Amazon EC2 Auto Scaling: User Guide
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# Table of Contents

What is Amazon EC2 Auto Scaling? ................................................................. 1
  Auto Scaling components ........................................................................ 1
  Pricing for Amazon EC2 Auto Scaling .................................................... 2
  Get started ................................................................................................. 2
  Work with Auto Scaling groups ............................................................... 2
  Auto scaling benefits ............................................................................... 3
    Example: Cover variable demand .......................................................... 3
    Example: Web app architecture ............................................................ 5
    Example: Distribute instances across Availability Zones ....................... 5
  Instance lifecycle ..................................................................................... 7
    Scale out ............................................................................................... 8
    Instances in service ............................................................................. 9
    Scale in .............................................................................................. 9
    Attach an instance ............................................................................... 10
    Detach an instance ............................................................................ 10
    Lifecycle hooks ................................................................................ 10
    Enter and exit standby ....................................................................... 11
  Quotas .................................................................................................... 11
    EC2 termination rates ....................................................................... 12
    Other services .................................................................................. 12
  Set up ..................................................................................................... 13
    Prepare to use Amazon EC2 ............................................................... 13
    Prepare to use the AWS CLI ............................................................... 13
  Get started ............................................................................................ 14
    Walkthrough summary ..................................................................... 14
    Prepare for the walkthrough ............................................................. 15
    Step 1: Create a launch template ......................................................... 15
    Step 2: Create a single-instance Auto Scaling group ....................... 17
    Step 3: Verify your Auto Scaling group ............................................. 17
    Step 4: Terminate an instance in your Auto Scaling group ............... 18
    Step 5: Next steps ............................................................................ 18
    Step 6: Clean up ................................................................................ 19
  Launch templates .................................................................................. 21
  Permissions ............................................................................................ 21
    Create a launch template for an Auto Scaling group ....................... 22
      Create your launch template (console) .......................................... 22
      Create a launch template from an existing instance (console) ....... 29
      Related resources ........................................................................... 29
      Limitations .................................................................................... 29
    Migrate to launch templates ............................................................. 30
      Step 1: Find Auto Scaling groups that use launch configurations .... 30
      Step 2: Copy a launch configuration to a launch template ............ 32
      Step 3: Update an Auto Scaling group to use a launch template ...... 32
      Step 4: Replace your instances .................................................... 33
      Additional information .................................................................. 33
    Request Spot Instances .................................................................... 33
    AWS CLI examples for working with launch templates ...................... 35
      Example usage ............................................................................... 35
      Create a basic launch template ...................................................... 36
      Specify tags that tag instances at launch .................................... 36
      Specify an IAM role to pass to instances ..................................... 37
      Assign public IP addresses ............................................................ 37
      Specify a user data script that configures instances at launch ....... 37
      Specify a block device mapping ..................................................... 37
Specify Dedicated Hosts to bring software licenses from external vendors ........................................... 38
Specify an existing network interface ........................................................................................................... 38
Create multiple network interfaces ............................................................................................................ 38
Manage your launch templates .................................................................................................................. 39
Update an Auto Scaling group to use a launch template ........................................................................... 41
Using Systems Manager parameters instead of AMI IDs .......................................................................... 41
Limitations .................................................................................................................................................. 45
Launch configurations ................................................................................................................................. 46
Create a launch configuration ..................................................................................................................... 46
Create a launch configuration (console) ..................................................................................................... 47
Create a launch configuration (AWS CLI) ................................................................................................. 48
Configure IMDS ......................................................................................................................................... 48
Create a launch configuration using an EC2 instance ............................................................................. 50
Create a launch configuration using an EC2 instance ............................................................................. 50
Create a launch configuration from an instance and override the block devices (AWS CLI) ................. 51
Create a launch configuration and override the instance type (AWS CLI) ............................................... 52
Change a launch configuration ................................................................................................................. 53
Configure instance tenancy ......................................................................................................................... 54
Auto Scaling groups ................................................................................................................................. 57
Create Auto Scaling groups using launch templates ............................................................................. 58
Create a group using a launch template .................................................................................................. 58
Create a group using the EC2 launch wizard ......................................................................................... 60
Use multiple instance types and purchase options .................................................................................. 62
Create a group using attribute-based instance type selection .................................................................. 87
Create Auto Scaling groups using launch configurations ....................................................................... 93
Create a group using a launch configuration .......................................................................................... 93
Create a group using an EC2 instance .................................................................................................... 95
Update an Auto Scaling group .................................................................................................................. 99
Update Auto Scaling instances ............................................................................................................... 100
Replace instances .................................................................................................................................... 101
Replace instances based on an instance refresh ................................................................................... 101
Replace instances based on maximum instance lifetime ....................................................................... 127
Tag groups and instances ......................................................................................................................... 129
Tag naming and usage restrictions ......................................................................................................... 130
EC2 instance tagging lifecycle ................................................................................................................ 130
Tag your Auto Scaling groups ................................................................................................................. 131
Delete tags ............................................................................................................................................... 133
Tags for security ....................................................................................................................................... 134
Control access to tags .............................................................................................................................. 134
Use tags to filter Auto Scaling groups .................................................................................................... 135
Delete your Auto Scaling infrastructure .................................................................................................. 137
Delete your Auto Scaling group .............................................................................................................. 137
(Optional) Delete the launch configuration .............................................................................................. 138
(Optional) Delete the launch template ..................................................................................................... 138
(Optional) Delete the load balancer and target groups ......................................................................... 139
(Optional) Delete CloudWatch alarms ................................................................................................... 140
AWS SDK examples for working with Auto Scaling groups ................................................................. 140
Create an Auto Scaling group ............................................................................................................... 140
Update an Auto Scaling group ................................................................................................................. 145
Delete an Auto Scaling group ................................................................................................................. 150
Related resources .................................................................................................................................... 153
Scale your group ....................................................................................................................................... 155
Scaling options .......................................................................................................................................... 155
Set capacity limits ..................................................................................................................................... 156
Maintain a fixed number of instances ...................................................................................................... 157
Manual scaling .......................................................................................................................................... 158
Change the size of your Auto Scaling group (console) ............................................................................ 158
Change the size of your Auto Scaling group (AWS CLI) .................................................. 159
Attach EC2 instances to your Auto Scaling group ....................................................... 160
Detach EC2 instances from your Auto Scaling group .................................................. 164
Dynamic scaling ............................................................................................................. 167
  How dynamic scaling policies work ................................................................. 168
  Multiple dynamic scaling policies ................................................................. 168
  Target tracking scaling policies ................................................................. 169
  Step and simple scaling policies ................................................................. 178
  Set default warm-up or cooldown values .................................................. 187
Scaling based on Amazon SQS .............................................................................. 196
Verify a scaling activity ......................................................................................... 200
Disable a scaling policy ....................................................................................... 202
Delete a scaling policy ......................................................................................... 204
AWS CLI examples for scaling policies .......................................................... 205
Predictive scaling ........................................................................................................... 207
  How predictive scaling works .................................................................................. 208
  Best practices ........................................................................................................ 208
  Create a predictive scaling policy (console) .................................................. 209
  Create a predictive scaling policy (AWS CLI) .................................................. 212
  Limitations ............................................................................................................. 214
Supported Regions ........................................................................................................ 214
Evaluate your predictive scaling policies ............................................................ 214
Override the forecast ............................................................................................... 220
Use custom metrics ...................................................................................................... 223
Scheduled scaling ........................................................................................................... 231
  Considerations ........................................................................................................ 231
  Recurring schedules .............................................................................................. 232
  Create and manage scheduled actions (console) ........................................ 232
  Create and manage scheduled actions (AWS CLI) ........................................ 234
  Limitations ............................................................................................................. 236
Lifecycle hooks ................................................................................................................. 236
  Lifecycle hook availability .................................................................................... 236
  Considerations and limitations ............................................................................ 237
  Related resources .................................................................................................. 238
  How lifecycle hooks work ..................................................................................... 238
  Prepare to add a lifecycle hook ............................................................................ 240
  Retrieve the target lifecycle state ......................................................................... 245
  Add lifecycle hooks ............................................................................................... 246
  Complete a lifecycle action ................................................................................... 248
Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata ... 250
Tutorial: Configure a lifecycle hook that invokes a Lambda function ...................... 255
Warm pools ....................................................................................................................... 261
  Core concepts ........................................................................................................ 261
  Prerequisites .......................................................................................................... 263
  Create a warm pool ............................................................................................... 264
  Update a warm pool .............................................................................................. 264
  Delete a warm pool .............................................................................................. 265
  Limitations ............................................................................................................. 265
  Use lifecycle hooks ............................................................................................... 265
  View health check status ...................................................................................... 268
  AWS CLI examples for working with warm pools ............................................ 270
Control instance termination ....................................................................................... 272
  Termination policy scenarios ............................................................................... 273
  Work with termination policies ............................................................................ 275
  Create a custom termination policy with Lambda ........................................ 278
  Use instance scale-in protection .......................................................................... 282
  Design for graceful instance termination ......................................................... 284
Temporarily remove instances ................................................................. 287
How the standby state works .................................................................. 287
Considerations ....................................................................................... 287
Health status of an instance in a standby state ....................................... 288
Temporarily remove an instance (console) ........................................... 288
Temporarily remove an instance (AWS CLI) ......................................... 289
Suspend-resume processes ..................................................................... 291
Types of processes ................................................................................ 291
Considerations ....................................................................................... 292
Suspend and resume processes (console) ............................................. 294
Suspend and resume processes (AWS CLI) ........................................... 295
Monitor .................................................................................................. 296
Check instance health ........................................................................... 297
Health check types ................................................................................ 297
Amazon EC2 health checks .................................................................... 298
Elastic Load Balancing health checks .................................................. 299
VPC Lattice health checks ..................................................................... 299
Custom health detection tasks .............................................................. 300
Unhealthy instance replacement .......................................................... 301
How Amazon EC2 Auto Scaling minimizes downtime ....................... 301
Health check considerations .................................................................. 302
Additional information .......................................................................... 302
Health check grace period ..................................................................... 302
Monitor with AWS Health Dashboard ................................................... 304
Monitor CloudWatch metrics ............................................................... 305
View monitoring graphs in the Amazon EC2 Auto Scaling console ....... 305
CloudWatch metrics for Amazon EC2 Auto Scaling ............................. 308
Configure monitoring for Auto Scaling instances .................................. 313
Log API calls with AWS CloudTrail ...................................................... 314
Amazon EC2 Auto Scaling information in CloudTrail ......................... 315
Understand Amazon EC2 Auto Scaling log file entries ....................... 315
Related resources ................................................................................ 316
Monitor with Amazon SNS notifications .............................................. 317
SNS notifications .................................................................................. 317
Configure Amazon SNS notifications for Amazon EC2 Auto Scaling .... 318
Key policy for an encrypted Amazon SNS topic .................................... 320
Work with other services ...................................................................... 322
Capacity Rebalancing ........................................................................... 322
Overview .............................................................................................. 323
Capacity Rebalancing behavior ............................................................ 323
Considerations ....................................................................................... 324
Enable Capacity Rebalancing (console) ............................................... 325
Enable Capacity Rebalancing (AWS CLI) ............................................. 326
Related resources ................................................................................ 329
Limitations ........................................................................................... 329
Capacity Reservations ........................................................................ 329
Step 1: Create the Capacity Reservations ............................................ 330
Step 2: Create a Capacity Reservation group ....................................... 331
Step 3: Create a launch template ......................................................... 332
Step 4: Create an Auto Scaling group .................................................. 334
Related resources ................................................................................ 335
AWS CloudShell .................................................................................. 335
AWS CloudFormation .......................................................................... 335
Amazon EC2 Auto Scaling and AWS CloudFormation templates .......... 336
Learn more about AWS CloudFormation .......................................... 336
Migrate launch configurations to launch templates ............................. 336
Compute Optimizer .............................................................................. 342
The requested configuration is currently not supported. ............................................... 431
The security group <name of the security group> does not exist. Launching EC2 instance failed. 431
The key pair <key pair associated with your EC2 instance> does not exist. Launching EC2 instance failed. ........................................................................................................ 432
Your requested instance type (<instance type>) is not supported in your requested Availability Zone (<instanceAvailabilityZone>). ................................................................. 432
Your Spot request price of 0.015 is lower than the minimum required Spot request fulfillment price of 0.0735. ................................................................................................. 432
Invalid device name <device name> / Invalid device name upload. Launching EC2 instance failed. ................................................................................................................... 433
Value <name associated with the instance storage device> for parameter virtualName is invalid... ...................................................................................................................... 433
EBS block device mappings not supported for instance-store AMIs. .................................. 433
Placement groups may not be used with instances of type 'm1.large'. Launching EC2 instance failed. ........................................................................................................ 434
Client.InternalError: Client error on launch. .................................................................. 434
We currently do not have sufficient <instance type> capacity in the Availability Zone you requested... Launching EC2 instance failed. .......................................................... 435
There is no spot capacity available that matches your request. Launching EC2 instance failed. ... 435
<number of instances> instance(s) are already running. Launching EC2 instance failed. ........ 436
AMI issues .......................................................................................................................... 436
The AMI ID <ID of your AMI> does not exist. Launching EC2 instance failed. ............... 436
AMI <AMI ID> is pending, and cannot be run. Launching EC2 instance failed. ................ 437
Invalid device name <device name>. Launching EC2 instance failed. ............................. 437
The architecture 'x86_64' of the specified instance type does not match the architecture 'arm64' of the specified AMI... Launching EC2 instance failed. .......................... 437
Load balancer issues ......................................................................................................... 438
One or more target groups not found. Validating load balancer configuration failed. ....... 439
Cannot find Load Balancer <your load balancer>. Validating load balancer configuration failed. .................................................................................................................. 439
There is no ACTIVE Load Balancer named <load balancer name>. Updating load balancer configuration failed. ...................................................................................... 439
EC2 instance <instance ID> is not in VPC. Updating load balancer configuration failed. .... 440
EC2 instance <instance ID> is in VPC. Updating load balancer configuration failed. ......... 440
Launch template issues ....................................................................................................... 440
You must use a valid fully-formed launch template (invalid value) ................................. 440
You are not authorized to use launch template (insufficient permissions) ................. 441
Health checks ...................................................................................................................... 441
An instance was taken out of service in response to an EC2 instance status check failure .... 442
An instance was taken out of service in response to an EC2 scheduled reboot ............... 442
An instance was taken out of service in response to an EC2 health check that indicated it had been terminated or stopped ............................................................................. 443
An instance was taken out of service in response to an ELB system health check failure .... 443
Related information .............................................................................................................. 445
Document history ............................................................................................................. 447
What is Amazon EC2 Auto Scaling?

Amazon EC2 Auto Scaling helps you ensure that you have the correct number of Amazon EC2 instances available to handle the load for your application. You create collections of EC2 instances, called Auto Scaling groups. You can specify the minimum number of instances in each Auto Scaling group, and Amazon EC2 Auto Scaling ensures that your group never goes below this size. You can specify the maximum number of instances in each Auto Scaling group, and Amazon EC2 Auto Scaling ensures that your group never goes above this size. If you specify the desired capacity, either when you create the group or at any time thereafter, Amazon EC2 Auto Scaling ensures that your group has this many instances. If you specify scaling policies, then Amazon EC2 Auto Scaling can launch or terminate instances as demand on your application increases or decreases.

For example, the following Auto Scaling group has a minimum size of one instance, a desired capacity of two instances, and a maximum size of four instances. The scaling policies that you define adjust the number of instances, within your minimum and maximum number of instances, based on the criteria that you specify.

For more information about the benefits of Amazon EC2 Auto Scaling, see Amazon EC2 Auto Scaling benefits (p. 3).

To configure auto scaling for scalable resources for Amazon Web Services beyond Amazon EC2, see the Application Auto Scaling User Guide.

Auto Scaling components

The following table describes the key components of Amazon EC2 Auto Scaling.

<table>
<thead>
<tr>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your EC2 instances are organized into groups so that they can be treated as a logical unit for the purposes of scaling and management. When you create a group, you can specify its minimum, maximum, and, desired number of EC2 instances. For more information, see Auto Scaling groups (p. 57).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Configuration templates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your group uses a launch template, or a launch configuration (not recommended, offers fewer features), as a configuration template for its EC2 instances. You can specify information such as the AMI ID, instance type, key pair, security groups, and block device mapping for your instances. For more information, see Launch templates (p. 21) and Launch configurations (p. 46).</td>
</tr>
</tbody>
</table>
Scaling options
Amazon EC2 Auto Scaling provides several ways for you to scale your Auto Scaling groups. For example, you can configure a group to scale based on the occurrence of specified conditions (dynamic scaling) or on a schedule. For more information, see Scaling options (p. 155).

Pricing for Amazon EC2 Auto Scaling
There are no additional fees with Amazon EC2 Auto Scaling, so it’s easy to try it out and see how it can benefit your AWS architecture. You only pay for the AWS resources (for example, EC2 instances, EBS volumes, and CloudWatch alarms) that you use.

Get started
To begin, complete the Get started with Amazon EC2 Auto Scaling (p. 14) tutorial to create an Auto Scaling group and see how it responds when an instance in that group terminates.

For additional tutorials that focus on specific use cases, see the following topics:

- Tutorial: Set up a scaled and load-balanced application (p. 358). This tutorial shows you how to configure your Auto Scaling group to receive traffic from an Elastic Load Balancing load balancer.
- Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255). This tutorial shows you how to use Amazon EventBridge to create rules that invoke Lambda functions based on events that happen to the instances in your Auto Scaling group.
- Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata (p. 250). This tutorial shows you how to use the Instance Metadata Service (IMDS) to invoke an action from within the instance itself.

Work with Auto Scaling groups
You can create, access, and manage your Auto Scaling groups using any of the following interfaces:

- AWS Management Console – Provides a web interface that you can use to access your Auto Scaling groups. If you’ve signed up for an AWS account, you can access your Auto Scaling groups by signing into the AWS Management Console, using the search box on the navigation bar to search for Auto Scaling groups, and then choosing Auto Scaling groups.
- AWS Command Line Interface (AWS CLI) – Provides commands for a broad set of AWS services, and is supported on Windows, macOS, and Linux. To get started, see Prepare to use the AWS CLI (p. 13). For more information, see autoscaling in the AWS CLI Command Reference.
- AWS Tools for Windows PowerShell – Provides commands for a broad set of AWS products for those who script in the PowerShell environment. To get started, see the AWS Tools for Windows PowerShell User Guide. For more information, see the AWS Tools for PowerShell Cmdlet Reference.
- AWS SDKs – Provides language-specific API operations and takes care of many of the connection details, such as calculating signatures, handling request retries, and handling errors. For more information, see AWS SDKs.
- Query API – Provides low-level API actions that you call using HTTPS requests. Using the Query API is the most direct way to access AWS services. However, it requires your application to handle low-level
Amazon EC2 Auto Scaling benefits

Adding Amazon EC2 Auto Scaling to your application architecture is one way to maximize the benefits of the AWS Cloud. When you use Amazon EC2 Auto Scaling, your applications gain the following benefits:

- Better fault tolerance. Amazon EC2 Auto Scaling can detect when an instance is unhealthy, terminate it, and launch an instance to replace it. You can also configure Amazon EC2 Auto Scaling to use multiple Availability Zones. If one Availability Zone becomes unavailable, Amazon EC2 Auto Scaling can launch instances in another one to compensate.
- Better availability. Amazon EC2 Auto Scaling helps ensure that your application always has the right amount of capacity to handle the current traffic demand.
- Better cost management. Amazon EC2 Auto Scaling can dynamically increase and decrease capacity as needed. Because you pay for the EC2 instances you use, you save money by launching instances when they are needed and terminating them when they aren't.

Contents
- Example: Cover variable demand (p. 3)
- Example: Web app architecture (p. 5)
- Example: Distribute instances across Availability Zones (p. 5)
  - Instance distribution (p. 6)
  - Rebalancing activities (p. 6)

Example: Cover variable demand

To demonstrate some of the benefits of Amazon EC2 Auto Scaling, consider a basic web application running on AWS. This application allows employees to search for conference rooms that they might want to use for meetings. During the beginning and end of the week, usage of this application is minimal. During the middle of the week, more employees are scheduling meetings, so the demand on the application increases significantly.

The following graph shows how much of the application's capacity is used over the course of a week.
Traditionally, there are two ways to plan for these changes in capacity. The first option is to add enough servers so that the application always has enough capacity to meet demand. The downside of this option, however, is that there are days in which the application doesn't need this much capacity. The extra capacity remains unused and, in essence, raises the cost of keeping the application running.

The second option is to have enough capacity to handle the average demand on the application. This option is less expensive, because you aren't purchasing equipment that you'll only use occasionally. However, you risk creating a poor customer experience when the demand on the application exceeds its capacity.

By adding Amazon EC2 Auto Scaling to this application, you have a third option available. You can add new instances to the application only when necessary, and terminate them when they're no longer needed. Because Amazon EC2 Auto Scaling uses EC2 instances, you only have to pay for the instances you use, when you use them. You now have a cost-effective architecture that provides the best customer experience while minimizing expenses.
Example: Web app architecture

In a common web app scenario, you run multiple copies of your app simultaneously to cover the volume of your customer traffic. These multiple copies of your application are hosted on identical EC2 instances (cloud servers), each handling customer requests.

Amazon EC2 Auto Scaling manages the launch and termination of these EC2 instances on your behalf. You define a set of criteria (such as an Amazon CloudWatch alarm) that determines when the Auto Scaling group launches or terminates EC2 instances. Adding Auto Scaling groups to your network architecture helps make your application more highly available and fault tolerant.

You can create as many Auto Scaling groups as you need. For example, you can create an Auto Scaling group for each tier.

To distribute traffic between the instances in your Auto Scaling groups, you can introduce a load balancer into your architecture. For more information, see Elastic Load Balancing (p. 344).

Example: Distribute instances across Availability Zones

Availability Zones are isolated locations in a given AWS Region. Each Region has multiple Availability Zones designed to provide high availability for the Region. Availability Zones are independent, and therefore you increase application availability when you design your application to use multiple zones. For more information, see Resilience in Amazon EC2 Auto Scaling (p. 424).

An Availability Zone is identified by the AWS Region code followed by a letter identifier (for example, us-east-1a). If you create your VPC and subnets rather than using the default VPC, you can define
one or more subnets in each Availability Zone. Each subnet must reside entirely within one Availability Zone and cannot span zones. For more information, see [How Amazon VPC works](https://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/) in the Amazon VPC User Guide.

When you create an Auto Scaling group, you must choose the VPC and subnets where you will deploy the Auto Scaling group. Amazon EC2 Auto Scaling creates your instances in your chosen subnets. Each instance is thus associated with a specific Availability Zone chosen by Amazon EC2 Auto Scaling. When instances launch, Amazon EC2 Auto Scaling tries to evenly distribute them between the zones for high availability and reliability.

The following image shows an overview of multi-tier architecture deployed across three Availability Zones.

![Multi-tier architecture diagram](image)

**Instance distribution**

Amazon EC2 Auto Scaling automatically tries to maintain equivalent numbers of instances in each enabled Availability Zone. Amazon EC2 Auto Scaling does this by attempting to launch new instances in the Availability Zone with the fewest instances. If there are multiple subnets chosen for the Availability Zone, Amazon EC2 Auto Scaling selects a subnet from the Availability Zone at random. If the attempt fails, however, Amazon EC2 Auto Scaling attempts to launch the instances in another Availability Zone until it succeeds.

In circumstances where an Availability Zone becomes unhealthy or unavailable, the distribution of instances might become unevenly distributed across the Availability Zones. When the Availability Zone recovers, Amazon EC2 Auto Scaling automatically rebalances the Auto Scaling group. It does this by launching instances in the enabled Availability Zones with the fewest instances and terminating instances elsewhere.

**Rebalancing activities**

Rebalancing activities fall into two categories: Availability Zone rebalancing and capacity rebalancing.
Availability Zone rebalancing

After certain actions occur, your Auto Scaling group can become unbalanced between Availability Zones. Amazon EC2 Auto Scaling compensates by rebalancing the Availability Zones. The following actions can lead to rebalancing activity:

- You change the Availability Zones associated with your Auto Scaling group.
- You explicitly terminate or detach instances or place instances in standby, and then the group becomes unbalanced.
- An Availability Zone that previously had insufficient capacity recovers and now has additional capacity.
- An Availability Zone that previously had a Spot price above your maximum price now has a Spot price below your maximum price.

When rebalancing, Amazon EC2 Auto Scaling launches new instances before terminating the earlier ones. This way, rebalancing does not compromise the performance or availability of your application.

Because Amazon EC2 Auto Scaling attempts to launch new instances before terminating the earlier ones, being at or near the specified maximum capacity could impede or completely halt rebalancing activities.

To avoid this problem, the system can temporarily exceed the specified maximum capacity of a group during a rebalancing activity. It can do so by a margin of 10 percent or one instance, whichever is greater. The margin is extended only if the group is at or near maximum capacity and needs rebalancing. This can happen because of user-requested rezoning, or to compensate for zone availability issues. The extension lasts only as long as needed to rebalance the group (typically a few minutes).

Capacity Rebalancing

You can turn on Capacity Rebalancing for your Auto Scaling groups when using Spot Instances. This lets Amazon EC2 Auto Scaling attempt to launch a Spot Instance whenever Amazon EC2 reports that a Spot Instance is at an elevated risk of interruption. After launching a new instance, it then terminates an earlier instance. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

Amazon EC2 Auto Scaling instance lifecycle

The EC2 instances in an Auto Scaling group have a path, or lifecycle, that differs from that of other EC2 instances. The lifecycle starts when the Auto Scaling group launches an instance and puts it into service. The lifecycle ends when you terminate the instance, or the Auto Scaling group takes the instance out of service and terminates it.

Note
You are billed for instances as soon as they are launched, including the time that they are not yet in service.

The following illustration shows the transitions between instance states in the Amazon EC2 Auto Scaling lifecycle.
Scale out

The following scale-out events direct the Auto Scaling group to launch EC2 instances and attach them to the group:

- You manually increase the size of the group. For more information, see Manual scaling for Amazon EC2 Auto Scaling (p. 158).
- You create a scaling policy to automatically increase the size of the group based on a specified increase in demand. For more information, see Dynamic scaling for Amazon EC2 Auto Scaling (p. 167).
- You set up scaling by schedule to increase the size of the group at a specific time. For more information, see Scheduled scaling for Amazon EC2 Auto Scaling (p. 231).

When a scale-out event occurs, the Auto Scaling group launches the required number of EC2 instances, using its assigned launch template. These instances start in the Pending state. If you add a lifecycle hook to your Auto Scaling group, you can perform a custom action here. For more information, see Lifecycle hooks (p. 10).

When each instance is fully configured and passes the Amazon EC2 health checks, it is attached to the Auto Scaling group and it enters the InService state. The instance is counted against the desired capacity of the Auto Scaling group.

If your Auto Scaling group is configured to receive traffic from an Elastic Load Balancing load balancer, Amazon EC2 Auto Scaling automatically registers your instance with the load balancer before it marks the instance as InService.

The following summarizes the workflow for registering an instance with a load balancer for a scale-out event.
Instances in service

Instances remain in the InService state until one of the following occurs:

- A scale-in event occurs, and Amazon EC2 Auto Scaling chooses to terminate this instance in order to reduce the size of the Auto Scaling group. For more information, see Control which Auto Scaling instances terminate during scale in (p. 272).
- You put the instance into a Standby state. For more information, see Enter and exit standby (p. 11).
- You detach the instance from the Auto Scaling group. For more information, see Detach an instance (p. 10).
- The instance fails a required number of health checks, so it is removed from the Auto Scaling group, terminated, and replaced. For more information, see Health checks for Auto Scaling instances (p. 297).

Scale in

The following scale-in events direct the Auto Scaling group to detach EC2 instances from the group and terminate them:

- You manually decrease the size of the group. For more information, see Manual scaling for Amazon EC2 Auto Scaling (p. 158).
- You create a scaling policy to automatically decrease the size of the group based on a specified decrease in demand. For more information, see Dynamic scaling for Amazon EC2 Auto Scaling (p. 167).
- You set up scaling by schedule to decrease the size of the group at a specific time. For more information, see Scheduled scaling for Amazon EC2 Auto Scaling (p. 231).

It is important that you create a corresponding scale-in event for each scale-out event that you create. This helps ensure that the resources assigned to your application match the demand for those resources as closely as possible.

When a scale-in event occurs, the Auto Scaling group terminates one or more instances. The Auto Scaling group uses its termination policy to determine which instances to terminate. Instances that are in the process of terminating from the Auto Scaling group and shutting down enter the Terminating state, and can’t be put back into service. If you add a lifecycle hook to your Auto Scaling group, you can perform a custom action here. Finally, the instances are completely terminated and enter the Terminated state.
If your Auto Scaling group is configured to receive traffic from an Elastic Load Balancing load balancer, Amazon EC2 Auto Scaling automatically deregisters the terminating instance from the load balancer before running lifecycle hooks. Deregistering the instance ensures that all new requests are redirected to other instances in the load balancer’s target group while existing connections to the instance are allowed to continue until the deregistration delay expires.

The following summarizes the workflow for deregistering an instance with a load balancer for a scale-in event.

<table>
<thead>
<tr>
<th>Scale In</th>
<th>Auto Scaling group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance enters Terminating state</td>
<td>No load balancer</td>
</tr>
<tr>
<td>Elastic Load Balancing</td>
<td>Instance enters draining state with load balancer</td>
</tr>
<tr>
<td></td>
<td>Deregistration delay</td>
</tr>
<tr>
<td></td>
<td>Instance deregistered from load balancer</td>
</tr>
<tr>
<td>Run lifecycle hooks</td>
<td>Instance enters Terminated state</td>
</tr>
</tbody>
</table>

**Attach an instance**

You can attach a running EC2 instance that meets certain criteria to your Auto Scaling group. After the instance is attached, it is managed as part of the Auto Scaling group.

For more information, see [Attach EC2 instances to your Auto Scaling group](p. 160).

**Detach an instance**

You can detach an instance from your Auto Scaling group. After the instance is detached, you can manage it separately from the Auto Scaling group or attach it to a different Auto Scaling group.

For more information, see [Detach EC2 instances from your Auto Scaling group](p. 164).

**Lifecycle hooks**

You can add a lifecycle hook to your Auto Scaling group so that you can perform custom actions when instances launch or terminate.

When Amazon EC2 Auto Scaling responds to a scale-out event, it launches one or more instances. These instances start in the Pending state. If you added an autoscaling:EC2_INSTANCE_LAUNCHING lifecycle hook to your Auto Scaling group, the instances move from the Pending state to the Pending:Wait state. After you complete the lifecycle action, the instances enter the Pending:Proceed state. When the instances are fully configured, they are attached to the Auto Scaling group and they enter the InService state.

When Amazon EC2 Auto Scaling responds to a scale-in event, it terminates one or more instances. These instances are detached from the Auto Scaling group and enter the Terminating state. If you added an autoscaling:EC2_INSTANCE_TERMINATING lifecycle hook to your Auto Scaling group, the instances move from the Terminating state to the Terminating:Wait state. After you complete the lifecycle action, the instances enter the Terminating:Proceed state. When the instances are fully terminated, they enter the Terminated state.
Enter and exit standby

You can put any instance that is in an InService state into a Standby state. This enables you to remove the instance from service, troubleshoot or make changes to it, and then put it back into service.

Instances in a Standby state continue to be managed by the Auto Scaling group. However, they are not an active part of your application until you put them back into service.

For more information, see Temporarily remove instances from your Auto Scaling group (p. 287).

Quotas for Amazon EC2 Auto Scaling

Your AWS account has default quotas, formerly referred to as limits, for each AWS service. Unless otherwise noted, each quota is Region-specific. You can request increases for some quotas, and other quotas cannot be increased.

To view the quotas for Amazon EC2 Auto Scaling, open the Service Quotas console. In the navigation pane, choose AWS services and select Amazon EC2 Auto Scaling.

To request a quota increase, see Requesting a Quota Increase in the Service Quotas User Guide. If the quota is not yet available in Service Quotas, use the Auto Scaling Limits form. Quota increases are tied to the Region they were requested for.

All requests are submitted to AWS Support. You can track your request case in the AWS Support console.

Amazon EC2 Auto Scaling resources

Your AWS account has the following quotas related to the number of Auto Scaling groups and launch configurations that you can create.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Default quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Scaling groups per region</td>
<td>500</td>
</tr>
<tr>
<td>Launch configurations per region</td>
<td>200</td>
</tr>
</tbody>
</table>

Auto Scaling group configuration

Your AWS account has the following quotas related to the configuration of Auto Scaling groups. They cannot be changed.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling policies per Auto Scaling group</td>
<td>50</td>
</tr>
<tr>
<td>Scheduled actions per Auto Scaling group</td>
<td>125</td>
</tr>
<tr>
<td>Step adjustments per step scaling policy</td>
<td>20</td>
</tr>
<tr>
<td>Lifecycle hooks per Auto Scaling group</td>
<td>50</td>
</tr>
<tr>
<td>SNS topics per Auto Scaling group</td>
<td>10</td>
</tr>
<tr>
<td>Resource</td>
<td>Quota</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Classic Load Balancers per Auto Scaling group</td>
<td>50</td>
</tr>
<tr>
<td>Elastic Load Balancing target groups per Auto Scaling group</td>
<td>50</td>
</tr>
<tr>
<td>VPC Lattice target groups per Auto Scaling group</td>
<td>5</td>
</tr>
</tbody>
</table>

**Auto Scaling group API operations**

Amazon EC2 Auto Scaling provides API operations to make changes to your Auto Scaling groups in batches. The following are the API limits on the maximum number of items (maximum array members) that are allowed in a single operation. They cannot be changed.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Maximum array members</th>
</tr>
</thead>
<tbody>
<tr>
<td>AttachInstances</td>
<td>20 instance IDs</td>
</tr>
<tr>
<td>AttachLoadBalancers</td>
<td>10 load balancers</td>
</tr>
<tr>
<td>AttachLoadBalancerTargetGroups</td>
<td>10 target groups</td>
</tr>
<tr>
<td>BatchDeleteScheduledAction</td>
<td>50 scheduled actions</td>
</tr>
<tr>
<td>BatchPutScheduledUpdateGroupAction</td>
<td>50 scheduled actions</td>
</tr>
<tr>
<td>DetachInstances</td>
<td>20 instance IDs</td>
</tr>
<tr>
<td>DetachLoadBalancers</td>
<td>10 load balancers</td>
</tr>
<tr>
<td>DetachLoadBalancerTargetGroups</td>
<td>10 target groups</td>
</tr>
<tr>
<td>EnterStandby</td>
<td>20 instance IDs</td>
</tr>
<tr>
<td>ExitStandby</td>
<td>20 instance IDs</td>
</tr>
<tr>
<td>SetInstanceProtection</td>
<td>50 instance IDs</td>
</tr>
</tbody>
</table>

**EC2 termination rates**

Amazon EC2 Auto Scaling dynamically determines the number of EC2 instance termination operations it can perform at a time when your Auto Scaling group scales in. This means you might see variations in the number of instances terminated at a time across Auto Scaling groups. These variations are caused by external considerations, such as whether Amazon EC2 Auto Scaling must deregister instances with a load balancer.

**Other services**

Quotas for other services, such as Amazon EC2, can impact your Auto Scaling groups. For quotas for other AWS services, see Service endpoints and quotas in the Amazon Web Services General Reference. For quotas for launch templates, see Launch template restrictions in the Amazon EC2 User Guide for Linux Instances.
Set up Amazon EC2 Auto Scaling

Before you start using Amazon EC2 Auto Scaling, complete the following tasks.

Tasks
- Prepare to use Amazon EC2 (p. 13)
- Prepare to use the AWS CLI (p. 13)

Prepare to use Amazon EC2

If you haven't used Amazon EC2 before, complete the tasks described in the Amazon EC2 documentation. For more information, see Setting up with Amazon EC2 in the Amazon EC2 User Guide for Linux Instances or Setting up with Amazon EC2 in the Amazon EC2 User Guide for Windows Instances.

Prepare to use the AWS CLI

You can use the AWS command line tools to issue commands at your system's command line to perform Amazon EC2 Auto Scaling and other AWS tasks.

To use the AWS Command Line Interface (AWS CLI), download, install, and configure version 1 or 2 of the AWS CLI. The same Amazon EC2 Auto Scaling functionality is available in version 1 and 2. To install the AWS CLI version 1, see Installing, updating, and uninstalling the AWS CLI in the AWS CLI Version 1 User Guide. To install the AWS CLI version 2, see Installing or updating the latest version of the AWS CLI in the AWS CLI Version 2 User Guide.

AWS CloudShell lets you skip installing the AWS CLI in your development environment, and use it in the AWS Management Console instead. In addition to avoiding installation, you also don't need to configure credentials, and you don't need to specify a region. Your AWS Management Console session provides this context to the AWS CLI. You can use AWS CloudShell in supported AWS Regions. For more information, see Create Auto Scaling groups from the command line using AWS CloudShell (p. 335).

For more information, see autoscaling in the AWS CLI Command Reference.
Get started with Amazon EC2 Auto Scaling

When you use Amazon EC2 Auto Scaling, you must use certain building blocks to get started. This tutorial walks you through the process for setting up building blocks to create a basic infrastructure for Amazon EC2 Auto Scaling.

Before you create an Auto Scaling group for use with your application, review your application thoroughly as it runs in the AWS Cloud. Consider the following:

- How many Availability Zones the Auto Scaling group should span.
- What existing resources can be used, such as security groups or Amazon Machine Images (AMIs).
- Whether you want to scale to increase or decrease capacity, or if you just want to ensure that a specific number of servers are always running. Keep in mind that Amazon EC2 Auto Scaling can do both simultaneously.
- What metrics have the most relevance to your application's performance.
- How long it takes to launch and configure a server.

The better you understand your application, the more effective you can make your Auto Scaling architecture.

Note

For an introduction video, see AWS re:Invent 2018: Capacity Management Made Easy with Amazon EC2 Auto Scaling on YouTube.

Tasks

- Walkthrough summary (p. 14)
- Prepare for the walkthrough (p. 15)
- Step 1: Create a launch template (p. 15)
- Step 2: Create a single-instance Auto Scaling group (p. 17)
- Step 3: Verify your Auto Scaling group (p. 17)
- Step 4: Terminate an instance in your Auto Scaling group (p. 18)
- Step 5: Next steps (p. 18)
- Step 6: Clean up (p. 19)

Walkthrough summary

In this walkthrough, you:

- Create a configuration template that defines your EC2 instances. You can choose either the launch template or the launch configuration instructions. Although you can use a launch configuration, we recommend a launch template so that you can use the latest features of Amazon EC2 and Amazon EC2 Auto Scaling.
- Create an Auto Scaling group with a single instance in it.
• Terminate the instance and verify that the instance was removed from service and replaced. To maintain a constant number of instances, Amazon EC2 Auto Scaling detects and responds to Amazon EC2 health and reachability checks automatically.

If you created your AWS account less than 12 months ago, and have not already exceeded the free tier benefits for Amazon EC2, it will not cost you anything to complete this tutorial, because we help you select an instance type that is within the free tier benefits. Otherwise, when you follow this tutorial, you incur the standard Amazon EC2 usage fees from the time that the instance launches until you delete the Auto Scaling group (which is the final task of this tutorial) and the instance status changes to terminated.

Prepare for the walkthrough

This walkthrough assumes that you are familiar with launching EC2 instances and that you have already created a key pair and a security group. For more information, see Setting up with Amazon EC2 in the Amazon EC2 User Guide for Linux Instances.

If you are new to Amazon EC2 Auto Scaling and want to get started using the service, you can use the default VPC for your AWS account. The default VPC includes a default public subnet in each Availability Zone and an internet gateway that is attached to your VPC. You can view your VPCs on the Your VPCs page of the Amazon Virtual Private Cloud (Amazon VPC) console.

Step 1: Create a launch template

In this step, you sign in to the Amazon EC2 console with your AWS account credentials and create a launch template that specifies the type of EC2 instance that Amazon EC2 Auto Scaling creates for you. Include information such as the ID of the Amazon Machine Image (AMI) to use, the instance type, the key pair, and security groups.

Note
To use a launch configuration instead, see Create a launch configuration.

To create a launch template

1. Open the Launch templates page of the Amazon EC2 console.
2. On the top navigation bar, select an AWS Region. The launch template and Auto Scaling group that you create are tied to the Region that you specify.
3. Choose Create launch template.
4. For Launch template name, enter my-template-for-auto-scaling.
5. Under Auto Scaling guidance, select the check box.
6. For Application and OS Images (Amazon Machine Image), choose a version of Amazon Linux 2 (HVM) from the Quick Start list. The AMI serves as a basic configuration template for your instances.
7. For Instance type, choose a hardware configuration that is compatible with the AMI that you specified.

Note
If your account is less than 12 months old, you can use a t2.micro instance for free within certain usage limits. For more information, see AWS free tier.
8. (Optional) For Key pair (login), choose an existing key pair. You use key pairs to connect to an Amazon EC2 instance with SSH. Connecting to an instance is not included as part of this tutorial. Therefore, you don't need to specify a key pair unless you intend to connect to your instance using SSH.
9. For **Network settings**, **Security groups**, choose a security group in the same VPC that you plan to use as the VPC for your Auto Scaling group. If you don’t specify a security group, your instance is automatically associated with the default security group for the VPC.

10. You can leave **Advanced network configuration** empty. Leaving the setting empty creates a primary network interface with IP addresses that we select for your instance based on the subnet to which the network interface is established. If instead you choose to configure a network interface, the security group must be a part of it.

11. Choose **Create launch template**.

12. On the confirmation page, choose **Create Auto Scaling group**.

If you are not currently using launch templates and prefer not to create one now, you can create a launch configuration instead.

A launch configuration is similar to a launch template, in that it specifies the type of EC2 instance that Amazon EC2 Auto Scaling creates for you. You create the launch configuration by including information such as the ID of the Amazon Machine Image (AMI) to use, the instance type, the key pair, and security groups.

**To create a launch configuration**

1. Open the Launch configurations page of the Amazon EC2 console. When prompted for confirmation, choose View launch configurations to confirm that you want to view the Launch configurations page.

2. On the top navigation bar, select an AWS Region. The launch configuration and Auto Scaling group that you create are tied to the Region that you specify.

3. Choose **Create launch configuration**, and then enter **my-first-launch-configuration** in the Name field.

4. For **Amazon machine image (AMI)**, choose an AMI. To find a specific AMI, you can find a suitable AMI, make note of its ID, and enter the ID as search criteria.

To get the ID of the Amazon Linux 2 AMI:

a. Open the [Amazon EC2 console](#).

b. On the left navigation pane, under **Instances**, choose **Instances**, and then choose **Launch instances**.

   c. On the Quick Start tab of the Choose an Amazon Machine Image page, note the ID of the AMI next to **Amazon Linux 2 AMI (HVM)**. Notice that this AMI is marked “Free tier eligible.”

5. For **Instance type**, select a hardware configuration for your instance.

   **Note**

   If your account is less than 12 months old, you can use a t2.micro instance for free within certain usage limits. For more information, see [AWS free tier](#).

6. Under **Additional configuration**, for **Advanced details**, **IP address type**, make a selection. To provide internet connectivity to instances in a VPC, choose an option that assigns a public IP address. If an instance is launched into a default VPC, the default is to assign a public IP address. If you want to provide internet connectivity to your instance but aren’t sure whether you have a default VPC, choose Assign a public IP address to every instance.

7. For **Security groups**, choose an existing security group. If you leave the Create a new security group option selected, a default SSH rule is configured for Amazon EC2 instances running Linux. A default RDP rule is configured for Amazon EC2 instances running Windows.

8. For **Key pair (login)**, choose an option under **Key pair options** as instructed. Connecting to an instance is not included as part of this tutorial. Therefore, you can select Proceed without a key pair unless you intend to connect to your instance using SSH.

9. Choose **Create launch configuration**.
10. Select the check box next to the name of your new launch configuration and choose Actions, Create Auto Scaling group.

Step 2: Create a single-instance Auto Scaling group

Now use Amazon EC2 Auto Scaling to create an Auto Scaling group and add the launch template or launch configuration to the group. Also include information such as the VPC subnets for the instances.

Use the following procedure to continue where you left off after creating either a launch template or a launch configuration.

To create an Auto Scaling group

1. On the Choose launch template or configuration page, for Auto Scaling group name, enter my-first-asg.
2. Choose Next.

   The Choose instance launch options page appears, allowing you to choose the VPC network settings you want the Auto Scaling group to use and giving you options for launching On-Demand and Spot Instances (if you chose a launch template).
3. In the Network section, keep VPC set to the default VPC for your chosen AWS Region, or select your own VPC. The default VPC is automatically configured to provide internet connectivity to your instance. This VPC includes a public subnet in each Availability Zone in the Region.
4. For Availability Zones and subnets, choose a subnet from each Availability Zone that you want to include. Use subnets in multiple Availability Zones for high availability. For more information, see Considerations when choosing VPC subnets (p. 388).
5. [Launch template only] In the Instance type requirements section, use the default setting to simplify this step. (Do not override the launch template.) For this tutorial, you will launch only one On-Demand Instance using the instance type specified in your launch template.
6. Keep the rest of the defaults for this tutorial and choose Skip to review.
   
   Note
   The initial size of the group is determined by its desired capacity. The default value is 1 instance.
7. On the Review page, review the information for the group, and then choose Create Auto Scaling group.

Step 3: Verify your Auto Scaling group

Now that you have created an Auto Scaling group, you are ready to verify that the group has launched an EC2 instance.

Tip
In the following procedure, you look at the Activity history and Instances sections for the Auto Scaling group. In both, the named columns should already be displayed. To display hidden columns or change the number of rows shown, choose the gear icon on the top right corner of each section to open the preferences modal, update the settings as needed, and choose Confirm.

To verify that your Auto Scaling group has launched an EC2 instance

1. Open the Auto Scaling groups page of the Amazon EC2 console.
Step 4: Terminate an instance in your Auto Scaling group

Use these steps to learn more about how Amazon EC2 Auto Scaling works, specifically, how it launches new instances when necessary. The minimum size for the Auto Scaling group that you created in this tutorial is one instance. Therefore, if you terminate that running instance, Amazon EC2 Auto Scaling must launch a new instance to replace it.

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group.
3. On the Instance management tab, under Instances, select the ID of the instance.
   
   This takes you to the Instances page of the Amazon EC2 console, where you can terminate the instance.
5. On the navigation pane, under Auto Scaling, choose Auto Scaling Groups. Select your Auto Scaling group and choose the Activity tab.

   The default cooldown for the Auto Scaling group is 300 seconds (5 minutes), so it takes about 5 minutes until you see the scaling activity. In the activity history, when the scaling activity starts, you see an entry for the termination of the first instance and an entry for the launch of a new instance.
6. On the Instance management tab, the Instances section shows the new instance only.
7. On the navigation pane, under Instances, choose Instances. This page shows both the terminated instance and the new running instance.

Step 5: Next steps

Go to the next step if you would like to delete the basic infrastructure for automatic scaling that you just created. Otherwise, you can use this infrastructure as your base and try one or more of the following:

- Connect to your Linux instance using Session Manager or SSH. For more information, see Connect to your Linux instance using Session Manager and Connect to your Linux instance using SSH in the Amazon EC2 User Guide for Linux Instances.
Step 6: Clean up

You can either delete your scaling infrastructure or delete just your Auto Scaling group and keep your launch template or launch configuration to use later.

If you launched an instance that is not within the AWS Free Tier, you should terminate your instance to prevent additional charges. When you terminate the instance, the data associated with it will also be deleted.

To delete your Auto Scaling group

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group (my-first-asg).
3. Choose Delete.
4. When prompted for confirmation, type delete to confirm deleting the specified Auto Scaling group and then choose Delete.

A loading icon in the Name column indicates that the Auto Scaling group is being deleted. When the deletion has occurred, the Desired, Min, and Max columns show 0 instances for the Auto Scaling group. It takes a few minutes to terminate the instance and delete the group. Refresh the list to see the current state.

Skip the following procedure if you would like to keep your launch template.

To delete your launch template

1. Open the Launch templates page of the Amazon EC2 console.
2. Select your launch template (my-template-for-auto-scaling).
3. Choose Actions, Delete template.
4. When prompted for confirmation, type Delete to confirm deleting the specified launch template and then choose Delete.

Skip the following procedure if you would like to keep your launch configuration.

To delete your launch configuration

1. Open the Launch configurations page of the Amazon EC2 console.
2. Select your launch configuration (my-first-launch-configuration).
3. Choose Actions, Delete launch configuration.
4. When prompted for confirmation, choose Delete.
Launch templates

A launch template is similar to a launch configuration (p. 46), in that it specifies instance configuration information. It includes the ID of the Amazon Machine Image (AMI), the instance type, a key pair, security groups, and other parameters used to launch EC2 instances. However, defining a launch template instead of a launch configuration allows you to have multiple versions of a launch template.

With versioning of launch templates, you can create a subset of the full set of parameters. Then, you can reuse it to create other versions of the same launch template. For example, you can create a launch template that defines a base configuration without an AMI or user data script. After you create your launch template, you can create a new version and add the AMI and user data that has the latest version of your application for testing. This results in two versions of the launch template. Storing a base configuration helps you to maintain the required general configuration parameters. You can create a new version of your launch template from the base configuration whenever you want. You can also delete the versions used for testing your application when you no longer need them.

We recommend that you use launch templates to ensure that you’re accessing the latest features and improvements. Not all Amazon EC2 Auto Scaling features are available when you use launch configurations. For example, you cannot create an Auto Scaling group that launches both Spot and On-Demand Instances or that specifies multiple instance types. You must use a launch template to configure these features. For more information, see Auto Scaling groups with multiple instance types and purchase options (p. 62).

With launch templates, you can also use newer features of Amazon EC2. This includes Systems Manager parameters (AMI ID), the current generation of EBS Provisioned IOPS volumes (io2), EBS volume tagging, T2 Unlimited instances, Elastic Inference, and Dedicated Hosts, to name a few. Dedicated Hosts are physical servers with EC2 instance capacity that are dedicated to your use. While Amazon EC2 Dedicated Instances also run on dedicated hardware, the advantage of using Dedicated Hosts over Dedicated Instances is that you can bring eligible software licenses from external vendors and use them on EC2 instances.

When you create a launch template, all parameters are optional. However, if a launch template does not specify an AMI, you cannot add the AMI when you create your Auto Scaling group. If you specify an AMI but no instance type, you can add one or more instance types when you create your Auto Scaling group.

Contents

• Permissions (p. 21)
• Create a launch template for an Auto Scaling group (p. 22)
• Migrate to launch templates (p. 30)
• Request Spot Instances for fault-tolerant and flexible applications (p. 33)
• Examples for creating and managing launch templates with the AWS Command Line Interface (AWS CLI) (p. 35)
• Using AWS Systems Manager parameters instead of AMI IDs in launch templates (p. 41)

Permissions

The procedures in this section assume that you already have the required permissions to use launch templates. With permissions in place, you can create and manage launch templates. You can also create and update Auto Scaling groups and specify a launch template instead of a launch configuration.

When you update or create an Auto Scaling group and specify a launch template, your ec2:RunInstances permissions are checked. If you do not have sufficient permissions, you receive an error that you’re not authorized to use the launch template.
Some additional functionality in the request requires additional permissions, such as the ability to pass an IAM role to provisioned instances or to add tags to provisioned instances and volumes.

For information about how an administrator grants you permissions, see Launch template support (p. 412).

Create a launch template for an Auto Scaling group

Before you can create an Auto Scaling group using a launch template, you must create a launch template with the parameters required to launch an EC2 instance. These parameters include the ID of the Amazon Machine Image (AMI) and an instance type.

A launch template provides full functionality for Amazon EC2 Auto Scaling and also newer features of Amazon EC2 such as the current generation of Amazon EBS Provisioned IOPS volumes (io2), EBS volume tagging, T2 Unlimited instances, Elastic Inference, and Dedicated Hosts.

To create new launch templates, use the following procedures.

Contents
- Create your launch template (console) (p. 22)
  - Change the default network interface settings (p. 24)
  - Modify the storage configuration (p. 25)
  - Configure advanced settings for your launch template (p. 27)
- Create a launch template from an existing instance (console) (p. 29)
- Related resources (p. 29)
- Limitations (p. 29)

Important
Launch template parameters are not fully validated when you create the launch template. If you specify incorrect values for parameters, or if you do not use supported parameter combinations, no instances can launch using this launch template. Be sure to specify the correct values for the parameters and use supported parameter combinations. For example, to launch instances with an Arm-based AWS Graviton or Graviton2 AMI, you must specify an Arm-compatible instance type.

Create your launch template (console)

The following steps describe how to configure your launch template:

- Specify the Amazon Machine Image (AMI) from which to launch the instances.
- Choose an instance type that is compatible with the AMI that you specify.
- Specify the key pair to use when connecting to instances, for example, using SSH.
- Add one or more security groups to allow network access to the instances.
- Specify whether to attach additional volumes to each instance.
- Add custom tags (key-value pairs) to the instances and volumes.

To create a launch template

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation pane, under **Instances**, choose **Launch Templates**.

3. Choose **Create launch template**. Enter a name and provide a description for the initial version of the launch template.

4. (Optional) Under **Auto Scaling guidance**, select the check box to have Amazon EC2 provide guidance to help create a template to use with Amazon EC2 Auto Scaling.

5. Under **Launch template contents**, fill out each required field and any optional fields as needed.

   a. **Application and OS Images (Amazon Machine Image)**: (Required) Choose the ID of the AMI for your instances. You can search through all available AMIs, or select an AMI from the **Recents** or **Quick Start** list. If you don’t see the AMI that you need, choose **Browse more AMIs** to browse the full AMI catalog.

      To choose a custom AMI, you must first create your AMI from a customized instance. For more information, see [Create an AMI](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html) in the *Amazon EC2 User Guide for Linux Instances*.

   b. For **Instance type**, choose a single instance type that’s compatible with the AMI that you specified.

      Alternatively, to launch an Auto Scaling group with multiple instance types, choose **Advanced**, **Specify instance type attributes**, and then specify the following options:

      - **Number of vCPUs**: Enter the minimum and maximum number of vCPUs. To indicate no limits, enter a minimum of 0, and keep the maximum blank.

      - **Amount of memory (MiB)**: Enter the minimum and maximum amount of memory, in MiB. To indicate no limits, enter a minimum of 0, and keep the maximum blank.

      - Expand **Optional instance type attributes** and choose **Add attribute** to further limit the types of instances that can be used to fulfill your desired capacity. For information about each attribute, see **InstanceRequirementsRequest** in the *Amazon EC2 API Reference*.

      - **Resulting instance types**: You can view the instance types that match the specified compute requirements, such as vCPUs, memory, and storage.

      - To exclude instance types, choose **Add attribute**. From the **Attribute list**, choose **Excluded instance types**. From the **Attribute value list**, select the instance types to exclude.

      For more information, see [Create an Auto Scaling group using attribute-based instance type selection](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html). (p. 87).

   c. **Key pair (login)**: For **Key pair name**, choose an existing key pair, or choose **Create new key pair** to create a new one. For more information, see [Amazon EC2 key pairs and Linux instances](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html) in the *Amazon EC2 User Guide for Linux Instances*.

   d. **Network settings**: For **Firewall (security groups)**, use one or more security groups, or keep this blank and configure one or more security groups as part of the network interface. For more information, see [Amazon EC2 security groups for Linux instances](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html) in the *Amazon EC2 User Guide for Linux Instances*.

      If you don’t specify any security groups in your launch template, Amazon EC2 uses the default security group for the VPC that your Auto Scaling group will launch instances into. By default, this security group doesn’t allow inbound traffic from external networks. For more information, see [Default security groups for your VPCs](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html) in the *Amazon VPC User Guide*.

   e. Do one of the following:

      - Change the default network interface settings. For example, you can enable or disable the public IPv4 addressing feature, which overrides the auto-assign public IPv4 addresses setting on the subnet. For more information, see [Change the default network interface settings](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/guides-creating-ami.html) (p. 24).

      - Skip this step to keep the default network interface settings.

   f. Do one of the following:
Create your launch template (console)

- Modify the storage configuration. For more information, see Modify the storage configuration (p. 25).
- Skip this step to keep the default storage configuration.

9. For Resource tags, specify tags by providing key and value combinations. If you specify instance tags in your launch template and then you choose to propagate your Auto Scaling group’s tags to its instances, all the tags are merged. If the same tag key is specified for a tag in your launch template and a tag in your Auto Scaling group, then the tag value from the group takes precedence.

6. (Optional) Configure advanced settings. For more information, see Configure advanced settings for your launch template (p. 27).

7. When you are ready to create the launch template, choose Create launch template.

8. To create an Auto Scaling group, choose Create Auto Scaling group from the confirmation page.

Change the default network interface settings

This section shows you how to change the default network interface settings. For example, you can define whether you want to assign a public IPv4 address to each instance instead of defaulting to the auto-assign public IPv4 addresses setting on the subnet.

Considerations and limitations

When changing the default network interface settings, keep in mind the following considerations and limitations:

- You must configure the security groups as part of the network interface, not in the Security groups section of the template. You cannot specify security groups in both places.
- You cannot assign secondary private IP addresses, known as secondary IP addresses, to a network interface.
- If you specify an existing network interface ID, you can launch only one instance. To do this, you must use the AWS CLI or an SDK to create the Auto Scaling group. When you create the group, you must specify the Availability Zone, but not the subnet ID. Also, you can specify an existing network interface only if it has a device index of 0.
- You cannot auto-assign a public IPv4 address if you specify more than one network interface. You also cannot specify duplicate device indexes across network interfaces. Both the primary and secondary network interfaces reside in the same subnet. For more information, see Provide network connectivity for your Auto Scaling instances using Amazon VPC (p. 386).
- When an instance launches, a private address is automatically allocated to each network interface. The address comes from the CIDR range of the subnet in which the instance is launched. For information on specifying CIDR blocks (or IP address ranges) for your VPC or subnet, see the Amazon VPC User Guide.

To change the default network interface settings

1. Under Network settings, expand Advanced network configuration.
2. Choose Add network interface to configure the primary network interface, paying attention to the following fields:
   a. Device index: Keep the default value, 0, to apply your changes to the primary network interface (eth0).
   b. Network interface: Keep the default value, New interface, to have Amazon EC2 Auto Scaling automatically create a new network interface when an instance is launched. Alternatively, you
can choose an existing, available network interface with a device index of 0, but this limits your Auto Scaling group to one instance.

c. **Description**: (Optional) Enter a descriptive name.

d. **Subnet**: Keep the default *Don't include in launch template* setting.

If the AMI specifies a subnet for the network interface, this results in an error. We recommend turning off *Auto Scaling guidance* as a workaround. After you make this change, you will not receive an error message. However, regardless of where the subnet is specified, the subnet settings of the Auto Scaling group take precedence and cannot be overridden.

e. **Auto-assign public IP**: Change whether your network interface with a device index of 0 receives a public IPv4 address. By default, instances in a default subnet receive a public IPv4 address, while instances in a nondefault subnet do not. Select *Enable* or *Disable* to override the subnet's default setting.

f. **Security groups**: Choose one or more security groups for the network interface. Each security group must be configured for the VPC that your Auto Scaling group will launch instances into. For more information, see *Amazon EC2 security groups for Linux instances* in the *Amazon EC2 User Guide for Linux Instances*.

g. **Delete on termination**: Choose *Yes* to delete the network interface when the instance is terminated, or choose *No* to keep the network interface.

h. **Elastic Fabric Adapter**: To support high performance computing (HPC) use cases, change the network interface into an Elastic Fabric Adapter network interface. For more information, see *Elastic Fabric Adapter* in the *Amazon EC2 User Guide for Linux Instances*.

i. **Network card index**: Choose *0* to attach the primary network interface to the network card with a device index of 0. If this option isn't available, keep the default value, *Don't include in launch template*. Attaching the network interface to a specific network card is available only for supported instance types. For more information, see *Network cards* in the *Amazon EC2 User Guide for Linux Instances*.

3. To add a secondary network interface, choose *Add network interface*.

**Modify the storage configuration**

You can modify the storage configuration for instances launched from an Amazon EBS-backed AMI or an instance store-backed AMI. You can also specify additional EBS volumes to attach to the instances. The AMI includes one or more volumes of storage, including the root volume (*Volume 1 (AMI Root)*).

**To modify the storage configuration**

1. In *Configure storage*, modify the size or type of volume.

   If the value you specify for volume size is outside the limits of the volume type, or smaller than the snapshot size, an error message is displayed. To help you address the issue, this message gives the minimum or maximum value that the field can accept.

   Only volumes associated with an Amazon EBS-backed AMI appear. To display information about the storage configuration for an instance launched from an instance store-backed AMI, choose *Show details* from the *Instance store volumes* section.

   To specify all EBS volume parameters, switch to the *Advanced* view in the top right corner.

2. For advanced options, expand the volume that you want to modify and configure the volume as follows:

   a. **Storage type**: The type of volume (EBS or ephemeral) to associate with your instance. The instance store (ephemeral) volume type is only available if you select an instance type that supports it. For more information, see *Amazon EC2 instance store* and *Amazon EBS volumes* in the *Amazon EC2 User Guide for Linux Instances*.
b. **Device name**: Select from the list of available device names for the volume.

c. **Snapshot**: Select the snapshot from which to create the volume. You can search for available shared and public snapshots by entering text into the **Snapshot** field.

d. **Size (GiB)**: For EBS volumes, you can specify a storage size. If you have selected an AMI and instance that are eligible for the free tier, keep in mind that to stay within the free tier, you must stay under 30 GiB of total storage. For more information, see Constraints on the size and configuration of an EBS volume in the Amazon EC2 User Guide for Linux Instances.

e. **Volume type**: For EBS volumes, choose the volume type. For more information, see Amazon EBS volume types in the Amazon EC2 User Guide for Linux Instances.

f. **IOPS**: If you have selected a Provisioned IOPS SSD (io1 and io2) or General Purpose SSD (gp3) volume type, then you can enter the number of I/O operations per second (IOPS) that the volume can support. This is required for io1, io2, and gp3 volumes. It is not supported for gp2, st1, sc1, or standard volumes.

g. **Delete on termination**: For EBS volumes, choose Yes to delete the volume when the instance is terminated, or choose No to keep the volume.

h. **Encrypted**: If the instance type supports EBS encryption, you can choose Yes to enable encryption for the volume. If you have enabled encryption by default in this Region, encryption is enabled for you. For more information, see Amazon EBS encryption and Encryption by default in the Amazon EC2 User Guide for Linux Instances.

The default effect of setting this parameter varies with the choice of volume source, as described in the following table. In all cases, you must have permission to use the specified AWS KMS key.

### Encryption outcomes

<table>
<thead>
<tr>
<th>If Encrypted parameter is set to...</th>
<th>And if source of volume is...</th>
<th>Then the default encryption state is...</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>New (empty) volume</td>
<td>Unencrypted*</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Unencrypted snapshot that you own</td>
<td>Unencrypted*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encrypted snapshot that you own</td>
<td>Encrypted by same key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unencrypted snapshot that is shared with you</td>
<td>Unencrypted*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encrypted snapshot that is shared with you</td>
<td>Encrypted by default KMS key</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>New volume</td>
<td>Encrypted by default KMS key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unencrypted snapshot that you own</td>
<td>Encrypted by default KMS key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encrypted snapshot that you own</td>
<td>Encrypted by same key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unencrypted snapshot that is shared with you</td>
<td>Encrypted by default KMS key</td>
<td></td>
</tr>
</tbody>
</table>

To use a non-default KMS key, specify a value for the **KMS key** parameter.
Create your launch template (console)

<table>
<thead>
<tr>
<th>If Encrypted parameter is set to...</th>
<th>And if source of volume is...</th>
<th>Then the default encryption state is...</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encrypted snapshot that is shared with you</td>
<td>Encrypted by default KMS key</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* If encryption by default is enabled, all newly created volumes (whether or not the Encrypted parameter is set to Yes) are encrypted using the default KMS key. If you set both the Encrypted and KMS key parameters, then you can specify a non-default KMS key.

i. **KMS key**: If you chose Yes for Encrypted, then you must select a customer managed key to use to encrypt the volume. If you have enabled encryption by default in this Region, the default customer managed key is selected for you. You can select a different key or specify the ARN of any customer managed key that you previously created using the AWS Key Management Service.

3. To specify additional volumes to attach to the instances launched by this launch template, choose Add new volume.

### Configure advanced settings for your launch template

You can define any additional capabilities that your Auto Scaling instances need. For example, you can choose an IAM role that your application can use when it accesses other AWS resources or specify the instance user data that can be used to perform common automated configuration tasks after an instance starts.

The following steps discuss the most useful settings to pay attention to. For more information about any of the settings under Advanced details, see [Creating a launch template](#) in the Amazon EC2 User Guide for Linux Instances.

**To configure advanced settings**

1. For Advanced details, expand the section to view the fields.

2. For Purchasing option, you can choose Request Spot Instances to request Spot Instances at the Spot price, capped at the On-Demand price, and choose Customize to change the default Spot Instance settings. For an Auto Scaling group, you must specify a one-time request with no end date (the default). For more information, see [Request Spot Instances for fault-tolerant and flexible applications](#) (p. 33).

   **Note**

   Amazon EC2 Auto Scaling lets you override the instance type in your launch template to create an Auto Scaling group that uses multiple instance types and launches Spot and On-Demand Instances. To do so, you must leave Purchasing option unspecified in your launch template.

   If you try to create a mixed instances group using a launch template with **Purchasing option** specified, you get the following error.

   Incompatible launch template: You cannot use a launch template that is set to request Spot Instances (InstanceMarketOptions) when you configure an Auto Scaling group with a mixed instances policy. Add a different launch template to the group and try again.

   For information about creating mixed instances groups, see [Auto Scaling groups with multiple instance types and purchase options](#) (p. 62).

3. For IAM instance profile, you can specify an AWS Identity and Access Management (IAM) instance profile to associate with the instances. When you choose an instance profile, you associate the corresponding IAM role with the EC2 instances. For more information, see [IAM role for applications that run on Amazon EC2 instances](#) (p. 417).
4. For **Termination protection**, choose whether to protect instances from accidental termination. When you enable termination protection, it provides additional termination protection, but it does not protect from Amazon EC2 Auto Scaling initiated termination. To control whether an Auto Scaling group can terminate a particular instance, use [Use instance scale-in protection](p. 282).

5. For **Detailed CloudWatch monitoring**, choose whether to enable the instances to publish metric data at 1-minute intervals to Amazon CloudWatch. Additional charges apply. For more information, see [Configure monitoring for Auto Scaling instances](p. 313).

6. For **Elastic inference**, choose an elastic inference accelerator to attach to your EC2 CPU instance. Additional charges apply. For more information, see [Working with Amazon Elastic Inference](p. 285) in the *Amazon Elastic Inference Developer Guide*.

7. For **T2/T3 Unlimited**, choose whether to enable applications to burst beyond the baseline for as long as needed. This field is only valid for T2, T3, and T3a instances. Additional charges may apply. For more information, see [Using an Auto Scaling group to launch a burstable performance instance as Unlimited](p. 285) in the *Amazon EC2 User Guide for Linux Instances*.

8. For **Placement group name**, you can specify a placement group in which to launch the instances. Not all instance types can be launched in a placement group. If you configure an Auto Scaling group using a CLI command that specifies a different placement group, the placement group for the Auto Scaling group takes precedence.

9. For **Capacity Reservation**, you can specify whether to launch the instances into shared capacity, any open Capacity Reservation, a specific Capacity Reservation, or a Capacity Reservation group. For more information, see [Use On-Demand Capacity Reservations to reserve capacity in specific Availability Zones](p. 329).

10. For **Tenancy**, you can choose to run your instances on shared hardware (**Shared**), on dedicated hardware (**Dedicated**), or when using a host resource group, on Dedicated Hosts (**Dedicated host**). Additional charges may apply.

    If you chose **Dedicated Hosts**, complete the following information:

    - For **Tenancy host resource group**, you can specify a host resource group for a BYOL AMI to use on Dedicated Hosts. You do not have to have already allocated Dedicated Hosts in your account before you use this feature. Your instances will automatically launch onto Dedicated Hosts regardless. Note that an AMI based on a license configuration association can be mapped to only one host resource group at a time. For more information, see [Host resource groups](p. 285) in the *AWS License Manager User Guide*.

11. For **License configurations**, specify the license configuration to use. You can launch instances against the specified license configuration to track your license usage. For more information, see [Create a license configuration](p. 285) in the *License Manager User Guide*.

12. To configure instance metadata options for all of the instances that are associated with this version of the launch template, do the following:

    a. For **Metadata accessible**, choose whether to enable or disable access to the HTTP endpoint of the instance metadata service. By default, the HTTP endpoint is enabled. If you choose to disable the endpoint, access to your instance metadata is turned off. You can specify the condition to require IMDSv2 only when the HTTP endpoint is enabled.

    b. For **Metadata version**, you can choose to require the use of Instance Metadata Service Version 2 (IMDSv2) when requesting instance metadata. If you do not specify a value, the default is to support both IMDSv1 and IMDSv2.

    c. For **Metadata token response hop limit**, you can set the allowable number of network hops for the metadata token. If you do not specify a value, the default is 1.

    For more information, see [Configuring the instance metadata service](p. 285) in the *Amazon EC2 User Guide for Linux Instances*.
13. For User data, you can add shell scripts and cloud-init directives to customize an instance at launch. For more information, see Run commands on your Linux instance at launch in the Amazon EC2 User Guide for Linux Instances.

   **Note**
   Running scripts at launch adds to the amount of time it takes for an instance to be ready for use. However, you can allow extra time for the scripts to complete before the instance enters the InService state by adding a lifecycle hook to the Auto Scaling group. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

14. Choose Create launch template.

15. To create an Auto Scaling group, choose Create Auto Scaling group from the confirmation page.

---

**Create a launch template from an existing instance (console)**

**To create a launch template from an existing instance**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation pane, under Instances, choose Instances.
3. Select the instance and choose Actions, Image and templates, Create template from instance.
4. Provide a name and description.
5. Under Auto Scaling guidance, select the check box.
6. Adjust any settings as required, and choose Create launch template.
7. To create an Auto Scaling group, choose Create Auto Scaling group from the confirmation page.

---

**Related resources**

For the procedures for creating an Auto Scaling group with a launch template, see Create Auto Scaling groups using launch templates (p. 58).

We also provide a few JSON and YAML template snippets that you can use to understand how to declare launch templates in your AWS CloudFormation stack templates. For more information, see the AWS::EC2::LaunchTemplate and Auto scaling template snippets sections of the AWS CloudFormation User Guide.

For more information about launch templates, see Launching an instance from a launch template in the Amazon EC2 User Guide for Linux Instances.

---

**Limitations**

- Amazon EC2 lets you configure a subnet in a launch template. However, the subnet settings of the Auto Scaling group take precedence over the subnet settings of the launch template.
- Because the subnet settings in your launch template are ignored in favor of what is specified in the Auto Scaling group, all of the network interfaces that are created for a given instance will be connected to the same subnet as the instance. For additional limitations on user-defined network interfaces, see Change the default network interface settings (p. 24).
- A launch template lets you configure additional settings in your Auto Scaling group to launch multiple instance types and combine On-Demand and Spot purchase options, as described in Auto Scaling groups with multiple instance types and purchase options (p. 62). Launching instances with such a combination is not supported if you specify a Spot Instance request in the launch template.
Support for Dedicated Hosts (host tenancy) is only available if you specify a host resource group. You cannot target a specific host ID or use host placement affinity.

Migrate to launch templates

Starting in 2023, launch configurations do not support any new Amazon EC2 instance types released after December 31, 2022. For more information, see Launch configurations (p. 46).

To migrate from a launch configuration to a launch template, see the following steps.

Important
Before you continue, confirm that you have the permissions required to work with launch templates. For more information, see Launch template support (p. 412).

Step 1: Find Auto Scaling groups that use launch configurations

To identify whether you have Auto Scaling groups that are still using launch configurations, run the following describe-auto-scaling-groups command using the AWS CLI. Replace REGION with your AWS Region.

```bash
aws autoscaling describe-auto-scaling-groups --region REGION \  
   --query 'AutoScalingGroups[?LaunchConfigurationName!=`null`]'`
```

The following is example output.

```json
[
   {
      "AutoScalingGroupName": "group-1",
      "AutoScalingGroupARN": "arn",
      "LaunchConfigurationName": "my-launch-config",
      "MinSize": 1,
      "MaxSize": 5,
      "DesiredCapacity": 2,
      "DefaultCooldown": 300,
      "AvailabilityZones": ["us-west-2a", "us-west-2b", "us-west-2c"],
      "LoadBalancerNames": [],
      "TargetGroupARNs": [],
      "HealthCheckType": "EC2",
      "HealthCheckGracePeriod": 300,
      "Instances": [
         {
            "ProtectedFromScaleIn": false,
            "AvailabilityZone": "us-west-2a",
            "LaunchConfigurationName": "my-launch-config",
            "InstanceId": "i-05b4f7d5be4822a6",
            "InstanceType": "t3.micro",
            "HealthStatus": "Healthy",
            "LifecycleState": "InService"
         },
         {
            "ProtectedFromScaleIn": false,
Step 1: Find Auto Scaling groups that use launch configurations

... additional groups ...

Alternatively, to remove everything except the Auto Scaling group names with the names of their respective launch configurations and tags in the output, run the following command:

```
aws autoscaling describe-auto-scaling-groups --region REGION \  
--query 'AutoScalingGroups[?LaunchConfigurationName!=`null`].{AutoScalingGroupName: AutoScalingGroupName, LaunchConfigurationName: LaunchConfigurationName, Tags: Tags}'
```

The following shows example output.

```
[  
  {  
    "AutoScalingGroupName": "group-1",  
    "LaunchConfigurationName": "my-launch-config",  
    "Tags": [  
      {  
        "ResourceId": "group-1",  
        "ResourceType": "auto-scaling-group",  
        "Key": "environment",  
        "Value": "production",  
        "PropagateAtLaunch": true  
      }  
    ],  
    "TerminationPolicies": [  
      "Default"  
    ],  
    "NewInstancesProtectedFromScaleIn": false,  
    "ServiceLinkedRoleARN": "arn"  
  },  
  ... additional groups ...
]
```

For more information about filtering, see Filtering AWS CLI output in the AWS Command Line Interface User Guide.
Step 2: Copy a launch configuration to a launch template

You can copy a launch configuration to a launch template using the following procedure. Then, you can add it to your Auto Scaling group.

Copying multiple launch configurations results in identically named launch templates. To change the name given to a launch template during the copying process, you must copy the launch configurations one by one.

Note
The copying feature is available only from the console.

To copy a launch configuration to a launch template (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the left navigation pane, under Auto Scaling, choose Auto Scaling Groups.
3. Choose Launch configurations near the top of the page. When prompted for confirmation, choose View launch configurations to confirm that you want to view the Launch configurations page.
4. Select the launch configuration you want to copy and choose Copy to launch template, Copy selected. This sets up a new launch template with the same name and options as the launch configuration that you selected.
5. For New launch template name, you can use the name of the launch configuration (the default) or enter a new name. Launch template names must be unique.
6. (Optional) Select Create an Auto Scaling group using the new template.
   You can skip this step to finish copying the launch configuration. You do not need to create a new Auto Scaling group.
7. Choose Copy.

To copy all launch configurations to launch templates (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation pane, under Auto Scaling, choose Launch Configurations.
3. Choose Copy to launch template, Copy all. This copies each launch configuration in the current Region to a new launch template with the same name and options.
4. Choose Copy.

Step 3: Update an Auto Scaling group to use a launch template

After creating a launch template, you're ready to add it to your Auto Scaling group.

To update an Auto Scaling group to use a launch template (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom part of the page, showing information about the group that's selected.
3. On the Details tab, choose Launch configuration, Edit.
4. Choose Switch to launch template.
5. For Launch template, select your launch template.
6. For Version, select the launch template version, as needed. After you create versions of a launch template, you can choose whether the Auto Scaling group uses the default or the latest version of the launch template when scaling out.
7. Choose Update.

To update an Auto Scaling group to use a launch template (AWS CLI)

The following update-auto-scaling-group command updates the specified Auto Scaling group to use the initial version of the specified launch template.

```bash
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \
   --launch-template LaunchTemplateName=my-template-for-auto-scaling,Version='1'
```

For more examples of using CLI commands to update an Auto Scaling group to use a launch template, see Update an Auto Scaling group to use a launch template (p. 41).

**Step 4: Replace your instances**

After you replace the launch configuration with a launch template, any new instances will use the new launch template. Existing instances are not affected.

To update the existing instances, you can start an instance refresh to replace the instances in your Auto Scaling group instead of manually replacing instances a few at a time. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101). If the group is large, an instance refresh can be particularly helpful.

Alternatively, you can allow automatic scaling to gradually replace existing instances with new instances based on the group’s termination policies (p. 272), or you can terminate them. Manual termination forces your Auto Scaling group to launch new instances to maintain the group’s desired capacity. For more information, see Terminate an instance in the Amazon EC2 User Guide for Linux Instances.

**Additional information**

For more information about migrating to launch templates, see Amazon EC2 Auto Scaling will no longer add support for new EC2 features to Launch Configurations on the AWS Compute Blog.

For a topic that takes you through how to migrate AWS CloudFormation stacks from launch configurations to launch templates, see Migrate AWS CloudFormation stacks from launch configurations to launch templates (p. 336).

For instructions that show you how to create a new launch template for Amazon EC2 Auto Scaling from the console, see Create a launch template for an Auto Scaling group (p. 22).

**Request Spot Instances for fault-tolerant and flexible applications**

In your launch template, you can optionally request Spot Instances with no end date or duration. Amazon EC2 Spot Instances are spare capacity available at steep discounts compared to the EC2
On-Demand price. Spot Instances are a cost-effective choice if you can be flexible about when your applications run and if your applications can be interrupted. For more information about creating a launch template that requests Spot Instances, see Configure advanced settings for your launch template (p. 27).

Important
Spot Instances are typically used to supplement On-Demand Instances. For this scenario, you can specify the same settings that are used to launch Spot Instances as part of the settings of your Auto Scaling group. When you specify the settings as part of the Auto Scaling group, you can request to launch Spot Instances only after launching a certain number of On-Demand Instances and then continue to launch some combination of On-Demand Instances and Spot Instances as the group scales. For more information, see Auto Scaling groups with multiple instance types and purchase options (p. 62).

This topic describes how to launch only Spot Instances in your Auto Scaling group by specifying settings in a launch template, rather than in the Auto Scaling group itself. The information in this topic also applies to Auto Scaling groups that request Spot Instances with a launch configuration (p. 46). The difference is that a launch configuration requires a maximum price, but for launch templates, the maximum price is optional.

When you create a launch template to launch only Spot Instances, keep the following considerations in mind:

- **Spot price.** You pay only the current Spot price for the Spot Instances that you launch. This pricing changes slowly over time based on long-term trends in supply and demand. For more information, see Spot Instances and Pricing and savings in the Amazon EC2 User Guide for Linux Instances.
- **Setting your maximum price.** You can optionally include a maximum price per hour for Spot Instances in your launch template. If your maximum price exceeds the current Spot price, the Amazon EC2 Spot service fulfills your request immediately if capacity is available. If the price for Spot Instances rises above your maximum price for a running instance in your Auto Scaling group, it terminates your instance.

  **Warning**

  Your application might not run if you do not receive any Spot Instances, such as when your maximum price is too low. To take advantage of the Spot Instances available for as long as possible, set your maximum price close to the On-Demand price.

- **Balancing across Availability Zones.** If you specify multiple Availability Zones, Amazon EC2 Auto Scaling distributes the Spot requests across the specified zones. If your maximum price is too low in one Availability Zone for any requests to be fulfilled, Amazon EC2 Auto Scaling checks whether requests were fulfilled in the other zones. If so, Amazon EC2 Auto Scaling cancels the requests that failed and redistributes them across the Availability Zones that have requests fulfilled. If the price in an Availability Zone with no fulfilled requests drops enough that future requests succeed, Amazon EC2 Auto Scaling rebalances across all of the Availability Zones.

- **Spot Instance termination.** Spot Instances can be terminated at any time. The Amazon EC2 Spot service can terminate Spot Instances in your Auto Scaling group as the availability of, or price for, Spot Instances changes. When scaling or performing health checks, Amazon EC2 Auto Scaling can also terminate Spot Instances in the same way that it can terminate On-Demand Instances. When an instance is terminated, any storage is deleted.

- **Maintaining your desired capacity.** When a Spot Instance is terminated, Amazon EC2 Auto Scaling attempts to launch another Spot Instance to maintain the desired capacity for the group. If the current Spot price is less than your maximum price, it launches a Spot Instance. If the request for a Spot Instance is unsuccessful, it keeps trying.

- **Changing your maximum price.** To change your maximum price, create a new launch template or update an existing launch template with the new maximum price, and then associate it with your Auto Scaling group. The existing Spot Instances continue to run as long as the maximum price specified in the launch template used for those instances is higher than the current Spot price. If you did not set a maximum price, the default maximum price is the On-Demand price.
Examples for creating and managing launch templates with the AWS Command Line Interface (AWS CLI)

You can create and manage launch templates through the AWS Management Console, AWS CLI, or SDKs. This section shows you examples of creating and managing launch templates for Amazon EC2 Auto Scaling from the AWS CLI.

Contents

- Example usage (p. 35)
- Create a basic launch template (p. 36)
- Specify tags that tag instances at launch (p. 36)
- Specify an IAM role to pass to instances (p. 37)
- Assign public IP addresses (p. 37)
- Specify a user data script that configures instances at launch (p. 37)
- Specify a block device mapping (p. 37)
- Specify Dedicated Hosts to bring software licenses from external vendors (p. 38)
- Specify an existing network interface (p. 38)
- Create multiple network interfaces (p. 38)
- Manage your launch templates (p. 39)
- Update an Auto Scaling group to use a launch template (p. 41)

Example usage

```json
{
    "LaunchTemplateName": "my-template-for-auto-scaling",
    "VersionDescription": "test description",
    "LaunchTemplateData": {
        "ImageId": "ami-04d5cc9b8example",
        "InstanceType": "t2.micro",
        "SecurityGroupIds": [
            "sg-903004f88example"
        ],
        "KeyName": "MyKeyPair",
        "Monitoring": {
            "Enabled": true
        },
        "Placement": {
            "Tenancy": "dedicated"
        },
        "CreditSpecification": {
            "CpuCredits": "unlimited"
        },
        "MetadataOptions": {
            "HttpTokens": "required",
            "HttpPutResponseHopLimit": 1,
            "HttpEndpoint": "enabled"
        }
    }
}
```
Create a basic launch template

To create a basic launch template, use the `create-launch-template` command as follows, with these modifications:

- Replace `ami-04d5cc9b88example` with the ID of the AMI from which to launch the instances.
- Replace `t2.micro` with an instance type that is compatible with the AMI that you specified.

This example creates a launch template with the name `my-template-for-auto-scaling`. If the instances created by this launch template 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.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"ImageId":"ami-04d5cc9b88example","InstanceType":"t2.micro"}'
```

For more information about quoting JSON-formatted parameters, see Using quotation marks with strings in the AWS CLI in the AWS Command Line Interface User Guide.

Alternatively, you can specify the JSON-formatted parameters in a configuration file.

The following example creates a basic launch template, referencing a configuration file for launch template parameter values.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data file://config.json
```

Contents of `config.json`:

```
{
    "ImageId": "ami-04d5cc9b88example",
    "InstanceType": "t2.micro"
}
```

Specify tags that tag instances at launch

The following example adds a tag (for example, `purpose=webserver`) to instances at launch.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"TagSpecifications": [{"ResourceType": "instance", "Tags": [{"Key": "purpose", "Value": "webserver"}]}], "ImageId": "ami-04d5cc9b88example", "InstanceType": "t2.micro"}'}
```

**Note**

If you specify instance tags in your launch template and then you choose to propagate your Auto Scaling group's tags to its instances, all the tags are merged. If the same tag key is specified for a tag in your launch template and a tag in your Auto Scaling group, then the tag value from the group takes precedence.
Specify an IAM role to pass to instances

The following example specifies the name of the instance profile associated with the IAM role to pass to instances at launch. For more information, see IAM role for applications that run on Amazon EC2 instances (p. 417).

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description 'version1' --launch-template-data '{"IamInstanceProfile":{"Name": "my-instance-profile"}, "ImageId": "ami-04d5cc9b88example", "InstanceType": "t2.micro"}'
```

Assign public IP addresses

The following create-launch-template example configures the launch template to assign public addresses to instances launched in a nondefault VPC.

**Note**

When you specify a network interface, 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 subnets as properties of the Auto Scaling group.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description 'version1' --launch-template-data '{NetworkInterfaces:[{"DeviceIndex":0,"AssociatePublicIpAddress":true,"Groups": ["sg-903004f88example"], "DeleteOnTermination": true} ], "ImageId": "ami-04d5cc9b88example", "InstanceType": "t2.micro"}'
```

Specify a user data script that configures instances at launch

The following example specifies a user data script as a base64-encoded string that configures instances at launch. The create-launch-template command requires base64-encoded user data.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description 'version1' --launch-template-data '{"UserData": "IyEvYmluL2Jhc...", "ImageId": "ami-04d5cc9b88example", "InstanceType": "t2.micro"}"
```

Specify a block device mapping

The following create-launch-template example creates a launch template with a block device mapping: a 22-gigabyte EBS volume mapped to /dev/xvdcz. The /dev/xvdcz volume uses the General Purpose SSD (gp2) volume type and is deleted when terminating the instance it is attached to.

```
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description 'version1' --launch-template-data '{"BlockDeviceMappings": [{"DeviceName": "/dev/xvdcz", "Ebs": {"VolumeSize": 22, "VolumeType": "gp2", "DeleteOnTermination": true } }], "ImageId": "ami-04d5cc9b88example", "InstanceType": "t2.micro"}'
```
Specify Dedicated Hosts to bring software licenses from external vendors

If you specify host tenancy, you can specify a host resource group and a License Manager license configuration to bring eligible software licenses from external vendors. Then, you can use the licenses on EC2 instances by using the following `create-launch-template` command.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"Placement":{"Tenancy":"host","HostResourceGroupArn":"arn"},"LicenseSpecifications": [{"LicenseConfigurationArn":"arn"},"ImageId":"ami-04d5cc9b88example","InstanceType":"t2.micro"}
```

Specify an existing network interface

The following `create-launch-template` example configures the primary network interface to use an existing network interface.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"NetworkInterfaces":[{"DeviceIndex":0,"NetworkInterfaceId":"eni-b9a5ac93","DeleteOnTermination":false}],"ImageId":"ami-04d5cc9b88example","InstanceType":"t2.micro"}
```

Create multiple network interfaces

The following `create-launch-template` example adds a secondary network interface. The primary network interface has a device index of 0, and the secondary network interface has a device index of 1.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"NetworkInterfaces":[{"DeviceIndex":0,"Groups":["sg-903004f88example"],"DeleteOnTermination":true},{"DeviceIndex":1,"Groups":["sg-903004f88example"],"DeleteOnTermination":true}],"ImageId":"ami-04d5cc9b88example","InstanceType":"t2.micro"}
```

If you use an instance type that supports multiple network cards and Elastic Fabric Adapters (EFAs), you can add a secondary interface to a secondary network card and enable EFA by using the following `create-launch-template` command. For more information, see Adding an EFA to a launch template in the Amazon EC2 User Guide for Linux Instances.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 --launch-template-data '{"NetworkInterfaces":[{"NetworkCardIndex":0,"DeviceIndex":0,"Groups":["sg-7c2270198example"],"DeleteOnTermination":true}, {"NetworkCardIndex":1,"DeviceIndex":1,"Groups":["sg-7c2270198example"],"DeleteOnTermination":true}],"ImageId":"ami-09d95fab7fexample","InstanceType":"p4d.24xlarge"}
```

**Warning**
The p4d.24xlarge instance type incurs higher costs than the other examples in this section. For more information about pricing for P4d instances, see Amazon EC2 P4d Instances pricing.

**Note**
Attaching multiple network interfaces from the same subnet to an instance can introduce asymmetric routing, especially on instances using a variant of non-Amazon Linux. If you need this type of configuration, you must configure the secondary network interface within the OS.
For an example, see How can I make my secondary network interface work in my Ubuntu EC2 instance? in the AWS Knowledge Center.

## Manage your launch templates

The AWS CLI includes several other commands that help you manage your launch templates.

### Contents

- List and describe your launch templates (p. 39)
- Create a launch template version (p. 40)
- Delete a launch template version (p. 40)
- Delete a launch template (p. 40)

### List and describe your launch templates

You can use two AWS CLI commands to get information about your launch templates: describe-launch-templates and describe-launch-template-versions.

The describe-launch-templates command enables you to get a list of any of the launch templates that you have created. You can use an option to filter results on a launch template name, create time, tag key, or tag key-value combination. This command returns summary information about any of your launch templates, including the launch template identifier, latest version, and default version.

The following example provides a summary of the specified launch template.

```
aws ec2 describe-launch-templates --launch-template-names my-template-for-auto-scaling
```

The following is an example response.

```
{
   "LaunchTemplates": [
      {
         "LaunchTemplateId": "lt-068f72b729example",
         "LaunchTemplateName": "my-template-for-auto-scaling",
         "CreateTime": "2020-02-28T19:52:27.000Z",
         "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
         "DefaultVersionNumber": 1,
         "LatestVersionNumber": 1
      }
   ]
}
```

If you don't use the --launch-template-names option to limit the output to one launch template, information on all of your launch templates is returned.

The following describe-launch-template-versions command provides information describing the versions of the specified launch template.

```
aws ec2 describe-launch-template-versions --launch-template-id lt-068f72b729example
```

The following is an example response.

```
{
   "LaunchTemplateVersions": [
      {
         "VersionDescription": "version1",
         "VersionNumber": 1
      }
   ]
}
```
Create a launch template version

The following `create-launch-template-version` command creates a new launch template version based on version 1 of the launch template and specifies a different AMI ID.

```
aws ec2 create-launch-template-version --launch-template-id lt-068f72b729example --version-description version2 --source-version 1 --launch-template-data "ImageId=ami-c998b6b2example"
```

To set the default version of the launch template, use the `modify-launch-template` command.

Delete a launch template version

The following `delete-launch-template-versions` command deletes the specified launch template version.

```
aws ec2 delete-launch-template-versions --launch-template-id lt-068f72b729example --versions 1
```

Delete a launch template

If you no longer require a launch template, you can delete it using the following `delete-launch-template` command. Deleting a launch template deletes all of its versions.

```
aws ec2 delete-launch-template --launch-template-id lt-068f72b729example
```
Update an Auto Scaling group to use a launch template

You can use the `update-auto-scaling-group` command to add a launch template to an existing Auto Scaling group.

**Note**
If you switch your Auto Scaling group from using a launch configuration, be sure that your permissions are up to date. In order to use a launch template, you need specific permissions.

Update an Auto Scaling group to use the latest version of a launch template

The following `update-auto-scaling-group` command updates the specified Auto Scaling group to use the latest version of the specified launch template.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg
   --launch-template LaunchTemplateId=lt-068f72b729example,Version='$Latest'
```

Update an Auto Scaling group to use a specific version of a launch template

The following `update-auto-scaling-group` command updates the specified Auto Scaling group to use a specific version of the specified launch template.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg
   --launch-template LaunchTemplateName=my-template-for-auto-scaling,Version='2'
```

Using AWS Systems Manager parameters instead of AMI IDs in launch templates

Amazon EC2 Auto Scaling supports using AWS Systems Manager parameters that reference Amazon Machine Image (AMI) IDs in launch templates. With Systems Manager parameters, you can update your Auto Scaling groups to use new AMI IDs without needing to create new launch templates or new versions of launch templates each time an AMI ID changes. These IDs can change regularly, such as when an AMI is updated with the latest operating system or software updates.

You can create, update, or delete your Systems Manager parameters using the Parameter Store, a capability of AWS Systems Manager. You must create a Systems Manager parameter before you can use it in a launch template. To get started, create a parameter with the data type `aws:ec2:image`, and for its value, enter the ID of an AMI. The AMI ID has the form `ami-<identifier>`, for example, `ami-123example456`. The correct AMI ID depends on the instance type and AWS Region that you're launching your Auto Scaling group in.

**Important**
To specify Systems Manager parameters in launch templates, you must have permission to use the `ssm:GetParameters` action. You also need permission to use the `ssm:GetParameters` action to use a launch template that specifies a Systems Manager parameter. This allows the parameter value to be validated. For example IAM policies, see [Restricting access to Systems Manager parameters using IAM policies](https://docs.aws.amazon.com/systems-manager/latest/userguide/restrict-access-systems-manager-parameters-using-iam-policies.html) in the *AWS Systems Manager User Guide*.

For more information, see the following resources:
To create a parameter in the console, see Create a Systems Manager parameter (console) in the AWS Systems Manager User Guide.

To create a parameter with the AWS CLI, see Create a Systems Manager parameter (AWS CLI) in the AWS Systems Manager User Guide.

To create parameter versions and labels, see Working with parameter versions and Working with parameter labels in the AWS Systems Manager User Guide.

For information about making sure that the parameter value you enter is a valid AMI ID, see Native parameter support for Amazon Machine Image IDs in the AWS Systems Manager User Guide.

For more information about using parameters that reference AMI IDs in launch templates, see Use a Systems Manager parameter instead of an AMI ID in the Amazon EC2 User Guide for Linux Instances.

You can also reference AWS Systems Manager public parameters for public AMIs maintained by AWS in your launch templates. To learn how to reference these public parameters, see Find the latest Amazon Linux AMI using Systems Manager in the Amazon EC2 User Guide for Linux Instances and Find the latest Amazon Linux AMI using Systems Manager in the Amazon EC2 User Guide for Windows Instances.

Console

To create a launch template using an AWS Systems Manager parameter

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. In the navigation pane, choose Launch Templates, and then choose Create launch template.
3. For Launch template name, enter a descriptive name for the launch template.
4. Under Application and OS Images (Amazon Machine Image), choose Browse more AMIs.
5. Choose the arrow button to the right of the search bar, and then choose Specify custom value/Systems Manager parameter.
6. In the Specify custom value or Systems Manager parameter dialog box, do the following:
   a. For AMI ID or Systems Manager parameter string, enter the Systems Manager parameter name using one of the following formats:
      - resolve:ssm:parameter-name
      - resolve:ssm:parameter-name:version-number
      - resolve:ssm:parameter-name:label
      - resolve:ssm:public-parameter
   b. Choose Save.
7. Specify any other launch template parameters as needed, and then choose Create launch template.

For more information about creating a launch template from the console, see Create a launch template for an Auto Scaling group (p. 22).

AWS CLI

Example launch template that specifies a customer-owned parameter

1. Use the following syntax: resolve:ssm:parameter-name, where resolve:ssm is the standard prefix and parameter-name is the Systems Manager parameter name.

The following example creates a launch template that gets the AMI ID from an existing Systems Manager parameter named golden-ami.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling
```

42
Using Systems Manager parameters instead of AMI IDs

--launch-template-data file://config.json

Contents of config.json:

```
{
    "ImageId": "resolve:ssm:golden-ami",
    "InstanceType": "t2.micro"
}
```

The default version of the parameter, if it is not specified, is the latest version.

The following example references a specific version of the golden-ami parameter. The example uses version 3 of the golden-ami parameter, but you can use any valid version number.

```
{
    "ImageId": "resolve:ssm:golden-ami:3",
    "InstanceType": "t2.micro"
}
```

The following similar example references the parameter label prod that maps to a specific version of the golden-ami parameter.

```
{
    "ImageId": "resolve:ssm:golden-ami:prod",
    "InstanceType": "t2.micro"
}
```

The following is example output.

```
{
    "LaunchTemplate": {
        "LaunchTemplateId": "lt-068f72b724example",
        "LaunchTemplateName": "my-template-for-auto-scaling",
        "CreateTime": "2022-12-27T17:11:21.000Z",
        "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
        "DefaultVersionNumber": 1,
        "LatestVersionNumber": 1
    }
}
```

2. To confirm that the launch template gets your preferred AMI ID, use the `describe-launch-template-versions` command. The command uses the `--resolve-alias` option to resolve the parameter to the actual AMI ID.

```
aws ec2 describe-launch-template-versions --launch-template-name my-template-for-auto-scaling
--versions $Default --resolve-alias
```

The example returns the AMI ID for ImageId. When an instance is launched using this launch template, the AMI ID resolves to ami-04d5cc9b88example.

```
{
    "LaunchTemplateVersions": [
        {
            "LaunchTemplateId": "lt-068f72b724example",
            "LaunchTemplateName": "my-template-for-auto-scaling",
```

43
Example launch template that specifies an AWS-owned public parameter

1. Use the following syntax: `resolve:ssm:public-parameter`, where `resolve:ssm` is the standard prefix and `public-parameter` is the path and name of the public parameter.

   In this example, the launch template uses an AWS-provided public parameter to launch instances using the latest Amazon Linux 2 AMI in the AWS Region that is configured for your profile.

   ```
   aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling
   --version-description version1
   --launch-template-data file://config.json
   ```

   Contents of `config.json`:

   ```
   {
     "ImageId": "resolve:ssm:/aws/service/ami-amazon-linux-latest/amzn2-ami-hvm-x86_64-gp2",
     "InstanceType": "t2.micro"
   }
   ```

   The following is an example response.

   ```
   {
     "LaunchTemplate": {
       "LaunchTemplateId": "lt-089c023a30example",
       "LaunchTemplateName": "my-template-for-auto-scaling",
       "CreateTime": "2022-12-28T19:52:27.000Z",
       "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
       "DefaultVersionNumber": 1,
       "LatestVersionNumber": 1
     }
   }
   ```

2. To confirm that the launch template gets the correct AMI ID, use the `describe-launch-template-versions` command. The command uses the `--resolve-alias` option to resolve the parameter to the actual AMI ID.

   ```
   aws ec2 describe-launch-template-versions --launch-template-name my-template-for-auto-scaling
   --versions $Default --resolve-alias
   ```

   The example returns the AMI ID for `ImageId`. When an instance is launched using this launch template, the AMI ID resolves to `ami-0ac394d6a3example`. 
Limitations

- Currently, you cannot use a launch template that specifies a Systems Manager parameter instead of an AMI ID on an Auto Scaling group with a mixed instances policy (p. 62).
- The Systems Manager Parameter Store parameters that you create must exist in the same account that the instances are run in.
- Amazon EC2 Auto Scaling only supports specifying AMI IDs as parameters.
- While your Auto Scaling group has a launch template that references a parameter instead of an AMI ID, you cannot start an instance refresh that specifies a desired configuration or uses skip matching to replace the instances in the group.
- On each call to create or update your Auto Scaling group, Amazon EC2 Auto Scaling will resolve the Systems Manager parameter in the launch template. If you are using advanced parameters or higher throughput limits, the frequent calls to the Parameter Store (that is, the GetParameters operation) can increase your costs for Systems Manager because charges are incurred per Parameter Store API interaction. For more information, see AWS Systems Manager pricing.
Launch configurations

Important
Launch configurations no longer add support for new Amazon EC2 instance types that are released after December 31, 2022. In addition, any new accounts created on or after June 1, 2023 will not have the option to create new launch configurations through the console. However, API, CLI, and CloudFormation access will be available to new accounts created between June 1, 2023 and December 31, 2023 to support customers with automation use cases. New accounts created on or after January 1, 2024 will not be able to create new launch configurations by using the console, API, CLI, and CloudFormation. For information about migrating your Auto Scaling groups to launch templates, see Migrate to launch templates (p. 30).

A launch configuration is an instance configuration template that an Auto Scaling group uses to launch EC2 instances. When you create a launch configuration, you specify information for the instances. Include the ID of the Amazon Machine Image (AMI), the instance type, a key pair, one or more security groups, and a block device mapping. If you’ve launched an EC2 instance before, you specified the same information in order to launch the instance.

You can specify your launch configuration with multiple Auto Scaling groups. However, you can only specify one launch configuration for an Auto Scaling group at a time, and you can’t modify a launch configuration after you’ve created it. To change the launch configuration for an Auto Scaling group, you must create a launch configuration and then update your Auto Scaling group with it.

Contents
- Create a launch configuration (p. 46)
- Create a launch configuration using an EC2 instance (p. 50)
- Change the launch configuration for an Auto Scaling group (p. 53)
- Configure instance tenancy with a launch configuration (p. 54)

Create a launch configuration

Important
Launch configurations no longer add support for new Amazon EC2 instance types that are released after December 31, 2022. In addition, any new accounts created on or after June 1, 2023 will not have the option to create new launch configurations through the console. However, API, CLI, and CloudFormation access will be available to new accounts created between June 1, 2023 and December 31, 2023 to support customers with automation use cases. New accounts created on or after January 1, 2024 will not be able to create new launch configurations by using the console, API, CLI, and CloudFormation. For information about migrating your Auto Scaling groups to launch templates, see Migrate to launch templates (p. 30).

When you create a launch configuration, you must specify information about the EC2 instances to launch. Include the Amazon Machine Image (AMI), instance type, key pair, security groups, and block device mapping. Alternatively, you can create a launch configuration using attributes from a running EC2 instance. For more information, see Create a launch configuration using an EC2 instance (p. 50).

After you create a launch configuration, you can create an Auto Scaling group. For more information, see Create an Auto Scaling group using a launch configuration (p. 93).
An Auto Scaling group is associated with one launch configuration at a time, and you can't modify a launch configuration after you've created it. Therefore, if you want to change the launch configuration for an existing Auto Scaling group, you must update it with the new launch configuration. For more information, see Change the launch configuration for an Auto Scaling group (p. 53).

Contents
- Create a launch configuration (console) (p. 47)
- Create a launch configuration (AWS CLI) (p. 48)
- Configure the instance metadata options (p. 48)

Create a launch configuration (console)

To create a launch configuration (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the top navigation bar, select your AWS Region.
3. On the left navigation pane, under Auto Scaling, choose Auto Scaling Groups.
4. Choose Launch configurations near the top of the page. When prompted for confirmation, choose View launch configurations to confirm that you want to view the Launch configurations page.
5. Choose Create launch configuration, and enter a name for your launch configuration.
6. For Amazon machine image (AMI), choose an AMI. To find a specific AMI, you can find a suitable AMI, make note of its ID, and enter the ID as search criteria.

To get the ID of the Amazon Linux 2 AMI:
   a. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
   b. On the left navigation pane, under Instances, choose Instances, and then choose Launch instances.
   c. On the Quick Start tab of the Choose an Amazon Machine Image page, note the ID of the AMI next to Amazon Linux 2 AMI (HVM).
7. For Instance type, select a hardware configuration for your instances.
8. Under Additional configuration, pay attention to the following fields:
   a. (Optional) For Purchasing option, you can choose Request Spot Instances to request Spot Instances at the Spot price, capped at the On-Demand price. Optionally, you can specify a maximum price per instance hour for your Spot Instances.
      
      **Note**
      
      Spot Instances are a cost-effective choice compared to On-Demand Instances, if you can be flexible about when your applications run and if your applications can be interrupted. For more information, see Request Spot Instances for fault-tolerant and flexible applications (p. 33).
   b. (Optional) For IAM instance profile, choose a role to associate with the instances. For more information, see IAM role for applications that run on Amazon EC2 instances (p. 417).
   c. (Optional) For Monitoring, choose whether to enable the instances to publish metric data at 1-minute intervals to Amazon CloudWatch by enabling detailed monitoring. Additional charges apply. For more information, see Configure monitoring for Auto Scaling instances (p. 313).
   d. (Optional) For Advanced details, User data, you can specify user data to configure an instance during launch, or to run a configuration script after the instance starts.
   e. (Optional) For Advanced details, IP address type, choose whether to assign a public IP address to the group's instances. If you do not set a value, the default is to use the auto-assign public IP settings of the subnets that your instances are launched into.

47
9. (Optional) For Storage (volumes), if you don't need additional storage, you can skip this section. Otherwise, to specify volumes to attach to the instances in addition to the volumes specified by the AMI, choose Add new volume. Then choose the desired options and associated values for Devices, Snapshot, Size, Volume type, IOPS, Throughput, Delete on termination, and Encrypted.

10. For Security groups, create or select the security group to associate with the group's instances. If you leave the Create a new security group option selected, a default SSH rule is configured for Amazon EC2 instances running Linux. A default RDP rule is configured for Amazon EC2 instances running Windows.

11. For Key pair (login), choose an option under Key pair options.

   If you've already configured an Amazon EC2 instance key pair, you can choose it here.

   If you don't already have an Amazon EC2 instance key pair, choose Create a new key pair and give it a recognizable name. Choose Download key pair to download the key pair to your computer.

   **Important**
   If you need to connect to your instances, do not choose Proceed without a key pair.

12. Select the acknowledgment check box, and then choose Create launch configuration.

Create a launch configuration (AWS CLI)

To create a launch configuration using the command line

You can use one of the following commands:

- `create-launch-configuration` (AWS CLI)
- `New-ASLaunchConfiguration` (AWS Tools for Windows PowerShell)

Configure the instance metadata options

Amazon EC2 Auto Scaling supports configuring the Instance Metadata Service (IMDS) in launch configurations. This gives you the option of using launch configurations to configure the Amazon EC2 instances in your Auto Scaling groups to require Instance Metadata Service Version 2 (IMDSv2), which is a session-oriented method for requesting instance metadata. For details about IMDSv2's advantages, see this article on the AWS Blog about enhancements to add defense in depth to the EC2 instance metadata service.

You can configure IMDS to support both IMDSv2 and IMDSv1 (the default), or to require the use of IMDSv2. If you are using the AWS CLI or one of the SDKs to configure IMDS, you must use the latest version of the AWS CLI or the SDK to require the use of IMDSv2.

You can configure your launch configuration for the following:

- Require the use of IMDSv2 when requesting instance metadata
- Specify the PUT response hop limit
- Turn off access to instance metadata

You can find more details on configuring the Instance Metadata Service in the following topic: Configuring the instance metadata service in the Amazon EC2 User Guide for Linux Instances.

Use the following procedure to configure IMDS options in a launch configuration. After you create your launch configuration, you can associate it with your Auto Scaling group. If you associate the launch
configuration with an existing Auto Scaling group, the existing launch configuration is disassociated from
the Auto Scaling group, and existing instances will require replacement to use the IMDS options that you
specified in the new launch configuration. For more information, see Change the launch configuration for
an Auto Scaling group (p. 53).

To configure IMDS in a launch configuration (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the top navigation bar, select your AWS Region.
3. On the left navigation pane, under Auto Scaling, choose Auto Scaling Groups.
4. Choose Launch configurations near the top of the page. When prompted for confirmation, choose
View launch configurations to confirm that you want to view the Launch configurations page.
5. Choose Create launch configuration, and create the launch configuration the usual way. Include the
ID of the Amazon Machine Image (AMI), the instance type, and optionally, a key pair, one or more
security groups, and any additional EBS volumes or instance store volumes for your instances.
6. To configure instance metadata options for all of the instances associated with this launch
configuration, in Additional configuration, under Advanced details, do the following:
   a. For Metadata accessible, choose whether to enable or disable access to the HTTP endpoint
      of the instance metadata service. By default, the HTTP endpoint is enabled. If you choose
to disable the endpoint, access to your instance metadata is turned off. You can specify the
      condition to require IMDSv2 only when the HTTP endpoint is enabled.
   b. For Metadata version, you can choose to require the use of Instance Metadata Service Version
      2 (IMDSv2) when requesting instance metadata. If you do not specify a value, the default is to
      support both IMDSv1 and IMDSv2.
   c. For Metadata token response hop limit, you can set the allowable number of network hops for
      the metadata token. If you do not specify a value, the default is 1.
7. When you have finished, choose Create launch configuration.

To require the use of IMDSv2 in a launch configuration using the AWS CLI

Use the following create-launch-configuration command with --metadata-options set to
HttpTokens=required. When you specify a value for HttpTokens, you must also set HttpEndpoint
to enabled. Because the secure token header is set to required for metadata retrieval requests, this opts
in the instance to require using IMDSv2 when requesting instance metadata.

```bash
aws autoscaling create-launch-configuration \
   --launch-configuration-name my-lc-with-imdsv2 \ 
   --image-id ami-01e24be29428c15b2 \ 
   --instance-type t2.micro \ 
   ... \ 
   --metadata-options "HttpEndpoint=enabled,HttpTokens=required"
```

To turn off access to instance metadata

Use the following create-launch-configuration command to turn off access to instance metadata. You
can turn access back on later by using the modify-instance-metadata-options command.

```bash
aws autoscaling create-launch-configuration \
   --launch-configuration-name my-lc-with-imds-disabled \ 
   --image-id ami-01e24be29428c15b2 \ 
   --instance-type t2.micro \ 
   ... \ 
   --metadata-options "HttpEndpoint=disabled"
```
Create a launch configuration using an EC2 instance

Important
We provide information about launch configurations for customers who have not yet migrated from launch configurations to launch templates. For information about migrating your Auto Scaling groups to launch templates, see Migrate to launch templates (p. 30).

Amazon EC2 Auto Scaling provides you with an option to create a launch configuration using the attributes from a running EC2 instance.

If the specified instance has properties that are not currently supported by launch configurations, the instances launched by the Auto Scaling group might not be identical to the original EC2 instance.

There are differences between creating a launch configuration from scratch and creating a launch configuration from an existing EC2 instance. When you create a launch configuration from scratch, you specify the image ID, instance type, optional resources (such as storage devices), and optional settings (like monitoring). When you create a launch configuration from a running instance, Amazon EC2 Auto Scaling derives attributes for the launch configuration from the specified instance. Attributes are also derived from the block device mapping for the AMI from which the instance was launched, ignoring any additional block devices that were added after launch.

When you create a launch configuration using a running instance, you can override the following attributes by specifying them as part of the same request: AMI, block devices, key pair, instance profile, instance type, kernel, instance monitoring, placement tenancy, ramdisk, security groups, Spot (max) price, user data, whether the instance has a public IP address, and whether the instance is EBS-optimized.

You can also create an Auto Scaling group directly from an EC2 instance (p. 95). When you use this feature, Amazon EC2 Auto Scaling automatically creates a launch configuration for you as well.

The following examples show you to create a launch configuration from an EC2 instance.

Examples
• Create a launch configuration using an EC2 instance (p. 50)
• Create a launch configuration from an instance and override the block devices (AWS CLI) (p. 51)
• Create a launch configuration and override the instance type (AWS CLI) (p. 52)

Create a launch configuration using an EC2 instance

To create a launch configuration using the attributes of an existing EC2 instance, specify the ID of the instance.

Important
The AMI used to launch the specified instance must still exist.

Create a launch configuration from an EC2 instance (console)

You can use the console to create a launch configuration and an Auto Scaling group from a running EC2 instance and add the instance to the new Auto Scaling group. For more information, see Attach EC2 instances to your Auto Scaling group (p. 160).

Create a launch configuration from an EC2 instance (AWS CLI)

Use the following create-launch-configuration command to create a launch configuration from an instance using the same attributes as the instance. Any block devices added after launch are ignored.
Create a launch configuration from an instance and override the block devices (AWS CLI)

By default, Amazon EC2 Auto Scaling uses the attributes from the EC2 instance that you specify to create the launch configuration. However, the block devices come from the AMI used to launch the instance, not the instance. To add block devices to the launch configuration, override the block device mapping for the launch configuration.

Important
The AMI used to launch the specified instance must still exist.

Create a launch configuration and override the block devices

Use the following `create-launch-configuration` command to create a launch configuration using an EC2 instance but with a custom block device mapping.

```
aws autoscaling create-launch-configuration --launch-configuration-name my-lc-from-instance-bdm --instance-id i-a8e09d9c --block-device-mappings 
  "[]"
```
Create a launch configuration and override the instance type (AWS CLI)

By default, Amazon EC2 Auto Scaling uses the attributes from the EC2 instance you specify to create the launch configuration. Depending on your requirements, you might want to override attributes from the instance and use the values that you need. For example, you can override the instance type.

**Important**
The AMI used to launch the specified instance must still exist.
Create a launch configuration and override the instance type

Use the following `create-launch-configuration` command to create a launch configuration using an EC2 instance but with a different instance type (for example `t2.medium`) than the instance (for example `t2.micro`).

```
aws autoscaling create-launch-configuration --launch-configuration-name my-lc-from-instance-changetype \
--instance-id i-a8e09d9c --instance-type t2.medium
```

Use the following `describe-launch-configurations` command to describe the launch configuration and verify that the instance type was overridden.

```
aws autoscaling describe-launch-configurations --launch-configuration-names my-lc-from-instance-changetype
```

The following example response describes the launch configuration.

```
{
  "LaunchConfigurations": [
    {
      "UserData": null,
      "EbsOptimized": false,
      "LaunchConfigurationARN": "arn",
      "InstanceMonitoring": {
        "Enabled": false
      },
      "ImageId": "ami-05355a6c",
      "CreatedTime": "2014-12-29T16:14:50.382Z",
      "BlockDeviceMappings": [],
      "KeyName": "my-key-pair",
      "SecurityGroups": [
        "sg-8422d1eb"
      ],
      "LaunchConfigurationName": "my-lc-from-instance-changetype",
      "KernelId": "null",
      "RamdiskId": null,
      "InstanceType": "t2.medium",
      "AssociatePublicIpAddress": true
    }
  ]
}
```

Change the launch configuration for an Auto Scaling group

**Important**

We provide information about launch configurations for customers who have not yet migrated from launch configurations to launch templates. For information about migrating your Auto Scaling groups to launch templates, see [Migrate to launch templates](p. 30).

An Auto Scaling group is associated with one launch configuration at a time, and you can't modify a launch configuration after you've created it. To change the launch configuration for an Auto Scaling group, use an existing launch configuration as the basis for a new launch configuration. Then, update the Auto Scaling group to use the new launch configuration.
After you change the launch configuration for an Auto Scaling group, any new instances are launched using the new configuration options, but existing instances are not affected. To update the existing instances, terminate them so that they are replaced by your Auto Scaling group, or allow auto scaling to gradually replace older instances with newer instances based on your termination policies (p. 272).

**Note**
You can also replace all instances in the Auto Scaling group to launch new instances that use the new launch configuration. For more information, see Replace Auto Scaling instances (p. 101).

**To change the launch configuration for an Auto Scaling group (console)**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the top navigation bar, select your AWS Region.
3. On the left navigation pane, under Auto Scaling, choose Auto Scaling Groups.
4. Choose Launch configurations near the top of the page. When prompted for confirmation, choose View launch configurations to confirm that you want to view the Launch configurations page.
5. Select the launch configuration and choose Actions, Copy launch configuration. This sets up a new launch configuration with the same options as the original, but with "Copy" added to the name.
6. On the Copy Launch Configuration page, edit the configuration options as needed and choose Create launch configuration.
7. On the left navigation pane, under Auto Scaling, choose Auto Scaling Groups.
8. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
10. For Launch configuration, select the new launch configuration.
11. When you have finished, choose Update.

**To change the launch configuration for an Auto Scaling group (AWS CLI)**

1. Describe the current launch configuration using the describe-launch-configurations command.
2. Create a new launch configuration using the create-launch-configuration command.
3. Update the launch configuration for the Auto Scaling group using the update-auto-scaling-group command with the --launch-configuration-names parameter.

**To change the launch configuration for an Auto Scaling group (Tools for Windows PowerShell)**

1. Describe the current launch configuration using the Get-ASLaunchConfiguration command.
2. Create a new launch configuration using the New-ASLaunchConfiguration command.
3. Update the launch configuration for the Auto Scaling group using the Update-ASAutoScalingGroup command with the -LaunchConfigurationName parameter.

## Configure instance tenancy with a launch configuration

Tenancy defines how EC2 instances are distributed across physical hardware and affects pricing. There are three tenancy options available:
Configure instance tenancy

- Shared (default) — Multiple AWS accounts may share the same physical hardware.
- Dedicated Instance (dedicated) — Your instance runs on single-tenant hardware.
- Dedicated Host (host) — Your instance runs on a physical server with EC2 instance capacity fully dedicated to your use, an isolated server with configurations that you can control.

This topic describes how to launch Dedicated Instances in your Auto Scaling group by specifying settings in a launch configuration. For pricing information and to learn more about Dedicated Instances, see the Amazon EC2 dedicated instances product page and Dedicated Instances in the Amazon EC2 User Guide for Linux Instances.

You can configure tenancy for EC2 instances using a launch configuration or launch template. However, the host tenancy value cannot be used with a launch configuration. Use the default or dedicated tenancy values only.

**Important**
To use a tenancy value of host, you must use a launch template. For more information, see Create a launch template for an Auto Scaling group (p. 22). Before launching Dedicated Hosts, we recommend that you become familiar with launching and managing Dedicated Hosts using AWS License Manager. For more information, see the License Manager User Guide.

When you create a VPC, by default its tenancy attribute is set to default. In such a VPC, you can launch instances with a tenancy value of dedicated so that they run as single-tenancy instances. Otherwise, they run as shared-tenancy instances by default. If you set the tenancy attribute of a VPC to dedicated, all instances launched in the VPC run as single-tenancy instances.

When you create a launch configuration, the default value for the instance placement tenancy is null and the instance tenancy is controlled by the tenancy attribute of the VPC. You can specify the instance placement tenancy for your launch configuration as default or dedicated using the create-launch-configuration CLI command with the --placement-tenancy option.

The following table summarizes the instance placement tenancy of the Auto Scaling instances launched in a VPC.

<table>
<thead>
<tr>
<th>Launch configuration tenancy</th>
<th>VPC tenancy = default</th>
<th>VPC tenancy = dedicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>not specified</td>
<td>shared-tenancy instances</td>
<td>Dedicated Instances</td>
</tr>
<tr>
<td>default</td>
<td>shared-tenancy instances</td>
<td>Dedicated Instances</td>
</tr>
<tr>
<td>dedicated</td>
<td>Dedicated Instances</td>
<td>Dedicated Instances</td>
</tr>
</tbody>
</table>

**To create a launch configuration that creates Dedicated Instances (AWS CLI)**

Use the following create-launch-configuration command to create a launch configuration that sets the launch configuration tenancy to dedicated.

```
aws autoscaling create-launch-configuration --launch-configuration-name my-launch-config --placement-tenancy dedicated --image-id ...
```

You can use the following describe-launch-configuration command to verify the instance placement tenancy of the launch configuration.

```
aws autoscaling describe-launch-configuration --launch-configuration-names my-launch-config
```
The following is example output for a launch configuration that creates Dedicated Instances. The PlacementTenancy parameter is only part of the output for this command when you explicitly set the instance placement tenancy.

```json
{
  "LaunchConfigurations": [
    {
      "UserData": null,
      "EbsOptimized": false,
      "PlacementTenancy": "dedicated",
      "LaunchConfigurationARN": "arn",
      "InstanceMonitoring": {
        "Enabled": true
      },
      "ImageId": "ami-b5a7ea85",
      "CreatedTime": "2020-03-08T23:39:49.011Z",
      "BlockDeviceMappings": [],
      "KeyName": null,
      "SecurityGroups": [],
      "LaunchConfigurationName": "my-launch-config",
      "KernelId": null,
      "RamdiskId": null,
      "InstanceType": "m3.medium"
    }
  ]
}
```
Auto Scaling groups

Note
If you are new to Auto Scaling groups, you can learn more in the Get started with Amazon EC2 Auto Scaling (p. 14) tutorial. You start by creating a launch template or a launch configuration and then use it to create an Auto Scaling group in which all instances have the same instance attributes. For example, you can set the following instance attributes by specifying them as part of the launch template or launch configuration: Amazon Machine Image (AMI), instance type, block storage devices, SSH key pair, and security groups that control the inbound and outbound traffic for an instance.

An Auto Scaling group contains a collection of EC2 instances that are treated as a logical grouping for the purposes of automatic scaling and management. An Auto Scaling group also lets you use Amazon EC2 Auto Scaling features such as health check replacements and scaling policies. Both maintaining the number of instances in an Auto Scaling group and automatic scaling are the core functionality of the Amazon EC2 Auto Scaling service.

The size of an Auto Scaling group depends on the number of instances that you set as the desired capacity. You can adjust its size to meet demand, either manually or by using automatic scaling.

An Auto Scaling group starts by launching enough instances to meet its desired capacity. It maintains this number of instances by performing periodic health checks on the instances in the group. The Auto Scaling group continues to maintain a fixed number of instances even if an instance becomes unhealthy. If an instance becomes unhealthy, the group terminates the unhealthy instance and launches another instance to replace it. For more information, see Health checks for Auto Scaling instances (p. 297).

You can use scaling policies to increase or decrease the number of instances in your group dynamically to meet changing conditions. When the scaling policy is in effect, the Auto Scaling group adjusts the desired capacity of the group, between the minimum and maximum capacity values that you specify, and launches or terminates the instances as needed. You can also scale on a schedule. For more information, see Scale the size of your Auto Scaling group (p. 155).

An Auto Scaling group can launch On-Demand Instances, Spot Instances, or both. You can specify multiple purchase options for your Auto Scaling group only when you use a launch template.

Spot Instances provide you with access to unused EC2 capacity at steep discounts relative to On-Demand prices. For more information, see Amazon EC2 Spot Instances. There are key differences between Spot Instances and On-Demand Instances:

- The price for Spot Instances varies based on demand
- Amazon EC2 can terminate an individual Spot Instance as the availability of, or price for, Spot Instances changes

When a Spot Instance is terminated, the Auto Scaling group attempts to launch a replacement instance to maintain the desired capacity for the group.

When instances are launched, if you specified multiple Availability Zones, the desired capacity is distributed across these Availability Zones. If a scaling action occurs, Amazon EC2 Auto Scaling automatically maintains balance across all of the Availability Zones that you specify.

Contents
- Create Auto Scaling groups using launch templates (p. 58)
- Create Auto Scaling groups using launch configurations (p. 93)
Create Auto Scaling groups using launch templates

If you have created a launch template, you can create an Auto Scaling group that uses a launch template as a configuration template for its EC2 instances. The launch template specifies information such as the AMI ID, instance type, key pair, security groups, and block device mapping for your instances. For information about creating launch templates, see Create a launch template for an Auto Scaling group (p. 22).

You must have sufficient permissions to create an Auto Scaling group. You must also have sufficient permissions to create the service-linked role that Amazon EC2 Auto Scaling uses to perform actions on your behalf if it does not yet exist. For examples of IAM policies that an administrator can use as a reference for granting you permissions, see Identity-based policy examples (p. 406) and Launch template support (p. 412).

Contents

- Create an Auto Scaling group using a launch template (p. 58)
- Create an Auto Scaling group using the Amazon EC2 launch wizard (p. 60)
- Auto Scaling groups with multiple instance types and purchase options (p. 62)
- Create an Auto Scaling group using attribute-based instance type selection (p. 87)

Create an Auto Scaling group using a launch template

When you create an Auto Scaling group, you must specify the necessary information to configure the Amazon EC2 instances, the Availability Zones and VPC subnets for the instances, the desired capacity, and the minimum and maximum capacity limits.

To configure Amazon EC2 instances that are launched by your Auto Scaling group, you can specify a launch template or a launch configuration. The following procedure demonstrates how to create an Auto Scaling group using a launch template.

Prerequisites

- You must have created a launch template. For more information, see Create a launch template for an Auto Scaling group (p. 22).

To create an Auto Scaling group using a launch template (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the same AWS Region that you used when you created the launch template.
3. Choose Create an Auto Scaling group.
4. On the Choose launch template or configuration page, do the following:
a. For **Auto Scaling group name**, enter a name for your Auto Scaling group.

b. For **Launch template**, choose an existing launch template.

c. For **Launch template version**, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.

d. Verify that your launch template supports all of the options that you are planning to use, and then choose **Next**.

5. On the **Choose instance launch options** page, under **Network**, for **VPC**, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch template.

6. For **Availability Zones and subnets**, choose one or more subnets in the specified VPC. Use subnets in multiple Availability Zones for high availability. For more information, see **Considerations when choosing VPC subnets** (p. 388).

7. If you created a launch template with an instance type specified, then you can continue to the next step to create an Auto Scaling group that uses the instance type in the launch template.

Alternatively, you can choose the **Override launch template** option if no instance type is specified in your launch template or if you want to use multiple instance types for auto scaling. For more information, see **Auto Scaling groups with multiple instance types and purchase options** (p. 62).

8. Choose **Next** to continue to the next step.

Or, you can accept the rest of the defaults, and choose **Skip to review**.

9. (Optional) On the **Configure advanced options** page, configure the following options, and then choose **Next**:

   a. To register your Amazon EC2 instances with a load balancer, choose an existing load balancer or create a new one. For more information, see **Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group** (p. 344). To create a new load balancer, follow the procedure in **Configure an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console** (p. 348).

   b. (Optional) For **Health checks, Additional health check types**, select **Turn on Elastic Load Balancing health checks**.

   c. (Optional) For **Health check grace period**, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state. For more information, see **Set the health check grace period for an Auto Scaling group** (p. 302).

   d. Under **Additional settings, Monitoring**, choose whether to enable CloudWatch group metrics collection. These metrics provide measurements that can be indicators of a potential issue, such as number of terminating instances or number of pending instances. For more information, see **Monitor CloudWatch metrics for your Auto Scaling groups and instances** (p. 305).

   e. For **Enable default instance warmup**, select this option and choose the warm-up time for your application. If you are creating an Auto Scaling group that has a scaling policy, the default instance warmup feature improves the Amazon CloudWatch metrics used for dynamic scaling. For more information, see **Set the default instance warmup for an Auto Scaling group** (p. 187).

10. (Optional) On the **Configure group size and scaling policies** page, configure the following options, and then choose **Next**:

    a. For **Desired capacity**, enter the initial number of instances to launch. When you change this number to a value outside of the minimum or maximum capacity limits, you must update the values of **Minimum capacity** or **Maximum capacity**. For more information, see **Set capacity limits on your Auto Scaling group** (p. 156).

    b. To automatically scale the size of the Auto Scaling group, choose **Target tracking scaling policy** and follow the directions. For more information, see **Target tracking scaling policies for Amazon EC2 Auto Scaling** (p. 169).
Create an Auto Scaling group using the Amazon EC2 launch wizard

The following procedure shows how to create an Auto Scaling group by using the Launch instance wizard in the Amazon EC2 console. This option automatically populates a launch template with certain configuration details from the Launch instance wizard.

Note

The wizard does not populate the Auto Scaling group with the number of instances you specify; it only populates the launch template with the Amazon Machine Image (AMI) ID and instance type. Use the Create Auto Scaling group wizard to specify the number of instances to launch. An AMI provides the information required to configure an instance. You can launch multiple instances from a single AMI when you need multiple instances with the same configuration. We recommend using a custom AMI that already has your application installed on it to avoid having your instances terminated if you reboot an instance belonging to an Auto Scaling group. To use a custom AMI with Amazon EC2 Auto Scaling, you must first create your AMI from a customized instance, and then use the AMI to create a launch template for your Auto Scaling group.

Prerequisites

- You must have created a custom AMI in the same AWS Region where you plan to create the Auto Scaling group. For more information, see Create an AMI in the Amazon EC2 User Guide for Linux Instances.

Use a custom AMI as a template

In this section, you use the Amazon EC2 launch wizard to automatically populate a launch template with your custom AMI. Alternatively, to set up the launch template from scratch or for more description of the parameters you can configure for your launch template, see Create your launch template (console) (p. 22).

To use a custom AMI as a template

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation bar at the top of the screen, the current AWS Region is displayed. Select a Region in which to launch your Auto Scaling group.
3. In the navigation pane, choose **Instances**.
4. Choose **Launch instance**, and then do the following:
   a. Under **Name and tags**, leave **Name** blank. The name isn't part of the data that's used to create a launch template.
   b. Under **Application and OS Images (Amazon Machine Image)**, choose **Browse more AMIs** to browse the full AMI catalog.
   c. Choose **My AMIs**, find the AMI that you created, and then choose **Select**.
   d. Under **Instance type**, choose an instance type.
      
      **Note**
      Choose the same instance type that you used when you created the AMI or a more powerful one.
   e. On the right side of the screen, under **Summary**, for **Number of instances**, enter any number. The number that you enter here isn't important. You will specify the number of instances that you want to launch when you create the Auto Scaling group.
      
      Under the **Number of instances** field, a message displays that says **When launching more than 1 instance, consider EC2 Auto Scaling**.
   f. Choose the **consider EC2 Auto Scaling** hyperlink text.
   g. On the **Launch into Auto Scaling Group** confirmation dialogue, choose **Continue** to go to the **Create launch template** page with the AMI and instance type you selected in the launch instance wizard already populated.

After you choose **Continue**, the **Create launch template** page opens. Follow this procedure to finish creating a launch template.

**To create a launch template**

1. Under **Launch template name and description**, enter a name and description for the new launch template.
2. (Optional) Under **Key pair (login)**, for **Key pair name**, choose the name of the previously created key pair to use when connecting to instances, for example, using SSH.
3. (Optional) Under **Network settings**, for **Security groups**, choose one or more previously created security groups.
4. (Optional) Under **Configure storage**, update the storage configuration. The default storage configuration is determined by the AMI and the instance type.
5. When you are done configuring the launch template, choose **Create launch template**.
6. On the confirmation page, choose **Create Auto Scaling group**.

**Create an Auto Scaling group**

**Note**
The rest of this topic describes the basic procedure for creating an Auto Scaling group. For more description of the parameters you can configure for your Auto Scaling group, see **Create an Auto Scaling group using a launch template** (p. 58).

After you choose **Create Auto Scaling group**, the **Create Auto Scaling group** wizard opens. Follow this procedure to create an Auto Scaling group.

**To create an Auto Scaling group**

1. On the **Choose launch template or configuration** page, enter a name for the Auto Scaling group.
2. The launch template that you created is already selected for you.
   For **Launch template version**, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.

3. Choose **Next** to continue to the next step.

4. On the **Choose instance launch options** page, under **Network**, for **VPC**, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch template.
   
   **Tip**
   If you didn't specify a security group in your launch template, your instances are launched with a default security group from the VPC that you specify. By default, this security group doesn't allow inbound traffic from external networks.

5. For **Availability Zones and subnets**, choose one or more subnets in the specified VPC.

6. Choose **Next** twice to go to the **Configure group size and scaling policies** page.

7. Under **Group size**, define the **Desired capacity** (initial number of instances to launch immediately after the Auto Scaling group is created), **Minimum capacity** (minimum number of instances), and **Maximum capacity** (maximum number of instances).

8. Choose **Skip to review**.

9. On the **Review** page, choose **Create Auto Scaling group**.

**Next steps**

You can check that the Auto Scaling group has been created correctly by viewing the activity history. On the **Activity** tab, under **Activity history**, the **Status** column shows whether your Auto Scaling group has successfully launched instances. If the instances fail to launch or they launch but then immediately terminate, see the following topics for possible causes and resolutions:

- **Troubleshoot Amazon EC2 Auto Scaling: EC2 instance launch failures** (p. 430)
- **Troubleshoot Amazon EC2 Auto Scaling: AMI issues** (p. 436)
- **Troubleshoot Amazon EC2 Auto Scaling: Health checks** (p. 441)

You can now attach a load balancer in the same Region as your Auto Scaling group, if desired. For more information, see **Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group** (p. 344).

**Auto Scaling groups with multiple instance types and purchase options**

You can launch and automatically scale a fleet of On-Demand Instances and Spot Instances within a single Auto Scaling group. In addition to receiving discounts for using Spot Instances, you can use Reserved Instances or a Savings Plan to receive discounted rates of the regular On-Demand Instance pricing. All of these factors combined help you to optimize your cost savings for EC2 instances and help you get the desired scale and performance for your application.

The following steps describe how to create the Auto Scaling group:

- Specify the launch template for launching the instances.
- Choose the VPC and subnets to launch your Auto Scaling group in.
- Choose the option to override the existing instance type requirements of the launch template with new requirements.
You enhance availability by deploying your application across multiple instance types running in multiple Availability Zones. Although you can use one instance type, it's a best practice to use multiple instance types. This way, Amazon EC2 Auto Scaling can launch another instance type if there is insufficient instance capacity in your chosen Availability Zones. If there is insufficient instance capacity with Spot Instances, Amazon EC2 Auto Scaling keeps trying to launch from other Spot Instance pools. (The pools it uses are determined by your choice of instance types and allocation strategy.) Amazon EC2 Auto Scaling helps you leverage the cost savings of Spot Instances by launching them instead of On-Demand Instances.

Contents

- Allocation strategies (p. 63)
- Best practices for Spot Instances (p. 65)
- Control the proportion of On-Demand Instances (p. 66)
- Prerequisites (p. 67)
- Create an Auto Scaling group with Spot and On-Demand Instances (console) (p. 67)
- Create an Auto Scaling group with Spot and On-Demand Instances (AWS CLI) (p. 69)
- Verify your Auto Scaling group configuration and launched instances (AWS CLI) (p. 77)
- Configure overrides (p. 77)

Allocation strategies

Note

If you configure your Spot Instances to launch with AMD SEV-SNP turned on, you are charged an additional hourly usage fee that is equivalent to 10% of the On-Demand hourly rate of the selected instance type. If the allocation strategy uses price as an input, Amazon EC2 Auto Scaling does not include this additional fee; only the Spot price is used.

The following allocation strategies determine how the Auto Scaling group fulfills your On-Demand and Spot capacities from the possible instance types.

First, Amazon EC2 Auto Scaling tries to balance your instances evenly across your specified Availability Zones. Then, it launches instance types according to the specified allocation strategy.

Spot Instances

Amazon EC2 Auto Scaling provides the following allocation strategies that can be used for Spot Instances:

- capacity-optimized

Amazon EC2 Auto Scaling requests your Spot Instance from the pool with optimal capacity for the number of instances that are launching.

With Spot Instances, the pricing changes slowly over time based on long-term trends in supply and demand, but capacity fluctuates in real time. The capacity-optimized strategy automatically launches Spot Instances into the most available pools by looking at real-time capacity data and
predicting which are the most available. This helps to minimize possible disruptions for workloads that might have a higher cost of interruption associated with restarting work and checkpointing.

To give certain instance types a higher chance of launching first, use capacity-optimized-prioritized.

You set the order of instance types for the launch template overrides from highest to lowest priority (from first to last in the list). Amazon EC2 Auto Scaling honors the instance type priorities on a best-effort basis but optimizes for capacity first. This is a good option for workloads where the possibility of disruption must be minimized, but also the preference for certain instance types matters. If the On-Demand allocation strategy is set to prioritized, the same priority is applied when fulfilling On-Demand capacity.

Amazon EC2 Auto Scaling requests your Spot Instances using the lowest priced pools within an Availability Zone, across the N number of pools of Spot pools that you specify for the **Lowest priced pools** setting. For example, if you specify four instance types and four Availability Zones, your Auto Scaling group can access up to 16 Spot pools. (Four in each Availability Zone.) If you specify two Spot pools (N=2) for the allocation strategy, your Auto Scaling group can draw on the two lowest priced pools per Availability Zone to fulfill your Spot capacity.

Because this strategy only considers instance price and not capacity availability, it might lead to high interruption rates.

The price and capacity optimized allocation strategy looks at both price and capacity to select the Spot Instance pools that are the least likely to be interrupted and have the lowest possible price.

To get started, we recommend choosing the price-capacity-optimized allocation strategy and specifying a set of instance types that are appropriate for your application. In addition, you can define a range of Availability Zones for Amazon EC2 Auto Scaling to choose from when launching instances.

For more information about the price-capacity-optimized strategy and use cases where it's helpful, see [Introducing the price-capacity-optimized allocation strategy for EC2 Spot Instances](https://aws.amazon.com/blogs/compute/introducing-the-price-capacity-optimized-allocation-strategy-for-ec2-spot-instances/) in the AWS blog.

Optionally, you can specify a maximum price for your Spot Instances. If you don't specify a maximum price, the default maximum price is the On-Demand price. However, you still receive the steep discounts provided by Spot Instances. These discounts are possible because of the stable Spot pricing that's available with the [Spot pricing model](https://aws.amazon.com/ec2/SpotPricingModel/).

**On-Demand Instances**

Amazon EC2 Auto Scaling provides the following allocation strategies that can be used for On-Demand Instances:

**lowest-price**

Amazon EC2 Auto Scaling automatically deploys the lowest priced instance type in each Availability Zone based on the current On-Demand price.

To meet your desired capacity, you might receive On-Demand Instances of more than one instance type in each Availability Zone. This depends on how much capacity you request.

**prioritized**

When fulfilling On-Demand capacity, Amazon EC2 Auto Scaling determines which instance type to use first based on the order of instance types in the list of launch template overrides. For example,
let's say that you specify three launch template overrides in the following order: c5.large, c4.large, and c3.large. When your On-Demand Instances launch, the Auto Scaling group fulfills On-Demand capacity by starting with c5.large, followed by c4.large, and lastly c3.large.

Consider the following when managing the priority order of your On-Demand Instances:

You can pay for usage upfront to get significant discounts for On-Demand Instances by using Savings Plans or Reserved Instances. For more information, see the Amazon EC2 pricing page.

- With Reserved Instances, your discounted rate of the regular On-Demand Instance pricing applies if Amazon EC2 Auto Scaling launches matching instance types. Therefore, if you have unused Reserved Instances for c4.large, you can set the instance type priority to give the highest priority for your Reserved Instances to a c4.large instance type. When a c4.large instance launches, you receive the Reserved Instance pricing.

- With Savings Plans, your discounted rate of the regular On-Demand Instance pricing applies when using Amazon EC2 Instance Savings Plans or Compute Savings Plans. With Savings Plans, you have more flexibility when prioritizing your instance types. As long as you use instance types that are covered by your Savings Plan, you can set them in any priority order. You can also occasionally change the entire order of your instance types, while still receiving the Savings Plan discounted rate. For more information about Savings Plans, see the Savings Plans User Guide.

**Best practices for Spot Instances**

Before you create your Auto Scaling group to request Spot Instances, review Best practices for EC2 Spot in the Amazon EC2 User Guide for Linux Instances. Use these best practices to plan your request so that you can provision the type of instances that you want at the lowest possible price. We also recommend that you do the following:

- Do not specify a maximum price. Your application might not run if you do not receive any Spot Instances, such as when your maximum price is too low. The default maximum price is the On-Demand price, and you pay only the Spot price for the Spot Instances that you launch. When the Spot price is lower than the maximum price, whether your request is fulfilled depends on availability. For more information, see Pricing and savings in the Amazon EC2 User Guide for Linux Instances.

- A good rule of thumb is to be flexible across at least 10 instance types for each workload. In addition, make sure that all Availability Zones are configured for use in your VPC and selected for your workload. Because capacity fluctuates independently for each instance type in an Availability Zone, you can often get more compute capacity when you have instance type flexibility.

- Don't limit yourself to the most popular new instance types. Choosing older generation instance types tends to result in fewer interruptions because they are less in demand from On-Demand customers.

- Enable Capacity Rebalancing. When you do this, Amazon EC2 Auto Scaling attempts to launch a Spot Instance whenever the Amazon EC2 Spot service notifies that a Spot Instance is at an elevated risk of interruption. After launching a new instance, it then terminates an old instance. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

- We recommend that you use the price-capacity-optimized allocation strategy instead of the lowest-price allocation strategy to avoid requesting Spot Instances from pools with a high chance of interruption.

- If you choose the lowest-price allocation strategy and you run a web service, specify a high number of Spot pools, such as N=10. Doing this reduces the impact of Spot Instance interruptions if a pool in one of the Availability Zones becomes temporarily unavailable. If you run batch processing or other non-mission critical applications, you can specify a lower number of Spot pools, such as N=2. This provisions Spot Instances from only the lowest priced Spot pools available per Availability Zone.

Amazon EC2 Auto Scaling attempts to draw Spot Instances from the N number of pools that you specify on a best-effort basis. If a pool runs out of Spot capacity before fulfilling your desired capacity, Amazon EC2 Auto Scaling will continue to fulfill your request by drawing from the next lowest priced pool. To meet your desired capacity, you might receive Spot Instances from more pools than your
specified N number. Likewise, if most of the pools have no Spot capacity, you might receive your full desired capacity from fewer pools than your specified N number.

If you intend to specify a maximum price, use the AWS CLI or an SDK to create the Auto Scaling group, but be cautious. If your maximum price is lower than the Spot price for the instance types that you selected, your Spot Instances are not launched.

Control the proportion of On-Demand Instances

You have full control over the proportion of instances in the Auto Scaling group that are launched as On-Demand Instances. To make sure that you always have instance capacity, you can designate a percentage of the group to launch as On-Demand Instances. Optionally, you can also designate a base number of On-Demand Instances to start with. If you designate a base capacity of On-Demand Instances, Amazon EC2 Auto Scaling waits to launch Spot Instances until after it launches the base capacity of On-Demand Instances when the group scales out. Anything beyond the base capacity uses the On-Demand percentage to determine how many On-Demand Instances and Spot Instances to launch. You can specify any number from 0 to 100 for the On-Demand percentage.

Amazon EC2 Auto Scaling converts the percentage to the equivalent number of instances. If the result creates a fractional number, Amazon EC2 Auto Scaling rounds up to the next integer in favor of On-Demand Instances.

The following table demonstrates the behavior of the Auto Scaling group as it increases in size.

Example: Scaling behavior

<table>
<thead>
<tr>
<th>Instances distribution</th>
<th>Total number of running instances across purchase options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td><strong>Example 1</strong></td>
<td></td>
</tr>
<tr>
<td>On-Demand base: 10</td>
<td>10</td>
</tr>
<tr>
<td>On-Demand percentage above base: 50%</td>
<td>0</td>
</tr>
<tr>
<td>Spot percentage: 50%</td>
<td>0</td>
</tr>
<tr>
<td><strong>Example 2</strong></td>
<td></td>
</tr>
<tr>
<td>On-Demand base: 0</td>
<td>0</td>
</tr>
<tr>
<td>On-Demand percentage above base: 0%</td>
<td>0</td>
</tr>
<tr>
<td>Spot percentage: 100%</td>
<td>10</td>
</tr>
<tr>
<td><strong>Example 3</strong></td>
<td></td>
</tr>
<tr>
<td>On-Demand base: 0</td>
<td>0</td>
</tr>
</tbody>
</table>
### Prerequisites

- Create a launch template. For more information, see [Create a launch template for an Auto Scaling group (p. 22)]).
- Verify that the launch template doesn't already request Spot Instances.

### Create an Auto Scaling group with Spot and On-Demand Instances (console)

Use the following procedure to choose which individual instance types your group can launch. If you prefer to use instance attributes as criteria for selecting instance types, configure instance type requirements by specifying the number of vCPUs and memory that you need. For more information, see [Create an Auto Scaling group using attribute-based instance type selection (p. 87)]. You can also specify other attributes like storage type, network interfaces, CPU manufacturer, and accelerator type.

#### To create an Auto Scaling group with Spot and On-Demand Instances

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. On the navigation bar at the top of the screen, choose the same AWS Region that you used when you created the launch template.
3. Choose **Create an Auto Scaling group**.
4. On the **Choose launch template or configuration** page, for **Auto Scaling group name**, enter a name for your Auto Scaling group.

5. To choose your launch template, do the following:
   
   a. For **Launch template**, choose an existing launch template.
   
   b. For **Launch template version**, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.
   
   c. Verify that your launch template supports all of the options that you plan to use, and then choose **Next**.

6. To choose a VPC and the subnets you want to launch your instances in, do the following:
   
   a. On the **Choose instance launch options** page, under **Network**, for **VPC**, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch template.
   
   b. For **Availability Zones and subnets**, choose one or more subnets in the specified VPC. Use subnets in multiple Availability Zones for high availability. For more information, see [Considerations when choosing VPC subnets](p. 388).

7. To manually choose which individual instance types your group can launch, do the following:
   
   a. For **Instance type requirements**, choose **Override launch template**, and then choose **Manually add instance types**.
   
   b. Choose your instance types. You can use our recommendations as a starting point. **Family and generation flexible** is selected by default.

   To change the order of the instance types, use the arrows. If you choose an allocation strategy that supports prioritization, the instance type order sets their launch priority.

   To remove an instance type, choose **X**.

   Optionally, for the boxes in the **Weight** column, assign each instance type a relative weight. To do so, enter the number of units that an instance of that type counts toward the desired capacity of the group. Doing so might be useful if the instance types offer different vCPU, memory, storage, or network bandwidth capabilities. For more information, see [Configure instance weighting for Amazon EC2 Auto Scaling](p. 81).

   **Note**

   If you chose to use **Size flexible** recommendations, then all instance types that are part of this section automatically have a weight value. If you don’t want to specify any weights, clear the boxes in the **Weight** column for all instance types.

   c. Under **Instance purchase options**, for **Instances distribution**, specify the percentages of the group to be launched as On-Demand Instances and Spot Instances respectively. If your application is stateless, fault tolerant and can handle an instance being interrupted, you can specify a higher percentage of Spot Instances.

   d. When you specify a percentage for Spot Instances, you can select the check box next to **Include On-Demand base capacity** and then specify the minimum amount of the Auto Scaling group’s initial capacity that must be fulfilled by On-Demand Instances. Anything beyond the base capacity uses the **Instances distribution** settings to determine how many On-Demand Instances and Spot Instances to launch.

   e. Under **Allocation strategies**, for **On-Demand allocation strategy**, choose an allocation strategy. When you manually choose your instance types, **Prioritized** is selected by default.

   f. For **Spot allocation strategy**, choose an allocation strategy. **Price capacity optimized** is selected by default. **Lowest price** is hidden by default and only appears when you choose **Show all strategies**.
Use multiple instance types and purchase options

Note
If you chose Lowest price, enter the number of lowest priced pools to diversify across for Lowest priced pools. If you chose Capacity optimized, you can optionally check the Prioritize instance types box to let Amazon EC2 Auto Scaling choose which instance type to launch first based on the order your instance types are listed in.

g. For Capacity rebalance, choose whether to enable or disable Capacity Rebalancing.

If you chose a percentage for Spot Instances, you can use Capacity Rebalancing to automatically respond when your Spot Instances approach termination from a Spot interruption. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

h. When finished, choose Next twice to go to the Configure group size and scaling policies page.

8. For the Configure group size and scaling policies step, do the following:

a. Enter the initial size of your Auto Scaling group for Desired capacity and update the Minimum capacity and Maximum capacity limits as needed. For more information, see Set capacity limits on your Auto Scaling group (p. 156).

Note
By default, the desired capacity and minimum and maximum capacity limits are expressed as the number of instances. If you assigned weights to your instance types, you must convert these values to the same unit of measurement that you used to assign weights, such as the number of vCPUs.

b. (Optional) Configure the group to scale by specifying a target tracking scaling policy. Alternatively, specify this policy after you create the group. For more information, see Target tracking scaling policies for Amazon EC2 Auto Scaling (p. 169).

c. (Optional) Enable instance scale-in protection, which prevents your Auto Scaling group from terminating instances when scaling in. For more information, see Use instance scale-in protection (p. 282).

d. When finished, choose Next.

9. (Optional) To receive notifications when your group scales, for Add notification, configure the notification, and then choose Next. For more information, see Get Amazon SNS notifications when your Auto Scaling group scales (p. 317).

10. (Optional) To add tags, choose Add tag, provide a tag key and value for each tag, and then choose Next. For more information, see Tag Auto Scaling groups and instances (p. 129).


Create an Auto Scaling group with Spot and On-Demand Instances (AWS CLI)

The following example configurations show how to launch Spot Instances using the different Spot allocation strategies.

Note
These examples show how to use a configuration file formatted in JSON or YAML. If you use AWS CLI version 1, you must specify a JSON-formatted configuration file. If you use AWS CLI version 2, you can specify a configuration file formatted in either YAML or JSON.

Examples

• Example 1: Launch Spot Instances using the capacity-optimized allocation strategy (p. 70)
• Example 2: Launch Spot Instances using the capacity-optimized-prioritized allocation strategy (p. 71)
• Example 3: Launch Spot Instances using the lowest-price allocation strategy diversified over two pools (p. 73)
- **Example 4: Launch Spot Instances using the price-capacity-optimized allocation strategy (p. 75)**

**Example 1: Launch Spot Instances using the capacity-optimized allocation strategy**

The following `create-auto-scaling-group` command creates an Auto Scaling group that specifies the following:

- The percentage of the group to launch as On-Demand Instances (0) and a base number of On-Demand Instances to start with (1).
- The instance types to launch in priority order (`c5.large`, `c5a.large`, `m5.large`, `m5a.large`, `c4.large`, `m4.large`, `c3.large`, `m3.large`).
- The subnets in which to launch the instances (`subnet-5ea0c127`, `subnet-6194ea3b`, `subnet-c934b782`). Each corresponds to a different Availability Zone.
- The launch template (`my-launch-template`) and the launch template version (`$Default`).

When Amazon EC2 Auto Scaling attempts to fulfill your On-Demand capacity, it launches the `c5.large` instance type first. The Spot Instances come from the optimal Spot pool in each Availability Zone based on Spot Instance capacity.

**JSON**

```bash
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example `config.json` file.

```json
{
    "AutoScalingGroupName": "my-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateSpecification": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "$Default"
            }
        },
        "Overrides": [
            {
                "InstanceType": "c5.large"
            },
            {
                "InstanceType": "c5a.large"
            },
            {
                "InstanceType": "m5.large"
            },
            {
                "InstanceType": "m5a.large"
            },
            {
                "InstanceType": "c4.large"
            },
            {
                "InstanceType": "m4.large"
            },
            {
                "InstanceType": "c3.large"
            },
            {
                "InstanceType": "m3.large"
            }
        ]
    }
}
```
Use multiple instance types and purchase options

YAML

Alternatively, you can use the following `create-auto-scaling-group` command to create the Auto Scaling group. This references a YAML file as the sole parameter for your Auto Scaling group, instead of a JSON file.

```
aws autoscaling create-auto-scaling-group --cli-input-yaml file://~/config.yaml
```

The following is an example `config.yaml` file.

```
---
AutoScalingGroupName: my-asg
MixedInstancesPolicy:
  LaunchTemplate:
    LaunchTemplateSpecification:
      LaunchTemplateName: my-launch-template
      Version: $Default
    Overrides:
      - InstanceType: c5.large
      - InstanceType: c5a.large
      - InstanceType: m5.large
      - InstanceType: m5a.large
      - InstanceType: c4.large
      - InstanceType: m4.large
      - InstanceType: c3.large
      - InstanceType: m3.large
  InstancesDistribution:
    OnDemandBaseCapacity: 1
    OnDemandPercentageAboveBaseCapacity: 0
    SpotAllocationStrategy: capacity-optimized
  MinSize: 1
  MaxSize: 5
  DesiredCapacity: 3
  VPCZoneIdentifier: subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782
```

Example 2: Launch Spot Instances using the capacity-optimized-prioritized allocation strategy

The following `create-auto-scaling-group` command creates an Auto Scaling group that specifies the following:

- The percentage of the group to launch as On-Demand Instances (0) and a base number of On-Demand Instances to start with (1).
- The instance types to launch in priority order (c5.large, c5a.large, m5.large, m5a.large, c4.large, m4.large, c3.large, m3.large).
• The subnets in which to launch the instances (subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782). Each corresponds to a different Availability Zone.
• The launch template (my-launch-template) and the launch template version ($Latest).

When Amazon EC2 Auto Scaling attempts to fulfill your On-Demand capacity, it launches the c5.large instance type first. When Amazon EC2 Auto Scaling attempts to fulfill your Spot capacity, it honors the instance type priorities on a best-effort basis. However, it optimizes for capacity first.

**JSON**

```bash
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example config.json file.

```json
{
    "AutoScalingGroupName": "my-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateSpecification": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "$Latest"
            },
            "Overrides": [
                { "InstanceType": "c5.large" },
                { "InstanceType": "c5a.large" },
                { "InstanceType": "m5.large" },
                { "InstanceType": "m5a.large" },
                { "InstanceType": "c4.large" },
                { "InstanceType": "m4.large" },
                { "InstanceType": "c3.large" },
                { "InstanceType": "m3.large" }
            ],
            "InstancesDistribution": {
                "OnDemandBaseCapacity": 1,
                "OnDemandPercentageAboveBaseCapacity": 0,
                "SpotAllocationStrategy": "capacity-optimized-prioritized"
            }
        },
        "MinSize": 1,
        "MaxSize": 5,
        "DesiredCapacity": 3,
        "VPCZoneIdentifier": "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
    }
}
```
YAML

Alternatively, you can use the following `create-auto-scaling-group` command to create the Auto Scaling group. This references a YAML file as the sole parameter for your Auto Scaling group, instead of a JSON file.

```
aws autoscaling create-auto-scaling-group --cli-input-yaml file://~/config.yaml
```

The following is an example config.yaml file.

```yaml
---
AutoScalingGroupName: my-asg
MixedInstancesPolicy:
  LaunchTemplate:
    LaunchTemplateSpecification:
      LaunchTemplateName: my-launch-template
      Version: $Default
    Overrides:
      - InstanceType: c5.large
      - InstanceType: c5a.large
      - InstanceType: m5.large
      - InstanceType: m5a.large
      - InstanceType: c4.large
      - InstanceType: m4.large
      - InstanceType: c3.large
      - InstanceType: m3.large
  InstancesDistribution:
    OnDemandBaseCapacity: 1
    OnDemandPercentageAboveBaseCapacity: 0
    SpotAllocationStrategy: capacity-optimized-prioritized
MinSize: 1
MaxSize: 5
DesiredCapacity: 3
VPCZoneIdentifier: subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782
```

Example 3: Launch Spot Instances using the lowest-price allocation strategy diversified over two pools

The following `create-auto-scaling-group` command creates an Auto Scaling group that specifies the following:

- The percentage of the group to launch as On-Demand Instances (50). (This does not specify a base number of On-Demand Instances to start with.)
- The instance types to launch in priority order (c5.large, c5a.large, m5.large, m5a.large, c4.large, m4.large, c3.large, m3.large).
- The subnets in which to launch the instances (subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782). Each corresponds to a different Availability Zone.
- The launch template (my-launch-template) and the launch template version ($Latest).

When Amazon EC2 Auto Scaling attempts to fulfill your On-Demand capacity, it launches the c5.large instance type first. For your Spot capacity, Amazon EC2 Auto Scaling attempts to launch the Spot Instances evenly across the two lowest priced pools in each Availability Zone.

JSON

```
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example config.json file.

```json
73
```
Use multiple instance types and purchase options

```json
{
    "AutoScalingGroupName": "my-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateSpecification": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "$Latest"
            },
            "Overrides": [
                {
                    "InstanceType": "c5.large"
                },
                {
                    "InstanceType": "c5a.large"
                },
                {
                    "InstanceType": "m5.large"
                },
                {
                    "InstanceType": "m5a.large"
                },
                {
                    "InstanceType": "c4.large"
                },
                {
                    "InstanceType": "m4.large"
                },
                {
                    "InstanceType": "c3.large"
                },
                {
                    "InstanceType": "m3.large"
                }
            ],
            "InstancesDistribution": {
                "OnDemandPercentageAboveBaseCapacity": 50,
                "SpotAllocationStrategy": "lowest-price",
                "SpotInstancePools": 2
            }
        },
        "MinSize": 1,
        "MaxSize": 5,
        "DesiredCapacity": 3,
        "VPCZoneIdentifier": "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
    }
}
```

**YAML**

Alternatively, you can use the following `create-auto-scaling-group` command to create the Auto Scaling group. This references a YAML file as the sole parameter for your Auto Scaling group, instead of a JSON file.

```bash
aws autoscaling create-auto-scaling-group --cli-input-yaml file://~/config.yaml
```

The following is an example `config.yaml` file.

```yaml
---
AutoScalingGroupName: my-asg
MixedInstancesPolicy:
    LaunchTemplate:
        LaunchTemplateSpecification:
```
Example 4: Launch Spot Instances using the price-capacity-optimized allocation strategy

The following `create-auto-scaling-group` command creates an Auto Scaling group that specifies the following:

- The percentage of the group to launch as On-Demand Instances (30). (This does not specify a base number of On-Demand Instances to start with.)
- The instance types to launch in priority order (`c5.large`, `c5a.large`, `m5.large`, `m5a.large`, `c4.large`, `m4.large`, `c3.large`, `m3.large`).
- The subnets in which to launch the instances (`subnet-5ea0c127`, `subnet-6194ea3b`, `subnet-c934b782`). Each corresponds to a different Availability Zone.
- The launch template (`my-launch-template`) and the launch template version (`$Latest`).

When Amazon EC2 Auto Scaling attempts to fulfill your On-Demand capacity, it launches the `c5.large` instance type first. For your Spot capacity, Amazon EC2 Auto Scaling attempts to launch the Spot Instances from Spot Instances pools with the lowest price possible, but also with optimal capacity for the number of instances that are launching.

```json
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example `config.json` file.

```json
{
    "AutoScalingGroupName": "my-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateSpecification": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "$Latest"
            },
            "Overrides": [
                {
                    "InstanceType": "c5.large"
                },
                {
                    "InstanceType": "c5a.large"
                }
            ]
        }
    }
}
```
Use multiple instance types and purchase options

YAML

Alternatively, you can use the following `create-auto-scaling-group` command to create the Auto Scaling group. This references a YAML file as the sole parameter for your Auto Scaling group, instead of a JSON file.

```bash
aws autoscaling create-auto-scaling-group --cli-input-yaml file:///~/config.yaml
```

The following is an example `config.yaml` file.

```yaml
---
AutoScalingGroupName: my-asg
MixedInstancesPolicy:
  LaunchTemplate:
    LaunchTemplateName: my-launch-template
    Version: $Default
  Overrides:
    - InstanceType: c5.large
    - InstanceType: c5a.large
    - InstanceType: m5.large
    - InstanceType: m5a.large
    - InstanceType: c4.large
    - InstanceType: m4.large
    - InstanceType: c3.large
    - InstanceType: m3.large
  InstancesDistribution:
    OnDemandPercentageAboveBaseCapacity: 30
    SpotAllocationStrategy: price-capacity-optimized
MinSize: 1
MaxSize: 5
```
DesiredCapacity: 3
VPCZoneIdentifier: subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782

Note
For additional examples, see Specify a different launch template for an instance type (p. 77), Configure instance weighting for Amazon EC2 Auto Scaling (p. 81), and Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

Verify your Auto Scaling group configuration and launched instances (AWS CLI)
To check whether your Auto Scaling group is configured correctly and that it has launched instances, use the describe-auto-scaling-groups command. Verify that the mixed instances policy and the list of subnets exist and are configured correctly. If the instances have launched, you see a list of the instances and their statuses. To view the scaling activities that result from instances launching, use the describe-scaling-activities command. You can monitor scaling activities that are in progress and that are recently completed. For more information, see Verify a scaling activity for an Auto Scaling group (p. 200).

Configure overrides
Overrides are changes you make to the properties of your launch template. Amazon EC2 Auto Scaling supports overrides to the instance type property. That way, you can specify multiple instance types. You can also define multiple launch templates to allow instances with different CPU architectures (for example, Arm and x86) to launch in the same Auto Scaling group. To do so, you must add the Overrides structure to your mixed instances policy.

The Overrides structure allows you to define a set of parameters that Amazon EC2 Auto Scaling can use to launch instances, including:

- InstanceType — The instance type. For more information about the instance types that are available, see Instance types in the Amazon EC2 User Guide for Linux Instances.
- LaunchTemplateSpecification — (Optional) A launch template for an individual instance type. This property is currently limited to the AWS CLI or an SDK, and is not available from the console.
- WeightedCapacity — (Optional) The number of units that a provisioned instance of this type provides toward fulfilling the desired capacity of the Auto Scaling group. If you specify a weight value for one instance type, you must specify a weight value for all of them.

Note
As an alternative to specifying a list of instance types, you can specify a set of instance attributes to use as criteria for selecting the instance types your Auto Scaling group uses. This is known as attribute-based instance type selection. For more information, see Using attribute-based instance type selection (p. 87).

Specify a different launch template for an instance type
The Overrides structure allows you to define a new launch template for individual instance types for a new or existing Auto Scaling group. For example, if the architecture of an instance type requires a different AMI from the rest of the group, you must specify a launch template with a compatible AMI.

Say that you configure an Auto Scaling group for compute-intensive applications and want to include a mix of C5, C5a, and C6g instance types. However, C6g instances feature an AWS Graviton processor
based on 64-bit Arm architecture, while the C5 and C5a instances run on 64-bit Intel x86 processors. The
AMI for C5 instances works on C5a instances and vice-versa, but not on C6g instances. The Overrides
property allows you to include a different launch template for C6g instances, while still using the same
launch template for C5 and C5a instances.

Note
Currently, this feature is available only if you use the AWS CLI or an SDK, and is not available
from the console.

Contents
• Add or change a launch template for an instance type (AWS CLI) (p. 78)

Add or change a launch template for an instance type (AWS CLI)
The following procedure shows you how to use the AWS CLI to configure an Auto Scaling group so that
one or more of the instance types uses a launch template that is different from the rest of the group.

To create and configure a new Auto Scaling group
1. Create a configuration file where you specify a mixed instances policy structure and include the
Overrides structure.

The following are the contents of an example configuration file formatted in JSON. It specifies the
c5.large, c5a.large, and c6g.large instance types and defines a new launch template for the
c6g.large instance type to ensure that an appropriate AMI is used to launch Arm instances.
Amazon EC2 Auto Scaling uses the order of instance types to determine which instance type to use
first when fulfilling On-Demand capacity.

```json
{
  "AutoScalingGroupName": "my-asg",
  "MixedInstancesPolicy": {
    "LaunchTemplate": {
      "LaunchTemplateSpecification": {
        "LaunchTemplateName": "my-launch-template-for-x86",
        "Version": "$Latest"
      },
      "Overrides": [
        {
          "InstanceType": "c6g.large",
          "LaunchTemplateSpecification": {
            "LaunchTemplateName": "my-launch-template-for-arm",
            "Version": "$Latest"
          }
        },
        {
          "InstanceType": "c5.large"
        },
        {
          "InstanceType": "c5a.large"
        }
      ],
      "InstancesDistribution": {
        "OnDemandBaseCapacity": 1,
        "OnDemandPercentageAboveBaseCapacity": 50,
        "SpotAllocationStrategy": "capacity-optimized"
      }
    },
    "MinSize": 1,
    "MaxSize": 5,
    "DesiredCapacity": 3,
  }
}
```
2. Use the following `create-auto-scaling-group` command, referencing the JSON file as the sole parameter for your Auto Scaling group.

```bash
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

**To change the launch template for an instance type in an existing Auto Scaling group**

- Use the following `update-auto-scaling-group` command to specify a different launch template for an instance type by passing the `Overrides` structure.

When this change is made, any new instances that are launched are based on the new settings, but existing instances are not affected. To ensure that your Auto Scaling group is using the new settings, you can replace all instances in the group by starting an instance refresh or by using the maximum instance lifetime feature.

```bash
aws autoscaling update-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example `config.json` file.

```json
{
  "AutoScalingGroupName": "my-asg",
  "MixedInstancesPolicy": {
    "LaunchTemplate": {
      "Overrides": [
        {
          "InstanceType": "c6g.large",
          "LaunchTemplateSpecification": {
            "LaunchTemplateName": "my-launch-template-for-arm",
            "Version": "$Latest"
          }
        },
        {
          "InstanceType": "c5.large"
        },
        {
          "InstanceType": "c5a.large"
        }
      ]
    }
  }
}
```

**To verify the launch templates for an Auto Scaling group**

- Use the following `describe-auto-scaling-groups` command to verify and view the currently specified launch templates.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

The following is an example response.

```json
{
  ...
}
```
Use multiple instance types and purchase options

```
"AutoScalingGroups": [  
  {  
    "AutoScalingGroupName": "my-asg",
    "AutoScalingGroupARN": "arn",
    "MixedInstancesPolicy": {  
      "LaunchTemplate": {  
        "LaunchTemplateSpecification": {  
          "LaunchTemplateId": "lt-0fb0e487336917fb2",
          "LaunchTemplateName": "my-launch-template-for-x86",
          "Version": "$Latest"
        },  
        "Overrrides": [  
          {  
            "InstanceType": "c6g.large",
            "LaunchTemplateSpecification": {  
              "LaunchTemplateId": "lt-09d958b8fb2ba5bcc",
              "LaunchTemplateName": "my-launch-template-for-arm",
              "Version": "$Latest"
            },  
            "InstanceType": "c5.large"
          },  
          {  
            "InstanceType": "c5a.large"
          }  
        ]  
      },  
      "InstancesDistribution": {  
        "OnDemandAllocationStrategy": "prioritized",
        "OnDemandBaseCapacity": 1,
        "OnDemandPercentageAboveBaseCapacity": 50,
        "SpotAllocationStrategy": "capacity-optimized"
      }  
    },  
    "MinSize": 1,
    "MaxSize": 5,
    "DesiredCapacity": 3,
    "Instances": [  
      {  
        "InstanceId": "i-07c63168522c0f620",
        "InstanceType": "c5.large",
        "AvailabilityZone": "us-west-2c",
        "LifecycleState": "InService",
        "HealthStatus": "Healthy",
        "LaunchTemplate": {  
          "LaunchTemplateId": "lt-0fb0e487336917fb2",
          "LaunchTemplateName": "my-launch-template-for-x86",
          "Version": "1"
        },  
        "ProtectedFromScaleIn": false
      },  
      {  
        "InstanceId": "i-0b7ff78e9896a2c2",
        "InstanceType": "c5.large",
        "AvailabilityZone": "us-west-2a",
        "LifecycleState": "InService",
        "HealthStatus": "Healthy",
        "LaunchTemplate": {  
          "LaunchTemplateId": "lt-0fb0e487336917fb2",
          "LaunchTemplateName": "my-launch-template-for-x86",
          "Version": "1"
        },  
        "ProtectedFromScaleIn": false
      }  
    ]  
  }  
]  
```
Configure instance weighting for Amazon EC2 Auto Scaling

When you configure an Auto Scaling group to launch multiple instance types, you have the option of defining the number of capacity units that each instance contributes to the desired capacity of the group, using instance weighting. This allows you to specify the relative weight of each instance type in a way that directly maps to the performance of your application. You can weight your instances to suit your specific application needs, for example, by the cores (vCPUs) or by memory (GiBs).

For example, let's say that you run a compute-intensive application that performs best with at least 8 vCPUs and 15 GiB of RAM. If you use c5.2xlarge as your base unit, any of the following EC2 instance types would meet your application needs.

### Instance types example

<table>
<thead>
<tr>
<th>Instance type</th>
<th>vCPU</th>
<th>Memory (GiB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c5.2xlarge</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>c5.4xlarge</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>c5.12xlarge</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>c5.18xlarge</td>
<td>72</td>
<td>144</td>
</tr>
<tr>
<td>c5.24xlarge</td>
<td>96</td>
<td>192</td>
</tr>
</tbody>
</table>

By default, all instance types are treated as the same weight. In other words, whether Amazon EC2 Auto Scaling launches a large or small instance type, each instance counts toward the group's desired capacity.

With instance weighting, however, you assign a number value that specifies how many capacity units to associate with each instance type. For example, if the instances are of different sizes, a c5.2xlarge instance could have the weight of 2, and a c5.4xlarge (which is two times bigger) could have the weight of 4, and so on. Then, when Amazon EC2 Auto Scaling launches instances, their weights count toward your desired capacity.

### Contents
- Price per unit hour (p. 82)
- Considerations (p. 82)
- Add or modify weights for your Auto Scaling group (p. 83)
- Additional information (p. 86)
Price per unit hour

The following table compares the hourly price for Spot Instances in different Availability Zones in US East (N. Virginia, Ohio) with the price for On-Demand Instances in the same Region. The prices shown are example pricing and not current pricing. These are your costs per instance hour.

Example: Spot pricing per instance hour

<table>
<thead>
<tr>
<th>Instance type</th>
<th>us-east-1a</th>
<th>us-east-1b</th>
<th>us-east-1c</th>
<th>On-Demand pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>c5.2xlarge</td>
<td>$0.180</td>
<td>$0.191</td>
<td>$0.170</td>
<td>$0.34</td>
</tr>
<tr>
<td>c5.4xlarge</td>
<td>$0.341</td>
<td>$0.361</td>
<td>$0.318</td>
<td>$0.68</td>
</tr>
<tr>
<td>c5.12xlarge</td>
<td>$0.779</td>
<td>$0.777</td>
<td>$0.777</td>
<td>$2.04</td>
</tr>
<tr>
<td>c5.18xlarge</td>
<td>$1.207</td>
<td>$1.475</td>
<td>$1.357</td>
<td>$3.06</td>
</tr>
<tr>
<td>c5.24xlarge</td>
<td>$1.555</td>
<td>$1.555</td>
<td>$1.555</td>
<td>$4.08</td>
</tr>
</tbody>
</table>

With instance weighting, you can evaluate your costs based on what you use per unit hour. You can determine the price per unit hour by dividing your price for an instance type by the number of units that it represents. For On-Demand Instances, the price per unit hour is the same when deploying one instance type as it is when deploying a different size of the same instance type. In contrast, however, the Spot price per unit hour varies by Spot pool.

The easiest way to understand how the price per unit hour calculation works with weighted instances is with an example. For example, for ease of calculation, let's say you want to launch Spot Instances only in us-east-1a. The per unit hour price is captured below.

Example: Spot Price per unit hour example

<table>
<thead>
<tr>
<th>Instance type</th>
<th>us-east-1a</th>
<th>Instance weight</th>
<th>Price per unit hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>c5.2xlarge</td>
<td>$0.180</td>
<td>2</td>
<td>$0.090</td>
</tr>
<tr>
<td>c5.4xlarge</td>
<td>$0.341</td>
<td>4</td>
<td>$0.085</td>
</tr>
<tr>
<td>c5.12xlarge</td>
<td>$0.779</td>
<td>12</td>
<td>$0.065</td>
</tr>
<tr>
<td>c5.18xlarge</td>
<td>$1.207</td>
<td>18</td>
<td>$0.067</td>
</tr>
<tr>
<td>c5.24xlarge</td>
<td>$1.555</td>
<td>24</td>
<td>$0.065</td>
</tr>
</tbody>
</table>

Considerations

This section discusses the key considerations in implementing instance weighting effectively.

- Start by choosing a few instance types that reflect the actual performance requirements of your application. Then, decide how much each instance type should count toward the desired capacity of your Auto Scaling group by specifying their weights. The weights apply to current and future instances in the group.
- Be cautious about choosing very large ranges for your weights. For example, we don't recommend specifying a weight of 1 for an instance type when the next larger instance type has a weight of 200. The difference between the smallest and largest weights should also not be extreme. If any of the instance types have too large of a weight difference, this can have a negative effect on ongoing cost-performance optimization.
The size of the Auto Scaling group is measured in capacity units, and not in instances. For example, if your weights are based on vCPUs, you must specify the desired, minimum, and maximum number of cores you want.

Set your weights and desired capacity so that the desired capacity is at least two to three times larger than your largest weight.

With instance weighting, the following new behaviors are introduced:

- Current capacity will either be at the desired capacity or above it. Because Amazon EC2 Auto Scaling wants to provision instances until the desired capacity is totally fulfilled, an overage can happen. For example, suppose that you specify two instance types, c5.2xlarge and c5.12xlarge, and you assign instance weights of 2 for c5.2xlarge and 12 for c5.12xlarge. If there are 5 units remaining to fulfill the desired capacity, and Amazon EC2 Auto Scaling provisions a c5.12xlarge, the desired capacity is exceeded by 7 units.
- When Amazon EC2 Auto Scaling provisions instances to reach the desired capacity, distributing instances across Availability Zones and respecting the allocation strategies for On-Demand and Spot Instances both take precedence over avoiding overages.
- Amazon EC2 Auto Scaling can overstep the maximum capacity limit to maintain balance across Availability Zones, using your preferred allocation strategies. The hard limit enforced by Amazon EC2 Auto Scaling is a value that is equal to your desired capacity plus your largest weight.

Note the following when adding or modifying weights for existing groups:

- When adding instance weights to an existing Auto Scaling group, you must include any instance types that are already running in the group.
- When modifying existing instance weights, Amazon EC2 Auto Scaling will launch or terminate instances to reach your desired capacity based on the new weights.
- If you remove an instance type, any running instances of that instance type will continue to have their last updated weight values, even though the instance type has been removed.

Add or modify weights for your Auto Scaling group

You can add weights to an existing Auto Scaling group, or to a new Auto Scaling group as you create it. You can also update an existing Auto Scaling group to define new configuration options (Spot/On-Demand usage, Spot allocation strategy, instance types). If you change how many Spot or On-Demand Instances you want, Amazon EC2 Auto Scaling gradually replaces existing instances to match the new purchase options.

Before creating Auto Scaling groups using instance weighting, we recommend that you become familiar with launching groups with multiple instance types. For more information and additional examples, see Auto Scaling groups with multiple instance types and purchase options (p. 62).

The following examples show how to use the AWS CLI to add weights when you create Auto Scaling groups, and to add or modify weights for existing Auto Scaling groups. You can configure a variety of parameters in a JSON file, and then reference the JSON file as the sole parameter for your Auto Scaling group.

To add weights to an Auto Scaling group on creation

- Use the create-auto-scaling-group command to create a new Auto Scaling group. For example, the following command creates a new Auto Scaling group and adds instance weighting by specifying the following:
  - The percentage of the group to launch as On-Demand Instances (0)
  - The allocation strategy for Spot Instances in each Availability Zone (capacity-optimized)
• The instance types to launch in priority order (m4.16xlarge, m5.24xlarge)
• The instance weights that correspond to the relative size difference (vCPUs) between instance types (16, 24)
• The subnets in which to launch the instances (subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782), each corresponding to a different Availability Zone
• The launch template (my-launch-template) and the launch template version ($Latest)

```bash
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example `config.json` file.

```json
{
    "AutoScalingGroupName": "my-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateSpecification": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "$Latest"
            },
            "Overrides": [
                {
                    "InstanceType": "m4.16xlarge",
                    "WeightedCapacity": "16"
                },
                {
                    "InstanceType": "m5.24xlarge",
                    "WeightedCapacity": "24"
                }
            ]
        },
        "InstancesDistribution": {
            "OnDemandPercentageAboveBaseCapacity": 0,
            "SpotAllocationStrategy": "capacity-optimized"
        }
    },
    "MinSize": 160,
    "MaxSize": 720,
    "DesiredCapacity": 480,
    "VPCZoneIdentifier": "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782",
    "Tags": []
}
```

To add or modify weights for an existing Auto Scaling group

• Use the `update-auto-scaling-group` command to add or modify weights. For example, the following command adds weights to instance types in an existing Auto Scaling group by specifying the following:
  • The instance types to launch in priority order (c5.18xlarge, c5.24xlarge, c5.2xlarge, c5.4xlarge)
  • The instance weights that correspond to the relative size difference (vCPUs) between instance types (18, 24, 2, 4)
  • The new, increased desired capacity, which is larger than the largest weight

```bash
aws autoscaling update-auto-scaling-group --cli-input-json file://~/config.json
```
The following is an example config.json file.

```
{
    "AutoScalingGroupName": "my-existing-asg",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "Overrides": [
                {
                    "InstanceType": "c5.18xlarge",
                    "WeightedCapacity": "18"
                },
                {
                    "InstanceType": "c5.24xlarge",
                    "WeightedCapacity": "24"
                },
                {
                    "InstanceType": "c5.2xlarge",
                    "WeightedCapacity": "2"
                },
                {
                    "InstanceType": "c5.4xlarge",
                    "WeightedCapacity": "4"
                }
            ]
        },
        "MinSize": 0,
        "MaxSize": 100,
        "DesiredCapacity": 100
    }
}
```

To verify the weights for an Auto Scaling group

- Use the following `describe-auto-scaling-groups` command to verify the weights.

```
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

The following is an example response.

```
{
    "AutoScalingGroups": [
        {
            "AutoScalingGroupName": "my-asg",
            "AutoScalingGroupARN": "arn",
            "MixedInstancesPolicy": {
                "LaunchTemplate": {
                    "LaunchTemplateSpecification": {
                        "LaunchTemplateId": "lt-0b97f1e282EXAMPLE",
                        "LaunchTemplateName": "my-launch-template",
                        "Version": "$Latest"
                    },
                    "Overrides": [
                        {
                            "InstanceType": "m4.16xlarge",
                            "WeightedCapacity": "16"
                        },
                        {
                            "InstanceType": "m5.24xlarge",
                            "WeightedCapacity": "24"
                        }
                    ]
                }
            }
        }
    ]
}
```
Use multiple instance types and purchase options

```
{
  "InstancesDistribution": {
    "OnDemandAllocationStrategy": "prioritized",
    "OnDemandBaseCapacity": 0,
    "OnDemandPercentageAboveBaseCapacity": 0,
    "SpotAllocationStrategy": "capacity-optimized"
  },
  "MinSize": 160,
  "MaxSize": 720,
  "DesiredCapacity": 480,
  "DefaultCooldown": 300,
  "AvailabilityZones": ["us-west-2a", "us-west-2b", "us-west-2c"],
  "LoadBalancerNames": [],
  "TargetGroupARNs": [],
  "HealthCheckType": "EC2",
  "HealthCheckGracePeriod": 0,
  "Instances": [
    {
      "InstanceId": "i-027327f0ace86f499",
      "InstanceType": "m5.24xlarge",
      "AvailabilityZone": "us-west-2a",
      "LifecycleState": "InService",
      "HealthStatus": "Healthy",
      "LaunchTemplate": {
        "LaunchTemplateId": "lt-0b97f1e282EXAMPLE",
        "LaunchTemplateName": "my-launch-template",
        "Version": "7"
      },
      "ProtectedFromScaleIn": false,
      "WeightedCapacity": "24"
    },
    {
      "InstanceId": "i-0ec0d761cc134878d",
      "InstanceType": "m4.16xlarge",
      "AvailabilityZone": "us-west-2a",
      "LifecycleState": "Pending",
      "HealthStatus": "Healthy",
      "LaunchTemplate": {
        "LaunchTemplateId": "lt-0b97f1e282EXAMPLE",
        "LaunchTemplateName": "my-launch-template",
        "Version": "7"
      },
      "ProtectedFromScaleIn": false,
      "WeightedCapacity": "16"
    },
    ...
  ]
}
```

Additional information

Instance weighting and allocation strategies

The allocation strategies (p. 63) determine which instance pools your instances come from. When you use the instance weighting feature, the allocation strategies perform exactly like they do for other Auto Scaling groups. However, there is one key difference in how instance pools are chosen when you use the
lowest-price strategy. When you choose lowest-price for your allocation strategy, your instances come from the instance pools with the lowest price per unit in each Availability Zone.

For example, consider you have an Auto Scaling group that has several instance types with varying amounts of vCPUs. You use lowest-price for your Spot and On-Demand allocation strategies. If you choose to assign weights based on the vCPU count of each instance type, Amazon EC2 Auto Scaling launches whichever instance types have the lowest price per your assigned weight values (for example, per vCPU) at the time of fulfillment. If it's a Spot Instance, then this means the lowest Spot price per vCPU. If it's an On-Demand Instance, then this means the lowest On-Demand price per vCPU.

**Instance weighting and Spot max price**

When you create your Auto Scaling group using the AWS CLI or an SDK, you can specify the SpotMaxPrice parameter. This parameter determines the maximum price you would be willing to pay for a Spot instance hour, and by default, is set at the On-Demand price. When you use the instance weighting feature, remember that the maximum Spot price reflects the maximum unit price (for example, price per vCPU) instead of the maximum price for a whole instance.

## Create an Auto Scaling group using attribute-based instance type selection

When you create an Auto Scaling group, you must specify information to configure the following:

- The launch template that specifies the AMI and an instance type for the Amazon EC2 instances
- The Availability Zones and VPC subnets for the instances
- The desired capacity
- The minimum and maximum capacity limits

As an alternative to manually choosing instance types when creating a mixed instances group (p. 62), you can specify a set of instance attributes that describe your compute requirements. As Amazon EC2 Auto Scaling launches instances, any instance types used by the Auto Scaling group must match your required instance attributes. This is known as attribute-based instance type selection.

Your Auto Scaling group or your launch template specifies your instance attributes. These attributes include the amount of memory and computing power that you need for the applications that you plan to run on the instances. Also, your Auto Scaling group or your launch template specifies two price protection thresholds for Spot and On-Demand Instances that you can customize. This way, you can prevent Amazon EC2 Auto Scaling from launching more expensive instance types if you don’t need them.

This approach is ideal for workloads and frameworks that can be flexible about which instance types they use, such as containers, big data, and CI/CD.

The following are benefits of attribute-based instance type selection:

- Amazon EC2 Auto Scaling can select from a wide range of instance types for launching Spot Instances. This meets the Spot best practice of being flexible about instance types, which gives the Amazon EC2 Spot service a better chance of finding and allocating your required amount of compute capacity.
- With so many options available, finding the right instance types for your workload can be time consuming. By specifying instance attributes, you can simplify instance type selection when configuring a mixed instances group.
- Your Auto Scaling groups can use newer generation instance types as they’re released. Newer generation instance types are automatically used when they match your requirements and align with the allocation strategies you choose for your Auto Scaling group.
For information about the configuration parameters available for attribute-based instance type selection when you create an Auto Scaling group using the CLI or an SDK, see `InstanceRequirements` in the Amazon EC2 Auto Scaling API Reference. To learn how to declare attribute-based instance type selection when you create an Auto Scaling group using AWS CloudFormation, see the example snippet in the Auto scaling template snippets section of the AWS CloudFormation User Guide.

To learn more about attribute-based instance type selection, see Attribute-Based Instance Type Selection for EC2 Auto Scaling and EC2 Fleet on the AWS Blog.

Contents

- Considerations (p. 88)
- Prerequisites (p. 89)
- Use attribute-based instance type selection (p. 89)
- Limitations (p. 93)

Considerations

The following are things to consider when using attribute-based instance type selection:

- For most general purpose workloads, it is enough to specify the number of vCPUs and memory that you need. For advanced use cases, you can specify attributes like storage type, network interfaces, CPU manufacturer, and accelerator type.

- By default, you set the value for the desired capacity of your Auto Scaling group as the number of instances. You can optionally specify the desired capacity type as the number of vCPUs or the amount of memory when you use attribute-based instance type selection. Then, when Amazon EC2 Auto Scaling launches instances, their number of vCPUs or amount of memory count toward your desired capacity. When creating your group in the Amazon EC2 Auto Scaling console, this setting appears in the Group size section on the Configure group size and scaling policies page. This feature is a useful replacement for the instance weighting (p. 81) feature.

- You can preview the instance types that match your compute requirements without launching them and adjust your requirements if necessary. When creating your Auto Scaling group in the Amazon EC2 Auto Scaling console, a preview of the instance types appears in the Preview matching instance types section on the Choose instance launch options page.

- Alternatively, you can preview the instance types by making an Amazon EC2 `GetInstanceTypesFromInstanceRequirements` API call using the AWS CLI or an SDK. Pass the `InstanceRequirements` parameters in the request in the exact format that you would use to create or update an Auto Scaling group. For more information, see Preview instance types with specified attributes in the Amazon EC2 User Guide for Linux Instances.

Understand price protection

Price protection is a feature that protects your Auto Scaling group from extreme price differences across instance types. When you create a new Auto Scaling group or update an existing Auto Scaling group with attribute-based instance type selection, we enable price protection by default. Optionally, you can choose your price protection thresholds for Spot and On-Demand Instances. When you do this, Amazon EC2 Auto Scaling doesn’t select instance types with prices higher than your specified thresholds. The thresholds represent what you are willing to pay, defined in terms of a percentage above a baseline, rather than as absolute values. The baseline is determined by the price of the least expensive current generation M, C, or R instance type with your specified attributes. If your attributes don’t match any M, C, or R instance types, we use the lowest priced instance type.

If you don’t specify a threshold, the following are used by default:

- For On-Demand Instances, the price protection threshold is set to 20 percent.
For Spot Instances, the price protection threshold is set to 100 percent.

You can update these values when creating your Auto Scaling group in the Amazon EC2 Auto Scaling console. On the Choose instance launch options page, choose the desired price protection attribute from the Additional instance attributes drop-down list. Then, type or choose a value for the attribute in the text box. You can also update these values later by editing the Auto Scaling group from the console or by using the AWS CLI or an SDK.

**Note**

If you set Desired capacity type to vCPUs or Memory GiB, the price protection threshold is applied based on the per vCPU or per memory price instead of the per instance price.

**Prerequisites**

- Create a launch template. For more information, see [Create a launch template for an Auto Scaling group](p. 22).
- Verify that the launch template doesn’t already request Spot Instances.

**Use attribute-based instance type selection**

Use the following procedure to use attribute-based instance type selection. If you prefer to choose which individual instance types your group can launch, see [Auto Scaling groups with multiple instance types and purchase options](p. 62) to configure instance type requirements by manually choosing the instance types.

The following steps describe how to create an Auto Scaling group using attribute-based instance type selection:

- Specify the launch template for launching the instances.
- Choose the VPC and subnets to launch your Auto Scaling group in.
- Choose the option to override the existing instance type requirements of the launch template with new requirements.
- Specify instance attributes that match your compute requirements, such as vCPUs, memory, and storage.
- Specify the percentages of On-Demand Instances and Spot Instances to launch.
- Choose allocation strategies that determine how Amazon EC2 Auto Scaling fulfills your On-Demand and Spot capacities from the possible instance types.
- Specify your group size, including your desired capacity, minimum capacity, maximum capacity, and desired capacity type, which defines a unit of measurement for your desired capacity.

**To create an Auto Scaling group using attribute-based instance type selection (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the same AWS Region that you used when you created the launch template.
3. Choose Create an Auto Scaling group.
4. On the Choose launch template or configuration page, for Auto Scaling group name, enter a name for your Auto Scaling group.
5. To choose your launch template, do the following:
   a. For Launch template, choose an existing launch template.
b. For **Launch template version**, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.

c. Verify that your launch template supports all of the options that you are planning to use, and then choose **Next**.

6. To choose the VPC and subnets to launch your instances in, do the following:

   a. On the **Choose instance launch options** page, under **Network**, for **VPC**, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch template.

   b. For **Availability Zones and subnets**, choose one or more subnets in the specified VPC. Use subnets in multiple Availability Zones for high availability. For more information, see [Considerations when choosing VPC subnets](p. 388).

7. To configure your group to use attribute-based instance type selection, do the following:

   a. For **Instance type requirements**, choose **Override launch template**.

      **Note**
      If you choose a launch template that already contains your requirements, then the launch template settings, such as vCPUs and memory, are automatically used as attributes. You can update these attributes from the Amazon EC2 Auto Scaling console at any time.

   b. Under **Specify instance attributes**, start by entering your vCPUs and memory requirements.

      • **vCPUs**: Enter the minimum and maximum number of vCPUs for your compute requirements. Select the **No minimum** or **No maximum** check box to indicate no limit in that direction.

      • **Memory (MiB)**: Enter the minimum and maximum amount of memory, in MiB, for your compute requirements. Select the **No minimum** or **No maximum** check box to indicate no limit in that direction.

   c. (Optional) For **Additional instance attributes**, choose **Add attribute** to express your compute requirements in more detail. The attributes and values that you choose here further define which instance types may be launched.

      For more information about all the supported attributes, see [InstanceRequirements](p. 388) in the Amazon EC2 Auto Scaling API Reference.

   d. For **Preview matching instance types**, view the instance types that match the specified compute requirements, such as vCPUs, memory, and storage.

   e. Under **Instance purchase options**, for **Instances distribution**, specify the percentages of the group to be launched as On-Demand Instances and Spot Instances respectively. If your application is stateless, fault tolerant and can handle an instance being interrupted, you can specify a higher percentage of Spot Instances.

   f. When you specify a percentage for Spot Instances, you can select the check box next to **Include On-Demand base capacity** and then specify the minimum amount of the Auto Scaling group’s initial capacity that must be fulfilled by On-Demand Instances. Anything beyond the base capacity uses the **Instances distribution** settings to determine how many On-Demand Instances and Spot Instances to launch.

   g. Under **Allocation strategies**, **Lowest price** is automatically selected for the **On-Demand allocation strategy** and cannot be changed.

   h. For **Spot allocation strategy**, choose an allocation strategy. **Price capacity optimized** is selected by default. **Lowest price** is hidden by default and only appears when you choose **Show all strategies**.

      **Note**
      If you chose **Lowest price**, enter the number of lowest priced pools to diversify across for **Lowest priced pools**.

   i. For **Capacity rebalance**, choose whether to enable or disable Capacity Rebalancing.
If you chose a percentage for Spot Instances, you can use Capacity Rebalancing to automatically respond when your Spot Instances approach termination from a Spot interruption. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

j. When finished, choose Next twice to go to the Configure group size and scaling policies page.

8. For the Configure group size and scaling policies step, do the following:
   a. If you want your desired capacity to be measured in units other than instances, choose the appropriate option for Desired capacity type. Units, vCPUs, and Memory GiB are supported. By default, Amazon EC2 Auto Scaling specifies Units, which translates into number of instances.
   b. Enter the initial size of your Auto Scaling group for Desired capacity and update the Minimum capacity and Maximum capacity limits as needed. For more information, see Set capacity limits on your Auto Scaling group (p. 156).
   c. (Optional) Configure the group to scale by specifying a target tracking scaling policy. Alternatively, specify this policy after you create the group. For more information, see Target tracking scaling policies for Amazon EC2 Auto Scaling (p. 169).
   d. (Optional) Enable instance scale-in protection, which prevents your Auto Scaling group from terminating instances when scaling in. For more information, see Use instance scale-in protection (p. 282).
   e. When finished, choose Next.

9. (Optional) To receive notifications when your group scales, for Add notification, configure the notification, and then choose Next. For more information, see Get Amazon SNS notifications when your Auto Scaling group scales (p. 317).

10. (Optional) To add tags, choose Add tag, provide a tag key and value for each tag, and then choose Next. For more information, see Tag Auto Scaling groups and instances (p. 129).


Example: Create an Auto Scaling group using attribute-based instance type selection (AWS CLI)

To create an Auto Scaling group with attribute-based instance type selection using the command line, you can use the following create-auto-scaling-group command.

The following instance attributes are specified:

- VcpuCount – The instance types must have a minimum of four vCPUs and a maximum of eight vCPUs.
- MemoryMiB – The instance types must have a minimum of 16,384 MiB of memory.
- CpuManufacturers – The instance types must have an Intel manufactured CPU.

**JSON**

```bash
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

The following is an example config.json file.

```json
{
    "AutoScalingGroupName": "my-asg",
    "DesiredCapacityType": "units",
    "MixedInstancesPolicy": {
        "LaunchTemplate": {
            "LaunchTemplateName": "my-launch-template",
            "Version": "$Default"
        }
    }
}
```
To set the value for desired capacity as the number of vCPUs or the amount of memory, specify "DesiredCapacityType": "vcpu" or "DesiredCapacityType": "memory-mib" in the file. The default desired capacity type is units, which sets the value for desired capacity as the number of instances.

YAML

Alternatively, you can use the following `create-auto-scaling-group` command to create the Auto Scaling group. This references a YAML file as the sole parameter for your Auto Scaling group, instead of a JSON file.

```bash
aws autoscaling create-auto-scaling-group --cli-input-yaml file://~/config.yaml
```

The following is an example `config.yaml` file.

```yaml
---
AutoScalingGroupName: my-asg
DesiredCapacityType: units
MixedInstancesPolicy:
  LaunchTemplate:
    LaunchTemplateSpecification:
      LaunchTemplateName: my-launch-template
      Version: $Default
  Overrides:
    - InstanceRequirements:
      VCpuCount:
        Min: 2
        Max: 4
      MemoryMiB:
        Min: 2048
      CpuManufacturers:
        - intel
    InstancesDistribution:
      OnDemandPercentageAboveBaseCapacity: 50
      SpotAllocationStrategy: price-capacity-optimized
    MinSize: 0
    MaxSize: 100
    DesiredCapacity: 4
    DesiredCapacityType: units
  VPCZoneIdentifier: subnet-5ea0c127, subnet-6194ea3b, subnet-c934b782
---
```
To set the value for desired capacity as the number of vCPUs or the amount of memory, specify DesiredCapacityType: vcpu or DesiredCapacityType: memory-mib in the file. The default desired capacity type is units, which sets the value for desired capacity as the number of instances.

**Limitations**

- You can configure attribute-based instance type selection only for Auto Scaling groups that use a launch template.
- If you have an existing Auto Scaling group and plan to substitute your instance types with your required instance attributes, your On-Demand allocation strategy must be lowest-price. To use the prioritized allocation strategy, you must continue to manually add and prioritize your instance types. Additionally, your Spot allocation strategy must be price-capacity-optimized, capacity-optimized, or lowest-price. To use the capacity-optimized-prioritized allocation strategy, you must manually add and prioritize your instance types.

**Create Auto Scaling groups using launch configurations**

**Important**
Launch configurations no longer add support for new Amazon EC2 instance types that are released after December 31, 2022. In addition, any new accounts created on or after June 1, 2023 will not have the option to create new launch configurations through the console. However, API, CLI, and CloudFormation access will be available to new accounts created between June 1, 2023 and December 31, 2023 to support customers with automation use cases. New accounts created on or after January 1, 2024 will not be able to create new launch configurations by using the console, API, CLI, and CloudFormation. For information about migrating your Auto Scaling groups to launch templates, see [Migrate to launch templates](p. 30).

If you have created a launch configuration or an EC2 instance, you can create an Auto Scaling group that uses a launch configuration as a configuration template for its EC2 instances. The launch configuration specifies information such as the AMI ID, instance type, key pair, security groups, and block device mapping for your instances. For information about creating launch configurations, see [Create a launch configuration](p. 46).

You must have sufficient permissions to create an Auto Scaling group. You must also have sufficient permissions to create the service-linked role that Amazon EC2 Auto Scaling uses to perform actions on your behalf if it does not yet exist. For examples of IAM policies that an administrator can use as a reference for granting you permissions, see [Identity-based policy examples](p. 406).

**Contents**

- [Create an Auto Scaling group using a launch configuration](p. 93)
- [Create an Auto Scaling group using parameters from an existing instance](p. 95)

**Create an Auto Scaling group using a launch configuration**

**Important**
Launch configurations no longer add support for new Amazon EC2 instance types that are released after December 31, 2022. In addition, any new accounts created on or after June 1, 2023 will not have the option to create new launch configurations through the console.
However, API, CLI, and CloudFormation access will be available to new accounts created between June 1, 2023 and December 31, 2023 to support customers with automation use cases. New accounts created on or after January 1, 2024 will not be able to create new launch configurations by using the console, API, CLI, and CloudFormation. For information about migrating your Auto Scaling groups to launch templates, see [Migrate to launch templates](p. 30).

When you create an Auto Scaling group, you must specify the necessary information to configure the Amazon EC2 instances, the Availability Zones and VPC subnets for the instances, the desired capacity, and the minimum and maximum capacity limits.

The following procedure demonstrates how to create an Auto Scaling group using a launch configuration. You cannot modify a launch configuration after it is created, but you can replace the launch configuration for an Auto Scaling group. For more information, see [Change the launch configuration for an Auto Scaling group](p. 53).

### Prerequisites

- You must have created a launch configuration. For more information, see [Create a launch configuration](p. 46).

### To create an Auto Scaling group using a launch configuration (console)

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the same AWS Region that you used when you created the launch configuration.
3. Choose Create an Auto Scaling group.
4. On the Choose launch template or configuration page, for Auto Scaling group name, enter a name for your Auto Scaling group.
5. To choose a launch configuration, do the following:
   a. For Launch template, choose Switch to launch configuration.
   b. For Launch configuration, choose an existing launch configuration.
   c. Verify that your launch configuration supports all of the options that you are planning to use, and then choose Next.
6. On the Configure instance launch options page, under Network, for VPC, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch configuration.
7. For Availability Zones and subnets, choose one or more subnets in the specified VPC. Use subnets in multiple Availability Zones for high availability. For more information, see [Considerations when choosing VPC subnets](p. 388).
8. Choose Next.
9. (Optional) On the Configure advanced options page, configure the following options, and then choose Next:
   a. To register your Amazon EC2 instances with a load balancer, choose an existing load balancer or create a new one. For more information, see [Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group](p. 344). To create a new load balancer, follow the procedure in [Configure an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console](p. 348).
   b. (Optional) For Health checks, Additional health check types, select Turn on Elastic Load Balancing health checks.
c. (Optional) For **Health check grace period**, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the *InService* state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

d. Under **Additional settings, Monitoring**, choose whether to enable CloudWatch group metrics collection. These metrics provide measurements that can be indicators of a potential issue, such as number of terminating instances or number of pending instances. For more information, see Monitor CloudWatch metrics for your Auto Scaling groups and instances (p. 305).

e. For **Enable default instance warmup**, select this option and choose the warm-up time for your application. If you are creating an Auto Scaling group that has a scaling policy, the default instance warmup feature improves the Amazon CloudWatch metrics used for dynamic scaling. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

10. (Optional) On the **Configure group size and scaling policies** page, configure the following options, and then choose **Next**:

   a. For **Desired capacity**, enter the initial number of instances to launch. When you change this number to a value outside of the minimum or maximum capacity limits, you must update the values of **Minimum capacity** or **Maximum capacity**. For more information, see Set capacity limits on your Auto Scaling group (p. 156).

   b. To automatically scale the size of the Auto Scaling group, choose **Target tracking scaling policy** and follow the directions. For more information, see Target tracking scaling policies for Amazon EC2 Auto Scaling (p. 169).

   c. Under **Instance scale-in protection**, choose whether to enable instance scale-in protection. For more information, see Use instance scale-in protection (p. 282).

11. (Optional) To receive notifications, for **Add notification**, configure the notification, and then choose **Next**. For more information, see Get Amazon SNS notifications when your Auto Scaling group scales (p. 317).

12. (Optional) To add tags, choose **Add tag**, provide a tag key and value for each tag, and then choose **Next**. For more information, see Tag Auto Scaling groups and instances (p. 129).

13. On the **Review** page, choose **Create Auto Scaling group**.

**To create an Auto Scaling group using the command line**

You can use one of the following commands:

- `create-auto-scaling-group` (AWS CLI)
- `New-ASAutoScalingGroup` (AWS Tools for Windows PowerShell)

**Create an Auto Scaling group using parameters from an existing instance**

*Important*

This topic only applies to creating an Auto Scaling group using a launch configuration. We provide information about launch configurations for customers who have not yet migrated from launch configurations to launch templates.

If this is your first time creating an Auto Scaling group, we recommend you use the console to create a launch template from an existing EC2 instance. Then use the launch template to create a new Auto Scaling group. For this procedure, see Create an Auto Scaling group using the Amazon EC2 launch wizard (p. 60).

The following procedure shows how to create an Auto Scaling group by specifying an existing instance to use as a base for launching other instances. Multiple parameters are required to create an EC2 instance, such as the Amazon Machine Image (AMI) ID, instance type, key pair, and security group. All of this
information is also used by Amazon EC2 Auto Scaling to launch instances on your behalf when there is a need to scale. This information is stored in either a launch template or a launch configuration.

When you use an existing instance, Amazon EC2 Auto Scaling creates an Auto Scaling group that launches instances based on a launch configuration that's created at the same time. The new launch configuration has the same name as the Auto Scaling group, and it includes certain configuration details from the identified instance.

The following configuration details are copied from the identified instance into the launch configuration:

- AMI ID
- Instance type
- Key pair
- Security groups
- IP address type (public or private)
- IAM instance profile, if applicable
- Monitoring (true or false)
- EBS optimized (true or false)
- Tenancy setting, if launching into a VPC (shared or dedicated)
- Kernel ID and RAM disk ID, if applicable
- User data, if specified
- Spot (maximum) price

The following configuration details are not copied from your identified instance:

- Storage: The block devices (EBS volumes and instance store volumes) are not copied from the identified instance. Instead, the block device mapping created as part of creating the AMI determines which devices are used.
- Number of network interfaces: The network interfaces are not copied from your identified instance. Instead, Amazon EC2 Auto Scaling uses its default settings to create one network interface, which is the primary network interface (eth0).
- Instance metadata options: The metadata accessible, metadata version, and token response hop limit settings are not copied from the identified instance. Instead, Amazon EC2 Auto Scaling uses its default settings. For more information, see Configure the instance metadata options (p. 48).
- Load balancers: If the identified instance is registered with one or more load balancers, the information about the load balancer is not copied to the load balancer or target group attribute of the new Auto Scaling group.
- Tags: If the identified instance has tags, the tags are not copied to the Tags attribute of the new Auto Scaling group.

The new Auto Scaling group launches instances into the same Availability Zone, VPC, and subnet in which the identified instance is located.

If the identified instance is in a placement group, the new Auto Scaling group launches instances into the same placement group as the identified instance. Because the launch configuration settings do not allow a placement group to be specified, the placement group is copied to the PlacementGroup attribute of the new Auto Scaling group.

**Prerequisites**

The EC2 instance must meet the following criteria:

- The instance is in the subnet and Availability Zone in which you want to create the Auto Scaling group.
Create a group using an EC2 instance

- The instance is not a member of another Auto Scaling group.
- The instance is in the running state.
- The AMI that was used to launch the instance must still exist.

Create an Auto Scaling group from an EC2 instance (console)

To create an Auto Scaling group from an EC2 instance

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation pane, under Instances, choose Instances, and then select an instance.
3. Choose Actions, Instance settings, Attach to Auto Scaling Group.
4. On the Attach to Auto Scaling group page, for Auto Scaling Group, enter a name for the group, and then choose Attach.

After the instance is attached, it is considered part of the Auto Scaling group. The new Auto Scaling group is created using a new launch configuration with the same name that you specified for the Auto Scaling group. The Auto Scaling group has a desired capacity and maximum size of 1.

5. (Optional) To edit the settings for the Auto Scaling group, on the navigation pane, under Auto Scaling, choose Auto Scaling Groups. Select the check box next to the new Auto Scaling group, choose the Edit button that is above the list of groups, change the settings as needed, and then choose Update.

Create an Auto Scaling group from an EC2 instance (AWS CLI)

In this exercise, we demonstrate how to use the AWS CLI to create an Auto Scaling group from an EC2 instance.

This procedure does not add the instance to the Auto Scaling group. For the instance to be attached, you must run the attach-instances command after the Auto Scaling group has been created.

Before you begin, find the ID of the EC2 instance using the Amazon EC2 console or the describe-instances command.

To use your current instance as a template

- Use the following create-auto-scaling-group command to create an Auto Scaling group, my-asg-from-instance, from the EC2 instance i-0e69cc3f05f825f4f.

```bash
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg-from-instance \ 
--instance-id i-0e69cc3f05f825f4f --min-size 1 --max-size 2 --desired-capacity 2
```

To verify that your Auto Scaling group has launched instances

- Use the following describe-auto-scaling-groups command to verify that the Auto Scaling group was created successfully.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg-from-instance
```

The following example response shows that the desired capacity of the group is 2, the group has 2 running instances, and the launch configuration is named my-asg-from-instance.
To view the launch configuration

- Use the following `describe-launch-configurations` command to view the details of the launch configuration.

```
aws autoscaling describe-launch-configurations --launch-configuration-names my-asg-from-instance
```

The following is example output:
To terminate the instance

- If you no longer need the instance, you can terminate it. The following `terminate-instances` command terminates the instance `i-0e69cc3f05f825f4f`.

```bash
aws ec2 terminate-instances --instance-ids i-0e69cc3f05f825f4f
```

After you terminate an Amazon EC2 instance, you can't restart the instance. After termination, its data is gone and the volume can't be attached to any instance. To learn more about terminating instances, see [Terminate an instance](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/terminate-instances.html) in the *Amazon EC2 User Guide for Linux Instances*.

Update an Auto Scaling group

You can update most of your Auto Scaling group's details. You can't update the name of an Auto Scaling group or change its AWS Region.

**To update an Auto Scaling group (console)**

1. Open the Amazon EC2 console at `https://console.aws.amazon.com/ec2/`, and choose **Auto Scaling Groups** from the navigation pane.
2. Choose your Auto Scaling group to display information about the group, with tabs for **Details**, **Activity**, **Automatic scaling**, **Instance management**, **Monitoring**, and **Instance refresh**.
3. Choose the tabs for the configuration areas that you're interested in and update the settings as needed. For each setting that you edit, choose **Update** to save your changes to the Auto Scaling group's configuration.

- **Details** tab

    These are the general settings for your Auto Scaling group. You can edit and manage these in the same way as during Auto Scaling group creation.
Update Auto Scaling instances

If you associate a new launch template or launch configuration with an Auto Scaling group, all new instances will get the updated configuration. Existing instances continue to run with the configuration that they were originally launched with. To apply your changes to existing instances, you have the following options:

- Start an instance refresh to replace the older instances. For more information, see Replace Auto Scaling instances (p. 101) and Update a warm pool (p. 264).
- Wait for scaling activities to gradually replace older instances with newer instances based on your termination policies (p. 272).
- Manually terminate them so that they are replaced by your Auto Scaling group.

**Note**

You can change the following instance attributes by specifying them as part of the launch template or launch configuration:

- Amazon Machine Image (AMI)
- block devices
- key pair
- instance type
Replace Auto Scaling instances

Amazon EC2 Auto Scaling offers capabilities that let you replace instances after you update your Auto Scaling group. Amazon EC2 Auto Scaling also helps you streamline updates by giving you the option of including them in the same operation that replaces the instances.

This section includes information to help you do the following:

- Start an instance refresh to replace instances in your Auto Scaling group.
- Declare specific updates that describe a desired configuration and update the Auto Scaling group to the desired configuration.
- Skip replacing already updated instances.
- Use checkpoints to replace instances in phases and perform verifications on your instances at specific points.
- Receive notifications by email when a checkpoint is reached.
- Use a rollback to restore the Auto Scaling group to the configuration it was previously using.
- Automatically roll back if the instance refresh fails for some reason or if any Amazon CloudWatch alarms you specify go into the ALARM state.
- Limit the lifetime of instances to provide consistent software versions and instance configurations across the Auto Scaling group.

Contents

- Replace Auto Scaling instances based on an instance refresh (p. 101)
- Replace Auto Scaling instances based on maximum instance lifetime (p. 127)

Replace Auto Scaling instances based on an instance refresh

You can use an instance refresh to update the instances in your Auto Scaling group instead of manually replacing instances a few at a time. This can be useful when a configuration change requires you to replace instances, and you have a large number of instances in your Auto Scaling group.

An instance refresh can be helpful when you have a new Amazon Machine Image (AMI) or a new user data script. To use an instance refresh, first create a new launch template that specifies the new AMI or user data script. Then, start an instance refresh to begin updating the instances in the group immediately.

An instance refresh can also be helpful when you are migrating your Auto Scaling groups from launch configurations to launch templates. First, copy your launch configurations to new launch templates.
Then, start an instance refresh that specifies the launch template as part of the desired configuration to begin updating the instances in the group immediately. For more information about migrating to launch templates, see Migrate to launch templates (p. 30).

Contents
- How it works (p. 102)
- Core concepts and terms (p. 102)
- Instance type compatibility (p. 104)
- Limitations (p. 104)
- Start an instance refresh (p. 104)
- Understand the default values for an instance refresh (p. 110)
- Check the status of an instance refresh (p. 111)
- Cancel an instance refresh (p. 113)
- Undo changes with a rollback (p. 114)
- Use an instance refresh with skip matching (p. 117)
- Add checkpoints to an instance refresh (p. 123)

How it works

To update your Auto Scaling group with a new launch template, you typically perform the following actions:

- You create a new launch template for your Auto Scaling group. For more information, see Create a launch template for an Auto Scaling group (p. 22).
- You configure the minimum healthy percentage, optional checkpoints, and any other settings as needed, specify a desired configuration that includes your launch template, and start an instance refresh. Optionally, your desired configuration can specify whether to apply a mixed instances policy (p. 62).
- Amazon EC2 Auto Scaling starts performing a rolling replacement of the instances. It takes a set of instances out of service, terminates them, and launches a set of instances with the new desired configuration. Then, it waits until the instances pass your health checks and complete warmup before it moves on to replacing other instances.
- After a certain percentage of the group is replaced, a checkpoint is reached. Whenever there is a checkpoint, Amazon EC2 Auto Scaling temporarily stops replacing instances and sends a notification. Then, it waits for the amount of time you specified before continuing. After you receive the notification, you can verify that your new instances are working as expected.
- After the instance refresh succeeds, the Auto Scaling group settings are automatically updated with the launch template that you specified at the start of the operation.

Core concepts and terms

Before you get started, familiarize yourself with the following instance refresh core concepts and terms:

Minimum healthy percentage

As part of starting an instance refresh, you specify the minimum healthy percentage to maintain at all times. This is the amount of capacity in an Auto Scaling group that must pass your health checks (p. 297) during an instance refresh so that the refresh can continue. For example, if the minimum healthy percentage is 90 percent, then 10 percent is the percentage of capacity that will be terminated and replaced at a time. If the new instances don't pass their health checks, Amazon
EC2 Auto Scaling terminates and replaces them. If the instance refresh can't launch any healthy instances, it will eventually fail, leaving the other 90 percent of the group untouched. If the new instances stay healthy and finish their warm-up period, Amazon EC2 Auto Scaling can continue to replace other instances.

An instance refresh can replace instances one at a time, several at a time, or all at once. To replace one instance at a time, set a minimum healthy percentage of 100 percent. To replace all at once, set a minimum healthy percentage of 0 percent.

Amazon EC2 Auto Scaling determines whether an instance is healthy based on the status of the health checks that your Auto Scaling group uses. For more information, see Health checks for Auto Scaling instances (p. 297). To make sure that these health checks start as soon as possible, don't set the group's health check grace period too high, but high enough for your Elastic Load Balancing health checks to determine whether a target is available to handle requests. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

### Instance warmup

The **instance warmup** is the time period from when a new instance's state changes to InService to when it is considered to have finished initializing. During an instance refresh, if the instances pass their health checks, Amazon EC2 Auto Scaling does not immediately move on to replacing the next instance after determining that a newly launched instance is healthy. It waits for the warm-up period before it moves on to replacing the next instance. This can be helpful when your application still needs some initialization time before it responds to requests.

You can reduce the value of the warm-up period if you use a lifecycle hook to prepare new instances for use. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

Only specify the instance warmup for an instance refresh when you haven’t enabled the default instance warmup, or if you need to override it. The instance warmup works the same way as the default instance warmup. Therefore, the same scaling considerations apply. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

### Desired configuration

The **desired configuration** is the new configuration that you want Amazon EC2 Auto Scaling to deploy across your Auto Scaling group. For example, you can specify a new launch template and new instance types for your instances. During an instance refresh, Amazon EC2 Auto Scaling updates the Auto Scaling group to the desired configuration. If a scale-out event occurs during an instance refresh, Amazon EC2 Auto Scaling launches new instances with the desired configuration instead of the group's current settings. After the instance refresh succeeds, Amazon EC2 Auto Scaling updates the Auto Scaling group settings to reflect the new desired configuration that you specified as part of the instance refresh.

### Skip matching

Skip matching tells Amazon EC2 Auto Scaling to ignore instances that already have your latest updates. This way, you don't replace more instances than you need to. This is helpful when you want to make sure your Auto Scaling group uses a particular version of your launch template and only replaces those instances that use a different version.

### Checkpoints

A **checkpoint** is a point in time where the instance refresh pauses for a specified amount of time. An instance refresh can contain multiple checkpoints. Amazon EC2 Auto Scaling emits events for each checkpoint. Therefore, you can add an EventBridge rule to send the events to a target, such as Amazon SNS, to be notified when a checkpoint is reached. After a checkpoint is reached, you have the opportunity to verify your deployment. If any problems are identified, you can cancel the instance refresh or roll it back. The ability to deploy updates in phases is a key benefit of checkpoints. If you don't use checkpoints, rolling replacements are performed continuously.
Important
To learn more about all of the default settings you can configure when starting an instance refresh, see Understand the default values for an instance refresh (p. 110).

Instance type compatibility

Before you change your instance type, it's a good idea to verify that it works with your launch template. This confirms compatibility with the AMI that you specified. For example, let's say you launched your original instances from a paravirtual (PV) AMI, but you want to change to a current generation instance type that is only supported by a hardware virtual machine (HVM) AMI. In this case, you must use an HVM AMI in your launch template.

To confirm compatibility of the instance type without launching instances, use the run-instances command with the --dry-run option, as shown in the following example.

```bash
aws ec2 run-instances --launch-template LaunchTemplateName=my-template,Version='1' --dry-run
```

For information about how compatibility is determined, see Compatibility for changing the instance type in the Amazon EC2 User Guide for Linux Instances.

Limitations

- **Instances terminated before launch**: When there is only one instance in the Auto Scaling group, starting an instance refresh can result in an outage. This is because Amazon EC2 Auto Scaling terminates an instance and then launches a new instance.

- **Total duration**: The maximum amount of time that an instance refresh can continue to actively replace instances is 14 days.

- **Difference in behavior specific to weighted groups**: If a mixed instances group is configured with an instance weight that is larger than or equal to the group's desired capacity, Amazon EC2 Auto Scaling might replace all InService instances at once. To avoid this situation, follow the recommendation in the Configure instance weighting for Amazon EC2 Auto Scaling (p. 81) topic. Specify a desired capacity that is larger than your largest weight when you use weights with your Auto Scaling group.

- **One-hour timeout**: When an instance refresh is unable to continue making replacements because it is waiting to replace instances on standby or protected from scale in, or the new instances do not pass their health checks, Amazon EC2 Auto Scaling keeps retrying for an hour. It also provides a status message to help you resolve the issue. If the problem persists after an hour, the operation fails. The intention is to give it time to recover if there is a temporary issue.

Start an instance refresh

Important
You can roll back an instance refresh that is in progress to undo any changes. For this to work, the Auto Scaling group must meet the prerequisites for using rollbacks before starting the instance refresh. For more information, see Undo changes with a rollback (p. 114).

The following procedures help you start an instance refresh using the AWS Management Console or AWS CLI.

Start an instance refresh (console)

If this is your first time starting an instance refresh, using the console will help you understand the features and options available.
Start an instance refresh in the console (basic procedure)

Use the following procedure if you have not previously defined a mixed instances policy (p. 62) for your Auto Scaling group. If you have previously defined a mixed instances policy, see Start an instance refresh in the console (mixed instances group) (p. 107) to start an instance refresh.

To start an instance refresh

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   
   A split pane opens up at the bottom of the Auto Scaling groups page.
3. On the Instance refresh tab, in Active instance refresh, choose Start instance refresh.
4. For Minimum healthy percentage, enter the percentage of the Auto Scaling group that must remain healthy during an instance refresh. Setting the minimum healthy percentage to 100 percent limits the rate of replacement to one instance at a time. In contrast, setting it to 0 percent makes it replace all the instances at the same time.
5. For Instance warmup, enter the number of seconds from when a new instance's state changes to InService to when it finishes initializing. Amazon EC2 Auto Scaling waits this amount of time before moving on to replace the next instance.

   While warming up, a newly launched instance is also not counted toward the aggregated instance metrics of the Auto Scaling group (such as CPUUtilization, NetworkIn, and NetworkOut). If you added scaling policies to the Auto Scaling group, the scaling activities run in parallel. If you set a long interval for the instance refresh warm-up period, it takes more time for newly launched instances to show up in the metrics. Therefore, an adequate warm-up period keeps Amazon EC2 Auto Scaling from scaling on stale metric data.

   If you have already correctly defined a default instance warmup for the Auto Scaling group, then you don’t need to change the instance warmup. However, if you want to override the default, you can. For more information about setting the default instance warmup, see Set the default instance warmup for an Auto Scaling group (p. 187).
6. (Optional) For Checkpoints, choose Enable checkpoints to replace instances using an incremental or phased approach to an instance refresh. This provides additional time for verification between sets of replacements. If you choose not to enable checkpoints, the instances are replaced in one nearly continuous operation.

   If you enable checkpoints, see Enable checkpoints (console) (p. 125) for additional steps.
7. Enable or turn off Skip matching:
   
   • To skip replacing instances that already match your launch template, keep the Enable skip matching check box selected.
   • If you turn off skip matching by clearing this check box, all instances can be replaced.

   When you enable skip matching, you can set a new launch template or a new version of the launch template instead of using the existing one. Do this in the Desired configuration section of the Start instance refresh page.

   Note
   To use the skip matching feature to update an Auto Scaling group that currently uses a launch configuration, you must select a launch template in Desired configuration. Skip matching with a launch configuration is not supported.
8. For Standby instances, choose Ignore, Terminate, or Wait. This determines what happens if instances are found in Standby state. For more information, see Temporarily remove instances from your Auto Scaling group (p. 287).
If you choose `Wait`, you must take additional steps to return these instances to service. If you don't, the instance refresh replaces all `InService` instances and waits for one hour. Then, if any `Standby` instances remain, the instance refresh fails. To prevent this situation, choose to `Ignore` or `Terminate` these instances instead.

9. For `Scale-in protected instances`, choose `Ignore`, `Replace`, or `Wait`. This determines what happens if scale-in protected instances are found. For more information, see [Use instance scale-in protection](p. 282).

If you choose `Wait`, you must take additional steps to remove scale-in protection from these instances. If you don't, the instance refresh replaces all unprotected instances and waits one hour. Then, if any scale-in protected instances remain, the instance refresh fails. To prevent this situation, choose to `Ignore` or `Replace` these instances instead.

10. (Optional) For `CloudWatch alarm`, choose `Enable CloudWatch alarms`, and then choose one or more alarms. CloudWatch alarms can be used to identify any issues and fail the operation if an alarm goes into the ALARM state. For more information, see [Start an instance refresh with auto rollback](p. 115).

11. (Optional) Expand the `Desired configuration` section to specify updates that you want to make to your Auto Scaling group.

For this step, you can choose to use JSON or YAML syntax to edit parameter values instead of making selections in the console interface. To do so, choose `Use code editor` instead of `Use console interface`. The following procedure explains how to make selections using the console interface.

a. For `Update launch template`:

   • If you haven't created a new launch template or a new launch template version for your Auto Scaling group, don't select this check box.

   • If you've created a new launch template or a new launch template version, select this check box. When you select this option, Amazon EC2 Auto Scaling shows you the current launch template and current launch template version. It also lists any other available versions. Choose the launch template and then choose the version.

   After you choose a version, you can see the version information. This is the version of the launch template that will be used when replacing instances as part of an instance refresh. If the instance refresh succeeds, this version of the launch template will also be used whenever new instances launch, such as when the group scales.

b. For `Choose a set of instance types and purchase options to override the instance type in the launch template`:

   • Don't select this check box if you want to use the instance type and purchase option you specified in your launch template.

   • Select this check box if you want to override the instance type in the launch template or run Spot Instances. You can either manually add each instance type or choose a primary instance type and recommendation option that retrieves any additional matching instance types for you. If you plan to launch Spot Instances, we recommend adding a few different instance types. This way, Amazon EC2 Auto Scaling can launch another instance type if there is insufficient instance capacity in your chosen Availability Zones. For more information, see [Auto Scaling groups with multiple instance types and purchase options](p. 62).

   **Warning**

   Don't use Spot Instances with applications that can't handle a Spot Instance interruption. Interruptions can occur if the Amazon EC2 Spot service needs to reclaim capacity.
If you select this check box, make sure that the launch template doesn't already request Spot Instances. You can't use a launch template that requests Spot instances to create an Auto Scaling group that uses multiple instance types and launches Spot and On-Demand Instances.

**Note**
To configure these options on an Auto Scaling group that currently uses a launch configuration, you must select a launch template in **Update launch template**. 
OVERRIDING THE INSTANCE TYPE IN YOUR LAUNCH CONFIGURATION IS NOT SUPPORTED.

12. (Optional) For **Rollback settings**, choose **Enable auto rollback** to automatically roll back the instance refresh if it fails.

This setting cannot be enabled when the Auto Scaling group doesn't meet the prerequisites for using rollbacks.

For more information, see [Undo changes with a rollback](p. 114).

13. Review all of your selections to confirm that everything is set up correctly.

At this point, it's a good idea to verify that the differences between the current and proposed changes won't affect your application in unexpected or unwanted ways. To confirm that your instance type is compatible with your launch template, see [Instance type compatibility](p. 104).

14. When you are satisfied with your instance refresh selections, choose **Start instance refresh**.

**Start an instance refresh in the console (mixed instances group)**

Use the following procedure if you have created an Auto Scaling group with a [mixed instances policy](p. 62). If you haven't defined a mixed instances policy for your group yet, see [Start an instance refresh in the console (basic procedure)](p. 105) to start an instance refresh.

**To start an instance refresh**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.

2. Select the check box next to your Auto Scaling group.

   A split pane opens up at the bottom of the **Auto Scaling groups** page.

3. On the **Instance refresh** tab, in **Active instance refresh**, choose **Start instance refresh**.

4. For **Minimum healthy percentage**, enter the percentage of the Auto Scaling group that must remain healthy during an instance refresh. Setting the minimum healthy percentage to 100 percent limits the rate of replacement to one instance at a time. In contrast, setting it to 0 percent makes it replace all the instances at the same time.

5. For **Instance warmup**, enter the number of seconds from when a new instance's state changes to **InService** to when it finishes initializing. Amazon EC2 Auto Scaling waits this amount of time before moving on to replace the next instance.

   While warming up, a newly launched instance is also not counted toward the aggregated instance metrics of the Auto Scaling group (such as CPUUtilization, NetworkIn, NetworkOut, and so on). If you added scaling policies to the Auto Scaling group, the scaling activities run in parallel. If you set a long interval for the instance refresh warm-up period, it takes more time for newly launched instances to show up in the metrics. Therefore, an adequate warm-up period keeps Amazon EC2 Auto Scaling from scaling on stale metric data.

   If you have already correctly defined a default instance warmup for the Auto Scaling group, then you don't need to change the instance warmup (unless you want to override the default). For more information about setting the default instance warmup, see [Set the default instance warmup for an Auto Scaling group](p. 187).
6. (Optional) For **Checkpoints**, choose **Enable checkpoints** to replace instances using an incremental or phased approach to an instance refresh. This provides additional time for verification between sets of replacements. If you choose not to enable checkpoints, the instances are replaced in one nearly continuous operation.

If you enable checkpoints, see [Enable checkpoints (console) (p. 125)](#) for additional steps.

7. Enable or turn off **Skip matching:**

   - To skip replacing instances that already match your launch template and any instance type overrides, keep the **Enable skip matching** check box selected.
   - If you choose to turn off skip matching by clearing this check box, all instances can be replaced.

When you enable skip matching, you can set a new launch template or a new version of the launch template instead of using the existing one. Do this in the **Desired configuration** section of the **Start instance refresh** page.

8. For **Standby instances**, choose **Ignore**, **Terminate**, or **Wait**. This determines what happens if instances are found in Standby state. For more information, see [Temporarily remove instances from your Auto Scaling group (p. 287)](#).

   If you choose **Wait**, you must take additional steps to return these instances to service. If you don't, the instance refresh replaces all InService instances and waits one hour. Then, if any Standby instances remain, the instance refresh fails. To prevent this situation, choose to **Ignore** or **Terminate** these instances instead.

9. For **Scale-in protected instances**, choose **Ignore**, **Replace**, or **Wait**. This determines what happens if scale-in protected instances are found. For more information, see [Use instance scale-in protection (p. 282)](#).

   If you choose **Wait**, you must take additional steps to remove scale-in protection from these instances. If you don't, the instance refresh replaces all unprotected instances and waits one hour. Then, if any scale-in protected instances remain, the instance refresh fails. To prevent this situation, choose to **Ignore** or **Replace** these instances instead.

10. (Optional) For **CloudWatch alarm**, choose **Enable CloudWatch alarms**, and then choose one or more alarms. CloudWatch alarms can be used to identify any issues and fail the operation if an alarm goes into the ALARM state. For more information, see [Start an instance refresh with auto rollback (p. 115)](#).

11. In the **Desired configuration** section, do the following.

    For this step, you can choose to use JSON or YAML syntax to edit parameter values instead of making selections in the console interface. To do so, choose **Use code editor** instead of **Use console interface**. The following procedure explains how to make selections using the console interface.

    a. For **Update launch template**:

       - If you haven't created a new launch template or a new launch template version for your Auto Scaling group, don't select this check box.
       - If you've created a new launch template or a new launch template version, select this check box. When you select this option, Amazon EC2 Auto Scaling shows you the current launch template and current launch template version. It also lists any other available versions. Choose the launch template and then choose the version.

       After you choose a version, you can see the version information. This is the version of the launch template that will be used when replacing instances as part of an instance refresh. If the instance refresh succeeds, this version of the launch template will also be used whenever new instances launch, such as when the group scales.

    b. For **Use these settings to override the instance type and purchase option defined in the launch template**:
By default, this check box is selected. Amazon EC2 Auto Scaling populates each parameter with the value that's currently set in the *mixed instances policy* for the Auto Scaling group. Only update values for the parameters that you want to change. For guidance on these settings, see *Auto Scaling groups with multiple instance types and purchase options* (p. 62).

**Warning**

We recommend that you do not clear this check box. Only clear it if you want to stop using a mixed instances policy. After the instance refresh succeeds, Amazon EC2 Auto Scaling updates your group to match the *Desired configuration*. If it no longer includes a mixed instances policy, Amazon EC2 Auto Scaling gradually terminates any Spot Instances that are currently running and replaces them with On-Demand Instances. Or, if your launch template requests Spot Instances, then Amazon EC2 Auto Scaling gradually terminates any On-Demand Instances that are currently running and replaces them with Spot Instances.

12. (Optional) For **Rollback settings**, choose **Enable auto rollback** to automatically roll back the instance refresh if it fails for any reason.

   This setting cannot be enabled when the Auto Scaling group doesn't meet the prerequisites for using rollbacks.

   For more information, see *Undo changes with a rollback* (p. 114).

13. Review all of your selections to confirm that everything is set up correctly.

   At this point, it's a good idea to verify that the differences between the current and proposed changes won't affect your application in unexpected or unwanted ways. To confirm that your instance type is compatible with your launch template, see *Instance type compatibility* (p. 104).

   When you are satisfied with your instance refresh selections, choose **Start instance refresh**.

**Start an instance refresh (AWS CLI)**

**To start an instance refresh**

Use the following `start-instance-refresh` command to start an instance refresh from the AWS CLI. You can specify any preferences that you want to change in a JSON configuration file. When you reference the configuration file, provide the file path and name as shown in the following example.

```bash
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of `config.json`:

```json
{
    "AutoScalingGroupName": "my-asg",
    "Preferences": {
        "InstanceWarmup": 60,
        "MinHealthyPercentage": 50,
        "AutoRollback": true,
        "ScaleInProtectedInstances": Ignore,
        "StandbyInstances": Terminate
    }
}
```

If preferences are not provided, default values are used. For more information, see *Understand the default values for an instance refresh* (p. 110).

Example output:
Understand the default values for an instance refresh

Before you start an instance refresh, you can customize various preferences that affect the instance refresh. Some preference defaults are different depending on whether you use the console or the command line (AWS CLI or AWS SDK).

The following table lists the default values for the instance refresh settings.

<table>
<thead>
<tr>
<th>Setting</th>
<th>AWS CLI or AWS SDK</th>
<th>Amazon EC2 Auto Scaling console</th>
</tr>
</thead>
<tbody>
<tr>
<td>CloudWatch alarm</td>
<td>Disabled (null)</td>
<td>Disabled</td>
</tr>
<tr>
<td>Auto rollback</td>
<td>Disabled (false)</td>
<td>Disabled</td>
</tr>
<tr>
<td>Checkpoints</td>
<td>Disabled (false)</td>
<td>Disabled</td>
</tr>
<tr>
<td>Checkpoint delay</td>
<td>1 hour (3600 seconds)</td>
<td>1 hour</td>
</tr>
<tr>
<td>Instance warmup</td>
<td>The default instance warmup (p. 187), if defined, or the health check grace period (p. 302) otherwise.</td>
<td>The default instance warmup (p. 187), if defined, or the health check grace period (p. 302) otherwise.</td>
</tr>
<tr>
<td>Minimum healthy percentage</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Scale-in protected instances</td>
<td>Wait</td>
<td>Ignore</td>
</tr>
<tr>
<td>Skip matching</td>
<td>Disabled (false)</td>
<td>Enabled</td>
</tr>
<tr>
<td>Standby instances</td>
<td>Wait</td>
<td>Ignore</td>
</tr>
</tbody>
</table>

A description of each setting follows:

**CloudWatch alarm (AlarmSpecification)**

The CloudWatch alarm specification. CloudWatch alarms can be used to identify any issues and fail the operation if an alarm goes into the ALARM state. For more information, see [Start an instance refresh with auto rollback (p. 115)](#).

**Auto rollback (AutoRollback)**

Controls whether Amazon EC2 Auto Scaling rolls back the Auto Scaling group to its previous configuration if the instance refresh fails. For more information, see [Undo changes with a rollback (p. 114)](#).

**Checkpoints (CheckpointPercentages)**

Controls whether Amazon EC2 Auto Scaling replaces instances in phases. This is useful if you need to perform verifications on your instances before replacing all instances. For more information, see [Add checkpoints to an instance refresh (p. 123)](#).

**Checkpoint delay (CheckpointDelay)**

The amount of time, in seconds, to wait after a checkpoint before continuing. For more information, see [Add checkpoints to an instance refresh (p. 123)](#).
Instance warmup (InstanceWarmup)

A time period, in seconds, during which Amazon EC2 Auto Scaling waits until a new instance is considered to have finished initializing before moving on to replacing the next instance. If you have already correctly defined a default instance warmup for the Auto Scaling group, then you don't need to change the instance warmup (unless you want to override the default). For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

Minimum healthy percentage (MinHealthyPercentage)

The percentage of the desired capacity of the Auto Scaling group that must pass the group's health checks before the refresh can continue. For more information about these health checks, see Health checks for Auto Scaling instances (p. 297).

Scale-in protected instances (ScaleInProtectedInstances)

Controls what Amazon EC2 Auto Scaling does if instances that are protected from scale in are found. For more information about these instances, see Use instance scale-in protection (p. 282).

Amazon EC2 Auto Scaling provides the following options:

- Replace (Refresh) — Replaces instances that are protected from scale in.
- Ignore (Ignore) — Ignores instances that are protected from scale in and continues to replace instances that are not protected.
- Wait (Wait) — Waits one hour for you to remove scale-in protection. If you don't do so, the instance refresh fails.

Skip matching (SkipMatching)

Controls whether Amazon EC2 Auto Scaling skips replacing instances that match the desired configuration. If no desired configuration is specified, then it skips replacing instances that have the same launch template and instance types that the Auto Scaling group was using before the instance refresh started. For more information, see Use an instance refresh with skip matching (p. 117).

Standby instances (StandbyInstances)

Controls what Amazon EC2 Auto Scaling does if instances are found in Standby state. For more information about these instances, see Temporarily remove instances from your Auto Scaling group (p. 287).

Amazon EC2 Auto Scaling provides the following options:

- Terminate (Terminate) — Terminates instances that are in Standby.
- Ignore (Ignore) — Ignores instances that are in Standby and continues to replace instances that are in the InService state.
- Wait (Wait) — Waits one hour for you to return the instances to service. If you don't do so, the instance refresh fails.

Check the status of an instance refresh

After an instance refresh has begun, you can get its status using the AWS Management Console or AWS CLI.

Tip

In the following procedure, you look at the Instance refresh history, Activity history, and Instances sections for the Auto Scaling group. In each, the named columns should already be displayed. To display hidden columns or change the number of rows shown, choose the gear icon on the top right corner of each section to open the preferences modal. Update the settings as needed and choose Confirm.
To check the status of an instance refresh (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   - A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Instance refresh tab, under Instance refresh history, you can determine the status of your request by looking at the Status column. The operation goes into Pending status while it is initializing. The status should then quickly change to InProgress. When all instances are updated, the status changes to Successful.
4. On the Activity tab, under Activity history, when the instance refresh starts, you see entries when instances are terminated and another set of entries when instances are launched. In the Description column, you can find the instance ID.
5. (Optional) If you have numerous scaling activities, you can see more of them by choosing the > icon at the top of the activity history.
6. On the Instance management tab, under Instances, you can verify that your instances launched successfully. Initially, your instances are in a pending state while waiting for any actions defined by lifecycle hooks to complete. After that, the instance is added to the Auto Scaling group and its state is InService. The Health status column shows the result of the health checks on your instances.

To check the status of an instance refresh (AWS CLI)

View the instance refreshes for an Auto Scaling group by using the following describe-instance-refreshes command.

```
aws autoscaling describe-instance-refreshes --auto-scaling-group-name my-asg
```

Example output:

```
{
  "InstanceRefreshes": [
    {
      "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b",
      "AutoScalingGroupName": "my-asg",
      "Status": "InProgress",
      "StatusReason": "Waiting for instances to warm up before continuing. For example: 0e69cc3f05f825f4f is warming up."
    }
  ],
  "CheckpointPercentages": [50],
  "CheckpointDelay": 3600,
  "SkipMatching": false,
  "AutoRollback": true,
  "ScaleInProtectedInstances": "Ignore",
  "StandbyInstances": "Ignore"
}
```
Instance refresh statuses

When you start an instance refresh, it enters the **Pending** status. It passes from **Pending** to **InProgress** until it reaches **Successful**, **Failed**, **Cancelled**, **RollbackSuccessful**, or **RollbackFailed**.

An instance refresh can have the following statuses:

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pending</td>
<td>The request was created, but the instance refresh has not started.</td>
</tr>
<tr>
<td>InProgress</td>
<td>An instance refresh is in progress.</td>
</tr>
<tr>
<td>Successful</td>
<td>An instance refresh completed successfully.</td>
</tr>
<tr>
<td>Failed</td>
<td>An instance refresh failed to complete. You can troubleshoot using the</td>
</tr>
<tr>
<td></td>
<td>status reason and the scaling activities.</td>
</tr>
<tr>
<td>Cancelling</td>
<td>An ongoing instance refresh is being cancelled.</td>
</tr>
<tr>
<td>Cancelled</td>
<td>The instance refresh is cancelled.</td>
</tr>
<tr>
<td>RollbackInProgress</td>
<td>An instance refresh is being rolled back.</td>
</tr>
<tr>
<td>RollbackFailed</td>
<td>The rollback failed to complete. You can troubleshoot using the status</td>
</tr>
<tr>
<td></td>
<td>reason and the scaling activities.</td>
</tr>
<tr>
<td>RollbackSuccessful</td>
<td>The rollback completed successfully.</td>
</tr>
</tbody>
</table>

**Cancel an instance refresh**

You can cancel an instance refresh that is still in progress. You can't cancel it after it's finished.

Canceling an instance refresh does not roll back any instances that were already replaced. To roll back the changes to your instances, perform a rollback instead. For more information, see [Undo changes with a rollback](p. 114).

**Topics**

- [Cancel an instance refresh (console)](p. 114)
- [Cancel an instance refresh (AWS CLI)](p. 114)
Cancel an instance refresh (console)

To cancel an instance refresh

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
3. On the Instance refresh tab, in Active instance refresh, choose Actions, Cancel.
4. When prompted for confirmation, choose Confirm.

The status of the instance refresh is set to Cancelling. After the cancellation is complete, the status of the instance refresh is set to Cancelled.

Cancel an instance refresh (AWS CLI)

To cancel an instance refresh

Use the cancel-instance-refresh command from the AWS CLI and provide the Auto Scaling group name.

```
aws autoscaling cancel-instance-refresh --auto-scaling-group-name my-asg
```

Example output:

```
{
  "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b"
}
```

Undo changes with a rollback

You can roll back an instance refresh that is still in progress. You can't roll it back after it's finished. You can, however, update your Auto Scaling group again by starting a new instance refresh.

When rolling back, Amazon EC2 Auto Scaling replaces the instances that have been deployed so far. The new instances match the configuration that you last saved on the Auto Scaling group before starting the instance refresh.

Amazon EC2 Auto Scaling provides the following ways to roll back:

- Manual rollback: You start a rollback manually to reverse what was deployed up to the rollback point.
- Auto rollback: Amazon EC2 Auto Scaling automatically reverses what was deployed if the instance refresh fails for some reason or if any CloudWatch alarms you specify go into the ALARM state.

Contents

- Considerations (p. 114)
- Manually start a rollback (p. 115)
  - Start an instance refresh with auto rollback (p. 115)

Considerations

The following considerations apply when using a rollback:

- The rollback option is only available if you specify a desired configuration as part of starting an instance refresh.
• You can only roll back to a previous version of a launch template if the version is a specific numbered version. The rollback option is not available if the Auto Scaling group is configured to use the $Latest or $Default launch template version.

• You also cannot roll back to a launch template that is configured to use an AMI alias from the AWS Systems Manager Parameter Store.

• The configuration that you last saved on the Auto Scaling group must be in a stable state. If it's not in a stable state, the rollback workflow will still occur, but it will eventually fail. Until you resolve the issue, the Auto Scaling group might be in a failed state where it can no longer launch instances successfully. This might impact the availability of the service or application.

Manually start a rollback

Console

To manually start a rollback of an instance refresh (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
3. On the Instance refresh tab, in Active instance refresh, choose Actions, Start rollback.
4. When prompted for confirmation, choose Confirm.

AWS CLI

To manually start a rollback of an instance refresh (AWS CLI)

Use the rollback-instance-refresh command from the AWS CLI and provide the Auto Scaling group name.

aws autoscaling rollback-instance-refresh --auto-scaling-group-name my-asg

Example output:

```json
{
   "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b"
}
```

Tip
If this command throws an error, make sure that you have updated the AWS CLI locally to the latest version.

Start an instance refresh with auto rollback

Using the auto rollback feature, you can automatically roll back the instance refresh when it fails, such as when there are errors or a specified Amazon CloudWatch alarm goes into the ALARM state.

If you enable auto rollback, and there are errors while replacing instances, the instance refresh attempts to complete all replacements for one hour before it fails and rolls back. These errors are usually caused by things like EC2 launch failures, misconfigured health checks, or not ignoring or allowing the termination of instances that are in Standby state or protected from scale in.

Specifying CloudWatch alarms is optional. To specify an alarm, you first need to create it. You can specify metric alarms and composite alarms. For information about creating the alarm, see the Amazon
CloudWatch User Guide. Using Elastic Load Balancing metrics as an example, if you use an Application Load Balancer, you could use the HTTPCode_ELB_5XX_Count and HTTPCode_ELB_4XX_Count metrics.

Considerations

- If you specify a CloudWatch alarm but do not enable auto rollback, and the alarm state goes to ALARM, the instance refresh fails without rolling back.
- You can choose a maximum of 10 alarms when you start an instance refresh.
- When choosing a CloudWatch alarm, the alarm must be in a compatible state. If the alarm state is INSUFFICIENT_DATA or ALARM, you receive an error when you try to start the instance refresh.
- When creating an alarm for Amazon EC2 Auto Scaling to use, the alarm should include how to treat missing data points. If a metric is frequently missing data points by design, the state of the alarm is INSUFFICIENT_DATA during those periods. When this happens, Amazon EC2 Auto Scaling cannot replace instances until new data points are found. To force the alarm to maintain the previous ALARM or OK state, you could choose to ignore missing data instead. For more information, see Configuring how alarms treat missing data in the Amazon CloudWatch User Guide.

Console

To start an instance refresh with auto rollback (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
3. On the Instance refresh tab, in Active instance refresh, choose Start instance refresh.
4. Follow the Start an instance refresh (console) (p. 104) procedure and configure your instance refresh settings as needed.
5. (Optional) Under Refresh settings, for CloudWatch alarm, choose Enable CloudWatch alarms, and then choose one or more alarms to identify any issues and fail the operation if an alarm goes into the ALARM state.
6. Under Rollback settings, choose Enable auto rollback to automatically roll back a failed instance refresh to the configuration that you last saved on the Auto Scaling group before starting the instance refresh.
7. Review your selections, and then choose Start instance refresh.

AWS CLI

To start an instance refresh with auto rollback (AWS CLI)

Use the start-instance-refresh command and specify true for the AutoRollback option in the Preferences.

The following example shows how to start an instance refresh that will automatically roll back if something fails. Replace the italicized parameter values with your own.

```
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of config.json.

```
{
  "AutoScalingGroupName": "my-asg",
  "DesiredConfiguration": {
    "LaunchTemplate": {
      "LaunchTemplateName": "my-launch-template",
      "Version": "1"
    }
  }
}```
Alternatively, to automatically roll back when the instance refresh fails or when a specified CloudWatch alarm is in the ALARM state, specify the AlarmSpecification option in the Preferences and provide the alarm name, as in the following example. Replace the italicized parameter values with your own.

```json
{
  "AutoScalingGroupName": "my-asg",
  "DesiredConfiguration": {
    "LaunchTemplate": {
      "LaunchTemplateName": "my-launch-template",
      "Version": "1"
    }
  },
  "Preferences": {
    "AutoRollback": true,
    "AlarmSpecification": { "Alarms": [ "my-alarm" ] }
  }
}
```

If successful, the command returns output similar to the following.

```json
{
  "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b"
}
```

**Tip**

If this command throws an error, make sure that you have updated the AWS CLI locally to the latest version.

### Use an instance refresh with skip matching

Skip matching tells Amazon EC2 Auto Scaling to ignore instances that already have your latest updates. This way, you don't replace more instances than you need to. This is helpful when you want to make sure that your Auto Scaling group uses a particular version of your launch template and only replaces those instances that use a different version.

The following considerations apply to skip matching:

- If you start an instance refresh with both skip matching and a desired configuration, Amazon EC2 Auto Scaling checks to see if any instances match your desired configuration. Then, it only replaces the instances that don't match your desired configuration. After the instance refresh succeeds, Amazon EC2 Auto Scaling updates the group to reflect your desired configuration.
- If you start an instance refresh with skip matching, but you don't specify a desired configuration, Amazon EC2 Auto Scaling checks to see if any instances match the configuration that you last saved on the Auto Scaling group. Then, it only replaces the instances that don't match your last saved configuration.
- You can use skip matching with a new launch template, a new version of a launch template, or a set of instance types. If you enable skip matching, but none of these are changing, the instance refresh will succeed immediately without replacing any instances. If you made any other changes in your desired configuration (such as changing your Spot allocation strategy), Amazon EC2 Auto Scaling waits for the
instance refresh to succeed. Then, it updates the Auto Scaling group settings to reflect the new desired configuration.

- You cannot use skip matching with a new launch configuration.
- During an instance refresh with skip matching, if either $Default or $Latest is specified for the launch template, Amazon EC2 Auto Scaling re-evaluates the launch template version as each instance is replaced. Therefore, if you create a new version of your launch template while the instances are still being replaced, Amazon EC2 Auto Scaling can end up using the new version of your launch template. This can cause previously replaced instances to be replaced again as Amazon EC2 Auto Scaling applies the new version across the group.

This section includes AWS CLI instructions for starting an instance refresh with skip matching enabled. For instructions on using the console, see Start an instance refresh (console) (p. 104).

Skip matching (basic procedure)

Follow the steps in this section to use the AWS CLI to do the following:

- Create the launch template that you want to apply to your instances.
- Start an instance refresh to apply your launch template to your Auto Scaling group. If you do not enable skip matching, all instances will be replaced. This is true even if the launch template used to provision the instance is the same as the one that you specified for your desired configuration.

To use skip matching with a new launch template

1. Use the create-launch-template command to create a new launch template for your Auto Scaling group. Include the --launch-template-data option and JSON input that defines the details of the instances that are created for your Auto Scaling group.

For example, use the following command to create a basic launch template with the AMI ID ami-0123456789abcdef0 and the t2.micro instance type.

```bash
aws ec2 create-launch-template --launch-template-name my-template-for-auto-scaling --version-description version1 \ --launch-template-data '{"ImageId": "ami-0123456789abcdef0", "InstanceType": "t2.micro"}"
```

If successful, the command returns output similar to the following.

```json
{
  "LaunchTemplate": {
    "LaunchTemplateId": "lt-068f72b729example",
    "LaunchTemplateName": "my-template-for-auto-scaling",
    "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
    "CreateTime": "2023-01-30T18:16:06.000Z",
    "DefaultVersionNumber": 1,
    "LatestVersionNumber": 1
  }
}
```

For more information, see Examples for creating and managing launch templates with the AWS Command Line Interface (AWS CLI) (p. 35).

2. Use the start-instance-refresh command to initiate the instance replacement workflow and apply your new launch template with the ID lt-068f72b729example. Because the launch template is new, it only has one version. This means that version 1 of the launch template is the target of this instance refresh. If a scale-out event occurs during the instance refresh, and Amazon EC2 Auto Scaling provisions new instances using the version 1 of this launch template, they will not be
replaced. On successful completion of the operation, the new launch template is successfully applied to your Auto Scaling group.

```bash
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of config.json.

```json
{
   "AutoScalingGroupName": "my-asg",
   "DesiredConfiguration": {
      "LaunchTemplate": {
         "LaunchTemplateId": "lt-068f72b729example",
         "Version": "$Default"
      }
   },
   "Preferences": {
      "SkipMatching": true
   }
}
```

If successful, the command returns output similar to the following.

```json
{
   "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b"
}
```

**Skip matching (mixed instances group)**

If you have an Auto Scaling group with a [mixed instances policy](p. 62), follow the steps in this section to use the AWS CLI to start an instance refresh with skip matching. You have the following options:

- Provide a new launch template to apply to all instance types specified in the policy.
- Provide an updated set of instance types with or without changing the launch template in the policy. For example, you might want to migrate away from unwanted instance types. You would use the launch template as is, without changing the AMI, security groups, or other specifics of the instances being replaced.

Follow the steps in one of the following sections, depending on which option fits your needs.

**To use skip matching with a new launch template**

1. Use the `create-launch-template` command to create a new launch template for your Auto Scaling group. Include the `--launch-template-data` option and JSON input that defines the details of the instances that are created for your Auto Scaling group.

   For example, use the following command to create a launch template with the AMI ID `ami-0123456789abcdef0`.

   ```bash
   aws ec2 create-launch-template --launch-template-name my-new-template --version-description version1 \   --launch-template-data '{"ImageId":"ami-0123456789abcdef0"}'
   ```

   If successful, the command returns output similar to the following.

   ```json
   {
      "LaunchTemplate": {
      ```
Replace instances based on an instance refresh

```
"LaunchTemplateId": "lt-04d5cc9b8example",
"LaunchTemplateName": "my-new-template",
"CreatedBy": "arn:aws:iam::123456789012:user/Bob",
"CreateTime": "2023-01-31T15:56:02.000Z",
"DefaultVersionNumber": 1,
"LatestVersionNumber": 1
}
```

For more information, see Examples for creating and managing launch templates with the AWS Command Line Interface (AWSCLI) (p. 35).

2. To view the existing mixed instances policy for your Auto Scaling group, run the `describe-auto-scaling-groups` command. You'll need this information in the next step, when you start the instance refresh.

The following example command returns the mixed instances policy configured for the Auto Scaling group named `my-asg`.

```
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

If successful, the command returns output similar to the following.

```
{
  "AutoScalingGroups":[
    {
      "AutoScalingGroupName":"my-asg",
      "AutoScalingGroupARN": "arn",
      "MixedInstancesPolicy":{
        "LaunchTemplate":{
          "LaunchTemplateSpecification":{
            "LaunchTemplateId": "lt-073693ed2example",
            "LaunchTemplateName": "my-old-template",
            "Version": "$Default"
          },
          "Overrides":[
            {
              "InstanceType": "c5.large"
            },
            {
              "InstanceType": "c5a.large"
            },
            {
              "InstanceType": "m5.large"
            },
            {
              "InstanceType": "m5a.large"
            }
          ]
        }
      },
      "InstancesDistribution":{
        "OnDemandAllocationStrategy": "prioritized",
        "OnDemandBaseCapacity": 1,
        "OnDemandPercentageAboveBaseCapacity": 50,
        "SpotAllocationStrategy": "price-capacity-optimized"
      }
    }
  ],
  "MinSize": 1,
  "MaxSize": 5,
  "DesiredCapacity": 4,
  ...
}
```
3. Use the `start-instance-refresh` command to initiate the instance replacement workflow and apply your new launch template with the ID `lt-04d5cc9b88example`. Because the launch template is new, it only has one version. This means that version 1 of the launch template is the target of this instance refresh. If a scale-out event occurs during the instance refresh, and Amazon EC2 Auto Scaling provisions new instances using the version 1 of this launch template, they will not be replaced. On successful completion of the operation, the updated mixed instances policy is successfully applied to your Auto Scaling group.

```bash
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of `config.json`.

```json
{
    "AutoScalingGroupName": "my-asg",
    "DesiredConfiguration": {
        "MixedInstancesPolicy": {
            "LaunchTemplate": {
                "LaunchTemplateName": "lt-04d5cc9b88example",
                "Version": "$Default"
            },
            "Overrides": [
                { "InstanceType": "c5.large" },
                { "InstanceType": "c5a.large" },
                { "InstanceType": "m5.large" },
                { "InstanceType": "m5a.large" }
            ],
            "InstancesDistribution": {
                "OnDemandAllocationStrategy": "prioritized",
                "OnDemandBaseCapacity": 1,
                "OnDemandPercentageAboveBaseCapacity": 50,
                "SpotAllocationStrategy": "price-capacity-optimized"
            }
        }
    },
    "Preferences": {
        "SkipMatching": true
    }
}
```

If successful, the command returns output similar to the following.

```json
{
    "InstanceRefreshId": "08b91cf7-8fa6-48af-b6a6-d227f40f1b9b"
}
```
In this next procedure, you provide an updated set of instance types without changing the launch template.

**To use skip matching with an updated set of instance types**

1. To view the existing mixed instances policy for your Auto Scaling group, run the `describe-auto-scaling-groups` command. You'll need this information in the next step, when you start the instance refresh.

   The following example command returns the mixed instances policy configured for the Auto Scaling group named *my-asg*.

   ```
   aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
   ```

   If successful, the command returns output similar to the following.

   ```
   {
   "AutoScalingGroups": [
   {
   "AutoScalingGroupName": "my-asg",
   "AutoScalingGroupARN": "arn",
   "MixedInstancesPolicy": {
   "LaunchTemplate": {
   "LaunchTemplateSpecification": {
   "LaunchTemplateId": "lt-073693ed27example",
   "LaunchTemplateName": "my-template-for-auto-scaling",
   "Version": "$Default"
   },
   "Overrides": [
   {
   "InstanceType": "c5.large"
   },
   {
   "InstanceType": "c5a.large"
   },
   {
   "InstanceType": "m5.large"
   },
   {
   "InstanceType": "m5a.large"
   }
   ],
   "InstancesDistribution": {
   "OnDemandAllocationStrategy": "prioritized",
   "OnDemandBaseCapacity": 1,
   "OnDemandPercentageAboveBaseCapacity": 50,
   "SpotAllocationStrategy": "price-capacity-optimized"
   }
   },
   "MinSize": 1,
   "MaxSize": 5,
   "DesiredCapacity": 4,
   ...
   }
   ]
   }
   ```

2. Use the `start-instance-refresh` command to initiate the instance replacement workflow and apply your updates. If you want to replace instances that use specific instance types, your desired configuration must specify the mixed instance policy with only the instance types that you want. You can choose whether to add new instance types in their place.
The following example command starts an instance refresh without the unwanted instance type \textit{m5a.large}. When an instance type in your group doesn’t match one of the remaining three instance types, the instances are replaced. (Note that an instance refresh does not choose the instance types from which to provision the new instances; instead, the \textit{allocation strategies} (p. 63) do that.) On successful completion of the operation, the updated mixed instances policy is successfully applied to your Auto Scaling group.

```
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of config.json

```
{
  "AutoScalingGroupName":"my-asg",
  "DesiredConfiguration":{
    "MixedInstancesPolicy":{
      "LaunchTemplate":{
        "LaunchTemplateSpecification":{
          "LaunchTemplateId":"lt-073693ed27example",
          "Version":"$Default"
        },
        "Overrides":[
          {
            "InstanceType":"c5.large"
          },
          {
            "InstanceType":"c5a.large"
          },
          {
            "InstanceType":"m5.large"
          }
        ],
        "InstancesDistribution":{
          "OnDemandAllocationStrategy":"prioritized",
          "OnDemandBaseCapacity":1,
          "OnDemandPercentageAboveBaseCapacity":50,
          "SpotAllocationStrategy":"price-capacity-optimized"
        }
      }
    },
    "Preferences":{
      "SkipMatching":true
    }
  }
}
```

Add checkpoints to an instance refresh

When using an instance refresh, you can choose to replace instances in phases, so that you can perform verifications on your instances as you go. To do a phased replacement, you add checkpoints, which are points in time where the instance refresh pauses. Using checkpoints gives you greater control over how you choose to update your Auto Scaling group. It helps you to confirm that your application will function in a reliable, predictable manner.

Amazon EC2 Auto Scaling emits events for each checkpoint. You can add an EventBridge rule to send the events to a target such as Amazon SNS. This way, you are notified when you can run the required verifications. For more information, see Create EventBridge rules for instance refresh events (p. 383).
Consider the following Auto Scaling group that has 10 instances. The checkpoint percentages are `[20, 50, 100]` and the minimum healthy percentage is 80 percent. To maintain the minimum healthy percentage, only two instances can be replaced at a time. To reach a checkpoint percentage, Amazon EC2 Auto Scaling will sometimes replace fewer but never more than what the minimum healthy percentage allows. The following diagram summarizes the process for replacing instances before a checkpoint is reached.

In the above example, there is an instance warm-up period for each new instance that starts. You might also have a lifecycle hook that puts an instance into a wait state and then performs a custom action as it's launching or terminating.

Contents
- Considerations (p. 124)
- Enable checkpoints (console) (p. 125)
- Enable checkpoints (AWS CLI) (p. 125)

Considerations

Keep the following considerations in mind when using checkpoints:

- A checkpoint is reached when a specified percentage of the total number of instances in the Auto Scaling group is replaced. The percentage is the minimum percentage of the Auto Scaling group that you want the checkpoint to represent. In some cases, the actual percentage complete might be higher than the percentage for that checkpoint when the checkpoint's percentage is too low relative to the number of instances in the group. For example, suppose the checkpoint's percentage is 20 percent and the group has four instances. If Amazon EC2 Auto Scaling replaces one of the four instances, the actual percentage replaced (25 percent) will be higher than the checkpoint's percentage (20 percent).
- After a checkpoint is reached, the overall percentage complete doesn't display the latest status until after the instances finish warming up.

For example, assume that your Auto Scaling group has 10 instances. Your checkpoint percentages are `[20, 50]` with a checkpoint delay of 15 minutes and a minimum healthy percentage of 80 percent. Your group makes the following replacements:

- 0:00: Two earlier instances are replaced with new ones.
- 0:10: Two new instances finish warming up.
- 0:25: Two earlier instances are replaced with new ones. (To maintain the minimum healthy percentage, only two instances are replaced.)
- 0:35: Two new instances finish warming up.
- 0:35: One earlier instance is replaced with a new one.
- 0:45: One new instance finishes warming up.
At 0:35, the operation stops launching new instances. The percentage complete doesn't accurately reflect the number of completed replacements yet (50 percent), because the new instance isn't done warming up. After the new instance completes its warm-up period at 0:45, the percentage complete shows 50 percent.

- Because checkpoints are based on percentages, the number of instances to replace changes with the size of the group. When a scale-out activity occurs and the size of the group increases, an in-progress operation could reach a checkpoint again. If that happens, Amazon EC2 Auto Scaling sends another notification and repeats the wait time between checkpoints before continuing.
- It's possible to skip a checkpoint under certain circumstances. For example, suppose that your Auto Scaling group has two instances and your checkpoint percentages are \( \{10, 40, 100\} \). After the first instance is replaced, Amazon EC2 Auto Scaling calculates that 50 percent of the group was replaced. Because 50 percent is higher than the first two checkpoints, it skips the first checkpoint (10) and sends a notification for the second checkpoint (40).
- Canceling the operation stops any further replacements from being made. If you cancel the operation or it fails before reaching the last checkpoint, any instances that were already replaced are not rolled back to their previous configuration.
- For a partial refresh, when you rerun the operation, Amazon EC2 Auto Scaling doesn't restart from the point of the last checkpoint, nor does it stop when only the earlier instances are replaced. However, it targets earlier instances for replacement first, before targeting new instances.

### Enable checkpoints (console)

You can enable checkpoints before starting an instance refresh to replace instances using an incremental or phased approach. This provides additional time for verification.

**To start an instance refresh that uses checkpoints**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   - A split pane opens up at the bottom of the Auto Scaling groups page.
3. On the Instance refresh tab, in Active instance refresh, choose Start instance refresh.
4. On the Start instance refresh page, enter the values for Minimum healthy percentage and Instance warmup.
5. Select the Enable checkpoints check box.
   - This displays a box where you can define the percentage threshold for the first checkpoint.
6. For Proceed until ____ % of the group is refreshed, enter a number (1–100). This sets the percentage for the first checkpoint.
7. To add another checkpoint, choose Add checkpoint and then define the percentage for the next checkpoint.
8. To specify how long Amazon EC2 Auto Scaling waits after a checkpoint is reached, update the fields in Wait for 1 hour between checkpoints. The time unit can be hours, minutes, or seconds.
9. If you are finished with your instance refresh selections, choose Start instance refresh.

### Enable checkpoints (AWS CLI)

To start an instance refresh with checkpoints enabled using the AWS CLI, you need a configuration file that defines the following parameters:

- **Checkpoint Percentages**: Specifies threshold values for the percentage of instances to be replaced. These threshold values provide the checkpoints. When the percentage of instances that are replaced
and warmed up reaches one of the specified thresholds, the operation waits for a specified period of time. You specify the number of seconds to wait in CheckpointDelay. When the specified period of time has passed, the instance refresh continues until it reaches the next checkpoint (if applicable).

- **CheckpointDelay**: Specifies the amount of time, in seconds, to wait after a checkpoint is reached before continuing. Choose a time period that provides enough time to perform your verifications.

The last value shown in the CheckpointPercentages array describes the percentage of the Auto Scaling group that needs to be successfully replaced. The operation transitions to Successful after this percentage is successfully replaced and each instance is considered to have finished initializing.

**To create multiple checkpoints**

To create multiple checkpoints, use the following example `start-instance-refresh` command. This example configures an instance refresh that initially refreshes one percent of the Auto Scaling group. After waiting 10 minutes, it then refreshes the next 19 percent and waits another 10 minutes. Finally, it refreshes the rest of the group before concluding the operation.

```
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of `config.json`:

```json
{
    "AutoScalingGroupName": "my-asg",
    "Preferences": {
        "InstanceWarmup": 60,
        "MinHealthyPercentage": 80,
        "CheckpointPercentages": [1, 20, 100],
        "CheckpointDelay": 600
    }
}
```

**To create a single checkpoint**

To create a single checkpoint, use the following example `start-instance-refresh` command. This example configures an instance refresh that initially refreshes 20 percent of the Auto Scaling group. After waiting 10 minutes, it then refreshes the rest of the group before concluding the operation.

```
aws autoscaling start-instance-refresh --cli-input-json file://config.json
```

Contents of `config.json`:

```json
{
    "AutoScalingGroupName": "my-asg",
    "Preferences": {
        "InstanceWarmup": 60,
        "MinHealthyPercentage": 80,
        "CheckpointPercentages": [20, 100],
        "CheckpointDelay": 600
    }
}
```

**To partially refresh the Auto Scaling group**

To replace only a portion of your Auto Scaling group and then stop completely, use the following example `start-instance-refresh` command. This example configures an instance refresh that initially refreshes one percent of the Auto Scaling group. After waiting 10 minutes, it then refreshes the next 19 percent before concluding the operation.
Replace Auto Scaling instances based on maximum instance lifetime

The maximum instance lifetime specifies the maximum amount of time (in seconds) that an instance can be in service before it is terminated and replaced. A common use case might be a requirement to replace your instances on a schedule because of internal security policies or external compliance controls.

You must specify a value of at least 86,400 seconds (one day). To clear a previously set value, specify a new value of 0. This setting applies to all current and future instances in your Auto Scaling group.

Setting this value too low can cause instances to be replaced faster than desired. In general, Amazon EC2 Auto Scaling replaces instances one at a time, with a pause between replacements. However, if the maximum instance lifetime that you specify doesn't provide enough time to replace each instance individually, Amazon EC2 Auto Scaling must replace more than one instance at a time. Several instances might be replaced at once, by up to 10 percent of the current capacity of your Auto Scaling group.

To manage the rate of replacement, you can do the following:

- Set the maximum instance lifetime limit to a longer period of time. This spaces out the replacements, which is helpful for groups that have a large number of instances to replace.
- Add extra time between certain replacements by using instance protection. This temporarily prevents individual instances in your Auto Scaling group from being replaced. When you're ready to replace these instances, remove instance protection from each individual instance. For more information, see Use instance scale-in protection (p. 282).

**Note**
Whenever an earlier instance is replaced and a new instance launches, the new instance uses the launch template or launch configuration that is currently associated with the Auto Scaling group. If your launch template or launch configuration specifies the AMI ID of a different version of your application, this version of your application will be deployed automatically.

Set the maximum instance lifetime

When you create an Auto Scaling group in the console, you cannot set the maximum instance lifetime. However, after the group is created, you can edit it to set the maximum instance lifetime.

To set the maximum instance lifetime for a group (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
A split pane opens up at the bottom of the Auto Scaling groups page, showing information about the group you selected.

3. On the Details tab, choose Advanced configurations, Edit.
4. For Maximum instance lifetime, enter the maximum number of seconds that an instance can be in service.
5. Choose Update.

On the Activity tab, under Activity history, you can view the replacement of instances in the group throughout its history.

To set the maximum instance lifetime for a group (AWS CLI)

You can also use the AWS CLI to set the maximum instance lifetime for new or existing Auto Scaling groups.

For new Auto Scaling groups, use the create-auto-scaling-group command.

```
aws autoscaling create-auto-scaling-group --cli-input-json file:///~/.config.json
```

The following is an example config.json file that shows a maximum instance lifetime of 2592000 seconds (30 days).

```json
{
  "AutoScalingGroupName": "my-asg",
  "LaunchTemplate": {
    "LaunchTemplateName": "my-launch-template",
    "Version": "$Latest"
  },
  "MinSize": 1,
  "MaxSize": 5,
  "MaxInstanceLifetime": 2592000,
  "VPCZoneIdentifier": "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782",
  "Tags": []
}
```

For existing Auto Scaling groups, use the update-auto-scaling-group command.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-existing-asg --max-instance-lifetime 2592000
```

To verify the maximum instance lifetime for an Auto Scaling group

Use the describe-auto-scaling-groups command.

```
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

The following is an example response.

```
{
  "AutoScalingGroups": [
  {
    "AutoScalingGroupName": "my-asg",
    "AutoScalingGroupARN": "arn",
    "LaunchTemplate": {
      "LaunchTemplateId": "lt-0b9f1e282EXAMPLE",
      "LaunchTemplateName": "my-launch-template",
      "Version": "$Latest"
    },
```
Limitations

- **Maximum lifetime not guaranteed to be exact for every instance**: Instances are not guaranteed to be replaced only at the end of their maximum duration. In some situations, Amazon EC2 Auto Scaling might need to start replacing instances immediately after you update the maximum instance lifetime parameter. The reason for this behavior is to avoid replacing all instances at the same time.

- **Instances terminated before launch**: When there is only one instance in the Auto Scaling group, the maximum instance lifetime feature can result in an outage because Amazon EC2 Auto Scaling terminates an instance and then launches a new instance.

**Tag Auto Scaling groups and instances**

A tag is a custom attribute label that you assign or that AWS assigns to an AWS resource. Each tag has two parts:

- A tag key (for example, costcenter, environment, or project)
• An optional field known as a tag value (for example, 111122223333 or production)

Tags help you do the following:

• Track your AWS costs. You activate these tags on the AWS Billing and Cost Management dashboard. AWS uses the tags to categorize your costs and deliver a monthly cost allocation report to you. For more information, see Using cost allocation tags in the AWS Billing User Guide.

• Control access to Auto Scaling groups based on tags. You can use conditions in your IAM policies to control access to Auto Scaling groups based on the tags on that group. For more information, see Tags for security (p. 134).

• Filter and search for Auto Scaling groups based on the tags that you add. For more information, see Use tags to filter Auto Scaling groups (p. 135).

• Identify and organize your AWS resources. Many AWS services support tagging, so you can assign the same tag to resources from different services to indicate that the resources are related.

You can tag new or existing Auto Scaling groups. You can also propagate tags from an Auto Scaling group to the EC2 instances that it launches.

Tags are not propagated to Amazon EBS volumes. To add tags to Amazon EBS volumes, specify the tags in a launch template. For more information, see Create a launch template for an Auto Scaling group (p. 22).

You can create and manage tags through the AWS Management Console, AWS CLI, or SDKs.

Contents

• Tag naming and usage restrictions (p. 130)
• EC2 instance tagging lifecycle (p. 130)
• Tag your Auto Scaling groups (p. 131)
• Delete tags (p. 133)
• Tags for security (p. 134)
• Control access to tags (p. 134)
• Use tags to filter Auto Scaling groups (p. 135)

Tag naming and usage restrictions

The following basic restrictions apply to tags:

• The maximum number of tags per resource is 50.
• The maximum number of tags that you can add or remove using a single call is 25.
• The maximum key length is 128 Unicode characters.
• The maximum value length is 256 Unicode characters.
• Tag keys and values are case-sensitive. As a best practice, decide on a strategy for capitalizing tags, and consistently implement that strategy across all resource types.
• Do not use the aws: prefix in your tag names or values, because it is reserved for AWS use. You can't edit or delete tag names or values with this prefix, and they do not count toward your tags per resource quota.

EC2 instance tagging lifecycle

If you have opted to propagate tags to your EC2 instances, the tags are managed as follows:
Tag your Auto Scaling groups

When you add a tag to your Auto Scaling group, you can specify whether it should be added to instances launched in the Auto Scaling group. If you modify a tag, the updated version of the tag is added to instances launched in the Auto Scaling group after the change. If you create or modify a tag for an Auto Scaling group, these changes are not made to instances that are already running in the Auto Scaling group.

Contents

- Add or modify tags (console) (p. 131)
- Add or modify tags (AWS CLI) (p. 131)

Add or modify tags (console)

To tag an Auto Scaling group on creation

When you use the Amazon EC2 console to create an Auto Scaling group, you can specify tag keys and values on the Add tags page of the Create Auto Scaling group wizard. To propagate a tag to the instances launched in the Auto Scaling group, make sure that you keep the Tag new instances option for that tag selected. Otherwise, you can deselect it.

To add or modify tags for an existing Auto Scaling group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Details tab, choose Tags, Edit.
4. To modify existing tags, edit Key and Value.
5. To add a new tag, choose Add tag and edit Key and Value. You can keep Tag new instances selected to add the tag to the instances launched in the Auto Scaling group automatically, and deselect it otherwise.
6. When you have finished adding tags, choose Update.

Add or modify tags (AWS CLI)

The following examples show how to use the AWS CLI to add tags when you create Auto Scaling groups, and to add or modify tags for existing Auto Scaling groups.
Tag your Auto Scaling groups

To tag an Auto Scaling group on creation

Use the `create-auto-scaling-group` command to create a new Auto Scaling group and add a tag, for example, `environment=production`, to the Auto Scaling group. The tag is also added to any instances launched in the Auto Scaling group.

```bash
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg
    --launch-configuration-name my-launch-config --min-size 1 --max-size 3
    --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
    --tags Key=environment,Value=production,PropagateAtLaunch=true
```

To create or modify tags for an existing Auto Scaling group

Use the `create-or-update-tags` command to create or modify a tag. For example, the following command adds the `Name=my-asg` and `costcenter=cc123` tags. The tags are also added to any instances launched in the Auto Scaling group after this change. If a tag with either key already exists, the existing tag is replaced. The Amazon EC2 console associates the display name for each instance with the name that is specified for the `Name` key (case-sensitive).

```bash
aws autoscaling create-or-update-tags
    --tags ResourceId=my-asg,ResourceType=auto-scaling-group,Key=Name,Value=my-asg,PropagateAtLaunch=true
    ResourceId=my-asg,ResourceType=auto-scaling-group,Key=costcenter,Value=cc123,PropagateAtLaunch=true
```

Describe the tags for an Auto Scaling group (AWS CLI)

If you want to view the tags that are applied to a specific Auto Scaling group, you can use either of the following commands:

- **describe-tags** — You supply your Auto Scaling group name to view a list of the tags for the specified group.

  ```bash
  aws autoscaling describe-tags --filters Name=auto-scaling-group,Values=my-asg
  ```

  The following is an example response.

  ```json
  {
  "Tags": [
    {
      "ResourceType": "auto-scaling-group",
      "ResourceId": "my-asg",
      "PropagateAtLaunch": true,
      "Value": "production",
      "Key": "environment"
    }
  ]
  }
  ```

- **describe-auto-scaling-groups** — You supply your Auto Scaling group name to view the attributes of the specified group, including any tags.

  ```bash
  aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
  ```

  The following is an example response.

132
Delete tags

You can delete a tag associated with your Auto Scaling group at any time.

Contents

- Delete tags (console) (p. 133)
- Delete tags (AWS CLI) (p. 133)

Delete tags (console)

To delete a tag

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to an existing group.
   
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Details tab, choose Tags, Edit.
4. Choose Remove next to the tag.
5. Choose Update.

Delete tags (AWS CLI)

Use the delete-tags command to delete a tag. For example, the following command deletes a tag with a key of environment.

```
aws autoscaling delete-tags --tags "ResourceId=my-asg,ResourceType=auto-scaling-group,Key=environment"
```
You must specify the tag key, but you don't have to specify the value. If you specify a value and the value is incorrect, the tag is not deleted.

**Tags for security**

Use tags to verify that the requester (such as an IAM user or role) has permissions to create, modify, or delete specific Auto Scaling groups. Provide tag information in the condition element of an IAM policy by using one or more of the following condition keys:

- Use `autoscaling:ResourceTag/tag-key: tag-value` to allow (or deny) user actions on Auto Scaling groups with specific tags.
- Use `aws:RequestTag/tag-key: tag-value` to require that a specific tag be present (or not present) in a request.
- Use `aws:TagKeys [tag-key, ...]` to require that specific tag keys be present (or not present) in a request.

For example, you could deny access to all Auto Scaling groups that include a tag with the key `environment` and the value `production`, as shown in the following example.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Deny",
         "Action": [ "autoscaling:CreateAutoScalingGroup", "autoscaling:UpdateAutoScalingGroup", "autoscaling:DeleteAutoScalingGroup" ],
         "Resource": ",",
         "Condition": {
            "StringEquals": {"autoscaling:ResourceTag/environment": "production"}
         }
      }
   ]
}
```

For more information about using condition keys to control access to Auto Scaling groups, see [How Amazon EC2 Auto Scaling works with IAM](p. 392).

**Control access to tags**

Use tags to verify that the requester (such as an IAM user or role) has permissions to add, modify, or delete tags for Auto Scaling groups.

The following example IAM policy gives the principal permission to remove only the tag with the key `temporary` from Auto Scaling groups.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": "autoscaling:DeleteTags",
         "Resource": ",",
         "Condition": {
            "ForAllValues:StringEquals": { "aws:TagKeys": ["temporary"] }
         }
      }
   ]
}
```
Use tags to filter Auto Scaling groups

The following examples show you how to use filters with the `describe-auto-scaling-groups` command to describe Auto Scaling groups with specific tags. Filtering by tags is limited to the AWS CLI or an SDK, and is not available from the console.

Filtering considerations

- You can specify multiple filters and multiple filter values in a single request.
- You cannot use wildcards with the filter values.
- Filter values are case-sensitive.

Example: Describe Auto Scaling groups with a specific tag key and value pair

The following command shows how to filter results to show only Auto Scaling groups with the tag key and value pair of `environment=production`.

```bash
aws autoscaling describe-auto-scaling-groups \
  --filters Name=tag-key,Values=environment Name=tag-value,Values=production
```

The following is an example response.

```json
{
  "AutoScalingGroups": [
    {
      "AutoScalingGroupARN": "arn",
      "HealthCheckGracePeriod": 0,
      "SuspendedProcesses": [],
      "DesiredCapacity": 1,
      "Tags": [
        {
          "ResourceType": "auto-scaling-group",
          "ResourceId": "my-asg",
          "PropagateAtLaunch": true,
          "Value": "production",
          "Key": "environment"
        }
      ],
      "EnabledMetrics": [],
      "LoadBalancerNames": [],
      "AutoScalingGroupName": "my-asg",
      ...
    }
  ]
}
```
Alternatively, you can specify tags using a tag:\texttt{<key>} filter. For example, the following command shows how to filter results to show only Auto Scaling groups with a tag key and value pair of \texttt{environment=production}. This filter is formatted as follows: Name=tag:\texttt{<key>},Values=\texttt{<value>}, with \texttt{<key>} and \texttt{<value>} representing a tag key and value pair.

```
aws autoscaling describe-auto-scaling-groups \
--filters Name=tag:environment,Values=production
```

You can also filter AWS CLI output by using the --query option. The following example shows how to limit AWS CLI output for the previous command to the group name, minimum size, maximum size, and desired capacity attributes only.

```
aws autoscaling describe-auto-scaling-groups \
--filters Name=tag:environment,Values=production \
--query "AutoScalingGroups[].{AutoScalingGroupName: AutoScalingGroupName, MinSize: MinSize, MaxSize: MaxSize, DesiredCapacity: DesiredCapacity}"
```

The following is an example response.

```
[
  {"AutoScalingGroupName": "my-asg", "MinSize": 0, "MaxSize": 10, "DesiredCapacity": 1}
]
```

For more information about filtering, see Filtering AWS CLI output in the AWS Command Line Interface User Guide.

**Example: Describe Auto Scaling groups with tags that match the tag key specified**

The following command shows how to filter results to show only Auto Scaling groups with the \texttt{environment} tag, regardless of the tag value.

```
aws autoscaling describe-auto-scaling-groups \
--filters Name=tag-key,Values=environment
```

**Example: Describe Auto Scaling groups with tags that match the set of tag keys specified**

The following command shows how to filter results to show only Auto Scaling groups with tags for \texttt{environment} and \texttt{project}, regardless of the tag values.

```
aws autoscaling describe-auto-scaling-groups \
--filters Name=tag-key,Values=environment Name=tag-key,Values=project
```

**Example: Describe Auto Scaling groups with tags that match at least one of the tag keys specified**

The following command shows how to filter results to show only Auto Scaling groups with tags for \texttt{environment} or \texttt{project}, regardless of the tag values.

```
aws autoscaling describe-auto-scaling-groups \
--filters Name=tag-key,Values=environment,project
```

**Example: Describe Auto Scaling groups with the specified tag value**
Delete your Auto Scaling infrastructure

To completely delete your scaling infrastructure, complete the following tasks.

Tasks
• Delete your Auto Scaling group (p. 137)
• (Optional) Delete the launch configuration (p. 138)
• (Optional) Delete the launch template (p. 138)
• (Optional) Delete the load balancer and target groups (p. 139)
• (Optional) Delete CloudWatch alarms (p. 140)

Delete your Auto Scaling group

When you delete an Auto Scaling group, its desired, minimum, and maximum values are set to 0. As a result, the instances are terminated. Deleting an instance also deletes any associated logs or data, and any volumes on the instance. If you do not want to terminate one or more instances, you can detach
them before you delete the Auto Scaling group. If the group has scaling policies, deleting the group deletes the policies, the underlying alarm actions, and any alarm that no longer has an associated action.

**To delete your Auto Scaling group (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to your Auto Scaling group and choose **Actions, Delete**.
3. When prompted for confirmation, type `delete` to confirm deleting the specified Auto Scaling group and then choose **Delete**.

   A loading icon in the **Name** column indicates that the Auto Scaling group is being deleted. The **Desired**, **Min**, and **Max** columns show 0 instances for the Auto Scaling group. It takes a few minutes to terminate the instance and delete the group. Refresh the list to see the current state.

**To delete your Auto Scaling group (AWS CLI)**

Use the following `delete-auto-scaling-group` command to delete the Auto Scaling group. This operation does not work if the group has any EC2 instances; it is for group's with zero instances only.

```
aws autoscaling delete-auto-scaling-group --auto-scaling-group-name my-asg
```

If the group has instances or scaling activities in progress, use the `delete-auto-scaling-group` command with the `--force-delete` option. This will also terminate the EC2 instances. When you delete an Auto Scaling group from the Amazon EC2 Auto Scaling console, the console uses this operation to terminate any EC2 instances and delete the group at the same time.

```
aws autoscaling delete-auto-scaling-group --auto-scaling-group-name my-asg --force-delete
```

**(Optional) Delete the launch configuration**

You can skip this step to keep the launch configuration for future use.

**To delete the launch configuration (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. On the left navigation pane, under **Auto Scaling**, choose **Auto Scaling Groups**.
3. Choose **Launch configurations** near the top of the page. When prompted for confirmation, choose **View launch configurations** to confirm that you want to view the **Launch configurations** page.
4. Select your launch configuration and choose **Actions, Delete launch configuration**.
5. When prompted for confirmation, choose **Delete**.

**To delete the launch configuration (AWS CLI)**

Use the following `delete-launch-configuration` command.

```
aws autoscaling delete-launch-configuration --launch-configuration-name my-launch-config
```

**(Optional) Delete the launch template**

You can delete your launch template or just one version of your launch template. When you delete a launch template, all its versions are deleted.
You can skip this step to keep the launch template for future use.

**To delete your launch template (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. On the navigation pane, under **Instances**, choose **Launch Templates**.
3. Select your launch template and then do one of the following:
   - Choose **Actions**, **Delete template**. When prompted for confirmation, type **Delete** to confirm deleting the specified launch template and then choose **Delete**.
   - Choose **Actions**, **Delete template version**. Select the version to delete and choose **Delete**.

**To delete the launch template (AWS CLI)**

Use the following `delete-launch-template` command to delete your template and all its versions.

```
aws ec2 delete-launch-template --launch-template-id lt-068f72b72934aff71
```

Alternatively, you can use the `delete-launch-template-versions` command to delete a specific version of a launch template.

```
aws ec2 delete-launch-template-versions --launch-template-id lt-068f72b72934aff71 --versions 1
```

**Optional** Delete the load balancer and target groups

Skip this step if your Auto Scaling group is not associated with an Elastic Load Balancing load balancer, or if you want to keep the load balancer for future use.

**To delete your load balancer (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. On the navigation pane, under **Load Balancing**, choose **Load Balancers**.
3. Choose the load balancer and choose **Actions**, **Delete**.
4. When prompted for confirmation, choose **Yes**, **Delete**.

**To delete your target group (console)**

1. On the navigation pane, under **Load Balancing**, choose **Target Groups**.
2. Choose the target group and choose **Actions**, **Delete**.
3. When prompted for confirmation, choose **Yes**, **Delete**.

**To delete the load balancer associated with the Auto Scaling group (AWS CLI)**

For Application Load Balancers and Network Load Balancers, use the following `delete-load-balancer` and `delete-target-group` commands.

```
aws elbv2 delete-load-balancer --load-balancer-arn my-load-balancer-arn
aws elbv2 delete-target-group --target-group-arn my-target-group-arn
```

For Classic Load Balancers, use the following `delete-load-balancer` command.
(Optional) Delete CloudWatch alarms

To delete the CloudWatch alarms associated with your Auto Scaling group, complete the following steps. For example, you might have alarms associated with step scaling or simple scaling policies.

**Note**
Deleting an Auto Scaling group automatically deletes the CloudWatch alarms that Amazon EC2 Auto Scaling manages for a target tracking scaling policy.

You can skip this step if your Auto Scaling group is not associated with any CloudWatch alarms, or if you want to keep the alarms for future use.

**To delete the CloudWatch alarms (console)**

2. On the navigation pane, choose **Alarms**.
3. Choose the alarms and choose **Action, Delete**.
4. When prompted for confirmation, choose **Delete**.

**To delete the CloudWatch alarms (AWS CLI)**

Use the `delete-alarms` command. You can delete one or more alarms at a time. For example, use the following command to delete the `Step-Scaling-AlarmHigh-AddCapacity` and `Step-Scaling-AlarmLow-RemoveCapacity` alarms.

```
aws cloudwatch delete-alarms --alarm-name Step-Scaling-AlarmHigh-AddCapacity Step-Scaling-AlarmLow-RemoveCapacity
```

Examples for creating and managing Auto Scaling groups with the AWS SDKs

You can create an Auto Scaling group using the AWS Management Console, the AWS CLI, an AWS SDK, and AWS CloudFormation.

The following code examples show how to create, update, and delete an Auto Scaling group in your favorite supported programming language using the AWS SDKs.

**Contents**

- [Create an Auto Scaling group using an AWS SDK (p. 140)](#create_an_auto_scaling_group_using_an_aws_sdk)
- [Update an Auto Scaling group using an AWS SDK (p. 145)](#update_an_auto_scaling_group_using_an_aws_sdk)
- [Delete an Auto Scaling group using an AWS SDK (p. 150)](#delete_an_auto_scaling_group_using_an_aws_sdk)
- [Related resources (p. 153)](#related_resources)

## Create an Auto Scaling group using an AWS SDK

The following code examples show how to create an Auto Scaling group.

```
aws elb delete-load-balancer --load-balancer-name my-load-balancer
```
Amazon EC2 Auto Scaling User Guide
Create an Auto Scaling group

.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 a new Amazon EC2 Auto Scaling group.
/// </summary>
/// <param name="groupName">The name to use for the new Auto Scaling
/// group.</param>
/// <param name="launchTemplateName">The name of the Amazon EC2 Auto Scaling
/// launch template to use to create instances in the group.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> CreateAutoScalingGroupAsync(
string groupName,
string launchTemplateName,
string availabilityZone)
{
var templateSpecification = new LaunchTemplateSpecification
{
LaunchTemplateName = launchTemplateName,
};
var zoneList = new List<string>
{
availabilityZone,
};
var request = new CreateAutoScalingGroupRequest
{
AutoScalingGroupName = groupName,
AvailabilityZones = zoneList,
LaunchTemplate = templateSpecification,
MaxSize = 6,
MinSize = 1
};
var response = await
_amazonAutoScaling.CreateAutoScalingGroupAsync(request);
Console.WriteLine($"{groupName} Auto Scaling Group created");
}

• For API details, see CreateAutoScalingGroup 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.
Aws::Client::ClientConfiguration clientConfig;
// Optional: Set to the AWS Region (overrides config file).
// clientConfig.region = "us-east-1";

141


Create an Auto Scaling group

```cpp
Aws::AutoScaling::AutoScalingClient autoScalingClient(clientConfig);
Aws::AutoScaling::Model::CreateAutoScalingGroupRequest request;
Aws::AutoScaling::Model::CreateAutoScalingGroupOutcome outcome =
    autoScalingClient.CreateAutoScalingGroup(request);

// For API details, see CreateAutoScalingGroup in AWS SDK for C++ API Reference.
```

Java

```java
public static void createAutoScalingGroup(AutoScalingClient autoScalingClient,
                                        String groupName,
                                        String launchTemplateName,
                                        String vpcZoneId) {

    try {
        AutoScalingWaiter waiter = autoScalingClient.waiter();
        LaunchTemplateSpecification templateSpecification =
            LaunchTemplateSpecification.builder().
                launchTemplateName(launchTemplateName).build();

        CreateAutoScalingGroupRequest request =
            CreateAutoScalingGroupRequest.builder().
                autoScalingGroupName(groupName).availabilityZones(availabilityZones).build();

        CreateAutoScalingGroupOutcome outcome =
            autoScalingClient.createAutoScalingGroup(request);

        if (outcome.isSuccess()) {
            System.out.println("Created Auto Scaling group ", groupName, "...");
        } else if (outcome.getErrorCode() ==
            Aws::AutoScaling::AutoScalingErrors::ALREADY_EXISTS_FAULT) {
            System.out.println("Auto Scaling group ", groupName, " already exists.");
        } else {
            System.err.println("Error with AutoScaling::CreateAutoScalingGroup. ", outcome.getErrorCode().getErrorMessage());
        }
    }
```

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 Auto Scaling group

```kotlin
suspend fun createAutoScalingGroup(groupName: String, launchTemplateNameVal: String, serviceLinkedRoleARNVal: String, vpcZoneIdVal: String) {
    val templateSpecification = LaunchTemplateSpecification {
        launchTemplateName = launchTemplateNameVal
    }

    val request = CreateAutoScalingGroupRequest {
        autoScalingGroupName = groupName
        availabilityZones = listOf("us-east-1a")
        launchTemplate = templateSpecification
        maxSize = 1
        minSize = 1
        vpcZoneIdentifier = vpcZoneIdVal
        serviceLinkedRoleArn = serviceLinkedRoleARNVal
    }

    // This object is required for the waiter call.
    val groupsRequestWaiter = DescribeAutoScalingGroupsRequest {
        autoScalingGroupNames = listOf(groupName)
    }

    AutoScalingClient { region = "us-east-1" }.use { autoScalingClient ->
        autoScalingClient.createAutoScalingGroup(request)
        autoScalingClient.waitUntilGroupExists(groupsRequestWaiter)
        println("$groupName was created!")
    }
}
```

For API details, see [CreateAutoScalingGroup](https://docs.aws.amazon.com/AmazonEC2/latest/APIReference/API_CreateAutoScalingGroup.html) in [AWS SDK for Java 2.x API Reference](https://docs.aws.amazon.com/AWSJavaSDK/latest/api/index.html).

**Note**
This is prerelease documentation for a feature in preview release. It is subject to change.

**Note**
There’s more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](https://github.com/aws-samples/aws-sdk-java-examples).
• For API details, see CreateAutoScalingGroup in AWS SDK for Kotlin API reference.

PHP

SDK for PHP

Note
There's more on GitHub. Find the complete example and learn how to set up and run in the AWS Code Examples Repository.

```php
public function createAutoScalingGroup(
    $autoScalingGroupName,
    $availabilityZones,
    $minSize,
    $maxSize,
    $launchTemplateId
) {
    return $this->autoScalingClient->createAutoScalingGroup(
        
        'AutoScalingGroupName' => $autoScalingGroupName,
        'AvailabilityZones' => $availabilityZones,
        'MinSize' => $minSize,
        'MaxSize' => $maxSize,
        'LaunchTemplate' => [
            'LaunchTemplateId' => $launchTemplateId,
        ],
    );
}
```

• For API details, see CreateAutoScalingGroup in AWS SDK for PHP 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.

```python
class AutoScalingWrapper:
    """Encapsulates Amazon EC2 Auto Scaling actions."""
    def __init__(self, autoscaling_client):
        """param autoscaling_client: A Boto3 Amazon EC2 Auto Scaling client."
        self.autoscaling_client = autoscaling_client

    def create_group(
        self, group_name, group_zones, launch_template_name, min_size, max_size):
        """ Creates an Auto Scaling group.
            
            param group_name: The name to give to the group.
            param group_zones: The Availability Zones in which instances can be created.
        ```
Update an Auto Scaling group

:paramref launch_template_name: The name of an existing Amazon EC2 launch template. The launch template specifies the configuration of instances that are created by auto scaling activities.

:paramref min_size: The minimum number of active instances in the group.

:paramref max_size: The maximum number of active instances in the group.

```python
try:
    self.autoscaling_client.create_auto_scaling_group(
        AutoScalingGroupName=group_name,
        AvailabilityZones=group_zones,
        LaunchTemplate={
            'LaunchTemplateName': launch_template_name, 'Version': '$Default'},
            MinSize=min_size, MaxSize=max_size
    )
except ClientError as err:
    logger.error("Couldn't create group %s. Here's why: %s: %s", group_name, err.response['Error']['Code'], err.response['Error']['Message'])
    raise
```

• For API details, see CreateAutoScalingGroup in AWS SDK for Python (Boto3) API Reference.

Rust

SDK for Rust

**Note**
This documentation is for an SDK in preview release. The SDK is subject to change and should not be used in production.

**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
async fn create_group(client: &Client, name: &str, id: &str) -> Result<(), Error> {
    client  
        .create_auto_scaling_group()
        .auto_scaling_group_name(name)
        .instance_id(id)
        .min_size(1)
        .max_size(5)
        .send()
        .await?

    println!("Created AutoScaling group");

    Ok(())
}
```

• For API details, see CreateAutoScalingGroup in AWS SDK for Rust API reference.

Update an Auto Scaling group using an AWS SDK

The following code examples show how to update the configuration for an Auto Scaling group.
Note
There's more on GitHub. Find the complete example and learn how to set up and run in the AWS Code Examples Repository.

```csharp
/// <summary>
/// Update the capacity of an Auto Scaling group.
/// </summary>
/// <param name="groupName">The name of the Auto Scaling group.</param>
/// <param name="launchTemplateName">The name of the EC2 launch template.</param>
/// <param name="maxSize">The maximum number of instances that can be created for the Auto Scaling group.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> UpdateAutoScalingGroupAsync(
    string groupName,
    string launchTemplateName,
    int maxSize)
{
    var templateSpecification = new LaunchTemplateSpecification
    {
        LaunchTemplateName = launchTemplateName,
    };

    var groupRequest = new UpdateAutoScalingGroupRequest
    {
        MaxSize = maxSize,
        AutoScalingGroupName = groupName,
        LaunchTemplate = templateSpecification,
    };

    var response = await _amazonAutoScaling.UpdateAutoScalingGroupAsync(groupRequest);
    {
        Console.WriteLine($"You successfully updated the Auto Scaling group {groupName}.");
        return true;
    }
    else
    {
        return false;
    }
}
```

For API details, see [UpdateAutoScalingGroup](https://aws.amazon.com/api-reference) in AWS SDK for .NET API Reference.

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.

```cpp
Aws::Client::ClientConfiguration clientConfig;
```
Update an Auto Scaling group

```cpp
// Optional: Set to the AWS Region (overrides config file).
// clientConfig.region = "us-east-1";

Aws::AutoScaling::AutoScalingClient autoScalingClient(clientConfig);

Aws::AutoScaling::Model::UpdateAutoScalingGroupRequest request;
request.SetAutoScalingGroupName(groupName);
request.SetMaxSize(3);

Aws::AutoScaling::Model::UpdateAutoScalingGroupOutcome outcome =
    autoScalingClient.UpdateAutoScalingGroup(request);

if (!outcome.IsSuccess()) {
    std::cerr << "Error with AutoScaling::UpdateAutoScalingGroup. "
        << outcome.GetError().GetMessage()
    << std::endl;
}
```


**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](https://github.com/aws-samples/aws-sdk-java-code-examples).

```java
public static void updateAutoScalingGroup(AutoScalingClient autoScalingClient,
    String groupName, String launchTemplateName) {
    try {
        AutoScalingWaiter waiter = autoScalingClient.waiter();
        LaunchTemplateSpecification templateSpecification =
            LaunchTemplateSpecification.builder()
                .launchTemplateName(launchTemplateName)
                .build();

        UpdateAutoScalingGroupRequest groupRequest =
            UpdateAutoScalingGroupRequest.builder()
                .maxSize(3)
                .autoScalingGroupName(groupName)
                .launchTemplate(templateSpecification)
                .build();

        autoScalingClient.updateAutoScalingGroup(groupRequest);
        DescribeAutoScalingGroupsRequest groupsRequest =
            DescribeAutoScalingGroupsRequest.builder()
                .autoScalingGroupNames(groupName)
                .build();

        WaiterResponse<DescribeAutoScalingGroupsResponse> waiterResponse =
            waiter.waitUntilGroupInService(groupsRequest);

        waiterResponse.matched().response().ifPresent(System.out::println);
        System.out.println("You successfully updated the auto scaling group "
            +groupName);
    } catch (AutoScalingException e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
```
• For API details, see `UpdateAutoScalingGroup` in AWS SDK for Java 2.x API Reference.

**SDK for Kotlin**

**Note**

This is prerelease documentation for a feature in preview release. It is subject to change.

**Note**

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

```kotlin
suspend fun updateAutoScalingGroup(groupName: String, launchTemplateNameVal: String, serviceLinkedRoleARNVal: String) {
    val templateSpecification = LaunchTemplateSpecification {
        launchTemplateName = launchTemplateNameVal
    }

    val groupRequest = UpdateAutoScalingGroupRequest {
        maxSize = 3
        serviceLinkedRoleArn = serviceLinkedRoleARNVal
        autoScalingGroupName = groupName
        launchTemplate = templateSpecification
    }

    val groupsRequestWaiter = DescribeAutoScalingGroupsRequest {
        autoScalingGroupNames = listOf(groupName)
    }

    AutoScalingClient { region = "us-east-1" }.use { autoScalingClient ->
        autoScalingClient.updateAutoScalingGroup(groupRequest)
        autoScalingClient.waitUntilGroupExists(groupsRequestWaiter)
        println("You successfully updated the Auto Scaling group $groupName")
    }
}
```

• For API details, see `UpdateAutoScalingGroup` in AWS SDK for Kotlin API reference.

**SDK for PHP**

**Note**

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

```php
public function updateAutoScalingGroup($autoScalingGroupName, $args) {
    if (array_key_exists('MaxSize', $args)) {
        $maxSize = ['MaxSize' => $args['MaxSize']];
    } else {
        $maxSize = [];
    }
```
if (array_key_exists('MinSize', $args)) {
    $minSize = ['MinSize' => $args['MinSize']];
} else {
    $minSize = [];
}
$parameters = ['AutoScalingGroupName' => $autoScalingGroupName];
$parameters = array_merge($parameters, $minSize, $maxSize);
return $this->autoScalingClient->updateAutoScalingGroup($parameters);

For API details, see UpdateAutoScalingGroup in AWS SDK for PHP API Reference.

Python SDK for Python (Boto3)

```python
class AutoScalingWrapper:
    """Encapsulates Amazon EC2 Auto Scaling actions."""
    def __init__(self, autoscaling_client):
        """"""" autoscaling_client: A Boto3 Amazon EC2 Auto Scaling client.
        """"
        self.autoscaling_client = autoscaling_client
    def update_group(self, group_name, **kwargs):
        """Updates an Auto Scaling group."
        """"""" group_name: The name of the group to update.
        kwargs: Keyword arguments to pass through to the service.
        """""""
        try:
            self.autoscaling_client.update_auto_scaling_group(
                AutoScalingGroupName=group_name, **kwargs)
        except ClientError as err:
            logger.error("Couldn't update group %s. Here's why: %s", group_name,
                          err.response['Error']['Code'], err.response['Error']['Message'])
            raise
```

For API details, see UpdateAutoScalingGroup in AWS SDK for Python (Boto3) API Reference.

Rust SDK for Rust

```rust
Note
This documentation is for an SDK in preview release. The SDK is subject to change and should not be used in production.

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 Auto Scaling group using an AWS SDK

The following code examples show how to delete an Auto Scaling group.

**.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](https://github.com/aws-samples/aws-code-examples).

```csharp
/// <summary>
/// Delete an Auto Scaling group.
/// </summary>
/// <param name="groupName">The name of the Amazon EC2 Auto Scaling group.</param>
/// <returns>A Boolean value indicating the success of the action.</returns>
public async Task<bool> DeleteAutoScalingGroupAsync(
    string groupName)
{
    var deleteAutoScalingGroupRequest = new DeleteAutoScalingGroupRequest
    {
        AutoScalingGroupName = groupName,
        ForceDelete = true,
    };

    var response = await _amazonAutoScaling.DeleteAutoScalingGroupAsync(deleteAutoScalingGroupRequest);
    {
        Console.WriteLine("You successfully deleted {groupName}");
        return true;
    } else
    {
        Console.WriteLine("Couldn't delete {groupName}");
        return false;
    }
}
```

*For API details, see [DeleteAutoScalingGroup](https://docs.aws.amazon.com/sdk-for-net/v3/api/aws.sdk/latest/apiemodels/DeleteAutoScalingGroupRequest.html) in AWS SDK for .NET API Reference.*
Delete an Auto Scaling group

**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](https://github.com/aws-samples/aws-sdk-cpp-examples).

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

Aws::AutoScaling::AutoScalingClient autoScalingClient(clientConfig);

Aws::AutoScaling::Model::DeleteAutoScalingGroupRequest request;
request.SetAutoScalingGroupName(groupName);

Aws::AutoScaling::Model::DeleteAutoScalingGroupOutcome outcome =
    autoScalingClient.DeleteAutoScalingGroup(request);

if (outcome.IsSuccess()) {
    std::cout << "Auto Scaling group '" << groupName << "," was deleted."
        << std::endl;
} else {
    std::cerr << "Error with AutoScaling::DeleteAutoScalingGroup. "
        << outcome.GetError().GetMessage() << std::endl;
    result = false;
}
```

- For API details, see [DeleteAutoScalingGroup](https://docs.aws.amazon.com/sdk-for-cpp/v1/developer-guide/aws-cpp-sdk-auto-scaling.html) 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](https://github.com/aws-samples/aws-sdk-java-examples).

```java
public static void deleteAutoScalingGroup(AutoScalingClient autoScalingClient,
    String groupName) {
    try {
        DeleteAutoScalingGroupRequest deleteAutoScalingGroupRequest =
            DeleteAutoScalingGroupRequest.builder()
                .autoScalingGroupName(groupName)
                .forceDelete(true)
                .build();

        autoScalingClient.deleteAutoScalingGroup(deleteAutoScalingGroupRequest);
        System.out.println("You successfully deleted " + groupName);
    } catch (AutoScalingException e) {
        System.err.println(e.awsErrorDetails().errorMessage());
        System.exit(1);
    }
}
Delete an Auto Scaling group

Kotlin

**SDK for Kotlin**

**Note**
This is prerelease documentation for a feature in preview release. It is subject to change.

**Note**
There’s more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](https://github.com/aws-samples/aws-code-examples).

```kotlin
suspend fun deleteSpecificAutoScalingGroup(groupName: String) {
    val deleteAutoScalingGroupRequest = DeleteAutoScalingGroupRequest {
        autoScalingGroupName = groupName
        forceDelete = true
    }

    AutoScalingClient { region = "us-east-1" }.use { autoScalingClient ->
        autoScalingClient.deleteAutoScalingGroup(deleteAutoScalingGroupRequest)
        println("You successfully deleted $groupName")
    }
}
```

**For API details, see** [DeleteAutoScalingGroup](https://docs.aws.amazon.com/sdk-for-java-developer-guide/api/latest/reference/com/amazonaws/services/autoscaling/model/DeleteAutoScalingGroupRequest.html) in **AWS SDK for Java 2.x API Reference**.

PHP

**SDK for PHP**

**Note**
There’s more on GitHub. Find the complete example and learn how to set up and run in the [AWS Code Examples Repository](https://github.com/aws-samples/aws-code-examples).

```php
public function deleteAutoScalingGroup($autoScalingGroupName)
{
    return $this->autoScalingClient->deleteAutoScalingGroup(["AutoScalingGroupName" => $autoScalingGroupName,
                                                             'ForceDelete' => true,
                                                             ]);}
```

**For API details, see** [DeleteAutoScalingGroup](https://docs.aws.amazon.com/sdk-for-php/api/latest/service-summary.html) in **AWS SDK for PHP 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](https://github.com/aws-samples/aws-code-examples).

```python
public function deleteAutoScalingGroup($autoScalingGroupName)
{
    return $this->autoScalingClient->deleteAutoScalingGroup(["AutoScalingGroupName" => $autoScalingGroupName,
                                                             'ForceDelete' => true,
                                                             ]);}
```
class AutoScalingWrapper:
    """Encapsulates Amazon EC2 Auto Scaling actions."""
    def __init__(self, autoscaling_client):
        ":param autoscaling_client: A Boto3 Amazon EC2 Auto Scaling client.
        """
        self.autoscaling_client = autoscaling_client

    def delete_group(self, group_name):
        """
        Deletes an Auto Scaling group. All instances must be stopped before the
        group can be deleted.
        """
        try:
            self.autoscaling_client.delete_auto_scaling_group(
                AutoScalingGroupName=group_name)
        except ClientError as err:
            logger.error("Couldn't delete group %s. Here's why: %s: %s", group_name,
                        err.response['Error']['Code'], err.response['Error']['Message'])
            raise

    async def delete_group(client: &Client, name: &str, force: bool) -> Result<() , Error> {
        client
        .delete_auto_scaling_group()
        .auto_scaling_group_name(name)
        .set_force_delete(if force { Some(true) } else { None })
        .send()
        .await?;
        println!("Deleted Auto Scaling group");
        Ok(())
    }

For API details, see DeleteAutoScalingGroup in AWS SDK for Python (Boto3) API Reference.

For API details, see DeleteAutoScalingGroup in AWS SDK for Rust API reference.

### Related resources

For more examples and information about other properties you can use when creating Auto Scaling groups, see the following resources.
• AWS SDK for .NET
  • AWS SDK for C++
  • AWS SDK for Go
  • AWS SDK for Java V2
  • AWS SDK for JavaScript
  • AWS SDK for PHP V3
  • AWS SDK for Python
  • AWS SDK for Ruby V3

For more examples and information about other properties you can use when updating Auto Scaling groups, see the following resources.
  • AWS SDK for .NET
    • AWS SDK for C++
      • AWS SDK for Go
          • AWS SDK for Java V2
              • AWS SDK for JavaScript
                  • AWS SDK for PHP V3
                      • AWS SDK for Python
                          • AWS SDK for Ruby V3
Scale the size of your Auto Scaling group

*Scaling* is the ability to increase or decrease the compute capacity of your application. Scaling starts with an event, or scaling action, which instructs an Auto Scaling group to either launch or terminate Amazon EC2 instances.

Amazon EC2 Auto Scaling provides a number of ways to adjust scaling to best meet the needs of your applications. As a result, it's important that you have a good understanding of your application. Keep the following considerations in mind:

- What role should Amazon EC2 Auto Scaling play in your application's architecture? It's common to think about automatic scaling primarily as a way to increase and decrease capacity, but it's also useful for maintaining a steady number of servers.
- What cost constraints are important to you? Because Amazon EC2 Auto Scaling uses EC2 instances, you only pay for the resources that you use. Knowing your cost constraints helps you decide when to scale your applications, and by how much.
- What metrics are important to your application? Amazon CloudWatch supports a number of different metrics that you can use with your Auto Scaling group.

**Contents**

- Scaling options (p. 155)
- Set capacity limits on your Auto Scaling group (p. 156)
- Maintain a fixed number of instances in your Auto Scaling group (p. 157)
- Manual scaling for Amazon EC2 Auto Scaling (p. 158)
- Dynamic scaling for Amazon EC2 Auto Scaling (p. 167)
- Predictive scaling for Amazon EC2 Auto Scaling (p. 207)
- Scheduled scaling for Amazon EC2 Auto Scaling (p. 231)
- Amazon EC2 Auto Scaling lifecycle hooks (p. 236)
- Warm pools for Amazon EC2 Auto Scaling (p. 261)
- Control which Auto Scaling instances terminate during scale in (p. 272)
- Temporarily remove instances from your Auto Scaling group (p. 287)
- Suspend and resume a process for an Auto Scaling group (p. 291)

**Scaling options**

Amazon EC2 Auto Scaling provides several ways for you to scale your Auto Scaling group.

**Maintain current instance levels at all times**

You can configure your Auto Scaling group to maintain a specified number of running instances at all times. To maintain the current instance levels, Amazon EC2 Auto Scaling performs a periodic health check on running instances within an Auto Scaling group. When Amazon EC2 Auto Scaling finds an unhealthy instance, it terminates that instance and launches a new one. For more information, see Maintain a fixed number of instances in your Auto Scaling group (p. 157).
Set capacity limits on your Auto Scaling group

Capacity limits represent the minimum and maximum group size that you want for your Auto Scaling group. You set limits separately for the minimum and maximum size.

The group's desired capacity can be resized to a number that's within the range of your minimum and maximum size limits. The desired capacity must be equal to or greater than the minimum group size, and equal to or less than the maximum group size.

- **Desired capacity**: Represents the initial capacity of the Auto Scaling group at the time of creation. An Auto Scaling group attempts to maintain the desired capacity. It starts by launching the number of instances that are specified for the desired capacity, and maintains this number of instances as long as there are no scaling policies or scheduled actions attached to the Auto Scaling group.

- **Minimum capacity**: Represents the minimum group size. When scaling policies are set, an Auto Scaling group cannot decrease its desired capacity lower than the minimum size limit.

- **Maximum capacity**: Represents the maximum group size. When scaling policies are set, an Auto Scaling group cannot increase its desired capacity higher than the maximum size limit.

The minimum and maximum size limits also apply in the following scenarios:

- When you manually scale your Auto Scaling group by updating its desired capacity.

- When scheduled actions run that update the desired capacity. If a scheduled action runs without specifying new minimum and maximum size limits for the group, then the group's current minimum and maximum size limits apply.
An Auto Scaling group always tries to maintain its desired capacity. In cases where an instance terminates unexpectedly (for example, because of a Spot Instance interruption, a health check failure, or human action), the group automatically launches a new instance to maintain its desired capacity.

**To manage these settings in the console**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. On the navigation pane, under Auto Scaling, choose Auto Scaling Groups.
3. On the Auto Scaling groups page, select the check box next to your Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
4. In the lower pane, in the Details tab, view or change the current settings for minimum, maximum, and desired capacity. For more information, see Change the size of your Auto Scaling group (console) (p. 158).

Above the Details pane, you can find information such as the current number of instances in the Auto Scaling group, the minimum, maximum, and desired capacity, and a status column. If the Auto Scaling group uses instance weighting, you can also find the number of capacity units contributed to the desired capacity.

To add or remove columns from the list, choose the settings icon at the top of the page. Then, for Auto Scaling groups attributes, turn each column on or off, and choose Confirm.

**To verify the size of your Auto Scaling group after making changes**

The Instances column shows the number of instances that are currently running. While an instance is being launched or terminated, the Status column displays a status of Updating capacity, as shown in the following image.

![Auto Scaling groups](image)

Wait for a few minutes, and then refresh the view to see the latest status. After a scaling activity completes, the Instances column shows an updated value.

You can view the number of instances and the status of the currently running instances from the Instance management tab, under Instances.

**Note**

You can use Service Quotas to update the total capacity limits for EC2 instances and other resources in your AWS account. In the Service Quotas console, you can view all your available service quotas and request increases for them. For more information, see Requesting a quota increase in the Service Quotas User Guide.

### Maintain a fixed number of instances in your Auto Scaling group

Amazon EC2 Auto Scaling lets you set up an Auto Scaling group to maintain a fixed size. You can then choose whether to adjust the desired capacity of the group or manually add or remove Amazon EC2 instances from the group to handle traffic changes to your application.
If a fixed number of instances is needed, this can be achieved by setting the same value for minimum, maximum, and desired capacity. After you have created your Auto Scaling group, the group starts by launching enough instances to meet its desired capacity. If there are no other scaling conditions attached to the Auto Scaling group, the group maintains this number of running instances at all times.

Your Auto Scaling group continues to maintain a fixed number of instances even if an instance becomes unhealthy. Amazon EC2 Auto Scaling monitors the health of each Auto Scaling instance. When it finds that an instance has become unhealthy, it terminates that instance and launches a new one. Instances can fail a health check because of a variety of reasons. For more information, see Health checks for Auto Scaling instances (p. 297).

Manual scaling for Amazon EC2 Auto Scaling

At any time, you can change the size of an existing Auto Scaling group manually. You can either update the desired capacity of the Auto Scaling group, or update the instances that are attached to the Auto Scaling group. Manually scaling your group can be useful when automatic scaling is not needed or when you need to hold capacity at a fixed number of instances.

Change the size of your Auto Scaling group (console)

When you change the desired capacity of your Auto Scaling group, Amazon EC2 Auto Scaling manages the process of launching or terminating instances to maintain the new group size.

The following example assumes that you’ve created an Auto Scaling group with a minimum size of 1 and a maximum size of 5. Therefore, the group currently has one running instance.

To change the size of your Auto Scaling group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Details tab, choose Group details, Edit.
4. For Desired capacity, increase the desired capacity by one. For example, if the current value is 1, enter 2.
   The desired capacity must be less than or equal to the maximum size of the group. If your new value for Desired capacity is greater than Maximum capacity, you must update Maximum capacity.
5. When you are finished, choose Update.

Now, verify that your Auto Scaling group has launched one additional instance.

To verify that the size of your Auto Scaling group has changed

1. On the Activity tab, in Activity history, the Status column shows the current status of your instance. Use the refresh button until you see the status of your instance change to Successful. This indicates that your Auto Scaling group has successfully launched a new instance.
   Note
   If the instance fails to launch, you can find troubleshooting tips in Troubleshoot Amazon EC2 Auto Scaling (p. 428).
2. On the Instance management tab, in Instances, the Lifecycle column shows the state of your instances. It takes a short time for an instance to launch. After the instance starts, its state changes
Change the size of your Auto Scaling group (AWS CLI)

When you change the size of your Auto Scaling group, Amazon EC2 Auto Scaling manages the process of launching or terminating instances to maintain the new group size. The default behavior is not to wait for the default cooldown period to complete, but you can override the default and wait for the cooldown period to complete. For more information, see Scaling cooldowns for Amazon EC2 Auto Scaling (p. 192).

The following example assumes that you've created an Auto Scaling group with a minimum size of 1 and a maximum size of 5. Therefore, the group currently has one running instance.

To change the size of your Auto Scaling group

Use the `set-desired-capacity` command to change the size of your Auto Scaling group, as shown in the following example.

```bash
aws autoscaling set-desired-capacity --auto-scaling-group-name my-asg --desired-capacity 2
```

If you choose to honor the default cooldown period for your Auto Scaling group, you must specify the `--honor-cooldown` option as shown in the following example.

```bash
aws autoscaling set-desired-capacity --auto-scaling-group-name my-asg --desired-capacity 2 --honor-cooldown
```

To verify the size of your Auto Scaling group

Use the `describe-auto-scaling-groups` command to confirm that the size of your Auto Scaling group has changed, as in the following example.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

The following is example output, with details about the group and instances launched.

```json
{
   "AutoScalingGroups": [
   {
      "AutoScalingGroupARN": "arn",
      "ServiceLinkedRoleARN": "arn",
      "TargetGroupARNs": [],
      "SuspendedProcesses": [],
      "LaunchTemplate": {
         "LaunchTemplateName": "my-launch-template",
         "Version": "1",
         "LaunchTemplateId": "lt-050555ad16a3f9c7f"
      },
      "Tags": [],
      "EnabledMetrics": [],
      "LoadBalancerNames": [],
      "AutoScalingGroupName": "my-asg",
      "DefaultCooldown": 300,
      "MinSize": 1,
      "Instances": [
         {
            "ProtectedFromScaleIn": false,
```
Notice that DesiredCapacity shows the new value. Your Auto Scaling group has launched an additional instance.

**Attach EC2 instances to your Auto Scaling group**

Amazon EC2 Auto Scaling provides you with the option of attaching one or more EC2 instances to your existing Auto Scaling group. After an instance is attached, it is considered part of the Auto Scaling group.

When you attach instances, consider the following:

- When you attach instances, the desired capacity of the group increases by the number of instances being attached. If the number of instances being attached plus the desired capacity exceeds the maximum size of the group, the request fails.
- If you attach an instance to an Auto Scaling group that has an attached load balancer target group or Classic Load Balancer, the instance is registered with the load balancer.

For an instance to be attached, it must meet the following criteria:

- The instance is in the *running* state with Amazon EC2.
Attach EC2 instances to your Auto Scaling group

- The AMI used to launch the instance must still exist.
- The instance is not a member of another Auto Scaling group.
- The instance is launched into one of the Availability Zones defined in your Auto Scaling group.
- If the Auto Scaling group has an attached load balancer target group or Classic Load Balancer, the instance and the load balancer must both be in the same VPC.

### Attach an instance (console)

Use the following procedure to attach an instance to your Auto Scaling group.

#### To attach an instance to an existing Auto Scaling group

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. (Optional) On the navigation pane, under **Auto Scaling**, choose **Auto Scaling Groups**. Select the Auto Scaling group and verify that the maximum size of the Auto Scaling group is large enough that you can add another instance. Otherwise, on the details tab, increase the maximum capacity.
3. On the navigation pane, under **Instances**, choose **Instances**, and then select an instance.
4. Choose **Actions**, **Instance settings**, **Attach to Auto Scaling Group**.
5. On the **Attach to Auto Scaling group** page, for **Auto Scaling Group**, select the Auto Scaling group, and then choose **Attach**.
6. If the instance doesn’t meet the criteria, you get an error message with the details. For example, the instance might not be in the same Availability Zone as the Auto Scaling group. Choose **Close** and try again with an instance that meets the criteria.

### Attach an instance (AWS CLI)

Use the following procedure to attach an instance to your Auto Scaling group.

The examples use an Auto Scaling group with the following configuration:

- Auto Scaling group name = my-asg
- Minimum size = 1
- Maximum size = 5
- Desired capacity = 2

#### To attach an instance to an Auto Scaling group

1. Describe a specific Auto Scaling group using the following `describe-auto-scaling-groups` command.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-names my-asg
```

The following example response shows that the desired capacity is 2 and that the group has two running instances.

```
{
    "AutoScalingGroups": [
        {
            "AutoScalingGroupARN": "arn",
            "ServiceLinkedRoleARN": "arn",
            "TargetGroupARNs": [],
            "SuspendedProcesses": []
        }
    ]
}
```
Attach an instance to the Auto Scaling group using the following `attach-instances` command.

```
aws autoscaling attach-instances --instance-ids i-0787762faf1c28619 --auto-scaling-group-name my-asg
```

3. To verify that the instance is attached, use the following `describe-auto-scaling-groups` command.

```
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-names my-asg
```
The following example response shows that the desired capacity has increased by 1 instance (to a new capacity of 3), and that there is a new instance, i-0787762faf1c28619.

```json
{
    "AutoScalingGroups": [
        {
            "AutoScalingGroupARN": "arn",
            "ServiceLinkedRoleARN": "arn",
            "TargetGroupARNs": [],
            "SuspendedProcesses": [],
            "LaunchTemplate": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "1",
                "LaunchTemplateId": "lt-050555ad16a3f9c7f"
            },
            "Tags": [],
            "EnabledMetrics": [],
            "LoadBalancerNames": [],
            "AutoScalingGroupName": "my-asg",
            "DefaultCooldown": 300,
            "MinSize": 1,
            "Instances": [
                {
                    "ProtectedFromScaleIn": false,
                    "AvailabilityZone": "us-west-2a",
                    "LaunchTemplate": {
                        "LaunchTemplateName": "my-launch-template",
                        "Version": "1",
                        "LaunchTemplateId": "lt-050555ad16a3f9c7f"
                    },
                    "InstanceId": "i-05b4f7d5be44822a6",
                    "HealthStatus": "Healthy",
                    "LifecycleState": "Pending"
                },
                {
                    "ProtectedFromScaleIn": false,
                    "AvailabilityZone": "us-west-2a",
                    "LaunchTemplate": {
                        "LaunchTemplateName": "my-launch-template",
                        "Version": "1",
                        "LaunchTemplateId": "lt-050555ad16a3f9c7f"
                    },
                    "InstanceId": "i-0c20ac468fa3049e8",
                    "HealthStatus": "Healthy",
                    "LifecycleState": "InService"
                },
                {
                    "ProtectedFromScaleIn": false,
                    "AvailabilityZone": "us-west-2a",
                    "LaunchTemplate": {
                        "LaunchTemplateName": "my-launch-template",
                        "Version": "1",
                        "LaunchTemplateId": "lt-050555ad16a3f9c7f"
                    },
                    "InstanceId": "i-0787762faf1c28619",
                    "HealthStatus": "Healthy",
                    "LifecycleState": "InService"
                }
            ],
            "MaxSize": 5,
            "VPCZoneIdentifier": "subnet-c87f2be0",
            "HealthCheckGracePeriod": 300,
            "TerminationPolicies": [
                "Default"
            ]
        }
    ]
}`
Detach EC2 instances from your Auto Scaling group

You can remove (detach) an instance that is in the InService state from an Auto Scaling group. After the instance is detached, you can manage it independently from the rest of the Auto Scaling group. By detaching an instance, you can:

- Move an instance out of one Auto Scaling group and attach it to a different group. For more information, see Attach EC2 instances to your Auto Scaling group (p. 160).
- Test an Auto Scaling group by creating it using existing instances running your application. You can then detach these instances from the Auto Scaling group when your tests are complete.

When you detach instances, consider the following:

- If the number of instances that you are detaching decreases the size of the Auto Scaling group below its minimum capacity, you must decrement the minimum capacity for the group before you can detach the instances.
- When you detach instances, you have the option of decrementing the desired capacity for the Auto Scaling group by the number of instances that you are detaching. If you choose not to decrement the capacity, Amazon EC2 Auto Scaling launches new instances to replace the ones that you detach. If you decrement the capacity but detach multiple instances from the same Availability Zone, Amazon EC2 Auto Scaling can rebalance the Availability Zones unless you suspend the AZRebalance process. For more information, see Suspend and resume a process for an Auto Scaling group (p. 291).
- If you detach an instance from an Auto Scaling group that has an attached load balancer target group or Classic Load Balancer, the instance is deregistered from the load balancer. If connection draining (deregistration delay) is enabled for your load balancer, Amazon EC2 Auto Scaling waits for in-flight requests to complete.

**Note**

If you are detaching instances that are in the Standby state, exercise caution. Attempting to detach instances after putting them into the Standby state may cause other instances to terminate unexpectedly.

Detach instances (console)

Use the following procedure to detach an instance from your Auto Scaling group.

**To detach an instance from an existing Auto Scaling group**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the **Instance management** tab, in **Instances**, select an instance and choose **Actions, Detach**.

4. In the **Detach instance** dialog box, keep the **Replace instance** check box selected to launch a replacement instance. Clear the check box to decrement the desired capacity.

5. When prompted for confirmation, type **detach** to confirm removing the specified instance from the Auto Scaling group, and then choose **Detach instance**.

### Detach instances (AWS CLI)

Use the following procedure to detach an instance from your Auto Scaling group.

The examples use an Auto Scaling group with the following configuration:

- Auto Scaling group name = **my-asg**
- Minimum size = 1
- Maximum size = 5
- Desired capacity = 4

#### To detach an instance from an existing Auto Scaling group

1. List the current instances using the following **describe-auto-scaling-instances** command.

   ```bash
   aws autoscaling describe-auto-scaling-instances
   ```

   The following example response shows that the group has four running instances.

   ```json
   {
     "AutoScalingInstances": [
       {
         "ProtectedFromScaleIn": false,
         "AvailabilityZone": "us-west-2a",
         "LaunchTemplate": {
           "LaunchTemplateName": "my-launch-template",
           "Version": "1",
           "LaunchTemplateId": "lt-050555ad16a3f9c7f"
         },
         "InstanceId": "i-0b4f7d5be4822a6",
         "AutoScalingGroupName": "my-asg",
         "HealthStatus": "HEALTHY",
         "LifecycleState": "InService"
       },
       {
         "ProtectedFromScaleIn": false,
         "AvailabilityZone": "us-west-2a",
         "LaunchTemplate": {
           "LaunchTemplateName": "my-launch-template",
           "Version": "1",
           "LaunchTemplateId": "lt-050555ad16a3f9c7f"
         },
         "InstanceId": "i-0c20ac468fa3049e8",
         "AutoScalingGroupName": "my-asg",
         "HealthStatus": "HEALTHY",
         "LifecycleState": "InService"
       },
       {
         "ProtectedFromScaleIn": false,
         "AvailabilityZone": "us-west-2a",
         "LaunchTemplate": {
           "LaunchTemplateName": "my-launch-template",
           "Version": "1",
           "LaunchTemplateId": "lt-050555ad16a3f9c7f"
         },
         "InstanceId": "i-05b4f7d5be4822a6",
         "AutoScalingGroupName": "my-asg",
         "HealthStatus": "HEALTHY",
         "LifecycleState": "InService"
       },
       {
         "ProtectedFromScaleIn": false,
         "AvailabilityZone": "us-west-2a",
         "LaunchTemplate": {
           "LaunchTemplateName": "my-launch-template",
           "Version": "1",
           "LaunchTemplateId": "lt-050555ad16a3f9c7f"
         },
         "InstanceId": "i-0c20ac468fa3049e8",
         "AutoScalingGroupName": "my-asg",
         "HealthStatus": "HEALTHY",
         "LifecycleState": "InService"
       }
     ]
   }
   ```
2. Detach an instance and decrement the desired capacity using the following `detach-instances` command.

   aws autoscaling detach-instances --instance-ids i-05b4f7d5be44822a6 --auto-scaling-group-name my-asg --should-decrement-desired-capacity

3. Verify that the instance is detached using the following `describe-auto-scaling-instances` command.

   aws autoscaling describe-auto-scaling-instances

   The following example response shows that there are now three running instances.

   ```json
   { "AutoScalingInstances": [ 
   { "ProtectedFromScaleIn": false, "AvailabilityZone": "us-west-2a", "LaunchTemplate": { 
   "LaunchTemplateName": "my-launch-template", "Version": "1", "LaunchTemplateId": "lt-050555ad16a3f9c7f" }, "InstanceId": "i-0c20ac468fa3049e8", "AutoScalingGroupName": "my-asg", "HealthStatus": "HEALTHY", "LifecycleState": "InService" } 
   ]
   ```
Dynamic scaling for Amazon EC2 Auto Scaling

Dynamic scaling scales the capacity of your Auto Scaling group as traffic changes occur.

Amazon EC2 Auto Scaling supports the following types of dynamic scaling policies:

- **Target tracking scaling**—Increase and decrease the current capacity of the group based on a Amazon CloudWatch metric and a target value. It works similar to the way that your thermostat maintains the temperature of your home—you select a temperature and the thermostat does the rest.
- **Step scaling**—Increase and decrease the current capacity of the group based on a set of scaling adjustments, known as *step adjustments*, that vary based on the size of the alarm breach.
- **Simple scaling**—Increase and decrease the current capacity of the group based on a single scaling adjustment, with a cooldown period between each scaling activity.

If you are scaling based on a metric that increases or decreases proportionally to the number of instances in an Auto Scaling group, we recommend that you use target tracking scaling policies. Otherwise, we recommend that you use step scaling policies.

With target tracking, an Auto Scaling group scales in direct proportion to the actual load on your application. That means that in addition to meeting the immediate need for capacity in response to load changes, a target tracking policy can also adapt to load changes that take place over time, for example, due to seasonal variations.

By default, new Auto Scaling groups start without any scaling policies. When you use an Auto Scaling group without any form of dynamic scaling, it doesn't scale on its own unless you set up scheduled scaling or predictive scaling.

Contents

- How dynamic scaling policies work (p. 168)
- Multiple dynamic scaling policies (p. 168)
- Target tracking scaling policies for Amazon EC2 Auto Scaling (p. 169)
- Step and simple scaling policies for Amazon EC2 Auto Scaling (p. 178)
- Set default values for instance warmup or scaling cooldown (p. 187)
- Scaling based on Amazon SQS (p. 196)
- Verify a scaling activity for an Auto Scaling group (p. 200)
- Disable a scaling policy for an Auto Scaling group (p. 202)
- Delete a scaling policy (p. 204)
How dynamic scaling policies work

A dynamic scaling policy instructs Amazon EC2 Auto Scaling to track a specific CloudWatch metric, and it defines what action to take when the associated CloudWatch alarm is in ALARM. The metrics that are used to invoke the alarm state are an aggregation of metrics coming from all of the instances in the Auto Scaling group. (For example, let's say you have an Auto Scaling group with two instances where one instance is at 60 percent CPU and the other is at 40 percent CPU. On average, they are at 50 percent CPU.) When the policy is in effect, Amazon EC2 Auto Scaling adjusts the group's desired capacity up or down when the threshold of an alarm is breached.

When a dynamic scaling policy is invoked, if the capacity calculation produces a number outside of the minimum and maximum size range of the group, Amazon EC2 Auto Scaling ensures that the new capacity never goes outside of the minimum and maximum size limits. Capacity is measured in one of two ways: using the same units that you chose when you set the desired capacity in terms of instances, or using capacity units (if instance weighting is applied).

- Example 1: An Auto Scaling group has a maximum capacity of 3, a current capacity of 2, and a dynamic scaling policy that adds 3 instances. When invoking this policy, Amazon EC2 Auto Scaling adds only 1 instance to the group to prevent the group from exceeding its maximum size.
- Example 2: An Auto Scaling group has a minimum capacity of 2, a current capacity of 3, and a dynamic scaling policy that removes 2 instances. When invoking this policy, Amazon EC2 Auto Scaling removes only 1 instance from the group to prevent the group from becoming less than its minimum size.

When the desired capacity reaches the maximum size limit, scaling out stops. If demand drops and capacity decreases, Amazon EC2 Auto Scaling can scale out again.

The exception is when you use instance weighting. In this case, Amazon EC2 Auto Scaling can scale out above the maximum size limit, but only by up to your maximum instance weight. Its intention is to get as close to the new desired capacity as possible but still adhere to the allocation strategies that are specified for the group. The allocation strategies determine which instance types to launch. The weights determine how many capacity units each instance contributes to the desired capacity of the group based on its instance type.

- Example 3: An Auto Scaling group has a maximum capacity of 12, a current capacity of 10, and a dynamic scaling policy that adds 5 capacity units. Instance types have one of three weights assigned: 1, 4, or 6. When invoking the policy, Amazon EC2 Auto Scaling chooses to launch an instance type with a weight of 6 based on the allocation strategy. The result of this scale-out event is a group with a desired capacity of 12 and a current capacity of 16.

Multiple dynamic scaling policies

In most cases, a target tracking scaling policy is sufficient to configure your Auto Scaling group to scale out and scale in automatically. A target tracking scaling policy allows you to select a desired outcome and have the Auto Scaling group add and remove instances as needed to achieve that outcome.

For an advanced scaling configuration, your Auto Scaling group can have more than one scaling policy. For example, you can define one or more target tracking scaling policies, one or more step scaling policies, or both. This provides greater flexibility to cover multiple scenarios.

To illustrate how multiple dynamic scaling policies work together, consider an application that uses an Auto Scaling group and an Amazon SQS queue to send requests to a single EC2 instance. To help ensure that the application performs at optimum levels, there are two policies that control when the Auto Scaling group should scale out. One is a target tracking policy that uses a custom metric to add and
remove capacity based on the number of SQS messages in the queue. The other is a step scaling policy that uses the Amazon CloudWatch CPUUtilization metric to add capacity when the instance exceeds 90 percent utilization for a specified length of time.

When there are multiple policies in force at the same time, there's a chance that each policy could instruct the Auto Scaling group to scale out (or in) at the same time. For example, it's possible that the CPUUtilization metric spikes and breaches the threshold of the CloudWatch alarm at the same time that the SQS custom metric spikes and breaches the threshold of the custom metric alarm.

When these situations occur, Amazon EC2 Auto Scaling chooses the policy that provides the largest capacity for both scale out and scale in. Suppose, for example, that the policy for CPUUtilization launches one instance, while the policy for the SQS queue launches two instances. If the scale-out criteria for both policies are met at the same time, Amazon EC2 Auto Scaling gives precedence to the SQS queue policy. This results in the Auto Scaling group launching two instances.

The approach of giving precedence to the policy that provides the largest capacity applies even when the policies use different criteria for scaling in. For example, if one policy terminates three instances, another policy decreases the number of instances by 25 percent, and the group has eight instances at the time of scale in, Amazon EC2 Auto Scaling gives precedence to the policy that provides the largest number of instances for the group. This results in the Auto Scaling group terminating two instances (25 percent of 8 = 2). The intention is to prevent Amazon EC2 Auto Scaling from removing too many instances.

We recommend caution, however, when using target tracking scaling policies with step scaling policies because conflicts between these policies can cause undesirable behavior. For example, if the step scaling policy initiates a scale-in activity before the target tracking policy is ready to scale in, the scale-in activity will not be blocked. After the scale-in activity completes, the target tracking policy could instruct the group to scale out again.

**Target tracking scaling policies for Amazon EC2 Auto Scaling**

To create a target tracking scaling policy, you specify an Amazon CloudWatch metric and a target value that represents the ideal average utilization or throughput level for your application. Amazon EC2 Auto Scaling can then scale out your group (add more instances) to handle peak traffic, and scale in your group (run fewer instances) to reduce costs during periods of low utilization or throughput.

For example, let's say that you currently have an application that runs on two instances, and you want the CPU utilization of the Auto Scaling group to stay at around 50 percent when the load on the application changes. This gives you extra capacity to handle traffic spikes without maintaining an excessive number of idle resources.

You can meet this need by creating a target tracking scaling policy that targets an average CPU utilization of 50 percent. Then, your Auto Scaling group scales the number of instances to keep the actual metric value at or near 50 percent.

**Topics**

- Multiple target tracking scaling policies (p. 170)
- Considerations (p. 170)
- Choose metrics (p. 170)
- Define target value (p. 172)
- Define instance warm-up time (p. 172)
- Create a target tracking scaling policy (console) (p. 172)
- Create a target tracking scaling policy (AWS CLI) (p. 173)
- Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math (p. 175)
Multiple target tracking scaling policies

To help optimize scaling performance, you can use multiple target tracking scaling policies together, provided that each of them uses a different metric. For example, utilization and throughput can influence each other. Whenever one of these metrics changes, it usually implies that other metrics will also be impacted. The use of multiple metrics therefore provides additional information about the load that your Auto Scaling group is under and improves decision making when determining how much capacity to add to your group.

The intention of Amazon EC2 Auto Scaling is to always prioritize availability, so its behavior differs depending on whether the target tracking policies are ready for scale out or scale in. It will scale out the Auto Scaling group if any of the target tracking policies are ready for scale out, but will scale in only if all of the target tracking policies (with the scale-in portion enabled) are ready to scale in.

Considerations

The following considerations apply when working with target tracking scaling policies:

- Do not create, edit, or delete the CloudWatch alarms that are used with a target tracking scaling policy. Amazon EC2 Auto Scaling creates and manages the CloudWatch alarms that are associated with your target tracking scaling policies and deletes them when no longer needed.
- A target tracking scaling policy prioritizes availability during periods of fluctuating traffic levels by scaling in more gradually when traffic is decreasing. If you want your Auto Scaling group to scale in immediately when a workload finishes, you can disable the scale-in portion of the policy. This provides you with the flexibility to use the scale-in method that best meets your needs when utilization is low. To ensure that scale in happens as quickly as possible, we recommend not using a simple scaling policy to prevent a cooldown period from being added.
- If the metric is missing data points, this causes the CloudWatch alarm state to change to INSUFFICIENT_DATA. When this happens, Amazon EC2 Auto Scaling cannot scale your group until new data points are found.
- You might see gaps between the target value and the actual metric data points. This is because we act conservatively by rounding up or down when determining how many instances to add or remove. This prevents us from adding an insufficient number of instances or removing too many instances. However, for smaller Auto Scaling groups with fewer instances, the utilization of the group might seem far from the target value. For example, let's say that you set a target value of 50 percent for CPU utilization and your Auto Scaling group then exceeds the target. We might determine that adding 1.5 instances will decrease the CPU utilization to close to 50 percent. Because it is not possible to add 1.5 instances, we round up and add two instances. This might decrease the CPU utilization to a value below 50 percent, but it ensures that your application has enough resources to support it. Similarly, if we determine that removing 1.5 instances increases your CPU utilization to above 50 percent, we remove just one instance.
- For larger Auto Scaling groups with more instances, the utilization is spread over a larger number of instances, in which case adding or removing instances causes less of a gap between the target value and the actual metric data points.
- A target tracking scaling policy assumes that it should scale out your Auto Scaling group when the specified metric is above the target value. You can't use a target tracking scaling policy to scale out your Auto Scaling group when the specified metric is below the target value.

Choose metrics

You can create target tracking scaling policies with either predefined metrics or custom metrics.

When you create a target tracking scaling policy with a predefined metric type, you choose one metric from the following list of predefined metrics:
• ASGAverageCPUUtilization—Average CPU utilization of the Auto Scaling group.
• ASGAverageNetworkIn—Average number of bytes received by a single instance on all network interfaces.
• ASGAverageNetworkOut—Average number of bytes sent out from a single instance on all network interfaces.
• ALBRequestCountPerTarget—Average Application Load Balancer request count per target.

**Important**
Other valuable information about the metrics for CPU utilization, network I/O, and Application Load Balancer request count per target can be found in the List the available CloudWatch metrics for your instances topic in the Amazon EC2 User Guide for Linux Instances and the CloudWatch metrics for your Application Load Balancer topic in the User Guide for Application Load Balancers, respectively.

You can choose other available CloudWatch metrics or your own metrics in CloudWatch by specifying a custom metric. You must use the AWS CLI or an SDK to create a target tracking policy with a custom metric.

Keep the following in mind when choosing a metric:

• We recommend that you only use metrics that are available at one-minute intervals to help you scale faster in response to utilization changes. Target tracking will evaluate metrics aggregated at a one-minute granularity for all predefined metrics and custom metrics, but the underlying metric might publish data less frequently. For example, all Amazon EC2 metrics are sent in five-minute intervals by default, but they are configurable to one minute (known as detailed monitoring). This choice is up to the individual services. Most try to use the smallest interval possible. For information about enabling detailed monitoring, see Configure monitoring for Auto Scaling instances (p. 313).

• Not all custom metrics work for target tracking. The metric must be a valid utilization metric and describe how busy an instance is. The metric value must increase or decrease proportionally to the number of instances in the Auto Scaling group. That's so the metric data can be used to proportionally scale out or in the number of instances. For example, the CPU utilization of an Auto Scaling group works (that is, the Amazon EC2 metric CPUUtilization with the metric dimension AutoScalingGroupName), if the load on the Auto Scaling group is distributed across the instances.

• The following metrics do not work for target tracking:
  • The number of requests received by the load balancer fronting the Auto Scaling group (that is, the Elastic Load Balancing metric RequestCount). The number of requests received by the load balancer doesn't change based on the utilization of the Auto Scaling group.
  • Load balancer request latency (that is, the Elastic Load Balancing metric Latency). Request latency can increase based on increasing utilization, but doesn't necessarily change proportionally.
  • The CloudWatch Amazon SQS queue metric ApproximateNumberOfMessagesVisible. The number of messages in a queue might not change proportionally to the size of the Auto Scaling group that processes messages from the queue. However, a custom metric that measures the number of messages in the queue per EC2 instance in the Auto Scaling group can work. For more information, see Scaling based on Amazon SQS (p. 196).
  • To use the ALBRequestCountPerTarget metric, you must specify the ResourceLabel parameter to identify the load balancer target group that is associated with the metric.
  • When a metric emits real 0 values to CloudWatch (for example, ALBRequestCountPerTarget), an Auto Scaling group can scale in to 0 when there is no traffic to your application. To have your Auto Scaling group scale in to 0 when no requests are routed it, the group's minimum capacity must be set to 0.
  • When you create a target tracking scaling policy with a custom metric, you can use metric math to combine metrics. For more information, see Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math (p. 175).
Define target value

When you create a target tracking scaling policy, you must specify a target value. The target value represents the optimal average utilization or throughput for the Auto Scaling group. To use resources cost efficiently, set the target value as high as possible with a reasonable buffer for unexpected traffic increases. When your application is optimally scaled out for a normal traffic flow, the actual metric value should be at or just below the target value.

When a scaling policy is based on throughput, such as the request count per target for an Application Load Balancer, network I/O, or other count metrics, the target value represents the optimal average throughput from a single instance, for a one-minute period.

Define instance warm-up time

You can optionally specify the number of seconds that it takes for a newly launched instance to warm up. Until its specified warm-up time has expired, an instance is not counted toward the aggregated EC2 instance metrics of the Auto Scaling group.

While instances are in the warm-up period, your scaling policies only scale out if the metric value from instances that are not warming up is greater than the policy's target utilization.

If the group scales out again, the instances that are still warming up are counted as part of the desired capacity for the next scale-out activity. The intention is to continuously (but not excessively) scale out.

While the scale-out activity is in progress, all scale-in activities initiated by scaling policies are blocked until the instances finish warming up. When the instances finish warming up, if a scale-in event occurs, any instances currently in the process of terminating will be counted towards the current capacity of the group when calculating the new desired capacity. Therefore, we don't remove more instances from the Auto Scaling group than necessary.

Default value

If no value is set, then the scaling policy will use the default value, which is the value for the default instance warmup defined for the group. If the default instance warmup is null, then it falls back to the value of the default cooldown. We recommend using the default instance warmup to make it easier to update all scaling policies when the warm-up time changes. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

Create a target tracking scaling policy (console)

You can choose to configure a target tracking scaling policy on an Auto Scaling group as you create it or after the Auto Scaling group is created.

Before you begin, confirm that your preferred metric is available at 1-minute intervals (compared to the default 5-minute interval of Amazon EC2 metrics).

To create an Auto Scaling group with a target tracking scaling policy

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Choose Create Auto Scaling group.
3. In Steps 1, 2, and 3, choose the options as desired and proceed to Step 4: Configure group size and scaling policies.
4. Under Group size, specify the range that you want to scale between by updating the minimum capacity and maximum capacity. These two settings allow your Auto Scaling group to scale...
dynamically. Amazon EC2 Auto Scaling scales your group in the range of values specified by the minimum capacity and maximum capacity.

5. Under **Scaling policies**, choose **Target tracking scaling policy**.

6. To define a policy, do the following:
   a. Specify a name for the policy.
   b. For **Metric type**, choose a metric.
      - If you chose **Application Load Balancer request count per target**, choose a target group in **Target group**.
   c. Specify a **Target value** for the metric.
   d. (Optional) For **Instances need**, update the instance warm-up value as needed.
   e. (Optional) Select **Disable scale in to create only a scale-out policy**. This allows you to create a separate scale-in policy of a different type if wanted.

7. Proceed to create the Auto Scaling group. Your scaling policy will be created after the Auto Scaling group has been created.

**To create a target tracking scaling policy for an existing Auto Scaling group**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.

2. Select the check box next to your Auto Scaling group.

   A split pane opens up in the bottom of the page.

3. Verify that the minimum capacity and maximum capacity are appropriately set. For example, if your group is already at its maximum size, specify a new maximum in order to scale out. Amazon EC2 Auto Scaling does not scale your group below the minimum capacity or above the maximum capacity. To update your group, on the **Details** tab, change the current settings for minimum and maximum capacity.

4. On the **Automatic scaling** tab, in **Dynamic scaling policies**, choose **Create dynamic scaling policy**.

5. To define a policy, do the following:
   a. For **Policy type**, keep the default of **Target tracking scaling**.
   b. Specify a name for the policy.
   c. For **Metric type**, choose a metric. You can choose only one metric type. To use more than one metric, create multiple policies.
      - If you chose **Application Load Balancer request count per target**, choose a target group in **Target group**.
   d. Specify a **Target value** for the metric.
   e. (Optional) For **Instances need**, update the instance warm-up value as needed.
   f. (Optional) Select **Disable scale in to create only a scale-out policy**. This allows you to create a separate scale-in policy of a different type if wanted.

6. Choose **Create**.

**Create a target tracking scaling policy (AWS CLI)**

Use the AWS CLI as follows to configure target tracking scaling policies for your Auto Scaling group.

**Tasks**
- [Step 1: Create an Auto Scaling group (p. 174)]
- [Step 2: Create a target tracking scaling policy (p. 174)]
Step 1: Create an Auto Scaling group

Use the `create-auto-scaling-group` command to create an Auto Scaling group named `my-asg` using the launch template `my-template`. If you don't have a launch template, see AWS CLI examples for working with launch templates (p. 35).

```
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg \
  --launch-template LaunchTemplateName=my-template,Version='2' \
  --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782" \
  --max-size 5 --min-size 1
```

Step 2: Create a target tracking scaling policy

After you have created the Auto Scaling group, you can create a target tracking scaling policy that instructs Amazon EC2 Auto Scaling to increase and decrease the number of running EC2 instances in the group dynamically when the load on the application changes.

Example: target tracking configuration file

The following is an example target tracking configuration that keeps the average CPU utilization at 40 percent. Save this configuration in a file named `config.json`.

```
{
  "TargetValue": 40.0,
  "PredefinedMetricSpecification":
    {
      "PredefinedMetricType": "ASGAverageCPUUtilization"
    }
}
```

For more information, see `PredefinedMetricSpecification` in the Amazon EC2 Auto Scaling API Reference.

Alternatively, you can use a custom metric for scaling by creating a customized metric specification and adding values for each parameter from CloudWatch. The following is an example target tracking configuration that keeps the average utilization of the specified metric at 40 percent.

```
{
  "TargetValue":40.0,
  "CustomizedMetricSpecification":{
    "MetricName":"MyUtilizationMetric",
    "Namespace":"MyNamespace",
    "Dimensions":[
      {
        "Name":"MyOptionalMetricDimensionName",
        "Value":"MyOptionalMetricDimensionValue"
      }
    ],
    "Statistic":"Average",
    "Unit":"Percent"
  }
}
```

For more information, see `CustomizedMetricSpecification` in the Amazon EC2 Auto Scaling API Reference.

Example: cpu40-target-tracking-scaling-policy

Use the `put-scaling-policy` command, along with the `config.json` file that you created previously, to create a scaling policy named `cpu40-target-tracking-scaling-policy` that keeps the average CPU utilization of the Auto Scaling group at 40 percent.

174
Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math

Using metric math, you can query multiple CloudWatch metrics and use math expressions to create new time series based on these metrics. You can visualize the resulting time series in the CloudWatch console and add them to dashboards. For more information about metric math, see Using metric math in the Amazon CloudWatch User Guide.

The following considerations apply to metric math expressions:

- You can query any available CloudWatch metric. Each metric is a unique combination of metric name, namespace, and zero or more dimensions.
- You can use any arithmetic operator (+ - * / ^), statistical function (such as AVG or SUM), or other function that CloudWatch supports.
- You can use both metrics and the results of other math expressions in the formulas of the math expression.
- Any expressions used in a metric specification must eventually return a single time series.
- You can verify that a metric math expression is valid by using the CloudWatch console or the CloudWatch GetMetricData API.

Note
You can create a target tracking scaling policy using metric math only if you use the AWS CLI or an SDK. This feature is not yet available in the console and AWS CloudFormation.

Example: Amazon SQS queue backlog per instance

To calculate the Amazon SQS queue backlog per instance, take the approximate number of messages available for retrieval from the queue and divide that number by the Auto Scaling group's running
capacity, which is the number of instances in the InService state. For more information, see Scaling based on Amazon SQS (p. 196).

The logic for the expression is this:

\[
\text{sum of \(\frac{\text{number of messages in the queue}}{\text{number of InService instances}}\)}
\]

Then your CloudWatch metric information is the following.

<table>
<thead>
<tr>
<th>ID</th>
<th>CloudWatch metric</th>
<th>Statistic</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>m1</td>
<td>ApproximateNumberOfMessagesVisible</td>
<td>Sum</td>
<td>1 minute</td>
</tr>
<tr>
<td>m2</td>
<td>GroupInServiceInstances</td>
<td>Average</td>
<td>1 minute</td>
</tr>
</tbody>
</table>

Your metric math ID and expression are the following.

<table>
<thead>
<tr>
<th>ID</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>e1</td>
<td>(\frac{m1}{m2})</td>
</tr>
</tbody>
</table>

To use this metric math to create a target tracking scaling policy (AWS CLI)

1. Store the metric math expression as part of a customized metric specification in a JSON file named config.json.

Use the following example to help you get started. Replace the replaceable italicized values with those that are appropriate for your application.

```json
{
    "CustomizedMetricSpecification": {
        "Metrics": [
            {
                "Label": "Get the queue size (the number of messages waiting to be processed)",
                "Id": "m1",
                "MetricStat": {
                    "Metric": {
                        "MetricName": "ApproximateNumberOfMessagesVisible",
                        "Namespace": "AWS/SQS",
                        "Dimensions": [
                            {
                                "Name": "QueueName",
                                "Value": "my-queue"
                            }
                        ],
                        "Stat": "Sum"
                    },
                    "ReturnData": false
                }
            },
            {
                "Label": "Get the group size (the number of InService instances)",
                "Id": "m2",
                "MetricStat": {
                    "Metric": {
                        "MetricName": "GroupInServiceInstances",
                        "Namespace": "AWS/AutoScaling",
                        "Dimensions": [
                            {
                                "Name": "AutoScalingGroup",
                                "Value": "my-auto-scaling-group"
                            }
                        ],
                        "Stat": "Average"
                    },
                    "ReturnData": false
                }
            }
        ]
    }
}
```
Target tracking scaling policies

```json
{
    "Name": "AutoScalingGroupName",
    "Value": "my-asg"
}
```

For more information, see TargetTrackingConfiguration in the Amazon EC2 Auto Scaling API Reference.

**Note**
Following are some additional resources that can help you find metric names, namespaces, dimensions, and statistics for CloudWatch metrics:

- For information about the available metrics for AWS services, see AWS services that publish CloudWatch metrics in the Amazon CloudWatch User Guide.
- To get the exact metric name, namespace, and dimensions (if applicable) for a CloudWatch metric with the AWS CLI, see list-metrics.

2. To create this policy, run the put-scaling-policy command using the JSON file as input, as demonstrated in the following example.

```
aws autoscaling put-scaling-policy --policy-name sqs-backlog-target-tracking-scaling-policy \
    --auto-scaling-group-name my-asg --policy-type TargetTrackingScaling \
    --target-tracking-configuration file://config.json
```

If successful, this command returns the policy's Amazon Resource Name (ARN) and the ARNs of the two CloudWatch alarms created on your behalf.

```json
{
    "Alarms": [
        {
            "AlarmName": "TargetTracking-my-asg-AlarmHigh-fc0e4185-23ac-497e-9992-691c9980c38e"
        },
        {
            "AlarmName": "TargetTracking-my-asg-AlarmLow-61a352ee1a2"
        }
    ]
}
```
Step and simple scaling policies for Amazon EC2 Auto Scaling

With step scaling and simple scaling, you choose scaling metrics and threshold values for the CloudWatch alarms that invoke the scaling process. You also define how your Auto Scaling group should be scaled when a threshold is in breach for a specified number of evaluation periods.

We strongly recommend that you use a target tracking scaling policy to scale on a metric like average CPU utilization or the RequestCountPerTarget metric from the Application Load Balancer. Metrics that decrease when capacity increases and increase when capacity decreases can be used to proportionally scale out or in the number of instances using target tracking. This helps ensure that Amazon EC2 Auto Scaling follows the demand curve for your applications closely. For more information, see Target tracking scaling policies (p. 169). You still have the option to use step scaling as an additional policy for a more advanced configuration. For example, you can configure a more aggressive response when demand reaches a certain level.

Contents

- Differences between step scaling policies and simple scaling policies (p. 178)
- Step adjustments for step scaling (p. 179)
- Scaling adjustment types (p. 180)
- Instance warm-up (p. 181)
- Create CloudWatch alarms for the metric high and low thresholds (console) (p. 182)
- Create step scaling policies (console) (p. 183)
- Create scaling policies and CloudWatch alarms (AWS CLI) (p. 185)
  - Step 1: Create an Auto Scaling group (p. 185)
  - Step 2: Create scaling policies (p. 185)
    - Step scaling policies (p. 185)
    - Simple scaling policies (p. 186)
  - Step 3: Create CloudWatch alarms for the metric high and low thresholds (p. 187)

Differences between step scaling policies and simple scaling policies

Step scaling policies and simple scaling policies are two of the dynamic scaling options available for you to use. Both require you to create CloudWatch alarms for the scaling policies. Both require you to specify the high and low thresholds for the alarms. Both require you to define whether to add or remove instances, and how many, or set the group to an exact size.

The main difference between the policy types is the step adjustments that you get with step scaling policies. When step adjustments are applied, and they increase or decrease the current capacity of your Auto Scaling group, the adjustments vary based on the size of the alarm breach.

In most cases, step scaling policies are a better choice than simple scaling policies, even if you have only a single scaling adjustment.
The main issue with simple scaling is that after a scaling activity is started, the policy must wait for the scaling activity or health check replacement to complete and the cooldown period (p. 192) to end before responding to additional alarms. Cooldown periods help to prevent the initiation of additional scaling activities before the effects of previous activities are visible.

In contrast, with step scaling the policy can continue to respond to additional alarms, even while a scaling activity or health check replacement is in progress. Therefore, all alarms that are breached are evaluated by Amazon EC2 Auto Scaling as it receives the alarm messages.

Amazon EC2 Auto Scaling originally supported only simple scaling policies. If you created your scaling policy before target tracking and step policies were introduced, your policy is treated as a simple scaling policy.

**Step adjustments for step scaling**

When you create a step scaling policy, you specify one or more step adjustments that automatically scale the number of instances dynamically based on the size of the alarm breach. Each step adjustment specifies the following:

- A lower bound for the metric value
- An upper bound for the metric value
- The amount by which to scale, based on the scaling adjustment type

CloudWatch aggregates metric data points based on the statistic for the metric that is associated with your CloudWatch alarm. When the alarm is breached, the appropriate scaling policy is invoked. Amazon EC2 Auto Scaling applies the aggregation type to the most recent metric data points from CloudWatch (as opposed to the raw metric data). It compares this aggregated metric value against the upper and lower bounds defined by the step adjustments to determine which step adjustment to perform.

You specify the upper and lower bounds relative to the breach threshold. For example, let's say that you have an Auto Scaling group that has both a current capacity and a desired capacity of 10. You have a CloudWatch alarm with a breach threshold of 50 percent and scale-out and scale-in policies. You have a set of step adjustments with an adjustment type of PercentChangeInCapacity (or Percent of group in the console) for each policy:

**Example: Step adjustments for scale-out policy**

<table>
<thead>
<tr>
<th>Lower bound</th>
<th>Upper bound</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>null</td>
<td>30</td>
</tr>
</tbody>
</table>

**Example: Step adjustments for scale-in policy**

<table>
<thead>
<tr>
<th>Lower bound</th>
<th>Upper bound</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-20</td>
<td>-10</td>
<td>-10</td>
</tr>
<tr>
<td>null</td>
<td>-20</td>
<td>-30</td>
</tr>
</tbody>
</table>

This creates the following scaling configuration.
The following points summarize the behavior of the scaling configuration in relation to the desired and current capacity of the group:

- The desired and current capacity is maintained while the aggregated metric value is greater than 40 and less than 60.
- If the metric value gets to 60, the desired capacity of the group increases by 1 instance, to 11 instances, based on the second step adjustment of the scale-out policy (add 10 percent of 10 instances). After the new instance is running and its specified warm-up time has expired, the current capacity of the group increases to 11 instances. If the metric value rises to 70 even after this increase in capacity, the desired capacity of the group increases by another 3 instances, to 14 instances. This is based on the third step adjustment of the scale-out policy (add 30 percent of 11 instances, 3.3 instances, rounded down to 3 instances).
- If the metric value gets to 40, the desired capacity of the group decreases by 1 instance, to 13 instances, based on the second step adjustment of the scale-in policy (remove 10 percent of 14 instances, 1.4 instances, rounded down to 1 instance). If the metric value falls to 30 even after this decrease in capacity, the desired capacity of the group decreases by another 3 instances, to 10 instances. This is based on the third step adjustment of the scale-in policy (remove 30 percent of 13 instances, 3.9 instances, rounded down to 3 instances).

When you specify the step adjustments for your scaling policy, note the following:

- If you are using the AWS Management Console, you specify the upper and lower bounds as absolute values. If you are using the AWS CLI or an SDK, you specify the upper and lower bounds relative to the breach threshold.
- The ranges of your step adjustments can’t overlap or have a gap.
- Only one step adjustment can have a null lower bound (negative infinity). If one step adjustment has a negative lower bound, then there must be a step adjustment with a null lower bound.
- Only one step adjustment can have a null upper bound (positive infinity). If one step adjustment has a positive upper bound, then there must be a step adjustment with a null upper bound.
- The upper and lower bound can’t be null in the same step adjustment.
- If the metric value is above the breach threshold, the lower bound is inclusive and the upper bound is exclusive. If the metric value is below the breach threshold, the lower bound is exclusive and the upper bound is inclusive.

### Scaling adjustment types

You can define a scaling policy that performs the optimal scaling action, based on the scaling adjustment type that you choose. You can specify the adjustment type as a percentage of the current capacity of your Auto Scaling group, or in capacity units. Normally a capacity unit means one instance, unless you are using the instance weighting feature.

Amazon EC2 Auto Scaling supports the following adjustment types for step scaling and simple scaling:

- **ChangeInCapacity** — Increment or decrement the current capacity of the group by the specified value. A positive value increases the capacity and a negative adjustment value decreases the capacity. For example: If the current capacity of the group is 3 and the adjustment is 5, then when this policy is performed, we add 5 capacity units to the capacity for a total of 8 capacity units.
• **ExactCapacity** — Change the current capacity of the group to the specified value. Specify a non-negative value with this adjustment type. For example: If the current capacity of the group is 3 and the adjustment is 5, then when this policy is performed, we change the capacity to 5 capacity units.

• **PercentChangeInCapacity** — Increment or decrement the current capacity of the group by the specified percentage. A positive value increases the capacity and a negative value decreases the capacity. For example: If the current capacity is 10 and the adjustment is 10 percent, then when this policy is performed, we add 1 capacity unit to the capacity for a total of 11 capacity units.

**Note**
If the resulting value is not an integer, it is rounded as follows:
- Values greater than 1 are rounded down. For example, 12.7 is rounded to 12.
- Values between 0 and 1 are rounded to 1. For example, .67 is rounded to 1.
- Values between 0 and -1 are rounded to -1. For example, -.58 is rounded to -1.
- Values less than -1 are rounded up. For example, -6.67 is rounded to -6.

With PercentChangeInCapacity, you can also specify the minimum number of instances to scale using the MinAdjustmentMagnitude parameter. For example, suppose that you create a policy that adds 25 percent and you specify a minimum increment of 2 instances. If you have an Auto Scaling group with 4 instances and the scaling policy is executed, 25 percent of 4 is 1 instance. However, because you specified a minimum increment of 2, there are 2 instances added.

When instance weighting (p. 81) is used, the effect of setting the MinAdjustmentMagnitude parameter to a non-zero value changes. The value is in capacity units. To set the minimum number of instances to scale, set this parameter to a value that is at least as large as your largest instance weight.

If you are using instance weighting, keep in mind that the current capacity of your Auto Scaling group can exceed the desired capacity as needed. If your absolute number to decrement, or the amount that the percentage says to decrement, is less than the difference between current and desired capacity, no scaling action is taken. You must take these behaviors into account when you look at the outcome of a scaling policy when a threshold alarm is in breach. For example, suppose that the desired capacity is 30 and the current capacity is 32. When the alarm is in breach, if the scaling policy decrements the desired capacity by 1, then no scaling action is taken.

**Instance warm-up**

For step scaling, you can optionally specify the number of seconds that it takes for a newly launched instance to warm up. Until its specified warm-up time has expired, an instance is not counted toward the aggregated EC2 instance metrics of the Auto Scaling group.

While instances are in the warm-up period, your scaling policies only scale out if the metric value from instances that are not warming up is greater than the policy's alarm high threshold.

If the group scales out again, the instances that are still warming up are counted as part of the desired capacity for the next scale-out activity. Therefore, multiple alarm breaches that fall in the range of the same step adjustment result in a single scaling activity. The intention is to continuously (but not excessively) scale out.

For example, let's say that you create a policy with two steps. The first step adds 10 percent when the metric gets to 60, and the second step adds 30 percent when the metric gets to 70 percent. Your Auto Scaling group has a desired and current capacity of 10. The desired and current capacity do not change while the aggregated metric value is less than 60. Suppose that the metric gets to 60, so 1 instance is added (10 percent of 10 instances). Then, the metric gets to 62 while the new instance is still warming up. The scaling policy calculates the new desired capacity based on the current capacity, which is still 10. However, the desired capacity of the group has already increased to 11 instances, so the scaling policy does not increase the desired capacity further. If the metric gets to 70 while the new instance is still warming up, we should add 3 instances (30 percent of 10 instances). However, the desired capacity of the group is already 11, so we add only 2 instances, for a new desired capacity of 13 instances.
While the scale-out activity is in progress, all scale-in activities initiated by scaling policies are blocked until the instances finish warming up. When the instances finish warming up, if a scale-in event occurs, any instances currently in the process of terminating will be counted towards the current capacity of the group when calculating the new desired capacity. Therefore, we don't remove more instances from the Auto Scaling group than necessary. For example, while an instance is already terminating, if an alarm is in breach in the range of the same step adjustment that decremented the desired capacity by 1, then no scaling action is taken.

**Default value**

If no value is set, then the scaling policy will use the default value, which is the value for the default instance warmup defined for the group. If the default instance warmup is null, then it falls back to the value of the default cooldown. We recommend using the default instance warmup to make it easier to update all scaling policies when the warm-up time changes. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

**Create CloudWatch alarms for the metric high and low thresholds (console)**

You can use the CloudWatch console to create two alarms, one for scaling out (metric high) and the other for scaling in (metric low). When the threshold of an alarm is breached, for example, because the traffic has increased, the alarm goes into the ALARM state. This state change invokes the scaling policy associated with the alarm. The policy then instructs Amazon EC2 Auto Scaling how to respond to the alarm breach, such as by adding or removing a specified number of instances.

**Example: To create a CloudWatch alarm for the metric high threshold**

2. If necessary, change the Region. From the navigation bar, select the Region where your Auto Scaling group resides.
3. In the navigation pane, choose **Alarms, All alarms** and then choose **Create alarm**.
4. Choose **Select metric**.
5. On the **All metrics** tab, choose **EC2, By Auto Scaling Group**, and enter the Auto Scaling group's name in the search field. Then, select CPUUtilization and choose **Select metric**. The **Specify metric and conditions** page appears, showing a graph and other information about the metric.
6. For **Period**, choose the evaluation period for the alarm, for example, 1 minute. When evaluating the alarm, each period is aggregated into one data point.
   - **Note**
     A shorter period creates a more sensitive alarm.
7. Under **Conditions**, do the following:
   - For **Threshold type**, choose **Static**.
   - For **Whenever CPUUtilization is**, specify whether you want the value of the metric to be greater than, greater than or equal to, less than, or less than or equal to the threshold to breach the alarm. Then, under **than**, enter the threshold value that you want to breach the alarm.
     - **Important**
       For an alarm to use with a scale-out policy (metric high), make sure you do not choose less than or less than or equal to the threshold. For an alarm to use with a scale-in policy (metric low), make sure you do not choose greater than or greater than or equal to the threshold.
8. Under **Additional configuration**, do the following:
   - For **Datapoints to alarm**, enter the number of data points (evaluation periods) during which the metric value must meet the threshold conditions for the alarm. For example, two consecutive periods of 5 minutes would take 10 minutes to invoke the alarm state.
• For **Missing data treatment**, choose **Treat missing data as bad (breaching threshold)**. For more information, see [Configuring how CloudWatch alarms treat missing data](https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/configuring.html) in the *Amazon CloudWatch User Guide*.

9. Choose **Next**.

   The **Configure actions** page appears.

10. Under **Notification**, select an Amazon SNS topic to notify when the alarm is in **ALARM** state, **OK** state, or **INSUFFICIENT_DATA** state.

   To have the alarm send multiple notifications for the same alarm state or for different alarm states, choose **Add notification**.

   To have the alarm not send notifications, choose **Remove**.

11. You can leave the other sections of the **Configure actions** page empty. Leaving the other sections empty creates an alarm without associating it to a scaling policy. You can then associate the alarm with a scaling policy from the Amazon EC2 Auto Scaling console.

12. Choose **Next**.

13. Enter a name (for example, **Step-Scaling-AlarmHigh-AddCapacity**) and, optionally, a description for the alarm, and then choose **Next**.

14. Choose **Create alarm**.

**Example: CloudWatch alarm that breaches if CPU goes above the 80 percent threshold for 4 minutes**

![CloudWatch alarm diagram](image)

**Create step scaling policies (console)**

You can choose to configure a step scaling policy on an Auto Scaling group after the group is created.

The following procedure shows you how to use the Amazon EC2 Auto Scaling console to create two step scaling policies: a scale-out policy that increases the capacity of the group by 30 percent, and a scale-in policy that decreases the capacity of the group to two instances.

While you are configuring your scaling policies, you can create the alarms at the same time. Alternatively, you can use alarms that you created from the CloudWatch console, as described in the previous section.

**To create a step scaling policy for scale out**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to your Auto Scaling group.

   A split pane opens up in the bottom of the page.

3. Verify that the minimum and maximum size limits are appropriately set. For example, if your group is already at its maximum size, you need to specify a new maximum in order to scale out. Amazon EC2 Auto Scaling does not scale your group below the minimum capacity or above the maximum capacity. To update your group, on the Details tab, change the current settings for minimum and maximum capacity.

4. On the Automatic scaling tab, in Dynamic scaling policies, choose Create dynamic scaling policy.

5. To define a policy for scale out (increase capacity), do the following:

   a. For Policy type, choose Step scaling.

   b. Specify a name for the policy.

   c. For CloudWatch alarm, choose your alarm. If you haven't already created an alarm, choose Create a CloudWatch alarm and complete step 4 through step 14 in Create CloudWatch alarms for the metric high and low thresholds (console) (p. 182) to create an alarm that monitors CPU utilization. Set the alarm threshold to greater than or equal to 80 percent.

   d. Specify the change in the current group size that this policy will make when executed using Take the action. You can add a specific number of instances or a percentage of the existing group size, or set the group to an exact size.

      For example, choose Add, enter 30 in the next field, and then choose percent of group. By default, the lower bound for this step adjustment is the alarm threshold and the upper bound is positive (+) infinity.

   e. To add another step, choose Add step and then define the amount by which to scale and the lower and upper bounds of the step relative to the alarm threshold.

   f. To set a minimum number of instances to scale, update the number field in Add capacity units in increments of at least 1 capacity units.

   g. (Optional) For Instances need, update the instance warm-up value as needed.

6. Choose Create.

To create a step scaling policy for scale in

1. Choose Create dynamic scaling policy to continue where you left off after creating a policy for scale out.

2. To define a policy for scale in (decrease capacity), do the following:

   a. For Policy type, choose Step scaling.

   b. Specify a name for the policy.

   c. For CloudWatch alarm, choose your alarm. If you haven't already created an alarm, choose Create a CloudWatch alarm and complete step 4 through step 14 in Create CloudWatch alarms for the metric high and low thresholds (console) (p. 182) to create an alarm that monitors CPU utilization. Set the alarm threshold to less than or equal to 40 percent.

   d. Specify the change in the current group size that this policy will make when executed using Take the action. You can remove a specific number of instances or a percentage of the existing group size, or set the group to an exact size.

      For example, choose Remove, enter 2 in the next field, and then choose capacity units. By default, the upper bound for this step adjustment is the alarm threshold and the lower bound is negative (-) infinity.

   e. To add another step, choose Add step and then define the amount by which to scale and the lower and upper bounds of the step relative to the alarm threshold.

3. Choose Create.
Create scaling policies and CloudWatch alarms (AWS CLI)

Use the AWS CLI as follows to configure step or simple scaling policies for your Auto Scaling group.

Tasks
- **Step 1: Create an Auto Scaling group (p. 185)**
- **Step 2: Create scaling policies (p. 185)**
- **Step 3: Create CloudWatch alarms for the metric high and low thresholds (p. 187)**

**Step 1: Create an Auto Scaling group**

Use the following `create-auto-scaling-group` command to create an Auto Scaling group named `my-asg` using the launch template `my-template`. If you don't have a launch template, see AWS CLI examples for working with launch templates (p. 35).

```
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg \
  --launch-template LaunchTemplateName=my-template,Version='2' \
  --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782" \
  --max-size 5 --min-size 1
```

**Step 2: Create scaling policies**

You can create step or simple scaling policies that tell the Auto Scaling group what to do when the load on the application changes.

**Step scaling policies**

**Example: my-step-scale-out-policy**

Use the following `put-scaling-policy` command to create a step scaling policy named `my-step-scale-out-policy`, with an adjustment type of PercentChangeInCapacity that increases the capacity of the group based on the following step adjustments (assuming a CloudWatch alarm threshold of 60 percent):

- Increase the instance count by 10 percent when the value of the metric is greater than or equal to 60 percent but less than 75 percent
- Increase the instance count by 20 percent when the value of the metric is greater than or equal to 75 percent but less than 85 percent
- Increase the instance count by 30 percent when the value of the metric is greater than or equal to 85 percent

```
aws autoscaling put-scaling-policy \
  --auto-scaling-group-name my-asg \
  --policy-name my-step-scale-out-policy \
  --policy-type StepScaling \
  --adjustment-type PercentChangeInCapacity \
  --metric-aggregation-type Average \
  --step-adjustments MetricIntervalLowerBound=0.0,MetricIntervalUpperBound=15.0,ScalingAdjustment=10 \
  MetricIntervalLowerBound=15.0,MetricIntervalUpperBound=25.0,ScalingAdjustment=20 \
  MetricIntervalLowerBound=25.0,MetricIntervalUpperBound=25.0,ScalingAdjustment=30 \
  --min-adjustment-magnitude 1
```

Record the policy's Amazon Resource Name (ARN). You need it to create a CloudWatch alarm for the policy.
Step and simple scaling policies

Example: my-step-scale-in-policy

Use the following `put-scaling-policy` command to create a step scaling policy named `my-step-scale-in-policy`, with an adjustment type of `ChangeInCapacity` that decreases the capacity of the group by 2 instances when the associated CloudWatch alarm breaches the metric low threshold value.

```
aws autoscaling put-scaling-policy \\
  --auto-scaling-group-name my-asg \\
  --policy-name my-step-scale-in-policy \\
  --policy-type StepScaling \\
  --adjustment-type ChangeInCapacity \\
  --step-adjustments MetricIntervalUpperBound=0.0,ScalingAdjustment=-2
```

Record the policy’s Amazon Resource Name (ARN). You need it to create the CloudWatch alarm for the policy.

```
{
}
```

Simple scaling policies

Alternatively, you can create simple scaling policies by using the following CLI commands instead of the preceding CLI commands. Keep in mind that a cooldown period will be in place due to the use of simple scaling policies.

Example: my-simple-scale-out-policy

Use the following `put-scaling-policy` command to create a simple scaling policy named `my-simple-scale-out-policy`, with an adjustment type of `PercentChangeInCapacity` that increases the capacity of the group by 30 percent when the associated CloudWatch alarm breaches the metric high threshold value.

```
aws autoscaling put-scaling-policy --policy-name my-simple-scale-out-policy \\
  --auto-scaling-group-name my-asg --scaling-adjustment 30 \\
  --adjustment-type PercentChangeInCapacity
```

Record the policy’s Amazon Resource Name (ARN). You need it to create the CloudWatch alarm for the policy.

Example: my-simple-scale-in-policy

Use the following `put-scaling-policy` command to create a simple scaling policy named `my-simple-scale-in-policy`, with an adjustment type of `ChangeInCapacity` that decreases the capacity of the group by one instance when the associated CloudWatch alarm breaches the metric low threshold value.

```
aws autoscaling put-scaling-policy --policy-name my-simple-scale-in-policy \\
  --auto-scaling-group-name my-asg --scaling-adjustment -1 \\
  --adjustment-type ChangeInCapacity --cooldown 180
```

Record the policy’s Amazon Resource Name (ARN). You need it to create the CloudWatch alarm for the policy.
Amazon EC2 Auto Scaling User Guide
Set default warm-up or cooldown values

Step 3: Create CloudWatch alarms for the metric high and low thresholds

In step 2, you created scaling policies that provided instructions to Amazon EC2 Auto Scaling about how to scale out and scale in when a metric's value is increasing or decreasing. In this step, you create two alarms by identifying the metric to watch, defining the metric high and low thresholds and other details for the alarms, and associating the alarms with the scaling policies.

Example: AddCapacity

Use the following CloudWatch `put-metric-alarm` command to create an alarm that increases the size of the Auto Scaling group based on an average CPU threshold value of 60 percent for at least two consecutive evaluation periods of two minutes. To use your own custom metric, specify its name in `--metric-name` and its namespace in `--namespace`.

```
aws cloudwatch put-metric-alarm --alarm-name Step-Scaling-AlarmHigh-AddCapacity
  --metric-name CPUUtilization --namespace AWS/EC2 --statistic Average
  --period 120 --evaluation-periods 2 --threshold 60
  --comparison-operator GreaterThanOrEqualToThreshold
  --dimensions "Name=AutoScalingGroupName,Value=my-asg"
  --alarm-actions PolicyARN
```

Example: RemoveCapacity

Use the following CloudWatch `put-metric-alarm` command to create an alarm that decreases the size of the Auto Scaling group based on average CPU threshold value of 40 percent for at least two consecutive evaluation periods of two minutes. To use your own custom metric, specify its name in `--metric-name` and its namespace in `--namespace`.

```
aws cloudwatch put-metric-alarm --alarm-name Step-Scaling-AlarmLow-RemoveCapacity
  --metric-name CPUUtilization --namespace AWS/EC2 --statistic Average
  --period 120 --evaluation-periods 2 --threshold 40
  --comparison-operator LessThanOrEqualToThreshold
  --dimensions "Name=AutoScalingGroupName,Value=my-asg"
  --alarm-actions PolicyARN
```

Set default values for instance warmup or scaling cooldown

The default instance warmup and the default cooldown are Auto Scaling group properties that you can use to fine-tune scaling performance.

Contents

- Set the default instance warmup for an Auto Scaling group (p. 187)
- Scaling cooldowns for Amazon EC2 Auto Scaling (p. 192)
- Available warm-up and cooldown settings (p. 194)

Set the default instance warmup for an Auto Scaling group

CloudWatch collects and aggregates usage data, such as CPU and network I/O, across your Auto Scaling instances. You use these metrics to create scaling policies that adjust the number of instances in your Auto Scaling group as the selected metric's value increases and decreases.

The default instance warmup lets you specify how long after an instance reaches the InService state it waits before contributing usage data to the aggregated metrics. This keeps dynamic scaling from being
affected by metrics for individual instances that aren't handling application traffic yet and that might be experiencing temporarily high usage of compute resources.

Default instance warmup is not configured and is not enabled by default. To optimize the performance of your target tracking and step scaling policies, we strongly recommend that you enable the default instance warmup.

In addition to affecting scaling performance, the default instance warmup influences the overall time required to replace an instance during an instance refresh.

Contents

- Scaling performance considerations (p. 188)
- Choose the default instance warm-up time (p. 188)
- Enable the default instance warmup for a group (p. 189)
- Verify the default instance warmup for a group (p. 190)
- Find scaling policies with a previously set instance warm-up time (p. 191)
- Clear the previously set instance warmup for a scaling policy (p. 191)

Scaling performance considerations

Most applications will benefit from having one default instance warm-up time that applies to all features rather than different warm-up times for different features. For example, if you don't set a default instance warmup, the instance refresh feature uses the health check grace period as the default warm-up time. If you have any target tracking and step scaling policies, they use the value set for the default cooldown as the default warm-up time. If you have any predictive scaling policies, they have no default warm-up time.

While instances are warming up, your dynamic scaling policies only scale out if the metric value from instances that are not warming up is greater than the policy's alarm high threshold (or the target utilization of a target tracking scaling policy). If demand decreases, the intention is to scale in conservatively to protect your application's availability. This blocks scale in for dynamic scaling until the instances finish warming up.

While scaling out, we consider instances that are warming up as part of the theoretical capacity of the group when deciding how many instances to add to the group. Therefore, multiple alarm breaches that fall in the range of the same step adjustment result in a single scaling activity. The intention is to continuously (but not excessively) scale out. For more information, see the instance warm-up (p. 181) section in the step scaling topic.

If default instance warmup is not enabled, the amount of time an instance waits before sending metrics to CloudWatch and counting it towards the current capacity will vary from instance to instance. In which case, there is the potential for your scaling policies to perform unpredictably compared to the actual workload that is occurring.

For example, consider an application with a recurring on-and-off workload pattern. A predictive scaling policy is used to make recurring decisions about whether to increase the number of instances. Because there is no default warm-up time for predictive scaling policies, the instances start contributing to the aggregated metrics immediately. If these instances have higher resource usage on startup, then adding instances could cause the aggregated metrics to spike. Depending on how long it takes for usage to stabilize, this could impact any dynamic scaling policies that use these metrics. If a dynamic scaling policy's alarm high threshold is breached, then the group increases in size again. While the new instances are warming up, scale-in activities will be blocked.

Choose the default instance warm-up time

The key to setting the default instance warmup is determining how long your instances need to finish initializing and for resource consumption to stabilize after they reach the InService state. When
choosing the instance warm-up time, aim for an optimal balance between collecting usage data for legitimate traffic, but minimizing data collection associated with temporary usage spikes on startup.

Suppose you have an Auto Scaling group attached to an Elastic Load Balancing load balancer. When new instances finish launching, they're registered to the load balancer before they enter the InService state. After the instances enter the InService state, resource consumption can still experience temporary spikes and need time to stabilize. For example, resource consumption for an application server that must download and cache large assets takes longer to stabilize than a lightweight web server with no large assets to download. The instance warmup provides the time delay necessary for resource consumption to stabilize.

**Important**

If you're not sure how much time you need, you could start with 300 seconds and gradually decrease or increase it until you get the best scaling performance for your application. You might need to experiment to get it right. Alternatively, if you have any scaling policies that have their own warm-up time (EstimatedInstanceWarmup), you could use this value to start. For more information, see Find scaling policies with a previously set instance warm-up time (p. 191).

Depending on whether your group uses any lifecycle hooks, you might be able to use a shorter warm-up time.

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your Auto Scaling group has a lifecycle hook that delays instances from being put in service until they have finished initializing.</td>
<td>You can set the default instance warmup to a shorter duration.</td>
</tr>
<tr>
<td>Your Auto Scaling group does not have a lifecycle hook that initializes instances before they're put in service.</td>
<td>You can specify a longer duration for the default instance warmup that includes the time your instances need to finish initializing.</td>
</tr>
</tbody>
</table>

**Enable the default instance warmup for a group**

You can enable the default instance warmup when you create an Auto Scaling group. You can also enable it for existing groups.

By enabling the default instance warmup feature, you no longer have to specify values for warm-up parameters for the following features:

- **Instance refresh** (p. 102)
- **Target tracking scaling** (p. 172)
- **Step scaling** (p. 181)

**Console**

**To enable the default instance warmup for a new group (console)**

When you create the Auto Scaling group, on the **Configure advanced options** page, under **Additional settings**, select the **Enable default instance warmup** option. Choose the warm-up time that you need for your application.
AWS CLI

To enable the default instance warmup for a new group (AWS CLI)

To enable the default instance warmup for an Auto Scaling group, add the `--default-instance-warmup` option and specify a value, in seconds, from 0 to 3600. After it's enabled, a value of -1 will turn this setting off.

The following `create-auto-scaling-group` command creates an Auto Scaling group with the name `my-asg` and enables the default instance warmup with a value of 120 seconds.

```bash
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg --default-instance-warmup 120 ...
```

Tip
If this command throws an error, make sure that you have updated the AWS CLI locally to the latest version.

Console

To enable the default instance warmup for an existing group (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the AWS Region that you created your Auto Scaling group in.
3. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
5. For Default instance warmup, choose the warm-up time that you need for your application.
6. Choose Update.

AWS CLI

To enable the default instance warmup for an existing group (AWS CLI)

The following example uses the `update-auto-scaling-group` command to enable the default instance warmup with a value of 120 seconds for an existing Auto Scaling group named `my-asg`.

```bash
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --default-instance-warmup 120
```

Tip
If this command throws an error, make sure that you have updated the AWS CLI locally to the latest version.

Verify the default instance warmup for a group

To verify the default instance warmup for an Auto Scaling group (AWS CLI)

Use the `describe-auto-scaling-groups` command.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```
Set default warm-up or cooldown values

The following is an example response.

```json
{
    "AutoScalingGroups": [
        {
            "AutoScalingGroupName": "my-asg",
            "AutoScalingGroupARN": "arn",
            "DefaultInstanceWarmup": 120
        }
    ]
}
```

Find scaling policies with a previously set instance warm-up time

To identify whether you have policies that have their own warm-up time for `EstimatedInstanceWarmup`, run the following `describe-policies` command using the AWS CLI. Replace `my-asg` with the name of your Auto Scaling group.

```
aws autoscaling describe-policies --auto-scaling-group-name my-asg
--query 'ScalingPolicies[?EstimatedInstanceWarmup!=null]'
```

The following is example output.

```json
[
    {
        "AutoScalingGroupName": "my-asg",
        "PolicyName": "cpu40-target-tracking-scaling-policy",
        "PolicyARN": "arn",
        "PolicyType": "TargetTrackingScaling",
        "StepAdjustments": [],
        "EstimatedInstanceWarmup": 120,
        "Alarms": [{
            "AlarmName": "TargetTracking-my-asg-AlarmHigh-fc0e4183-23ac-497e-9992-691c9980c38e"
        },
        {
            "AlarmName": "TargetTracking-my-asg-AlarmLow-61a39305-ed0c-47af-bd9e-471a352e1a2"
        }],
        "TargetTrackingConfiguration": {
            "PredefinedMetricSpecification": {
                "PredefinedMetricType": "ASGAverageCPUUtilization"
            },
            "TargetValue": 40.0,
            "DisableScaleIn": false
        },
        "Enabled": true
    },
    ... additional policies ...
]
```

Clear the previously set instance warmup for a scaling policy

After enabling the default instance warmup, update any scaling policies that have still their own warm-up time to clear the previously set value. Otherwise, it will override the default instance warmup.
You can update scaling policies using the console, AWS CLI, or AWS SDKs. This section covers the steps for the console. If you use the AWS CLI or AWS SDKs, make sure you preserve the existing policy configuration, but remove the `EstimatedInstanceWarmup` property. When you update an existing scaling policy, the policy will be replaced with what you specify when you programmatically call `PutScalingPolicy`. The original values are not kept.

**To clear the previously set instance warmup for a scaling policy (console)**

1. Open the Amazon EC2 console at `https://console.aws.amazon.com/ec2/`, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
3. A split pane opens up in the bottom of the page.
4. On the Automatic scaling tab, in Dynamic scaling policies, choose the policy you're interested in, and then choose Actions, Edit.
5. For Instances need, clear the instance warm-up value to use the default instance warm-up value instead.
6. Choose Update.

**Scaling cooldowns for Amazon EC2 Auto Scaling**

After your Auto Scaling group launches or terminates instances, it waits for a cooldown period to end before any further scaling activities initiated by simple scaling policies can start. The intention of the cooldown period is to prevent your Auto Scaling group from launching or terminating additional instances before the effects of previous activities are visible.

**Important**

As a best practice, we recommend that you do not use simple scaling policies and scaling cooldowns. In most cases, a target tracking scaling policy or a step scaling policy is better for scaling performance. For a scaling policy that changes the size of your Auto Scaling group proportionally as the value of the scaling metric decreases or increases, we recommend target tracking (p. 169) over either simple scaling or step scaling.

Suppose, for example, that a simple scaling policy for CPU utilization recommends launching two instances. Amazon EC2 Auto Scaling launches two instances and then pauses the scaling activities until the cooldown period ends. After the cooldown period ends, any scaling activities initiated by simple scaling policies can resume. If CPU utilization breaches the alarm high threshold again, the Auto Scaling group scales out again, and the cooldown period takes effect again. However, if two instances were enough to bring the metric value back down, the group remains at its current size.

**Considerations**

The following considerations apply when working with simple scaling policies and scaling cooldowns:

- Target tracking and step scaling policies can initiate a scale-out activity immediately without waiting for the cooldown period to end. Instead, whenever your Auto Scaling group launches instances, the individual instances have a warm-up period. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).
• When a scheduled action starts at the scheduled time, it can also initiate a scaling activity immediately without waiting for the cooldown period to end.

• If an instance becomes unhealthy, Amazon EC2 Auto Scaling does not wait for the cooldown period to end before replacing the unhealthy instance.

• When multiple instances launch or terminate, the cooldown period (either the default cooldown or the scaling policy-specific cooldown) takes effect starting when the last instance finishes launching or terminating.

• When you manually scale your Auto Scaling group, the default is not to wait for a cooldown to end. However, you can override this behavior and honor the default cooldown when you use the AWS CLI or an SDK to manually scale.

• By default, Elastic Load Balancing waits 300 seconds to complete the deregistration (connection draining) process. If the group is behind an Elastic Load Balancing load balancer, it will wait for the terminating instances to deregister before starting the cooldown period.

Lifecycle hooks can cause additional delays

If a lifecycle hook (p. 236) is invoked, the cooldown period begins after you complete the lifecycle action or after the timeout period ends. For example, consider an Auto Scaling group that has a lifecycle hook for instance launch. When the application experiences an increase in demand, the group launches an instance to add capacity. Because there is a lifecycle hook, the instance is put into a wait state and scaling activities due to simple scaling policies are paused. When the instance enters the InService state, the cooldown period starts. When the cooldown period ends, simple scaling policy activities are resumed.

When Elastic Load Balancing is enabled, for the purposes of scaling in, the cooldown period starts when the terminating instance finishes connection draining (deregistration delay). It doesn't wait for the hook duration. This means that any scaling activities due to simple scaling policies can resume as soon as the result of the scale-in event is reflected in the capacity of the group. Otherwise, waiting to complete all three activities—connection draining, a lifecycle hook, and a cooldown period—would significantly increase the amount of time that the Auto Scaling group needs to pause scaling.

Change the default cooldown period

You can't set the default cooldown when you initially create an Auto Scaling group in the Amazon EC2 Auto Scaling console. By default, this cooldown period is set to 300 seconds (5 minutes). If needed, you can update this after the group is created.

To change the default cooldown period (console)

After creating the Auto Scaling group, on the Details tab, choose Advanced configurations, Edit. For Default cooldown, choose the amount of time that you want based on your instance startup time or other application needs.

To change the default cooldown period (AWS CLI)

Use the following commands to change the default cooldown for new or existing Auto Scaling groups. If the default cooldown is not defined, the default value of 300 seconds is used.

• create-auto-scaling-group
• update-auto-scaling-group

To confirm the value of the default cooldown, use the describe-auto-scaling-groups command.

Set a cooldown period for specific simple scaling policies

By default, all simple scaling policies use the default cooldown period that is defined for the Auto Scaling group. To set a cooldown period for specific simple scaling policies, use the optional cooldown parameter
when you create or update the policy. When a cooldown period is specified for a policy, it overrides the default cooldown.

One common use for a scaling policy-specific cooldown period is with a scale-in policy. Because this policy terminates instances, Amazon EC2 Auto Scaling needs less time to determine whether to terminate additional instances. Terminating instances should be a much quicker operation than launching instances. The default cooldown period of 300 seconds is therefore too long. In this case, a scaling policy-specific cooldown period with a lower value for your scale-in policy can help you reduce costs by allowing the group to scale in faster.

To create or update simple scaling policies in the console, choose the **Automatic scaling** tab after you create the group. To create or update simple scaling policies using the AWS CLI, use the `put-scaling-policy` command. For more information, see [Step and simple scaling policies](p. 178).

### Available warm-up and cooldown settings

To help optimize scaling performance, choose the appropriate warm-up and cooldown settings for your Auto Scaling group.

We recommend using the `DefaultInstanceWarmup` setting, which unifies all the warm-up and cooldown settings. If needed, you can also use the `HealthCheckGracePeriod` setting.

The other available settings are not intended to be used at the same time as the `DefaultInstanceWarmup` setting. For example, `EstimatedInstanceWarmup` and `InstanceWarmup` are not needed when `DefaultInstanceWarmup` is already defined, and `DefaultCooldown` and `Cooldown` are only needed when you use simple scaling policies. (As a best practice, we recommend target tracking and step scaling policies instead of simple scaling policies.) However, we will continue to support all of these settings so that you can choose the appropriate settings for your use case.

#### DefaultInstanceWarmup (Recommended)

**API operation:** CreateAutoScalingGroup, UpdateAutoScalingGroup

The amount of time, in seconds, until a new instance is considered to have finished initializing and resource consumption to become stable after it enters the InService state.

During an instance refresh, Amazon EC2 Auto Scaling waits for the warm-up period after it replaces an instance before it moves on to replacing the next instance. Amazon EC2 Auto Scaling also waits for the warm-up period before aggregating the metrics for new instances with existing instances in the Amazon CloudWatch metrics that are used for scaling, resulting in more reliable usage data. For more information, see [Set the default instance warmup for an Auto Scaling group](p. 187).

You can reduce the value of the warm-up period if you use a lifecycle hook to prepare new instances for use. For more information, see [Amazon EC2 Auto Scaling lifecycle hooks](p. 236).

**Important**

To manage various warm-up settings at the group level, we recommend that you set the default instance warmup, *even if it is set to 0 seconds*. To remove a value that you previously set, include the property but specify -1 for the value. However, we strongly recommend keeping the default instance warmup enabled by specifying a value of 0 or other nominal value.

**Default:** None

#### EstimatedInstanceWarmup

*Not needed if DefaultInstanceWarmup is defined.*

**API operation:** PutScalingPolicy

The estimated time, in seconds, until a newly launched instance can contribute to the CloudWatch metrics. This warm-up period applies to instances launched due to a specific target tracking or step
scaling policy. When a warm-up period is specified here, it overrides the default instance warmup. For more information, see Target tracking scaling policies (p. 169) and Step and simple scaling policies (p. 178).

Default: If not defined, the value of this parameter defaults to the value for the default instance warmup defined for the group. If default instance warmup is null, then it falls back to the value of default cooldown.

**InstanceWarmup**

*Not needed if DefaultInstanceWarmup is defined.*

**API operation:** StartInstanceRefresh

A time period, in seconds, during which an instance refresh waits before moving on to replacing the next instance after a new instance enters the InService state. Specifying a warm-up period when you start an instance refresh overrides the default instance warmup, but only for the current instance refresh. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101).

Default: If not defined, the value of this parameter defaults to the value for the default instance warmup defined for the group. If default instance warmup is null, then it falls back to the value of the health check grace period.

**DefaultCooldown**

*Only needed if you use simple scaling policies.*

**API operation:** CreateAutoScalingGroup, UpdateAutoScalingGroup

The amount of time, in seconds, between one scaling activity ending and another one starting due to simple scaling policies. For more information, see Scaling cooldowns for Amazon EC2 Auto Scaling (p. 192).

Default: 300 seconds

**Cooldown**

*Only needed if you use simple scaling policies.*

**API operation:** PutScalingPolicy

A cooldown period, in seconds, that applies to a specific simple scaling policy. (Simple scaling policies are no longer recommended. As a best practice, we recommend target tracking and step scaling policies instead.) When a cooldown period is specified here, it overrides the default cooldown. For more information, see Scaling cooldowns for Amazon EC2 Auto Scaling (p. 192).

Default: None

**HealthCheckGracePeriod**

**API operation:** CreateAutoScalingGroup, UpdateAutoScalingGroup

The amount of time, in seconds, that Amazon EC2 Auto Scaling waits before checking the health status of an EC2 instance that has come into service and marking it unhealthy due to a failed Elastic Load Balancing or custom health check. This is useful if your instances do not immediately pass these health checks after they enter the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

You can set the value of the health check grace period to 0 if you use a lifecycle hook for instance launch. If your Auto Scaling group is behind a load balancer, consider adding a lifecycle hook to the group to make sure that your instances are ready to serve traffic before they are registered to the load balancer.
Scaling based on Amazon SQS

Important

The following information and steps shows you how to calculate the Amazon SQS queue backlog per instance using the ApproximateNumberOfMessages queue attribute before publishing it as a custom metric to CloudWatch. However, you can now save the cost and effort put into publishing your own metric by using metric math. For more information, see Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math (p. 175).

This section shows you how to scale your Auto Scaling group in response to changes in system load in an Amazon Simple Queue Service (Amazon SQS) queue. To learn more about how you can use Amazon SQS, see the Amazon Simple Queue Service Developer Guide.

There are some scenarios where you might think about scaling in response to activity in an Amazon SQS queue. For example, suppose that you have a web app that lets users upload images and use them online. In this scenario, each image requires resizing and encoding before it can be published. The app runs on EC2 instances in an Auto Scaling group, and it's configured to handle your typical upload rates. Unhealthy instances are terminated and replaced to maintain current instance levels at all times. The app places the raw bitmap data of the images in an SQS queue for processing. It processes the images and then publishes the processed images where they can be viewed by users. The architecture for this scenario works well if the number of image uploads doesn't vary over time. But if the number of uploads changes over time, you might consider using dynamic scaling to scale the capacity of your Auto Scaling group.

Contents

- Use target tracking with the right metric (p. 196)
- Limitations and prerequisites (p. 197)
- Configure scaling based on Amazon SQS (p. 198)
- Amazon SQS and instance scale-in protection (p. 200)

Use target tracking with the right metric

If you use a target tracking scaling policy based on a custom Amazon SQS queue metric, dynamic scaling can adjust to the demand curve of your application more effectively. For more information about choosing metrics for target tracking, see Choose metrics (p. 170).

The issue with using a CloudWatch Amazon SQS metric like ApproximateNumberOfMessagesVisible for target tracking is that the number of messages in the queue might not change proportionally to the size of the Auto Scaling group that processes messages from the queue. That's because the number of messages in your SQS queue does not solely define the number of instances needed. The number of instances in your Auto Scaling group can be driven by multiple factors, including how long it takes to process a message and the acceptable amount of latency (queue delay).

The solution is to use a backlog per instance metric with the target value being the acceptable backlog per instance to maintain. You can calculate these numbers as follows:

- **Backlog per instance**: To calculate your backlog per instance, start with the ApproximateNumberOfMessages queue attribute to determine the length of the SQS queue (number of messages available for retrieval from the queue). Divide that number by the fleet's running capacity, which for an Auto Scaling group is the number of instances in the InService state, to get the backlog per instance.
• **Acceptable backlog per instance:** To calculate your target value, first determine what your application can accept in terms of latency. Then, take the acceptable latency value and divide it by the average time that an EC2 instance takes to process a message.

As an example, let’s say that you currently have an Auto Scaling group with 10 instances and the number of visible messages in the queue (**ApproximateNumberOfMessages**) is 1500. If the average processing time is 0.1 seconds for each message and the longest acceptable latency is 10 seconds, then the acceptable backlog per instance is 10 / 0.1, which equals 100 messages. This means that 100 is the target value for your target tracking policy. When the backlog per instance reaches the target value, a scale-out event will happen. Because the backlog per instance is already 150 messages (1500 messages / 10 instances), your group scales out, and it scales out by five instances to maintain proportion to the target value.

The following procedures demonstrate how to publish the custom metric and create the target tracking scaling policy that configures your Auto Scaling group to scale based on these calculations.

**Important**
Remember, to reduce costs, use metric math instead. For more information, see [Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math](mailto:p. 175).

There are three main parts to this configuration:

• An Auto Scaling group to manage EC2 instances for the purposes of processing messages from an SQS queue.
• A custom metric to send to Amazon CloudWatch that measures the number of messages in the queue per EC2 instance in the Auto Scaling group.
• A target tracking policy that configures your Auto Scaling group to scale based on the custom metric and a set target value. CloudWatch alarms invoke the scaling policy.

The following diagram illustrates the architecture of this configuration.

**Limitations and prerequisites**
To use this configuration, you need to be aware of the following limitations:

• You must use the AWS CLI or an SDK to publish your custom metric to CloudWatch. You can then monitor your metric with the AWS Management Console.
The Amazon EC2 Auto Scaling console does not support target tracking scaling policies that use custom metrics. You must use the AWS CLI or an SDK to specify a custom metric for your scaling policy.

The following sections direct you to use the AWS CLI for the tasks you need to perform. For example, to get metric data that reflects the present use of the queue, you use the SQS `get-queue-attributes` command. Make sure that you have the CLI installed and configured.

Before you begin, you must have an Amazon SQS queue to use. The following sections assume that you already have a queue (standard or FIFO), an Auto Scaling group, and EC2 instances running the application that uses the queue. For more information about Amazon SQS, see the Amazon Simple Queue Service Developer Guide.

## Configure scaling based on Amazon SQS

### Tasks

- **Step 1: Create a CloudWatch custom metric** (p. 198)
- **Step 2: Create a target tracking scaling policy** (p. 199)
- **Step 3: Test your scaling policy** (p. 200)

### Step 1: Create a CloudWatch custom metric

A custom metric is defined using a metric name and namespace of your choosing. Namespaces for custom metrics cannot start with `AWS/`. For more information about publishing custom metrics, see the Publish custom metrics topic in the Amazon CloudWatch User Guide.

Follow this procedure to create the custom metric by first reading information from your AWS account. Then, calculate the backlog per instance metric, as recommended in an earlier section. Lastly, publish this number to CloudWatch at a 1-minute granularity. Whenever possible, we strongly recommend that you scale on metrics with a 1-minute granularity to ensure a faster response to changes in system load.

#### To create a CloudWatch custom metric (AWS CLI)

1. Use the SQS `get-queue-attributes` command to get the number of messages waiting in the queue (ApproximateNumberOfMessages).

   ```bash
   aws sqs get-queue-attributes --queue-url https://sqs.region.amazonaws.com/123456789/MyQueue
   --attribute-names ApproximateNumberOfMessages
   ```

2. Use the `describe-auto-scaling-groups` command to get the running capacity of the group, which is the number of instances in the InService lifecycle state. This command returns the instances of an Auto Scaling group along with their lifecycle state.

   ```bash
   aws autoscaling describe-auto-scaling-groups --auto-scaling-group-names my-asg
   ```

3. Calculate the backlog per instance by dividing the approximate number of messages available for retrieval from the queue by the group's running capacity.

4. Create a script that runs every minute to retrieve the backlog per instance value and publish it to a CloudWatch custom metric. When you publish a custom metric, you specify the metric's name, namespace, unit, value, and zero or more dimensions. A dimension consists of a dimension name and a dimension value.

   To publish your custom metric, replace placeholder values in `italics` with your preferred metric name, the metric's value, a namespace (as long as it doesn't begin with "AWS"), and dimensions (optional), and then run the following `put-metric-data` command.
After your application is emitting the desired metric, the data is sent to CloudWatch. The metric is visible in the CloudWatch console. You can access it by logging into the AWS Management Console and navigating to the CloudWatch page. Then, view the metric by navigating to the metrics page or by searching for it using the search box. For information about viewing metrics, see View available metrics in the Amazon CloudWatch User Guide.

**Step 2: Create a target tracking scaling policy**

The metric you created can now be added to a target tracking scaling policy.

**To create a target tracking scaling policy (AWS CLI)**

1. Use the following `cat` command to store a target value for your scaling policy and a customized metric specification in a JSON file named `config.json` in your home directory. Replace placeholder values in *italics* with your own values. For the `TargetValue`, calculate the acceptable backlog per instance metric and enter it here. To calculate this number, decide on a normal latency value and divide it by the average time that it takes to process a message, as described in an earlier section.

   If you didn't specify any dimensions for the metric you created in step 1, don't include any dimensions in the customized metric specification.

   ```
   $ cat ~/config.json
   {
   "TargetValue":100,
   "CustomizedMetricSpecification":{
   "MetricName":"MyBacklogPerInstance",
   "Namespace":"MyNamespace",
   "Dimensions":[
   {
   "Name":"MyOptionalMetricDimensionName",
   "Value":"MyOptionalMetricDimensionValue"
   }
   ],
   "Statistic":"Average",
   "Unit":"None"
   }
   }
   ```

2. Use the `put-scaling-policy` command, along with the `config.json` file that you created in the previous step, to create your scaling policy.

   ```
   aws autoscaling put-scaling-policy --policy-name sqs100-target-tracking-scaling-policy
   \|--auto-scaling-group-name my-asg --policy-type TargetTrackingScaling \
   \|--target-tracking-configuration file://~/config.json
   ```

   This creates two alarms: one for scaling out and one for scaling in. It also returns the Amazon Resource Name (ARN) of the policy that is registered with CloudWatch, which CloudWatch uses to invoke scaling whenever the metric threshold is in breach.
Step 3: Test your scaling policy

After your setup is complete, verify that your scaling policy is working. You can test it by increasing the number of messages in your SQS queue and then verifying that your Auto Scaling group has launched an additional EC2 instance. You can also test it by decreasing the number of messages in your SQS queue and then verifying that the Auto Scaling group has terminated an EC2 instance.

To test the scale-out function

1. Follow the steps in Sending messages to a queue (console) to add messages to your queue. Make sure that you have increased the number of messages in the queue so that the backlog per instance metric exceeds the target value.

   It can take a few minutes for your changes to invoke the alarm.

2. Use the describe-auto-scaling-groups command to verify that the group has launched an instance.

   ```bash
   aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
   ```

To test the scale-in function

1. Follow the steps in Receiving and deleting messages (console) to delete messages from the queue. Make sure that you have decreased the number of messages in the queue so that the backlog per instance metric is below the target value.

   It can take a few minutes for your changes to invoke the alarm.

2. Use the describe-auto-scaling-groups command to verify that the group has terminated an instance.

   ```bash
   aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
   ```

Amazon SQS and instance scale-in protection

Messages that have not been processed at the time an instance is terminated are returned to the SQS queue where they can be processed by another instance that is still running. For applications where long running tasks are performed, you can optionally use instance scale-in protection to have control over which queue workers are terminated when your Auto Scaling group scales in.

The following pseudocode shows one way to protect long-running, queue-driven worker processes from scale-in termination.

```plaintext
while (true)
{
    SetInstanceProtection(False);
    Work = GetNextWorkUnit();
    SetInstanceProtection(True);
    ProcessWorkUnit(Work);
    SetInstanceProtection(False);
}
```

For more information, see Design your applications on Amazon EC2 Auto Scaling to gracefully handle instance termination (p. 284).

Verify a scaling activity for an Auto Scaling group

In the Amazon EC2 Auto Scaling section of the Amazon EC2 console, the Activity history for an Auto Scaling group lets you view the current status of a scaling activity that is currently in progress. When the
When you add a target tracking, step, or simple scaling policy to your Auto Scaling group, Amazon EC2 Auto Scaling immediately starts evaluating the policy against the metric. The metric alarm goes to ALARM state when the metric breaches the threshold for a specified number of evaluation periods. This means that a scaling policy could result in a scaling activity soon after it's created. After Amazon EC2 Auto Scaling adjusts the desired capacity in response to a scaling policy, you can verify the scaling activity in your account. If you want to receive email notification from Amazon EC2 Auto Scaling informing you about a scaling activity, follow the instructions in Get Amazon SNS notifications when your Auto Scaling group scales (p. 317).

**Tip**

In the following procedure, you look at the Activity history and Instances sections for the Auto Scaling group. In both, the named columns should already be displayed. To display hidden columns or change the number of rows shown, choose the gear icon on the top right corner of each section to open the preferences modal, update the settings as needed, and choose Confirm.

**To view the scaling activities for an Auto Scaling group (console)**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched or terminated instances, or whether the scaling activity is still in progress.
4. (Optional) If you have a lot of scaling activities, you can choose the > icon at the top edge of the activity history to see the next page of scaling activities.
5. On the Instance management tab, under Instances, the Lifecycle column contains the state of your instances. After the instance starts and any lifecycle hooks have finished, its lifecycle state changes to InService. The Health status column shows the result of the EC2 instance health check on your instance.

**To view the scaling activities for an Auto Scaling group (AWS CLI)**

Use the following describe-scaling-activities command.

```
aws autoscaling describe-scaling-activities --auto-scaling-group-name my-asg
```

The following is example output.

Scaling activities are ordered by start time. Activities still in progress are described first.

```json
{
    "Activities": [
        
        {
            "ActivityId": "5e3a1f47-2309-415c-bfd8-35aa06300799",
            "AutoScalingGroupName": "my-asg",
            "Description": "Terminating EC2 instance: i-06c4794c2499af1df",
            "Cause": "At 2020-02-11T18:34:10Z a monitor alarm TargetTracking-my-asg-AlarmLow-b9376cab-18a7-4385-920c-dfa3f7783f82 in state ALARM triggered policy my-target-tracking-policy changing the desired capacity from 3 to 2. At 2020-02-11T18:34:31Z an instance was taken out of service in response to a difference between desired and actual capacity,
```
This topic describes how to temporarily disable a scaling policy so it won't initiate changes to the number of instances the Auto Scaling group contains. When you disable a scaling policy, the configuration details are preserved, so you can quickly re-enable the policy. This is easier than temporarily deleting a policy when you don't need it, and recreating it later.

When a scaling policy is disabled, the Auto Scaling group does not scale out or scale in for the metric alarms that are breached while the scaling policy is disabled. However, any scaling activities still in progress are not stopped.

Note that disabled scaling policies still count toward your quotas on the number of scaling policies that you can add to an Auto Scaling group.

**To disable a scaling policy (console)**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the Automatic scaling tab, under Dynamic scaling policies, select the check box in the top right corner of the desired scaling policy.
4. Scroll to the top of the Dynamic scaling policies section, and choose Actions, Disable.

When you are ready to re-enable the scaling policy, repeat these steps and then choose Actions, Enable. After you re-enable a scaling policy, your Auto Scaling group may immediately initiate a scaling action if there are any alarms currently in ALARM state.

**To disable a scaling policy (AWS CLI)**

Use the put-scaling-policy command with the --no-enabled option as follows. Specify all options in the command as you would specify them when creating the policy.

```
aws autoscaling put-scaling-policy --auto-scaling-group-name my-asg \ 
  --policy-name my-scaling-policy --policy-type TargetTrackingScaling \ 
```

For a description of the fields in the output, see Activity in the Amazon EC2 Auto Scaling API Reference.

For help retrieving the scaling activities for a deleted group and for information about the types of errors that you may encounter and how to handle them, see Troubleshoot Amazon EC2 Auto Scaling (p. 428).
Disable a scaling policy

```
--estimated-instance-warmup 360 \n--target-tracking-configuration '{ "TargetValue": 70, "PredefinedMetricSpecification": { "PredefinedMetricType": "ASGAverageCPUUtilization" } }' \n--no-enabled
```

To re-enable a scaling policy (AWS CLI)

Use the `put-scaling-policy` command with the `--enabled` option as follows. Specify all options in the command as you would specify them when creating the policy.

```
aws autoscaling put-scaling-policy --auto-scaling-group-name my-asg \n--policy-name my-scaling-policy --policy-type TargetTrackingScaling \n--estimated-instance-warmup 360 \n--target-tracking-configuration '{ "TargetValue": 70, "PredefinedMetricSpecification": { "PredefinedMetricType": "ASGAverageCPUUtilization" } }' \n--enabled
```

To describe a scaling policy (AWS CLI)

Use the `describe-policies` command to verify the enabled status of a scaling policy.

```
aws autoscaling describe-policies --auto-scaling-group-name my-asg \n--policy-names my-scaling-policy
```

The following is example output.

```
{
   "ScalingPolicies": [
   {
      "AutoScalingGroupName": "my-asg",
      "PolicyName": "my-scaling-policy",
      "PolicyType": "TargetTrackingScaling",
      "StepAdjustments": [],
      "Alarms": [
      {
         "AlarmName": "TargetTracking-my-asg-AlarmHigh-9ca53fdd-7cf5-4223-938a-a6e1199204502",
      },
      {
         "AlarmName": "TargetTracking-my-asg-AlarmLow-7010c83d-d55a-4a7a-abe0-1cf8b9de66dc",
      }
      ],
      "TargetTrackingConfiguration": {
         "PredefinedMetricSpecification": {
            "PredefinedMetricType": "ASGAverageCPUUtilization"
         },
         "TargetValue": 70.0,
         "DisableScaleIn": false
      },
      "Enabled": true
   }
```
Delete a scaling policy

After you no longer need a scaling policy, you can delete it. Depending on the type of scaling policy, you might also need to delete the CloudWatch alarms. Deleting a target tracking scaling policy also deletes any associated CloudWatch alarms. Deleting a step scaling policy or a simple scaling policy deletes the underlying alarm action, but it does not delete the CloudWatch alarm, even if it no longer has an associated action.

To delete a scaling policy (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Automatic scaling tab, under Dynamic scaling policies, select the check box in the top right corner of the desired scaling policy.
4. Scroll to the top of the Dynamic scaling policies section, and choose Actions, Delete.
5. When prompted for confirmation, choose Yes, Delete.
6. (Optional) If you deleted a step scaling policy or a simple scaling policy, do the following to delete the CloudWatch alarm that was associated with the policy. You can skip these substeps to keep the alarm for future use.
   b. On the navigation pane, choose Alarms.
   c. Choose the alarm (for example, Step-Scaling-AlarmHigh-AddCapacity) and choose Action, Delete.
   d. When prompted for confirmation, choose Delete.

To get the scaling policies for an Auto Scaling group (AWS CLI)

Before you delete a scaling policy, use the following describe-policies command to see what scaling policies were created for the Auto Scaling group. You can use the output when deleting the policy and the CloudWatch alarms.

```bash
aws autoscaling describe-policies --auto-scaling-group-name my-asg
```

You can filter the results by the type of scaling policy using the --query parameter. This syntax for query works on Linux or macOS. On Windows, change the single quotes to double quotes.

```bash
aws autoscaling describe-policies --auto-scaling-group-name my-asg
--query 'ScalingPolicies[?PolicyType==`TargetTrackingScaling`]'
```

The following is example output.

```
[
    {
        "AutoScalingGroupName": "my-asg",
        "PolicyName": "cpu40-target-tracking-scaling-policy",
        "PolicyARN": "PolicyARN",
    }
]```
To delete your scaling policy (AWS CLI)

Use the following `delete-policy` command.

```
aws autoscaling delete-policy --auto-scaling-group-name my-asg \
    --policy-name cpu40-target-tracking-scaling-policy
```

To delete your CloudWatch alarm (AWS CLI)

For step and simple scaling policies, use the `delete-alarms` command to delete the CloudWatch alarm that was associated with the policy. You can skip this step to keep the alarm for future use. You can delete one or more alarms at a time. For example, use the following command to delete the Step-Scaling-AlarmHigh-AddCapacity and Step-Scaling-AlarmLow-RemoveCapacity alarms.

```
aws cloudwatch delete-alarms --alarm-name Step-Scaling-AlarmHigh-AddCapacity Step-Scaling-AlarmLow-RemoveCapacity
```

Example scaling policies for the AWS Command Line Interface (AWS CLI)

You can create scaling policies for Amazon EC2 Auto Scaling through the AWS Management Console, AWS CLI, or SDKs.

The following examples show how you can create scaling policies for Amazon EC2 Auto Scaling with the AWS CLI `put-scaling-policy` command. For introductory exercises for creating scaling policies from the AWS CLI, see Target tracking scaling policies (p. 169) and Step and simple scaling policies (p. 178).

Example 1: To apply a target tracking scaling policy with a predefined metric specification

```
aws autoscaling put-scaling-policy --policy-name cpu40-target-tracking-scaling-policy \ 
    --auto-scaling-group-name my-asg --policy-type TargetTrackingScaling \ 
    --target-tracking-configuration PredefinedMetricSpecification="PredefinedMetricType: ASGAverageCPUUtilization, TargetValue: 40.0, DisableScaleIn: false, Enabled: true"
```
Example 2: To apply a target tracking scaling policy with a customized metric specification

```bash
aws autoscaling put-scaling-policy --policy-name sqs100-target-tracking-scaling-policy
  --auto-scaling-group-name my-asg --policy-type TargetTrackingScaling
  --target-tracking-configuration file://config.json
{
  "TargetValue": 100.0,
  "CustomizedMetricSpecification": {
    "MetricName": "MyBacklogPerInstance",
    "Namespace": "MyNamespace",
    "Dimensions": [{
      "Name": "MyOptionalMetricDimensionName",
      "Value": "MyOptionalMetricDimensionValue"
    }],
    "Statistic": "Average",
    "Unit": "None"
  }
}
```

Example 3: To apply a target tracking scaling policy for scale out only

```bash
aws autoscaling put-scaling-policy --policy-name alb1000-target-tracking-scaling-policy
  --auto-scaling-group-name my-asg --policy-type TargetTrackingScaling
  --target-tracking-configuration file://config.json
{
  "TargetValue": 1000.0,
  "PredefinedMetricSpecification": {
    "PredefinedMetricType": "ALBRequestCountPerTarget",
    "ResourceLabel": "app/my-alb/778d41231b141a0f/targetgroup/my-alb-target-group/943f017f100becff"
  },
  "DisableScaleIn": true
}
```

Example 4: To apply a step scaling policy for scale out

```bash
aws autoscaling put-scaling-policy
  --auto-scaling-group-name my-asg
  --policy-name my-step-scale-out-policy
  --policy-type StepScaling
  --adjustment-type PercentChangeInCapacity
  --metric-aggregation-type Average
  --step-adjustments
  MetricIntervalLowerBound=10.0,MetricIntervalUpperBound=20.0,ScalingAdjustment=10
  MetricIntervalLowerBound=20.0,MetricIntervalUpperBound=30.0,ScalingAdjustment=20
  MetricIntervalLowerBound=30.0,MetricIntervalUpperBound=50.0,ScalingAdjustment=30
  --min-adjustment-magnitude 1
```

Record the policy's Amazon Resource Name (ARN). You need the ARN when you create the CloudWatch alarm.

Example 5: To apply a step scaling policy for scale in
Predictive scaling

Use predictive scaling to increase the number of EC2 instances in your Auto Scaling group in advance of daily and weekly patterns in traffic flows.

Predictive scaling is well suited for situations where you have:

- Cyclical traffic, such as high use of resources during regular business hours and low use of resources during evenings and weekends
- Recurring on-and-off workload patterns, such as batch processing, testing, or periodic data analysis
- Applications that take a long time to initialize, causing a noticeable latency impact on application performance during scale-out events

In general, if you have regular patterns of traffic increases and applications that take a long time to initialize, you should consider using predictive scaling. Predictive scaling can help you scale faster by launching capacity in advance of forecasted load, compared to using only dynamic scaling, which is reactive in nature. Predictive scaling can also potentially save you money on your EC2 bill by helping you avoid the need to overprovision capacity.

For example, consider an application that has high usage during business hours and low usage overnight. At the start of each business day, predictive scaling can add capacity before the first influx of traffic. This helps your application maintain high availability and performance when going from a period of lower utilization to a period of higher utilization. You don’t have to wait for dynamic scaling to react to changing traffic. You also don’t have to spend time reviewing your application’s load patterns and trying to schedule the right amount of capacity using scheduled scaling.
Use the AWS Management Console, the AWS CLI, or one of the SDKs to add a predictive scaling policy to any Auto Scaling group.

**How predictive scaling works**

Predictive scaling uses machine learning to predict capacity requirements based on historical data from CloudWatch. The machine learning algorithm consumes the available historical data and calculates capacity that best fits the historical load pattern, and then continuously learns based on new data to make future forecasts more accurate.

To use predictive scaling, you first create a scaling policy with a pair of metrics and a target utilization. Forecast creation starts immediately after you create your policy if there is at least 24 hours of historical data. Predictive scaling finds patterns in CloudWatch metric data from the previous 14 days to create an hourly forecast for the next 48 hours. Forecast data is updated every six hours based on the most recent CloudWatch metric data.

You can configure predictive scaling in *forecast only* mode so that you can evaluate the forecast before predictive scaling starts actively scaling capacity. You can then view the forecast and recent metric data from CloudWatch in graph form from the Amazon EC2 Auto Scaling console. You can also access forecast data by using the AWS CLI or one of the SDKs.

When you are ready to start scaling with predictive scaling, switch the policy from *forecast only* mode to *forecast and scale* mode. After you switch to *forecast and scale* mode, your Auto Scaling group starts scaling based on the forecast.

Using the forecast, Amazon EC2 Auto Scaling scales the number of instances at the beginning of each hour:

- If actual capacity is less than the predicted capacity, Amazon EC2 Auto Scaling scales out your Auto Scaling group so that its desired capacity is equal to the predicted capacity.
- If actual capacity is greater than the predicted capacity, Amazon EC2 Auto Scaling doesn't scale in capacity.
- The values that you set for the minimum and maximum capacity of the Auto Scaling group are adhered to if the predicted capacity is outside of this range.

**Best practices**

- Confirm whether predictive scaling is suitable for your workload. A workload is a good fit for predictive scaling if it exhibits recurring load patterns that are specific to the day of the week or the time of day. To check this, configure predictive scaling policies in *forecast only* mode and then refer to the
Create a predictive scaling policy (console)

You can create, view, and delete your predictive scaling policies with the Amazon EC2 Auto Scaling console.

Create a predictive scaling policy in the console (predefined metrics)

Use the following procedure to create a predictive scaling policy using predefined metrics (CPU, network I/O, or Application Load Balancer request count per target). The easiest way to create a predictive scaling policy is to use predefined metrics. If you prefer to use custom metrics instead, see Create a predictive scaling policy in the console (custom metrics) (p. 210).

If the Auto Scaling group is new, it must provide at least 24 hours of data before Amazon EC2 Auto Scaling can generate a forecast for it.

To create a predictive scaling policy

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up at the bottom of the page.
3. On the Automatic scaling tab, in Scaling policies, choose Create predictive scaling policy.
4. Enter a name for the policy.
5. Turn on Scale based on forecast to give Amazon EC2 Auto Scaling permission to start scaling right away.

   To keep the policy in forecast only mode, keep Scale based on forecast turned off.
6. For **Metrics**, choose your metrics from the list of options. Options include **CPU**, **Network In**, **Network Out**, **Application Load Balancer request count**, and **Custom metric pair**.

   If you chose **Application Load Balancer request count per target**, then choose a target group in **Target group**. **Application Load Balancer request count per target** is only supported if you have attached an Application Load Balancer target group to your Auto Scaling group.

   If you chose **Custom metric pair**, choose individual metrics from the drop-down lists for **Load metric** and **Scaling metric**.

7. For **Target utilization**, enter the target value that Amazon EC2 Auto Scaling should maintain. Amazon EC2 Auto Scaling scales out your capacity until the average utilization is at the target utilization, or until it reaches the maximum number of instances you specified.

<table>
<thead>
<tr>
<th>If your scaling metric is...</th>
<th>Then the target utilization represents...</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>The percentage of CPU that each instance should ideally use.</td>
</tr>
<tr>
<td>Network In</td>
<td>The average number of bytes per minute that each instance should ideally receive.</td>
</tr>
<tr>
<td>Network Out</td>
<td>The average number of bytes per minute that each instance should ideally send out.</td>
</tr>
<tr>
<td>Application Load Balancer request count per target</td>
<td>The average number of requests per minute that each instance should ideally receive.</td>
</tr>
</tbody>
</table>

8. (Optional) For **Pre-launch instances**, choose how far in advance you want your instances launched before the forecast calls for the load to increase.

9. (Optional) For **Max capacity behavior**, choose whether to let Amazon EC2 Auto Scaling scale out higher than the group's maximum capacity when predicted capacity exceeds the defined maximum. Turning on this setting lets scale out occur during periods when your traffic is forecasted to be at its highest.

10. (Optional) For **Buffer maximum capacity above the forecasted capacity**, choose how much additional capacity to use when the predicted capacity is close to or exceeds the maximum capacity. The value is specified as a percentage relative to the predicted capacity. For example, if the buffer is 10, this means a 10 percent buffer. Therefore, if the predicted capacity is 50 and the maximum capacity is 40, the effective maximum capacity is 55.

    If set to 0, Amazon EC2 Auto Scaling might scale capacity higher than the maximum capacity to equal but not exceed predicted capacity.

11. Choose **Create predictive scaling policy**.

### Create a predictive scaling policy in the console (custom metrics)

Use the following procedure to create a predictive scaling policy using custom metrics. Custom metrics can include other metrics provided by CloudWatch or metrics that you publish to CloudWatch. To use CPU, network I/O, or Application Load Balancer request count per target, see [Create a predictive scaling policy in the console (predefined metrics)](p. 209).

To create a predictive scaling policy using custom metrics, you must do the following:

- You must provide the raw queries that let Amazon EC2 Auto Scaling interact with the metrics in CloudWatch. For more information, see [Advanced predictive scaling policy configurations using custom metrics](p. 223). To be sure that Amazon EC2 Auto Scaling can extract the metric data from CloudWatch, confirm that each query is returning data points. Confirm this by using the CloudWatch console or the CloudWatch [GetMetricData](http://cloudwatch.amazon.com) API operation.
Note
We provide sample JSON payloads in the JSON editor in the Amazon EC2 Auto Scaling console.
These examples give you a reference for the key-value pairs that are required to add other
CloudWatch metrics provided by AWS or metrics that you previously published to
CloudWatch. You can use them as a starting point, then customize them for your needs.

- If you use any metric math, you must manually construct the JSON to fit your unique scenario.
  For more information, see Use metric math expressions (p. 226). Before using metric math in your policy,
  confirm that metric queries based on metric math expressions are valid and return a single time series.
  Confirm this by using the CloudWatch console or the CloudWatch GetMetricData API operation.

If you make an error in a query by providing incorrect data, such as the wrong Auto Scaling group name,
the forecast won’t have any data. For troubleshooting custom metric issues, see Considerations and troubleshooting (p. 230).

To create a predictive scaling policy

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up at the bottom of the page.
3. On the Automatic scaling tab, in Scaling policies, choose Create predictive scaling policy.
4. Enter a name for the policy.
5. Turn on Scale based on forecast to give Amazon EC2 Auto Scaling permission to start scaling right away.
   To keep the policy in forecast only mode, keep Scale based on forecast turned off.
6. For Metrics, choose Custom metric pair.
   a. For Load metric, choose Custom CloudWatch metric to use a custom metric. Construct the
      JSON payload that contains the load metric definition for the policy and paste it into the JSON
      editor box, replacing what is already in the box.
   b. For Scaling metric, choose Custom CloudWatch metric to use a custom metric. Construct the
      JSON payload that contains the scaling metric definition for the policy and paste it into the
      JSON editor box, replacing what is already in the box.
   c. (Optional) To add a custom capacity metric, select the check box for Add custom capacity
      metric. Construct the JSON payload that contains the capacity metric definition for the policy
      and paste it into the JSON editor box, replacing what is already in the box.
      You only need to enable this option to create a new time series for capacity if your capacity
      metric data spans multiple Auto Scaling groups. In this case, you must use metric math to
      aggregate the data into a single time series.
7. For Target utilization, enter the target value that Amazon EC2 Auto Scaling should maintain.
   Amazon EC2 Auto Scaling scales out your capacity until the average utilization is at the target
   utilization, or until it reaches the maximum number of instances you specified.
8. (Optional) For Pre-launch instances, choose how far in advance you want your instances launched
    before the forecast calls for the load to increase.
9. (Optional) For Max capacity behavior, choose whether to let Amazon EC2 Auto Scaling scale out
    higher than the group’s maximum capacity when predicted capacity exceeds the defined maximum.
    Turning on this setting lets scale out occur during periods when your traffic is forecasted to be at its
    highest.
10. (Optional) For Buffer maximum capacity above the forecasted capacity, choose how much
    additional capacity to use when the predicted capacity is close to or exceeds the maximum capacity.
The value is specified as a percentage relative to the predicted capacity. For example, if the buffer is 10, this means a 10 percent buffer. Therefore, if the predicted capacity is 50 and the maximum capacity is 40, the effective maximum capacity is 55.

If set to 0, Amazon EC2 Auto Scaling might scale capacity higher than the maximum capacity to equal but not exceed predicted capacity.

11. Choose Create predictive scaling policy.

Create a predictive scaling policy (AWS CLI)

Use the AWS CLI as follows to configure predictive scaling policies for your Auto Scaling group. For more information about the CloudWatch metrics you can specify for a predictive scaling policy, see PredictiveScalingMetricSpecification in the Amazon EC2 Auto Scaling API Reference.

Example 1: A predictive scaling policy that creates forecasts but doesn't scale

The following example policy shows a complete policy configuration that uses CPU utilization metrics for predictive scaling with a target utilization of 40. ForecastOnly mode is used by default, unless you explicitly specify which mode to use. Save this configuration in a file named config.json.

```json
{
   "MetricSpecifications": [
      {
         "TargetValue": 40,
         "PredefinedMetricPairSpecification": {
            "PredefinedMetricType": "ASGCPUPerUtilization"
         }
      }
   ]
}
```

To create the policy from the command line, run the `put-scaling-policy` command with the configuration file specified, as demonstrated in the following example.

```
aws autoscaling put-scaling-policy --policy-name cpu40-predictive-scaling-policy --auto-scaling-group-name my-asg --policy-type PredictiveScaling --predictive-scaling-configuration file://config.json
```

If successful, this command returns the policy's Amazon Resource Name (ARN).

```json
{
   "Alarms": []
}
```

Example 2: A predictive scaling policy that forecasts and scales

For a policy that allows Amazon EC2 Auto Scaling to forecast and scale, add the property Mode with a value of ForecastAndScale. The following example shows a policy configuration that uses Application Load Balancer request count metrics. The target utilization is 1000, and predictive scaling is set to ForecastAndScale mode.
Create a predictive scaling policy (AWS CLI)

To create this policy, run the `put-scaling-policy` command with the configuration file specified, as demonstrated in the following example.

```
aws autoscaling put-scaling-policy --policy-name alb1000-predictive-scaling-policy \  --auto-scaling-group-name my-asg --policy-type PredictiveScaling \  --predictive-scaling-configuration file://config.json
```

If successful, this command returns the policy's Amazon Resource Name (ARN).

```
{
   "Alarms": []
}
```

**Example 3: A predictive scaling policy that can scale higher than maximum capacity**

The following example shows how to create a policy that can scale higher than the group's maximum size limit when you need it to handle a higher than normal load. By default, Amazon EC2 Auto Scaling doesn't scale your EC2 capacity higher than your defined maximum capacity. However, it might be helpful to let it scale higher with slightly more capacity to avoid performance or availability issues.

To provide room for Amazon EC2 Auto Scaling to provision additional capacity when the capacity is predicted to be at or very close to your group's maximum size, specify the `MaxCapacityBreachBehavior` and `MaxCapacityBuffer` properties, as shown in the following example. You must specify `MaxCapacityBreachBehavior` with a value of `IncreaseMaxCapacity`. The maximum number of instances that your group can have depends on the value of `MaxCapacityBuffer`.

```
{
   "MetricSpecifications": [
      {
         "TargetValue": 70,
         "PredefinedMetricPairSpecification": {
            "PredefinedMetricType": "ASGCPUUtilization"
         }
      },
      {
         "MaxCapacityBreachBehavior": "IncreaseMaxCapacity",
         "MaxCapacityBuffer": 10
      }
   ]
}
```
In this example, the policy is configured to use a 10 percent buffer ("MaxCapacityBuffer": 10), so if the predicted capacity is 50 and the maximum capacity is 40, then the effective maximum capacity is 55. A policy that can scale capacity higher than the maximum capacity to equal but not exceed predicted capacity would have a buffer of 0 ("MaxCapacityBuffer": 0).

To create this policy, run the put-scaling-policy command with the configuration file specified, as demonstrated in the following example.

```
aws autoscaling put-scaling-policy --policy-name cpu70-predictive-scaling-policy \\
    --auto-scaling-group-name my-asg --policy-type PredictiveScaling \\
    --predictive-scaling-configuration file://config.json
```

If successful, this command returns the policy's Amazon Resource Name (ARN).

```
{
    "Alarms": []
}
```

### Limitations

- Predictive scaling requires 24 hours of metric history before it can generate forecasts.
- A core assumption of predictive scaling is that the Auto Scaling group is homogenous and all instances are of equal capacity. If this isn't true for your group, forecasted capacity can be inaccurate. Therefore, use caution when creating predictive scaling policies for mixed instances groups (p. 62), because instances of different types can be provisioned that are of unequal capacity. Following are some examples where the forecasted capacity will be inaccurate:
  - Your predictive scaling policy is based on CPU utilization, but the number of vCPUs on each Auto Scaling instance varies between instance types.
  - Your predictive scaling policy is based on network in or network out, but the network bandwidth throughput for each Auto Scaling instance varies between instance types. For example, the M5 and M5n instance types are similar, but the M5n instance type delivers significantly higher network throughput.

### Supported Regions

Amazon EC2 Auto Scaling supports predictive scaling policies in the following AWS Regions: US East (N. Virginia), US East (Ohio), US West (Oregon), US West (N. California), Africa (Cape Town), Canada (Central), EU (Frankfurt), EU (Ireland), EU (London), EU (Milan), EU (Paris), EU (Stockholm), Asia Pacific (Hong Kong), Asia Pacific (Jakarta), Asia Pacific (Mumbai), Asia Pacific (Osaka), Asia Pacific (Tokyo), Asia Pacific (Singapore), Asia Pacific (Seoul), Asia Pacific (Sydney), Middle East (Bahrain), Middle East (UAE), South America (Sao Paulo), China (Beijing), China (Ningxia), AWS GovCloud (US-East), and AWS GovCloud (US-West).

### Evaluate your predictive scaling policies

Before you use a predictive scaling policy to scale your Auto Scaling group, review the recommendations and other data for your policy in the Amazon EC2 Auto Scaling console. This is important because you don't want a predictive scaling policy to scale your actual capacity until you know that its predictions are accurate.

If the Auto Scaling group is new, give Amazon EC2 Auto Scaling 24 hours to create the first forecast.
When Amazon EC2 Auto Scaling creates a forecast, it uses historical data. If your Auto Scaling group doesn't have much recent historical data yet, Amazon EC2 Auto Scaling might temporarily backfill the forecast with aggregates created from the currently available historical aggregates. Forecasts are backfilled for up to two weeks before a policy's creation date.

Contents
- View your predictive scaling recommendations (p. 215)
- Review predictive scaling monitoring graphs (p. 216)
- Monitor predictive scaling metrics with CloudWatch (p. 217)

View your predictive scaling recommendations

For effective analysis, Amazon EC2 Auto Scaling should have at least two predictive scaling policies to compare. (However, you can still review the findings for a single policy.) When you create multiple policies, you can evaluate a policy that uses one metric against a policy that uses a different metric. You can also evaluate the impact of different target value and metric combinations. After the predictive scaling policies are created, Amazon EC2 Auto Scaling immediately starts evaluating which policy would do a better job of scaling your group.

To view your recommendations in the Amazon EC2 Auto Scaling console
1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Auto scaling tab, under Predictive scaling policies, you can view details about a policy along with our recommendation. The recommendation tells you whether the predictive scaling policy does a better job than not using it.
   If you're unsure whether a predictive scaling policy is appropriate for your group, review the Availability impact and Cost impact columns to choose the right policy. The information for each column tells you what the impact of the policy is.

   - Availability impact: Describes whether the policy would avoid negative impact to availability by provisioning enough instances to handle the workload, compared to not using the policy.
   - Cost impact: Describes whether the policy would avoid negative impact on your costs by not over-provisioning instances, compared to not using the policy. By over-provisioning too much, your instances are underutilized or idle, which only adds to the cost impact.

   If you have multiple policies, then a Best prediction tag displays next to the name of the policy that gives the most availability benefits at lower cost. More weight is given to availability impact.
4. (Optional) To select the desired time period for recommendation results, choose your preferred value from the Evaluation period dropdown: 2 days, 1 week, 2 weeks, 4 weeks, 6 weeks, or 8 weeks. By default, the evaluation period is the last two weeks. A longer evaluation period provides more data points to the recommendation results. However, adding more data points might not improve the results if your load patterns have changed, such as after a period of exceptional demand. In this case, you can get a more focused recommendation by looking at more recent data.

   Note
   Recommendations are generated only for policies that are in Forecast only mode. The recommendations feature works better when a policy is in the Forecast only mode throughout the evaluation period. If you start a policy in Forecast and scale mode and switch it to Forecast
only mode later, the findings for that policy are likely to be biased. This is because the policy has already contributed toward the actual capacity.

**Review predictive scaling monitoring graphs**

In the Amazon EC2 Auto Scaling console, you can review the forecast of the previous days, weeks, or months to visualize how well the policy performs over time. You can also use this information to evaluate the accuracy of predictions when deciding whether to let a policy scale your actual capacity.

**To review predictive scaling monitoring graphs in the Amazon EC2 Auto Scaling console**

1. Choose a policy from the Predictive scaling policies list.
2. In the Monitoring section, you can view your policy's past and future forecasts for load and capacity against actual values. The Load graph shows load forecast and actual values for the load metric that you chose. The Capacity graph shows the number of instances predicted by the policy. It also includes the actual number of instances launched. The vertical line separates historical values from future forecasts. These graphs become available shortly after the policy is created.
3. (Optional) To change the amount of historical data shown in the chart, choose your preferred value from the Evaluation period dropdown at the top of the page. The evaluation period does not transform the data on this page in any way. It only changes the amount of historical data shown.

The following image shows the Load and Capacity graphs when forecasts have been applied multiple times. Predictive scaling forecasts load based on your historical load data. The load your application generates is represented as the sum of the CPU utilization, network in/out, received requests, or custom metric for each instance in the Auto Scaling group. Predictive scaling calculates future capacity needs based on the load forecast and the target utilization that you want to achieve for the scaling metric.

**Compare data in the Load graph**

Each horizontal line represents a different set of data points reported in one-hour intervals:

1. **Actual observed load** uses the SUM statistic for your chosen load metric to show the total hourly load in the past.
2. **Load predicted by the policy** shows the hourly load prediction. This prediction is based on the previous two weeks of actual load observations.

**Compare data in the Capacity graph**

Each horizontal line represents a different set of data points reported in one-hour intervals:
Evaluate your predictive scaling policies

1. **Actual observed capacity** shows your Auto Scaling group’s actual capacity in the past, which depends on your other scaling policies and minimum group size in effect for the selected time period.

2. **Capacity predicted by the policy** shows the baseline capacity that you can expect to have at the beginning of each hour when the policy is in Forecast and scale mode.

3. **Inferred required capacity** shows the ideal capacity to maintain the scaling metric at the target value you chose.

4. **Minimum capacity** shows the minimum capacity of the Auto Scaling group.

5. **Maximum capacity** shows the maximum capacity of the Auto Scaling group.

For the purpose of calculating the inferred required capacity, we begin by assuming that each instance is equally utilized at a specified target value. In practice, instances are not equally utilized. By assuming that utilization is uniformly spread between instances, however, we can make a likelihood estimate of the amount of capacity that is needed. The capacity requirement is then calculated to be inversely proportional to the scaling metric that you used for your predictive scaling policy. In other words, as capacity increases, the scaling metric decreases at the same rate. For example, if capacity doubles, the scaling metric must decrease by half.

The formula for the inferred required capacity:

\[ \text{sum of } \left( \frac{\text{actualCapacityUnits} \times \text{scalingMetricValue}}{\text{targetUtilization}} \right) \]

For example, we take the actualCapacityUnits (10) and the scalingMetricValue (30) for a given hour. We then take the targetUtilization that you specified in your predictive scaling policy (60) and calculate the inferred required capacity for the same hour. This returns a value of 5. This means that five is the inferred amount of capacity required to maintain capacity in direct inverse proportion to the target value of the scaling metric.

**Note**
Various levers are available for you to adjust and improve the cost savings and availability of your application.

- You use predictive scaling for the baseline capacity and dynamic scaling to handle additional capacity. Dynamic scaling works independently from predictive scaling, scaling in and out based on current utilization. First, Amazon EC2 Auto Scaling calculates the recommended number of instances for each dynamic scaling policy. Then, it scales based on the policy that provides the largest number of instances.
- To allow scale in to occur when the load decreases, your Auto Scaling group should always have at least one dynamic scaling policy with the scale-in portion enabled.
- You can improve scaling performance by making sure that your minimum and maximum capacity are not too restrictive. A policy with a recommended number of instances that does not fall within the minimum and maximum capacity range will be prevented from scaling in and out.

**Monitor predictive scaling metrics with CloudWatch**

Depending on your needs, you might prefer to access monitoring data for predictive scaling from Amazon CloudWatch instead of the Amazon EC2 Auto Scaling console. After you create a predictive scaling policy, the policy collects data that is used to forecast your future load and capacity. After this data is collected, it is automatically stored in CloudWatch at regular intervals. Then, you can use CloudWatch to visualize how well the policy performs over time. You can also create CloudWatch alarms to notify you when performance indicators change beyond the limits that you define in CloudWatch.

**Topics**

- [Visualize historical forecast data](p. 218)
- [Create accuracy metrics using metric math](p. 218)
Visualize historical forecast data

You can view the load and capacity forecast data for a predictive scaling policy in CloudWatch. This can be useful when visualizing forecasts against other CloudWatch metrics in a single graph. It can also help when viewing a broader time range so that you can see trends over time. You can access up to 15 months of historical metrics to get a better perspective on how your policy is performing.

For more information, see Predictive scaling metrics and dimensions (p. 311).

To view historical forecast data using the CloudWatch console

2. In the navigation pane, choose Metrics and then All metrics.
3. Choose the Auto Scaling metric namespace.
4. Choose one of the following options to view either the load forecast or capacity forecast metrics:
   - Predictive Scaling Load Forecasts
   - Predictive Scaling Capacity Forecasts
5. In the search field, enter the name of the predictive scaling policy or the name of the Auto Scaling group, and then press Enter to filter the results.
6. To graph a metric, select the check box next to the metric. To change the name of the graph, choose the pencil icon. To change the time range, select one of the predefined values or choose custom. For more information, see Graphing a metric in the Amazon CloudWatch User Guide.
7. To change the statistic, choose the Graphed metrics tab. Choose the column heading or an individual value, and then choose a different statistic. Although you can choose any statistic for each metric, not all statistics are useful for PredictiveScalingLoadForecast and PredictiveScalingCapacityForecast metrics. For example, the Average, Minimum, and Maximum statistics are useful, but the Sum statistic is not.
8. To add another metric to the graph, under Browse, choose All, find the specific metric, and then select the check box next to it. You can add up to 10 metrics.

   For example, to add the actual values for CPU utilization to the graph, choose the EC2 namespace and then choose By Auto Scaling Group. Then, select the check box for the CPUUtilization metric and the specific Auto Scaling group.
9. (Optional) To add the graph to a CloudWatch dashboard, choose Actions, Add to dashboard.

Create accuracy metrics using metric math

With metric math, you can query multiple CloudWatch metrics and use math expressions to create new time series based on these metrics. You can visualize the resulting time series on the CloudWatch console and add them to dashboards. For more information about metric math, see Using metric math in the Amazon CloudWatch User Guide.

Using metric math, you can graph the data that Amazon EC2 Auto Scaling generates for predictive scaling in different ways. This helps you monitor policy performance over time, and helps you understand whether your combination of metrics can be improved.

For example, you can use a metric math expression to monitor the mean absolute percentage error (MAPE). The MAPE metric helps monitor the difference between the forecasted values and the actual values observed during a given forecast window. Changes in the value of MAPE can indicate whether the policy's performance is degrading over time as the nature of your application changes. An increase in MAPE signals a wider gap between the forecasted values and the actual values.

Example: Metric math expression
To get started with this type of graph, you can create a metric math expression like the one shown in the following example.

```json
{
    "MetricDataQueries": [
        {
            "Expression": "TIME_SERIES(AVG(ABS(m1-m2)/m1))",
            "Id": "e1",
            "Period": 3600,
            "Label": "MeanAbsolutePercentageError",
            "ReturnData": true
        },
        {
            "Id": "m1",
            "Label": "ActualLoadValues",
            "MetricStat": {
                "Metric": {
                    "Namespace": "AWS/EC2",
                    "MetricName": "CPUUtilization",
                    "Dimensions": [
                        {
                            "Name": "AutoScalingGroupName",
                            "Value": "my-asg"
                        }
                    ],
                    "Period": 3600,
                    "Stat": "Sum"
                },
                "ReturnData": false
            },
            "Id": "m2",
            "Label": "ForecastedLoadValues",
            "MetricStat": {
                "Metric": {
                    "Namespace": "AWS/AutoScaling",
                    "MetricName": "PredictiveScalingLoadForecast",
                    "Dimensions": [
                        {
                            "Name": "AutoScalingGroupName",
                            "Value": "my-asg"
                        },
                        {
                            "Name": "PolicyName",
                            "Value": "my-predictive-scaling-policy"
                        },
                        {
                            "Name": "PairIndex",
                            "Value": "0"
                        }
                    ],
                    "Period": 3600,
                    "Stat": "Average"
                },
                "ReturnData": false
            }
        }
    ]
}
```

Instead of a single metric, there is an array of metric data query structures for `MetricDataQueries`. Each item in `MetricDataQueries` gets a metric or performs a math expression. The first item, e1, is the...
math expression. The designated expression sets the ReturnData parameter to true, which ultimately produces a single time series. For all other metrics, the ReturnData value is false.

In the example, the designated expression uses the actual and forecasted values as input and returns the new metric (MAPE). \( m_1 \) is the CloudWatch metric that contains the actual load values (assuming CPU utilization is the load metric that was originally specified for the policy named my-predictive-scaling-policy). \( m_2 \) is the CloudWatch metric that contains the forecasted load values. The math syntax for the MAPE metric is as follows:

\[
\text{Average of } \left( \frac{|\text{Actual} - \text{Forecast}|}{\text{Actual}} \right)
\]

**Visualize your accuracy metrics and set alarms**

To visualize the accuracy metric data, select the **Metrics** tab in the CloudWatch console. You can graph the data from there. For more information, see [Adding a math expression to a CloudWatch graph](https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/MetricsGraph.html) in the Amazon CloudWatch User Guide.

You can also set an alarm on a metric that you’re monitoring from the **Metrics** section. While on the **Graphed metrics** tab, select the **Create alarm** icon under the **Actions** column. The **Create alarm** icon is represented as a small bell. For more information, see [Creating a CloudWatch alarm based on a metric math expression](https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/CreateMetricAlarm.html) in the Amazon CloudWatch User Guide. For information about receiving alerts with Amazon SNS, see [Setting up Amazon SNS notifications](https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/SendMetricsToSNS.html) in the Amazon CloudWatch User Guide.

Alternatively, you can use **GetMetricData** and **PutMetricAlarm** to perform calculations using metric math and create alarms based on the output.

**Override forecast values using scheduled actions**

Sometimes, you might have additional information about your future application requirements that the forecast calculation is unable to take into account. For example, forecast calculations might underestimate the capacity needed for an upcoming marketing event. You can use scheduled actions to temporarily override the forecast during future time periods. The scheduled actions can run on a recurring basis, or at a specific date and time when there are one-time demand fluctuations.

For example, you can create a scheduled action with a higher minimum capacity than what is forecasted. At runtime, Amazon EC2 Auto Scaling updates the minimum capacity of your Auto Scaling group. Because predictive scaling optimizes for capacity, a scheduled action with a minimum capacity that is higher than the forecast values is honored. This prevents capacity from being less than expected. To stop overriding the forecast, use a second scheduled action to return the minimum capacity to its original setting.

The following procedure outlines the steps for overriding the forecast during future time periods.

**Contents**

- [Step 1: (Optional) Analyze time series data (p. 220)](#)
- [Step 2: Create two scheduled actions (p. 222)](#)

**Step 1: (Optional) Analyze time series data**

Start by analyzing the forecast time series data. This is an optional step, but it is helpful if you want to understand the details of the forecast.

1. **Retrieve the forecast**

   After the forecast is created, you can query for a specific time period in the forecast. The goal of the query is to get a complete view of the time series data for a specific time period.
Your query can include up to two days of future forecast data. If you have been using predictive scaling for a while, you can also access your past forecast data. However, the maximum time duration between the start and end time is 30 days.

To get the forecast using the `get-predictive-scaling-forecast` AWS CLI command, provide the following parameters in the command:

- Enter the name of the Auto Scaling group in the `--auto-scaling-group-name` parameter.
- Enter the name of the policy in the `--policy-name` parameter.
- Enter the start time in the `--start-time` parameter to return only forecast data for after or at the specified time.
- Enter the end time in the `--end-time` parameter to return only forecast data for before the specified time.

```
aws autoscaling get-predictive-scaling-forecast --auto-scaling-group-name my-asg
   --policy-name cpu40-predictive-scaling-policy
   --start-time "2021-05-19T17:00:00Z"
   --end-time "2021-05-19T23:00:00Z"
```

If successful, the command returns data similar to the following example.

```
{
   "LoadForecast": [
      {
         "Timestamps": [
            "2021-05-19T17:00:00+00:00",
            "2021-05-19T18:00:00+00:00",
            "2021-05-19T19:00:00+00:00",
            "2021-05-19T20:00:00+00:00",
            "2021-05-19T21:00:00+00:00",
            "2021-05-19T22:00:00+00:00",
            "2021-05-19T23:00:00+00:00"
         ],
         "Values": [
            153.0655799339254,
            128.8288551285919,
            107.1179447150675,
            197.3601844551528,
            626.4039934516954,
            596.9441277518481,
            677.9675713779869
         ],
         "MetricSpecification": {
            "TargetValue": 40.0,
            "PredefinedMetricPairSpecification": {
               "PredefinedMetricType": "ASGCPUUtilization"
            }
         }
      }],
   "CapacityForecast": [
      "Timestamps": [
         "2021-05-19T17:00:00+00:00",
         "2021-05-19T18:00:00+00:00",
         "2021-05-19T19:00:00+00:00",
         "2021-05-19T20:00:00+00:00",
         "2021-05-19T21:00:00+00:00",
         "2021-05-19T22:00:00+00:00",
         "2021-05-19T23:00:00+00:00"
      ]
   ]
}
```
The response includes two forecasts: LoadForecast and CapacityForecast. LoadForecast shows the hourly load forecast. CapacityForecast shows forecast values for the capacity that is needed on an hourly basis to handle the forecasted load while maintaining a TargetValue of 40.0 (40% average CPU utilization).

2. **Identify the target time period**

   Identify the hour or hours when the one-time demand fluctuation should take place. Remember that dates and times shown in the forecast are in UTC.

**Step 2: Create two scheduled actions**

Next, create two scheduled actions for a specific time period when your application will have a higher than forecasted load. For example, if you have a marketing event that will drive traffic to your site for a limited period of time, you can schedule a one-time action to update the minimum capacity when it starts. Then, schedule another action to return the minimum capacity to the original setting when the event ends.

**To create two scheduled actions for one-time events (console)**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the **Automatic scaling** tab, in **Scheduled actions**, choose **Create scheduled action**.
4. Fill in the following scheduled action settings:
   a. Enter a **Name** for the scheduled action.
   b. For **Min**, enter the new minimum capacity for your Auto Scaling group. The **Min** must be less than or equal to the maximum size of the group. If your value for **Min** is greater than group's maximum size, you must update **Max**.
   c. For **Recurrence**, choose **Once**.
   d. For **Time zone**, choose a time zone. If no time zone is chosen, ETC/UTC is used by default.
   e. Define a **Specific start time**.
5. Choose **Create**.
   
   The console displays the scheduled actions for the Auto Scaling group.
6. Configure a second scheduled action to return the minimum capacity to the original setting at the end of the event. Predictive scaling can scale capacity only when the value you set for **Min** is lower than the forecast values.
To create two scheduled actions for one-time events (AWS CLI)

To use the AWS CLI to create the scheduled actions, use the `put-scheduled-update-group-action` command.

For example, let's define a schedule that maintains a minimum capacity of three instances on May 19 at 5:00 PM for eight hours. The following commands show how to implement this scenario.

The first `put-scheduled-update-group-action` command instructs Amazon EC2 Auto Scaling to update the minimum capacity of the specified Auto Scaling group at 5:00 PM UTC on May 19, 2021.

```plaintext
aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-event-start --auto-scaling-group-name my-asg --start-time "2021-05-19T17:00:00Z" --minimum-capacity 3
```

The second command instructs Amazon EC2 Auto Scaling to set the group's minimum capacity to one at 1:00 AM UTC on May 20, 2021.

```plaintext
aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-event-end --auto-scaling-group-name my-asg --start-time "2021-05-20T01:00:00Z" --minimum-capacity 1
```

After you add these scheduled actions to the Auto Scaling group, Amazon EC2 Auto Scaling does the following:

- At 5:00 PM UTC on May 19, 2021, the first scheduled action runs. If the group currently has fewer than three instances, the group scales out to three instances. During this time and for the next eight hours, Amazon EC2 Auto Scaling can continue to scale out if the predicted capacity is higher than the actual capacity or if there is a dynamic scaling policy in effect.
- At 1:00 AM UTC on May 20, 2021, the second scheduled action runs. This returns the minimum capacity to its original setting at the end of the event.

Scaling based on recurring schedules

To override the forecast for the same time period every week, create two scheduled actions and provide the time and date logic using a cron expression.

The cron expression format consists of five fields separated by spaces: [Minute] [Hour] [Day_of_Month] [Month_of_Year] [Day_of_Week]. Fields can contain any allowed values, including special characters.

For example, the following cron expression runs the action every Tuesday at 6:30 AM. The asterisk is used as a wildcard to match all values for a field.

```plaintext
30 6 * * 2
```

See also

For more information about how to create, list, edit, and delete scheduled actions, see Scheduled scaling for Amazon EC2 Auto Scaling (p. 231).

Advanced predictive scaling policy configurations using custom metrics

In a predictive scaling policy, you can use predefined or custom metrics. Custom metrics are useful when the predefined metrics (CPU, network I/O, and Application Load Balancer request count) do not sufficiently describe your application load.
When creating a predictive scaling policy with custom metrics, you can specify other CloudWatch metrics provided by AWS, or you can specify metrics that you define and publish yourself. You can also use metric math to aggregate and transform existing metrics into a new time series that AWS doesn't automatically track. When you combine values in your data, for example, by calculating new sums or averages, it's called aggregating. The resulting data is called an aggregate.

The following section contains best practices and examples of how to construct the JSON structure for the policy.

Contents

• Best practices (p. 224)
• Prerequisites (p. 224)
• Constructing the JSON for custom metrics (p. 225)
• Considerations and troubleshooting (p. 230)
• Limitations (p. 231)

Best practices

The following best practices can help you use custom metrics more effectively:

• For the load metric specification, the most useful metric is a metric that represents the load on an Auto Scaling group as a whole, regardless of the group's capacity.

• For the scaling metric specification, the most useful metric to scale by is an average throughput or utilization per instance metric.

• The scaling metric must be inversely proportional to capacity. That is, if the number of instances in the Auto Scaling group increases, the scaling metric should decrease by roughly the same proportion. To ensure that predictive scaling behaves as expected, the load metric and the scaling metric must also correlate strongly with each other.

• The target utilization must match the type of scaling metric. For a policy configuration that uses CPU utilization, this is a target percentage. For a policy configuration that uses throughput, such as the number of requests or messages, this is the target number of requests or messages per instance during any one-minute interval.

• If these recommendations are not followed, the forecasted future values of the time series will probably be incorrect. To validate that the data is correct, you can view the forecasted values in the Amazon EC2 Auto Scaling console. Alternatively, after you create your predictive scaling policy, inspect the LoadForecast and CapacityForecast objects returned by a call to the GetPredictiveScalingForecast API.

• We strongly recommend that you configure predictive scaling in forecast only mode so that you can evaluate the forecast before predictive scaling starts actively scaling capacity.

Prerequisites

To add custom metrics to your predictive scaling policy, you must have cloudwatch:GetMetricData permissions.

To specify your own metrics instead of the metrics that AWS provides, you must first publish your metrics to CloudWatch. For more information, see Publishing custom metrics in the Amazon CloudWatch User Guide.

If you publish your own metrics, make sure to publish the data points at a minimum frequency of five minutes. Amazon EC2 Auto Scaling retrieves the data points from CloudWatch based on the length of
the period that it needs. For example, the load metric specification uses hourly metrics to measure the load on your application. CloudWatch uses your published metric data to provide a single data value for any one-hour period by aggregating all data points with timestamps that fall within each one-hour period.

Constructing the JSON for custom metrics

The following section contains examples for how to configure predictive scaling to query data from CloudWatch. There are two different methods to configure this option, and the method that you choose affects which format you use to construct the JSON for your predictive scaling policy. When you use metric math, the format of the JSON varies further based on the metric math being performed.

1. To create a policy that gets data directly from other CloudWatch metrics provided by AWS or metrics that you publish to CloudWatch, see Example predictive scaling policy with custom load and scaling metrics (AWS CLI) (p. 225).
2. To create a policy that can query multiple CloudWatch metrics and use math expressions to create new time series based on these metrics, see Use metric math expressions (p. 226).

Example predictive scaling policy with custom load and scaling metrics (AWS CLI)

To create a predictive scaling policy with custom load and scaling metrics with the AWS CLI, store the arguments for --predictive-scaling-configuration in a JSON file named config.json.

You start adding custom metrics by replacing the replaceable values in the following example with those of your metrics and your target utilization.

```json
{
    "MetricSpecifications": [
    {
        "TargetValue": 50,
        "CustomizedScalingMetricSpecification": {
            "MetricDataQueries": [
            {
                "MetricStat": {
                    "Metric": {
                        "MetricName": "MyUtilizationMetric",
                        "Namespace": "MyNameSpace",
                        "Dimensions": [
                            {
                                "Name": "MyOptionalMetricDimensionName",
                                "Value": "MyOptionalMetricDimensionValue"
                            }
                        ]
                    },
                    "Stat": "Average"
                }
            }
        },
        "CustomizedLoadMetricSpecification": {
            "MetricDataQueries": [
            {
                "MetricStat": {
                    "Metric": {
                        "MetricName": "MyLoadMetric",
                        "Namespace": "MyNameSpace",
                        "Dimensions": [
                            {
                                "Name": "MyOptionalMetricDimensionName",
                                "Value": "MyOptionalMetricDimensionValue"
                            }
                        ]
                    },
                    "Stat": "Average"
                }
            }
        }
    }
}
Use custom metrics

"Value": "MyOptionalMetricDimensionValue"
}
]
"Stat": "Sum"
}
]
]
]
]

For more information, see MetricDataQuery in the Amazon EC2 Auto Scaling API Reference.

Note
Following are some additional resources that can help you find metric names, namespaces, dimensions, and statistics for CloudWatch metrics:

- For information about the available metrics for AWS services, see AWS services that publish CloudWatch metrics in the Amazon CloudWatch User Guide.
- To get the exact metric name, namespace, and dimensions (if applicable) for a CloudWatch metric with the AWS CLI, see list-metrics.

To create this policy, run the put-scaling-policy command using the JSON file as input, as demonstrated in the following example.

```
aws autoscaling put-scaling-policy --policy-name my-predictive-scaling-policy \
--auto-scaling-group-name my-asg --policy-type PredictiveScaling \
--predictive-scaling-configuration file://config.json
```

If successful, this command returns the policy's Amazon Resource Name (ARN).

```
{
  "Alarms": []
}
```

Use metric math expressions

The following section provides information and examples of predictive scaling policies that show how you can use metric math in your policy.

Contents

- Understand metric math (p. 226)
- Example predictive scaling policy that combines metrics using metric math (AWS CLI) (p. 227)
- Example predictive scaling policy to use in a blue/green deployment scenario (AWS CLI) (p. 229)

Understand metric math

If all you want to do is aggregate existing metric data, CloudWatch metric math saves you the effort and cost of publishing another metric to CloudWatch. You can use any metric that AWS provides, and you can also use metrics that you define as part of your applications. For example, you might want to calculate the Amazon SQS queue backlog per instance. You can do this by taking the approximate number of
messages available for retrieval from the queue and dividing that number by the Auto Scaling group's running capacity.

For more information, see Using metric math in the Amazon CloudWatch User Guide.

If you choose to use a metric math expression in your predictive scaling policy, consider the following points:

• Metric math operations use the data points of the unique combination of metric name, namespace, and dimension keys/value pairs of metrics.
• You can use any arithmetic operator (+ - * / ^), statistical function (such as AVG or SUM), or other function that CloudWatch supports.
• You can use both metrics and the results of other math expressions in the formulas of the math expression.
• Your metric math expressions can be made up of different aggregations. However, it's a best practice for the final aggregation result to use Average for the scaling metric and Sum for the load metric.
• Any expressions used in a metric specification must eventually return a single time series.

To use metric math, do the following:

• Choose one or more CloudWatch metrics. Then, create the expression. For more information, see Using metric math in the Amazon CloudWatch User Guide.
• Verify that the metric math expression is valid by using the CloudWatch console or the CloudWatch GetMetricData API.

Example predictive scaling policy that combines metrics using metric math (AWS CLI)

Sometimes, instead of specifying the metric directly, you might need to first process its data in some way. For example, you might have an application that pulls work from an Amazon SQS queue, and you might want to use the number of items in the queue as criteria for predictive scaling. The number of messages in the queue does not solely define the number of instances that you need. Therefore, more work is needed to create a metric that can be used to calculate the backlog per instance. For more information, see Scaling based on Amazon SQS (p. 196).

The following is an example predictive scaling policy for this scenario. It specifies scaling and load metrics that are based on the Amazon SQS ApproximateNumberOfMessagesVisible metric, which is the number of messages available for retrieval from the queue. It also uses the Amazon EC2 Auto Scaling GroupInServiceInstances metric and a math expression to calculate the backlog per instance for the scaling metric.

```
aws autoscaling put-scaling-policy --policy-name my-sqs-custom-metrics-policy
--auto-scaling-group-name my-asg --policy-type PredictiveScaling
--predictive-scaling-configuration file:///config.json
{
  "MetricSpecifications": [
    {
      "TargetValue": 100,
      "CustomizedScalingMetricSpecification": {
        "MetricDataQueries": [
          {
            "Label": "Get the queue size (the number of messages waiting to be processed)",
            "Id": "queue_size",
            "MetricStat": {
              "Metric": {
                "MetricName": "ApproximateNumberOfMessagesVisible",
                "Namespace": "AWS/SQS",
```
"Dimensions": [
    {
        "Name": "QueueName",
        "Value": "my-queue"
    }
],
"Stat": "Sum",
"ReturnData": false,
{
    "Label": "Get the group size (the number of running instances)",
    "Id": "running_capacity",
    "MetricStat": {
        "Metric": {
            "MetricName": "GroupInServiceInstances",
            "Namespace": "AWS/AutoScaling",
            "Dimensions": [
                {
                    "Name": "AutoScalingGroupName",
                    "Value": "my-asg"
                }
            ]
        },
        "Stat": "Sum",
        "ReturnData": false
    }
},
{
    "Label": "Calculate the backlog per instance",
    "Id": "scaling_metric",
    "Expression": "queue_size / running_capacity",
    "ReturnData": true
}
],
"CustomizedLoadMetricSpecification": {
    "MetricDataQueries": {
        "Id": "load_metric",
        "MetricStat": {
            "Metric": {
                "MetricName": "ApproximateNumberOfMessagesVisible",
                "Namespace": "AWS/SQS",
                "Dimensions": [
                    {
                        "Name": "QueueName",
                        "Value": "my-queue"
                    }
                ],
                "Stat": "Sum",
                "ReturnData": true
            }
        }
    }
}

The example returns the policy's ARN.
Use custom metrics

"Alarms": []
}

Example predictive scaling policy to use in a blue/green deployment scenario (AWS CLI)

A search expression provides an advanced option in which you can query for a metric from multiple Auto Scaling groups and perform math expressions on them. This is especially useful for blue/green deployments.

Note

A blue/green deployment is a deployment method in which you create two separate but identical Auto Scaling groups. Only one of the groups receives production traffic. User traffic is initially directed to the earlier ("blue") Auto Scaling group, while a new group ("green") is used for testing and evaluation of a new version of an application or service. User traffic is shifted to the green Auto Scaling group after a new deployment is tested and accepted. You can then delete the blue group after the deployment is successful.

When new Auto Scaling groups get created as part of a blue/green deployment, the metric history of each group can be automatically included in the predictive scaling policy without you having to change its metric specifications. For more information, see Using EC2 Auto Scaling predictive scaling policies with Blue/Green deployments on the AWS Compute Blog.

The following example policy shows how this can be done. In this example, the policy uses the CPUUtilization metric emitted by Amazon EC2. It uses the Amazon EC2 Auto Scaling GroupInServiceInstances metric and a math expression to calculate the value of the scaling metric per instance. It also specifies a capacity metric specification to get the GroupInServiceInstances metric.

The search expression finds the CPUUtilization of instances in multiple Auto Scaling groups based on the specified search criteria. If you later create a new Auto Scaling group that matches the same search criteria, the CPUUtilization of the instances in the new Auto Scaling group is automatically included.

```bash
aws autoscaling put-scaling-policy --policy-name my-blue-green-predictive-scaling-policy
--auto-scaling-group-name my-asg --policy-type PredictiveScaling
--predictive-scaling-configuration file://config.json
{
  "MetricSpecifications": [
    {
      "TargetValue": 25,
      "CustomizedScalingMetricSpecification": {
        "MetricDataQueries": [
          {
            "Id": "load_sum",
            "Expression": "SUM(SEARCH('{AWS/EC2,AutoScalingGroupName} MetricName="CPUUtilization" ASG-myapp', 'Sum', 300))",
            "ReturnData": false
          },
          {
            "Id": "capacity_sum",
            "Expression": "SUM(SEARCH('{AWS/AutoScaling,AutoScalingGroupName} MetricName="GroupInServiceInstances" ASG-myapp', 'Average', 300))",
            "ReturnData": false
          },
          {
            "Id": "weighted_average",
            "Expression": "load_sum / capacity_sum",
            "ReturnData": true
          }
        ]
      }
    }
  ]
}```
Use custom metrics

The example returns the policy's ARN.

```
{
  "Alarms": []
}
```

Considerations and troubleshooting

If an issue occurs while using custom metrics, we recommend that you do the following:

- If an error message is provided, read the message and resolve the issue it reports, if possible.
- If an issue occurs when you are trying to use a search expression in a blue/green deployment scenario, first make sure that you understand how to create a search expression that looks for a partial match instead of an exact match. Also, check that your query finds only the Auto Scaling groups that are running the specific application. For more information about the search expression syntax, see CloudWatch search expression syntax in the Amazon CloudWatch User Guide.
- If you did not validate an expression in advance, the put-scaling-policy command validates it when you create your scaling policy. However, there is a possibility that this command might fail to identify the exact cause of the detected errors. To fix the issues, troubleshoot the errors that you receive in a response from a request to the get-metric-data command. You can also troubleshoot the expression from the CloudWatch console.
- When you view your Load and Capacity graphs in the console, the Capacity graph might not show any data. To ensure that the graphs have complete data, make sure that you consistently enable group metrics for your Auto Scaling groups. For more information, see Enable Auto Scaling group metrics (console) (p. 312).
- The capacity metric specification is only useful for blue/green deployments when you have applications that run in different Auto Scaling groups over their lifetime. This custom metric lets you provide the total capacity of multiple Auto Scaling groups. Predictive scaling uses this to show historical data in the Capacity graphs in the console.
- You must specify false for ReturnData if MetricDataQueries specifies the SEARCH() function on its own without a math function like SUM(). This is because search expressions might return multiple time series, and a metric specification based on an expression can return only one time series.
Scheduled scaling helps you to set up your own scaling schedule according to predictable load changes. For example, let’s say that every week the traffic to your web application starts to increase on Wednesday, remains high on Thursday, and starts to decrease on Friday. You can configure a schedule for Amazon EC2 Auto Scaling to increase capacity on Wednesday and decrease capacity on Friday.

To use scheduled scaling, you create scheduled actions. Scheduled actions are performed automatically as a function of date and time. When you create a scheduled action, you specify when the scaling activity should occur and the new desired, minimum, and maximum sizes for the scaling action. You can create scheduled actions that scale one time only or that scale on a recurring schedule.

Contents

- Considerations (p. 231)
- Recurring schedules (p. 232)
- Create and manage scheduled actions (console) (p. 232)
- Create and manage scheduled actions (AWS CLI) (p. 234)
- Limitations (p. 236)

Considerations

When you create a scheduled action, keep the following in mind:

- A scheduled action sets the desired, minimum, and maximum sizes to what is specified by the scheduled action at the date and time specified. The request can optionally include only one of these sizes. For example, you can create a scheduled action with only the desired capacity specified. In some cases, however, you must include the minimum and maximum sizes to ensure that the new desired capacity that you specified in the action is not outside of these limits.

- By default, the recurring schedules that you set are in Coordinated Universal Time (UTC). You can change the time zone to correspond to your local time zone or a time zone for another part of your network. When you specify a time zone that observes Daylight Saving Time (DST), the action automatically adjusts for DST.

- You can temporarily turn off scheduled scaling for an Auto Scaling group by suspending the ScheduledActions process. This helps you prevent scheduled actions from being active without having to delete them. You can then resume scheduled scaling when you want to use it again. For more information, see Suspend and resume a process for an Auto Scaling group (p. 291).

- The order of execution for scheduled actions is guaranteed within the same group, but not for scheduled actions across groups.

- A scheduled action generally executes within seconds. However, the action might be delayed for up to two minutes from the scheduled start time. Because scheduled actions within an Auto Scaling group are executed in the order that they are specified, actions with scheduled start times close to each other can take longer to execute.
Recurring schedules

You can create scheduled actions that scale your Auto Scaling group on a recurring schedule.

To create a recurring schedule using the AWS CLI or an SDK, specify a cron expression and a time zone to describe when that scheduled action is to recur. You can optionally specify a date and time for the start time, the end time, or both.

To create a recurring schedule using the AWS Management Console, specify the recurrence pattern, time zone, start time, and optional end time of your scheduled action. All of the recurrence pattern options are based on cron expressions. Alternatively, you can write your own custom cron expression.

The supported cron expression format consists of five fields separated by white spaces: [Minute] [Hour] [Day_of_Month] [Month_of_Year] [Day_of_Week]. For example, the cron expression 30 6 * * 2 configures a scheduled action that recurs every Tuesday at 6:30 AM. The asterisk is used as a wildcard to match all values for a field. For other examples of cron expressions, see https://crontab.guru/examples.html. For information about writing your own cron expressions in this format, see Crontab.

Choose your start and end times carefully. Keep the following in mind:

- If you specify a start time, Amazon EC2 Auto Scaling performs the action at this time, and then performs the action based on the specified recurrence.
- If you specify an end time, the action stops repeating after this time. A scheduled action does not persist in your account once it has reached its end time.
- The start time and end time must be set in UTC when you use the AWS CLI or an SDK.

Create and manage scheduled actions (console)

Use the procedures in this section to create and manage scheduled actions using the AWS Management Console.

If you create a scheduled action using the console and specify a time zone that observes Daylight Saving Time (DST), both the recurring schedule and the start and end times automatically adjust for DST.

Create a scheduled action

Complete the following procedure to create a scheduled action to scale your Auto Scaling group.

To create a scheduled action for an Auto Scaling group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Automatic scaling tab, in Scheduled actions, choose Create scheduled action.
4. Enter a Name for the scheduled action.
5. For Desired capacity, Min, Max, choose the new desired size of the group and the new minimum and maximum capacity.
6. For Recurrence, choose one of the available options.
   - If you want to scale on a recurring schedule, choose how often Amazon EC2 Auto Scaling should run the scheduled action.
   - If you choose an option that begins with Every, the cron expression is created for you.
7. For **Time zone**, choose a time zone. The default is Etc/UTC.

   **Note**
   All of the time zones listed are from the IANA Time Zone database. For more information, see [https://en.wikipedia.org/wiki/List_of_tz_database_time_zones](https://en.wikipedia.org/wiki/List_of_tz_database_time_zones).

8. Define a date and time for **Specific start time**.

   - If you chose a recurring schedule, the start time defines when the first scheduled action in the recurring series runs.
   - If you chose **Once** as the recurrence, the start time defines the date and time for the schedule action to run.

9. (Optional) For recurring schedules, you can specify an end time by choosing **Set End Time** and then choosing a date and time for **End by**.

10. Choose **Create**. The console displays the scheduled actions for the Auto Scaling group.

### Verify the time, date, and time zone

To verify whether your time, date, and time zone are configured correctly, check the **Start time**, **End time**, and **Time zone** values in the **Scheduled actions** table on the **Automatic scaling** tab for your Auto Scaling group.

Amazon EC2 Auto Scaling shows the values for **Start time** and **End time** in your local time with the UTC offset in effect at the specified date and time. The UTC offset is the difference, in hours and minutes, from local time to UTC. The value for **Time zone** shows your requested time zone, for example, America/New_York.

Location-based time zones such as America/New_York automatically adjust for Daylight Savings Time (DST). However, a UTC-based time zone such as Etc/UTC is an absolute time and will not adjust for DST.

For example, you have a recurring schedule whose time zone is America/New_York. The first scaling action happens in the America/New_York time zone before DST starts. The next scaling action happens in the America/New_York time zone after DST starts. The first action starts at 8:00 AM UTC-5 in local time, while the second time starts at 8:00 AM UTC-4 in local time.

### Update a scheduled action

After creating a scheduled action, you can update any of its settings except the name.

**To update a scheduled action**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the **Automatic scaling** tab, in **Scheduled actions**, select a scheduled action.
4. Choose **Actions**, **Edit**.
5. Make the needed changes and choose **Save changes**.

### Delete a scheduled action

When you no longer need a scheduled action, you can delete it.
Create and manage scheduled actions (AWS CLI)

You can create and update scheduled actions that scale one time only or that scale on a recurring schedule using the `put-scheduled-update-group-action` command.

Create a scheduled action that occurs only once

To automatically scale your Auto Scaling group one time only, at a specified date and time, use the `--start-time "YYYY-MM-DDThh:mm:ssZ"` option.

Example: To scale out one time only

To increase the number of running instances in your Auto Scaling group at a specific time, use the following command.

At the date and time specified for `--start-time` (8:00 AM UTC on March 31, 2021), if the group currently has fewer than 3 instances, it scales out to 3 instances.

```
aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-one-time-action
  --auto-scaling-group-name my-asg --start-time "2021-03-31T08:00:00Z" --desired-capacity 3
```

Example: To scale in one time only

To decrease the number of running instances in your Auto Scaling group at a specific time, use the following command.

At the date and time specified for `--start-time` (4:00 PM UTC on March 31, 2021), if the group currently has more than 1 instance, it scales in to 1 instance.

```
aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-one-time-action
  --auto-scaling-group-name my-asg --start-time "2021-03-31T16:00:00Z" --desired-capacity 1
```

Create a scheduled action that runs on a recurring schedule

To schedule scaling on a recurring schedule, use the `--recurrence "cron expression"` option.

The following is an example of a scheduled action that specifies a cron expression.

On the specified schedule (every day at 9:00 AM UTC), if the group currently has fewer than 3 instances, it scales out to 3 instances. If the group currently has more than 3 instances, it scales in to 3 instances.
aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-recurring-action \ 
--auto-scaling-group-name my-asg --recurrence "0 9 * * *" --desired-capacity 3

Create a recurring scheduled action that specifies a time zone

Scheduled actions are set to the UTC time zone by default. To specify a different time zone, include the --time-zone option and specify the canonical name for the IANA time zone (America/New_York, for example). For more information, see https://en.wikipedia.org/wiki/List_of_tz_database_time_zones.

The following is an example that uses the --time-zone option when creating a recurring scheduled action to scale capacity.

On the specified schedule (every Monday through Friday at 6:00 PM local time), if the group currently has fewer than 2 instances, it scales out to 2 instances. If the group currently has more than 2 instances, it scales in to 2 instances.

aws autoscaling put-scheduled-update-group-action --scheduled-action-name my-recurring-action \ 
--auto-scaling-group-name my-asg --recurrence "0 18 * * 1-5" --time-zone "America/New_York" \ 
--desired-capacity 2

Describe scheduled actions

To describe the scheduled actions for an Auto Scaling group, use the following describe-scheduled-actions command.

aws autoscaling describe-scheduled-actions --auto-scaling-group-name my-asg

If successful, this command returns output similar to the following.

```json
{
    "ScheduledUpdateGroupActions": [
        {
            "AutoScalingGroupName": "my-asg",
            "ScheduledActionName": "my-recurring-action",
            "Recurrence": "30 0 1 1,6,12 **",
            "StartTime": "2020-12-01T00:30:00Z",
            "Time": "2020-12-01T00:30:00Z",
            "MinSize": 1,
            "MaxSize": 6,
            "DesiredCapacity": 4
        }
    ]
}
```

Delete a scheduled action

To delete a scheduled action, use the following delete-scheduled-action command.

aws autoscaling delete-scheduled-action --auto-scaling-group-name my-asg \ 
--scheduled-action-name my-recurring-action
Limitations

- The names of scheduled actions must be unique per Auto Scaling group.
- A scheduled action must have a unique time value. If you attempt to schedule an activity at a time when another scaling activity is already scheduled, the call is rejected and returns an error indicating that a scheduled action with this scheduled start time already exists.
- You can create a maximum of 125 scheduled actions per Auto Scaling group.

Amazon EC2 Auto Scaling lifecycle hooks

Amazon EC2 Auto Scaling offers the ability to add lifecycle hooks to your Auto Scaling groups. These hooks let you create solutions that are aware of events in the Auto Scaling instance lifecycle, and then perform a custom action on instances when the corresponding lifecycle event occurs. A lifecycle hook provides a specified amount of time (one hour by default) to wait for the action to complete before the instance transitions to the next state.

As an example of using lifecycle hooks with Auto Scaling instances:

- When a scale-out event occurs, your newly launched instance completes its startup sequence and transitions to a wait state. While the instance is in a wait state, it runs a script to download and install the needed software packages for your application, making sure that your instance is fully ready before it starts receiving traffic. When the script is finished installing software, it sends the `complete-lifecycle-action` command to continue.
- When a scale-in event occurs, a lifecycle hook pauses the instance before it is terminated and sends you a notification using Amazon EventBridge. While the instance is in the wait state, you can invoke an AWS Lambda function or connect to the instance to download logs or other data before the instance is fully terminated.

A popular use of lifecycle hooks is to control when instances are registered with Elastic Load Balancing. By adding a launch lifecycle hook to your Auto Scaling group, you can ensure that your bootstrap scripts have completed successfully and the applications on the instances are ready to accept traffic before they are registered to the load balancer at the end of the lifecycle hook.

Contents

- Lifecycle hook availability (p. 236)
- Considerations and limitations for lifecycle hooks (p. 237)
- Related resources (p. 238)
- How lifecycle hooks work (p. 238)
- Prepare to add a lifecycle hook to your Auto Scaling group (p. 240)
- Retrieve the target lifecycle state through instance metadata (p. 245)
- Add lifecycle hooks (p. 246)
- Complete a lifecycle action (p. 248)
- Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata (p. 250)
- Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255)

Lifecycle hook availability

The following table lists the lifecycle hooks available for various scenarios.
Considerations and limitations for lifecycle hooks

When working with lifecycle hooks, keep in mind the following notes and limitations:

- Amazon EC2 Auto Scaling provides its own lifecycle to help with the management of Auto Scaling groups. This lifecycle differs from that of other EC2 instances. For more information, see Amazon EC2 Auto Scaling instance lifecycle. Instances in a warm pool also have their own lifecycle, as described in Lifecycle state transitions for instances in a warm pool.

- You can use lifecycle hooks with Spot Instances, but a lifecycle hook does not prevent an instance from terminating in the event that capacity is no longer available, which can happen at any time with a two-minute interruption notice. For more information, see Spot Instance interruptions in the Amazon EC2 User Guide for Linux Instances. However, you can enable Capacity Rebalancing to proactively replace Spot Instances that have received a rebalance recommendation from the Amazon EC2 Spot service, a signal that is sent when a Spot Instance is at elevated risk of interruption. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions.

- Instances can remain in a wait state for a finite period of time. The default timeout for a lifecycle hook is one hour (heartbeat timeout). There is also a global timeout that specifies the maximum amount of time that you can keep an instance in a wait state. The global timeout is 48 hours or 100 times the heartbeat timeout, whichever is smaller.

- The result of the lifecycle hook can be either abandon or continue. If an instance is launching, continue indicates that your actions were successful, and that Amazon EC2 Auto Scaling can put the instance into service. Otherwise, abandon indicates that your custom actions were unsuccessful, and that we can terminate and replace the instance. If an instance is terminating, both abandon and continue allow the instance to terminate. However, abandon stops any remaining actions, such as other lifecycle hooks, and continue allows any other lifecycle hooks to complete.

- Amazon EC2 Auto Scaling limits the rate at which it allows instances to launch if the lifecycle hooks are failing consistently, so make sure to test and fix any permanent errors in your lifecycle actions.

- Creating and updating lifecycle hooks using the AWS CLI, AWS CloudFormation, or an SDK provides options not available when creating a lifecycle hook from the AWS Management Console. For example, the field to specify the ARN of an SNS topic or SQS queue doesn't appear in the console, because Amazon EC2 Auto Scaling already sends events to Amazon EventBridge. These events can be filtered and redirected to AWS services such as Lambda, Amazon SNS, and Amazon SQS as needed.

- You can add multiple lifecycle hooks to an Auto Scaling group while you are creating it, by calling the CreateAutoScalingGroup API using the AWS CLI, AWS CloudFormation, or an SDK. However, each hook must have the same notification target and IAM role, if specified. To create lifecycle hooks with different notification targets and different roles, create the lifecycle hooks one at a time in separate calls to the PutLifecycleHook API.
• If you add a lifecycle hook for instance launch, the health check grace period starts as soon as the instance reaches the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

**Scaling considerations**

• Dynamic scaling policies scale in and out in response to CloudWatch metric data, such as CPU and network I/O, that's aggregated across multiple instances. When scaling out, Amazon EC2 Auto Scaling doesn't immediately count a new instance towards the aggregated instance metrics of the Auto Scaling group. It waits until the instance reaches the InService state and the instance warmup has finished. For more information, see Scaling performance considerations (p. 188) in the default instance warmup topic.

• On scale in, the aggregated instance metrics might not instantly reflect the removal of a terminating instance. The terminating instance stops counting toward the group's aggregated instance metrics shortly after the Amazon EC2 Auto Scaling termination workflow begins.

• In most cases when lifecycle hooks are invoked, scaling activities due to simple scaling policies are paused until the lifecycle actions have completed and the cooldown period has expired. Setting a long interval for the cooldown period means that it will take longer for scaling to resume. For more information, see Lifecycle hooks can cause additional delays (p. 193) in the cooldown topic. In general, we recommend against using simple scaling policies if you can use either step scaling or target tracking scaling policies instead.

**Related resources**

For an introduction video, see AWS re:Invent 2018: Capacity Management Made Easy with Amazon EC2 Auto Scaling on YouTube.

We provide a few JSON and YAML template snippets that you can use to understand how to declare lifecycle hooks in your AWS CloudFormation stack templates. For more information, see the AWS::AutoScaling::LifecycleHook reference in the AWS CloudFormation User Guide.

You can also visit our GitHub repository to download example templates and user data scripts for lifecycle hooks.

For examples of the use of lifecycle hooks, see the following blog posts.

• Building a Backup System for Scaled Instances using Lambda and Amazon EC2 Run Command
• Run code before terminating an EC2 Auto Scaling instance.

**How lifecycle hooks work**

An Amazon EC2 instance transitions through different states from the time it launches until it is terminated. You can create custom actions for your Auto Scaling group to act when an instance transitions into a wait state due to a lifecycle hook.

The following illustration shows the transitions between Auto Scaling instance states.
As shown in the preceding diagram:

1. The Auto Scaling group responds to a scale-out event and begins launching an instance.
2. The lifecycle hook puts the instance into a wait state (Pending:Wait) and then performs a custom action.

   The instance remains in a wait state until you either complete the lifecycle action, or the timeout period ends. By default, the instance remains in a wait state for one hour, and then the Auto Scaling group continues the launch process (Pending:Proceed). If you need more time, you can restart the timeout period by recording a heartbeat. If you complete the lifecycle action when the custom action has completed and the timeout period hasn’t expired yet, the period ends and the Auto Scaling group continues the launch process.

3. The instance enters the InService state and the health check grace period starts. However, before the instance reaches the InService state, if the Auto Scaling group is associated with an Elastic Load Balancing load balancer, the instance is registered with the load balancer, and the load balancer starts checking its health. After the health check grace period ends, Amazon EC2 Auto Scaling begins checking the health state of the instance.

4. The Auto Scaling group responds to a scale-in event and begins terminating an instance. If the Auto Scaling group is being used with Elastic Load Balancing, the terminating instance is first deregistered from the load balancer. If connection draining is enabled for the load balancer, the instance stops accepting new connections and waits for existing connections to drain before completing the deregistration process.

5. The lifecycle hook puts the instance into a wait state (Terminating:Wait) and then performs a custom action.

   The instance remains in a wait state either until you complete the lifecycle action, or until the timeout period ends (one hour by default). After you complete the lifecycle hook or the timeout period expires, the instance transitions to the next state (Terminating:Proceed).

6. The instance is terminated.

   **Important**

   Instances in a warm pool also have their own lifecycle with corresponding wait states, as described in [Lifecycle state transitions for instances in a warm pool](p. 266).
Prepare to add a lifecycle hook to your Auto Scaling group

Before you add a lifecycle hook to your Auto Scaling group, be sure that your user data script or notification target is set up correctly.

- To use a user data script to perform custom actions on your instances as they are launching, you do not need to configure a notification target. However, you must have already created the launch template or launch configuration that specifies your user data script and associated it with your Auto Scaling group. For more information about user data scripts, see Run commands on your Linux instance at launch in the Amazon EC2 User Guide for Linux Instances.

- To signal Amazon EC2 Auto Scaling when the lifecycle action is complete, you must add the CompleteLifecycleAction API call to the script, and you must manually create an IAM role with a policy that allows Auto Scaling instances to call this API. Your launch template or launch configuration must specify this role using an IAM instance profile that gets attached to your Amazon EC2 instances at launch. For more information, see Complete a lifecycle action (p. 248) and IAM role for applications that run on Amazon EC2 instances (p. 417).

- To use a service such as Lambda to perform a custom action, you must have already created an EventBridge rule and specified a Lambda function as its target. For more information, see Configure a notification target for lifecycle notifications (p. 240).

- To allow Lambda to signal Amazon EC2 Auto Scaling when the lifecycle action is complete, you must add the CompleteLifecycleAction API call to the function code. You must also have attached an IAM policy to the function's execution role that gives Lambda permission to complete lifecycle actions. For more information, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255).

- To use a service such as a Amazon SNS or Amazon SQS to perform a custom action, you must have already created the SNS topic or SQS queue and have ready its Amazon Resource Name (ARN). You must also have already created the IAM role that gives Amazon EC2 Auto Scaling access to your SNS topic or SQS target and have ready its ARN. For more information, see Configure a notification target for lifecycle notifications (p. 240).

Note
By default, when you add a lifecycle hook in the console, Amazon EC2 Auto Scaling sends lifecycle event notifications to Amazon EventBridge. Using EventBridge or a user data script is a recommended best practice. To create a lifecycle hook that sends notifications directly to Amazon SNS or Amazon SQS, use the AWS CLI, AWS CloudFormation, or an SDK to add the lifecycle hook.

Configure a notification target for lifecycle notifications

You can add lifecycle hooks to an Auto Scaling group to perform custom actions when an instance enters a wait state. You can choose a target service to perform these actions depending on your preferred development approach.

The first approach uses Amazon EventBridge to invoke a Lambda function that performs the action you want. The second approach involves creating an Amazon Simple Notification Service (Amazon SNS) topic to which notifications are published. Clients can subscribe to the SNS topic and receive published messages using a supported protocol. The last approach involves using Amazon Simple Queue Service (Amazon SQS), a messaging system used by distributed applications to exchange messages through a polling model.

As a best practice, we recommend that you use EventBridge. The notifications sent to Amazon SNS and Amazon SQS contain the same information as the notifications that Amazon EC2 Auto Scaling sends to EventBridge. Before EventBridge, the standard practice was to send a notification to SNS or SQS and integrate another service with SNS or SQS to perform programmatic actions. Today, EventBridge gives
you more options for which services you can target and makes it easier to handle events using serverless architecture.

The following procedures cover how to set up your notification target.

Remember, if you have a user data script in your launch template or launch configuration that configures your instances when they launch, you do not need to receive notifications to perform custom actions on your instances.

Contents

- Route notifications to Lambda using EventBridge (p. 241)
- Receive notifications using Amazon SNS (p. 243)
- Receive notifications using Amazon SQS (p. 243)
- Notification message example for Amazon SNS and Amazon SQS (p. 244)

Important

The EventBridge rule, Lambda function, Amazon SNS topic, and Amazon SQS queue that you use with lifecycle hooks must always be in the same Region where you created your Auto Scaling group.

Route notifications to Lambda using EventBridge

You can configure an EventBridge rule to invoke a Lambda function when an instance enters a wait state. Amazon EC2 Auto Scaling emits a lifecycle event notification to EventBridge about the instance that is launching or terminating and a token that you can use to control the lifecycle action. For examples of these events, see Amazon EC2 Auto Scaling event reference (p. 372).

Note

When you use the AWS Management Console to create an event rule, the console automatically adds the IAM permissions necessary to grant EventBridge permission to call your Lambda function. If you are creating an event rule using the AWS CLI, you need to grant this permission explicitly.

For information about how to create event rules in the EventBridge console, see Creating Amazon EventBridge rules that react to events in the Amazon EventBridge User Guide. – or – For an introductory tutorial that is directed towards console users, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255). This tutorial shows you how to create a simple Lambda function that listens for launch events and writes them out to a CloudWatch Logs log.

To create an EventBridge rule that invokes a Lambda function

1. Create a Lambda function by using the Lambda console and note its Amazon Resource Name (ARN). For example, arn:aws:lambda:region:123456789012:function:my-function. You need the ARN to create an EventBridge target. For more information, see Getting started with Lambda in the AWS Lambda Developer Guide.

2. To create a rule that matches events for instance launch, use the following put-rule command.

   ```bash
   aws events put-rule --name my-rule --event-pattern file://pattern.json --state ENABLED
   ```

   The following example shows the pattern.json for an instance launch lifecycle action. Replace the text in italics with the name of your Auto Scaling group.

   ```json
   {
   ```
Prepare to add a lifecycle hook

```json
"source": [ "aws.autoscaling" ],
"detail-type": [ "EC2 Instance-launch Lifecycle Action" ],
"detail": {
    "AutoScalingGroupName": [ "my-asg" ]
}
```

If the command runs successfully, EventBridge responds with the ARN of the rule. Note this ARN. You'll need to enter it in step 4.

To create a rule that matches for other events, modify the event pattern. For more information, see Use EventBridge to handle Auto Scaling events (p. 372).

3. To specify the Lambda function to use as a target for the rule, use the following `put-targets` command.

```
aws events put-targets --rule my-rule --targets
  Id=1,Arn=arn:aws:lambda:region:123456789012:function:my-function
```

In the preceding command, `my-rule` is the name that you specified for the rule in step 2, and the value for the `Arn` parameter is the ARN of the function that you created in step 1.

4. To add permissions that allow the rule to invoke your Lambda function, use the following Lambda `add-permission` command. This command trusts the EventBridge service principal (`events.amazonaws.com`) and scopes permissions to the specified rule.

```
aws lambda add-permission --function-name my-function --statement-id my-unique-id
  --action 'lambda:InvokeFunction' --principal events.amazonaws.com --source-arn
  arn:aws:events:region:123456789012:rule/my-rule
```

In the preceding command:
- `my-function` is the name of the Lambda function that you want the rule to use as a target.
- `my-unique-id` is a unique identifier that you define to describe the statement in the Lambda function policy.
- `source-arn` is the ARN of the EventBridge rule.

If the command runs successfully, you receive output similar to the following.

```
{
```

The `Statement` value is a JSON string version of the statement that was added to the Lambda function policy.

5. After you have followed these instructions, continue on to Add lifecycle hooks (p. 246) as a next step.
Receive notifications using Amazon SNS

You can use Amazon SNS to set up a notification target (an SNS topic) to receive notifications when a lifecycle action occurs. Amazon SNS then sends the notifications to the subscribed recipients. Until the subscription is confirmed, no notifications published to the topic are sent to the recipients.

To set up notifications using Amazon SNS

1. Create an Amazon SNS topic by using either the Amazon SNS console or the following `create-topic` command. Ensure that the topic is in the same Region as the Auto Scaling group that you're using. For more information, see Getting started with Amazon SNS in the Amazon Simple Notification Service Developer Guide.

   
   ```
   aws sns create-topic --name my-sns-topic
   ```

2. Note the topic Amazon Resource Name (ARN), for example, `arn:aws:sns:region:123456789012:my-sns-topic`. You need it to create the lifecycle hook.

3. Create an IAM service role to give Amazon EC2 Auto Scaling access to your Amazon SNS notification target.

   To give Amazon EC2 Auto Scaling access to your SNS topic
   
   b. In the navigation pane on the left, choose Roles.
   c. Choose Create role.
   d. For Select trusted entity, choose AWS service.
   e. For your use case, under Use cases for other AWS services, choose EC2 Auto Scaling and then EC2 Auto Scaling Notification Access.
   f. Choose Next twice to go to the Name, review, and create page.
   g. For Role name, enter a name for the role (for example, `my-notification-role`) and choose Create role.
   h. On the Roles page, choose the role that you just created to open the Summary page. Make a note of the role ARN. For example, `arn:aws:iam::123456789012:role/my-notification-role`. You need it to create the lifecycle hook.

4. After you have followed these instructions, continue on to Add lifecycle hooks (AWS CLI) (p. 247) as a next step.

Receive notifications using Amazon SQS

You can use Amazon SQS to set up a notification target to receive messages when a lifecycle action occurs. A queue consumer must then poll an SQS queue to act on these notifications.

Important

FIFO queues are not compatible with lifecycle hooks.

To set up notifications using Amazon SQS

1. Create an Amazon SQS queue by using the Amazon SQS console. Ensure that the queue is in the same Region as the Auto Scaling group that you're using. For more information, see Getting started with Amazon SQS in the Amazon Simple Queue Service Developer Guide.

2. Note the queue ARN, for example, `arn:aws:sqs:us-west-2:123456789012:my-sqs-queue`. You need it to create the lifecycle hook.

3. Create an IAM service role to give Amazon EC2 Auto Scaling access to your Amazon SQS notification target.
To give Amazon EC2 Auto Scaling access to your SQS queue

b. In the navigation pane on the left, choose Roles.
c. Choose Create role.
d. For Select trusted entity, choose AWS service.
e. For your use case, under Use cases for other AWS services, choose EC2 Auto Scaling and then EC2 Auto Scaling Notification Access.
f. Choose Next twice to go to the Name, review, and create page.
g. For Role name, enter a name for the role (for example, my-notification-role) and choose Create role.
h. On the Roles page, choose the role that you just created to open the Summary page.
Make a note of the role ARN. For example, arn:aws:iam::123456789012:role/my-notification-role. You need it to create the lifecycle hook.

4. After you have followed these instructions, continue on to Add lifecycle hooks (AWS CLI) (p. 247) as a next step.

Notification message example for Amazon SNS and Amazon SQS

While the instance is in a wait state, a message is published to the Amazon SNS or Amazon SQS notification target. The message includes the following information:

- LifecycleActionToken — The lifecycle action token.
- AccountId — The AWS account ID.
- AutoScalingGroupName — The name of the Auto Scaling group.
- LifecycleHookName — The name of the lifecycle hook.
- EC2InstanceId — The ID of the EC2 instance.
- LifecycleTransition — The lifecycle hook type.
- NotificationMetadata — The notification metadata.

The following is a notification message example.

```
Service: AWS Auto Scaling
Time: 2021-01-19T00:36:26.533Z
RequestId: 18b2ec17-3e9b-4c15-8024-ff2e8ce8786a
LifecycleActionToken: 71514b9d-6a40-4b26-8523-05e7ee35fa40
AccountId: 123456789012
AutoScalingGroupName: my-asg
LifecycleHookName: my-hook
EC2InstanceId: i-0598c7d356eb4a8d7
LifecycleTransition: autoscaling:EC2_INSTANCE_LAUNCHING
NotificationMetadata: hook message metadata
```

Test notification message example

When you first add a lifecycle hook, a test notification message is published to the notification target. The following is a test notification message example.

```
Service: AWS Auto Scaling
Time: 2021-01-19T00:35:52.359Z
RequestId: 18b2ec17-3e9b-4c15-8024-ff2e8ce8786a
Event: autoscaling:TEST_NOTIFICATION
```

244
Retrieve the target lifecycle state through instance metadata

Each Auto Scaling instance that you launch goes through several lifecycle states. To invoke custom actions from within an instance that act on specific lifecycle state transitions, you must retrieve the target lifecycle state through instance metadata.

For example, you might need a mechanism to detect instance termination from inside the instance to run some code on the instance before it's terminated. You can do this by writing code that polls for the lifecycle state of an instance directly from the instance. You can then add a lifecycle hook to the Auto Scaling group to keep the instance running until your code sends the `complete-lifecycle-action` command to continue.

The Auto Scaling instance lifecycle has two primary steady states—`InService` and `Terminated`—and two side steady states—`Detached` and `Standby`. If you use a warm pool, the lifecycle has four additional steady states—`Warmed:Hibernated`, `Warmed:Running`, `Warmed:Stopped`, and `Warmed:Terminated`.

When an instance prepares to transition to one of the preceding steady states, Amazon EC2 Auto Scaling updates the value of the instance metadata item `autoscaling/target-lifecycle-state`. To get the target lifecycle state from within the instance, you must use the Instance Metadata Service to retrieve it from the instance metadata.

**Note**

*Instance metadata* is data about an Amazon EC2 instance that applications can use to query instance information. The *Instance Metadata Service* is an on-instance component that local code uses to access instance metadata. Local code can include user data scripts or applications running on the instance.

Local code can access instance metadata from a running instance using one of two methods: Instance Metadata Service Version 1 (IMDSv1) or Instance Metadata Service Version 2 (IMDSv2). IMDSv2 uses session-oriented requests and mitigates several types of vulnerabilities that could be used to try to access the instance metadata. For details about these two methods, see [Use IMDSv2](#) in the *Amazon EC2 User Guide for Linux Instances*.

```
IMDSv2
```

```
IMDSv1

```

The following is example output.
Add lifecycle hooks

The target lifecycle state is the state that the instance is transitioning to. The current lifecycle state is the state that the instance is in. These can be the same after the lifecycle action is complete and the instance finishes its transition to the target lifecycle state. You cannot retrieve the current lifecycle state of the instance from the instance metadata.

Amazon EC2 Auto Scaling started generating the target lifecycle state on March 10, 2022. If your instance transitions to one of the target lifecycle states after that date, the target lifecycle state item is present in your instance metadata. Otherwise, it is not present, and you receive an HTTP 404 error.

For more information about retrieving instance metadata, see Retrieve instance metadata in the Amazon EC2 User Guide for Linux Instances.

For a tutorial that shows you how to create a lifecycle hook with a custom action in a user data script that uses the target lifecycle state, see Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata (p. 250).

Important
To ensure that you can invoke a custom action as soon as possible, your local code should poll IMDS frequently and retry on errors.

Add lifecycle hooks

To put your Auto Scaling instances into a wait state and perform custom actions on them, you can add lifecycle hooks to your Auto Scaling group. Custom actions are performed as the instances launch or before they terminate. Instances remain in a wait state until you either complete the lifecycle action, or the timeout period ends.

After you create an Auto Scaling group from the AWS Management Console, you can add one or more lifecycle hooks to it, up to a total of 50 lifecycle hooks. You can also use the AWS CLI, AWS CloudFormation, or an SDK to add lifecycle hooks to an Auto Scaling group as you are creating it.

By default, when you add a lifecycle hook in the console, Amazon EC2 Auto Scaling sends lifecycle event notifications to Amazon EventBridge. Using EventBridge or a user data script is a recommended best practice. To create a lifecycle hook that sends notifications directly to Amazon SNS or Amazon SQS, you can use the put-lifecycle-hook command, as shown in the examples in this topic.

Contents
- Add lifecycle hooks (console) (p. 246)
- Add lifecycle hooks (AWS CLI) (p. 247)

Add lifecycle hooks (console)

Follow these steps to add lifecycle hooks to your Auto Scaling group. To add lifecycle hooks for scaling out (instances launching) and scaling in (instances terminating or returning to a warm pool), you must create two separate hooks.

Before you begin, confirm that you have set up a custom action, as needed, as described in Prepare to add a lifecycle hook to your Auto Scaling group (p. 240).

To add a lifecycle hook for scale out

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group. A split pane opens up in the bottom of the page.

3. On the **Instance management** tab, in **Lifecycle hooks**, choose **Create lifecycle hook**.

4. To define a lifecycle hook for scale out (instances launching), do the following:
   a. For **Lifecycle hook name**, specify a name for the lifecycle hook.
   b. For **Lifecycle transition**, choose **Instance launch**.
   c. For **Heartbeat timeout**, specify the amount of time, in seconds, for instances to remain in a wait state when scaling out before the hook times out. The range is from 30 to 7200 seconds. Setting a long timeout period provides more time for your custom action to complete. Then, if you finish before the timeout period ends, send the **complete-lifecycle-action** command to allow the instance to proceed to the next state.
   d. For **Default result**, specify the action to take when the lifecycle hook timeout elapses or when an unexpected failure occurs. You can choose to either **CONTINUE** or **ABANDON**.
      - If you choose **CONTINUE**, the Auto Scaling group can proceed with any other lifecycle hooks and then put the instance into service.
      - If you choose **ABANDON**, the Auto Scaling group stops any remaining actions and terminates the instance immediately.
   e. (Optional) For **Notification metadata**, specify other information that you want to include when Amazon EC2 Auto Scaling sends a message to the notification target.

5. Choose **Create**.

**To add a lifecycle hook for scale in**

1. Choose **Create lifecycle hook** to continue where you left off after creating a lifecycle hook for scale out.

2. To define a lifecycle hook for scale in (instances terminating or returning to a warm pool), do the following:
   a. For **Lifecycle hook name**, specify a name for the lifecycle hook.
   b. For **Lifecycle transition**, choose **Instance terminate**.
   c. For **Heartbeat timeout**, specify the amount of time, in seconds, for instances to remain in a wait state when scaling out before the hook times out. We recommend a short timeout period of 30 to 120 seconds, depending on how much time you need to perform any final tasks, such as pulling EC2 logs from CloudWatch.
   d. For **Default result**, specify the action that the Auto Scaling group takes when the timeout elapses or if an unexpected failure occurs. Both **ABANDON** and **CONTINUE** let the instance terminate.
      - If you choose **CONTINUE**, the Auto Scaling group can proceed with any remaining actions, such as other lifecycle hooks, before termination.
      - If you choose **ABANDON**, the Auto Scaling group terminates the instance immediately.
   e. (Optional) For **Notification metadata**, specify other information that you want to include when Amazon EC2 Auto Scaling sends a message to the notification target.

3. Choose **Create**.

**Add lifecycle hooks (AWS CLI)**

Create and update lifecycle hooks using the **put-lifecycle-hook** command.

To perform an action on scale out, use the following command.
Complete a lifecycle action

When an Auto Scaling group responds to a lifecycle event, it puts the instance in a wait state and sends an event notification. You can perform a custom action while the instance is in a wait state.

Completing the lifecycle action with a result of CONTINUE is helpful if you finish before the timeout period has expired. If you don’t complete the lifecycle action, the lifecycle hook goes to the status that you specified for Default result after the timeout period ends.

Contents

- Complete a lifecycle action (manual) (p. 249)
- Complete a lifecycle action (automatic) (p. 249)
Complete a lifecycle action (manual)

The following procedure is for the command line interface and is not supported in the console. Information that must be replaced, such as the instance ID or the name of an Auto Scaling group, are shown in italics.

To complete a lifecycle action (AWS CLI)

1. If you need more time to complete the custom action, use the `record-lifecycle-action-heartbeat` command to restart the timeout period and keep the instance in a wait state. For example, if the timeout period is one hour, and you call this command after 30 minutes, the instance remains in a wait state for an additional hour, or a total of 90 minutes.

   You can specify the lifecycle action token that you received with the notification (p. 244), as shown in the following command.

   ```bash
   aws autoscaling record-lifecycle-action-heartbeat --lifecycle-hook-name my-launch-hook
   \   --auto-scaling-group-name my-asg --lifecycle-action-token bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635
   ```

   Alternatively, you can specify the ID of the instance that you received with the notification (p. 244), as shown in the following command.

   ```bash
   aws autoscaling record-lifecycle-action-heartbeat --lifecycle-hook-name my-launch-hook
   \   --auto-scaling-group-name my-asg --instance-id i-1a2b3c4d
   ```

2. If you finish the custom action before the timeout period ends, use the `complete-lifecycle-action` command so that the Auto Scaling group can continue launching or terminating the instance. You can specify the lifecycle action token, as shown in the following command.

   ```bash
   aws autoscaling complete-lifecycle-action --lifecycle-action-result CONTINUE \   --lifecycle-hook-name my-launch-hook --auto-scaling-group-name my-asg \   --lifecycle-action-token bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635
   ```

   Alternatively, you can specify the ID of the instance, as shown in the following command.

   ```bash
   aws autoscaling complete-lifecycle-action --lifecycle-action-result CONTINUE \   --instance-id i-1a2b3c4d --lifecycle-hook-name my-launch-hook \   --auto-scaling-group-name my-asg
   ```

Complete a lifecycle action (automatic)

If you have a user data script that configures your instances after they launch, you do not need to manually complete lifecycle actions. You can add the `complete-lifecycle-action` command to the script. The script can retrieve the instance ID from the instance metadata and signal Amazon EC2 Auto Scaling when the bootstrap scripts have completed successfully.

If you are not doing so already, update your script to retrieve the instance ID of the instance from the instance metadata. For more information, see Retrieve instance metadata in the Amazon EC2 User Guide for Linux Instances.

If you use Lambda, you can also set up a callback in your function's code to let the lifecycle of the instance proceed if the custom action is successful. For more information, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255).
Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata

A common way to create custom actions for lifecycle hooks is to use notifications that Amazon EC2 Auto Scaling sends to other services, such as Amazon EventBridge. However, you can avoid having to create additional infrastructure by instead using a user data script to move the code that configures instances and completes the lifecycle action into the instances themselves.

The following tutorial shows you how to get started using a user data script and instance metadata. You create a basic Auto Scaling group configuration with a user data script that reads the target lifecycle state of the instances in your group and performs a callback action at a specific phase of an instance's lifecycle to continue the launch process.

Contents
- Step 1: Create an IAM role with permissions to complete lifecycle actions (p. 250)
- Step 2: Create a launch template and include the IAM role and a user data script (p. 251)
- Step 3: Create an Auto Scaling group (p. 252)
- Step 4: Add a lifecycle hook (p. 253)
- Step 5: Test and verify the functionality (p. 253)
- Step 6: Clean up (p. 254)
- Related resources (p. 255)

Step 1: Create an IAM role with permissions to complete lifecycle actions

When you use the AWS CLI or an AWS SDK to send a callback to complete lifecycle actions, you must use an IAM role with permissions to complete lifecycle actions.

To create the policy

1. Open the Policies page of the IAM console, and then choose Create policy.
2. Choose the JSON tab.
3. In the Policy Document box, copy and paste the following policy document into the box. Replace the sample text with your account number and the name of the Auto Scaling group that you want to create (TestAutoScalingEvent-group).

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "autoscaling:CompleteLifecycleAction"
      ],
      "Resource":
      "arn:aws:autoscaling::*:123456789012:autoscalingGroup::autoScalingGroupName/TestAutoScalingEvent-group"
    }
  ]
}
```
4. Choose Next.
5. For Policy name, enter TestAutoScalingEvent-policy. Choose Create policy.

When you finish creating the policy, you can create a role that uses it.

To create the role

1. In the navigation pane on the left, choose Roles.
2. Choose Create role.
3. For Select trusted entity, choose AWS service.
4. For your use case, choose EC2 and then choose Next.
5. Under Add permissions, choose the policy that you created (TestAutoScalingEvent-policy). Then, choose Next.
6. On the Name, review, and create page, for Role name, enter TestAutoScalingEvent-role and choose Create role.

Step 2: Create a launch template and include the IAM role and a user data script

Create a launch template to use with your Auto Scaling group. Include the IAM role you created and the provided sample user data script.

To create a launch template

1. Open the Launch templates page of the Amazon EC2 console.
2. Choose Create launch template.
3. For Launch template name, enter TestAutoScalingEvent-template.
4. Under Auto Scaling guidance, select the check box.
5. For Application and OS Images (Amazon Machine Image), choose Amazon Linux 2 (HVM), SSD Volume Type, 64-bit (x86) from the Quick Start list.
6. For Instance type, choose a type of Amazon EC2 instance (for example, "t2.micro").
7. For Advanced details, expand the section to view the fields.
8. For IAM instance profile, choose the IAM instance profile name of your IAM role (TestAutoScalingEvent-role). An instance profile is a container for an IAM role that allows Amazon EC2 to pass the IAM role to an instance when the instance is launched.

When you used the IAM console to create an IAM role, the console automatically created an instance profile with the same name as its corresponding role.

9. For User data, copy and paste the following sample user data script into the field. Replace the sample text for group_name with the name of the Auto Scaling group that you want to create and region with the AWS Region you want your Auto Scaling group to use.

```bash
#!/bin/bash

function get_target_state {
}

function get_instance_id {
}
```
This simple user data script does the following:

- Calls the instance metadata to retrieve the target lifecycle state and instance ID from the instance metadata
- Retrieves the target lifecycle state repeatedly until it changes to InService
- Changes the hostname of the instance to the instance ID prepended with the name of the Auto Scaling group, if the target lifecycle state is InService
- Sends a callback by calling the `complete-lifecycle-action` CLI command to signal Amazon EC2 Auto Scaling to CONTINUE the EC2 launch process

Step 3: Create an Auto Scaling group

After you create your launch template, create an Auto Scaling group.

To create an Auto Scaling group

1. On the Choose launch template or configuration page, for Auto Scaling group name, enter a name for your Auto Scaling group (TestAutoScalingEvent-group).
2. Choose Next to go to the Choose instance launch options page.
3. For Network, choose a VPC.
4. For Availability Zones and subnets, choose one or more subnets from one or more Availability Zones.
5. In the Instance type requirements section, use the default setting to simplify this step. (Do not override the launch template.) For this tutorial, you will launch only one On-Demand Instance using the instance type specified in your launch template.
6. Choose Skip to review at the bottom of the screen.
7. On the Review page, review the details of your Auto Scaling group, and then choose Create Auto Scaling group.

Step 4: Add a lifecycle hook

Add a lifecycle hook to hold the instance in a wait state until your lifecycle action is complete.

To add a lifecycle hook

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group. A split pane opens up in the bottom of the page.
3. In the lower pane, on the Instance management tab, in Lifecycle hooks, choose Create lifecycle hook.
4. To define a lifecycle hook for scale out (instances launching), do the following:
   a. For Lifecycle hook name, enter TestAutoScalingEvent-hook.
   b. For Lifecycle transition, choose Instance launch.
   c. For Heartbeat timeout, enter 300 for the number of seconds to wait for a callback from your user data script.
   d. For Default result, choose ABANDON. If the hook times out without receiving a callback from your user data script, the Auto Scaling group terminates the new instance.
   e. (Optional) Keep Notification metadata blank.
5. Choose Create.

Step 5: Test and verify the functionality

To test the functionality, update the Auto Scaling group by increasing the desired capacity of the Auto Scaling group by 1. The user data script runs and starts to check the instance's target lifecycle state soon after the instance launches. The script changes the hostname and sends a callback action when the target lifecycle state is InService. This usually takes only a few seconds to finish.

To increase the size of the Auto Scaling group

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group. View details in a lower pane while still seeing the top rows of the upper pane.
3. In the lower pane, on the Details tab, choose Group details, Edit.
4. For Desired capacity, increase the current value by 1.
5. Choose Update. While the instance is being launched, the Status column in the upper pane displays a status of Updating capacity.
After increasing the desired capacity, you can verify that your instance has successfully launched and is not terminated from the description of scaling activities.

**To view the scaling activity**

1. Return to the Auto Scaling groups page and select your group.
2. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched an instance.
3. If the user data script fails, after the timeout period passes, you see a scaling activity with a status of Canceled and a status message of Instance failed to complete user's Lifecycle Action: Lifecycle Action with token e85eb647-4fe0-4909-b341-a6c42EXAMPLE was abandoned: Lifecycle Action Completed with ABANDON Result.

**Step 6: Clean up**

If you are done working with the resources that you created for this tutorial, use the following steps to delete them.

**To delete the lifecycle hook**

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group.
3. On the Instance management tab, in Lifecycle hooks, choose the lifecycle hook (TestAutoScalingEvent-hook).
4. Choose Actions, Delete.
5. Choose Delete again to confirm.

**To delete the launch template**

1. Open the Launch templates page of the Amazon EC2 console.
2. Select your launch template (TestAutoScalingEvent-template) and then choose Actions, Delete template.
3. When prompted for confirmation, type Delete to confirm deleting the specified launch template and then choose Delete.

If you are done working with the example Auto Scaling group, delete it. You can also delete the IAM role and permissions policy that you created.

**To delete the Auto Scaling group**

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group (TestAutoScalingEvent-group) and choose Delete.
3. When prompted for confirmation, type delete to confirm deleting the specified Auto Scaling group and then choose Delete.

A loading icon in the Name column indicates that the Auto Scaling group is being deleted. It takes a few minutes to terminate the instances and delete the group.

**To delete the IAM role**

1. Open the Roles page of the IAM console.
2. Select the function’s role (TestAutoScalingEvent-role).
3. Choose Delete.
4. When prompted for confirmation, type the name of the role and then choose Delete.

To delete the IAM policy
1. Open the Policies page of the IAM console.
2. Select the policy that you created (TestAutoScalingEvent-policy).
3. Choose Actions, Delete.
4. When prompted for confirmation, type the name of the policy and then choose Delete.

Related resources
The following related topics can be helpful as you develop code that invokes actions on instances based on data available in the instance metadata.

- Retrieve the target lifecycle state through instance metadata (p. 245). This section describes the lifecycle state for other use cases, such as instance termination.
- Add lifecycle hooks (console) (p. 246). This procedure shows you how to add lifecycle hooks for both scale out (instances launching) and scale in (instances terminating or returning to a warm pool).
- Instance metadata categories in the Amazon EC2 User Guide for Linux Instances. This topic lists all categories of instance metadata that you can use to invokes actions on EC2 instances.

For a tutorial that shows you how to use Amazon EventBridge to create rules that invoke Lambda functions based on events that happen to the instances in your Auto Scaling group, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255).

Tutorial: Configure a lifecycle hook that invokes a Lambda function

In this exercise, you create an Amazon EventBridge rule that includes a filter pattern that when matched, invokes an AWS Lambda function as the rule target. We provide the filter pattern and sample function code to use.

If everything is configured correctly, at the end of this tutorial, the Lambda function performs a custom action when instances launch. The custom action simply logs the event in the CloudWatch Logs log stream associated with the Lambda function.

The Lambda function also performs a callback to let the lifecycle of the instance proceed if this action is successful, but lets the instance abandon the launch and terminate if the action fails.

For more information about using EventBridge, see Use EventBridge to handle Auto Scaling events (p. 372).

Contents
- Prerequisites (p. 256)
- Step 1: Create an IAM role with permissions to complete lifecycle actions (p. 256)
- Step 2: Create a Lambda function (p. 257)
- Step 3: Create an EventBridge rule (p. 258)
- Step 4: Add a lifecycle hook (p. 258)
Prerequisites

Before you begin this tutorial, create an Auto Scaling group, if you don’t have one already. To create an Auto Scaling group, open the Auto Scaling groups page of the Amazon EC2 console and choose Create Auto Scaling group.

Step 1: Create an IAM role with permissions to complete lifecycle actions

Before you create a Lambda function, you must first create an execution role and a permissions policy to allow Lambda to complete lifecycle hooks.

To create the policy

1. Open the Policies page of the IAM console, and then choose Create policy.
2. Choose the JSON tab.
3. In the Policy Document box, paste the following policy document into the box, replacing the text in italics with your account number and the name of your Auto Scaling group.

```json
{
"Version": "2012-10-17",
"Statement": [
{
"Effect": "Allow",
"Action": [
"autoscaling:CompleteLifecycleAction"
],
"Resource":
"arn:aws:autoscaling:*:123456789012:autoScalingGroup:*:autoScalingGroupName/my-asg"
}
]
}
```

4. Choose Next.
5. For Policy name, enter LogAutoScalingEvent-policy. Choose Create policy.

When you finish creating the policy, you can create a role that uses it.

To create the role

1. In the navigation pane on the left, choose Roles.
2. Choose Create role.
3. For Select trusted entity, choose AWS service.
4. For your use case, choose Lambda and then choose Next.
5. Under Add permissions, choose the policy that you created (LogAutoScalingEvent-policy) and the policy named AWSLambdaBasicExecutionRole. Then, choose Next.

Note

The AWSLambdaBasicExecutionRole policy has the permissions that the function needs to write logs to CloudWatch Logs.
6. On the Name, review, and create page, for Role name, enter LogAutoScalingEvent-role and choose Create role.

**Step 2: Create a Lambda function**

Create a Lambda function to serve as the target for events. The sample Lambda function, written in Node.js, is invoked by EventBridge when a matching event is emitted by Amazon EC2 Auto Scaling.

**To create a Lambda function**

1. Open the Functions page on the Lambda console.
2. Choose Create function, Author from scratch.
3. Under Basic information, for Function name, enter LogAutoScalingEvent.
4. For Runtime, choose Node.js 18.x.
5. Scroll down and choose Change default execution role, and then for Execution role, choose Use an existing role.
6. For Existing role, choose LogAutoScalingEvent-role.
7. Leave the other default values.
8. Choose Create function. You are returned to the function's code and configuration.
9. With your LogAutoScalingEvent function still open in the console, under Code source, in the editor, paste the following sample code into the file named index.mjs.

```javascript
import { AutoScalingClient, CompleteLifecycleActionCommand } from '@aws-sdk/client-auto-scaling';
export const handler = async(event) => {
  console.log('LogAutoScalingEvent');
  console.log('Received event:', JSON.stringify(event, null, 2));
  var autoscaling = new AutoScalingClient({ region: event.region });
  var eventDetail = event.detail;
  var params = {
    AutoScalingGroupName: eventDetail['AutoScalingGroupName'], /* required */
    LifecycleActionResult: 'CONTINUE', /* required */
    LifecycleHookName: eventDetail['LifecycleHookName'], /* required */
    InstanceId: eventDetail['EC2InstanceId'],
    LifecycleActionToken: eventDetail['LifecycleActionToken']
  };
  var response;
  const command = new CompleteLifecycleActionCommand(params);
  try {
    var data = await autoscaling.send(command);
    console.log(data); // successful response
    response = {
      statusCode: 200,
      body: JSON.stringify('SUCCESS'),
    };
  } catch (err) {
    console.log(err, err.stack); // an error occurred
    response = {
      statusCode: 500,
      body: JSON.stringify('ERROR'),
    };
  }
  return response;
};
```

This code simply logs the event so that, at the end of this tutorial, you can see an event appear in the CloudWatch Logs log stream that's associated with this Lambda function.
Step 3: Create an EventBridge rule

Create an EventBridge rule to run your Lambda function.

To create a rule using the console

1. Open the EventBridge console.
2. In the navigation pane, choose Rules.
3. Choose Create rule.
4. For Define rule detail, do the following:
   a. For Name, enter LogAutoScalingEvent-rule.
   b. For Event bus, choose default. When an AWS service in your account generates an event, it always goes to your account's default event bus.
   c. For Rule type, choose Rule with an event pattern.
   d. Choose Next.
5. For Build event pattern, do the following:
   a. For Event source, choose AWS events or EventBridge partner events.
   b. Scroll down to Event pattern, and do the following:
   c. i. For Event source, choose AWS services.
      ii. For AWS service, choose Auto Scaling.
      iii. For Event type, choose Instance Launch and Terminate.
      iv. By default, the rule matches any scale-in or scale-out event. To create a rule that notifies you when there is a scale-out event and an instance is put into a wait state due to a lifecycle hook, choose Specific instance event(s) and select EC2 Instance-launch Lifecycle Action.
      v. By default, the rule matches any Auto Scaling group in the Region. To make the rule match a specific Auto Scaling group, choose Specific group name(s) and select the group.
   vi. Choose Next.
6. For Select target(s), do the following:
   a. For Target types, choose AWS service.
   b. For Select a target, choose Lambda function.
   c. For Function, choose LogAutoScalingEvent.
   d. Choose Next twice.
7. On the Review and create page, choose Create rule.

Step 4: Add a lifecycle hook

In this section, you add a lifecycle hook so that Lambda runs your function on instances at launch.

To add a lifecycle hook

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group. A split pane opens up in the bottom of the page.
3. In the lower pane, on the Instance management tab, in Lifecycle hooks, choose Create lifecycle hook.
4. To define a lifecycle hook for scale out (instances launching), do the following:
   a. For Lifecycle hook name, enter LogAutoScalingEvent-hook.
   b. For Lifecycle transition, choose Instance launch.
   c. For Heartbeat timeout, enter 300 for the number of seconds to wait for a callback from your Lambda function.
   d. For Default result, choose ABANDON. This means that the Auto Scaling group will terminate a new instance if the hook times out without receiving a callback from your Lambda function.
   e. (Optional) Leave Notification metadata empty. The event data that we pass to EventBridge contains all of the necessary information to invoke the Lambda function.

5. Choose Create.

Step 5: Test and verify the event

To test the event, update the Auto Scaling group by increasing the desired capacity of the Auto Scaling group by 1. Your Lambda function is invoked within a few seconds after increasing the desired capacity.

To increase the size of the Auto Scaling group

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group to view details in a lower pane and still see the top rows of the upper pane.
3. In the lower pane, on the Details tab, choose Group details, Edit.
4. For Desired capacity, increase the current value by 1.
5. Choose Update. While the instance is being launched, the Status column in the upper pane displays a status of Updating capacity.

After increasing the desired capacity, you can verify that your Lambda function was invoked.

To view the output from your Lambda function

1. Open the Log groups page of the CloudWatch console.
2. Select the name of the log group for your Lambda function (/aws/lambda/LogAutoScalingEvent).
3. Select the name of the log stream to view the data provided by the function for the lifecycle action.

Next, you can verify that your instance has successfully launched from the description of scaling activities.

To view the scaling activity

1. Return to the Auto Scaling groups page and select your group.
2. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched an instance.
   - If the action was successful, the scaling activity will have a status of "Successful".
   - If it failed, after waiting a few minutes, you will see a scaling activity with a status of "Cancelled" and a status message of "Instance failed to complete user's Lifecycle Action: Lifecycle Action with token e85eb647-4fe0-4909-b341-a6c42EXAMPLE was abandoned: Lifecycle Action Completed with ABANDON Result".

To decrease the size of the Auto Scaling group
If you do not need the additional instance that you launched for this test, you can open the Details tab and decrease Desired capacity by 1.

Step 6: Clean up

If you are done working with the resources that you created just for this tutorial, use the following steps to delete them.

To delete the lifecycle hook
1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group.
3. On the Instance management tab, in Lifecycle hooks, choose the lifecycle hook (LogAutoScalingEvent-hook).
4. Choose Actions, Delete.
5. Choose Delete again to confirm.

To delete the Amazon EventBridge rule
1. Open the Rules page in the Amazon EventBridge console.
2. Under Event bus, choose the event bus that is associated with the rule (Default).
3. Select the check box next to your rule (LogAutoScalingEvent-rule).
4. Choose Delete.
5. When prompted for confirmation, type the name of the rule and then choose Delete.

If you are done working with the example function, delete it. You can also delete the log group that stores the function's logs, and the execution role and permissions policy that you created.

To delete a Lambda function
1. Open the Functions page on the Lambda console.
2. Choose the function (LogAutoScalingEvent).
3. Choose Actions, Delete.
4. When prompted for confirmation, type delete to confirm deleting the specified function and then choose Delete.

To delete the log group
1. Open the Log groups page of the CloudWatch console.
2. Select the function's log group (/aws/lambda/LogAutoScalingEvent).
3. Choose Actions, Delete log group(s).
4. In the Delete log group(s) dialog box, choose Delete.

To delete the execution role
1. Open the Roles page of the IAM console.
2. Select the function's role (LogAutoScalingEvent-role).
3. Choose Delete.
4. When prompted for confirmation, type the name of the role and then choose Delete.
To delete the IAM policy

1. Open the Policies page of the IAM console.
2. Select the policy that you created (LogAutoScalingEvent-policy).
3. Choose Actions, Delete.
4. When prompted for confirmation, type the name of the policy and then choose Delete.

Related resources

The following related topics can be helpful as you create EventBridge rules based on events that happen to the instances in your Auto Scaling group.

- Use EventBridge to handle Auto Scaling events (p. 372). This section shows you examples of events for other use cases, including events for scale in.
- Add lifecycle hooks (console) (p. 246). This procedure shows you how to add lifecycle hooks for both scale out (instances launching) and scale in (instances terminating or returning to a warm pool).

For a tutorial that shows you how to use the Instance Metadata Service (IMDS) to invoke an action from within the instance itself, see Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata (p. 250).

Warm pools for Amazon EC2 Auto Scaling

A warm pool gives you the ability to decrease latency for your applications that have exceptionally long boot times, for example, because instances need to write massive amounts of data to disk. With warm pools, you no longer have to over-provision your Auto Scaling groups to manage latency in order to improve application performance. For more information, see the following blog post Scaling your applications faster with EC2 Auto Scaling Warm Pools.

Important
Creating a warm pool when it's not required can lead to unnecessary costs. If your first boot time does not cause noticeable latency issues for your application, there probably isn't a need for you to use a warm pool.

Contents

- Core concepts (p. 261)
- Prerequisites (p. 263)
- Create a warm pool (p. 264)
- Update a warm pool (p. 264)
- Delete a warm pool (p. 265)
- Limitations (p. 265)
- Use lifecycle hooks with a warm pool (p. 265)
- View health check status and the reason for health check failures (p. 268)
- Examples for creating and managing warm pools with the AWS CLI (p. 270)

Core concepts

Before you get started, familiarize yourself with the following core concepts:
Warm pool

A warm pool is a pool of pre-initialized EC2 instances that sits alongside an Auto Scaling group. Whenever your application needs to scale out, the Auto Scaling group can draw on the warm pool to meet its new desired capacity. This helps you to ensure that instances are ready to quickly start serving application traffic, accelerating the response to a scale-out event. As instances leave the warm pool, they count toward the desired capacity of the group. This is known as a warm start.

While instances are in the warm pool, your scaling policies only scale out if the metric value from instances that are in the InService state is greater than the scaling policy's alarm high threshold (which is the same as the target utilization of a target tracking scaling policy).

Warm pool size

By default, the size of the warm pool is calculated as the difference between the Auto Scaling group's maximum capacity and its desired capacity. For example, if the desired capacity of your Auto Scaling group is 6 and the maximum capacity is 10, the size of your warm pool will be 4 when you first set up the warm pool and the pool is initializing.

To specify the warm pool's maximum capacity separately, set a value for maximum prepared capacity that is greater than the current capacity of the group. When you set a value for maximum prepared capacity, the size of the warm pool is calculated as the difference between the maximum prepared capacity and the current desired capacity of the group. For example, if the desired capacity of your Auto Scaling group is 6, if the maximum capacity is 10, and if the maximum prepared capacity is 8, the size of your warm pool will be 2 when you first set up the warm pool and the pool is initializing.

You might only need to use the maximum prepared capacity option when working with large Auto Scaling groups to manage the cost benefits of having a warm pool. For example, an Auto Scaling group with 1,000 instances, a maximum capacity of 1,500 (to provide extra capacity for emergency traffic spikes), and a warm pool of 100 instances might help you achieve your goals better than keeping 500 instances reserved for future use inside the warm pool.

Minimum warm pool size

Consider using the minimum size setting to statically set the minimum number of instances to maintain in the warm pool. There is no minimum size set by default.

Warm pool instance state

You can keep instances in the warm pool in one of three states: Stopped, Running, or Hibernated. Keeping instances in a Stopped state is an effective way to minimize costs. With stopped instances, you pay only for the volumes that you use and the Elastic IP addresses attached to the instances.

Alternatively, you can keep instances in a Hibernated state to stop instances without deleting their memory contents (RAM). When an instance is hibernated, this signals the operating system to save the contents of your RAM to your Amazon EBS root volume. When the instance is started again, the root volume is restored to its previous state and the RAM contents are reloaded. While the instances are in hibernation, you pay only for the EBS volumes, including storage for the RAM contents, and the Elastic IP addresses attached to the instances.

Keeping instances in a Running state inside the warm pool is also possible, but is highly discouraged to avoid incurring unnecessary charges. When instances are stopped or hibernated, you are saving the cost of the instances themselves. You pay for the instances only when they are running.

Lifecycle hooks

Lifecycle hooks (p. 236) let you put instances into a wait state so that you can perform custom actions on the instances. Custom actions are performed as the instances launch or before they terminate.
In a warm pool configuration, lifecycle hooks can also delay instances from being stopped or hibernated and from being put in service during a scale-out event until they have finished initializing. If you add a warm pool to your Auto Scaling group without a lifecycle hook, instances that take a long time to finish initializing could be stopped or hibernated and then put in service during a scale-out event before they are ready.

**Instance reuse policy**

By default, Amazon EC2 Auto Scaling terminates your instances when your Auto Scaling group scales in. Then, it launches new instances into the warm pool to replace the instances that were terminated.

If you want to return instances to the warm pool instead, you can specify an instance reuse policy. This lets you reuse instances that are already configured to serve application traffic. To make sure that your warm pool is not over-provisioned, Amazon EC2 Auto Scaling can terminate instances in the warm pool to reduce its size when it is larger than necessary based on its settings. When terminating instances in the warm pool, it uses the default termination policy (p. 275) to choose which instances to terminate first.

**Important**

If you want to hibernate instances on scale in and there are existing instances in the Auto Scaling group, they must meet the requirements for instance hibernation. If they don't, when instances return to the warm pool, they will fallback to being stopped instead of being hibernated.

**Note**

Currently, you can only specify an instance reuse policy by using the AWS CLI or an SDK. This feature is not available from the console.

---

**Prerequisites**

Decide how you will use lifecycle hooks to prepare the instances for use. There are two ways to perform custom actions on your instances.

- For simple scenarios where you want to run commands on your instances at launch, you can include a user data script when you create a launch template or launch configuration for your Auto Scaling group. User data scripts are just normal shell scripts or cloud-init directives that are run by **cloud-init** when your instances start. The script can also control when your instances transition to the next state by using the ID of the instance on which it runs. If you are not doing so already, update your script to retrieve the instance ID of the instance from the instance metadata. For more information, see Retrieve instance metadata in the Amazon EC2 User Guide for Linux Instances.

  **Tip**

  To run user data scripts when an instance restarts, the user data must be in the MIME multi-part format and specify the following in the #cloud-config section of the user data:

  ```
  #cloud-config
  cloud_final_modules:
    - [scripts-user, always]
  ```

- For advanced scenarios where you need a service such as AWS Lambda to do something as instances are entering or leaving the warm pool, you can create a lifecycle hook for your Auto Scaling group and configure the target service to perform custom actions based on lifecycle notifications. For more information, see Supported notification targets (p. 267).

For more information, see the lifecycle hook examples in our [GitHub repository](https://github.com/aws-docs/aws-sdk-

**Prepare instances for hibernation**
To prepare Auto Scaling instances to use the Hibernated pool state, create a new launch template or launch configuration that is set up correctly to support instance hibernation, as described in the Hibernation prerequisites topic in the Amazon EC2 User Guide for Linux Instances. Then, associate the new launch template or launch configuration with the Auto Scaling group and start an instance refresh to replace the instances associated with a previous launch template or launch configuration. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101).

Create a warm pool

Create a warm pool using the console according to the following instructions.

Before you begin, confirm that you have created a lifecycle hook for your Auto Scaling group.

To create a warm pool (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to an existing group.
   A split pane opens up at the bottom of the Auto Scaling groups page.
3. Choose the Instance management tab.
4. Under Warm pool, choose Create warm pool.
5. To configure a warm pool, do the following:
   a. For Warm pool instance state, choose which state you want to transition your instances to when they enter the warm pool. The default is Stopped.
   b. For Minimum warm pool size, enter the minimum number of instances to maintain in the warm pool.
   c. For Max prepared capacity, you can specify the maximum prepared capacity by defining a set number of instances, or keep the default option to keep the maximum prepared capacity undefined.

   If you keep the default, Equal to the Auto Scaling group's maximum capacity, the warm pool size is sized to match the difference between the Auto Scaling group's maximum capacity and its desired capacity. To make it easier to manage the warm pool's size by adjusting the group's maximum capacity, we recommend that you use the default option.

   If you choose the Define a set number of instances option, enter a value that represents the maximum number of instances that are allowed to be in the warm pool and the Auto Scaling group at the same time.
6. Choose Create.

Update a warm pool

To change the launch template or launch configuration for a warm pool, associate a new launch template or launch configuration with the Auto Scaling group. Any new instances are launched using the new AMI and other updates that are specified in the launch template or launch configuration, but existing instances are not affected.

To force replacement warm pool instances to launch that use the new launch template or launch configuration, you can start an instance refresh to do a rolling update of your group. An instance refresh first replaces InService instances. Then it replaces instances in the warm pool. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101).
Delete a warm pool

When you no longer need the warm pool, use the following procedure to delete it.

To delete your warm pool (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to an existing group.
   A split pane opens up at the bottom of the Auto Scaling groups page.
3. Choose the Instance management tab.
4. For Warm pool, choose Actions, Delete.
5. When prompted for confirmation, choose Delete.

Limitations

- You cannot add a warm pool to Auto Scaling groups that have a mixed instances policy or that launch Spot Instances.
- Amazon EC2 Auto Scaling can put an instance in a Stopped or Hibernated state only if it has an Amazon EBS volume as its root device. Instances that use instance stores for the root device cannot be stopped or hibernated.
- Amazon EC2 Auto Scaling can put an instance in a Hibernated state only if it meets all of the requirements listed in the Hibernation prerequisites topic in the Amazon EC2 User Guide for Linux Instances.
- If your warm pool is depleted when there is a scale-out event, instances will launch directly into the Auto Scaling group (a cold start). You could also experience cold starts if an Availability Zone is out of capacity.
- If you try using a warm pool with an Amazon Elastic Kubernetes Service (Amazon EKS) managed node group, instances that are still initializing might register with your Amazon EKS cluster. As a result, the cluster might schedule jobs on an instance as it is preparing to be stopped or hibernated.
- Likewise, if you try using a warm pool with an Amazon ECS cluster, instances might register with the cluster before they finish initializing. To solve this problem, you must configure a launch template or launch configuration that includes a special agent configuration variable in the user data. For more information, see Using a warm pool for your Auto Scaling group in the Amazon Elastic Container Service Developer Guide.
- Hibernation support for warm pools is available in all commercial AWS Regions where Amazon EC2 Auto Scaling is available, excluding the Middle East (UAE) Region, the China Regions, and the AWS GovCloud (US) Regions.

Use lifecycle hooks with a warm pool

Instances in a warm pool maintain their own independent lifecycle to help you create the appropriate custom action for each transition. This lifecycle is designed to help you to invoke actions in a target service (for example, a Lambda function) while an instance is still initializing and before it is put in service.

**Note**

The API operations that you use to add and manage lifecycle hooks and complete lifecycle actions are not changed. Only the instance lifecycle is changed.
For more information about adding a lifecycle hook, see Add lifecycle hooks (p. 246). For more information about completing a lifecycle action, see Complete a lifecycle action (p. 248).

For instances entering the warm pool, you might need a lifecycle hook for one of the following reasons:
- You want to launch EC2 instances from an AMI that takes a long time to finish initializing.
- You want to run user data scripts to bootstrap the EC2 instances.

For instances leaving the warm pool, you might need a lifecycle hook for one of the following reasons:
- You can use some extra time to prepare EC2 instances for use. For example, you might have services that must start when an instance restarts before your application can work correctly.
- You want to pre-populate cache data so that a new server doesn't launch with an empty cache.
- You want to register new instances as managed instances with your configuration management service.

Lifecycle state transitions for instances in a warm pool

An Auto Scaling instance can transition through many states as part of its lifecycle.

The following diagram shows the transition between Auto Scaling states when you use a warm pool:

1 This state varies based on the warm pool's pool state setting. If the pool state is set to Running, then this state is Warmed:Running instead. If the pool state is set to Hibernated, then this state is Warmed:Hibernated instead.

When you add lifecycle hooks, consider the following:
- When a lifecycle hook is configured for the autoscaling:EC2_INSTANCE_LAUNCHING lifecycle action, a newly launched instance first pauses to perform a custom action when it reaches the Warmed:Pending:Wait state, and then again when the instance restarts and reaches the Pending:Wait state.
• When a lifecycle hook is configured for the EC2_INSTANCE_TERMINATING lifecycle action, a terminating instance pauses to perform a custom action when it reaches the Terminating:Wait state. However, if you specify an instance reuse policy to return instances to the warm pool on scale in instead of terminating them, then an instance that is returning to the warm pool pauses to perform a custom action at the Warmed:Pending:Wait state for the EC2_INSTANCE_TERMINATING lifecycle action.

• If the demand on your application depletes the warm pool, Amazon EC2 Auto Scaling can launch instances directly into the Auto Scaling group as long as the group isn’t at its maximum capacity yet. If the instances launch directly into the group, they are only paused to perform a custom action at the Pending:Wait state.

• To control how long an instance stays in a wait state before it transitions to the next state, configure your custom action to use the complete-lifecycle-action command. With lifecycle hooks, instances remain in a wait state either until you notify Amazon EC2 Auto Scaling that the specified lifecycle action is complete, or until the timeout period ends (one hour by default).

The following summarizes the flow for a scale-out event.

When instances reach a wait state, Amazon EC2 Auto Scaling sends a notification. Examples of these notifications are available in the EventBridge section of this guide. For more information, see Warm pool example events and patterns (p. 379).

**Supported notification targets**

Amazon EC2 Auto Scaling provides support for defining any of the following as notification targets for lifecycle notifications:

- EventBridge rules
- Amazon SNS topics
- Amazon SQS queues

**Important**

Remember, if you have a user data (cloud-init) script in your launch template or launch configuration that configures your instances when they launch, you do not need to receive notifications to perform custom actions on instances that are starting or restarting.

The following sections contain links to documentation that describes how to configure notification targets:

**EventBridge rules:** To run code when Amazon EC2 Auto Scaling puts an instance into a wait state, you can create an EventBridge rule and specify a Lambda function as its target. To invoke different Lambda functions based on different lifecycle notifications, you can create multiple rules and associate each rule with a specific event pattern and Lambda function. For more information, see Create EventBridge rules for warm pool events (p. 384).

**Amazon SNS topics:** To receive a notification when an instance is put into a wait state, you create an Amazon SNS topic and then set up Amazon SNS message filtering to deliver lifecycle notifications differently based on a message attribute. For more information, see Receive notifications using Amazon SNS (p. 243).
Amazon SQS queues: To set up a delivery point for lifecycle notifications where a relevant consumer can pick them up and process them, you can create an Amazon SQS queue and a queue consumer that processes messages from the SQS queue. If you want the queue consumer to process lifecycle notifications differently based on a message attribute, you must also set up the queue consumer to parse the message and then act on the message when a specific attribute matches the desired value. For more information, see Receive notifications using Amazon SQS (p. 243).

View health check status and the reason for health check failures

Health checks allow Amazon EC2 Auto Scaling to determine when an instance is unhealthy and should be terminated. For warm pool instances kept in a Stopped state, it employs the knowledge that Amazon EBS has of a Stopped instance’s availability to identify unhealthy instances. It does this by calling the DescribeVolumeStatus API to determine the status of the EBS volume that’s attached to the instance. For warm pool instances kept in a Running state, it relies on EC2 status checks to determine instance health. While there is no health check grace period for warm pool instances, Amazon EC2 Auto Scaling doesn’t start checking instance health until the lifecycle hook finishes.

When an instance is found to be unhealthy, Amazon EC2 Auto Scaling automatically deletes the unhealthy instance and creates a new one to replace it. Instances are usually terminated within a few minutes after failing their health check. For more information, see Unhealthy instance replacement (p. 301).

Custom health checks are also supported. This can be helpful if you have your own health check system that can detect an instance's health and send this information to Amazon EC2 Auto Scaling. For more information, see Custom health detection tasks (p. 300).

On the Amazon EC2 Auto Scaling console, you can view the status (healthy or unhealthy) of your warm pool instances. You can also view their health status using the AWS CLI or one of the SDKs.

To view the status of your warm pool instances (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Instance management tab, under Warm pool instances, the Lifecycle column contains the state of your instances.
   The Health status column shows the assessment that Amazon EC2 Auto Scaling has made of instance health.
   Note
   New instances start healthy. Until the lifecycle hook is finished, an instance's health is not checked.

To view the reason for health check failures (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched or terminated instances.
If it terminated any unhealthy instances, the **Cause** column shows the date and time of the termination and the reason for the health check failure. For example, "At 2021-04-01T21:48:35Z an instance was taken out of service in response to EBS volume health check failure."

**To view the status of your warm pool instances (AWS CLI)**

View the warm pool for an Auto Scaling group by using the following `describe-warm-pool` command.

```
aws autoscaling describe-warm-pool --auto-scaling-group-name my-asg
```

Example output.

```
{
  "WarmPoolConfiguration": {
    "MinSize": 0,
    "PoolState": "Stopped"
  },
  "Instances": [
    {
      "InstanceId": "i-0b5e5e7521cfaa46c",
      "InstanceType": "t2.micro",
      "AvailabilityZone": "us-west-2a",
      "LifecycleState": "Warmed:Stopped",
      "HealthStatus": "Healthy",
      "LaunchTemplate": {
        "LaunchTemplateId": "lt-08c4cd42f320d5dcd",
        "LaunchTemplateName": "my-template-for-auto-scaling",
        "Version": "1"
      }
    },
    {
      "InstanceId": "i-0e21af9dcb7aa6bf",
      "InstanceType": "t2.micro",
      "AvailabilityZone": "us-west-2a",
      "LifecycleState": "Warmed:Stopped",
      "HealthStatus": "Healthy",
      "LaunchTemplate": {
        "LaunchTemplateId": "lt-08c4cd42f320d5dcd",
        "LaunchTemplateName": "my-template-for-auto-scaling",
        "Version": "1"
      }
    }
  ]
}
```

**To view the reason for health check failures (AWS CLI)**

Use the following `describe-scaling-activities` command.

```
aws autoscaling describe-scaling-activities --auto-scaling-group-name my-asg
```

The following is an example response, where **Description** indicates that your Auto Scaling group has terminated an instance and **Cause** indicates the reason for the health check failure.

Scaling activities are ordered by start time. Activities still in progress are described first.

```
{
  "Activities": [
```

269
Examples for creating and managing warm pools with the AWS CLI

You can create and manage warm pools using the AWS Management Console, AWS Command Line Interface (AWS CLI), or SDKs.

The following examples show you how to create and manage warm pools using the AWS CLI.

Contents

- Example 1: Keep instances in the Stopped state (p. 270)
- Example 2: Keep instances in the Running state (p. 270)
- Example 3: Keep instances in the Hibernated state (p. 271)
- Example 4: Return instances to the warm pool when scaling in (p. 271)
- Example 5: Specify the minimum number of instances in the warm pool (p. 271)
- Example 6: Define the warm pool maximum capacity separately (p. 271)
- Example 7: Define an absolute warm pool size (p. 271)
- Example 8: Delete a warm pool (p. 272)

Example 1: Keep instances in the Stopped state

The following `put-warm-pool` example creates a warm pool that keeps instances in a Stopped state.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg/ --pool-state Stopped
```

Example 2: Keep instances in the Running state

The following `put-warm-pool` example creates a warm pool that keeps instances in a Running state instead of a Stopped state.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg/ --pool-state Running
```
Example 3: Keep instances in the Hibernated state

The following `put-warm-pool` example creates a warm pool that keeps instances in a Hibernated state instead of a Stopped state. This lets you stop instances without deleting their memory contents (RAM).

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg /  
--pool-state Hibernated
```

Example 4: Return instances to the warm pool when scaling in

The following `put-warm-pool` example creates a warm pool that keeps instances in a Stopped state and includes the `--instance-reuse-policy` option. The instance reuse policy value `"{"ReuseOnScaleIn": true}"` tells Amazon EC2 Auto Scaling to return instances to the warm pool when your Auto Scaling group scales in.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg / 
--pool-state Stopped --instance-reuse-policy '{"ReuseOnScaleIn": true}'
```

Example 5: Specify the minimum number of instances in the warm pool

The following `put-warm-pool` example creates a warm pool that maintains a minimum of 4 instances, so that there are at least 4 instances available to handle traffic spikes.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg / 
--pool-state Stopped --min-size 4
```

Example 6: Define the warm pool maximum capacity separately

Generally, you understand how much to increase your maximum capacity above your desired capacity. There's usually no need to define an additional maximum size, because Amazon EC2 Auto Scaling creates a warm pool that dynamically resizes based on your group's desired and maximum capacity. However, you can use the `--max-group-prepared-capacity` option to define the warm pool maximum capacity separately when desired.

The following `put-warm-pool` example creates a warm pool that defines its maximum capacity separately. Suppose that the Auto Scaling group has a desired capacity of 800. The size of the warm pool will be 100 when you run this command and the pool is initializing.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg / 
--pool-state Stopped --max-group-prepared-capacity 900
```

To maintain a minimum number of instances in the warm pool, include the `--min-size` option with the command, as follows.

```
aws autoscaling put-warm-pool --auto-scaling-group-name my-asg / 
--pool-state Stopped --max-group-prepared-capacity 900 --min-size 25
```

Example 7: Define an absolute warm pool size

If you set the same values for the `--max-group-prepared-capacity` and `--min-size` options, the warm pool has an absolute size. The following `put-warm-pool` example creates a warm pool that maintains a constant warm pool size of 10 instances.
Control which Auto Scaling instances terminate during scale in

Amazon EC2 Auto Scaling uses termination policies to determine which instances it terminates first during scale-in events. Termination policies define the termination criteria that is used by Amazon EC2 Auto Scaling when choosing which instances to terminate.

Your Auto Scaling groups use a default termination policy, but you can optionally choose or create your own termination policies with your own termination criteria. This lets you ensure that your instances are terminated based on your specific application needs.

Amazon EC2 Auto Scaling also provides instance scale-in protection. When you enable this feature, it prevents instances from being terminated during scale-in events. You can enable instance scale-in protection when you create an Auto Scaling group, and you can change the setting on running instances. If you enable instance scale-in protection on an existing Auto Scaling group, all new instances launched after that will have instance scale-in protection enabled.

Note
Instance scale-in protection does not guarantee that instances won't be terminated in the event of a human error—for example, if someone manually terminates an instance using the Amazon EC2 console or AWS CLI. To protect your instance from accidental termination, you can use Amazon EC2 termination protection. However, even with termination protection and instance scale-in protection enabled, data saved to instance storage can be lost if a health check determines that an instance is unhealthy or if the group itself is accidentally deleted. As with any environment, a best practice is to back up your data frequently, or whenever it's appropriate for your business continuity requirements.

Contents
- Scenarios for termination policy use (p. 273)
- Work with Amazon EC2 Auto Scaling termination policies (p. 275)
- Create a custom termination policy with Lambda (p. 278)
- Use instance scale-in protection (p. 282)
- Design your applications on Amazon EC2 Auto Scaling to gracefully handle instance termination (p. 284)
Scenarios for termination policy use

The following sections describe the scenarios in which Amazon EC2 Auto Scaling uses termination policies.

Contents

- Scale-in events (p. 273)
- Instance refreshes (p. 274)
- Availability Zone rebalancing (p. 274)

Scale-in events

A scale-in event occurs when there is a new value for the desired capacity of an Auto Scaling group that is lower than the current capacity of the group.

Scale-in events occur in the following scenarios:

- When using dynamic scaling policies and the size of the group decreases as a result of changes in a metric's value
- When using scheduled scaling and the size of the group decreases as a result of a scheduled action
- When you manually decrease the size of the group

The following example shows how termination policies work when there is a scale-in event.

1. The Auto Scaling group in this example has one instance type, two Availability Zones, and a desired capacity of two instances. It also has a dynamic scaling policy that adds and removes instances when resource utilization increases or decreases. The two instances in this group are distributed across the two Availability Zones as shown in the following diagram.

2. When the Auto Scaling group scales out, Amazon EC2 Auto Scaling launches a new instance. The Auto Scaling group now has three instances, distributed across the two Availability Zones as shown in the following diagram.

3. When the Auto Scaling group scales in, Amazon EC2 Auto Scaling terminates one of the instances.

4. If you did not assign a specific termination policy to the group, Amazon EC2 Auto Scaling uses the default termination policy. It selects the Availability Zone with two instances, and terminates the instance that was launched from the oldest launch template or launch configuration. If the instances
were launched from the same launch template or launch configuration, Amazon EC2 Auto Scaling selects the instance that is closest to the next billing hour and terminates it.

**Instance refreshes**

You start instance refreshes in order to update the instances in your Auto Scaling group. During an instance refresh, Amazon EC2 Auto Scaling terminates instances in the group and then launches replacements for the terminated instances. The termination policy for the Auto Scaling group controls which instances are replaced first.

**Availability Zone rebalancing**

Amazon EC2 Auto Scaling balances your capacity evenly across the Availability Zones enabled for your Auto Scaling group. This helps reduce the impact of an Availability Zone outage. If the distribution of capacity across Availability Zones becomes out of balance, Amazon EC2 Auto Scaling rebalances the Auto Scaling group by launching instances in the enabled Availability Zones with the fewest instances and terminating instances elsewhere. The termination policy controls which instances are prioritized for termination first.

There are a number of reasons why the distribution of instances across Availability Zones can become out of balance.

**Removing instances**

If you detach instances from your Auto Scaling group, you put instances on standby, or you explicitly terminate instances and decrement the desired capacity, which prevents replacement instances from launching, the group can become unbalanced. If this occurs, Amazon EC2 Auto Scaling compensates by rebalancing the Availability Zones.

**Using different Availability Zones than originally specified**

If you expand your Auto Scaling group to include additional Availability Zones, or you change which Availability Zones are used, Amazon EC2 Auto Scaling launches instances in the new Availability Zones and terminates instances in other zones to help ensure that your Auto Scaling group spans Availability Zones evenly.

**Availability outage**

Availability outages are rare. However, if one Availability Zone becomes unavailable and recovers later, your Auto Scaling group can become unbalanced between Availability Zones. Amazon EC2 Auto Scaling tries to gradually rebalance the group, and rebalancing might terminate instances in other zones.

For example, imagine that you have an Auto Scaling group that has one instance type, two Availability Zones, and a desired capacity of two instances. In a situation where one Availability Zone fails, Amazon EC2 Auto Scaling automatically launches a new instance in the healthy Availability Zone to replace the one in the unhealthy Availability Zone. Then, when the unhealthy Availability Zone returns to a healthy state later on, Amazon EC2 Auto Scaling automatically launches a new instance in this zone, which in turn terminates an instance in the unaffected zone.

**Note**

When rebalancing, Amazon EC2 Auto Scaling launches new instances before terminating the old ones, so that rebalancing does not compromise the performance or availability of your application. Because Amazon EC2 AutoScaling attempts to launch new instances before terminating the old ones, being at or near the specified maximum capacity could impede or completely stop rebalancing activities. To avoid this problem, the system can temporarily exceed the specified maximum capacity of a group by a 10 percent margin (or by a margin of one instance, whichever
is greater) during a rebalancing activity. The margin is extended only if the group is at or near maximum capacity and needs rebalancing, either because of user-requested rezoning or to compensate for zone availability issues. The extension lasts only as long as needed to rebalance the group.

Work with Amazon EC2 Auto Scaling termination policies

This topic provides detailed information about the default termination policy and the options available to you to choose different termination policies for individual Auto Scaling groups. By choosing different termination policies, you can control which instances you prefer to terminate first when a scale-in event occurs. For example, you can choose a different termination policy so that Amazon EC2 Auto Scaling prioritizes terminating the oldest instances first.

When Amazon EC2 Auto Scaling terminates instances, it attempts to maintain balance across the Availability Zones that are used by your Auto Scaling group. Maintaining balance across Availability Zones takes precedence over termination policies. If one Availability Zone has more instances than the other Availability Zones that are used by the group, Amazon EC2 Auto Scaling applies the termination policies to the instances from the imbalanced Availability Zone. If the Availability Zones used by the group are balanced, Amazon EC2 Auto Scaling applies the termination policies across all of the Availability Zones for the group.

Contents

- Default termination policy (p. 275)
- Default termination policy and mixed instances groups (p. 276)
- Use different termination policies (p. 276)
  - Use different termination policies (console) (p. 277)
  - Use different termination policies (AWS CLI) (p. 277)

Default termination policy

The default termination policy applies multiple termination criteria before selecting an instance to terminate. When Amazon EC2 Auto Scaling terminates instances, it first determines which Availability Zones have the most instances, and it finds at least one instance that is not protected from scale in. Within the selected Availability Zone, the following default termination policy behavior applies:

1. Determine whether any of the instances eligible for termination use the oldest launch template or launch configuration:
   a. [For Auto Scaling groups that use a launch template]
      Determine whether any of the instances use the oldest launch template, unless there are instances that use a launch configuration. Amazon EC2 Auto Scaling terminates instances that use a launch configuration before it terminates instances that use a launch template.
   b. [For Auto Scaling groups that use a launch configuration]
      Determine whether any of the instances use the oldest launch configuration.

2. After applying the preceding criteria, if there are multiple unprotected instances to terminate, determine which instances are closest to the next billing hour. If there are multiple unprotected instances closest to the next billing hour, terminate one of these instances at random.

Note that terminating the instance closest to the next billing hour helps you maximize the use of your instances that have an hourly charge. Alternatively, if your Auto Scaling group uses Amazon Linux, Windows, or Ubuntu, your EC2 usage is billed in one-second increments. For more information, see Amazon EC2 pricing.
Default termination policy and mixed instances groups

When an Auto Scaling group with a mixed instances policy (p. 62) scales in, Amazon EC2 Auto Scaling still uses termination policies to prioritize which instances to terminate, but first it identifies which of the two types (Spot or On-Demand) should be terminated. It then applies the termination policies in each Availability Zone individually. It also identifies which instances (within the identified purchase option) in which Availability Zones to terminate that will result in the Availability Zones being most balanced. The same logic applies to Auto Scaling groups that use a mixed instances configuration with weights defined for the instance types.

The default termination policy changes slightly due to differences in how mixed instances policies (p. 62) are implemented. The following new behavior of the default termination policy applies:

1. Determine which instances are eligible for termination in order to align the remaining instances to the allocation strategy (p. 63) for the On-Demand or Spot Instance that is terminating.

   For example, after your instances launch, you might change the priority order of your preferred instance types. When a scale-in event occurs, Amazon EC2 Auto Scaling tries to gradually shift the On-Demand Instances away from instance types that are lower priority.

2. Determine whether any of the instances use the oldest launch template, unless there are instances that use a launch configuration. Amazon EC2 Auto Scaling terminates instances that use a launch configuration before it terminates instances that use a launch template.

3. After applying the preceding criteria, if there are multiple unprotected instances to terminate, determine which instances are closest to the next billing hour. If there are multiple unprotected instances closest to the next billing hour, terminate one of these instances at random.

Use different termination policies

To specify the termination criteria to apply before Amazon EC2 Auto Scaling chooses an instance for termination, you can choose from any of the following predefined termination policies:

- **Default.** Terminate instances according to the default termination policy. This policy is useful when you want your Spot allocation strategy evaluated before any other policy, so that every time your Spot instances are terminated or replaced, you continue to make use of Spot Instances in the optimal pools. It is also useful, for example, when you want to move off launch configurations and start using launch templates.

- **AllocationStrategy.** Terminate instances in the Auto Scaling group to align the remaining instances to the allocation strategy for the type of instance that is terminating (either a Spot Instance or an On-Demand Instance). This policy is useful when your preferred instance types have changed. If the Spot allocation strategy is lowest-price, you can gradually rebalance the distribution of Spot Instances across your N lowest priced Spot pools. If the Spot allocation strategy is capacity-optimized, you can gradually rebalance the distribution of Spot Instances across Spot pools where there is more available Spot capacity. You can also gradually replace On-Demand Instances of a lower priority type with On-Demand Instances of a higher priority type.

- **OldestLaunchTemplate.** Terminate instances that have the oldest launch template. With this policy, instances that use the noncurrent launch template are terminated first, followed by instances that use the oldest version of the current launch template. This policy is useful when you’re updating a group and phasing out the instances from a previous configuration.

- **OldestLaunchConfiguration.** Terminate instances that have the oldest launch configuration. This policy is useful when you’re updating a group and phasing out the instances from a previous configuration. With this policy, instances that use the noncurrent launch configuration are terminated first.

- **ClosestToNextInstanceHour.** Terminate instances that are closest to the next billing hour. This policy helps you maximize the use of your instances that have an hourly charge. (Only instances that use Amazon Linux, Windows, or Ubuntu are billed in one-second increments.)
• **NewestInstance.** Terminate the newest instance in the group. This policy is useful when you're testing a new launch configuration but don't want to keep it in production.

• **OldestInstance.** Terminate the oldest instance in the group. This option is useful when you're upgrading the instances in the Auto Scaling group to a new EC2 instance type. You can gradually replace instances of the old type with instances of the new type.

**Note**
Amazon EC2 Auto Scaling always balances instances across Availability Zones first, regardless of which termination policy is used. As a result, you might encounter situations in which some newer instances are terminated before older instances. For example, when there is a more recently added Availability Zone, or when one Availability Zone has more instances than the other Availability Zones that are used by the group.

### Use different termination policies (console)

After your Auto Scaling group has been created, you can update the termination policies for your group. The default termination policy is used automatically. You have the option of replacing the default policy with a different termination policy (such as `OldestLaunchTemplate`) or multiple termination policies listed in the order in which they should apply.

#### To choose different termination policies

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.

2. Select the check box next to the Auto Scaling group.

3. On the **Details** tab, choose **Advanced configurations, Edit**.

4. For **Termination policies**, choose one or more termination policies. If you choose multiple policies, put them in the order that you want them evaluated in.

   You can optionally choose **Custom termination policy** and then choose a Lambda function that meets your needs. If you have created versions and aliases for your Lambda function, you can choose a version or alias from the **Version/Alias** drop-down. To use the unpublished version of your Lambda function, keep **Version/Alias** set to its default. For more information, see [Create a custom termination policy with Lambda](p. 278).

   **Note**
   When using multiple policies, their order must be set correctly:
   - If you use the **Default** policy, it must be the last policy in the list.
   - If you use a **Custom termination policy**, it must be the first policy in the list.

5. Choose **Update**.

### Use different termination policies (AWS CLI)

The default termination policy is used automatically unless a different policy is specified.

#### To use a different termination policy

Use one of the following commands:

- `create-auto-scaling-group`
- `update-auto-scaling-group`
You can use termination policies individually, or combine them into a list of policies. For example, use the following command to update an Auto Scaling group to use the `OldestLaunchConfiguration` policy first and then use the `ClosestToNextInstanceHour` policy.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --termination-policies "OldestLaunchConfiguration" "ClosestToNextInstanceHour"
```

If you use the `Default` termination policy, make it the last one in the list of termination policies. For example, `--termination-policies "OldestLaunchConfiguration" "Default"`.

To use a custom termination policy, you must first create your termination policy using AWS Lambda. To specify the Lambda function to use as your termination policy, make it the first one in the list of termination policies. For example, `--termination-policies "arn:aws:lambda:us-west-2:123456789012:function:HelloFunction:prod" "OldestLaunchConfiguration"`. For more information, see Create a custom termination policy with Lambda (p. 278).

## Create a custom termination policy with Lambda

Amazon EC2 Auto Scaling uses termination policies to prioritize which instances to terminate first when decreasing the size of your Auto Scaling group (referred to as scaling in). Your Auto Scaling group uses a default termination policy, but you can optionally choose or create your own termination policies. For more information about choosing a predefined termination policy, see Work with Amazon EC2 Auto Scaling termination policies (p. 275).

In this topic, you learn how to create a custom termination policy using an AWS Lambda function that Amazon EC2 Auto Scaling invokes in response to certain events. The Lambda function that you create processes the information in the input data sent by Amazon EC2 Auto Scaling and returns a list of instances that are ready to terminate.

A custom termination policy provides better control over which instances are terminated, and when. For example, when your Auto Scaling group scales in, Amazon EC2 Auto Scaling cannot determine whether there are workloads running that should not be disrupted. With a Lambda function, you can validate the termination request and wait until the workload is done before returning the instance ID to Amazon EC2 Auto Scaling for termination.

### Contents

- **Input data** (p. 278)
- **Response data** (p. 280)
- **Considerations** (p. 280)
- **Create the Lambda function** (p. 281)
- **Limitations** (p. 282)

### Input data

Amazon EC2 Auto Scaling generates a JSON payload for scale-in events, and also does so when instances are about to be terminated as a result of the maximum instance lifetime or instance refresh features. It also generates a JSON payload for the scale-in events that it can initiate when rebalancing your group across Availability Zones.

This payload contains information about the capacity Amazon EC2 Auto Scaling needs to terminate, a list of instances that it suggests for termination, and the event that initiated the termination.

The following is an example payload:
The payload includes the name of the Auto Scaling group, its Amazon Resource Name (ARN), and the following elements:

- **CapacityToTerminate** describes how much of your Spot or On-Demand capacity is set to be terminated in a given Availability Zone.
- **Instances** represents the instances that Amazon EC2 Auto Scaling suggests for termination based on the information in **CapacityToTerminate**.
- **Cause** describes the event that caused the termination: SCALE_IN, INSTANCE_REFRESH, MAX_INSTANCE_LIFETIME, or REBALANCE.

The following information outlines the most significant factors in how Amazon EC2 Auto Scaling generates the **Instances** in the input data:

- Maintaining balance across Availability Zones takes precedence when an instance is terminating due to scale-in events and instance refresh-based terminations. Therefore, if one Availability Zone has more instances than the other Availability Zones that are used by the group, the input data
contains instances that are eligible for termination only from the imbalanced Availability Zone. If the Availability Zones used by the group are balanced, the input data contains instances from all of the Availability Zones for the group.

- When using a mixed instances policy (p. 62), maintaining your Spot and On-Demand capacities in balance based on your desired percentages for each purchase option also takes precedence. We first identify which of the two types (Spot or On-Demand) should be terminated. We then identify which instances (within the identified purchase option) in which Availability Zones we can terminate that will result in the Availability Zones being most balanced.

Response data

The input data and response data work together to narrow down the list of instances to terminate.

With the given input, the response from your Lambda function should look like the following example:

```json
{
  "InstanceIDs": [
    "i-02e1c6938a3ed501",
    "i-036bc44b6092c01c7",
    ...
  ]
}
```

The `InstanceIDs` in the response represent the instances that are ready to terminate.

Alternatively, you can return a different set of instances that are ready to be terminated, which overrides the instances in the input data. If no instances are ready to terminate when your Lambda function is invoked, you can also choose not to return any instances.

When no instances are ready to terminate, the response from your Lambda function should look like the following example:

```json
{
  "InstanceIDs": [
  ]
}
```

Considerations

Note the following considerations when using a custom termination policy:

- Returning an instance first in the response data does not guarantee its termination. If more than the required number of instances are returned when your Lambda function is invoked, Amazon EC2 Auto Scaling evaluates each instance against the other termination policies that you specified for your Auto Scaling group. When there are multiple termination policies, it tries to apply the next termination policy in the list, and if there are more instances than are required to terminate, it moves on to the next termination policy, and so on. If no other termination policies are specified, then the default termination policy is used to determine which instances to terminate.

- If no instances are returned or your Lambda function times out, then Amazon EC2 Auto Scaling waits a short time before invoking your function again. For any scale-in event, it keeps trying as long as the group's desired capacity is less than its current capacity. For instance refresh-based terminations, it keeps trying for an hour. After that, if it continues to fail to terminate any instances, the instance refresh operation fails. With maximum instance lifetime, Amazon EC2 Auto Scaling keeps trying to terminate the instance that is identified as exceeding its maximum lifetime.

- Because your function is retried repeatedly, make sure to test and fix any permanent errors in your code before using a Lambda function as a custom termination policy.
• If you override the input data with your own list of instances to terminate, and terminating these instances puts the Availability Zones out of balance, Amazon EC2 Auto Scaling gradually rebalances the distribution of capacity across Availability Zones. First, it invokes your Lambda function to see if there are instances that are ready to be terminated so that it can determine whether to start rebalancing. If there are instances ready to be terminated, it launches new instances first. When the instances finish launching, it then detects that your group's current capacity is higher than its desired capacity and initiates a scale-in event.

• A custom termination policy does not affect your ability to also use scale-in protection to protect certain instances from being terminated. For more information, see Use instance scale-in protection (p. 282).

Create the Lambda function

Start by creating the Lambda function, so that you can specify its Amazon Resource Name (ARN) in the termination policies for your Auto Scaling group.

To create a Lambda function (console)

1. Open the Functions page on the Lambda console.
2. On the navigation bar at the top of the screen, choose the same Region that you used when you created the Auto Scaling group.
3. Choose Create function, Author from scratch.
4. Under Basic information, for Function name, enter the name of your function.
5. Choose Create function. You are returned to the function's code and configuration.
6. With your function still open in the console, under Function code, paste your code into the editor.
7. Choose Deploy.
8. Optionally, create a published version of the Lambda function by choosing the Versions tab and then Publish new version. To learn more about versioning in Lambda, see Lambda function versions in the AWS Lambda Developer Guide.
9. If you chose to publish a version, choose the Aliases tab if you want to associate an alias with this version of the Lambda function. To learn more about aliases in Lambda, see Lambda function aliases in the AWS Lambda Developer Guide
10. Next, choose the Configuration tab and then Permissions.
11. Scroll down to Resource-based policy and then choose Add permissions. A resource-based policy is used to grant permissions to invoke your function to the principal that is specified in the policy. In this case, the principal will be the Amazon EC2 Auto Scaling service-linked role that is associated with the Auto Scaling group.
12. In the Policy statement section, configure your permissions:
   a. Choose AWS account.
   b. For Principal, enter the ARN of the calling service-linked role, for example, arn:aws:iam::<aws-account-id>::role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling.
   c. For Action, choose lambda:InvokeFunction.
   d. For Statement ID, enter a unique statement ID, such as AllowInvokeByAutoScaling.
   e. Choose Save.
13. After you have followed these instructions, continue on to specify the ARN of your function in the termination policies for your Auto Scaling group as a next step. For more information, see Use different termination policies (console) (p. 277).
Use instance scale-in protection

When a scaling activity occurs, Amazon EC2 Auto Scaling does one of the following:

- Increases the capacity of the Auto Scaling group (referred to as *scaling out*)
- Decreases the capacity of the Auto Scaling group (referred to as *scaling in*)

The instance scale-in protection setting controls whether the Auto Scaling group can terminate a particular instance when scaling in. A common use case for such a requirement is scaling container-based workloads.

You can protect instances as soon as they launch by enabling the instance scale-in protection setting on your Auto Scaling group. Instance scale-in protection starts when the instance state is *InService*. Then, to control which instances can terminate, disable the scale-in protection setting on individual instances within the Auto Scaling group. By doing so, you can continue to protect certain instances from unwanted terminations.

Instance scale-in protection does not protect Auto Scaling instances from the following:

- Manual termination through the `terminate-instance-in-auto-scaling-group` command, or the `TerminateInstanceInAutoScalingGroup` action. For more information, see `TerminateInstanceInAutoScalingGroup` in the *Amazon EC2 Auto Scaling API Reference*.
- Manual termination through the Amazon EC2 console, the Amazon EC2 `terminate-instances` command, or the Amazon EC2 `TerminateInstances` action. To protect Auto Scaling instances from manual termination, enable Amazon EC2 termination protection. (This does not prevent Amazon EC2 Auto Scaling from terminating instances.) For more information, see *Enabling termination protection* in the *Amazon EC2 User Guide for Linux Instances*.
- Health check replacement if the instance fails health checks. For more information, see *Health checks for Auto Scaling instances* (p. 297).
• Spot Instance interruptions. A Spot Instance is terminated when capacity is no longer available or the Spot price exceeds your maximum price.

If you detach an instance that is protected from scale-in, its instance scale-in protection setting is lost. When you attach the instance to the group again, it inherits the current instance scale-in protection setting of the group. When Amazon EC2 Auto Scaling launches a new instance or moves an instance from a warm pool into the Auto Scaling group, the instance inherits the instance scale-in protection setting of the Auto Scaling group.

Tasks
• Enable instance scale-in protection for a group (p. 283)
• Modify the instance scale-in protection setting for a group (p. 283)
• Modify the instance scale-in protection setting for an instance (p. 284)

Note
If all instances in an Auto Scaling group are protected from scale in, and a scale-in event occurs, its desired capacity is decremented. However, the Auto Scaling group can't terminate the required number of instances until their instance scale-in protection settings are disabled. In the AWS Management Console, the Activity History for the Auto Scaling group includes the following message if all instances in an Auto Scaling group are protected from scale in when a scale-in event occurs: Could not scale to desired capacity because all remaining instances are protected from scale-in.

Enable instance scale-in protection for a group

You can enable instance scale-in protection when you create an Auto Scaling group. By default, instance scale-in protection is disabled.

To enable instance scale-in protection (console)

When you create the Auto Scaling group, on the Configure group size and scaling policies page, under Instance scale-in protection, select the Enable instance scale-in protection option.

To enable instance scale-in protection (AWS CLI)

Use the following create-auto-scaling-group command to enable instance scale-in protection.

```
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg --new-instances-protected-from-scale-in ...
```

Modify the instance scale-in protection setting for a group

You can enable or disable the instance scale-in protection setting for an Auto Scaling group. When the instance scale-in protection setting is enabled, all new instances launched after enabling it will have instance scale-in protection enabled. Previously launched instances are only protected from scale in if you enable the instance scale-in protection setting for each instance individually.

To change the instance scale-in protection setting for a group (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Details tab, choose Advanced configurations, Edit.
4. For **Instance scale-in protection**, select **Enable instance scale-in protection**.
5. Choose **Update**.

### To change the instance scale-in protection setting for a group (AWS CLI)

Use the following `update-auto-scaling-group` command to enable instance scale-in protection for the specified Auto Scaling group.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --new-instances-protected-from-scale-in
```

Use the following command to disable instance scale-in protection for the specified group.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --no-new-instances-protected-from-scale-in
```

### Modify the instance scale-in protection setting for an instance

By default, an instance gets its instance scale-in protection setting from its Auto Scaling group. However, you can enable or disable instance scale-in protection for an instance at any time.

#### To change the instance scale-in protection setting for an instance (console)

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   笔记：A split pane opens up in the bottom of the page.
3. On the **Instance management** tab, in **Instances**, select an instance.
4. To enable instance scale-in protection, choose **Actions**, **Set scale-in protection**. When prompted, choose **Set scale-in protection**.
5. To disable instance scale-in protection, choose **Actions**, **Remove scale-in protection**. When prompted, choose **Remove scale-in protection**.

#### To change the instance scale-in protection setting for an instance (AWS CLI)

Use the following `set-instance-protection` command to enable instance scale-in protection for the specified instance.

```
aws autoscaling set-instance-protection --instance-ids i-5f2e8a0d --auto-scaling-group-name my-asg --protected-from-scale-in
```

Use the following command to disable instance scale-in protection for the specified instance.

```
aws autoscaling set-instance-protection --instance-ids i-5f2e8a0d --auto-scaling-group-name my-asg --no-protected-from-scale-in
```

### Design your applications on Amazon EC2 Auto Scaling to gracefully handle instance termination

This topic covers the different approaches that you can take if you have applications running on instances that ideally shouldn't terminate unexpectedly when Amazon EC2 Auto Scaling responds to a scale-in event.
For example, suppose you have an Amazon SQS queue that collects incoming messages for long-running jobs. When a new message arrives, an instance in the Auto Scaling group retrieves the message and starts processing it. Each message takes 3 hours to process. As the number of messages increase, new instances are automatically added to the Auto Scaling group. As the number of messages decrease, existing instances are automatically terminated. In this case, Amazon EC2 Auto Scaling must decide which instance to terminate. By default, it's possible that Amazon EC2 Auto Scaling might terminate an instance that is 2.9 hours into processing a 3-hour long job, rather than an instance that's currently idle. To avoid issues with unexpected terminations when using Amazon EC2 Auto Scaling, you must design your application to respond to this scenario.

You can use the following features to prevent your Auto Scaling group from terminating instances that aren't yet ready to terminate, or from terminating instances too quickly for them to complete their assigned jobs. All three of these features can be used in combination or separately.

Contents

- Instance scale-in protection (p. 285)
- Custom termination policy (p. 285)
- Termination lifecycle hooks (p. 286)

**Important**

When designing your applications on Amazon EC2 Auto Scaling to gracefully handle instance termination, keep these points in mind.

- If an instance is unhealthy, Amazon EC2 Auto Scaling will replace it regardless of which feature you use (unless you suspend the ReplaceUnhealthy process). You can use a lifecycle hook to allow the application to shut down gracefully or copy any data that you need to recover before the instance is terminated.
- A termination lifecycle hook is not guaranteed to run or finish before an instance is terminated. If something fails, Amazon EC2 Auto Scaling still terminates the instance.

**Instance scale-in protection**

You can use instance scale-in protection in many situations where terminating instances is a critical action that should be denied by default, and only explicitly allowed for specific instances. For example, when running containerized workloads, it's common to want to protect all instances and remove protection only for instances with no current or scheduled tasks. Services such as Amazon ECS have built integrations with instance scale-in protection into their products.

You can enable scale-in protection on the Auto Scaling group to apply scale-in protection to instances when they're created and enable it for existing instances. When an instance has no more work to do, it can toggle off protection. The instance can continue polling for new jobs and re-enable protection when there are new jobs assigned.

Applications can set protection either from a centralized control plane that manages whether an instance is terminable or not, or from the instances themselves. However, a large fleet could run into throttling issues if large numbers of instances are continuously toggling their scale-in protection.

For more information, see Use instance scale-in protection (p. 282).

**Custom termination policy**

Like instance scale-in protection, a custom termination policy helps you prevent your Auto Scaling group from terminating specific instances.

By default, your Auto Scaling group uses a default termination policy to determine which instances it terminates first. If you want more control over which instances terminate first, you can implement your
own custom termination policy using a Lambda function. Amazon EC2 Auto Scaling calls the function whenever it must decide which instance to terminate. It will only terminate an instance that's returned by the function. If the function errors, times out, or produces an empty list, Amazon EC2 Auto Scaling doesn't terminate instances.

A custom termination policy is useful if it's known when an instance is sufficiently redundant or underutilized so that it can be terminated. To support this, you need to implement your application with a control plane that monitors workload across the group. That way, if an instance is still processing jobs, the Lambda function knows not to include it.

For more information, see Create a custom termination policy with Lambda (p. 278).

**Termination lifecycle hooks**

A termination lifecycle hook extends the life of an instance that's already selected for termination. It provides extra time to complete all messages or requests currently assigned to the instance, or to save progress and transfer the work to another instance.

For many workloads, a lifecycle hook may be enough to gracefully shut down an application on an instance that's selected for termination. This is a best-effort approach and can't be used to prevent termination if there's a failure.

To use a lifecycle hook, you need to know when an instance is selected to be terminated. You have two ways to know this:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Best used for</th>
<th>Link to documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside the instance</td>
<td>The Instance Metadata Service (IMDS) is a secure endpoint that you can poll for the status of an instance directly from the instance. If the metadata comes back with Terminated, then your instance is scheduled to be terminated.</td>
<td>Applications where you must perform an action on the instance before the instance is terminated.</td>
<td>Retrieve the target lifecycle state</td>
</tr>
<tr>
<td>Outside the instance</td>
<td>When an instance is terminating, an event notification is generated. You can create rules using Amazon EventBridge, Amazon SQS, or Amazon SNS to capture these events, and invoke a response such as with a Lambda function.</td>
<td>Applications that need to take action outside of the instance.</td>
<td>Configure a notification target</td>
</tr>
</tbody>
</table>

To use a lifecycle hook, you also need to know when your instance is ready to be fully terminated. Amazon EC2 Auto Scaling will not tell Amazon EC2 to terminate the instance until it receives a CompleteLifecycleAction call or the timeout elapses, whichever happens first.

By default, an instance can continue running for one hour (heartbeat timeout) due to a termination lifecycle hook. You can configure the default timeout if one hour is not enough time to complete the lifecycle action. When a lifecycle action is actually in progress, you can extend the timeout with RecordLifecycleActionHeartbeat API calls.

For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).
Temporarily remove instances from your Auto Scaling group

You can put an instance that is in the InService state into the Standby state, update or troubleshoot the instance, and then return the instance to service. Instances that are on standby are still part of the Auto Scaling group, but they do not actively handle load balancer traffic.

This feature helps you stop and start the instances or reboot them without worrying about Amazon EC2 Auto Scaling terminating the instances as part of its health checks or during scale-in events.

For example, you can change the Amazon Machine Image (AMI) for an Auto Scaling group at any time by changing the launch template or launch configuration. Any subsequent instances that the Auto Scaling group launches use this AMI. However, the Auto Scaling group does not update the instances that are currently in service. You can terminate these instances and let Amazon EC2 Auto Scaling replace them, or use the instance refresh feature to terminate and replace the instances. Or, you can put the instances on standby, update the software, and then put the instances back in service.

Detaching instances from an Auto Scaling group is similar to putting instances on standby. Detaching instances might be useful if you want to manage the instances like standalone EC2 instances and possibly terminate them. For more information, see Detach EC2 instances from your Auto Scaling group (p. 164).

Contents
- How the standby state works (p. 287)
- Considerations (p. 287)
- Health status of an instance in a standby state (p. 288)
- Temporarily remove an instance (console) (p. 288)
- Temporarily remove an instance (AWS CLI) (p. 289)

How the standby state works

The standby state works as follows to help you temporarily remove an instance from your Auto Scaling group:

1. You put an instance into the standby state. The instance remains in this state until you exit the standby state.
2. If there is a load balancer target group or Classic Load Balancer attached to your Auto Scaling group, the instance is deregistered from the load balancer. If connection draining is enabled for the load balancer, Elastic Load Balancing waits 300 seconds by default before completing the deregistration process, which helps in-flight requests to complete.
3. You can update or troubleshoot the instance.
4. You return the instance to service by exiting the standby state.
5. If there is a load balancer target group or Classic Load Balancer attached to your Auto Scaling group, the instance is registered with the load balancer.

For more information about the lifecycle of instances in an Auto Scaling group, see Amazon EC2 Auto Scaling instance lifecycle (p. 7).

Considerations

The following are considerations when moving instances in and out of the standby state:
Health status of an instance in a standby state

Amazon EC2 Auto Scaling does not perform health checks on instances that are in a standby state. While the instance is in a standby state, its health status reflects the status that it had before you put it on standby. Amazon EC2 Auto Scaling does not perform a health check on the instance until you put it back in service.

For example, if you put a healthy instance on standby and then terminate it, Amazon EC2 Auto Scaling continues to report the instance as healthy. If you attempt to put a terminated instance that was on standby back in service, Amazon EC2 Auto Scaling performs a health check on the instance, determines that it is terminating and unhealthy, and launches a replacement instance. For more information, see Health checks for Auto Scaling instances (p. 297).

Temporarily remove an instance (console)

This section explains how you can temporarily remove an instance from your Auto Scaling group using the console.

To temporarily remove an instance

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Instance management tab, in Instances, select an instance.
4. Choose Actions, Set to Standby.
5. In the Set to Standby dialog box, keep the Replace instance check box selected to launch a replacement instance. Clear the check box to decrement the desired capacity.
6. When prompted for confirmation, type standby to confirm putting the specified instance into the Standby state, and then choose Set to Standby.
7. You can update or troubleshoot your instance as needed. When you have finished, continue with the next step to return the instance to service.
8. Select the instance, choose Actions, Set to InService. In the Set to InService dialog box, choose Set to InService.
Temporarily remove an instance (AWS CLI)

This section explains how you can temporarily remove an instance from your Auto Scaling group using the AWS CLI.

To temporarily remove an instance

1. Use the following `describe-auto-scaling-instances` command to identify the instance to update.

```bash/aws autoscaling describe-auto-scaling-instances```

The following is an example response.

```json
{
    "AutoScalingInstances": [
        {
            "ProtectedFromScaleIn": false,
            "AvailabilityZone": "us-west-2a",
            "LaunchTemplate": {
                "LaunchTemplateName": "my-launch-template",
                "Version": "1",
                "LaunchTemplateId": "lt-050555ad16a3f9c7f"
            },
            "InstanceId": "i-05b4f7d5be44822a6",
            "AutoScalingGroupName": "my-asg",
            "HealthStatus": "HEALTHY",
            "LifecycleState": "InService"
        }, ...
    ]
}
```

2. Move the instance into a Standby state using the following `enter-standby` command. The `--should-decrement-desired-capacity` option decreases the desired capacity so that the Auto Scaling group does not launch a replacement instance.

```bash/aws autoscaling enter-standby --instance-ids i-05b4f7d5be44822a6 \ --auto-scaling-group-name my-asg --should-decrement-desired-capacity```

The following is an example response.

```json
{
    "Activities": [
        {
            "Description": "Moving EC2 instance to Standby: i-05b4f7d5be44822a6",
            "AutoScalingGroupName": "my-asg",
            "ActivityId": "3b1839fe-24b0-40d9-80ae-bcd883c2be32",
            "Details": "{Availability Zone:"us-west-2a"}",
            "Progress": 50,
            "Cause": "At 2014-12-15T21:31:26Z instance i-05b4f7d5be44822a6 was moved to standby in response to a user request, shrinking the capacity from 4 to 3.",
            "StatusCode": "InProgress"
        }
    ]
}
```

3. (Optional) Verify that the instance is in Standby using the following `describe-auto-scaling-instances` command.
aws autoscaling describe-auto-scaling-instances --instance-ids i-05b4f7d5be44822a6

The following is an example response. Notice that the status of the instance is now Standby.

```json
{
  "AutoScalingInstances": [
    {
      "ProtectedFromScaleIn": false,
      "AvailabilityZone": "us-west-2a",
      "LaunchTemplate": {
        "LaunchTemplateName": "my-launch-template",
        "Version": "1",
        "LaunchTemplateId": "lt-050555ad16a3f9c7f"
      },
      "InstanceId": "i-05b4f7d5be44822a6",
      "AutoScalingGroupName": "my-asg",
      "HealthStatus": "HEALTHY",
      "LifecycleState": "Standby"
    },
    ...
  ]
}
```

4. You can update or troubleshoot your instance as needed. When you have finished, continue with the next step to return the instance to service.

5. Put the instance back in service using the following `exit-standby` command.

```
aws autoscaling exit-standby --instance-ids i-05b4f7d5be44822a6 --auto-scaling-group-name my-asg
```

The following is an example response.

```json
{
  "Activities": [
    {
      "Description": "Moving EC2 instance out of Standby: i-05b4f7d5be44822a6",
      "AutoScalingGroupName": "my-asg",
      "ActivityId": "db12b166-cdcc-4c54-8aac-08c5935f8389",
      "Details": "{Availability Zone: us-west-2a}"",
      "Progress": 30,
      "Cause": "At 2014-12-15T21:46:14Z instance i-05b4f7d5be44822a6 was moved out of standby in response to a user request, increasing the capacity from 3 to 4.,",
      "StatusCode": "PreInService"
    }
  ]
}
```

6. (Optional) Verify that the instance is back in service using the following `describe-auto-scaling-instances` command.

```
aws autoscaling describe-auto-scaling-instances --instance-ids i-05b4f7d5be44822a6
```

The following is an example response. Notice that the status of the instance is InService.

```json
{
  "AutoScalingInstances": [
```
Suspend and resume a process for an Auto Scaling group

This topic explains how to suspend and then resume one or more of the processes for your Auto Scaling group. You might want to do this, for example, so that you can investigate a configuration issue that is causing the process to fail, or to prevent Amazon EC2 Auto Scaling from marking instances unhealthy and replacing them while you are making changes to your Auto Scaling group.

Contents

- Types of processes (p. 291)
- Considerations (p. 292)
- Suspend and resume processes (console) (p. 294)
- Suspend and resume processes (AWS CLI) (p. 295)

Note

In addition to suspensions that you initiate, Amazon EC2 Auto Scaling can also suspend processes for Auto Scaling groups that repeatedly fail to launch instances. This is known as an administrative suspension. An administrative suspension most commonly applies to Auto Scaling groups that have been trying to launch instances for over 24 hours but have not succeeded in launching any instances. You can resume processes that were suspended by Amazon EC2 Auto Scaling for administrative reasons.

Types of processes

The suspend-resume feature supports the following processes:

- Launch—Adds instances to the Auto Scaling group when the group scales out, or when Amazon EC2 Auto Scaling chooses to launch instances for other reasons, such as when it adds instances to a warm pool.
- Terminate—Removes instances from the Auto Scaling group when the group scales in, or when Amazon EC2 Auto Scaling chooses to terminate instances for other reasons, such as when an instance is terminated for exceeding its maximum lifetime duration or failing a health check.
- AddToLoadBalancer—Adds instances to the attached load balancer target group or Classic Load Balancer when they are launched. For more information, see Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group (p. 344).
• AlarmNotification—Accepts notifications from CloudWatch alarms that are associated with dynamic scaling policies. For more information, see Dynamic scaling for Amazon EC2 Auto Scaling (p. 167).

• AZRebalance—Balances the number of EC2 instances in the group evenly across all of the specified Availability Zones when the group becomes unbalanced, for example, when a previously unavailable Availability Zone returns to a healthy state. For more information, see Rebalancing activities (p. 6).

• HealthCheck—Checks the health of the instances and marks an instance as unhealthy if Amazon EC2 or Elastic Load Balancing tells Amazon EC2 Auto Scaling that the instance is unhealthy. This process can override the health status of an instance that you set manually. For more information, see Health checks for Auto Scaling instances (p. 297).

• InstanceRefresh—Terminates and replaces instances using the instance refresh feature. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101).

• ReplaceUnhealthy—Terminates instances that are marked as unhealthy and then creates new instances to replace them. For more information, see Health checks for Auto Scaling instances (p. 297).

• ScheduledActions—Performs the scheduled scaling actions that you create or that are created for you when you create an AWS Auto Scaling scaling plan and turn on predictive scaling. For more information, see Scheduled scaling for Amazon EC2 Auto Scaling (p. 231).

Considerations

Consider the following before suspending processes:

• You can suspend and resume individual processes or all processes.

• Suspending a process affects all instances in your Auto Scaling group. For example, you can suspend the HealthCheck and ReplaceUnhealthy processes to reboot instances without Amazon EC2 Auto Scaling terminating the instances based on its health checks. If you need Amazon EC2 Auto Scaling to perform health checks on remaining instances, then use the standby feature instead of the suspend-resume feature. For more information, see Temporarily remove instances from your Auto Scaling group (p. 287).

• Suspending AlarmNotification allows you to temporarily stop the group's target tracking, step, and simple scaling policies without deleting the scaling policies or their associated CloudWatch alarms. To temporarily stop individual scaling policies instead, see Disable a scaling policy for an Auto Scaling group (p. 202).

• If you suspend the Launch and Terminate processes, or AZRebalance, and then you make changes to your Auto Scaling group, for example, by detaching instances or changing the Availability Zones that are specified, your group can become unbalanced between Availability Zones. If that happens, after you resume the suspended processes, Amazon EC2 Auto Scaling gradually redistributes instances evenly between the Availability Zones.

• Suspending the Terminate process doesn't prevent the successful termination of instances using the force delete option with the delete-auto-scaling-group command.

• The RemoveFromLoadBalancerLowPriority process should be ignored when it is present in calls to describe Auto Scaling groups using the AWS CLI or SDKs. This process is deprecated and is retained only for backward compatibility.

Understand how suspending processes affects other processes

The following descriptions explain what happens when individual process types are suspended.

Scenario 1: Launch is suspended

• AlarmNotification is still active, but your Auto Scaling group can't initiate scale-out activities for alarms that are in breach.
Considerations

- **ScheduledActions** is active, but your Auto Scaling group can't initiate scale-out activities for any scheduled actions that occur.
- **AZRebalance** stops rebalancing the group.
- **ReplaceUnhealthy** continues to terminate unhealthy instances, but does not launch replacements. When you resume the Launch process, Amazon EC2 Auto Scaling immediately replaces any instances that it terminated during the time that Launch was suspended.
- **InstanceRefresh** does not replace instances.

**Scenario 2: Terminate is suspended**

- **AlarmNotification** is still active, but your Auto Scaling group can't initiate scale-in activities for alarms that are in breach.
- **ScheduledActions** is active, but your Auto Scaling group can't initiate scale-in activities for any scheduled actions that occur.
- **AZRebalance** is still active but does not function properly. It can launch new instances without terminating the old ones. This could cause your Auto Scaling group to grow up to 10 percent larger than its maximum size, because this is allowed temporarily during rebalancing activities. Your Auto Scaling group could remain above its maximum size until you resume the Terminate process.
- **ReplaceUnhealthy** is inactive but not **HealthCheck**. When Terminate resumes, the ReplaceUnhealthy process immediately starts running. If any instances were marked as unhealthy while Terminate was suspended, they are immediately replaced.
- **InstanceRefresh** does not replace instances.

**Scenario 3: AddToLoadBalancer is suspended**

- Amazon EC2 Auto Scaling launches the instances but does not add them to the load balancer target group or Classic Load Balancer. When you resume the AddToLoadBalancer process, it resumes adding instances to the load balancer when they are launched. However, it does not add the instances that were launched while this process was suspended. You must register those instances manually.

**Scenario 4: AlarmNotification is suspended**

- Amazon EC2 Auto Scaling does not invoke scaling policies when a CloudWatch alarm threshold is in breach. When you resume **AlarmNotification**, Amazon EC2 Auto Scaling considers policies with alarm thresholds that are currently in breach.

**Scenario 5: AZRebalance is suspended**

- Amazon EC2 Auto Scaling does not attempt to redistribute instances after certain events. However, if a scale-out or scale-in event occurs, the scaling process still tries to balance the Availability Zones. For example, during scale out, it launches the instance in the Availability Zone with the fewest instances. If the group becomes unbalanced while AZRebalance is suspended and you resume it, Amazon EC2 Auto Scaling attempts to rebalance the group. It first calls **Launch** and then **Terminate**.

**Scenario 6: HealthCheck is suspended**

- Amazon EC2 Auto Scaling stops marking instances unhealthy as a result of EC2 and Elastic Load Balancing health checks. Your custom health checks continue to function properly. After you suspend HealthCheck, if you need to, you can manually set the health state of instances in your group and have ReplaceUnhealthy replace them.

**Scenario 7: InstanceRefresh is suspended**
- Amazon EC2 Auto Scaling stops replacing instances as a result of an instance refresh. If there is an instance refresh in progress, this pauses the operation without canceling it.

Scenario 8: ReplaceUnhealthy is suspended

- Amazon EC2 Auto Scaling stops replacing instances that are marked as unhealthy. Instances that fail EC2 or Elastic Load Balancing health checks are still marked as unhealthy. As soon as you resume the ReplaceUnhealthy process, Amazon EC2 Auto Scaling replaces instances that were marked unhealthy while this process was suspended. The ReplaceUnhealthy process calls Terminate first and then Launch.

Scenario 9: ScheduledActions is suspended

- Amazon EC2 Auto Scaling does not run scheduled actions that are scheduled to run during the suspension period. When you resume ScheduledActions, Amazon EC2 Auto Scaling only considers scheduled actions whose scheduled time has not yet passed.

Additional considerations

In addition, when Launch or Terminate are suspended, the following features might not function correctly:

- **Maximum instance lifetime**—When Launch or Terminate are suspended, the maximum instance lifetime feature can't replace any instances.

- **Spot Instance interruptions**—If Terminate is suspended and your Auto Scaling group has Spot Instances, they can still terminate in the event that Spot capacity is no longer available. While Launch is suspended, Amazon EC2 Auto Scaling can't launch replacement instances from another Spot Instance pool or from the same Spot Instance pool when it is available again.

- **Capacity Rebalancing**—If Terminate is suspended and you use Capacity Rebalancing to handle Spot Instance interruptions, the Amazon EC2 Spot service can still terminate instances in the event that Spot capacity is no longer available. If Launch is suspended, Amazon EC2 Auto Scaling can't launch replacement instances from another Spot Instance pool or from the same Spot Instance pool when it is available again.

- **Attaching and detaching instances**—When Launch and Terminate are suspended, you can detach instances that are attached to your Auto Scaling group, but while Launch is suspended, you can't attach new instances to the group.

- **Standby instances**—When Launch and Terminate are suspended, you can put an instance in the Standby state, but while Launch is suspended, you can't return an instance in the Standby state to service.

Suspend and resume processes (console)

Use the following procedure to suspend a process.

**To suspend a process**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   
   A split pane opens up in the bottom of the page.
3. On the Details tab, choose Advanced configurations, Edit.
4. For **Suspended processes**, choose the process to suspend.
5. Choose **Update**.

When you are ready, use the following procedure to resume the suspended process.

**To resume a process**

1. On the **Details** tab, choose **Advanced configurations**, **Edit**.
2. For **Suspended processes**, remove the suspended process.
3. Choose **Update**.

### Suspend and resume processes (AWS CLI)

Use the following `suspend-processes` command to suspend individual processes.

```bash
aws autoscaling suspend-processes --auto-scaling-group-name my-asg --scaling-processes HealthCheck ReplaceUnhealthy
```

To suspend all processes, omit the `--scaling-processes` option, as follows.

```bash
aws autoscaling suspend-processes --auto-scaling-group-name my-asg
```

When you are ready to resume a suspended process, use the following `resume-processes` command.

```bash
aws autoscaling resume-processes --auto-scaling-group-name my-asg --scaling-processes HealthCheck
```

To resume all suspended processes, omit the `--scaling-processes` option, as follows.

```bash
aws autoscaling resume-processes --auto-scaling-group-name my-asg
```
Monitor your Auto Scaling groups

Monitoring is an important part of maintaining the reliability, availability, and performance of Amazon EC2 Auto Scaling and your AWS Cloud solutions. AWS provides the following monitoring tools to watch Amazon EC2 Auto Scaling, report when something is wrong, and take automatic actions when appropriate:

Health checks

Amazon EC2 Auto Scaling periodically performs health checks on the instances in your Auto Scaling group. If an instance does not pass its health check, it is marked unhealthy and will be terminated while Amazon EC2 Auto Scaling launches a new instance to replace it. For more information, see Health checks for Auto Scaling instances (p. 297).

AWS Health Dashboard

The AWS Health Dashboard displays information, and also provides notifications that are invoked by changes in the health of AWS resources. The information is presented in two ways: on a dashboard that shows recent and upcoming events organized by category, and in a full event log that shows all events from the past 90 days. For more information, see AWS Health Dashboard notifications for Amazon EC2 Auto Scaling (p. 304).

CloudTrail

With AWS CloudTrail, you can track the calls made to the Amazon EC2 Auto Scaling API by or on behalf of your AWS account. CloudTrail stores the information in log files in the Amazon S3 bucket that you specify. You can use these log files to monitor activity of your Auto Scaling groups. Logs include which requests were made, the source IP addresses where the requests came from, who made the request, when the request was made, and so on. For more information, see Log Amazon EC2 Auto Scaling API calls with AWS CloudTrail (p. 314).

Log collection for your Amazon EC2 instances

You can use CloudWatch to collect logs from the operating systems for your EC2 instances. For more information, see Collect metrics and logs from Amazon EC2 instances and on-premises servers with the CloudWatch agent and View log data sent to CloudWatch Logs in the Amazon CloudWatch User Guide. For information about other AWS services that can help you log and collect data about your workloads, see the Logging and monitoring guide for application owners guide in the AWS Prescriptive Guidance.

Amazon CloudWatch

Amazon CloudWatch helps you analyze logs and, in real time, monitor the metrics of your AWS resources and hosted applications. You can collect and track metrics, create customized dashboards, and set alerts that notify you or take actions when a specified metric reaches a threshold that you specify. For example, you can be notified when network activity is suddenly higher or lower than a metric's expected value. For more information about using this service to monitor the metrics of your Auto Scaling groups and instances, see Monitor CloudWatch metrics for your Auto Scaling groups and instances (p. 305).

CloudWatch also tracks AWS API usage metrics for Amazon EC2 Auto Scaling. You can use these metrics to configure alarms that alert you when your API call volume violates a threshold that you define. For more information, see AWS usage metrics in the Amazon CloudWatch User Guide.

AWS Compute Optimizer

Compute Optimizer provides Amazon EC2 instance recommendations that can help you decide whether to move to a new instance type. It analyzes whether an Auto Scaling group's instance type is optimal and generates recommendations to reduce the cost and improve the performance of your workloads. For more information, see Use AWS Compute Optimizer to get recommendations for the instance type for an Auto Scaling group (p. 342).
Amazon EventBridge

Amazon EventBridge is a serverless event bus service that makes it easy to connect your applications with data from a variety of sources. EventBridge delivers a stream of real-time data from your own applications, Software-as-a-Service (SaaS) applications, and AWS services and routes that data to targets such as Lambda. This lets you monitor events that happen in services, and build event-driven architectures. For more information, see Use EventBridge to handle Auto Scaling events (p. 372).

AWS Security Hub

Use AWS Security Hub to monitor your usage of Amazon EC2 Auto Scaling as it relates to security best practices. Security Hub uses detective security controls to evaluate resource configurations and security standards to help you comply with various compliance frameworks. For more information about using Security Hub to evaluate Amazon EC2 Auto Scaling resources, see Amazon EC2 Auto Scaling controls in the AWS Security Hub User Guide.

Amazon Simple Notification Service

You can configure Auto Scaling groups to send Amazon SNS notifications when Amazon EC2 Auto Scaling launches or terminates instances. For more information, see Get Amazon SNS notifications when your Auto Scaling group scales (p. 317).

Health checks for Auto Scaling instances

The health status of an Auto Scaling instance indicates whether it's healthy or unhealthy. All instances in your Auto Scaling group start with a Healthy status. Instances are assumed to be healthy unless Amazon EC2 Auto Scaling receives notification that they are unhealthy. This notification can come from sources such as Amazon EC2, Elastic Load Balancing, VPC Lattice, or custom health checks. When Amazon EC2 Auto Scaling detects an unhealthy instance, it replaces it with a new instance.

Contents

- Health check types (p. 297)
- Amazon EC2 health checks (p. 298)
- Elastic Load Balancing health checks (p. 299)
- VPC Lattice health checks (p. 299)
- Custom health detection tasks (p. 300)
- Unhealthy instance replacement (p. 301)
- How Amazon EC2 Auto Scaling minimizes downtime (p. 301)
- Health check considerations (p. 302)
- Additional information (p. 302)
- Set the health check grace period for an Auto Scaling group (p. 302)

Health check types

Amazon EC2 Auto Scaling can determine the health status of an instance by using one or more of the following health checks:

<table>
<thead>
<tr>
<th>Health check type</th>
<th>What it checks</th>
</tr>
</thead>
</table>
| Amazon EC2 status checks and scheduled events | • Checks that the instance is running
• Checks for underlying hardware or software issues that might impair the instance |
Amazon EC2 health checks

After an instance launches, it's attached to the Auto Scaling group and enters the InService state. For more information about the different lifecycle states for instances in an Auto Scaling group, see Amazon EC2 Auto Scaling instance lifecycle on page 7.

Amazon EC2 Auto Scaling periodically checks the health status of all instances within the Auto Scaling group to make sure that they're running and in good condition.

### Status checks

Amazon EC2 Auto Scaling uses the results of the Amazon EC2 instance status checks and system status checks to determine the health status of an instance. If the instance is in any Amazon EC2 state other than running, or if its status for the status checks becomes impaired, Amazon EC2 Auto Scaling considers the instance to be unhealthy and replaces it. This includes when the instance has any of the following states:

- stopping
- stopped
- shutting-down
- terminated

The Amazon EC2 status checks do not require any special configuration and are always enabled. For more information, see Types of status checks in the Amazon EC2 User Guide for Linux Instances.

#### Important

Amazon EC2 Auto Scaling lets the status checks fail occasionally, without taking any action. When a status check fails, Amazon EC2 Auto Scaling waits a few minutes for AWS to fix the issue. It does not immediately mark an instance Unhealthy when its status for the status checks becomes impaired.

However, if Amazon EC2 Auto Scaling detects that an instance is no longer in the running state, this situation is treated as an immediate failure. In this case, it immediately marks the instance Unhealthy and replaces it.

### Scheduled events

---

<table>
<thead>
<tr>
<th>Health check type</th>
<th>What it checks</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is the default health check type for an Auto Scaling group.</td>
<td></td>
</tr>
<tr>
<td>Elastic Load Balancing health checks</td>
<td>Checks whether the load balancer reports the instance as healthy, confirming whether the instance is available to handle requests</td>
</tr>
<tr>
<td>To run this health check type, you must enable it for your Auto Scaling group.</td>
<td></td>
</tr>
<tr>
<td>VPC Lattice health checks</td>
<td>Checks whether VPC Lattice reports the instance as healthy, confirming whether the instance is available to handle requests</td>
</tr>
<tr>
<td>To run this health check type, you must enable it for your Auto Scaling group.</td>
<td></td>
</tr>
<tr>
<td>Custom health checks</td>
<td>Checks for any other problems that might indicate instance health issues, according to your custom health checks</td>
</tr>
</tbody>
</table>
Amazon EC2 can occasionally schedule events on your instances to be run after a particular timestamp. For more information, see Scheduled events for your instances in the Amazon EC2 User Guide for Linux Instances.

If one of your instances is affected by a scheduled event, Amazon EC2 Auto Scaling considers the instance to be unhealthy and replaces it. The instance doesn't start terminating until the date and time specified in the timestamp is reached.

**Elastic Load Balancing health checks**

When you enable Elastic Load Balancing health checks for your Auto Scaling group, Amazon EC2 Auto Scaling can use the results of those health checks to determine the health status of an instance.

Before you can enable Elastic Load Balancing health checks for your Auto Scaling group, you must do the following:

- Set up an Elastic Load Balancing load balancer and configure a health check for it to use to determine if your instances are healthy.
- Attach the load balancer to your Auto Scaling group.

After you complete the preceding actions, the following occurs:

- Amazon EC2 Auto Scaling registers the instances in the Auto Scaling group with the load balancer.
- After an instance finishes registering, it enters the InService state and becomes available for use with the load balancer.

By default, Amazon EC2 Auto Scaling ignores the results of the Elastic Load Balancing health checks. However, you can enable these health checks for your Auto Scaling group. After you do this, when Elastic Load Balancing reports a registered instance as Unhealthy, Amazon EC2 Auto Scaling marks the instance Unhealthy on its next periodic health check and replaces it.

If connection draining (deregistration delay) is enabled for your load balancer, Amazon EC2 Auto Scaling waits for either in-flight requests to complete or the maximum timeout to expire before it terminates unhealthy instances.

To learn how to enable Elastic Load Balancing health checks for your Auto Scaling group, see Add Elastic Load Balancing health checks to an Auto Scaling group (p. 350).

**Note**

When you enable Elastic Load Balancing health checks for a group, Amazon EC2 Auto Scaling can terminate and replace instances that Elastic Load Balancing reports as unhealthy, but only after the load balancer is in the InService state. For more information, see Verify the attachment status of your load balancer (p. 349).

**VPC Lattice health checks**

By default, Amazon EC2 Auto Scaling ignores the results of the VPC Lattice health checks. You can optionally enable these health checks for your Auto Scaling group. After you do this, when VPC Lattice reports a registered instance as Unhealthy, Amazon EC2 Auto Scaling marks the instance Unhealthy on its next periodic health check and replaces it. The process of registering instances and then checking their health is the same as how Elastic Load Balancing health checks work.

To learn how to enable VPC Lattice health checks for your Auto Scaling group, see Attach a VPC Lattice target group to your Auto Scaling group (p. 368).
**Note**
When you enable VPC Lattice health checks for a group, Amazon EC2 Auto Scaling can replace instances that VPC Lattice reports as unhealthy, but only after the target group is in the `InService` state. For more information, see [Verify the attachment status of your VPC Lattice target group](p. 371).

### Custom health detection tasks

You might also want to run custom health detection tasks on the instances in your Auto Scaling group and set the health status of an instance to `Unhealthy` if the task fails. This extends your health checks by using a combination of custom health checks, Amazon EC2 status checks, and Elastic Load Balancing health checks, if enabled.

You can send the instance health information directly to Amazon EC2 Auto Scaling using the AWS CLI or an SDK. The following examples show how to use the AWS CLI to configure the health status of an instance and then verify the instance's health status.

Use the following `set-instance-health` command to set the health status of the specified instance to `Unhealthy`.

```bash
aws autoscaling set-instance-health --instance-id i-1234567890abcdef0 --health-status Unhealthy
```

By default, this command respects the health check grace period. However, you can override this behavior and not respect the grace period by including the `--no-should-respect-grace-period` option.

Use the following `describe-auto-scaling-groups` command to verify that the instance's health status is Unhealthy.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-names my-asg
```

The following is an example response that shows that the health status of the instance is Unhealthy and that the instance is terminating.

```json
{
    "AutoScalingGroups": [
        {
            "Instances": [
                {
                    "ProtectedFromScaleIn": false,
                    "AvailabilityZone": "us-west-2a",
                    "LaunchTemplate": {
                        "LaunchTemplateName": "my-launch-template",
                        "Version": "1",
                        "LaunchTemplateId": "lt-1234567890abcdef0"
                    },
                    "InstanceId": "i-1234567890abcdef0",
                    "InstanceType": "t2.micro",
                    "HealthStatus": "Unhealthy",
                    "LifecycleState": "Terminating"
                }
            ]
        }
    ]
}
```
Unhealthy instance replacement

When Amazon EC2 Auto Scaling determines that an InService instance is unhealthy, it terminates the instance while it launches a new replacement instance. The new instance launches using the current settings of the Auto Scaling group and its associated launch template or launch configuration.

Amazon EC2 Auto Scaling creates a new scaling activity for terminating the unhealthy instance and then terminations it. While the instance is terminating, another scaling activity launches a new instance.

To view the reason for health check failures (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to the Auto Scaling group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched or terminated instances.
   If it terminated any unhealthy instances, the Cause column shows the date and time of the termination and the reason for the health check failure. For example, At 2022-05-14T20:11:53Z an instance was taken out of service in response to an ELB system health check failure.

How Amazon EC2 Auto Scaling minimizes downtime

Health check replacements require instances to terminate first, which might prevent new requests from being accepted until new instances launch.

If Amazon EC2 Auto Scaling determines that any instances are no longer running or were marked Unhealthy with the set-instance-health command, it immediately replaces them. However, if other instances are found to be unhealthy, Amazon EC2 Auto Scaling uses the following approach to recover from failures. This approach minimizes any downtime that might occur because of temporary issues or misconfigured health checks.

- If a scaling activity is in progress and your Auto Scaling group is below its desired capacity by 10 percent or more, Amazon EC2 Auto Scaling waits for the in-progress scaling activity before replacing the unhealthy instances.
- When scaling out, Amazon EC2 Auto Scaling waits for the instances to pass an initial health check. It also waits for the default instance warmup to finish to make sure that the new instances are ready.
- After the instances finish warming up and the group has risen to above 90 percent of its desired capacity, Amazon EC2 Auto Scaling replaces the unhealthy instances as follows:
  - Amazon EC2 Auto Scaling only replaces up to 10 percent of the group's desired capacity at a time. It does this until all of the unhealthy instances are replaced.
  - When replacing instances, it waits for the new instances to pass an initial health check. It also waits for the default instance warmup to finish before continuing.

Note

If the size of an Auto Scaling group is small enough that the resulting value of 10 percent is less than one, Amazon EC2 Auto Scaling replaces the unhealthy instances one at a time instead. This might result in some downtime for the group. Also, if all instances in an Auto Scaling group are reported unhealthy by Elastic Load Balancing health checks and the load balancer is in the InService state, Amazon EC2 Auto Scaling might mark fewer instances unhealthy at a time. This can result in much fewer instances replaced at a
time than the 10 percent applied in other scenarios. This provides you time to fix the problem without Amazon EC2 Auto Scaling automatically terminating the entire group.

Health check considerations

This section contains considerations for Amazon EC2 Auto Scaling health checks.

- If you need something to happen on the instance that is terminating, or on the instance that is starting up, you can use lifecycle hooks. These hooks let you perform a custom action as Amazon EC2 Auto Scaling launches or terminates instances. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

- Amazon EC2 Auto Scaling does not provide a way of removing the Amazon EC2 status checks and scheduled events from its health checks. If you do not want instances to be replaced, we recommend that you suspend the ReplaceUnhealthy and HealthCheck process for individual Auto Scaling groups. For more information, see Suspend and resume a process for an Auto Scaling group (p. 291).

- To manually set an unhealthy instance's health status back to Healthy, you can try to use the set-instance-health command. If you get an error, this is probably because the instance is already terminating. Generally, setting an instance's health status back to Healthy with the set-instance-health command is only useful in cases where either the ReplaceUnhealthy process or the Terminate process is suspended.

- Amazon EC2 Auto Scaling does not perform health checks on instances that are in the Standby state. For more information, see Temporarily remove instances from your Auto Scaling group (p. 287).

- When your instance is terminated, any associated Elastic IP addresses are disassociated and are not automatically associated with the new instance. You must manually associate the Elastic IP addresses with the new instance, or do it automatically with a lifecycle hook-based solution. For more information, see Elastic IP addresses in the Amazon EC2 User Guide for Linux Instances.

- Similarly, when your instance is terminated, its attached EBS volumes are detached (or deleted depending on the volume's DeleteOnTermination attribute). You must manually attach these EBS volumes to the new instance, or do it automatically with a lifecycle hook-based solution. For more information, see Attach an Amazon EBS volume to an instance in the Amazon EC2 User Guide for Linux Instances.

Additional information

For information about troubleshooting health checks, see Troubleshoot Amazon EC2 Auto Scaling: Health checks (p. 441). If your health checks fail, check this topic for troubleshooting steps. This topic will help you figure out what has gone wrong in your Auto Scaling group and give you suggestions on how to fix it.

Amazon EC2 Auto Scaling also monitors the health of instances that you launch into a warm pool using Amazon EC2, Amazon EBS, or custom health checks. For more information, see View health check status and the reason for health check failures (p. 268).

Set the health check grace period for an Auto Scaling group

When an Amazon EC2 Auto Scaling health check determines that an InService instance is unhealthy, it terminates the instance and launches a new replacement instance. The health check grace period specifies the minimum amount of time (in seconds) to keep a new instance in service before terminating it if it's found to be unhealthy.

An example use case might be a requirement for Amazon EC2 Auto Scaling to avoid taking action if the Elastic Load Balancing health checks fail and the cause is that the instance is still initializing. Elastic Load
Balancing health checks run in parallel, starting when the instance is registered with the load balancer. The grace period prevents Amazon EC2 Auto Scaling from marking your newly launched instances Unhealthy and terminating them unnecessarily if they do not immediately pass these health checks after they enter the InService state.

In the console, by default, the health check grace period is 300 seconds when you create an Auto Scaling group. Its default value is 0 seconds when you create an Auto Scaling group using the AWS CLI or an SDK.

Setting this value too high reduces the effectiveness of the Amazon EC2 Auto Scaling health checks. If you use lifecycle hooks for instance launch, you can set the health check grace period to 0. With lifecycle hooks, Amazon EC2 Auto Scaling provides a way to make sure that instances are always initialized before they enter the InService state. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

The grace period applies to the following instances:

- Newly launched instances
- Instances that are put back into service after being in standby
- Instances that you manually attach to the group

**Important**

During the health check grace period, if Amazon EC2 Auto Scaling detects that an instance is no longer in the Amazon EC2 running state, it immediately marks the instance Unhealthy and replaces it. For example, if you stop an instance in an Auto Scaling group, it is marked Unhealthy and replaced.

**Set the health check grace period for a group**

You can set the health check grace period for new and existing Auto Scaling groups.

**Console**

**To modify the health check grace period for a new group (console)**

When you create the Auto Scaling group, on the Configure advanced options page, for Health checks, **Health check grace period**, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state.

**AWS CLI**

**To modify the health check grace period for a new group (AWS CLI)**

Add the `--health-check-grace-period` option to the `create-auto-scaling-group` command. The following example configures the health check grace period with a value of 60 seconds for a new Auto Scaling group named `my-asg`.

```
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg --health-check-grace-period 60 ...
```

**Console**

**To modify the health check grace period for an existing group (console)**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the AWS Region that you created your Auto Scaling group in.

3. Select the check box next to the Auto Scaling group.

   A split pane opens up in the bottom of the Auto Scaling groups page.

4. On the Details tab, choose Health checks, Edit.

5. Under Health check grace period, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state.

6. Choose Update.

AWS CLI

To modify the health check grace period for an existing group (AWS CLI)

Add the --health-check-grace-period option to the update-auto-scaling-group command. The following example configures the health check grace period with a value of 120 seconds for an existing Auto Scaling group named my-asg.

```bash
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --health-check-grace-period 120
```

Note

We strongly recommend also setting the default instance warm-up time for your Auto Scaling group. For more information, see Set the default instance warmup for an Auto Scaling group (p. 187).

AWS Health Dashboard notifications for Amazon EC2 Auto Scaling

Your AWS Health Dashboard provides support for notifications that come from Amazon EC2 Auto Scaling. These notifications provide awareness and remediation guidance for resource performance or availability issues that may affect your applications. Only events that are specific to missing security groups and launch templates are currently available.

The AWS Health Dashboard is part of the AWS Health service. It requires no set up and can be viewed by any user that is authenticated in your account. For more information, see Getting started with the AWS Health Dashboard.

If you receive a message similar to the following messages, it should be treated as an alarm to take action.

Example: Auto Scaling group is not scaling out due to a missing security group

Hello,

At 2020-01-11 04:00 UTC, we detected an issue with your Auto Scaling group [ARN] in AWS account 123456789012.

A security group associated with this Auto Scaling group cannot be found. Each time a scale out operation is performed, it will be prevented until you make a change that fixes the issue.
Monitor CloudWatch metrics for your Auto Scaling groups and instances

*Metrics* are the fundamental concept in Amazon CloudWatch. A metric represents a time-ordered set of data points that are published to CloudWatch. Think of a metric as a variable to monitor, and the data points as representing the values of that variable over time. You can use these metrics to verify that your system is performing as expected.

Amazon EC2 Auto Scaling metrics that collect information about Auto Scaling groups are in the AWS/AutoScaling namespace. Amazon EC2 instance metrics that collect CPU and other usage data from Auto Scaling instances are in the AWS/EC2 namespace.

The Amazon EC2 Auto Scaling console displays a series of graphs for the group metrics and the aggregated instance metrics for the group. Depending on your needs, you might prefer to access data for your Auto Scaling groups and instances from Amazon CloudWatch instead of the Amazon EC2 Auto Scaling console.

For more information, see the [Amazon CloudWatch User Guide](#).

**Contents**
- View monitoring graphs in the Amazon EC2 Auto Scaling console (p. 305)
- Amazon CloudWatch metrics for Amazon EC2 Auto Scaling (p. 308)
- Configure monitoring for Auto Scaling instances (p. 313)

**View monitoring graphs in the Amazon EC2 Auto Scaling console**

In the Amazon EC2 Auto Scaling section of the Amazon EC2 console, you can monitor minute-by-minute progress of individual Auto Scaling groups using CloudWatch metrics.
You can monitor the following types of metrics:

- **Auto Scaling metrics** – Auto Scaling metrics are turned on only when you enable them. For more information, see [Enable Auto Scaling group metrics (console)](p. 312). When Auto Scaling metrics are enabled, the monitoring graphs show data published at one-minute granularity for Auto Scaling metrics.

- **EC2 metrics** – The Amazon EC2 instance metrics are always enabled. When detailed monitoring is enabled, the monitoring graphs show data published at one-minute granularity for instance metrics. For more information, see [Configure monitoring for Auto Scaling instances](p. 313).

To view monitoring graphs using the Amazon EC2 Auto Scaling console

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.

   A split pane opens up in the bottom part of the **Auto Scaling groups** page.

2. Select the check box next to the Auto Scaling group that you want to view metrics for.

3. Choose the **Monitoring** tab.

   Amazon EC2 Auto Scaling displays monitoring graphs for **Auto Scaling** metrics.

4. To view monitoring graphs of the aggregated instance metrics for the group, choose **EC2**.

Graph actions

- Hover on a data point to view a data pop-up for a specific time in UTC.

- To enlarge a graph, choose **Enlarge** from the menu tool (the three vertical dots) in the upper right of the graph. Alternatively, choose the maximize icon at the top of the graph.

- Adjust the time period for data displayed in the graph by selecting one of the predefined time period values. If the graph is enlarged, you can choose **Custom** to define your own time period.

- Choose **Refresh** from the menu tool to update the data in a graph.

- Drag your cursor over the graph data to select a specific range. You can then choose **Apply time range** in the menu tool.

- Choose **View logs** from the menu tool to view associated log streams (if any) in the CloudWatch console.

- To view a graph in CloudWatch, choose **View in metrics** from the menu tool. This takes you to the CloudWatch page for that graph. There, you can view more information or access historical information to gain a better understanding of how your Auto Scaling group changed over an extended period.

Graph metrics for your Auto Scaling groups

After you create an Auto Scaling group, you can open the Amazon EC2 Auto Scaling console and view the monitoring graphs for the group on the **Monitoring** tab.

In the **Auto Scaling** section, the graph metrics include the following metrics. These metrics provide measurements that can be indicators of a potential issue, such as number of terminating instances or number of pending instances. You can find definitions for these metrics in [Amazon CloudWatch metrics for Amazon EC2 Auto Scaling](p. 308).

<table>
<thead>
<tr>
<th>Display name</th>
<th>CloudWatch metric name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Group Size</td>
<td>GroupMinSize</td>
</tr>
</tbody>
</table>
View monitoring graphs in the Amazon EC2 Auto Scaling console

<table>
<thead>
<tr>
<th>Display name</th>
<th>CloudWatch metric name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Group Size</td>
<td>GroupMaxSize</td>
</tr>
<tr>
<td>Desired Capacity</td>
<td>GroupDesiredCapacity</td>
</tr>
<tr>
<td>In Service Instances</td>
<td>GroupInServiceInstances</td>
</tr>
<tr>
<td>Pending Instances</td>
<td>GroupPendingInstances</td>
</tr>
<tr>
<td>Standby Instances</td>
<td>GroupStandbyInstances</td>
</tr>
<tr>
<td>Terminating Instances</td>
<td>GroupTerminatingInstances</td>
</tr>
<tr>
<td>Total Instances</td>
<td>GroupTotalInstances</td>
</tr>
</tbody>
</table>

In the EC2 section, you can find the following graph metrics based on key performance metrics for your Amazon EC2 instances. These EC2 metrics are an aggregate of metrics for all instances in the group. You can find definitions for these metrics in [List the available CloudWatch metrics for your instances](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/cloudwatch-metrics.html) in the Amazon EC2 User Guide for Linux Instances.

<table>
<thead>
<tr>
<th>Display name</th>
<th>CloudWatch metric name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Utilization</td>
<td>CPUUtilization</td>
</tr>
<tr>
<td>Disk Reads</td>
<td>DiskReadBytes</td>
</tr>
<tr>
<td>Disk Read Operations</td>
<td>DiskReadOps</td>
</tr>
<tr>
<td>Disk Writes</td>
<td>DiskWriteBytes</td>
</tr>
<tr>
<td>Disk Write Operations</td>
<td>DiskWriteOps</td>
</tr>
<tr>
<td>Network In</td>
<td>NetworkIn</td>
</tr>
<tr>
<td>Network Out</td>
<td>NetworkOut</td>
</tr>
<tr>
<td>Status Check Failed (Any)</td>
<td>StatusCheckFailed</td>
</tr>
<tr>
<td>Status Check Failed (Instance)</td>
<td>StatusCheckFailed_Instance</td>
</tr>
<tr>
<td>Status Check Failed (System)</td>
<td>StatusCheckFailed_System</td>
</tr>
</tbody>
</table>

In addition, some metrics are available for specific use cases in the Auto Scaling graph metrics.

The following metrics are useful if your group uses weights that define how many units each instance contributes to the desired capacity of the group. You can find definitions for these metrics in [Amazon CloudWatch metrics for Amazon EC2 Auto Scaling](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/cloudwatch-metrics-auto-scaling.html) (p. 308).

<table>
<thead>
<tr>
<th>Display name</th>
<th>CloudWatch metric name</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Service Capacity Units</td>
<td>GroupInServiceCapacity</td>
</tr>
<tr>
<td>Pending Capacity Units</td>
<td>GroupPendingCapacity</td>
</tr>
<tr>
<td>Standby Capacity Units</td>
<td>GroupStandbyCapacity</td>
</tr>
<tr>
<td>Terminating Capacity Units</td>
<td>GroupTerminatingCapacity</td>
</tr>
</tbody>
</table>
The following metrics are useful if your group uses the warm pool (p. 261) feature. You can find definitions for these metrics in Amazon CloudWatch metrics for Amazon EC2 Auto Scaling (p. 308).

<table>
<thead>
<tr>
<th>Display name</th>
<th>CloudWatch metric name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Capacity Units</td>
<td>GroupTotalCapacity</td>
</tr>
<tr>
<td>Warm Pool Minimum Size</td>
<td>WarmPoolMinSize</td>
</tr>
<tr>
<td>Warm Pool Desired Capacity</td>
<td>WarmPool DesiredCapacity</td>
</tr>
<tr>
<td>Warm Pool Pending Capacity Units</td>
<td>WarmPool PendingCapacity</td>
</tr>
<tr>
<td>Warm Pool Terminating Capacity Units</td>
<td>WarmPool TerminatingCapacity</td>
</tr>
<tr>
<td>Warm Pool Warmed Capacity Units</td>
<td>WarmPool WarmedCapacity</td>
</tr>
<tr>
<td>Warm Pool Total Capacity Units Launched</td>
<td>WarmPool TotalCapacity</td>
</tr>
<tr>
<td>Group and Warm Pool Desired Capacity</td>
<td>GroupAndWarmPool DesiredCapacity</td>
</tr>
<tr>
<td>Group and Warm Pool Total Capacity Units Launched</td>
<td>GroupAndWarmPool TotalCapacity</td>
</tr>
</tbody>
</table>

Related resources

- To monitor per-instance metrics, see [Graph metrics for your instances](#) in the Amazon EC2 User Guide for Linux Instances.
- CloudWatch dashboards are customizable home pages in the CloudWatch console. You can use these pages to monitor your resources in a single view, even including resources that are spread across different Regions. You can use CloudWatch dashboards to create customized views of the metrics and alarms for your AWS resources. For more information, see the Amazon CloudWatch User Guide.

Amazon CloudWatch metrics for Amazon EC2 Auto Scaling

Amazon EC2 Auto Scaling publishes the following metrics in the AWS/AutoScaling namespace. The actual Auto Scaling group metrics made available will depend on whether you have group metrics enabled, and which group metrics you enabled. Group metrics are available at one-minute granularity at no additional charge, but you must enable them.

When you enable Auto Scaling group metrics, Amazon EC2 Auto Scaling sends sampled data to CloudWatch every minute on a best-effort basis. In rare cases when CloudWatch experiences a service disruption, data isn't backfilled to fill gaps in group metric history.

Contents
Auto Scaling group metrics

With these metrics, you get nearly continuous visibility into the history of your Auto Scaling group, such as changes in the size of the group over time.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GroupMinSize</td>
<td>The minimum size of the Auto Scaling group.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupMaxSize</td>
<td>The maximum size of the Auto Scaling group.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupDesiredCapacity</td>
<td>The number of instances that the Auto Scaling group attempts to maintain.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupInServiceInstances</td>
<td>The number of instances that are running as part of the Auto Scaling group. This metric does not include instances that are pending or terminating.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupPendingInstances</td>
<td>The number of instances that are pending. A pending instance is not yet in service. This metric does not include instances that are in service or terminating.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupStandbyInstances</td>
<td>The number of instances that are in a Standby state. Instances in this state are still running but are not actively in service.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupTerminatingInstances</td>
<td>The number of instances that are in the process of terminating. This metric does not include instances that are in service or pending.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupTotalInstances</td>
<td>The total number of instances in the Auto Scaling group. This metric identifies the number of instances that are in service, pending, and terminating.</td>
</tr>
<tr>
<td><strong>Reporting criteria:</strong></td>
<td>Reported if metrics collection is enabled.</td>
</tr>
</tbody>
</table>

When instance weighting is used, the following metrics count the number of capacity units used by your Auto Scaling group. If instance weighting is not used, then the following metrics are populated, but are equal to the metrics that are defined in the previous table. For more information about instance
weighting, see Configure instance weighting for Amazon EC2 Auto Scaling (p. 81) and Create an Auto
Scaling group using attribute-based instance type selection (p. 87).

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GroupInServiceCapacity</td>
<td>The number of capacity units that are running as part of the Auto Scaling group.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupPendingCapacity</td>
<td>The number of capacity units that are pending.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupStandbyCapacity</td>
<td>The number of capacity units that are in a Standby state.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupTerminatingCapacity</td>
<td>The number of capacity units that are in the process of terminating.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupTotalCapacity</td>
<td>The total number of capacity units in the Auto Scaling group.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
</tbody>
</table>

Amazon EC2 Auto Scaling also reports the following metrics for Auto Scaling groups that have a warm pool. For more information, see Warm pools for Amazon EC2 Auto Scaling (p. 261).

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WarmPoolMinSize</td>
<td>The minimum size of the warm pool.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>WarmPoolDesiredCapacity</td>
<td>The amount of capacity that Amazon EC2 Auto Scaling attempts to maintain in the warm pool.</td>
</tr>
<tr>
<td></td>
<td>This is equivalent to the maximum size of the Auto Scaling group minus its desired capacity, or, if set, as the maximum prepared capacity of the Auto Scaling group minus its desired capacity.</td>
</tr>
<tr>
<td></td>
<td>However, when the minimum size of the warm pool is equal to or greater than the difference between the maximum size (or, if set, the maximum prepared capacity) and the desired capacity of the Auto Scaling group, then the warm pool desired capacity will be equivalent to the WarmPoolMinSize.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>WarmPoolPendingCapacity</td>
<td>The amount of capacity in the warm pool that is pending. This metric does not include instances that are running, stopped, or terminating.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>WarmPoolTerminatingCapacity</td>
<td>The amount of capacity in the warm pool that is in the process of terminating. This metric does not include instances that are running, stopped, or pending.</td>
</tr>
</tbody>
</table>
### Metric Description

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>WarmPoolWarmedCapacity</td>
<td>The amount of capacity available to enter the Auto Scaling group during scale out. This metric does not include instances that are pending or terminating.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>WarmPoolTotalCapacity</td>
<td>The total capacity of the warm pool, including instances that are running, stopped, pending, or terminating.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupAndWarmPoolDesiredCapacity</td>
<td>The desired capacity of the Auto Scaling group and the warm pool combined.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
<tr>
<td>GroupAndWarmPoolTotalCapacity</td>
<td>The total capacity of the Auto Scaling group and the warm pool combined. This includes instances that are running, stopped, pending, terminating, or in service.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported if metrics collection is enabled.</td>
</tr>
</tbody>
</table>

### Dimensions for Auto Scaling group metrics

You can use the following dimensions to refine the metrics listed in the previous tables.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoScalingGroupName</td>
<td>Filters on the name of an Auto Scaling group.</td>
</tr>
</tbody>
</table>

### Predictive scaling metrics and dimensions

The AWS/AutoScaling namespace includes the following metrics for predictive scaling.

Metrics are available with a resolution of one hour.

You can evaluate forecast accuracy by comparing forecasted values with actual values. For more information about evaluating forecast accuracy using these metrics, see [Monitor predictive scaling metrics with CloudWatch](#) (p. 217).

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PredictiveScalingLoad</td>
<td>The amount of load that's anticipated to be generated by your application.</td>
</tr>
<tr>
<td></td>
<td>The Average, Minimum, and Maximum statistics are useful, but the Sum statistic is not.</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria:</strong> Reported after the initial forecast is created.</td>
</tr>
</tbody>
</table>

Dimensions: AutoScalingGroupName, PolicyName, PairIndex
### CloudWatch metrics for Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PredictiveScalingCapacityForecast</td>
<td>The anticipated amount of capacity needed to meet application demand. This is based on the load forecast and target utilization level at which you want to maintain your Auto Scaling instances. The Average, Minimum, and Maximum statistics are useful, but the Sum statistic is not.</td>
<td>AutoScalingGroupName, PolicyName</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria</strong>: Reported after the initial forecast is created.</td>
<td></td>
</tr>
<tr>
<td>PredictiveScalingMetricPairCorrelation</td>
<td>The correlation between the scaling metric and the per-instance average of the load metric. Predictive scaling assumes high correlation. Therefore, if you observe a low value for this metric, it's better not to use a metric pair. The Average, Minimum, and Maximum statistics are useful, but the Sum statistic is not.</td>
<td>AutoScalingGroupName, PolicyName, PairIndex</td>
</tr>
<tr>
<td></td>
<td><strong>Reporting criteria</strong>: Reported after the initial forecast is created.</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The PairIndex dimension returns information associated with the index of the load-scaling metric pair as assigned by Amazon EC2 Auto Scaling. Currently, the only valid value is 0.

### Enable Auto Scaling group metrics (console)

**To enable group metrics**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group. A split pane opens up in the bottom of the page.
3. On the Monitoring tab, select the Auto Scaling group metrics collection, Enable check box located at the top of the page under Auto Scaling.

**To disable group metrics**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select your Auto Scaling group.
3. On the Monitoring tab, clear the Auto Scaling group metrics collection, Enable check box.

### Enable Auto Scaling group metrics (AWS CLI)

**To enable Auto Scaling group metrics**

Enable one or more group metrics by using the `enable-metrics-collection` command. For example, the following command enables a single metric for the specified Auto Scaling group.
Configure monitoring for Auto Scaling instances

Amazon EC2 collects and processes raw data from instances into readable, near real-time metrics that describe the CPU and other usage data for your Auto Scaling group. You can configure the interval for monitoring these metrics by choosing one-minute or five-minute granularity.

Instance monitoring is enabled whenever an instance is launched, using either basic monitoring (five-minute granularity) or detailed monitoring (one-minute granularity). For detailed monitoring, additional charges apply. For more information, see Amazon CloudWatch pricing and Monitoring your instances using CloudWatch in the Amazon EC2 User Guide for Linux Instances.

Before creating an Auto Scaling group, you should create a launch template or launch configuration that permits the type of monitoring that is appropriate to your application. If you add a scaling policy to your group, we strongly recommend that you use detailed monitoring to get metric data for EC2 instances at a one-minute granularity, because that achieves a faster response to changes in load.

Contents
- Enable detailed monitoring (console) (p. 313)
- Enable detailed monitoring (AWS CLI) (p. 314)
- Switch between basic and detailed monitoring (p. 314)
- Collect additional metrics using the CloudWatch agent (p. 314)

Enable detailed monitoring (console)

By default, basic monitoring is enabled when you use the AWS Management Console to create a launch template or launch configuration.

To enable detailed monitoring in a launch template

When you create the launch template using the AWS Management Console, in the Advanced details section, for Detailed CloudWatch monitoring, choose Enable. Otherwise, basic monitoring is enabled. For more information, see Configure advanced settings for your launch template (p. 27).

To enable detailed monitoring in a launch configuration

When you create the launch configuration using the AWS Management Console, in the Additional configuration section, select Enable EC2 instance detailed monitoring within CloudWatch. Otherwise, basic monitoring is enabled. For more information, see Create a launch configuration (p. 46).
Enable detailed monitoring (AWS CLI)

By default, basic monitoring is enabled when you create a launch template using the AWS CLI. Detailed monitoring is enabled by default when you create a launch configuration using the AWS CLI.

To enable detailed monitoring in a launch template

For launch templates, use the `create-launch-template` command and pass a JSON file that contains the information for creating the launch template. Set the monitoring attribute to "Monitoring": {"Enabled":true} to enable detailed monitoring or "Monitoring":{"Enabled":false} to enable basic monitoring.

To enable detailed monitoring in a launch configuration

For launch configurations, use the `create-launch-configuration` command with the --instance-monitoring option. Set this option to true to enable detailed monitoring or false to enable basic monitoring.

```
--instance-monitoring Enabled=true
```

Switch between basic and detailed monitoring

To change the type of monitoring enabled on new EC2 instances, update the launch template or update the Auto Scaling group to use a new launch template or launch configuration. Existing instances continue to use the previously enabled monitoring type. To update all instances, terminate them so that they are replaced by your Auto Scaling group or update instances individually using `monitor-instances` and `unmonitor-instances`.

**Note**

With the instance refresh and maximum instance lifetime features, you can also replace all instances in the Auto Scaling group to launch new instances that use the new settings. For more information, see [Replace Auto Scaling instances](p. 101).

When you switch between basic and detailed monitoring:

If you have CloudWatch alarms associated with the step scaling policies or simple scaling policies for your Auto Scaling group, use the `put-metric-alarm` command to update each alarm. Make each period match the monitoring type (300 seconds for basic monitoring and 60 seconds for detailed monitoring). If you change from detailed monitoring to basic monitoring but do not update your alarms to match the five-minute period, they continue to check for statistics every minute. They might find no data available for as many as four out of every five periods.

Collect additional metrics using the CloudWatch agent

To collect operating system-level metrics like available and used memory, you must install the CloudWatch agent. Additional fees may apply. You can use the CloudWatch agent to collect both system metrics and log files from Amazon EC2 instances. For more information, see [Metrics collected by the CloudWatch agent](in the Amazon CloudWatch User Guide).

Log Amazon EC2 Auto Scaling API calls with AWS CloudTrail

Amazon EC2 Auto Scaling is integrated with AWS CloudTrail, a service that provides a record of actions taken by a user, role, or a service using Amazon EC2 Auto Scaling. CloudTrail captures all API calls for
Amazon EC2 Auto Scaling as events. The calls captured include calls from the Amazon EC2 Auto Scaling console and code calls to the Amazon EC2 Auto Scaling API.

If you create a trail, you can enable continuous delivery of CloudTrail events to an Amazon S3 bucket, including events for Amazon EC2 Auto Scaling. If you don't configure a trail, you can still view the most recent events in the CloudTrail console in Event history. Using the information collected by CloudTrail, you can determine the request that was made to Amazon EC2 Auto Scaling, the IP address from which the request was made, who made the request, when it was made, and additional details.

To learn more about CloudTrail, see the AWS CloudTrail User Guide.

Amazon EC2 Auto Scaling information in CloudTrail

CloudTrail is enabled on your Amazon Web Services account when you create the account. When activity occurs in Amazon EC2 Auto Scaling, that activity is recorded in a CloudTrail event along with other Amazon Web Services events in Event history. You can view, search, and download recent events in your Amazon Web Services account. For more information, see Viewing events with CloudTrail event history.

For an ongoing record of events in your Amazon Web Services account, including events for Amazon EC2 Auto Scaling, create a trail. A trail enables CloudTrail to deliver log files to an Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all Regions. The trail logs events from all Regions in the Amazon Web Services partition and delivers the log files to the Amazon S3 bucket that you specify. Additionally, you can configure other Amazon Web Services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see the following:

- Overview for creating a trail
- CloudTrail supported services and integrations
- Configuring Amazon SNS notifications for CloudTrail
- Receiving CloudTrail log files from multiple regions
- Receiving CloudTrail log files from multiple accounts

All Amazon EC2 Auto Scaling actions are logged by CloudTrail and are documented in the Amazon EC2 Auto Scaling API Reference. For example, calls to the CreateLaunchConfiguration, DescribeAutoScalingGroup, and UpdateAutoScalingGroup actions generate entries in the CloudTrail log files.

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root or AWS Identity and Access Management (IAM) user credentials.
- Whether the request was made with temporary security credentials for a role or federated user.
- Whether the request was made by another service.

For more information, see the CloudTrail userIdentity element.

Understand Amazon EC2 Auto Scaling log file entries

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files aren't an ordered stack trace of the public API calls, so they don't appear in any specific order.
The following example shows a CloudTrail log entry that demonstrates the \texttt{CreateLaunchConfiguration} action.

```json
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "Root",
        "principalId": "123456789012",
        "arn": "arn:aws:iam::123456789012:root",
        "accountId": "123456789012",
        "accessKeyId": "AKIAIOSFODNN7EXAMPLE",
        "sessionContext": {
            "attributes": {
                "mfaAuthenticated": "false",
                "creationDate": "2018-08-21T17:05:42Z"
            }
        }
    },
    "eventTime": "2018-08-21T17:07:49Z",
    "eventSource": "autoscaling.amazonaws.com",
    "eventName": "CreateLaunchConfiguration",
    "awsRegion": "us-west-2",
    "sourceIPAddress": "192.0.2.0",
    "userAgent": "Coral/Jakarta",
    "requestParameters": {
        "ebsOptimized": false,
        "instanceMonitoring": {
            "enabled": false
        },
        "instanceType": "t2.micro",
        "keyName": "EC2-key-pair-oregon",
        "blockDeviceMappings": [
            {
                "deviceName": "/dev/xvda",
                "ebs": {
                    "deleteOnTermination": true,
                    "volumeSize": 8,
                    "snapshotId": "snap-01676e0a2c3c7de9e",
                    "volumeType": "gp2"
                }
            }
        ],
        "launchConfigurationName": "launch_configuration_1",
        "imageId": "ami-6cd6f714d79675a5",
        "securityGroups": [
            "sg-00c429965fd921483"
        ]
    },
    "responseElements": null,
    "requestID": "0737e2ea-fb2d-11e3-bfd8-99133058e7bb",
    "eventID": "3fcbf82-98f8-4744-bd45-b38835ab61cb",
    "eventType": "AwsApiCall",
    "recipientAccountId": "123456789012"
}
```

\textbf{Related resources}

With CloudWatch Logs, you can monitor and receive alerts for specific events captured by CloudTrail. The events sent to CloudWatch Logs are those configured to be logged by your trail, so make sure you have configured your trail or trails to log the event types that you are interested in monitoring. CloudWatch Logs can monitor information in the log files and notify you when certain thresholds are met. You can also archive your log data in highly durable storage. For more information, see the Amazon CloudWatch
Get Amazon SNS notifications when your Auto Scaling group scales

You can be notified when Amazon EC2 Auto Scaling is launching or terminating the EC2 instances in your Auto Scaling group. You manage notifications using Amazon Simple Notification Service (Amazon SNS).

Amazon SNS coordinates and manages the delivery of notifications to subscribing clients or endpoints. Amazon SNS offers a variety of notification options, including the ability to deliver notifications as HTTP or HTTPS POST, email (SMTP, either plaintext or in JSON format), or as a message posted to an Amazon SQS queue, which enables you to handle these notifications programmatically. For more information, see Amazon Simple Notification Service Developer Guide.

For example, if you configure your Auto Scaling group to use the autoscaling: EC2_INSTANCE_TERMINATE notification type, and your Auto Scaling group terminates an instance, it sends an email notification. This email contains the details of the terminated instance, such as the instance ID and the reason that the instance was terminated.

Notifications are useful for designing event-driven applications. If you use notifications to check that a resource enters a desired state, you can eliminate polling, and you won’t encounter the RequestLimitExceeded error that sometimes results from polling.

AWS provides various tools that you can use to send notifications. Alternatively, you can use EventBridge and Amazon SNS to send notifications when your Auto Scaling groups launch or terminate instances. In EventBridge, the rule describes which events you’re notified about. In Amazon SNS, the topic describes what kind of notification you receive. With EventBridge, you can decide if certain events should trigger a Lambda function instead. For more information, see Use EventBridge to handle Auto Scaling events (p. 372).

Contents

- SNS notifications (p. 317)
- Configure Amazon SNS notifications for Amazon EC2 Auto Scaling (p. 318)
  - Create an Amazon SNS topic (p. 318)
  - Subscribe to the Amazon SNS topic (p. 319)
  - Confirm your Amazon SNS subscription (p. 319)
  - Configure your Auto Scaling group to send notifications (p. 319)
  - Test the notification (p. 319)
  - Delete the notification configuration (p. 320)
- Key policy for an encrypted Amazon SNS topic (p. 320)

### SNS notifications

Amazon EC2 Auto Scaling supports sending Amazon SNS notifications when the following events occur.

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>autoscaling:EC2_INSTANCE_LAUNCH</td>
<td>Successful instance launch</td>
</tr>
<tr>
<td>autoscaling:EC2_INSTANCE_LAUNCH_ERROR</td>
<td>Failed instance launch</td>
</tr>
</tbody>
</table>
Configure Amazon SNS notifications for Amazon EC2 Auto Scaling

The message includes the following information:

- **Event** — The event.
- **AccountId** — The Amazon Web Services account ID.
- **AutoScalingGroupName** — The name of the Auto Scaling group.
- **AutoScalingGroupARN** — The ARN of the Auto Scaling group.
- **EC2InstanceId** — The ID of the EC2 instance.

For example:

```
Service: AWS Auto Scaling
Time: 2016-09-30T19:00:36.414Z
RequestId: 4e6156f4-a9e2-4bda-a7fd-33f2ae528958
Event: autoscaling:EC2_INSTANCE_LAUNCH
AccountId: 123456789012
AutoScalingGroupName: my-asg
AutoScalingGroupARN: arn:aws:autoscaling:region:123456789012:autoScalingGroup...
ActivityId: 4e6156f4-a9e2-4bda-a7fd-33f2ae528958
Description: Launching a new EC2 instance: i-0598c7d356eba48d7
Cause: At 2016-09-30T18:59:38Z a user request update of AutoScalingGroup constraints to ...
StartTime: 2016-09-30T19:00:04.445Z
EndTime: 2016-09-30T19:00:36.414Z
StatusCode: InProgress
StatusMessage:
Progress: 50
EC2InstanceId: i-0598c7d356eba48d7
Details: {"Subnet ID":"subnet-id","Availability Zone":"zone"}
Origin: AutoScalingGroup
Destination: EC2
```

Configure Amazon SNS notifications for Amazon EC2 Auto Scaling

To use Amazon SNS to send email notifications, you must first create a topic and then subscribe your email addresses to the topic.

### Create an Amazon SNS topic

An SNS topic is a logical access point, a communication channel your Auto Scaling group uses to send the notifications. You create a topic by specifying a name for your topic.

When you create a topic name, the name must meet the following requirements:

- Between 1 and 256 characters long
- Contain uppercase and lowercase ASCII letters, numbers, underscores, or hyphens

For more information, see [Creating an Amazon SNS topic](#) in the [Amazon Simple Notification Service Developer Guide](#).
Subscribe to the Amazon SNS topic

To receive the notifications that your Auto Scaling group sends to the topic, you must subscribe an endpoint to the topic. In this procedure, for Endpoint, specify the email address where you want to receive the notifications from Amazon EC2 Auto Scaling.

For more information, see Subscribing to an Amazon SNS topic in the Amazon Simple Notification Service Developer Guide.

Confirm your Amazon SNS subscription

Amazon SNS sends a confirmation email to the email address you specified in the previous step.

Make sure that you open the email from AWS Notifications and choose the link to confirm the subscription before you continue with the next step.

You will receive an acknowledgment message from AWS. Amazon SNS is now configured to receive notifications and send the notification as an email to the email address that you specified.

Configure your Auto Scaling group to send notifications

You can configure your Auto Scaling group to send notifications to Amazon SNS when a scaling event, such as launching instances or terminating instances, takes place. Amazon SNS sends a notification with information about the instances to the email address that you specified.

To configure Amazon SNS notifications for your Auto Scaling group (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom part of the page, showing information about the group that's selected.
3. On the Activity tab, choose Activity notifications, Create notification.
4. On the Create notifications pane, do the following:
   a. For SNS Topic, select your SNS topic.
   b. For Event types, select the events to send the notifications.
   c. Choose Create.

To configure Amazon SNS notifications for your Auto Scaling group (AWS CLI)

Use the following put-notification-configuration command.

```sh
aws autoscaling put-notification-configuration --auto-scaling-group-name my-asg --topic-arn arn --notification-types "autoscaling:EC2_INSTANCE_LAUNCH" "autoscaling:EC2_INSTANCE_TERMINATE"
```

Test the notification

To generate a notification for a launch event, update the Auto Scaling group by increasing the desired capacity of the Auto Scaling group by 1. You receive a notification within a few minutes after instance launch.
To change the desired capacity (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   - A split pane opens up in the bottom part of the Auto Scaling groups page, showing information about the group that's selected.
3. On the Details tab, choose Group details, Edit.
4. For Desired capacity, increase the current value by 1. If this value exceeds Maximum capacity, you must also increase the value of Maximum capacity by 1.
5. Choose Update.
6. After a few minutes, you'll receive notification for the event. If you do not need the additional instance that you launched for this test, you can decrease Desired capacity by 1. After a few minutes, you'll receive notification for the event.

Delete the notification configuration

You can delete your Amazon EC2 Auto Scaling notification configuration if it is no longer being used.

To delete Amazon EC2 Auto Scaling notification configuration (console)

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select your Auto Scaling group.
3. On the Activity tab, select the check box next to the notification you want to delete and then choose Actions, Delete.

To delete Amazon EC2 Auto Scaling notification configuration (AWS CLI)

Use the following delete-notification-configuration command.

```bash
aws autoscaling delete-notification-configuration --auto-scaling-group-name my-asg --topic-arn
```

For information about deleting the Amazon SNS topic and all subscriptions associated with your Auto Scaling group, see Deleting an Amazon SNS subscription and topic in the Amazon Simple Notification Service Developer Guide.

Key policy for an encrypted Amazon SNS topic

The Amazon SNS topic you specify might be encrypted with a customer managed key created with the AWS Key Management Service. To give Amazon EC2 Auto Scaling permission to publish to encrypted topics, you must first create your KMS key and then add the following statement to the policy of the KMS key. Replace the example ARN with the ARN of the appropriate service-linked role that is allowed access to the key. For more information, see Configuring AWS KMS permissions in the Amazon Simple Notification Service Developer Guide.

In this example, the policy statement gives the service-linked role named AWSServiceRoleForAutoScaling permissions to use the customer managed key. To learn more about the Amazon EC2 Auto Scaling service-linked role, see Service-linked roles for Amazon EC2 Auto Scaling (p. 401).
```
"Sid": "Allow service-linked role use of the customer managed key",
"Effect": "Allow",
"Principal": {
  "AWS": "arn:aws:iam::123456789012:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling"
},
"Action": [
  "kms:GenerateDataKey*",
  "kms:Decrypt"
],
"Resource": "*"
```

The `aws:SourceArn` and `aws:SourceAccount` condition keys are not supported in key policies that allow Amazon EC2 Auto Scaling to publish to encrypted topics.
AWS services integrated with Amazon EC2 Auto Scaling

Amazon EC2 Auto Scaling can be integrated with other AWS services. Review the following integration options to learn more about how each service works with Amazon EC2 Auto Scaling.

Topics
- Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322)
- Use On-Demand Capacity Reservations to reserve capacity in specific Availability Zones (p. 329)
- Create Auto Scaling groups from the command line using AWS CloudShell (p. 335)
- Create Auto Scaling groups with AWS CloudFormation (p. 335)
- Use AWS Compute Optimizer to get recommendations for the instance type for an Auto Scaling group (p. 342)
- Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group (p. 344)
- Route traffic to your Auto Scaling group with a VPC Lattice target group (p. 365)
- Use EventBridge to handle Auto Scaling events (p. 372)
- Provide network connectivity for your Auto Scaling instances using Amazon VPC (p. 386)

Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions

You can configure Amazon EC2 Auto Scaling to monitor and automatically respond to changes that affect the availability of your Spot Instances. Capacity Rebalancing helps you maintain workload availability by proactively augmenting your fleet with a new Spot Instance before a running instance is interrupted by Amazon EC2.

The goal of Capacity Rebalancing is to keep processing your workload without interruption. When Spot Instances are at an elevated risk of interruption, the Amazon EC2 Spot service notifies Amazon EC2 Auto Scaling with an EC2 instance rebalance recommendation.

When you enable Capacity Rebalancing for your Auto Scaling group, Amazon EC2 Auto Scaling attempts to proactively replace the Spot Instances in your group that have received a rebalance recommendation. This provides an opportunity to rebalance your workload to new Spot Instances that aren't at an elevated risk of interruption. Your workload can continue to process the work while Amazon EC2 Auto Scaling launches new Spot Instances before your existing instances are interrupted.

When you don't use Capacity Rebalancing, Amazon EC2 Auto Scaling doesn't replace Spot Instances until after the Amazon EC2 Spot service interrupts the instances and their health check fails. Before interrupting an instance, Amazon EC2 always gives both an EC2 instance rebalance recommendation and a Spot two-minute instance interruption notice.

Contents
- Overview (p. 323)
- Capacity Rebalancing behavior (p. 323)
- Considerations (p. 324)
- Enable Capacity Rebalancing (console) (p. 325)
Overview

To use Capacity Rebalancing with your Auto Scaling group, the basic steps are:

1. Configure your Auto Scaling group to use multiple instance types and Availability Zones. This way, Amazon EC2 Auto Scaling can look at the available capacity for Spot Instances in each Availability Zone.
2. Add lifecycle hooks as needed to perform a graceful shutdown of your application inside the instances that receive the rebalance notification. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

   The following are some reasons why you might use a lifecycle hook:
   - For graceful shutdown of Amazon SQS workers
   - To complete deregistration from the Domain Name System (DNS)
   - To pull system or application logs and upload them to Amazon Simple Storage Service (Amazon S3)

3. Develop a custom action for the lifecycle hook. To invoke your custom action as soon as possible, you need to know when an instance is ready to be terminated. Find this out by detecting the lifecycle state of the instance.
   - To invoke an action outside of the instance, write an EventBridge rule and automate what action to take when an event pattern matches the rule.
   - To invoke an action inside of the instance, configure the instance to run a shutdown script and retrieve the lifecycle state through instance metadata.

   It's critical to design the custom action to finish in under two minutes. This makes sure there's enough time to complete tasks before instance termination.

After you complete these steps, you can begin using Capacity Rebalancing.

Capacity Rebalancing behavior

With Capacity Rebalancing, Amazon EC2 Auto Scaling behaves in the following way when an instance receives a rebalance recommendation:

- When the new Spot Instance launches, Amazon EC2 Auto Scaling waits until the new instance passes its health check before it terminates the previous instance. When replacing more than one instance, the termination of each previous instance starts after the new instance has launched and passed its health check.
- Because Amazon EC2 Auto Scaling attempts to launch new instances before terminating previous ones, being at or near the specified maximum capacity could impede or completely halt rebalancing activities. To avoid this problem, Amazon EC2 Auto Scaling can temporarily exceed the group's maximum size by up to 10 percent of the desired capacity.
- If you didn't add a lifecycle hook to your Auto Scaling group, Amazon EC2 Auto Scaling starts terminating the previous instances as soon as the new instances pass their health check.
- If you added a lifecycle hook, this extends the amount of time it takes before we start terminating the previous instances by the timeout value you specified for the lifecycle hook.
- If you are using scaling policies or scheduled scaling, the scaling activities run in parallel. If a scaling activity is in progress and your Auto Scaling group is below its new desired capacity, Amazon EC2 Auto Scaling scales out first before terminating the previous instances.
If there is no capacity for your instance types in one Availability Zone, Amazon EC2 Auto Scaling keeps trying to launch Spot Instances in other enabled Availability Zones until it succeeds.

In the worst case scenario, if new instances fail to launch or their health checks fail, Amazon EC2 Auto Scaling keeps trying to relaunch them. While it's trying to launch new instances, your previous ones will eventually be interrupted and forcibly terminated with a two-minute interruption notice.

**Considerations**

Consider the following when using Capacity Rebalancing:

**Design your application to be tolerant to Spot interruptions**

Your application should be able to handle dynamic changes in the number of instances and the possibility of a Spot Instance being interrupted early. For example, if your Auto Scaling group is behind an Elastic Load Balancing load balancer, Amazon EC2 Auto Scaling waits for the instance to deregister from the load balancer before calling your lifecycle hook. If the time to deregister the instance and complete the lifecycle action takes too long, the instance might be interrupted while Amazon EC2 Auto Scaling waits for your lifecycle action to complete before terminating the instance.

It's not always possible for Amazon EC2 to send the rebalance recommendation signal before the two-minute Spot Instance interruption notice. Sometimes, the rebalance recommendation signal arrives at the same time as the two-minute interruption notice. When this happens, Amazon EC2 Auto Scaling calls the lifecycle hook and attempts to launch a new Spot Instance immediately.

**Avoid an elevated risk of interruption of replacement Spot Instances**

Your replacement Spot Instances might be at an elevated risk of interruption if you use the lowest-price allocation strategy. This is because we launch instances in the lowest priced pool that has available capacity at that moment, even if your replacement Spot Instances are likely to be interrupted soon after they launch. To avoid an elevated risk of interruption, we strongly recommend that you do not use the lowest-price allocation strategy. Instead, we recommend the price-capacity-optimized allocation strategy. This strategy launches replacement Spot Instances in Spot pools that are least likely to be interrupted and have the lowest possible price. Therefore, they're less likely to be interrupted in the near future.

**Amazon EC2 Auto Scaling will only launch a new instance if availability is the same or better**

One of the goals of Capacity Rebalancing is to improve a Spot Instance's availability. If an existing Spot Instance receives a rebalance recommendation, Amazon EC2 Auto Scaling will only launch a new instance if the new instance provides the same or better availability than the existing instance. If the risk of interruption of a new instance will be worse than the existing instance, then Amazon EC2 Auto Scaling will not launch a new instance. Amazon EC2 Auto Scaling will, however, continue to assess the Spot capacity pools based on information provided by the Amazon EC2 Spot service, and will launch a new instance if availability improves.

There is a chance that your existing instance will be interrupted without Amazon EC2 Auto Scaling proactively launching a new instance. When this happens, Amazon EC2 Auto Scaling attempts to launch a new instance as soon as it receives the Spot Instance interruption notice. This happens regardless of whether the new instance has a high risk of interruption.

**Capacity Rebalancing does not increase your Spot Instance interruption rate**

When you enable Capacity Rebalancing, it does not increase your Spot Instance interruption rate (the number of Spot Instances that are reclaimed when Amazon EC2 needs the capacity back). However, if Capacity Rebalancing detects an instance is at risk of interruption, Amazon EC2 Auto Scaling will immediately attempt to launch a new instance. Therefore, more instances might be replaced than if you waited for Amazon EC2 Auto Scaling to launch a new instance after the at-risk instance was interrupted.
While you might replace more instances with Capacity Rebalancing enabled, you benefit from being proactive rather than reactive. This gives you more time to take action before your instances are interrupted. With a Spot Instance interruption notice, you typically only have up to two minutes to gracefully shut down your instance. With Capacity Rebalancing launching a new instance in advance, you give existing processes a better chance of completing on your at-risk instance. You can also start your instance shutdown procedures, prevent new work from being scheduled on your at-risk instance, and prepare the newly launched instance to take over the application. With proactive replacement in Capacity Rebalancing, you benefit from graceful continuity.

The following theoretical example demonstrates the risks and benefits of using Capacity Rebalancing:

- 2:00 PM – A rebalance recommendation is received for instance A. Amazon EC2 Auto Scaling immediately attempts to launch replacement instance B, giving you time to start your shutdown procedures.
- 2:30 PM – A rebalance recommendation is received for instance B, which is replaced with instance C. This gives you time to start your shutdown procedures.
- 2:32 PM – If Capacity Rebalancing isn’t enabled, and if a Spot Instance interruption notice would’ve been received at 2:32 PM for instance A, you would have had only two minutes to take action. However, Instance A would have continued running until this time.

### Enable Capacity Rebalancing (console)

You can enable or disable Capacity Rebalancing when you create or update an Auto Scaling group.

**To enable Capacity Rebalancing for a new Auto Scaling group**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Choose Create Auto Scaling group.
3. For Step 1: Choose launch template or configuration, enter a name for the Auto Scaling group, choose a launch template, and then choose Next to proceed to the next step.
4. For Step 2: Choose instance launch options, under Network, choose the options as desired. Verify that the subnets you want to use are in different Availability Zones.
5. For Instance type requirements, choose settings to create a mixed instances group. This includes the instance types that it can launch, instance purchase options, and allocation strategies for Spot and On-Demand Instances. By default, these settings are not configured. To configure them, you must select Override launch template. For more information about creating a mixed instances group, see Auto Scaling groups with multiple instance types and purchase options (p. 62).
6. Under the Allocation strategies section at the bottom of the page, choose a Spot allocation strategy. Enable or disable Capacity Rebalancing by selecting or clearing the Capacity rebalance check box. You only see this option when you request a percentage of the Auto Scaling group to be launched as Spot Instances in the Instance purchase options section.
7. Create the Auto Scaling group.
8. (Optional) Add lifecycle hooks as needed. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

**To enable or disable Capacity Rebalancing for an existing Auto Scaling group**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group. A split pane opens in the bottom of the page.
4. Under the Allocation strategies section, enable or disable Capacity Rebalancing by selecting or clearing the Capacity rebalance check box.
5. Choose Update.

Enable Capacity Rebalancing (AWS CLI)

The following examples show how to use the AWS CLI to enable and disable Capacity Rebalancing.

Use the create-auto-scaling-group or update-auto-scaling-group command with the following parameter:

• --capacity-rebalance / --no-capacity-rebalance — Boolean value that indicates whether Capacity Rebalancing is enabled.

Before you call the create-auto-scaling-group command, you need the name of a launch template that is configured for use with an Auto Scaling group. For more information, see Create a launch template for an Auto Scaling group (p. 22).

Note
The following procedures show how to use a configuration file formatted in JSON or YAML. If you use AWS CLI version 1, you must specify a JSON-formatted configuration file. If you use AWS CLI version 2, you can specify a configuration file formatted in either YAML or JSON.

JSON

To create and configure a new Auto Scaling group

• Use the following create-auto-scaling-group command to create a new Auto Scaling group and enable Capacity Rebalancing. This command references a JSON file as the sole parameter for your Auto Scaling group.

```
aws autoscaling create-auto-scaling-group --cli-input-json file://~/config.json
```

If you don't already have a CLI configuration file that specifies a mixed instances policy (p. 62), create one.

Add the following line to the top-level JSON object in the configuration file.

```
{ 
  "CapacityRebalance": true
}
```

The following is an example config.json file.

```
{
  "AutoScalingGroupName": "my-asg",
  "DesiredCapacity": 12,
  "MinSize": 12,
  "MaxSize": 15,
  "CapacityRebalance": true,
  "MixedInstancesPolicy": {
    "InstancesDistribution": {
      "OnDemandBaseCapacity": 0,
      "OnDemandPercentageAboveBaseCapacity": 25,
      "SpotAllocationStrategy": "price-capacity-optimized"
    }
  }
}
```
YAML

To create and configure a new Auto Scaling group

- Use the following `create-auto-scaling-group` command to create a new Auto Scaling group and enable Capacity Rebalancing. This command references a YAML file as the sole parameter for your Auto Scaling group.

```
aws autoscaling create-auto-scaling-group --cli-input-yaml file://~/config.yaml
```

Add the following line to your configuration file formatted in YAML.

```
CapacityRebalance: true
```

The following is an example `config.yaml` file.

```
---
AutoScalingGroupName: my-asg
DesiredCapacity: 12
MinSize: 12
MaxSize: 15
```
To enable Capacity Rebalancing for an existing Auto Scaling group

- Use the following `update-auto-scaling-group` command to enable Capacity Rebalancing.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \  
    --capacity-rebalance
```

To verify that Capacity Rebalancing is enabled for an Auto Scaling group

- Use the following `describe-auto-scaling-groups` command to verify that Capacity Rebalancing is enabled and to view the details.

```
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

The following is an example response.

```
{
    "AutoScalingGroups": [
        {
            "AutoScalingGroupName": "my-asg",
            "AutoScalingGroupARN": "arn",
            "CapacityRebalance": true
        }
    ]
}
```

To disable Capacity Rebalancing

Use the `update-auto-scaling-group` command with the `--no-capacity-rebalance` option to disable Capacity Rebalancing.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \  
    --no-capacity-rebalance
```
Related resources

For more information about Capacity Rebalancing, see Proactively manage Spot Instance lifecycle using the new Capacity Rebalancing feature for EC2 Auto Scaling on the AWS Compute Blog.

For more information about the EC2 instance rebalance recommendations, see EC2 instance rebalance recommendations in the Amazon EC2 User Guide for Linux Instances.

To learn more about lifecycle hooks, see the following resources.

- Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255) (using EventBridge)
- Tutorial: Configure user data to retrieve the target lifecycle state through instance metadata (p. 250)

Limitations

- Amazon EC2 Auto Scaling can terminate the instance that receives the rebalance notification only if the instance isn’t protected from scale in. However, this protection doesn’t prevent termination from a Spot interruption.
- Support for Capacity Rebalancing is available in all commercial AWS Regions where Amazon EC2 Auto Scaling is available, except for the Middle East (UAE) Region.

Use On-Demand Capacity Reservations to reserve capacity in specific Availability Zones

Amazon EC2 On-Demand Capacity Reservations help you reserve compute capacity in specific Availability Zones. To start using Capacity Reservations, you create a Capacity Reservation in a specific Availability Zone. Then, you can launch instances into the reserved capacity, view its capacity utilization in real time, and increase or decrease its capacity as needed.

Capacity Reservations are configured as either open or targeted. If the Capacity Reservation is open, all new and existing instances that have matching attributes automatically run in the capacity of the Capacity Reservation. If the Capacity Reservation is targeted, instances must specifically target it to run in the reserved capacity.

This topic shows how to create an Auto Scaling group that launches On-Demand Instances into targeted Capacity Reservations. This gives you more control over when to use specific Capacity Reservations.

The basic steps are:

1. Create Capacity Reservations in multiple Availability Zones that have the same instance type, platform, and instance count.
3. Create an Auto Scaling group with a launch template that targets the resource group, using the same Availability Zones as the Capacity Reservations.

Contents

- Step 1: Create the Capacity Reservations (p. 330)
- Step 2: Create a Capacity Reservation group (p. 331)
Step 1: Create the Capacity Reservations

The first step is to create a Capacity Reservation in each Availability Zone where your Auto Scaling group will be deployed.

**Note**
You can only create targeted reservations when you first create the Capacity Reservations.

**Console**

**To create your Capacity Reservations**

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. Choose Capacity Reservations, and then choose Create Capacity Reservation.
3. On the Create a Capacity Reservation page, pay attention to following settings in the Instance details section. The instance type, platform, and Availability Zone of the instances that you launch must match the instance type, platform, and Availability Zone that you specify here or the Capacity Reservation is not applied.
   a. For Instance type, choose the type of instance to launch into the reserved capacity.
   b. For Platform, choose the operating system for your instances.
   c. For Availability Zone, choose the first Availability Zone that you want to reserve capacity in.
   d. For Quantity, choose the number of instances you need. Calculate the total number of instances you need for your Auto Scaling group divided by the number of Availability Zones you plan to use.
4. Under Capacity Reservation details, for Capacity Reservation ends, choose one of the following options:
   a. At specific time—Cancel the Capacity Reservation automatically at the specified date and time.
   b. Manually—Reserve the capacity until you explicitly cancel it.
5. For Instance eligibility, choose Targeted: Only instances that target the Capacity Reservation.
6. (Optional) For Tags, specify any tags to associate with the Capacity Reservation.
7. Choose Create.
8. Note the ID of the newly created Capacity Reservation. You need it to set up the Capacity Reservation group.

Repeat this procedure for each Availability Zone you want to enable for your Auto Scaling group, changing only the value of the Availability Zone option.

**AWS CLI**

**To create your Capacity Reservations**

Use the following create-capacity-reservation command to create the Capacity Reservations. Replace the sample values for --availability-zone, --instance-type, --instance-platform, and --instance-count.

```
aws ec2 create-capacity-reservation \
   --availability-zone us-east-1a \
```
Step 2: Create a Capacity Reservation group

When you finish creating the Capacity Reservations, you can group them together using the AWS Resource Groups service. AWS Resource Groups supports several different types of groups for different uses. Amazon EC2 uses a special-purpose group, known as a service-linked resource group, to target a group of Capacity Reservations. To interact with this service-linked resource group, you can use the AWS CLI or an SDK but not the console. For more information about service-linked resource groups, see Service configurations for resource groups in the AWS Resource Groups User Guide.

To create a Capacity Reservation group using the AWS CLI

Use the create-group command to create a resource group that can contain only Capacity Reservations. In this example, the resource group is named my-cr-group.

```
aws resource-groups create-group \
  --name my-cr-group \
  --configuration '{"Type":"AWS::EC2::CapacityReservationPool"}'

aws resource-groups create-group \
  --name my-cr-group \
  --configuration '{"Type":"AWS::EC2::CapacityReservationPool"}'}

The following is an example response.

```
"Name": "my-cr-group"
},
"GroupConfiguration": {
  "Configuration": [
    {
      "Type": "AWS::EC2::CapacityReservationPool"
    },
    {
      "Type": "AWS::ResourceGroups::Generic",
      "Parameters": [
        {
          "Name": "allowed-resource-types",
          "Values": [
            "AWS::EC2::CapacityReservation"
          ]
        }
      ]
    }
  ],
  "Status": "UPDATE_COMPLETE"
}

Note the ARN of the resource group. You need it to set up the launch template for your Auto Scaling group.

To associate your Capacity Reservations to the newly created group using the AWS CLI

Use the following `group-resources` command to associate the Capacity Reservations to the newly created Capacity Reservation group. For the `--resource-arns` option, specify the Capacity Reservations using their ARNs. Construct the ARNs using the relevant Region, your account ID, and the reservation IDs you noted earlier. In this example, the reservations with IDs `cr-1234567890abcdef1` and `cr-54321abcdef567890` will be grouped together in the group named `my-cr-group`.

```
aws resource-groups group-resources
  --group my-cr-group
  --resource-arns
    arn:aws:ec2:region:account-id:capacity-reservation/cr-1234567890abcdef1
```

The following is an example response.

```
{
  "Succeeded": [
    "arn:aws:ec2:us-east-1:123456789012:capacity-reservation/cr-54321abcdef567890"
  ],
  "Failed": [],
  "Pending": []
}
```

For information about modifying or deleting the resource group, see the AWS Resource Groups API Reference.

**Step 3: Create a launch template**

**Console**

To create a launch template

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/).
2. On the navigation pane, under **Instances**, choose **Launch Templates**.

3. Choose **Create launch template**. Enter a name and provide a description for the initial version of the launch template.

4. Under **Auto Scaling guidance**, select the check box.

5. Create the launch template. Choose an AMI and instance type that matches the Capacity Reservations you are planning to use, and optionally, a key pair, one or more security groups, and any additional EBS volumes or instance store volumes for your instances.

6. Expand **Advanced details**, and do the following:
   a. For **Capacity Reservation**, choose **Target by group**.
   b. For **Capacity reservation - Target by group**, choose the Capacity Reservations group that you created in the previous section, and then choose **Save**.

7. Choose **Create launch template**.

8. On the confirmation page, choose **Create Auto Scaling group**.

**AWS CLI**

**To create a launch template**

Use the following `create-launch-template` command to create a launch template that specifies that the Capacity Reservation targets a specific resource group. Replace the sample value for `--launch-template-name`. Replace `c5.xlarge` with the instance type that you used in the Capacity Reservation and `ami-0123456789EXAMPLE` with the ID of the AMI that you want to use. Replace `arn:aws:resource-groups:region:account-id:group/my-cr-group` with the ARN of the resource group that you created in the beginning of the previous section.

```bash
aws ec2 create-launch-template
  --launch-template-name my-launch-template
  --launch-template-data
  '{"InstanceType": "c5.xlarge",
   "ImageId": "ami-0123456789EXAMPLE",
   "CapacityReservationSpecification": {
     "CapacityReservationTarget": {
     }
   }
}
```

The following is an example response.

```json
{
  "LaunchTemplate": {
    "LaunchTemplateId": "lt-0dd77bd41dEXAMPLE",
    "LaunchTemplateName": "my-launch-template",
    "CreateTime": "2023-07-26T21:42:48+00:00",
    "CreatedBy": "arn:aws:iam::123456789012:user/Bob",
    "DefaultVersionNumber": 1,
    "LatestVersionNumber": 1
  }
}
```
Step 4: Create an Auto Scaling group

Console

Create your Auto Scaling group as you usually do, but when you choose your VPC subnets, choose a subnet from each Availability Zone that matches the targeted Capacity Reservations you created. Then, when your Auto Scaling group launches an On-Demand Instance in one of these Availability Zones, the instance will be run in the reserved capacity for that Availability Zone. If the resource group runs out of Capacity Reservations before your desired capacity is fulfilled, we launch anything beyond the reserved capacity as regular On-Demand capacity.

To create a simple Auto Scaling group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the same AWS Region that you used when you created the launch template.
3. Choose Create an Auto Scaling group.
4. On the Choose launch template or configuration page, for Auto Scaling group name, enter a name for your Auto Scaling group.
5. For Launch template, choose an existing launch template.
6. For Launch template version, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.
7. On the Choose instance launch options page, under Network, for VPC, choose a VPC. The Auto Scaling group must be created in the same VPC as the security group you specified in your launch template. If you didn't specify a security group in your launch template, you can choose any VPC that has subnets in the same Availability Zones as your Capacity Reservations.
8. For Availability Zones and subnets, choose subnets from each Availability Zone that you want to include, based on which Availability Zones your Capacity Reservations are in.
9. Choose Next twice.
10. On the Configure group size and scaling policies page, for Desired capacity, enter the initial number of instances to launch. When you change this number to a value outside of the minimum or maximum capacity limits, you must update the values of Minimum capacity or Maximum capacity. For more information, see Set capacity limits on your Auto Scaling group (p. 156).
11. Choose Skip to review.

AWS CLI

To create a simple Auto Scaling group

Use the following create-auto-scaling-group command and specify the name and version of your launch template as the value for the --launch-template option. Replace the sample values for --auto-scaling-group-name, --min-size, --max-size, and --vpc-zone-identifier.

For the --availability-zones option, specify the Availability Zones that you created Capacity Reservations for. For example, if your Capacity Reservations specify the us-east-1a and us-east-1b Availability Zones, then you must create your Auto Scaling group in the same zones. Then, when your Auto Scaling group launches an On-Demand Instance in one of these Availability Zones, the instance will be run in the reserved capacity for that Availability Zone. If the resource group runs out of Capacity Reservations before your desired capacity is fulfilled, we launch anything beyond the reserved capacity as regular On-Demand capacity.
aws autoscaling create-auto-scaling-group \\ 
--auto-scaling-group-name my-asg \\ 
--launch-template LaunchTemplateName=my-launch-template,Version='1' \\ 
--min-size 6 \\ 
--max-size 6 \\ 
--vpc-zone-identifier "subnet-5f46ec3b,subnet-0ecac448" \\ 
--availability-zones us-east-1a us-east-1b

Related resources

For an example implementation, see the AWS CloudFormation template in the following AWS samples GitHub repository: https://github.com/aws-samples/aws-auto-scaling-backed-by-on-demand-capacity-reservations/.

For more information about Capacity Reservations, see the following resources.

- Create a Capacity Reservation in the Amazon EC2 User Guide for Linux Instances
- On-Demand Capacity Reservations in the Amazon EC2 User Guide for Linux Instances
- Target a group of Amazon EC2 On-Demand Capacity Reservations on the AWS Cloud Operations & Migrations Blog

Create Auto Scaling groups from the command line using AWS CloudShell

In supported AWS Regions, you can run AWS CLI commands using AWS CloudShell for a browser-based, pre-authenticatated shell that launches directly from the AWS Management Console. You can run AWS CLI commands against services using your preferred shell (Bash, PowerShell, or Z shell).

You can launch AWS CloudShell from the AWS Management Console using either one of the following two methods:

- Choose the AWS CloudShell icon on the console navigation bar. It's located to the right of the search box.
- Use the search box on the console navigation bar to search for CloudShell and then choose the CloudShell option.

When AWS CloudShell launches in a new browser window for the first time, a welcome panel displays and lists key features. After you close this panel, status updates are provided while the shell configures and forwards your console credentials. When the command prompt displays, the shell is ready for interaction.

For more information on this service, see the AWS CloudShell User Guide.

Create Auto Scaling groups with AWS CloudFormation

Amazon EC2 Auto Scaling 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 all the AWS resources that you want (such as Auto Scaling groups), 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 Auto Scaling 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 Auto Scaling and AWS CloudFormation templates**

To provision and configure resources for Amazon EC2 Auto Scaling and related services, you must understand [AWS CloudFormation templates](https://aws.amazon.com/cloudformation). Templates are formatted text files in JSON or YAML. These templates describe the resources that you want to 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?](https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/getting-started.html) in the [AWS CloudFormation User Guide](https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/what-is-cloudformation-designer.html).

To get started creating your own stack templates for Amazon EC2 Auto Scaling, complete the following tasks:

- Create a launch template using `AWS::EC2::LaunchTemplate`.
- Create an Auto Scaling group using `AWS::AutoScaling::AutoScalingGroup`.


**Learn more about AWS CloudFormation**

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

- [AWS CloudFormation](https://aws.amazon.com/cloudformation/)
- [AWS CloudFormation API Reference](https://docs.aws.amazon.com/AWSCloudFormation/latest/AWSSdkReference/)

**Migrate AWS CloudFormation stacks from launch configurations to launch templates**

You can migrate your existing AWS CloudFormation stack templates from launch configurations to launch templates. To do this, add a launch template directly to an existing stack template and then associate the launch template with the Auto Scaling group in the stack template. Then, use your modified template to update your stack.

When migrating to launch templates, this topic saves you time by providing instructions for rewriting the launch configurations in your CloudFormation stack templates as launch templates. For more information about migrating launch configurations to launch templates, see [Migrate to launch templates](https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/migrate-launch-configurations-to-launch-templates.html) (p. 30).
Topics

- Find Auto Scaling groups that use a launch configuration (p. 337)
- Update a stack to use a launch template (p. 337)
- Understand update behavior of stack resources (p. 340)
- Track the migration (p. 340)
- Launch configuration mapping reference (p. 341)

Find Auto Scaling groups that use a launch configuration

To find Auto Scaling groups that use a launch configuration

- Use the following `describe-auto-scaling-groups` command to list the names of Auto Scaling groups that are using launch configurations in the specified Region. Include the `--filters` option to narrow the results to groups associated with a CloudFormation stack (by filtering by the `aws:cloudformation:stack-name` tag key).

```bash
aws autoscaling describe-auto-scaling-groups --region REGION \   --filters Name=tag-key,Values=aws:cloudformation:stack-name \   --query 'AutoScalingGroups[?LaunchConfigurationName!=null].AutoScalingGroupName'
```

The following shows example output.

```
[  
  "{stack-name}-group-1",
  "{stack-name}-group-2",
  "{stack-name}-group-3"
]
```

You can find additional useful AWS CLI commands for finding Auto Scaling groups to migrate and filtering the output in Migrate to launch templates (p. 30).

**Important**

If your stack resources have AWSEB in their name, this means they were created through AWS Elastic Beanstalk. In this case, you must update the Beanstalk environment to direct Elastic Beanstalk to remove the launch configuration and replace it with a launch template.

Update a stack to use a launch template

Follow the steps in this section to do the following:

- Rewrite the launch configuration as a launch template using the equivalent launch template properties.
- Associate the new launch template with the Auto Scaling group.
- Deploy these updates.

**To modify the stack template and update the stack**

1. Follow the same general procedures for modifying the stack template described in Modifying a stack template in the AWS CloudFormation User Guide.
2. Rewrite the launch configuration as a launch template. See the following example:

   **Example: A simple launch configuration**
Migrate launch configurations to launch templates

---

Resources:
myLaunchConfig:
  Type: AWS::AutoScaling::LaunchConfiguration
  Properties:
    ImageId: ami-02354e95b3example
    InstanceType: t3.micro
    SecurityGroups:
      - !Ref EC2SecurityGroup
    KeyName: MyKeyPair
    BlockDeviceMappings:
      - DeviceName: /dev/xvda
        Ebs:
          VolumeSize: 150
          DeleteOnTermination: true
    UserData:
      Fn::Base64:
        !Sub
        #!/bin/bash -xe
        yum install -y aws-cfn-bootstrap
        /opt/aws/bin/cfn-signal -e $? --stack ${AWS::StackName} --resource myASG --region ${AWS::Region}

Example: The launch template equivalent

---

Resources:
myLaunchTemplate:
  Type: AWS::EC2::LaunchTemplate
  Properties:
    LaunchTemplateName:
      !Sub ${AWS::StackName}-launch-template
    LaunchTemplateData:
      ImageId: ami-02354e95b3example
      InstanceType: t3.micro
      SecurityGroupIds:
        - Ref! EC2SecurityGroup
      KeyName: MyKeyPair
      BlockDeviceMappings:
        - DeviceName: /dev/xvda
          Ebs:
            VolumeSize: 150
            DeleteOnTermination: true
      UserData:
        Fn::Base64:
          !Sub
          #!/bin/bash -x
          yum install -y aws-cfn-bootstrap
          /opt/aws/bin/cfn-signal -e $? --stack ${AWS::StackName} --resource myASG --region ${AWS::Region}

For reference information for all the properties that Amazon EC2 supports, see AWS::EC2::LaunchTemplate in the AWS CloudFormation User Guide.

Note how the launch template includes the LaunchTemplateName property with a value of !Sub
${AWS::StackName}-launch-template. This is required if you want the name of the launch
template to include the stack name.

3. If the IamInstanceProfile property is present in your launch configuration, you must convert it
to a structure and specify either the name or the ARN of the instance profile. For an example, see
AWS::EC2::LaunchTemplate.

4. If the AssociatePublicIpAddress, InstanceMonitoring, or PlacementTenancy properties
are present in your launch configuration, you must convert these to a structure. For examples, see
AWS::EC2::LaunchTemplate.
An exception is when the value for the MapPublicIpOnLaunch property on the subnets you used for your Auto Scaling group matches the value for the AssociatePublicIpAddress property in your launch configuration. In this case, you can ignore the AssociatePublicIpAddress property. The AssociatePublicIpAddress property is only used to override the MapPublicIpOnLaunch property to change whether instances receive a public IPv4 address at launch.

5. You can copy security groups from the **SecurityGroups** property to one of two places in your launch template. Normally, you copy the security groups to the SecurityGroupIds property. However, if you create a NetworkInterfaces structure within your launch template to specify the AssociatePublicIpAddress property, then you must copy the security groups to the Groups property of the network interface instead.

6. If any BlockDeviceMapping structures are present in your launch configuration with **NoDevice** set to true, then you must specify an empty string for NoDevice in your launch template to have Amazon EC2 omit the device.

7. If the **SpotPrice** property is present in your launch configuration, we recommend that you omit it from your launch template. Your Spot Instances will launch at the current Spot price. This price will never exceed the On-Demand price.

To request Spot Instances, you have two mutually exclusive options:

- The first is to use the InstanceMarketOptions structure in your launch template (not recommended). For more information, see [AWS::EC2::LaunchTemplate InstanceMarketOptions](https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/aws-properties-ec2-launchtemplate-infacmarketoptions.html) in the **AWS CloudFormation User Guide**.

- The other is to add a MixedInstancesPolicy structure to your Auto Scaling group. Doing so provides you with more options for how you make the request. A Spot Instance request in your launch template doesn't support more than one instance type selection per Auto Scaling group. However, a mixed instances policy does support more than one instance type selection per Auto Scaling group. Spot Instance requests benefit from having more than one instance type to choose from. For more information, see [AWS::AutoScaling::AutoScalingGroup MixedInstancesPolicy](https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/aws-properties-ec2-autoscalinggroup-mixedinstancespolicy.html) in the **AWS CloudFormation User Guide**.

8. Remove the **LaunchConfigurationName** property from the **AWS::AutoScaling::AutoScalingGroup** resource. Add the launch template in its place.

In the following examples, the **Ref** intrinsic function gets the ID of the **AWS::EC2::LaunchTemplate** resource with the logical ID `myLaunchTemplate`. The **GetAtt** function gets the latest version number (for example, 1) of the launch template for the **Version** property.

**Example: Without a mixed instances policy**

```yaml
---
Resources:
  myASG:
    Type: AWS::AutoScaling::AutoScalingGroup
    Properties:
      LaunchTemplate:
        LaunchTemplateId: !Ref myLaunchTemplate
        Version: !GetAtt myLaunchTemplate.LatestVersionNumber
...```

**Example: With a mixed instances policy**

```yaml
---
Resources:
  myASG:
    Type: AWS::AutoScaling::AutoScalingGroup
    Properties:
      MixedInstancesPolicy:
```
Migrate launch configurations to launch templates

LaunchTemplate:
  LaunchTemplateSpecification:
    LaunchTemplateId: !Ref myLaunchTemplate
    Version: !GetAtt myLaunchTemplate.LatestVersionNumber

For reference information for all the properties that Amazon EC2 Auto Scaling supports, see AWS::AutoScaling::AutoScalingGroup in the AWS CloudFormation User Guide.

9. When you are ready to deploy these updates, follow the CloudFormation procedures to update the stack with your modified stack template. For more information, see Modifying a stack template in the AWS CloudFormation User Guide.

Understand update behavior of stack resources

CloudFormation updates stack resources by comparing changes between the updated template you provide, and resource configurations you described in the previous version of your stack template. Resource configurations that haven't changed remain unaffected during the update process.

CloudFormation supports the UpdatePolicy attribute for Auto Scaling groups. During an update, if UpdatePolicy is set to AutoScalingRollingUpdate, CloudFormation replaces InService instances after you perform the steps in this procedure. If UpdatePolicy is set to AutoScalingReplacingUpdate, CloudFormation replaces the Auto Scaling group and its warm pool (if one exists).

If you didn't specify an UpdatePolicy attribute for your Auto Scaling group, the launch template is checked for correctness, but CloudFormation does not deploy any change across the instances in the Auto Scaling group. All new instances will use your launch template, but existing instances continue to run with the launch configuration that they were originally launched with (despite the launch configuration not existing). The exception is when you change your purchase options, for example, by adding a mixed instances policy. In this case, your Auto Scaling group gradually replaces the existing instances with new instances to match the new purchase options.

Track the migration

To track the migration

1. In the AWS CloudFormation console, select the stack that you updated and then choose the Events tab to view the stacks events.
2. To update the event list with the most recent events, choose the refresh button in the CloudFormation console.
3. While your stack is updating, you will notice multiple events for each resource update. If you see an exception in the Status reason column that indicates a problem when trying to create the launch template, see Troubleshoot Amazon EC2 Auto Scaling: Launch templates (p. 440) for potential causes.
4. (Optional) Depending on your use of the UpdatePolicy attribute, you can monitor the progress of your Auto Scaling group from the Auto Scaling groups page of the Amazon EC2 console. Select the Auto Scaling group. On the Activity tab, under Activity history, the Status column shows whether your Auto Scaling group has successfully launched or terminated instances, or whether the scaling activity is still in progress.
5. When the stack update is complete, CloudFormation issues an UPDATE_COMPLETE stack event. For more information, see Monitoring the progress of a stack update in the AWS CloudFormation User Guide.
6. After the stack update is complete, open the Launch templates page and Launch configurations page of the Amazon EC2 console. You will notice a new launch template is created, and the launch configuration is deleted.
Launch configuration mapping reference

For reference purposes, the following table lists all the top-level properties in the `AWS::AutoScaling::LaunchConfiguration` resource with their corresponding property in the `AWS::EC2::LaunchTemplate` resource.

<table>
<thead>
<tr>
<th>Launch configuration source property</th>
<th>Launch template target property</th>
</tr>
</thead>
<tbody>
<tr>
<td>AssociatePublicIpAddress</td>
<td>NetworkInterfaces.AssociatePublicIpAddress</td>
</tr>
<tr>
<td>BlockDeviceMappings</td>
<td>BlockDeviceMappings</td>
</tr>
<tr>
<td>ClassicLinkVPCId</td>
<td>Not available¹</td>
</tr>
<tr>
<td>ClassicLinkVPCSecurityGroups</td>
<td>Not available¹</td>
</tr>
<tr>
<td>EbsOptimized</td>
<td>EbsOptimized</td>
</tr>
<tr>
<td>IamInstanceProfile</td>
<td>Either IamInstanceProfile.Arn or IamInstanceProfile.Name, but not both</td>
</tr>
<tr>
<td>ImageId</td>
<td>ImageId</td>
</tr>
<tr>
<td>InstanceId</td>
<td>InstanceId</td>
</tr>
<tr>
<td>InstanceMonitoring</td>
<td>Monitoring.Enabled</td>
</tr>
<tr>
<td>InstanceType</td>
<td>InstanceType</td>
</tr>
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<td>KernelId</td>
<td>KernelId</td>
</tr>
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<td>KeyName</td>
<td>KeyName</td>
</tr>
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<td>LaunchConfigurationName</td>
<td>LaunchTemplateName</td>
</tr>
<tr>
<td>MetadataOptions</td>
<td>MetadataOptions</td>
</tr>
<tr>
<td>PlacementTenancy</td>
<td>Placement.Tenancy</td>
</tr>
<tr>
<td>RamDiskId</td>
<td>RamDiskId</td>
</tr>
<tr>
<td>SecurityGroups</td>
<td>Either SecurityGroupIds or NetworkInterfaces.Groups, but not both</td>
</tr>
<tr>
<td>SpotPrice</td>
<td>InstanceMarketOptions.SpotOptions(MaxPrice)</td>
</tr>
<tr>
<td>UserData</td>
<td>UserData</td>
</tr>
</tbody>
</table>

¹ The `ClassicLinkVPCId` and `ClassicLinkVPCSecurityGroups` properties are not available to use in a launch template. If your launch configuration has these properties, you can use this opportunity to migrate from EC2-Classic to VPC. For more information, see [Migrate from EC2-Classic to a VPC](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/migrate-ec2-classic-vpc.html) in the *Amazon EC2 User Guide for Linux Instances.*
Use AWS Compute Optimizer to get recommendations for the instance type for an Auto Scaling group

AWS provides Amazon EC2 instance recommendations to help you improve performance, save money, or both, by using features powered by AWS Compute Optimizer. You can use these recommendations to decide whether to move to a new instance type.

To make recommendations, Compute Optimizer analyzes your existing instance specifications and recent metric history. The compiled data is then used to recommend which Amazon EC2 instance types are best optimized to handle the existing performance workload. Recommendations are returned along with per-hour instance pricing.

**Note**
To get recommendations from Compute Optimizer, you must first opt in to Compute Optimizer. For more information, see [Getting started with AWS Compute Optimizer](#) in the [AWS Compute Optimizer User Guide](#).

**Contents**
- Limitations (p. 342)
- Findings (p. 342)
- View recommendations (p. 343)
- Considerations for evaluating the recommendations (p. 343)

**Limitations**
Compute Optimizer generates recommendations for instances in Auto Scaling groups that are configured to launch and run M, C, R, T, and X instance types. However, it does not generate recommendations for -g instance types powered by AWS Graviton2 processors (e.g., C6g), and for -n instance types that have higher network bandwidth performance (e.g., M5n).

The Auto Scaling groups must also be configured to run a single instance type (i.e., no mixed instance types), must not have a scaling policy attached to them, and have the same values for desired, minimum, and maximum capacity (i.e., an Auto Scaling group with a fixed number of instances). Compute Optimizer generates recommendations for instances in Auto Scaling groups that meet all of these configuration requirements.

**Findings**
Compute Optimizer classifies its findings for Auto Scaling groups as follows:

- **Not optimized** – An Auto Scaling group is considered not optimized when Compute Optimizer has identified a recommendation that can provide better performance for your workload.
- **Optimized** – An Auto Scaling group is considered optimized when Compute Optimizer determines that the group is correctly provisioned to run your workload, based on the chosen instance type. For optimized resources, Compute Optimizer might sometimes recommend a new generation instance type.
- **None** – There are no recommendations for this Auto Scaling group. This might occur if you've been opted in to Compute Optimizer for less than 12 hours, or when the Auto Scaling group has been running for less than 30 hours, or when the Auto Scaling group or instance type is not supported by Compute Optimizer. For more information, see the Limitations (p. 342) section.
View recommendations

After you opt in to Compute Optimizer, you can view the findings and recommendations that it generates for your Auto Scaling groups. If you recently opted in, recommendations might not be available for up to 12 hours.

To view recommendations generated for an Auto Scaling group

   The Dashboard page opens.
2. Choose View recommendations for all Auto Scaling groups.
3. Select your Auto Scaling group.
4. Choose View detail.
   The view changes to display up to three different instance recommendations in a preconfigured view, based on default table settings. It also provides recent CloudWatch metric data (average CPU utilization, average network in, and average network out) for the Auto Scaling group.

Determine whether you want to use one of the recommendations. Decide whether to optimize for performance improvement, for cost reduction, or for a combination of these two.

To change the instance type in your Auto Scaling group, update the launch template or update the Auto Scaling group to use a new launch configuration. Existing instances continue to use the previous configuration. To update the existing instances, terminate them so that they are replaced by your Auto Scaling group, or allow automatic scaling to gradually replace older instances with newer instances based on your termination policies (p. 272).

Note
With the maximum instance lifetime and instance refresh features, you can also replace existing instances in your Auto Scaling group to launch new instances that use the new launch template or launch configuration. For more information, see Replace Auto Scaling instances based on maximum instance lifetime (p. 127) and Replace Auto Scaling instances based on an instance refresh (p. 101).

Considerations for evaluating the recommendations

Before moving to a new instance type, consider the following:

- The recommendations don't forecast your usage. Recommendations are based on your historical usage over the most recent 14-day time period. Be sure to choose an instance type that is expected to meet your future usage needs.
- Focus on the graphed metrics to determine whether actual usage is lower than instance capacity. You can also view metric data (average, peak, percentile) in CloudWatch to further evaluate your EC2 instance recommendations. For example, notice how CPU percentage metrics change during the day and whether there are peaks that need to be accommodated. For more information, see Viewing available metrics in the Amazon CloudWatch User Guide.
- Compute Optimizer might supply recommendations for burstable performance instances, which are T3, T3a, and T2 instances. If you periodically burst above your baseline, make sure that you can continue to do so based on the vCPUs of the new instance type. For more information, see CPU credits and baseline performance for burstable performance instances in the Amazon EC2 User Guide for Linux Instances.
- If you've purchased a Reserved Instance, your On-Demand Instance might be billed as a Reserved Instance. Before you change your current instance type, first evaluate the impact on Reserved Instance utilization and coverage.
Use Elastic Load Balancer to distribute traffic across the instances in your Auto Scaling group

Elastic Load Balancing automatically distributes your incoming application traffic across all the EC2 instances that you are running. Elastic Load Balancing helps to manage incoming requests by optimally routing traffic so that no one instance is overwhelmed.

To use Elastic Load Balancing with your Auto Scaling group, attach the load balancer to your Auto Scaling group (p. 346). This registers the group with the load balancer, which acts as a single point of contact for all incoming web traffic to your Auto Scaling group.

When you use Elastic Load Balancing with your Auto Scaling group, it's not necessary to register individual EC2 instances with the load balancer. Instances that are launched by your Auto Scaling group are automatically registered with the load balancer. Likewise, instances that are terminated by your Auto Scaling group are automatically deregistered from the load balancer.

After attaching a load balancer to your Auto Scaling group, you can configure your Auto Scaling group to use Elastic Load Balancing metrics (such as the Application Load Balancer request count per target) to scale the number of instances in the group as demand fluctuates.

Optionally, you can add Elastic Load Balancing health checks to your Auto Scaling group so that Amazon EC2 Auto Scaling can identify and replace unhealthy instances based on these additional health checks. Otherwise, you can create a CloudWatch alarm that notifies you if the healthy host count of the target group is lower than allowed.

Contents
- Elastic Load Balancing types (p. 345)
- Prerequisites for getting started with Elastic Load Balancing (p. 345)
- Attach a load balancer to your Auto Scaling group (p. 346)
- Configure an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console (p. 348)
- Verify the attachment status of your load balancer (p. 349)
- Add Elastic Load Balancing health checks to an Auto Scaling group (p. 350)
- Add and remove Availability Zones (p. 351)
- Examples for working with Elastic Load Balancing with the AWS Command Line Interface (AWS CLI) (p. 353)
Elastic Load Balancing types

Elastic Load Balancing provides four types of load balancers that can be used with your Auto Scaling group: Application Load Balancers, Network Load Balancers, Gateway Load Balancers, and Classic Load Balancers.

There is a key difference in how the load balancer types are configured. With Application Load Balancers, Network Load Balancers, and Gateway Load Balancers, instances are registered as targets with a target group, and you route traffic to the target group. With Classic Load Balancers, instances are registered directly with the load balancer.

Application Load Balancer

Routes and load balances at the application layer (HTTP/HTTPS), and supports path-based routing. An Application Load Balancer can route requests to ports on one or more registered targets, such as EC2 instances, in your virtual private cloud (VPC).

Network Load Balancer

Routes and load balances at the transport layer (TCP/UDP Layer-4), based on address information extracted from the Layer-4 header. Network Load Balancers can handle traffic bursts, retain the source IP of the client, and use a fixed IP for the life of the load balancer.

Gateway Load Balancer

Distributes traffic to a fleet of appliance instances. Provides scale, availability, and simplicity for third-party virtual appliances, such as firewalls, intrusion detection and prevention systems, and other appliances. Gateway Load Balancers work with virtual appliances that support the GENEVE protocol. Additional technical integration is required, so make sure to consult the user guide before choosing a Gateway Load Balancer.

Classic Load Balancer

Routes and load balances either at the transport layer (TCP/SSL), or at the application layer (HTTP/HTTPS).

To learn more about Elastic Load Balancing, see the following topics:

- What is Elastic Load Balancing?
- What is an Application Load Balancer?
- What is a Network Load Balancer?
- What is a Gateway Load Balancer?
- What is a Classic Load Balancer?

Prerequisites for getting started with Elastic Load Balancing

You must complete the prerequisites before you can attach a load balancer to your Auto Scaling group. This includes creating the load balancer and the target group that is used to route traffic to your Auto Scaling group.

You can either create the load balancer before creating the Auto Scaling group or during Auto Scaling group creation.
• Follow the procedures in the Elastic Load Balancing documentation to create the load balancer before creating the Auto Scaling group. Skip the step for registering your Amazon EC2 instances. Amazon EC2 Auto Scaling automatically takes care of registering (and deregistering) instances. For more information, see Getting started with Elastic Load Balancing in the Elastic Load Balancing User Guide.

• Alternatively, you can create and attach an Application Load Balancer or Network Load Balancer with a basic configuration from the Amazon EC2 Auto Scaling console. For more information, see Configure an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console (p. 348).

To attach a load balancer to your Auto Scaling group, first make sure you have met these prerequisites:

• The load balancer and its target group must be in the same AWS account, VPC, and Region as your Auto Scaling group.

• The target group must specify a target type of instance. You can’t specify a target type of ip when using an Auto Scaling group.

• If your launch template does not contain a security group that allows traffic from the load balancer to reach your Auto Scaling group, you must update the launch template. The recommended rules depend on the type of load balancer and the types of backends that the load balancer uses. For example, to route traffic to web servers, allow inbound HTTP access on port 80 from the load balancer.

  Note
  Existing instances are not updated with the new settings when the launch template is modified. To update existing instances, you can terminate existing instances in the Auto Scaling group. Amazon EC2 Auto Scaling immediately starts launching new instances to replace the instances that you terminated. Alternatively, you can start an instance refresh to replace the instances. For more information, see Replace Auto Scaling instances based on an instance refresh (p. 101).

• When deploying virtual appliances behind a Gateway Load Balancer, the Amazon Machine Image (AMI) must specify the ID of an AMI that supports the GENEVE protocol to allow the Auto Scaling group to exchange traffic with a Gateway Load Balancer. Also, the security groups that you specify in the launch template or launch configuration must allow UDP traffic on port 6081.

Before allowing your Auto Scaling group to use the results of the Elastic Load Balancing health checks to determine an instance’s health, make sure you have met this additional prerequisite:

• The security groups that you specify in the launch template must allow access from the load balancer on the correct port for Elastic Load Balancing to perform its health checks. For more information, see Add Elastic Load Balancing health checks to an Auto Scaling group (p. 350).

  Tip
  If you have bootstrapping scripts that take a while to complete, you can optionally add a launch lifecycle hook to your Auto Scaling group to delay instances from registering behind the load balancer before your bootstrap scripts have completed successfully and the applications on the instances are ready to accept traffic. You can’t add a lifecycle hook when you initially create an Auto Scaling group in the Amazon EC2 Auto Scaling console. You can add a lifecycle hook after creating the group. For more information, see Amazon EC2 Auto Scaling lifecycle hooks (p. 236).

Attach a load balancer to your Auto Scaling group

This topic describes how to attach an Elastic Load Balancing load balancer to your Auto Scaling group. Amazon EC2 Auto Scaling integrates with Elastic Load Balancing to help you to insert an Application Load Balancer, Network Load Balancer, Classic Load Balancer, or Gateway Load Balancer in front of your Auto Scaling group. To learn more about the different types of load balancers, see Elastic Load Balancing types (p. 345).
When you attach an Application Load Balancer, Network Load Balancer, or Gateway Load Balancer, you attach a target group. Amazon EC2 Auto Scaling adds instances to the attached target group when they are launched. You can attach one or multiple target groups, and configure health checks on a per target group basis.

For an introductory guide for attaching a target group to your Auto Scaling group, see Tutorial: Set up a scaled and load-balanced application (p. 358).

**Important**
Before you continue, complete all prerequisites (p. 345) in the previous section.

**Contents**
- Attach a load balancer (p. 347)
- Detach a load balancer (p. 348)

### Attach a load balancer

Use the following procedures to attach a load balancer to your Auto Scaling group. You can specify the load balancer by choosing either a target group that you created for an Application Load Balancer, Network Load Balancer, or Gateway Load Balancer, or a Classic Load Balancer.

#### To attach an existing load balancer as you are creating a new Auto Scaling group

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Choose Create Auto Scaling group.
3. In steps 1 and 2, choose the options as desired and proceed to Step 3: Configure advanced options.
4. For Load balancing, choose Attach to an existing load balancer.
5. Under Attach to an existing load balancer, do one of the following:
   a. For Application Load Balancers, Network Load Balancers, and Gateway Load Balancers:
      Choose Choose from your load balancer target groups, and then choose a target group in the Existing load balancer target groups field.
   b. For Classic Load Balancers:
      Choose Choose from Classic Load Balancers, and then choose your load balancer in the Classic Load Balancers field.
6. Proceed to create the Auto Scaling group. Your instances will be automatically registered to the load balancer after the Auto Scaling group has been created.

#### To attach an existing load balancer to your Auto Scaling group after it’s created

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Details tab, choose Load balancing, Edit.
4. Under Load balancing, do one of the following:
   a. For Application, Network or Gateway Load Balancer target groups, select its check box and choose a target group.
   b. For Classic Load Balancers, select its check box and choose your load balancer.
5. Choose Update.

Note
You can monitor the status of the load balancer while it is being attached by using the AWS CLI. When Amazon EC2 Auto Scaling has successfully registered the instances and at least one registered instance passes the health checks, you receive a status of InService. For more information, see Verify the attachment status of your load balancer (p. 349).

Detach a load balancer

When you no longer need the load balancer, use the following procedure to detach it from your Auto Scaling group.

To detach a load balancer from a group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to an existing group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
3. On the Details tab, choose Load balancing, Edit.
4. Under Load balancing, do one of the following:
   a. For Application, Network or Gateway Load Balancer target groups, choose the delete (X) icon next to the target group.
   b. For Classic Load Balancers, choose the delete (X) icon next to the load balancer.
5. Choose Update.

Configure an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console

Use the following procedure to create and attach an Application Load Balancer or a Network Load Balancer as you create your Auto Scaling group.

To create and attach a new load balancer as you create a new Auto Scaling group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Choose Create Auto Scaling group.
3. In steps 1 and 2, choose the options as desired and proceed to Step 3: Configure advanced options.
4. For Load balancing, choose Attach to a new load balancer.
   a. Under Attach to a new load balancer, for Load balancer type, choose whether to create an Application Load Balancer or Network Load Balancer.
   b. For Load balancer name, enter a name for the load balancer, or keep the default name.
   c. For Load balancer scheme, choose whether to create a public internet-facing load balancer, or keep the default for an internal load balancer.
   d. For Availability Zones and subnets, select the public subnet for each Availability Zone in which you chose to launch your EC2 instances. (These prepopulate from step 2.).
e. For **Listeners and routing**, update the port number for your listener (if necessary), and under **Default routing**, choose **Create a target group**. Alternatively, you can choose an existing target group from the drop-down list.

f. If you chose **Create a target group** in the last step, for **New target group name**, enter a name for the target group, or keep the default name.

g. To add tags to your load balancer, choose **Add tag**, and provide a tag key and value for each tag.

5. Proceed to create the Auto Scaling group. Your instances will be automatically registered to the load balancer after the Auto Scaling group has been created.

**Note**

After creating your Auto Scaling group, you can use the Elastic Load Balancing console to create additional listeners. This is useful if you need to create a listener with a secure protocol, such as HTTPS, or a UDP listener. You can add more listeners to existing load balancers, as long as you use distinct ports.

### Verify the attachment status of your load balancer

After you attach a load balancer, it enters the **Adding** state while registering the instances in the group. When all instances in the group are registered, it enters the **Added** state. After at least one registered instance passes the health checks, it enters the **InService** state. When the load balancer is in the **InService** state, Amazon EC2 Auto Scaling can terminate and replace any instances that are reported as unhealthy. If no registered instances pass the health checks (for example, due to a misconfigured health check), the load balancer doesn't enter the **InService** state. Amazon EC2 Auto Scaling doesn't terminate and replace the instances.

When you detach a load balancer, it enters the **Removing** state while deregistering the instances in the group. The instances remain running after they deregister. By default, connection draining (deregistration delay) is enabled for Application Load Balancers, Network Load Balancers, and Gateway Load Balancers. If connection draining is enabled, Elastic Load Balancing waits for in-flight requests to complete or for the maximum timeout to expire (whichever comes first) before it deregisters the instances.

You can verify the attachment status by using the AWS Command Line Interface (AWS CLI) or AWS SDKs. You cannot verify the attachment status from the console.

#### To use the AWS CLI to verify the attachment status

The following **describe-traffic-sources** command returns the attachment status of all traffic sources for the specified Auto Scaling group.

```bash
aws autoscaling describe-traffic-sources --auto-scaling-group-name my-asg
```

The example returns the ARN of the Elastic Load Balancing target group that's attached to the Auto Scaling group, along with the attachment status of the target group in the **State** element.
Add Elastic Load Balancing health checks to an Auto Scaling group

The default health checks for an Auto Scaling group are EC2 health checks only. If an instance fails these health checks, it is marked unhealthy and is terminated while Amazon EC2 Auto Scaling launches a new replacement instance. For more information, see Health checks for Auto Scaling instances (p. 297).

You can attach one or more load balancer target groups, one or more Classic Load Balancers, or both to your Auto Scaling group. However, by default, the Auto Scaling group does not consider an instance unhealthy and replace it if it fails the Elastic Load Balancing health checks.

To ensure that your Auto Scaling group can determine instance health based on additional load balancer tests, configure the Auto Scaling group to use Elastic Load Balancing (ELB) health checks. The load balancer periodically sends pings, attempts connections, or sends requests to test the EC2 instances and determines if an instance is unhealthy. If you configure the Auto Scaling group to use Elastic Load Balancing health checks, it considers the instance unhealthy if it fails either the EC2 health checks or the Elastic Load Balancing health checks. If you attach multiple load balancer target groups or Classic Load Balancers to the group, all of them must report that an instance is healthy in order for it to consider the instance healthy. If any one of them reports an instance as unhealthy, the Auto Scaling group replaces the instance, even if others report it as healthy.

Add Elastic Load Balancing health checks

To add Elastic Load Balancing health checks using the Amazon EC2 Auto Scaling console, perform the following steps.

To add Elastic Load Balancing health checks to a new group

When you create the Auto Scaling group, on the Configure advanced options page, for Health checks, Additional health check types, select Turn on Elastic Load Balancing health checks. Then, for Health check grace period, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

To add Elastic Load Balancing health checks to an existing group

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. On the navigation bar at the top of the screen, choose the AWS Region that you created your Auto Scaling group in.
3. Select the check box next to an existing group.
   A split pane opens up in the bottom of the Auto Scaling groups page.
4. On the Details tab, choose Health checks, Edit.
5. For Health checks, Additional health check types, select Turn on Elastic Load Balancing health checks.
6. For Health check grace period, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).
7. Choose Update.
8. On the Instance management tab, under Instances, you can view the health status of instances. The Health Status column displays the results of the newly added health checks.
Add and remove Availability Zones

To take advantage of the safety and reliability of geographic redundancy, span your Auto Scaling group across multiple Availability Zones of the Region you are working in and attach a load balancer to distribute incoming traffic across those Availability Zones.

When one Availability Zone becomes unhealthy or unavailable, Amazon EC2 Auto Scaling launches new instances in an unaffected Availability Zone. When the unhealthy Availability Zone returns to a healthy state, Amazon EC2 Auto Scaling automatically redistributes the application instances evenly across all the Availability Zones for your Auto Scaling group. Amazon EC2 Auto Scaling does this by attempting to launch new instances in the Availability Zone with the fewest instances. If the attempt fails, however, Amazon EC2 Auto Scaling attempts to launch in other Availability Zones until it succeeds.

Elastic Load Balancing creates a load balancer node for each Availability Zone you enable for the load balancer. If you enable cross-zone load balancing for your load balancer, each load balancer node distributes traffic evenly across the registered instances in all enabled Availability Zones. If cross-zone load balancing is disabled, each load balancer node distributes requests evenly across the registered instances in its Availability Zone only.

You must specify at least one Availability Zone when you are creating your Auto Scaling group. Later, you can expand the availability of your application by adding an Availability Zone to your Auto Scaling group and enabling that Availability Zone for your load balancer (if the load balancer supports it).

Contents

- Add an Availability Zone (p. 351)
- Remove an Availability Zone (p. 352)
- Limitations (p. 353)

Add an Availability Zone

Use the following procedure to expand your Auto Scaling group and load balancer to a subnet in an additional Availability Zone.

To add an Availability Zone

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to an existing group.

A split pane opens up in the bottom of the Auto Scaling groups page.
4. In **Subnets**, choose the subnet corresponding to the Availability Zone that you want to add to the Auto Scaling group.

5. Choose **Update**.

6. To update the Availability Zones for your load balancer so that it shares the same Availability Zones as your Auto Scaling group, complete the following steps:
   
   a. On the navigation pane, under **Load Balancing**, choose **Load Balancers**.
   
   b. Choose your load balancer.
   
   c. Do one of the following:
      
      • For Application Load Balancers and Network Load Balancers:
         
         1. On the **Description** tab, for **Availability Zones**, choose **Edit subnets**.
         
         2. On the **Edit subnets** page, for **Availability Zones**, select the check box for the Availability Zone to add. If there is only one subnet for that zone, it is selected. If there is more than one subnet for that zone, select one of the subnets.
      
      • For Classic Load Balancers in a VPC:
         
         1. On the **Instances** tab, choose **Edit Availability Zones**.
         
         2. On the **Add and Remove Subnets** page, for **Available subnets**, select the subnet using its add (+) icon. The subnet is moved under **Selected subnets**.
   
   d. Choose **Save**.

### Remove an Availability Zone

To remove an Availability Zone from your Auto Scaling group and load balancer, use the following procedure.

**To remove an Availability Zone**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.

2. Select the check box next to an existing group.
   
   A split pane opens up in the bottom of the **Auto Scaling groups** page.

3. On the **Details** tab, choose **Network, Edit**.

4. In **Subnets**, choose the delete (X) icon for the subnet corresponding to the Availability Zone that you want to remove from the Auto Scaling group. If there is more than one subnet for that zone, choose the delete (X) icon for each one.

5. Choose **Update**.

6. To update the Availability Zones for your load balancer so that it shares the same Availability Zones as your Auto Scaling group, complete the following steps:
   
   a. On the navigation pane, under **Load Balancing**, choose **Load Balancers**.
   
   b. Choose your load balancer.
   
   c. Do one of the following:
      
      • For Application Load Balancers and Network Load Balancers:
         
         1. On the **Description** tab, for **Availability Zones**, choose **Edit subnets**.
         
         2. On the **Edit subnets** page, for **Availability Zones**, clear the check box to remove the subnet for that Availability Zone.
      
      • For Classic Load Balancers in a VPC:
         
         1. On the **Instances** tab, choose **Edit Availability Zones**.
2. On the *Add and Remove Subnets* page, for *Available subnets*, remove the subnet using its delete (-) icon. The subnet is moved under *Available subnets*.

d. Choose *Save*.

**Limitations**

To update which Availability Zones are enabled for your load balancer, you need to be aware of the following limitations:

- When you enable an Availability Zone for your load balancer, you specify one subnet from that Availability Zone. Note that you can enable at most one subnet per Availability Zone for your load balancer.
- For internet-facing load balancers, the subnets that you specify for the load balancer must have at least eight available IP addresses.
- For Application Load Balancers, you must enable at least two Availability Zones.
- For Network Load Balancers, you cannot disable the enabled Availability Zones, but you can enable additional ones.
- For Gateway Load Balancers, you cannot change the Availability Zones or subnets that were added when the load balancer was created.

**Examples for working with Elastic Load Balancing with the AWS Command Line Interface (AWS CLI)**

Use the AWS CLI to attach, detach, and describe load balancers and target groups, add and remove Elastic Load Balancing health checks, and change which Availability Zones are enabled.

This topic shows examples of AWS CLI commands that perform common tasks for Amazon EC2 Auto Scaling.

*Important*

For additional command examples, see `aws elbv2` and `aws elb` in the *AWS CLI Command Reference*.

**Contents**

- Attach your target group or Classic Load Balancer (p. 353)
- Describe your target groups or Classic Load Balancers (p. 354)
- Add Elastic Load Balancing health checks (p. 355)
- Change your Availability Zones (p. 355)
- Detach your target group or Classic Load Balancer (p. 356)
- Remove Elastic Load Balancing health checks (p. 357)
- Legacy commands (p. 357)

**Attach your target group or Classic Load Balancer**

Use the following `create-auto-scaling-group` command to create an Auto Scaling group and simultaneously attach a target group by specifying its Amazon Resource Name (ARN). The target group can be associated with an Application Load Balancer, a Network Load Balancer, or a Gateway Load Balancer.
Replace the sample values for --auto-scaling-group-name, --vpc-zone-identifier, --min-size, and --max-size. For the --launch-template option, replace my-launch-template and 1 with the name and version of a launch template for your Auto Scaling group. For the --traffic-sources option, replace the sample ARN with the ARN of a target group for an Application Load Balancer, Network Load Balancer, or Gateway Load Balancer.

```bash
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg \
--launch-template LaunchTemplateName=my-launch-template,Version='1' \
--vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782" \
--min-size 1 --max-size 5 \
--traffic-sources "Identifier=arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/12345678EXAMPLE1"
```

Use the attach-traffic-sources command to attach additional target groups to the Auto Scaling group after it's created.

The following command adds another target group to the same group.

```bash
aws autoscaling attach-traffic-sources --auto-scaling-group-name my-asg \
--traffic-sources "Identifier=arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/12345678EXAMPLE2"
```

Alternatively, to attach a Classic Load Balancer to your group, specify the --traffic-sources and --type options when you use create-auto-scaling-group or attach-traffic-sources, as in the following example. Replace my-classic-load-balancer with the name of a Classic Load Balancer. For the --type option, specify a value of elb.

```bash
--traffic-sources "Identifier=my-classic-load-balancer" --type elb
```

### Describe your target groups or Classic Load Balancers

To describe the load balancers or target groups attached to your Auto Scaling group, use the following describe-traffic-sources command. Replace my-asg with the name of your group.

```bash
aws autoscaling describe-traffic-sources --auto-scaling-group-name my-asg
```

The example returns the ARN of the Elastic Load Balancing target groups that you attached to the Auto Scaling group.

```json
{
  "TrafficSources": [
    {
      "Identifier": "arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/12345678EXAMPLE1",
      "State": "InService",
      "Type": "elbv2"
    },
    {
      "Identifier": "arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/12345678EXAMPLE2",
      "State": "InService",
      "Type": "elbv2"
    }
  ]
}
```
For an explanation of the State field in the output, see Verify the attachment status of your load balancer (p. 349).

**Add Elastic Load Balancing health checks**

To add Elastic Load Balancing health checks to the health checks that your Auto Scaling group performs on instances, use the following `update-auto-scaling-group` command and specify `ELB` as the value for the `--health-check-type` option. Replace `my-asg` with the name of your group.

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \
  --health-check-type "ELB"
```

New instances often need time for a brief warm-up before they can pass a health check. If the grace period doesn't provide enough warm-up time, the instances might not appear ready to serve traffic. Amazon EC2 Auto Scaling might consider those instances unhealthy and replace them.

To update the health check grace period, use the `--health-check-grace-period` option when you use `update-auto-scaling-group`, as in the following example. Replace `300` with the number of seconds to keep new instances in service before terminating them if they're found to be unhealthy.

```
--health-check-grace-period 300
```

For more information, see Health checks for Auto Scaling instances (p. 297).

**Change your Availability Zones**

Changing your Availability Zones has some limitations that you should be aware of. For more information, see Limitations (p. 353).

**To change the Availability Zones for an Application Load Balancer or Network Load Balancer**

1. Before you change the Availability Zones of the load balancer, it's a good idea to first update the Availability Zones of the Auto Scaling group to verify that there is availability for your instance types in the specified zones.

   To update the Availability Zones for your Auto Scaling group, use the following `update-auto-scaling-group` command. Replace the sample subnet IDs with the IDs of the subnets in the Availability Zones to enable. The specified subnets replace the previously enabled subnets. Replace `my-asg` with the name of your group.

   ```
   aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \
   --vpc-zone-identifier "subnet-41767929,subnet-cb663da2,subnet-8360a9e7"
   ```

2. Use the following `describe-auto-scaling-groups` command to verify that the instances in the new subnets have launched. If the instances have launched, you see a list of the instances and their statuses. Replace `my-asg` with the name of your group.

   ```
   aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
   ```

3. Use the following `set-subnets` command to specify the subnets for your load balancer. Replace the sample subnet IDs with the IDs of the subnets in the Availability Zones to enable. You can specify only one subnet per Availability Zone. The specified subnets replace the previously enabled subnets. Replace `my-lb-arn` with the ARN of your load balancer.

   ```
   aws elbv2 set-subnets --load-balancer-arn my-lb-arn
   ```
To change the Availability Zones for a Classic Load Balancer

1. Before you change the Availability Zones of the load balancer, it's a good idea to first update the Availability Zones of the Auto Scaling group to verify that there is availability for your instance types in the specified zones.

To update the Availability Zones for your Auto Scaling group, use the following `update-auto-scaling-group` command. Replace the sample subnet IDs with the IDs of the subnets in the Availability Zones to enable. The specified subnets replace the previously enabled subnets. Replace `my-asg` with the name of your group.

```bash
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg --vpc-zone-identifier "subnet-41767929,subnet-cb663da2"
```

2. Use the following `describe-auto-scaling-groups` command to verify that the instances in the new subnets have launched. If the instances have launched, you see a list of the instances and their statuses. Replace `my-asg` with the name of your group.

```bash
aws autoscaling describe-auto-scaling-groups --auto-scaling-group-name my-asg
```

3. Use the following `attach-load-balancer-to-subnets` command to enable a new Availability Zone for your Classic Load Balancer. Replace the sample subnet ID with the ID of the subnet for the Availability Zone to enable. Replace `my-lb` with the name of your load balancer.

```bash
aws elb attach-load-balancer-to-subnets --load-balancer-name my-lb --subnets subnet-cb663da2
```

To disable an Availability Zone, use the following `detach-load-balancer-from-subnets` command. Replace the sample subnet ID with the ID of the subnet for the Availability Zone to disable. Replace `my-lb` with the name of your load balancer.

```bash
aws elb detach-load-balancer-from-subnets --load-balancer-name my-lb --subnets subnet-8360a9e7
```

Detach your target group or Classic Load Balancer

The following `detach-traffic-sources` command detaches a target group from your Auto Scaling group when you no longer need it.

For the `--auto-scaling-group-name` option, replace `my-asg` with the name of your group. For the `--traffic-sources` option, replace the sample ARN with the ARN of a target group for an Application Load Balancer, Network Load Balancer, or Gateway Load Balancer.

```bash
aws autoscaling detach-traffic-sources --auto-scaling-group-name my-asg --traffic-sources "Identifier=arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/1234567890123456"
```

To detach a Classic Load Balancer from your group, specify the `--traffic-sources` and `--type` options, as in the following example. Replace `my-classic-load-balancer` with the name of a Classic Load Balancer. For the `--type` option, specify a value of `elb`.

```bash
--traffic-sources "Identifier=my-classic-load-balancer" --type elb
```
Remove Elastic Load Balancing health checks

To remove Elastic Load Balancing health checks from your Auto Scaling group, use the following `update-auto-scaling-group` command and specify `EC2` as the value for the `--health-check-type` option. Replace `my-asg` with the name of your group.

```plaintext
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg
   --health-check-type "EC2"
```

For more information, see Health checks for Auto Scaling instances (p. 297).

Legacy commands

The following examples show how you can use legacy CLI commands to attach, detach, and describe load balancers and target groups. They remain in this document as a reference for any customers who want to use them. We continue to support the legacy CLI commands, but we recommend that you use the new "traffic sources" CLI commands, which can attach and detach multiple traffic sources types. You can use both the legacy CLI commands and the "traffic sources" CLI commands on the same Auto Scaling group.

Attach your target group or Classic Load Balancer (legacy)

To attach your target group

The following `create-auto-scaling-group` command creates an Auto Scaling group with an attached target group. Specify the Amazon Resource Name (ARN) of a target group for an Application Load Balancer, Network Load Balancer, or Gateway Load Balancer.

```plaintext
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg
   --launch-template LaunchTemplateName=my-launch-template,Version='1'
   --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
   --target-group-arns "arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/1234567890123456"
   --min-size 1 --max-size 5
```

The following `attach-load-balancer-target-groups` command attaches a target group to an existing Auto Scaling group.

```plaintext
aws autoscaling attach-load-balancer-target-groups --auto-scaling-group-name my-asg
   --target-group-arns "arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/1234567890123456"
```

To attach your Classic Load Balancer

The following `create-auto-scaling-group` command creates an Auto Scaling group with an attached Classic Load Balancer.

```plaintext
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg
   --launch-configuration-name my-launch-config
   --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
   --load-balancer-names "my-load-balancer"
   --min-size 1 --max-size 5
```

The following `attach-load-balancers` command attaches the specified Classic Load Balancer to an existing Auto Scaling group.

```plaintext
aws autoscaling attach-load-balancers --auto-scaling-group-name my-asg
```
Describe your target group or Classic Load Balancer (legacy)

To describe target groups

To describe the target groups associated with an Auto Scaling group, use the `describe-load-balancer-target-groups` command. The following example lists the target groups for `my-asg`.

```
aws autoscaling describe-load-balancer-target-groups --auto-scaling-group-name my-asg
```

To describe Classic Load Balancers

To describe the Classic Load Balancers associated with an Auto Scaling group, use the `describe-load-balancers` command. The following example lists the Classic Load Balancers for `my-asg`.

```
aws autoscaling describe-load-balancers --auto-scaling-group-name my-asg
```

Detach your target group or Classic Load Balancer (legacy)

To detach a target group

The following `detach-load-balancer-target-groups` command detaches a target group from your Auto Scaling group when you no longer need it.

```
aws autoscaling detach-load-balancer-target-groups --auto-scaling-group-name my-asg --target-group-arns "arn:aws:elasticloadbalancing:region:account-id:targetgroup/my-targets/1234567890123456"
```

To detach a Classic Load Balancer

The following `detach-load-balancers` command detaches a Classic Load Balancer from your Auto Scaling group when you no longer need it.

```
aws autoscaling detach-load-balancers --auto-scaling-group-name my-asg --load-balancer-names my-lb
```

Tutorial: Set up a scaled and load-balanced application

**Important**

Before you explore this tutorial, we recommend that you first review the following introductory tutorial: Get started with Amazon EC2 Auto Scaling (p. 14).

Registering your Auto Scaling group with an Elastic Load Balancing load balancer helps you set up a load-balanced application. Elastic Load Balancing works with Amazon EC2 Auto Scaling to distribute incoming traffic across your healthy Amazon EC2 instances. This increases the scalability and availability of your application. You can enable Elastic Load Balancing within multiple Availability Zones to increase the fault tolerance of your applications.

In this tutorial, we cover the basics steps for setting up a load-balanced application when the Auto Scaling group is created. When complete, your architecture should look similar to the following diagram:
Elastic Load Balancing supports different types of load balancers. We recommend that you use an Application Load Balancer for this tutorial.

For more information about introducing a load balancer into your architecture, see Use Elastic Load Balancing to distribute traffic across the instances in your Auto Scaling group (p. 344).

Tasks

- Prerequisites (p. 359)
- Step 1: Set up a launch template or launch configuration (p. 360)
- Step 2: Create an Auto Scaling group (p. 362)
- Step 3: Verify that your load balancer is attached (p. 363)
- Step 4: Next steps (p. 363)
- Step 5: Clean up (p. 364)
- Related resources (p. 365)

Prerequisites

- A load balancer and target group. Make sure to choose the same Availability Zones for the load balancer that you plan to use for your Auto Scaling group. For more information, see Getting started with Elastic Load Balancing in the Elastic Load Balancing User Guide.
- A security group for your launch template or launch configuration. The security group must allow access from the load balancer on both the listener port (usually port 80 for HTTP traffic) and the
port that you want Elastic Load Balancing to use for health checks. For more information, see the applicable documentation:

- Target security groups in the User Guide for Application Load Balancers
- Target security groups in the User Guide for Network Load Balancers

Optionally, if your instances will have public IP addresses, you can allow SSH traffic for connecting to the instances.

- (Optional) An IAM role that grants your application access to AWS.
- (Optional) An Amazon Machine Image (AMI) defined as the source template for your Amazon EC2 instances. To create one now, launch an instance. Specify the IAM role (if you created one) and any configuration scripts that you need as user data. Connect to the instance and customize it. For example, you can install software and applications, copy data, and attach additional EBS volumes. Test your applications on your instance to ensure that it is configured correctly. Save this updated configuration as a custom AMI. If you don't need the instance later, you can terminate it. Instances launched from this new custom AMI include the customizations that you made when you created the AMI.
- A virtual private cloud (VPC). This tutorial refers to the default VPC, but you can use your own. If using your own VPC, make sure that it has a subnet mapped to each Availability Zone of the Region you are working in. At minimum, you must have two public subnets available to create the load balancer. You must also have either two private subnets or two public subnets to create your Auto Scaling group and register it with the load balancer.

**Step 1: Set up a launch template or launch configuration**

Use either a launch template or a launch configuration for this tutorial.

If you already have a launch template that you'd like to use, select it by using the following procedure.

**Note**

Alternatively, you can use a launch configuration instead of a launch template. For the launch configuration instructions, see Select or create a launch configuration (p. 361).

**To select an existing launch template**

1. Open the Launch templates page of the Amazon EC2 console.
2. On the navigation bar at the top of the screen, choose the Region where the load balancer was created.
3. Select a launch template.
4. Choose Actions, Create Auto Scaling group.

Alternatively, to create a new launch template, use the following procedure.

**To create a launch template**

1. Open the Launch templates page of the Amazon EC2 console.
2. On the navigation bar at the top of the screen, choose the Region where the load balancer was created.
3. Choose Create launch template.
4. Enter a name and provide a description for the initial version of the launch template.
5. For Application and OS Images (Amazon Machine Image), choose the ID of the AMI for your instances. You can search through all available AMIs, or select an AMI from the Recents or Quick Start list. If you don't see the AMI that you need, choose Browse more AMIs to browse the full AMI catalog.
6. For **Instance type**, select a hardware configuration for your instances that is compatible with the AMI that you specified.

7. (Optional) For **Key pair (login)**, choose the key pair to use when connecting to your instances.

8. For **Network settings**, expand **Advanced network configuration** and do the following:
   
   a. Choose **Add network interface** to configure the primary network interface.

   b. (Optional) For **Auto-assign public IP**, keep the default value, **Don't include in launch template**. When you create your Auto Scaling group, you can assign a public IPv4 address to instances in your Auto Scaling group by using subnets that have the public IPv4 addressing attribute enabled, such as the default subnets in the default VPC. Alternatively, if you don’t need to connect to your instances, you can choose **Disable** to prevent instances in your group from receiving traffic directly from the internet. In this case, they will receive traffic only from the load balancer.

   c. For **Security group ID**, specify a security group for your instances from the same VPC as the load balancer.

   d. For **Delete on termination**, choose **Yes**. This deletes the network interface when the Auto Scaling group scales in, and terminates the instance to which the network interface is attached.

9. (Optional) To securely distribute credentials to your instances, for **Advanced details, IAM instance profile**, enter the Amazon Resource Name (ARN) of your IAM role.

10. (Optional) To specify user data or a configuration script for your instances, paste it into **Advanced details, User data**.

11. Choose **Create launch template**.

12. On the confirmation page, choose **Create Auto Scaling group**.

### Select or create a launch configuration

If you already have a launch configuration that you'd like to use, select it by using the following procedure.

**To select an existing launch configuration**

1. Open the **Launch configurations page** of the Amazon EC2 console.
2. On the top navigation bar, choose the Region where the load balancer was created.
3. Select a launch configuration.
4. Choose **Actions**, **Create Auto Scaling group**.

Alternatively, to create a new launch configuration, use the following procedure.

**To create a launch configuration**

1. Open the **Launch configurations page** of the Amazon EC2 console. When prompted for confirmation, choose **View launch configurations** to confirm that you want to view the **Launch configurations** page.
2. On the top navigation bar, choose the Region where the load balancer was created.
3. Choose **Create launch configuration**, and enter a name for your launch configuration.
4. For **Amazon machine image (AMI)**, enter the ID of the AMI for your instances as search criteria.
5. For **Instance type**, select a hardware configuration for your instance.
6. Under **Additional configuration**, pay attention to the following fields:

   a. (Optional) To securely distribute credentials to your EC2 instance, for **IAM instance profile**, select your IAM role. For more information, see **IAM role for applications that run on Amazon EC2 instances** (p. 417).
b. (Optional) To specify user data or a configuration script for your instance, paste it into **Advanced details, User data.**

c. (Optional) For **Advanced details, IP address type**, keep the default value. When you create your Auto Scaling group, you can assign a public IP address to instances in your Auto Scaling group by using subnets that have the public IP addressing attribute enabled, such as the default subnets in the default VPC. Alternatively, if you don't need to connect to your instances, you can choose **Do not assign a public IP address to any instances** to prevent instances in your group from receiving traffic directly from the internet. In this case, they will receive traffic only from the load balancer.

7. For **Security groups**, choose an existing security group from the same VPC as the load balancer. If you keep the **Create a new security group** option selected, a default SSH rule is configured for Amazon EC2 instances running Linux. A default RDP rule is configured for Amazon EC2 instances running Windows.

8. For **Key pair (login)**, choose an option under **Key pair options**.

   If you've already configured an Amazon EC2 instance key pair, you can choose it here. If you don't already have an Amazon EC2 instance key pair, choose **Create a new key pair** and give it a recognizable name. Choose **Download key pair** to download the key pair to your computer. **Important** If you need to connect to your instances, do not choose **Proceed without a key pair**.

9. Select the acknowledgment check box, and then choose **Create launch configuration**.

10. Select the check box next to the name of your new launch configuration and choose **Actions, Create Auto Scaling group**.

**Step 2: Create an Auto Scaling group**

Use the following procedure to continue where you left off after creating or selecting your launch template or launch configuration.

**To create an Auto Scaling group**

1. On the **Choose launch template or configuration** page, for **Auto Scaling group name**, enter a name for your Auto Scaling group.

2. [Launch template only] For **Launch template**, choose whether the Auto Scaling group uses the default, the latest, or a specific version of the launch template when scaling out.

3. Choose **Next**.

   The **Choose instance launch options** page appears, allowing you to choose the VPC network settings you want the Auto Scaling group to use and giving you options for launching On-Demand and Spot Instances (if you chose a launch template).

4. In the **Network** section, for **VPC**, choose the VPC that you used for your load balancer. If you chose the default VPC, it is automatically configured to provide internet connectivity to your instances. This VPC includes a public subnet in each Availability Zone in the Region.

5. For **Availability Zones and subnets**, choose one or more subnets from each Availability Zone that you want to include, based on which Availability Zones the load balancer is in. For more information, see **Considerations when choosing VPC subnets (p. 388)**.

6. [Launch template only] In the **Instance type requirements** section, use the default setting to simplify this step. (Do not override the launch template.) For this tutorial, you will launch only On-Demand Instances using the instance type specified in your launch template.

7. Choose **Next** to go to the **Configure advanced options** page.

8. To attach the group to an existing load balancer, in the **Load balancing** section, choose **Attach to an existing load balancer**. You can choose **Choose from your load balancer target groups** or **Choose
from Classic Load Balancers. You can then choose the name of a target group for the Application
Load Balancer or Network Load Balancer you created, or choose the name of a Classic Load Balancer.

9. (Optional) To use Elastic Load Balancing health checks, for Health checks, choose ELB under Health
   check type.

10. When you have finished configuring the Auto Scaling group, choose Skip to review.

11. On the Review page, review the details of your Auto Scaling group. You can choose Edit to make
    changes. When you are finished, choose Create Auto Scaling group.

After you have created the Auto Scaling group with the load balancer attached, the load balancer
automatically registers new instances as they come online. You have only one instance at this point,
so there isn’t much to register. However, you can add additional instances by updating the desired capacity
of the group. For step-by-step instructions, see Manual scaling (p. 158).

Step 3: Verify that your load balancer is attached

To verify that your load balancer is attached

1. From the Auto Scaling groups page of the Amazon EC2 console, select the check box next to your
   Auto Scaling group.

2. On the Details tab, Load balancing shows any attached load balancer target groups or Classic Load
   Balancers.

3. On the Activity tab, in Activity history, you can verify that your instances launched successfully. The
   Status column shows whether your Auto Scaling group has successfully launched instances. If your
   instances fail to launch, you can find troubleshooting ideas for common instance launch issues in
   Troubleshoot Amazon EC2 Auto Scaling (p. 428).

4. On the Instance management tab, under Instances, you can verify that your instances are ready to
   receive traffic. Initially, your instances are in the Pending state. After an instance is ready to receive
   traffic, its state is InService. The Health status column shows the result of the Amazon EC2 Auto
   Scaling health checks on your instances. Although an instance may be marked as healthy, the load
   balancer will only send traffic to instances that pass the load balancer health checks.

5. Verify that your instances are registered with the load balancer. Open the Target groups page of the
   Amazon EC2 console. Select your target group, and then choose the Targets tab. If the state of your
   instances is initial, it’s probably because they are still in the process of being registered, or they
   are still undergoing health checks. When the state of your instances is healthy, they are ready for
   use.

Step 4: Next steps

Now that you have completed this tutorial, you can learn more:

• You can configure your Auto Scaling group to use Elastic Load Balancing health checks. If you enable
  load balancer health checks and an instance fails the health checks, the Auto Scaling group considers
  the instance unhealthy and replaces it. For more information, see Add Elastic Load Balancing health
  checks (p. 350).

• You can expand your application to an additional Availability Zone in the same Region to increase fault
  tolerance if there is a service disruption. For more information, see Add Availability Zones (p. 351).

• You can configure your Auto Scaling group to use a target tracking scaling policy. This automatically
  increases or decreases the number of instances as the demand on your instances changes. This
  allows the group to handle changes in the amount of traffic that your application receives. For more
  information, see Target tracking scaling policies (p. 169).
Step 5: Clean up

After you're finished with the resources that you created for this tutorial, you should consider cleaning them up to avoid incurring unnecessary charges.

To delete your Auto Scaling group

1. Open the Auto Scaling groups page of the Amazon EC2 console.
2. Select the check box next to your Auto Scaling group.
3. Choose Delete.
4. When prompted for confirmation, type delete to confirm deleting the specified Auto Scaling group and then choose Delete.

A loading icon in the Name column indicates that the Auto Scaling group is being deleted. When the deletion has occurred, the Desired, Min, and Max columns show 0 instances for the Auto Scaling group. It takes a few minutes to terminate the instance and delete the group. Refresh the list to see the current state.

Skip the following procedure if you would like to keep your launch template.

To delete your launch template

1. Open the Launch templates page of the Amazon EC2 console.
2. Select your launch template.
3. Choose Actions, Delete template.
4. When prompted for confirmation, type Delete to confirm deleting the specified launch template and then choose Delete.

Skip the following procedure if you would like to keep your launch configuration.

To delete your launch configuration

1. Open the Launch configurations page of the Amazon EC2 console.
2. Select your launch configuration.
3. Choose Actions, Delete launch configuration.
4. When prompted for confirmation, choose Delete.

Skip the following procedure if you want to keep the load balancer for future use.

To delete your load balancer

1. Open the Load balancers page of the Amazon EC2 console.
2. Choose the load balancer and choose Actions, Delete.
3. When prompted for confirmation, choose Yes, Delete.

To delete your target group

1. Open the Target groups page of the Amazon EC2 console.
2. Choose the target group and choose Actions, Delete.
3. When prompted for confirmation, choose Yes, Delete.
Related resources

With AWS CloudFormation, you can create and provision AWS infrastructure deployments predictably and repeatedly, by using template files to create and delete a collection of resources together as a single unit (a stack). For more information, see the AWS CloudFormation User Guide.

For a walkthrough that uses a stack template to provision an Auto Scaling group and Application Load Balancer, see Walkthrough: Create a scaled and load-balanced application in the AWS CloudFormation User Guide. Use the walkthrough and sample template as a starting point to create similar templates to meet your needs.

Route traffic to your Auto Scaling group with a VPC Lattice target group

You can use Amazon VPC Lattice to manage the flow of traffic and API calls between your applications and services that run on separate resources, such as Auto Scaling groups or Lambda functions. VPC Lattice is an application networking service that lets you connect, secure, and monitor all your services across multiple accounts and virtual private clouds (VPCs). To learn more about VPC Lattice, see What is VPC Lattice?

To get started with VPC Lattice, first create the necessary VPC Lattice resources that enable resources in a VPC associated with a service network to connect to each other. These resources include the services, listeners, listener rules, and target groups.

To associate an Auto Scaling group to a VPC Lattice service, create a target group for the service that routes requests to instances registered by instance ID, and add a listener to the service that sends requests to the target group. Then, attach the target group to your Auto Scaling group. Amazon EC2 Auto Scaling automatically registers the EC2 instances as targets with the target group. Later, when Amazon EC2 Auto Scaling needs to terminate an instance, it automatically deregisters the instance from the target group before termination.

After you attach the target group, it's the entry point for all incoming requests to your Auto Scaling group. As the example in the following diagram shows, incoming requests can then be routed to the appropriate target group using listener rules specified for a VPC Lattice service.

When traffic is routed through VPC Lattice to your Auto Scaling group, VPC Lattice balances requests among the instances in the group using round robin load balancing. VPC Lattice also can monitor the health of its registered instances and route traffic only to healthy instances.
To keep your instances available for incoming requests, you can optionally add VPC Lattice health checks to your Auto Scaling group. This way, if one of the EC2 instances fails, your Auto Scaling group automatically launches a new instance to replace it. The behavior of the VPC Lattice health checks is similar to the behavior of the Elastic Load Balancing health checks. The default health checks for an Auto Scaling group are EC2 health checks only.

To learn more about VPC Lattice, see Simplify Service-to-Service Connectivity, Security, and Monitoring with Amazon VPC Lattice – Now Generally Available on the AWS Blog.

Contents
- Prepare to attach a VPC Lattice target group to your Auto Scaling group (p. 366)
- Attach a VPC Lattice target group to your Auto Scaling group (p. 368)
- Verify the attachment status of your VPC Lattice target group (p. 371)

Prepare to attach a VPC Lattice target group to your Auto Scaling group

Before you attach a VPC Lattice target group to your Auto Scaling group, you must complete the following prerequisites:

- You must have already created a VPC Lattice service network, service, listener, and target group. For more information, see the following topics in the VPC Lattice User Guide:
  - Service networks
  - Services
  - Listeners
  - Target groups
- The target group must be in the same AWS account, VPC, and Region as your Auto Scaling group.
- The target group must specify a target type of instance. You can't specify a target type of ip when using an Auto Scaling group.
- You must have sufficient IAM permissions to attach the target group to the Auto Scaling group. The following example policy shows the minimum required permissions that are necessary to attach and detach target groups.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "autoscaling:AttachTrafficSources",
                "autoscaling:DetachTrafficSources",
                "autoscaling:DescribeTrafficSources",
                "vpc-lattice:RegisterTargets",
                "vpc-lattice:DeregisterTargets"
            ],
            "Resource": "*"
        }
    ]
}
```

- If the launch template for your Auto Scaling group does not contain the correct settings for VPC Lattice, such as a compatible security group, you must update the launch template. Existing instances are not updated with the new settings when the launch template is modified. To update existing instances, you can terminate existing instances in the Auto Scaling group. Amazon EC2 Auto Scaling immediately starts launching new instances to replace the instances that you terminated. Alternatively,
you can start an instance refresh to replace the instances. For more information, see Replace Auto
Scaling instances based on an instance refresh (p. 101).

- Before enabling the VPC Lattice health checks on your Auto Scaling group, you can configure an
application-based health check to verify that your application is responding as expected. For more
information, see Health checks for your target groups in the VPC Lattice User Guide.

Security groups: Inbound and outbound rules

Security groups act as a firewall for associated EC2 instances, controlling both inbound and outbound
traffic at the instance level.

**Note**

Network configuration is sufficiently complex that we strongly recommend that you create a
new security group for use with VPC Lattice. It also makes it easier for AWS Support to help
you if you need to contact them. The following sections are based on the assumption that you
follow this recommendation.

To learn more about creating security groups for VPC Lattice that you can use with your
Auto Scaling group, see Control traffic using security groups in the VPC Lattice User Guide. To
troubleshoot issues with traffic flow, consult the VPC Lattice User Guide for further information.

For information about how to create a security group, see Create a security group in the Amazon EC2
User Guide for Linux Instances and use the following table to determine what options to select.

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>A name that's easy for you to remember.</td>
</tr>
<tr>
<td>Description</td>
<td>A description to help you identify the security group.</td>
</tr>
<tr>
<td>VPC</td>
<td>The same VPC as the Auto Scaling group.</td>
</tr>
</tbody>
</table>

Inbound rules

When you create a security group, it has no inbound rules. No inbound traffic originating from clients
within a VPC Lattice service network to your instance is allowed until you add inbound rules to the
security group.

To allow clients within a VPC Lattice service network to connect to instances in your Auto Scaling group,
the security group for your Auto Scaling group must be set up correctly. In this case, give it an inbound
rule to allow traffic from the name of the AWS managed prefix list for VPC Lattice, instead of a specific
IP address. The VPC Lattice prefix list is a range of IP addresses used by VPC Lattice in CIDR notation. For
more information, see Work with AWS-managed prefix lists in the Amazon VPC User Guide.

For information about how to add rules to a security group, see Add rules to your security group in the
Amazon VPC User Guide and use the following table to determine what options to select.

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP rule</td>
<td>Type: HTTP</td>
</tr>
<tr>
<td></td>
<td>Source: com.amazonaws.region.vpc-lattice</td>
</tr>
</tbody>
</table>
The security group is stateful: it allows traffic from clients within the VPC Lattice service network to instances in your Auto Scaling group, and then sends the response back to the client it previously left.

**Outbound rules**

By default, a security group includes an outbound rule that allows all outbound traffic. You can optionally remove this default rule and add an outbound rule to accommodate specific security needs.

**Limitations**

- **Mixed instances groups** (p. 62) are not supported. If you try to attach a VPC Lattice target group to an Auto Scaling group that has a mixed instances policy, you receive the error message **Currently, Auto Scaling Groups with mixed instances cannot be integrated with a VPC Lattice service.** This is because the load balancing algorithm evenly distributes load onto all available resources and assumes that instances are similar enough to handle equal loads.

**Attach a VPC Lattice target group to your Auto Scaling group**

This topic describes how to attach a VPC Lattice target group to an Auto Scaling group. It also describes how to turn on VPC Lattice health checks to let Amazon EC2 Auto Scaling replace instances that VPC Lattice reports as unhealthy.

By default, Amazon EC2 Auto Scaling only replaces instances that are unhealthy or unreachable based on Amazon EC2 health checks. If you turn on VPC Lattice health checks, Amazon EC2 Auto Scaling can replace a running instance if any of the VPC Lattice target groups you attach to the Auto Scaling group report it as unhealthy. For more information, see **Health checks for Auto Scaling instances (p. 297).**

**Important**

Before you continue, complete all **prerequisites (p. 366)** in the previous section.

**Attach a VPC Lattice target group**

You can attach one or multiple target groups to an Auto Scaling group when you create or update the group.

**Console**

Follow the steps in this section to use the console to:

- Attach a VPC Lattice target group to an Auto Scaling group
- Turn on the health checks for VPC Lattice

**To attach a VPC Lattice target group to a new Auto Scaling group**

1. Open the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/), and choose **Auto Scaling Groups** from the navigation pane.
2. On the navigation bar at the top of the screen, choose the AWS Region that you created your target group in.
3. Choose Create Auto Scaling group.
4. In steps 1 and 2, choose your desired options and proceed to Step 3: Configure advanced options.
5. For VPC Lattice integration options, choose Attach to VPC Lattice service.
6. Under Choose VPC Lattice target group, choose your target group.
7. (Optional) For Health checks, Additional health check types, select Turn on VPC Lattice health checks.
8. (Optional) For Health check grace period, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).
9. Proceed to create the Auto Scaling group. Your instances will be automatically registered to the VPC Lattice target group after the Auto Scaling group has been created.

To attach a VPC Lattice target group to an existing Auto Scaling group

Use the following procedure to attach a target group for a service to an existing Auto Scaling group.

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/, and choose Auto Scaling Groups from the navigation pane.
2. Select the check box next to your Auto Scaling group.
   A split pane opens up in the bottom of the page.
3. On the Details tab, choose VPC Lattice integration options, Edit.
4. Under VPC Lattice integration options, choose Attach to VPC Lattice service.
5. Under Choose VPC Lattice target group, choose your target group.
6. Choose Update.

When you finish attaching the target group, you can optionally turn on the health checks that use it.

To turn on the VPC Lattice health checks

1. On the Details tab, choose Health checks, Edit.
2. For Health checks, Additional health check types, select Turn on VPC Lattice health checks.
3. For Health check grace period, enter the amount of time, in seconds. This is how long Amazon EC2 Auto Scaling needs to wait before checking the health status of an instance after it enters the InService state. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).
4. Choose Update.

AWS CLI

Follow the steps in this section to use the AWS CLI to:
- Attach a VPC Lattice target group to an Auto Scaling group
- Turn on the health checks for VPC Lattice

To attach a VPC Lattice target group to an Auto Scaling group

369
Use the following `create-auto-scaling-group` command to create an Auto Scaling group and simultaneously attach a VPC Lattice target group by specifying its Amazon Resource Name (ARN).

Replace the sample values for `--auto-scaling-group-name`, `--vpc-zone-identifier`, `--min-size`, and `--max-size`. For the `--launch-template` option, replace `my-launch-template` and 1 with the name and version of the launch template that you created for instances registered to a VPC Lattice target group. For the `--traffic-sources` option, replace the sample ARN with the ARN of your VPC Lattice target group.

```bash
aws autoscaling create-auto-scaling-group --auto-scaling-group-name my-asg
  --launch-template LaunchTemplateName=my-launch-template,Version='1'
  --vpc-zone-identifier "subnet-5ea0c127,subnet-6194ea3b,subnet-c934b782"
  --min-size 1 --max-size 5
  --traffic-sources "Identifier=arn:aws:vpc-lattice:region:account-id:targetgroup/tg-0e2f2665eEXAMPLE"
```

Use the following `attach-traffic-sources` command to attach a VPC Lattice target group to an Auto Scaling group after it's already created.

```bash
aws autoscaling attach-traffic-sources --auto-scaling-group-name my-asg
  --traffic-sources "Identifier=arn:aws:vpc-lattice:region:account-id:targetgroup/tg-0e2f2665eEXAMPLE"
```

To turn on the health checks for VPC Lattice

If you have configured an application-based health check for your VPC Lattice target group, you can turn on these health checks. Use the `create-auto-scaling-group` or `update-auto-scaling-group` command with the `--health-check-type` option and a value of `VPC_LATTICE`. To specify the grace period for the health checks performed by your Auto Scaling group, include the `--health-check-grace-period` option and provide its value in seconds.

```bash
--health-check-type "VPC_LATTICE" --health-check-grace-period 60
```

**Detach a VPC Lattice target group**

If you no longer need to use VPC Lattice, use the following procedure to detach the target group from your Auto Scaling group.

**Console**

Follow the steps in this section to use the console to:

- Detach a VPC Lattice target group from an Auto Scaling group
- Turn off the health checks for VPC Lattice

**To detach a VPC Lattice target group from an Auto Scaling group**

1. Open the Amazon EC2 console at `https://console.aws.amazon.com/ec2/`, and choose **Auto Scaling Groups** from the navigation pane.
2. Select the check box next to an existing group.
   
   A split pane opens up in the bottom of the page.
3. On the **Details** tab, choose **VPC Lattice integration options**, **Edit**.
4. Under **VPC Lattice integration options**, choose the delete (X) icon next to the target group.
5. Choose **Update**.

When you finish detaching the target group, you can turn off the VPC Lattice health checks.

**To turn off the VPC Lattice health checks**

1. On the **Details** tab, choose **Health checks**, **Edit**.
2. For **Health checks**, **Additional health check types**, deselect **Turn on VPC Lattice health checks**.
3. Choose **Update**.

**AWS CLI**

Follow the steps in this section to use the AWS CLI to:

- Detach a VPC Lattice target group from an Auto Scaling group
- Turn off the health checks for VPC Lattice

Use the **detach-traffic-sources** command to detach a target group from your Auto Scaling group when you no longer need it.

```bash
aws autoscaling detach-traffic-sources --auto-scaling-group-name my-asg \ 
  --traffic-sources "Identifier=arn:aws:vpc-lattice:region:account-id:targetgroup/ 
  tg-0e2f2665eEXAMPLE"
```

To update the health checks on an Auto Scaling group so that it no longer uses VPC Lattice health checks, use the **update-auto-scaling-group** command. Include the **--health-check-type** option and a value of **EC2**.

```bash
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg \ 
  --health-check-type "EC2"
```

**Verify the attachment status of your VPC Lattice target group**

After you attach a VPC Lattice target group to an Auto Scaling group, it enters the **Adding** state while registering the instances in the group. When all instances in the group are registered, it enters the **Added** state. After at least one registered instance passes the health checks, it enters the **InService** state. When the target group is in the **InService** state, Amazon EC2 Auto Scaling can terminate and replace any instances that are reported as unhealthy. If no registered instances pass the health checks (for example, due to a misconfigured health check), the target group doesn't enter the **InService** state. Amazon EC2 Auto Scaling doesn't terminate and replace the instances.

When you detach a target group for a service, it enters the **Removing** state while deregistering the instances in the group. The instances remain running after they deregister. By default, connection draining (deregistration delay) is enabled. If connection draining is enabled, VPC Lattice waits for in-flight requests to complete or for the maximum timeout to expire (whichever comes first) before it deregisters the instances.

You can verify the attachment status by using the AWS Command Line Interface (AWS CLI) or AWS SDKs. You cannot verify the attachment status from the console.
To use the AWS CLI to verify the attachment status

The following `describe-traffic-sources` command returns the attachment status of all traffic sources for the specified Auto Scaling group.

```bash
aws autoscaling describe-traffic-sources --auto-scaling-group-name my-asg
```

The example returns the ARN of the VPC Lattice target group that's attached to the Auto Scaling group, along with the attachment status of the target group in the `State` element.

```json
{
    "TrafficSources": [
        {
            "Identifier": "arn:aws:vpc-lattice:region:account-id:targetgroup/tg-0e2f2665eEXAMPLE",
            "State": "InService",
            "Type": "vpc-lattice"
        }
    ]
}
```

Use EventBridge to handle Auto Scaling events

Amazon EventBridge, formerly called CloudWatch Events, helps you set up event-driven rules that monitor resources and initiate target actions that use other AWS services.

Events from Amazon EC2 Auto Scaling are delivered to EventBridge in near real time. You can establish EventBridge rules that invoke programmatic actions and notifications in response to a variety of these events. For example, while instances are in the process of launching or terminating, you can invoke an AWS Lambda function to perform a preconfigured task.

Targets of EventBridge rules can include AWS Lambda functions, Amazon SNS topics, API destinations, event buses in other AWS accounts, and many more. For information about supported targets, see Amazon EventBridge targets in the Amazon EventBridge User Guide.

Get started by creating EventBridge rules with an example using an Amazon SNS topic and an EventBridge rule. Then, when a user starts an instance refresh, Amazon SNS notifies you by email whenever a checkpoint is reached. For more information, see Create EventBridge rules for instance refresh events (p. 383).

Contents

- Amazon EC2 Auto Scaling event reference (p. 372)
- Warm pool example events and patterns (p. 379)
- Create EventBridge rules (p. 382)

Amazon EC2 Auto Scaling event reference

Using Amazon EventBridge, you can create `rules` that match incoming `events` and route them to `targets` for processing.

Contents

- Lifecycle action events (p. 373)
Lifecycle action events

When you add lifecycle hooks to your Auto Scaling group, Amazon EC2 Auto Scaling sends events to EventBridge when an instance transitions into a wait state. Events are produced on a best-effort basis.

Event types

- **Scale-out lifecycle action** (p. 373)
- **Scale-in lifecycle action** (p. 373)

Scale-out lifecycle action

The following example event shows that Amazon EC2 Auto Scaling moved an instance to a Pending:Wait state due to a launch lifecycle hook.

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance-launch Lifecycle Action",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "yyyy-mm-ddThh:mm:ssZ",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn"
    ],
    "detail": {
        "LifecycleActionToken": "87654321-4321-4321-210987654321",
        "AutoScalingGroupName": "my-asg",
        "LifecycleHookName": "my-lifecycle-hook",
        "EC2InstanceId": "i-1234567890abcdef0",
        "LifecycleTransition": "autoscaling:EC2_INSTANCE_LAUNCHING",
        "NotificationMetadata": "additional-info",
        "Origin": "EC2",
        "Destination": "AutoScalingGroup"
    }
}
```

Scale-in lifecycle action

The following example event shows that Amazon EC2 Auto Scaling moved an instance to a Terminating:Wait state due to a termination lifecycle hook.

**Important**

When an Auto Scaling group returns instances to a warm pool on scale in, returning instances to the warm pool can also generate EC2 Instance-terminate Lifecycle Action events. Events that are delivered when an instance moves to the wait state on scale in have WarmPool as the value for Destination. For more information, see Instance reuse policy.

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance-terminate Lifecycle Action",
    "source": "aws.autoscaling",
}
```
Successful scaling events

The following examples show the event types for successful scaling events. Events are produced on a best-effort basis.

Event types
- **Successful scale-out event** (p. 374)
- **Successful scale-in event** (p. 375)

Successful scale-out event

The following example event shows that Amazon EC2 Auto Scaling successfully launched an instance.

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance Launch Successful",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "yyyy-mm-ddThh:mm:ssZ",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn",
        "instance-arn"
    ],
    "detail": {
        "StatusCode": "InProgress",
        "Description": "Launching a new EC2 instance: i-12345678",
        "AutoScalingGroupName": "my-asg",
        "ActivityId": "87654321-4321-4321-210987654321",
        "LifecycleHookName": "my-lifecycle-hook",
        "EC2InstanceId": "i-1234567890abcdef0",
        "LifecycleTransition": "autoscaling:EC2_INSTANCE_TERMINATING",
        "NotificationMetadata": "additional-info",
        "Origin": "AutoScalingGroup",
        "Destination": "EC2"
    }
}
```
Successful scale-in event

The following example event shows that Amazon EC2 Auto Scaling successfully terminated an instance.

Important

When an Auto Scaling group returns instances to a warm pool on scale in, returning instances to the warm pool can also generate EC2 Instance Terminate Successful events. Events that are delivered when an instance successfully returns to the warm pool have WarmPool as the value for Destination. For more information, see Instance reuse policy.

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance Terminate Successful",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "yyyy-mm-ddThh:mm:ssZ",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn",
        "instance-arn"
    ],
    "detail": {
        "StatusCode": "InProgress",
        "Description": "Terminating EC2 instance: i-12345678",
        "AutoScalingGroupName": "my-asg",
        "ActivityId": "87654321-4321-4321-210987654321",
        "Details": {
            "Availability Zone": "us-west-2b",
            "Subnet ID": "subnet-12345678"
        },
        "RequestId": "12345678-1234-1234-1234-123456789012",
        "StatusMessage": "",
        "EndTime": "yyyy-mm-ddThh:mm:ssZ",
        "EC2InstanceId": "i-1234567890abcdef0",
        "StartTime": "yyyy-mm-ddThh:mm:ssZ",
        "Cause": "description-text",
        "Origin": "AutoScalingGroup",
        "Destination": "EC2"
    }
}
```

Unsuccessful scaling events

The following examples show the event types for unsuccessful scaling events. Events are produced on a best-effort basis.

Event types

- Unsuccessful scale-out event (p. 375)
- Unsuccessful scale-in event (p. 376)

Unsuccessful scale-out event

The following example event shows that Amazon EC2 Auto Scaling failed to launch an instance.

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance Launch Failed",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "yyyy-mm-ddThh:mm:ssZ",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn",
        "instance-arn"
    ],
    "detail": {
        "StatusCode": "InProgress",
        "Description": "Launching EC2 instance: i-12345678",
        "AutoScalingGroupName": "my-asg",
        "ActivityId": "87654321-4321-4321-210987654321",
        "Details": {
            "Availability Zone": "us-west-2b",
            "Subnet ID": "subnet-12345678"
        },
        "RequestId": "12345678-1234-1234-1234-123456789012",
        "StatusMessage": "",
        "EndTime": "yyyy-mm-ddThh:mm:ssZ",
        "EC2InstanceId": "i-1234567890abcdef0",
        "StartTime": "yyyy-mm-ddThh:mm:ssZ",
        "Cause": "description-text",
        "Origin": "AutoScalingGroup",
        "Destination": "EC2"
    }
}
```
Unsuccessful scale-in event

The following example event shows that Amazon EC2 Auto Scaling failed to terminate an instance.

**Important**

When an Auto Scaling group returns instances to a warm pool on scale-in, failing to return instances to the warm pool can also generate EC2 Instance Terminate Unsuccessful events. Events that are delivered when an instance fails to return to the warm pool have WarmPool as the value for Destination. For more information, see Instance reuse policy.

```
{"version": "0",
"id": "12345678-1234-1234-1234-123456789012",
"detail-type": "EC2 Instance Terminate Unsuccessful",
"source": "aws.autoscaling",
"account": "123456789012",
"time": "yyyy-mm-ddThh:mm:ssZ",
"region": "us-west-2",
"resources": [
  "auto-scaling-group-arn",
  "instance-arn"
],
"detail": {
  "StatusCode": "Failed",
  "AutoScalingGroupName": "my-asg",
  "ActivityId": "87654321-4321-4321-210987654321",
  "Details": {
    "Availability Zone": "us-west-2b",
    "Subnet ID": "subnet-12345678"
  },
  "RequestId": "12345678-1234-1234-1234-123456789012",
  "StatusMessage": "message-text",
  "EndTime": "yyyy-mm-ddThh:mm:ssZ",
  "EC2InstanceId": "i-1234567890abcdef0",
  "StartTime": "yyyy-mm-ddThh:mm:ssZ",
  "Cause": "description-text",
  "Origin": "EC2",
  "Destination": "AutoScalingGroup"
}
```
Instance refresh events

The following examples show events for the instance refresh feature. Events are produced on a best-effort basis.

Event types

- **Checkpoint reached** (p. 377)
- **Instance refresh started** (p. 377)
- **Instance refresh succeeded** (p. 378)
- **Instance refresh failed** (p. 378)
- **Instance refresh cancelled** (p. 378)

Checkpoint reached

When the number of instances that have been replaced reaches the percentage threshold defined for the checkpoint, Amazon EC2 Auto Scaling sends the following event.

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Auto Scaling Instance Refresh Checkpoint Reached",
  "source": "aws.autoscaling",
  "account": "123456789012",
  "time": "yyyy-mm-ddThh:mm:ssZ",
  "region": "us-west-2",
  "resources": [
    "auto-scaling-group-arn"
  ],
  "detail": {
    "InstanceRefreshId": "ab00cf8f-9126-4f3c-8010-dbb8cad6fb86",
    "AutoScalingGroupName": "my-asg",
    "CheckpointPercentage": "50",
    "CheckpointDelay": "500"
  }
}
```

Instance refresh started

When the status of an instance refresh changes to InProgress, Amazon EC2 Auto Scaling sends the following event.

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Auto Scaling Instance Refresh Started",
  "source": "aws.autoscaling",
  "account": "123456789012",
  "time": "yyyy-mm-ddThh:mm:ssZ",
  "region": "us-west-2",
  "resources": [n
    "auto-scaling-group-arn"
  ]
}
```
Instance refresh succeeded

When the status of an instance refresh changes to Succeeded, Amazon EC2 Auto Scaling sends the following event.

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Auto Scaling Instance Refresh Succeeded",
  "source": "awsautoscaling",
  "account": "123456789012",
  "time": "yyyy-mm-ddThh:mm:ssZ",
  "region": "us-west-2",
  "resources": [
    "auto-scaling-group-arn"
  ],
  "detail": {
    "InstanceRefreshId": "c613620e-07e2-4ed2-a9e2-ef8258911ade",
    "AutoScalingGroupName": "my-asg"
  }
}
```

Instance refresh failed

When the status of an instance refresh changes to Failed, Amazon EC2 Auto Scaling sends the following event.

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Auto Scaling Instance Refresh Failed",
  "source": "awsautoscaling",
  "account": "123456789012",
  "time": "yyyy-mm-ddThh:mm:ssZ",
  "region": "us-west-2",
  "resources": [
    "auto-scaling-group-arn"
  ],
  "detail": {
    "InstanceRefreshId": "c613620e-07e2-4ed2-a9e2-ef8258911ade",
    "AutoScalingGroupName": "my-asg"
  }
}
```

Instance refresh cancelled

When the status of an instance refresh changes to Cancelled, Amazon EC2 Auto Scaling sends the following event.

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Auto Scaling Instance Refresh Cancelled",
  "source": "awsautoscaling",
  "account": "123456789012",
  "time": "yyyy-mm-ddThh:mm:ssZ",
  "region": "us-west-2",
  "resources": [
    "auto-scaling-group-arn"
  ],
  "detail": {
    "InstanceRefreshId": "c613620e-07e2-4ed2-a9e2-ef8258911ade",
    "AutoScalingGroupName": "my-asg"
  }
}
```
Warm pool example events and patterns

Amazon EC2 Auto Scaling supports several predefined patterns in Amazon EventBridge. This simplifies how an event pattern is created. You select field values on a form, and EventBridge generates the pattern for you. At this time, Amazon EC2 Auto Scaling doesn't support predefined patterns for any events that are emitted by an Auto Scaling group with a warm pool. You must enter the pattern as a JSON object. This section and the Create EventBridge rules for warm pool events (p. 384) topic show you how to use an event pattern to select events and send them to targets.

To create EventBridge rules that filter for warm pool-related events that Amazon EC2 Auto Scaling sends to EventBridge, include the Origin and Destination fields from the detail section of the event.

The values of Origin and Destination can be the following:

EC2 | AutoScalingGroup | WarmPool

Contents

- Example events (p. 379)
- Example event patterns (p. 381)

Example events

When you add lifecycle hooks to your Auto Scaling group, Amazon EC2 Auto Scaling sends events to EventBridge when an instance transitions into a wait state. For more information, see Use lifecycle hooks with a warm pool (p. 265).

This section includes examples of these events when your Auto Scaling group has a warm pool. Events are emitted on a best-effort basis.

Note

For events that Amazon EC2 Auto Scaling sends to EventBridge when scaling is successful, see Successful scaling events (p. 374). For events when scaling is unsuccessful, see Unsuccessful scaling events (p. 375).

Event examples

- Scale-out lifecycle action (p. 379)
- Scale-in lifecycle action (p. 380)

Scale-out lifecycle action

Events that are delivered when an instance transitions into a wait state for scale-out events have EC2 Instance-launch Lifecycle Action as the value for detail-type. In the detail object, the
values for the Origin and Destination attributes show where the instance is coming from and where it's going.

In this example scale-out event, a new instance launches and its state changes to Warmed:Pending:Wait because it's added to the warm pool. For more information, see Lifecycle state transitions for instances in a warm pool (p. 266).

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance-launch Lifecycle Action",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "2021-01-13T00:12:37.214Z",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn"
    ],
    "detail": {
        "LifecycleActionToken": "71514b9d-6a40-4b26-8523-05e7eEXAMPLE",
        "AutoScalingGroupName": "my-asg",
        "LifecycleHookName": "my-launch-lifecycle-hook",
        "EC2InstanceId": "i-1234567890abcdef0",
        "LifecycleTransition": "autoscaling:EC2_INSTANCE_LAUNCHING",
        "NotificationMetadata": "additional-info",
        "Origin": "EC2",
        "Destination": "WarmPool"
    }
}
```

In this example scale-out event, the state of the instance changes to Pending:Wait because it's added to the Auto Scaling group from the warm pool. For more information, see Lifecycle state transitions for instances in a warm pool (p. 266).

```json
{
    "version": "0",
    "id": "12345678-1234-1234-1234-123456789012",
    "detail-type": "EC2 Instance-launch Lifecycle Action",
    "source": "aws.autoscaling",
    "account": "123456789012",
    "time": "2021-01-19T00:35:52.359Z",
    "region": "us-west-2",
    "resources": [
        "auto-scaling-group-arn"
    ],
    "detail": {
        "LifecycleActionToken": "19cc4d4a-e450-4d1c-b448-0de67EXAMPLE",
        "AutoScalingGroupName": "my-asg",
        "LifecycleHookName": "my-launch-lifecycle-hook",
        "EC2InstanceId": "i-1234567890abcdef0",
        "LifecycleTransition": "autoscaling:EC2_INSTANCE_LAUNCHING",
        "NotificationMetadata": "additional-info",
        "Origin": "WarmPool",
        "Destination": "AutoScalingGroup"
    }
}
```

**Scale-in lifecycle action**

Events that are delivered when an instance transitions into a wait state for scale-in events have EC2 Instance-terminate Lifecycle Action as the value for detail-type. In the detail object, the
values for the Origin and Destination attributes show where the instance is coming from and where it's going.

In this example scale-in event, the state of an instance changes to Warmed:Pending:Wait because it's returned to the warm pool. For more information, see Lifecycle state transitions for instances in a warm pool (p. 266).

```
{
  "version": "0",
  "id": "12345678-1234-1234-1234-123456789012",
  "detail-type": "EC2 Instance-terminate Lifecycle Action",
  "source": "aws.autoscaling",
  "account": "123456789012",
  "time": "2022-03-28T00:12:37.214Z",
  "region": "us-west-2",
  "resources": [ "auto-scaling-group-arn" ],
  "detail": {
    "LifecycleActionToken": "42694b3d-4b70-6a62-8523-09a1eEXAMPLE",
    "AutoScalingGroupName": "my-asg",
    "LifecycleHookName": "my-termination-lifecycle-hook",
    "EC2InstanceId": "i-1234567890abcdef0",
    "LifecycleTransition": "autoscaling:EC2_INSTANCE_TERMINATING",
    "NotificationMetadata": "additional-info",
    "Origin": "AutoScalingGroup",
    "Destination": "WarmPool"
  }
}
```

**Example event patterns**

The preceding section provides example events emitted by Amazon EC2 Auto Scaling.

EventBridge event patterns have the same structure as the events that they match. The pattern quotes the fields that you want to match and provides the values that you're looking for.

The following fields in the event form the event pattern that is defined in the rule to invoke an action:

"source": "aws.autoscaling"

Identifies that the event is from Amazon EC2 Auto Scaling.

"detail-type": "EC2 Instance-launch Lifecycle Action"

Identifies the event type.

"Origin": "EC2"

Identifies where the instance is coming from.

"Destination": "WarmPool"

Identifies where the instance is going to.

Use the following sample event pattern to capture all EC2 Instance-launch Lifecycle Action events that are associated with instances entering the warm pool.

```
[
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-launch Lifecycle Action" ],
  "detail": {
```

381
Use the following sample event pattern to capture all EC2 Instance-launch Lifecycle Action events that are associated with instances leaving the warm pool because of a scale-out event.

```
{
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-launch Lifecycle Action" ],
  "detail": {
    "Origin": [ "WarmPool" ],
    "Destination": [ "AutoScalingGroup" ]
  }
}
```

Use the following sample event pattern to capture all EC2 Instance-launch Lifecycle Action events that are associated with instances launching directly into the Auto Scaling group.

```
{
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-launch Lifecycle Action" ],
  "detail": {
    "Origin": [ "EC2" ],
    "Destination": [ "AutoScalingGroup" ]
  }
}
```

Use the following sample event pattern to capture all EC2 Instance-terminate Lifecycle Action events that are associated with instances returning to the warm pool on scale in.

```
{
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-terminate Lifecycle Action" ],
  "detail": {
    "Origin": [ "AutoScalingGroup" ],
    "Destination": [ "WarmPool" ]
  }
}
```

Use the following sample event pattern to capture all events that are associated with EC2 Instance-launch Lifecycle Action, regardless of the origin or destination.

```
{
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-launch Lifecycle Action" ]
}
```

Create EventBridge rules

When an event is emitted by Amazon EC2 Auto Scaling, an event notification is sent to Amazon EventBridge as a JSON file. You can write an EventBridge rule to automate what actions to take when an event pattern matches the rule. If EventBridge detects an event pattern that matches a pattern defined in a rule, EventBridge invokes the target (or targets) specified in the rule.

You can use the example procedures in this section as a starting point.
You may also find the following documentation useful.

- To perform custom actions on instances as they are launching or before they are terminated using a Lambda function, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255).
- To invoke a Lambda function on API calls logged with CloudTrail, see Tutorial: Log AWS API calls using EventBridge in the Amazon EventBridge User Guide.
- For more information about how to create event rules, see Creating Amazon EventBridge rules that react to events in the Amazon EventBridge User Guide.

Topics
- Create EventBridge rules for instance refresh events (p. 383)
- Create EventBridge rules for warm pool events (p. 384)

Create EventBridge rules for instance refresh events

The following example creates an EventBridge rule to send an email notification. It does this each time that your Auto Scaling group emits an event when a checkpoint is reached during an instance refresh. The procedure for setting up email notifications using Amazon SNS is included. To use Amazon SNS to send email notifications, you must first create a topic and then subscribe your email addresses to the topic.

For more information about the instance refresh feature, see Replace Auto Scaling instances based on an instance refresh (p. 101).

Create an Amazon SNS topic

An SNS topic is a logical access point, a communication channel that your Auto Scaling group uses to send the notifications. You create a topic by specifying a name for your topic.

Topic names must meet the following requirements:

- Have 1-256 characters
- Contain uppercase and lowercase ASCII letters, numbers, underscores, or hyphens

For more information, see Creating an Amazon SNS topic in the Amazon Simple Notification Service Developer Guide.

Subscribe to the Amazon SNS topic

To receive the notifications that your Auto Scaling group sends to the topic, you must subscribe an endpoint to the topic. In this procedure, for Endpoint, specify the email address where you want to receive the notifications from Amazon EC2 Auto Scaling.

For more information, see Subscribing to an Amazon SNS topic in the Amazon Simple Notification Service Developer Guide.

Confirm your Amazon SNS subscription

Amazon SNS sends a confirmation email to the email address you specified in the previous step.

Make sure that you open the email from AWS Notifications and choose the link to confirm the subscription before you continue with the next step.

You will receive an acknowledgment message from AWS. Amazon SNS is now configured to receive notifications and send the notification as an email to the email address that you specified.
Route events to your Amazon SNS topic

Create a rule that matches selected events and routes them to your Amazon SNS topic to notify subscribed email addresses.

To create a rule that sends notifications to your Amazon SNS topic

1. Open the Amazon EventBridge console at https://console.aws.amazon.com/events/.
2. In the navigation pane, choose Rules.
3. Choose Create rule.
4. For Define rule detail, do the following:
   a. Enter a Name for the rule, and, optionally, a description.
   A rule can't have the same name as another rule in the same Region and on the same event bus.
   b. For Event bus, choose default. When an AWS service in your account generates an event, it always goes to your account's default event bus.
   c. For Rule type, choose Rule with an event pattern.
   d. Choose Next.
5. For Build event pattern, do the following:
   a. For Event source, choose AWS events or EventBridge partner events.
   b. For Event pattern, do the following:
      i. For Event source, choose AWS services.
      ii. For AWS service, choose Auto Scaling.
      iii. For Event type, choose Instance Refresh.
      iv. By default, the rule matches any instance refresh event. To create a rule that notifies you when a checkpoint is reached during an instance refresh, choose Specific instance event(s) and select EC2 Auto Scaling Instance Refresh Checkpoint Reached.
      v. By default, the rule matches any Auto Scaling group in the Region. To make the rule match a specific Auto Scaling group, choose Specific group name(s) and select one or more Auto Scaling groups.
     vi. Choose Next.
6. For Select target(s), do the following:
   a. For Target types, choose AWS service.
   b. For Select a target, choose SNS topic.
   c. For Topic, choose your Amazon SNS topic.
   d. (Optional) Under Additional settings, you can optionally configure additional settings. For more information, see Creating Amazon EventBridge rules that react to events (step 16) in the Amazon EventBridge User Guide.
   e. Choose Next.
7. (Optional) For Tags, you can optionally assign one or more tags to your rule, and then choose Next.
8. For Review and create, review the details of the rule and modify them as necessary. Then, choose Create rule.

Create EventBridge rules for warm pool events

The following example creates an EventBridge rule to invoke programmatic actions. It does this each time that your Auto Scaling group emits an event when a new instance is added to the warm pool.
Before you create the rule, create the AWS Lambda function that you want the rule to use as a target. You must specify this function as the target for the rule. The following procedure provides only the steps for creating the EventBridge rule that acts when new instances enter the warm pool. For an introductory tutorial that shows you how to create a simple Lambda function to invoke when an incoming event matches a rule, see Tutorial: Configure a lifecycle hook that invokes a Lambda function (p. 255).

For more information about creating and working with warm pools, see Warm pools for Amazon EC2 Auto Scaling (p. 261).

To create an event rule that invokes a Lambda function

1. Open the Amazon EventBridge console at https://console.aws.amazon.com/events/.
2. In the navigation pane, choose Rules.
3. Choose Create rule.
4. For Define rule detail, do the following:
   a. Enter a Name for the rule, and, optionally, a description.
      A rule can't have the same name as another rule in the same Region and on the same event bus.
   b. For Event bus, choose default. When an AWS service in your account generates an event, it always goes to your account's default event bus.
   c. For Rule type, choose Rule with an event pattern.
   d. Choose Next.
5. For Build event pattern, do the following:
   a. For Event source, choose AWS events or EventBridge partner events.
   b. For Event pattern, choose Custom pattern (JSON editor), and paste the following pattern into the Event pattern box, replacing the text in italics with the name of your Auto Scaling group.

```json
{
  "source": [ "aws.autoscaling" ],
  "detail-type": [ "EC2 Instance-launch Lifecycle Action" ],
  "detail": {
    "AutoScalingGroupName": [ "my-asg" ],
    "Origin": [ "EC2" ],
    "Destination": [ "WarmPool" ]
  }
}
```

To create a rule that matches for other events, modify the event pattern. For more information, see Example event patterns (p. 381).
   c. Choose Next.
6. For Select target(s), do the following:
   a. For Target types, choose AWS service.
   b. For Select a target, choose Lambda function.
   c. For Function, choose the function that you want to send the events to.
   d. (Optional) For Configure version/alias, enter version and alias settings for the target Lambda function.
   e. (Optional) For Additional settings, enter any additional settings as appropriate for your application. For more information, see Creating Amazon EventBridge rules that react to events (step 16) in the Amazon EventBridge User Guide.
   f. Choose Next.
7. (Optional) For Tags, you can optionally assign one or more tags to your rule, and then choose Next.
8. For **Review and create**, review the details of the rule and modify them as necessary. Then, choose **Create rule**.

**Provide network connectivity for your Auto Scaling instances using Amazon VPC**

We are retiring EC2-Classic. We recommend that you migrate from EC2-Classic to a VPC. For more information, see the blog post [EC2-Classic Networking is Retiring - Here's How to Prepare](https://example.com/retire-ec2-classic).

Amazon Virtual Private Cloud (Amazon VPC) enables you to define a virtual networking environment in a private, isolated section of the AWS Cloud. You have complete control over your virtual networking environment.

Within a virtual private cloud (VPC), you can launch AWS resources such as Auto Scaling groups. An Auto Scaling group in a VPC works essentially the same way as it does on EC2-Classic and supports the same set of features.

A subnet in Amazon VPC is a subdivision within an Availability Zone defined by a segment of the IP address range of the VPC. Using subnets, you can group your instances based on your security and operational needs. A subnet resides entirely within the Availability Zone it was created in. You launch Auto Scaling instances within the subnets.

To enable communication between the internet and the instances in your subnets, you must create an internet gateway and attach it to your VPC. An internet gateway enables your resources within the subnets to connect to the internet through the Amazon EC2 network edge. If a subnet's traffic is routed to an internet gateway, the subnet is known as a **public** subnet. If a subnet's traffic is not routed to an internet gateway, the subnet is known as a **private** subnet. Use a public subnet for resources that must be connected to the internet, and a private subnet for resources that need not be connected to the internet. For more information about giving internet access to instances in a VPC, see [Accessing the internet](https://example.com/accessing-internet) in the Amazon VPC User Guide.

**Contents**

- [EC2-Classic](#) (p. 386)
- Default VPC (p. 387)
- Nondefault VPC (p. 387)
- Considerations when choosing VPC subnets (p. 388)
- IP addressing in a VPC (p. 388)
- Network interfaces in a VPC (p. 388)
- Instance placement tenancy (p. 389)
- AWS Outposts (p. 389)
- More resources for learning about VPCs (p. 389)

**EC2-Classic**

If you created your AWS account before December 4, 2013, it may allow you to choose between Amazon VPC and EC2-Classic in certain Regions. If you have one of these older accounts, you might have Auto Scaling groups in EC2-Classic in some Regions instead of Amazon VPC.
For information about migrating from EC2-Classic to a VPC, see the blog post EC2-Classic Networking is Retiring - Here's How to Prepare. For information about the differences between instances in EC2-Classic and a VPC, see EC2-Classic in the Amazon EC2 User Guide for Linux Instances.

To determine whether any of the AWS Regions you use are still using EC2-Classic, open the Amazon EC2 console. If Supported platforms indicates only VPC, as shown in the following example, your AWS account in the current AWS Region uses the VPC platform, and uses a default VPC. The name of the default VPC is shown below the supported platform.

Tip
Any Auto Scaling groups created in a Region that has a default VPC can launch instances into the default VPC or a nondefault VPC, but not in EC2-Classic.

Default VPC

If you created your AWS account after December 4, 2013 or you are creating your Auto Scaling group in a new AWS Region, we create a default VPC for you. Your default VPC comes with a default subnet in each Availability Zone. If you have a default VPC, your Auto Scaling group is created in the default VPC by default.

You can view your VPCs on the Your VPCs page of the Amazon VPC console.

For more information about the default VPC, see Default VPC and default subnets in the Amazon VPC User Guide.

Nondefault VPC

You can choose to create additional VPCs by going to the VPC Dashboard page in the AWS Management Console and selecting Create VPC.

For more information, see the Amazon VPC User Guide.

Note
A VPC spans all Availability Zones in its AWS Region. When you add subnets to your VPC, choose multiple Availability Zones to ensure that the applications hosted in those subnets are highly...
Considerations when choosing VPC subnets

Note the following considerations when choosing VPC subnets for your Auto Scaling group:

- If you're attaching an Elastic Load Balancing load balancer to your Auto Scaling group, the instances can be launched into either public or private subnets. However, the load balancer must be created in public subnets to support DNS resolution.
- If you're accessing your Auto Scaling instances directly through SSH, the instances can be launched into public subnets only.
- If you're accessing no-ingress Auto Scaling instances using AWS Systems Manager Session Manager, the instances can be launched into either public or private subnets.
- If you're using private subnets, you can allow the Auto Scaling instances to access the internet by using a public NAT gateway.
- By default, the default subnets in a default VPC are public subnets.

IP addressing in a VPC

When you launch your Auto Scaling instances in a VPC, your instances are automatically assigned a private IP address from the CIDR range of the subnet in which the instance is launched. This enables your instances to communicate with other instances in the VPC.

You can configure a launch template or launch configuration to assign public IPv4 addresses to your instances. Assigning public IP addresses to your instances enables them to communicate with the internet or other AWS services.

When you launch instances into a subnet that is configured to automatically assign IPv6 addresses, they receive both IPv4 and IPv6 addresses. Otherwise, they receive only IPv4 addresses. For more information, see IPv6 addresses in the Amazon EC2 User Guide for Linux Instances.

For information on specifying CIDR ranges for your VPC or subnet, see the Amazon VPC User Guide.

Amazon EC2 Auto Scaling can automatically assign additional private IP addresses on instance launch when you use a launch template that specifies additional network interfaces. Each network interface is assigned a single private IP address from the CIDR range of the subnet in which the instance is launched. In this case, the system can no longer auto-assign a public IPv4 address to the primary network interface. You will not be able to connect to your instances over a public IPv4 address unless you associate available Elastic IP addresses to the Auto Scaling instances.

Network interfaces in a VPC

Each instance in your VPC has a default network interface (the primary network interface). You cannot detach a primary network interface from an instance. You can create and attach an additional network interface to any instance in your VPC. The number of network interfaces you can attach varies by instance type.

When launching an instance using a launch template, you can specify additional network interfaces. However, launching an Auto Scaling instance with multiple network interfaces automatically creates each interface in the same subnet as the instance. This is because Amazon EC2 Auto Scaling ignores the subnets defined in the launch template in favor of what is specified in the Auto Scaling group. For more information, see Creating a launch template for an Auto Scaling group.
If you create or attach two or more network interfaces from the same subnet to an instance, you might encounter networking issues such as asymmetric routing, especially on instances using a variant of non-Amazon Linux. If you need this type of configuration, you must configure the secondary network interface within the OS. For an example, see How can I make my secondary network interface work in my Ubuntu EC2 instance? in the AWS Knowledge Center.

**Instance placement tenancy**

By default, all instances in the VPC run as shared tenancy instances. Amazon EC2 Auto Scaling also supports Dedicated Instances and Dedicated Hosts. However, support for Dedicated Hosts is only available for Auto Scaling groups that use a launch template. For more information, see Configure instance tenancy with a launch configuration (p. 54).

**AWS Outposts**

AWS Outposts extends an Amazon VPC from an AWS Region to an Outpost with the VPC components that are accessible in the Region, including internet gateways, virtual private gateways, Amazon VPC Transit Gateways, and VPC endpoints. An Outpost is homed to an Availability Zone in the Region and is an extension of that Availability Zone that you can use for resiliency.

For more information, see the AWS Outposts User Guide.

For an example of how to deploy an Auto Scaling group that serves traffic from an Application Load Balancer within an Outpost, see the following blog post Configuring an Application Load Balancer on AWS Outposts.

**More resources for learning about VPCs**

Use the following topics to learn more about VPCs and subnets.

- Private subnets in a VPC
  - VPC with public and private subnets (NAT)
  - NAT gateways
- Public subnets in a VPC
  - VPC with a single public subnet
- Subnets for your Application Load Balancer
  - Subnets for your load balancer
- General VPC information
  - Amazon VPC User Guide
  - VPC peering
  - Elastic network interfaces
  - Use VPC endpoints for private connectivity (p. 426)
  - Migrate from EC2-Classic to a VPC
Security in Amazon EC2 Auto Scaling

Cloud security at AWS is the highest priority. As an AWS customer, you benefit from a data center and network architecture that is built to meet the requirements of the most security-sensitive organizations.

Security is a shared responsibility between AWS and you. The shared responsibility model describes this as security of the cloud and security in the cloud:

- **Security of the cloud** – AWS is responsible for protecting the infrastructure that runs AWS services in the AWS Cloud. AWS also provides you with services that you can use securely. Third-party auditors regularly test and verify the effectiveness of our security as part of the AWS compliance programs. To learn about the compliance programs that apply to Amazon EC2 Auto Scaling, see AWS services in scope by compliance program.
- **Security in the cloud** – Your responsibility is determined by the AWS service that you use. You are also responsible for other factors including the sensitivity of your data, your company's requirements, and applicable laws and regulations.

This documentation helps you understand how to apply the shared responsibility model when using Amazon EC2 Auto Scaling. The following topics show you how to configure Amazon EC2 Auto Scaling to meet your security and compliance objectives. You also learn how to use other AWS services that help you to monitor and secure your Amazon EC2 Auto Scaling resources.

**Topics**

- Amazon EC2 Auto Scaling and data protection (p. 390)
- Identity and Access Management for Amazon EC2 Auto Scaling (p. 391)
- Compliance validation for Amazon EC2 Auto Scaling (p. 423)
- Resilience in Amazon EC2 Auto Scaling (p. 424)
- Infrastructure security in Amazon EC2 Auto Scaling (p. 425)
- Amazon EC2 Auto Scaling and interface VPC endpoints (p. 426)

Amazon EC2 Auto Scaling and data protection

The AWS shared responsibility model applies to data protection in Amazon EC2 Auto Scaling. As described in this model, AWS is responsible for protecting the global infrastructure that runs all of the AWS Cloud. You are responsible for maintaining control over your content that is hosted on this infrastructure. This content includes the security configuration and management tasks for the AWS services that you use. For more information about data privacy, see the Data Privacy FAQ. For information about data protection in Europe, see the AWS Shared Responsibility Model and GDPR blog post on the AWS Security Blog.

For data protection purposes, we recommend that you protect AWS account credentials and set up individual users with AWS IAM Identity Center (successor to AWS Single Sign-On) or AWS Identity and Access Management (IAM). That way, each user is given only the permissions necessary to fulfill their job duties. We also recommend that you secure your data in the following ways:

- Use multi-factor authentication (MFA) with each account.
- Use SSL/TLS to communicate with AWS resources. We require TLS 1.2 and recommend TLS 1.3.
- Set up API and user activity logging with AWS CloudTrail.
• Use AWS encryption solutions, along with all default security controls within AWS services.
• Use advanced managed security services such as Amazon Macie, which assists in discovering and securing sensitive data that is stored in Amazon S3.
• If you require FIPS 140-2 validated cryptographic modules when accessing AWS through a command line interface or an API, use a FIPS endpoint. For more information about the available FIPS endpoints, see Federal Information Processing Standard (FIPS) 140-2.

We strongly recommend that you never put confidential or sensitive information, such as your customers' email addresses, into tags or free-form text fields such as a Name field. This includes when you work with Amazon EC2 Auto Scaling or other AWS services using the console, API, AWS CLI, or AWS SDKs. Any data that you enter into tags or free-form text fields used for names may be used for billing or diagnostic logs. If you provide a URL to an external server, we strongly recommend that you do not include credentials information in the URL to validate your request to that server.

When you launch an instance in Amazon EC2, you have the option of passing user data to the instance to do additional configuration when the instance boots. We also recommend that you never put confidential or sensitive information in the user data that will get passed to an instance.

Use AWS KMS keys to encrypt Amazon EBS volumes

You can configure your Auto Scaling group to encrypt Amazon EBS volume data stored in the cloud with AWS KMS keys. Amazon EC2 Auto Scaling supports AWS managed and customer managed keys to encrypt your data. Note that the KmsKeyId option to specify a customer managed key is not available when you use a launch configuration. To specify your customer managed key, use a launch template instead. For more information, see Create a launch template for an Auto Scaling group (p. 22).

You can also configure a customer managed key in your EBS-backed AMI before setting up the launch template or launch configuration, or use encryption by default to enforce the encryption of the new EBS volumes and snapshot copies that you create.

For information about how to set up the key policy that you need to launch Auto Scaling instances when you use a customer managed key for encryption, see Required AWS KMS key policy for use with encrypted volumes (p. 419). For information about how to create, store, and manage your AWS KMS encryption keys, see What is AWS Key Management Service?

Related topics
• Data protection in Amazon EC2 in the Amazon EC2 User Guide for Linux Instances
• Use encryption with EBS-backed AMIs in the Amazon EC2 User Guide for Linux Instances
• Encryption by default in the Amazon EC2 User Guide for Linux Instances

Identity and Access Management for Amazon EC2 Auto Scaling

AWS Identity and Access Management (IAM) is an AWS service that helps an administrator securely control access to AWS resources. IAM administrators control who can be authenticated (signed in) and authorized (have permissions) to use Amazon EC2 Auto Scaling resources. IAM is an AWS service that you can use with no additional charge.

To use Amazon EC2 Auto Scaling, you need an AWS account and your security credentials for signing into your account. For more information, see AWS security credentials in the AWS General Reference.
Access control

You can have valid credentials to authenticate your requests, but unless you have permissions you cannot create or access Amazon EC2 Auto Scaling resources. For example, you must have permissions to create Auto Scaling groups, launch instances with launch templates, and so on.

The following sections provide details on how an IAM administrator can use IAM to help secure your Amazon EC2 Auto Scaling resources, by controlling who can perform Amazon EC2 Auto Scaling actions.

We recommend that you read the Amazon EC2 topics first. See Identity and access management for Amazon EC2 in the Amazon EC2 User Guide for Linux Instances. After reading the topics in this section, you should have a good idea what access control permissions Amazon EC2 offers and how they can fit in with your Amazon EC2 Auto Scaling resource permissions.

Topics

- How Amazon EC2 Auto Scaling works with IAM (p. 392)
- Amazon EC2 Auto Scaling API permissions (p. 398)
- AWS managed policies for Amazon EC2 Auto Scaling (p. 399)
- Service-linked roles for Amazon EC2 Auto Scaling (p. 401)
- Amazon EC2 Auto Scaling identity-based policy examples (p. 406)
- Cross-service confused deputy prevention (p. 411)
- Launch template support (p. 412)
- IAM role for applications that run on Amazon EC2 instances (p. 417)
- Required AWS KMS key policy for use with encrypted volumes (p. 419)

How Amazon EC2 Auto Scaling works with IAM

Before you use IAM to manage access to Amazon EC2 Auto Scaling, learn what IAM features are available to use with Amazon EC2 Auto Scaling.

IAM features you can use with Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>IAM feature</th>
<th>Amazon EC2 Auto Scaling support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity-based policies (p. 393)</td>
<td>Yes</td>
</tr>
<tr>
<td>Resource-based policies (p. 393)</td>
<td>No</td>
</tr>
<tr>
<td>Policy actions (p. 393)</td>
<td>Yes</td>
</tr>
<tr>
<td>Policy resources (p. 394)</td>
<td>Yes</td>
</tr>
<tr>
<td>Policy condition keys (service-specific) (p. 395)</td>
<td>Yes</td>
</tr>
<tr>
<td>ACLs (p. 397)</td>
<td>No</td>
</tr>
<tr>
<td>ABAC (tags in policies) (p. 397)</td>
<td>Partial</td>
</tr>
<tr>
<td>Temporary credentials (p. 397)</td>
<td>Yes</td>
</tr>
<tr>
<td>Service roles (p. 398)</td>
<td>Yes</td>
</tr>
<tr>
<td>Service-linked roles (p. 398)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Identity-based policies for Amazon EC2 Auto Scaling

| Supports identity-based policies | Yes |

Identity-based policies are JSON permissions policy documents that you can attach to an identity, such as an IAM user, group of users, or role. These policies control what actions users and roles can perform, on which resources, and under what conditions. To learn how to create an identity-based policy, see [Creating IAM policies](https://docs.aws.amazon.com/IAM/latest/userguide/creating-iam-policies.html) in the IAM User Guide.

With IAM identity-based policies, you can specify allowed or denied actions and resources as well as the conditions under which actions are allowed or denied. You can't specify the principal in an identity-based policy because it applies to the user or role to which it is attached. To learn about all of the elements that you can use in a JSON policy, see [IAM JSON policy elements reference](https://docs.aws.amazon.com/IAM/latest/userguide/iam-json-policy-reference.html) in the IAM User Guide.

Resource-based policies within Amazon EC2 Auto Scaling

| Supports resource-based policies | No |

Resource-based policies are JSON policy documents that you attach to a resource. Examples of resource-based policies are IAM role trust policies and Amazon S3 bucket policies. In services that support resource-based policies, service administrators can use them to control access to a specific resource. For the resource where the policy is attached, the policy defines what actions a specified principal can perform on that resource and under what conditions. You must specify a principal in a resource-based policy. Principals can include accounts, users, roles, federated users, or AWS services.

To enable cross-account access, you can specify an entire account or IAM entities in another account as the principal in a resource-based policy. Adding a cross-account principal to a resource-based policy is only half of establishing the trust relationship. When the principal and the resource are in different AWS accounts, an IAM administrator in the trusted account must also grant the principal entity (user or role) permission to access the resource. They grant permission by attaching an identity-based policy to the entity. However, if a resource-based policy grants access to a principal in the same account, no additional identity-based policy is required. For more information, see [How IAM roles differ from resource-based policies](https://docs.aws.amazon.com/IAM/latest/userguide/iam-policy-based-permissions.html) in the IAM User Guide.

Policy actions for Amazon EC2 Auto Scaling

| Supports policy actions | Yes |

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Action element of a JSON policy describes the actions that you can use to allow or deny access in a policy. Policy actions usually have the same name as the associated AWS API operation. There are some exceptions, such as permission-only actions that don’t have a matching API operation. There are also some operations that require multiple actions in a policy. These additional actions are called dependent actions.

Include actions in a policy to grant permissions to perform the associated operation.
To see a list of Amazon EC2 Auto Scaling actions, see Actions defined by Amazon EC2 Auto Scaling in the Service Authorization Reference.

Policy actions in Amazon EC2 Auto Scaling use the following prefix before the action:

```
autoscaling
```

To specify multiple actions in a single statement, separate them with commas.

```
"Action": [  
    "autoscaling:action1",  
    "autoscaling:action2"  
]
```

You can specify multiple actions by using wildcards (*). For example, to specify all actions that begin with the word Describe, include the following action:

```
"Action": "autoscaling:Describe*"
```

## Policy resources for Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Supports policy resources</th>
<th>Yes</th>
</tr>
</thead>
</table>

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Resource JSON policy element specifies the object or objects to which the action applies. Statements must include either a Resource or a NotResource element. As a best practice, specify a resource using its Amazon Resource Name (ARN). You can do this for actions that support a specific resource type, known as resource-level permissions.

For actions that don't support resource-level permissions, such as listing operations, use a wildcard (*) to indicate that the statement applies to all resources.

```
"Resource": "*
```

You can use ARNs to identify the Auto Scaling groups and launch configurations that the IAM policy applies to.

An Auto Scaling group has the following ARN.

```
```

A launch configuration has the following ARN.

```
```

To specify an Auto Scaling group with the CreateAutoScalingGroup action, you must replace the UUID with a wildcard (*) as shown in the following example.

```
```
To specify a launch configuration with the CreateLaunchConfiguration action, you must replace the UUID with a wildcard (*) as shown in the following example.

```
"Resource": "arn:aws:autoscaling:region:account-id:launchConfiguration:*:launchConfigurationName/lc-name"
```

For more information about Amazon EC2 Auto Scaling resource types and their ARNs, see Resources defined by Amazon EC2 Auto Scaling in the Service Authorization Reference. To learn with which actions you can specify the ARN of each resource, see Actions defined by Amazon EC2 Auto Scaling.

**Note**

For an example of an IAM policy that uses ARNs to control access to Auto Scaling groups, see Control which Auto Scaling groups can be deleted (p. 409).

Not all Amazon EC2 Auto Scaling actions support resource-level permissions. For actions that don't support resource-level permissions, you must use a wildcard (*) as the resource.

The following Amazon EC2 Auto Scaling actions do not support resource-level permissions.

- DescribeAccountLimits
- DescribeAdjustmentTypes
- DescribeAutoScalingGroups
- DescribeAutoScalingInstances
- DescribeAutoScalingNotificationTypes
- DescribeInstanceRefreshes
- DescribeLaunchConfigurations
- DescribeLifecycleHooks
- DescribeLifecycleHookTypes
- DescribeLoadBalancers
- DescribeLoadBalancerTargetGroups
- DescribeMetricCollectionTypes
- DescribeNotificationConfigurations
- DescribePolicies
- DescribeScalingActivities
- DescribeScalingProcessTypes
- DescribeScheduledActions
- DescribeTags
- DescribeTerminationPolicyTypes
- DescribeWarmPool

### Policy condition keys for Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Supports service-specific policy condition keys</th>
<th>Yes</th>
</tr>
</thead>
</table>

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Condition element (or Condition block) lets you specify conditions in which a statement is in effect. The Condition element is optional. You can create conditional expressions that use condition operators, such as equals or less than, to match the condition in the policy with values in the request.
If you specify multiple Condition elements in a statement, or multiple keys in a single Condition element, AWS evaluates them using a logical AND operation. If you specify multiple values for a single condition key, AWS evaluates the condition using a logical OR operation. All of the conditions must be met before the statement's permissions are granted.

You can also use placeholder variables when you specify conditions. For example, you can grant an IAM user permission to access a resource only if it is tagged with their IAM user name. For more information, see IAM policy elements: variables and tags in the IAM User Guide.

AWS supports global condition keys and service-specific condition keys. To see all AWS global condition keys, see AWS global condition context keys in the IAM User Guide.

Amazon EC2 Auto Scaling supports the following condition keys that can be used to control access to supported actions and enforce the configuration of Auto Scaling groups:

- autoscaling:InstanceTypes
- autoscaling:LaunchConfigurationName
- autoscaling:LaunchTemplateVersionSpecified
- autoscaling:LoadBalancerNames
- autoscaling:MaxSize
- autoscaling:MinSize
- autoscaling:ResourceTag/key-name: tag-value
- autoscaling:TargetGroupARNs
- autoscaling:VPCZoneIdentifiers

The following condition keys are specific to create launch configuration requests:

- autoscaling:ImageId
- autoscaling:InstanceType
- autoscaling:MetadataHttpEndpoint
- autoscaling:MetadataHttpPutResponseHopLimit
- autoscaling:MetadataHttpTokens
- autoscaling:SpotPrice

Amazon EC2 Auto Scaling also supports the following global condition keys that you can use to define permissions based on the tags in the request or present on the Auto Scaling group. For more information, see Tag Auto Scaling groups and instances (p. 129).

- aws:RequestTag/key-name: tag-value
- aws:ResourceTag/key-name: tag-value
- aws:TagKeys: [tag-key, ...]

To learn which Amazon EC2 Auto Scaling API actions you can use a condition key with, see Actions defined by Amazon EC2 Auto Scaling in the Service Authorization Reference. For more information about Amazon EC2 Auto Scaling condition keys, see Condition keys for Amazon EC2 Auto Scaling.

**Note**

For examples of IAM policies that use condition keys to control access to supported actions and enforce the configuration of Auto Scaling groups, see the following resources:

- **Require a launch template and a version number (p. 414)** — This example enforces that a launch template and the version number of the launch template must be specified when creating or updating Auto Scaling groups.
• Control the size of the Auto Scaling groups that can be created (p. 407) — This example enforces constraints on the possible values for the MinSize and MaxSize properties when creating or updating Auto Scaling groups with a specific tag.

• Control which scaling policies can be deleted (p. 410) — This example enforces that deleting scaling policies is allowed only for Auto Scaling groups without a specific tag.

ACLs in Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Supports ACLs</th>
<th>No</th>
</tr>
</thead>
</table>

Access control lists (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they do not use the JSON policy document format.

ABAC with Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Supports ABAC (tags in policies)</th>
<th>Partial</th>
</tr>
</thead>
</table>

Attribute-based access control (ABAC) is an authorization strategy that defines permissions based on attributes. In AWS, these attributes are called tags. You can attach tags to IAM entities (users or roles) and to many AWS resources. Tagging entities and resources is the first step of ABAC. Then you design ABAC policies to allow operations when the principal's tag matches the tag on the resource that they are trying to access.

ABAC is helpful in environments that are growing rapidly and helps with situations where policy management becomes cumbersome.

To control access based on tags, you provide tag information in the condition element of a policy using the aws:ResourceTag/key-name, aws:RequestTag/key-name, or aws:TagKeys condition keys.

If a service supports all three condition keys for every resource type, then the value is Yes for the service. If a service supports all three condition keys for only some resource types, then the value is Partial.

For more information about ABAC, see What is ABAC? in the IAM User Guide. To view a tutorial with steps for setting up ABAC, see Use attribute-based access control (ABAC) in the IAM User Guide.

ABAC is possible for resources that support tags, but not everything supports tags. Launch configurations and scaling policies don't support tags, but Auto Scaling groups support tags.

For more information, see Tag Auto Scaling groups and instances (p. 129).

Using temporary credentials with Amazon EC2 Auto Scaling

<table>
<thead>
<tr>
<th>Supports temporary credentials</th>
<th>Yes</th>
</tr>
</thead>
</table>

Some AWS services don't work when you sign in using temporary credentials. For additional information, including which AWS services work with temporary credentials, see AWS services that work with IAM in the IAM User Guide.

You are using temporary credentials if you sign in to the AWS Management Console using any method except a user name and password. For example, when you access AWS using your company's single sign-on (SSO) link, that process automatically creates temporary credentials. You also automatically
create temporary credentials when you sign in to the console as a user and then switch roles. For more information about switching roles, see Switching to a role (console) in the IAM User Guide.

You can manually create temporary credentials using the AWS CLI or AWS API. You can then use those temporary credentials to access AWS. AWS recommends that you dynamically generate temporary credentials instead of using long-term access keys. For more information, see Temporary security credentials in IAM.

**Service roles for Amazon EC2 Auto Scaling**

<table>
<thead>
<tr>
<th>Supports service roles</th>
<th>Yes</th>
</tr>
</thead>
</table>

A service role is an IAM role that a service assumes to perform actions on your behalf. An IAM administrator can create, modify, and delete a service role from within IAM. For more information, see Creating a role to delegate permissions to an AWS service in the IAM User Guide.

When you create a lifecycle hook that notifies an Amazon SNS topic or Amazon SQS queue, you must specify a role to allow Amazon EC2 Auto Scaling to access Amazon SNS or Amazon SQS on your behalf. Use the IAM console to set up the service role for your lifecycle hook. The console helps you create a role with a sufficient set of permissions using a managed policy. For more information, see Receive notifications using Amazon SNS and Receive notifications using Amazon SQS.

When you create an Auto Scaling group, you can optionally pass in a service role to allow Amazon EC2 instances to access other AWS services on your behalf. The service role for Amazon EC2 instances (also called the Amazon EC2 instance profile for a launch template or launch configuration) is a special type of service role that is assigned to every EC2 instance in an Auto Scaling group when the instance launches. You can use the IAM console and AWS CLI to create or edit this service role. For more information, see IAM role for applications that run on Amazon EC2 instances.

**Warning**
Changing the permissions for a service role might break Amazon EC2 Auto Scaling functionality. Edit service roles only when Amazon EC2 Auto Scaling provides guidance to do so.

**Service-linked roles for Amazon EC2 Auto Scaling**

<table>
<thead>
<tr>
<th>Supports service-linked roles</th>
<th>Yes</th>
</tr>
</thead>
</table>

A service-linked role is a type of service role that is linked to an AWS service. The service can assume the role to perform an action on your behalf. Service-linked roles appear in your AWS account and are owned by the service. An IAM administrator can view, but not edit the permissions for service-linked roles.

For details about creating or managing Amazon EC2 Auto Scaling service-linked roles, see Service-linked roles for Amazon EC2 Auto Scaling.

**Amazon EC2 Auto Scaling API permissions**

You must grant users permission to call the Amazon EC2 Auto Scaling API actions they need, as described in Policy actions for Amazon EC2 Auto Scaling. In addition, for some Amazon EC2 Auto Scaling actions, you must grant users permission to call specific actions from other AWS APIs.

**Required permissions from other AWS APIs**

In addition to Amazon EC2 Auto Scaling API permissions, users must have the following permissions from other AWS APIs to successfully perform the associated action.
Create an Auto Scaling group (autoscaling:CreateAutoScalingGroup)

- **iam:CreateServiceLinkedRole** — To create the default service-linked role if that role does not yet exist.
- **iam:PassRole** — To pass an IAM role to the service or to EC2 instances on launch. Needed when a nondefault service-linked role, an IAM role for a lifecycle hook, or a launch template that specifies an instance profile (a container for an IAM role) is provided.
- **ec2:RunInstance** — To launch instances when a launch template is provided.
- **ec2:CreateTags** — To tag instances and volumes on launch when a launch template with a tag specification is provided.

Create a lifecycle hook (autoscaling:PutLifecycleHook)

- **iam:PassRole** — To pass an IAM role to the service. Needed when an IAM role is provided.

Attach a VPC Lattice target group (autoscaling:AttachTrafficSources)

- **vpc-lattice:RegisterTargets** — To automatically register instances with the target group.

Detach a VPC Lattice target group (autoscaling:DetachTrafficSources)

- **vpc-lattice:DeregisterTargets** — To automatically deregister instances with the target group.

Create a launch configuration (autoscaling:CreateLaunchConfiguration)

- **ec2:DescribeImages**
- **ec2:DescribeInstances**
- **ec2:DescribeInstanceAttribute**
- **ec2:DescribeKeyPairs**
- **ec2:DescribeSecurityGroups**
- **ec2:DescribeSpotInstanceRequests**
- **ec2:DescribeVpcClassicLink**
- **iam:PassRole** — To pass an IAM role to EC2 instances on launch. Needed when a launch configuration specifies an instance profile (a container for an IAM role).

**AWS managed policies for Amazon EC2 Auto Scaling**

An AWS managed policy is a standalone policy that is created and administered by AWS. AWS managed policies are designed to provide permissions for many common use cases so that you can start assigning permissions to users, groups, and roles.

Keep in mind that AWS managed policies might not grant least-privilege permissions for your specific use cases because they're available for all AWS customers to use. We recommend that you reduce permissions further by defining customer managed policies that are specific to your use cases.

You cannot change the permissions defined in AWS managed policies. If AWS updates the permissions defined in an AWS managed policy, the update affects all principal identities (users, groups, and roles) that the policy is attached to. AWS is most likely to update an AWS managed policy when a new AWS service is launched or new API operations become available for existing services.

For more information, see AWS managed policies in the IAM User Guide.

**Amazon EC2 Auto Scaling managed policies**

You can attach the following managed policies to your AWS Identity and Access Management (IAM) identities (users or roles). Each policy provides access to all or some of the API actions for Amazon EC2 Auto Scaling.
• **AutoScalingFullAccess** — Grants full access to Amazon EC2 Auto Scaling for IAM identities that need full Amazon EC2 Auto Scaling access from the AWS CLI or SDKs, but not AWS Management Console access.

• **AutoScalingReadOnlyAccess** — Grants read-only access to Amazon EC2 Auto Scaling for IAM identities that are making calls only to the AWS CLI or SDKs.

• **AutoScalingConsoleFullAccess** — Grants full access to Amazon EC2 Auto Scaling using the AWS Management Console. This policy works when you are using launch configurations, but not when you are using launch templates.

• **AutoScalingConsoleReadOnlyAccess** — Grants read-only access to Amazon EC2 Auto Scaling using the AWS Management Console. This policy works when you are using launch configurations, but not when you are using launch templates.

When you are using launch templates from the console, you need to grant additional permissions specific to launch templates, which are discussed in [Launch template support](p. 412). The Amazon EC2 Auto Scaling console needs permissions for ec2 actions so it can display information about launch templates and launch instances using launch templates.

**AutoScalingServiceRolePolicy AWS managed policy**

You can't attach [AutoScalingServiceRolePolicy](#) to your IAM identities. This policy is attached to a service-linked role that allows Amazon EC2 Auto Scaling to launch and terminate instances. For more information, see [Service-linked roles for Amazon EC2 Auto Scaling](p. 401).

**Amazon EC2 Auto Scaling updates to AWS managed policies**

View details about updates to AWS managed policies for Amazon EC2 Auto Scaling since this service began tracking these changes. For automatic alerts about changes to this page, subscribe to the RSS feed on the Amazon EC2 Auto Scaling Document history page.

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
</table>
| Amazon EC2 Auto Scaling adds permissions to its service-linked role | The AutoScalingServiceRolePolicy policy now grants permissions to the service to access the API actions it needs for an integration with VPC Lattice.  
  - GetTargetGroup and ListTargetGroup actions. Required to retrieve information about VPC Lattice target groups.  
  - RegisterTargets and DeregisterTargets actions. Required to register and deregister instances from VPC Lattice target groups.  
  - ListTargets. Allows Amazon EC2 Auto Scaling to retrieve health information for instances registered to VPC Lattice target groups. | December 6, 2022 |
Service-linked roles for Amazon EC2 Auto Scaling

Amazon EC2 Auto Scaling uses service-linked roles for the permissions that it requires to call other AWS services on your behalf. A service-linked role is a unique type of IAM role that is linked directly to an AWS service.

Service-linked roles provide a secure way to delegate permissions to other AWS services because only the linked service can assume a service-linked role. For more information, see Using service-linked roles in the IAM User Guide. Service-linked roles also enable all API calls to be visible through AWS CloudTrail. This helps with monitoring and auditing requirements because you can track all actions that Amazon EC2 Auto Scaling performs on your behalf. For more information, see Log Amazon EC2 Auto Scaling API calls with AWS CloudTrail (p. 314).

The following sections describe how to create and manage Amazon EC2 Auto Scaling service-linked roles. Start by configuring permissions to allow an IAM identity (such as a user or role) to create, edit, or delete a service-linked role. For more information, see Using service-linked roles in the IAM User Guide.

Contents

- **Overview** (p. 402)
- Permissions granted by the service-linked role (p. 402)
- Create a service-linked role (automatic) (p. 405)
- Create a service-linked role (manual) (p. 405)
- Edit the service-linked role (p. 406)
Overview

There are two types of Amazon EC2 Auto Scaling service-linked roles:

- The default service-linked role for your account, named `AWSServiceRoleForAutoScaling`. This role is automatically assigned to your Auto Scaling groups unless you specify a different service-linked role.
- A service-linked role with a custom suffix that you specify when you create the role, for example, `AWSServiceRoleForAutoScaling_mysuffix`.

The permissions of a custom suffix service-linked role are identical to those of the default service-linked role. In both cases, you cannot edit the roles, and you also cannot delete them if they are still in use by an Auto Scaling group. The only difference is the role name suffix.

You can specify either role when you edit your AWS Key Management Service key policies to allow instances that are launched by Amazon EC2 Auto Scaling to be encrypted with your customer managed key. However, if you plan to give granular access to a specific customer managed key, you should use a custom suffix service-linked role. Using a custom suffix service-linked role provides you with:

- More control over the customer managed key
- The ability to track which Auto Scaling group made an API call in your CloudTrail logs

If you create customer managed keys that not all users should have access to, follow these steps to allow the use of a custom suffix service-linked role:

1. Create a service-linked role with a custom suffix. For more information, see Create a service-linked role (manual).
2. Give the service-linked role access to a customer managed key. For more information about the key policy that allows the key to be used by a service-linked role, see Required AWS KMS key policy for use with encrypted volumes.
3. Give users access to the service-linked role that you created. For more information about creating the IAM policy, see Control which service-linked role can be passed (using PassRole). If users try to specify a service-linked role without permission to pass that role to the service, they receive an error.

Permissions granted by the service-linked role

Amazon EC2 Auto Scaling uses the service-linked role named `AWSServiceRoleForAutoScaling` or your custom suffix service-linked role.

The service-linked role trusts the following service to assume the role:

- `autoscaling.amazonaws.com`

The role uses the `AutoScalingServiceRolePolicy` policy, which includes the following permissions:

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
```
"Sid":"EC2InstanceManagement",
"Effect":"Allow",
"Action":[
  "ec2:AttachClassicLinkVpc",
  "ec2:CancelSpotInstanceRequests",
  "ec2:CreateFleet",
  "ec2:CreateTags",
  "ec2:DeleteTags",
  "ec2:Describe",
  "ec2:DetachClassicLinkVpc",
  "ec2:ModifyInstanceAttribute",
  "ec2:RequestSpotInstances",
  "ec2:RunInstances",
  "ec2:StartInstances",
  "ec2:StopInstances",
  "ec2:TerminateInstances"
],
"Resource":"*
],
{
  "Sid":"EC2InstanceProfileManagement",
  "Effect":"Allow",
  "Action":[
    "iam:PassRole"
  ],
  "Resource":"*
},

  "Condition":{
      "StringLike":{
        "iam:PassedToService":"ec2.amazonaws.com*"
      }
  }
},
{
  "Sid":"EC2SpotManagement",
  "Effect":"Allow",
  "Action":[
    "iam:CreateServiceLinkedRole"
  ],
  "Resource":"*
},

  "Condition":{
      "StringEquals":{
        "iam:AWSServiceName":"spot.amazonaws.com"
      }
  }
},
{
  "Sid":"ELBManagement",
  "Effect":"Allow",
  "Action":[
    "elasticloadbalancing:Register*",
    "elasticloadbalancing:Deregister*",
    "elasticloadbalancing:Describe*"
  ],
  "Resource":"*
},
{
  "Sid":"CWManagement",
  "Effect":"Allow",
  "Action":[
    "cloudwatch:DeleteAlarms",
    "cloudwatch:DescribeAlarms",
    "cloudwatch:GetMetricData",
    "cloudwatch:PutMetricAlarm"
  ],
  "Resource":"*
}
{  
  "Sid":"SNSManagement",
  "Effect":"Allow",
  "Action":[
    "sns:Publish"
  ],
  "Resource":"*"
},
{  
  "Sid":"EventBridgeRuleManagement",
  "Effect":"Allow",
  "Action":[
    "events:PutRule",
    "events:PutTargets",
    "events:RemoveTargets",
    "events:DeleteRule",
    "events:DescribeRule"
  ],
  "Resource":"*",
  "Condition":{  
    "StringEquals":{
      "events:ManagedBy":"autoscaling.amazonaws.com"
    }
  }
},
{  
  "Sid":"SystemsManagerParameterManagement",
  "Effect":"Allow",
  "Action":[
    "ssm:GetParameters"
  ],
  "Resource": "*"
},
{  
  "Sid":"VpcLatticeManagement",
  "Effect":"Allow",
  "Action":[
    "vpc-lattice:DeregisterTargets",
    "vpc-lattice:GetTargetGroup",
    "vpc-lattice:ListTargets",
    "vpc-lattice:ListTargetGroups",
    "vpc-lattice:RegisterTargets"
  ],
  "Resource": "*"
}

The role has permissions to do all of the following:

- ec2 — Create, describe, modify, start/stop, and terminate EC2 instances.
- iam — Pass IAM roles (p. 417) to EC2 instances so that applications running on the instances can access temporary credentials for the role.
- iam — Create the AWSServiceRoleForEC2Spot service-linked role to allow Amazon EC2 Auto Scaling to launch Spot Instances on your behalf.
- elasticloadbalancing — Register and deregister instances with Elastic Load Balancing and check the health of registered targets.
- cloudwatch — Create, describe, modify, and delete CloudWatch alarms for scaling policies and retrieve metrics used for predictive scaling.
- sns — Publish notifications to Amazon SNS when instances launch or terminate.
- events — Create, describe, update, and delete EventBridge rules on your behalf.
• **ssm** — Read parameters from Parameter Store when using a Systems Manager parameter as an alias for an AMI ID in a launch template.

• **vpc-lattice** — Register and deregister instances with VPC Lattice and check the health of registered targets.

### Create a service-linked role (automatic)

Amazon EC2 Auto Scaling creates the `AWSServiceRoleForAutoScaling` service-linked role for you the first time that you create an Auto Scaling group, unless you manually create a custom suffix service-linked role and specify it when creating the group.

**Important**

You must have IAM permissions to create the service-linked role. Otherwise, the automatic creation fails. For more information, see [Service-linked role permissions](#) in the *IAM User Guide* and [Create a service-linked role (p. 410)](#) in this guide.

Amazon EC2 Auto Scaling began supporting service-linked roles in March 2018. If you created an Auto Scaling group before then, Amazon EC2 Auto Scaling created the `AWSServiceRoleForAutoScaling` role in your account. For more information, see [A new role appeared in my AWS account](#) in the *IAM User Guide*.

### Create a service-linked role (manual)

**To create a service-linked role (console)**

2. In the navigation pane, choose **Roles, Create role**.
3. For **Select trusted entity**, choose **AWS service**.
4. For **Choose the service that will use this role**, choose **EC2 Auto Scaling** and the **EC2 Auto Scaling** use case.
5. Choose **Next: Permissions, Next: Tags**, and then **Next: Review**. Note: You cannot attach tags to service-linked roles during creation.
6. On the **Review** page, leave **Role name** blank to create a service-linked role with the name `AWSServiceRoleForAutoScaling`, or enter a suffix to create a service-linked role with the name `AWSServiceRoleForAutoScaling_suffix`.
7. (Optional) For **Role description**, edit the description for the service-linked role.
8. Choose **Create role**.

**To create a service-linked role (AWS CLI)**

Use the following `create-service-linked-role` CLI command to create a service-linked role for Amazon EC2 Auto Scaling with the name `AWSServiceRoleForAutoScaling_suffix`.

```bash
aws iam create-service-linked-role --aws-service-name autoscaling.amazonaws.com --custom-suffix suffix
```

The output of this command includes the ARN of the service-linked role, which you can use to give the service-linked role access to your customer managed key.

```json
{
  "Role": {
    "RoleId": "ABCDEF0123456789ABCDEF",
    "CreateDate": "2018-08-30T21:59:18Z",
    "RoleName": "AWSServiceRoleForAutoScaling_suffix",
    "Arn": "arn:aws:iam::123456789012:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling_suffix",
```

405
Identity-based policy examples

```
"Path": "/aws-service-role/autoscaling.amazonaws.com/",
"AssumeRolePolicyDocument": {
   "Version": "2012-10-17",
   "Statement": [
      {
         "Action": [
            "sts:AssumeRole"
         ],
         "Principal": {
            "Service": [
               "autoscaling.amazonaws.com"
            ],
            "Effect": "Allow"
         }
      }
   ]
}
```

For more information, see Creating a service-linked role in the IAM User Guide.

Edit the service-linked role

You cannot edit the service-linked roles that are created for Amazon EC2 Auto Scaling. After you create a service-linked role, you cannot change the name of the role or its permissions. However, you can edit the description of the role. For more information, see Editing a service-linked role in the IAM User Guide.

Delete the service-linked role

If you are not using an Auto Scaling group, we recommend that you delete its service-linked role. Deleting the role prevents you from having an entity that is not used or actively monitored and maintained.

You can delete a service-linked role only after first deleting the related dependent resources. This protects you from inadvertently revoking Amazon EC2 Auto Scaling permissions to your resources. If a service-linked role is used with multiple Auto Scaling groups, you must delete all Auto Scaling groups that use the service-linked role before you can delete it. For more information, see Delete your Auto Scaling infrastructure (p. 137).

You can use IAM to delete a service-linked role. For more information, see Deleting a service-linked role in the IAM User Guide.

If you delete the AWSServiceRoleForAutoScaling service-linked role, Amazon EC2 Auto Scaling creates the role again when you create an Auto Scaling group and do not specify a different service-linked role.

Supported Regions for Amazon EC2 Auto Scaling service-linked roles

Amazon EC2 Auto Scaling supports using service-linked roles in all of the AWS Regions where the service is available.

Amazon EC2 Auto Scaling identity-based policy examples

By default, a brand new user in your AWS account has no permissions to do anything. An IAM administrator must create and assign IAM policies that give an IAM identity (such as a user or role) permission to perform Amazon EC2 Auto Scaling API actions.
Identity-based policy examples

To learn how to create an IAM policy using these example JSON policy documents, see Creating policies on the JSON tab in the IAM User Guide.

The following shows an example of a permissions policy.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "autoscaling:CreateAutoScalingGroup",
                "autoscaling:UpdateAutoScalingGroup",
                "autoscaling:DeleteAutoScalingGroup"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": { "autoscaling:ResourceTag/purpose": "test" }
            }
        },
        {
            "Effect": "Allow",
            "Action": "autoscaling:Describe*",
            "Resource": "*"
        }
    ]
}
```

This sample policy grants permissions to create, update, and delete Auto Scaling groups, but only if the group uses the tag `purpose=test`. Because Describe actions do not support resource-level permissions, you must specify them in a separate statement without conditions.

**Note**
You can create your own custom IAM policies to allow or deny permissions for IAM identities (users or roles) to perform Amazon EC2 Auto Scaling actions. You can attach these custom policies to the IAM identities that require the specified permissions. The following examples show permissions for some common use cases.

Some Amazon EC2 Auto Scaling API actions allow you to include specific Auto Scaling groups in your policy that can be created or modified by the action. You can restrict the target resources for these actions by specifying individual Auto Scaling group ARNs. As a best practice, however, we recommend that you use tag-based policies that allow (or deny) actions on Auto Scaling groups with a specific tag.

**Topics**

- Control the size of the Auto Scaling groups that can be created (p. 407)
- Control which tag keys and tag values can be used (p. 408)
- Control which Auto Scaling groups can be deleted (p. 409)
- Control which scaling policies can be deleted (p. 410)
- Create a service-linked role (p. 410)
- Control which service-linked role can be passed (using PassRole) (p. 410)

**Control the size of the Auto Scaling groups that can be created**

The following policy grants permissions to create and update all Auto Scaling groups with the tag `environment=development`, as long as the requester doesn't specify a minimum size less than 1 or a maximum size greater than 10.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "autoscaling:CreateAutoScalingGroup",
                "autoscaling:UpdateAutoScalingGroup"
            ],
            "Resource": "*",
            "Condition": {
                "NotStringEquals": { "autoscaling:ResourceTag/environment": "development" }
            }
        }
    ]
}
```
Identity-based policy examples

The following policy requires the requester to specify a tag with the key `environment` in the request. The "?*" value enforces that there is some value for the tag key. To use a wildcard, you must use the StringLike condition operator.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "autoscaling:CreateAutoScalingGroup",
        "autoscaling:CreateOrUpdateTags"
      ],
      "Resource": "*",
      "Condition": {
        "StringLike": { "aws:RequestTag/environment": "?*" }
      }
    }
  ]
}
```

The following policy specifies that the requester can only tag Auto Scaling groups with the tags `purpose=webserver` and `cost-center=cc123`, and allows only the `purpose` and `cost-center` tags (no other tags can be specified).

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "autoscaling:CreateAutoScalingGroup",
        "autoscaling:CreateOrUpdateTags"
      ],
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "aws:RequestTag/purpose": "webserver",
          "aws:RequestTag/cost-center": "cc123"
        },
        "ForAllValues: StringEquals": { "aws:TagKeys": ["purpose", "cost-center"] }
      }
    }
  ]
}
```
The following policy requires the requester to specify at least one tag in the request, and allows only the `cost-center` and `owner` keys.

```json
{
    "Version": "2012-10-17",
    "Statement": [{
        "Effect": "Allow",
        "Action": ["autoscaling:CreateAutoScalingGroup", "autoscaling:CreateOrUpdateTags"],
        "Resource": "*",
        "Condition": {
            "ForAnyValue:StringEquals": { "aws:TagKeys": ["cost-center", "owner"] }
        }
    }]
}
```

**Note**

For conditions, the condition key is not case-sensitive and the condition value is case-sensitive. Therefore, to enforce the case-sensitivity of a tag key, use the `aws:TagKeys` condition key, where the tag key is specified as a value in the condition.

**Control which Auto Scaling groups can be deleted**

If you are not using condition keys to control access to Auto Scaling groups, you can specify the ARNs of resources in the `Resource` element to control access instead.

The following policy gives users permissions to use the `DeleteAutoScalingGroup` API action, but only for only for Auto Scaling groups whose name begins with `devteam-`.

```json
{
    "Version": "2012-10-17",
    "Statement": [{
        "Effect": "Allow",
        "Action": "autoscaling:DeleteAutoScalingGroup",
    }]
}
```

You can also specify multiple ARNs by enclosing them in a list. Including the UUID ensures that access is granted to the specific Auto Scaling group. The UUID for a new group is different than the UUID for a deleted group with the same name.

```json
"Resource": [
]
```

For more information about specifying the ARNs of Amazon EC2 Auto Scaling resources in the `Resource` element, see [Policy resources for Amazon EC2 Auto Scaling](p. 394).
Control which scaling policies can be deleted

The following policy grants permissions to use the DeletePolicy action to delete a scaling policy. However, it also denies the action if the Auto Scaling group being acted upon has the tag environment=production.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "autoscaling:DeletePolicy",
            "Resource": "*"
        },
        {
            "Effect": "Deny",
            "Action": "autoscaling:DeletePolicy",
            "Resource": "*",
            "Condition": {
                "StringEquals": { "autoscaling:ResourceTag/environment": "production" }
            }
        }
    ]
}
```

Create a service-linked role

Amazon EC2 Auto Scaling requires permissions to create a service-linked role the first time that any user in your AWS account calls Amazon EC2 Auto Scaling API actions. If the service-linked role does not exist already, Amazon EC2 Auto Scaling creates it in your account. The service-linked role gives permissions to Amazon EC2 Auto Scaling so that it can call other AWS services on your behalf.

For automatic role creation to succeed, users must have permissions for the iam:CreateServiceLinkedRole action.

```
"Action": "iam:CreateServiceLinkedRole"
```

The following shows an example of a permissions policy that allows a user to create an Amazon EC2 Auto Scaling service-linked role for Amazon EC2 Auto Scaling.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "iam:CreateServiceLinkedRole",
            "Resource": "arn:aws:iam::*:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling",
            "Condition": {
                "StringLike": { "iam:AWSServiceName":"autoscaling.amazonaws.com" }
            }
        }]
}
```

Control which service-linked role can be passed (using PassRole)

Users who create or update Auto Scaling groups and specify a custom suffix service-linked role in the request require the iam:PassRole permission.

You can use the iam:PassRole permission to protect the security of your AWS KMS customer managed keys if you give different service-linked roles access to different keys. Depending on your organization's
needs, you might have a key for the development team, another for the QA team, and another for the finance team. First, create a service-linked role that has access to the required key, for example, a service-linked role named `AWSServiceRoleForAutoScaling_devteamkeyaccess`. Then, attach the policy to an IAM identity, such as a user or role.

The following policy grants permissions to pass the `AWSServiceRoleForAutoScaling_devteamkeyaccess` role to any Auto Scaling group whose name begins with `devteam-`. If the IAM identity that creates the Auto Scaling group tries to specify a different service-linked role, they receive an error. If they choose not to specify a service-linked role, the default `AWSServiceRoleForAutoScaling` role is used instead.

```
{
    "Version": "2012-10-17",
    "Statement": [{
        "Effect": "Allow",
        "Action": "iam:PassRole",
        "Resource": "arn:aws:iam::account-id:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling_devteamkeyaccess",
        "Condition": {
            "StringEquals": { "iam:PassedToService": [ "autoscaling.amazonaws.com" ] },
        }
    }]
}
```

For more information about custom suffix service-linked roles, see [Service-linked roles for Amazon EC2 Auto Scaling](p. 401).

**Cross-service confused deputy prevention**

The confused deputy problem is a security issue where an entity that doesn't have permission to perform an action can coerce a more-privileged entity to perform the action.

In AWS, cross-service impersonation can result in the confused deputy problem. Cross-service impersonation can occur when one service (the calling service) calls another service (the called service). The calling service can be manipulated to use its permissions to act on another customer's resources in a way it should not otherwise have permission to access.

To prevent this, AWS provides tools that help you protect your data for all services with service principals that have been given access to resources in your account. We recommend using the `aws:SourceArn` and `aws:SourceAccount` global condition context keys in trust policies for Amazon EC2 Auto Scaling service roles. These keys limit the permissions that Amazon EC2 Auto Scaling gives another service to the resource.

The values for the `SourceArn` and `SourceAccount` fields are set when Amazon EC2 Auto Scaling uses AWS Security Token Service (AWS STS) to assume a role on your behalf.

To use the `aws:SourceArn` or `aws:SourceAccount` global condition keys, set the value to the Amazon Resource Name (ARN) or account of the resource that Amazon EC2 Auto Scaling stores. Whenever possible, use `aws:SourceArn`, which is more specific. Set the value to the ARN or an ARN pattern with wildcards (*) for the unknown portions of the ARN. If you don't know the ARN of the resource, use `aws:SourceAccount` instead.

The following example shows how you can use the `aws:SourceArn` and `aws:SourceAccount` global condition context keys in Amazon EC2 Auto Scaling to prevent the confused deputy problem.
Example: Using `aws:SourceArn` and `aws:SourceAccount` condition keys

A role that a service assumes to perform actions on your behalf is called a [service role (p. 398)](https://docs.aws.amazon.com/IAM/latest/UserGuide/id界face(adhvmt.html). In cases where you want to create lifecycle hooks that send notifications to anywhere other than Amazon EventBridge, you must create a service role to allow Amazon EC2 Auto Scaling to send notifications to an Amazon SNS topic or Amazon SQS queue on your behalf. If you want only one Auto Scaling group to be associated with the cross-service access, you can specify the trust policy of the service role as follows.

This example trust policy uses condition statements to limit the `AssumeRole` capability on the service role to only the actions that affect the specified Auto Scaling group in the specified account. The `aws:SourceArn` and `aws:SourceAccount` conditions are evaluated independently. Any request to use the service role must satisfy both conditions.

Before using this policy, replace the Region, account ID, UUID, and group name with valid values from your account.

```json
{
"Version": "2012-10-17",
"Statement": {
  "Sid": "ConfusedDeputyPreventionExamplePolicy",
  "Effect": "Allow",
  "Principal": {
    "Service": "autoscaling.amazonaws.com"
  },
  "Action": "sts:AssumeRole",
  "Condition": {
    "ArnLike": {
    },
    "StringEquals": {
      "aws:SourceAccount": "account_id"
    }
  }
}
```

In the preceding example:

- The `Principal` element specifies the service principal of the service (`autoscaling.amazonaws.com`).
- The `Action` element specifies the `sts:AssumeRole` action.
- The `Condition` element specifies the `aws:SourceArn` and `aws:SourceAccount` global condition keys. The source's ARN includes the account ID, so it is not necessary to use `aws:SourceAccount` with `aws:SourceArn`.

**Additional information**


**Launch template support**

Amazon EC2 Auto Scaling supports using Amazon EC2 launch templates with your Auto Scaling groups. We recommend that you allow users to create Auto Scaling groups from launch templates, because
doing so allows them to use the latest features of Amazon EC2 Auto Scaling and Amazon EC2. For example, users must specify a launch template to use a mixed instances policy.

You can use the AmazonEC2FullAccess policy to give users complete access to work with Amazon EC2 Auto Scaling resources, launch templates, and other EC2 resources in their account. Or, you can create your own custom IAM policies to give users fine-grained permissions to work with launch templates, as described in this topic.

A sample policy that you can tailor for your own use

The following shows an example of a basic permissions policy that you can tailor for your own use. The policy grants permissions to create, update, and delete all Auto Scaling groups, but only if the group uses the tag purpose=test. It then gives permission for all Describe actions. Because Describe actions do not support resource-level permissions, you must specify them in a separate statement without conditions.

IAM identities (users or roles) with this policy have permission to create or update an Auto Scaling group using a launch template because they're also given permission to use the ec2:RunInstances action.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "autoscaling:CreateAutoScalingGroup",
        "autoscaling:UpdateAutoScalingGroup",
        "autoscaling:DeleteAutoScalingGroup"
      ],
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "autoscaling:ResourceTag/purpose": "test"
        }
      }
    },
    {
      "Effect": "Allow",
      "Action": [
        "autoscaling:Describe*",
        "ec2:RunInstances"
      ],
      "Resource": "*"
    }
  ]
}
```

Users who create or update Auto Scaling groups might need some related permissions, such as:

- **ec2:CreateTags** — To add tags to the instances and volumes on creation, the user must have the ec2:CreateTags permission in an IAM policy. For more information, see Permissions required to tag instances and volumes (p. 416).
- **iam:PassRole** — To launch EC2 instances from a launch template that contains an instance profile (a container for an IAM role), the user must also have the iam:PassRole permission in an IAM policy. For more information and an example IAM policy, see IAM role for applications that run on Amazon EC2 instances (p. 417).
- **ssm:GetParameters** — To launch EC2 instances from a launch template that uses an AWS Systems Manager parameter, the user must also have the ssm:GetParameters permission in an IAM policy. For more information, see Using AWS Systems Manager parameters instead of AMI IDs in launch templates (p. 41).
These permissions for actions to be completed when launching instances are checked when the user interacts with an Auto Scaling group. For more information, see Permissions validation for ec2:RunInstances and iam:PassRole (p. 417).

The following examples show policy statements that you could use to control the access that IAM users have to using launch templates.

**Topics**

- Require launch templates that have a specific tag (p. 414)
- Require a launch template and a version number (p. 414)
- Require the use of instance metadata service version 2 (IMDSv2) (p. 415)
- Restrict access to Amazon EC2 resources (p. 415)
- Permissions required to tag instances and volumes (p. 416)
- Additional launch template permissions (p. 416)
- Permissions validation for ec2:RunInstances and iam:PassRole (p. 417)

## Require launch templates that have a specific tag

You can use IAM permissions to control access to the ec2:RunInstances action. When granting ec2:RunInstances permissions, you can specify that users can only use launch templates with specific tags or specific IDs.

The following example restricts permissions for the ec2:RunInstances action to launch templates that are located in the specified Region and that have the tag purpose=test.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "ec2:RunInstances",
            "Condition": {
                "StringEquals": { "aws:ResourceTag/purpose": "test" }
            }
        }
    ]
}
```

For more information about using tag-based policies with launch templates, see Control access to launch templates with IAM permissions in the Amazon EC2 User Guide for Linux Instances.

## Require a launch template and a version number

You can also use IAM permissions to enforce that a launch template and the version number of the launch template must be specified when creating or updating Auto Scaling groups.

The following example allows users to create and update Auto Scaling groups if they specify the version number of the launch template, and then denies permission to create or update any Auto Scaling groups using a launch configuration. If users with this policy omit the version number to specify either the $Latest or $Default launch template version, or specify a launch configuration instead, the action fails.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "ec2:RunInstances",
            "Condition": {
                "StringEquals": { "aws:ResourceTag/purpose": "test" }
            }
        }
    ]
}
```
Launch template support

```
{
  "Effect": "Allow",
  "Action": [
    "autoscaling:CreateAutoScalingGroup",
    "autoscaling:UpdateAutoScalingGroup"
  ],
  "Resource": "*",
  "Condition": {
    "Bool": { "autoscaling:LaunchTemplateVersionSpecified": "true" }
  }
},
{
  "Effect": "Deny",
  "Action": [
    "autoscaling:CreateAutoScalingGroup",
    "autoscaling:UpdateAutoScalingGroup"
  ],
  "Resource": "*",
  "Condition": {
    "Null": { "autoscaling:LaunchConfigurationName": "false" }
  }
}
```

Require the use of instance metadata service version 2 (IMDSv2)

For extra security, you can set your users' permissions to require the use of a launch template that requires IMDSv2. For more information, see Configuring the instance metadata service in the Amazon EC2 User Guide for Linux Instances.

The following example specifies that users can’t call the `ec2:RunInstances` action unless the instance is also opted in to require the use of IMDSv2 (indicated by "ec2:MetadataHttpTokens":"required").

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "RequireImdsV2",
      "Effect": "Deny",
      "Action": "ec2:RunInstances",
      "Resource": "arn:aws:ec2::*::*:instance/*",
      "Condition": {
        "StringNotEquals": { "ec2:MetadataHttpTokens": "required" }
      }
    }
  ]
}
```

Tip

To force replacement Auto Scaling instances to launch that use a new launch template or a new version of a launch template with the instance metadata options configured, you can start an instance refresh. For more information, see Update Auto Scaling instances (p. 100).

Restrict access to Amazon EC2 resources

The following example controls the configuration of the instances that a user can launch by restricting access to Amazon EC2 resources.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "RequireImdsV2",
      "Effect": "Deny",
      "Action": "ec2:RunInstances",
      "Resource": "arn:aws:ec2::*::*:instance/*",
      "Condition": {
        "StringNotEquals": { "ec2:MetadataHttpTokens": "required" }
      }
    }
  ]
}
```
Launch template support

"Version": "2012-10-17",
"Statement": [
  {
    "Effect": "Allow",
    "Action": "ec2:RunInstances",
    "Resource": [
      "arn:aws:ec2:region:account-id:subnet/subnet-1a2b3c4d",
      "arn:aws:ec2:region:account-id:volume/**",
      "arn:aws:ec2:region:::image/ami-04d5cc9b88example"
    ]
  },
  {
    "Effect": "Allow",
    "Action": "ec2:RunInstances",
    "Condition": {
      "StringEquals": { "ec2:InstanceType": "t2.micro" }
    }
  }
]
}

In this example, there are two statements:

- The first statement requires that users launch instances into a specific subnet (subnet-1a2b3c4d), using a specific security group (sg-903004f88example), and using a specific AMI (ami-04d5cc9b88example). It also gives users access to additional resources that they need to launch instances: network interfaces and volumes.
- The second statement allows users to launch instances only of a specific instance type (t2.micro).

Permissions required to tag instances and volumes

The following example allows users to tag instances and volumes on creation. This policy is needed if there are tags specified in the launch template. For more information, see Grant permission to tag resources during creation in the Amazon EC2 User Guide for Linux Instances.

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "ec2:CreateTags",
      "Resource": "arn:aws:ec2:region:account-id:/**",
      "Condition": {
        "StringEquals": { "ec2:CreateAction": "RunInstances" }
      }
    }
  ]
}

Additional launch template permissions

Depending on which scenarios you want to support, you can specify these additional actions in the Action element of an IAM policy statement.

You must give your console users permissions for the ec2:DescribeLaunchTemplates and ec2:DescribeLaunchTemplateVersions actions. Without these permissions, launch template
data cannot load in the Auto Scaling group wizard, and users cannot step through the wizard to launch instances using a launch template.

You must also decide who should have permissions to create and delete launch templates and launch template versions. For more information, see Control access to launch templates with IAM permissions in the Amazon EC2 User Guide for Linux Instances.

**Permissions validation for ec2:RunInstances and iam:PassRole**

Users can specify which version of a launch template their Auto Scaling group uses. Depending on their permissions, this can be a specific numbered version, or the $Latest or $Default version of the launch template. If it's the latter, take special care. This may override permissions for ec2:RunInstances and iam:PassRole that you intended to restrict.

This section explains the scenario of using the latest or default version of the launch template with an Auto Scaling group.

When a user calls the CreateAutoScalingGroup, UpdateAutoScalingGroup, or StartInstanceRefresh APIs, Amazon EC2 Auto Scaling checks their permissions against the version of the launch template that is the latest or default version at that time before proceeding with the request. This validates permissions for actions to be completed when launching instances, such as the ec2:RunInstances and iam:PassRole actions. To accomplish this, we issue an Amazon EC2 RunInstances dry run call to validate whether the user has the required permissions for the action, without actually making the request. When a response is returned, it is read by Amazon EC2 Auto Scaling. If the user's permissions do not allow a given action, Amazon EC2 Auto Scaling fails the request and returns an error to the user containing information about the missing permission.

After the initial verification and request are complete, whenever instances launch, Amazon EC2 Auto Scaling launches them with the latest or default version, even if it has changed, using the permissions of its service-linked role (p. 402). This means that a user who is using the launch template could potentially update it to pass an IAM role to an instance even if they don't have the iam:PassRole permission.

Use the autoscaling:LaunchTemplateVersionSpecified condition key if you want to limit who has access to configuring groups to use the $Latest or $Default version. This ensures that the Auto Scaling group only accepts a specific numbered version when a user calls the CreateAutoScalingGroup and UpdateAutoScalingGroup APIs. For an example that shows how to add this condition key to an IAM policy, see Require a launch template and a version number (p. 414).

For Auto Scaling groups that are configured to use the $Latest or $Default launch template version, consider limiting who can create and manage versions of the launch template, including the ec2:ModifyLaunchTemplate action that allows a user to specify the default launch template version. For more information, see Control access to launch templates with IAM permissions in the Amazon EC2 User Guide for Linux Instances.

**IAM role for applications that run on Amazon EC2 instances**

Applications that run on Amazon EC2 instances need credentials to access other AWS services. To provide these credentials in a secure way, use an IAM role. The role supplies temporary permissions that the application can use when it accesses other AWS resources. The role's permissions determine what the application is allowed to do.

For instances in an Auto Scaling group, you must create a launch template or launch configuration and choose an instance profile to associate with the instances. An instance profile is a container for an IAM
role that allows Amazon EC2 to pass the IAM role to an instance when the instance is launched. First, create an IAM role that has all of the permissions required to access the AWS resources. Then, create the instance profile and assign the role to it.

**Note**
As a best practice, we strongly recommend that you create the role so that it has the minimum permissions to other AWS services that your application requires.

**Contents**
- Prerequisites (p. 418)
- Create a launch template (p. 419)
- See also (p. 419)

**Prerequisites**
Create the IAM role that your application running on Amazon EC2 can assume. Choose the appropriate permissions so that the application that is subsequently given the role can make the specific API calls that it needs.

If you use the IAM console instead of the AWS CLI or one of the AWS SDKs, the console creates an instance profile automatically and gives it the same name as the role to which it corresponds.

**To create an IAM role (console)**
2. In the navigation pane on the left, choose Roles.
3. Choose Create role.
4. For Select trusted entity, choose AWS service.
5. For your use case, choose EC2 and then choose Next.
6. If possible, select the policy to use for the permissions policy or choose Create policy to open a new browser tab and create a new policy from scratch. For more information, see Creating IAM policies in the IAM User Guide. After you create the policy, close that tab and return to your original tab. Select the check box next to the permissions policies that you want the service to have.
7. (Optional) Set a permissions boundary. This is an advanced feature that is available for service roles. For more information, see Permissions boundaries for IAM entities in the IAM User Guide.
8. Choose Next.
9. On the Name, review, and create page, for Role name, enter a role name to help you identify the purpose of this role. This name must be unique within your AWS account. Because other AWS resources might reference the role, you can't edit the name of the role after it has been created.
10. Review the role, and then choose Create role.

**IAM permissions**
Use an IAM identity-based policy to control access to your new IAM role. The iam:PassRole permission is needed on the IAM identity (user or role) that creates or updates an Auto Scaling group using a launch template that specifies an instance profile.

The following example policy grants permissions to pass only IAM roles whose name begins with qateam-.

```json
{
    "Version": "2012-10-17",
    "Statement": [
```
{  
  "Effect": "Allow",
  "Action": "iam:PassRole",
  "Resource": "arn:aws:iam::account-id:role/qateam-*",
  "Condition": {
    "StringEquals": {
      "iam:PassedToService": [
        "ec2.amazonaws.com",
        "ec2.amazonaws.com.cn"
      ]
    }
  }
}

**Important**

For information about how Amazon EC2 Auto Scaling validates permissions for the `iam:PassRole` action for an Auto Scaling group that uses a launch template, see [Permissions validation for `ec2:RunInstances` and `iam:PassRole`](p. 417).

### Create a launch template

When you create the launch template using the AWS Management Console, in the [Advanced details](p. 27) section, select the role from [IAM instance profile](p. 27). For more information, see [Configure advanced settings for your launch template](p. 27).

When you create the launch template using the `create-launch-template` command from the AWS CLI, specify the instance profile name of your IAM role as shown in the following example.

```bash
aws ec2 create-launch-template --launch-template-name my-lt-with-instance-profile --version-description version1 --launch-template-data '{"ImageId": "ami-04d5cc9b8example", "InstanceType": "t2.micro", "IamInstanceProfile": {"Name": "my-instance-profile"}}'
```

### See also

For more information to help you start learning about and using IAM roles for Amazon EC2, see:

- [IAM roles for Amazon EC2](p. 401) in the Amazon EC2 User Guide for Linux Instances
- [Using instance profiles](p. 401) and [Using an IAM role to grant permissions to applications running on Amazon EC2 instances](p. 401) in the IAM User Guide

### Required AWS KMS key policy for use with encrypted volumes

Amazon EC2 Auto Scaling uses [service-linked roles](p. 401) to delegate permissions to other AWS services. Amazon EC2 Auto Scaling service-linked roles are predefined and include permissions that Amazon EC2 Auto Scaling requires to call other AWS services on your behalf. The predefined permissions also include access to your AWS managed keys. However, they do not include access to your customer managed keys, allowing you to maintain full control over these keys.

This topic describes how to set up the key policy that you need to launch Auto Scaling instances when you specify a customer managed key for Amazon EBS encryption.
Amazon EC2 Auto Scaling does not need additional authorization to use the default AWS managed key to protect the encrypted volumes in your account.

Contents
- **Overview** (p. 420)
- **Configure key policies** (p. 420)
- **Example 1: Key policy sections that allow access to the customer managed key** (p. 421)
- **Example 2: Key policy sections that allow cross-account access to the customer managed key** (p. 422)
- **Edit key policies in the AWS KMS console** (p. 423)

**Overview**

The following AWS KMS keys can be used for Amazon EBS encryption when Amazon EC2 Auto Scaling launches instances:

- **AWS managed key** — An encryption key in your account that Amazon EBS creates, owns, and manages. This is the default encryption key for a new account. The AWS managed key is used for encryption unless you specify a customer managed key.
- **Customer managed key** — A custom encryption key that you create, own, and manage. For more information, see [Creating keys](#) in the *AWS Key Management Service Developer Guide*.

Note: The key must be symmetric. Amazon EBS does not support asymmetric customer managed keys.

You configure customer managed keys when creating encrypted snapshots or a launch template that specifies encrypted volumes, or enabling encryption by default.

**Configure key policies**

Your KMS keys must have a key policy that allows Amazon EC2 Auto Scaling to launch instances with Amazon EBS volumes encrypted with a customer managed key.

Use the examples on this page to configure a key policy to give Amazon EC2 Auto Scaling access to your customer managed key. You can modify the customer managed key's key policy either when the key is created or at a later time.

You must, at minimum, add two policy statements to your key policy for it to work with Amazon EC2 Auto Scaling.

- The first statement allows the IAM identity specified in the `Principal` element to use the customer managed key directly. It includes permissions to perform the AWS KMS `Encrypt`, `Decrypt`, `ReEncrypt*`, `GenerateDataKey*`, and `DescribeKey` operations on the key.
- The second statement allows the IAM identity specified in the `Principal` element to use grants to delegate a subset of its own permissions to AWS services that are integrated with AWS KMS or another principal. This allows them to use the key to create encrypted resources on your behalf.

When you add the new policy statements to your key policy, do not change any existing statements in the policy.

For each of the following examples, arguments that must be replaced, such as a key ID or the name of a service-linked role, are shown as *replaceable text in italics*. In most cases, you can replace the name of the service-linked role with the name of an Amazon EC2 Auto Scaling service-linked role.
For more information, see the following resources:

- To create a key with the AWS CLI, see [create-key](#).
- To update a key policy with the AWS CLI, see [put-key-policy](#).
- To find a key ID and Amazon Resource Name (ARN), see [Finding the key ID and ARN](#) in the AWS Key Management Service Developer Guide.
- For information about Amazon EC2 Auto Scaling service-linked roles, see [Service-linked roles for Amazon EC2 Auto Scaling](#) (p. 401).
- For more information about Amazon EBS and KMS, [Amazon EBS Encryption](#) in the [Amazon EC2 User Guide for Linux Instances](#) and the AWS Key Management Service Developer Guide.

Example 1: Key policy sections that allow access to the customer managed key

Add the following two policy statements to the key policy of the customer managed key, replacing the example ARN with the ARN of the appropriate service-linked role that is allowed access to the key. In this example, the policy sections give the service-linked role named `AWSServiceRoleForAutoScaling` permissions to use the customer managed key.

```json
{
    "Sid": "Allow service-linked role use of the customer managed key",
    "Effect": "Allow",
    "Principal": {
        "AWS": [
            "arn:aws:iam::account-id:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling"
        ]
    },
    "Action": [
        "kms:Encrypt",
        "kms:Decrypt",
        "kms:ReEncrypt*",
        "kms:GenerateDataKey*",
        "kms:DescribeKey"
    ],
    "Resource": "*
}

{
    "Sid": "Allow attachment of persistent resources",
    "Effect": "Allow",
    "Principal": {
        "AWS": [
            "arn:aws:iam::account-id:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling"
        ]
    },
    "Action": [
        "kms:CreateGrant"
    ],
    "Resource": "*
    "Condition": {
        "Bool": {
            "kms:GrantIsForAWSResource": true
        }
    }
}
```
Example 2: Key policy sections that allow cross-account access to the customer managed key

If you create a customer managed key in a different account than the Auto Scaling group, you must use a grant in combination with the key policy to allow cross-account access to the key.

There are two steps that must be completed in the following order:

1. First, add the following two policy statements to the customer managed key's key policy. Replace the example ARN with the ARN of the other account, making sure to replace 111122223333 with the actual account ID of the AWS account that you want to create the Auto Scaling group in. This allows you to give an IAM user or role in the specified account permission to create a grant for the key using the CLI command that follows. However, this does not by itself give any users access to the key.

   ```json
   {
     "Sid": "Allow external account 111122223333 use of the customer managed key",
     "Effect": "Allow",
     "Principal": {
       "AWS": [
         "arn:aws:iam::111122223333:root"
       ],
     },
     "Action": [
       "kms:Encrypt",
       "kms:Decrypt",
       "kms:ReEncrypt*",
       "kms:GenerateDataKey*",
       "kms:DescribeKey"
     ],
     "Resource": "*"
   }
   {
     "Sid": "Allow attachment of persistent resources in external account 111122223333",
     "Effect": "Allow",
     "Principal": {
       "AWS": [
         "arn:aws:iam::111122223333:root"
       ],
     },
     "Action": [
       "kms:CreateGrant"
     ],
     "Resource": "*"
   }
   ```

2. Then, from the account that you want to create the Auto Scaling group in, create a grant that delegates the relevant permissions to the appropriate service-linked role. The Grantee Principal element of the grant is the ARN of the appropriate service-linked role. The key-id is the ARN of the key.

   The following is an example `create-grant` CLI command that gives the service-linked role named AWSServiceRoleForAutoScaling in account 111122223333 permissions to use the customer managed key in account 444455556666.

   ```bash
   aws kms create-grant \
   --region us-west-2 \
   --key-id arn:aws:kms:us-west-2:444455556666:key/1a2b3c4d-5e6f-1a2b-3c4d-5e6f1a2b3c4d \
   --grantee-principal arn:aws:iam::111122223333:role/aws-service-role/autoscaling.amazonaws.com/AWSServiceRoleForAutoScaling
   ```
For this command to succeed, the user making the request must have permissions for the 
CreateGrant action.

The following example IAM policy allows an IAM identity (user or role) in account 111122223333 to 
create a grant for the customer managed key in account 444455556666.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowCreation0fGrantForTheKMSKeyinExternalAccount444455556666",
      "Effect": "Allow",
      "Action": "kms:CreateGrant",
      "Resource": "arn:aws:kms:us-west-2:444455556666:key/1a2b3c4d-5e6f-1a2b-3c4d-5e6f1a2b3c4d"
    }
  ]
}
```

For more information about creating a grant for a KMS key in a different AWS account, see Grants in 
AWS KMS in the AWS Key Management Service Developer Guide.

**Important**
The service-linked role name specified as the grantee principal must be the name of an 
existing role. After creating the grant, to ensure that the grant allows Amazon EC2 Auto 
Scaling to use the specified KMS key, do not delete and recreate the service-linked role.

**Edit key policies in the AWS KMS console**

The examples in the previous sections show only how to add statements to a key policy, which is 
just one way of changing a key policy. The easiest way to change a key policy is to use the AWS KMS 
console's default view for key policies and make an IAM identity (user or role) one of the key users for the 
appropriate key policy. For more information, see Using the AWS Management Console default view in 
the AWS Key Management Service Developer Guide.

**Important**
Be cautious. The console's default view policy statements include permissions to perform AWS 
KMS Revoke operations on the customer managed key. If you give an AWS account access to a 
customer managed key in your account, and you accidentally revoke the grant that gave them 
this permission, external users can no longer access their encrypted data or the key that was 
used to encrypt their data.

**Compliance validation for Amazon EC2 Auto Scaling**

To learn whether an AWS service is within the scope of specific compliance programs, see AWS services in Scope by Compliance Program and choose the compliance program that you are interested in. For 
general information, see AWS Compliance Programs.

You can download third-party audit reports using AWS Artifact. For more information, see Downloading 
Reports in AWS Artifact.
Your compliance responsibility when using AWS services is determined by the sensitivity of your data, your company's compliance objectives, and applicable laws and regulations. AWS provides the following resources to help with compliance:

- **Security and Compliance Quick Start Guides** – These deployment guides discuss architectural considerations and provide steps for deploying baseline environments on AWS that are security and compliance focused.
- **Architecting for HIPAA Security and Compliance on Amazon Web Services** – This whitepaper describes how companies can use AWS to create HIPAA-eligible applications.

  **Note**
  
  Not all AWS services are HIPAA eligible. For more information, see the [HIPAA Eligible Services Reference](#).
- **AWS Compliance Resources** – This collection of workbooks and guides might apply to your industry and location.
- **Evaluating Resources with Rules** in the *AWS Config Developer Guide* – The AWS Config service assesses how well your resource configurations comply with internal practices, industry guidelines, and regulations.
- **AWS Security Hub** – This AWS service provides a comprehensive view of your security state within AWS. Security Hub uses security controls to evaluate your AWS resources and to check your compliance against security industry standards and best practices. For a list of supported services and controls, see [Security Hub controls reference](#).
- **AWS Audit Manager** – This AWS service helps you continuously audit your AWS usage to simplify how you manage risk and compliance with regulations and industry standards.

### PCI DSS compliance

Amazon EC2 Auto Scaling supports the processing, storage, and transmission of credit card data by a merchant or service provider, and has been validated as being compliant with Payment Card Industry (PCI) Data Security Standard (DSS). For more information about PCI DSS, including how to request a copy of the AWS PCI Compliance Package, see [PCI DSS Level 1](#).

For information on achieving PCI DSS compliance for your AWS workloads, refer to the following compliance guide:

- **Payment Card Industry Data Security Standard (PCI DSS) 3.2.1 on AWS**

### Resilience in Amazon EC2 Auto Scaling

The AWS global infrastructure is built around AWS Regions and Availability Zones. AWS Regions provide multiple physically separated and isolated Availability Zones, which are connected with low-latency, high-throughput, and highly redundant networking. With Availability Zones, you can design and operate applications and databases that automatically fail over between zones without interruption. Availability Zones are more highly available, fault tolerant, and scalable than traditional single or multiple data center infrastructures.

For more information about AWS Regions and Availability Zones, see [AWS Global Infrastructure](#).

To benefit from the geographic redundancy of the Availability Zone design, do the following:

- Span your Auto Scaling group across multiple Availability Zones.
- Maintain at least one instance in each Availability Zone.
- Attach a load balancer to distribute incoming traffic across the same Availability Zones. If you use an Application Load Balancer, make sure that each EC2 instance gets a similar amount of traffic by
keeping cross-zone load balancing enabled. This helps limit the impact of increased load on existing instances during a failover event and results in greater resiliency than without cross-zone load balancing.

- Make sure that the Elastic Load Balancing health checks are configured correctly, and also that they are enabled on the Auto Scaling group. Then, if an instance fails its health check, Elastic Load Balancing stops sending traffic to it and reroutes traffic to healthy instances, while Amazon EC2 Auto Scaling replaces the unhealthy instance.

Amazon EC2 Auto Scaling helps support your application resiliency needs in the following ways:

- Checks instances for health and reachability issues. When an instance becomes unhealthy, it automatically terminates the instance and launches a new one.
- If dynamic scaling policies are in effect, automatically scales capacity according to incoming traffic.
- Detects issues in the reliability of the Amazon CloudWatch metrics that support scaling policies and pauses scale-in activities when reliable metrics are not available, such as when data points are missing.
- Tries to maintain equivalent numbers of instances in each enabled Availability Zone as your group scales.
- Uses Availability Zones to maintain high availability. When an Availability Zone becomes unhealthy, Amazon EC2 Auto Scaling does the following:
  - Launches new instances in a different Availability Zone that is enabled for your Auto Scaling group.
  - Redistributions instances across all enabled Availability Zones when the unhealthy Availability Zone returns to a healthy state.
  - Keeps trying to launch instances in other enabled Availability Zones if an instance fails to launch in a given Availability Zone.
  - Automatically registers and deregisters instances with the load balancers associated with your Auto Scaling group. This way, you don’t need to register and deregister instances separately.

For information on features to help support your Amazon EC2 data resiliency and backup needs, see Resilience in Amazon EC2 in the Amazon EC2 User Guide for Linux Instances.

Infrastructure security in Amazon EC2 Auto Scaling

As a managed service, Amazon EC2 Auto Scaling is protected by AWS global network security. For information about AWS security services and how AWS protects infrastructure, see AWS Cloud Security. To design your AWS environment using the best practices for infrastructure security, see Infrastructure Protection in Security Pillar AWS Well-Architected Framework.

You use AWS published API calls to access Amazon EC2 Auto Scaling through the network. Clients must support the following:

- Transport Layer Security (TLS). We require TLS 1.2 and recommend TLS 1.3.
- Cipher suites with perfect forward secrecy (PFS) such as DHE (Ephemeral Diffie-Hellman) or ECDHE (Elliptic Curve Ephemeral Diffie-Hellman). Most modern systems such as Java 7 and later support these modes.

Additionally, requests must be signed by using an access key ID and a secret access key that is associated with an IAM principal. Or you can use the AWS Security Token Service (AWS STS) to generate temporary security credentials to sign requests.

You can also use a virtual private cloud (VPC) endpoint for Amazon EC2 Auto Scaling. Interface VPC endpoints enable your Amazon VPC resources to use their private IP addresses to access Amazon EC2...
Use VPC endpoints for private connectivity

Auto Scaling with no exposure to the public internet. For more information, see Amazon EC2 Auto Scaling and interface VPC endpoints (p. 426)

Related topics

• Infrastructure security in Amazon EC2 in the Amazon EC2 User Guide for Linux Instances

Amazon EC2 Auto Scaling and interface VPC endpoints

You can improve the security posture of your VPC by configuring Amazon EC2 Auto Scaling to use an interface VPC endpoint. Interface endpoints are powered by AWS PrivateLink, a technology that enables you to privately access Amazon EC2 Auto Scaling APIs by restricting all network traffic between your VPC and Amazon EC2 Auto Scaling to the AWS network. With interface endpoints, you also don't need an internet gateway, a NAT device, or a virtual private gateway.

You are not required to configure AWS PrivateLink, but it's recommended. For more information about AWS PrivateLink and VPC endpoints, see What is AWS PrivateLink? in the AWS PrivateLink Guide.

Topics

• Create an interface VPC endpoint (p. 426)
• Create a VPC endpoint policy (p. 426)

Create an interface VPC endpoint

Create an endpoint for Amazon EC2 Auto Scaling using the following service name:

com.amazonaws.region.autoscaling

For more information, see Access an AWS service using an interface VPC endpoint in the AWS PrivateLink Guide.

You do not need to change any Amazon EC2 Auto Scaling settings. Amazon EC2 Auto Scaling calls other AWS services using either service endpoints or private interface VPC endpoints, whichever are in use.

Create a VPC endpoint policy

You can attach a policy to your VPC endpoint to control access to the Amazon EC2 Auto Scaling API. The policy specifies:

• The principal that can perform actions.
• The actions that can be performed.
• The resource on which the actions can be performed.

The following example shows a VPC endpoint policy that denies everyone permission to delete a scaling policy through the endpoint. The example policy also grants everyone permission to perform all other actions.

```json
{
   "Statement": [
      {
```
Create a VPC endpoint policy

```json
{
    "Action": "*",
    "Effect": "Allow",
    "Resource": "*",
    "Principal": "*"
},
{
    "Action": "autoscaling:DeleteScalingPolicy",
    "Effect": "Deny",
    "Resource": "*",
    "Principal": "*"
}
```

For more information, see [VPC endpoint policies](https://docs.aws.amazon.com/AWSPreLinkGuide/latest/privateLinkGuide/vpc-endpoint-policies.html) in the *AWS PrivateLink Guide*. 
Troubleshoot Amazon EC2 Auto Scaling

Amazon EC2 Auto Scaling provides specific and descriptive errors to help you troubleshoot issues. You can find the error messages in the description of the scaling activities.

Topics
- Retrieve an error message from scaling activities (p. 428)
- Additional troubleshooting resources (p. 429)
- Troubleshoot Amazon EC2 Auto Scaling: EC2 instance launch failures (p. 430)
- Troubleshoot Amazon EC2 Auto Scaling: AMI issues (p. 436)
- Troubleshoot Amazon EC2 Auto Scaling: Load balancer issues (p. 438)
- Troubleshoot Amazon EC2 Auto Scaling: Launch templates (p. 440)
- Troubleshoot Amazon EC2 Auto Scaling: Health checks (p. 441)

Retrieve an error message from scaling activities

To retrieve an error message from the description of scaling activities, use the `describe-scaling-activities` command. You have a record of scaling activities that dates back 6 weeks. Scaling activities are ordered by start time, with the latest scaling activities listed first.

**Note**
The scaling activities are also displayed in the activity history in the Amazon EC2 Auto Scaling console on the Activity tab for the Auto Scaling group.

To see the scaling activities for a specific Auto Scaling group, use the following command.

```
aws autoscaling describe-scaling-activities --auto-scaling-group-name my-asg
```

The following is an example response, where StatusCode contains the current status of the activity and StatusMessage contains the error message.

```
{
  "Activities": [
    {
      "ActivityId": "3b05dbf6-037c-b92f-133f-38275269dc0f",
      "AutoScalingGroupName": "my-asg",
      "Description": "Launching a new EC2 instance: i-003a5b3ffe1e9358e. Status Reason: Instance failed to complete user's Lifecycle Action: Lifecycle Action with token e85eb647-4fe0-4909-b341-a6c42d8aba1f was abandoned: Lifecycle Action Completed with ABANDON Result",
      "Cause": "At 2021-01-11T00:35:52Z a user request created an AutoScalingGroup changing the desired capacity from 0 to 1. At 2021-01-11T00:35:53Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 1."
    }
  ]
}
```

428
"StatusMessage": "Instance failed to complete user's Lifecycle Action: Lifecycle Action with token e85eb647-4fe0-4909-b341-a6c42d8aba1f was abandoned: Lifecycle Action Completed with ABANDON Result",
  "Progress": 100,
  "Details": "{"Subnet ID":"subnet-5ea0c127","Availability Zone":"us-west-2b"...}",
},
... ]
}

For a description of the fields in the output, see Activity in the Amazon EC2 Auto Scaling API Reference.

To view scaling activities for a deleted group

To view scaling activities after the Auto Scaling group has been deleted, add the --include-deleted-groups option to the describe-scaling-activities command as follows.

aws autoscaling describe-scaling-activities --auto-scaling-group-name my-asg --include-deleted-groups

The following is an example response, with a scaling activity for a deleted group.

{
  "Activities": [
    {
      "ActivityId": "e1f5de0e-f93e-1417-34ac-092a76fba220",
      "AutoScalingGroupName": "my-asg",
      "Description": "Launching a new EC2 instance. Status Reason: Your Spot request price of 0.001 is lower than the minimum required Spot request fulfillment price of 0.0031. Launching EC2 instance failed.",
      "Cause": "At 2021-01-13T20:47:24Z a user request update of AutoScalingGroup constraints to min: 1, max: 5, desired: 3 changing the desired capacity from 0 to 3. At 2021-01-13T20:47:27Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 3.",
      "StartTime": "2021-01-13T20:47:30.094Z",
      "EndTime": "2021-01-13T20:47:30Z",
      "StatusCode": "Failed",
      "StatusMessage": "Your Spot request price of 0.001 is lower than the minimum required Spot request fulfillment price of 0.0031. Launching EC2 instance failed.",
      "Progress": 100,
      "Details": "{"Subnet ID":"subnet-5ea0c127","Availability Zone":"us-west-2b"...}",
      "AutoScalingGroupState": "Deleted",
    },
    ...
  ]
}

Additional troubleshooting resources

The following pages provide additional information for troubleshooting issues with Amazon EC2 Auto Scaling.
Troubleshoot Amazon EC2 Auto Scaling: EC2 instance launch failures

This page provides information about your EC2 instances that fail to launch, potential causes, and the steps you can take to resolve the issues.

To retrieve an error message, see Retrieve an error message from scaling activities (p. 428).

When your EC2 instances fail to launch, you might get one or more of the following error messages:

**Launch issues**
- The requested configuration is currently not supported. (p. 431)
- The security group `<name of the security group>` does not exist. Launching EC2 instance failed. (p. 431)
- The key pair `<key pair associated with your EC2 instance>` does not exist. Launching EC2 instance failed. (p. 432)
- Your requested instance type `<instance type>` is not supported in your requested Availability Zone `<instance Availability Zone>`... (p. 432)
- Your Spot request price of 0.015 is lower than the minimum required Spot request fulfillment price of 0.0735... (p. 432)
The requested configuration is currently not supported.

**Cause:** Some options in your launch template or launch configuration might not be compatible with the instance type, or the instance configuration might not be supported in your requested AWS Region or Availability Zones.

**Solution:**

Try a different instance configuration. To search for an instance type that meets your requirements, see [Finding an Amazon EC2 instance type](https://docs.aws.amazon.com/AmazonEC2/latest/UserGuide/finding-an-instance-type.html) in the *Amazon EC2 User Guide for Linux Instances*.

For further guidance to resolve this issue, check the following:

- Ensure that you have chosen an AMI that is supported by your instance type. For example, if the instance type uses an Arm-based AWS Graviton processor instead of an Intel Xeon processor, you need an Arm-compatible AMI. For more information about choosing a compatible instance type, see [Compatibility for changing the instance type](https://docs.aws.amazon.com/AmazonEC2/latest/UserGuide/compatibility-for-changing-instance-type.html) in the *Amazon EC2 User Guide for Linux Instances*.
- Test that the instance type is available in your requested Region and Availability Zones. The newest generation instance types might not yet be available in a given Region or Availability Zone. The older generation instance types might not be available in newer Regions and Availability Zones. To search for instance types offered by location (Region or Availability Zone), use the `describe-instance-type-offerings` command. For more information, see [Finding an Amazon EC2 instance type](https://docs.aws.amazon.com/AmazonEC2/latest/UserGuide/finding-an-instance-type.html) in the *Amazon EC2 User Guide for Linux Instances*.
- If you use Dedicated Instances or Dedicated Hosts, ensure that you have chosen an instance type that's supported as a Dedicated Instance or Dedicated Host.

The security group <name of the security group> does not exist. Launching EC2 instance failed.

**Cause:** The security group specified in your launch template or launch configuration might have been deleted.

**Solution:**

1. Use the `describe-security-groups` command to get the list of the security groups associated with your account.
The key pair <key pair associated with your EC2 instance> does not exist. Launching EC2 instance failed.

**Cause:** The key pair that was used when launching the instance might have been deleted.

**Solution:**

1. Use the `describe-key-pairs` command to get the list of the key pairs available to you.
2. From the list, select the key pair to use. To create a key pair instead, use the `create-key-pair` command.
3. Create a new launch template or launch configuration.
4. Update your Auto Scaling group with the new launch template or launch configuration using the `update-auto-scaling-group` command.

Your requested instance type (<instance type>) is not supported in your requested Availability Zone (<instance Availability Zone>)...

**Error message:** Your requested instance type (<instance type>) is not supported in your requested Availability Zone (<instance Availability Zone>)...Launching EC2 instance failed.

**Cause:** The Availability Zones specified in your Auto Scaling group don't support your chosen instance type.

**Solution:**

1. Verify which Availability Zones support your chosen instance type using the `describe-instance-type-offerings` command or from the Amazon EC2 console by checking the Availability Zones value on the Instance types page.
2. Update or remove the subnet for any unsupported zones in the settings of your Auto Scaling group using the `update-auto-scaling-group` command. For more information, see Add and remove Availability Zones [p. 351].

Your Spot request price of 0.015 is lower than the minimum required Spot request fulfillment price of 0.0735...

**Cause:** The Spot maximum price in your request is lower than the Spot price for the instance type that you selected.
Solution: Submit a new request with a higher Spot maximum price (possibly the On-Demand price). Previously, the Spot price you paid was based on bidding. Today, you pay the current Spot price. By setting your maximum price higher, it gives the Amazon EC2 Spot service a better chance of launching and maintaining your required amount of capacity.

Invalid device name <device name> / Invalid device name upload. Launching EC2 instance failed.

Cause 1: The block device mappings in your launch template or launch configuration might contain block device names that are not available or currently not supported.

Solution:

1. Verify which device names are available for your specific instance configuration. For more details on device naming, see Device names on Linux instances in the Amazon EC2 User Guide for Linux Instances.
2. Manually create an Amazon EC2 instance that is not part of the Auto Scaling group and investigate the problem. If the block device naming configuration conflicts with the names in the Amazon Machine Image (AMI), the instance will fail during launch. For more information, see Block device mappings in the Amazon EC2 User Guide for Linux Instances.
3. After you confirm that your instance launched successfully, use the describe-volumes command to see how the volumes are exposed to the instance.
4. Create a new launch template or launch configuration using the device name listed in the volume description.
5. Update your Auto Scaling group with the new launch template or launch configuration using the update-auto-scaling-group command.

Value (<name associated with the instance storage device>) for parameter virtualName is invalid...

Error message: Value (<name associated with the instance storage device>) for parameter virtualName is invalid. Expected format: 'ephemeralNUMBER'. Launching EC2 instance failed.

Cause: The format specified for the virtual name associated with the block device is incorrect.

Solution:

1. Create a new launch template or launch configuration by specifying the device name in the virtualName parameter. For information about the device name format, see Device naming on Linux instances in the Amazon EC2 User Guide for Linux Instances.
2. Update your Auto Scaling group with the new launch template or launch configuration using the update-auto-scaling-group command.

EBS block device mappings not supported for instance-store AMIs.

Cause: The block device mappings specified in the launch template or launch configuration are not supported on your instance.

Solution:
1. Create a new launch template or launch configuration with block device mappings supported by your instance type. For more information, see Block device mapping in the Amazon EC2 User Guide for Linux Instances.

2. Update your Auto Scaling group with the new launch template or launch configuration using the update-auto-scaling-group command.

Placement groups may not be used with instances of type 'm1.large'. Launching EC2 instance failed.

Cause: Your cluster placement group contains an invalid instance type.

Solution:

1. For information about valid instance types supported by the placement groups, see Placement groups in the Amazon EC2 User Guide for Linux Instances.

2. Follow the instructions detailed in the Placement groups to create a new placement group.

3. Alternatively, create a new launch template or launch configuration with the supported instance type.

4. Update your Auto Scaling group with a new placement group, launch template, or launch configuration using the update-auto-scaling-group command.

Client.InternalError: Client error on launch.

Problem: Amazon EC2 Auto Scaling tries to launch an instance that has an encrypted EBS volume, but the service-linked role does not have access to the AWS KMS customer managed key used to encrypt it. For more information, see Required AWS KMS key policy for use with encrypted volumes (p. 419).

Cause 1: You need a key policy that gives permission to use the customer managed key to the proper service-linked role.

Solution 1: Allow the service-linked role to use the customer managed key as follows:

1. Determine which service-linked role to use for this Auto Scaling group.

2. Update the key policy on the customer managed key and allow the service-linked role to use the customer managed key.

3. Update the Auto Scaling group to use the service-linked role.

For an example of a key policy that lets the service-linked role use the customer managed key, see Example 1: Key policy sections that allow access to the customer managed key (p. 421).

Cause 2: If the customer managed key and Auto Scaling group are in different AWS accounts, you need to configure cross-account access to the customer managed key in order to give permission to use the customer managed key to the proper service-linked role.

Solution 2: Allow the service-linked role in the external account to use the customer managed key in the local account as follows:

1. Update the key policy on the customer managed key to allow the Auto Scaling group account access to the customer managed key.

2. Define an IAM user or role in the Auto Scaling group account that can create a grant.

3. Determine which service-linked role to use for this Auto Scaling group.
4. Create a grant to the customer managed key with the proper service-linked role as the grantee principal.
5. Update the Auto Scaling group to use the service-linked role.

For more information, see Example 2: Key policy sections that allow cross-account access to the customer managed key (p. 422).

Solution 3: Use a customer managed key in the same AWS account as the Auto Scaling group.
1. Copy and re-encrypt the snapshot with another customer managed key that belongs to the same account as the Auto Scaling group.
2. Allow the service-linked role to use the new customer managed key. See the steps for Solution 1.

We currently do not have sufficient <instance type> capacity in the Availability Zone you requested...
Launching EC2 instance failed.

Error message: We currently do not have sufficient <instance type> capacity in the Availability Zone you requested (<requested Availability Zone>). Our system will be working on provisioning additional capacity. You can currently get <instance type> capacity by not specifying an Availability Zone in your request or choosing <list of Availability Zones that currently supports the instance type>. Launching EC2 instance failed.

Cause: At this time, the requested instance type and Availability Zone combination isn't supported.

Solution:
To resolve the issue, try the following:
• Wait a few minutes for Amazon EC2 Auto Scaling to find capacity for this instance type in other enabled Availability Zones.
• Expand your Auto Scaling group to additional Availability Zones. For more information, see Add and remove Availability Zones (p. 351).
• Follow the best practice of using a diverse set of instance types so that you're not reliant on one specific instance type. For more information, see Auto Scaling groups with multiple instance types and purchase options (p. 62).

There is no Spot capacity available that matches your request. Launching EC2 instance failed.

Cause: At this time, there isn't enough spare capacity to fulfill your request for Spot Instances.

Solution:
To resolve the issue, try the following:
• Wait a few minutes; capacity can shift frequently. Amazon EC2 Auto Scaling continues to automatically make the launch request until capacity becomes available.
• Expand your Auto Scaling group to additional Availability Zones. For more information, see Add and remove Availability Zones (p. 351).
<number of instances> instance(s) are already running. Launching EC2 instance failed.

**Cause:** You have reached the limit on the number of instances that you can launch in a Region. When you create your AWS account, we set default limits on the number of instances you can run on a per-Region basis.

**Solution:**

To resolve the issue, try the following:

- If your current limits aren't adequate for your needs, you can request a quota increase on a per-Region basis. For more information, see [Amazon EC2 service quotas](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/using-scaling.html) in the *Amazon EC2 User Guide for Linux Instances*.
- Submit a new request with a reduced number of instances (which you can increase at a later stage).

---

**Troubleshoot Amazon EC2 Auto Scaling: AMI issues**

This page provides information about the issues associated with your AMIs, potential causes, and the steps you can take to resolve the issues.

To retrieve an error message, see [Retrieve an error message from scaling activities](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/troubleshooting-errors.html) (p. 428).

When your EC2 instances fail to launch due to issues with your AMI, you might get one or more of the following error messages.

**AMI issues**

- The AMI ID <ID of your AMI> does not exist. Launching EC2 instance failed. (p. 436)
- AMI <AMI ID> is pending, and cannot be run. Launching EC2 instance failed. (p. 437)
- Invalid device name <device name>. Launching EC2 instance failed. (p. 437)
- The architecture 'x86_64' of the specified instance type does not match the architecture 'arm64' of the specified AMI...Launching EC2 instance failed. (p. 437)

**Important**

AWS supports sharing an AMI privately with another AWS account by modifying the AMI permissions. If an AMI is made private without being shared, this can result in an authorization error when launching new instances. For more information about sharing private AMIs, see [Share an AMI with specific AWS accounts](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/using-ec2-account.html) in the *Amazon EC2 User Guide for Linux Instances*.

**The AMI ID <ID of your AMI> does not exist. Launching EC2 instance failed.**

- **Cause:** The AMI might have been deleted after creating the launch template or launch configuration.
- **Solution:**

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436
1. Create a new launch template or launch configuration using a valid AMI.

2. Update your Auto Scaling group with the new launch template or launch configuration using the `update-auto-scaling-group` command.

AMI <AMI ID> is pending, and cannot be run. Launching EC2 instance failed.

**Cause**: You might have just created your AMI (by taking a snapshot of a running instance or any other way), and it might not be available yet.

**Solution**: You must wait for your AMI to be available and then create your launch template or launch configuration.

Invalid device name <device name>. Launching EC2 instance failed.

**Cause**: When attaching an EBS volume to an EC2 instance, you must provide a valid device name for the volume. The selected AMI must support this device name.

**Solution**:

1. Create a new launch template or launch configuration and specify the correct device name for your AMI. The recommended naming convention varies based on the virtualization type of the AMI. For more information, see Device names in the Amazon EC2 User Guide for Linux Instances.

2. Update your Auto Scaling group with the new launch template or launch configuration using the `update-auto-scaling-group` command.

The architecture 'x86_64' of the specified instance type does not match the architecture 'arm64' of the specified AMI...Launching EC2 instance failed.

**Cause 1**: If the architecture of the AMI and the instance type used in your launch template or launch configuration are not the same, you get an error when Amazon EC2 Auto Scaling tries to launch an instance using the incompatible instance configuration.

**Solution 1**:

1. Verify the architecture of your AMI using the `describe-images` command or from the Amazon EC2 console by checking the Architecture value on the details pane of the Amazon Machine Images (AMIs) page.

2. Find an instance type that has the same architecture as your AMI using the `describe-instance-types` command or from the Amazon EC2 console by checking the Architecture column on the Instance types screen. For more information about choosing a compatible instance type, see Compatibility for changing the instance type in the Amazon EC2 User Guide for Linux Instances.

3. Create a new launch template or launch configuration using an instance type that has the same architecture as your AMI.

4. Update your Auto Scaling group with the new launch template or launch configuration using the `update-auto-scaling-group` command.
**Cause 2:** Amazon EC2 Auto Scaling tries to launch an instance type that's specified in the mixed instances policy for your Auto Scaling group, but the instance type does not have the same architecture as the AMI specified in your launch template.

**Solution 1:** Do not include instance types that have different architectures in your mixed instances policy.

1. Verify the architecture of your AMI using the `describe-images` command or from the Amazon EC2 console by checking the **Architecture** value on the details pane of the **Amazon Machine Images (AMIs)** page.
2. Verify the architecture of each instance type that you intend to include in your mixed instances policy using the `describe-instance-types` command or from the Amazon EC2 console by checking the **Architecture** column on the **Instance types** screen. For more information about choosing compatible instance types, see [Compatibility for changing the instance type](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEC2LinuxChangerInstanceType.html) in the *Amazon EC2 User Guide for Linux Instances*.
3. Update or remove the incompatible instance types from your Auto Scaling group using the `update-auto-scaling-group` command.

**Solution 2:** To launch both Arm (Graviton2) and x86_64 (Intel) instances in the same Auto Scaling group, you must use launch templates supported by an Arm-compatible AMI and an Intel x86-compatible AMI, respectively, to match the instance types in your mixed instances policy.

1. Verify the architecture of the AMI in your existing launch template using the `describe-images` command or from the Amazon EC2 console by checking the **Architecture** value on the details pane of the **Amazon Machine Images (AMIs)** page.
2. Create a new launch template using an AMI that matches the other architecture you intend to use.
3. Update your Auto Scaling group to override the existing launch template and specify the new launch template for each compatible instance type using the `update-auto-scaling-group` command. For more information, see [Specify a different launch template for an instance type](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2AutoScalingLaunchTemplates.html) (p. 77).

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**Troubleshoot Amazon EC2 Auto Scaling: Load balancer issues**

This page provides information about issues caused by the load balancer associated with your Auto Scaling group, potential causes, and the steps you can take to resolve the issues.

To retrieve an error message, see [Retrieve an error message from scaling activities](https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2AutoScalingRetrieveErrorMessages.html) (p. 428).

When your EC2 instances fail to launch due to issues with the load balancer associated with your Auto Scaling group, you might get one or more of the following error messages.

**Load balancer issues**

- One or more target groups not found. Validating load balancer configuration failed. (p. 439)
- Cannot find Load Balancer <your load balancer>. Validating load balancer configuration failed. (p. 439)
- There is no ACTIVE Load Balancer named <load balancer name>. Updating load balancer configuration failed. (p. 439)
- EC2 instance <instance ID> is not in VPC. Updating load balancer configuration failed. (p. 440)
- EC2 instance <instance ID> is in VPC. Updating load balancer configuration failed. (p. 440)

**Note**

You can use Reachability Analyzer to troubleshoot connectivity issues by checking whether instances in your Auto Scaling group are reachable through the load balancer. To learn about
One or more target groups not found. Validating load balancer configuration failed.

**Problem:** When your Auto Scaling group launches instances, Amazon EC2 Auto Scaling tries to validate that the Elastic Load Balancing resources that are associated with the Auto Scaling group exist. When a target group cannot be found, the scaling activity fails, and you get the One or more target groups not found. Validating load balancer configuration failed. error.

**Cause 1:** A target group attached to your Auto Scaling group has been deleted.

**Solution 1:** You can either create a new Auto Scaling group without the target group or remove the unused target group from the Auto Scaling group by using the Amazon EC2 Auto Scaling console or the detach-load-balancer-target-groups command.

**Cause 2:** The target group exists, but there was an issue trying to specify the target group ARN when creating the Auto Scaling group. Resources are not created in the right order.

**Solution 2:** Create a new Auto Scaling group and specify the target group at the end.

**Cannot find Load Balancer <your load balancer>. Validating load balancer configuration failed.**

**Problem:** When your Auto Scaling group launches instances, Amazon EC2 Auto Scaling tries to validate that the Elastic Load Balancing resources that are associated with the Auto Scaling group exist. When a Classic Load Balancer cannot be found, the scaling activity fails, and you get the Cannot find Load Balancer <your load balancer>. Validating load balancer configuration failed. error.

**Cause 1:** The Classic Load Balancer has been deleted.

**Solution 1:** You can either create a new Auto Scaling group without the load balancer or remove the unused load balancer from the Auto Scaling group by using the Amazon EC2 Auto Scaling console or the detach-load-balancers command.

**Cause 2:** The Classic Load Balancer exists, but there was an issue trying to specify the load balancer name when creating the Auto Scaling group. Resources are not created in the right order.

**Solution 2:** Create a new Auto Scaling group and specify the load balancer name at the end.

**There is no ACTIVE Load Balancer named <load balancer name>. Updating load balancer configuration failed.**

**Cause:** The specified load balancer might have been deleted.

**Solution:** You can either create a new load balancer and then create a new Auto Scaling group or create a new Auto Scaling group without the load balancer.
EC2 instance <instance ID> is not in VPC. Updating load balancer configuration failed.

**Cause:** The specified instance does not exist in the VPC.

**Solution:** You can either delete your load balancer associated with the instance or create a new Auto Scaling group.

EC2 instance <instance ID> is in VPC. Updating load balancer configuration failed.

**Cause:** The load balancer is in EC2-Classic but the Auto Scaling group is in a VPC.

**Solution:** Ensure that the load balancer and the Auto Scaling group are in the same network (EC2-Classic or a VPC).

Troubleshoot Amazon EC2 Auto Scaling: Launch templates

Use the following information to help you diagnose and fix common issues that you might encounter when trying to specify a launch template for your Auto Scaling group.

**Can't launch instances**

If you are unable to launch any instances with an already specified launch template, check the following for general troubleshooting: Troubleshoot Amazon EC2 Auto Scaling: EC2 instance launch failures (p. 430).

**You must use a valid fully-formed launch template (invalid value)**

**Problem:** When you try to specify a launch template for an Auto Scaling group, you get the You must use a valid fully-formed launch template error. You might encounter this error because the values in the launch template are only validated when an Auto Scaling group that is using the launch template is created or updated.

**Cause 1:** If you receive a You must use a valid fully-formed launch template error, then there are issues that cause Amazon EC2 Auto Scaling to consider something about the launch template not valid. This is a generic error that can have several different causes.

**Solution 1:** Try the following steps to troubleshoot:

1. Pay attention to the second part of the error message to find more information. Following the You must use a valid fully-formed launch template error, see the more specific error message that identifies the issue that you will need to address.
2. If you are unable to find the cause, test your launch template with the run-instances command. Use the --dry-run option, as shown in the following example. This lets you reproduce the issue and can provide insights about its cause.

```bash
aws ec2 run-instances --launch-template LaunchTemplateName=my-template,Version='1' --dry-run
```
3. If a value is not valid, verify that the specified resource exists and that it's correct. For example, when you specify an Amazon EC2 key pair, the resource must exist in your account and in the Region in which you are creating or updating your Auto Scaling group.

4. If expected information is missing, verify your settings and adjust the launch template as needed.

5. After making your changes, re-run the `run-instances` command with the `--dry-run` option to verify that your launch template uses valid values.

For more information, see Create a launch template for an Auto Scaling group (p. 22).

You are not authorized to use launch template (insufficient permissions)

Problem: When you try to specify a launch template for an Auto Scaling group, you get the **You are not authorized to use launch template** error.

Cause 1: If you are attempting to use a launch template, and the IAM credentials that you are using do not have sufficient permissions, you receive an error that you're not authorized to use the launch template.

Solution 1: Verify that the IAM credentials that you are using to make the request has permissions to call the EC2 API actions you need, including the `ec2:RunInstances` action. If you specified any tags in your launch template, you must also have permission to use the `ec2:CreateTags` action.

Solution 2: Verify that the IAM credentials that you are using to make the request is assigned the AmazonEC2FullAccess policy. This AWS managed policy grants full access to all Amazon EC2 resources and related services, including Amazon EC2 Auto Scaling, CloudWatch, and Elastic Load Balancing.

Cause 2: If you are attempting to use a launch template that specifies an instance profile, you must have IAM permission to pass the IAM role that is associated with the instance profile.

Solution 3: Verify that the IAM credentials that you are using to make the request has the correct `iam:PassRole` permission to pass the specified role to the Amazon EC2 Auto Scaling service. For more information and an example IAM policy, see IAM role for applications that run on Amazon EC2 instances (p. 417). For further troubleshooting topics related to instance profiles, see Troubleshooting Amazon EC2 and IAM in the IAM User Guide.

Cause 3: If you are attempting to use a launch template that specifies an AMI in another AWS account, and the AMI is private and not shared with the AWS account you are using, you receive an error that you're not authorized to use the launch template.

Solution 4: Verify that the permissions on the AMI include the account that you are using. For more information, see Share an AMI with specific AWS accounts in the Amazon EC2 User Guide for Linux Instances.

**Important**
For more information about permissions for launch templates, including example IAM policies, see Launch template support (p. 412).

Troubleshoot Amazon EC2 Auto Scaling: Health checks

This page provides information about your EC2 instances that terminate due to a health check. It describes potential causes, and the steps that you can take to resolve the issues.

To retrieve an error message, see Retrieve an error message from scaling activities (p. 428).
Health check issues

- An instance was taken out of service in response to an EC2 instance status check failure (p. 442)
- An instance was taken out of service in response to an EC2 scheduled reboot (p. 442)
- An instance was taken out of service in response to an EC2 health check that indicated it had been terminated or stopped (p. 443)
- An instance was taken out of service in response to an ELB system health check failure (p. 443)

Note

You can be notified when Amazon EC2 Auto Scaling terminates the instances in your Auto Scaling group, including when the cause of instance termination is not the result of a scaling activity. For more information, see Get Amazon SNS notifications when your Auto Scaling group scales (p. 317). The sections that follow describe the most common health check errors and causes that you'll encounter. If you have a different issue, see the following AWS Knowledge Center articles for additional troubleshooting help:

- Why did Amazon EC2 Auto Scaling terminate an instance?
- Why didn't Amazon EC2 Auto Scaling terminate an unhealthy instance?

An instance was taken out of service in response to an EC2 instance status check failure

Problem: Auto Scaling instances fail the Amazon EC2 status checks.

Cause 1: If there are issues that cause Amazon EC2 to consider the instances in your Auto Scaling group impaired, Amazon EC2 Auto Scaling automatically replaces the impaired instances as part of its health check. Status checks are built into Amazon EC2, so they cannot be disabled or deleted. When an instance status check fails, you typically must address the problem yourself by making instance configuration changes until your application is no longer exhibiting any problems.

Solution 1: To address this issue, follow these steps:

1. Manually create an Amazon EC2 instance that is not part of the Auto Scaling group and investigate the problem. For general help with investigating impaired instances, see Troubleshoot instances with failed status checks in the Amazon EC2 User Guide for Linux Instances and Troubleshooting Windows Instances in the Amazon EC2 User Guide for Windows Instances.
2. After you confirm that your instance launched successfully and is healthy, deploy a new, error-free instance configuration to the Auto Scaling group.
3. Delete the instance that you created to avoid ongoing charges to your AWS account.

Cause 2: There is a mismatch between the health check grace period and the instance startup time.

Solution 2: Edit the health check grace period for your Auto Scaling group to an appropriate time period for your application. Instances launched in an Auto Scaling group require sufficient warm-up time (grace period) to prevent early termination due to a health check replacement. For more information, see Set the health check grace period for an Auto Scaling group (p. 302).

An instance was taken out of service in response to an EC2 scheduled reboot

Problem: Auto Scaling instances are replaced when a scheduled event indicates a problem with the instance.
An instance was taken out of service in response to an EC2 health check that indicated it had been terminated or stopped

**Problem:** Auto Scaling instances that have been stopped, rebooted, or terminated are replaced.

**Cause 1:** A user manually stopped, rebooted, or terminated the instance.

**Solution 1:** If a health check fails because a user manually stopped, rebooted, or terminated the instance, this is due to how Amazon EC2 Auto Scaling health checks work. The instance must be healthy and reachable. If you need to reboot the instances in your Auto Scaling group, we recommend that you put the instances on standby first. For more information, see Temporarily remove instances from your Auto Scaling group (p. 287).

Note that when you terminate instances manually, termination lifecycle hooks and Elastic Load Balancing deregistration (and connection draining) must be completed before the instance is actually terminated.

**Cause 2:** Amazon EC2 Auto Scaling attempts to replace Spot Instances after the Amazon EC2 Spot service interrupts the instances, because the Spot price increases above your maximum price or capacity is no longer available.

**Solution 2:** There is no guarantee that a Spot Instance exists to fulfill the request at any given point in time. However, you can try the following:

- Use a higher Spot maximum price (possibly the On-Demand price). By setting your maximum price higher, it gives the Amazon EC2 Spot service a better chance of launching and maintaining your required amount of capacity.
- Increase the number of different capacity pools that you can launch instances from by running multiple instance types in multiple Availability Zones. For more information, see Auto Scaling groups with multiple instance types and purchase options (p. 62).
- If you use multiple instance types, consider enabling the Capacity Rebalancing feature. This is useful if you want the Amazon EC2 Spot service to attempt to launch a new Spot Instance before a running instance is terminated. For more information, see Use Capacity Rebalancing to handle Amazon EC2 Spot interruptions (p. 322).

An instance was taken out of service in response to an ELB system health check failure

**Problem:** Auto Scaling instances might pass the EC2 status checks. But they might fail the Elastic Load Balancing health checks for the target groups or Classic Load Balancers with which the Auto Scaling group is registered.
An instance was taken out of service in response to an ELB system health check failure.

**Cause:** If your Auto Scaling group relies on health checks provided by Elastic Load Balancing, Amazon EC2 Auto Scaling determines the health status of your instances by checking the results of both the EC2 status checks and the Elastic Load Balancing health checks. The load balancer performs health checks by sending a request to each instance and waiting for the correct response, or by establishing a connection with the instance. An instance might fail the Elastic Load Balancing health check because an application running on the instance has issues that cause the load balancer to consider the instance out of service. For more information, see [Add Elastic Load Balancing health checks to an Auto Scaling group](p. 350).

**Solution 1:** To pass the Elastic Load Balancing health checks:

- Make note of the success codes that the load balancer is expecting, and verify that your application is configured correctly to return these codes on success.
- Verify that the security groups for your load balancer and Auto Scaling group are correctly configured.
- Verify that the health check settings of your target groups are correctly configured. You define health check settings for your load balancer per target group.
- Consider adding a launch lifecycle hook to the Auto Scaling group to ensure that the applications on the instances are ready to accept traffic before they are registered to the load balancer at the end of the lifecycle hook.
- Set the health check grace period for your Auto Scaling group to a long enough time period to support the number of consecutive successful health checks required before Elastic Load Balancing considers a newly launched instance healthy.
- Verify that the load balancer is configured in the same Availability Zones as your Auto Scaling group.

For more information, see the following topics:

- [Health checks for your target groups](User Guide for Application Load Balancers) in the User Guide for Application Load Balancers
- [Health checks for your target groups](User Guide for Network Load Balancers) in the User Guide for Network Load Balancers
- [Health checks for your target groups](User Guide for Gateway Load Balancers) in the User Guide for Gateway Load Balancers
- [Configure health checks for your Classic Load Balancer](User Guide for Classic Load Balancers) in the User Guide for Classic Load Balancers

**Solution 2:** Update the Auto Scaling group to disable Elastic Load Balancing health checks.
## Related information

The following related resources can help you as you work with this service.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amazon EC2 Auto Scaling API Reference</strong></td>
<td>The documentation for each API operation shows the request parameters and the XML response and provides links to language-specific SDK reference topics.</td>
</tr>
<tr>
<td><strong>autoscaling</strong> in the AWS CLI Command Reference</td>
<td>Descriptions of the AWS CLI commands that you can use to work with Auto Scaling groups.</td>
</tr>
<tr>
<td><strong>AWS Tools for PowerShell Cmdlet Reference</strong></td>
<td>The AWS Tools for PowerShell enable you to script operations on your AWS resources from the PowerShell command line.</td>
</tr>
<tr>
<td><strong>Create Auto Scaling groups with AWS CloudFormation (p. 335)</strong></td>
<td>The AWS::AutoScaling::AutoScalingGroup resource lets you build, model, and manage your Auto Scaling groups without manual actions.</td>
</tr>
<tr>
<td><strong>Amazon EC2 Auto Scaling endpoints and quotas</strong> in the AWS General Reference</td>
<td>Information about Amazon EC2 Auto Scaling regions and endpoints.</td>
</tr>
<tr>
<td><strong>Product Page</strong></td>
<td>The primary web page for information about Amazon EC2 Auto Scaling.</td>
</tr>
<tr>
<td><strong>AWS re:Post</strong></td>
<td>AWS managed question and answer (Q &amp; A) service offering crowd-sourced, expert-reviewed answers to your technical questions.</td>
</tr>
<tr>
<td><strong>Create an AMI</strong> in the Amazon EC2 User Guide for Linux Instances</td>
<td>Learn how to create an Amazon Machine Image (AMI) from a customized instance.</td>
</tr>
<tr>
<td><strong>How to connect to your Linux instance</strong> in the Amazon EC2 User Guide for Linux Instances</td>
<td>Learn how to connect to the Linux instances that you launch.</td>
</tr>
<tr>
<td><strong>How to connect to your Windows instance</strong> in the Amazon EC2 User Guide for Windows Instances</td>
<td>Learn how to connect to the Windows instances that you launch.</td>
</tr>
<tr>
<td><strong>Creating a billing alarm to monitor your estimated AWS charges</strong> in the Amazon CloudWatch User Guide</td>
<td>Learn how to monitor your estimated charges using CloudWatch.</td>
</tr>
</tbody>
</table>

The following general resources are available to help you learn more about AWS.

- **Classes & Workshops** – Links to role-based and specialty courses, in addition to self-paced labs to help sharpen your AWS skills and gain practical experience.
- **AWS Developer Center** – Explore tutorials, download tools, and learn about AWS developer events.
- **AWS Developer Tools** – Links to developer tools, SDKs, IDE toolkits, and command line tools for developing and managing AWS applications.
- **Getting Started Resource Center** – Learn how to set up your AWS account, join the AWS community, and launch your first application.
• **Hands-On Tutorials** – Follow step-by-step tutorials to launch your first application on AWS.

• **AWS Whitepapers** – Links to a comprehensive list of technical AWS whitepapers, covering topics such as architecture, security, and economics and authored by AWS Solutions Architects or other technical experts.

• **AWS Support Center** – The hub for creating and managing your AWS Support cases. Also includes links to other helpful resources, such as forums, technical FAQs, service health status, and AWS Trusted Advisor.

• **AWS Support** – The primary webpage for information about AWS Support, a one-on-one, fast-response support channel to help you build and run applications in the cloud.

• **Contact Us** – A central contact point for inquiries concerning AWS billing, account, events, abuse, and other issues.

• **AWS Site Terms** – Detailed information about our copyright and trademark; your account, license, and site access; and other topics.
The following table describes important additions to the Amazon EC2 Auto Scaling documentation, beginning in July 2018. For notification about updates to this documentation, you can subscribe to the RSS feed.

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New instance refresh features (p. 447)</strong></td>
<td>You can now configure an instance refresh to set its status to failed and optionally roll back when it detects that a specified CloudWatch alarm has gone into the ALARM state. For more information, see <em>Undo changes with a rollback</em> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 31, 2023</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>A new topic about launching On-Demand Instances into Capacity Reservations has been added to the guide. For more information, see <em>Use On-Demand Capacity Reservations to reserve capacity in specific Availability Zones</em> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 28, 2023</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>A new topic about migrating your AWS CloudFormation stacks from launch configurations to launch templates has been added to the guide. For more information, see <em>Migrate AWS CloudFormation stacks from launch configurations to launch templates</em> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>April 18, 2023</td>
</tr>
<tr>
<td><strong>Support for new API operations (p. 447)</strong></td>
<td>This release adds three new API operations, AttachTrafficSources, DetachTrafficSources, and DescribeTrafficSources. Also, a new field, TrafficSources, has been added to the results of DescribeAutoScalingGroups operations. A new activity status, WaitingForConnectionDraining, has been added to the results of DescribeScalingActivities operations. Amazon EC2 Auto Scaling also supports a new value, VPC_LATTICE, for the</td>
<td>March 31, 2023</td>
</tr>
</tbody>
</table>
### HealthCheckType field

The HealthCheckType field in `CreateAutoScalingGroup`, `UpdateAutoScalingGroup`, and `DescribeAutoScalingGroups` operations. For more information, see the [Amazon EC2 Auto Scaling API Reference](https://docs.aws.amazon.com/autoscaling/ec2/api/2011-01-01/index.html).

<table>
<thead>
<tr>
<th>Support for Amazon VPC Lattice (p. 447)</th>
<th>This is the general availability release of VPC Lattice for Amazon EC2 Auto Scaling. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/vpc-lattice-autoscaling.html">Route traffic to your Auto Scaling group with a VPC Lattice target group</a> in the Amazon EC2 Auto Scaling User Guide.</th>
<th>March 31, 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide changes (p. 447)</td>
<td>The section with AWS CLI examples for working with Elastic Load Balancing now includes new and updated examples. For more information, see <a href="https://docs.aws.amazon.com/elasticloadbalancing/latest/commandline/working-with-elastic-load-balancing.html">Examples for working with Elastic Load Balancing with the AWS Command Line Interface (AWS CLI)</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>March 31, 2023</td>
</tr>
<tr>
<td>Support for predictive scaling in additional AWS Regions (p. 447)</td>
<td>You can now create predictive scaling policies in the Middle East (UAE) and AWS GovCloud (US-East) Regions. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/predictive-scaling.html">Predictive scaling for Amazon EC2 Auto Scaling</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>March 16, 2023</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
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</tr>
<tr>
<td><strong>New instance refresh features (p. 447)</strong></td>
<td>You can now choose to terminate or ignore instances on standby and replace or ignore instances protected from scale in, instead of waiting for them to become replaceable. You can also roll back changes from a failed instance refresh. As part of this update, the documentation has been expanded to include topics for rolling back an instance refresh, cancelling an instance refresh, and understanding the default values for the configurable parameters of an instance refresh. For more information, see Replacing Auto Scaling instances based on an instance refresh in the Amazon EC2 Auto Scaling User Guide.</td>
<td>February 10, 2023</td>
</tr>
<tr>
<td><strong>Support for using an AWS Systems Manager parameter for an AMI ID (p. 447)</strong></td>
<td>You can now use a Systems Manager parameter instead of an AMI ID in your launch template. For more information, see Using AWS Systems Manager parameters instead of AMI IDs in launch templates in the Amazon EC2 Auto Scaling User Guide.</td>
<td>January 19, 2023</td>
</tr>
<tr>
<td><strong>Predictive scaling recommendations (p. 447)</strong></td>
<td>You can now get recommendations for evaluating and choosing the right predictive scaling policy from the Amazon EC2 Auto Scaling console. For more information, see Evaluate your predictive scaling policies in the Amazon EC2 Auto Scaling User Guide.</td>
<td>January 18, 2023</td>
</tr>
<tr>
<td><strong>Predictive scaling forecasts (p. 447)</strong></td>
<td>The forecasts generated by predictive scaling now update every six hours instead of daily. For more information, see Predictive scaling for Amazon EC2 Auto Scaling in the Amazon EC2 Auto Scaling User Guide.</td>
<td>January 6, 2023</td>
</tr>
<tr>
<td>Change</td>
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<tr>
<td>Support for CloudWatch metric math</td>
<td>You can now use metric math when you create target tracking scaling policies. With metric math, you can query multiple CloudWatch metrics and use math expressions to create new time series based on these metrics. For more information, see Create a target tracking scaling policy for Amazon EC2 Auto Scaling using metric math in the Amazon EC2 Auto Scaling User Guide.</td>
<td>December 8, 2022</td>
</tr>
<tr>
<td>Update to IAM service-linked role permissions</td>
<td>The AutoScalingServiceRolePolicy policy now grants additional permissions to Amazon EC2 Auto Scaling. For more information, see AWS managed policies for Amazon EC2 Auto Scaling in the Amazon EC2 Auto Scaling User Guide.</td>
<td>December 6, 2022</td>
</tr>
<tr>
<td>New Spot allocation strategy</td>
<td>You can now use the price and capacity optimized allocation strategy to request Spot Instances from the Spot pools that are the least likely to be interrupted and have the lowest possible price. For more information, see Allocation strategies in the Amazon EC2 Auto Scaling User Guide.</td>
<td>November 10, 2022</td>
</tr>
<tr>
<td>Support for predictive scaling in Asia Pacific (Jakarta) Region</td>
<td>You can now create predictive scaling policies in Asia Pacific (Jakarta) Region. For more information, see Predictive scaling for Amazon EC2 Auto Scaling in the Amazon EC2 Auto Scaling User Guide.</td>
<td>October 13, 2022</td>
</tr>
<tr>
<td>Support for custom metrics for predictive scaling in the console</td>
<td>You can now use custom metrics when creating predictive scaling policies from the Amazon EC2 Auto Scaling console. For more information, see Predictive scaling for Amazon EC2 Auto Scaling in the Amazon EC2 Auto Scaling User Guide.</td>
<td>October 13, 2022</td>
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<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
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<tr>
<td><strong>CloudWatch monitoring for predictive scaling metrics</strong> (p. 447)</td>
<td>You can now access monitoring data for predictive scaling using CloudWatch. This lets you use metric math to create new time series that display the accuracy of forecast data. For more information, see <a href="#">Monitor predictive scaling metrics with CloudWatch</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 7, 2022</td>
</tr>
<tr>
<td><strong>Support for predictive scaling in Asia Pacific (Osaka) Region</strong> (p. 447)</td>
<td>You can now create predictive scaling policies in Asia Pacific (Osaka) Region. For more information, see <a href="#">Predictive scaling for Amazon EC2 Auto Scaling</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 6, 2022</td>
</tr>
<tr>
<td><strong>Warm pool hibernation supported in additional Regions</strong> (p. 447)</td>
<td>You can now hibernate instances in a warm pool in four additional Regions: Africa (Cape Town), Asia Pacific (Jakarta), Asia Pacific (Osaka), and Europe (Milan). For more information about warm pools, see <a href="#">Warm pools for Amazon EC2 Auto Scaling</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 5, 2022</td>
</tr>
<tr>
<td><strong>Update to health checks</strong> (p. 447)</td>
<td>When performing health checks, Amazon EC2 Auto Scaling now helps you minimize any downtime that can occur because of temporary issues or misconfigured health checks. For more information, see <a href="#">How Amazon EC2 Auto Scaling minimizes downtime</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>May 21, 2022</td>
</tr>
<tr>
<td><strong>Default instance warmup</strong> (p. 447)</td>
<td>You can now unify all the warm-up and cooldown settings for an Auto Scaling group and optimize the performance of scaling policies that scale continuously by enabling default instance warmup. For more information, see <a href="#">Set the default instance warmup for an Auto Scaling group</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>April 19, 2022</td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>A new chapter about integrating with other AWS services has been added to the guide. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/">AWS services integrated with Amazon EC2 Auto Scaling</a>.</td>
<td>March 29, 2022</td>
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<tr>
<td>Update to IAM service-linked role permissions (p. 447)</td>
<td>The AutoScalingServiceRolePolicy now grants additional read permissions to Amazon EC2 Auto Scaling. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/">AWS managed policies for Amazon EC2 Auto Scaling</a>.</td>
<td>March 28, 2022</td>
</tr>
<tr>
<td>Instance metadata provides target lifecycle state (p. 447)</td>
<td>You can retrieve an Auto Scaling instance's target lifecycle state from the instance metadata. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/">Retrieve the target lifecycle state through instance metadata</a>.</td>
<td>March 24, 2022</td>
</tr>
<tr>
<td>Support for new warm pool functionality (p. 447)</td>
<td>You can now hibernate instances in a warm pool to stop instances without deleting their memory contents (RAM). You can now also return instances to the warm pool on scale in, instead of always terminating instance capacity that you will need later. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/">Warm pools for Amazon EC2 Auto Scaling</a>.</td>
<td>February 24, 2022</td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>The Amazon EC2 Auto Scaling console has been updated with additional options to help you start an instance refresh with skip matching enabled and a desired configuration specified. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/">Start or cancel an instance refresh (console)</a>.</td>
<td>February 3, 2022</td>
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<tr>
<td>Custom metrics for predictive scaling</td>
<td>You can now choose whether to use custom metrics when you create predictive scaling policies. You can also use metric math to further customize the metrics that you include in your policy. For more information, see Advanced predictive scaling policy configurations using custom metrics.</td>
<td>November 24, 2021</td>
</tr>
<tr>
<td>New On-Demand allocation strategy</td>
<td>You can now choose whether to launch On-Demand Instances based on price (lowest priced instance types first) when you create an Auto Scaling group that uses a mixed instances policy. For more information, see Allocation strategies in the Amazon EC2 Auto Scaling User Guide.</td>
<td>October 27, 2021</td>
</tr>
<tr>
<td>Attribute-based instance type selection</td>
<td>Amazon EC2 Auto Scaling adds support for attribute-based instance type selection. Instead of manually choosing instance types, you can express your instance requirements as a set of attributes, such as vCPU, memory, and storage. For more information, see Creating an Auto Scaling group using attribute-based instance type selection in the Amazon EC2 Auto Scaling User Guide.</td>
<td>October 27, 2021</td>
</tr>
<tr>
<td>Support for filtering groups by tags</td>
<td>You can now filter your Auto Scaling groups using tag filters when you retrieve information about your Auto Scaling groups using the describe-auto-scaling-groups command. For more information, see Use tags to filter Auto Scaling groups in the Amazon EC2 Auto Scaling User Guide.</td>
<td>October 14, 2021</td>
</tr>
<tr>
<td>Guide changes</td>
<td>The Amazon EC2 Auto Scaling console has been updated to help you create custom termination policies with AWS Lambda. The console documentation has been revised accordingly. For more information, see Using different termination policies (console).</td>
<td>October 14, 2021</td>
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<tr>
<td>Feature</td>
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<td>Date</td>
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<tr>
<td><strong>Support for copying launch configurations to launch templates (p. 447)</strong></td>
<td>You can now copy all launch configurations in an AWS Region to new launch templates from the Amazon EC2 Auto Scaling console. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide">Copy launch configurations to launch templates</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>August 9, 2021</td>
</tr>
<tr>
<td><strong>Expands instance refresh functionality (p. 447)</strong></td>
<td>You can now include updates, such as a new version of a launch template, when replacing instances by adding your desired configuration to the <code>start-instance-refresh</code> command. You can also skip replacing instances that already have your desired configuration by enabling skip matching. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide">Replacing Auto Scaling instances based on an instance refresh</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>August 5, 2021</td>
</tr>
<tr>
<td><strong>Support for custom termination policies (p. 447)</strong></td>
<td>You can now create custom termination policies with AWS Lambda. For more information, see <a href="https://docs.aws.amazon.com/lambda/latest/dg/python-quickstart.html">Creating a custom termination policy with Lambda</a>. The documentation for specifying termination policies has been updated accordingly.</td>
<td>July 29, 2021</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>The Amazon EC2 Auto Scaling console has been updated and enhanced with additional features to help you create scheduled actions with a time zone specified. The documentation for <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide">Scheduled scaling</a> has been revised accordingly.</td>
<td>June 3, 2021</td>
</tr>
<tr>
<td><strong>gp3 volumes in launch configurations (p. 447)</strong></td>
<td>You can now specify gp3 volumes in the block device mappings for launch configurations.</td>
<td>June 2, 2021</td>
</tr>
<tr>
<td>Support for predictive scaling (p. 447)</td>
<td>You can now use predictive scaling to proactively scale your Amazon EC2 Auto Scaling groups using a scaling policy. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Predictive scaling for Amazon EC2 Auto Scaling</a> in the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Amazon EC2 Auto Scaling User Guide</a>. With this update, the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">AutoScalingServiceRolePolicy</a> managed policy now includes permission to call the <code>cloudwatch:GetMetricData</code> API action.</td>
<td>May 19, 2021</td>
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<tr>
<td>Guide changes (p. 447)</td>
<td>You can now access example templates for lifecycle hooks from GitHub. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/lifecyclehooks/index.html">Amazon EC2 Auto Scaling lifecycle hooks</a> in the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Amazon EC2 Auto Scaling User Guide</a>.</td>
<td>April 9, 2021</td>
</tr>
<tr>
<td>Support for warm pools (p. 447)</td>
<td>You can now balance performance (minimize cold starts) and cost (stop over-provisioning instance capacity) for applications with long first boot times by adding warm pools to Auto Scaling groups. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/lifecyclehooks/index.html">Warm pools for Amazon EC2 Auto Scaling</a> in the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Amazon EC2 Auto Scaling User Guide</a>.</td>
<td>April 8, 2021</td>
</tr>
<tr>
<td>Support for checkpoints (p. 447)</td>
<td>You can now add checkpoints to an instance refresh to replace instances in phases and perform verifications on your instances at specific points. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/lifecyclehooks/index.html">Adding checkpoints to an instance refresh</a> in the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Amazon EC2 Auto Scaling User Guide</a>.</td>
<td>March 18, 2021</td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>Improved documentation for using EventBridge with Amazon EC2 Auto Scaling events and lifecycle hooks. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/eventbridgeguide/index.html">Using Amazon EC2 Auto Scaling with EventBridge</a> and <a href="https://docs.aws.amazon.com/autoscaling/lifecyclehooks/index.html">Tutorial: Configure a lifecycle hook that invokes a Lambda function</a> in the <a href="https://docs.aws.amazon.com/autoscaling/usersguide/index.html">Amazon EC2 Auto Scaling User Guide</a>.</td>
<td>March 18, 2021</td>
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<td>Feature</td>
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<tr>
<td><strong>Support for local time zones</strong> (p. 447)</td>
<td>You can now create recurring scheduled actions in the local time zone by adding the <code>--time-zone</code> option to the <code>put-scheduled-update-group-action</code> command. If your time zone observes Daylight Saving Time (DST), the recurring action automatically adjusts for Daylight Saving Time. For more information, see <a href="#">Scheduled scaling</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>March 9, 2021</td>
</tr>
<tr>
<td>Expands functionality for mixed instances policies (p. 447)</td>
<td>You can now prioritize instance types for your Spot capacity when you use a mixed instances policy. Amazon EC2 Auto Scaling attempts to fulfill priorities on a best-effort basis but optimizes for capacity first. For more information, see <a href="#">Auto Scaling groups with multiple instance types and purchase options</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>March 8, 2021</td>
</tr>
<tr>
<td><strong>Scaling activities for deleted groups</strong> (p. 447)</td>
<td>You can now view scaling activities for deleted Auto Scaling groups by adding the <code>--include-deleted-groups</code> option to the <code>describe-scaling-activities</code> command. For more information, see <a href="#">Troubleshooting Amazon EC2 Auto Scaling</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>February 23, 2021</td>
</tr>
<tr>
<td><strong>Console improvements</strong> (p. 447)</td>
<td>You can now create and attach an Application Load Balancer or Network Load Balancer from the Amazon EC2 Auto Scaling console. For more information, see <a href="#">Create and attach a new Application Load Balancer or Network Load Balancer (console)</a> in the <em>Amazon EC2 Auto Scaling User Guide</em>.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td><strong>Multiple network interfaces</strong> (p. 447)</td>
<td>You can now configure a launch template for an Auto Scaling group that specifies multiple network interfaces. For more information, see <a href="#">Network interfaces in a VPC</a>.</td>
<td>November 23, 2020</td>
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<tr>
<td><strong>Multiple launch templates (p. 447)</strong></td>
<td>Multiple launch templates can now be used with Auto Scaling groups. For more information, see <a href="#">Specifying a different launch template for an instance type</a> in the Amazon EC2 Auto Scaling User Guide.</td>
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</tr>
<tr>
<td><strong>Gateway Load Balancers (p. 447)</strong></td>
<td>Updated guide to show how to attach a Gateway Load Balancer to an Auto Scaling group to ensure that appliance instances launched by Amazon EC2 Auto Scaling are automatically registered and deregistered from the load balancer. For more information, see <a href="#">Elastic Load Balancing types</a> and <a href="#">Attaching a load balancer to your Auto Scaling group</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum instance lifetime (p. 447)</strong></td>
<td>You can now reduce the maximum instance lifetime to one day (86,400 seconds). For more information, see <a href="#">Replacing Auto Scaling instances based on maximum instance lifetime</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td></td>
</tr>
<tr>
<td><strong>Capacity Rebalancing (p. 447)</strong></td>
<td>You can configure your Auto Scaling group to launch a replacement Spot Instance when Amazon EC2 emits a rebalancing recommendation. For more information, see <a href="#">Amazon EC2 Auto Scaling Capacity Rebalancing</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td></td>
</tr>
<tr>
<td><strong>Instance metadata service version 2 (p. 447)</strong></td>
<td>You can require the use of Instance Metadata Service Version 2, which is a session-oriented method for requesting instance metadata, when using launch configurations. For more information, see <a href="#">Configuring the instance metadata options</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td></td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>Various improvements and new console procedures in the Controlling which Auto Scaling instances terminate during scale in, Monitoring your Auto Scaling instances and groups, Launch templates, and Launch configurations sections of the Amazon EC2 Auto Scaling User Guide.</td>
<td>July 28, 2020</td>
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</tr>
<tr>
<td>Instance refresh (p. 447)</td>
<td>Start an instance refresh to update all instances in your Auto Scaling group when you make a configuration change. For more information, see Replacing Auto Scaling instances based on an instance refresh in the Amazon EC2 Auto Scaling User Guide.</td>
<td>June 16, 2020</td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>Various improvements in the Replacing Auto Scaling instances based on maximum instance lifetime, Auto Scaling groups with multiple instance types and purchase options, Scaling based on Amazon SQS, and Tagging Auto Scaling groups and instances sections of the Amazon EC2 Auto Scaling User Guide.</td>
<td>May 6, 2020</td>
</tr>
<tr>
<td>Guide changes (p. 447)</td>
<td>Various improvements to IAM documentation. For more information, see Launch template support and Amazon EC2 Auto Scaling identity-based policy examples in the Amazon EC2 Auto Scaling User Guide.</td>
<td>March 4, 2020</td>
</tr>
<tr>
<td>Disable scaling policies (p. 447)</td>
<td>You can now disable and re-enable scaling policies. This feature allows you to temporarily disable a scaling policy while preserving the configuration details so that you can enable the policy again later. For more information, see Disabling a scaling policy for an Auto Scaling group in the Amazon EC2 Auto Scaling User Guide.</td>
<td>February 18, 2020</td>
</tr>
<tr>
<td><strong>Add notification functionality (p. 447)</strong></td>
<td>Amazon EC2 Auto Scaling now sends events to your AWS Health Dashboard when your Auto Scaling groups cannot scale out due to a missing security group or launch template. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/auto-scaling/latest/userguide/health-dashboard-notifications.html">AWS Health Dashboard notifications for Amazon EC2 Auto Scaling</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>February 12, 2020</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>Various improvements and corrections in the How Amazon EC2 Auto Scaling works with IAM, Amazon EC2 Auto Scaling identity-based policy examples, Required CMK key policy for use with encrypted volumes, and Monitoring your Auto Scaling instances and groups sections of the Amazon EC2 Auto Scaling User Guide.</td>
<td>February 10, 2020</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>Improved documentation for Auto Scaling groups that use instance weighting. Learn how to use scaling policies when using &quot;capacity units&quot; to measure desired capacity. For more information, see How scaling policies work and Scaling adjustment types in the Amazon EC2 Auto Scaling User Guide.</td>
<td>February 6, 2020</td>
</tr>
<tr>
<td><strong>New &quot;Security&quot; chapter (p. 447)</strong></td>
<td>A new Security chapter in the Amazon EC2 Auto Scaling User Guide helps you understand how to apply the shared responsibility model when using Amazon EC2 Auto Scaling. As part of this update, the user guide chapter &quot;Controlling Access to Your Amazon EC2 Auto Scaling Resources&quot; has been replaced by a new, more useful section, Identity and access management for Amazon EC2 Auto Scaling.</td>
<td>February 4, 2020</td>
</tr>
<tr>
<td>Feature</td>
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<tr>
<td>Recommendations for instance types (p. 447)</td>
<td>AWS Compute Optimizer provides Amazon EC2 instance recommendations to help you improve performance, save money, or both. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/autoscaling-recommendations.html">Getting recommendations for an instance type</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>December 3, 2019</td>
</tr>
<tr>
<td>Dedicated Hosts and host resource groups (p. 447)</td>
<td>Updated guide to show how to create a launch template that specifies a host resource group. This allows you to create an Auto Scaling group with a launch template that specifies a BYOL AMI to use on Dedicated Hosts. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/launch-template-host.html">Creating a launch template for an Auto Scaling group</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>December 3, 2019</td>
</tr>
<tr>
<td>Support for Amazon VPC endpoints (p. 447)</td>
<td>You can now establish a private connection between your VPC and Amazon EC2 Auto Scaling. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/vpc-endpoints.html">Amazon EC2 Auto Scaling and interface VPC endpoints</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Maximum instance lifetime (p. 447)</td>
<td>You can now replace instances automatically by specifying the maximum length of time that an instance can be in service. If any instances are approaching this limit, Amazon EC2 Auto Scaling gradually replaces them. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/instance-lifetime.html">Replacing Auto Scaling instances based on maximum instance lifetime</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>November 19, 2019</td>
</tr>
<tr>
<td>Instance weighting (p. 447)</td>
<td>For Auto Scaling groups with multiple instance types, you can now optionally specify the number of capacity units that each instance type contributes to the capacity of the group. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/instance-weighting.html">Instance weighting for Amazon EC2 Auto Scaling</a> in the Amazon EC2 Auto Scaling User Guide.</td>
<td>November 19, 2019</td>
</tr>
<tr>
<td>Change Type</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>Minimum number of instance types (p. 447)</strong></td>
<td>You no longer have to specify additional instance types for groups of Spot, On-Demand, and Reserved Instances. For all Auto Scaling groups, the minimum is now one instance type. For more information, see Auto Scaling groups with multiple instance types and purchase options in the Amazon EC2 Auto Scaling User Guide.</td>
<td>September 16, 2019</td>
</tr>
<tr>
<td><strong>Support for new Spot allocation strategy (p. 447)</strong></td>
<td>Amazon EC2 Auto Scaling now supports a new Spot allocation strategy &quot;capacity-optimized&quot; that fulfills your request using Spot Instance pools that are optimally chosen based on the available Spot capacity. For more information, see Auto Scaling groups with multiple instance types and purchase options in the Amazon EC2 Auto Scaling User Guide.</td>
<td>August 12, 2019</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>Improved Amazon EC2 Auto Scaling documentation in the Service-linked roles and Required CMK key policy for use with encrypted volumes topics.</td>
<td>August 1, 2019</td>
</tr>
<tr>
<td><strong>Support for tagging enhancement (p. 447)</strong></td>
<td>Amazon EC2 Auto Scaling now adds tags to Amazon EC2 instances as part of the same API call that launches the instances. For more information, see Tagging Auto Scaling groups and instances.</td>
<td>July 26, 2019</td>
</tr>
<tr>
<td><strong>Guide changes (p. 447)</strong></td>
<td>Improved Amazon EC2 Auto Scaling documentation in the Suspending and resuming scaling processes topic. Updated Customer managed policy examples to include an example policy that allows users to pass only specific custom suffix service-linked roles to Amazon EC2 Auto Scaling.</td>
<td>June 13, 2019</td>
</tr>
</tbody>
</table>
### Support for new Amazon EBS feature (p. 447)

Added support for new Amazon EBS feature in the launch template topic. Change the encryption state of an EBS volume while restoring from a snapshot. For more information, see [Creating a launch template for an Auto Scaling group](https://docs.aws.amazon.com/autoscaling/ec2/userguide/launch-template-topic.html) in the Amazon EC2 Auto Scaling User Guide.

**Release date:** May 13, 2019

### Guide changes (p. 447)

Improved Amazon EC2 Auto Scaling documentation in the following sections: [Controlling which Auto Scaling instances terminate during scale in](https://docs.aws.amazon.com/autoscaling/ec2/userguide/terminating-instances.html), [Auto Scaling groups](https://docs.aws.amazon.com/autoscaling/ec2/userguide/auto-scaling-groups.html), [Auto Scaling groups with multiple instance types and purchase options](https://docs.aws.amazon.com/autoscaling/ec2/userguide/auto-scaling-groups-multiple-instance-types.html), and [Dynamic scaling for Amazon EC2 Auto Scaling](https://docs.aws.amazon.com/autoscaling/ec2/userguide/dynamic-scaling.html).

**Release date:** March 12, 2019

### Support for combining instance types and purchase options (p. 447)

Provision and automatically scale instances across purchase options (Spot, On-Demand, and Reserved Instances) and instance types within a single Auto Scaling group. For more information, see [Auto Scaling groups with multiple instance types and purchase options](https://docs.aws.amazon.com/autoscaling/ec2/userguide/auto-scaling-groups-multiple-instance-types.html) in the Amazon EC2 Auto Scaling User Guide.

**Release date:** November 13, 2018

### Updated topic for scaling based on Amazon SQS (p. 447)

Updated guide to explain how you can use custom metrics to scale an Auto Scaling group in response to changing demand from an Amazon SQS queue. For more information, see [Scaling based on Amazon SQS](https://docs.aws.amazon.com/autoscaling/ec2/userguide/scale-event-sqs.html) in the Amazon EC2 Auto Scaling User Guide.

**Release date:** July 26, 2018

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The following table describes important changes to the Amazon EC2 Auto Scaling documentation before July 2018.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Release date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for target tracking scaling policies</td>
<td>Set up dynamic scaling for your application in just a few steps. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/target-tracking-scaling-policies.html">Target tracking scaling policies for Amazon EC2 Auto Scaling</a>.</td>
<td>12 July 2017</td>
</tr>
<tr>
<td>Support for resource-level permissions</td>
<td>Create IAM policies to control access at the resource level. For more information, see <a href="https://docs.aws.amazon.com/autoscaling/ec2/userguide/iam-policy-examples.html">Controlling access to your Amazon EC2 Auto Scaling resources</a>.</td>
<td>15 May 2017</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Release date</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Monitoring improvements</td>
<td>Auto Scaling group metrics no longer require that you enable detailed monitoring. You can now enable group metrics collection and view metrics graphs from the Monitoring tab in the console. For more information, see Monitoring your Auto Scaling groups and instances using Amazon CloudWatch.</td>
<td>18 August 2016</td>
</tr>
<tr>
<td>Support for Application Load Balancers</td>
<td>Attach one or more target groups to a new or existing Auto Scaling group. For more information, see Attaching a load balancer to your Auto Scaling group.</td>
<td>11 August 2016</td>
</tr>
<tr>
<td>Events for lifecycle hooks</td>
<td>Amazon EC2 Auto Scaling sends events to EventBridge when it calls lifecycle hooks. For more information, see Getting EventBridge when your Auto Scaling group scales.</td>
<td>24 February 2016</td>
</tr>
<tr>
<td>Instance protection</td>
<td>Prevent Amazon EC2 Auto Scaling from selecting specific instances for termination when scaling in. For more information, see Instance protection.</td>
<td>07 December 2015</td>
</tr>
<tr>
<td>Step scaling policies</td>
<td>Create a scaling policy that enables you to scale based on the size of the alarm breach. For more information, see Scaling policy types.</td>
<td>06 July 2015</td>
</tr>
<tr>
<td>Update load balancer</td>
<td>Attach a load balancer to or detach a load balancer from an existing Auto Scaling group. For more information, see Attaching a load balancer to your Auto Scaling group.</td>
<td>11 June 2015</td>
</tr>
<tr>
<td>Support for ClassicLink</td>
<td>Link EC2-Classic instances in your Auto Scaling group to a VPC, enabling communication between these linked EC2-Classic instances and instances in the VPC using private IP addresses. For more information, see Linking EC2-Classic instances to a VPC.</td>
<td>19 January 2015</td>
</tr>
<tr>
<td>Lifecycle hooks</td>
<td>Hold your newly launched or terminating instances in a pending state while you perform actions on them. For more information, see Amazon EC2 Auto Scaling lifecycle hooks.</td>
<td>30 July 2014</td>
</tr>
<tr>
<td>Detach instances</td>
<td>Detach instances from an Auto Scaling group. For more information, see Detach EC2 instances from your Auto Scaling group.</td>
<td>30 July 2014</td>
</tr>
<tr>
<td>Put instances into a Standby state</td>
<td>Put instances that are in an InService state into a Standby state. For more information, see Temporarily removing instances from your Auto Scaling group.</td>
<td>30 July 2014</td>
</tr>
<tr>
<td>Manage tags</td>
<td>Manage your Auto Scaling groups using the AWS Management Console. For more information, see Tagging Auto Scaling groups and instances.</td>
<td>01 May 2014</td>
</tr>
<tr>
<td>Support for Dedicated Instances</td>
<td>Launch Dedicated Instances by specifying a placement tenancy attribute when you create a launch configuration. For more information, see Instance placement tenancy.</td>
<td>23 April 2014</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Release date</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>Create a group or launch configuration from an EC2 instance</td>
<td>Create an Auto Scaling group or a launch configuration using an EC2 instance. For information about creating a launch configuration using an EC2 instance, see <a href="#">Creating a launch configuration using an EC2 instance</a>. For information about creating an Auto Scaling group using an EC2 instance, see <a href="#">Creating an Auto Scaling group using an EC2 instance</a>.</td>
<td>02 January 2014</td>
</tr>
<tr>
<td>Attach instances</td>
<td>Enable automatic scaling for an EC2 instance by attaching the instance to an existing Auto Scaling group. For more information, see <a href="#">Attach EC2 instances to your Auto Scaling group</a>.</td>
<td>02 January 2014</td>
</tr>
<tr>
<td>View account limits</td>
<td>View the limits on Auto Scaling resources for your account. For more information, see <a href="#">Auto Scaling limits</a>.</td>
<td>02 January 2014</td>
</tr>
<tr>
<td>Console support for Amazon EC2 Auto Scaling</td>
<td>Access Amazon EC2 Auto Scaling using the AWS Management Console. For more information, see <a href="#">Getting started with Amazon EC2 Auto Scaling</a>.</td>
<td>10 December 2013</td>
</tr>
<tr>
<td>Assign a public IP address</td>
<td>Assign a public IP address to an instance launched into a VPC. For more information, see <a href="#">Launching Auto Scaling instances in a VPC</a>.</td>
<td>19 September 2013</td>
</tr>
<tr>
<td>Instance termination policy</td>
<td>Specify an instance termination policy for Amazon EC2 Auto Scaling to use when terminating EC2 instances. For more information, see <a href="#">Controlling which Auto Scaling instances terminate during scale in</a>.</td>
<td>17 September 2012</td>
</tr>
<tr>
<td>Support for IAM roles</td>
<td>Launch EC2 instances with an IAM instance profile. You can use this feature to assign IAM roles to your instances, allowing your applications to access other Amazon Web Services securely. For more information, see <a href="#">Launch Auto Scaling instances with an IAM role</a>.</td>
<td>11 June 2012</td>
</tr>
<tr>
<td>Support for Spot Instances</td>
<td>Launch Spot Instances with a launch configuration. For more information, see <a href="#">Requesting Spot Instances for fault-tolerant and flexible applications</a>.</td>
<td>7 June 2012</td>
</tr>
<tr>
<td>Tag groups and instances</td>
<td>Tag Auto Scaling groups and specify that the tag also applies to EC2 instances launched after the tag was created. For more information, see <a href="#">Tagging Auto Scaling groups and instances</a>.</td>
<td>26 January 2012</td>
</tr>
</tbody>
</table>
### Feature Description

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Release date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Amazon SNS</td>
<td>Use Amazon SNS to receive notifications whenever Amazon EC2 Auto Scaling launches or terminates EC2 instances. For more information, see <a href="#">Getting SNS notifications when your Auto Scaling group scales</a>.</td>
<td>20 July 2011</td>
</tr>
<tr>
<td></td>
<td>Amazon EC2 Auto Scaling also added the following new features:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The ability to set up recurring scaling activities using cron syntax. For more information, see the <a href="#">PutScheduledUpdateGroupAction</a> API operation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A new configuration setting that allows you to scale out without adding the launched instance to the load balancer (LoadBalancer). For more information, see the <a href="#">ProcessType</a> API data type.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The ForceDelete flag in the <a href="#">DeleteAutoScalingGroup</a> operation that tells Amazon EC2 Auto Scaling to delete the Auto Scaling group with the instances associated to it without waiting for the instances to be terminated first. For more information, see the <a href="#">DeleteAutoScalingGroup</a> API operation.</td>
<td></td>
</tr>
<tr>
<td>Scheduled scaling actions</td>
<td>Added support for scheduled scaling actions. For more information, see <a href="#">Scheduled scaling for Amazon EC2 Auto Scaling</a>.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Support for Amazon VPC</td>
<td>Added support for Amazon VPC. For more information, see <a href="#">Launching Auto Scaling instances in a VPC</a>.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Support for HPC clusters</td>
<td>Added support for high performance computing (HPC) clusters.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Support for health checks</td>
<td>Added support for using Elastic Load Balancing health checks with Amazon EC2 Auto Scaling-managed EC2 instances. For more information, see <a href="#">Using ELB health checks with Auto Scaling</a>.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Support for CloudWatch alarms</td>
<td>Removed the older trigger mechanism and redesigned Amazon EC2 Auto Scaling to use the CloudWatch alarm feature. For more information, see <a href="#">Dynamic scaling for Amazon EC2 Auto Scaling</a>.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Suspend and resume scaling</td>
<td>Added support to suspend and resume scaling processes.</td>
<td>2 December 2010</td>
</tr>
<tr>
<td>Support for IAM</td>
<td>Added support for IAM. For more information, see <a href="#">Controlling access to your Amazon EC2 Auto Scaling resources</a>.</td>
<td>2 December 2010</td>
</tr>
</tbody>
</table>