }
    }
}
```

```
        },
        MaxSize = groupSize,
        MinSize = groupSize
    );
    Console.WriteLine($"Created EC2 Auto Scaling group {groupName} with
size {groupSize}.");
}
catch (EntityAlreadyExistsException)
{
    Console.WriteLine($"EC2 Auto Scaling group {groupName} already
exists.");
}
}

/// <summary>
/// Get the default VPC for the account.
/// </summary>
/// <returns>The default VPC object.</returns>
public async Task<Vpc> GetDefaultVpc()
{
    var vpcResponse = await _amazonEc2.DescribeVpcsAsync(
        new DescribeVpcsRequest()
    {
        Filters = new List<Amazon.EC2.Model.Filter>()
        {
            new ("is-default", new List<string>() { "true" })
        }
    });
    return vpcResponse.Vpcs[0];
}

/// <summary>
/// Get all the subnets for a Vpc in a set of availability zones.
/// </summary>
/// <param name="vpcId">The Id of the Vpc.</param>
/// <param name="availabilityZones">The list of availability zones.</param>
/// <returns>The collection of subnet objects.</returns>
public async Task<List<Subnet>> GetAllVpcSubnetsForZones(string vpcId,
List<string> availabilityZones)
{
    var subnets = new List<Subnet>();
    var subnetPaginator = _amazonEc2.Paginator.DescribeSubnets(
        new DescribeSubnetsRequest()
    {
```

```
        Filters = new List<Amazon.EC2.Model.Filter>()
    {
        new ("vpc-id", new List<string>() { vpcId}),
        new ("availability-zone", availabilityZones),
        new ("default-for-az", new List<string>() { "true" })
    }
});

// Get the entire list using the paginator.
await foreach (var subnet in subnetPaginator.Subnets)
{
    subnets.Add(subnet);
}

return subnets;
}

/// <summary>
/// Delete a launch template by name.
/// </summary>
/// <param name="templateName">The name of the template to delete.</param>
/// <returns>Async task.</returns>
public async Task DeleteTemplateByName(string templateName)
{
    try
    {
        await _amazonEc2.DeleteLaunchTemplateAsync(
            new DeleteLaunchTemplateRequest()
        {
            LaunchTemplateName = templateName
        });
    }
    catch (AmazonClientException)
    {
        Console.WriteLine($"Unable to delete template {templateName}.");
    }
}

/// <summary>
/// Detaches a role from an instance profile, detaches policies from the
role,
/// and deletes all the resources.
/// </summary>
/// <param name="profileName">The name of the profile to delete.</param>
```

```
/// <param name="roleName">The name of the role to delete.</param>
/// <returns>Async task.</returns>
public async Task DeleteInstanceProfile(string profileName, string roleName)
{
    try
    {
        await _amazonIam.RemoveRoleFromInstanceProfileAsync(
            new RemoveRoleFromInstanceProfileRequest()
            {
                InstanceProfileName = profileName,
                RoleName = roleName
            });
        await _amazonIam.DeleteInstanceProfileAsync(
            new DeleteInstanceProfileRequest() { InstanceProfileName =
profileName });
        var attachedPolicies = await
_amazonIam.ListAttachedRolePoliciesAsync(
            new ListAttachedRolePoliciesRequest() { RoleName = roleName });
        foreach (var policy in attachedPolicies.AttachedPolicies)
        {
            await _amazonIam.DetachRolePolicyAsync(
                new DetachRolePolicyRequest()
                {
                    RoleName = roleName,
                    PolicyArn = policy.PolicyArn
                });
            // Delete the custom policies only.
            if (!policy.PolicyArn.StartsWith("arn:aws:iam::aws"))
            {
                await _amazonIam.DeletePolicyAsync(
                    new Amazon.IdentityManagement.Model.DeletePolicyRequest()
                    {
                        PolicyArn = policy.PolicyArn
                    });
            }
        }

        await _amazonIam.DeleteRoleAsync(
            new DeleteRoleRequest() { RoleName = roleName });
    }
    catch (NoSuchEntityException)
    {
        Console.WriteLine($"Instance profile {profileName} does not exist.");
    }
}
```

```
}

/// <summary>
/// Gets data about the instances in an EC2 Auto Scaling group by its group
name.
/// </summary>
/// <param name="group">The name of the auto scaling group.</param>
/// <returns>A collection of instance Ids.</returns>
public async Task<IEnumerable<string>> GetInstancesByGroupName(string group)
{
    var instanceResponse = await
_amazonAutoScaling.DescribeAutoScalingGroupsAsync(
    new DescribeAutoScalingGroupsRequest()
    {
        AutoScalingGroupNames = new List<string>() { group }
    });
    var instanceIds = instanceResponse.AutoScalingGroups.SelectMany(
        g => g.Instances.Select(i => i.InstanceId));
    return instanceIds;
}

/// <summary>
/// Get the instance profile association data for an instance.
/// </summary>
/// <param name="instanceId">The Id of the instance.</param>
/// <returns>Instance profile associations data.</returns>
public async Task<IamInstanceProfileAssociation> GetInstanceProfile(string
instanceId)
{
    var response = await
_amazonEc2.DescribeIamInstanceProfileAssociationsAsync(
    new DescribeIamInstanceProfileAssociationsRequest()
    {
        Filters = new List<Amazon.EC2.Model.Filter>()
        {
            new ("instance-id", new List<string>() { instanceId })
        },
    });
    return response.IamInstanceProfileAssociations[0];
}

/// <summary>
/// Replace the profile associated with a running instance. After the profile
is replaced, the instance
```

```
    /// is rebooted to ensure that it uses the new profile. When the instance is
    ready, Systems Manager is
    /// used to restart the Python web server.
    /// </summary>
    /// <param name="instanceId">The Id of the instance to update.</param>
    /// <param name="credsProfileName">The name of the new profile to associate
    with the specified instance.</param>
    /// <param name="associationId">The Id of the existing profile association
    for the instance.</param>
    /// <returns>Async task.</returns>
    public async Task ReplaceInstanceProfile(string instanceId, string
credsProfileName, string associationId)
{
    await _amazonEc2.ReplaceIamInstanceProfileAssociationAsync(
        new ReplaceIamInstanceProfileAssociationRequest()
    {
        AssociationId = associationId,
        IamInstanceProfile = new IamInstanceProfileSpecification()
        {
            Name = credsProfileName
        }
    });
    // Allow time before resetting.
    Thread.Sleep(25000);
    var instanceReady = false;
    var retries = 5;
    while (retries-- > 0 && !instanceReady)
    {
        await _amazonEc2.RebootInstancesAsync(
            new RebootInstancesRequest(new List<string>() { instanceId }));
        Thread.Sleep(10000);

        var instancesPaginator =
_amazonSsm.Paginator.DescribeInstanceInformation(
            new DescribeInstanceInformationRequest());
        // Get the entire list using the paginator.
        await foreach (var instance in
instancesPaginator.InstanceInformationList)
        {
            instanceReady = instance.InstanceId == instanceId;
            if (instanceReady)
            {
                break;
            }
        }
    }
}
```

```
        }
    }

    Console.WriteLine($"Sending restart command to instance {instanceId}");
    await _amazonSsm.SendCommandAsync(
        new SendCommandRequest()
    {
        InstanceIds = new List<string>() { instanceId },
        DocumentName = "AWS-RunShellScript",
        Parameters = new Dictionary<string, List<string>>()
    {
        {"commands", new List<string>() { "cd / && sudo python3 server.py 80" }};
    }
});

Console.WriteLine($"Restarted the web server on instance {instanceId}");
}

/// <summary>
/// Try to terminate an instance by its Id.
/// </summary>
/// <param name="instanceId">The Id of the instance to terminate.</param>
/// <returns>Async task.</returns>
public async Task TryTerminateInstanceId(string instanceId)
{
    var stopping = false;
    Console.WriteLine($"Stopping {instanceId}...");
    while (!stopping)
    {
        try
        {
            await
_amazonAutoScaling.TerminateInstanceInAutoScalingGroupAsync(
                new TerminateInstanceInAutoScalingGroupRequest()
            {
                InstanceId = instanceId,
                ShouldDecrementDesiredCapacity = false
            });
            stopping = true;
        }
        catch (ScalingActivityInProgressException)
        {
            Console.WriteLine($"Scaling activity in progress for {instanceId}. Waiting...");  
Thread.Sleep(10000);
        }
    }
}
```

```
        }
    }

/// <summary>
/// Tries to delete the EC2 Auto Scaling group. If the group is in use or in
/// progress,
/// waits and retries until the group is successfully deleted.
/// </summary>
/// <param name="groupName">The name of the group to try to delete.</param>
/// <returns>Async task.</returns>
public async Task TryDeleteGroupByName(string groupName)
{
    var stopped = false;
    while (!stopped)
    {
        try
        {
            await _amazonAutoScaling.DeleteAutoScalingGroupAsync(
                new DeleteAutoScalingGroupRequest()
                {
                    AutoScalingGroupName = groupName
                });
            stopped = true;
        }
        catch (Exception e)
            when ((e is ScalingActivityInProgressException)
                || (e is Amazon.AutoScaling.Model.ResourceInUseException))
        {
            Console.WriteLine($"Some instances are still running.
Waiting...");
            Thread.Sleep(10000);
        }
    }
}

/// <summary>
/// Terminate instances and delete the Auto Scaling group by name.
/// </summary>
/// <param name="groupName">The name of the group to delete.</param>
/// <returns>Async task.</returns>
public async Task TerminateAndDeleteAutoScalingGroupWithName(string
groupName)
{
```

```
        var describeGroupsResponse = await
    _amazonAutoScaling.DescribeAutoScalingGroupsAsync(
        new DescribeAutoScalingGroupsRequest()
    {
        AutoScalingGroupNames = new List<string>() { groupName }
    });
    if (describeGroupsResponse.AutoScalingGroups.Any())
    {
        // Update the size to 0.
        await _amazonAutoScaling.UpdateAutoScalingGroupAsync(
            new UpdateAutoScalingGroupRequest()
        {
            AutoScalingGroupName = groupName,
            MinSize = 0
        });
        var group = describeGroupsResponse.AutoScalingGroups[0];
        foreach (var instance in group.Instances)
        {
            await TryTerminateInstanceById(instance.InstanceId);
        }

        await TryDeleteGroupByName(groupName);
    }
    else
    {
        Console.WriteLine($"No groups found with name {groupName}.");
    }
}

/// <summary>
/// Get the default security group for a specified Vpc.
/// </summary>
/// <param name="vpc">The Vpc to search.</param>
/// <returns>The default security group.</returns>
public async Task<SecurityGroup> GetDefaultSecurityGroupForVpc(Vpc vpc)
{
    var groupResponse = await _amazonEc2.DescribeSecurityGroupsAsync(
        new DescribeSecurityGroupsRequest()
    {
        Filters = new List<Amazon.EC2.Model.Filter>()
    {
        new ("group-name", new List<string>() { "default" }),
        new ("vpc-id", new List<string>() { vpc.VpcId })
    }
}
```

```
        }
    });

    return groupResponse.SecurityGroups[0];
}

/// <summary>
/// Verify the default security group of a Vpc allows ingress from the
calling computer.
/// This can be done by allowing ingress from this computer's IP address.
/// In some situations, such as connecting from a corporate network, you must
instead specify
/// a prefix list Id. You can also temporarily open the port to any IP
address while running this example.
/// If you do, be sure to remove public access when you're done.
/// </summary>
/// <param name="vpc">The group to check.</param>
/// <param name="port">The port to verify.</param>
/// <param name="ipAddress">This computer's IP address.</param>
/// <returns>True if the ip address is allowed on the group.</returns>
public bool VerifyInboundPortForGroup(SecurityGroup group, int port, string
ipAddress)
{
    var portIsOpen = false;
    foreach (var ipPermission in group.IpPermissions)
    {
        if (ipPermission.FromPort == port)
        {
            foreach (var ipRange in ipPermission.Ipv4Ranges)
            {
                var cidr = ipRange.CidrIp;
                if (cidr.StartsWith(ipAddress) || cidr == "0.0.0.0/0")
                {
                    portIsOpen = true;
                }
            }

            if (ipPermission.PrefixListIds.Any())
            {
                portIsOpen = true;
            }
        }

        if (!portIsOpen)
        {
```

```
                Console.WriteLine("The inbound rule does not appear to be
open to either this computer's IP\n" +
                                "address, to all IP addresses (0.0.0.0/0),
or to a prefix list ID.");
            }
            else
            {
                break;
            }
        }

        return portIsOpen;
    }

/// <summary>
/// Add an ingress rule to the specified security group that allows access on
the
/// specified port from the specified IP address.
/// </summary>
/// <param name="groupId">The Id of the security group to modify.</param>
/// <param name="port">The port to open.</param>
/// <param name="ipAddress">The IP address to allow access.</param>
/// <returns>Async task.</returns>
public async Task OpenInboundPort(string groupId, int port, string ipAddress)
{
    await _amazonEc2.AuthorizeSecurityGroupIngressAsync(
        new AuthorizeSecurityGroupIngressRequest()
    {
        GroupId = groupId,
        IpPermissions = new List<IpPermission>()
    {
        new IpPermission()
    {
        FromPort = port,
        ToPort = port,
        IpProtocol = "tcp",
        Ipv4Ranges = new List<IpRange>()
    {
        new IpRange() { CidrIp = $"{ipAddress}/32" }
    }
}
    });
}
```

```
}

/// <summary>
/// Attaches an Elastic Load Balancing (ELB) target group to this EC2 Auto
Scaling group.
/// The
/// </summary>
/// <param name="autoScalingGroupName">The name of the Auto Scaling group.</
param>
/// <param name="targetGroupArn">The Arn for the target group.</param>
/// <returns>Async task.</returns>
public async Task AttachLoadBalancerToGroup(string autoScalingGroupName,
string targetGroupArn)
{
    await _amazonAutoScaling.AttachLoadBalancerTargetGroupsAsync(
        new AttachLoadBalancerTargetGroupsRequest()
    {
        AutoScalingGroupName = autoScalingGroupName,
        TargetGroupARNs = new List<string>() { targetGroupArn }
    });
}
}
```

Create a class that wraps Elastic Load Balancing actions.

```
/// <summary>
/// Encapsulates Elastic Load Balancer actions.
/// </summary>
public class ElasticLoadBalancerWrapper
{
    private readonly IAmazonElasticLoadBalancingV2 _amazonElasticLoadBalancingV2;
    private string? _endpoint = null;
    private readonly string _targetGroupName = "";
    private readonly string _loadBalancerName = "";
    HttpClient _httpClient = new();

    public string TargetGroupName => _targetGroupName;
    public string LoadBalancerName => _loadBalancerName;

    /// <summary>
    /// Constructor for the Elastic Load Balancer wrapper.
    /// </summary>
```

```
/// </summary>
/// <param name="amazonElasticLoadBalancingV2">The injected load balancing v2
client.</param>
/// <param name="configuration">The injected configuration.</param>
public ElasticLoadBalancerWrapper(
    IAmazonElasticLoadBalancingV2 amazonElasticLoadBalancingV2,
    IConfiguration configuration)
{
    _amazonElasticLoadBalancingV2 = amazonElasticLoadBalancingV2;
    var prefix = configuration["resourcePrefix"];
    _targetGroupName = prefix + "-tg";
    _loadBalancerName = prefix + "-lb";
}

/// <summary>
/// Get the HTTP Endpoint of a load balancer by its name.
/// </summary>
/// <param name="loadBalancerName">The name of the load balancer.</param>
/// <returns>The HTTP endpoint.</returns>
public async Task<string> GetEndpointForLoadBalancerByName(string
loadBalancerName)
{
    if (_endpoint == null)
    {
        var endpointResponse =
            await _amazonElasticLoadBalancingV2.DescribeLoadBalancersAsync(
                new DescribeLoadBalancersRequest()
                {
                    Names = new List<string>() { loadBalancerName }
                });
        _endpoint = endpointResponse.LoadBalancers[0].DNSName;
    }

    return _endpoint;
}

/// <summary>
/// Return the GET response for an endpoint as text.
/// </summary>
/// <param name="endpoint">The endpoint for the request.</param>
/// <returns>The request response.</returns>
public async Task<string> GetEndPointResponse(string endpoint)
{
    var endpointResponse = await _httpClient.GetAsync($"http://{endpoint}");
}
```

```
        var textResponse = await endpointResponse.Content.ReadAsStringAsync();
        return textResponse!;
    }

    /// <summary>
    /// Get the target health for a group by name.
    /// </summary>
    /// <param name="groupName">The name of the group.</param>
    /// <returns>The collection of health descriptions.</returns>
    public async Task<List<TargetHealthDescription>>
CheckTargetHealthForGroup(string groupName)
{
    List<TargetHealthDescription> result = null!;
    try
    {
        var groupResponse =
            await _amazonElasticLoadBalancingV2.DescribeTargetGroupsAsync(
                new DescribeTargetGroupsRequest()
                {
                    Names = new List<string>() { groupName }
                });
        var healthResponse =
            await _amazonElasticLoadBalancingV2.DescribeTargetHealthAsync(
                new DescribeTargetHealthRequest()
                {
                    TargetGroupArn =
groupResponse.TargetGroups[0].TargetGroupArn
                });
        ;
        result = healthResponse.TargetHealthDescriptions;
    }
    catch (TargetGroupNotFoundException)
    {
        Console.WriteLine($"Target group {groupName} not found.");
    }
    return result;
}

    /// <summary>
    /// Create an Elastic Load Balancing target group. The target group specifies
    how the load balancer forwards
    /// requests to instances in the group and how instance health is checked.
    ///

```

```
    /// To speed up this demo, the health check is configured with shortened
    /// times and lower thresholds. In production,
    /// you might want to decrease the sensitivity of your health checks to avoid
    /// unwanted failures.
    /// </summary>
    /// <param name="groupName">The name for the group.</param>
    /// <param name="protocol">The protocol, such as HTTP.</param>
    /// <param name="port">The port to use to forward requests, such as 80.</
param>
    /// <param name="vpcId">The Id of the Vpc in which the load balancer
exists.</param>
    /// <returns>The new TargetGroup object.</returns>
    public async Task<TargetGroup> CreateTargetGroupOnVpc(string groupName,
ProtocolEnum protocol, int port, string vpcId)
{
    var createResponse = await
_amazonElasticLoadBalancingV2.CreateTargetGroupAsync(
        new CreateTargetGroupRequest()
    {
        Name = groupName,
        Protocol = protocol,
        Port = port,
        HealthCheckPath = "/healthcheck",
        HealthCheckIntervalSeconds = 10,
        HealthCheckTimeoutSeconds = 5,
        HealthyThresholdCount = 2,
        UnhealthyThresholdCount = 2,
        VpcId = vpcId
    });
    var targetGroup = createResponse.TargetGroups[0];
    return targetGroup;
}

    /// <summary>
    /// Create an Elastic Load Balancing load balancer that uses the specified
subnets
    /// and forwards requests to the specified target group.
    /// </summary>
    /// <param name="name">The name for the new load balancer.</param>
    /// <param name="subnetIds">Subnets for the load balancer.</param>
    /// <param name="targetGroup">Target group for forwarded requests.</param>
    /// <returns>The new LoadBalancer object.</returns>
    public async Task<LoadBalancer> CreateLoadBalancerAndListener(string name,
List<string> subnetIds, TargetGroup targetGroup)
```

```
{  
    var createLbResponse = await  
_amazonElasticLoadBalancingV2.CreateLoadBalancerAsync(  
        new CreateLoadBalancerRequest()  
    {  
        Name = name,  
        Subnets = subnetIds  
    });  
    var loadBalancerArn = createLbResponse.LoadBalancers[0].LoadBalancerArn;  
  
    // Wait for load balancer to be available.  
    var loadBalancerReady = false;  
    while (!loadBalancerReady)  
    {  
        try  
        {  
            var describeResponse =  
                await  
_amazonElasticLoadBalancingV2.DescribeLoadBalancersAsync(  
                    new DescribeLoadBalancersRequest()  
                {  
                    Names = new List<string>() { name }  
                });  
  
            var loadBalancerState =  
describeResponse.LoadBalancers[0].State.Code;  
  
            loadBalancerReady = loadBalancerState ==  
LoadBalancerStateEnum.Active;  
        }  
        catch (LoadBalancerNotFoundException)  
        {  
            loadBalancerReady = false;  
        }  
        Thread.Sleep(10000);  
    }  
    // Create the listener.  
    await _amazonElasticLoadBalancingV2.CreateListenerAsync(  
        new CreateListenerRequest()  
    {  
        LoadBalancerArn = loadBalancerArn,  
        Protocol = targetGroup.Protocol,  
        Port = targetGroup.Port,  
        DefaultActions = new List<Action>()  
    }  
}
```

```
        {
            new Action()
            {
                Type = ActionTypeEnum.Forward,
                TargetGroupArn = targetGroup.TargetGroupArn
            }
        }
    });

    return createLbResponse.LoadBalancers[0];
}

/// <summary>
/// Verify this computer can successfully send a GET request to the
/// load balancer endpoint.
/// </summary>
/// <param name="endpoint">The endpoint to check.</param>
/// <returns>True if successful.</returns>
public async Task<bool> VerifyLoadBalancerEndpoint(string endpoint)
{
    var success = false;
    var retries = 3;
    while (!success && retries > 0)
    {
        try
        {
            var endpointResponse = await _httpClient.GetAsync($"http://
{endpoint}");
            Console.WriteLine($"Response: {endpointResponse.StatusCode}.");

            if (endpointResponse.IsSuccessStatusCode)
            {
                success = true;
            }
            else
            {
                retries = 0;
            }
        }
        catch (HttpRequestException)
        {
            Console.WriteLine("Connection error, retrying...");
            retries--;
            Thread.Sleep(10000);
        }
    }
}
```

```
        }

        return success;
    }

    ///<summary>
    /// Delete a load balancer by its specified name.
    ///</summary>
    ///<param name="name">The name of the load balancer to delete.</param>
    ///<returns>Async task.</returns>
    public async Task DeleteLoadBalancerByName(string name)
    {
        try
        {
            var describeLoadBalancerResponse =
                await _amazonElasticLoadBalancingV2.DescribeLoadBalancersAsync(
                    new DescribeLoadBalancersRequest()
                {
                    Names = new List<string>() { name }
                });
            var lbArn =
                describeLoadBalancerResponse.LoadBalancers[0].LoadBalancerArn;
            await _amazonElasticLoadBalancingV2.DeleteLoadBalancerAsync(
                new DeleteLoadBalancerRequest()
            {
                LoadBalancerArn = lbArn
            });
        }
        catch (LoadBalancerNotFoundException)
        {
            Console.WriteLine($"Load balancer {name} not found.");
        }
    }

    ///<summary>
    /// Delete a TargetGroup by its specified name.
    ///</summary>
    ///<param name="groupName">Name of the group to delete.</param>
    ///<returns>Async task.</returns>
    public async Task DeleteTargetGroupByName(string groupName)
    {
        var done = false;
        while (!done)
```

```
    {
        try
        {
            var groupResponse =
                await
                    _amazonElasticLoadBalancingV2.DescribeTargetGroupsAsync(
                        new DescribeTargetGroupsRequest()
                        {
                            Names = new List<string>() { groupName }
                        });

            var targetArn = groupResponse.TargetGroups[0].TargetGroupArn;
            await _amazonElasticLoadBalancingV2.DeleteTargetGroupAsync(
                new DeleteTargetGroupRequest() { TargetGroupArn =
targetArn });
            Console.WriteLine($"Deleted load balancing target group
{groupName}.");
            done = true;
        }
        catch (TargetGroupNotFoundException)
        {
            Console.WriteLine(
                $"Target group {groupName} not found, could not delete.");
            done = true;
        }
        catch (ResourceInUseException)
        {
            Console.WriteLine("Target group not yet released, waiting...");
            Thread.Sleep(10000);
        }
    }
}
```

Create a class that uses DynamoDB to simulate a recommendation service.

```
/// <summary>
/// Encapsulates a DynamoDB table to use as a service that recommends books,
/// movies, and songs.
/// </summary>
public class Recommendations
{
```

```
private readonly IAmazonDynamoDB _amazonDynamoDb;
private readonly DynamoDBContext _context;
private readonly string _tableName;

public string TableName => _tableName;

/// <summary>
/// Constructor for the Recommendations service.
/// </summary>
/// <param name="amazonDynamoDb">The injected DynamoDb client.</param>
/// <param name="configuration">The injected configuration.</param>
public Recommendations(IAmazonDynamoDB amazonDynamoDb, IConfiguration
configuration)
{
    _amazonDynamoDb = amazonDynamoDb;
    _context = new DynamoDBContext(_amazonDynamoDb);
    _tableName = configuration["databaseName"]!;
}

/// <summary>
/// Create the DynamoDb table with a specified name.
/// </summary>
/// <param name="tableName">The name for the table.</param>
/// <returns>True when ready.</returns>
public async Task<bool> CreateDatabaseWithName(string tableName)
{
    try
    {
        Console.WriteLine($"Creating table {tableName}...");
        var createRequest = new CreateTableRequest()
        {
            TableName = tableName,
            AttributeDefinitions = new List<AttributeDefinition>()
            {
                new AttributeDefinition()
                {
                    AttributeName = "MediaType",
                    AttributeType = ScalarAttributeType.S
                },
                new AttributeDefinition()
                {
                    AttributeName = "ItemId",
                    AttributeType = ScalarAttributeType.N
                }
            }
        };
        await _amazonDynamoDb.CreateTableAsync(createRequest);
        return true;
    }
    catch (AmazonDynamoDBException ex)
    {
        Console.WriteLine($"Error creating table {tableName}: {ex.Message}");
        return false;
    }
}
```

```
        },
        KeySchema = new List<KeySchemaElement>()
        {
            new KeySchemaElement()
            {
                AttributeName = "MediaType",
                KeyType = KeyType.HASH
            },
            new KeySchemaElement()
            {
                AttributeName = "ItemId",
                KeyType = KeyType.RANGE
            }
        },
        ProvisionedThroughput = new ProvisionedThroughput()
        {
            ReadCapacityUnits = 5,
            WriteCapacityUnits = 5
        }
    };
    await _amazonDynamoDb.CreateTableAsync(createRequest);

    // Wait until the table is ACTIVE and then report success.
    Console.WriteLine("\nWaiting for table to become active...");

    var request = new DescribeTableRequest
    {
        TableName = tableName
    };

    TableStatus status;
    do
    {
        Thread.Sleep(2000);

        var describeTableResponse = await
            _amazonDynamoDb.DescribeTableAsync(request);
        status = describeTableResponse.Table.TableStatus;

        Console.WriteLine(".");
    }
    while (status != "ACTIVE");

    return status == TableStatus.ACTIVE;
```

```
        }

        catch (ResourceInUseException)
        {
            Console.WriteLine($"Table {tableName} already exists.");
            return false;
        }
    }

    ///<summary>
    ///<summary> Populate the database table with data from a specified path.
    ///</summary>
    ///<param name="databaseTableName">The name of the table.</param>
    ///<param name="recommendationsPath">The path of the recommendations data.</param>
    ///<returns>Async task.</returns>
    public async Task PopulateDatabase(string databaseTableName, string recommendationsPath)
    {
        var recommendationsText = await
File.ReadAllTextAsync(recommendationsPath);
        var records =
JsonSerializer.Deserialize<RecommendationModel[]>(recommendationsText);
        var batchWrite = _context.CreateBatchWrite<RecommendationModel>();

        foreach (var record in records!)
        {
            batchWrite.AddPutItem(record);
        }

        await batchWrite.ExecuteAsync();
    }

    ///<summary>
    ///<summary> Delete the recommendation table by name.
    ///</summary>
    ///<param name="tableName">The name of the recommendation table.</param>
    ///<returns>Async task.</returns>
    public async Task DestroyDatabaseByName(string tableName)
    {
        try
        {
            await _amazonDynamoDb.DeleteTableAsync(
                new DeleteTableRequest() { TableName = tableName });
        }
    }
}
```

```
        Console.WriteLine($"Table {tableName} was deleted.");
    }
    catch (ResourceNotFoundException)
    {
        Console.WriteLine($"Table {tableName} not found");
    }
}
```

## Create a class that wraps Systems Manager actions.

```
/// <summary>
/// Encapsulates Systems Manager parameter operations. This example uses these
/// parameters
/// to drive the demonstration of resilient architecture, such as failure of a
/// dependency or
/// how the service responds to a health check.
/// </summary>
public class SmParameterWrapper
{
    private readonly IAmazonSimpleSystemsManagement
    _amazonSimpleSystemsManagement;

    private readonly string _tableParameter = "doc-example-resilient-
architecture-table";
    private readonly string _failureResponseParameter = "doc-example-resilient-
architecture-failure-response";
    private readonly string _healthCheckParameter = "doc-example-resilient-
architecture-health-check";
    private readonly string _tableName = "";

    public string TableParameter => _tableParameter;
    public string TableName => _tableName;
    public string HealthCheckParameter => _healthCheckParameter;
    public string FailureResponseParameter => _failureResponseParameter;

    /// <summary>
    /// Constructor for the SmParameterWrapper.
    /// </summary>
    /// <param name="amazonSimpleSystemsManagement">The injected Simple Systems
    Management client.</param>
    /// <param name="configuration">The injected configuration.</param>
```

```
public SmParameterWrapper(IAmazonSimpleSystemsManagement  
amazonSimpleSystemsManagement, IConfiguration configuration)  
{  
    _amazonSimpleSystemsManagement = amazonSimpleSystemsManagement;  
    _tableName = configuration["databaseName"]!;  
}  
  
/// <summary>  
/// Reset the Systems Manager parameters to starting values for the demo.  
/// </summary>  
/// <returns>Async task.</returns>  
public async Task Reset()  
{  
    await this.PutParameterByName(_tableParameter, _tableName);  
    await this.PutParameterByName(_failureResponseParameter, "none");  
    await this.PutParameterByName(_healthCheckParameter, "shallow");  
}  
  
/// <summary>  
/// Set the value of a named Systems Manager parameter.  
/// </summary>  
/// <param name="name">The name of the parameter.</param>  
/// <param name="value">The value to set.</param>  
/// <returns>Async task.</returns>  
public async Task PutParameterByName(string name, string value)  
{  
    await _amazonSimpleSystemsManagement.PutParameterAsync(  
        new PutParameterRequest() { Name = name, Value = value, Overwrite =  
true });  
}  
}
```

- For API details, see the following topics in *AWS SDK for .NET API Reference*.
  - [AttachLoadBalancerTargetGroups](#)
  - [CreateAutoScalingGroup](#)
  - [CreateInstanceProfile](#)
  - [CreateLaunchTemplate](#)
  - [CreateListener](#)
  - [CreateLoadBalancer](#)

- [CreateTargetGroup](#)
- [DeleteAutoScalingGroup](#)
- [DeleteInstanceProfile](#)
- [DeleteLaunchTemplate](#)
- [DeleteLoadBalancer](#)
- [DeleteTargetGroup](#)
- [DescribeAutoScalingGroups](#)
- [DescribeAvailabilityZones](#)
- [DescribeElamInstanceProfileAssociations](#)
- [DescribeInstances](#)
- [DescribeLoadBalancers](#)
- [DescribeSubnets](#)
- [DescribeTargetGroups](#)
- [DescribeTargetHealth](#)
- [DescribeVpcs](#)
- [RebootInstances](#)
- [ReplaceElamInstanceProfileAssociation](#)
- [TerminateInstanceInAutoScalingGroup](#)
- [UpdateAutoScalingGroup](#)

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run the interactive scenario at a command prompt.

```
public class Main {
```

```
    public static final String fileName = "C:\\AWS\\resworkflow\\recommendations.json"; // Modify file location.
    public static final String tableName = "doc-example-recommendation-service";
    public static final String startScript = "C:\\AWS\\resworkflow\\server_startup_script.sh"; // Modify file location.
    public static final String policyFile = "C:\\AWS\\resworkflow\\instance_policy.json"; // Modify file location.
    public static final String ssmJSON = "C:\\AWS\\resworkflow\\ssm_only_policy.json"; // Modify file location.
    public static final String failureResponse = "doc-example-resilient-architecture-failure-response";
    public static final String healthCheck = "doc-example-resilient-architecture-health-check";
    public static final String templateName = "doc-example-resilience-template";
    public static final String roleName = "doc-example-resilience-role";
    public static final String policyName = "doc-example-resilience-pol";
    public static final String profileName = "doc-example-resilience-prof";

    public static final String badCredsProfileName = "doc-example-resilience-prof-bc";

    public static final String targetGroupName = "doc-example-resilience-tg";
    public static final String autoScalingGroupName = "doc-example-resilience-group";
    public static final String lbName = "doc-example-resilience-lb";
    public static final String protocol = "HTTP";
    public static final int port = 80;

    public static final String DASHES = new String(new char[80]).replace("\0", "-");

    public static void main(String[] args) throws IOException,
InterruptedException {
    Scanner in = new Scanner(System.in);
    Database database = new Database();
    AutoScaler autoScaler = new AutoScaler();
    LoadBalancer loadBalancer = new LoadBalancer();

    System.out.println(DASHES);
    System.out.println("Welcome to the demonstration of How to Build and
Manage a Resilient Service!");
    System.out.println(DASHES);

    System.out.println(DASHES);
```

```
        System.out.println("A - SETUP THE RESOURCES");
        System.out.println("Press Enter when you're ready to start deploying
resources.");
        in.nextLine();
        deploy(loadBalancer);
        System.out.println(DASHES);
        System.out.println(DASHES);
        System.out.println("B - DEMO THE RESILIENCE FUNCTIONALITY");
        System.out.println("Press Enter when you're ready.");
        in.nextLine();
        demo(loadBalancer);
        System.out.println(DASHES);

        System.out.println(DASHES);
        System.out.println("C - DELETE THE RESOURCES");
        System.out.println(""""

            This concludes the demo of how to build and manage a resilient
service.

            To keep things tidy and to avoid unwanted charges on your
account, we can clean up all AWS resources
            that were created for this demo.
            """);

System.out.println("\n Do you want to delete the resources (y/n)? ");
String userInput = in.nextLine().trim().toLowerCase(); // Capture user
input

if (userInput.equals("y")) {
    // Delete resources here
    deleteResources(loadBalancer, autoScaler, database);
    System.out.println("Resources deleted.");
} else {
    System.out.println("""
        Okay, we'll leave the resources intact.
        Don't forget to delete them when you're done with them or you
might incur unexpected charges.
        """);
}
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("The example has completed. ");
System.out.println("\n Thanks for watching!");
System.out.println(DASHES);
```

```
}

// Deletes the AWS resources used in this example.
private static void deleteResources(LoadBalancer loadBalancer, AutoScaler
autoScaler, Database database)
    throws IOException, InterruptedException {
loadBalancer.deleteLoadBalancer(lbName);
System.out.println("*** Wait 30 secs for resource to be deleted");
TimeUnit.SECONDS.sleep(30);
loadBalancer.deleteTargetGroup(targetGroupName);
autoScaler.deleteAutoScaleGroup(autoScalingGroupName);
autoScaler.deleteRolesPolicies(policyName, roleName, profileName);
autoScaler.deleteTemplate(templateName);
database.deleteTable(tableName);
}

private static void deploy(LoadBalancer loadBalancer) throws
InterruptedException, IOException {
Scanner in = new Scanner(System.in);
System.out.println(
"""
For this demo, we'll use the AWS SDK for Java (v2) to
create several AWS resources
        to set up a load-balanced web service endpoint and
explore some ways to make it resilient
        against various kinds of failures.

        Some of the resources create by this demo are:
        \t* A DynamoDB table that the web service depends on to
provide book, movie, and song recommendations.
        \t* An EC2 launch template that defines EC2 instances
that each contain a Python web server.
        \t* An EC2 Auto Scaling group that manages EC2 instances
across several Availability Zones.
        \t* An Elastic Load Balancing (ELB) load balancer that
targets the Auto Scaling group to distribute requests.
        """);

System.out.println("Press Enter when you're ready.");
in.nextLine();
System.out.println(DASHES);

System.out.println(DASHES);
```

```
System.out.println("Creating and populating a DynamoDB table named " +  
tableName);  
Database database = new Database();  
database.createTable(tableName, fileName);  
System.out.println(DASHES);  
  
System.out.println(DASHES);  
System.out.println("")"  
    Creating an EC2 launch template that runs '{startup_script}' when  
an instance starts.  
        This script starts a Python web server defined in the `server.py`  
script. The web server  
            listens to HTTP requests on port 80 and responds to requests to  
'/' and to '/healthcheck'.  
            For demo purposes, this server is run as the root user. In  
production, the best practice is to  
                run a web server, such as Apache, with least-privileged  
credentials.  
  
            The template also defines an IAM policy that each instance uses  
to assume a role that grants  
                permissions to access the DynamoDB recommendation table and  
Systems Manager parameters  
                that control the flow of the demo.  
            "");  
  
LaunchTemplateCreator templateCreator = new LaunchTemplateCreator();  
templateCreator.createTemplate(policyFile, policyName, profileName,  
startScript, templateName, roleName);  
System.out.println(DASHES);  
  
System.out.println(DASHES);  
System.out.println(  
    "Creating an EC2 Auto Scaling group that maintains three EC2  
instances, each in a different Availability Zone.");  
System.out.println("*** Wait 30 secs for the VPC to be created");  
TimeUnit.SECONDS.sleep(30);  
AutoScaler autoScaler = new AutoScaler();  
String[] zones = autoScaler.createGroup(3, templateName,  
autoScalingGroupName);  
  
System.out.println("")"  
    At this point, you have EC2 instances created. Once each instance  
starts, it listens for
```

```
HTTP requests. You can see these instances in the console or
continue with the demo.

Press Enter when you're ready to continue.

""");

in.nextLine();
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("Creating variables that control the flow of the
demo.");
ParameterHelper paramHelper = new ParameterHelper();
paramHelper.reset();
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("""
    Creating an Elastic Load Balancing target group and load
balancer. The target group
        defines how the load balancer connects to instances. The load
balancer provides a
            single endpoint where clients connect and dispatches requests to
instances in the group.
""");

String vpcId = autoScaler.getDefaultVPC();
List<Subnet> subnets = autoScaler.getSubnets(vpcId, zones);
System.out.println("You have retrieved a list with " + subnets.size() + " "
subnets);
String targetGroupArn = loadBalancer.createTargetGroup(protocol, port,
vpcId, targetGroupName);
String elbDnsName = loadBalancer.createLoadBalancer(subnets,
targetGroupArn, lbName, port, protocol);
autoScaler.attachLoadBalancerTargetGroup(autoScalingGroupName,
targetGroupArn);
System.out.println("Verifying access to the load balancer endpoint...");
boolean wasSuccessful =
loadBalancer.verifyLoadBalancerEndpoint(elbDnsName);
if (!wasSuccessful) {
    System.out.println("Couldn't connect to the load balancer, verifying
that the port is open...");
    CloseableHttpClient httpClient = HttpClients.createDefault();

    // Create an HTTP GET request to "http://checkip.amazonaws.com"
```

```
HttpGet httpGet = new HttpGet("http://checkip.amazonaws.com");
try {
    // Execute the request and get the response
    HttpResponse response = httpClient.execute(httpGet);

    // Read the response content.
    String ipAddress =
    IOUtils.toString(response.getEntity().getContent(),
    StandardCharsets.UTF_8).trim();

    // Print the public IP address.
    System.out.println("Public IP Address: " + ipAddress);
    GroupInfo groupInfo = autoScaler.verifyInboundPort(vpcId, port,
    ipAddress);
    if (!groupInfo.isPortOpen()) {
        System.out.println("""
            For this example to work, the default security group
            for your default VPC must
            allow access from this computer. You can either add
            it automatically from this
            example or add it yourself using the AWS Management
            Console.
            """);
        System.out.println(
            "Do you want to add a rule to security group " +
            groupInfo.getGroupName() + " to allow");
        System.out.println("inbound traffic on port " + port + " from
            your computer's IP address (y/n) ");
        String ans = in.nextLine();
        if ("y".equalsIgnoreCase(ans)) {
            autoScaler.openInboundPort(groupInfo.getGroupName(),
            String.valueOf(port), ipAddress);
            System.out.println("Security group rule added.");
        } else {
            System.out.println("No security group rule added.");
        }
    }
} catch (AutoScalingException e) {
    e.printStackTrace();
}
} else if (wasSuccessful) {
```

```
        System.out.println("Your load balancer is ready. You can access it by
browsing to:");
        System.out.println("\t http://" + elbDnsName);
    } else {
        System.out.println("Couldn't get a successful response from the load
balancer endpoint. Troubleshoot by");
        System.out.println("manually verifying that your VPC and security
group are configured correctly and that");
        System.out.println("you can successfully make a GET request to the
load balancer.");
    }

    System.out.println("Press Enter when you're ready to continue with the
demo.");
    in.nextLine();
}

// A method that controls the demo part of the Java program.
public static void demo(LoadBalancer loadBalancer) throws IOException,
InterruptedException {
    ParameterHelper paramHelper = new ParameterHelper();
    System.out.println("Read the ssm_only_policy.json file");
    String ssmOnlyPolicy = readFileAsString(ssmJSON);

    System.out.println("Resetting parameters to starting values for demo.");
    paramHelper.reset();

    System.out.println(
        """
            This part of the demonstration shows how to toggle
different parts of the system
            to create situations where the web service fails, and
shows how using a resilient
            architecture can keep the web service running in spite
of these failures.

            At the start, the load balancer endpoint returns
recommendations and reports that all targets are healthy.
        """);
    demoChoices(loadBalancer);

    System.out.println(
        """

```

```
The web service running on the EC2 instances gets
recommendations by querying a DynamoDB table.

The table name is contained in a Systems Manager
parameter named self.param_helper.table.

To simulate a failure of the recommendation service,
let's set this parameter to name a non-existent table.

    """);
paramHelper.put(paramHelper.tableName, "this-is-not-a-table");

System.out.println(
    """
        \nNow, sending a GET request to the load balancer
endpoint returns a failure code. But, the service reports as
        healthy to the load balancer because shallow health
checks don't check for failure of the recommendation service.

    """);
demoChoices(loadBalancer);

System.out.println(
    """
        Instead of failing when the recommendation service fails,
the web service can return a static response.

        While this is not a perfect solution, it presents the
customer with a somewhat better experience than failure.

    """);
paramHelper.put(paramHelper.failureResponse, "static");

System.out.println("""
        Now, sending a GET request to the load balancer endpoint returns
a static response.

        The service still reports as healthy because health checks are
still shallow.

    """);
demoChoices(loadBalancer);

System.out.println("Let's reinstate the recommendation service.");
paramHelper.put(paramHelper.tableName, paramHelper.dyntable);

System.out.println("""
        Let's also substitute bad credentials for one of the instances in
the target group so that it can't
        access the DynamoDB recommendation table. We will get an instance
id value.

    """);
```

```
LaunchTemplateCreator templateCreator = new LaunchTemplateCreator();
AutoScaler autoScaler = new AutoScaler();

// Create a new instance profile based on badCredsProfileName.
templateCreator.createInstanceProfile(policyFile, policyName,
badCredsProfileName, roleName);
String badInstanceId = autoScaler.getBadInstance(autoScalingGroupName);
System.out.println("The bad instance id values used for this demo is " +
badInstanceId);

String profileAssociationId =
autoScaler.getInstanceProfile(badInstanceId);
System.out.println("The association Id value is " +
profileAssociationId);
System.out.println("Replacing the profile for instance " + badInstanceId
+ " with a profile that contains bad credentials");
autoScaler.replaceInstanceProfile(badInstanceId, badCredsProfileName,
profileAssociationId);

System.out.println(
"""
Now, sending a GET request to the load balancer endpoint
returns either a recommendation or a static response,
depending on which instance is selected by the load
balancer.
""");

demoChoices(loadBalancer);

System.out.println("""
Let's implement a deep health check. For this demo, a deep health
check tests whether
the web service can access the DynamoDB table that it depends on
for recommendations. Note that
the deep health check is only for ELB routing and not for Auto
Scaling instance health.
This kind of deep health check is not recommended for Auto
Scaling instance health, because it
risks accidental termination of all instances in the Auto Scaling
group when a dependent service fails.
""");

System.out.println("""

```

```
        By implementing deep health checks, the load balancer can detect
when one of the instances is failing
        and take that instance out of rotation.
""");

paramHelper.put(paramHelper.healthCheck, "deep");

System.out.println("""
    Now, checking target health indicates that the instance with bad
credentials
    is unhealthy. Note that it might take a minute or two for the
load balancer to detect the unhealthy
    instance. Sending a GET request to the load balancer endpoint
always returns a recommendation, because
    the load balancer takes unhealthy instances out of its rotation.
""");

demoChoices(loadBalancer);

System.out.println(
"""
    Because the instances in this demo are controlled by an
auto scaler, the simplest way to fix an unhealthy
    instance is to terminate it and let the auto scaler start
a new instance to replace it.
""");
autoScaler.terminateInstance(badInstanceId);

System.out.println("""
    Even while the instance is terminating and the new instance is
starting, sending a GET
    request to the web service continues to get a successful
recommendation response because
    the load balancer routes requests to the healthy instances. After
the replacement instance
    starts and reports as healthy, it is included in the load
balancing rotation.
    Note that terminating and replacing an instance typically takes
several minutes, during which time you
    can see the changing health check status until the new instance
is running and healthy.
""");

demoChoices(loadBalancer);
```

```
        System.out.println(
            "If the recommendation service fails now, deep health checks mean
all instances report as unhealthy.");
        paramHelper.put(paramHelper.tableName, "this-is-not-a-table");

        demoChoices(loadBalancer);
        paramHelper.reset();
    }

    public static void demoChoices(LoadBalancer loadBalancer) throws IOException,
InterruptedException {
    String[] actions = {
        "Send a GET request to the load balancer endpoint.",
        "Check the health of load balancer targets.",
        "Go to the next part of the demo."
    };
    Scanner scanner = new Scanner(System.in);

    while (true) {
        System.out.println("-".repeat(88));
        System.out.println("See the current state of the service by selecting
one of the following choices:");
        for (int i = 0; i < actions.length; i++) {
            System.out.println(i + ": " + actions[i]);
        }

        try {
            System.out.print("\nWhich action would you like to take? ");
            int choice = scanner.nextInt();
            System.out.println("-".repeat(88));

            switch (choice) {
                case 0 -> {
                    System.out.println("Request:\n");
                    System.out.println("GET http://" +
loadBalancer.getEndpoint(lbName));
                    CloseableHttpClient httpClient =
HttpClients.createDefault();

                    // Create an HTTP GET request to the ELB.
                    HttpGet httpGet = new HttpGet("http://" +
loadBalancer.getEndpoint(lbName));

                    // Execute the request and get the response.

```

```
        HttpResponse response = httpClient.execute(httpGet);
        int statusCode =
response.getStatusLine().getStatusCode();
        System.out.println("HTTP Status Code: " + statusCode);

        // Display the JSON response
        BufferedReader reader = new BufferedReader(
                new
InputStreamReader(response.getEntity().getContent()));
        StringBuilder jsonResponse = new StringBuilder();
        String line;
        while ((line = reader.readLine()) != null) {
            jsonResponse.append(line);
        }
        reader.close();

        // Print the formatted JSON response.
        System.out.println("Full Response:\n");
        System.out.println(jsonResponse.toString());

        // Close the HTTP client.
        httpClient.close();

    }

    case 1 -> {
        System.out.println("\nChecking the health of load
balancer targets:\n");
        List<TargetHealthDescription> health =
loadBalancer.checkTargetHealth(targetGroupName);
        for (TargetHealthDescription target : health) {
            System.out.printf("\tTarget %s on port %d is %s%n",
target.getTarget().getId(),
                    target.getTarget().getPort(),
target.getTargetHealth().getStateAsString());
        }
        System.out.println(""""
                    Note that it can take a minute or two for the
health check to update
                    after changes are made.
""");
    }

    case 2 -> {
        System.out.println("\nOkay, let's move on.");
        System.out.println("-".repeat(88));
    }
}
```

```
        return; // Exit the method when choice is 2
    }
    default -> System.out.println("You must choose a value
between 0-2. Please select again.");
}

} catch (java.util.InputMismatchException e) {
    System.out.println("Invalid input. Please select again.");
    scanner.nextLine(); // Clear the input buffer.
}
}

public static String readFileAsString(String filePath) throws IOException {
    byte[] bytes = Files.readAllBytes(Paths.get(filePath));
    return new String(bytes);
}
}
```

Create a class that wraps Auto Scaling and Amazon EC2 actions.

```
public class AutoScaler {

    private static Ec2Client ec2Client;
    private static AutoScalingClient autoScalingClient;
    private static IamClient iamClient;

    private static SsmClient ssmClient;

    private IamClient getIAMClient() {
        if (iamClient == null) {
            iamClient = IamClient.builder()
                .region(Region.US_EAST_1)
                .build();
        }
        return iamClient;
    }

    private SsmClient getSSMClient() {
        if (ssmClient == null) {
            ssmClient = SsmClient.builder()
                .region(Region.US_EAST_1)
```

```
        .build();
    }
    return ssmClient;
}

private Ec2Client getEc2Client() {
    if (ec2Client == null) {
        ec2Client = Ec2Client.builder()
            .region(Region.US_EAST_1)
            .build();
    }
    return ec2Client;
}

private AutoScalingClient getAutoScalingClient() {
    if (autoScalingClient == null) {
        autoScalingClient = AutoScalingClient.builder()
            .region(Region.US_EAST_1)
            .build();
    }
    return autoScalingClient;
}

/**
 * Terminates and instances in an EC2 Auto Scaling group. After an instance
 * is
 * terminated, it can no longer be accessed.
 */
public void terminateInstance(String instanceId) {
    TerminateInstanceInAutoScalingGroupRequest terminateInstanceRequest =
TerminateInstanceInAutoScalingGroupRequest
        .builder()
        .instanceId(instanceId)
        .shouldDecrementDesiredCapacity(false)
        .build();

getAutoScalingClient().terminateInstanceInAutoScalingGroup(terminateInstanceRequest);
    System.out.format("Terminated instance %s.", instanceId);
}

/**
 * Replaces the profile associated with a running instance. After the profile
 * is
```

```
* replaced, the instance is rebooted to ensure that it uses the new profile.  
* When  
* the instance is ready, Systems Manager is used to restart the Python web  
* server.  
*/  
public void replaceInstanceProfile(String instanceId, String  
newInstanceProfileName, String profileAssociationId)  
    throws InterruptedException {  
    // Create an IAM instance profile specification.  
    software.amazon.awssdk.services.ec2.model.IamInstanceProfileSpecification  
    iamInstanceProfile =  
    software.amazon.awssdk.services.ec2.model.IamInstanceProfileSpecification  
        .builder()  
        .name(newInstanceProfileName) // Make sure  
'newInstanceProfileName' is a valid IAM Instance Profile  
                // name.  
        .build();  
  
    // Replace the IAM instance profile association for the EC2 instance.  
    ReplaceIamInstanceProfileAssociationRequest replaceRequest =  
ReplaceIamInstanceProfileAssociationRequest  
    .builder()  
    .iamInstanceProfile(iamInstanceProfile)  
    .associationId(profileAssociationId) // Make sure  
'profileAssociationId' is a valid association ID.  
    .build();  
  
    try {  
        getEc2Client().replaceIamInstanceProfileAssociation(replaceRequest);  
        // Handle the response as needed.  
    } catch (Ec2Exception e) {  
        // Handle exceptions, log, or report the error.  
        System.err.println("Error: " + e.getMessage());  
    }  
    System.out.format("Replaced instance profile for association %s with  
profile %s.", profileAssociationId,  
                    newInstanceProfileName);  
    TimeUnit.SECONDS.sleep(15);  
    boolean instReady = false;  
    int tries = 0;  
  
    // Reboot after 60 seconds  
    while (!instReady) {  
        if (tries % 6 == 0) {
```

```
        getEc2Client().rebootInstances(RebootInstancesRequest.builder()
            .instanceIds(instanceId)
            .build());
        System.out.println("Rebooting instance " + instanceId + " and
waiting for it to be ready.");
    }
    tries++;
    try {
        TimeUnit.SECONDS.sleep(10);
    } catch (InterruptedException e) {
        e.printStackTrace();
    }

    DescribeInstanceInformationResponse informationResponse =
getSSMClient().describeInstanceInformation();
    List<InstanceInformation> instanceInformationList =
informationResponse.instanceInformationList();
    for (InstanceInformation info : instanceInformationList) {
        if (info.instanceId().equals(instanceId)) {
            instReady = true;
            break;
        }
    }
}

SendCommandRequest sendCommandRequest = SendCommandRequest.builder()
    .instanceIds(instanceId)
    .documentName("AWS-RunShellScript")
    .parameters(Collections.singletonMap("commands",
        Collections.singletonList("cd / && sudo python3 server.py
80")))
    .build();

getSSMClient().sendCommand(sendCommandRequest);
System.out.println("Restarted the Python web server on instance " +
instanceId + ".");
}

public void openInboundPort(String secGroupId, String port, String ipAddress)
{
    AuthorizeSecurityGroupIngressRequest ingressRequest =
AuthorizeSecurityGroupIngressRequest.builder()
    .groupName(secGroupId)
    .cidrIp(ipAddress)
```

```
        .fromPort(Integer.parseInt(port))
        .build();

    getEc2Client().authorizeSecurityGroupIngress(ingressRequest);
    System.out.format("Authorized ingress to %s on port %s from %s.",
secGroupId, port, ipAddress);
}

/**
 * Detaches a role from an instance profile, detaches policies from the role,
 * and deletes all the resources.
 */
public void deleteInstanceProfile(String roleName, String profileName) {
    try {
        software.amazon.awssdk.services.iam.model.GetInstanceProfileRequest
getInstanceProfileRequest =
software.amazon.awssdk.services.iam.model.GetInstanceProfileRequest
        .builder()
        .instanceProfileName(profileName)
        .build();

        GetInstanceProfileResponse response =
getIAMClient().getInstanceProfile(getInstanceProfileRequest);
        String name = response.instanceProfile().instanceProfileName();
        System.out.println(name);

        RemoveRoleFromInstanceProfileRequest profileRequest =
RemoveRoleFromInstanceProfileRequest.builder()
        .instanceProfileName(profileName)
        .roleName(roleName)
        .build();

        getIAMClient().removeRoleFromInstanceProfile(profileRequest);
        DeleteInstanceProfileRequest deleteInstanceProfileRequest =
DeleteInstanceProfileRequest.builder()
        .instanceProfileName(profileName)
        .build();

        getIAMClient().deleteInstanceProfile(deleteInstanceProfileRequest);
        System.out.println("Deleted instance profile " + profileName);

        DeleteRoleRequest deleteRoleRequest = DeleteRoleRequest.builder()
        .roleName(roleName)
        .build();
    }
}
```

```
// List attached role policies.
ListAttachedRolePoliciesResponse rolesResponse = getIAMClient()
    .listAttachedRolePolicies(role -> role.roleName(roleName));
List<AttachedPolicy> attachedPolicies =
rolesResponse.attachedPolicies();
for (AttachedPolicy attachedPolicy : attachedPolicies) {
    DetachRolePolicyRequest request =
DetachRolePolicyRequest.builder()
    .roleName(roleName)
    .policyArn(attachedPolicy.policyArn())
    .build();

    getIAMClient().detachRolePolicy(request);
    System.out.println("Detached and deleted policy " +
attachedPolicy.policyName());
}

getIAMClient().deleteRole(deleteRoleRequest);
System.out.println("Instance profile and role deleted.");

} catch (IamException e) {
    System.err.println(e.getMessage());
    System.exit(1);
}
}

public void deleteTemplate(String templateName) {
    getEc2Client().deleteLaunchTemplate(name ->
name.launchTemplateName(templateName));
    System.out.format(templateName + " was deleted.");
}

public void deleteAutoScaleGroup(String groupName) {
    DeleteAutoScalingGroupRequest deleteAutoScalingGroupRequest =
DeleteAutoScalingGroupRequest.builder()
    .autoScalingGroupName(groupName)
    .forceDelete(true)
    .build();

getAutoScalingClient().deleteAutoScalingGroup(deleteAutoScalingGroupRequest);
    System.out.println(groupName + " was deleted.");
}
```

```
/*
 * Verify the default security group of the specified VPC allows ingress from
 * this
 * computer. This can be done by allowing ingress from this computer's IP
 * address. In some situations, such as connecting from a corporate network,
you
 * must instead specify a prefix list ID. You can also temporarily open the
port
 * to
 * any IP address while running this example. If you do, be sure to remove
 * public
 * access when you're done.
 *
*/
public GroupInfo verifyInboundPort(String VPC, int port, String ipAddress) {
    boolean portIsOpen = false;
    GroupInfo groupInfo = new GroupInfo();
    try {
        Filter filter = Filter.builder()
            .name("group-name")
            .values("default")
            .build();

        Filter filter1 = Filter.builder()
            .name("vpc-id")
            .values(VPC)
            .build();

        DescribeSecurityGroupsRequest securityGroupsRequest =
DescribeSecurityGroupsRequest.builder()
            .filters(filter, filter1)
            .build();

        DescribeSecurityGroupsResponse securityGroupsResponse =
getEc2Client()
            .describeSecurityGroups(securityGroupsRequest);
        String securityGroup =
securityGroupsResponse.securityGroups().get(0).groupName();
        groupInfo.setGroupName(securityGroup);

        for (SecurityGroup secGroup :
securityGroupsResponse.securityGroups()) {
```

```
        System.out.println("Found security group: " +
secGroup.groupId());

        for (IpPermission ipPermission : secGroup.ipPermissions()) {
            if (ipPermission.fromPort() == port) {
                System.out.println("Found inbound rule: " +
ipPermission);
                for (IpRange ipRange : ipPermission.ipRanges()) {
                    String cidrIp = ipRange.cidrIp();
                    if (cidrIp.startsWith(ipAddress) ||
cidrIp.equals("0.0.0.0/0")) {
                        System.out.println(cidrIp + " is applicable");
                        portIsOpen = true;
                    }
                }
            }

            if (!ipPermission.prefixListIds().isEmpty()) {
                System.out.println("Prefix lList is applicable");
                portIsOpen = true;
            }
        }

        if (!portIsOpen) {
            System.out
                .println("The inbound rule does not appear to
be open to either this computer's IP,"
                + " all IP addresses (0.0.0.0/0), or
to a prefix list ID.");
        } else {
            break;
        }
    }
}

} catch (AutoScalingException e) {
    System.err.println(e.awsErrorDetails().errorMessage());
}

groupInfo.setPortOpen(portIsOpen);
return groupInfo;
}

/*
 * Attaches an Elastic Load Balancing (ELB) target group to this EC2 Auto
```

```
* Scaling group.
* The target group specifies how the load balancer forward requests to the
* instances
* in the group.
*/
public void attachLoadBalancerTargetGroup(String asGroupName, String
targetGroupARN) {
    try {
        AttachLoadBalancerTargetGroupsRequest targetGroupsRequest =
AttachLoadBalancerTargetGroupsRequest.builder()
            .autoScalingGroupName(asGroupName)
            .targetGroupARNs(targetGroupARN)
            .build();

getAutoScalingClient().attachLoadBalancerTargetGroups(targetGroupsRequest);
        System.out.println("Attached load balancer to " + asGroupName);

    } catch (AutoScalingException e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}

// Creates an EC2 Auto Scaling group with the specified size.
public String[] createGroup(int groupSize, String templateName, String
autoScalingGroupName) {

    // Get availability zones.

software.amazon.awssdk.services.ec2.model.DescribeAvailabilityZonesRequest
zonesRequest =
software.amazon.awssdk.services.ec2.model.DescribeAvailabilityZonesRequest
    .builder()
    .build();

    DescribeAvailabilityZonesResponse zonesResponse =
getEc2Client().describeAvailabilityZones(zonesRequest);
    List<String> availabilityZoneNames =
zonesResponse.availabilityZones().stream()

    .map(software.amazon.awssdk.services.ec2.model.AvailabilityZone::zoneName)
    .collect(Collectors.toList());
```

```
String availabilityZones = String.join(", ", availabilityZoneNames);
LaunchTemplateSpecification specification =
LaunchTemplateSpecification.builder()
    .launchTemplateName(templateName)
    .version("$Default")
    .build();

String[] zones = availabilityZones.split(",");
CreateAutoScalingGroupRequest groupRequest =
CreateAutoScalingGroupRequest.builder()
    .launchTemplate(specification)
    .availabilityZones(zones)
    .maxSize(groupSize)
    .minSize(groupSize)
    .autoScalingGroupName(autoScalingGroupName)
    .build();

try {
    getAutoScalingClient().createAutoScalingGroup(groupRequest);

} catch (AutoScalingException e) {
    System.err.println(e.awsErrorDetails().errorMessage());
    System.exit(1);
}
System.out.println("Created an EC2 Auto Scaling group named " +
autoScalingGroupName);
return zones;
}

public String getDefaultVPC() {
    // Define the filter.
    Filter defaultFilter = Filter.builder()
        .name("is-default")
        .values("true")
        .build();

    software.amazon.awssdk.services.ec2.model.DescribeVpcsRequest request =
software.amazon.awssdk.services.ec2.model.DescribeVpcsRequest
    .builder()
    .filters(defaultFilter)
    .build();

DescribeVpcsResponse response = getEc2Client().describeVpcs(request);
return response.vpcs().get(0).vpcId();
```

```
}

// Gets the default subnets in a VPC for a specified list of Availability Zones.
public List<Subnet> getSubnets(String vpcId, String[] availabilityZones) {
    List<Subnet> subnets = null;
    Filter vpcFilter = Filter.builder()
        .name("vpc-id")
        .values(vpcId)
        .build();

    Filter azFilter = Filter.builder()
        .name("availability-zone")
        .values(availabilityZones)
        .build();

    Filter defaultForAZ = Filter.builder()
        .name("default-for-az")
        .values("true")
        .build();

    DescribeSubnetsRequest request = DescribeSubnetsRequest.builder()
        .filters(vpcFilter, azFilter, defaultForAZ)
        .build();

    DescribeSubnetsResponse response =
getEc2Client().describeSubnets(request);
    subnets = response.subnets();
    return subnets;
}

// Gets data about the instances in the EC2 Auto Scaling group.
public String getBadInstance(String groupName) {
    DescribeAutoScalingGroupsRequest request =
DescribeAutoScalingGroupsRequest.builder()
    .autoScalingGroupNames(groupName)
    .build();

    DescribeAutoScalingGroupsResponse response =
getAutoScalingClient().describeAutoScalingGroups(request);
    AutoScalingGroup autoScalingGroup = response.autoScalingGroups().get(0);
    List<String> instanceIds = autoScalingGroup.instances().stream()
        .map(instance -> instance.instanceId())
        .collect(Collectors.toList());
}
```

```
String[] instanceIdArray = instanceIds.toArray(new String[0]);
for (String instanceId : instanceIdArray) {
    System.out.println("Instance ID: " + instanceId);
    return instanceId;
}
return "";

}

// Gets data about the profile associated with an instance.
public String getInstanceProfile(String instanceId) {
    Filter filter = Filter.builder()
        .name("instance-id")
        .values(instanceId)
        .build();

    DescribeIamInstanceProfileAssociationsRequest associationsRequest =
DescribeIamInstanceProfileAssociationsRequest
        .builder()
        .filters(filter)
        .build();

    DescribeIamInstanceProfileAssociationsResponse response = getEc2Client()
        .describeIamInstanceProfileAssociations(associationsRequest);
    return response.iamInstanceProfileAssociations().get(0).associationId();
}

public void deleteRolesPolicies(String policyName, String roleName, String
InstanceProfile) {
    ListPoliciesRequest listPoliciesRequest =
ListPoliciesRequest.builder().build();
    ListPoliciesResponse listPoliciesResponse =
getIAMClient().listPolicies(listPoliciesRequest);
    for (Policy policy : listPoliciesResponse.policies()) {
        if (policy.policyName().equals(policyName)) {
            // List the entities (users, groups, roles) that are attached to
the policy.

software.amazon.awssdk.services.iam.model.ListEntitiesForPolicyRequest
listEntitiesRequest =
software.amazon.awssdk.services.iam.model.ListEntitiesForPolicyRequest
        .builder()
        .policyArn(policy.arn())
        .build();
}
```

```
        ListEntitiesForPolicyResponse listEntitiesResponse = iamClient
            .listEntitiesForPolicy(listEntitiesRequest);
        if (!listEntitiesResponse.policyGroups().isEmpty() || !
listEntitiesResponse.policyUsers().isEmpty()
            || !listEntitiesResponse.policyRoles().isEmpty()) {
            // Detach the policy from any entities it is attached to.
            DetachRolePolicyRequest detachPolicyRequest =
DetachRolePolicyRequest.builder()
                .policyArn(policy.arn())
                .roleName(roleName) // Specify the name of the IAM
role
                .build();

            getIAMClient().detachRolePolicy(detachPolicyRequest);
            System.out.println("Policy detached from entities.");
        }

        // Now, you can delete the policy.
        DeletePolicyRequest deletePolicyRequest =
DeletePolicyRequest.builder()
            .policyArn(policy.arn())
            .build();

        getIAMClient().deletePolicy(deletePolicyRequest);
        System.out.println("Policy deleted successfully.");
        break;
    }
}

// List the roles associated with the instance profile
ListInstanceProfilesForRoleRequest listRolesRequest =
ListInstanceProfilesForRoleRequest.builder()
    .roleName(roleName)
    .build();

// Detach the roles from the instance profile
ListInstanceProfilesForRoleResponse listRolesResponse =
iamClient.listInstanceProfilesForRole(listRolesRequest);
for (software.amazon.awssdk.services.iam.model.InstanceProfile profile :
listRolesResponse.instanceProfiles()) {
    RemoveRoleFromInstanceProfileRequest removeRoleRequest =
RemoveRoleFromInstanceProfileRequest.builder()
    .instanceProfileName(InstanceProfile)
    .roleName(roleName) // Remove the extra dot here
```

```
        .build();

        getIAMClient().removeRoleFromInstanceProfile(removeRoleRequest);
        System.out.println("Role " + roleName + " removed from instance
profile " + InstanceProfile);
    }

    // Delete the instance profile after removing all roles
    DeleteInstanceProfileRequest deleteInstanceProfileRequest =
DeleteInstanceProfileRequest.builder()
        .instanceProfileName(InstanceProfile)
        .build();

    getIAMClient().deleteInstanceProfile(r ->
r.instanceProfileName(InstanceProfile));
    System.out.println(InstanceProfile + " Deleted");
    System.out.println("All roles and policies are deleted.");
}
}
```

Create a class that wraps Elastic Load Balancing actions.

```
public class LoadBalancer {
    public ElasticLoadBalancingV2Client elasticLoadBalancingV2Client;

    public ElasticLoadBalancingV2Client getLoadBalancerClient() {
        if (elasticLoadBalancingV2Client == null) {
            elasticLoadBalancingV2Client = ElasticLoadBalancingV2Client.builder()
                .region(Region.US_EAST_1)
                .build();
        }

        return elasticLoadBalancingV2Client;
    }

    // Checks the health of the instances in the target group.
    public List<TargetHealthDescription> checkTargetHealth(String
targetGroupName) {
        DescribeTargetGroupsRequest targetGroupsRequest =
DescribeTargetGroupsRequest.builder()
            .names(targetGroupName)
            .build();
    }
}
```

```
        DescribeTargetGroupsResponse tgResponse =
getLoadBalancerClient().describeTargetGroups(targetGroupsRequest);

        DescribeTargetHealthRequest healthRequest =
DescribeTargetHealthRequest.builder()

.targetGroupArn(tgResponse.targetGroups().get(0).targetGroupArn())
.build();

        DescribeTargetHealthResponse healthResponse =
getLoadBalancerClient().describeTargetHealth(healthRequest);
        return healthResponse.targetHealthDescriptions();
    }

// Gets the HTTP endpoint of the load balancer.
public String getEndpoint(String lbName) {
    DescribeLoadBalancersResponse res = getLoadBalancerClient()
        .describeLoadBalancers(describe -> describe.names(lbName));
    return res.loadBalancers().get(0).dnsName();
}

// Deletes a load balancer.
public void deleteLoadBalancer(String lbName) {
    try {
        // Use a waiter to delete the Load Balancer.
        DescribeLoadBalancersResponse res = getLoadBalancerClient()
            .describeLoadBalancers(describe -> describe.names(lbName));
        ElasticLoadBalancingV2Waiter loadBalancerWaiter =
getLoadBalancerClient().waiter();
        DescribeLoadBalancersRequest request =
DescribeLoadBalancersRequest.builder()

.loadBalancerArns(res.loadBalancers().get(0).loadBalancerArn())
.build();

        getLoadBalancerClient().deleteLoadBalancer(
builder ->
builder.loadBalancerArn(res.loadBalancers().get(0).loadBalancerArn()));
        WaiterResponse<DescribeLoadBalancersResponse> waiterResponse =
loadBalancerWaiter
            .waitForLoadBalancersDeleted(request);
        waiterResponse.matched().response().ifPresent(System.out::println);
    }
}
```

```
        } catch (ElasticLoadBalancingV2Exception e) {
            System.err.println(e.awsErrorDetails().errorMessage());
        }
        System.out.println(lbName + " was deleted.");
    }

    // Deletes the target group.
    public void deleteTargetGroup(String targetGroupName) {
        try {
            DescribeTargetGroupsResponse res = getLoadBalancerClient()
                .describeTargetGroups(describe ->
describe.names(targetGroupName));
            getLoadBalancerClient()
                .deleteTargetGroup(builder ->
builder.targetGroupArn(res.targetGroups().get(0).targetGroupArn()));
        } catch (ElasticLoadBalancingV2Exception e) {
            System.err.println(e.awsErrorDetails().errorMessage());
        }
        System.out.println(targetGroupName + " was deleted.");
    }

    // Verify this computer can successfully send a GET request to the load
    // balancer
    // endpoint.
    public boolean verifyLoadBalancerEndpoint(String elbDnsName) throws
IOException, InterruptedException {
        boolean success = false;
        int retries = 3;
        CloseableHttpClient httpClient = HttpClients.createDefault();

        // Create an HTTP GET request to the ELB.
        HttpGet httpGet = new HttpGet("http://" + elbDnsName);
        try {
            while ((!success) && (retries > 0)) {
                // Execute the request and get the response.
                HttpResponse response = httpClient.execute(httpGet);
                int statusCode = response.getStatusLine().getStatusCode();
                System.out.println("HTTP Status Code: " + statusCode);
                if (statusCode == 200) {
                    success = true;
                } else {
                    retries--;
                    System.out.println("Got connection error from load balancer
endpoint, retrying...");
```

```
        TimeUnit.SECONDS.sleep(15);
    }
}

} catch (org.apache.http.conn.HttpHostConnectException e) {
    System.out.println(e.getMessage());
}

System.out.println("Status.." + success);
return success;
}

/*
 * Creates an Elastic Load Balancing target group. The target group specifies
 * how
 * the load balancer forward requests to instances in the group and how
instance
 * health is checked.
*/
public String createTargetGroup(String protocol, int port, String vpcId,
String targetGroupName) {
    CreateTargetGroupRequest targetGroupRequest =
CreateTargetGroupRequest.builder()
        .healthCheckPath("/healthcheck")
        .healthCheckTimeoutSeconds(5)
        .port(port)
        .vpcId(vpcId)
        .name(targetGroupName)
        .protocol(protocol)
        .build();

    CreateTargetGroupResponse targetGroupResponse =
getLoadBalancerClient().createTargetGroup(targetGroupRequest);
    String targetGroupArn =
targetGroupResponse.targetGroups().get(0).targetGroupArn();
    String targetGroup =
targetGroupResponse.targetGroups().get(0).targetGroupName();
    System.out.println("The " + targetGroup + " was created with ARN" +
targetGroupArn);
    return targetGroupArn;
}

/*
 * Creates an Elastic Load Balancing load balancer that uses the specified

```

```
* subnets
* and forwards requests to the specified target group.
*/
public String createLoadBalancer(List<Subnet> subnetIds, String
targetGroupARN, String lbName, int port,
        String protocol) {
    try {
        List<String> subnetIdStrings = subnetIds.stream()
            .map(Subnet::subnetId)
            .collect(Collectors.toList());

        CreateLoadBalancerRequest balancerRequest =
CreateLoadBalancerRequest.builder()
            .subnets(subnetIdStrings)
            .name(lbName)
            .scheme("internet-facing")
            .build();

        // Create and wait for the load balancer to become available.
        CreateLoadBalancerResponse lsResponse =
getLoadBalancerClient().createLoadBalancer(balancerRequest);
        String lbARN = lsResponse.loadBalancers().get(0).loadBalancerArn();

        ElasticLoadBalancingV2Waiter loadBalancerWaiter =
getLoadBalancerClient().waiter();
        DescribeLoadBalancersRequest request =
DescribeLoadBalancersRequest.builder()
            .loadBalancerArns(lbARN)
            .build();

        System.out.println("Waiting for Load Balancer " + lbName + " to
become available.");
        WaiterResponse<DescribeLoadBalancersResponse> waiterResponse =
loadBalancerWaiter
            .waitUntilLoadBalancerAvailable(request);
        waiterResponse.matched().response().ifPresent(System.out::println);
        System.out.println("Load Balancer " + lbName + " is available.");

        // Get the DNS name (endpoint) of the load balancer.
        String lbDNSName = lsResponse.loadBalancers().get(0).dnsName();
        System.out.println("**** Load Balancer DNS Name: " + lbDNSName);

        // Create a listener for the load balance.
        Action action = Action.builder()
```

```
.targetGroupArn(targetGroupARN)
.type("forward")
.build();

CreateListenerRequest listenerRequest =
CreateListenerRequest.builder()

.loadBalancerArn(lsResponse.loadBalancers().get(0).loadBalancerArn())
.defaultActions(action)
.port(port)
.protocol(protocol)
.defaultActions(action)
.build();

getLoadBalancerClient().createListener(listenerRequest);
System.out.println("Created listener to forward traffic from load
balancer " + lbName + " to target group "
+ targetGroupARN);

// Return the load balancer DNS name.
return lbDNSName;

} catch (ElasticLoadBalancingV2Exception e) {
    e.printStackTrace();
}
return "";
}

}
```

Create a class that uses DynamoDB to simulate a recommendation service.

```
public class Database {

    private static DynamoDbClient dynamoDbClient;

    public static DynamoDbClient getDynamoDbClient() {
        if (dynamoDbClient == null) {
            dynamoDbClient = DynamoDbClient.builder()
                .region(Region.US_EAST_1)
                .build();
        }
        return dynamoDbClient;
    }
}
```

```
}

// Checks to see if the Amazon DynamoDB table exists.
private boolean doesTableExist(String tableName) {
    try {
        // Describe the table and catch any exceptions.
        DescribeTableRequest describeTableRequest =
DescribeTableRequest.builder()
    .tableName(tableName)
    .build();

        getDynamoDbClient().describeTable(describeTableRequest);
        System.out.println("Table '" + tableName + "' exists.");
        return true;

    } catch (ResourceNotFoundException e) {
        System.out.println("Table '" + tableName + "' does not exist.");
    } catch (DynamoDbException e) {
        System.err.println("Error checking table existence: " +
e.getMessage());
    }
    return false;
}

/*
 * Creates a DynamoDB table to use a recommendation service. The table has a
 * hash key named 'MediaType' that defines the type of media recommended,
such
 * as
 * Book or Movie, and a range key named 'ItemId' that, combined with the
 * MediaType,
 * forms a unique identifier for the recommended item.
 */
public void createTable(String tableName, String fileName) throws IOException
{
    // First check to see if the table exists.
    boolean doesExist = doesTableExist(tableName);
    if (!doesExist) {
        DynamoDbWaiter dbWaiter = getDynamoDbClient().waiter();
        CreateTableRequest createTableRequest = CreateTableRequest.builder()
            .tableName(tableName)
            .attributeDefinitions(
                AttributeDefinition.builder()
                    .attributeName("MediaType")
```

```
        .attributeType(ScalarAttributeType.S)
        .build(),
    AttributeDefinition.builder()
        .attributeName("ItemId")
        .attributeType(ScalarAttributeType.N)
        .build())
.keySchema(
    KeySchemaElement.builder()
        .attributeName("MediaType")
        .keyType(KeyType.HASH)
        .build(),
    KeySchemaElement.builder()
        .attributeName("ItemId")
        .keyType(KeyType.RANGE)
        .build())
.provisionedThroughput(
    ProvisionedThroughput.builder()
        .readCapacityUnits(5L)
        .writeCapacityUnits(5L)
        .build())
.build();

getDynamoDbClient().createTable(createTableRequest);
System.out.println("Creating table " + tableName + "...");

// Wait until the Amazon DynamoDB table is created.
DescribeTableRequest tableRequest = DescribeTableRequest.builder()
    .tableName(tableName)
    .build();

WaiterResponse<DescribeTableResponse> waiterResponse =
dbWaiter.waitUntilTableExists(tableRequest);
waiterResponse.matched().response().ifPresent(System.out::println);
System.out.println("Table " + tableName + " created.");

// Add records to the table.
populateTable(fileName, tableName);
}

}

public void deleteTable(String tableName) {
    getDynamoDbClient().deleteTable(table -> table.tableName(tableName));
    System.out.println("Table " + tableName + " deleted.");
}
```

```
// Populates the table with data located in a JSON file using the DynamoDB
// enhanced client.
public void populateTable(String fileName, String tableName) throws
IOException {
    DynamoDbEnhancedClient enhancedClient = DynamoDbEnhancedClient.builder()
        .dynamoDbClient(getDynamoDbClient())
        .build();
    ObjectMapper objectMapper = new ObjectMapper();
    File jsonFile = new File(fileName);
    JsonNode rootNode = objectMapper.readTree(jsonFile);

    DynamoDbTable<Recommendation> mappedTable =
enhancedClient.table(tableName,
        TableSchema.fromBean(Recommendation.class));
    for (JsonNode currentNode : rootNode) {
        String mediaType = currentNode.path("MediaType").path("S").asText();
        int itemId = currentNode.path("ItemId").path("N").asInt();
        String title = currentNode.path("Title").path("S").asText();
        String creator = currentNode.path("Creator").path("S").asText();

        // Create a Recommendation object and set its properties.
        Recommendation rec = new Recommendation();
        rec.setMediaType(mediaType);
        rec.setItemId(itemId);
        rec.setTitle(title);
        rec.setCreator(creator);

        // Put the item into the DynamoDB table.
        mappedTable.putItem(rec); // Add the Recommendation to the list.
    }
    System.out.println("Added all records to the " + tableName);
}
}
```

Create a class that wraps Systems Manager actions.

```
public class ParameterHelper {

    String tableName = "doc-example-resilient-architecture-table";
    String dyntable = "doc-example-recommendation-service";
```

```
String failureResponse = "doc-example-resilient-architecture-failure-response";
String healthCheck = "doc-example-resilient-architecture-health-check";

public void reset() {
    put(dyntable, tableName);
    put(failureResponse, "none");
    put(healthCheck, "shallow");
}

public void put(String name, String value) {
    SsmClient ssmClient = SsmClient.builder()
        .region(Region.US_EAST_1)
        .build();

    PutParameterRequest parameterRequest = PutParameterRequest.builder()
        .name(name)
        .value(value)
        .overwrite(true)
        .type("String")
        .build();

    ssmClient.putParameter(parameterRequest);
    System.out.printf("Setting demo parameter %s to '%s'.", name, value);
}
}
```

- For API details, see the following topics in *AWS SDK for Java 2.x API Reference*.
  - [AttachLoadBalancerTargetGroups](#)
  - [CreateAutoScalingGroup](#)
  - [CreateInstanceProfile](#)
  - [CreateLaunchTemplate](#)
  - [CreateListener](#)
  - [CreateLoadBalancer](#)
  - [CreateTargetGroup](#)
  - [DeleteAutoScalingGroup](#)
  - [DeleteInstanceProfile](#)
  - [DeleteLaunchTemplate](#)

- [DeleteLoadBalancer](#)
- [DeleteTargetGroup](#)
- [DescribeAutoScalingGroups](#)
- [DescribeAvailabilityZones](#)
- [DescribelamInstanceProfileAssociations](#)
- [DescribeInstances](#)
- [DescribeLoadBalancers](#)
- [DescribeSubnets](#)
- [DescribeTargetGroups](#)
- [DescribeTargetHealth](#)
- [DescribeVpcs](#)
- [RebootInstances](#)
- [ReplaceIamInstanceProfileAssociation](#)
- [TerminateInstanceInAutoScalingGroup](#)
- [UpdateAutoScalingGroup](#)

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run the interactive scenario at a command prompt.

```
#!/usr/bin/env node
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0

import {
```

```
    parseScenarioArgs,
} from "@aws-doc-sdk-examples/lib/scenario/index.js";

/** 
 * The workflow steps are split into three stages:
 *   - deploy
 *   - demo
 *   - destroy
 *
 * Each of these stages has a corresponding file prefixed with steps-*.
*/
import { deploySteps } from "./steps-deploy.js";
import { demoSteps } from "./steps-demo.js";
import { destroySteps } from "./steps-destroy.js";

/** 
 * The context is passed to every scenario. Scenario steps
 * will modify the context.
*/
const context = {};

/** 
 * Three Scenarios are created for the workflow. A Scenario is an orchestration
 * class
 * that simplifies running a series of steps.
*/
export const scenarios = {
    // Deploys all resources necessary for the workflow.
    deploy: new Scenario("Resilient Workflow - Deploy", deploySteps, context),
    // Demonstrates how a fragile web service can be made more resilient.
    demo: new Scenario("Resilient Workflow - Demo", demoSteps, context),
    // Destroys the resources created for the workflow.
    destroy: new Scenario("Resilient Workflow - Destroy", destroySteps, context),
};

// Call function if run directly
import { fileURLToPath } from "url";

if (process.argv[1] === fileURLToPath(import.meta.url)) {
    parseScenarioArgs(scenarios);
}
```

## Create steps to deploy all of the resources.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.  
// SPDX-License-Identifier: Apache-2.0  
import { join } from "node:path";  
import { readFileSync, writeFileSync } from "node:fs";  
import axios from "axios";  
  
import {  
    BatchWriteItemCommand,  
    CreateTableCommand,  
    DynamoDBClient,  
    waitUntilTableExists,  
} from "@aws-sdk/client-dynamodb";  
import {  
    EC2Client,  
    CreateKeyPairCommand,  
    CreateLaunchTemplateCommand,  
    DescribeAvailabilityZonesCommand,  
    DescribeVpcsCommand,  
    DescribeSubnetsCommand,  
    DescribeSecurityGroupsCommand,  
    AuthorizeSecurityGroupIngressCommand,  
} from "@aws-sdk/client-ec2";  
import {  
    IAMClient,  
    CreatePolicyCommand,  
    CreateRoleCommand,  
    CreateInstanceProfileCommand,  
    AddRoleToInstanceProfileCommand,  
    AttachRolePolicyCommand,  
    waitUntilInstanceProfileExists,  
} from "@aws-sdk/client-iam";  
import { SSMClient, GetParameterCommand } from "@aws-sdk/client-ssm";  
import {  
    CreateAutoScalingGroupCommand,  
    AutoScalingClient,  
    AttachLoadBalancerTargetGroupsCommand,  
} from "@aws-sdk/client-auto-scaling";  
import {  
    CreateListenerCommand,  
    CreateLoadBalancerCommand,  
    CreateTargetGroupCommand,  
    ElasticLoadBalancingV2Client,
```

```
    waitUntilLoadBalancerAvailable,
} from "@aws-sdk/client-elastic-load-balancing-v2";

import {
  ScenarioOutput,
  ScenarioInput,
  ScenarioAction,
} from "@aws-doc-sdk-examples/lib/scenario/index.js";
import { retry } from "@aws-doc-sdk-examples/lib/utils/util-timers.js";

import { MESSAGES, NAMES, RESOURCES_PATH, ROOT } from "./constants.js";
import { initParamsSteps } from "./steps-reset-params.js";

/**
 * @type {import('@aws-doc-sdk-examples/lib/scenario.js').Step[]}
 */
export const deploySteps = [
  new ScenarioOutput("introduction", MESSAGES.introduction, { header: true }),
  new ScenarioInput("confirmDeployment", MESSAGES.confirmDeployment, {
    type: "confirm",
  }),
  new ScenarioAction(
    "handleConfirmDeployment",
    (c) => c.confirmDeployment === false && process.exit(),
  ),
  new ScenarioOutput(
    "creatingTable",
    MESSAGES.creatingTable.replace("${TABLE_NAME}", NAMES.tableName),
  ),
  new ScenarioAction("createTable", async () => {
    const client = new DynamoDBClient({});
    await client.send(
      new CreateTableCommand({
        TableName: NAMES.tableName,
        ProvisionedThroughput: {
          ReadCapacityUnits: 5,
          WriteCapacityUnits: 5,
        },
        AttributeDefinitions: [
          {
            AttributeName: "MediaType",
            AttributeType: "S",
          },
          {
            AttributeName: "LastModifiedTime",
            AttributeType: "N",
          },
        ],
      })
    );
  })
];
```

```
        AttributeName: "ItemId",
        AttributeType: "N",
    },
],
KeySchema: [
{
    AttributeName: "MediaType",
    KeyType: "HASH",
},
{
    AttributeName: "ItemId",
    KeyType: "RANGE",
},
],
}),
);
await waitUntilTableExists({ client }, { TableName: NAMES.tableName });
}),
new ScenarioOutput(
"createdTable",
MESSAGES.createdTable.replace("${TABLE_NAME}", NAMES.tableName),
),
new ScenarioOutput(
"populatingTable",
MESSAGES.populatingTable.replace("${TABLE_NAME}", NAMES.tableName),
),
new ScenarioAction("populateTable", () => {
const client = new DynamoDBClient({});
/**
 * @type {{ default: import("@aws-sdk/client-dynamodb").PutRequest['Item'] []}}
 */
const recommendations = JSON.parse(
readFileSync(join(RESOURCES_PATH, "recommendations.json"))),
);

return client.send(
new BatchWriteItemCommand({
RequestItems: [
[NAMES.tableName]: recommendations.map((item) => ({
PutRequest: { Item: item },
})),
],
}),
),
});
```

```
        );
    }),
    new ScenarioOutput(
        "populatedTable",
        MESSAGES.populatedTable.replace("${TABLE_NAME}", NAMES.tableName),
    ),
    new ScenarioOutput(
        "creatingKeyPair",
        MESSAGES.creatingKeyPair.replace("${KEY_PAIR_NAME}", NAMES.keyPairName),
    ),
    new ScenarioAction("createKeyPair", async () => {
        const client = new EC2Client({});
        const { KeyMaterial } = await client.send(
            new CreateKeyPairCommand({
                KeyName: NAMES.keyPairName,
            }),
        );
    });

    writeFileSync(`.${NAMES.keyPairName}.pem`, KeyMaterial, { mode: 0o600 });
}),
new ScenarioOutput(
    "createdKeyPair",
    MESSAGES.createdKeyPair.replace("${KEY_PAIR_NAME}", NAMES.keyPairName),
),
new ScenarioOutput(
    "creatingInstancePolicy",
    MESSAGES.creatingInstancePolicy.replace(
        "${INSTANCE_POLICY_NAME}",
        NAMES.instancePolicyName,
    ),
),
new ScenarioAction("createInstancePolicy", async (state) => {
    const client = new IAMClient({});
    const {
        Policy: { Arn },
    } = await client.send(
        new CreatePolicyCommand({
            PolicyName: NAMES.instancePolicyName,
            PolicyDocument: readFileSync(
                join(RESOURCES_PATH, "instance_policy.json"),
            ),
        }),
    );
    state.instancePolicyArn = Arn;
```

```
}),
new ScenarioOutput("createdInstancePolicy", (state) =>
  MESSAGES.createdInstancePolicy
    .replace("${INSTANCE_POLICY_NAME}", NAMES.instancePolicyName)
    .replace("${INSTANCE_POLICY_ARN}", state.instancePolicyArn),
),
new ScenarioOutput(
  "creatingInstanceRole",
  MESSAGES.creatingInstanceRole.replace(
    "${INSTANCE_ROLE_NAME}",
    NAMES.instanceRoleName,
  ),
),
new ScenarioAction("createInstanceRole", () => {
  const client = new IAMClient({});
  return client.send(
    new CreateRoleCommand({
      RoleName: NAMES.instanceRoleName,
      AssumeRolePolicyDocument: readFileSync(
        join(ROOT, "assume-role-policy.json"),
      ),
    }),
  );
}),
new ScenarioOutput(
  "createdInstanceRole",
  MESSAGES.createdInstanceRole.replace(
    "${INSTANCE_ROLE_NAME}",
    NAMES.instanceRoleName,
  ),
),
new ScenarioOutput(
  "attachingPolicyToRole",
  MESSAGES.attachingPolicyToRole
    .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName)
    .replace("${INSTANCE_POLICY_NAME}", NAMES.instancePolicyName),
),
new ScenarioAction("attachPolicyToRole", async (state) => {
  const client = new IAMClient({});
  await client.send(
    new AttachRolePolicyCommand({
      RoleName: NAMES.instanceRoleName,
      PolicyArn: state.instancePolicyArn,
    }),
  );
});
```

```
        );
    }),
    new ScenarioOutput(
        "attachedPolicyToRole",
        MESSAGES.attachedPolicyToRole
            .replace("${INSTANCE_POLICY_NAME}", NAMES.instancePolicyName)
            .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName),
    ),
    new ScenarioOutput(
        "creatingInstanceProfile",
        MESSAGES.creatingInstanceProfile.replace(
            "${INSTANCE_PROFILE_NAME}",
            NAMES.instanceProfileName,
        ),
    ),
    new ScenarioAction("createInstanceProfile", async (state) => {
        const client = new IAMClient({});
        const {
            InstanceProfile: { Arn },
        } = await client.send(
            new CreateInstanceProfileCommand({
                InstanceProfileName: NAMES.instanceProfileName,
            }),
        );
        state.instanceProfileArn = Arn;

        await waitUntilInstanceProfileExists(
            { client },
            { InstanceProfileName: NAMES.instanceProfileName },
        );
    }),
    new ScenarioOutput("createdInstanceProfile", (state) =>
        MESSAGES.createdInstanceProfile
            .replace("${INSTANCE_PROFILE_NAME}", NAMES.instanceProfileName)
            .replace("${INSTANCE_PROFILE_ARN}", state.instanceProfileArn),
    ),
    new ScenarioOutput(
        "addingRoleToInstanceProfile",
        MESSAGES.addingRoleToInstanceProfile
            .replace("${INSTANCE_PROFILE_NAME}", NAMES.instanceProfileName)
            .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName),
    ),
    new ScenarioAction("addRoleToInstanceProfile", () => {
        const client = new IAMClient({});
```

```
        return client.send(
            new AddRoleToInstanceProfileCommand({
                RoleName: NAMES.instanceRoleName,
                InstanceProfileName: NAMES.instanceProfileName,
            }),
        );
    },
    new ScenarioOutput(
        "addedRoleToInstanceProfile",
        MESSAGES.addedRoleToInstanceProfile
            .replace("${INSTANCE_PROFILE_NAME}", NAMES.instanceProfileName)
            .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName),
    ),
    ...initParamsSteps,
    new ScenarioOutput("creatingLaunchTemplate", MESSAGES.creatingLaunchTemplate),
    new ScenarioAction("createLaunchTemplate", async () => {
        // snippet-start:[javascript.v3.wkflw.resilient.CreateLaunchTemplate]
        const ssmClient = new SSMClient({});

        const { Parameter } = await ssmClient.send(
            new GetParameterCommand({
                Name: "/aws/service/ami-amazon-linux-latest/amzn2-ami-hvm-x86_64-gp2",
            }),
        );
        const ec2Client = new EC2Client({});

        await ec2Client.send(
            new CreateLaunchTemplateCommand({
                LaunchTemplateName: NAMES.launchTemplateName,
                LaunchTemplateData: {
                    InstanceType: "t3.micro",
                    ImageId: Parameter.Value,
                    IamInstanceProfile: { Name: NAMES.instanceProfileName },
                    UserData: readFileSync(
                        join(RESOURCES_PATH, "server_startup_script.sh"),
                        ).toString("base64"),
                    KeyName: NAMES.keyPairName,
                },
            }),
        );
        // snippet-end:[javascript.v3.wkflw.resilient.CreateLaunchTemplate]
    });
},
new ScenarioOutput(
    "createdLaunchTemplate",
    MESSAGES.createdLaunchTemplate.replace(
        "${LAUNCH_TEMPLATE_NAME}",
```

```
        NAMES.launchTemplateName,
    ),
),
),
new ScenarioOutput(
    "creatingAutoScalingGroup",
MESSAGES.creatingAutoScalingGroup.replace(
    "${AUTO_SCALING_GROUP_NAME}",
    NAMES.autoScalingGroupName,
),
),
new ScenarioAction("createAutoScalingGroup", async (state) => {
    const ec2Client = new EC2Client({});
    const { AvailabilityZones } = await ec2Client.send(
        new DescribeAvailabilityZonesCommand({})
    );
    state.availabilityZoneNames = AvailabilityZones.map((az) => az.ZoneName);
    const autoScalingClient = new AutoScalingClient({});
    await retry({ intervalInMs: 1000, maxRetries: 30 }, () =>
        autoScalingClient.send(
            new CreateAutoScalingGroupCommand({
                AvailabilityZones: state.availabilityZoneNames,
                AutoScalingGroupName: NAMES.autoScalingGroupName,
                LaunchTemplate: {
                    LaunchTemplateName: NAMES.launchTemplateName,
                    Version: "$Default",
                },
                MinSize: 3,
                MaxSize: 3,
            }),
        ),
    );
}),
new ScenarioOutput(
    "createdAutoScalingGroup",
    /**
     * @param {{ availabilityZoneNames: string[] }} state
     */
    (state) =>
        MESSAGES.createdAutoScalingGroup
            .replace("${AUTO_SCALING_GROUP_NAME}", NAMES.autoScalingGroupName)
            .replace("${AVAILABILITY_ZONE_NAMES}",
                state.availabilityZoneNames.join(", ")),
    ),
)
```

```
),
new ScenarioInput("confirmContinue", MESSAGES.confirmContinue, {
  type: "confirm",
}),
new ScenarioOutput("loadBalancer", MESSAGES.loadBalancer),
new ScenarioOutput("gettingVpc", MESSAGES.gettingVpc),
new ScenarioAction("getVpc", async (state) => {
  // snippet-start:[javascript.v3.wkflw.resilient.DescribeVpcs]
  const client = new EC2Client({});
  const { Vpcs } = await client.send(
    new DescribeVpcsCommand({
      Filters: [{ Name: "is-default", Values: ["true"] }],
    }),
  );
  // snippet-end:[javascript.v3.wkflw.resilient.DescribeVpcs]
  state.defaultVpc = Vpcs[0].VpcId;
}),
new ScenarioOutput("gotVpc", (state) =>
  MESSAGES.gotVpc.replace("${VPC_ID}", state.defaultVpc),
),
new ScenarioOutput("gettingSubnets", MESSAGES.gettingSubnets),
new ScenarioAction("getSubnets", async (state) => {
  // snippet-start:[javascript.v3.wkflw.resilient.DescribeSubnets]
  const client = new EC2Client({});
  const { Subnets } = await client.send(
    new DescribeSubnetsCommand({
      Filters: [
        { Name: "vpc-id", Values: [state.defaultVpc] },
        { Name: "availability-zone", Values: state.availabilityZoneNames },
        { Name: "default-for-az", Values: ["true"] },
      ],
    }),
  );
  // snippet-end:[javascript.v3.wkflw.resilient.DescribeSubnets]
  state.subnets = Subnets.map((subnet) => subnet.SubnetId);
}),
new ScenarioOutput(
  "gotSubnets",
  /**
   * @param {{ subnets: string[] }} state
   */
  (state) =>
  MESSAGES.gotSubnets.replace("${SUBNETS}", state.subnets.join(", ")),
),
```

```
new ScenarioOutput(
    "creatingLoadBalancerTargetGroup",
    MESSAGES.creatingLoadBalancerTargetGroup.replace(
        "${TARGET_GROUP_NAME}",
        NAMES.loadBalancerTargetGroupName,
    ),
),
new ScenarioAction("createLoadBalancerTargetGroup", async (state) => {
    // snippet-start:[javascript.v3.wkflw.resilient.CreateTargetGroup]
    const client = new ElasticLoadBalancingV2Client({});
    const { TargetGroups } = await client.send(
        new CreateTargetGroupCommand({
            Name: NAMES.loadBalancerTargetGroupName,
            Protocol: "HTTP",
            Port: 80,
            HealthCheckPath: "/healthcheck",
            HealthCheckIntervalSeconds: 10,
            HealthCheckTimeoutSeconds: 5,
            HealthyThresholdCount: 2,
            UnhealthyThresholdCount: 2,
            VpcId: state.defaultVpc,
        }),
    );
    // snippet-end:[javascript.v3.wkflw.resilient.CreateTargetGroup]
    const targetGroup = TargetGroups[0];
    state.targetGroupArn = targetGroup.TargetGroupArn;
    state.targetGroupProtocol = targetGroup.Protocol;
    state.targetGroupPort = targetGroup.Port;
}),
new ScenarioOutput(
    "createdLoadBalancerTargetGroup",
    MESSAGES.createdLoadBalancerTargetGroup.replace(
        "${TARGET_GROUP_NAME}",
        NAMES.loadBalancerTargetGroupName,
    ),
),
new ScenarioOutput(
    "creatingLoadBalancer",
    MESSAGES.creatingLoadBalancer.replace("${LB_NAME}", NAMES.loadBalancerName),
),
new ScenarioAction("createLoadBalancer", async (state) => {
    // snippet-start:[javascript.v3.wkflw.resilient.CreateLoadBalancer]
    const client = new ElasticLoadBalancingV2Client({});
    const { LoadBalancers } = await client.send(
```

```
        new CreateLoadBalancerCommand({
            Name: NAMES.loadBalancerName,
            Subnets: state.subnets,
        }),
    );
    state.loadBalancerDns = LoadBalancers[0].DNSName;
    state.loadBalancerArn = LoadBalancers[0].LoadBalancerArn;
    await waitUntilLoadBalancerAvailable(
        { client },
        { Names: [NAMES.loadBalancerName] },
    );
    // snippet-end:[javascript.v3.wkflw.resilient.CreateLoadBalancer]
},
new ScenarioOutput("createdLoadBalancer", (state) =>
MESSAGES.createdLoadBalancer
    .replace("${LB_NAME}", NAMES.loadBalancerName)
    .replace("${DNS_NAME}", state.loadBalancerDns),
),
new ScenarioOutput(
    "creatingListener",
MESSAGES.creatingLoadBalancerListener
    .replace("${LB_NAME}", NAMES.loadBalancerName)
    .replace("${TARGET_GROUP_NAME}", NAMES.loadBalancerTargetGroupName),
),
new ScenarioAction("createListener", async (state) => {
// snippet-start:[javascript.v3.wkflw.resilient.CreateListener]
const client = new ElasticLoadBalancingV2Client({});
const { Listeners } = await client.send(
    new CreateListenerCommand({
        LoadBalancerArn: state.loadBalancerArn,
        Protocol: state.targetGroupProtocol,
        Port: state.targetGroupPort,
        DefaultActions: [
            { Type: "forward", TargetGroupArn: state.targetGroupArn },
        ],
    }),
);
// snippet-end:[javascript.v3.wkflw.resilient.CreateListener]
const listener = Listeners[0];
state.loadBalancerListenerArn = listener.ListenerArn;
}),
new ScenarioOutput("createdListener", (state) =>
MESSAGES.createdLoadBalancerListener.replace(
    "${LB_LISTENER_ARN}",

```

```
        state.loadBalancerListenerArn,
    ),
),
new ScenarioOutput(
    "attachingLoadBalancerTargetGroup",
MESSAGES.attachingLoadBalancerTargetGroup
    .replace("${TARGET_GROUP_NAME}", NAMES.loadBalancerTargetGroupName)
    .replace("${AUTO_SCALING_GROUP_NAME}", NAMES.autoScalingGroupName),
),
new ScenarioAction("attachLoadBalancerTargetGroup", async (state) => {
    // snippet-start:[javascript.v3.wkflw.resilient.AttachTargetGroup]
    const client = new AutoScalingClient({});
    await client.send(
        new AttachLoadBalancerTargetGroupsCommand({
            AutoScalingGroupName: NAMES.autoScalingGroupName,
            TargetGroupARNs: [state.targetGroupArn],
        }),
    );
    // snippet-end:[javascript.v3.wkflw.resilient.AttachTargetGroup]
}),
new ScenarioOutput(
    "attachedLoadBalancerTargetGroup",
MESSAGES.attachedLoadBalancerTargetGroup,
),
new ScenarioOutput("verifyingInboundPort", MESSAGES.verifyingInboundPort),
new ScenarioAction(
    "verifyInboundPort",
    /**
     *
     * @param {{ defaultSecurityGroup: import('@aws-sdk/client-
     ec2').SecurityGroup}} state
     */
    async (state) => {
        const client = new EC2Client({});
        const { SecurityGroups } = await client.send(
            new DescribeSecurityGroupsCommand({
                Filters: [{ Name: "group-name", Values: ["default"] }],
            }),
        );
        if (!SecurityGroups) {
            state.verifyInboundPortError = new Error(MESSAGES.noSecurityGroups);
        }
        state.defaultSecurityGroup = SecurityGroups[0];
    }
);
```

```
/**
 * @type {string}
 */
const ipResponse = (await axios.get("http://checkip.amazonaws.com")).data;
state.myIp = ipResponse.trim();
const myIpRules = state.defaultSecurityGroup.IpPermissions.filter(
  ({ IpRanges }) =>
    IpRanges.some(
      ({ CidrIp }) =>
        CidrIp.startsWith(state.myIp) || CidrIp === "0.0.0.0/0",
    ),
)
.filter(({ IpProtocol }) => IpProtocol === "tcp")
.filter(({ FromPort }) => FromPort === 80);

state.myIpRules = myIpRules;
},
),
new ScenarioOutput(
  "verifiedInboundPort",
 /**
  * @param {{ myIpRules: any[] }} state
  */
(state) => {
  if (state.myIpRules.length > 0) {
    return MESSAGES.foundIpRules.replace(
      "${IP_RULES}",
      JSON.stringify(state.myIpRules, null, 2),
    );
  } else {
    return MESSAGES.noIpRules;
  }
},
),
new ScenarioInput(
  "shouldAddInboundRule",
 /**
  * @param {{ myIpRules: any[] }} state
  */
(state) => {
  if (state.myIpRules.length > 0) {
    return false;
  } else {
    return MESSAGES.noIpRules;
  }
});
```

```
        }
    },
    { type: "confirm" },
),
new ScenarioAction(
    "addInboundRule",
    /**
     * @param {{ defaultSecurityGroup: import('@aws-sdk/client-
ec2').SecurityGroup }} state
     */
    async (state) => {
        if (!state.shouldAddInboundRule) {
            return;
        }

        const client = new EC2Client({});
        await client.send(
            new AuthorizeSecurityGroupIngressCommand({
                GroupId: state.defaultSecurityGroup.GroupId,
                CidrIp: `${state.myIp}/32`,
                FromPort: 80,
                ToPort: 80,
                IpProtocol: "tcp",
            }),
        );
    },
),
new ScenarioOutput("addedInboundRule", (state) => {
    if (state.shouldAddInboundRule) {
        return MESSAGES.addedInboundRule.replace("${IP_ADDRESS}", state.myIp);
    } else {
        return false;
    }
}),
new ScenarioOutput("verifyingEndpoint", (state) =>
    MESSAGES.verifyingEndpoint.replace("${DNS_NAME}", state.loadBalancerDns),
),
new ScenarioAction("verifyEndpoint", async (state) => {
    try {
        const response = await retry({ intervalInMs: 2000, maxRetries: 30 }, () =>
            axios.get(`http://${state.loadBalancerDns}`),
        );
        state.endpointResponse = JSON.stringify(response.data, null, 2);
    } catch (e) {
```

```
        state.verifyEndpointError = e;
    }
}),
new ScenarioOutput("verifiedEndpoint", (state) => {
    if (state.verifyEndpointError) {
        console.error(state.verifyEndpointError);
    } else {
        return MESSAGES.verifiedEndpoint.replace(
            "${ENDPOINT_RESPONSE}",
            state.endpointResponse,
        );
    }
}),
];

```

Create steps to run the demo.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0
import { readFileSync } from "node:fs";
import { join } from "node:path";

import axios from "axios";

import {
    DescribeTargetGroupsCommand,
    DescribeTargetHealthCommand,
    ElasticLoadBalancingV2Client,
} from "@aws-sdk/client-elastic-load-balancing-v2";
import {
    DescribeInstanceInformationCommand,
    PutParameterCommand,
    SSMClient,
    SendCommandCommand,
} from "@aws-sdk/client-ssm";
import {
    IAMClient,
    CreatePolicyCommand,
    CreateRoleCommand,
    AttachRolePolicyCommand,
    CreateInstanceProfileCommand,
    AddRoleToInstanceProfileCommand,
```

```
    waitUntilInstanceProfileExists,
} from "@aws-sdk/client-iam";
import {
  AutoScalingClient,
  DescribeAutoScalingGroupsCommand,
  TerminateInstanceInAutoScalingGroupCommand,
} from "@aws-sdk/client-auto-scaling";
import {
  DescribeIamInstanceProfileAssociationsCommand,
  EC2Client,
  RebootInstancesCommand,
  ReplaceIamInstanceProfileAssociationCommand,
} from "@aws-sdk/client-ec2";

import {
  ScenarioAction,
  ScenarioInput,
  ScenarioOutput,
} from "@aws-doc-sdk-examples/lib/scenario/scenario.js";
import { retry } from "@aws-doc-sdk-examples/lib/utils/util-timers.js";

import { MESSAGES, NAMES, RESOURCES_PATH } from "./constants.js";
import { findLoadBalancer } from "./shared.js";

const getRecommendation = new ScenarioAction(
  "getRecommendation",
  async (state) => {
    const loadBalancer = await findLoadBalancer(NAMES.loadBalancerName);
    if (loadBalancer) {
      state.loadBalancerDnsName = loadBalancer.DNSName;
      try {
        state.recommendation = (
          await axios.get(`http://${state.loadBalancerDnsName}`)
        ).data;
      } catch (e) {
        state.recommendation = e instanceof Error ? e.message : e;
      }
    } else {
      throw new Error(MESSAGES.demoFindLoadBalancerError);
    }
  },
);

const getRecommendationResult = new ScenarioOutput(
```

```
"getRecommendationResult",
(state) =>
  `Recommendation:\n${JSON.stringify(state.recommendation, null, 2)}`,
  { preformatted: true },
);

const getHealthCheck = new ScenarioAction("getHealthCheck", async (state) => {
  // snippet-start:[javascript.v3.wkflw.resilient.DescribeTargetGroups]
  const client = new ElasticLoadBalancingV2Client({});
  const { TargetGroups } = await client.send(
    new DescribeTargetGroupsCommand({
      Names: [NAMES.loadBalancerTargetGroupName],
    }),
  );
  // snippet-end:[javascript.v3.wkflw.resilient.DescribeTargetGroups]

  // snippet-start:[javascript.v3.wkflw.resilient.DescribeTargetHealth]
  const { TargetHealthDescriptions } = await client.send(
    new DescribeTargetHealthCommand({
      TargetGroupArn: TargetGroups[0].TargetGroupArn,
    }),
  );
  // snippet-end:[javascript.v3.wkflw.resilient.DescribeTargetHealth]
  state.targetHealthDescriptions = TargetHealthDescriptions;
});

const getHealthCheckResult = new ScenarioOutput(
  "getHealthCheckResult",
  /**
   * @param {{ targetHealthDescriptions: import('@aws-sdk/client-elastic-load-balancing-v2').TargetHealthDescription[]}} state
   */
  (state) => {
    const status = state.targetHealthDescriptions
      .map((th) => `${th.Target.Id}: ${th.TargetHealth.State}`)
      .join("\n");
    return `Health check:\n${status}`;
  },
  { preformatted: true },
);

const loadBalancerLoop = new ScenarioAction(
  "loadBalancerLoop",
  getRecommendation.action,
```

```
{  
  whileConfig: {  
    whileFn: ({ loadBalancerCheck }) => loadBalancerCheck,  
    input: new ScenarioInput(  
      "loadBalancerCheck",  
      MESSAGES.demoLoadBalancerCheck,  
      {  
        type: "confirm",  
      },  
    ),  
    output: getRecommendationResult,  
  },  
},  
);  
  
const healthCheckLoop = new ScenarioAction(  
  "healthCheckLoop",  
  getHealthCheck.action,  
  {  
    whileConfig: {  
      whileFn: ({ healthCheck }) => healthCheck,  
      input: new ScenarioInput("healthCheck", MESSAGES.demoHealthCheck, {  
        type: "confirm",  
      }),  
      output: getHealthCheckResult,  
    },  
  },  
);  
  
const statusSteps = [  
  getRecommendation,  
  getRecommendationResult,  
  getHealthCheck,  
  getHealthCheckResult,  
];  
  
/**  
 * @type {import('@aws-doc-sdk-examples/lib/scenario.js').Step[]}  
 */  
export const demoSteps = [  
  new ScenarioOutput("header", MESSAGES.demoHeader, { header: true }),  
  new ScenarioOutput("sanityCheck", MESSAGES.demoSanityCheck),  
  ...statusSteps,  
  new ScenarioInput(
```

```
"brokenDependencyConfirmation",
MESSAGES.demoBrokenDependencyConfirmation,
{ type: "confirm" },
),
new ScenarioAction("brokenDependency", async (state) => {
  if (!state.brokenDependencyConfirmation) {
    process.exit();
  } else {
    const client = new SSMClient({});
    state.badTableName = `fake-table-${Date.now()}`;
    await client.send(
      new PutParameterCommand({
        Name: NAMES.ssmTableNameKey,
        Value: state.badTableName,
        Overwrite: true,
        Type: "String",
      }),
    );
  }
}),
new ScenarioOutput("testBrokenDependency", (state) =>
  MESSAGES.demoTestBrokenDependency.replace(
    "${TABLE_NAME}",
    state.badTableName,
  ),
),
...statusSteps,
new ScenarioInput(
  "staticResponseConfirmation",
  MESSAGES.demoStaticResponseConfirmation,
  { type: "confirm" },
),
new ScenarioAction("staticResponse", async (state) => {
  if (!state.staticResponseConfirmation) {
    process.exit();
  } else {
    const client = new SSMClient({});
    await client.send(
      new PutParameterCommand({
        Name: NAMES.ssmFailureResponseKey,
        Value: "static",
        Overwrite: true,
        Type: "String",
      }),
    );
  }
});
```

```
        );
    }
}),
new ScenarioOutput("testStaticResponse", MESSAGES.demoTestStaticResponse),
...statusSteps,
new ScenarioInput(
    "badCredentialsConfirmation",
    MESSAGES.demoBadCredentialsConfirmation,
    { type: "confirm" },
),
new ScenarioAction("badCredentialsExit", (state) => {
    if (!state.badCredentialsConfirmation) {
        process.exit();
    }
}),
new ScenarioAction("fixDynamoDBName", async () => {
    const client = new SSMClient({});
    await client.send(
        new PutParameterCommand({
            Name: NAMES.ssmTableNameKey,
            Value: NAMES.tableName,
            Overwrite: true,
            Type: "String",
        }),
    );
}),
new ScenarioAction(
    "badCredentials",
    /**
     * @param {{ targetInstance: import('@aws-sdk/client-auto-scaling').Instance }} state
     */
    async (state) => {
        await createSsmOnlyInstanceProfile();
        const autoScalingClient = new AutoScalingClient({});
        const { AutoScalingGroups } = await autoScalingClient.send(
            new DescribeAutoScalingGroupsCommand({
                AutoScalingGroupNames: [NAMES.autoScalingGroupName],
            }),
        );
        state.targetInstance = AutoScalingGroups[0].Instances[0];
        // snippet-start:
[javascript.v3.wkflw.resilient.DescribeIamInstanceProfileAssociations]
        const ec2Client = new EC2Client({});
```

```
const { IamInstanceProfileAssociations } = await ec2Client.send(
  new DescribeIamInstanceProfileAssociationsCommand({
    Filters: [
      { Name: "instance-id", Values: [state.targetInstance.InstanceId] },
    ],
  }),
);
// snippet-end:
[javascript.v3.wkflw.resilient.DescribeIamInstanceProfileAssociations]
  state.instanceProfileAssociationId =
    IamInstanceProfileAssociations[0].AssociationId;
// snippet-start:
[javascript.v3.wkflw.resilient.ReplaceIamInstanceProfileAssociation]
  await retry({ intervalInMs: 1000, maxRetries: 30 }, () =>
  ec2Client.send(
    new ReplaceIamInstanceProfileAssociationCommand({
      AssociationId: state.instanceProfileAssociationId,
      IamInstanceProfile: { Name: NAMES.ssmOnlyInstanceProfileName },
    }),
  ),
);
// snippet-end:
[javascript.v3.wkflw.resilient.ReplaceIamInstanceProfileAssociation]

  await ec2Client.send(
    new RebootInstancesCommand({
      InstanceIds: [state.targetInstance.InstanceId],
    }),
  );

  const ssmClient = new SSMClient({});
  await retry({ intervalInMs: 20000, maxRetries: 15 }, async () => {
    const { InstanceInformationList } = await ssmClient.send(
      new DescribeInstanceInformationCommand({}),
    );

    const instance = InstanceInformationList.find(
      (info) => info.InstanceId === state.targetInstance.InstanceId,
    );

    if (!instance) {
      throw new Error("Instance not found.");
    }
  });
}
```

```
        await ssmClient.send(
            new SendCommandCommand({
                InstanceIds: [state.targetInstance.InstanceId],
                DocumentName: "AWS-RunShellScript",
                Parameters: { commands: ["cd / && sudo python3 server.py 80"] },
            }),
        );
    },
),
new ScenarioOutput(
    "testBadCredentials",
    /**
     * @param {{ targetInstance: import('@aws-sdk/client-ssm').InstanceInformation}} state
     */
    (state) =>
        MESSAGES.demoTestBadCredentials.replace(
            "${INSTANCE_ID}",
            state.targetInstance.InstanceId,
        ),
),
loadBalancerLoop,
new ScenarioInput(
    "deepHealthCheckConfirmation",
    MESSAGES.demoDeepHealthCheckConfirmation,
    { type: "confirm" },
),
new ScenarioAction("deepHealthCheckExit", (state) => {
    if (!state.deepHealthCheckConfirmation) {
        process.exit();
    }
}),
new ScenarioAction("deepHealthCheck", async () => {
    const client = new SSMClient({});
    await client.send(
        new PutParameterCommand({
            Name: NAMES.ssmHealthCheckKey,
            Value: "deep",
            Overwrite: true,
            Type: "String",
        }),
    );
}),
});
```

```
new ScenarioOutput("testDeepHealthCheck", MESSAGES.demoTestDeepHealthCheck),
healthCheckLoop,
loadBalancerLoop,
new ScenarioInput(
    "killInstanceConfirmation",
    /**
     * @param {{ targetInstance: import('@aws-sdk/client-
ssm').InstanceInformation }} state
    */
    (state) =>
        MESSAGES.demoKillInstanceConfirmation.replace(
            "${INSTANCE_ID}",
            state.targetInstance.InstanceId,
        ),
        { type: "confirm" },
),
new ScenarioAction("killInstanceExit", (state) => {
    if (!state.killInstanceConfirmation) {
        process.exit();
    }
}),
new ScenarioAction(
    "killInstance",
    /**
     * @param {{ targetInstance: import('@aws-sdk/client-
ssm').InstanceInformation }} state
    */
    async (state) => {
        const client = new AutoScalingClient({});
        await client.send(
            new TerminateInstanceInAutoScalingGroupCommand({
                InstanceId: state.targetInstance.InstanceId,
                ShouldDecrementDesiredCapacity: false,
            }),
        );
    },
),
new ScenarioOutput("testKillInstance", MESSAGES.demoTestKillInstance),
healthCheckLoop,
loadBalancerLoop,
new ScenarioInput("failOpenConfirmation", MESSAGES.demoFailOpenConfirmation, {
    type: "confirm",
}),
new ScenarioAction("failOpenExit", (state) => {
```

```
        if (!state.failOpenConfirmation) {
            process.exit();
        }
    ),
    new ScenarioAction("failOpen", () => {
        const client = new SSMClient({});
        return client.send(
            new PutParameterCommand({
                Name: NAMES.ssmTableNameKey,
                Value: `fake-table-${Date.now()}`,
                Overwrite: true,
                Type: "String",
            }),
        );
    },
    new ScenarioOutput("testFailOpen", MESSAGES.demoFailOpenTest),
    healthCheckLoop,
    loadBalancerLoop,
    new ScenarioInput(
        "resetTableConfirmation",
        MESSAGES.demoResetTableConfirmation,
        { type: "confirm" },
    ),
    new ScenarioAction("resetTableExit", (state) => {
        if (!state.resetTableConfirmation) {
            process.exit();
        }
    },
    new ScenarioAction("resetTable", async () => {
        const client = new SSMClient({});
        await client.send(
            new PutParameterCommand({
                Name: NAMES.ssmTableNameKey,
                Value: NAMES.tableName,
                Overwrite: true,
                Type: "String",
            }),
        );
    },
    new ScenarioOutput("testResetTable", MESSAGES.demoTestResetTable),
    healthCheckLoop,
    loadBalancerLoop,
];

```

```
async function createSsmOnlyInstanceProfile() {
    const iamClient = new IAMClient({});
    const { Policy } = await iamClient.send(
        new CreatePolicyCommand({
            PolicyName: NAMES.ssmOnlyPolicyName,
            PolicyDocument: readFileSync(
                join(RESOURCES_PATH, "ssm_only_policy.json"),
            ),
        }),
    );
    await iamClient.send(
        new CreateRoleCommand({
            RoleName: NAMES.ssmOnlyRoleName,
            AssumeRolePolicyDocument: JSON.stringify({
                Version: "2012-10-17",
                Statement: [
                    {
                        Effect: "Allow",
                        Principal: { Service: "ec2.amazonaws.com" },
                        Action: "sts:AssumeRole",
                    },
                ],
            }),
        }),
    );
    await iamClient.send(
        new AttachRolePolicyCommand({
            RoleName: NAMES.ssmOnlyRoleName,
            PolicyArn: Policy.Arn,
        }),
    );
    await iamClient.send(
        new AttachRolePolicyCommand({
            RoleName: NAMES.ssmOnlyRoleName,
            PolicyArn: "arn:aws:iam::aws:policy/AmazonSSMManagedInstanceCore",
        }),
    );
    // snippet-start:[javascript.v3.wkflw.resilient.CreateInstanceProfile]
    const { InstanceProfile } = await iamClient.send(
        new CreateInstanceProfileCommand({
            InstanceProfileName: NAMES.ssmOnlyInstanceProfileName,
        }),
    );
    await waitUntilInstanceProfileExists(  
}
```

```
{ client: iamClient },
  { InstanceProfileName: NAMES.ssmOnlyInstanceProfileName },
);
// snippet-end:[javascript.v3.wkflw.resilient.CreateInstanceProfile]
await iamClient.send(
  new AddRoleToInstanceProfileCommand({
    InstanceProfileName: NAMES.ssmOnlyInstanceProfileName,
    RoleName: NAMES.ssmOnlyRoleName,
  }),
);
return InstanceProfile;
}
```

Create steps to destroy all of the resources.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0
import { unlinkSync } from "node:fs";

import { DynamoDBClient, DeleteTableCommand } from "@aws-sdk/client-dynamodb";
import {
  EC2Client,
  DeleteKeyPairCommand,
  DeleteLaunchTemplateCommand,
} from "@aws-sdk/client-ec2";
import {
  IAMClient,
  DeleteInstanceProfileCommand,
  RemoveRoleFromInstanceProfileCommand,
  DeletePolicyCommand,
  DeleteRoleCommand,
  DetachRolePolicyCommand,
  paginateListPolicies,
} from "@aws-sdk/client-iam";
import {
  AutoScalingClient,
  DeleteAutoScalingGroupCommand,
  TerminateInstanceInAutoScalingGroupCommand,
  UpdateAutoScalingGroupCommand,
  paginateDescribeAutoScalingGroups,
} from "@aws-sdk/client-auto-scaling";
```

```
import {
  DeleteLoadBalancerCommand,
  DeleteTargetGroupCommand,
  DescribeTargetGroupsCommand,
  ElasticLoadBalancingV2Client,
} from "@aws-sdk/client-elastic-load-balancing-v2";

import {
  ScenarioOutput,
  ScenarioInput,
  ScenarioAction,
} from "@aws-doc-sdk-examples/lib/scenario/index.js";
import { retry } from "@aws-doc-sdk-examples/lib/utils/util-timers.js";

import { MESSAGES, NAMES } from "./constants.js";
import { findLoadBalancer } from "./shared.js";

/**
 * @type {import('@aws-doc-sdk-examples/lib/scenario.js').Step[]}
 */
export const destroySteps = [
  new ScenarioInput("destroy", MESSAGES.destroy, { type: "confirm" }),
  new ScenarioAction(
    "abort",
    (state) => state.destroy === false && process.exit(),
  ),
  new ScenarioAction("deleteTable", async (c) => {
    try {
      const client = new DynamoDBClient({});
      await client.send(new DeleteTableCommand({ TableName: NAMES.tableName }));
    } catch (e) {
      c.deleteTableError = e;
    }
  }),
  new ScenarioOutput("deleteTableResult", (state) => {
    if (state.deleteTableError) {
      console.error(state.deleteTableError);
      return MESSAGES.deleteTableError.replace(
        "${TABLE_NAME}",
        NAMES.tableName,
      );
    } else {
      return MESSAGES.deletedTable.replace("${TABLE_NAME}", NAMES.tableName);
    }
  })
];
```

```
}),
new ScenarioAction("deleteKeyPair", async (state) => {
    try {
        const client = new EC2Client({});
        await client.send(
            new DeleteKeyPairCommand({ KeyName: NAMES.keyPairName }),
        );
        unlinkSync(`.${NAMES.keyPairName}.pem`);
    } catch (e) {
        state.deleteKeyPairError = e;
    }
}),
new ScenarioOutput("deleteKeyPairResult", (state) => {
    if (state.deleteKeyPairError) {
        console.error(state.deleteKeyPairError);
        return MESSAGES.deleteKeyPairError.replace(
            "${KEY_PAIR_NAME}",
            NAMES.keyPairName,
        );
    } else {
        return MESSAGES.deletedKeyPair.replace(
            "${KEY_PAIR_NAME}",
            NAMES.keyPairName,
        );
    }
}),
new ScenarioAction("detachPolicyFromRole", async (state) => {
    try {
        const client = new IAMClient({});
        const policy = await findPolicy(NAMES.instancePolicyName);

        if (!policy) {
            state.detachPolicyFromRoleError = new Error(
                `Policy ${NAMES.instancePolicyName} not found.`,
            );
        } else {
            await client.send(
                new DetachRolePolicyCommand({
                    RoleName: NAMES.instanceRoleName,
                    PolicyArn: policy.Arn,
                }),
            );
        }
    } catch (e) {
```

```
        state.detachPolicyFromRoleError = e;
    }
}),
new ScenarioOutput("detachedPolicyFromRole", (state) => {
    if (state.detachPolicyFromRoleError) {
        console.error(state.detachPolicyFromRoleError);
        return MESSAGES.detachPolicyFromRoleError
            .replace("${INSTANCE_POLICY_NAME}", NAMES.instancePolicyName)
            .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName);
    } else {
        return MESSAGES.detachedPolicyFromRole
            .replace("${INSTANCE_POLICY_NAME}", NAMES.instancePolicyName)
            .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName);
    }
}),
new ScenarioAction("deleteInstancePolicy", async (state) => {
    const client = new IAMClient({});
    const policy = await findPolicy(NAMES.instancePolicyName);

    if (!policy) {
        state.deletePolicyError = new Error(
            `Policy ${NAMES.instancePolicyName} not found.`,
        );
    } else {
        return client.send(
            new DeletePolicyCommand({
                PolicyArn: policy.Arn,
            }),
        );
    }
}),
new ScenarioOutput("deletePolicyResult", (state) => {
    if (state.deletePolicyError) {
        console.error(state.deletePolicyError);
        return MESSAGES.deletePolicyError.replace(
            "${INSTANCE_POLICY_NAME}",
            NAMES.instancePolicyName,
        );
    } else {
        return MESSAGES.deletedPolicy.replace(
            "${INSTANCE_POLICY_NAME}",
            NAMES.instancePolicyName,
        );
    }
})
```

```
}),
new ScenarioAction("removeRoleFromInstanceProfile", async (state) => {
  try {
    const client = new IAMClient({});
    await client.send(
      new RemoveRoleFromInstanceProfileCommand({
        RoleName: NAMES.instanceRoleName,
        InstanceProfileName: NAMES.instanceProfileName,
      }),
    );
  } catch (e) {
    state.removeRoleFromInstanceProfileError = e;
  }
}),
new ScenarioOutput("removeRoleFromInstanceProfileResult", (state) => {
  if (state.removeRoleFromInstanceProfile) {
    console.error(state.removeRoleFromInstanceProfileError);
    return MESSAGES.removeRoleFromInstanceProfileError
      .replace("${INSTANCE_PROFILE_NAME}", NAMES.instanceProfileName)
      .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName);
  } else {
    return MESSAGES.removedRoleFromInstanceProfile
      .replace("${INSTANCE_PROFILE_NAME}", NAMES.instanceProfileName)
      .replace("${INSTANCE_ROLE_NAME}", NAMES.instanceRoleName);
  }
}),
new ScenarioAction("deleteInstanceRole", async (state) => {
  try {
    const client = new IAMClient({});
    await client.send(
      new DeleteRoleCommand({
        RoleName: NAMES.instanceRoleName,
      }),
    );
  } catch (e) {
    state.deleteInstanceRoleError = e;
  }
}),
new ScenarioOutput("deleteInstanceRoleResult", (state) => {
  if (state.deleteInstanceRoleError) {
    console.error(state.deleteInstanceRoleError);
    return MESSAGES.deleteInstanceRoleError.replace(
      "${INSTANCE_ROLE_NAME}",
      NAMES.instanceRoleName,
    );
  }
});
```

```
        );
    } else {
        return MESSAGES.deletedInstanceRole.replace(
            "${INSTANCE_ROLE_NAME}",
            NAMES.instanceRoleName,
        );
    }
}),
new ScenarioAction("deleteInstanceProfile", async (state) => {
    try {
        // snippet-start:[javascript.v3.wkflw.resilient.DeleteInstanceProfile]
        const client = new IAMClient({});
        await client.send(
            new DeleteInstanceProfileCommand({
                InstanceProfileName: NAMES.instanceProfileName,
            }),
        );
        // snippet-end:[javascript.v3.wkflw.resilient.DeleteInstanceProfile]
    } catch (e) {
        state.deleteInstanceProfileError = e;
    }
}),
new ScenarioOutput("deleteInstanceProfileResult", (state) => {
    if (state.deleteInstanceProfileError) {
        console.error(state.deleteInstanceProfileError);
        return MESSAGES.deleteInstanceProfileError.replace(
            "${INSTANCE_PROFILE_NAME}",
            NAMES.instanceProfileName,
        );
    } else {
        return MESSAGES.deletedInstanceProfile.replace(
            "${INSTANCE_PROFILE_NAME}",
            NAMES.instanceProfileName,
        );
    }
}),
new ScenarioAction("deleteAutoScalingGroup", async (state) => {
    try {
        await terminateGroupInstances(NAMES.autoScalingGroupName);
        await retry({ intervalInMs: 60000, maxRetries: 60 }, async () => {
            await deleteAutoScalingGroup(NAMES.autoScalingGroupName);
        });
    } catch (e) {
        state.deleteAutoScalingGroupError = e;
    }
});
```

```
        },
    )),
    new ScenarioOutput("deleteAutoScalingGroupResult", (state) => {
        if (state.deleteAutoScalingGroupError) {
            console.error(state.deleteAutoScalingGroupError);
            return MESSAGES.deleteAutoScalingGroupError.replace(
                "${AUTO_SCALING_GROUP_NAME}",
                NAMES.autoScalingGroupName,
            );
        } else {
            return MESSAGES.deletedAutoScalingGroup.replace(
                "${AUTO_SCALING_GROUP_NAME}",
                NAMES.autoScalingGroupName,
            );
        }
    }),
    new ScenarioAction("deleteLaunchTemplate", async (state) => {
        const client = new EC2Client({});
        try {
            // snippet-start:[javascript.v3.wkflw.resilient.DeleteLaunchTemplate]
            await client.send(
                new DeleteLaunchTemplateCommand({
                    LaunchTemplateName: NAMES.launchTemplateName,
                }),
            );
            // snippet-end:[javascript.v3.wkflw.resilient.DeleteLaunchTemplate]
        } catch (e) {
            state.deleteLaunchTemplateError = e;
        }
    }),
    new ScenarioOutput("deleteLaunchTemplateResult", (state) => {
        if (state.deleteLaunchTemplateError) {
            console.error(state.deleteLaunchTemplateError);
            return MESSAGES.deleteLaunchTemplateError.replace(
                "${LAUNCH_TEMPLATE_NAME}",
                NAMES.launchTemplateName,
            );
        } else {
            return MESSAGES.deletedLaunchTemplate.replace(
                "${LAUNCH_TEMPLATE_NAME}",
                NAMES.launchTemplateName,
            );
        }
    }),
});
```

```
new ScenarioAction("deleteLoadBalancer", async (state) => {
  try {
    // snippet-start:[javascript.v3.wkflw.resilient.DeleteLoadBalancer]
    const client = new ElasticLoadBalancingV2Client({});
    const loadBalancer = await findLoadBalancer(NAMES.loadBalancerName);
    await client.send(
      new DeleteLoadBalancerCommand({
        LoadBalancerArn: loadBalancer.LoadBalancerArn,
      }),
    );
    await retry({ intervalInMs: 1000, maxRetries: 60 }, async () => {
      const lb = await findLoadBalancer(NAMES.loadBalancerName);
      if (lb) {
        throw new Error("Load balancer still exists.");
      }
    });
    // snippet-end:[javascript.v3.wkflw.resilient.DeleteLoadBalancer]
  } catch (e) {
    state.deleteBalancerError = e;
  }
}),
new ScenarioOutput("deleteLoadBalancerResult", (state) => {
  if (state.deleteBalancerError) {
    console.error(state.deleteBalancerError);
    return MESSAGES.deleteBalancerError.replace(
      "${LB_NAME}",
      NAMES.loadBalancerName,
    );
  } else {
    return MESSAGES.deletedLoadBalancer.replace(
      "${LB_NAME}",
      NAMES.loadBalancerName,
    );
  }
}),
new ScenarioAction("deleteLoadBalancerTargetGroup", async (state) => {
  // snippet-start:[javascript.v3.wkflw.resilient.DeleteTargetGroup]
  const client = new ElasticLoadBalancingV2Client({});
  try {
    const { TargetGroups } = await client.send(
      new DescribeTargetGroupsCommand({
        Names: [NAMES.loadBalancerTargetGroupName],
      }),
    );
  }
```

```
        await retry({ intervalInMs: 1000, maxRetries: 30 }, () =>
          client.send(
            new DeleteTargetGroupCommand({
              TargetGroupArn: TargetGroups[0].TargetGroupArn,
            }),
          ),
        );
      } catch (e) {
        state.deleteLoadBalancerTargetGroupError = e;
      }
    // snippet-end:[javascript.v3.wkflw.resilient.DeleteTargetGroup]
  },
  new ScenarioOutput("deleteLoadBalancerTargetGroupResult", (state) => {
    if (state.deleteLoadBalancerTargetGroupError) {
      console.error(state.deleteLoadBalancerTargetGroupError);
      return MESSAGES.deleteLoadBalancerTargetGroupError.replace(
        "${TARGET_GROUP_NAME}",
        NAMES.loadBalancerTargetGroupName,
      );
    } else {
      return MESSAGES.deletedLoadBalancerTargetGroup.replace(
        "${TARGET_GROUP_NAME}",
        NAMES.loadBalancerTargetGroupName,
      );
    }
  }),
  new ScenarioAction("detachSsmOnlyRoleFromProfile", async (state) => {
    try {
      const client = new IAMClient({});
      await client.send(
        new RemoveRoleFromInstanceProfileCommand({
          InstanceProfileName: NAMES.ssmOnlyInstanceProfileName,
          RoleName: NAMES.ssmOnlyRoleName,
        }),
      );
    } catch (e) {
      state.detachSsmOnlyRoleFromProfileError = e;
    }
  }),
  new ScenarioOutput("detachSsmOnlyRoleFromProfileResult", (state) => {
    if (state.detachSsmOnlyRoleFromProfileError) {
      console.error(state.detachSsmOnlyRoleFromProfileError);
      return MESSAGES.detachSsmOnlyRoleFromProfileError
```

```
.replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
.replace("${PROFILE_NAME}", NAMES.ssmOnlyInstanceProfileName);
} else {
    return MESSAGES.detachedSsmOnlyRoleFromProfile
    .replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
    .replace("${PROFILE_NAME}", NAMES.ssmOnlyInstanceProfileName);
}
}),
new ScenarioAction("detachSsmOnlyCustomRolePolicy", async (state) => {
    try {
        const iamClient = new IAMClient({});
        const ssmOnlyPolicy = await findPolicy(NAMES.ssmOnlyPolicyName);
        await iamClient.send(
            new DetachRolePolicyCommand({
                RoleName: NAMES.ssmOnlyRoleName,
                PolicyArn: ssmOnlyPolicy.Arn,
            }),
        );
    } catch (e) {
        state.detachSsmOnlyCustomRolePolicyError = e;
    }
}),
new ScenarioOutput("detachSsmOnlyCustomRolePolicyResult", (state) => {
    if (state.detachSsmOnlyCustomRolePolicyError) {
        console.error(state.detachSsmOnlyCustomRolePolicyError);
        return MESSAGES.detachSsmOnlyCustomRolePolicyError
            .replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
            .replace("${POLICY_NAME}", NAMES.ssmOnlyPolicyName);
    } else {
        return MESSAGES.detachedSsmOnlyCustomRolePolicy
            .replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
            .replace("${POLICY_NAME}", NAMES.ssmOnlyPolicyName);
    }
}),
new ScenarioAction("detachSsmOnlyAWSRolePolicy", async (state) => {
    try {
        const iamClient = new IAMClient({});
        await iamClient.send(
            new DetachRolePolicyCommand({
                RoleName: NAMES.ssmOnlyRoleName,
                PolicyArn: "arn:aws:iam::aws:policy/AmazonSSMManagedInstanceCore",
            }),
        );
    } catch (e) {
```

```
        state.detachSsmOnlyAWSRolePolicyError = e;
    }
}),
new ScenarioOutput("detachSsmOnlyAWSRolePolicyResult", (state) => {
    if (state.detachSsmOnlyAWSRolePolicyError) {
        console.error(state.detachSsmOnlyAWSRolePolicyError);
        return MESSAGES.detachSsmOnlyAWSRolePolicyError
            .replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
            .replace("${POLICY_NAME}", "AmazonSSMManagedInstanceCore");
    } else {
        return MESSAGES.detachedSsmOnlyAWSRolePolicy
            .replace("${ROLE_NAME}", NAMES.ssmOnlyRoleName)
            .replace("${POLICY_NAME}", "AmazonSSMManagedInstanceCore");
    }
}),
new ScenarioAction("deleteSsmOnlyInstanceProfile", async (state) => {
    try {
        const iamClient = new IAMClient({});
        await iamClient.send(
            new DeleteInstanceProfileCommand({
                InstanceProfileName: NAMES.ssmOnlyInstanceProfileName,
            }),
        );
    } catch (e) {
        state.deleteSsmOnlyInstanceProfileError = e;
    }
}),
new ScenarioOutput("deleteSsmOnlyInstanceProfileResult", (state) => {
    if (state.deleteSsmOnlyInstanceProfileError) {
        console.error(state.deleteSsmOnlyInstanceProfileError);
        return MESSAGES.deleteSsmOnlyInstanceProfileError.replace(
            "${INSTANCE_PROFILE_NAME}",
            NAMES.ssmOnlyInstanceProfileName,
        );
    } else {
        return MESSAGES.deletedSsmOnlyInstanceProfile.replace(
            "${INSTANCE_PROFILE_NAME}",
            NAMES.ssmOnlyInstanceProfileName,
        );
    }
}),
new ScenarioAction("deleteSsmOnlyPolicy", async (state) => {
    try {
        const iamClient = new IAMClient({});
```

```
const ssmOnlyPolicy = await findPolicy(NAMES.ssmOnlyPolicyName);
await iamClient.send(
  new DeletePolicyCommand({
    PolicyArn: ssmOnlyPolicy.Arn,
  }),
);
} catch (e) {
  state.deleteSsmOnlyPolicyError = e;
}
),
new ScenarioOutput("deleteSsmOnlyPolicyResult", (state) => {
  if (state.deleteSsmOnlyPolicyError) {
    console.error(state.deleteSsmOnlyPolicyError);
    return MESSAGES.deleteSsmOnlyPolicyError.replace(
      "${POLICY_NAME}",
      NAMES.ssmOnlyPolicyName,
    );
  } else {
    return MESSAGES.deletedSsmOnlyPolicy.replace(
      "${POLICY_NAME}",
      NAMES.ssmOnlyPolicyName,
    );
  }
}),
new ScenarioAction("deleteSsmOnlyRole", async (state) => {
  try {
    const iamClient = new IAMClient({});
    await iamClient.send(
      new DeleteRoleCommand({
        RoleName: NAMES.ssmOnlyRoleName,
      }),
    );
  } catch (e) {
    state.deleteSsmOnlyRoleError = e;
  }
}),
new ScenarioOutput("deleteSsmOnlyRoleResult", (state) => {
  if (state.deleteSsmOnlyRoleError) {
    console.error(state.deleteSsmOnlyRoleError);
    return MESSAGES.deleteSsmOnlyRoleError.replace(
      "${ROLE_NAME}",
      NAMES.ssmOnlyRoleName,
    );
  } else {
```

```
        return MESSAGES.deletedSsmOnlyRole.replace(
            "${ROLE_NAME}",
            NAMES.ssmOnlyRoleName,
        );
    }
},
],
];

/**
 * @param {string} policyName
 */
async function findPolicy(policyName) {
    const client = new IAMClient({});
    const paginatedPolicies = paginateListPolicies({ client }, {});
    for await (const page of paginatedPolicies) {
        const policy = page.Policies.find((p) => p.PolicyName === policyName);
        if (policy) {
            return policy;
        }
    }
}

/**
 * @param {string} groupName
 */
async function deleteAutoScalingGroup(groupName) {
    const client = new AutoScalingClient({});
    try {
        await client.send(
            new DeleteAutoScalingGroupCommand({
                AutoScalingGroupName: groupName,
            }),
        );
    } catch (err) {
        if (!(err instanceof Error)) {
            throw err;
        } else {
            console.log(err.name);
            throw err;
        }
    }
}

/**

```

```
* @param {string} groupName
*/
async function terminateGroupInstances(groupName) {
  const autoScalingClient = new AutoScalingClient({});
  const group = await findAutoScalingGroup(groupName);
  await autoScalingClient.send(
    new UpdateAutoScalingGroupCommand({
      AutoScalingGroupName: group.AutoScalingGroupName,
      MinSize: 0,
    }),
  );
  for (const i of group.Instances) {
    await retry({ intervalInMs: 1000, maxRetries: 30 }, () =>
      autoScalingClient.send(
        new TerminateInstanceInAutoScalingGroupCommand({
          InstanceId: i.InstanceId,
          ShouldDecrementDesiredCapacity: true,
        }),
      ),
    );
  }
}

async function findAutoScalingGroup(groupName) {
  const client = new AutoScalingClient({});
  const paginatedGroups = paginateDescribeAutoScalingGroups({ client }, {});
  for await (const page of paginatedGroups) {
    const group = page.AutoScalingGroups.find(
      (g) => g.AutoScalingGroupName === groupName,
    );
    if (group) {
      return group;
    }
  }
  throw new Error(`Auto scaling group ${groupName} not found.`);
}
```

- For API details, see the following topics in *AWS SDK for JavaScript API Reference*.
  - [AttachLoadBalancerTargetGroups](#)
  - [CreateAutoScalingGroup](#)
  - [CreateInstanceProfile](#)

- [CreateLaunchTemplate](#)
- [CreateListener](#)
- [CreateLoadBalancer](#)
- [CreateTargetGroup](#)
- [DeleteAutoScalingGroup](#)
- [DeleteInstanceProfile](#)
- [DeleteLaunchTemplate](#)
- [DeleteLoadBalancer](#)
- [DeleteTargetGroup](#)
- [DescribeAutoScalingGroups](#)
- [DescribeAvailabilityZones](#)
- [DescribeElamInstanceProfileAssociations](#)
- [DescribeInstances](#)
- [DescribeLoadBalancers](#)
- [DescribeSubnets](#)
- [DescribeTargetGroups](#)
- [DescribeTargetHealth](#)
- [DescribeVpcs](#)
- [RebootInstances](#)
- [ReplaceElamInstanceProfileAssociation](#)
- [TerminateInstanceInAutoScalingGroup](#)
- [UpdateAutoScalingGroup](#)

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run the interactive scenario at a command prompt.

```
class Runner:
    def __init__(
        self, resource_path, recommendation, autoscaler, loadbalancer,
        param_helper
    ):
        self.resource_path = resource_path
        self.recommendation = recommendation
        self.autoscaler = autoscaler
        self.loadbalancer = loadbalancer
        self.param_helper = param_helper
        self.protocol = "HTTP"
        self.port = 80
        self.ssh_port = 22

    def deploy(self):
        recommendations_path = f"{self.resource_path}/recommendations.json"
        startup_script = f"{self.resource_path}/server_startup_script.sh"
        instance_policy = f"{self.resource_path}/instance_policy.json"

        print(
            "\nFor this demo, we'll use the AWS SDK for Python (Boto3) to create
several AWS resources\n"
            "to set up a load-balanced web service endpoint and explore some ways
to make it resilient\n"
            "against various kinds of failures.\n\n"
            "Some of the resources create by this demo are:\n"
        )
        print(
            "\t* A DynamoDB table that the web service depends on to provide
book, movie, and song recommendations."
        )
        print(
            "\t* An EC2 launch template that defines EC2 instances that each
contain a Python web server."
        )
        print(
            "\t* An EC2 Auto Scaling group that manages EC2 instances across
several Availability Zones."
        )
        print(
            "\t* An Elastic Load Balancing (ELB) load balancer that targets the
Auto Scaling group to distribute requests."
        )
```

```
)  
print("-" * 88)  
q.ask("Press Enter when you're ready to start deploying resources.")  
  
print(  
    f"Creating and populating a DynamoDB table named  
'{self.recommendation.table_name}'."  
)  
self.recommendation.create()  
self.recommendation.populate(recommendations_path)  
print("-" * 88)  
  
print(  
    f"Creating an EC2 launch template that runs '{startup_script}' when  
an instance starts.\n"  
    f"This script starts a Python web server defined in the `server.py`  
script. The web server\n"  
    f"listens to HTTP requests on port 80 and responds to requests to '/'  
and to '/healthcheck'.\n"  
    f"For demo purposes, this server is run as the root user. In  
production, the best practice is to\n"  
    f"run a web server, such as Apache, with least-privileged  
credentials.\n"  
)  
print(  
    f"The template also defines an IAM policy that each instance uses to  
assume a role that grants\n"  
    f"permissions to access the DynamoDB recommendation table and Systems  
Manager parameters\n"  
    f"that control the flow of the demo.\n")  
self.autoscaler.create_template(startup_script, instance_policy)  
print("-" * 88)  
  
print(  
    f"Creating an EC2 Auto Scaling group that maintains three EC2  
instances, each in a different\n"  
    f"Availability Zone."  
)  
zones = self.autoscaler.create_group(3)  
print("-" * 88)  
print(  
    "At this point, you have EC2 instances created. Once each instance  
starts, it listens for\n")
```

```
        "HTTP requests. You can see these instances in the console or
        continue with the demo."
    )
    print("-" * 88)
    q.ask("Press Enter when you're ready to continue.")

    print(f"Creating variables that control the flow of the demo.\n")
    self.param_helper.reset()

    print(
        "\nCreating an Elastic Load Balancing target group and load balancer.
The target group\n"
        "defines how the load balancer connects to instances. The load
balancer provides a\n"
        "single endpoint where clients connect and dispatches requests to
instances in the group.\n"
    )
    vpc = self.autoscaler.get_default_vpc()
    subnets = self.autoscaler.get_subnets(vpc["VpcId"], zones)
    target_group = self.loadbalancer.create_target_group(
        self.protocol, self.port, vpc["VpcId"]
    )
    self.loadbalancer.create_load_balancer(
        [subnet["SubnetId"] for subnet in subnets], target_group
    )
    self.autoscaler.attach_load_balancer_target_group(target_group)
    print(f"Verifying access to the load balancer endpoint...")
    lb_success = self.loadbalancer.verify_load_balancer_endpoint()
    if not lb_success:
        print(
            "Couldn't connect to the load balancer, verifying that the port
is open..."
        )
        current_ip_address = requests.get(
            "http://checkip.amazonaws.com"
        ).text.strip()
        sec_group, port_is_open = self.autoscaler.verify_inbound_port(
            vpc, self.port, current_ip_address
        )
        sec_group, ssh_port_is_open = self.autoscaler.verify_inbound_port(
            vpc, self.ssh_port, current_ip_address
        )
        if not port_is_open:
            print(
```

```
        "For this example to work, the default security group for
your default VPC must\n"
            "allows access from this computer. You can either add it
automatically from this\n"
                "example or add it yourself using the AWS Management Console.
\n"
        )
    if q.ask(
        f"Do you want to add a rule to security group
{sec_group['GroupId']} to allow\n"
            f"inbound traffic on port {self.port} from your computer's IP
address of {current_ip_address}? (y/n) ",
        q.is_yesno,
    ):
        self.autoscaler.open_inbound_port(
            sec_group["GroupId"], self.port, current_ip_address
        )
    if not ssh_port_is_open:
        if q.ask(
            f"Do you want to add a rule to security group
{sec_group['GroupId']} to allow\n"
                f"inbound SSH traffic on port {self.ssh_port} for debugging
from your computer's IP address of {current_ip_address}? (y/n) ",
            q.is_yesno,
        ):
            self.autoscaler.open_inbound_port(
                sec_group["GroupId"], self.ssh_port, current_ip_address
            )
    lb_success = self.loadbalancer.verify_load_balancer_endpoint()
if lb_success:
    print("Your load balancer is ready. You can access it by browsing to:
\n")
    print(f"\thttp://{{self.loadbalancer.endpoint()}}\n")
else:
    print(
        "Couldn't get a successful response from the load balancer
endpoint. Troubleshoot by\n"
            "manually verifying that your VPC and security group are
configured correctly and that\n"
                "you can successfully make a GET request to the load balancer
endpoint:\n"
    )
    print(f"\thttp://{{self.loadbalancer.endpoint()}}\n")
print("-" * 88)
```

```
q.ask("Press Enter when you're ready to continue with the demo.")

def demo_choices(self):
    actions = [
        "Send a GET request to the load balancer endpoint.",
        "Check the health of load balancer targets.",
        "Go to the next part of the demo.",
    ]
    choice = 0
    while choice != 2:
        print("-" * 88)
        print(
            "\nSee the current state of the service by selecting one of the
following choices:\n"
        )
        choice = q.choose("\nWhich action would you like to take? ", actions)
        print("-" * 88)
        if choice == 0:
            print("Request:\n")
            print(f"GET http://{self.loadbalancer.endpoint()}")
            response = requests.get(f"http://{self.loadbalancer.endpoint()}")
            print("\nResponse:\n")
            print(f"{response.status_code}")
            if response.headers.get("content-type") == "application/json":
                pp(response.json())
        elif choice == 1:
            print("\nChecking the health of load balancer targets:\n")
            health = self.loadbalancer.check_target_health()
            for target in health:
                state = target["TargetHealth"]["State"]
                print(
                    f"\tTarget {target['Target']['Id']} on port
{target['Target']['Port']} is {state}"
                )
                if state != "healthy":
                    print(
                        f"\t\t{target['TargetHealth']['Reason']}:
{target['TargetHealth']['Description']}\n"
                    )
            print(
                f"\nNote that it can take a minute or two for the health
check to update\n"
                f"after changes are made.\n"
            )
    
```

```
        elif choice == 2:
            print("\nOkay, let's move on.")
            print("-" * 88)

    def demo(self):
        ssm_only_policy = f"{self.resource_path}/ssm_only_policy.json"

        print("\nResetting parameters to starting values for demo.\n")
        self.param_helper.reset()

        print(
            "\nThis part of the demonstration shows how to toggle different parts
            of the system\n"
            "to create situations where the web service fails, and shows how
            using a resilient\n"
            "architecture can keep the web service running in spite of these
            failures."
        )
        print("-" * 88)

        print(
            "At the start, the load balancer endpoint returns recommendations and
            reports that all targets are healthy."
        )
        self.demo_choices()

        print(
            f"The web service running on the EC2 instances gets recommendations
            by querying a DynamoDB table.\n"
            f"The table name is contained in a Systems Manager parameter named
            '{self.param_helper.table}'.\n"
            f"To simulate a failure of the recommendation service, let's set this
            parameter to name a non-existent table.\n"
        )
        self.param_helper.put(self.param_helper.table, "this-is-not-a-table")
        print(
            "\nNow, sending a GET request to the load balancer endpoint returns a
            failure code. But, the service reports as\n"
            "healthy to the load balancer because shallow health checks don't
            check for failure of the recommendation service."
        )
        self.demo_choices()

        print(
```

```
f"Instead of failing when the recommendation service fails, the web
service can return a static response.\n"
    f"While this is not a perfect solution, it presents the customer with
a somewhat better experience than failure.\n"
)
self.param_helper.put(self.param_helper.failure_response, "static")
print(
    f"\nNow, sending a GET request to the load balancer endpoint returns
a static response.\n"
    f"The service still reports as healthy because health checks are
still shallow.\n"
)
self.demo_choices()

print("Let's reinstate the recommendation service.\n")
self.param_helper.put(self.param_helper.table,
self.recommendation.table_name)
print(
    "\nLet's also substitute bad credentials for one of the instances in
the target group so that it can't\n"
    "access the DynamoDB recommendation table.\n"
)
self.autoscaler.create_instance_profile(
    ssm_only_policy,
    self.autoscaler.bad_creds_policy_name,
    self.autoscaler.bad_creds_role_name,
    self.autoscaler.bad_creds_profile_name,
    ["AmazonSSMManagedInstanceCore"],
)
instances = self.autoscaler.get_instances()
bad_instance_id = instances[0]
instance_profile = self.autoscaler.get_instance_profile(bad_instance_id)
print(
    f"\nReplacing the profile for instance {bad_instance_id} with a
profile that contains\n"
    f"bad credentials...\n"
)
self.autoscaler.replace_instance_profile(
    bad_instance_id,
    self.autoscaler.bad_creds_profile_name,
    instance_profile["AssociationId"],
)
print()
```

```
        "Now, sending a GET request to the load balancer endpoint returns
either a recommendation or a static response,\n"
        "depending on which instance is selected by the load balancer.\n"
    )
self.demo_choices()

print(
    "\nLet's implement a deep health check. For this demo, a deep health
check tests whether\n"
    "the web service can access the DynamoDB table that it depends on for
recommendations. Note that\n"
    "the deep health check is only for ELB routing and not for Auto
Scaling instance health.\n"
    "This kind of deep health check is not recommended for Auto Scaling
instance health, because it\n"
    "risks accidental termination of all instances in the Auto Scaling
group when a dependent service fails.\n"
)
print(
    "By implementing deep health checks, the load balancer can detect
when one of the instances is failing\n"
    "and take that instance out of rotation.\n"
)
self.param_helper.put(self.param_helper.health_check, "deep")
print(
    f"\nNow, checking target health indicates that the instance with bad
credentials ({bad_instance_id})\n"
    f"is unhealthy. Note that it might take a minute or two for the load
balancer to detect the unhealthy \n"
    f"instance. Sending a GET request to the load balancer endpoint
always returns a recommendation, because\n"
    "the load balancer takes unhealthy instances out of its rotation.\n"
)
self.demo_choices()

print(
    "\nBecause the instances in this demo are controlled by an auto
scaler, the simplest way to fix an unhealthy\n"
    "instance is to terminate it and let the auto scaler start a new
instance to replace it.\n"
)
self.autoscaler.terminate_instance(bad_instance_id)
print(
```

```
        "\nEven while the instance is terminating and the new instance is
starting, sending a GET\n"
        "request to the web service continues to get a successful
recommendation response because\n"
        "the load balancer routes requests to the healthy instances. After
the replacement instance\n"
        "starts and reports as healthy, it is included in the load balancing
rotation.\n"
        "\nNote that terminating and replacing an instance typically takes
several minutes, during which time you\n"
        "can see the changing health check status until the new instance is
running and healthy.\n"
    )
    self.demo_choices()

    print(
        "\nIf the recommendation service fails now, deep health checks mean
all instances report as unhealthy.\n"
    )
    self.param_helper.put(self.param_helper.table, "this-is-not-a-table")
    print(
        "\nWhen all instances are unhealthy, the load balancer continues to
route requests even to\n"
        "unhealthy instances, allowing them to fail open and return a static
response rather than fail\n"
        "closed and report failure to the customer."
    )
    self.demo_choices()
    self.param_helper.reset()

def destroy(self):
    print(
        "This concludes the demo of how to build and manage a resilient
service.\n"
        "To keep things tidy and to avoid unwanted charges on your account,
we can clean up all AWS resources\n"
        "that were created for this demo."
    )
    if q.ask("Do you want to clean up all demo resources? (y/n) ",
q.is_yesno):
        self.loadbalancer.delete_load_balancer()
        self.loadbalancer.delete_target_group()
        self.autoscaler.delete_group()
        self.autoscaler.delete_key_pair()
```

```
        self.autoscaler.delete_template()
        self.autoscaler.delete_instance_profile(
            self.autoscaler.bad_creds_profile_name,
            self.autoscaler.bad_creds_role_name,
        )
        self.recommendation.destroy()
    else:
        print(
            "Okay, we'll leave the resources intact.\n"
            "Don't forget to delete them when you're done with them or you
might incur unexpected charges."
        )

def main():
    parser = argparse.ArgumentParser()
    parser.add_argument(
        "--action",
        required=True,
        choices=["all", "deploy", "demo", "destroy"],
        help="The action to take for the demo. When 'all' is specified, resources
are\n"
        "deployed, the demo is run, and resources are destroyed.",
    )
    parser.add_argument(
        "--resource_path",
        default="../../workflows/resilient_service/resources",
        help="The path to resource files used by this example, such as IAM
policies and\n"
        "instance scripts.",
    )
    args = parser.parse_args()

    print("-" * 88)
    print(
        "Welcome to the demonstration of How to Build and Manage a Resilient
Service!"
    )
    print("-" * 88)

    prefix = "doc-example-resilience"
    recommendation = RecommendationService.from_client(
        "doc-example-recommendation-service"
    )
```

```
autoscaler = AutoScaler.from_client(prefix)
loadbalancer = LoadBalancer.from_client(prefix)
param_helper = ParameterHelper.from_client(recommendation.table_name)
runner = Runner(
    args.resource_path, recommendation, autoscaler, loadbalancer,
    param_helper
)
actions = [args.action] if args.action != "all" else ["deploy", "demo",
"destroy"]
for action in actions:
    if action == "deploy":
        runner.deploy()
    elif action == "demo":
        runner.demo()
    elif action == "destroy":
        runner.destroy()

print("-" * 88)
print("Thanks for watching!")
print("-" * 88)

if __name__ == "__main__":
    logging.basicConfig(level=logging.INFO, format"%(levelname)s: %(message)s")
    main()
```

Create a class that wraps Auto Scaling and Amazon EC2 actions.

```
class AutoScaler:
    """
    Encapsulates Amazon EC2 Auto Scaling and EC2 management actions.
    """

    def __init__(
        self,
        resource_prefix,
        inst_type,
        ami_param,
        autoscaling_client,
        ec2_client,
        ssm_client,
        iam_client,
```

```
):
    """
        :param resource_prefix: The prefix for naming AWS resources that are
        created by this class.
        :param inst_type: The type of EC2 instance to create, such as t3.micro.
        :param ami_param: The Systems Manager parameter used to look up the AMI
        that is
            created.
        :param autoscaling_client: A Boto3 EC2 Auto Scaling client.
        :param ec2_client: A Boto3 EC2 client.
        :param ssm_client: A Boto3 Systems Manager client.
        :param iam_client: A Boto3 IAM client.
    """
    self.inst_type = inst_type
    self.ami_param = ami_param
    self.autoscaling_client = autoscaling_client
    self.ec2_client = ec2_client
    self.ssm_client = ssm_client
    self.iam_client = iam_client
    self.launch_template_name = f"{resource_prefix}-template"
    self.group_name = f"{resource_prefix}-group"
    self.instance_policy_name = f"{resource_prefix}-pol"
    self.instance_role_name = f"{resource_prefix}-role"
    self.instance_profile_name = f"{resource_prefix}-prof"
    self.bad_creds_policy_name = f"{resource_prefix}-bc-pol"
    self.bad_creds_role_name = f"{resource_prefix}-bc-role"
    self.bad_creds_profile_name = f"{resource_prefix}-bc-prof"
    self.key_pair_name = f"{resource_prefix}-key-pair"

    @classmethod
    def from_client(cls, resource_prefix):
        """
        Creates this class from Boto3 clients.

        :param resource_prefix: The prefix for naming AWS resources that are
        created by this class.
        """
        as_client = boto3.client("autoscaling")
        ec2_client = boto3.client("ec2")
        ssm_client = boto3.client("ssm")
        iam_client = boto3.client("iam")
        return cls(
            resource_prefix,
```

```
        "t3.micro",
        "/aws/service/ami-amazon-linux-latest/amzn2-ami-hvm-x86_64-gp2",
        as_client,
        ec2_client,
        ssm_client,
        iam_client,
    )

    def create_instance_profile(
        self, policy_file, policy_name, role_name, profile_name,
        aws_managed_policies=()
    ):
        """
        Creates a policy, role, and profile that is associated with instances
        created by
            this class. An instance's associated profile defines a role that is
        assumed by the
            instance. The role has attached policies that specify the AWS permissions
        granted to
            clients that run on the instance.

        :param policy_file: The name of a JSON file that contains the policy
        definition to
                            create and attach to the role.
        :param policy_name: The name to give the created policy.
        :param role_name: The name to give the created role.
        :param profile_name: The name to the created profile.
        :param aws_managed_policies: Additional AWS-managed policies that are
        attached to
                            the role, such as
        AmazonSSMManagedInstanceCore to grant
                            use of Systems Manager to send commands to
        the instance.

        :return: The ARN of the profile that is created.
        """
        assume_role_doc = {
            "Version": "2012-10-17",
            "Statement": [
                {
                    "Effect": "Allow",
                    "Principal": {"Service": "ec2.amazonaws.com"},
                    "Action": "sts:AssumeRole",
                }
            ],
        }
```

```
    }

    with open(policy_file) as file:
        instance_policy_doc = file.read()

    policy_arn = None
    try:
        pol_response = self.iam_client.create_policy(
            PolicyName=policy_name, PolicyDocument=instance_policy_doc
        )
        policy_arn = pol_response["Policy"]["Arn"]
        log.info("Created policy with ARN %s.", policy_arn)
    except ClientError as err:
        if err.response["Error"]["Code"] == "EntityAlreadyExists":
            log.info("Policy %s already exists, nothing to do.", policy_name)
            list_pol_response = self.iam_client.list_policies(Scope="Local")
            for pol in list_pol_response["Policies"]:
                if pol["PolicyName"] == policy_name:
                    policy_arn = pol["Arn"]
                    break
        if policy_arn is None:
            raise AutoScalerError(f"Couldn't create policy {policy_name}: {err}")

    try:
        self.iam_client.create_role(
            RoleName=role_name,
            AssumeRolePolicyDocument=json.dumps(assume_role_doc)
        )
        self.iam_client.attach_role_policy(RoleName=role_name,
                                           PolicyArn=policy_arn)
        for aws_policy in aws_managed_policies:
            self.iam_client.attach_role_policy(
                RoleName=role_name,
                PolicyArn=f"arn:aws:iam::aws:policy/{aws_policy}",
            )
        log.info("Created role %s and attached policy %s.", role_name,
                policy_arn)
    except ClientError as err:
        if err.response["Error"]["Code"] == "EntityAlreadyExists":
            log.info("Role %s already exists, nothing to do.", role_name)
        else:
            raise AutoScalerError(f"Couldn't create role {role_name}: {err}")

    try:
```

```
profile_response = self.iam_client.create_instance_profile(
    InstanceProfileName=profile_name
)
waiter = self.iam_client.get_waiter("instance_profile_exists")
waiter.wait(InstanceProfileName=profile_name)
time.sleep(10) # wait a little longer
profile_arn = profile_response["InstanceProfile"]["Arn"]
self.iam_client.add_role_to_instance_profile(
    InstanceProfileName=profile_name, RoleName=role_name
)
log.info("Created profile %s and added role %s.", profile_name,
role_name)
except ClientError as err:
    if err.response["Error"]["Code"] == "EntityAlreadyExists":
        prof_response = self.iam_client.get_instance_profile(
            InstanceProfileName=profile_name
        )
        profile_arn = prof_response["InstanceProfile"]["Arn"]
        log.info(
            "Instance profile %s already exists, nothing to do.",
profile_name
        )
    else:
        raise AutoScalerError(
            f"Couldn't create profile {profile_name} and attach it to
role\n"
            f"{role_name}: {err}"
        )
return profile_arn

def get_instance_profile(self, instance_id):
    """
    Gets data about the profile associated with an instance.

    :param instance_id: The ID of the instance to look up.
    :return: The profile data.
    """
    try:
        response =
self.ec2_client.describe_iam_instance_profile_associations(
            Filters=[{"Name": "instance-id", "Values": [instance_id]}]
    )
    except ClientError as err:
```

```
        raise AutoScalerError(
            f"Couldn't get instance profile association for instance
{instance_id}: {err}"
        )
    else:
        return response["IamInstanceProfileAssociations"][0]

def replace_instance_profile(
    self, instance_id, new_instance_profile_name, profile_association_id
):
    """
    Replaces the profile associated with a running instance. After the
    profile is
    replaced, the instance is rebooted to ensure that it uses the new
    profile. When
    the instance is ready, Systems Manager is used to restart the Python web
    server.

    :param instance_id: The ID of the instance to update.
    :param new_instance_profile_name: The name of the new profile to
    associate with
                           the specified instance.
    :param profile_association_id: The ID of the existing profile association
    for the
                           instance.

    """
    try:
        self.ec2_client.replace_iam_instance_profile_association(
            IamInstanceProfile={"Name": new_instance_profile_name},
            AssociationId=profile_association_id,
        )
        log.info(
            "Replaced instance profile for association %s with profile %s.",
            profile_association_id,
            new_instance_profile_name,
        )
        time.sleep(5)
        inst_ready = False
        tries = 0
        while not inst_ready:
            if tries % 6 == 0:
                self.ec2_client.reboot_instances(InstanceIds=[instance_id])
                log.info(
                    "Rebooted instance %s.", instance_id
                )
            tries += 1
            time.sleep(1)
            inst_ready = self.get_instance_profile(instance_id)
```

```
        "Rebooting instance %s and waiting for it to be
ready.",
        instance_id,
    )
tries += 1
time.sleep(10)
response = self.ssm_client.describe_instance_information()
for info in response["InstanceInformationList"]:
    if info["InstanceId"] == instance_id:
        inst_ready = True
self.ssm_client.send_command(
    InstanceIds=[instance_id],
    DocumentName="AWS-RunShellScript",
    Parameters={"commands": ["cd / && sudo python3 server.py 80"]},
)
log.info("Restarted the Python web server on instance %s.",
instance_id)
except ClientError as err:
    raise AutoScalerError(
        f"Couldn't replace instance profile for association
{profile_association_id}: {err}"
    )

def delete_instance_profile(self, profile_name, role_name):
    """
    Detaches a role from an instance profile, detaches policies from the
    role,
    and deletes all the resources.

    :param profile_name: The name of the profile to delete.
    :param role_name: The name of the role to delete.
    """
    try:
        self.iam_client.remove_role_from_instance_profile(
            InstanceProfileName=profile_name, RoleName=role_name
        )

    self.iam_client.delete_instance_profile(InstanceProfileName=profile_name)
    log.info("Deleted instance profile %s.", profile_name)
    attached_policies = self.iam_client.list_attached_role_policies(
        RoleName=role_name
    )
    for pol in attached_policies["AttachedPolicies"]:
```

```
        self.iam_client.detach_role_policy(
            RoleName=role_name, PolicyArn=pol["PolicyArn"])
    )
    if not pol["PolicyArn"].startswith("arn:aws:iam::aws"):
        self.iam_client.delete_policy(PolicyArn=pol["PolicyArn"])
    log.info("Detached and deleted policy %s.", pol["PolicyName"])
    self.iam_client.delete_role(RoleName=role_name)
    log.info("Deleted role %s.", role_name)
except ClientError as err:
    if err.response["Error"]["Code"] == "NoSuchEntity":
        log.info(
            "Instance profile %s doesn't exist, nothing to do.",
profile_name
        )
    else:
        raise AutoScalerError(
            f"Couldn't delete instance profile {profile_name} or detach "
            f"policies and delete role {role_name}: {err}"
        )

def create_key_pair(self, key_pair_name):
    """
    Creates a new key pair.

    :param key_pair_name: The name of the key pair to create.
    :return: The newly created key pair.
    """
    try:
        response = self.ec2_client.create_key_pair(KeyName=key_pair_name)
        with open(f"{key_pair_name}.pem", "w") as file:
            file.write(response["KeyMaterial"])
        chmod(f"{key_pair_name}.pem", 0o600)
        log.info("Created key pair %s.", key_pair_name)
    except ClientError as err:
        raise AutoScalerError(f"Couldn't create key pair {key_pair_name}: "
                           f"{err}")

def delete_key_pair(self):
    """
    Deletes a key pair.

    :param key_pair_name: The name of the key pair to delete.
    
```

```
"""
try:
    self.ec2_client.delete_key_pair(KeyName=self.key_pair_name)
    remove(f"{self.key_pair_name}.pem")
    log.info("Deleted key pair %s.", self.key_pair_name)
except ClientError as err:
    raise AutoScalerError(
        f"Couldn't delete key pair {self.key_pair_name}: {err}"
    )
except FileNotFoundError:
    log.info("Key pair %s doesn't exist, nothing to do.",
self.key_pair_name)
except PermissionError:
    log.info(
        "Inadequate permissions to delete key pair %s.",
self.key_pair_name
    )
except Exception as err:
    raise AutoScalerError(
        f"Couldn't delete key pair {self.key_pair_name}: {err}"
    )

def create_template(self, server_startup_script_file, instance_policy_file):
    """
    Creates an Amazon EC2 launch template to use with Amazon EC2 Auto
    Scaling. The
    launch template specifies a Bash script in its user data field that runs
    after
    the instance is started. This script installs Python packages and starts
    a
    Python web server on the instance.

    :param server_startup_script_file: The path to a Bash script file that is
run
                                                when an instance starts.
    :param instance_policy_file: The path to a file that defines a
permissions policy
                                                to create and attach to the instance
profile.
    :return: Information about the newly created template.
    """

    template = []
    try:
```

```
        self.create_key_pair(self.key_pair_name)
        self.create_instance_profile(
            instance_policy_file,
            self.instance_policy_name,
            self.instance_role_name,
            self.instance_profile_name,
        )
        with open(server_startup_script_file) as file:
            start_server_script = file.read()
        ami_latest = self.ssm_client.get_parameter(Name=self.ami_param)
        ami_id = ami_latest["Parameter"]["Value"]
        lt_response = self.ec2_client.create_launch_template(
            LaunchTemplateName=self.launch_template_name,
            LaunchTemplateData={
                "InstanceType": self.inst_type,
                "ImageId": ami_id,
                "IamInstanceProfile": {"Name": self.instance_profile_name},
                "UserData": base64.b64encode(
                    start_server_script.encode(encoding="utf-8")
                ).decode(encoding="utf-8"),
                "KeyName": self.key_pair_name,
            },
        )
        template = lt_response["LaunchTemplate"]
        log.info(
            "Created launch template %s for AMI %s on %s.",
            self.launch_template_name,
            ami_id,
            self.inst_type,
        )
    except ClientError as err:
        if (
            err.response["Error"]["Code"]
            == "InvalidLaunchTemplateName.AlreadyExistsException"
        ):
            log.info(
                "Launch template %s already exists, nothing to do.",
                self.launch_template_name,
            )
        else:
            raise AutoScalerError(
                f"Couldn't create launch template "
                f"{self.launch_template_name}: {err}."
            )
```

```
        return template

    def delete_template(self):
        """
        Deletes a launch template.

        """
        try:
            self.ec2_client.delete_launch_template(
                LaunchTemplateName=self.launch_template_name
            )
            self.delete_instance_profile(
                self.instance_profile_name, self.instance_role_name
            )
            log.info("Launch template %s deleted.", self.launch_template_name)
        except ClientError as err:
            if (
                err.response["Error"]["Code"]
                == "InvalidLaunchTemplateName.NotFoundException"
            ):
                log.info(
                    "Launch template %s does not exist, nothing to do.",
                    self.launch_template_name,
                )
            else:
                raise AutoScalerError(
                    f"Couldn't delete launch template {self.launch_template_name}: {err}.")

    def get_availability_zones(self):
        """
        Gets a list of Availability Zones in the AWS Region of the Amazon EC2
        client.

        :return: The list of Availability Zones for the client Region.
        """
        try:
            response = self.ec2_client.describe_availability_zones()
            zones = [zone["ZoneName"] for zone in response["AvailabilityZones"]]
        except ClientError as err:
            raise AutoScalerError(f"Couldn't get availability zones: {err}.")
        else:
```

```
        return zones

    def create_group(self, group_size):
        """
        Creates an EC2 Auto Scaling group with the specified size.

        :param group_size: The number of instances to set for the minimum and
                           maximum in
                           the group.
        :return: The list of Availability Zones specified for the group.
        """
        zones = []
        try:
            zones = self.get_availability_zones()
            self.autoscaling_client.create_auto_scaling_group(
                AutoScalingGroupName=self.group_name,
                AvailabilityZones=zones,
                LaunchTemplate={
                    "LaunchTemplateName": self.launch_template_name,
                    "Version": "$Default",
                },
                MinSize=group_size,
                MaxSize=group_size,
            )
            log.info(
                "Created EC2 Auto Scaling group %s with availability zones %s.",
                self.launch_template_name,
                zones,
            )
        except ClientError as err:
            if err.response["Error"]["Code"] == "AlreadyExists":
                log.info(
                    "EC2 Auto Scaling group %s already exists, nothing to do.",
                    self.group_name,
                )
            else:
                raise AutoScalerError(
                    f"Couldn't create EC2 Auto Scaling group {self.group_name}:
{err}"
                )
        return zones
```

```
def get_instances(self):
    """
    Gets data about the instances in the EC2 Auto Scaling group.

    :return: Data about the instances.
    """
    try:
        as_response = self.autoscaling_client.describe_auto_scaling_groups(
            AutoScalingGroupNames=[self.group_name]
        )
        instance_ids = [
            i["InstanceId"]
            for i in as_response["AutoScalingGroups"][0]["Instances"]
        ]
    except ClientError as err:
        raise AutoScalerError(
            f"Couldn't get instances for Auto Scaling group {self.group_name}: {err}"
        )
    else:
        return instance_ids

def terminate_instance(self, instance_id):
    """
    Terminates an instance in an EC2 Auto Scaling group. After an instance
    is terminated, it can no longer be accessed.

    :param instance_id: The ID of the instance to terminate.
    """
    try:
        self.autoscaling_client.terminate_instance_in_auto_scaling_group(
            InstanceId=instance_id, ShouldDecrementDesiredCapacity=False
        )
        log.info("Terminated instance %s.", instance_id)
    except ClientError as err:
        raise AutoScalerError(f"Couldn't terminate instance {instance_id}: {err}")

def attach_load_balancer_target_group(self, lb_target_group):
    """
    Attaches an Elastic Load Balancing (ELB) target group to this EC2 Auto
    Scaling group.
```

```
The target group specifies how the load balancer forward requests to the instances in the group.
```

```
:param lb_target_group: Data about the ELB target group to attach.  
"""  
try:  
    self.autoscaling_client.attach_load_balancer_target_groups(  
        AutoScalingGroupName=self.group_name,  
        TargetGroupARNs=[lb_target_group["TargetGroupArn"]],  
    )  
    log.info(  
        "Attached load balancer target group %s to auto scaling group  
        %s.",  
        lb_target_group["TargetGroupName"],  
        self.group_name,  
    )  
except ClientError as err:  
    raise AutoScalerError(  
        f"Couldn't attach load balancer target group  
{lb_target_group['TargetGroupName']}]\n"  
        f"to auto scaling group {self.group_name}"  
    )  
  
def _try_terminate_instance(self, inst_id):  
    stopping = False  
    log.info(f"Stopping {inst_id}.")  
    while not stopping:  
        try:  
            self.autoscaling_client.terminate_instance_in_auto_scaling_group(  
                InstanceId=inst_id, ShouldDecrementDesiredCapacity=True  
            )  
            stopping = True  
        except ClientError as err:  
            if err.response["Error"]["Code"] == "ScalingActivityInProgress":  
                log.info("Scaling activity in progress for %. Waiting...",  
inst_id)  
                time.sleep(10)  
            else:  
                raise AutoScalerError(f"Couldn't stop instance {inst_id}:  
{err}.")  
  
def _try_delete_group(self):
```

```
"""
    Tries to delete the EC2 Auto Scaling group. If the group is in use or in
    progress,
        the function waits and retries until the group is successfully deleted.
"""

stopped = False
while not stopped:
    try:
        self.autoscaling_client.delete_auto_scaling_group(
            AutoScalingGroupName=self.group_name
        )
        stopped = True
        log.info("Deleted EC2 Auto Scaling group %s.", self.group_name)
    except ClientError as err:
        if (
            err.response["Error"]["Code"] == "ResourceInUse"
            or err.response["Error"]["Code"] ==
"ScalingActivityInProgress"
        ):
            log.info(
                "Some instances are still running. Waiting for them to
stop..."
            )
            time.sleep(10)
        else:
            raise AutoScalerError(
                f"Couldn't delete group {self.group_name}: {err}."
            )

def delete_group(self):
    """
        Terminates all instances in the group, deletes the EC2 Auto Scaling
group.
    """
    try:
        response = self.autoscaling_client.describe_auto_scaling_groups(
            AutoScalingGroupNames=[self.group_name]
        )
        groups = response.get("AutoScalingGroups", [])
        if len(groups) > 0:
            self.autoscaling_client.update_auto_scaling_group(
                AutoScalingGroupName=self.group_name, MinSize=0
            )
    
```

```
instance_ids = [inst["InstanceId"] for inst in groups[0]
["Instances"]]
    for inst_id in instance_ids:
        self._try_terminate_instance(inst_id)
        self._try_delete_group()
    else:
        log.info("No groups found named %s, nothing to do.", self.group_name)
    except ClientError as err:
        raise AutoScalerError(f"Couldn't delete group {self.group_name}: {err}.")
```

```
def get_default_vpc(self):
    """
    Gets the default VPC for the account.

    :return: Data about the default VPC.
    """
    try:
        response = self.ec2_client.describe_vpcs(
            Filters=[{"Name": "is-default", "Values": ["true"]}]
    )
    except ClientError as err:
        raise AutoScalerError(f"Couldn't get default VPC: {err}")
    else:
        return response["Vpcs"][0]
```

```
def verify_inbound_port(self, vpc, port, ip_address):
    """
    Verify the default security group of the specified VPC allows ingress
    from this computer. This can be done by allowing ingress from this computer's IP
    address. In some situations, such as connecting from a corporate network,
    you must instead specify a prefix list ID. You can also temporarily open the
    port to any IP address while running this example. If you do, be sure to remove
    public access when you're done.

    :param vpc: The VPC used by this example.
    :param port: The port to verify.
```

```
:param ip_address: This computer's IP address.  
:return: The default security group of the specific VPC, and a value that  
indicates  
        whether the specified port is open.  
"""  
  
try:  
    response = self.ec2_client.describe_security_groups(  
        Filters=[  
            {"Name": "group-name", "Values": ["default"]},  
            {"Name": "vpc-id", "Values": [vpc["VpcId"]]},  
        ]  
    )  
    sec_group = response["SecurityGroups"][0]  
    port_is_open = False  
    log.info("Found default security group %s.", sec_group["GroupId"])  
    for ip_perm in sec_group["IpPermissions"]:  
        if ip_perm.get("FromPort", 0) == port:  
            log.info("Found inbound rule: %s", ip_perm)  
            for ip_range in ip_perm["IpRanges"]:  
                cidr = ip_range.get("CidrIp", "")  
                if cidr.startswith(ip_address) or cidr == "0.0.0.0/0":  
                    port_is_open = True  
                if ip_perm["PrefixListIds"]:  
                    port_is_open = True  
                if not port_is_open:  
                    log.info(  
                        "The inbound rule does not appear to be open to  
either this computer's IP\n"  
                        "address of %s, to all IP addresses (0.0.0.0/0), or  
to a prefix list ID.",  
                        ip_address,  
                    )  
                else:  
                    break  
            except ClientError as err:  
                raise AutoScalerError(  
                    f"Couldn't verify inbound rule for port {port} for VPC  
{vpc['VpcId']}": {err}"  
                )  
            else:  
                return sec_group, port_is_open  
  
  
def open_inbound_port(self, sec_group_id, port, ip_address):
```

```
"""
Add an ingress rule to the specified security group that allows access on
the
specified port from the specified IP address.

:param sec_group_id: The ID of the security group to modify.
:param port: The port to open.
:param ip_address: The IP address that is granted access.
"""

try:
    self.ec2_client.authorize_security_group_ingress(
        GroupId=sec_group_id,
        CidrIp=f"{ip_address}/32",
        FromPort=port,
        ToPort=port,
        IpProtocol="tcp",
    )
    log.info(
        "Authorized ingress to %s on port %s from %s.",
        sec_group_id,
        port,
        ip_address,
    )
except ClientError as err:
    raise AutoScalerError(
        f"Couldn't authorize ingress to {sec_group_id} on port {port}"
        f"from {ip_address}: {err}"
    )

def get_subnets(self, vpc_id, zones):
    """
Gets the default subnets in a VPC for a specified list of Availability
Zones.

:param vpc_id: The ID of the VPC to look up.
:param zones: The list of Availability Zones to look up.
:return: The list of subnets found.
"""

try:
    response = self.ec2_client.describe_subnets(
        Filters=[
            {"Name": "vpc-id", "Values": [vpc_id]},
            {"Name": "availability-zone", "Values": zones},
```

```
        {"Name": "default-for-az", "Values": ["true"]},  
    ]  
)  
subnets = response["Subnets"]  
log.info("Found %s subnets for the specified zones.", len(subnets))  
except ClientError as err:  
    raise AutoScalerError(f"Couldn't get subnets: {err}")  
else:  
    return subnets
```

Create a class that wraps Elastic Load Balancing actions.

```
class LoadBalancer:  
    """Encapsulates Elastic Load Balancing (ELB) actions."""  
  
    def __init__(self, target_group_name, load_balancer_name, elb_client):  
        """  
        :param target_group_name: The name of the target group associated with  
        the load balancer.  
        :param load_balancer_name: The name of the load balancer.  
        :param elb_client: A Boto3 Elastic Load Balancing client.  
        """  
        self.target_group_name = target_group_name  
        self.load_balancer_name = load_balancer_name  
        self.elb_client = elb_client  
        self._endpoint = None  
  
    @classmethod  
    def from_client(cls, resource_prefix):  
        """  
        Creates this class from a Boto3 client.  
  
        :param resource_prefix: The prefix to give to AWS resources created by  
        this class.  
        """  
        elb_client = boto3.client("elbv2")  
        return cls(f"{resource_prefix}-tg", f"{resource_prefix}-lb", elb_client)
```

```
def endpoint(self):
    """
    Gets the HTTP endpoint of the load balancer.

    :return: The endpoint.
    """
    if self._endpoint is None:
        try:
            response = self.elb_client.describe_load_balancers(
                Names=[self.load_balancer_name]
            )
            self._endpoint = response["LoadBalancers"][0]["DNSName"]
        except ClientError as err:
            raise LoadBalancerError(
                f"Couldn't get the endpoint for load balancer "
                f"{self.load_balancer_name}: {err}"
            )
    return self._endpoint

def create_target_group(self, protocol, port, vpc_id):
    """
    Creates an Elastic Load Balancing target group. The target group
    specifies how
        the load balancer forward requests to instances in the group and how
    instance
        health is checked.

    To speed up this demo, the health check is configured with shortened
    times and
        lower thresholds. In production, you might want to decrease the
    sensitivity of
        your health checks to avoid unwanted failures.

    :param protocol: The protocol to use to forward requests, such as 'HTTP'.
    :param port: The port to use to forward requests, such as 80.
    :param vpc_id: The ID of the VPC in which the load balancer exists.
    :return: Data about the newly created target group.
    """
    try:
        response = self.elb_client.create_target_group(
            Name=self.target_group_name,
            Protocol=protocol,
            Port=port,
```

```
        HealthCheckPath="/healthcheck",
        HealthCheckIntervalSeconds=10,
        HealthCheckTimeoutSeconds=5,
        HealthyThresholdCount=2,
        UnhealthyThresholdCount=2,
        VpcId=vpc_id,
    )
    target_group = response["TargetGroups"][0]
    log.info("Created load balancing target group %s.",
self.target_group_name)
except ClientError as err:
    raise LoadBalancerError(
        f"Couldn't create load balancing target group
{self.target_group_name}: {err}"
    )
else:
    return target_group

def delete_target_group(self):
    """
    Deletes the target group.
    """
    done = False
    while not done:
        try:
            response = self.elb_client.describe_target_groups(
                Names=[self.target_group_name]
            )
            tg_arn = response["TargetGroups"][0]["TargetGroupArn"]
            self.elb_client.delete_target_group(TargetGroupArn=tg_arn)
            log.info(
                "Deleted load balancing target group %s.",
self.target_group_name
            )
            done = True
        except ClientError as err:
            if err.response["Error"]["Code"] == "TargetGroupNotFound":
                log.info(
                    "Load balancer target group %s not found, nothing to
do.",
                    self.target_group_name,
                )
            done = True
```

```
        elif err.response["Error"]["Code"] == "ResourceInUse":
            log.info(
                "Target group not yet released from load balancer,
waiting...""
            )
            time.sleep(10)
        else:
            raise LoadBalancerError(
                f"Couldn't delete load balancing target group
{self.target_group_name}: {err}"
            )

def create_load_balancer(self, subnet_ids, target_group):
    """
    Creates an Elastic Load Balancing load balancer that uses the specified
    subnets
    and forwards requests to the specified target group.

    :param subnet_ids: A list of subnets to associate with the load balancer.
    :param target_group: An existing target group that is added as a listener
    to the
                           load balancer.

    :return: Data about the newly created load balancer.
    """
    try:
        response = self.elb_client.create_load_balancer(
            Name=self.load_balancer_name, Subnets=subnet_ids
        )
        load_balancer = response["LoadBalancers"][0]
        log.info("Created load balancer %s.", self.load_balancer_name)
        waiter = self.elb_client.get_waiter("load_balancer_available")
        log.info("Waiting for load balancer to be available...")
        waiter.wait(Names=[self.load_balancer_name])
        log.info("Load balancer is available!")
        self.elb_client.create_listener(
            LoadBalancerArn=load_balancer["LoadBalancerArn"],
            Protocol=target_group["Protocol"],
            Port=target_group["Port"],
            DefaultActions=[
                {
                    "Type": "forward",
                    "TargetGroupArn": target_group["TargetGroupArn"],
                }
            ]
    
```

```
        ],
    )
    log.info(
        "Created listener to forward traffic from load balancer %s to
target group %s.",
        self.load_balancer_name,
        target_group["TargetGroupName"],
    )
except ClientError as err:
    raise LoadBalancerError(
        f"Failed to create load balancer {self.load_balancer_name}"
        f"and add a listener for target group
{target_group['TargetGroupName']}": {err}"
    )
else:
    self._endpoint = load_balancer["DNSName"]
    return load_balancer

def delete_load_balancer(self):
    """
    Deletes a load balancer.
    """
    try:
        response = self.elb_client.describe_load_balancers(
            Names=[self.load_balancer_name]
        )
        lb_arn = response["LoadBalancers"][0]["LoadBalancerArn"]
        self.elb_client.delete_load_balancer(LoadBalancerArn=lb_arn)
        log.info("Deleted load balancer %s.", self.load_balancer_name)
        waiter = self.elb_client.get_waiter("load_balancers_deleted")
        log.info("Waiting for load balancer to be deleted...")
        waiter.wait(Names=[self.load_balancer_name])
    except ClientError as err:
        if err.response["Error"]["Code"] == "LoadBalancerNotFound":
            log.info(
                "Load balancer %s does not exist, nothing to do.",
                self.load_balancer_name,
            )
        else:
            raise LoadBalancerError(
                f"Couldn't delete load balancer {self.load_balancer_name}:
{err}"
            )
    
```

```
def verify_load_balancer_endpoint(self):
    """
    Verify this computer can successfully send a GET request to the load
    balancer endpoint.
    """
    success = False
    retries = 3
    while not success and retries > 0:
        try:
            lb_response = requests.get(f"http:///{self.endpoint()}")
            log.info(
                "Got response %s from load balancer endpoint.",
                lb_response.status_code,
            )
            if lb_response.status_code == 200:
                success = True
            else:
                retries = 0
        except requests.exceptions.ConnectionError:
            log.info(
                "Got connection error from load balancer endpoint,
retrying..."
            )
            retries -= 1
            time.sleep(10)
    return success

def check_target_health(self):
    """
    Checks the health of the instances in the target group.

    :return: The health status of the target group.
    """
    try:
        tg_response = self.elb_client.describe_target_groups(
            Names=[self.target_group_name]
        )
        health_response = self.elb_client.describe_target_health(
            TargetGroupArn=tg_response["TargetGroups"][0]["TargetGroupArn"]
        )
    except ClientError as err:
        raise LoadBalancerError(
```

```
f"Couldn't check health of {self.target_group_name} targets:  
{err}"  
    )  
else:  
    return health_response["TargetHealthDescriptions"]
```

Create a class that uses DynamoDB to simulate a recommendation service.

```
class RecommendationService:  
    """  
        Encapsulates a DynamoDB table to use as a service that recommends books,  
        movies,  
        and songs.  
    """  
  
    def __init__(self, table_name, dynamodb_client):  
        """  
            :param table_name: The name of the DynamoDB recommendations table.  
            :param dynamodb_client: A Boto3 DynamoDB client.  
        """  
        self.table_name = table_name  
        self.dynamodb_client = dynamodb_client  
  
    @classmethod  
    def from_client(cls, table_name):  
        """  
            Creates this class from a Boto3 client.  
  
            :param table_name: The name of the DynamoDB recommendations table.  
        """  
        ddb_client = boto3.client("dynamodb")  
        return cls(table_name, ddb_client)  
  
    def create(self):  
        """  
            Creates a DynamoDB table to use a recommendation service. The table has a  
            hash key named 'MediaType' that defines the type of media recommended,  
            such as  
        """
```

```
Book or Movie, and a range key named 'ItemId' that, combined with the
MediaType,
forms a unique identifier for the recommended item.

:return: Data about the newly created table.
"""
try:
    response = self.dynamodb_client.create_table(
        TableName=self.table_name,
        AttributeDefinitions=[
            {"AttributeName": "MediaType", "AttributeType": "S"},
            {"AttributeName": "ItemId", "AttributeType": "N"},
        ],
        KeySchema=[
            {"AttributeName": "MediaType", "KeyType": "HASH"},
            {"AttributeName": "ItemId", "KeyType": "RANGE"},
        ],
        ProvisionedThroughput={"ReadCapacityUnits": 5,
                               "WriteCapacityUnits": 5},
    )
    log.info("Creating table %s...", self.table_name)
    waiter = self.dynamodb_client.get_waiter("table_exists")
    waiter.wait(TableName=self.table_name)
    log.info("Table %s created.", self.table_name)
except ClientError as err:
    if err.response["Error"]["Code"] == "ResourceInUseException":
        log.info("Table %s exists, nothing to be do.", self.table_name)
    else:
        raise RecommendationServiceError(
            self.table_name, f"ClientError when creating table: {err}."
        )
else:
    return response

def populate(self, data_file):
    """
    Populates the recommendations table from a JSON file.

    :param data_file: The path to the data file.
    """
    try:
        with open(data_file) as data:
            items = json.load(data)
        batch = [{"PutRequest": {"Item": item}} for item in items]
```

```
        self.dynamodb_client.batch_write_item(RequestItems={self.table_name:
batch})
    log.info(
        "Populated table %s with items from %s.", self.table_name,
data_file
    )
except ClientError as err:
    raise RecommendationServiceError(
        self.table_name, f"Couldn't populate table from {data_file}:
{err}")
)

def destroy(self):
    """
    Deletes the recommendations table.
    """
    try:
        self.dynamodb_client.delete_table(TableName=self.table_name)
        log.info("Deleting table %s...", self.table_name)
        waiter = self.dynamodb_client.get_waiter("table_not_exists")
        waiter.wait(TableName=self.table_name)
        log.info("Table %s deleted.", self.table_name)
    except ClientError as err:
        if err.response["Error"]["Code"] == "ResourceNotFoundException":
            log.info("Table %s does not exist, nothing to do.",
self.table_name)
        else:
            raise RecommendationServiceError(
                self.table_name, f"ClientError when deleting table: {err}."
            )
    
```

## Create a class that wraps Systems Manager actions.

```
class ParameterHelper:
    """
    Encapsulates Systems Manager parameters. This example uses these parameters
    to drive
    the demonstration of resilient architecture, such as failure of a dependency
    or
    how the service responds to a health check.
    
```

```
"""

table = "doc-example-resilient-architecture-table"
failure_response = "doc-example-resilient-architecture-failure-response"
health_check = "doc-example-resilient-architecture-health-check"

def __init__(self, table_name, ssm_client):
    """
    :param table_name: The name of the DynamoDB table that is used as a
recommendation
        service.
    :param ssm_client: A Boto3 Systems Manager client.
    """
    self.ssm_client = ssm_client
    self.table_name = table_name

    @classmethod
    def from_client(cls, table_name):
        ssm_client = boto3.client("ssm")
        return cls(table_name, ssm_client)

    def reset(self):
        """
        Resets the Systems Manager parameters to starting values for the demo.
        These are the name of the DynamoDB recommendation table, no response when
        a
        dependency fails, and shallow health checks.
        """
        self.put(self.table, self.table_name)
        self.put(self.failure_response, "none")
        self.put(self.health_check, "shallow")

    def put(self, name, value):
        """
        Sets the value of a named Systems Manager parameter.

        :param name: The name of the parameter.
        :param value: The new value of the parameter.
        """
        try:
            self.ssm_client.put_parameter(
                Name=name, Value=value, Overwrite=True, Type="String"
            )
            log.info("Setting demo parameter %s to '%s'.", name, value)
        
```

```
        except ClientError as err:
            raise ParameterHelperError(
                f"Couldn't set parameter {name} to {value}: {err}"
            )
```

- For API details, see the following topics in *AWS SDK for Python (Boto3) API Reference*.

- [AttachLoadBalancerTargetGroups](#)
- [CreateAutoScalingGroup](#)
- [CreateInstanceProfile](#)
- [CreateLaunchTemplate](#)
- [CreateListener](#)
- [CreateLoadBalancer](#)
- [CreateTargetGroup](#)
- [DeleteAutoScalingGroup](#)
- [DeleteInstanceProfile](#)
- [DeleteLaunchTemplate](#)
- [DeleteLoadBalancer](#)
- [DeleteTargetGroup](#)
- [DescribeAutoScalingGroups](#)
- [DescribeAvailabilityZones](#)
- [DescribeElbInstanceProfileAssociations](#)
- [DescribeInstances](#)
- [DescribeLoadBalancers](#)
- [DescribeSubnets](#)
- [DescribeTargetGroups](#)
- [DescribeTargetHealth](#)
- [DescribeVpcs](#)
- [RebootInstances](#)
- [ReplaceElbInstanceProfileAssociation](#)
- [TerminateInstanceInAutoScalingGroup](#)

- [UpdateAutoScalingGroup](#)

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

## Get started with Amazon EC2 instances using an AWS SDK

The following code examples show how to:

- Create a key pair and security group.
- Select an Amazon Machine Image (AMI) and compatible instance type, then create an instance.
- Stop and restart the instance.
- Associate an Elastic IP address with your instance.
- Connect to your instance with SSH, then clean up resources.

### .NET

#### AWS SDK for .NET

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run a scenario at a command prompt.

```
/// <summary>
/// Show Amazon Elastic Compute Cloud (Amazon EC2) Basics actions.
/// </summary>
public class EC2Basics
{
    /// <summary>
    /// Perform the actions defined for the Amazon EC2 Basics scenario.
    /// </summary>
    /// <param name="args">Command line arguments.</param>
    /// <returns>A Task object.</returns>
    static async Task Main(string[] args)
```

```
{  
    // Set up dependency injection for Amazon EC2 and Amazon Simple Systems  
    // Management Service.  
    using var host =  
        Microsoft.Extensions.Hosting.Host.CreateDefaultBuilder(args)  
            .ConfigureServices(_ =>  
                services.AddAWSService<IAmazonEC2>()  
                    .AddAWSService<IAmazonSimpleSystemsManagement>()  
                    .AddTransient<EC2Wrapper>()  
                    .AddTransient<SsmWrapper>()  
            )  
            .Build();  
  
    // Now the client is available for injection.  
    var ec2Client = host.Services.GetRequiredService<IAmazonEC2>();  
    var ec2Methods = new EC2Wrapper(ec2Client);  
  
    var ssmClient =  
        host.Services.GetRequiredService<IAmazonSimpleSystemsManagement>();  
    var ssmMethods = new SsmWrapper(ssmClient);  
    var uiMethods = new UiMethods();  
  
    var uniqueName = Guid.NewGuid().ToString();  
    var keyPairName = "mvp-example-key-pair" + uniqueName;  
    var groupName = "ec2-scenario-group" + uniqueName;  
    var groupDescription = "A security group created for the EC2 Basics  
scenario.";  
  
    // Start the scenario.  
    uiMethods.DisplayOverview();  
    uiMethods.PressEnter();  
  
    // Create the key pair.  
    uiMethods.DisplayTitle("Create RSA key pair");  
    Console.WriteLine("Let's create an RSA key pair that you can be use to ");  
    Console.WriteLine("securely connect to your EC2 instance.");  
    var keyPair = await ec2Methods.CreateKeyPair(keyPairName);  
  
    // Save key pair information to a temporary file.  
    var tempFileName = ec2Methods.SaveKeyPair(keyPair);  
  
    Console.WriteLine($"Created the key pair: {keyPair.KeyName} and saved it  
to: {tempFileName}");  
    string? answer;
```

```
do
{
    Console.WriteLine("Would you like to list your existing key pairs? ");
    answer = Console.ReadLine();
} while (answer!.ToLower() != "y" && answer.ToLower() != "n");

if (answer == "y")
{
    // List existing key pairs.
    uiMethods.DisplayTitle("Existing key pairs");

    // Passing an empty string to the DescribeKeyPairs method will return
    // a list of all existing key pairs.
    var keyPairs = await ec2Methods.DescribeKeyPairs("");
    keyPairs.ForEach(kp =>
    {
        Console.WriteLine($"{kp.KeyName} created at: {kp.CreateTime}
Fingerprint: {kp.KeyFingerprint}");
    });
}

uiMethods.PressEnter();

// Create the security group.
Console.WriteLine("Let's create a security group to manage access to your
instance.");
var secGroupId = await ec2Methods.CreateSecurityGroup(groupName,
groupDescription);
Console.WriteLine("Let's add rules to allow all HTTP and HTTPS inbound
traffic and to allow SSH only from your current IP address.");

uiMethods.DisplayTitle("Security group information");
var secGroups = await ec2Methods.DescribeSecurityGroups(secGroupId);

Console.WriteLine($"Created security group {groupName} in your default
VPC.");
secGroups.ForEach(group =>
{
    ec2Methods.DisplaySecurityGroupInfoAsync(group);
});
uiMethods.PressEnter();

Console.WriteLine("Now we'll authorize the security group we just created
so that it can");
Console.WriteLine("access the EC2 instances you create.");
```

```
var success = await ec2Methods.AuthorizeSecurityGroupIngress(groupName);

secGroups = await ec2Methods.DescribeSecurityGroups(secGroupId);
Console.WriteLine($"Now let's look at the permissions again.");
secGroups.ForEach(group =>
{
    ec2Methods.DisplaySecurityGroupInfoAsync(group);
});
uiMethods.PressEnter();

// Get list of available Amazon Linux 2 Amazon Machine Images (AMIs).
var parameters = await ssmMethods.GetParametersByPath("/aws/service/ami-
amazon-linux-latest");

List<string> imageIds = parameters.Select(param => param.Value).ToList();

var images = await ec2Methods.DescribeImages(imageIds);

var i = 1;
images.ForEach(image =>
{
    Console.WriteLine($"{i++} {image.Description}");
});

int choice;
bool validNumber = false;

do
{
    Console.Write("Please select an image: ");
    var selImage = Console.ReadLine();
    validNumber = int.TryParse(selImage, out choice);
} while (!validNumber);

var selectedImage = images[choice - 1];

// Display available instance types.
uiMethods.DisplayTitle("Instance Types");
var instanceTypes = await
ec2Methods.DescribeInstanceTypes(selectedImage.Architecture);

i = 1;
instanceTypes.ForEach(instanceType =>
{
```

```
        Console.WriteLine($"\\t{i++}\\t{instanceType.InstanceType}");
    });

    do
    {
        Console.Write("Please select an instance type: ");
        var selImage = Console.ReadLine();
        validNumber = int.TryParse(selImage, out choice);
    } while (!validNumber);

    var selectedInstanceType = instanceTypes[choice - 1].InstanceType;

    // Create an EC2 instance.
    uiMethods.DisplayTitle("Creating an EC2 Instance");
    var instanceId = await ec2Methods.RunInstances(selectedImage.ImageId,
selectedInstanceType, keyPairName, secGroupId);
    Console.Write("Waiting for the instance to start.");
    var isRunning = false;
    do
    {
        isRunning = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Running);
    } while (!isRunning);

    uiMethods.PressEnter();

    var instance = await ec2Methods.DescribeInstance(instanceId);
    uiMethods.DisplayTitle("New Instance Information");
    ec2Methods.DisplayInstanceInformation(instance);

    Console.WriteLine("\nYou can use SSH to connect to your instance. For
example:");
    Console.WriteLine($"\\tssh -i {tempFileName} ec2-
user@{instance.PublicIpAddress}");

    uiMethods.PressEnter();

    Console.WriteLine("Now we'll stop the instance and then start it again to
see what's changed.");

    await ec2Methods.StopInstances(instanceId);
    var hasStopped = false;
    do
    {
```

```
        hasStopped = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Stopped);
    } while (!hasStopped);

    Console.WriteLine("\nThe instance has stopped.");

    Console.WriteLine("Now let's start it up again.");
    await ec2Methods.StartInstances(instanceId);
    Console.Write("Waiting for instance to start. ");

    isRunning = false;
    do
    {
        isRunning = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Running);
    } while (!isRunning);

    Console.WriteLine("\nLet's see what changed.");

    instance = await ec2Methods.DescribeInstance(instanceId);
    uiMethods.DisplayTitle("New Instance Information");
    ec2Methods.DisplayInstanceInformation(instance);

    Console.WriteLine("\nNotice the change in the SSH information:");
    Console.WriteLine($"\"tssh -i {tempFileName} ec2-
user@{instance.PublicIpAddress}\")");

    uiMethods.PressEnter();

    Console.WriteLine("Now we will stop the instance again. Then we will
create and associate an");
    Console.WriteLine("Elastic IP address to use with our instance.");

    await ec2Methods.StopInstances(instanceId);
    hasStopped = false;
    do
    {
        hasStopped = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Stopped);
    } while (!hasStopped);

    Console.WriteLine("\nThe instance has stopped.");
    uiMethods.PressEnter();
```

```
        uiMethods.DisplayTitle("Allocate Elastic IP address");
        Console.WriteLine("You can allocate an Elastic IP address and associate
it with your instance\n to keep a consistent IP address even when your instance
restarts.");
        var allocationId = await ec2Methods.AllocateAddress();
        Console.WriteLine("Now we will associate the Elastic IP address with our
instance.");
        var associationId = await ec2Methods.AssociateAddress(allocationId,
instanceId);

        // Start the instance again.
        Console.WriteLine("Now let's start the instance again.");
        await ec2Methods.StartInstances(instanceId);
        Console.Write("Waiting for instance to start. ");

        isRunning = false;
        do
        {
            isRunning = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Running);
        } while (!isRunning);

        Console.WriteLine("\nLet's see what changed.");

        instance = await ec2Methods.DescribeInstance(instanceId);
        uiMethods.DisplayTitle("Instance information");
        ec2Methods.DisplayInstanceInformation(instance);

        Console.WriteLine("\nHere is the SSH information:");
        Console.WriteLine($"\"tssh -i {tempFileName} ec2-
user@{instance.PublicIpAddress}\")");

        Console.WriteLine("Let's stop and start the instance again.");
        uiMethods.PressEnter();

        await ec2Methods.StopInstances(instanceId);

        hasStopped = false;
        do
        {
            hasStopped = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Stopped);
        } while (!hasStopped);
```

```
Console.WriteLine("\nThe instance has stopped.");

Console.WriteLine("Now let's start it up again.");
await ec2Methods.StartInstances(instanceId);
Console.Write("Waiting for instance to start. ");

isRunning = false;
do
{
    isRunning = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Running);
} while (!isRunning);

instance = await ec2Methods.DescribeInstance(instanceId);
uiMethods.DisplayTitle("New Instance Information");
ec2Methods.DisplayInstanceInformation(instance);
Console.WriteLine("Note that the IP address did not change this time.");
uiMethods.PressEnter();

uiMethods.DisplayTitle("Clean up resources");

Console.WriteLine("Now let's clean up the resources we created.");

// Terminate the instance.
Console.WriteLine("Terminating the instance we created.");
var stateChange = await ec2Methods.TerminateInstances(instanceId);

// Wait for the instance state to be terminated.
var hasTerminated = false;
do
{
    hasTerminated = await ec2Methods.WaitForInstanceState(instanceId,
InstanceStateName.Terminated);
} while (!hasTerminated);

Console.WriteLine($"\\nThe instance {instanceId} has been terminated.");
Console.WriteLine("Now we can disassociate the Elastic IP address and
release it.");

// Disassociate the Elastic IP address.
var disassociated = ec2Methods.DisassociateIp(associationId);

// Delete the Elastic IP address.
var released = ec2Methods.ReleaseAddress(allocationId);
```

```
// Delete the security group.  
Console.WriteLine($"Deleting the Security Group: {groupName}.");  
success = await ec2Methods.DeleteSecurityGroup(secGroupId);  
if (success)  
{  
    Console.WriteLine($"Successfully deleted {groupName}.");  
}  
  
// Delete the RSA key pair.  
Console.WriteLine($"Deleting the key pair: {keyPairName}");  
await ec2Methods.DeleteKeyPair(keyPairName);  
Console.WriteLine("Deleting the temporary file with the key  
information.");  
ec2Methods.DeleteTempFile(tempFileName);  
uiMethods.PressEnter();  
  
uiMethods.DisplayTitle("EC2 Basics Scenario completed.");  
uiMethods.PressEnter();  
}  
}  
}
```

Define a class that wraps EC2 actions.

```
/// <summary>  
/// Methods of this class perform Amazon Elastic Compute Cloud (Amazon EC2).  
/// </summary>  
public class EC2Wrapper  
{  
    private readonly IAmazonEC2 _amazonEC2;  
  
    public EC2Wrapper(IAmazonEC2 amazonService)  
    {  
        _amazonEC2 = amazonService;  
    }  
  
    /// <summary>  
    /// Allocate an Elastic IP address.  
    /// </summary>  
    /// <returns>The allocation Id of the allocated address.</returns>  
    public async Task<string> AllocateAddress()  
    {
```

```
        var request = new AllocateAddressRequest();

        var response = await _amazonEC2.AllocateAddressAsync(request);
        return response.AllocationId;
    }

    /// <summary>
    /// Associate an Elastic IP address to an EC2 instance.
    /// </summary>
    /// <param name="allocationId">The allocation Id of an Elastic IP address.</param>
    /// <param name="instanceId">The instance Id of the EC2 instance to
    /// associate the address with.</param>
    /// <returns>The association Id that represents
    /// the association of the Elastic IP address with an instance.</returns>
    public async Task<string> AssociateAddress(string allocationId, string
instanceId)
{
    var request = new AssociateAddressRequest
    {
        AllocationId = allocationId,
        InstanceId = instanceId
    };

    var response = await _amazonEC2.AssociateAddressAsync(request);
    return response.AssociationId;
}

    /// <summary>
    /// Authorize the local computer ingress to EC2 instances associated
    /// with the virtual private cloud (VPC) security group.
    /// </summary>
    /// <param name="groupName">The name of the security group.</param>
    /// <returns>A Boolean value indicating the success of the action.</returns>
    public async Task<bool> AuthorizeSecurityGroupIngress(string groupName)
{
    // Get the IP address for the local computer.
    var ipAddress = await GetIpAddress();
    Console.WriteLine($"Your IP address is: {ipAddress}");
    var ipRanges = new List<IpRange> { new IpRange { CidrIp =
 $"{ipAddress}/32" } };
    var permission = new IpPermission
    {
        Ipv4Ranges = ipRanges,
```

```
        IpProtocol = "tcp",
        FromPort = 22,
        ToPort = 22
    };
    var permissions = new List<IpPermission> { permission };
    var response = await _amazonEC2.AuthorizeSecurityGroupIngressAsync(
        new AuthorizeSecurityGroupIngressRequest(groupName, permissions));
    return response.HttpStatusCode == HttpStatusCode.OK;
}

/// <summary>
/// Authorize the local computer for ingress to
/// the Amazon EC2 SecurityGroup.
/// </summary>
/// <returns>The IPv4 address of the computer running the scenario.</returns>
private static async Task<string> GetIpAddress()
{
    var httpClient = new HttpClient();
    var ipString = await httpClient.GetStringAsync("https://
checkip.amazonaws.com");

    // The IP address is returned with a new line
    // character on the end. Trim off the whitespace and
    // return the value to the caller.
    return ipString.Trim();
}

/// <summary>
/// Create an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name for the new key pair.</param>
/// <returns>The Amazon EC2 key pair created.</returns>
public async Task<KeyPair?> CreateKeyPair(string keyPairName)
{
    var request = new CreateKeyPairRequest
    {
        KeyName = keyPairName,
    };

    var response = await _amazonEC2.CreateKeyPairAsync(request);

    if (response.HttpStatusCode == HttpStatusCode.OK)
    {
        var kp = response.KeyPair;
```

```
        return kp;
    }
    else
    {
        Console.WriteLine("Could not create key pair.");
        return null;
    }
}

/// <summary>
/// Save KeyPair information to a temporary file.
/// </summary>
/// <param name="keyPair">The name of the key pair.</param>
/// <returns>The full path to the temporary file.</returns>
public string SaveKeyPair(KeyPair keyPair)
{
    var tempPath = Path.GetTempPath();
    var tempFileName = $"{tempPath}\\{Path.GetRandomFileName()}";
    var pemFileName = Path.ChangeExtension(tempFileName, "pem");

    // Save the key pair to a file in a temporary folder.
    using var stream = new FileStream(pemFileName, FileMode.Create);
    using var writer = new StreamWriter(stream);
    writer.WriteLine(keyPair.KeyMaterial);

    return pemFileName;
}

/// <summary>
/// Create an Amazon EC2 security group.
/// </summary>
/// <param name="groupName">The name for the new security group.</param>
/// <param name="groupDescription">A description of the new security group.</param>
/// <returns>The group Id of the new security group.</returns>
public async Task<string> CreateSecurityGroup(string groupName, string
groupDescription)
{
    var response = await _amazonEC2.CreateSecurityGroupAsync(
        new CreateSecurityGroupRequest(groupName, groupDescription));

    return response.GroupId;
}
```

```
/// <summary>
/// Create a new Amazon EC2 VPC.
/// </summary>
/// <param name="cidrBlock">The CIDR block for the new security group.</param>
/// <returns>The VPC Id of the new VPC.</returns>
public async Task<string?> CreateVPC(string cidrBlock)
{
    try
    {
        var response = await _amazonEC2.CreateVpcAsync(new CreateVpcRequest
        {
            CidrBlock = cidrBlock,
        });

        Vpc vpc = response.Vpc;
        Console.WriteLine($"Created VPC with ID: {vpc.VpcId}.");
        return vpc.VpcId;
    }
    catch (AmazonEC2Exception ex)
    {
        Console.WriteLine($"Couldn't create VPC because: {ex.Message}");
        return null;
    }
}

/// <summary>
/// Delete an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name of the key pair to delete.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DeleteKeyPair(string keyPairName)
{
    try
    {
        await _amazonEC2.DeleteKeyPairAsync(new
DeleteKeyPairRequest(keyPairName)).ConfigureAwait(false);
        return true;
    }
    catch (Exception ex)
    {
```

```
        Console.WriteLine($"Couldn't delete the key pair because:  
{ex.Message}");  
        return false;  
    }  
  
}  
  
/// <summary>  
/// Delete the temporary file where the key pair information was saved.  
/// </summary>  
/// <param name="tempFileName">The path to the temporary file.</param>  
public void DeleteTempFile(string tempFileName)  
{  
    if (File.Exists(tempFileName))  
    {  
        File.Delete(tempFileName);  
    }  
}  
  
/// <summary>  
/// Delete an Amazon EC2 security group.  
/// </summary>  
/// <param name="groupName">The name of the group to delete.</param>  
/// <returns>A Boolean value indicating the success of the action.</returns>  
public async Task<bool> DeleteSecurityGroup(string groupId)  
{  
    var response = await _amazonEC2.DeleteSecurityGroupAsync(new  
DeleteSecurityGroupRequest { GroupId = groupId });  
    return response.HttpStatusCode == HttpStatusCode.OK;  
}  
  
/// <summary>  
/// Delete an Amazon EC2 VPC.  
/// </summary>  
/// <returns>A Boolean value indicating the success of the action.</returns>  
public async Task<bool> DeleteVpc(string vpcId)  
{  
    var request = new DeleteVpcRequest  
    {  
        VpcId = vpcId,  
    };  
  
    var response = await _amazonEC2.DeleteVpcAsync(request);  
  
    return response.HttpStatusCode == System.Net.HttpStatusCode.OK;
```

```
}

/// <summary>
/// Get information about existing Amazon EC2 images.
/// </summary>
/// <returns>A list of image information.</returns>
public async Task<List<Image>> DescribeImages(List<string>? imageIds)
{
    var request = new DescribeImagesRequest();
    if (imageIds is not null)
    {
        // If the imageIds list is not null, add the list
        // to the request object.
        request.ImageIds = imageIds;
    }

    var response = await _amazonEC2.DescribeImagesAsync(request);
    return response.Images;
}

/// <summary>
/// Display the information returned by DescribeImages.
/// </summary>
/// <param name="images">The list of image information to display.</param>
public void DisplayImageInfo(List<Image> images)
{
    images.ForEach(image =>
    {
        Console.WriteLine($"{image.Name} Created on: {image.CreationDate}");
    });
}

/// <summary>
/// Get information about an Amazon EC2 instance.
/// </summary>
/// <param name="instanceId">The instance Id of the EC2 instance.</param>
/// <returns>An EC2 instance.</returns>
public async Task<Instance> DescribeInstance(string instanceId)
{
    var response = await _amazonEC2.DescribeInstancesAsync(
        new DescribeInstancesRequest { InstanceIds = new List<string>
    { instanceId } });
    return response.Reservations[0].Instances[0];
}
```

```
}

/// <summary>
/// Display EC2 instance information.
/// </summary>
/// <param name="instance">The instance Id of the EC2 instance.</param>
public void DisplayInstanceInformation(Instance instance)
{
    Console.WriteLine($"ID: {instance.InstanceId}");
    Console.WriteLine($"Image ID: {instance.ImageId}");
    Console.WriteLine($"{{instance.InstanceType}}");
    Console.WriteLine($"Key Name: {instance.KeyName}");
    Console.WriteLine($"VPC ID: {instance.VpcId}");
    Console.WriteLine($"Public IP: {instance.PublicIpAddress}");
    Console.WriteLine($"State: {instance.State.Name}");
}

/// <summary>
/// Get information about existing EC2 images.
/// </summary>
/// <returns>Async task.</returns>
public async Task DescribeInstances()
{
    // List all EC2 instances.
    await GetInstanceDescriptions();

    string tagName = "IncludeInList";
    string tagValue = "Yes";
    await GetInstanceDescriptionsFiltered(tagName, tagValue);
}

/// <summary>
/// Get information for all existing Amazon EC2 instances.
/// </summary>
/// <returns>Async task.</returns>
public async Task GetInstanceDescriptions()
{
    Console.WriteLine("Showing all instances:");
    var paginator = _amazonEC2.Paginator.DescribeInstances(new
DescribeInstancesRequest());

    await foreach (var response in paginator.Responses)
    {
        foreach (var reservation in response.Reservations)
```

```
        {
            foreach (var instance in reservation.Instances)
            {
                Console.WriteLine($"Instance ID: {instance.InstanceId}");
                Console.WriteLine($"Current State: {instance.State.Name}");
            }
        }
    }

/// <summary>
/// Get information about EC2 instances filtered by a tag name and value.
/// </summary>
/// <param name="tagName">The name of the tag to filter on.</param>
/// <param name="tagValue">The value of the tag to look for.</param>
/// <returns>Async task.</returns>
public async Task<List<AmazonEC2.Model.InstanceDescription>> GetInstanceDescriptionsFiltered(string tagName, string tagValue)
{
    // This tag filters the results of the instance list.
    var filters = new List<Filter>
    {
        new Filter
        {
            Name = $"tag:{tagName}",
            Values = new List<string>
            {
                tagValue,
            },
        },
    };
    var request = new DescribeInstancesRequest
    {
        Filters = filters,
    };

    Console.WriteLine("\nShowing instances with tag: \"IncludeInList\" set to \"Yes\".");
    var paginator = _amazonEC2.Paginator<DescribeInstancesRequest>.Create();
    var responses = await paginator.ListResponsesAsync(request);
    foreach (var response in responses)
    {
        foreach (var reservation in response.Reservations)
        {
            foreach (var instance in reservation.Instances)
            {
                Console.WriteLine($"Instance ID: {instance.InstanceId}");
                Console.WriteLine($"Current State: {instance.State.Name}");
            }
        }
    }
}
```

```
        foreach (var instance in reservation.Instances)
        {
            Console.WriteLine($"Instance ID: {instance.InstanceId} ");
            Console.WriteLine($"\\tCurrent State: {instance.State.Name}");
        }
    }
}

/// <summary>
/// Describe the instance types available.
/// </summary>
/// <returns>A list of instance type information.</returns>
public async Task<List<InstanceTypeInfo>>
DescribeInstanceTypes(ArchitectureValues architecture)
{
    var request = new DescribeInstanceTypesRequest();

    var filters = new List<Filter>
    {
        new Filter("processor-info.supported-architecture", new
List<string> { architecture.ToString() });
    };
    filters.Add(new Filter("instance-type", new() { "* .micro", "* .small" }));

    request.Filters = filters;
    var instanceTypes = new List<InstanceTypeInfo>();

    var paginator = _amazonEC2.Paginator.DescribeInstanceTypes(request);
    await foreach (var instanceType in paginator.InstanceTypes)
    {
        instanceTypes.Add(instanceType);
    }
    return instanceTypes;
}

/// <summary>
/// Display the instance type information returned by
DescribeInstanceTypesAsync.
/// </summary>
/// <param name="instanceTypes">The list of instance type information.</
param>
public void DisplayInstanceTypeInfo(List<InstanceTypeInfo> instanceTypes)
{
    instanceTypes.ForEach(type =>
    {
```

```
        Console.WriteLine($"{type.InstanceType}\t{type.MemoryInfo}");
    });

}

/// <summary>
/// Get information about an Amazon EC2 key pair.
/// </summary>
/// <param name="keyPairName">The name of the key pair.</param>
/// <returns>A list of key pair information.</returns>
public async Task<List<KeyPairInfo>> DescribeKeyPairs(string keyPairName)
{
    var request = new DescribeKeyPairsRequest();
    if (!string.IsNullOrEmpty(keyPairName))
    {
        request = new DescribeKeyPairsRequest
        {
            KeyNames = new List<string> { keyPairName }
        };
    }
    var response = await _amazonEC2.DescribeKeyPairsAsync(request);
    return response.KeyPairs.ToList();
}

/// <summary>
/// Retrieve information for an Amazon EC2 security group.
/// </summary>
/// <param name="groupId">The Id of the Amazon EC2 security group.</param>
/// <returns>A list of security group information.</returns>
public async Task<List<SecurityGroup>> DescribeSecurityGroups(string groupId)
{
    var request = new DescribeSecurityGroupsRequest();
    var groupIds = new List<string> { groupId };
    request.GroupIds = groupIds;

    var response = await _amazonEC2.DescribeSecurityGroupsAsync(request);
    return response.SecurityGroups;
}

/// <summary>
/// Display the information returned by the call to
/// DescribeSecurityGroupsAsync.
/// </summary>
/// <param name="securityGroup">A list of security group information.</param>
```

```
public void DisplaySecurityGroupInfoAsync(SecurityGroup securityGroup)
{
    Console.WriteLine($"{{securityGroup.GroupName}}");
    Console.WriteLine("Ingress permissions:");
    securityGroup.IpPermissions.ForEach(permission =>
    {
        Console.WriteLine($"\\tFromPort: {permission.FromPort}");
        Console.WriteLine($"\\tIpProtocol: {permission.IpProtocol}");

        Console.Write($"\\tIpv4Ranges: ");
        permission.Ipv4Ranges.ForEach(range =>
        { Console.Write($"{{range.CidrIp}} "); });

        Console.WriteLine($"\\n\\tIpv6Ranges:");
        permission.Ipv6Ranges.ForEach(range =>
        { Console.Write($"{{range.CidrIpv6}} "); });

        Console.Write($"\\n\\tPrefixListIds: ");
        permission.PrefixListIds.ForEach(id => Console.WriteLine($"{{id.Id}}"));

        Console.WriteLine($"\\n\\tTo Port: {permission.ToPort}");
    });
    Console.WriteLine("Egress permissions:");
    securityGroup.IpPermissionsEgress.ForEach(permission =>
    {
        Console.WriteLine($"\\tFromPort: {permission.FromPort}");
        Console.WriteLine($"\\tIpProtocol: {permission.IpProtocol}");

        Console.Write($"\\tIpv4Ranges: ");
        permission.Ipv4Ranges.ForEach(range =>
        { Console.Write($"{{range.CidrIp}} "); });

        Console.WriteLine($"\\n\\tIpv6Ranges:");
        permission.Ipv6Ranges.ForEach(range =>
        { Console.Write($"{{range.CidrIpv6}} "); });

        Console.Write($"\\n\\tPrefixListIds: ");
        permission.PrefixListIds.ForEach(id => Console.WriteLine($"{{id.Id}}"));

        Console.WriteLine($"\\n\\tTo Port: {permission.ToPort}");
    });
}
```

```
/// <summary>
/// Disassociate an Elastic IP address from an EC2 instance.
/// </summary>
/// <param name="associationId">The association Id.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DisassociateIp(string associationId)
{
    var response = await _amazonEC2.DisassociateAddressAsync(
        new DisassociateAddressRequest { AssociationId = associationId });
    return response.HttpStatusCode == HttpStatusCode.OK;
}

/// <summary>
/// Retrieve a list of available Amazon Linux images.
/// </summary>
/// <returns>A list of image information.</returns>
public async Task<List<Image>> GetEC2AmiList()
{
    var filter = new Filter { Name = "architecture", Values = new
List<string> { "x86_64" } };
    var filters = new List<Filter> { filter };
    var response = await _amazonEC2.DescribeImagesAsync(new
DescribeImagesRequest { Filters = filters });
    return response.Images;
}

/// <summary>
/// Reboot EC2 instances.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the instances that will be
rebooted.</param>
/// <returns>Async task.</returns>
public async Task RebootInstances(string ec2InstanceId)
{
    var request = new RebootInstancesRequest
    {
        InstanceIds = new List<string> { ec2InstanceId },
    };

    var response = await _amazonEC2.RebootInstancesAsync(request);
    if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
    {
        Console.WriteLine("Instances successfully rebooted.");
    }
}
```

```
        else
        {
            Console.WriteLine("Could not reboot one or more instances.");
        }
    }

    /// <summary>
    /// Release an Elastic IP address.
    /// </summary>
    /// <param name="allocationId">The allocation Id of the Elastic IP address.</param>
    /// <returns>A Boolean value indicating the success of the action.</returns>
    public async Task<bool> ReleaseAddress(string allocationId)
    {
        var request = new ReleaseAddressRequest
        {
            AllocationId = allocationId
        };

        var response = await _amazonEC2.ReleaseAddressAsync(request);
        return response.HttpStatusCode == HttpStatusCode.OK;
    }

    /// <summary>
    /// Create and run an EC2 instance.
    /// </summary>
    /// <param name="ImageId">The image Id of the image used as a basis for the
    /// EC2 instance.</param>
    /// <param name="instanceType">The instance type of the EC2 instance to
    /// create.</param>
    /// <param name="keyName">The name of the key pair to associate with the
    /// instance.</param>
    /// <param name="groupId">The Id of the Amazon EC2 security group that will
    be
    /// allowed to interact with the new EC2 instance.</param>
    /// <returns>The instance Id of the new EC2 instance.</returns>
    public async Task<string> RunInstances(string imageId, string instanceType,
    string keyName, string groupId)
    {
        var request = new RunInstancesRequest
        {
            ImageId = imageId,
            InstanceType = instanceType,
            KeyName = keyName,
```

```
        MinCount = 1,
        MaxCount = 1,
        SecurityGroupIds = new List<string> { groupId }
    };
    var response = await _amazonEC2.RunInstancesAsync(request);
    return response.Reservation.Instances[0].InstanceId;
}

/// <summary>
/// Start an EC2 instance.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the Amazon EC2 instance
/// to start.</param>
/// <returns>Async task.</returns>
public async Task StartInstances(string ec2InstanceId)
{
    var request = new StartInstancesRequest
    {
        InstanceIds = new List<string> { ec2InstanceId },
    };

    var response = await _amazonEC2.StartInstancesAsync(request);

    if (response.StartingInstances.Count > 0)
    {
        var instances = response.StartingInstances;
        instances.ForEach(i =>
        {
            Console.WriteLine($"Successfully started the EC2 instance with
instance ID: {i.InstanceId}.");
        });
    }
}

/// <summary>
/// Stop an EC2 instance.
/// </summary>
/// <param name="ec2InstanceId">The instance Id of the EC2 instance to
/// stop.</param>
/// <returns>Async task.</returns>
public async Task StopInstances(string ec2InstanceId)
{
    // In addition to the list of instance Ids, the
```

```
// request can also include the following properties:  
// Force When true, forces the instances to  
// stop but you must check the integrity  
// of the file system. Not recommended on  
// Windows instances.  
// Hibernate When true, hibernates the instance if the  
// instance was enabled for hibernation when  
// it was launched.  
var request = new StopInstancesRequest  
{  
    InstanceIds = new List<string> { ec2InstanceId },  
};  
  
var response = await _amazonEC2.StopInstancesAsync(request);  
  
if (response.StoppingInstances.Count > 0)  
{  
    var instances = response.StoppingInstances;  
    instances.ForEach(i =>  
    {  
        Console.WriteLine($"Successfully stopped the EC2 Instance " +  
                         $"with InstanceID: {i.InstanceId}.");  
    });  
}  
}  
  
/// <summary>  
/// Terminate an EC2 instance.  
/// </summary>  
/// <param name="ec2InstanceId">The instance Id of the EC2 instance  
/// to terminate.</param>  
/// <returns>Async task.</returns>  
public async Task<List<InstanceStateChange>> TerminateInstances(string  
ec2InstanceId)  
{  
    var request = new TerminateInstancesRequest  
    {  
        InstanceIds = new List<string> { ec2InstanceId }  
    };  
  
    var response = await _amazonEC2.TerminateInstancesAsync(request);  
    return response.TerminatingInstances;  
}
```

```
/// <summary>
/// Wait until an EC2 instance is in a specified state.
/// </summary>
/// <param name="instanceId">The instance Id.</param>
/// <param name="stateName">The state to wait for.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> WaitForInstanceState(string instanceId,
InstanceStateName stateName)
{
    var request = new DescribeInstancesRequest
    {
        InstanceIds = new List<string> { instanceId }
    };

    // Wait until the instance is running.
    var hasState = false;
    do
    {
        // Wait 5 seconds.
        Thread.Sleep(5000);

        // Check for the desired state.
        var response = await _amazonEC2.DescribeInstancesAsync(request);
        var instance = response.Reservations[0].Instances[0];
        hasState = instance.State.Name == stateName;
        Console.Write(".");
    } while (!hasState);

    return hasState;
}

}
```

- For API details, see the following topics in *AWS SDK for .NET API Reference*.
  - [AllocateAddress](#)
  - [AssociateAddress](#)
  - [AuthorizeSecurityGroupIngress](#)
  - [CreateKeyPair](#)
  - [CreateSecurityGroup](#)
  - [DeleteKeyPair](#)

- [DeleteSecurityGroup](#)
- [DescribeImages](#)
- [DescribeInstanceTypes](#)
- [DescribeInstances](#)
- [DescribeKeyPairs](#)
- [DescribeSecurityGroups](#)
- [DisassociateAddress](#)
- [ReleaseAddress](#)
- [RunInstances](#)
- [StartInstances](#)
- [StopInstances](#)
- [TerminateInstances](#)
- [UnmonitorInstances](#)

## Bash

### AWS CLI with Bash script

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run an interactive scenario at a command prompt.

```
#####
# function get_started_with_ec2_instances
#
# Runs an interactive scenario that shows how to get started using EC2 instances.
#
#      "EC2 access" permissions are needed to run this code.
#
# Returns:
#      0 - If successful.
#      1 - If an error occurred.
```

```
#####
function get_started_with_ec2_instances() {
    # Requires version 4 for mapfile.
    local required_version=4.0

    # Get the current Bash version
    # Check if BASH_VERSION is set
    local current_version
    if [[ -n "$BASH_VERSION" ]]; then
        # Convert BASH_VERSION to a number for comparison
        current_version=$BASH_VERSION
    else
        # Get the current Bash version using the bash command
        current_version=$(bash --version | head -n 1 | awk '{ print $4 }')
    fi

    # Convert version strings to numbers for comparison
    local required_version_num current_version_num
    required_version_num=$(echo "$required_version" | awk -F. '{ print ($1 * 10000) + ($2 * 100) + $3 }')
    current_version_num=$(echo "$current_version" | awk -F. '{ print ($1 * 10000) + ($2 * 100) + $3 }')

    # Compare versions
    if ((current_version_num < required_version_num)); then
        echo "Error: This script requires Bash version $required_version or higher."
        echo "Your current Bash version is number is $current_version."
        exit 1
    fi

    {
        if [ "$EC2_OPERATIONS_SOURCED" != "True" ]; then

            source ./ec2_operations.sh
        fi
    }

    echo_repeat "*" 88
    echo "Welcome to the Amazon Elastic Compute Cloud (Amazon EC2) get started with instances demo."
    echo_repeat "*" 88
    echo

    echo "Let's create an RSA key pair that you can be use to securely connect to "
```

```
echo "your EC2 instance.\n\n"

echo -n "Enter a unique name for your key: "
get_input
local key_name
key_name=$get_input_result

local temp_dir
temp_dir=$(mktemp -d)
local key_file_name="$temp_dir/${key_name}.pem"

if ec2_create_keypair -n "${key_name}" -f "${key_file_name}"; then
    echo "Created a key pair $key_name and saved the private key to
$key_file_name"
    echo
else
    errecho "The key pair failed to create. This demo will exit."
    return 1
fi

chmod 400 "${key_file_name}"

if yes_no_input "Do you want to list some of your key pairs? (y/n) "; then
    local keys_and_fingerprints
    keys_and_fingerprints="$(ec2_describe_key_pairs)" && {
        local image_name_and_id
        while IFS=$'\n' read -r image_name_and_id; do
            local entries
            IFS=$'\t' read -ra entries <<< "$image_name_and_id"
            echo "Found rsa key ${entries[0]} with fingerprint:"
            echo "      ${entries[1]}"
            done <<< "$keys_and_fingerprints"
    }
fi

echo_repeat "*" 88
echo_repeat "*" 88

echo "Let's create a security group to manage access to your instance."
echo -n "Enter a unique name for your security group: "
get_input
local security_group_name
security_group_name=$get_input_result
```

```
local security_group_id
security_group_id=$(ec2_create_security_group -n "$security_group_name" \
-d "Security group for EC2 instance") || {
errecho "The security failed to create. This demo will exit."
clean_up "$key_name" "$key_file_name"
return 1
}

echo "Security group created with ID $security_group_id"
echo

local public_ip
public_ip=$(curl -s http://checkip.amazonaws.com)

echo "Let's add a rule to allow SSH only from your current IP address."
echo "Your public IP address is $public_ip"
echo -n "press return to add this rule to your security group."
get_input

if ! ec2_authorize_security_group_ingress -g "$security_group_id" -i
"$public_ip" -p tcp -f 22 -t 22; then
errecho "The security group rules failed to update. This demo will exit."
clean_up "$key_name" "$key_file_name" "$security_group_id"
return 1
fi

echo "Security group rules updated"

local security_group_description
security_group_description=$(ec2_describe_security_groups -g
"${security_group_id}") || {
errecho "Failed to describe security groups. This demo will exit."
clean_up "$key_name" "$key_file_name" "$security_group_id"
return 1
}

mapfile -t parameters <<<"$security_group_description"
IFS=$'\t' read -ra entries <<<"${parameters[0]}"
echo "Security group: ${entries[0]}"
echo "    ID: ${entries[1]}"
echo "    VPC: ${entries[2]}"
echo "Inbound permissions:"
IFS=$'\t' read -ra entries <<<"${parameters[1]}"
echo "    IpProtocol: ${entries[0]}
```

```
echo "    FromPort: ${entries[1]}"
echo "    ToPort: ${entries[2]}"
echo "    CidrIp: ${parameters[2]}"

local parameters
parameters=$(ssm_get_parameters_by_path -p "/aws/service/ami-amazon-linux-latest")" || {
    errecho "Failed to get parameters. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id"
    return 1
}

local image_ids=""
mapfile -t parameters <<<"$parameters"
for image_name_and_id in "${parameters[@]}"; do
    IFS=$'\t' read -ra values <<<"$image_name_and_id"
    if [[ "${values[0]}" == *"amzn2"* ]]; then
        image_ids+="${values[1]} "
    fi
done

local images
images=$(ec2_describe_images -i "$image_ids")" || {
    errecho "Failed to describe images. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id"
    return 1
}

new_line_and_tab_to_list "$images"
local images=("${list_result[@]}")

# Get the size of the array
local images_count=${#images[@]}

if ((images_count == 0)); then
    errecho "No images found. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id"
    return 1
fi

echo_repeat "*" 88
echo_repeat "*" 88
```

```
echo "Let's create an instance from an Amazon Linux 2 AMI. Here are some
options:"
for ((i = 0; i < images_count; i += 3)); do
    echo "$(((i / 3) + 1)) - ${images[$i]}"
done

integer_input "Please enter the number of the AMI you want to use: " 1
"$(images_count / 3)"
local choice=$get_input_result
choice=$((choice - 1) * 3))

echo "Great choice."
echo

local architecture=${images[$((choice + 1))]}
local image_id=${images[$((choice + 2))]}
echo "Here are some instance types that support the ${architecture}
architecture of the image:"
response=$(ec2_describe_instance_types -a "${architecture}" -t
"*.micro,*.small") || {
    errecho "Failed to describe instance types. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id"
    return 1
}

local instance_types
mapfile -t instance_types <<<"$response"

# Get the size of the array
local instance_types_count=${#instance_types[@]}

echo "Here are some options:"
for ((i = 0; i < instance_types_count; i++)); do
    echo "$((i + 1)) - ${instance_types[$i]}"
done

integer_input "Which one do you want to use? " 1 "${#instance_types[@]}"
"
choice=$get_input_result
local instance_type=${instance_types[$((choice - 1))]}
echo "Another great choice."
echo
```

```
echo "Creating your instance and waiting for it to start..."
local instance_id
instance_id=$(ec2_run_instances -i "$image_id" -t "$instance_type" -k
"$key_name" -s "$security_group_id") || {
    errecho "Failed to run instance. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id"
    return 1
}

ec2_wait_for_instance_running -i "$instance_id"
echo "Your instance is ready:"
echo

local instance_details
instance_details=$(ec2_describe_instances -i "${instance_id}")"

echo
print_instance_details "${instance_details}"

local public_ip
public_ip=$(echo "${instance_details}" | awk '{print $6}')
echo
echo "You can use SSH to connect to your instance"
echo "If the connection attempt times out, you might have to manually update
the SSH ingress rule"
echo "for your IP address in the AWS Management Console."
connect_to_instance "$key_file_name" "$public_ip"

echo -n "Press Enter when you're ready to continue the demo: "
get_input

echo_repeat "*" 88
echo_repeat "*" 88

echo "Let's stop and start your instance to see what changes."
echo "Stopping your instance and waiting until it's stopped..."
ec2_stop_instances -i "$instance_id"
ec2_wait_for_instance_stopped -i "$instance_id"

echo "Your instance is stopped. Restarting..."

ec2_start_instances -i "$instance_id"
ec2_wait_for_instance_running -i "$instance_id"
```

```
echo "Your instance is running again."
local instance_details
instance_details=$(ec2_describe_instances -i "${instance_id}"")"

print_instance_details "${instance_details}"

public_ip=$(echo "${instance_details}" | awk '{print $6}')

echo "Every time your instance is restarted, its public IP address changes"
connect_to_instance "$key_file_name" "$public_ip"

echo -n "Press Enter when you're ready to continue the demo: "
get_input

echo_repeat "*" 88
echo_repeat "*" 88

echo "You can allocate an Elastic IP address and associate it with your
instance"
echo "to keep a consistent IP address even when your instance restarts."

local result
result=$(ec2_allocate_address -d vpc) || {
    errecho "Failed to allocate an address. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id" "$instance_id"
    return 1
}

local elastic_ip allocation_id
elastic_ip=$(echo "$result" | awk '{print $1}')
allocation_id=$(echo "$result" | awk '{print $2}')

echo "Allocated static Elastic IP address: $elastic_ip"

local association_id
association_id=$(ec2_associate_address -i "$instance_id" -a "$allocation_id")
|| {
    errecho "Failed to associate an address. This demo will exit."
    clean_up "$key_name" "$key_file_name" "$security_group_id" "$instance_id"
    "$allocation_id"
    return 1
}

echo "Associated your Elastic IP with your instance."
```

```
echo "You can now use SSH to connect to your instance by using the Elastic IP."
connect_to_instance "$key_file_name" "$elastic_ip"

echo -n "Press Enter when you're ready to continue the demo: "
get_input

echo_repeat "*" 88
echo_repeat "*" 88

echo "Let's stop and start your instance to see what changes."
echo "Stopping your instance and waiting until it's stopped..."
ec2_stop_instances -i "$instance_id"
ec2_wait_for_instance_stopped -i "$instance_id"

echo "Your instance is stopped. Restarting..."

ec2_start_instances -i "$instance_id"
ec2_wait_for_instance_running -i "$instance_id"

echo "Your instance is running again."
local instance_details
instance_details=$(ec2_describe_instances -i "${instance_id}")

print_instance_details "${instance_details}"

echo "Because you have associated an Elastic IP with your instance, you can"
echo "connect by using a consistent IP address after the instance restarts."
connect_to_instance "$key_file_name" "$elastic_ip"

echo -n "Press Enter when you're ready to continue the demo: "
get_input

echo_repeat "*" 88
echo_repeat "*" 88

if yes_no_input "Do you want to delete the resources created in this demo: (y/n) ";
then
    clean_up "$key_name" "$key_file_name" "$security_group_id" "$instance_id" \
        "$allocation_id" "$association_id"
else
    echo "The following resources were not deleted."
    echo "Key pair: $key_name"
    echo "Key file: $key_file_name"
    echo "Security group: $security_group_id"
```

```
        echo "Instance: $instance_id"
        echo "Elastic IP address: $elastic_ip"
    fi
}

#####
# function clean_up
#
# This function cleans up the created resources.
#   $1 - The name of the ec2 key pair to delete.
#   $2 - The name of the key file to delete.
#   $3 - The ID of the security group to delete.
#   $4 - The ID of the instance to terminate.
#   $5 - The ID of the elastic IP address to release.
#   $6 - The ID of the elastic IP address to disassociate.
#
# Returns:
#   0 - If successful.
#   1 - If an error occurred.
#####
function clean_up() {
    local result=0
    local key_pair_name=$1
    local key_file_name=$2
    local security_group_id=$3
    local instance_id=$4
    local allocation_id=$5
    local association_id=$6

    if [ -n "$association_id" ]; then
        # bashsupport disable=BP2002
        if (ec2_disassociate_address -a "$association_id"); then
            echo "Disassociated elastic IP address with ID $association_id"
        else
            errecho "The elastic IP address disassociation failed."
            result=1
        fi
    fi

    if [ -n "$allocation_id" ]; then
        # bashsupport disable=BP2002
        if (ec2_release_address -a "$allocation_id"); then
            echo "Released elastic IP address with ID $allocation_id"
        else
    fi
}
```

```
    errecho "The elastic IP address release failed."
    result=1
  fi
fi

if [ -n "$instance_id" ]; then
  # bashsupport disable=BP2002
  if (ec2_terminate_instances -i "$instance_id"); then
    echo "Started terminating instance with ID $instance_id"

    ec2_wait_for_instance_terminated -i "$instance_id"
  else
    errecho "The instance terminate failed."
    result=1
  fi
fi

if [ -n "$security_group_id" ]; then
  # bashsupport disable=BP2002
  if (ec2_delete_security_group -i "$security_group_id"); then
    echo "Deleted security group with ID $security_group_id"
  else
    errecho "The security group delete failed."
    result=1
  fi
fi

if [ -n "$key_pair_name" ]; then
  # bashsupport disable=BP2002
  if (ec2_delete_keypair -n "$key_pair_name"); then
    echo "Deleted key pair named $key_pair_name"
  else
    errecho "The key pair delete failed."
    result=1
  fi
fi

if [ -n "$key_file_name" ]; then
  rm -f "$key_file_name"
fi

return $result
}
```

```
#####
# function ssm_get_parameters_by_path
#
# This function retrieves one or more parameters from the AWS Systems Manager
# Parameter Store
# by specifying a parameter path.
#
# Parameters:
#     -p parameter_path - The path of the parameter(s) to retrieve.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ssm_get_parameters_by_path() {
    local parameter_path response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ssm_get_parameters_by_path"
        echo "Retrieves one or more parameters from the AWS Systems Manager Parameter"
        echo "Store by specifying a parameter path."
        echo " -p parameter_path - The path of the parameter(s) to retrieve."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "p:h" option; do
        case "${option}" in
            p) parameter_path="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1
```

```
if [[ -z "$parameter_path" ]]; then
    errecho "ERROR: You must provide a parameter path with the -p parameter."
    usage
    return 1
fi

response=$(aws ssm get-parameters-by-path \
--path "$parameter_path" \
--query "Parameters[*].[Name, Value]" \
--output text) || {
aws_cli_error_log $?
errecho "ERROR: AWS reports get-parameters-by-path operation failed.
$response"
return 1
}

echo "$response"

return 0
}

#####
# function print_instance_details
#
# This function prints the details of an Amazon Elastic Compute Cloud (Amazon
# EC2) instance.
#
# Parameters:
#     instance_details - The instance details in the format "InstanceId ImageId
# InstanceType KeyName VpcId PublicIpAddress State.Name".
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#####
function print_instance_details() {
    local instance_details="$1"

    if [[ -z "${instance_details}" ]]; then
        echo "Error: Missing required instance details argument."
        return 1
    fi

    local instance_id image_id instance_type key_name vpc_id public_ip state
```

```
instance_id=$(echo "${instance_details}" | awk '{print $1}')
image_id=$(echo "${instance_details}" | awk '{print $2}')
instance_type=$(echo "${instance_details}" | awk '{print $3}')
key_name=$(echo "${instance_details}" | awk '{print $4}')
vpc_id=$(echo "${instance_details}" | awk '{print $5}')
public_ip=$(echo "${instance_details}" | awk '{print $6}')
state=$(echo "${instance_details}" | awk '{print $7}')

echo "    ID: ${instance_id}"
echo "    Image ID: ${image_id}"
echo "    Instance type: ${instance_type}"
echo "    Key name: ${key_name}"
echo "    VPC ID: ${vpc_id}"
echo "    Public IP: ${public_ip}"
echo "    State: ${state}"

return 0
}

#####
# function connect_to_instance
#
# This function displays the public IP address of an Amazon Elastic Compute Cloud
# (Amazon EC2) instance and prompts the user to connect to the instance via SSH.
#
# Parameters:
#     $1 - The name of the key file used to connect to the instance.
#     $2 - The public IP address of the instance.
#
# Returns:
#     None
#####
function connect_to_instance() {
local key_file_name="$1"
local public_ip="$2"

# Validate the input parameters
if [[ -z "$key_file_name" ]]; then
    echo "ERROR: You must provide a key file name as the first argument." >&2
    return 1
fi

if [[ -z "$public_ip" ]]; then
```

```
echo "ERROR: You must provide a public IP address as the second argument."
>&2
    return 1
fi

# Display the public IP address and connection command
echo "To connect, run the following command:"
echo "    ssh -i ${key_file_name} ec2-user@${public_ip}"

# Prompt the user to connect to the instance
if yes_no_input "Do you want to connect now? (y/n) "; then
    echo "After you have connected, you can return to this example by typing
'exit'"
    ssh -i "${key_file_name}" ec2-user@"${public_ip}"
fi
}

#####
# function get_input
#
# This function gets user input from the command line.
#
# Outputs:
#   User input to stdout.
#
# Returns:
#   0
#####
function get_input() {

    if [ -z "${mock_input+x}" ]; then
        read -r get_input_result
    else

        if [ "$mock_input_array_index" -lt ${#mock_input_array[@]} ]; then
            get_input_result="${mock_input_array[$mock_input_array_index]}"
            # bashsupport disable=BP2001
            # shellcheck disable=SC2206
            ((mock_input_array_index++))
            echo -n "$get_input_result"
        else
            echo "MOCK_INPUT_ARRAY has no more elements" 1>&2
            return 1
        fi
    fi
}
```

```
fi

return 0
}

#####
# function yes_no_input
#
# This function requests a yes/no answer from the user, following to a prompt.
#
# Parameters:
#     $1 - The prompt.
#
# Returns:
#     0 - If yes.
#     1 - If no.
#####

function yes_no_input() {
    if [ -z "$1" ]; then
        echo "Internal error yes_no_input"
        return 1
    fi

    local index=0
    local response="N"
    while [[ $index -lt 10 ]]; do
        index=$((index + 1))
        echo -n "$1"
        if ! get_input; then
            return 1
        fi
        response=$(echo "$get_input_result" | tr '[:upper:]' '[:lower:]')
        if [ "$response" = "y" ] || [ "$response" = "n" ]; then
            break
        else
            echo -e "\nPlease enter or 'y' or 'n'."
        fi
    done

    echo

    if [ "$response" = "y" ]; then
        return 0
    else
```

```
        return 1
    fi
}

#####
# function integer_input
#
# This function prompts the user to enter an integer within a specified range
# and validates the input.
#
# Parameters:
#     $1 - The prompt message to display to the user.
#     $2 - The minimum value of the accepted range.
#     $3 - The maximum value of the accepted range.
#
# Returns:
#     The valid integer input from the user.
#     If the input is invalid or out of range, the function will continue
#     prompting the user until a valid input is provided.
#####

function integer_input() {
    local prompt="$1"
    local min_value="$2"
    local max_value="$3"
    local input=""

    while true; do
        # Display the prompt message and wait for user input
        echo -n "$prompt"

        if ! get_input; then
            return 1
        fi

        input="$get_input_result"

        # Check if the input is a valid integer
        if [[ "$input" =~ ^-[0-9]+$ ]]; then
            # Check if the input is within the specified range
            if ((input >= min_value && input <= max_value)); then
                return 0
            else
                echo "Error: Input, $input, must be between $min_value and $max_value."
            fi
        fi
    done
}
```

```
        else
            echo "Error: Invalid input- $input. Please enter an integer."
        fi
    done
}
#####
# function new_line_and_tab_to_list
#
# This function takes a string input containing newlines and tabs, and
# converts it into a list (array) of elements.
#
# Parameters:
#     $1 - The input string containing newlines and tabs.
#
# Returns:
#     The resulting list (array) is stored in the global variable
#     'list_result'.
#####
function new_line_and_tab_to_list() {
    local input=$1
    export list_result

    list_result=()
    mapfile -t lines <<< "$input"
    local line
    for line in "${lines[@]}"; do
        IFS=$'\t' read -ra parameters <<< "$line"
        list_result+=("${parameters[@]}")
    done
}

#####
# function echo_repeat
#
# This function prints a string 'n' times to stdout.
#
# Parameters:
#     $1 - The string.
#     $2 - Number of times to print the string.
#
# Outputs:
#     String 'n' times to stdout.
#
# Returns:
```

```
#      0
#####
function echo_repeat() {
    local end=$2
    for ((i = 0; i < end; i++)); do
        echo -n "$1"
    done
    echo
}
```

The DynamoDB functions used in this scenario.

```
#####
# function ec2_create_keypair
#
# This function creates an Amazon Elastic Compute Cloud (Amazon EC2) ED25519 or
# 2048-bit RSA key pair
# and writes it to a file.
#
# Parameters:
#     -n key_pair_name - A key pair name.
#     -f file_path - File to store the key pair.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_create_keypair() {
    local key_pair_name file_path response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_create_keypair"
        echo "Creates an Amazon Elastic Compute Cloud (Amazon EC2) ED25519 or 2048-
bit RSA key pair"
        echo " and writes it to a file."
        echo " -n key_pair_name - A key pair name."
        echo " -f file_path - File to store the key pair."
        echo ""
    }
}
```

```
# Retrieve the calling parameters.
while getopts "n:f:h" option; do
    case "${option}" in
        n) key_pair_name="${OPTARG}" ;;
        f) file_path="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?) echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key name with the -n parameter."
    usage
    return 1
fi

if [[ -z "$file_path" ]]; then
    errecho "ERROR: You must provide a file path with the -f parameter."
    usage
    return 1
fi

response=$(aws ec2 create-key-pair \
    --key-name "$key_pair_name" \
    --query 'KeyMaterial' \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports create-access-key operation failed.$response"
    return 1
}

if [[ -n "$file_path" ]]; then
    echo "$response" >"$file_path"
fi

return 0
```

```
}
```

```
#####
# function ec2_describe_key_pairs
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# key pairs.
#
# Parameters:
#     -h - Display help.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_describe_key_pairs() {
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_key_pairs"
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2) key
pairs."
        echo "  -h - Display help."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "h" option; do
        case "${option}" in
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
            esac
    done
    export OPTIND=1

    local response
```

```
response=$(aws ec2 describe-key-pairs \
    --query 'KeyPairs[*].[KeyName, KeyFingerprint]' \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports describe-key-pairs operation failed.$response"
    return 1
}

echo "$response"

return 0
}

#####
# function ec2_create_security_group
#
# This function creates an Amazon Elastic Compute Cloud (Amazon EC2) security
# group.
#
# Parameters:
#     -n security_group_name - The name of the security group.
#     -d security_group_description - The description of the security group.
#
# Returns:
#     The ID of the created security group, or an error message if the
#     operation fails.
# And:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_create_security_group() {
    local security_group_name security_group_description response

    # Function to display usage information
    function usage() {
        echo "function ec2_create_security_group"
        echo "Creates an Amazon Elastic Compute Cloud (Amazon EC2) security group."
        echo "  -n security_group_name - The name of the security group."
        echo "  -d security_group_description - The description of the security
group."
        echo ""
    }
}
```

```
# Parse the command-line arguments
while getopts "n:d:h" option; do
    case "${option}" in
        n) security_group_name="${OPTARG}" ;;
        d) security_group_description="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?) echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$security_group_name" ]]; then
    errecho "ERROR: You must provide a security group name with the -n
parameter."
    return 1
fi

if [[ -z "$security_group_description" ]]; then
    errecho "ERROR: You must provide a security group description with the -d
parameter."
    return 1
fi

# Create the security group
response=$(aws ec2 create-security-group \
    --group-name "$security_group_name" \
    --description "$security_group_description" \
    --query "GroupId" \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports create-security-group operation failed."
    errecho "$response"
    return 1
}
```

```
echo "$response"
return 0
}

#####
# function ec2_describe_security_groups
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# security groups.
#
# Parameters:
#      -g security_group_id - The ID of the security group to describe
#                            (optional).
#
# And:
#      0 - If successful.
#      1 - If it fails.
#####
function ec2_describe_security_groups() {
    local security_group_id response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_security_groups"
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        echo "security groups."
        echo " -g security_group_id - The ID of the security group to describe"
        echo "(optional)."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "g:h" option; do
        case "${option}" in
            g) security_group_id="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
        esac
    done
}
```

```
;;
esac
done
export OPTIND=1

local query="SecurityGroups[*].[GroupName, GroupId, VpcId, IpPermissions[*].
[IpProtocol, FromPort, ToPort, IpRanges[*].CidrIp]]"

if [[ -n "$security_group_id" ]]; then
    response=$(aws ec2 describe-security-groups --group-ids "$security_group_id"
--query "${query}" --output text)
else
    response=$(aws ec2 describe-security-groups --query "${query}" --output text)
fi

local error_code=${?}

if [[ $error_code -ne 0 ]]; then
    aws_cli_error_log $error_code
    errecho "ERROR: AWS reports describe-security-groups operation failed.
$response"
    return 1
fi

echo "$response"

return 0
}

#####
# function ec2_authorize_security_group_ingress
#
# This function authorizes an ingress rule for an Amazon Elastic Compute Cloud
# (Amazon EC2) security group.
#
# Parameters:
#     -g security_group_id - The ID of the security group.
#     -i ip_address - The IP address or CIDR block to authorize.
#     -p protocol - The protocol to authorize (e.g., tcp, udp, icmp).
#     -f from_port - The start of the port range to authorize.
#     -t to_port - The end of the port range to authorize.
#
# And:
#     0 - If successful.
```

```
#      1 - If it fails.
#####
function ec2_authorize_security_group_ingress() {
    local security_group_id ip_address protocol from_port to_port response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_authorize_security_group_ingress"
        echo "Authorizes an ingress rule for an Amazon Elastic Compute Cloud (Amazon EC2) security group."
        echo "  -g security_group_id - The ID of the security group."
        echo "  -i ip_address - The IP address or CIDR block to authorize."
        echo "  -p protocol - The protocol to authorize (e.g., tcp, udp, icmp)."
        echo "  -f from_port - The start of the port range to authorize."
        echo "  -t to_port - The end of the port range to authorize."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "g:i:p:f:t:h" option; do
        case "${option}" in
            g) security_group_id="${OPTARG}" ;;
            i) ip_address="${OPTARG}" ;;
            p) protocol="${OPTARG}" ;;
            f) from_port="${OPTARG}" ;;
            t) to_port="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1

    if [[ -z "$security_group_id" ]]; then
        errecho "ERROR: You must provide a security group ID with the -g parameter."
        usage
        return 1
    fi
```

```
fi

if [[ -z "$ip_address" ]]; then
    errecho "ERROR: You must provide an IP address or CIDR block with the -i parameter."
    usage
    return 1
fi

if [[ -z "$protocol" ]]; then
    errecho "ERROR: You must provide a protocol with the -p parameter."
    usage
    return 1
fi

if [[ -z "$from_port" ]]; then
    errecho "ERROR: You must provide a start port with the -f parameter."
    usage
    return 1
fi

if [[ -z "$to_port" ]]; then
    errecho "ERROR: You must provide an end port with the -t parameter."
    usage
    return 1
fi

response=$(aws ec2 authorize-security-group-ingress \
--group-id "$security_group_id" \
--cidr "${ip_address}/32" \
--protocol "$protocol" \
--port "$from_port-$to_port" \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports authorize-security-group-ingress operation failed.$response"
return 1
}

return 0
}

#####
# function ec2_describe_images
```

```
#  
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)  
# images.  
#  
# Parameters:  
#     -i image_ids - A space-separated list of image IDs (optional).  
#     -h - Display help.  
#  
# And:  
#     0 - If successful.  
#     1 - If it fails.  
#####  
function ec2_describe_images() {  
    local image_ids response  
    local optionOPTARG # Required to use getopt command in a function.  
  
    # bashsupport disable=BP5008  
    function usage() {  
        echo "function ec2_describe_images"  
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)  
images."  
        echo "  -i image_ids - A space-separated list of image IDs (optional)."  
        echo "  -h - Display help."  
        echo ""  
    }  
  
    # Retrieve the calling parameters.  
    while getopt "i:h" option; do  
        case "${option}" in  
            i) image_ids="${OPTARG}" ;;  
            h)  
                usage  
                return 0  
                ;;  
            \?)  
                echo "Invalid parameter"  
                usage  
                return 1  
                ;;  
        esac  
    done  
    export OPTIND=1  
  
    local aws_cli_args=()
```

```
if [[ -n "$image_ids" ]]; then
    # shellcheck disable=SC2206
    aws_cli_args+=("--image-ids" $image_ids)
fi

response=$(aws ec2 describe-images \
"${aws_cli_args[@]}" \
--query 'Images[*].[Description,Architecture,ImageId]' \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports describe-images operation failed.$response"
return 1
}

echo "$response"

return 0
}

#####
# ec2_describe_instance_types
#
# This function describes EC2 instance types filtered by processor architecture
# and optionally by instance type. It takes the following arguments:
#
# -a, --architecture ARCHITECTURE Specify the processor architecture (e.g.,
# x86_64)
# -t, --type INSTANCE_TYPE           Comma-separated list of instance types (e.g.,
# t2.micro)
# -h, --help                          Show the usage help
#
# The function prints the instance type and supported architecture for each
# matching instance type.
#####
function ec2_describe_instance_types() {
    local architecture=""
    local instance_types=""

    # bashsupport disable=BP5008
    function usage() {
        echo "Usage: ec2_describe_instance_types [-a|--architecture ARCHITECTURE] [-t|--type INSTANCE_TYPE] [-h|--help]"
    }
}
```

```
echo " -a, --architecture ARCHITECTURE Specify the processor architecture
(e.g., x86_64)"
echo " -t, --type INSTANCE_TYPE Comma-separated list of instance
types (e.g., t2.micro)"
echo " -h, --help Show this help message"
}

while [[ $# -gt 0 ]]; do
  case "$1" in
    -a | --architecture)
      architecture="$2"
      shift 2
      ;;
    -t | --type)
      instance_types="$2"
      shift 2
      ;;
    -h | --help)
      usage
      return 0
      ;;
    *)
      echo "Unknown argument: $1"
      return 1
      ;;
  esac
done

if [[ -z "$architecture" ]]; then
  errecho "Error: Architecture not specified."
  usage
  return 1
fi

if [[ -z "$instance_types" ]]; then
  errecho "Error: Instance type not specified."
  usage
  return 1
fi

local tmp_json_file="temp_ec2.json"
echo -n '['
{
  "Name": "processor-info.supported-architecture",
```

```
"Values": ['>"$tmp_json_file"

local items
IFS=',' read -ra items <<<"$architecture"
local array_size
array_size=${#items[@]}
for i in $(seq 0 $((array_size - 1))); do
    echo -n '""${items[$i]}""' >>"$tmp_json_file"
    if [[ $i -lt $((array_size - 1)) ]]; then
        echo -n ',' >>"$tmp_json_file"
    fi
done
echo -n '],',
{
    "Name": "instance-type",
    "Values": ['>"$tmp_json_file"
IFS=',' read -ra items <<<"$instance_types"
local array_size
array_size=${#items[@]}
for i in $(seq 0 $((array_size - 1))); do
    echo -n '""${items[$i]}""' >>"$tmp_json_file"
    if [[ $i -lt $((array_size - 1)) ]]; then
        echo -n ',' >>"$tmp_json_file"
    fi
done

echo -n '}}]' >>"$tmp_json_file"

local response
response=$(aws ec2 describe-instance-types --filters file://"$tmp_json_file" \
--query 'InstanceTypes[*].[InstanceType]' --output text)

local error_code=$?

rm "$tmp_json_file"

if [[ $error_code -ne 0 ]]; then
    aws_cli_error_log $error_code
    echo "ERROR: AWS reports describe-instance-types operation failed."
    return 1
fi

echo "$response"
return 0
```

```
}
```

```
#####
# function ec2_run_instances
#
# This function launches one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.
#
# Parameters:
#   -i image_id - The ID of the Amazon Machine Image (AMI) to use.
#   -t instance_type - The instance type to use (e.g., t2.micro).
#   -k key_pair_name - The name of the key pair to use.
#   -s security_group_id - The ID of the security group to use.
#   -c count - The number of instances to launch (default: 1).
#   -h - Display help.
#
# Returns:
#   0 - If successful.
#   1 - If it fails.
#####
function ec2_run_instances() {
    local image_id instance_type key_pair_name security_group_id count response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_run_instances"
        echo "Launches one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        echo "instances."
        echo "  -i image_id - The ID of the Amazon Machine Image (AMI) to use."
        echo "  -t instance_type - The instance type to use (e.g., t2.micro)."
        echo "  -k key_pair_name - The name of the key pair to use."
        echo "  -s security_group_id - The ID of the security group to use."
        echo "  -c count - The number of instances to launch (default: 1)."
        echo "  -h - Display help."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "i:t:k:s:c:h" option; do
        case "${option}" in
            i) image_id="${OPTARG}" ;;
            t) instance_type="${OPTARG}" ;;
            k) key_pair_name="${OPTARG}" ;;
```

```
s) security_group_id="\${OPTARG}" ;;
c) count="\${OPTARG}" ;;
h)
    usage
    return 0
;;
\?)
    echo "Invalid parameter"
    usage
    return 1
;;
esac
done
export OPTIND=1

if [[ -z "$image_id" ]]; then
    errecho "ERROR: You must provide an Amazon Machine Image (AMI) ID with the -i parameter."
    usage
    return 1
fi

if [[ -z "$instance_type" ]]; then
    errecho "ERROR: You must provide an instance type with the -t parameter."
    usage
    return 1
fi

if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key pair name with the -k parameter."
    usage
    return 1
fi

if [[ -z "$security_group_id" ]]; then
    errecho "ERROR: You must provide a security group ID with the -s parameter."
    usage
    return 1
fi

if [[ -z "$count" ]]; then
    count=1
fi
```

```
response=$(aws ec2 run-instances \
--image-id "$image_id" \
--instance-type "$instance_type" \
--key-name "$key_pair_name" \
--security-group-ids "$security_group_id" \
--count "$count" \
--query 'Instances[*].[InstanceId]' \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports run-instances operation failed.$response"
return 1
}

echo "$response"

return 0
}

#####
# function ec2_describe_instances
#
# This function describes one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.
#
# Parameters:
#   -i instance_id - The ID of the instance to describe (optional).
#   -q query - The query to filter the response (optional).
#   -h - Display help.
#
# Returns:
#   0 - If successful.
#   1 - If it fails.
#####
function ec2_describe_instances() {
    local instance_id query response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_describe_instances"
        echo "Describes one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        instances."
        echo "  -i instance_id - The ID of the instance to describe (optional)."
        echo "  -q query - The query to filter the response (optional)."
    }
}
```

```
echo " -h - Display help."
echo ""
}

# Retrieve the calling parameters.
while getopts "i:q:h" option; do
    case "${option}" in
        i) instance_id="${OPTARG}" ;;
        q) query="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

local aws_cli_args=()

if [[ -n "$instance_id" ]]; then
    # shellcheck disable=SC2206
    aws_cli_args+=("--instance-ids" $instance_id)
fi

local query_arg=""
if [[ -n "$query" ]]; then
    query_arg="--query '$query'"
else
    query_arg="--query Reservations[*].Instances[*].
[InstanceId,ImageId,InstanceType,KeyName,VpcId,PublicIpAddress,State.Name]"
fi

# shellcheck disable=SC2086
response=$(aws ec2 describe-instances \
"${aws_cli_args[@]}" \
$query_arg \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports describe-instances operation failed.$response"
```

```
        return 1
    }

    echo "$response"

    return 0
}

#####
# function ec2_stop_instances
#
# This function stops one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances.
#
# Parameters:
#     -i instance_id - The ID(s) of the instance(s) to stop (comma-separated).
#     -h - Display help.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#####

function ec2_stop_instances() {
    local instance_ids
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_stop_instances"
        echo "Stops one or more Amazon Elastic Compute Cloud (Amazon EC2) instances."
        echo " -i instance_id - The ID(s) of the instance(s) to stop (comma-"
        separated)."
        echo " -h - Display help."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopt "i:h" option; do
        case "${option}" in
            i) instance_ids="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
        esac
    done
}
```

```
\?)  
    echo "Invalid parameter"  
    usage  
    return 1  
;;  
esac  
done  
export OPTIND=1  
  
if [[ -z "$instance_ids" ]]; then  
    errecho "ERROR: You must provide one or more instance IDs with the -i  
parameter."  
    usage  
    return 1  
fi  
  
response=$(aws ec2 stop-instances \  
    --instance-ids "${instance_ids}") || {  
    aws_cli_error_log ${?}  
    errecho "ERROR: AWS reports stop-instances operation failed with $response."  
    return 1  
}  
  
return 0  
}  
  
#####  
# function ec2_start_instances  
#  
# This function starts one or more Amazon Elastic Compute Cloud (Amazon EC2)  
instances.  
#  
# Parameters:  
#     -i instance_id - The ID(s) of the instance(s) to start (comma-separated).  
#     -h - Display help.  
#  
# Returns:  
#     0 - If successful.  
#     1 - If it fails.  
#####  
function ec2_start_instances() {  
    local instance_ids  
    local option OPTARG # Required to use getopt command in a function.
```

```
# bashsupport disable=BP5008
function usage() {
    echo "function ec2_start_instances"
    echo "Starts one or more Amazon Elastic Compute Cloud (Amazon EC2)
instances."
    echo " -i instance_id - The ID(s) of the instance(s) to start (comma-
separated)."
    echo " -h - Display help."
    echo ""
}

# Retrieve the calling parameters.
while getopts "i:h" option; do
    case "${option}" in
        i) instance_ids="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

if [[ -z "$instance_ids" ]]; then
    errecho "ERROR: You must provide one or more instance IDs with the -i
parameter."
    usage
    return 1
fi

response=$(aws ec2 start-instances \
--instance-ids "${instance_ids}") || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports start-instances operation failed with $response."
    return 1
}

return 0
}
```

```
#####
# function ec2_allocate_address
#
# This function allocates an Elastic IP address for use with Amazon Elastic
Compute Cloud (Amazon EC2) instances in a specific AWS Region.
#
# Parameters:
#     -d domain - The domain for the Elastic IP address (either 'vpc' or
'standard').
#
# Returns:
#     The allocated Elastic IP address, or an error message if the operation
fails.
# And:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_allocate_address() {
    local domain response

    # Function to display usage information
    function usage() {
        echo "function ec2_allocate_address"
        echo "Allocates an Elastic IP address for use with Amazon Elastic Compute
Cloud (Amazon EC2) instances in a specific AWS Region."
        echo "  -d domain - The domain for the Elastic IP address (either 'vpc' or
'standard')."
        echo ""
    }

    # Parse the command-line arguments
    while getopts "d:h" option; do
        case "${option}" in
            d) domain="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
        esac
    done
}
```

```
;;
esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$domain" ]]; then
    errecho "ERROR: You must provide a domain with the -d parameter (either 'vpc' or 'standard')."
    return 1
fi

if [[ "$domain" != "vpc" && "$domain" != "standard" ]]; then
    errecho "ERROR: Invalid domain value. Must be either 'vpc' or 'standard'."
    return 1
fi

# Allocate the Elastic IP address
response=$(aws ec2 allocate-address \
--domain "$domain" \
--query "[PublicIp,AllocationId]" \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports allocate-address operation failed."
errecho "$response"
return 1
}

echo "$response"
return 0
}

#####
# function ec2_associate_address
#
# This function associates an Elastic IP address with an Amazon Elastic Compute
# Cloud (Amazon EC2) instance.
#
# Parameters:
#     -a allocation_id - The allocation ID of the Elastic IP address to
#     associate.
#     -i instance_id - The ID of the EC2 instance to associate the Elastic IP
#     address with.
#
```

```
# Returns:
#     0 - If successful.
#     1 - If it fails.
#
#####
function ec2_associate_address() {
    local allocation_id instance_id response

    # Function to display usage information
    function usage() {
        echo "function ec2_associate_address"
        echo "Associates an Elastic IP address with an Amazon Elastic Compute Cloud"
        echo "(Amazon EC2) instance."
        echo " -a allocation_id - The allocation ID of the Elastic IP address to"
        echo "associate."
        echo " -i instance_id - The ID of the EC2 instance to associate the Elastic"
        echo "IP address with."
        echo ""
    }

    # Parse the command-line arguments
    while getopts "a:i:h" option; do
        case "${option}" in
            a) allocation_id="${OPTARG}" ;;
            i) instance_id="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1

    # Validate the input parameters
    if [[ -z "$allocation_id" ]]; then
        errecho "ERROR: You must provide an allocation ID with the -a parameter."
        return 1
    fi
```

```
if [[ -z "$instance_id" ]]; then
    errecho "ERROR: You must provide an instance ID with the -i parameter."
    return 1
fi

# Associate the Elastic IP address
response=$(aws ec2 associate-address \
    --allocation-id "$allocation_id" \
    --instance-id "$instance_id" \
    --query "AssociationId" \
    --output text) || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports associate-address operation failed."
    errecho "$response"
    return 1
}

echo "$response"
return 0
}

#####
# function ec2_disassociate_address
#
# This function disassociates an Elastic IP address from an Amazon Elastic
# Compute Cloud (Amazon EC2) instance.
#
# Parameters:
#     -a association_id - The association ID that represents the association of
#     the Elastic IP address with an instance.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#
#####

function ec2_disassociate_address() {
    local association_id response

    # Function to display usage information
    function usage() {
        echo "function ec2_disassociate_address"
        echo "Disassociates an Elastic IP address from an Amazon Elastic Compute"
        echo "Cloud (Amazon EC2) instance."
    }
```

```
echo " -a association_id - The association ID that represents the
association of the Elastic IP address with an instance."
echo ""
}

# Parse the command-line arguments
while getopts "a:h" option; do
    case "${option}" in
        a) association_id="${OPTARG}" ;;
        h)
            usage
            return 0
            ;;
        \?)
            echo "Invalid parameter"
            usage
            return 1
            ;;
    esac
done
export OPTIND=1

# Validate the input parameters
if [[ -z "$association_id" ]]; then
    errecho "ERROR: You must provide an association ID with the -a parameter."
    return 1
fi

response=$(aws ec2 disassociate-address \
    --association-id "$association_id") || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports disassociate-address operation failed."
    errecho "$response"
    return 1
}

return 0
}

#####
# function ec2_release_address
#
# This function releases an Elastic IP address from an Amazon Elastic Compute
Cloud (Amazon EC2) instance.
```

```
#  
# Parameters:  
#     -a allocation_id - The allocation ID of the Elastic IP address to  
#     release.  
#  
# Returns:  
#     0 - If successful.  
#     1 - If it fails.  
#  
#####  
function ec2_release_address() {  
    local allocation_id response  
  
    # Function to display usage information  
    function usage() {  
        echo "function ec2_release_address"  
        echo "Releases an Elastic IP address from an Amazon Elastic Compute Cloud  
(Amazon EC2) instance."  
        echo " -a allocation_id - The allocation ID of the Elastic IP address to  
release."  
        echo ""  
    }  
  
    # Parse the command-line arguments  
    while getopts "a:h" option; do  
        case "${option}" in  
            a) allocation_id="${OPTARG}" ;;  
            h)  
                usage  
                return 0  
                ;;  
            \?)  
                echo "Invalid parameter"  
                usage  
                return 1  
                ;;  
        esac  
    done  
    export OPTIND=1  
  
    # Validate the input parameters  
    if [[ -z "$allocation_id" ]]; then  
        errecho "ERROR: You must provide an allocation ID with the -a parameter."  
        return 1
```

```
fi

response=$(aws ec2 release-address \
    --allocation-id "$allocation_id") || {
    aws_cli_error_log ${?}
    errecho "ERROR: AWS reports release-address operation failed."
    errecho "$response"
    return 1
}

return 0
}

#####
# function ec2_terminate_instances
#
# This function terminates one or more Amazon Elastic Compute Cloud (Amazon EC2)
# instances using the AWS CLI.
#
# Parameters:
#     -i instance_ids - A space-separated list of instance IDs.
#     -h - Display help.
#
# Returns:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_terminate_instances() {
    local instance_ids response
    local option OPTARG # Required to use getopt command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_terminate_instances"
        echo "Terminates one or more Amazon Elastic Compute Cloud (Amazon EC2)"
        echo "instances."
        echo "  -i instance_ids - A space-separated list of instance IDs."
        echo "  -h - Display help."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopt "i:h" option; do
        case "${option}" in
            i
```

```
i) instance_ids="${OPTARG}" ;;
h)
    usage
    return 0
;;
\?)
    echo "Invalid parameter"
    usage
    return 1
;;
esac
done
export OPTIND=1

# Check if instance ID is provided
if [[ -z "${instance_ids}" ]]; then
    echo "Error: Missing required instance IDs parameter."
    usage
    return 1
fi

# shellcheck disable=SC2086
response=$(aws ec2 terminate-instances \
"--instance-ids" $instance_ids \
--query 'TerminatingInstances[*].[InstanceId,CurrentState.Name]' \
--output text) || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports terminate-instances operation failed.$response"
return 1
}

return 0
}

#####
# function ec2_delete_security_group
#
# This function deletes an Amazon Elastic Compute Cloud (Amazon EC2) security
# group.
#
# Parameters:
#     -i security_group_id - The ID of the security group to delete.
#
# And:
```

```
#      0 - If successful.
#      1 - If it fails.
#####
function ec2_delete_security_group() {
    local security_group_id response
    local option OPTARG # Required to use getopts command in a function.

    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_delete_security_group"
        echo "Deletes an Amazon Elastic Compute Cloud (Amazon EC2) security group."
        echo "  -i security_group_id - The ID of the security group to delete."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "i:h" option; do
        case "${option}" in
            i) security_group_id="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1

    if [[ -z "$security_group_id" ]]; then
        errecho "ERROR: You must provide a security group ID with the -i parameter."
        usage
        return 1
    fi

    response=$(aws ec2 delete-security-group --group-id "$security_group_id" --
output text) || {
        aws_cli_error_log ${?}
        errecho "ERROR: AWS reports delete-security-group operation failed.$response"
        return 1
    }
}
```

```
    return 0
}

#####
# function ec2_delete_keypair
#
# This function deletes an Amazon EC2 ED25519 or 2048-bit RSA key pair.
#
# Parameters:
#     -n key_pair_name - A key pair name.
#
# And:
#     0 - If successful.
#     1 - If it fails.
#####
function ec2_delete_keypair() {
    local key_pair_name response

    local option OPTARG # Required to use getopt command in a function.
    # bashsupport disable=BP5008
    function usage() {
        echo "function ec2_delete_keypair"
        echo "Deletes an Amazon EC2 ED25519 or 2048-bit RSA key pair."
        echo "  -n key_pair_name - A key pair name."
        echo ""
    }

    # Retrieve the calling parameters.
    while getopts "n:h" option; do
        case "${option}" in
            n) key_pair_name="${OPTARG}" ;;
            h)
                usage
                return 0
                ;;
            \?)
                echo "Invalid parameter"
                usage
                return 1
                ;;
        esac
    done
    export OPTIND=1
```

```
if [[ -z "$key_pair_name" ]]; then
    errecho "ERROR: You must provide a key pair name with the -n parameter."
    usage
    return 1
fi

response=$(aws ec2 delete-key-pair \
--key-name "$key_pair_name") || {
aws_cli_error_log ${?}
errecho "ERROR: AWS reports delete-key-pair operation failed.$response"
return 1
}

return 0
}
```

The utility functions used in this scenario.

```
#####
# function errecho
#
# This function outputs everything sent to it to STDERR (standard error output).
#####
function errecho() {
    printf "%s\n" "$*" 1>&2
}

#####
# function aws_cli_error_log()
#
# This function is used to log the error messages from the AWS CLI.
#
# The function expects the following argument:
#     $1 - The error code returned by the AWS CLI.
#
# Returns:
#     0: - Success.
#
#####
function aws_cli_error_log() {
    local err_code=$1
```

```
errecho "Error code : $err_code"
if [ "$err_code" == 1 ]; then
    errecho " One or more S3 transfers failed."
elif [ "$err_code" == 2 ]; then
    errecho " Command line failed to parse."
elif [ "$err_code" == 130 ]; then
    errecho " Process received SIGINT."
elif [ "$err_code" == 252 ]; then
    errecho " Command syntax invalid."
elif [ "$err_code" == 253 ]; then
    errecho " The system environment or configuration was invalid."
elif [ "$err_code" == 254 ]; then
    errecho " The service returned an error."
elif [ "$err_code" == 255 ]; then
    errecho " 255 is a catch-all error."
fi

return 0
}
```

- For API details, see the following topics in *AWS CLI Command Reference*.

- [AllocateAddress](#)
- [AssociateAddress](#)
- [AuthorizeSecurityGroupIngress](#)
- [CreateKeyPair](#)
- [CreateSecurityGroup](#)
- [DeleteKeyPair](#)
- [DeleteSecurityGroup](#)
- [DescribeImages](#)
- [DescribeInstanceTypes](#)
- [DescribeInstances](#)
- [DescribeKeyPairs](#)
- [DescribeSecurityGroups](#)
- [DisassociateAddress](#)
- [ReleaseAddress](#)

- [StartInstances](#)
- [StopInstances](#)
- [TerminateInstances](#)
- [UnmonitorInstances](#)

## Java

### SDK for Java 2.x

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/**  
 * Before running this Java (v2) code example, set up your development  
 * environment, including your credentials.  
 *  
 * For more information, see the following documentation topic:  
 *  
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-started.html  
 *  
 * This Java example performs the following tasks:  
 *  
 * 1. Creates an RSA key pair and saves the private key data as a .pem file.  
 * 2. Lists key pairs.  
 * 3. Creates a security group for the default VPC.  
 * 4. Displays security group information.  
 * 5. Gets a list of Amazon Linux 2 AMIs and selects one.  
 * 6. Gets more information about the image.  
 * 7. Gets a list of instance types that are compatible with the selected AMI's  
 * architecture.  
 * 8. Creates an instance with the key pair, security group, AMI, and an  
 * instance type.  
 * 9. Displays information about the instance.  
 * 10. Stops the instance and waits for it to stop.  
 * 11. Starts the instance and waits for it to start.  
 * 12. Allocates an Elastic IP address and associates it with the instance.
```

```
* 13. Displays SSH connection info for the instance.  
* 14. Disassociates and deletes the Elastic IP address.  
* 15. Terminates the instance and waits for it to terminate.  
* 16. Deletes the security group.  
* 17. Deletes the key pair.  
*/  
  
public class EC2Scenario {  
    public static final String DASHES = new String(new char[80]).replace("\0",  
"-");  
  
    public static void main(String[] args) throws InterruptedException {  
  
        final String usage = """  
  
        Usage:  
            <keyName> <fileName> <groupName> <groupDesc> <vpcId>  
  
        Where:  
            keyName - A key pair name (for example, TestKeyPair).\s  
            fileName - A file name where the key information is written  
to.\s  
            groupName - The name of the security group.\s  
            groupDesc - The description of the security group.\s  
            vpcId - A VPC Id value. You can get this value from the AWS  
Management Console.\s  
            myIpAddress - The IP address of your development machine.\s  
  
        """;  
  
        if (args.length != 6) {  
            System.out.println(usage);  
            System.exit(1);  
        }  
  
        String keyName = args[0];  
        String fileName = args[1];  
        String groupName = args[2];  
        String groupDesc = args[3];  
        String vpcId = args[4];  
        String myIpAddress = args[5];  
  
        Region region = Region.US_WEST_2;  
        Ec2Client ec2 = Ec2Client.builder()  
            .region(region)
```

```
.build();

SsmClient ssmClient = SsmClient.builder()
    .region(region)
    .build();

System.out.println(DASHES);
System.out.println("Welcome to the Amazon EC2 example scenario.");
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("1. Create an RSA key pair and save the private key material as a .pem file.");
createKeyPair(ec2, keyName, fileName);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("2. List key pairs.");
describeKeys(ec2);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("3. Create a security group.");
String groupId = createSecurityGroup(ec2, groupName, groupDesc, vpcId, myIpAddress);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("4. Display security group info for the newly created security group.");
describeSecurityGroups(ec2, groupId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("5. Get a list of Amazon Linux 2 AMIs and selects one with amzn2 in the name.");
String instanceId = getParaValues(ssmClient);
System.out.println("The instance Id is " + instanceId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("6. Get more information about an amzn2 image.");
String amiValue = describeImage(ec2, instanceId);
System.out.println(DASHES);
```

```
System.out.println(DASHES);
System.out.println("7. Get a list of instance types.");
String instanceType = getInstanceTypes(ec2);
System.out.println("The instance type is " + instanceType);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("8. Create an instance.");
String newInstanceId = runInstance(ec2, instanceType, keyName, groupName,
amiValue);
System.out.println("The instance Id is " + newInstanceId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("9. Display information about the running instance.");
");
String ipAddress = describeEC2Instances(ec2, newInstanceId);
System.out.println("You can SSH to the instance using this command:");
System.out.println("ssh -i " + fileName + "ec2-user@" + ipAddress);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("10. Stop the instance and use a waiter.");
stopInstance(ec2, newInstanceId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("11. Start the instance and use a waiter.");
startInstance(ec2, newInstanceId);
ipAddress = describeEC2Instances(ec2, newInstanceId);
System.out.println("You can SSH to the instance using this command:");
System.out.println("ssh -i " + fileName + "ec2-user@" + ipAddress);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("12. Allocate an Elastic IP address and associate it
with the instance.");
String allocationId = allocateAddress(ec2);
System.out.println("The allocation Id value is " + allocationId);
String associationId = associateAddress(ec2, newInstanceId,
allocationId);
System.out.println("The associate Id value is " + associationId);
System.out.println(DASHES);
```

```
System.out.println(DASHES);
System.out.println("13. Describe the instance again.");
ipAddress = describeEC2Instances(ec2, newInstanceId);
System.out.println("You can SSH to the instance using this command:");
System.out.println("ssh -i " + fileName + "ec2-user@" + ipAddress);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("14. Disassociate and release the Elastic IP
address.");
disassociateAddress(ec2, associationId);
releaseEC2Address(ec2, allocationId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("15. Terminate the instance and use a waiter.");
terminateEC2(ec2, newInstanceId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("16. Delete the security group.");
deleteEC2SecGroup(ec2, groupId);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("17. Delete the key.");
deleteKeys(ec2, keyName);
System.out.println(DASHES);

System.out.println(DASHES);
System.out.println("You successfully completed the Amazon EC2
scenario.");
System.out.println(DASHES);
ec2.close();
}

public static void deleteEC2SecGroup(Ec2Client ec2, String groupId) {
    try {
        DeleteSecurityGroupRequest request =
DeleteSecurityGroupRequest.builder()
            .groupId(groupId)
            .build();
```

```
        ec2.deleteSecurityGroup(request);
        System.out.println("Successfully deleted security group with Id " +
groupId);

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}

public static void terminateEC2(Ec2Client ec2, String instanceId) {
    try {
        Ec2Waiter ec2Waiter = Ec2Waiter.builder()
            .overrideConfiguration(b -> b.maxAttempts(100))
            .client(ec2)
            .build();

        TerminateInstancesRequest ti = TerminateInstancesRequest.builder()
            .instanceIds(instanceId)
            .build();

        System.out.println("Use an Ec2Waiter to wait for the instance to
terminate. This will take a few minutes.");
        ec2.terminateInstances(ti);
        DescribeInstancesRequest instanceRequest =
DescribeInstancesRequest.builder()
            .instanceIds(instanceId)
            .build();

        WaiterResponse<DescribeInstancesResponse> waiterResponse = ec2Waiter
            .waitUntilInstanceTerminated(instanceRequest);
        waiterResponse.matched().response().ifPresent(System.out::println);
        System.out.println("Successfully started instance " + instanceId);
        System.out.println(instanceId + " is terminated!");

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}

public static void deleteKeys(Ec2Client ec2, String keyPair) {
    try {
        DeleteKeyPairRequest request = DeleteKeyPairRequest.builder()
```

```
        .keyName(keyPair)
        .build();

    ec2.deleteKeyPair(request);
    System.out.println("Successfully deleted key pair named " + keyPair);

} catch (Ec2Exception e) {
    System.err.println(e.awsErrorDetails().errorMessage());
    System.exit(1);
}

public static void releaseEC2Address(Ec2Client ec2, String allocId) {
    try {
        ReleaseAddressRequest request = ReleaseAddressRequest.builder()
            .allocationId(allocId)
            .build();

        ec2.releaseAddress(request);
        System.out.println("Successfully released Elastic IP address " +
allocId);
    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}

public static void disassociateAddress(Ec2Client ec2, String associationId) {
    try {
        DisassociateAddressRequest addressRequest =
DisassociateAddressRequest.builder()
            .associationId(associationId)
            .build();

        ec2.disassociateAddress(addressRequest);
        System.out.println("You successfully disassociated the address!");

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
```

```
public static String associateAddress(Ec2Client ec2, String instanceId,
String allocationId) {
    try {
        AssociateAddressRequest associateRequest =
AssociateAddressRequest.builder()
            .instanceId(instanceId)
            .allocationId(allocationId)
            .build();

        AssociateAddressResponse associateResponse =
ec2.associateAddress(associateRequest);
        return associateResponse.associationId();

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
    return "";
}

public static String allocateAddress(Ec2Client ec2) {
    try {
        AllocateAddressRequest allocateRequest =
AllocateAddressRequest.builder()
            .domain(DomainType.VPC)
            .build();

        AllocateAddressResponse allocateResponse =
ec2.allocateAddress(allocateRequest);
        return allocateResponse.allocationId();

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
    return "";
}

public static void startInstance(Ec2Client ec2, String instanceId) {
    Ec2Waiter ec2Waiter = Ec2Waiter.builder()
        .overrideConfiguration(b -> b.maxAttempts(100))
        .client(ec2)
        .build();
}
```

```
StartInstancesRequest request = StartInstancesRequest.builder()
    .instanceIds(instanceId)
    .build();

System.out.println("Use an Ec2Waiter to wait for the instance to run.
This will take a few minutes.");
ec2.startInstances(request);
DescribeInstancesRequest instanceRequest =
DescribeInstancesRequest.builder()
    .instanceIds(instanceId)
    .build();

WaiterResponse<DescribeInstancesResponse> waiterResponse =
ec2Waiter.waitUntilInstanceRunning(instanceRequest);
waiterResponse.matched().response().ifPresent(System.out::println);
System.out.println("Successfully started instance " + instanceId);
}

public static void stopInstance(Ec2Client ec2, String instanceId) {
    Ec2Waiter ec2Waiter = Ec2Waiter.builder()
        .overrideConfiguration(b -> b.maxAttempts(100))
        .client(ec2)
        .build();
    StopInstancesRequest request = StopInstancesRequest.builder()
        .instanceIds(instanceId)
        .build();

System.out.println("Use an Ec2Waiter to wait for the instance to stop.
This will take a few minutes.");
    ec2.stopInstances(request);
    DescribeInstancesRequest instanceRequest =
DescribeInstancesRequest.builder()
    .instanceIds(instanceId)
    .build();

    WaiterResponse<DescribeInstancesResponse> waiterResponse =
ec2Waiter.waitUntilInstanceStopped(instanceRequest);
    waiterResponse.matched().response().ifPresent(System.out::println);
    System.out.println("Successfully stopped instance " + instanceId);
}

public static String describeEC2Instances(Ec2Client ec2, String
newInstanceId) {
    try {
```

```
        String pubAddress = "";
        boolean isRunning = false;
        DescribeInstancesRequest request = DescribeInstancesRequest.builder()
            .instanceIds(newInstanceId)
            .build();

        while (!isRunning) {
            DescribeInstancesResponse response =
                ec2.describeInstances(request);
            String state =
                response.reservations().get(0).instances().get(0).state().name().name();
            if (state.compareTo("RUNNING") == 0) {
                System.out.println("Image id is " +
                    response.reservations().get(0).instances().get(0).imageId());
                System.out.println(
                    "Instance type is " +
                    response.reservations().get(0).instances().get(0).instanceType());
                System.out.println(
                    "Instance state is " +
                    response.reservations().get(0).instances().get(0).state().name());
                pubAddress =
                    response.reservations().get(0).instances().get(0).publicIpAddress();
                System.out.println("Instance address is " + pubAddress);
                isRunning = true;
            }
        }
        return pubAddress;
    } catch (SsmException e) {
        System.err.println(e.getMessage());
        System.exit(1);
    }
    return "";
}

public static String runInstance(Ec2Client ec2, String instanceType, String
keyName, String groupName,
String amiId) {
try {
    RunInstancesRequest runRequest = RunInstancesRequest.builder()
        .instanceType(instanceType)
        .keyName(keyName)
        .securityGroups(groupName)
        .maxCount(1)
        .minCount(1)
```

```
        .imageId(amiId)
        .build();

        System.out.println("Going to start an EC2 instance using a waiter");
        RunInstancesResponse response = ec2.runInstances(runRequest);
        String instanceIdVal = response.instances().get(0).instanceId();
        ec2.waiter().waitUntilInstanceRunning(r ->
r.instanceIds(instanceIdVal));
        System.out.println("Successfully started EC2 instance " +
instanceIdVal + " based on AMI " + amiId);
        return instanceIdVal;

    } catch (SsmException e) {
        System.err.println(e.getMessage());
        System.exit(1);
    }
    return "";
}

// Get a list of instance types.
public static String getInstanceTypes(Ec2Client ec2) {
    String instanceType;
    try {
        DescribeInstanceTypesRequest typesRequest =
DescribeInstanceTypesRequest.builder()
        .maxResults(10)
        .build();

        DescribeInstanceTypesResponse response =
ec2.describeInstanceTypes(typesRequest);
        List<InstanceTypeInfo> instanceTypes = response.instanceTypes();
        for (InstanceTypeInfo type : instanceTypes) {
            System.out.println("The memory information of this type is " +
type.memoryInfo().sizeInMiB());
            System.out.println("Network information is " +
type.networkInfo().toString());
            System.out.println("Instance type is " +
type.instanceType().toString());
            instanceType = type.instanceType().toString();
            if (instanceType.compareTo("t2.2xlarge") == 0){
                return instanceType;
            }
        }
    }
}
```

```
        } catch (SsmException e) {
            System.err.println(e.getMessage());
            System.exit(1);
        }
        return "";
    }

    // Display the Description field that corresponds to the instance Id value.
    public static String describeImage(Ec2Client ec2, String instanceId) {
        try {
            DescribeImagesRequest imagesRequest = DescribeImagesRequest.builder()
                .imageIds(instanceId)
                .build();

            DescribeImagesResponse response = ec2.describeImages(imagesRequest);
            System.out.println("The description of the first image is " +
response.images().get(0).description());
            System.out.println("The name of the first image is " +
response.images().get(0).name());

            // Return the image Id value.
            return response.images().get(0).imageId();
        } catch (SsmException e) {
            System.err.println(e.getMessage());
            System.exit(1);
        }
        return "";
    }

    // Get the Id value of an instance with amzn2 in the name.
    public static String getParaValues(SsmClient ssmClient) {
        try {
            GetParametersByPathRequest parameterRequest =
GetParametersByPathRequest.builder()
                .path("/aws/service/ami-amazon-linux-latest")
                .build();

            GetParametersByPathIterable responses =
ssmClient.getParametersByPathPaginator(parameterRequest);
            for
(software.amazon.awssdk.services.ssm.model.GetParametersByPathResponse
response : responses) {
                System.out.println("Test " + response.nextToken());
            }
        } catch (SsmException e) {
            System.err.println(e.getMessage());
            System.exit(1);
        }
        return "";
    }
}
```

```
        List<Parameter> parameterList = response.parameters();
        for (Parameter para : parameterList) {
            System.out.println("The name of the para is: " +
para.name());
            System.out.println("The type of the para is: " +
para.type());
            if (filterName(para.name())) {
                return para.value();
            }
        }
    }

} catch (SsmException e) {
    System.err.println(e.getMessage());
    System.exit(1);
}
return "";
}

// Return true if the name has amzn2 in it. For example:
// /aws/service/ami-amazon-linux-latest/amzn2-ami-hvm-arm64-gp2
private static boolean filterName(String name) {
    String[] parts = name.split("/");
    String myValue = parts[4];
    return myValue.contains("amzn2");
}

public static void describeSecurityGroups(Ec2Client ec2, String groupId) {
    try {
        DescribeSecurityGroupsRequest request =
DescribeSecurityGroupsRequest.builder()
        .groupIds(groupId)
        .build();

        // Use a paginator.
        DescribeSecurityGroupsIterable listGroups =
ec2.describeSecurityGroupsPaginator(request);
        listGroups.stream()
        .flatMap(r -> r.securityGroups().stream())
        .forEach(group -> System.out
            .println(" Group id: " +group.groupId() + " group name = " +
group.groupName()));

    } catch (Ec2Exception e) {
```

```
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }

    public static String createSecurityGroup(Ec2Client ec2, String groupName,
String groupDesc, String vpcId,
        String myIpAddress) {
    try {
        CreateSecurityGroupRequest createRequest =
CreateSecurityGroupRequest.builder()
            .groupName(groupName)
            .description(groupDesc)
            .vpcId(vpcId)
            .build();

        CreateSecurityGroupResponse resp =
ec2.createSecurityGroup(createRequest);
        IpRange ipRange = IpRange.builder()
            .cidrIp(myIpAddress + "/0")
            .build();

        IpPermission ipPerm = IpPermission.builder()
            .ipProtocol("tcp")
            .toPort(80)
            .fromPort(80)
            .ipRanges(ipRange)
            .build();

        IpPermission ipPerm2 = IpPermission.builder()
            .ipProtocol("tcp")
            .toPort(22)
            .fromPort(22)
            .ipRanges(ipRange)
            .build();

        AuthorizeSecurityGroupIngressRequest authRequest =
AuthorizeSecurityGroupIngressRequest.builder()
            .groupName(groupName)
            .ipPermissions(ipPerm, ipPerm2)
            .build();

        ec2.authorizeSecurityGroupIngress(authRequest);
```

```
        System.out.println("Successfully added ingress policy to security
group " + groupName);
        return resp.groupId();

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
    return "";
}

public static void describeKeys(Ec2Client ec2) {
    try {
        DescribeKeyPairsResponse response = ec2.describeKeyPairs();
        response.keyPairs().forEach(keyPair -> System.out.printf(
            "Found key pair with name %s " +
            "and fingerprint %s",
            keyPair.keyName(),
            keyPair.keyFingerprint()));

    } catch (Ec2Exception e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}

public static void createKeyPair(Ec2Client ec2, String keyName, String
fileName) {
    try {
        CreateKeyPairRequest request = CreateKeyPairRequest.builder()
            .keyName(keyName)
            .build();

        CreateKeyPairResponse response = ec2.createKeyPair(request);
        String content = response.keyMaterial();
        BufferedWriter writer = new BufferedWriter(new FileWriter(fileName));
        writer.write(content);
        writer.close();
        System.out.println("Successfully created key pair named " + keyName);

    } catch (Ec2Exception | IOException e) {
        System.err.println(e.getMessage());
        System.exit(1);
    }
}
```

```
    }  
}
```

- For API details, see the following topics in *AWS SDK for Java 2.x API Reference*.
  - [AllocateAddress](#)
  - [AssociateAddress](#)
  - [AuthorizeSecurityGroupIngress](#)
  - [CreateKeyPair](#)
  - [CreateSecurityGroup](#)
  - [DeleteKeyPair](#)
  - [DeleteSecurityGroup](#)
  - [DescribeImages](#)
  - [DescribeInstanceTypes](#)
  - [DescribeInstances](#)
  - [DescribeKeyPairs](#)
  - [DescribeSecurityGroups](#)
  - [DisassociateAddress](#)
  - [ReleaseAddress](#)
  - [RunInstances](#)
  - [StartInstances](#)
  - [StopInstances](#)
  - [TerminateInstances](#)
  - [UnmonitorInstances](#)

## JavaScript

### SDK for JavaScript (v3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run  
in the [AWS Code Examples Repository](#).

## Run an interactive scenario at a command prompt.

```
import { mkdtempSync, writeFileSync, rmSync } from "fs";
import { tmpdir } from "os";
import { join } from "path";
import { get } from "http";

import {
  AllocateAddressCommand,
  AssociateAddressCommand,
  AuthorizeSecurityGroupIngressCommand,
  CreateKeyPairCommand,
  CreateSecurityGroupCommand,
  DeleteKeyPairCommand,
  DeleteSecurityGroupCommand,
  DescribeInstancesCommand,
  DescribeKeyPairsCommand,
  DescribeSecurityGroupsCommand,
  DisassociateAddressCommand,
  EC2Client,
  paginateDescribeImages,
  paginateDescribeInstanceTypes,
  ReleaseAddressCommand,
  RunInstancesCommand,
  StartInstancesCommand,
  StopInstancesCommand,
  TerminateInstancesCommand,
  waitUntilInstanceStateOk,
  waitUntilInstanceStopped,
  waitUntilInstanceTerminated,
} from "@aws-sdk/client-ec2";
import { paginateGetParametersByPath, SSMClient } from "@aws-sdk/client-ssm";

import { wrapText } from "@aws-doc-sdk-examples/lib/utils/util-string.js";
import { Prompter } from "@aws-doc-sdk-examples/lib/prompter.js";

const ec2Client = new EC2Client();
const ssmClient = new SSMClient();

const prompter = new Prompter();
const confirmMessage = "Continue?";
const tmpDirectory = mkdtempSync(join(tmpdir(), "ec2-scenario-tmp"));

const createKeyPair = async (keyPairName) => {
```

```
// Create a key pair in Amazon EC2.
const { KeyMaterial, KeyPairId } = await ec2Client.send(
    // A unique name for the key pair. Up to 255 ASCII characters.
    new CreateKeyPairCommand({ KeyName: keyPairName }),
);

// Save the private key in a temporary location.
writeFileSync(`.${tmpDirectory}/${keyPairName}.pem`, KeyMaterial, {
    mode: 0o400,
});

return KeyPairId;
};

const describeKeyPair = async (keyPairName) => {
    const command = new DescribeKeyPairsCommand({
        KeyNames: [keyPairName],
    });
    const { KeyPairs } = await ec2Client.send(command);
    return KeyPairs[0];
};

const createSecurityGroup = async (securityGroupName) => {
    const command = new CreateSecurityGroupCommand({
        GroupName: securityGroupName,
        Description: "A security group for the Amazon EC2 example.",
    });
    const {GroupId} = await ec2Client.send(command);
    return GroupId;
};

const allocateIpAddress = async () => {
    const command = new AllocateAddressCommand({});
    const { PublicIp, AllocationId } = await ec2Client.send(command);
    return { PublicIp, AllocationId };
};

const getLocalIpAddress = () => {
    return new Promise((res, rej) => {
        get("http://checkip.amazonaws.com", (response) => {
            let data = "";
            response.on("data", (chunk) => (data += chunk));
            response.on("end", () => res(data.trim()));
        }).on("error", (err) => {
```

```
        rej(err);
    });
});
};

const authorizeSecurityGroupIngress = async (securityGroupId) => {
    const ipAddress = await getLocalIpAddress();
    const command = new AuthorizeSecurityGroupIngressCommand({
        GroupId: securityGroupId,
        IpPermissions: [
            {
                IpProtocol: "tcp",
                FromPort: 22,
                ToPort: 22,
                IpRanges: [{ CidrIp: `${ipAddress}/32` }],
            },
        ],
    });
    await ec2Client.send(command);
    return ipAddress;
};

const describeSecurityGroup = async (securityGroupName) => {
    const command = new DescribeSecurityGroupsCommand({
        GroupNames: [securityGroupName],
    });
    const { SecurityGroups } = await ec2Client.send(command);

    return SecurityGroups[0];
};

const getAmznLinux2AMIs = async () => {
    const AMIs = [];
    for await (const page of paginateGetParametersByPath(
        {
            client: ssmClient,
        },
        { Path: "/aws/service/ami-amazon-linux-latest" },
    )) {
        page.Parameters.forEach((param) => {
            if (param.Name.includes("amzn2")) {
                AMIs.push(param.Value);
            }
        })
    }
}
```

```
    });
}

const imageDetails = [];

for await (const page of paginateDescribeImages(
  { client: ec2Client },
  { ImageIds: AMIs },
)) {
  imageDetails.push(...(page.Images || []));
}

const choices = imageDetails.map((image, index) => ({
  name: `${image.ImageId} - ${image.Description}`,
  value: index,
}));

/***
 * @type {number}
 */
const selectedIndex = await prompter.select({
  message: "Select an image.",
  choices,
});

return imageDetails[selectedIndex];
};

/***
 * @param {import('@aws-sdk/client-ec2').Image} imageDetails
 */
const getCompatibleInstanceTypes = async (imageDetails) => {
  const paginator = paginateDescribeInstanceTypes(
    { client: ec2Client, pageSize: 25 },
    {
      Filters: [
        {
          Name: "processor-info.supported-architecture",
          Values: [imageDetails.Architecture],
        },
        { Name: "instance-type", Values: ["*.micro", "*.small"] },
      ],
    },
  );
}
```

```
const instanceTypes = [];

for await (const page of paginator) {
    if (page.InstanceTypes.length) {
        instanceTypes.push(...(page.InstanceTypes || []));
    }
}

const choices = instanceTypes.map((type, index) => ({
    name: `${type.InstanceType} - Memory:${type.MemoryInfo.SizeInMiB}`,
    value: index,
}));

/** 
 * @type {number}
 */
const selectedIndex = await prompter.select({
    message: "Select an instance type.",
    choices,
});
return instanceTypes[selectedIndex];
};

const runInstance = async ({
    keyPairName,
    securityGroupId,
    imageId,
    instanceType,
}) => {
    const command = new RunInstancesCommand({
        KeyName: keyPairName,
        SecurityGroupIds: [securityGroupId],
        ImageId: imageId,
        InstanceType: instanceType,
        MinCount: 1,
        MaxCount: 1,
    });
    const { Instances } = await ec2Client.send(command);
    await waitUntilInstanceStateOk(
        { client: ec2Client },
        { InstanceIds: [Instances[0].InstanceId] },
    );
}
```

```
    return Instances[0].InstanceId;
};

const describeInstance = async (instanceId) => {
    const command = new DescribeInstancesCommand({
        InstanceIds: [instanceId],
    });

    const { Reservations } = await ec2Client.send(command);
    return Reservations[0].Instances[0];
};

const displaySSHConnectionInfo = ({ publicIp, keyPairName }) => {
    return `ssh -i ${tmpDirectory}/${keyPairName}.pem ec2-user@${publicIp}`;
};

const stopInstance = async (instanceId) => {
    const command = new StopInstancesCommand({ InstanceIds: [instanceId] });
    await ec2Client.send(command);
    await waitUntilInstanceStopped(
        { client: ec2Client },
        { InstanceIds: [instanceId] },
    );
};

const startInstance = async (instanceId) => {
    const startCommand = new StartInstancesCommand({ InstanceIds: [instanceId] });
    await ec2Client.send(startCommand);
    await waitUntilInstanceStateOk(
        { client: ec2Client },
        { InstanceIds: [instanceId] },
    );
    return await describeInstance(instanceId);
};

const associateAddress = async ({ allocationId, instanceId }) => {
    const command = new AssociateAddressCommand({
        AllocationId: allocationId,
        InstanceId: instanceId,
    });

    const { AssociationId } = await ec2Client.send(command);
    return AssociationId;
};
```

```
const disassociateAddress = async (associationId) => {
  const command = new DisassociateAddressCommand({
    AssociationId: associationId,
  });
  try {
    await ec2Client.send(command);
  } catch (err) {
    console.warn(
      `Failed to disassociated address with association id: ${associationId}`,
      err,
    );
  }
};

const releaseAddress = async (allocationId) => {
  const command = new ReleaseAddressCommand({
    AllocationId: allocationId,
  });

  try {
    await ec2Client.send(command);
    console.log(`Address with allocation ID ${allocationId} released.\n`);
  } catch (err) {
    console.log(
      `Failed to release address with allocation id: ${allocationId}.`,
      err,
    );
  }
};

const restartInstance = async (instanceId) => {
  console.log("Stopping instance.");
  await stopInstance(instanceId);
  console.log("Instance stopped.");
  console.log("Starting instance.");
  const { PublicIpAddress } = await startInstance(instanceId);
  return PublicIpAddress;
};

const terminateInstance = async (instanceId) => {
  const command = new TerminateInstancesCommand({
    InstanceIds: [instanceId],
  });
}
```

```
try {
    await ec2Client.send(command);
    await waitUntilInstanceTerminated(
        { client: ec2Client },
        { InstanceIds: [instanceId] },
    );
    console.log(`Instance with ID ${instanceId} terminated.\n`);
} catch (err) {
    console.warn(`Failed to terminate instance ${instanceId}.`, err);
}
};

const deleteSecurityGroup = async (securityGroupId) => {
    const command = new DeleteSecurityGroupCommand({
        GroupId: securityGroupId,
    });

    try {
        await ec2Client.send(command);
        console.log(`Security group ${securityGroupId} deleted.\n`);
    } catch (err) {
        console.warn(`Failed to delete security group ${securityGroupId}.`, err);
    }
};

const deleteKeyPair = async (keyPairName) => {
    const command = new DeleteKeyPairCommand({
        KeyName: keyPairName,
    });

    try {
        await ec2Client.send(command);
        console.log(`Key pair ${keyPairName} deleted.\n`);
    } catch (err) {
        console.warn(`Failed to delete key pair ${keyPairName}.`, err);
    }
};

const deleteTemporaryDirectory = () => {
    try {
        rmSync(tmpDirectory, { recursive: true });
        console.log(`Temporary directory ${tmpDirectory} deleted.\n`);
    } catch (err) {
```

```
        console.warn(`Failed to delete temporary directory ${tmpDirectory}.`, err);
    }
};

export const main = async () => {
    const keyPairName = "ec2-scenario-key-pair";
    const securityGroupName = "ec2-scenario-security-group";

    let securityGroupId, ipAllocationId, publicIp, instanceId, associationId;

    console.log(wrapText("Welcome to the Amazon EC2 basic usage scenario."));

    try {
        // Prerequisites
        console.log(
            "Before you launch an instance, you'll need a few things:",
            "\n - A Key Pair",
            "\n - A Security Group",
            "\n - An IP Address",
            "\n - An AMI",
            "\n - A compatible instance type",
            "\n\n I'll go ahead and take care of the first three, but I'll need your help for the rest.",
        );
    }

    await prompter.confirm({ message: confirmMessage });

    await createKeyPair(keyPairName);
    securityGroupId = await createSecurityGroup(securityGroupName);
    const { PublicIp, AllocationId } = await allocateIpAddress();
    ipAllocationId = AllocationId;
    publicIp = PublicIp;
    const ipAddress = await authorizeSecurityGroupIngress(securityGroupId);

    const { KeyName } = await describeKeyPair(keyPairName);
    const {GroupName} = await describeSecurityGroup(securityGroupName);
    console.log(`# created the key pair ${KeyName}.\n`);
    console.log(
        `# created the security group ${GroupName}`,
        `and allowed SSH access from ${ipAddress} (your IP).\n`,
    );
    console.log(`# allocated ${publicIp} to be used for your EC2 instance.\n`);

    await prompter.confirm({ message: confirmMessage });
}
```

```
// Creating the instance
console.log(wrapText("Create the instance."));
console.log(
    "You get to choose which image you want. Select an amazon-linux-2 image
from the following:",
);
const imageDetails = await getAmznLinux2AMIs();
const instanceTypeDetails = await getCompatibleInstanceTypes(imageDetails);
console.log("Creating your instance. This can take a few seconds.");
instanceId = await runInstance({
    keyPairName,
    securityGroupId,
    imageId: imageDetails.ImageId,
    instanceType: instanceTypeDetails.InstanceType,
});
const instanceDetails = await describeInstance(instanceId);
console.log(`# instance ${instanceId}.\n`);
console.log(instanceDetails);
console.log(
    `\nYou should now be able to SSH into your instance from another
terminal.`,
`#${displaySSHConnectionInfo({
    publicIp: instanceDetails.PublicIpAddress,
    keyPairName,
})}`,
);
await prompter.confirm({ message: confirmMessage });

// Understanding the IP address.
console.log(wrapText("Understanding the IP address."));
console.log(
    "When you stop and start an instance, the IP address will change. I'll
restart your",
    "instance for you. Notice how the IP address changes.",
);
const ipAddressAfterRestart = await restartInstance(instanceId);
console.log(
    `\n Instance started. The IP address changed from
${instanceDetails.PublicIpAddress} to ${ipAddressAfterRestart}`,
`#${displaySSHConnectionInfo({
    publicIp: ipAddressAfterRestart,
    keyPairName,
})}`,
);
```

```
        })}`,
    );
    await prompter.confirm({ message: confirmMessage });
    console.log(
      `If you want to the IP address to be static, you can associate an
allocated`,
      `IP address to your instance. I allocated ${publicIp} for you earlier, and
now I'll associate it to your instance.`,
    );
    associationId = await associateAddress({
      allocationId: ipAllocationId,
      instanceId,
    });
    console.log(
      "Done. Now you should be able to SSH using the new IP.\n",
      `${displaySSHConnectionInfo({ publicIp, keyPairName })}`,
    );
    await prompter.confirm({ message: confirmMessage });
    console.log(
      "I'll restart the server again so you can see the IP address remains the
same.",
    );
    const ipAddressAfterAssociated = await restartInstance(instanceId);
    console.log(
      `Done. Here's your SSH info. Notice the IP address hasn't changed.`,
      `\n${displaySSHConnectionInfo({
        publicIp: ipAddressAfterAssociated,
        keyPairName,
      })}`,
    );
    await prompter.confirm({ message: confirmMessage });
  } catch (err) {
    console.error(err);
  } finally {
    // Clean up.
    console.log(wrapText("Clean up."));
    console.log("Now I'll clean up all of the stuff I created.");
    await prompter.confirm({ message: confirmMessage });
    console.log("Cleaning up. Some of these steps can take a bit of time.");
    await disassociateAddress(associationId);
    await terminateInstance(instanceId);
    await releaseAddress(ipAllocationId);
    await deleteSecurityGroup(securityGroupId);
    deleteTemporaryDirectory();
  }
}
```

```
    await deleteKeyPair(keyPairName);
    console.log(
        "Done cleaning up. Thanks for staying until the end!",
        "If you have any feedback please use the feedback button in the docs",
        "or create an issue on GitHub.",
    );
}
};
```

- For API details, see the following topics in *AWS SDK for JavaScript API Reference*.
  - [AllocateAddress](#)
  - [AssociateAddress](#)
  - [AuthorizeSecurityGroupIngress](#)
  - [CreateKeyPair](#)
  - [CreateSecurityGroup](#)
  - [DeleteKeyPair](#)
  - [DeleteSecurityGroup](#)
  - [DescribeImages](#)
  - [DescribeInstanceTypes](#)
  - [DescribeInstances](#)
  - [DescribeKeyPairs](#)
  - [DescribeSecurityGroups](#)
  - [DisassociateAddress](#)
  - [ReleaseAddress](#)
  - [RunInstances](#)
  - [StartInstances](#)
  - [StopInstances](#)
  - [TerminateInstances](#)
  - [UnmonitorInstances](#)

## Kotlin

### SDK for Kotlin

#### Note

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

```
/**
```

Before running this Kotlin code example, set up your development environment, including your credentials.

For more information, see the following documentation topic:

<https://docs.aws.amazon.com/sdk-for-kotlin/latest/developer-guide/setup.html>

This Kotlin example performs the following tasks:

1. Creates an RSA key pair and saves the private key data as a .pem file.
  2. Lists key pairs.
  3. Creates a security group for the default VPC.
  4. Displays security group information.
  5. Gets a list of Amazon Linux 2 AMIs and selects one.
  6. Gets more information about the image.
  7. Gets a list of instance types that are compatible with the selected AMI's architecture.
  8. Creates an instance with the key pair, security group, AMI, and an instance type.
  9. Displays information about the instance.
  10. Stops the instance and waits for it to stop.
  11. Starts the instance and waits for it to start.
  12. Allocates an Elastic IP address and associates it with the instance.
  13. Displays SSH connection info for the instance.
  14. Disassociates and deletes the Elastic IP address.
  15. Terminates the instance.
  16. Deletes the security group.
  17. Deletes the key pair.
- ```
*/
```

```
val DASHES = String(CharArray(80)).replace("\u0000", "-")
```

```
suspend fun main(args: Array<String>) {
    val usage = """
        Usage:
            <keyName> <fileName> <groupName> <groupDesc> <vpcId> <myIpAddress>

        Where:
            keyName - A key pair name (for example, TestKeyPair).
            fileName - A file name where the key information is written to.
            groupName - The name of the security group.
            groupDesc - The description of the security group.
            vpcId - A VPC ID. You can get this value from the AWS Management
        Console.
            myIpAddress - The IP address of your development machine.

    """
    if (args.size != 6) {
        println(usage)
        exitProcess(0)
    }

    val keyName = args[0]
    val fileName = args[1]
    val groupName = args[2]
    val groupDesc = args[3]
    val vpcId = args[4]
    val myIpAddress = args[5]
    var newInstanceId: String? = ""

    println(DASHES)
    println("Welcome to the Amazon EC2 example scenario.")
    println(DASHES)

    println(DASHES)
    println("1. Create an RSA key pair and save the private key material as
a .pem file.")
    createKeyPairSc(keyName, fileName)
    println(DASHES)

    println(DASHES)
    println("2. List key pairs.")
    describeEC2KeysSc()
    println(DASHES)
```

```
println(DASHES)
println("3. Create a security group.")
val groupId = createEC2SecurityGroupSc(groupName, groupDesc, vpcId,
myIpAddress)
println(DASHES)

println(DASHES)
println("4. Display security group info for the newly created security
group.")
describeSecurityGroupsSc(groupId.toString())
println(DASHES)

println(DASHES)
println("5. Get a list of Amazon Linux 2 AMIs and select one with amzn2 in
the name.")
val instanceId = getParaValuesSc()
if (instanceId == "") {
    println("The instance Id value isn't valid.")
    exitProcess(0)
}
println("The instance Id is $instanceId.")
println(DASHES)

println(DASHES)
println("6. Get more information about an amzn2 image and return the AMI
value.")
val amiValue = instanceId?.let { describeImageSc(it) }
if (instanceId == "") {
    println("The instance Id value is invalid.")
    exitProcess(0)
}
println("The AMI value is $amiValue.")
println(DASHES)

println(DASHES)
println("7. Get a list of instance types.")
val instanceType = getInstanceTypesSc()
println(DASHES)

println(DASHES)
println("8. Create an instance.")
if (amiValue != null) {
    newInstanceId = runInstanceSc(instanceType, keyName, groupName, amiValue)
```

```
        println("The instance Id is $newInstanceId")
    }
    println(DASHES)

    println(DASHES)
    println("9. Display information about the running instance. ")
    var ipAddress = describeEC2InstancesSc(newInstanceId)
    println("You can SSH to the instance using this command:")
    println("ssh -i " + fileName + "ec2-user@" + ipAddress)
    println(DASHES)

    println(DASHES)
    println("10. Stop the instance.")
    if (newInstanceId != null) {
        stopInstanceSc(newInstanceId)
    }
    println(DASHES)

    println(DASHES)
    println("11. Start the instance.")
    if (newInstanceId != null) {
        startInstanceSc(newInstanceId)
    }
    ipAddress = describeEC2InstancesSc(newInstanceId)
    println("You can SSH to the instance using this command:")
    println("ssh -i " + fileName + "ec2-user@" + ipAddress)
    println(DASHES)

    println(DASHES)
    println("12. Allocate an Elastic IP address and associate it with the
instance.")
    val allocationId = allocateAddressSc()
    println("The allocation Id value is $allocationId")
    val associationId = associateAddressSc(newInstanceId, allocationId)
    println("The associate Id value is $associationId")
    println(DASHES)

    println(DASHES)
    println("13. Describe the instance again.")
    ipAddress = describeEC2InstancesSc(newInstanceId)
    println("You can SSH to the instance using this command:")
    println("ssh -i " + fileName + "ec2-user@" + ipAddress)
    println(DASHES)
```

```
    println(DASHES)
    println("14. Disassociate and release the Elastic IP address.")
    disassociateAddressSc(associationId)
    releaseEC2AddressSc(allocationId)
    println(DASHES)

    println(DASHES)
    println("15. Terminate the instance and use a waiter.")
    if (newInstanceId != null) {
        terminateEC2Sc(newInstanceId)
    }
    println(DASHES)

    println(DASHES)
    println("16. Delete the security group.")
    if (groupId != null) {
        deleteEC2SecGroupSc(groupId)
    }
    println(DASHES)

    println(DASHES)
    println("17. Delete the key pair.")
    deleteKeysSc(keyName)
    println(DASHES)

    println(DASHES)
    println("You successfully completed the Amazon EC2 scenario.")
    println(DASHES)
}

suspend fun deleteKeysSc(keyPair: String) {
    val request =
        DeleteKeyPairRequest {
            keyName = keyPair
        }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.deleteKeyPair(request)
        println("Successfully deleted key pair named $keyPair")
    }
}

suspend fun deleteEC2SecGroupSc(groupIdVal: String) {
    val request =
        DeleteSecurityGroupRequest {
```

```
        groupId = groupIdVal
    }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.deleteSecurityGroup(request)
        println("Successfully deleted security group with Id $groupIdVal")
    }
}

suspend fun terminateEC2Sc(instanceIdVal: String) {
    val ti =
        TerminateInstancesRequest {
            instanceIds = listOf(instanceIdVal)
        }
    println("Wait for the instance to terminate. This will take a few minutes.")
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.terminateInstances(ti)
        ec2.waitUntilInstanceTerminated {
            // suspend call
            instanceIds = listOf(instanceIdVal)
        }
        println("$instanceIdVal is terminated!")
    }
}

suspend fun releaseEC2AddressSc(allocId: String?) {
    val request =
        ReleaseAddressRequest {
            allocationId = allocId
        }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.releaseAddress(request)
        println("Successfully released Elastic IP address $allocId")
    }
}

suspend fun disassociateAddressSc(associationIdVal: String?) {
    val addressRequest =
        DisassociateAddressRequest {
            associationId = associationIdVal
        }
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.disassociateAddress(addressRequest)
        println("You successfully disassociated the address!")
    }
}
```

```
        }

    }

suspend fun associateAddressSc(
    instanceIdVal: String?,
    allocationIdVal: String?,
): String? {
    val associateRequest =
        AssociateAddressRequest {
            instanceId = instanceIdVal
            allocationId = allocationIdVal
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val associateResponse = ec2.associateAddress(associateRequest)
        return associateResponse.associationId
    }
}

suspend fun allocateAddressSc(): String? {
    val allocateRequest =
        AllocateAddressRequest {
            domain = DomainType.Vpc
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val allocateResponse = ec2.allocateAddress(allocateRequest)
        return allocateResponse.allocationId
    }
}

suspend fun startInstanceSc(instanceId: String) {
    val request =
        StartInstancesRequest {
            instanceIds = listOf(instanceId)
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.startInstances(request)
        println("Waiting until instance $instanceId starts. This will take a few
minutes.")
        ec2.waitUntilInstanceRunning {
            // suspend call
            instanceIds = listOf(instanceId)
        }
    }
}
```

```
        println("Successfully started instance $instanceId")
    }
}

suspend fun stopInstanceSc(instanceId: String) {
    val request =
        StopInstancesRequest {
            instanceIds = listOf(instanceId)
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        ec2.stopInstances(request)
        println("Waiting until instance $instanceId stops. This will take a few
minutes.")
        ec2.waitUntilInstanceStopped {
            // suspend call
            instanceIds = listOf(instanceId)
        }
        println("Successfully stopped instance $instanceId")
    }
}

suspend fun describeEC2InstancesSc(newInstanceId: String?): String {
    var pubAddress = ""
    var isRunning = false
    val request =
        DescribeInstancesRequest {
            instanceIds = listOf(newInstanceId.toString())
        }

    while (!isRunning) {
        Ec2Client { region = "us-west-2" }.use { ec2 ->
            val response = ec2.describeInstances(request)
            val state =
                response.reservations
                    ?.get(0)
                    ?.instances
                    ?.get(0)
                    ?.state
                    ?.name
                    ?.value
            if (state != null) {
                if (state.compareTo("running") == 0) {
```

```
        println("Image id is
${response.reservations!![0].instances?[0].imageId}")
        println("Instance type is
${response.reservations!![0].instances?[0].instanceType}")
        println("Instance state is
${response.reservations!![0].instances?[0].state}")
    pubAddress =
        response.reservations!!
            .get(0)
            .instances
            ?.get(0)
            ?.publicIpAddress
            .toString()
    println("Instance address is $pubAddress")
    isRunning = true
}
}
}
}
return pubAddress
}

suspend fun runInstanceSc(
    instanceTypeVal: String,
    keyNameVal: String,
    groupNameVal: String,
    amiIdVal: String,
): String {
    val runRequest =
        RunInstancesRequest {
            instanceType = InstanceType.fromValue(instanceTypeVal)
            keyName = keyNameVal
            securityGroups = listOf(groupNameVal)
            maxCount = 1
            minCount = 1
            imageId = amiIdVal
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.runInstances(runRequest)
        val instanceId = response.instances?[0].instanceId
        println("Successfully started EC2 Instance $instanceId based on AMI
$amiIdVal")
        return instanceId.toString()
    }
}
```

```
        }

    }

    // Get a list of instance types.
    suspend fun getInstanceTypesSc(): String {
        var instanceType = ""
        val filter0bs = ArrayList<Filter>()
        val filter =
            Filter {
                name = "processor-info.supported-architecture"
                values = listOf("arm64")
            }

        filter0bs.add(filter)
        val typesRequest =
            DescribeInstanceTypesRequest {
                filters = filter0bs
                maxResults = 10
            }
        Ec2Client { region = "us-west-2" }.use { ec2 ->
            val response = ec2.describeInstanceTypes(typesRequest)
            response.instanceTypes?.forEach { type ->
                println("The memory information of this type is
${type.memoryInfo?.sizeInMib}")
                println("Maximum number of network cards is
${type.networkInfo?.maximumNetworkCards}")
                instanceType = type.instanceType.toString()
            }
            return instanceType
        }
    }

    // Display the Description field that corresponds to the instance Id value.
    suspend fun describeImageSc(instanceId: String?): String? {
        val imagesRequest =
            DescribeImagesRequest {
                imageIds = listOf(instanceId)
            }

        Ec2Client { region = "us-west-2" }.use { ec2 ->
            val response = ec2.describeImages(imagesRequest)
            println("The description of the first image is
${response.images?.get(0)?.description}")
        }
    }
}
```

```
    println("The name of the first image is
${response.images?.get(0)?.name}")

    // Return the image Id value.
    return response.images?.get(0)?.imageId
}

}

// Get the Id value of an instance with amzn2 in the name.
suspend fun getParaValuesSc(): String? {
    val parameterRequest =
        GetParametersByPathRequest {
            path = "/aws/service/ami-amazon-linux-latest"
        }

    SsmClient { region = "us-west-2" }.use { ssmClient ->
        val response = ssmClient.getParametersByPath(parameterRequest)
        response.parameters?.forEach { para ->
            println("The name of the para is: ${para.name}")
            println("The type of the para is: ${para.type}")
            println("")
            if (para.name?.let { filterName(it) } == true) {
                return para.value
            }
        }
    }
    return ""
}

fun filterName(name: String): Boolean {
    val parts = name.split("/").toTypedArray()
    val myValue = parts[4]
    return myValue.contains("amzn2")
}

suspend fun describeSecurityGroupsSc(groupId: String) {
    val request =
        DescribeSecurityGroupsRequest {
            groupIds = listOf(groupId)
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.describeSecurityGroups(request)
        for (group in response.securityGroups!!) {
```

```
        println("Found Security Group with id " + group.groupId.toString() +
" and group VPC " + group.vpcId)
    }
}

suspend fun createEC2SecurityGroupSc(
    groupNameVal: String?,
    groupDescVal: String?,
    vpcIdVal: String?,
    myIpAddress: String?,
): String? {
    val request =
        CreateSecurityGroupRequest {
            groupName = groupNameVal
            description = groupDescVal
            vpcId = vpcIdVal
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val resp = ec2.createSecurityGroup(request)
        val ipRange =
            IpRange {
                cidrIp = "$myIpAddress/0"
            }

        val ipPerm =
            IpPermission {
                ipProtocol = "tcp"
                toPort = 80
                fromPort = 80
                ipRanges = listOf(ipRange)
            }

        val ipPerm2 =
            IpPermission {
                ipProtocol = "tcp"
                toPort = 22
                fromPort = 22
                ipRanges = listOf(ipRange)
            }

        val authRequest =
            AuthorizeSecurityGroupIngressRequest {
```

```
        groupName = groupNameVal
        ipPermissions = listOf(ipPerm, ipPerm2)
    }
    ec2.authorizeSecurityGroupIngress(authRequest)
    println("Successfully added ingress policy to Security Group
$groupNameVal")
    return resp.groupId
}
}

suspend fun describeEC2KeysSc() {
    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.describeKeyPairs(DescribeKeyPairsRequest {})
        response.keyPairs?.forEach { keyPair ->
            println("Found key pair with name ${keyPair.keyName} and fingerprint
${keyPair.keyFingerprint}")
        }
    }
}

suspend fun createKeyPairSc(
    keyNameVal: String,
    fileNameVal: String,
) {
    val request =
        CreateKeyPairRequest {
            keyName = keyNameVal
        }

    Ec2Client { region = "us-west-2" }.use { ec2 ->
        val response = ec2.createKeyPair(request)
        val content = response.keyMaterial
        if (content != null) {
            File(fileNameVal).writeText(content)
        }
        println("Successfully created key pair named $keyNameVal")
    }
}
```

- For API details, see the following topics in *AWS SDK for Kotlin API reference*.

- [AllocateAddress](#)
- [AssociateAddress](#)

- [AuthorizeSecurityGroupIngress](#)
- [CreateKeyPair](#)
- [CreateSecurityGroup](#)
- [DeleteKeyPair](#)
- [DeleteSecurityGroup](#)
- [DescribeImages](#)
- [DescribeInstanceTypes](#)
- [DescribeInstances](#)
- [DescribeKeyPairs](#)
- [DescribeSecurityGroups](#)
- [DisassociateAddress](#)
- [ReleaseAddress](#)
- [RunInstances](#)
- [StartInstances](#)
- [StopInstances](#)
- [TerminateInstances](#)
- [UnmonitorInstances](#)

## Python

### SDK for Python (Boto3)

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

Run an interactive scenario at a command prompt.

```
class Ec2InstanceScenario:  
    """Runs an interactive scenario that shows how to get started using EC2  
    instances."""
```

```
def __init__(self, inst_wrapper, key_wrapper, sg_wrapper, eip_wrapper,
ssm_client):
    """
    :param inst_wrapper: An object that wraps instance actions.
    :param key_wrapper: An object that wraps key pair actions.
    :param sg_wrapper: An object that wraps security group actions.
    :param eip_wrapper: An object that wraps Elastic IP actions.
    :param ssm_client: A Boto3 AWS Systems Manager client.
    """

    self.inst_wrapper = inst_wrapper
    self.key_wrapper = key_wrapper
    self.sg_wrapper = sg_wrapper
    self.eip_wrapper = eip_wrapper
    self.ssm_client = ssm_client

@demo_func
def create_and_list_key_pairs(self):
    """
    1. Creates an RSA key pair and saves its private key data as a .pem file
    in secure
        temporary storage. The private key data is deleted after the example
    completes.
    2. Lists the first five key pairs for the current account.
    """

    print(
        "Let's create an RSA key pair that you can be use to securely connect
    to "
        "your EC2 instance."
    )
    key_name = q.ask("Enter a unique name for your key: ", q.non_empty)
    self.key_wrapper.create(key_name)
    print(
        f"Created a key pair {self.key_wrapper.key_pair.key_name} and saved
    the "
        f"private key to {self.key_wrapper.key_file_path}.\n"
    )
    if q.ask("Do you want to list some of your key pairs? (y/n) ",
q.is_yesno):
        self.key_wrapper.list(5)

@demo_func
def create_security_group(self):
    """
    1. Creates a security group for the default VPC.
```

2. Adds an inbound rule to allow SSH. The SSH rule allows only inbound traffic from the current computer's public IPv4 address.
3. Displays information about the security group.

```
This function uses 'http://checkip.amazonaws.com' to get the current
public IP
    address of the computer that is running the example. This method works in
most
    cases. However, depending on how your computer connects to the internet,
you
    might have to manually add your public IP address to the security group
by using
    the AWS Management Console.
"""
print("Let's create a security group to manage access to your instance.")
sg_name = q.ask("Enter a unique name for your security group: ",
q.non_empty)
    security_group = self.sg_wrapper.create(
        sg_name, "Security group for example: get started with instances."
    )
    print(
        f"Created security group {security_group.group_name} in your default
"
        f"VPC {security_group.vpc_id}.\\n"
    )

ip_response = urllib.request.urlopen("http://checkip.amazonaws.com")
current_ip_address = ip_response.read().decode("utf-8").strip()
print("Let's add a rule to allow SSH only from your current IP address.")
print(f"Your public IP address is {current_ip_address}.")
q.ask("Press Enter to add this rule to your security group.")
response = self.sg_wrapper.authorize_ingress(current_ip_address)
if response["Return"]:
    print("Security group rules updated.")
else:
    print("Couldn't update security group rules.")
self.sg_wrapper.describe()

@demo_func
def create_instance(self):
"""
1. Gets a list of Amazon Linux 2 AMIs from AWS Systems Manager.
Specifying the
```

```
'/aws/service/ami-amazon-linux-latest' path returns only the latest AMIs.

2. Gets and displays information about the available AMIs and lets you select one.

3. Gets a list of instance types that are compatible with the selected AMI and lets you select one.

4. Creates an instance with the previously created key pair and security group, and the selected AMI and instance type.

5. Waits for the instance to be running and then displays its information.

"""

amiPaginator = self.ssm_client.get Paginator("get_parameters_by_path")
amiOptions = []
for page in amiPaginator.paginate(Path="/aws/service/ami-amazon-linux-latest"):
    amiOptions += page["Parameters"]
amzn2Images = self.instWrapper.get_images(
    [opt["Value"] for opt in amiOptions if "amzn2" in opt["Name"]])
)
print(
    "Let's create an instance from an Amazon Linux 2 AMI. Here are some options:")
)
imageChoice = q.choose(
    "Which one do you want to use? ", [opt.description for opt in amzn2Images]
)
print("Great choice!\n")

print(
    f"Here are some instance types that support the "
    f"{amzn2Images[imageChoice].architecture} architecture of the image:")
)
instTypes = self.instWrapper.get_instance_types(
    amzn2Images[imageChoice].architecture
)
instTypeChoice = q.choose(
    "Which one do you want to use? ", [it["InstanceType"] for it in instTypes]
)
print("Another great choice.\n")
```

```
print("Creating your instance and waiting for it to start...")
self.inst_wrapper.create(
    amzn2_images[image_choice],
    inst_types[inst_type_choice]["InstanceType"],
    self.key_wrapper.key_pair,
    [self.sg_wrapper.security_group],
)
print(f"Your instance is ready:\n")
self.inst_wrapper.display()

print("You can use SSH to connect to your instance.")
print(
    "If the connection attempt times out, you might have to manually
update "
    "the SSH ingress rule for your IP address in the AWS Management
Console."
)
self._display_ssh_info()

def _display_ssh_info(self):
    """
    Displays an SSH connection string that can be used to connect to a
running
instance.
    """

    print("To connect, open another command prompt and run the following
command:")
    if self.eip_wrapper.elastic_ip is None:
        print(
            f"\tssh -i {self.key_wrapper.key_file_path} "
            f"ec2-user@{self.inst_wrapper.instance.public_ip_address}"
        )
    else:
        print(
            f"\tssh -i {self.key_wrapper.key_file_path} "
            f"ec2-user@{self.eip_wrapper.elastic_ip.public_ip}"
        )
    q.ask("Press Enter when you're ready to continue the demo.")

@demo_func
def associate_elastic_ip(self):
    """
    1. Allocates an Elastic IP address and associates it with the instance.

```

```
2. Displays an SSH connection string that uses the Elastic IP address.  
    """  
    print(  
        "You can allocate an Elastic IP address and associate it with your  
instance\\n"  
        "to keep a consistent IP address even when your instance restarts."  
    )  
    elastic_ip = self.eip_wrapper.allocate()  
    print(f"Allocated static Elastic IP address: {elastic_ip.public_ip}.")  
    self.eip_wrapper.associate(self.inst_wrapper.instance)  
    print(f"Associated your Elastic IP with your instance.")  
    print(  
        "You can now use SSH to connect to your instance by using the Elastic  
IP."  
    )  
    self._display_ssh_info()  
  
@demo_func  
def stop_and_start_instance(self):  
    """  
    1. Stops the instance and waits for it to stop.  
    2. Starts the instance and waits for it to start.  
    3. Displays information about the instance.  
    4. Displays an SSH connection string. When an Elastic IP address is  
associated  
        with the instance, the IP address stays consistent when the instance  
stops  
        and starts.  
    """  
    print("Let's stop and start your instance to see what changes.")  
    print("Stopping your instance and waiting until it's stopped...")  
    self.inst_wrapper.stop()  
    print("Your instance is stopped. Restarting...")  
    self.inst_wrapper.start()  
    print("Your instance is running.")  
    self.inst_wrapper.display()  
    if self.eip_wrapper.elastic_ip is None:  
        print(  
            "Every time your instance is restarted, its public IP address  
changes."  
        )  
    else:  
        print(
```

```
"Because you have associated an Elastic IP with your instance,
you can \n"
    "connect by using a consistent IP address after the instance
restarts."
)
self._display_ssh_info()

@demo_func
def cleanup(self):
    """
    1. Disassociate and delete the previously created Elastic IP.
    2. Terminate the previously created instance.
    3. Delete the previously created security group.
    4. Delete the previously created key pair.
    """
    print("Let's clean everything up. This example created these resources:")
    print(f"\tElastic IP: {self.eip_wrapper.elastic_ip.allocation_id}")
    print(f"\tInstance: {self.inst_wrapper.instance.id}")
    print(f"\tSecurity group: {self.sg_wrapper.security_group.id}")
    print(f"\tKey pair: {self.key_wrapper.key_pair.name}")
    if q.ask("Ready to delete these resources? (y/n) ", q.is_yesno):
        self.eip_wrapper.disassociate()
        print("Disassociated the Elastic IP from the instance.")
        self.eip_wrapper.release()
        print("Released the Elastic IP.")
        print("Terminating the instance and waiting for it to terminate...")
        self.inst_wrapper.terminate()
        print("Instance terminated.")
        self.sg_wrapper.delete()
        print("Deleted security group.")
        self.key_wrapper.delete()
        print("Deleted key pair.")

def run_scenario(self):
    logging.basicConfig(level=logging.INFO, format"%(levelname)s:
%(message)s")

    print("-" * 88)
    print(
        "Welcome to the Amazon Elastic Compute Cloud (Amazon EC2) get started
with instances demo."
    )
    print("-" * 88)
```

```
        self.create_and_list_key_pairs()
        self.create_security_group()
        self.create_instance()
        self.stop_and_start_instance()
        self.associate_elastic_ip()
        self.stop_and_start_instance()
        self.cleanup()

        print("\nThanks for watching!")
        print("-" * 88)

if __name__ == "__main__":
    try:
        scenario = Ec2InstanceScenario(
            InstanceWrapper.from_resource(),
            KeyPairWrapper.from_resource(),
            SecurityGroupWrapper.from_resource(),
            ElasticIpWrapper.from_resource(),
            boto3.client("ssm"),
        )
        scenario.run_scenario()
    except Exception:
        logging.exception("Something went wrong with the demo.")
```

Define a class that wraps key pair actions.

```
class KeyPairWrapper:
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) key pair
    actions."""

    def __init__(self, ec2_resource, key_file_dir, key_pair=None):
        """
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
        resource
                is used to create additional high-level objects
                that wrap low-level Amazon EC2 service actions.
        :param key_file_dir: The folder where the private key information is
        stored.
                This should be a secure folder.
        :param key_pair: A Boto3 KeyPair object. This is a high-level object that
        wraps key pair actions.
```

```
"""
    self.ec2_resource = ec2_resource
    self.key_pair = key_pair
    self.key_file_path = None
    self.key_file_dir = key_file_dir

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource, tempfile.TemporaryDirectory())

    def create(self, key_name):
        """
            Creates a key pair that can be used to securely connect to an EC2
            instance.

            The returned key pair contains private key information that cannot be
            retrieved
            again. The private key data is stored as a .pem file.

            :param key_name: The name of the key pair to create.
            :return: A Boto3 KeyPair object that represents the newly created key
            pair.
        """
        try:
            self.key_pair = self.ec2_resource.create_key_pair(KeyName=key_name)
            self.key_file_path = os.path.join(
                self.key_file_dir.name, f"{self.key_pair.name}.pem"
            )
            with open(self.key_file_path, "w") as key_file:
                key_file.write(self.key_pair.key_material)
        except ClientError as err:
            logger.error(
                "Couldn't create key %s. Here's why: %s: %s",
                key_name,
                err.response["Error"]["Code"],
                err.response["Error"]["Message"],
            )
            raise
        else:
            return self.key_pair

    def list(self, limit):
```

```
"""
    Displays a list of key pairs for the current account.

:param limit: The maximum number of key pairs to list.
"""

try:
    for kp in self.ec2_resource.key_pairs.limit(limit):
        print(f"Found {kp.key_type} key {kp.name} with fingerprint:")
        print(f"\t{kp.key_fingerprint}")
except ClientError as err:
    logger.error(
        "Couldn't list key pairs. Here's why: %s: %s",
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise

def delete(self):
    """
    Deletes a key pair.
    """

    if self.key_pair is None:
        logger.info("No key pair to delete.")
        return

    key_name = self.key_pair.name
    try:
        self.key_pair.delete()
        self.key_pair = None
    except ClientError as err:
        logger.error(
            "Couldn't delete key %s. Here's why: %s : %s",
            key_name,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
```

## Define a class that wraps security group actions.

```
class SecurityGroupWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) security group  
    actions."""  
  
    def __init__(self, ec2_resource, security_group=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
            is used to create additional high-level objects  
            that wrap low-level Amazon EC2 service actions.  
        :param security_group: A Boto3 SecurityGroup object. This is a high-level  
        object  
            that wraps security group actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.security_group = security_group  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
  
    def create(self, group_name, group_description):  
        """  
        Creates a security group in the default virtual private cloud (VPC) of  
        the  
        current account.  
  
        :param group_name: The name of the security group to create.  
        :param group_description: The description of the security group to  
        create.  
        :return: A Boto3 SecurityGroup object that represents the newly created  
        security group.  
        """  
        try:  
            self.security_group = self.ec2_resource.create_security_group(  
                GroupName=group_name, Description=group_description  
            )  
        except ClientError as err:  
            logger.error(  
                "Couldn't create security group %s. Here's why: %s: %s",
```

```
        group_name,
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.security_group

def authorize_ingress(self, ssh_ingress_ip):
    """
    Adds a rule to the security group to allow access to SSH.

    :param ssh_ingress_ip: The IP address that is granted inbound access to
    connect
                           to port 22 over TCP, used for SSH.

    :return: The response to the authorization request. The 'Return' field of
    the
                           response indicates whether the request succeeded or failed.
    """

    if self.security_group is None:
        logger.info("No security group to update.")
        return

    try:
        ip_permissions = [
            {
                # SSH ingress open to only the specified IP address.
                "IpProtocol": "tcp",
                "FromPort": 22,
                "ToPort": 22,
                "IpRanges": [{"CidrIp": f"{ssh_ingress_ip}/32"}],
            }
        ]
        response = self.security_group.authorize_ingress(
            IpPermissions=ip_permissions
        )
    except ClientError as err:
        logger.error(
            "Couldn't authorize inbound rules for %s. Here's why: %s: %s",
            self.security_group.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
    
```

```
        raise
    else:
        return response

def describe(self):
    """
    Displays information about the security group.
    """
    if self.security_group is None:
        logger.info("No security group to describe.")
        return

    try:
        print(f"Security group: {self.security_group.group_name}")
        print(f"\tID: {self.security_group.id}")
        print(f"\tVPC: {self.security_group.vpc_id}")
        if self.security_group.ip_permissions:
            print(f"\t\tInbound permissions:")
            pp(self.security_group.ip_permissions)
    except ClientError as err:
        logger.error(
            "Couldn't get data for security group %s. Here's why: %s: %s",
            self.security_group.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise

def delete(self):
    """
    Deletes the security group.
    """
    if self.security_group is None:
        logger.info("No security group to delete.")
        return

    group_id = self.security_group.id
    try:
        self.security_group.delete()
    except ClientError as err:
        logger.error(
            "Couldn't delete security group %s. Here's why: %s: %s",
            group_id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
```

```
        group_id,
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
raise
```

## Define a class that wraps instance actions.

```
class InstanceWrapper:
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) instance
    actions."""

    def __init__(self, ec2_resource, instance=None):
        """
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level
        resource
                is used to create additional high-level objects
                that wrap low-level Amazon EC2 service actions.
        :param instance: A Boto3 Instance object. This is a high-level object
        that
                wraps instance actions.
        """
        self.ec2_resource = ec2_resource
        self.instance = instance

    @classmethod
    def from_resource(cls):
        ec2_resource = boto3.resource("ec2")
        return cls(ec2_resource)

    def create(self, image, instance_type, key_pair, security_groups=None):
        """
        Creates a new EC2 instance. The instance starts immediately after
        it is created.

        The instance is created in the default VPC of the current account.
    
```

```
:param image: A Boto3 Image object that represents an Amazon Machine
Image (AMI)
    that defines attributes of the instance that is created.

The AMI
    defines things like the kind of operating system and the
type of
    storage used by the instance.

:param instance_type: The type of instance to create, such as 't2.micro'.
    The instance type defines things like the number of
CPUs and
    the amount of memory.

:param key_pair: A Boto3 KeyPair or KeyPairInfo object that represents
the key
    pair that is used to secure connections to the instance.

:param security_groups: A list of Boto3 SecurityGroup objects that
represents the
    security groups that are used to grant access to
the
    instance. When no security groups are specified,
the
    default security group of the VPC is used.

:return: A Boto3 Instance object that represents the newly created
instance.

"""

try:
    instance_params = {
        "ImageId": image.id,
        "InstanceType": instance_type,
        "KeyName": key_pair.name,
    }
    if security_groups is not None:
        instance_params["SecurityGroupIds"] = [sg.id for sg in
security_groups]
        self.instance = self.ec2_resource.create_instances(
            **instance_params, MinCount=1, MaxCount=1
        )[0]
        self.instance.wait_until_running()
except ClientError as err:
    logging.error(
        "Couldn't create instance with image %s, instance type %s, and
key %s."
        "Here's why: %s: %s",
        image.id,
        instance_type,
```

```
        key_pair.name,
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.instance

def display(self, indent=1):
    """
    Displays information about an instance.

    :param indent: The visual indent to apply to the output.
    """
    if self.instance is None:
        logger.info("No instance to display.")
        return

    try:
        self.instance.load()
        ind = "\t" * indent
        print(f"{ind}ID: {self.instance.id}")
        print(f"{ind}Image ID: {self.instance.image_id}")
        print(f"{ind}Instance type: {self.instance.instance_type}")
        print(f"{ind}Key name: {self.instance.key_name}")
        print(f"{ind}VPC ID: {self.instance.vpc_id}")
        print(f"{ind}Public IP: {self.instance.public_ip_address}")
        print(f"{ind}State: {self.instance.state['Name']}")
    except ClientError as err:
        logger.error(
            "Couldn't display your instance. Here's why: %s: %s",
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise

def terminate(self):
    """
    Terminates an instance and waits for it to be in a terminated state.
    """
    if self.instance is None:
        logger.info("No instance to terminate.")
```

```
        return

    instance_id = self.instance.id
    try:
        self.instance.terminate()
        self.instance.wait_until_terminated()
        self.instance = None
    except ClientError as err:
        logging.error(
            "Couldn't terminate instance %s. Here's why: %s: %s",
            instance_id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise

def start(self):
    """
    Starts an instance and waits for it to be in a running state.

    :return: The response to the start request.
    """
    if self.instance is None:
        logger.info("No instance to start.")
        return

    try:
        response = self.instance.start()
        self.instance.wait_until_running()
    except ClientError as err:
        logger.error(
            "Couldn't start instance %s. Here's why: %s: %s",
            self.instance.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return response

def stop(self):
    """
```

```
    Stops an instance and waits for it to be in a stopped state.

    :return: The response to the stop request.
    """
    if self.instance is None:
        logger.info("No instance to stop.")
        return

    try:
        response = self.instance.stop()
        self.instance.wait_until_stopped()
    except ClientError as err:
        logger.error(
            "Couldn't stop instance %s. Here's why: %s: %s",
            self.instance.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return response

def get_images(self, image_ids):
    """
    Gets information about Amazon Machine Images (AMIs) from a list of AMI
    IDs.

    :param image_ids: The list of AMIs to look up.
    :return: A list of Boto3 Image objects that represent the requested AMIs.
    """
    try:
        images = list(self.ec2_resource.images.filter(ImageIds=image_ids))
    except ClientError as err:
        logger.error(
            "Couldn't get images. Here's why: %s: %s",
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return images
```

```
def get_instance_types(self, architecture):
    """
    Gets instance types that support the specified architecture and are
    designated
        as either 'micro' or 'small'. When an instance is created, the instance
    type
        you specify must support the architecture of the AMI you use.

    :param architecture: The kind of architecture the instance types must
    support,
                            such as 'x86_64'.
    :return: A list of instance types that support the specified architecture
    and are either 'micro' or 'small'.
    """
    try:
        inst_types = []
        it Paginator = self.ec2_resource.meta.client.getPaginator(
            "describe_instance_types"
        )
        for page in itPaginator.paginate(
            Filters=[
                {
                    "Name": "processor-info.supported-architecture",
                    "Values": [architecture],
                },
                {"Name": "instance-type", "Values": ["*.micro", "*.small"]},
            ]
        ):
            inst_types += page["InstanceTypes"]
    except ClientError as err:
        logger.error(
            "Couldn't get instance types. Here's why: %s: %s",
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    else:
        return inst_types
```

## Define a class that wraps Elastic IP actions.

```
class ElasticIpWrapper:  
    """Encapsulates Amazon Elastic Compute Cloud (Amazon EC2) Elastic IP address  
    actions."""  
  
    def __init__(self, ec2_resource, elastic_ip=None):  
        """  
        :param ec2_resource: A Boto3 Amazon EC2 resource. This high-level  
        resource  
                    is used to create additional high-level objects  
                    that wrap low-level Amazon EC2 service actions.  
        :param elastic_ip: A Boto3 VpcAddress object. This is a high-level object  
        that  
                    wraps Elastic IP actions.  
        """  
        self.ec2_resource = ec2_resource  
        self.elastic_ip = elastic_ip  
  
    @classmethod  
    def from_resource(cls):  
        ec2_resource = boto3.resource("ec2")  
        return cls(ec2_resource)  
  
  
    def allocate(self):  
        """  
        Allocates an Elastic IP address that can be associated with an Amazon EC2  
        instance. By using an Elastic IP address, you can keep the public IP  
        address  
        constant even when you restart the associated instance.  
  
        :return: The newly created Elastic IP object. By default, the address is  
        not  
                    associated with any instance.  
        """  
        try:  
            response =  
self.ec2_resource.meta.client.allocate_address(Domain="vpc")  
            self.elastic_ip =  
self.ec2_resource.VpcAddress(response["AllocationId"])  
        except ClientError as err:  
            logger.error(  
                "Couldn't allocate Elastic IP. Here's why: %s: %s",
```

```
        err.response["Error"]["Code"],
        err.response["Error"]["Message"],
    )
    raise
else:
    return self.elastic_ip

def associate(self, instance):
    """
    Associates an Elastic IP address with an instance. When this association
    is created, the Elastic IP's public IP address is immediately used as the
    public IP address of the associated instance.

    :param instance: A Boto3 Instance object. This is a high-level object
    that wraps
            Amazon EC2 instance actions.
    :return: A response that contains the ID of the association.
    """
    if self.elastic_ip is None:
        logger.info("No Elastic IP to associate.")
        return

    try:
        response = self.elastic_ip.associate(InstanceId=instance.id)
    except ClientError as err:
        logger.error(
            "Couldn't associate Elastic IP %s with instance %s. Here's why:
%s: %s",
            self.elastic_ip.allocation_id,
            instance.id,
            err.response["Error"]["Code"],
            err.response["Error"]["Message"],
        )
        raise
    return response

def disassociate(self):
    """
    Removes an association between an Elastic IP address and an instance.
    When the

```

```
association is removed, the instance is assigned a new public IP address.  
"""  
  
    if self.elastic_ip is None:  
        logger.info("No Elastic IP to disassociate.")  
        return  
  
    try:  
        self.elastic_ip.association.delete()  
    except ClientError as err:  
        logger.error(  
            "Couldn't disassociate Elastic IP %s from its instance. Here's  
why: %s: %s",  
            self.elastic_ip.allocation_id,  
            err.response["Error"]["Code"],  
            err.response["Error"]["Message"],  
        )  
        raise  
  
  
def release(self):  
    """  
Releases an Elastic IP address. After the Elastic IP address is released,  
it can no longer be used.  
"""  
  
    if self.elastic_ip is None:  
        logger.info("No Elastic IP to release.")  
        return  
  
    try:  
        self.elastic_ip.release()  
    except ClientError as err:  
        logger.error(  
            "Couldn't release Elastic IP address %s. Here's why: %s: %s",  
            self.elastic_ip.allocation_id,  
            err.response["Error"]["Code"],  
            err.response["Error"]["Message"],  
        )  
        raise
```

- For API details, see the following topics in *AWS SDK for Python (Boto3) API Reference*.

- [AllocateAddress](#)
- [AssociateAddress](#)
- [AuthorizeSecurityGroupIngress](#)
- [CreateKeyPair](#)
- [CreateSecurityGroup](#)
- [DeleteKeyPair](#)
- [DeleteSecurityGroup](#)
- [DescribeImages](#)
- [DescribeInstanceTypes](#)
- [DescribeInstances](#)
- [DescribeKeyPairs](#)
- [DescribeSecurityGroups](#)
- [DisassociateAddress](#)
- [ReleaseAddress](#)
- [RunInstances](#)
- [StartInstances](#)
- [StopInstances](#)
- [TerminateInstances](#)
- [UnmonitorInstances](#)

## Rust

### SDK for Rust

 **Note**

There's more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](#).

The EC2InstanceScenario implementation contains logic to run the example as a whole.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.  
// SPDX-License-Identifier: Apache-2.0
```

```
//! Scenario that uses the AWS SDK for Rust (the SDK) with Amazon Elastic Compute
Cloud
//! (Amazon EC2) to do the following:
//!
//! * Create a key pair that is used to secure SSH communication between your
computer and
//!   an EC2 instance.
//! * Create a security group that acts as a virtual firewall for your EC2
instances to
//!   control incoming and outgoing traffic.
//! * Find an Amazon Machine Image (AMI) and a compatible instance type.
//! * Create an instance that is created from the instance type and AMI you
select, and
//!   is configured to use the security group and key pair created in this
example.
//! * Stop and restart the instance.
//! * Create an Elastic IP address and associate it as a consistent IP address
for your instance.
//! * Connect to your instance with SSH, using both its public IP address and
your Elastic IP
//!   address.
//! * Clean up all of the resources created by this example.

use std::net::Ipv4Addr;

use crate::{
    ec2::{EC2Error, EC2},
    getting_started::{key_pair::KeyPairManager, util::Util},
    ssm::SSM,
};
use aws_sdk_ssm::types::Parameter;

use super::{
    elastic_ip::ElasticIpManager, instance::InstanceManager,
    security_group::SecurityGroupManager,
    util::ScenarioImage,
};
pub struct Ec2InstanceScenario {
    ec2: EC2,
    ssm: SSM,
    util: Util,
    key_pair_manager: KeyPairManager,
```

```
    security_group_manager: SecurityGroupManager,
    instance_manager: InstanceManager,
    elastic_ip_manager: ElasticIpManager,
}

impl Ec2InstanceScenario {
    pub fn new(ec2: EC2, ssm: SSM, util: Util) -> Self {
        Ec2InstanceScenario {
            ec2,
            ssm,
            util,
            key_pair_manager: Default::default(),
            security_group_manager: Default::default(),
            instance_manager: Default::default(),
            elastic_ip_manager: Default::default(),
        }
    }

    pub async fn run(&mut self) -> Result<(), EC2Error> {
        self.create_and_list_key_pairs().await?;
        self.create_security_group().await?;
        self.create_instance().await?;
        self.stop_and_start_instance().await?;
        self.associate_elastic_ip().await?;
        self.stop_and_start_instance().await?;
        Ok(())
    }

    /// 1. Creates an RSA key pair and saves its private key data as a .pem file
    in secure
    /// temporary storage. The private key data is deleted after the example
    completes.
    /// 2. Optionally, lists the first five key pairs for the current account.
    pub async fn create_and_list_key_pairs(&mut self) -> Result<(), EC2Error> {
        println!( "Let's create an RSA key pair that you can be use to securely
connect to your EC2 instance.");

        let key_name = self.util.prompt_key_name()?;

        self.key_pair_manager
            .create(&self.ec2, &self.util, key_name)
            .await?;

        println!(
            "Your RSA key pair has been created. You can now use it to securely
connect to your EC2 instance." );
    }
}
```

```
"Created a key pair {} and saved the private key to {:?}."  
    self.key_pair_manager  
        .key_pair()  
        .key_name()  
        .ok_or_else(|| EC2Error::new("No key name after creating key"))?,  
    self.key_pair_manager  
        .key_file_path()  
        .ok_or_else(|| EC2Error::new("No key file after creating key"))?  
);  
  
if self.util.should_list_key_pairs()? {  
    for pair in self.key_pair_manager.list(&self.ec2).await? {  
        println!(  
            "Found {:?} key {} with fingerprint:\t{:?}",  
            pair.key_type(),  
            pair.key_name().unwrap_or("Unknown"),  
            pair.key_fingerprint()  
        );  
    }  
}  
  
Ok(())  
}  
  
/// 1. Creates a security group for the default VPC.  
/// 2. Adds an inbound rule to allow SSH. The SSH rule allows only  
///     inbound traffic from the current computer's public IPv4 address.  
/// 3. Displays information about the security group.  
///  
/// This function uses <http://checkip.amazonaws.com> to get the current  
public IP  
    /// address of the computer that is running the example. This method works in  
most  
    /// cases. However, depending on how your computer connects to the internet,  
you  
    /// might have to manually add your public IP address to the security group  
by using  
    /// the AWS Management Console.  
pub async fn create_security_group(&mut self) -> Result<(), EC2Error> {  
    println!("Let's create a security group to manage access to your  
instance.");  
    let group_name = self.util.prompt_security_group_name()?  
  
    self.security_group_manager
```

```
.create(
    &self.ec2,
    &group_name,
    "Security group for example: get started with instances.",
)
.await?;

println!(
    "Created security group {} in your default VPC {}.",,
    self.security_group_manager.group_name(),
    self.security_group_manager
        .vpc_id()
        .unwrap_or("(unknown vpc)")
);

let check_ip = self.util.do_get("https://checkip.amazonaws.com").await?;
let current_ip_address: Ipv4Addr = check_ip.trim().parse().map_err(|e| {
    EC2Error::new(format!(
        "Failed to convert response {} to IP Address: {e:?}",
        check_ip
    ))
})?;

println!("Your public IP address seems to be {current_ip_address}");
if self.util.should_add_to_security_group() {
    match self
        .security_group_manager
        .authorize_ingress(&self.ec2, current_ip_address)
        .await
    {
        Ok(_) => println!("Security group rules updated"),
        Err(err) => eprintln!("Couldn't update security group rules:
{err:?}"),
    }
}
println!("{}", self.security_group_manager);

Ok(())
}

// snippet-start:[ec2.rust.create_instance.scenario]
/// 1. Gets a list of Amazon Linux 2 AMIs from AWS Systems Manager.
Specifying the
```

```
    /// '/aws/service/ami-amazon-linux-latest' path returns only the latest AMIs.  
    /// 2. Gets and displays information about the available AMIs and lets you select one.  
    /// 3. Gets a list of instance types that are compatible with the selected AMI and  
    /// lets you select one.  
    /// 4. Creates an instance with the previously created key pair and security group,  
    /// and the selected AMI and instance type.  
    /// 5. Waits for the instance to be running and then displays its information.  
  
    pub async fn create_instance(&mut self) -> Result<(), EC2Error> {  
        let ami = self.find_image().await?;  
  
        let instance_types = self  
            .ec2  
            .list_instance_types(&ami.0)  
            .await  
            .map_err(|e| e.add_message("Could not find instance types"))?;  
        println!(  
            "There are several instance types that support the {} architecture of the image.",  
            ami.0  
                .architecture  
                .as_ref()  
                .ok_or_else(|| EC2Error::new(format!("Missing architecture in {:?}", ami.0)))?  
        );  
        let instance_type = self.util.select_instance_type(instance_types)?;  
  
        println!("Creating your instance and waiting for it to start...");  
        self.instance_manager  
            .create(  
                &self.ec2,  
                ami.0  
                    .image_id()  
                    .ok_or_else(|| EC2Error::new("Could not find image ID"))?,  
                instance_type,  
                self.key_pair_manager.key_pair(),  
                self.security_group_manager  
                    .security_group()  
                    .map(|sg| vec![sg])
```

```
        .ok_or_else(|| EC2Error::new("Could not find security
group"))?,
    )
    .await
    .map_err(|e| e.add_message("Scenario failed to create instance"))?;

    while let Err(err) = self
        .ec2
        .wait_for_instance_ready(self.instance_manager.instance_id(), None)
        .await
    {
        println!("{}{err}");
        if !self.util.should_continue_waiting() {
            return Err(err);
        }
    }
}

println!("Your instance is ready:\n{}", self.instance_manager);

self.display_ssh_info();

Ok(())
}
// snippet-end:[ec2.rust.create_instance.scenario]

// snippet-start:[ec2.rust.find_image.scenario]
async fn find_image(&mut self) -> Result<ScenarioImage, EC2Error> {
    let params: Vec<Parameter> = self
        .ssm
        .list_path("/aws/service/ami-amazon-linux-latest")
        .await
        .map_err(|e| e.add_message("Could not find parameters for available
images"))?
        .into_iter()
        .filter(|param| param.name().is_some_and(|name|
name.contains("amzn2"))))
        .collect();
    let amzn2_images: Vec<ScenarioImage> = self
        .ec2
        .list_images(params)
        .await
        .map_err(|e| e.add_message("Could not find images"))?
        .into_iter()
        .map(ScenarioImage::from)
```

```
        .collect();
    println!("We will now create an instance from an Amazon Linux 2 AMI");
    let ami = self.util.select_scenario_image(amzn2_images)?;
    Ok(ami)
}
// snippet-end:[ec2.rust.find_image.scenario]

// 1. Stops the instance and waits for it to stop.
// 2. Starts the instance and waits for it to start.
// 3. Displays information about the instance.
// 4. Displays an SSH connection string. When an Elastic IP address is
associated
//     with the instance, the IP address stays consistent when the instance
stops
//     and starts.
pub async fn stop_and_start_instance(&self) -> Result<(), EC2Error> {
    println!("Let's stop and start your instance to see what changes.");
    println!("Stopping your instance and waiting until it's stopped...");
    self.instance_manager.stop(&self.ec2).await?;
    println!("Your instance is stopped. Restarting...");
    self.instance_manager.start(&self.ec2).await?;
    println!("Your instance is running.");
    println!("{}", self.instance_manager);
    if self.elastic_ip_manager.public_ip() == "0.0.0.0" {
        println!("Every time your instance is restarted, its public IP
address changes.");
    } else {
        println!(
            "Because you have associated an Elastic IP with your instance,
you can connect by using a consistent IP address after the instance restarts."
        );
    }
    self.display_ssh_info();
    Ok(())
}

/// 1. Allocates an Elastic IP address and associates it with the instance.
/// 2. Displays an SSH connection string that uses the Elastic IP address.
async fn associate_elastic_ip(&mut self) -> Result<(), EC2Error> {
    self.elastic_ip_manager.allocate(&self.ec2).await?;
    println!(
        "Allocated static Elastic IP address: {}",
        self.elastic_ip_manager.public_ip()
    );
}
```

```
        self.elastic_ip_manager
            .associate(&self.ec2, self.instance_manager.instance_id())
            .await?;
        println!("Associated your Elastic IP with your instance.");
        println!("You can now use SSH to connect to your instance by using the
Elastic IP.");
        self.display_ssh_info();
        Ok(())
    }

    /// Displays an SSH connection string that can be used to connect to a
running
    /// instance.
    fn display_ssh_info(&self) {
        let ip_addr = if self.elastic_ip_manager.has_allocation() {
            self.elastic_ip_manager.public_ip()
        } else {
            self.instance_manager.instance_ip()
        };
        let key_file_path = self.key_pair_manager.key_file_path().unwrap();
        println!("To connect, open another command prompt and run the following
command:");
        println!("\\nssh -i {} ec2-user@{ip_addr}\\n", key_file_path.display());
        let _ = self.util.enter_to_continue();
    }

    /// 1. Disassociate and delete the previously created Elastic IP.
    /// 2. Terminate the previously created instance.
    /// 3. Delete the previously created security group.
    /// 4. Delete the previously created key pair.
    pub async fn clean_up(self) {
        println!("Let's clean everything up. This example created these
resources:");
        println!(
            "\\tKey pair: {}",
            self.key_pair_manager
                .key_pair()
                .key_name()
                .unwrap_or("(unknown key pair)")
        );
        println!(
            "\\tSecurity group: {}",
            self.security_group_manager.group_name()
        )
    }
}
```

```
    );
    println!(
        "\tInstance: {}",
        self.instance_manager.instance_display_name()
    );
    if self.util.should_clean_resources() {
        if let Err(err) = self.elastic_ip_manager.remove(&self.ec2).await {
            eprintln!("{}{err}");
        }
        if let Err(err) = self.instance_manager.delete(&self.ec2).await {
            eprintln!("{}{err}");
        }
        if let Err(err) = self.security_group_manager.delete(&self.ec2).await {
            eprintln!("{}{err}");
        }
        if let Err(err) = self.key_pair_manager.delete(&self.ec2,
&self.util).await {
            eprintln!("{}{err}");
        }
    } else {
        println!("Ok, not cleaning up any resources!");
    }
}

pub async fn run(mut scenario: Ec2InstanceScenario) {
    println!(
("-----");
    );
    println!(
        "Welcome to the Amazon Elastic Compute Cloud (Amazon EC2) get started
with instances demo."
    );
    println!(
("-----");
    );

    if let Err(err) = scenario.run().await {
        eprintln!("There was an error running the scenario: {err}")
    }

    println!(
("-----");
    );

    scenario.clean_up().await;
}
```

```
    println!("Thanks for running!");
    println!
("-----");
}
```

The EC2Impl struct serves as a an automock point for testing, and its functions wrap the EC2 SDK calls.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0

use std::{net::Ipv4Addr, time::Duration};

use aws_sdk_ec2::{
    client::Waiters,
    error::ProvideErrorMetadata,
    operation::{
        allocate_address::AllocateAddressOutput,
        associate_address::AssociateAddressOutput,
    },
    types::{
        DomainType, Filter, Image, Instance, InstanceType, IpPermission, IpRange,
        KeyPairInfo,
        SecurityGroup, Tag,
    },
    Client as EC2Client,
};
use aws_sdk_ssm::types::Parameter;
use aws_smithy_runtime_api::client::waiters::error::WaiterError;

#[cfg(test)]
use mockall::automock;

#[cfg(not(test))]
pub use EC2Impl as EC2;

#[cfg(test)]
pub use MockEC2Impl as EC2;

#[derive(Clone)]
pub struct EC2Impl {
```

```
    pub client: EC2Client,
}

#[cfg_attr(test, automock)]
impl EC2Impl {
    pub fn new(client: EC2Client) -> Self {
        EC2Impl { client }
    }

    // snippet-start:[ec2.rust.create_key.impl]
    pub async fn create_key_pair(&self, name: String) -> Result<(KeyPairInfo, String), EC2Error> {
        tracing::info!("Creating key pair {name}");
        let output = self.client.create_key_pair().key_name(name).send().await?;
        let info = KeyPairInfo::builder()
            .set_key_name(output.key_name)
            .set_key_fingerprint(output.key_fingerprint)
            .set_key_pair_id(output.key_pair_id)
            .build();
        let material = output
            .key_material
            .ok_or_else(|| EC2Error::new("Create Key Pair has no key material"))?;
        Ok((info, material))
    }
    // snippet-end:[ec2.rust.create_key.impl]

    // snippet-start:[ec2.rust.list_keys.impl]
    pub async fn list_key_pair(&self) -> Result<Vec<KeyPairInfo>, EC2Error> {
        let output = self.client.describe_key_pairs().send().await?;
        Ok(output.key_pairs.unwrap_or_default())
    }
    // snippet-end:[ec2.rust.list_keys.impl]

    // snippet-start:[ec2.rust.delete_key.impl]
    pub async fn delete_key_pair(&self, key_pair_id: &str) -> Result<(), EC2Error> {
        let key_pair_id: String = key_pair_id.into();
        tracing::info!("Deleting key pair {key_pair_id}");
        self.client
            .delete_key_pair()
            .key_pair_id(key_pair_id)
            .send()
            .await?;
    }
}
```

```
    Ok(())
}

// snippet-end:[ec2.rust.delete_key.impl]

// snippet-start:[ec2.rust.create_security_group.impl]
pub async fn create_security_group(
    &self,
    name: &str,
    description: &str,
) -> Result<SecurityGroup, EC2Error> {
    tracing::info!("Creating security group {name}");
    let create_output = self
        .client
        .create_security_group()
        .group_name(name)
        .description(description)
        .send()
        .await
        .map_err(EC2Error::from)?;

    let group_id = create_output
        .group_id
        .ok_or_else(|| EC2Error::new("Missing security group id after
creation"))?;

    let group = self
        .describe_security_group(&group_id)
        .await?
        .ok_or_else(|| {
            EC2Error::new(format!("Could not find security group with id
{group_id}"))
        })?;

    tracing::info!("Created security group {name} as {group_id}");

    Ok(group)
}
// snippet-end:[ec2.rust.create_security_group.impl]

// snippet-start:[ec2.rust.describe_security_group.impl]
/// Find a single security group, by ID. Returns Err if multiple groups are
found.
pub async fn describe_security_group(
    &self,
```

```
        group_id: &str,
    ) -> Result<Option<SecurityGroup>, EC2Error> {
    let group_id: String = group_id.into();
    let describe_output = self
        .client
        .describe_security_groups()
        .group_ids(&group_id)
        .send()
        .await?;

    let mut groups = describe_output.security_groups.unwrap_or_default();

    match groups.len() {
        0 => Ok(None),
        1 => Ok(Some(groups.remove(0))),
        _ => Err(EC2Error::new(format!(
            "Expected single group for {group_id}"
        ))),
    }
}
// snippet-end:[ec2.rust.describe_security_group.impl]

// snippet-start:[ec2.rust.authorize_security_group_ssh_ingress.impl]
/// Add an ingress rule to a security group explicitly allowing IPv4 address
/// as {ip}/32 over TCP port 22.
pub async fn authorize_security_group_ssh_ingress(
    &self,
    group_id: &str,
    ingress_ips: Vec<Ipv4Addr>,
) -> Result<(), EC2Error> {
    tracing::info!("Authorizing ingress for security group {group_id}");
    self.client
        .authorize_security_group_ingress()
        .group_id(group_id)
        .set_ip_permissions(Some(
            ingress_ips
                .into_iter()
                .map(|ip| {
                    IpPermission::builder()
                        .ip_protocol("tcp")
                        .from_port(22)
                        .to_port(22)
                        .ip_ranges(IpRange::builder().cidr_ip(format!(
                            "{ip}/32")).build())))

```

```
        .build()
    })
    .collect(),
))
.send()
.await?;
Ok(())
}
// snippet-end:[ec2.rust.authorize_security_group_ssh_ingress.impl]

// snippet-start:[ec2.rust.delete_security_group.impl]
pub async fn delete_security_group(&self, group_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Deleting security group {group_id}");
    self.client
        .delete_security_group()
        .group_id(group_id)
        .send()
        .await?;
    Ok(())
}
// snippet-end:[ec2.rust.delete_security_group.impl]

// snippet-start:[ec2.rust.list_images.impl]
pub async fn list_images(&self, ids: Vec<Parameter>) -> Result<Vec<Image>, EC2Error> {
    let image_ids = ids.into_iter().filter_map(|p| p.value).collect();
    let output = self
        .client
        .describe_images()
        .set_image_ids(Some(image_ids))
        .send()
        .await?;

    let images = output.images.unwrap_or_default();
    if images.is_empty() {
        Err(EC2Error::new("No images for selected AMIs"))
    } else {
        Ok(images)
    }
}
// snippet-end:[ec2.rust.list_images.impl]

// snippet-start:[ec2.rust.list_instance_types.impl]
```

```
/// List instance types that match an image's architecture and are free tier
eligible.

pub async fn list_instance_types(&self, image: &Image) ->
Result<Vec<InstanceType>, EC2Error> {
    let architecture = format!(
        "{}",
        image.architecture().ok_or_else(|| EC2Error::new(format!(
            "Image {:?} does not have a listed architecture",
            image.image_id()
        )))?
    );
    let free_tier_eligible_filter = Filter::builder()
        .name("free-tier-eligible")
        .values("false")
        .build();
    let supported_architecture_filter = Filter::builder()
        .name("processor-info.supported-architecture")
        .values(architecture)
        .build();
    let response = self
        .client
        .describe_instance_types()
        .filters(free_tier_eligible_filter)
        .filters(supported_architecture_filter)
        .send()
        .await?;

    Ok(response
        .instance_types
        .unwrap_or_default()
        .into_iter()
        .filter_map(|iti| iti.instance_type)
        .collect())
}

// snippet-end:[ec2.rust.list_instance_types.impl]

// snippet-start:[ec2.rust.create_instance.impl]
pub async fn create_instance<'a>(
    &self,
    image_id: &'a str,
    instance_type: InstanceType,
    key_pair: &'a KeyPairInfo,
    security_groups: Vec<&'a SecurityGroup>,
) -> Result<String, EC2Error> {
```

```
let run_instances = self
    .client
    .run_instances()
    .image_id(image_id)
    .instance_type(instance_type)
    .key_name(
        key_pair
            .key_name()
            .ok_or_else(|| EC2Error::new("Missing key name when launching
instance"))?,
    )
    .set_security_group_ids(Some(
        security_groups
            .iter()
            .filter_map(|sg| sg.group_id.clone())
            .collect(),
    ))
    .min_count(1)
    .max_count(1)
    .send()
    .await?;

if run_instances.instances().is_empty() {
    return Err(EC2Error::new("Failed to create instance"));
}

let instance_id = run_instances.instances()[0].instance_id().unwrap();
let response = self
    .client
    .create_tags()
    .resources(instance_id)
    .tags(
        Tag::builder()
            .key("Name")
            .value("From SDK Examples")
            .build(),
    )
    .send()
    .await;

match response {
    Ok(_) => tracing::info!("Created {instance_id} and applied tags."),
    Err(err) => {
        tracing::info!("Error applying tags to {instance_id}: {err:?}");
    }
}
```

```
        return Err(err.into());
    }
}

tracing::info!("Instance is created.");

Ok(instance_id.to_string())
}
// snippet-end:[ec2.rust.create_instance.impl]

// snippet-start:[ec2.rust.wait_for_instance_ready.impl]
/// Wait for an instance to be ready and status ok (default wait 60 seconds)
pub async fn wait_for_instance_ready(
    &self,
    instance_id: &str,
    duration: Option<Duration>,
) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_status_ok()
        .instance_ids(instance_id)
        .wait(duration.unwrap_or(Duration::from_secs(60)))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to start.",
                exceeded.max_wait().as_secs()
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
// snippet-end:[ec2.rust.wait_for_instance_ready.impl]

// snippet-start:[ec2.rust.describe_instance.impl]
pub async fn describe_instance(&self, instance_id: &str) -> Result<Instance, EC2Error> {
    let response = self
        .client
        .describe_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    let instance = response
```

```
        .reservations()
        .first()
        .ok_or_else(|| EC2Error::new(format!("No instance reservations for
{instance_id}")))?  
        .instances()
        .first()
        .ok_or_else(|| {
            EC2Error::new(format!("No instances in reservation for
{instance_id}"))
        })?;  
  
        Ok(instance.clone())
    }
// snippet-end:[ec2.rust.describe_instance.impl]  
  
// snippet-start:[ec2.rust.start_instance.impl]
pub async fn start_instance(&self, instance_id: &str) -> Result<(), EC2Error>
{
    tracing::info!("Starting instance {instance_id}");  
  
    self.client
        .start_instances()
        .instance_ids(instance_id)
        .send()
        .await?;  
  
    tracing::info!("Started instance.");
  
    Ok(())
}
// snippet-end:[ec2.rust.start_instance.impl]  
  
// snippet-start:[ec2.rust.stop_instance.impl]
pub async fn stop_instance(&self, instance_id: &str) -> Result<(), EC2Error>
{
    tracing::info!("Stopping instance {instance_id}");  
  
    self.client
        .stop_instances()
        .instance_ids(instance_id)
        .send()
        .await?;  
  
    self.wait_for_instance_stopped(instance_id, None).await?;
```

```
    tracing::info!("Stopped instance.");

    Ok(())
}
// snippet-end:[ec2.rust.stop_instance.impl]

// snippet-start:[ec2.rust.reboot_instance.impl]
pub async fn reboot_instance(&self, instance_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Rebooting instance {instance_id}");

    self.client
        .reboot_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    Ok(())
}
// snippet-end:[ec2.rust.reboot_instance.impl]

// snippet-start:[ec2.rust.wait_for_instance_stopped.impl]
pub async fn wait_for_instance_stopped(
    &self,
    instance_id: &str,
    duration: Option<Duration>,
) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_stopped()
        .instance_ids(instance_id)
        .wait(duration.unwrap_or(Duration::from_secs(60)))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to stop.",
                exceeded.max_wait().as_secs(),
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
// snippet-end:[ec2.rust.wait_for_instance_stopped.impl]
```

```
// snippet-start:[ec2.rust.delete_instance.impl]
pub async fn delete_instance(&self, instance_id: &str) -> Result<(), EC2Error> {
    tracing::info!("Deleting instance with id {instance_id}");
    self.stop_instance(instance_id).await?;
    self.client
        .terminate_instances()
        .instance_ids(instance_id)
        .send()
        .await?;

    self.wait_for_instance_terminated(instance_id).await?;
    tracing::info!("Terminated instance with id {instance_id}");
    Ok(())
}
// snippet-end:[ec2.rust.delete_instance.impl]

// snippet-start:[ec2.rust.wait_for_instance_terminated.impl]
async fn wait_for_instance_terminated(&self, instance_id: &str) -> Result<(), EC2Error> {
    self.client
        .wait_until_instance_terminated()
        .instance_ids(instance_id)
        .wait(Duration::from_secs(60))
        .await
        .map_err(|err| match err {
            WaiterError::ExceededMaxWait(exceeded) => EC2Error(format!(
                "Exceeded max time ({}s) waiting for instance to terminate.", exceeded.max_wait().as_secs(),
            )),
            _ => EC2Error::from(err),
        })?;
    Ok(())
}
// snippet-end:[ec2.rust.wait_for_instance_terminated.impl]

// snippet-start:[ec2.rust.allocate_address.impl]
pub async fn allocate_ip_address(&self) -> Result<AllocateAddressOutput, EC2Error> {
    self.client
        .allocate_address()
        .domain(DomainType::Vpc)
        .send()
        .await
        .map_err(EC2Error::from)
```

```
    }
    // snippet-end:[ec2.rust.allocate_address.impl]

    // snippet-start:[ec2.rust.deallocate_address.impl]
    pub async fn deallocate_ip_address(&self, allocation_id: &str) -> Result<(), EC2Error> {
        self.client
            .release_address()
            .allocation_id(allocation_id)
            .send()
            .await?;
        Ok(())
    }
    // snippet-end:[ec2.rust.deallocate_address.impl]

    // snippet-start:[ec2.rust.associate_address.impl]
    pub async fn associate_ip_address(
        &self,
        allocation_id: &str,
        instance_id: &str,
    ) -> Result<AssociateAddressOutput, EC2Error> {
        let response = self
            .client
            .associate_address()
            .allocation_id(allocation_id)
            .instance_id(instance_id)
            .send()
            .await?;
        Ok(response)
    }
    // snippet-end:[ec2.rust.associate_address.impl]

    // snippet-start:[ec2.rust.disassociate_address.impl]
    pub async fn disassociate_ip_address(&self, association_id: &str) -> Result<(), EC2Error> {
        self.client
            .disassociate_address()
            .association_id(association_id)
            .send()
            .await?;
        Ok(())
    }
    // snippet-end:[ec2.rust.disassociate_address.impl]
}
```

```
// snippet-start:[ec2.rust.ec2error.impl]
#[derive(Debug)]
pub struct EC2Error(String);
impl EC2Error {
    pub fn new(value: impl Into<String>) -> Self {
        EC2Error(value.into())
    }

    pub fn add_message(self, message: impl Into<String>) -> Self {
        EC2Error(format!("{}: {}", self.0, message.into()))
    }
}

impl<T: ProvideErrorMetadata> From<T> for EC2Error {
    fn from(value: T) -> Self {
        EC2Error(format!(
            "{}: {}",
            value
                .code()
                .map(String::from)
                .unwrap_or("unknown code".into()),
            value
                .message()
                .map(String::from)
                .unwrap_or("missing reason".into()),
        ))
    }
}

impl std::error::Error for EC2Error {}

impl std::fmt::Display for EC2Error {
    fn fmt(&self, f: &mut std::fmt::Formatter<'_>) -> std::fmt::Result {
        write!(f, "{}", self.0)
    }
}
// snippet-end:[ec2.rust.ec2error.impl]
```

The SSM struct serves as a an automock point for testing, and its functions wraps SSM SDK calls.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
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use aws_sdk_ssm::{types::Parameter, Client};
use aws_smithy_async::future::pagination_stream::TryFlatMap;

use crate::ec2::EC2Error;

#[cfg(test)]
use mockall::automock;

#[cfg(not(test))]
pub use SSMImpl as SSM;

#[cfg(test)]
pub use MockSSMImpl as SSM;

pub struct SSMImpl {
    inner: Client,
}

#[cfg_attr(test, automock)]
impl SSMImpl {
    pub fn new(inner: Client) -> Self {
        SSMImpl { inner }
    }

    // snippet-start:[ec2.rust.ssm_list_path.impl]
    pub async fn list_path(&self, path: &str) -> Result<Vec<Parameter>, EC2Error>
    {
        let maybe_params: Vec<Result<Parameter, _>> = TryFlatMap::new(
            self.inner
                .get_parameters_by_path()
                .path(path)
                .into_paginator()
                .send(),
        )
        .flat_map(|item| item.parameters.unwrap_or_default())
        .collect()
        .await;
        // Fail on the first error
        let params = maybe_params
            .into_iter()

```

```
        .collect::<Result<Vec<Parameter>, _>>()?;
    Ok(params)
}
// snippet-end:[ec2.rust.ssm_list_path.impl]
}
```

The scenario uses several "Manager"-style structs to handle access to resources that are created and deleted throughout the scenario.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
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use aws_sdk_ec2::operation::{
    allocate_address::AllocateAddressOutput,
    associate_address::AssociateAddressOutput,
};

use crate::ec2::{EC2Error, EC2};

/// ElasticIpManager tracks the lifecycle of a public IP address, including its
/// allocation from the global pool and association with a specific instance.
#[derive(Debug, Default)]
pub struct ElasticIpManager {
    elastic_ip: Option<AllocateAddressOutput>,
    association: Option<AssociateAddressOutput>,
}

impl ElasticIpManager {
    pub fn has_allocation(&self) -> bool {
        self.elastic_ip.is_some()
    }

    pub fn public_ip(&self) -> &str {
        if let Some(allocation) = &self.elastic_ip {
            if let Some(addr) = allocation.public_ip() {
                return addr;
            }
        }
        "0.0.0.0"
    }

    pub async fn allocate(&mut self, ec2: &EC2) -> Result<(), EC2Error> {
```

```
        let allocation = ec2.allocate_ip_address().await?;
        self.elastic_ip = Some(allocation);
        Ok(())
    }

    pub async fn associate(&mut self, ec2: &EC2, instance_id: &str) -> Result<(), EC2Error> {
        if let Some(allocation) = &self.elastic_ip {
            if let Some(allocation_id) = allocation.allocation_id() {
                let association = ec2.associate_ip_address(allocation_id, instance_id).await?;
                self.association = Some(association);
                return Ok(());
            }
        }
        Err(EC2Error::new("No ip address allocation to associate"))
    }

    pub async fn remove(mut self, ec2: &EC2) -> Result<(), EC2Error> {
        if let Some(association) = &self.association {
            if let Some(association_id) = association.association_id() {
                ec2.disassociate_ip_address(association_id).await?;
            }
        }
        self.association = None;
        if let Some(allocation) = &self.elastic_ip {
            if let Some(allocation_id) = allocation.allocation_id() {
                ec2.deallocate_ip_address(allocation_id).await?;
            }
        }
        self.elastic_ip = None;
        Ok(())
    }
}

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use std::fmt::Display;

use aws_sdk_ec2::types::{Instance, InstanceType, KeyPairInfo, SecurityGroup};

use crate::ec2::{EC2Error, EC2};
```

```
/// InstanceManager wraps the lifecycle of an EC2 Instance.
#[derive(Debug, Default)]
pub struct InstanceManager {
    instance: Option<Instance>,
}

impl InstanceManager {
    pub fn instance_id(&self) -> &str {
        if let Some(instance) = &self.instance {
            if let Some(id) = instance.instance_id() {
                return id;
            }
        }
        "Unknown"
    }

    pub fn instance_name(&self) -> &str {
        if let Some(instance) = &self.instance {
            if let Some(tag) = instance.tags().iter().find(|e| e.key() == Some("Name")) {
                if let Some(value) = tag.value() {
                    return value;
                }
            }
        }
        "Unknown"
    }

    pub fn instance_ip(&self) -> &str {
        if let Some(instance) = &self.instance {
            if let Some(public_ip_address) = instance.public_ip_address() {
                return public_ip_address;
            }
        }
        "0.0.0.0"
    }

    pub fn instance_display_name(&self) -> String {
        format!("{} ({})", self.instance_name(), self.instance_id())
    }

    // snippet-start:[ec2.rust.create_instance.wrapper]
    /// Create an EC2 instance with the given ID on a given type, using a
    /// generated KeyPair and applying a list of security groups.
}
```

```
pub async fn create(
    &mut self,
    ec2: &EC2,
    image_id: &str,
    instance_type: InstanceType,
    key_pair: &KeyPairInfo,
    security_groups: Vec<&SecurityGroup>,
) -> Result<(), EC2Error> {
    let instance_id = ec2
        .create_instance(image_id, instance_type, key_pair, security_groups)
        .await?;
    let instance = ec2.describe_instance(&instance_id).await?;
    self.instance = Some(instance);
    Ok(())
}
// snippet-end:[ec2.rust.create_instance.wrapper]

/// Start the managed EC2 instance, if present.
pub async fn start(&self, ec2: &EC2) -> Result<(), EC2Error> {
    if self.instance.is_some() {
        ec2.start_instance(self.instance_id()).await?;
    }
    Ok(())
}

/// Stop the managed EC2 instance, if present.
pub async fn stop(&self, ec2: &EC2) -> Result<(), EC2Error> {
    if self.instance.is_some() {
        ec2.stop_instance(self.instance_id()).await?;
    }
    Ok(())
}

// snippet-start:[ec2.rust.reboot_instance.wrapper]
pub async fn reboot(&self, ec2: &EC2) -> Result<(), EC2Error> {
    if self.instance.is_some() {
        ec2.reboot_instance(self.instance_id()).await?;
        ec2.wait_for_instance_stopped(self.instance_id(), None)
            .await?;
        ec2.wait_for_instance_ready(self.instance_id(), None)
            .await?;
    }
    Ok(())
}
```

```
// snippet-end:[ec2.rust.reboot_instance.wrapper]

/// Terminate and delete the managed EC2 instance, if present.
pub async fn delete(self, ec2: &EC2) -> Result<(), EC2Error> {
    if self.instance.is_some() {
        ec2.delete_instance(self.instance_id()).await?;
    }
    Ok(())
}

impl Display for InstanceManager {
    fn fmt(&self, f: &mut std::fmt::Formatter<'_>) -> std::fmt::Result {
        if let Some(instance) = &self.instance {
            writeln!(f, "\tID: {}",
instance.instance_id().unwrap_or("(Unknown"))?;
            writeln!(
                f,
                "\tImage ID: {}",
                instance.image_id().unwrap_or("(Unknown"))
            )?;
            writeln!(
                f,
                "\tInstance type: {}",
                instance
                    .instance_type()
                    .map(|it| format!("{}")))
                    .unwrap_or("(Unknown)".to_string())
            )?;
            writeln!(
                f,
                "\tKey name: {}",
                instance.key_name().unwrap_or("(Unknown"))
            )?;
            writeln!(f, "\tVPC ID: {}",
instance.vpc_id().unwrap_or("(Unknown"))?;
            writeln!(
                f,
                "\tPublic IP: {}",
                instance.public_ip_address().unwrap_or("(Unknown"))
            )?;
        let instance_state = instance
            .state
            .as_ref()
        }
    }
}
```

```
.map(|is| {
    is.name()
        .map(|isn| format!("{}"),)
        .unwrap_or("(Unknown)".to_string())
)
    .unwrap_or("(Unknown)".to_string());
writeln!(f, "\tState: {instance_state}")?;
} else {
    writeln!(f, "\tNo loaded instance")?;
}
Ok(())
}

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use std::{env, path::PathBuf};

use aws_sdk_ec2::types::KeyPairInfo;

use crate::ec2::{EC2Error, EC2};

use super::util::Util;

/// KeyPairManager tracks a KeyPairInfo and the path the private key has been
/// written to, if it's been created.
#[derive(Debug)]
pub struct KeyPairManager {
    key_pair: KeyPairInfo,
    key_file_path: Option<PathBuf>,
    key_file_dir: PathBuf,
}

impl KeyPairManager {
    pub fn new() -> Self {
        Self::default()
    }

    pub fn key_pair(&self) -> &KeyPairInfo {
        &self.key_pair
    }

    pub fn key_file_path(&self) -> Option<&PathBuf> {
```

```
        self.key_file_path.as_ref()
    }

    pub fn key_file_dir(&self) -> &PathBuf {
        &self.key_file_dir
    }

    // snippet-start:[ec2.rust.create_key.wrapper]
    /// Creates a key pair that can be used to securely connect to an EC2
    instance.
    /// The returned key pair contains private key information that cannot be
    retrieved
    /// again. The private key data is stored as a .pem file.
    ///
    /// :param key_name: The name of the key pair to create.
    pub async fn create(
        &mut self,
        ec2: &EC2,
        util: &Util,
        key_name: String,
    ) -> Result<KeyPairInfo, EC2Error> {
        let (key_pair, material) = ec2
            .create_key_pair(key_name.clone())
            .await
            .map_err(|e| e.add_message(format!("Couldn't create key
{key_name}")))?;

        let path = self.key_file_dir.join(format!("{}{}.pem"), key_name);
        util.write_secure(&key_name, &path, material)?;

        self.key_file_path = Some(path);
        self.key_pair = key_pair.clone();

        Ok(key_pair)
    }
    // snippet-end:[ec2.rust.create_key.wrapper]

    // snippet-start:[ec2.rust.delete_key.wrapper]
    pub async fn delete(self, ec2: &EC2, util: &Util) -> Result<(), EC2Error> {
        if let Some(key_pair_id) = self.key_pair.key_pair_id() {
            ec2.delete_key_pair(key_pair_id).await?;
            if let Some(key_path) = self.key_file_path() {
                if let Err(err) = util.remove(key_path) {

```

```
        eprintln!("Failed to remove {key_path:?} ({err:?:})");
    }
}
Ok(())
}
// snippet-end:[ec2.rust.delete_key.wrapper]

pub async fn list(&self, ec2: &EC2) -> Result<Vec<KeyPairInfo>, EC2Error> {
    ec2.list_key_pair().await
}
}

impl Default for KeyPairManager {
    fn default() -> Self {
        KeyPairManager {
            key_pair: KeyPairInfo::builder().build(),
            key_file_path: Default::default(),
            key_file_dir: env::temp_dir(),
        }
    }
}

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use std::net::Ipv4Addr;

use aws_sdk_ec2::types::SecurityGroup;

use crate::ec2::{EC2Error, EC2};

/// SecurityGroupManager tracks the lifecycle of a SecurityGroup for an instance,
/// including adding a rule to allow SSH from a public IP address.
#[derive(Debug, Default)]
pub struct SecurityGroupManager {
    group_name: String,
    group_description: String,
    security_group: Option<SecurityGroup>,
}

impl SecurityGroupManager {
    pub async fn create(
        &mut self,
```

```
    ec2: &EC2,
    group_name: &str,
    group_description: &str,
) -> Result<(), EC2Error> {
    self.group_name = group_name.into();
    self.group_description = group_description.into();

    self.security_group = Some(
        ec2.create_security_group(group_name, group_description)
        .await
        .map_err(|e| e.add_message("Couldn't create security group"))?,
    );
}

Ok(())
}

pub async fn authorize_ingress(&self, ec2: &EC2, ip_address: Ipv4Addr) ->
Result<(), EC2Error> {
    if let Some(sg) = &self.security_group {
        ec2.authorize_security_group_ssh_ingress(
            sg.group_id()
            .ok_or_else(|| EC2Error::new("Missing security group ID"))?,
            vec![ip_address],
        )
        .await?;
    };
}

Ok(())
}

pub async fn delete(self, ec2: &EC2) -> Result<(), EC2Error> {
    if let Some(sg) = &self.security_group {
        ec2.delete_security_group(
            sg.group_id()
            .ok_or_else(|| EC2Error::new("Missing security group ID"))?,
        )
        .await?;
    };
}

Ok(())
}

pub fn group_name(&self) -> &str {
    &self.group_name
```

```
}

pub fn vpc_id(&self) -> Option<&str> {
    self.security_group.as_ref().and_then(|sg| sg.vpc_id())
}

pub fn security_group(&self) -> Option<&SecurityGroup> {
    self.security_group.as_ref()
}
}

impl std::fmt::Display for SecurityGroupManager {
    fn fmt(&self, f: &mut std::fmt::Formatter<'_>) -> std::fmt::Result {
        match &self.security_group {
            Some(sg) => {
                writeln!(f,
                    "Security group: {}",
                    sg.group_name().unwrap_or("(unknown group)")
                )?;
                writeln!(f, "\tID: {}", sg.group_id().unwrap_or("(unknown group id)"))?;
                writeln!(f, "\tVPC: {}", sg.vpc_id().unwrap_or("(unknown group vpc)"))?;
                if !sg.ip_permissions().is_empty() {
                    writeln!(f, "\tInbound Permissions:")?;
                    for permission in sg.ip_permissions() {
                        writeln!(f, "\t\t{}{}", permission.ip_protocol, permission.ip_ranges);
                    }
                }
                Ok(())
            }
            None => writeln!(f, "No security group loaded."),
        }
    }
}
```

The main entry point for the scenario.

```
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// SPDX-License-Identifier: Apache-2.0
```

```
use ec2_code_examples::{
    ec2::EC2,
    getting_started::{
        scenario::{run, Ec2InstanceStateScenario},
        util::UtilImpl,
    },
    ssm::SSM,
};

#[tokio::main]
async fn main() {
    tracing_subscriber::fmt::init();
    let sdk_config = aws_config::load_from_env().await;
    let ec2 = EC2::new(aws_sdk_ec2::Client::new(&sdk_config));
    let ssm = SSM::new(aws_sdk_ssm::Client::new(&sdk_config));
    let util = UtilImpl {};
    let scenario = Ec2InstanceStateScenario::new(ec2, ssm, util);
    run(scenario).await;
}
```

- For API details, see the following topics in *AWS SDK for Rust API reference*.

- [AllocateAddress](#)
- [AssociateAddress](#)
- [AuthorizeSecurityGroupIngress](#)
- [CreateKeyPair](#)
- [CreateSecurityGroup](#)
- [DeleteKeyPair](#)
- [DeleteSecurityGroup](#)
- [DescribeImages](#)
- [DescribeInstanceTypes](#)
- [DescribeInstances](#)
- [DescribeKeyPairs](#)
- [DescribeSecurityGroups](#)
- [DisassociateAddress](#)
- [ReleaseAddress](#)

- [StartInstances](#)
- [StopInstances](#)
- [TerminateInstances](#)
- [UnmonitorInstances](#)

For a complete list of AWS SDK developer guides and code examples, see [Create Amazon EC2 resources using an AWS SDK](#). This topic also includes information about getting started and details about previous SDK versions.

# Monitor Amazon EC2 API requests using Amazon CloudWatch

You can monitor Amazon EC2 API requests using Amazon CloudWatch, which collects raw data and processes it into readable, near real-time metrics. These metrics provide a simple way to track the usage and outcomes of the Amazon EC2 API operations over time. This information gives you a better perspective on how your web applications are performing, and enables you to identify and diagnose a variety of issues. You can also set alarms that watch for certain thresholds, and send notifications or take specific actions when those thresholds are met.

For more information about CloudWatch, see the [Amazon CloudWatch User Guide](#).

## Important

Amazon EC2 API metrics is an opt-in feature. You must request access to this feature. For more information, see [the section called “Enable Amazon EC2 API metrics”](#).

## Contents

- [Enable Amazon EC2 API metrics](#)
- [Amazon EC2 API metrics and dimensions](#)
- [Metric data retention](#)
- [Monitoring requests made on your behalf](#)
- [Billing](#)
- [Working with Amazon CloudWatch](#)

## Enable Amazon EC2 API metrics

Use the following procedure to request access to this feature for your AWS account.

### To request access to this feature

1. Open [AWS Support Center](#).
2. Choose **Create case**.

3. Choose **Account and billing**.
4. For **Service**, choose **General Info and Getting Started**.
5. For **Category**, choose **Using AWS & Services**.
6. Choose **Next step: Additional information**.
7. For **Subject**, enter **Request access to Amazon EC2 API metrics**.
8. For **Description**, enter **Please grant my account access to Amazon EC2 API metrics. Related page: <https://docs.aws.amazon.com/AWSEC2/latest/APIReference/monitor.html>**. Also include the Region where you need access.
9. Choose **Next step: Solve now or contact us**.
10. On the **Contact us** tab, choose your preferred contact language and method of contact.
11. Choose **Submit**.

## Amazon EC2 API metrics and dimensions

### Metrics

The Amazon EC2 API metrics are contained in the AWS/EC2/API namespace. The following tables list the metrics available for Amazon EC2 API requests.

| Metric               | Description                                                                                                                                                                                                                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ClientErrors         | <p>The number of failed API requests caused by client errors.</p> <p>These errors are usually caused by something the client did, such as specifying an incorrect or invalid parameter in the request, or using an action or resource on behalf of a user that does not have permission to use the action or resource.</p> <p>Unit: Count</p> |
| RequestLimitExceeded | The number of times the maximum request rate permitted by the Amazon EC2 APIs has been exceeded for your account.                                                                                                                                                                                                                             |

| Metric          | Description                                                                                                                                                                                                        |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | <p>Amazon EC2 API requests are throttled to help maintain the performance of the service. If your requests have been throttled, you get the <code>Client.RequestLimitExceeded</code> error.</p> <p>Unit: Count</p> |
| ServerErrors    | <p>The number of failed API requests caused by internal server errors.</p> <p>These errors are usually caused by an AWS server-side error, exception, or failure.</p> <p>Unit: Count</p>                           |
| SuccessfulCalls | <p>The number of successful API requests.</p> <p>Unit: Count</p>                                                                                                                                                   |

## Dimensions

The Amazon EC2 metric data can be filtered across all EC2 API actions. For more information about dimensions, see [Amazon CloudWatch concepts](#).

## Metric data retention

Amazon EC2 API metrics are sent to CloudWatch at 1-minute intervals. CloudWatch retains metric data as follows:

- Data points with a period of 60 seconds (1 minute) are available for 15 days.
- Data points with a period of 300 seconds (5 minutes) are available for 63 days.
- Data points with a period of 3600 seconds (1 hour) are available for 455 days (15 months).

## Monitoring requests made on your behalf

API requests made by AWS services on your behalf, such as requests made by service-linked roles, do not count toward your API throttling limits and they do not send metrics to Amazon CloudWatch for your account. These requests cannot be monitored using CloudWatch.

API requests made on your behalf by third-party service providers do count toward your API throttling limits and they do send metrics to Amazon CloudWatch for your account. These requests can be monitored using CloudWatch.

## Billing

Standard CloudWatch pricing and charges apply. No additional charges are applied for using the Amazon EC2 API metrics. For more information, see [Amazon CloudWatch Pricing](#).

## Working with Amazon CloudWatch

### Contents

- [Viewing CloudWatch metrics](#)
- [Creating CloudWatch alarms](#)

## Viewing CloudWatch metrics

Use the following procedure to view the Amazon EC2 API metrics.

### Prerequisite

You must enable access to Amazon EC2 API metrics for your account. For more information, see [the section called “Enable Amazon EC2 API metrics”](#).

### To view the Amazon EC2 API metrics using the console

1. Open the CloudWatch console at <https://console.aws.amazon.com/cloudwatch/>.
2. In the navigation pane, chose **Metrics, All metrics**.
3. On the **Browse** tab, choose the **EC2/API** metric namespace.
4. To view the metrics, select the metric dimension.

## To view Amazon EC2 API metrics using the command line

Use one of the following commands:

- [list-metrics](#) (AWS CLI)

```
aws cloudwatch list-metrics --namespace "AWS/EC2/API"
```

- [Get-CWMetricList](#) (AWS Tools for Windows PowerShell)

```
Get-CWMetricList -Namespace "AWS/EC2/API"
```

## Creating CloudWatch alarms

You can create a CloudWatch alarm that sends an Amazon SNS message when the alarm changes state. An alarm watches a single metric over a time period that you specify. It sends a notification to an SNS topic based on the value of the metric relative to a given threshold over a number of time periods.

For example, you can create an alarm that monitors the number of `DescribeInstances` API requests that fail due to server-side errors. The following alarm sends an email notification when the number of `DescribeInstances` API request failures reach a threshold of 10 server-side errors during a 5-minute period.

### Prerequisite

You must enable access to the Amazon EC2 API metrics for your account. For more information, see [the section called “Enable Amazon EC2 API metrics”](#).

### To create an alarm for Amazon EC2 `DescribeInstances` API request server errors

1. Open the CloudWatch console at <https://console.aws.amazon.com/cloudwatch/>.
2. In the navigation pane, choose **Alarms, All alarms**.
3. Choose **Create alarm**.
4. Choose **Select metric**, and the specify the following:
  - a. Choose **EC2/API**.
  - b. Choose **Per-Action Metrics**.

- c. Select the check box next to **DescribeInstances** that is in the same row as the **ServerError**s metric name.
  - d. Choose **Select metric**.
5. The **Specify metric and conditions** page appears, showing a graph and other information about the metric and statistic that you selected.
    - a. Under **Metric**, specify the following:
      - i. For **Statistic**, choose **Sum**.
      - ii. For **Period**, verify that **5 minutes** is selected.
    - b. Under **Conditions**, specify the following:
      - i. For **Threshold type**, choose **Static**.
      - ii. For **Whenever ServerErrors is**, choose **Greater/Equal >=**.
      - iii. For **than...**, enter **10**.
    - c. Choose **Next**.
  6. The **Configure actions** page appears.
    - Under **Notification**, specify the following:
      - i. For **Alarm state trigger**, choose **In alarm**.
      - ii. For **Select an SNS topic**, choose **Select an existing SNS topic or Create new topic**, and complete the required fields for the notification.
      - iii. Choose **Next**.
  7. The **Add name and description** page appears.
    - a. For **Alarm name**, enter a name for your alarm. The name must contain only ASCII characters.
    - b. For **Alarm description**, enter an optional description for your alarm.
    - c. Choose **Next**.
  8. The **Preview and create** page appears. Verify that the information is correct, and then choose **Create alarm**.

For more information, see [Using Amazon CloudWatch alarms](#) in the *Amazon CloudWatch User Guide*.