Auto Scaling

Developer Guide

API Version 2011-01-01

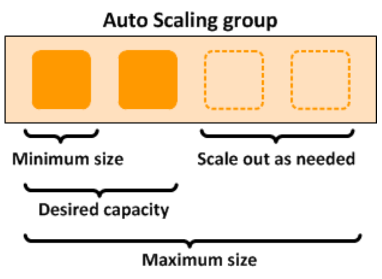
Auto Scaling: Developer Guide

Table of Contents

What Is Auto Scaling?

Auto Scaling helps you ensure that you have the correct number of 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 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 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, Auto Scaling ensures that your group has this many instances. If you specify scaling policies, then 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 1 instance, a desired capacity of 2 instances, and a maximum size of 4 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 Auto Scaling, see Benefits of Auto Scaling (p. 3).

Auto Scaling Components

The following table describes the key components of Auto Scaling.

	Groups 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. 8).
	Launch configurations Your group uses a *launch configuration* as a template for its EC2 instances. When you create a launch configuration, 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 Configurations (p. 7).
	Scaling plans A *scaling plan* tells Auto Scaling when and how to scale. For example, you can base a scaling plan on the occurrence of specified conditions (dynamic scaling) or on a schedule. For more information, see Scaling Plans (p. 8).

Getting Started

If you're new to Auto Scaling, we recommend that you review Auto Scaling Lifecycle (p. 9) before you begin.

To begin, complete the Getting Started with the Auto Scaling CLI (p. 22) tutorial to create an Auto Scaling group and see how it responds when an instance in that group terminates. If you already have running EC2 instances, you can create an Auto Scaling group using an existing EC2 instance, and remove the instance from the group at any time. After you are familiar with how Auto Scaling works, read *Planning Your Auto Scaling Group* (p. 26) to learn how to make the most of Auto Scaling.

Accessing Auto Scaling

AWS provides a web-based user interface, the AWS Management Console. If you've signed up for an AWS account, you can access Auto Scaling by signing into the AWS Management Console. To get started, select **EC2** from the console home page, and then select **Launch Configurations** from the navigation pane.

If you prefer to use a command line interface, you have several options:

AWS Command Line Interface (CLI)
: Provides commands for a broad set of AWS products, and is supported on Windows, Mac, and Linux. To get started, see AWS Command Line Interface User Guide. For more information about the commands for Auto Scaling, see autoscaling in the *AWS Command Line Interface Reference*.

Auto Scaling Command Line Interface (CLI) Tools
: Provides commands for Auto Scaling, and is supported on Windows, Mac, and Linux. To get started, see Install the Auto Scaling CLI (p. 16).

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 about the cmdlets for Auto Scaling, see the AWS Tools for Windows PowerShell Reference.

Auto Scaling provides a Query API. These requests are HTTP or HTTPS requests that use the HTTP verbs GET or POST and a Query parameter named `Action`. For more information about the API actions for Amazon EC2, see Actions in the *Amazon EC2 API Reference*.

If you prefer to build applications using language-specific APIs instead of submitting a request over HTTP or HTTPS, AWS provides libraries, sample code, tutorials, and other resources for software developers. These libraries provide basic functions that automate tasks such as cryptographically signing your requests, retrying requests, and handling error responses, making it is easier for you to get started. For more information, see AWS SDKs and Tools.

For information about your credentials for accessing AWS, see AWS Security Credentials in the *Amazon Web Services General Reference*.

Pricing for Auto Scaling

There are no additional fees with Auto Scaling, so it's easy to try it out and see how it can benefit your AWS architecture.

Related Services

To automatically distribute incoming application traffic across multiple instances in your Auto Scaling group, use Elastic Load Balancing. For more information, see Elastic Load Balancing Developer Guide.

To monitor basic statistics for your instances and Amazon EBS volumes, use Amazon CloudWatch. For more information, see the Amazon CloudWatch Developer Guide.

To monitor the calls made to the Auto Scaling API for your account, including calls made by the AWS Management Console, command line tools, and other services, use AWS CloudTrail. For more information, see the AWS CloudTrail User Guide.

Benefits of Auto Scaling

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

- Better fault tolerance. Auto Scaling can detect when an instance is unhealthy, terminate it, and launch an instance to replace it.
- Better availability. You can configure Auto Scaling to use multiple Availability Zones. If one Availability Zone becomes unavailable, Auto Scaling can launch instances in another one to compensate.

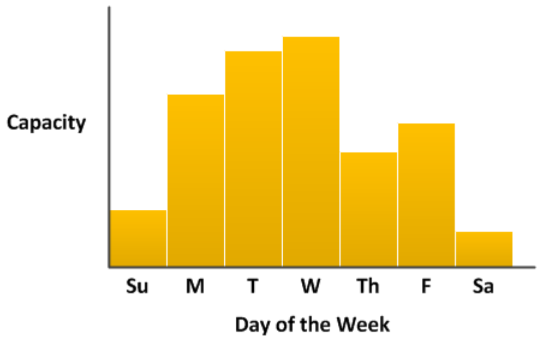
- Better cost management. Auto Scaling can dynamically increase and decrease capacity as needed. Because you pay for the EC2 instances you use, you save money by launching instances when they are actually needed and terminating them when they aren't needed.

Contents

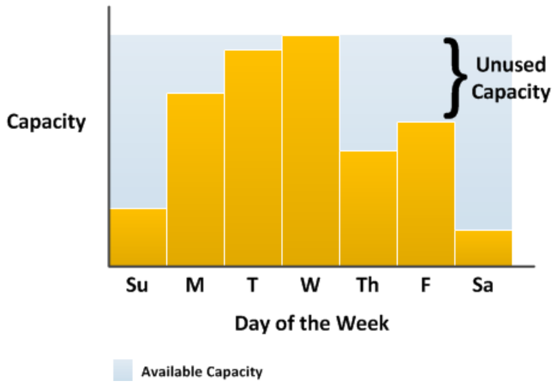
Example: Covering Variable Demand

To demonstrate some of the benefits of 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 demands on the application increases significantly.

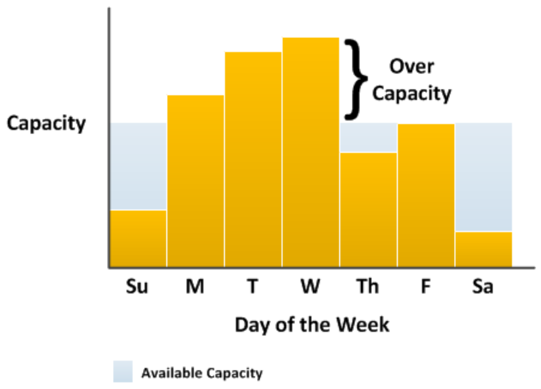
The following graph shows how much of the application's capacity is used over the course of a week.



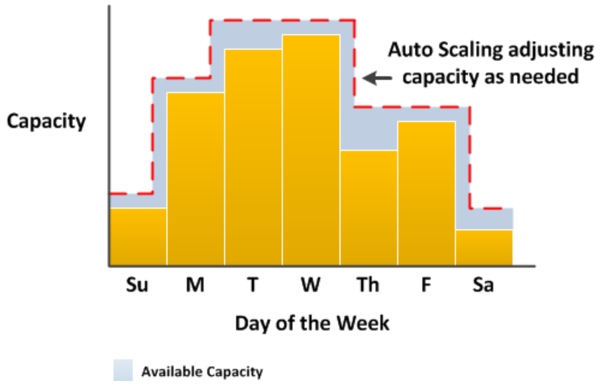
Traditionally, there are two ways to plan for these changes in capacity. The first option is to add enough servers so that the application always has enough capacity to meet demand. The downside of this option, however, is that there are days in which the application doesn't need this much capacity. 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 demands 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 demands on the application exceeds its capacity.

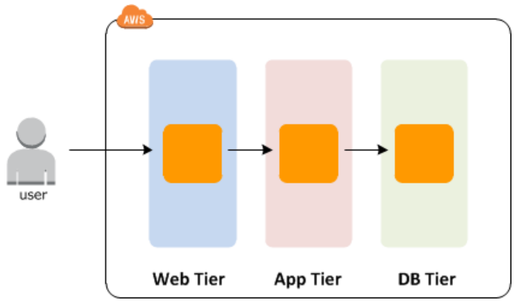


By adding Auto Scaling to this application, you have a third option available. You can add new instances to the application only when necessary, and terminate them when they're no longer needed. And because Auto Scaling uses EC2 instances, you only have to pay for the instances you use, when you use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

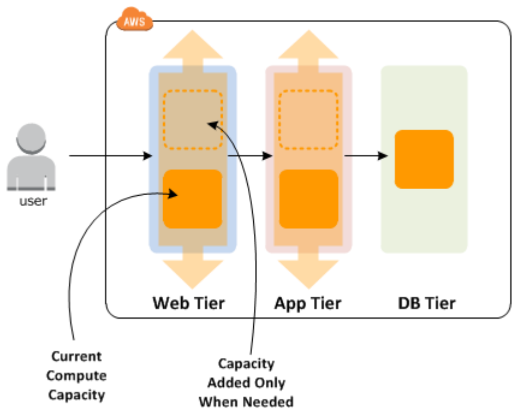


Example: Web App Architecture

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.



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 can help you 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 Load Balance Your Auto Scaling Group (p. 86).

Example: Distributing Instances Across Availability Zones

AWS resources, such as EC2 instances, are housed in highly-available data centers. To provide additional scalability and reliability, these data centers are in different physical locations. *Regions* are large and widely dispersed geographic locations. Each region contains multiple distinct locations, called *Availability Zones*, that are engineered to be isolated from failures in other Availability Zones and provide inexpensive, low-latency network connectivity to other Availability Zones in the same region. For information about the regions for Auto Scaling, see Regions and Endpoints: Auto Scaling in the *Amazon Web Services General Reference*.

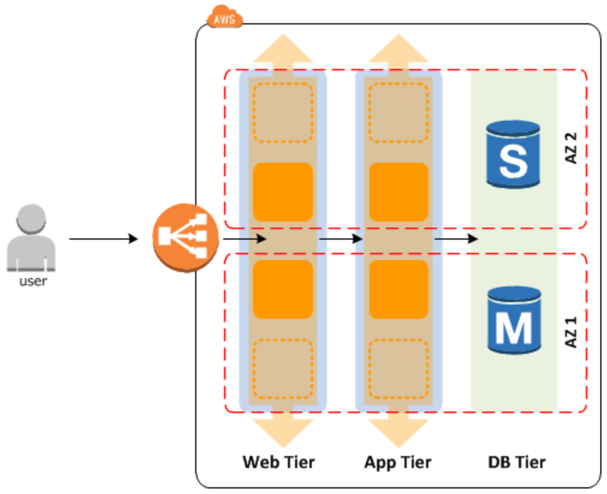
Auto Scaling enables you to take advantage of the safety and reliability of geographic redundancy by spanning Auto Scaling groups across multiple Availability Zones within a region. When one Availability Zone becomes unhealthy or unavailable, Auto Scaling launches new instances in an unaffected Availability Zone. When the unhealthy Availability Zone returns to a healthy state, Auto Scaling automatically redistributes the application instances evenly across all of the designated Availability Zones.

An Auto Scaling group can contain EC2 instances in one or more Availability Zones within the same region. However, Auto Scaling groups cannot span multiple regions.

For Auto Scaling groups in a VPC, the EC2 instances are launched in subnets. You can create your VPC with one or more subnets in each Availability Zone. You select the subnets for your EC2 instances when you create or update the Auto Scaling group. For more information, see Auto Scaling and Amazon Virtual Private Cloud (p. 61).

Instance Distribution

Auto Scaling attempts to distribute instances evenly between the Availability Zones that are enabled for your Auto Scaling group. Auto Scaling does this by attempting to launch new instances in the Availability Zone with the fewest instances. If the attempt fails, however, Auto Scaling attempts to launch the instances in another Availability Zone until it succeeds. For each instance that Auto Scaling launches in a VPC, it selects a subnet from the Availability Zone at random.



Rebalancing Activities

Certain operations and conditions can cause your Auto Scaling group to become unbalanced between Availability Zones. Auto Scaling compensates by creating a rebalancing activity under any of the following conditions:

- You issue a request to change the Availability Zones for your group.
- You explicitly call for termination of a specific instance that caused the group to become unbalanced.
- An Availability Zone that previously had insufficient capacity recovers and has additional capacity available.

When rebalancing, Auto Scaling launches new instances before terminating the old ones, so that rebalancing does not compromise the performance or availability of your application.

Because Auto Scaling attempts to launch new instances before terminating the old 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 by a 10 percent margin (or by a 1-instance margin, 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 typically a few minutes.

Launch Configurations

A *launch configuration* is a template that an Auto Scaling group uses to launch EC2 instances. When you create a launch configuration, you specify information for the instances such as the ID of the Amazon Machine Image (AMI), the instance type, a key pair, one or more security groups, and a block device mapping.

When you create an Auto Scaling group, you must specify a launch configuration. 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. Therefore, if you want to change the launch configuration for your Auto Scaling group, you must create a new launch configuration and then update your Auto Scaling group with the new launch configuration. When you change the launch configuration for your Auto Scaling group, any new instances are launched using the new configuration parameters, but existing instances are not affected.

For information about creating a launch configuration, see Creating Launch Configurations (p. 54).

Auto Scaling Groups

An *Auto Scaling group* contains a collection of EC2 instances that share similar characteristics and are treated as a logical grouping for the purposes of instance scaling and management. For example, if a single application operates across multiple instances, you might want to increase the number of instances in that group to improve the performance of the application, or decrease the number of instances to reduce costs when demand is low. You can use the Auto Scaling group to scale the number of instances automatically based on criteria that you specify, or maintain a fixed number of instances even if a instance becomes unhealthy. This automatic scaling and maintaining the number of instances in an Auto Scaling group is the core value of the Auto Scaling service.

When you create a Auto Scaling group, you must specify a name, launch configuration, minimum number of instances, and maximum number of instances. You can optionally specify a desired capacity, which is the number of instances that the group must have at all times. If you don't specify a desired capacity, the default desired capacity is the minimum number of instances that you specified. For information about creating an Auto Scaling group, see Creating Auto Scaling Groups (p. 58).

An Auto Scaling group starts by launching enough EC2 instances to meet its desired capacity. The Auto Scaling group maintains this number of instances by performing periodic health checks on the instances in the group. If an instance becomes unhealthy, the group terminates the unhealthy instance and launches another instance to replace it.

You can use scaling policies to increase or decrease the number of running EC2 instances in your group automatically to meet changing conditions. When the scaling policy is in effect, the Auto Scaling group adjusts the desired capacity of the group and launches or terminates the instances as needed. If you manually scale or scale on a schedule, you must adjust the desired capacity of the group in order for the changes to take effect. For more information, see Scaling Plans (p. 8).

Scaling Plans

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 minimum or specified number of running instances at all times. To maintain the current instance levels, Auto Scaling performs a periodic health check on running instances within an Auto Scaling group. When Auto Scaling finds an unhealthy instance, it terminates that instance and launches a new one. For information about configuring your Auto Scaling group to maintain the current instance levels, see Maintaining a Fixed Number of EC2 Instances in Your Auto Scaling Group (p. 34).

Manual scaling

Manual scaling is the most basic way to scale your resources. You only need to specify the change in the maximum, minimum, or desired capacity of your Auto Scaling group. Auto Scaling manages the process of creating or terminating instances to maintain the updated capacity. For more information, see Manual Scaling (p. 35).

Scale based on a schedule

Sometimes you know exactly when you will need to increase or decrease the number of instances in your group, simply because that need arises on a predictable schedule. Scaling by schedule means that scaling actions are performed automatically as a function of time and date. For more information, see Scheduled Scaling (p. 42).

Scale based on demand

A more advanced way to scale your resources, scaling by policy, lets you define parameters that control the Auto Scaling process. For example, you can create a policy that calls for enlarging your fleet of EC2 instances whenever the average CPU utilization rate stays above ninety percent for fifteen minutes. This is useful when you can define how you want to scale in response to changing conditions, but you don't know when those conditions will change. You can set up Auto Scaling to respond for you.

Note that you should have two policies, one for scaling in (terminating instances) and one for scaling out (launching instances), for each event to monitor. For example, if you want to scale out when the network bandwidth reaches a certain level, create a policy specifying that Auto Scaling should start a certain number of instances to help with your traffic. But you may also want an accompanying policy to scale in by a certain number when the network bandwidth level goes back down. For more information, see Dynamic Scaling (p. 35).

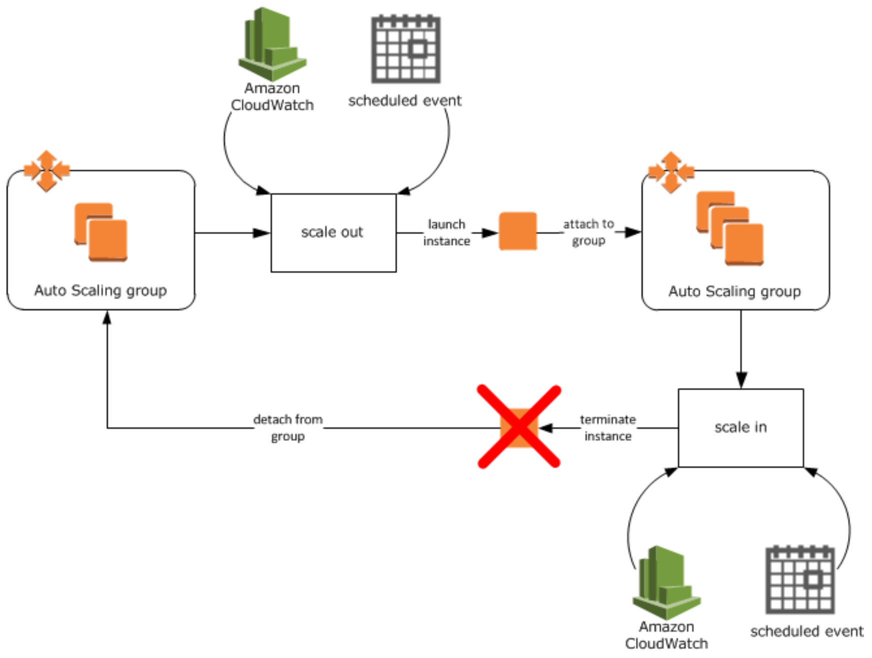
Auto Scaling Lifecycle

Like Amazon EC2 instances launched manually, instances in an Auto Scaling group follow a specific path, or lifecycle. For Auto Scaling instances, this lifecycle starts when you create a new Auto Scaling group or when a scale out event occurs. At that point, a new instance launches and is put into service by the Auto Scaling group. The lifecycle ends when a corresponding scale in event occurs, at which point the Auto Scaling group detaches the instance and terminates it.

Contents

Auto Scaling Basic Lifecycle

The following illustration shows the basic lifecycle of instances within an Auto Scaling group. The Auto Scaling group has a desired capacity of two instances, a CloudWatch alarm that can trigger scaling events, and policies that scale the group at specific dates and times.



Each part of the lifecycle has performance implications for your Auto Scaling group.

Scale out

These events direct the Auto Scaling group to launch new instances and add them to the group. For example:

- You manually (p. 35) increase the number of instances, either by setting a new minimum number of instances or desired capacity for the group.
- You use a Amazon CloudWatch alarm (p. 35) to monitor your application and scale based on specified criteria.
- You use a schedule-based policy (p. 42) to increase or decrease the number of instances in the group at a specific time.
- An existing instance fails required health checks, or you manually configure an instance (p. 106) to have a have an `Unhealthy` status.

Launch instances

After a scale out event occurs, the Auto Scaling group uses its assigned launch configuration to launch one or more EC2 instances. The number of instances launched depends on how you configured the scaling policies for your group. Instances that have launched but are not yet fully configured are typically in the `Pending` (p. 12) state. You have the option of adding a hook to your Auto Scaling group that puts instances in this state into a `Pending:Wait`. This state allows you to access these instances before they are put into service.

Attach instances to the Auto Scaling group

After an instance is launched and fully configured, it is put into service and attached to the Auto Scaling group. The instance now counts against the minimum size, maximum size, and desired capacity (if set) for the Auto Scaling group. These instances are in the `InService` state.

Scale in

These events direct the Auto Scaling group to terminate instances and detach them from the group. They can be triggered in the same way as a scale out event. It is important that you create a 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.

Terminate instances

Finally, the instance is completely terminated.

Detach instances from the Auto Scaling group

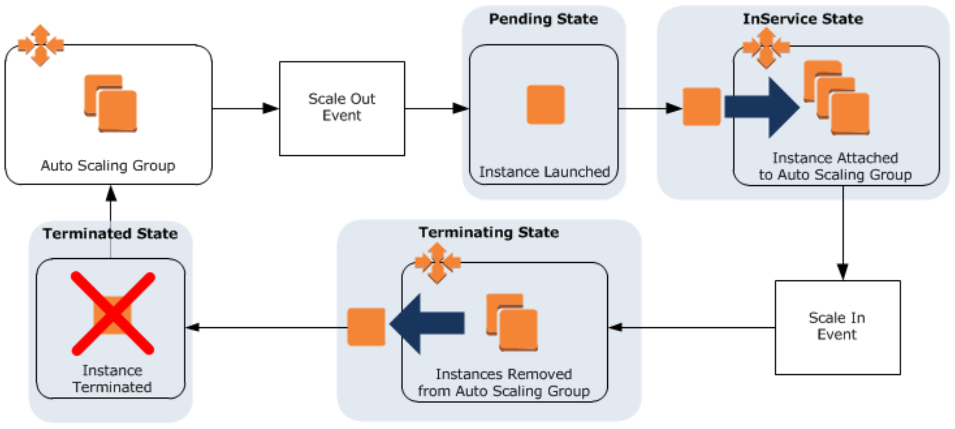
After a scale in event occurs, the Auto Scaling group detaches one or more instances. How the Auto Scaling group determines which instance to terminate depends on its termination policy (p. 31). Instances that are in the process of detaching from the Auto Scaling group and shutting down are in the `Terminating` (p. 13) state. You have the option of adding a hook to your Auto Scaling group instances in this state into a `Terminating:Wait` state. This state allows you to access these instances before they are terminated.

Auto Scaling Instance States

Instances in an Auto Scaling group can be in one of four main states:

- Pending (p. 12)
- InService (p. 12)
- Terminating (p. 13)
- Terminated

The following diagram shows how an instance moves from one state to another.



You can take specific actions when an instance is in one of these states:

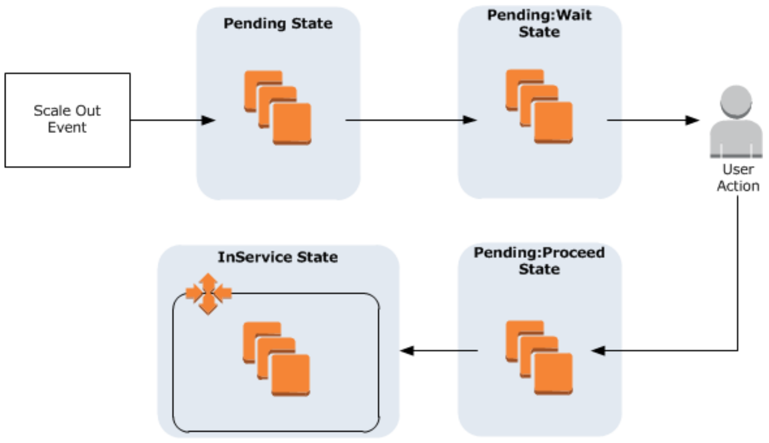
State	Action
Pending	Installing Software to Pending Instances (p. 70) Filling a Cache of Servers (p. 72)
InService	Updating or Modifying Instances in an Auto Scaling Group (p. 97) Troubleshooting Instances in an Auto Scaling Group (p. 95)

State	Action
Terminating	Analyzing an Instance Before Termination (p. 73) Retrieving Logs from Terminating Instances (p. 74)

Auto Scaling Pending State

When an Auto Scaling group reaches a scale out threshold, it launches one or more instances (as determined by your scaling policy). These instances are configured based on the launch configuration for the Auto Scaling group. While an instance is launched and configured, it is in a `Pending` state.

Depending on how you want to manage your Auto Scaling group, the `Pending` state can be divided into two additional states: `Pending:Wait` and `Pending:Proceed`. You can use these states to perform additional actions before the instances are added to the Auto Scaling group.



Examples of these additional actions include:

- Installing Software to Pending Instances (p. 70)
- Filling a Cache of Servers (p. 72)

Note
You are billed for instances as soon as they are launched. This means you will incur charges even if instances are in a `Pending:Wait` state but are not yet in service.

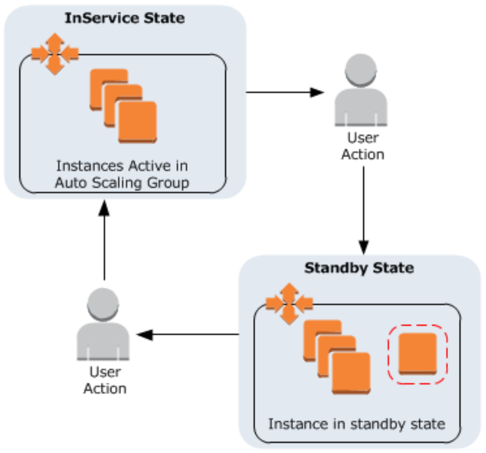
Auto Scaling InService State

Instances that are functioning within your application as part of an Auto Scaling group are in the `InService` state. Instances remain in this state until:

- An Auto Scaling scale in event occurs, reducing the size of the Auto Scaling group
- You put the instance into a `Standby` state.
- You manually detach the instance from the Auto Scaling group
- The instance fails a required number of health checks or you manually set the status of the instance to `Unhealthy`.

In addition, any running instances that you attach to the Auto Scaling group are also in the `InService` state.

You have the option of putting any `InService` instance into a `Standby` state. Instances in this 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.


InService State
Instances Active in Auto Scaling Group
User Action
Standby State
Instance in standby state
User Action

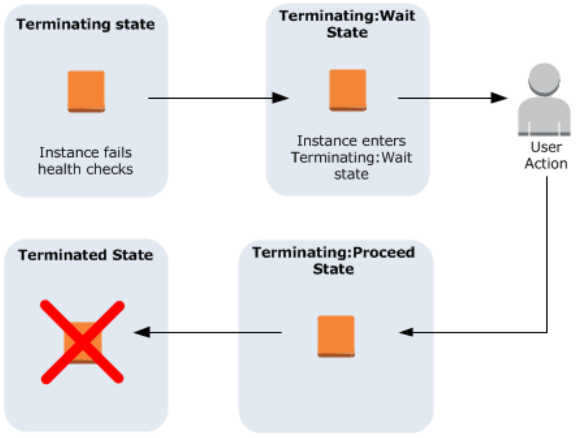
Examples of when you might put instances into the `Standby` state include:

- To update or modify (p. 97) the instance
- To troubleshoot an instance (p. 95) that isn't performing as expected

Auto Scaling Terminating State

Instances that fail a required number of health checks are removed from an Auto Scaling group and terminated. The instances first enter the `Terminating` state, then `Terminated`..

Depending on how you want to manage your Auto Scaling group, the `Terminating` state can be divided into two additional states: `Terminating:Wait` and `Terminating:Proceed`. You can use these states to perform additional actions before the instances are terminated.


Terminating state
Instance fails health checks
Terminating:Wait State
Instance enters Terminating:Wait state
User Action
Terminated State
Terminating:Proceed State

Examples of actions you can take while an instance is terminating include:

- Analyzing an instance (p. 73) to understand why it failed
- Retrieving logs (p. 74) stored on the instance.

Important
You can use lifecycle hooks with Spot Instances. However, a lifecycle hook does not prevent an instance from terminating due to a change in the Spot Price, which can happen at any time.

In addition, when a Spot Instance terminates, you must still complete the lifecycle action (such as with the **as-complete-lifecycle-action** command or **CompleteLifecycleAction** API call). For more information, see Spot Instances.

Auto Scaling Limits

Your AWS account comes with default limits on your AWS resources. To learn about the default limits for Auto Scaling, see AWS Service Limits: Auto Scaling Limits.

If you reach the default limit for an AWS resource, you can request a limit increase. For more information, see AWS Service Limits.

To view the current limit on your Auto Scaling resources, use the describe-account-limits (AWS CLI) command or the `as-describe-account-limits` (Auto Scaling CLI) command.

Setting Up Auto Scaling

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

Tasks

Sign Up for AWS

When you create an AWS account, we automatically sign up your account for all AWS services. You pay only for the services that you use. You can use Auto Scaling at no additional charge beyond what you are paying for your EC2 instances.

If you don't have an AWS account, sign up for AWS as follows.

To sign up for an AWS account

1. Open http://aws.amazon.com/, and then click **Sign Up**.
2. Follow the on-screen instructions.

   Part of the sign-up procedure involves receiving a phone call and entering a PIN using the phone keypad.

AWS sends you a confirmation e-mail after the sign-up process is complete.

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 Microsoft Windows Instances*, depending on which operating system you plan to use for your EC2 instances.

Install the Auto Scaling CLI

Complete the following tasks to set up the Auto Scaling CLI.

Tasks

Set the JAVA_HOME Environment Variable

If you do not have Java 1.5 or later installed, download and install it now. To view and download JREs for a range of platforms, including Linux/UNIX and Windows, go to http://java.oracle.com/.

The commands use the `JAVA_HOME` environment variable to locate the Java runtime. The CLI requires Java version 5 or later to run. You can use either a JRE or JDK installation.

Set `JAVA_HOME` to the full path of the directory that contains a subdirectory named `bin` that in turn contains the Java executable. For example, if your Java executable is in the `/usr/jdk/bin` directory, set `JAVA_HOME` to `/usr/jdk`. If your Java executable is in `C:\jdk\bin`, set `JAVA_HOME` to `C:\jdk`.

For detailed directions on setting this environment variable, see Tell the Tools Where Java Lives (Linux or Mac OS X) or Set the JAVA_HOME Environment Variable (Windows) in the *Amazon EC2 Command Line Reference*.

Install the Auto Scaling CLI

To use the Auto Scaling CLI, you need to download it and set it up to use your AWS credentials.

Tasks

Get the CLI

The CLI is available as a ZIP file in the Auto Scaling Command Line Tools website. These CLI tools are written in Java and include shell scripts for both Windows and Linux/Unix/Mac OS X. The ZIP file is self-contained; no installation is required. You just download ZIP file and unzip it.

Set the Environment Variable for the CLI

The CLI depends on an environment variable (`AWS_AUTO_SCALING_HOME`) to locate supporting libraries. You need to set this environment variable before you can use the CLI. You should set this variable to the path of the directory into which the CLI was unzipped. This directory is named `AutoScaling-a.b.c.d` (a, b, c, and d are version/release numbers) and contains sub-directories named `bin` and `lib`.

Linux/Unix

The following Linux/Unix example sets `AWS_AUTO_SCALING_HOME` for a directory named `AutoScaling-1.0.61.6` in the `/usr/local` directory.

```
$ export AWS_AUTO_SCALING_HOME=/usr/local/AutoScaling-1.0.61.6
```

In addition, you can add the CLI `bin` directory to your system `PATH` to avoid having to reference this directory specifically in every command. The examples in this guide assume that you have modified your `PATH` as follows.

```
$ export PATH=$PATH:$AWS_AUTO_SCALING_HOME/bin
```

Windows

The following Windows example sets `AWS_AUTO_SCALING_HOME` for a directory named `AutoScaling-1.0.61.6` in the `C:\CLIs` directory.

> **Note**
> If you set a Windows environment variable with **set**, it is reset when you close the command window. To set Windows environment variables permanently, use the **setx** command instead.

```
C:\> set AWS_AUTO_SCALING_HOME=C:\CLIs\AutoScaling-1.0.61.6
C:\> setx AWS_AUTO_SCALING_HOME C:\CLIs\AutoScaling-1.0.61.6
```

In addition, you can add the CLI `bin` directory to your system `PATH` to avoid having to reference this directory specifically in every command. The examples in this guide assume that you have modified your `PATH` as follows.

```
C:\> set PATH=%PATH%;%AWS_AUTO_SCALING_HOME%\bin
C:\> setx PATH %PATH%;%AWS_AUTO_SCALING_HOME%\bin
```

Manage Access for the CLI

After you sign up for AWS, you must create access keys for the account. Your access keys consists of an access key ID and a secret access key. You must provide your access keys to the CLI to authenticate the commands that you issue. The CLI reads your access keys from a credential file that you create on your local system.

You can either specify your credential file with the *--aws-credential-file* parameter every time you issue a command, or you can create an environment variable that points to the credential file on your local system. If the environment variable is properly configured, you can omit the *--aws-credential-file* parameter when you issue a command. The following procedure describes how to create a credential file and a corresponding `AWS_CREDENTIAL_FILE` environment variable.

To create a credential file on your local system

1. Retrieve your access keys

   Although you can retrieve the access key ID from the **Security Credentials** page, you cannot retrieve the secret access key. You'll need to create new access keys if the secret access key was lost or forgotten. You can create new access keys for the account by going to the Security Credentials page. In the **Access Keys** section, click **Create New Root Key**.
2. Write down your secret key and access key ID, or save them.
3. Add your access key ID and secret access key to the file named `credential-file-path.template`:

   a. Open the file `credential-file-path.template` included in your CLI archive.
   b. Copy and paste your access key ID and secret access key into the file.
   c. Rename the file and save it to a convenient location on your computer.
   d. If you are using Linux, set the file permissions as follows:

   ```
   $ chmod 600 credential-file-name
   ```

4. Set the `AWS_CREDENTIAL_FILE` environment variable to the fully qualified path of the file you just created.

   The following Linux/Unix example sets `AWS_CREDENTIAL_FILE` for `myCredentialFile` in the `/usr/local` directory.

   ```
   $ export AWS_CREDENTIAL_FILE=/usr/local/myCredentialFile
   ```

   The following Windows example sets `AWS_CREDENTIAL_FILE` for `myCredentialFile.txt` in the `C:\aws` directory.

   ```
   C:\> set AWS_CREDENTIAL_FILE=C:\aws\myCredentialFile.txt
   C:\> setx AWS_CREDENTIAL_FILE C:\aws\myCredentialFile.txt
   ```

Change the Region

By default, the Auto ScalingCLI uses the US East (N. Virginia) region (`us-east-1`) with the `autoscaling.us-east-1.amazonaws.com` service endpoint URL. If your instances are in a different region, you must specify the region where your instances reside. For example, if your instances are in Europe, you must specify the EU (Ireland) region by using the `--region eu-west-1` parameter or by setting the `AWS_AUTO_SCALING_URL` environment variable.

This section describes how to specify a different region by changing the service endpoint URL.

Note
Keep in mind that if you set the *EC2_REGION* environment variable, such as **us-east-1**, its value supersedes any value you set using *AWS_AUTO_SCALING_URL*.

To specify a different region

1. To view available regions, see Regions and Endpoints in the *AWS General Reference*.
2. If you want to change the service endpoint, set the AWS_AUTO_SCALING_URL environment variable as follows:
   - The following Linux example sets AWS_AUTO_SCALING_URL to the EU (Ireland) region.

```
$ export AWS_AUTO_SCALING_URL=https://autoscaling.eu-west-1.amazonaws.com
```

   - The following Windows example sets AWS_AUTO_SCALING_URL to the EU (Ireland) region.

```
C:\> set AWS_AUTO_SCALING_URL=https://autoscaling.eu-west-1.amazonaws.com

C:\> setx AWS_AUTO_SCALING_URL https://autoscaling.eu-west-1.amazonaws.com
```

Verify that the Auto Scaling CLI is Installed

Before you begin using the CLI, you should verify that it is properly installed. Type the following command:

```
as-cmd
```

The output is similar to the following.

```
Command Name                                  Description

------------                                  -----------

as-attach-instances                           Attaches Instances to Auto Scaling
 group
as-complete-lifecycle-action                 Completes the Lifecycle Ac... asso
ciated with the token
as-create-auto-scaling-group                  Create a new Auto Scaling group.
as-create-launch-config                      Creates a new launch configuration.
as-create-or-update-tags                      Create or update tags.
as-create-or-update-trigger                   Creates a new trigger or updates
an existing trigger.
as-delete-auto-scaling-group                  Deletes the specified Auto Scaling
 group.
as-delete-launch-config                     Deletes the specified launch config
uration.
as-delete-lifecycle-hook                      Deletes the specified lifecycle
hook.
as-delete-notification-configuration          Deletes the specified notification
 configuration.
as-delete-policy                              Deletes the specified policy.
```

```
as-delete-scheduled-action                  Deletes the specified scheduled
action.
as-delete-tags                              Delete the specified tags
as-delete-trigger                           Deletes a trigger.
as-describe-account-limits                  Describes limits for the account.
as-describe-adjustment-types                Describes all policy adjustment
types.
as-describe-auto-scaling-groups            Describes the specified Auto Scaling
 groups.
as-describe-auto-scaling-instances         Describes the specified Auto Scaling
 instances.
as-describe-auto-scaling-notification-types Describes all Auto Scaling notific
ation types.
as-describe-launch-configs                  Describes the specified launch
configurations.
as-describe-lifecycle-hook-types           Describes all Auto Scaling lifecycle
 hook transition types.
as-describe-lifecycle-hooks                 Describes the specified lifecycle
hooks.
as-describe-metric-collection-types        Describes all metric colle... metric
 granularity types.
as-describe-notification-configurations     Describes all notification...given
 Auto Scaling groups.
as-describe-policies                        Describes the specified policies.
as-describe-process-types                   Describes all Auto Scaling process
 types.
as-describe-scaling-activities              Describes a set of activities be
longing to a group.
as-describe-scheduled-actions               Describes the specified scheduled
actions.
as-describe-tags                            Describes tags
as-describe-termination-policy-types       Describes all Auto Scaling termina
tion policy types.
as-describe-triggers                        Describes a trigger, including its
 internal state.
as-detach-instances                        Detaches Instances from Auto Scaling
 group
as-disable-metrics-collection              Disables collection of Auto Scaling
 group metrics.
as-enable-metrics-collection                Enables collection of Auto Scaling
 group metrics.
as-enter-standby                            Move instances into Standby
as-execute-policy                           Executes the specified policy.
as-exit-standby                             Move instances out of Standby
as-put-lifecycle-hook                      Creates or updates a Lifecycle Hook.
as-put-notification-configuration          Creates or replaces notifi...or the
 Auto Scaling group.
as-put-scaling-policy                       Creates or updates an Auto Scaling
 policy.
as-put-scheduled-update-group-action       Creates or updates a scheduled update
 group action.
as-record-lifecycle-action-heartbeat       Records a heartbeat for th... asso
ciated with the token
as-resume-processes                        Resumes all suspended Auto... given
 Auto Scaling group.
as-set-desired-capacity                     Sets the desired capacity of the
Auto Scaling group.
as-set-instance-health                      Sets the health of the instance.
```

```
as-suspend-processes                       Suspends all Auto Scaling ... given
 Auto Scaling group.
as-terminate-instance-in-auto-scaling-group Terminates a given instance.
as-update-auto-scaling-group                Updates the specified Auto Scaling
 group.
help
version                                     Prints the version of the CLI tool
 and the API.

    For help on a specific command, type 'commandname --help'
```

Commands

To list the commands for the Auto Scaling CLI, use the following command:

```
as-cmd
```

To get a description of a command, use the following command:

```
as-cmd command --help
```

For a summary of commands and the general options that you can use with any Auto Scaling command, see the Auto Scaling Quick Reference Card.

Getting Started with the Auto Scaling CLI

You can use the Auto Scaling CLI to create your basic Auto Scaling infrastructure.

Prerequisites

Before you can use the Auto Scaling CLI, you must install the tools. For more information, see Install the Auto Scaling CLI (p. 16).

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 Microsoft Windows Instances*, depending on which operating system you plan to use for your EC2 instances.

Tasks

Create a Launch Configuration

A launch configuration serves as a template that Auto Scaling uses to launch EC2 instances. This template contains all the information necessary for Auto Scaling to launch instances that run your application (for example, the ID of an Amazon Machine Image (AMI), a key pair, and one or more security groups). For more information, see Launch Configurations (p. 7).

To create a launch configuration, use the `as-create-launch-config` command. The syntax for this command is as follows:

```
as-create-launch-config LaunchConfigurationName --image-id value --instance-type
value [--associate-public-ip-address value] [--spot-price value]
[--iam-instance-profile value] [--block-device-mapping
"key1=value1,key2=value2..." ] [--ebs-optimized] [--monitoring-enabled |
```

--monitoring-disabled] [--kernel *value*] [--key *value*] [--ramdisk *value*] [--group *value*[,*value*...]] [--user-data *value*] [--user-data-file *value*] [General Options]

The only required options are a name for the launch configuration, an AMI ID, and an instance type. Note that you can use the `ec2-describe-images` Amazon EC2 CLI command to get an AMI ID.

EC2-Classic or a default VPC

Use the following `as-create-launch-config` command to create a launch configuration:

```
as-create-launch-config my-test-lc --image-id ami-xxxxxxxx --instance-type
m1.small
```

Nondefault VPC

Use the following `as-create-launch-config` command to create a launch configuration that enables you to connect to the EC2 instances in your VPC using a public IP address:

```
as-create-launch-config my-test-lc --image-id ami-xxxxxxxx --instance-type
m1.small --associate-public-ip-address true
```

Create an Auto Scaling Group

Auto Scaling groups are the core of the Auto Scaling service. An Auto Scaling group is a collection of EC2 instances. You specify a launch configuration and settings such as the minimum, maximum, and desired number of EC2 instances. For more information, see Auto Scaling Groups (p. 8).

To create an Auto Scaling group, use the `as-create-auto-scaling-group` CLI command. The syntax for this command is as follows:

as-create-auto-scaling-group *AutoScalingGroupName* --availability-zones *value[,value...]* --launch-configuration *value* --max-size *value* --min-size *value* [--default-cooldown *value*] [--desired-capacity *value*] [--grace-period *value*] [--health-check-type *value*] [--load-balancers *value[, value]*] [--placement-group *value*] [--vpc-zone-identifier *value*] [General Options]

The required options are a name for your Auto Scaling group, a launch configuration, one or more Availability Zones, a minimum group size, and a maximum group size. The Availability Zones that you choose determine the physical location of your Auto Scaling instances. The minimum and maximum group size tells Auto Scaling the minimum and maximum number of instances the Auto Scaling group should have.

Desired capacity is an important component of the `as-create-auto-scaling-group` command. Although it is an optional parameter, desired capacity tells Auto Scaling the number of instances you want to run initially. To adjust the number of instances you want running in your Auto Scaling group, you change the value of `--desired-capacity`. If you don't specify `--desired-capacity`, the default value is the minimum group size.

If your AWS account supports the EC2-VPC platform only, it comes with a default VPC with a default subnet in each Availability Zone, a default security group, an Internet gateway connected to the default VPC, and routing to the Internet gateway. For more information, see Your Default VPC and Subnets in the *Amazon VPC User Guide*.

If you have a default VPC and do not specify `--vpc-zone-identifier`, your instances are automatically launched into a default subnet in your default VPC. By default, we select an Availability Zone and launch the Auto Scaling group into the corresponding subnet for that Availability Zone. Alternatively, you can select the Availability Zone for your Auto Scaling group by specifying its corresponding default subnet.

EC2-Classic or a default VPC

Use the following `as-create-auto-scaling-group` command to launch your Auto Scaling group in EC2-Classic or a default VPC. Based on the `my-test-asg` Auto Scaling group and the `my-test-lc` launch configuration, Auto Scaling launches one EC2 instance in the specified Availability Zone.

```
as-create-auto-scaling-group my-test-asg --launch-configuration my-test-lc -
-availability-zones us-east-1a --min-size 1 --max-size 10 --desired-capacity 1
```

Nondefault VPC

Use the following `as-create-auto-scaling-group` command to launch your Auto Scaling group in the specified subnet of a nondefault VPC. Based on the `my-test-asg` Auto Scaling group and the `my-test-lc` launch configuration, Auto Scaling launches one EC2 instance in the specified Availability Zone.

```
as-create-auto-scaling-group my-test-asg --launch-configuration my-test-lc -
-vpc-zone-identifier subnet-xxxxxxxx --min-size 1 --max-size 10 --desired-capa
city 1
```

If you also specify the `--availability-zones` option, be sure to specify the Availability Zone for the specified subnet. Note that depending on the version of the CLI that you're using, the command can fail if you specify both `--availability-zones` and `--vpc-zone-identifier` unless `--availability-zones` is the last parameter in the command.

Verify Your Auto Scaling Group

To verify that the Auto Scaling group has launched your EC2 instance, use the `as-describe-auto-scaling-groups` command. The syntax for this command is as follows:

`as-describe-auto-scaling-groups [`*`AutoScalingGroupName`*` [`*`AutoScalingGroupName`*`...]] [--max-records `*`value`*`] [General Options]`

Use the following `as-describe-auto-scaling-groups` command to get information about the `my-test-asg` group:

```
as-describe-auto-scaling-groups my-test-asg --headers
```

The following is an example response:

```
AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
MAX-SIZE  DESIRED-CAPACITY
AUTO-SCALING-GROUP  my-test-asg  my-test-lc     us-east-1a        1         10
         1
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-bcdd63d1   us-east-1a         InService  HEALTHY  my-test-lc
```

(Optional) Delete Your Auto Scaling Infrastructure

You can either delete your Auto Scaling set up or delete just your Auto Scaling group and keep your launch configuration to use at a later time.

To delete your Auto Scaling group, use the `as-delete-auto-scaling-group` command. The syntax for this command is as follows:

`as-delete-auto-scaling-group` ***`AutoScalingGroupName`*** **`[--force-delete] [General Options]`**

Use the following `as-delete-auto-scaling-group` command to delete the `my-test-asg` group:

```
as-delete-auto-scaling-group my-test-asg
```

When prompted "Are you sure you want to delete this AutoScalingGroup? [Ny]", enter `y`.

The following is an example response:

```
OK-Deleted AutoScalingGroup
```

To delete your launch configuration, use the `as-delete-launch-config` command. The syntax for this command is as follows:

`as-delete-launch-config` ***`LaunchConfigurationName`*** **`[General Options]`**

Use the following `as-delete-launch-config` command to delete the `my-test-lc` configuration:

```
as-delete-launch-config my-test-lc
```

When prompted "Are you sure you want to delete this launch configuration? [Ny]", enter `y`.

The following is an example response:

```
OK-Deleted launch configuration
```

Planning Your Auto Scaling Group

Auto Scaling, when correctly implemented, provides a number of advantages to your applications. An Auto Scaling group can help you make sure that your application always has the right amount of capacity to handle the current traffic demands. You can also use Auto Scaling to make your applications more highly available and fault tolerant. Most importantly, you can implement Auto Scaling at no additional cost—you only pay for the Amazon EC2 resources you use.

There are actions that you need to consider before you put your first Auto Scaling group into production. By planning ahead, you can help ensure that your Auto Scaling performs as expected and in a cost-effective manner.

Before you get started, take the time to review your application thoroughly as it runs in the AWS cloud. Take note of things like:

- How long it takes to launch and configure a server
- What metrics have the most relevance to your application's performance
- What existing resources (such as EC2 instances or AMIs) you might want to use as part of your Auto Scaling group
- How many Availability Zones you want to the Auto Scaling group to span
- The role you want Auto Scaling to play in your application. Do you want Auto Scaling to use scaling to increase or decrease capacity? Or do you want to use it solely to ensure that a specific number of servers are always running? (Keep in mind that an Auto Scaling group can actually perform both functions simultaneously.)

The better you understand your application, the more effective your implementation of Auto Scaling becomes.

When you have enough information about your application, take a look at the section, Scaling the Size of Your Auto Scaling Group (p. 27). This section describes the different ways that Auto Scaling can help you adjust your application's capacity. In addition, this section describes features such as Auto Scaling cooldowns (p. 28) and termination policies (p. 31), which play important roles in controlling how Auto Scaling scales your application.

When you have a good idea of how you want to scale your architecture, the next section you should review is Controlling Access to Your Auto Scaling Resources (p. 49), which describes the role AWS Identity and Access Management plays in managing your EC2 instances in an Auto Scaling group.

Contents

- Controlling Access to Your Auto Scaling Resources (p. 49)
- Creating Launch Configurations (p. 54)
- Creating Auto Scaling Groups (p. 58)
- Auto Scaling and Amazon Virtual Private Cloud (p. 61)
- Controlling How Instances Launch and Terminate (p. 65)
- Tagging Auto Scaling Groups and Instances (p. 76)
- Launching Spot Instances in Your Auto Scaling Group (p. 78)

Scaling 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 Auto Scaling to either launch or terminate EC2 instances.

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. You should keep the following considerations in mind:

- What role do you want Auto Scaling to play in your application's architecture? It's common to think about Auto Scaling as a way to increase and decrease capacity, but Auto Scaling is also useful for when you want to maintain a steady number of servers.
- What cost constraints are important to you? Because Auto Scaling uses EC2 instances, you only pay for the resources you use. Knowing your cost constraints can help you decide when to scale your applications, and by how much.
- What metrics are important to your application? CloudWatch supports a number of different metrics that you can use with your Auto Scaling group. We recommend reviewing them to see which of these metrics are the most relevant to your application.

To learn more about scaling implementations, see the following:

Cooldowns (p. 28)
: Periods of time during which Auto Scaling ignores any additional scaling actions.

Termination policies (p. 31)
: Criteria that determine which instances Auto Scaling should terminate first.

Maintaining a Fixed Number of EC2 Instances in Your Auto Scaling Group (p. 34)
: Maintains the minimum or specified number of instances in your Auto Scaling group at all times.

Manual Scaling (p. 35)
: Change the number of running instances in your Auto Scaling group manually at any time.

Dynamic Scaling (p. 35)
: Scale dynamically in response to changes in the demand for your application. You must specify when and how to scale.

Scheduled Scaling (p. 42)
: Scale your application on a predefined schedule (one-time only or on a recurring schedule).

Multiple Scaling Policies

An Auto Scaling group can have more than one scaling policy attached to it any given time. In fact, we recommend that each Auto Scaling group has at least two policies: one to scale your architecture out and another to scale your architecture in. You can also combine scaling policies to maximize the performance of an Auto Scaling group.

To illustrate how multiple policies work together, consider an application that uses an Auto Scaling group and an Amazon SQS queue to send requests to the EC2 instances in that group. To help ensure the application performs at optimum levels, there are two policies that control when the Auto Scaling group should scale out. One policy uses the Amazon CloudWatch metric, `CPUUtilization`, to detect when an instance is at 90% of capacity. The other uses the `NumberOfMessagesVisible` to detect when the SQS queue is becoming overwhelmed with messages.

> **Note**
> In a production environment, both of these policies would have complementary policies that control when Auto Scaling should scale in the number of EC2 instances.

When you have more than one policy attached to an Auto Scaling group, there's a chance that both policies could instruct Auto Scaling to scale out (or in) at the same time. In our previous example, it's possible that both an EC2 instance could trigger the CloudWatch alarm for the `CPUUtilization` metric, and the SQS queue trigger the alarm for the `NumberOfMessagesVisible` metric.

When these situations occur, Auto Scaling chooses the policy that has the greatest impact on the Auto Scaling group. For example, suppose that the policy for CPU utilization instructs Auto Scaling to launch 1 instance, while the policy for the SQS queue prompts Auto Scaling to launch 2 instances. If the scale out criteria for both policies are met at the same time, Auto Scaling gives precedence to the SQS queue policy, because it has the greatest impact on the Auto Scaling group. This results in Auto Scaling launching two instances into the group. This precedence applies even when the policies use different criteria for scaling out. For instance, if one policy instructs Auto Scaling to launch 3 instances, and another instructs Auto Scaling to increase capacity by 25 percent, Auto Scaling give precedence to whichever policy has the greatest impact on the group at that time.

Understanding Auto Scaling Cooldowns

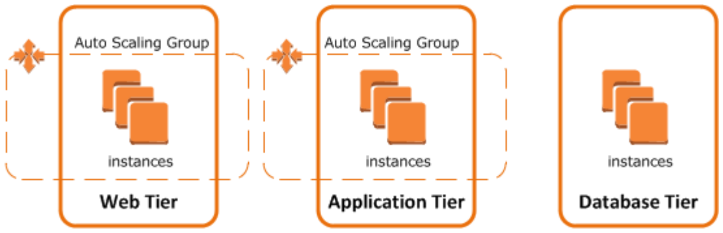
As described in What Is Auto Scaling? (p. 1), you can use Auto Scaling groups to scale—increase and decrease—the resources available to your application. You have a variety of different scaling methods available to you, such as manual scaling (p. 35) or dynamic scaling (p. 35). Regardless of how you decide to scale your resources, you need to consider the Auto Scaling cooldown period and how you want it to affect your Auto Scaling group.

The Auto Scaling cooldown period is a configurable setting that determines when Auto Scaling should suspend any scaling activities related to a specific Auto Scaling group. This cooldown period is important, because it helps to ensure you don’t launch or terminate more resources than you need.

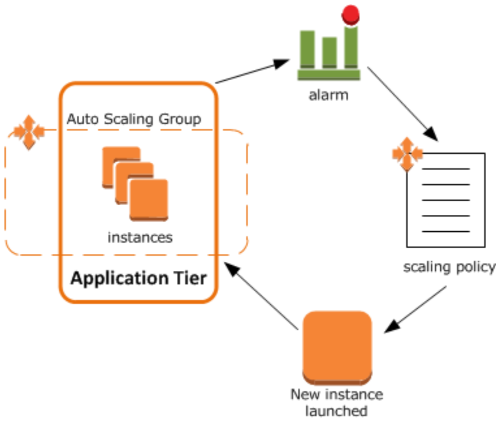
Contents

Example: Auto Scaling Cooldowns

Consider the following scenario: you have a web application running in AWS. This web application consists three basic tiers: web, application, and database. To make sure that the application always has the resources it needs to meet traffic demands, you create two Auto Scaling groups: one for your web tier and one for your application tier.



To help make sure the Auto Scaling group for the application tier has the appropriate amount of resources available, you create an CloudWatch alarm to occur whenever the CPUUtilization metric for the EC2 instances exceeds 90%. When the alarm occurs, Auto Scaling launches and configures another instance to join the application tier.



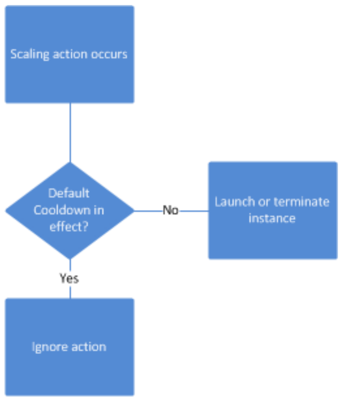
These instances use a configuration script to install and configure software before the instance is put into service. As a result, it takes around two or three minutes from the time the instance launches to when it is in service. (The actual time, of course, depends on several factors, such as whether you are using an AMI, the size of the instance, and so on.)

Now a spike in traffic occurs, causing the CloudWatch alarm to fire. When it does, Auto Scaling launches an instance to help handle the increase in demand. However, there's a problem: the instance takes a couple of minutes to launch. During that time, the CloudWatch alarm could continue to fire, resulting in Auto Scaling launch another instance each time the alarm goes off.

This is where the cooldown period comes into effect. With a cooldown period in place, Auto Scaling launches an instance and then suspends any scaling activities until a specific amount of time elapses. (The default amount of time is 300 seconds.) This way, the newly-launched instance has time to start handling application traffic. After the cooldown period expires, scaling actions resume for the Auto Scaling group. If the CloudWatch alarm is still occurring, Auto Scaling launches another instance, and the cooldown period takes effect again. If, however, the additional instance was enough to bring the CPU utilization back down, then the group remains at its current size.

Default Cooldowns

As illustrated in the previous example, an Auto Scaling cooldown period helps to ensure you don't launch or terminate more resources than your application needs. Auto Scaling supports two types of cooldown periods: a default cooldown period and a scaling-specific (p. 30) cooldown period.



The default cooldown period is applied when you create your Auto Scaling group. Its default value is 300 seconds. This cooldown period applies to any scaling activity that occurs within the Auto Scaling group. This means it not only applies to dynamic scaling (p. 35) actions, as described the preceding section, but manual scaling (p. 35) actions as well.

You can configure the default cooldown period when you create the Auto Scaling group, using any of the following:

- AWS Management Console
- AWS CLI (aws autoscaling create-auto-scaling-group)
- Auto Scaling CLI (`as-create-auto-scaling-group`)
- CreateAutoScalingGroup API

You can change the default cooldown period whenever you need to, using any of the following:

- AWS Management Console
- AWS CLI (aws autoscaling update-auto-scaling-group)
- Auto Scaling CLI (`as-update-auto-scaling-group`)
- UpdateAutoScalingGroup API

Scaling-Specific Cooldowns

In addition to the default cooldown period, you can create cooldowns that apply to a specific scaling policy. Any cooldown period that you configure with a scaling policy automatically overrides the default cooldown (p. 29) period.

Having a scaling-specific cooldown period can be very helpful in a number of situations. One common implementation is with a scale in policy—a policy that terminates instances based on a specific criteria or metric.

> **Note**
> It is always recommended that every Auto Scaling group that you create have at least two policies: one that scales out the number of instances in the group, and one that scales in the number of instances.

Consider the example described in the section called “Example: Auto Scaling Cooldowns” (p. 28). Let’s say that, in addition to a policy that scales out, or increases, the number of instances in the Auto Scaling group, there is also a policy that scales in when the CPU Utilization metric falls below a 50%. Because this policy terminates instances, less time is needed to determine whether to terminate additional instances in the Auto Scaling group. The default cooldown period of 300 seconds is too long—costs can be reduced by applying a scaling-specific cooldown period of 180 seconds.

You can create a scaling-specific cooldown period using one of the following:

- AWS Management Console
- AWS CLI (aws autoscaling put-scaling-policy)
- Auto Scaling CLI (`as-auto-scaling-put-scaling-policy`)
- PutScalingPolicy API

Cooldowns and Multiple Instances

The preceding sections have provided examples that show how cooldown periods affect Auto Scaling groups when a single instance launches or terminates. However, it is not uncommon for Auto Scaling groups to launch more than one instance at a time. For example, you might choose to have Auto Scaling launch three instances when a specific metric threshold is met.

In these situations, the cooldown period (either the default cooldown or the scaling-specific cooldown) take effect starting when the last instance launches.

Cooldowns and Lifecycle Hooks

Auto Scaling supports adding lifecycle hooks to Auto Scaling groups. These hooks allow you to control how instances launch and terminate (p. 65) within an Auto Scaling group, allowing you to perform actions on the instance before the instance is put into service or before it terminates.

These hooks can affect the impact of any cooldown periods configured for the Auto Scaling group or a scaling policy. If the instance remains in a wait state, any additional scaling actions for the Auto Scaling group are suspended. The cooldown period for the Auto Scaling group does not begin until after the instance moves out of the wait state.

Cooldowns and Spot Instances

You can create Auto Scaling groups to use Spot Instances (p. 78) instead of On-demand or Reserved Instances. In these situations, the cooldown periods for the Auto Scaling group take effect when the bid for any Spot Instance is successful.

Choosing a Termination Policy for Your Auto Scaling Group

With each Auto Scaling group, you control when Auto Scaling adds instances (referred to as *scaling out*) or remove instances (referred to as *scaling in*) from your network architecture. You can scale the size of your group manually by attaching and detaching instances, or you can automate the process through the use of a scaling policy.

When you have Auto Scaling automatically scale in, you must decide which instances Auto Scaling should terminate first. You can configure this through the use of a termination policy.

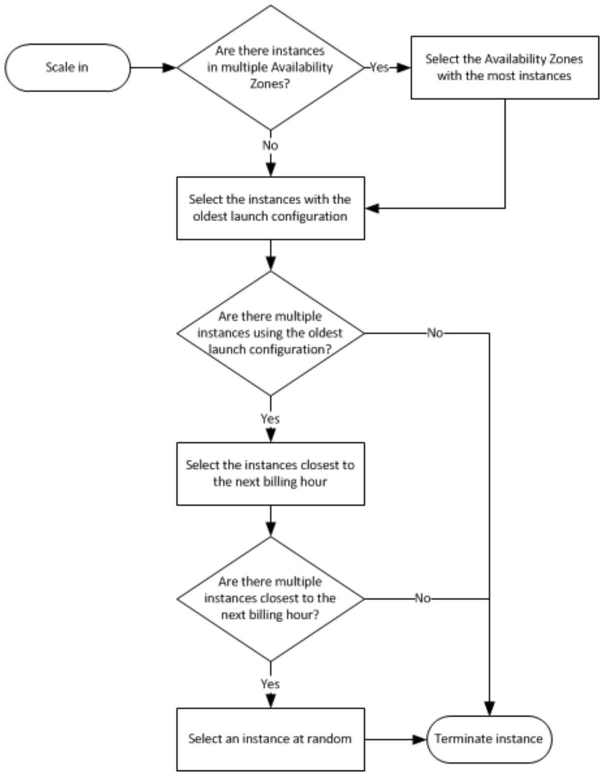
Contents

Default Termination Policy

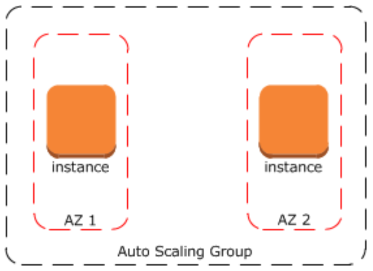
The default termination policy is designed to help ensure that your network architecture spans Availability Zones evenly. When using the default termination policy, Auto Scaling selects an instance to terminate as follows:

1. Auto Scaling determines whether there are instances in multiple Availability Zones. If so, it selects the Availability Zone with the most instances. If there is more than one Availability Zone with this number of instances, Auto Scaling selects the Availability Zone with the instances that use the oldest launch configuration.
2. Auto Scaling determines which instances in the selected Availability Zone use the oldest launch configuration. If there is one such instance, it terminates it.
3. If there are multiple instances that use the oldest launch configuration, Auto Scaling determines which instances are closest to the next billing hour. (This helps you maximize the use of your EC2 instances while minimizing the number of hours you are billed for Amazon EC2 usage.) If there is one such instance, Auto Scaling terminates it.
4. If there is more than one instance closest to the next billing hour, Auto Scaling selects one of these instances at random.

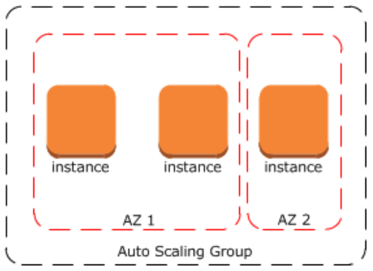
The following flow diagram illustrates how the default termination policy works.


Scale in
Are there instances in multiple Availability Zones?
Yes
Select the Availability Zones with the most instances
No
Select the instances with the oldest launch configuration
Are there multiple instances using the oldest launch configuration?
No
Yes
Select the instances closest to the next billing hour
Are there multiple instances closest to the next billing hour?
No
Yes
Select an instance at random
Terminate instance

Consider an Auto Scaling group that has two Availability Zones, a desired capacity of two instances, and scaling policies that increase and decrease the number of instances by 1 when certain thresholds are met. The two instances in this group are distributed as follows.



When the threshold for the scale out policy is met, the policy takes effect and Auto Scaling launches a new instance. The Auto Scaling group now has three instances, distributed as follows.



When the threshold for the scale in policy is met, the policy takes effect and Auto Scaling terminates one of the instances. If the group does not have a specific termination policy assigned to it, Auto Scaling uses the default termination policy. Auto Scaling selects the Availability Zone with two instances, and terminates the instance launched from the oldest launch configuration. If the instances were launched from the same launch configuration, then Auto Scaling selects the instance that is closest to the next billing hour and terminates it.

Customizing the Termination Policy

The default termination policy assigned to an Auto Scaling group is typically sufficient for most situations. However, you have the option of replacing the default policy with a customized one.

When you customize the termination policy, Auto Scaling first assesses the Availability Zones for any imbalance. If an Availability Zone has more instances than the other Availability Zones that are used by the group, then Auto Scaling applies your specified termination policy on the instances from the imbalanced Availability Zone. If the Availability Zones used by the group are balanced, then Auto Scaling applies the termination policy that you specified.

Auto Scaling currently supports the following custom termination policies:

- OldestInstance. Auto Scaling terminates 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, and want to eventually replace instances with older instances with newer ones.
- NewestInstance. Auto Scaling terminates 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.
- OldestLaunchConfiguration. Auto Scaling terminates 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.
- ClosestToNextInstanceHour. Auto Scaling terminates instances that are closest to the next billing hour. This policy helps you maximize the use of your instances and manage costs.
- Default. Auto Scaling uses its default termination policy. This policy is useful when you have more than one scaling policy associated with the group.

To customize a termination policy using the Auto Scaling CLI

Use one of the following commands:

- `as-create-auto-scaling-group`
- `as-update-auto-scaling-group`

Maintaining a Fixed Number of EC2 Instances in Your Auto Scaling Group

After you have created your launch configuration and Auto Scaling group, the Auto Scaling group starts by launching the minimum number of EC2 instances (or the desired number, if specified). If there are no other scaling conditions attached to the Auto Scaling group, the Auto Scaling group maintains this number of running instances at all times.

To maintain the same number of instances, Auto Scaling performs a periodic health check on running instances within an Auto Scaling group. When it finds that an instance is unhealthy, it terminates that instance and launches a new one.

All instances in your Auto Scaling group start in the healthy state. Instances are assumed to be healthy unless Auto Scaling receives notification that they are unhealthy. This notification can come from one or more of the following sources: Amazon EC2, Elastic Load Balancing, or your customized health check.

Determining Instance Health

By default, the Auto Scaling group determines the health state of each instance by periodically checking the results of EC2 instance status checks. If the instance status is any state other than `running` or if the system status is `impaired`, Auto Scaling considers the instance to be unhealthy and launches a replacement. For more information about EC2 instance status checks, see Monitoring the Status of Your Instances in the *Amazon EC2 User Guide for Linux Instances*.

If you have associated your Auto Scaling group with a load balancer and have chosen to use the Elastic Load Balancing health check, Auto Scaling determines the health status of the instances by checking the results of both EC2 instance status and Elastic Load Balancing instance health. Auto Scaling marks an instance unhealthy if the instance is in a state other than `running`, the system status is `impaired`, or Elastic Load Balancing reports the instance state as `OutOfService`. To learn more about Elastic Load Balancing health checks, see Elastic Load Balancing Health Check in the *Elastic Load Balancing Developer Guide*.

You can customize the health check conducted by your Auto Scaling group by specifying additional checks, or if you have your own health check system, you can send the instance's health information directly from your system to Auto Scaling.

Replacing Unhealthy Instances

After an instance has been marked unhealthy as a result of an Amazon EC2 or Elastic Load Balancing health check, it is almost immediately scheduled for replacement. It never automatically recovers its health. You can intervene manually by calling the SetInstanceHealth action (or the `as-set-instance-health` command) to set the instance's health status back to healthy, but you will get an error if the instance is already terminating. Because the interval between marking an instance unhealthy and its actual termination is so small, attempting to set an instance's health status back to healthy with the `SetInstanceHealth` action (or, `as-set-instance-health` command) is probably useful only for a suspended group. For more information, see Suspend and Resume Auto Scaling Processes (p. 98).

Auto Scaling creates a new scaling activity for terminating the unhealthy instance and then terminates it. Subsequently, another scaling activity launches a new instance to replace the terminated instance.

When your instance is terminated, any associated Elastic IP addresses are disassociated and are not automatically associated with the new instance. You must associate these Elastic IP addresses with the new instance manually. Similarly, when your instance is terminated, its attached EBS volumes are detached. You must attach these EBS volumes to the new instance manually.

Manual Scaling

At any time, you can manually change the size of an existing Auto Scaling group. Auto Scaling manages the process of launching or terminating instances to maintain the updated group size.

Prerequisites

The following examples assume 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.

Scaling Manually Using the Auto Scaling CLI

Use the `as-set-desired-capacity` command to change the size of your Auto Scaling group, as shown in the following example:

```
as-set-desired-capacity my-test-asg  --desired-capacity 2 --honor-cooldown
```

By default, the command overrides any cooldown period specified for the Auto Scaling group. You can choose to reject the default behavior and honor the cooldown period by specifying the `--honor-cooldown` option with the command. For more information, see Understanding Auto Scaling Cooldowns (p. 28).

Auto Scaling returns the following response:

```
OK-Desired Capacity Set
```

Use the `as-describe-auto-scaling-groups` command to confirm that the size of your Auto Scaling group has changed, as in the following example:

```
as-describe-auto-scaling-groups my-test-asg --headers
```

Auto Scaling responds with details about the group and instances launched. The response should be similar to the following example:

```
AUTO-SCALING-GROUP  GROUP-NAME    LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
 MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-test-asg  my-test-lc    us-east-1e         1        5
         2                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-98e204e8   us-east-1e         InService  Healthy  my-test-lc
INSTANCE  i-2a77ae5a   us-east-1e         InService  Healthy  my-test-lc
```

The desired capacity of your Auto Scaling group is updated to the new value. Your Auto Scaling group has launched an additional instance.

Dynamic Scaling

When you use Auto Scaling to scale on demand, you must define how you want to scale in response to changing conditions. For example, you have a web application that currently runs on two instances. You want to launch two additional instances when the load on the running instances reaches 70 percent, and then you want to terminate the additional instances when the load goes down to 40 percent. You can configure your Auto Scaling group to scale up and then scale down automatically based on specifying these conditions.

An Auto Scaling group uses a combination of policies and alarms to determine when the specified conditions for launching and terminating instances are met. An *alarm* is an object that watches over a single metric (for example, the average CPU utilization of your EC2 instances in an Auto Scaling group) over a time period that you specify. When the value of the metric breaches the thresholds that you define, over a number of time periods that you specify, the alarm performs one or more actions. An action can be sending messages to Auto Scaling. A *policy* is a set of instructions for Auto Scaling that tells the service how to respond to alarm messages.

Along with creating a launch configuration and Auto Scaling group, you need to create the alarms and the scaling policies and associate them with your Auto Scaling group. When the alarm sends the message, Auto Scaling executes the associated policy on your Auto Scaling group to scale the group in (terminate instances) or scale the group out (launch instances).

Auto Scaling integrates with CloudWatch for identifying metrics and defining alarms. For more information, see Creating CloudWatch Alarms in the *Amazon CloudWatch Developer Guide*.

Contents

Scaling Policies

When a scaling policy is executed, it changes the size of your Auto Scaling group by the amount specified in the policy. You can express the change to the current size as an absolute number, an increment, or as a percentage of the current group size. When the policy is executed, Auto Scaling uses both the current group capacity and the change specified in the policy to compute a new size for your Auto Scaling group. Auto Scaling then updates the current size, and this consequently affects the size of your group.

A positive adjustment value increases the current capacity and a negative adjustment value decreases the current capacity. Auto Scaling does not scale above the maximum size or below the minimum size of the Auto Scaling group.

We recommend that you create two policies for each scaling change that you want to perform: one policy for scaling out and another policy for scaling in.

To create a scaling policy, you need to specify a name for the policy, the name of the Auto Scaling group to associate the policy with, the number of instances by which to scale, and the adjustment type. Auto Scaling supports the following adjustment types:

- **ChangeInCapacity:** Increases or decreases the existing capacity. For example, the current capacity of your Auto Scaling group is set to three instances, and you then create a scaling policy on your Auto Scaling group, specify the type as `ChangeInCapacity`, and the adjustment as five. When the policy is executed, Auto Scaling adds five more instances to your Auto Scaling group. You then have eight running instances in your Auto Scaling group: current capacity (3) plus ChangeInCapacity (5) equals 8.
- **ExactCapacity:** Changes the current capacity to the specified value. For example, if the current capacity is 5 instances and you create a scaling policy on your Auto Scaling group, specify the type as

`ExactCapacity` and the adjustment as 3. When the policy is executed, your Auto Scaling group has three running instances.

You'll get an error if you specify a negative adjustment value for the `ExactCapacity` adjustment type.

- **PercentChangeInCapacity:** Increases or decreases the capacity by a percentage. For example, if the current capacity is 10 instances and you create a scaling policy on your Auto Scaling group, specify the type as `PercentChangeInCapacity`, and the adjustment as 10. When the policy is executed, your Auto Scaling group has eleven running instances because 10 percent of 10 instances is 1 instance, and 10 instances plus 1 instance is 11 instances.

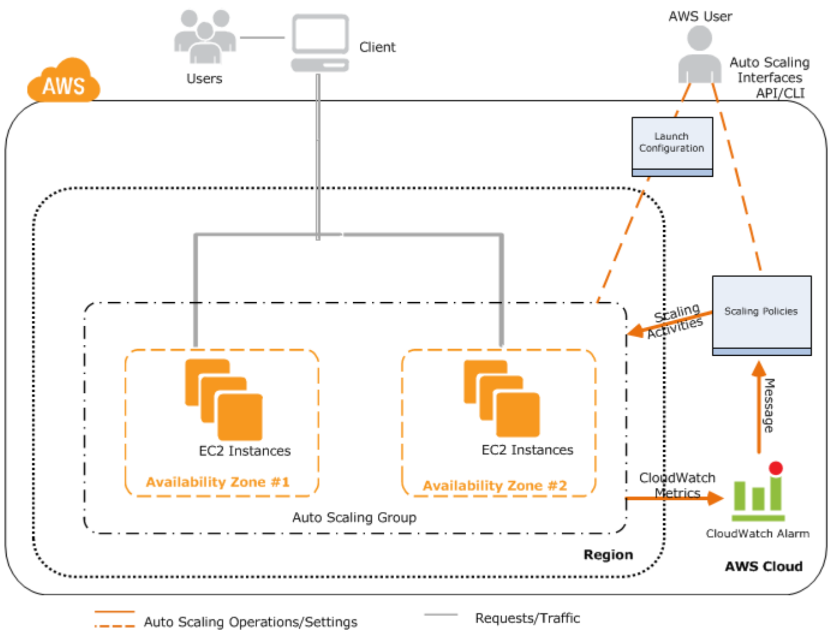
  Auto Scaling handles non-integer numbers returned by `PercentChangeInCapacity` as follows:

  - If the value is greater than 1, Auto Scaling rounds it to the lower value. For example, a return value of `12.7` is rounded to `12`.
  - If the value is between 0 and 1, Auto Scaling rounds it to 1. For example, a return value of `.67` is rounded to `1`.
  - If the value between 0 and -1, Auto Scaling rounds it to -1. For example, a return value of `-.58` is rounded to `-1`.
  - If the value is less than –1, Auto Scaling rounds it to the higher value. For example, a return value of `-6.67` is rounded to `-6`.

Architectural Overview of Dynamic Scaling

The following diagram shows how the various components of Auto Scaling work together when you scale dynamically based on demand. The AWS user has done the following:

- Created a launch configuration by providing all the information required to launch EC2 instances.
- Created an Auto Scaling group by defining maximum, minimum, and (optionally), the desired capacity for the EC2 instances.
- Created an CloudWatch alarm and defined which metrics to monitor.
- Created two scaling policies, one for scaling out and another for scaling in, and associated the policies with the alarm.
- Associated the scaling policies with the Auto Scaling group.



The following events begin when a client sends a request to the AWS user's application, and with the launch of EC2 instances in the Auto Scaling group:

1. The application is ready to communicate with users after the Auto Scaling group has launched all Amazon EC2 application instances for the application.
2. While requests are being sent by users and received by the application instances, CloudWatch monitors the specified metrics of all the instances in the Auto Scaling group.
3. As the demand for the application either grows or shrinks, the specified metrics change.
4. The change in metrics invokes the CloudWatch alarm to perform an action. The action is a message sent to either the scaling-in policy or the scaling-out policy, depending on the metrics that were breached.
5. The Auto Scaling policy that receives the message then invokes the scaling activity within the Auto Scaling group.
6. This Auto Scaling process continues until the policies are deleted or the Auto Scaling group is terminated.

Scaling Based on Metrics

When you create your policy, you can create CloudWatch alarms to watch specified scale-in and scale-out metrics. Then you associate the alarms with the scaling policies that you have created. These alarms send messages to Auto Scaling when the specified metrics breach the thresholds that you specified in your policies.

When you create your CloudWatch alarm, you can add an Amazon SNS topic to send an email notification when the alarm changes state. For more information, see the Amazon Simple Notification Service Getting Started Guide.

Scaling policies also enable you to specify a custom cooldown period. Cooldown periods help to prevent Auto Scaling from initiating additional scaling activities before the effects of previous activities are visible. Because scaling activities are suspended when an Auto Scaling group is in cooldown mode, an adequate cooldown period helps to prevent initiating a scaling activity based on stale metrics. By default, Auto Scaling uses a default period associated with your Auto Scaling group. When specified, the policy cooldown period takes priority over the default cooldown period specified in the Auto Scaling group. If the policy does not specify a cooldown period, the group's default cooldown period is used. For more information, see Understanding Auto Scaling Cooldowns (p. 28).

The following example uses `CPUUtilization` metrics.

Scaling with Metrics Using the Auto Scaling CLI

Use the Auto Scaling CLI as follows to create a launch configuration, Auto Scaling group, and Auto Scaling policies. For more information about the command syntax of any of these commands, use the `--help` option with the command or see the Auto Scaling Quick Reference Card.

Tasks

Create a Launch Configuration

Use the following `as-create-launch-config` command to create a launch configuration named `my-test-lc`:

```
as-create-launch-config my-test-lc --image-id ami-514ac838 --instance-type
m1.small --associate-public-ip-address true
```

If your request is successful, the response should be a confirmation like the following:

```
OK-Created launch config
```

Create an Auto Scaling Group

Use the following `as-create-auto-scaling-group` command to create an Auto Scaling group named `my-test-asg` using the launch configuration `my-test-lc` that you just created:

```
as-create-auto-scaling-group my-test-asg --launch-configuration my-test-lc -
-availability-zones "us-east-1e" --max-size 5 --min-size 1
```

If your request was successful, the response should be a confirmation like the following:

```
OK-Created AutoScalingGroup
```

(Optional) Verify Your Auto Scaling Group

Use the `as-describe-auto-scaling-groups` command, as in the following example, to verify your Auto Scaling group.

```
as-describe-auto-scaling-groups my-test-asg --headers
```

The following is an example response that shows that Auto Scaling launched an instance using `my-test-lc`, and the instance is running (`InService`):

```
AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-test-asg  my-test-lc     us-east-1e          1
5        1             Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE     STATUS    LAUNCH-CONFIG
INSTANCE  i-cbd7caba   us-east-1e         InService  InService  my-test-lc
```

Create Scaling Policies

You can create scaling policies that tell the Auto Scaling group what to do when the specified conditions change.

Example: my-scaleout-policy

Use the following `as-put-scaling-policy` command to create a scaling policy named `my-scaleout-policy` with an adjustment type of `PercentChangeInCapacity` that increases the capacity of the group by 30 percent:

```
as-put-scaling-policy my-scaleout-policy --auto-scaling-group my-test-asg -
-adjustment=30 --type PercentChangeInCapacity
```

Auto Scaling returns the ARN that serves as a unique name for the policy. Subsequently, you can use either the ARN or a combination of the policy name and group name to specify the policy. Store this ARN in a safe place. You'll need it to create CloudWatch alarms.

```
arn:aws:autoscaling:us-east-1:123456789012:scalingPolicy:ac542982-cbeb-4294-
891c-a5a941dfa787:autoScalingGroupName/my-test-asg:policyName/my-scaleout-policy
```

Example: my-scalein-policy

Use the following `as-put-scaling-policy` command to create a scaling policy named `my-scalein-policy` with an adjustment type of `ChangeInCapacity` that decreases the capacity of the group by two instances:

```
as-put-scaling-policy my-scalein-policy --auto-scaling-group my-test-asg "-
-adjustment=-2" --type ChangeInCapacity
```

Auto Scaling returns the ARN for the policy. Store this ARN in a safe place. You'll need it to create CloudWatch alarms.

```
arn:aws:autoscaling:us-east-1:123456789012:scalingPolicy:4ee9e543-86b5-4121-
b53b-aa4c23b5bbcc:autoScalingGroupName/my-test-asg:policyName/my-scalein-policy
```

Create CloudWatch Alarms

In the previous task, you created scaling policies that provided instructions to the Auto Scaling group about how to scale in and scale out when the conditions that you specify change. In this task you create alarms by identifying the metrics to watch, defining the conditions for scaling, and then associating the alarms with the scaling policies.

Example: AddCapacity

Use the following CloudWatch command mon-put-metric-alarm to create an alarm named `AddCapacity` that increases the size of the Auto Scaling group when the average CPU usage of all the instances (`CPUUtilization`) increases to 80 percent (`GreaterThanOrEqualToThreshold`):

```
mon-put-metric-alarm --alarm-name AddCapacity --metric-name CPUUtilization --
namespace AWS/EC2
--statistic Average --period 120 --threshold 80 --comparison-operator Greater
ThanOrEqualToThreshold
--dimensions "AutoScalingGroupName=my-test-asg" --evaluation-periods 2
--alarm-actions arn:aws:autoscaling...scalingPolicy:ac542982-cbeb-4294-891c-
a5a941dfa787:autoScalingGroupName/my-test-asg:policyName/my-scaleout-policy
```

Example: RemoveCapacity

Use the following CloudWatch command mon-put-metric-alarm to create an alarm named `RemoveCapacity` that decreases the size of the Auto Scaling group when the average CPU usage of all the instances (`CPUUtilization`) decreases to 40 percent (`LessThanOrEqualToThreshold`):

```
mon-put-metric-alarm --alarm-name RemoveCapacity --metric-name CPUUtilization
--namespace AWS/EC2
 --statistic Average --period 120 --threshold 40 --comparison-operator
LessThanOrEqualToThreshold
 --dimensions "AutoScalingGroupName=my-test-asg" --evaluation-periods 2
 --alarm-actions arn:aws:autoscaling...scalingPolicy:4ee9e543-86b5-4121-b53b-
aa4c23b5bbcc:autoScalingGroupName/my-test-asg:policyName/my-scalein-policy
```

(Optional) Verify Your Scaling Policies and CloudWatch Alarms

You can verify the scaling policies and CloudWatch alarms that you created.

To verify your CloudWatch alarms

Use the CloudWatch command `mon-describe-alarms` as follows:

```
mon-describe-alarms --headers
```

The following is an example response:

```
ALARM     STATE ALARM_ACTIONS  NAMESPACE  METRIC_NAME    PERIOD  STATISTIC  EV
AL_PERIODS  COMPARISON     THRESHOLD
RemoveCapacity OK arn:aws:autoscaling...policyName/my-scalein-policy  AWS/EC2
CPUUtilization 120 Average 5 LessThanOrEqualToThreshold 2
AddCapacity    OK arn:aws:autoscaling...policyName/my-scaleout-policy AWS/EC2
CPUUtilization 120 Average 5 GreaterThanOrEqualToThreshold 2
```

To verify your scaling policies

Use the Auto Scaling command `as-describe-policies` as follows:

```
as-describe-policies --auto-scaling-group my-test-asg --headers
```

The following is an example response:

```
SCALING-POLICY   GROUP-NAME   POLICY-NAME     SCALING-ADJUSTMENT  ADJUSTMENT-
TYPE          POLICY-ARN
SCALING-POLICY   my-test-asg  my-scalein-policy   -2             ChangeInCapa
city          policy-arn1
ALARM   ALARM-NAME          POLICY-NAME
ALARM   RemoveCapacity      my-scalein-policy
SCALING-POLICY  my-test-asg  my-scaleout-policy   30            PercentChange
InCapacity  policy-arn2
ALARM   ALARM-NAME      POLICY-NAME
ALARM   AddCapacity     my-scaleout-policy
```

Scheduled Scaling

Scaling based on a schedule allows you to scale your application in response to predictable load changes. For example, 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 plan your scaling activities based on the predictable traffic patterns of your web application.

To configure your Auto Scaling group to scale based on a schedule, you need to create scheduled actions. A scheduled action tells Auto Scaling to perform a scaling action at certain time in future. To create a scheduled scaling action, you specify the start time at which you want the scaling action to take effect, and you specify the new minimum, maximum, and desired size you want for that group at that time. At the specified time, Auto Scaling updates the group to set the new values for minimum, maximum, and desired sizes, as specified by your scaling action.

You can create scheduled actions for scaling one time only or for scaling on a recurring schedule.

Contents

Programming Considerations for Scheduled Actions

When you create a scheduled action, keep the following programming considerations in mind.

- Auto Scaling guarantees the order of execution for scheduled actions within the same group, but not for scheduled actions across groups.
- A scheduled action generally executes within seconds. However, the action may be delayed for up to two minutes from the scheduled start time. Because Auto Scaling executes actions within an Auto Scaling group in the order they are specified, scheduled actions with scheduled start times close to each other may take longer to execute.
- You can schedule a scheduled action for up to a month in the future.
- You can create a maximum of 125 scheduled actions per month per Auto Scaling group. This allows scaling four times a day for a 31-day month for each Auto Scaling group.
- A scheduled action must have a unique time value. If you attempt to schedule an activity at a time when another existing activity is already scheduled, the call is rejected with an error message noting the conflict.

Scheduling Scaling Using the Auto Scaling CLI

Complete the following tasks to create a scheduled action to scale your Auto Scaling group. For more information about the command syntax of any of these commands, use the `--help` option with the command or see the Auto Scaling Quick Reference Card.

Tasks

Create a Launch Configuration

Use the following `as-create-launch-config` command to create a launch configuration named `my-test-lc`:

```
as-create-launch-config my-test-lc --image-id ami-514ac838 --instance-type
m1.small
```

Create an Auto Scaling Group

Use the following `as-create-auto-scaling-group` command to create an Auto Scaling group named `my-test-asg`.

```
as-create-auto-scaling-group my-test-asg --launch-configuration my-test-lc -
-availability-zones "us-east-1e" --max-size 5 --min-size 1
```

(Optional) Verify Your Auto Scaling Group

Use the following `as-describe-auto-scaling-groups` command to get information about the `my-test-asg` group:

```
as-describe-auto-scaling-groups my-test-asg --headers
```

The following is an example response that shows that Auto Scaling launched an instance using `my-test-lc`, and the instance is running (`InService`):

```
AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-test-asg  my-test-lc     us-east-1e          1
5        1             Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS     LAUNCH-CONFIG
INSTANCE  i-cbd7caba   us-east-1e        InService  InService  my-test-lc
```

Create a Schedule for Scaling Actions

You can create a schedule for scaling one time only or for scaling on a recurring schedule.

To schedule scaling for one time only

To increase the number of running instances in your Auto Scaling group at a specific time, use the following `as-put-scheduled-update-group-action` command to create a scheduled action named `ScaleUp` that runs at the specified time (specified in "YYYY-MM-DDThh:mm:ssZ" format in UTC time):

```
as-put-scheduled-update-group-action ScaleUp --auto-scaling-group my-test-asg
--start-time "2013-05-12T08:00:00Z" --desired-capacity 3
```

To decrease the number of running instances in your Auto Scaling group at a specific time, use the following `as-put-scheduled-update-group-action` command to create a scheduled action named `ScaleDown` that runs at the specified time (specified in "YYYY-MM-DDThh:mm:ssZ" format in UTC time):

```
as-put-scheduled-update-group-action ScaleDown --auto-scaling-group my-test-asg
 --start-time "2013-05-13T08:00:00Z" --desired-capacity 1
```

To schedule scaling on a recurring schedule

You can specify a recurrence schedule using the Unix cron syntax format. For more information about cron syntax, see the Cron Wikipedia entry.

Use the following `as-put-scheduled-update-group-action` command to create a scheduled action named `scaleup-schedule-year` that runs at 00:30 hours on the first of January, June, and December each year:

```
as-put-scheduled-update-group-action  scaleup-schedule-year --auto-scaling-group
 my-test-asg --recurrence "30 0 1 1,6,12 0" --desired-capacity 3
```

(Optional) Verify that the Auto Scaling Group is Scheduled for Scaling

Use the following `as-describe-scheduled-actions` command to list all the scheduled actions attached to your Auto Scaling groups that are still waiting to be executed. After a scheduled action is completed, it is automatically deleted and no longer visible in the list of planned actions.

```
as-describe-scheduled-actions --auto-scaling-group my-test-asg --headers
```

The following is an example response:

```
UPDATE-GROUP-ACTION  my-test-asg  ScaleUp   2013-05-12T08:00:00Z  3
UPDATE-GROUP-ACTION  my-test-asg  ScaleDown 2013-01-13T08:00:00Z  1
```

If the scheduled action is already executed, use `as-describe-scaling-activities`, with the `--show-xml` option, as follows:

```
as-describe-scaling-activities --auto-scaling-group my-test-asg --show-xml
```

The following is an example response. You can determine whether instances were launched due to a scheduled action by examining the description in the `Cause` field. Activities launched as a direct result of a scheduled action have a reference to the specific action name in `Cause`, as shown here.

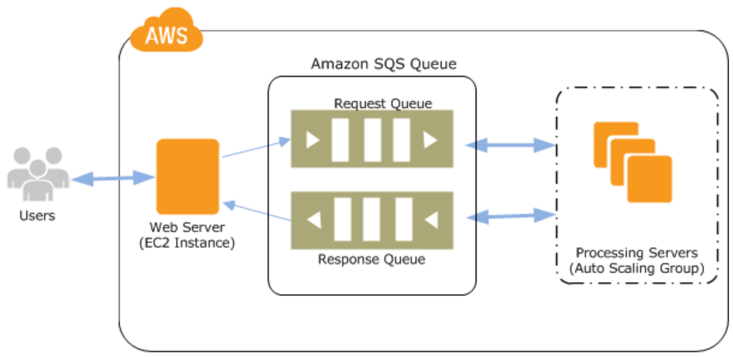
```
<DescribeScalingActivitiesResponse xmlns="http://autoscaling.amazon
aws.com/doc/2011-01-01/">
  <DescribeScalingActivitiesResult>
    <NextToken>71382dd3-75af-4a57-9c23-988fdcb1866a</NextToken>
    <Activities>
      <member>
        <StatusCode>Successful</StatusCode>
        <Progress>100</Progress>
        <ActivityId>7d1a9dd2-7b53-4334-8a5f-5fa2a9731d64</ActivityId>
        <StartTime>2013-01-30T03:00:51.931Z</StartTime>
        <AutoScalingGroupName>my-test-asg</AutoScalingGroupName>
        <Cause>At 2013-01-30T03:00:21Z a scheduled action update of AutoScal
```

```
ingGroup constraints to min: 1, max: 5, desired: 3
changing the desired capacity from 1 to 3.  At 2013-01-30T03:00:21Z the scheduled
 action ScaleUp executed. Setting desired capacity
from 1 to 3.  At 2013-01-30T03:00:51Z an instance was started in response to a
 difference between desired and actual capacity,
increasing the capacity from 1 to 3.</Cause>
        <Details>{}</Details>
        <Description>Launching a new EC2 instance: i-aacc62da</Description>
        <EndTime>2013-01-30T03:02:01Z</EndTime>
      </member>
```

Scaling Based on Amazon SQS

Amazon Simple Queue Service (Amazon SQS) is a scalable message queuing system that stores messages as they travel between various components of your application architecture. Amazon SQS enables web service applications to quickly and reliably queue messages that are generated by one component and consumed by another component. A queue is a temporary repository for messages that are awaiting processing. For more information about Amazon SQS, see the Amazon Simple Queue Service Developer Guide.

For example, suppose that you have a web app that receives orders from customers. The app runs on EC instances in an Auto Scaling group that is configured to handle a typical amount of orders. The app places the orders in an Amazon SQS queue until they are picked up for processing, processes the orders, and then sends the processed orders back to the customer. The following diagram illustrates the architecture of this example.



This architecture works well if your order levels remain the same at all times. What happens if your order levels change? You would need to launch additional EC2 instances when the orders increase and terminate the extra EC2 instances when the orders decrease. If your orders increase and decrease on a predictable schedule, you can specify the time and date to perform scaling activities. For more information, see Scheduled Scaling (p. 42). Otherwise, you can scale based on criteria, such as the number of messages in your Amazon SQS queue. For more information, see Dynamic Scaling (p. 35).

Queues provide a convenient mechanism to determine the load on an application. You can use the length of the queue (number of messages available for retrieval from the queue) to determine the load. Because each message in the queue represents a request from a user, measuring the length of the queue is a fair approximation of the load on the application. CloudWatch integrates with Amazon SQS to collect, view, and analyze metrics from Amazon SQS queues. You can use the metrics sent by Amazon SQS to determine the length of the Amazon SQS queue at any point in time. For a list of all the metrics that Amazon SQS sends to CloudWatch, see Amazon SQS Metrics in the *Amazon Simple Queue Service Developer Guide*.

The following examples create Auto Scaling policies that configure your Auto Scaling group to scale based on the number of messages in your Amazon SQS queue.

Scaling with Amazon SQS Using the Auto Scaling CLI

The following example shows you how to create policies for scaling in and scaling out, plus create, verify, and validate CloudWatch alarms for your scaling policies. It assumes that you already have an Amazon SQS queue, an Auto Scaling group, and EC2 instances running the application that uses the Amazon SQS queue.

Create the Scaling Policies

You can create scaling policies that tell the Auto Scaling group what to do when the specified conditions change.

To create scaling policies

1. Use the following `as-put-scaling-policy` command to create a scale out policy to increase the Auto Scaling group by one EC2 instance:

   ```
   as-put-scaling-policy my-sqs-scaleout-policy -–auto-scaling-group my-asg -
   -adjustment=1 --type ChangeInCapacity
   ```

   Auto Scaling returns the Amazon Resource Name (ARN) for the new policy. Store the ARN in a safe place. You'll need it when you create the CloudWatch alarms.
2. Use the following `as-put-scaling-policy` command to create a scale in policy to decrease the Auto Scaling group by one EC2 instance:

   ```
   as-put-scaling-policy my-sqs-scalein-policy --auto-scaling-group my-asg -
   -adjustment=-1 --type ChangeInCapacity
   ```

   Auto Scaling returns the ARN for the new policy. Store the ARN in a safe place. You'll need it when you create the CloudWatch alarms.

Create the CloudWatch Alarms

Next, you create alarms by identifying the metrics to watch, defining the conditions for scaling, and then associating the alarms with the scaling policies that you created in the previous task.

Note
All active Amazon SQS queues send metrics to CloudWatch every five minutes. We recommend that you set the alarm `Period` to at least `300` seconds. Setting the alarm `Period` to less than `300` seconds will result in alarm going to `INSUFFICIENT_DATA` state while waiting for the metrics.

To create CloudWatch alarms

1. Use the following CloudWatch command, mon-put-metric-alarm, to create an alarm that increases the size of the Auto Scaling group when the number of messages in the queue available for processing (`ApproximateNumberOfMessagesVisible`) increases to three and remains at three or greater for at least five minutes.

   ```
   mon-put-metric-alarm --alarm-name AddCapacityToProcessQueue --metric-name
   ApproximateNumberOfMessagesVisible --namespace "AWS/SQS"
   --statistic Average --period 300 --threshold 3 --comparison-operator Great
   erThanOrEqualToThreshold --dimensions "QueueName=my-queue"
   --evaluation-periods 2 --alarm-actions arn
   ```

2. Use the following CloudWatch command, mon-put-metric-alarm, to create an alarm that decreases the size of the Auto Scaling group when the number of messages in the queue available for processing (`ApproximateNumberOfMessagesVisible`) decreases to one and the length remains at one or fewer for at least five minutes.

```
mon-put-metric-alarm --alarm-name RemoveCapacityFromProcessQueue --metric-
name ApproximateNumberOfMessagesVisible --namespace "AWS/SQS"
 --statistic Average --period 300 --threshold 1 --comparison-operator
LessThanOrEqualToThreshold --dimensions "QueueName=my-queue"
 --evaluation-periods 2 --alarm-actions arn
```

Verify Your Scaling Policies and CloudWatch Alarms

You can verify that your CloudWatch alarms and scaling policies were created.

To verify your CloudWatch alarms

Use the following CloudWatch command mon-describe-alarms:

```
mon-describe-alarms AddCapacityToProcessQueue RemoveCapacityFromProcessQueue -
-headers
```

The following is example output:

```
ALARM    STATE ALARM_ACTIONS  NAMESPACE  METRIC_NAME    PERIOD  STATISTIC  EV
AL_PERIODS  COMPARISON     THRESHOLD
RemoveCapacityFromProcessQueue OK arn:aws:autoscaling...policyName/my-sqs-
scalein-policy AWS/SQS ApproximateNumberOfMessagesVisible 300 Average 5
LessThanOrEqualToThreshold 1
AddCapacityToProcessQueue OK arn:aws:autoscaling...:policyName/my-sqs-scaleout-
policy AWS/SQS ApproximateNumberOfMessagesVisible 300 Average 5 GreaterThanOrE
qualToThreshold 3
```

To verify your scaling policies

Use the following `as-describe-policies` command:

```
as-describe-policies --auto-scaling-group my-asg --headers
```

The following is example output:

```
SCALING-POLICY   GROUP-NAME   POLICY-NAME     SCALING-ADJUSTMENT  ADJUSTMENT-
TYPE   POLICY-ARN
SCALING-POLICY   my-asg       my-sqs-scalein-policy   1          ChangeInCapa
city  arn:aws:autoscaling:...
ALARM   ALARM-NAME                             POLICY-NAME
ALARM   RemoveCapacityFromProcessQueue         my-sqs-scalein-policy
SCALING-POLICY   my-asg       my-sqs-scaleout-policy  1          ChangeInCapa
city  arn:aws:autoscaling:...
ALARM   ALARM-NAME                   POLICY-NAME
ALARM   AddCapacityToProcessQueue    my-sqs-scaleout-policy
```

Test Your Scale Out and Scale In Policies

You can test your scale out policy by increasing the number of messages in your Amazon SQS queue and then verifying that your Auto Scaling group has launched an additional EC2 instance. Similarly, you can test your scale in policy by decreasing the number of messages in your Amazon SQS queue and then verifying that the Auto Scaling group has terminated an EC2 instance.

To test the scale out policy

1. Follow the steps in Sending a Message to add messages to your Amazon SQS queue. Make sure that you have at least three messages in the queue.

   It takes a few minutes for the Amazon SQS queue metric `ApproximateNumberOfmessagesVisible` to invoke the CloudWatch alarm. After the CloudWatch alarm is invoked, it notifies the Auto Scaling policy to launch one EC2 instance.
2. Use the following `as-describe-auto-scaling-groups` command to verify that the group has launched an instance:

   ```
   as-describe-auto-scaling-groups my-asg --headers
   ```

   The following is example output:

   ```
   AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
     MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
   AUTO-SCALING-GROUP  my-asg       my-lc          us-west-2b          1
       10        1                  Default
   INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
   INSTANCE  i-2cd22f5c   us-west-2b         InService  Healthy  my-lc
   INSTANCE  i-5a277829   us-west-2b         InService  Healthy  my-lc
   ```

To test the scale in policy

1. Follow the steps in Deleting a Message to remove messages from the Amazon SQS queue. Make sure that you have no more than one message in the queue.

   It takes a few minutes for the Amazon SQS queue metric `ApproximateNumberOfmessagesVisible` to invoke the CloudWatch alarm. After the CloudWatch alarm is invoked, it notifies the Auto Scaling policy to terminate one EC2 instance.
2. Use the following `as-describe-auto-scaling-groups` command to verify that the group has terminated an instance:

   ```
   as-describe-auto-scaling-groups my-asg --headers
   ```

   The following is example output:

   ```
   AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
     MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
   AUTO-SCALING-GROUP  my-asg       my-lc          us-west-2b          1
       10        1                  Default
   INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
   INSTANCE  i-5a277829   us-west-2b         InService  Healthy  my-lc
   ```

Controlling Access to Your Auto Scaling Resources

Auto Scaling integrates with AWS Identity and Access Management (IAM), a service that enables you to do the following:

- Create users and groups under your organization's AWS account
- Assign unique security credentials to each user under your AWS account
- Control each user's permissions to perform tasks using AWS resources
- Allow the users in another AWS account to share your AWS resources
- Create roles for your AWS account and define the users or services that can assume them
- Use existing identities for your enterprise to grant permissions to perform tasks using AWS resources

For example, you could create an IAM policy that grants the Managers group permission to use only `DescribeAutoScalingGroups`, `DescribeLaunchConfigurations`, `DescribeScalingActivities`, and `DescribePolicies`. Users in the Managers group could then use those actions with any Auto Scaling groups and launch configurations. Note that you can't restrict access to a particular Auto Scaling group or launch configuration.

For more information about IAM, see the following:

- Identity and Access Management (IAM)
- IAM Getting Started Guide
- Using IAM

Contents

Auto Scaling Actions

In an IAM policy, you can specify any and all Auto Scaling actions. For Auto Scaling, use the following prefix with the name of the action: `autoscaling:`. For example: `autoscaling:CreateAutoScalingGroup` and `autoscaling:CreateLaunchConfiguration`. You can also use wildcards. For example, use `autoscaling:*` to indicate all Auto Scaling actions.

For a list of the Auto Scaling actions, see Auto Scaling Actions in the *Auto Scaling API Reference*.

Auto Scaling Resources

When writing an IAM policy to control access to Auto Scaling actions, you must use "*" as the resource. There are no supported Amazon Resource Names (ARNs) for Auto Scaling resources.

Auto Scaling Keys

Auto Scaling implements the following policy keys only.

AWS-Wide Policy Keys

- `aws:CurrentTime`–To check for date/time conditions.
- `aws:EpochTime`–To check for date/time conditions using a date in epoch or UNIX time.
- `aws:principaltype`–To check the type of principal (user, account, federated user, etc.) for the current request.
- `aws:SecureTransport`–To check whether the request was sent using SSL. For services that use only SSL, such as Amazon RDS and Amazon Route 53, the `aws:SecureTransport` key has no meaning.
- `aws:SourceArn`–To check the source of the request, using the Amazon Resource Name (ARN) of the source. (This value is available for only some services. For more information, see Amazon Resource Name (ARN) under "Element Descriptions" in the *Amazon Simple Queue Service Developer Guide*.)
- `aws:SourceIp`–To check the IP address of the requester. Note that if you use `aws:SourceIp`, and the request comes from an Amazon EC2 instance, the public IP address of the instance is evaluated.
- `aws:UserAgent`–To check the client application that made the request.
- `aws:userid`–To check the user ID of the requester.
- `aws:username`–To check the user name of the requester, if available.

Note
Key names are case sensitive.

Example IAM Policies for Auto Scaling

The following are simple IAM policies that you can use to control user access to Auto Scaling. The resource is always "*", because you can't specify a particular Auto Scaling resource in a policy.

Example 1: Create and manage Auto Scaling launch configurations

The following policy grants users permission to use all Auto Scaling actions that include the string `LaunchConfiguration` in their names.

Alternatively, you can list each action explicitly instead of using wildcards. If you list each action separately, the policy would not automatically apply to any new Auto Scaling actions we introduce that include the string `LaunchConfiguration` in their names.

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

Example 2: Create and manage Auto Scaling groups and policies.

The following policy grants users permission to use all Auto Scaling actions that include the string `Scaling` in their names.

Alternatively, you can list each action explicitly instead of using wildcards. If you list each action separately, the policy would not automatically apply to any new Auto Scaling actions we introduce that include the string `Scaling` in their names.

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

Example 3: Change the capacity of Auto Scaling groups.

The following policy grants users permission to use the `SetDesiredCapacity` action to change the capacity of Auto Scaling groups.

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

Launch Auto Scaling Instances with an IAM Role

AWS Identity and Access Management (IAM) roles for EC2 instances make it easier for you to access other AWS services securely from within the EC2 instances. EC2 instances launched with an IAM role automatically have AWS security credentials available.

You can use IAM roles with Auto Scaling to automatically enable applications running on your EC2 instances to securely access other AWS resources.

To launch EC2 instances with an IAM role in Auto Scaling, you'll have to create an Auto Scaling launch configuration with an EC2 instance profile. An instance profile is simply a container for an IAM role. First, create an IAM role that has all the permissions required to access the AWS resources, then add your role to the instance profile.

For more information about IAM roles and instance profiles, see Delegating API Access by Using Roles in the *Using IAM* guide.

Prerequisites: Using IAM

Use these steps for launching Auto Scaling instances with an IAM role. Before you walk, be sure you've completed the following steps using IAM:

- Create an IAM role.
- Create an IAM instance profile.
- Add the IAM role to the IAM instance profile.
- Retrieve the IAM instance profile name or the full Amazon Resource Name (ARN) of the instance profile.

For more information about creating and managing an IAM role, see Create a Role in the *Using IAM* guide.

If you plan to use the IAM CLI, be sure to install the IAM CLI. For more information, see AWS Identity and Access Management Command Line Interface Reference.

Steps for Launching Instances with an IAM role

After you have created the IAM role, the IAM instance profile, and have added the role to the instance profile, you are ready to launch Auto Scaling instances with the IAM role, using the following steps:

- Create a launch configuration by specifying the IAM instance profile name or the full ARN of the IAM instance profile.
- Create an Auto Scaling group with the launch configuration that you just created.
- Verify that the EC2 instance was launched with the IAM role.

Launching Instances with the CLI

Use the following Auto Scaling commands to launch instances.

Commands	Description
`as-create-launch-config`	Creates a new launch configuration with specified attributes.
`as-create-auto-scaling-group`	Creates a new Auto Scaling group with the specified name and other attributes.
`as-describe-auto-scaling-groups`	Describes the Auto Scaling groups, if the groups exist.

Create a Launch Configuration

If you're not familiar with how to create a launch configuration or an Auto Scaling group, we recommend that you go through the steps in the Getting Started with the Auto Scaling CLI (p. 22). Use the basic scenario to get started with the infrastructure that you need in most Auto Scaling scenarios.

For this procedure, specify the following values for the `as-create-launch-config` command:

- Launch configuration name = `lc-with-instance-profile`
- Image ID = `ami-baba68d3`
  If you don't have an AMI, and you want to find a suitable one, follow the instructions in Finding an AMI.
- Instance type = `m1.small`
- Instance profile name = `mytest-instance-profile`.

Your command should look similar to the following example:

```
as-create-launch-config lc-with-instance-profile --image-id ami-baba68d3 --in
stance-type m1.small --iam-instance-profile mytest-instance-profile
```

You should get a confirmation like the following example:

```
OK-Created launch config
```

Create an Auto Scaling Group

Create your Auto Scaling group by using `as-create-auto-scaling-group` and then specifying the launch configuration you just created. For more information about the syntax of the `as-create-auto-scaling-group` command, see Create an Auto Scaling Group (p. 23).

Specify these values for the command:

- Auto Scaling group name = `asg-using-instance-profile`
- Launch configuration name = `lc-with-instance-profile`
- Availability Zone = `us-east-1e`
- Max size = `1`
- Min size = `1`

Your command should look similar to the following example:

```
as-create-auto-scaling-group asg-using-instance-profile --launch-configuration
 lc-with-instance-profile --availability-zones "us-east-1e" --max-size 1 --min-
size 1
```

You should get confirmation similar to the following example:

```
OK-Created AutoScalingGroup
```

Verify That the EC2 Instance Launches with the IAM Role

To confirm that Auto Scaling launches your EC2 instances using the IAM role you specify, use `as-describe-auto-scaling-groups`. The command shows details about the group and instances launched. For information about the `as-describe-auto-scaling-groups` command, see Verify Your Auto Scaling Group (p. 24).

Your command should look like the following example:

```
as-describe-auto-scaling-groups asg-using-instance-profile --headers
```

Note
Specify the `--headers` general option to show column headers that organize the describe command's information.

The information you get should be similar to the following example.

```
AUTO-SCALING-GROUP  GROUP-NAME            LAUNCH-CONFIG        AVAILABILITY-
ZONES  MIN-SIZE  MAX-SIZE  DESIRED-CAPACITY
AUTO-SCALING-GROUP  asg-using-instance-profile  lc-with-instance-profile
  us-east-1e                       1                 1                  1

INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-5d97a03b       us-east-1e                  InService  Healthy  lc-
with-instance-profile
```

You can see that Auto Scaling launched an instance using the `lc-with-instance-profile` launch configuration; and it is running (`InService`) and is healthy.

Clean Up

After you're finished using your instances and your Auto Scaling group, it is a good practice to clean up. Run the `as-delete-auto-scaling-group` command with the optional `--force-delete` parameter. *Force delete* specifies that EC2 instances that are part of the Auto Scaling group are deleted with the Auto Scaling group, even if the instances are still running. If you don't specify the `--force-delete` parameter, then you cannot delete your Auto Scaling group until you have terminated all instances in that Auto Scaling group.

Run the command with the following values:

- Auto Scaling group name = `asg-with-instance-profile`
- Force delete (optional parameter) = `--force-delete`

Your command should look like the following example:

```
as-delete-auto-scaling-group asg-with-instance-profile --force-delete
```

Confirm that you want to delete the Auto Scaling group. After you confirm that you want to delete the Auto Scaling group, Auto Scaling deletes the group, as the following example shows:

```
Are you sure you want to delete this AutoScalingGroup? [Ny]
OK-Deleted AutoScalingGroup
```

Creating Launch Configurations

A *launch configuration* is a template for the EC2 instances launched into an Auto Scaling group. You must specify a launch configuration when you create an Auto Scaling group. You can't modify a launch configuration after you've created it. However, you can change which launch configuration is associated with an Auto Scaling group at any time.

If you've launched an EC2 instance before, you've already walked through the process of defining compute characteristics such as the instance type, security groups, and configuration scripts. You define these same characteristics for any instances launched into the Auto Scaling group using a launch configuration.

When your launch configuration is ready, you can move straight to creating your Auto Scaling group (p. 58). However, you might also want to look at how to control when your instances launch and terminate (p. 65), how to tag instances (p. 76) so they're easier to identify, and how to incorporate Spot Instances (p. 78) to make your Auto Scaling group even more cost effective.

Contents

Create a Launch Configuration

When you create a launch configuration, you must specify information about the EC2 instances to launch, such as the Amazon Machine Image (AMI), instance type, key pair, security groups, and block device mapping.

To create a launch configuration using the console

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. In the navigation bar at the top of the screen, the current region is displayed. Select a region for your Auto Scaling group that meets your needs.
3. In the navigation pane, under **Auto Scaling**, click **Launch Configurations**. If you are new to Auto Scaling, you see a welcome page; click **Create Auto Scaling group**.
4. Click **Create launch configuration**.
5. On the **Choose AMI** page, select an AMI.
6. On the **Choose Instance Type** page, select a hardware configuration for your instance. Click **Next: Configure details**.

   Note
   T2 instances must be launched into a subnet of a VPC. If you select a `t2.micro` instance but don't have a VPC, one is created for you. This VPC includes a public subnet in each Availability Zone in the region.
7. On the **Configure Details** page, do the following:
   a. In the **Name** field, enter a name for your launch configuration.
   b. Under **Advanced Details**, select an IP address type. If you want to connect to an instance in a VPC, you must select an option that assigns a public IP address. If you want to connect to you instance but aren't sure whether you have a default VPC, select **Assign a public IP address to every instance**.
   c. Click **Skip to review**.
8. On the **Review** page, click **Edit security groups**, follow the instructions to choose an existing security group, and then click **Review**.
9. On the **Review** page, click **Create launch configuration**.
10. In the **Select an existing key pair or create a new key pair** field, select one of the listed options. Click the acknowledgment check box, and then click **Create launch configuration**.

    Warning
    Do not select **Proceed without a key pair** if you need to connect to your instance.

Create a Launch Configuration Using an EC2 Instance

Auto Scaling provides you with an option to create a new launch configuration using the attributes from a running EC2 instance. When you use this option, Auto Scaling copies the attributes from the specified instance into a template from which you can launch one or more Auto Scaling groups.

Tip
You can create an Auto Scaling group directly from an EC2 instance (p. 60). When you use this feature, Auto Scaling automatically creates a launch configuration for you as well.

If the specified instance has properties that are not currently supported by Auto Scaling, instances launched by Auto Scaling using the launch configuration created from the identified instance might not be identical to the identified 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, by default Auto Scaling derives attributes for the launch configuration from the specified instance, plus the block device mapping for the AMI that the instance was launched from (ignoring any additional block devices that were added to the instance after launch).

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

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

Examples

- Create a Launch Configuration Using an EC2 Instance (p. 56)
- Create a Launch Configuration from an Instance and Override the Block Devices (p. 57)
- Create a Launch Configuration and Override the Instance Type (p. 57)

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 Using the Auto Scaling CLI

Use the following `as-create-launch-config` command to create a new launch configuration from an instance using the same attributes as the instance (other than any block devices added after launch):

```
as-create-launch-config my-test-lc-from-instance --instance-id i-a8e09d9c
```

When the launch configuration is created, Auto Scaling returns a success message like the following.

```
OK-Created launch config
```

You can use the following `as-describe-launch-configs` command to describe the launch configuration and verify that its attributes match those of the instance:

```
as-describe-launch-configs my-test-lc-from-instance  --show-long
```

The following is an example response:

```
LAUNCH-CONFIG,my-test-lc-from-instance,ami-b8a63b88,t1.micro,(nil),aki-6065f250,
(nil),{/dev/sda1=snap-3decf207:6:true:standard},sg-d6b3dae6,2013-11-22T05:01:59.
291Z,false,arn:aws:autoscaling:us-east-1a:605053316265:launchConfiguration:39c956
71-708e-4cd2-8642-7fa491e3f114:launchConfigurationName/my-test-lc-from-instance,
(nil),(nil),false,(nil)
```

Create a Launch Configuration from an Instance and Override the Block Devices

By default, Auto Scaling uses the attributes from the EC2 instance you specify to create the launch configuration, except that 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 Using the Auto Scaling CLI

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

```
as-create-launch-config my-test-lc-from-instance-bdm --instance-id i-a8e09d9c
--block-device-mapping "/dev/sda1=snap-3decf207,/dev/sdf=snap-eed6ac86"
```

When the launch configuration is created, Auto Scaling returns a success message like the following:

```
OK-Created launch config
```

Use the following `as-describe-launch-configs` command to describe the launch configuration and verify that it uses your custom block device mapping:

```
as-describe-launch-configs my-test-lc-from-instance-bdm --show-long
```

The following example response describes the launch configuration:

```
LAUNCH-CONFIG,my-test-lc-from-instance-bdm,ami-c49c0dac,t1.mi
cro,(nil),(nil),(nil),
"{/dev/sda1=snap-3decf207,/dev/sdf=snap-eed6ac86}",sg-d6b3dae6,
2013-12-04T12:37:43.366Z,false,arn,(nil),(nil),false,(nil)
```

Create a Launch Configuration and Override the Instance Type

By default, Auto Scaling uses the attributes from the EC2 instance you specify to create the launch configuration. Depending on your requirements, you might want to change some of these attributes. Auto Scaling provides you with options 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 Using the Auto Scaling CLI

Use the following `as-create-launch-config` command to create a launch configuration using an EC2 instance but with a different instance type (for example `m1.small`) than the instance (for example `t1.micro`):

```
as-create-launch-config my-test-lc-from-instance-changetype --instance-id i-
a8e09d9c --instance-type m1.small
```

When the launch configuration is created, Auto Scaling returns a success message like the following:

```
OK-Created launch config
```

Use the following `as-describe-launch-configs` command to describe the launch configuration and verify that the instance type was overridden:

```
as-describe-launch-configs my-test-lc-from-instance-changetype --show-long
```

The following example response describes the launch configuration:

```
LAUNCH-CONFIG,my-test-lc-from-instance-changetype,ami-
b8a63b88,m1.small,(nil),(nil),(nil),
{/dev/sda1=snap-3decf207:6:true:standard},sg-d6b3dae6,2013-11-22T05:22:13.556Z,
false,arn,(nil),(nil),false,(nil)
```

Creating Auto Scaling Groups

An Auto Scaling group is a collection of EC2 instances managed by the Auto Scaling service. Each Auto Scaling group contains configuration options that control when Auto Scaling should launch new instances and terminate existing instances. At a minimum, an Auto Scaling group must contain the following:

- A name
- The maximum number of instances that can be in the Auto Scaling group
- The minimum number of instances that can be in the Auto Scaling group

However, an Auto Scaling group with these options only does not provide much value. The following are additional configuration options that you should define to get the most out of your Auto Scaling group:

- Desired capacity. This parameter specifies the number of instances you'd like to have in the Auto Scaling group.
- Availability Zones or subnets. It is often a good idea to build or modify your applications in AWS to use more than one Availability Zone. If your Auto Scaling group operates within a VPC, you can alternatively specify which subnets you want Auto Scaling to use.
- Launch configuration. As described in Creating Launch Configurations (p. 54), you must define an instance type and how each instance will be configured.
- Metrics and health checks. An effective Auto Scaling group uses metrics to determine when it should launch or terminate instances. In addition, it's helpful to define health checks which Auto Scaling uses to determine if an instance is healthy or, if not, if Auto Scaling should terminate the instance and replace it.

After you create your Auto Scaling, read Configuring Your Auto Scaling Groups (p. 85) to learn about actions that you can take and Monitoring Your Auto Scaling Instances (p. 102) to learn about tracking the performances of instances in the Auto Scaling group.

Contents

- Create an Auto Scaling Group from an EC2 Instance (p. 60)

Create an Auto Scaling Group

When you create an Auto Scaling group, you must specify the launch configuration to use for launching the instances, and the number of instances your group must maintain at all times. You can also specify the Availability Zone in which you want the instances to be launched.

Prerequisites

Create a launch configuration. For more information, see Create a Launch Configuration (p. 54).

To create an Auto Scaling group using the console

1. Open the Amazon EC2 console.
2. In the navigation bar at the top of the screen, the current region is displayed. Select the same region as the launch configuration.
3. In the navigation pane, under **Auto Scaling**, click **Auto Scaling Groups**.
4. Click **Create Auto Scaling group**.
5. On the **Create Auto Scaling Group** page, select **Create an Auto Scaling group from an existing launch configuration**, select a launch configuration, and then click **Next Step**.
6. On the **Configure Auto Scaling group details** page, do the following:

   a. In **Group name**, enter a name for your Auto Scaling group.
   b. In **Group size**, enter the desired capacity for your Auto Scaling group.
   c. If you are launching a T2 instance, you must select a VPC in **Network**. Otherwise, if your account supports EC2-Classic and you are launching a type of instance that doesn't require a VPC, you can select either `Launch into EC2-Classic` or a VPC.
   d. If you selected a VPC in the previous step, select a subnet from **Subnet**. If you selected EC2-Classic in the previous step, select an Availability Zone from **Availability Zone(s)**.
   e. Click **Next: Configure scaling policies**.

7. In the **Configure scaling policies** page, select one of the following options, and then click **Review**:

   - To automatically adjust the size of the Auto Scaling group based on criteria that you specify, select **Use scaling policies to adjust the capacity of this group** and follow the directions.
   - To manually adjust the size of the Auto Scaling group, select **Keep this group at its initial size**. For more information, see Manual Scaling (p. 35).

8. (Optional) To add tags now, click **Edit tags** and complete the following steps. Alternatively, you can add tags later on. For more information, see Tagging Auto Scaling Groups and Instances (p. 76).

   a. In the **Key** and **Value** fields, enter the key and the value for your first tag.
   b. Keep **Tag New Instances** selected if you want Auto Scaling to propagate the tag to the instances launched by your Auto Scaling group.
   c. Click **Add tag** to add additional tags and then specify keys and values for the tags.
   d. Click **Review**.

9. On the **Review** page, click **Create Auto Scaling group**.
10. On the **Auto Scaling group creation status** page, click **Close**.

To create an Auto Scaling group using the command line

You can use one of the following commands:

- create-auto-scaling-group (AWS CLI)
- as-create-auto-scaling-group (p. 23) (Auto Scaling CLI)
- New-ASAutoScalingGroup (AWS Tools for Windows PowerShell)

Create an Auto Scaling Group from an EC2 Instance

Auto Scaling provides you with the option to create an Auto Scaling group by specifying an EC2 instance, instead of a launch configuration, and by specifying attributes such as the minimum, maximum, and desired number of EC2 instances for the Auto Scaling group.

When you create an Auto Scaling group using an EC2 instance, Auto Scaling automatically creates a launch configuration for you and associates it with the Auto Scaling group. This launch configuration has the same name as the Auto Scaling group, and it derives its attributes, such as AMI ID, instance type, and Availability Zone, from the specified instance.

Limitations

The following are limitations when creating an Auto Scaling group from an EC2 instance:

- If the identified instance has tags, the tags are not copied to the `Tags` attribute of the new Auto Scaling group.
- The Auto Scaling group includes the block device mapping from the AMI used to launch the instance; it does not include any block devices attached after instance launch.
- If the identified instance is registered with one or more load balancers, the load balancer names are not copied to the `LoadBalancerNames` attribute of the new Auto Scaling group.

Prerequisites

Before you begin, find the ID of the EC2 instance using the Amazon EC2 console, the describe-instances command (AWS CLI), or the ec2-describe-instances command (Amazon EC2 CLI).

The EC2 instance must meet the following criteria:

- The instance is in the Availability Zone in which you want to create the Auto Scaling group.
- The instance is not a member of another Auto Scaling group.
- The instance is in `running` state.
- The AMI used to launch the instance must still exist.

Create an Auto Scaling Group from an EC2 Instance Using the Auto Scaling CLI

Use the following `as-create-auto-scaling-group` command to create an Auto Scaling group, *`my-asg-from-instance`*, from the EC2 instance `i-7f12e649`.

```
as-create-auto-scaling-group my-asg-from-instance --instance-id i-7f12e649 -
-min-size 1 --max-size 2 --desired-capacity 2
```

When the Auto Scaling group is created, Auto Scaling returns a success message.

```
OK-Created AutoScalingGroup
```

Use the following `as-describe-auto-scaling-groups` command to verify that the *`my-asg-from-instance`* group was created with the specified size and desired capacity:

```
as-describe-auto-scaling-groups my-asg-from-instance --headers
```

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 also named *`my-asg-from-instance`*:

```
AUTO-SCALING-GROUP  GROUP-NAME            LAUNCH-CONFIG      AVAILABILITY-ZONES
  MIN-SIZE  MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-asg-from-instance  my-asg-from-instance  us-east-1a
      1         2           2                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-08d6a93e   us-east-1a         InService  Healthy  my-asg-from-in
stance
INSTANCE  i-0bd6a93d   us-east-1a         InService  Healthy  my-asg-from-in
stance
```

Use the following `as-describe-launch-configs` command to describe the launch configuration *`my-asg-from-instance`*.

```
as-describe-launch-configs my-asg-from-instance  --show-long --headers
```

Auto Scaling and Amazon Virtual Private Cloud

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. For more information, see the Amazon VPC User Guide.

Within a virtual private cloud (VPC), you can launch AWS resources such as an Auto Scaling group. An Auto Scaling group in a VPC works essentially the same way as it does on Amazon EC2 and supports the same set of features. This section provides you with an overview of Auto Scaling groups in a VPC and steps you through the process of creating an Auto Scaling group in a VPC. If you want to launch your Auto Scaling instances in Amazon EC2, see Getting Started with the Auto Scaling CLI (p. 22).

Before you can create your Auto Scaling group in a VPC, you must first configure your VPC environment. You create your VPC by specifying a range of IP addresses in the classless inter-domain routing (CIDR) range of your choice (for example, 10.0.0.0/16). For more information about CIDR notation and what "/16" means, go to Classless Inter-Domain Routing on Wikipedia.

You can create a VPC that spans multiple Availability Zones then add one or more subnets in each Availability Zone. 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.

Contents

Default VPC

If you have created your AWS account after 2013-12-04 or you are creating your Auto Scaling group in a new region, we create a default VPC for you. Your default VPC comes with a subnet in each Availability Zone. If you have a default VPC, by default, your Auto Scaling group is created in the default VPC.

A default VPC combines the benefits of the advanced features provided by Amazon VPC platform with the ease of use of the Amazon EC2 platform. You can launch instances into your default VPC without needing to know anything about Amazon VPC.

For information about default VPC and to find out if your account comes with a default VPC, see Your Default VPC and Subnets in the *Amazon VPC Developer Guide*.

The steps for creating an Auto Scaling group in a default VPC is similar to the steps for creating an Auto Scaling group in Amazon EC2.

IP Addressing in a VPC

When you launch your Auto Scaling instances in a VPC, your instances are automatically assigned with a private IP address in the address range of the subnet. This enables your instances to communicate with other instances in the VPC. You have an option to assign a public IP address to your instance. Assigning a public IP address to your instance allows it to communicate with the Internet or other services in AWS. You can choose the option of assigning public IP address to your instances when you create your launch configuration.

Instance Placement Tenancy

Dedicated Instances are physically isolated at the host hardware level from instances that aren't dedicated and from instances that belong to other AWS accounts. 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, by default, they run as shared-tenancy instances. If you set the tenancy attribute of a VPC to `dedicated`, all instances launched in the VPC run as single-tenancy instances. For more information, see Dedicated Instances in the *Amazon VPC User Guide*. For pricing information, see the Amazon EC2 Dedicated Instances product page.

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

Launch Configuration Tenancy	VPC Tenancy = default	VPC Tenancy = dedicated
not specified	shared-tenancy instance	Dedicated Instance

Launch Configuration Tenancy	VPC Tenancy = default	VPC Tenancy = dedicated
`default`	shared-tenancy instance	Dedicated Instance
`dedicated`	Dedicated Instance	Dedicated Instance

You can specify the instance placement tenancy for your launch configuration as `default` or `dedicated` using the create-launch-configuration command with the `--placement-tenancy` option. For example, the following command 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-configurations command to verify the instance placement tenancy of the launch configuration:

```
aws autoscaling describe-launch-configurations --launch-configuration-names my-
launch-config
```

The following is example output for a launch configuration that creates Dedicated Instances. Note that `PlacementTenancy` is not part of the output for this command unless you have explicitly set the instance placement tenancy.

```
{
    "LaunchConfigurations": [
        {
            "UserData": null,
            "EbsOptimized": false,
            "PlacementTenancy": "dedicated",
            "LaunchConfigurationARN": "arn",
            "InstanceMonitoring": {
                "Enabled": true
            },
            "ImageId": "ami-b5a7ea85",
            "CreatedTime": "2015-03-08T23:39:49.011Z",
            "BlockDeviceMappings": [],
            "KeyName": null,
            "SecurityGroups": [],
            "LaunchConfigurationName": "my-launch-config",
            "KernelId": null,
            "RamdiskId": null,
            "InstanceType": "m3.medium"
        }
    ]
```

Linking EC2-Classic Instances to a VPC

If you are launching the instances in your Auto Scaling group in EC2-Classic, you can link them to a VPC using *ClassicLink*. ClassicLink enables you to associate one or more security groups for the VPC with the EC2-Classic instances in your Auto Scaling group, enabling communication between these linked EC2-Classic instances and instances in the VPC using private IP addresses. For more information, see ClassicLink in the *Amazon EC2 User Guide for Linux Instances*.

If you have running EC2-Classic instances in your Auto Scaling group, you can link them to a VPC with ClassicLink enabled. For more information, see Linking an Instance to a VPC in the *Amazon EC2 User Guide for Linux Instances*. Alternatively, you can update the Auto Scaling group to use a launch configuration that automatically links the EC2-Classic instances to a VPC at launch, then terminate the running instances and let Auto Scaling launch new instances that are linked to the VPC.

Link to a VPC Using the AWS Management Console

Use the following procedure to create a launch configuration that links EC2-Classic instances to the specified VPC and update an existing Auto Scaling group to use the launch configuration.

To link EC2-Classic instances in an Auto Scaling group to a VPC using the console

1. Verify that the VPC has ClassicLink enabled. For more information, see Viewing Your ClassicLink-Enabled VPCs in the *Amazon EC2 User Guide for Linux Instances*.
2. Create a security group for the VPC that you are going to link EC2-Classic instances to, with rules to control communication between the linked EC2-Classic instances and instances in the VPC.
3. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
4. In the navigation pane, click **Launch Configurations**. If you are new to Auto Scaling, you see a welcome page. Click **Create Auto Scaling group**.
5. Click **Create launch configuration**.
6. On the **Choose AMI** page, select an AMI.
7. On the **Choose an Instance Type** page, select an instance type, and then click **Next: Configure details**.
8. On the **Configure details** page, do the following:

   a. Enter a name for your launch configuration.
   b. Expand **Advanced Details**, select the **IP Address Type** that you need, and then select **Link to VPC**.
   c. From **VPC**, select the VPC with ClassicLink enabled from step 1.
   d. From **Security Groups**, select the security group from step 2.
   e. Click **Skip to review**.

9. On the **Review** page, make any changes that you need, and then click **Create launch configuration**. In the **Select an existing key pair or create a new key pair** field, select an option, click the acknowledgment check box (if present), and then click **Create launch configuration**.
10. When prompted, follow the directions to create an Auto Scaling group that uses the new launch configuration. Be sure to select **Launch into EC2-Classic** for **Network**. Otherwise, click **Cancel** and then add your launch configuration to an existing Auto Scaling group as follows:

    a. In the navigation pane, click **Auto Scaling Groups**.
    b. Select your Auto Scaling group, click **Actions**, and then click **Edit**.
    c. From **Launch Configuration**, select your new launch configuration and then click **Save**.

Link to a VPC Using the AWS CLI

Use the following procedure to create a launch configuration that links EC2-Classic instances to the specified VPC and update an existing Auto Scaling group to use the launch configuration.

To link EC2-Classic instances in an Auto Scaling group to a VPC using the AWS CLI

1. Verify that the VPC has ClassicLink enabled. For more information, see Viewing Your ClassicLink-Enabled VPCs in the *Amazon EC2 User Guide for Linux Instances*.
2. Create a security group for the VPC that you are going to link EC2-Classic instances to, with rules to control communication between the linked EC2-Classic instances and instances in the VPC.
3. Create a launch configuration using the create-launch-configuration command as follows, where *vpd_id* is the ID of the VPC with ClassicLink enabled from step 1 and *group_id* is the security group from step 2:

```
aws autoscaling create-launch-configuration --launch-configuration-name
classiclink-config
--image-id ami_id --instance-type instance_type
--classic-link-vpc-id vpc_id --classic-link-vpc-groups group_id
```

4. Update your existing Auto Scaling group, for example *my-asg*, with the launch configuration that you created in the previous step. Any new EC2-Classic instances launched in this Auto Scaling group are linked EC2-Classic instances. Use the update-auto-scaling-group command as follows:

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg

--launch-configuration-name classiclink-config
```

   Alternatively, you can use this launch configuration with a new Auto Scaling group that you create using create-auto-scaling-group.

Launch Auto Scaling Instances in a VPC

You can use Auto Scaling to launch instances into a virtual private cloud (VPC).

Prerequisites

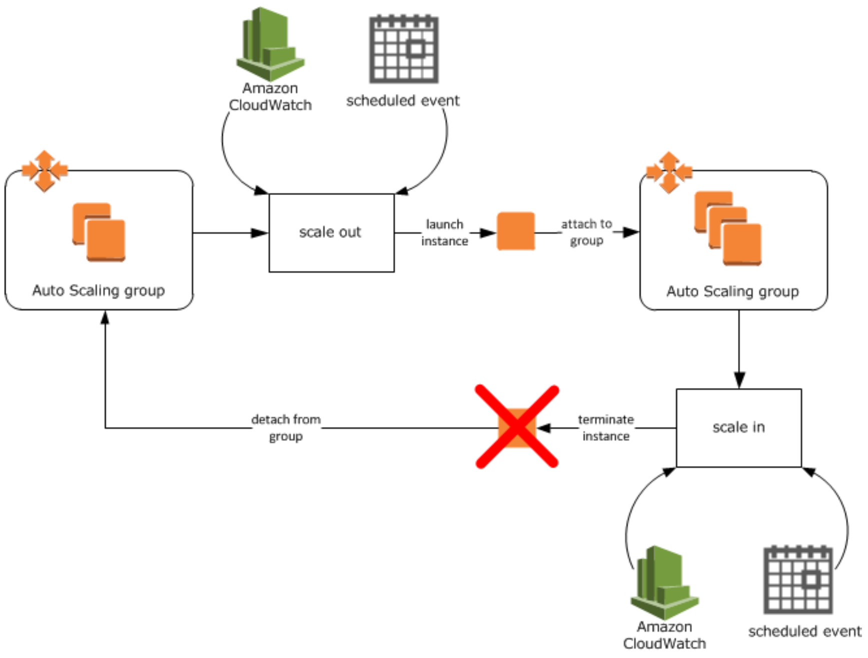
Before you can launch your Auto Scaling instances in a VPC, you must first create your VPC environment. After you create your VPC and subnets, you launch Auto Scaling instances within the subnets. The easiest way to create a VPC with one public subnet is to use the VPC wizard. For more information, see the Amazon VPC Getting Started Guide.

Examples

- Getting Started with the Auto Scaling CLI (p. 22)
- Hosting a Web App on Amazon Web Services
- Hosting a .NET Web App on Amazon Web Services

Controlling How Instances Launch and Terminate

The section, Auto Scaling Lifecycle (p. 9), describes the basic lifecycle of instances as they launch or terminate within an Auto Scaling group.

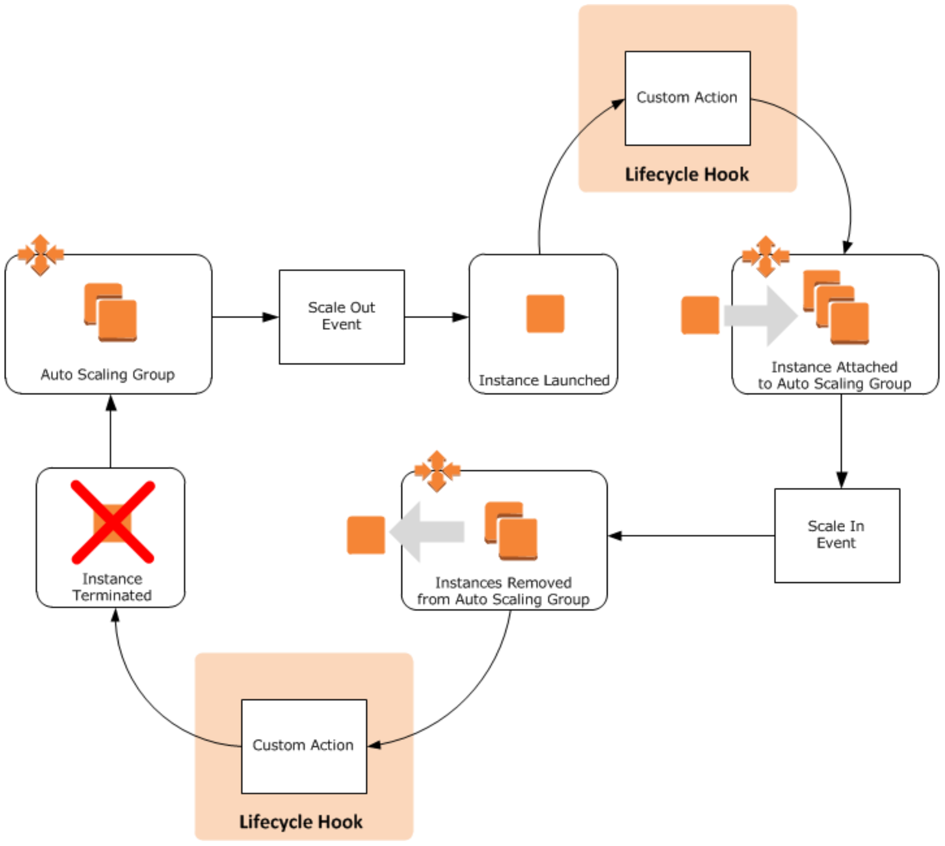


As this diagram illustrates, the standard procedure is for Auto Scaling to launch and configure an instance in response to a scale out event. When the instance is ready, it is immediately put into service. The same is true when a scale in event occurs. Auto Scaling selects an instances (based on any existing termination policies (p. 31) that are in place), removes it from the Auto Scaling group and terminates it.

While these processes are usually sufficient for most implementations of Auto Scaling groups, there are some situations in which you want more granular control over when instances are put into service and when they terminate. You can use *lifecycle hooks* to implement this level of control.

Introducing Lifecycle Hooks

An Auto Scaling lifecycle hook allows you to add custom events to instances as they launch or terminate. A custom event could be actions such as manually installing software, or retrieving log files.



When you add a lifecycle hook to your Auto Scaling group:

1. Auto Scaling responds to a scale in or scale out event by launching or terminating an instance.
2. Auto Scaling puts the instance into a wait state. The state of the instance becomes either `Pending:Wait` or `Terminating:Wait`.
3. Auto Scaling sends a message to the notification target defined for the lifecycle hook. The message contains information about the instance that is launching or terminating, and a token you can use to control the lifecycle action.
4. At this point, the instance is ready for you to perform a custom action. The instance remains in a wait state until you tell Auto Scaling to continue or until the timeout period for the lifecycle hook ends.
5. By default, the instance remains in the `Pending:Wait` or `Terminating:Wait` state for one hour. If you take no action during that time, Auto Scaling terminates the instance. You can extend the length of time the instance remains in a waiting state by recording a heartbeat.

Note
You can only add lifecycle hooks to your Auto Scaling group through the Auto Scaling CLI or API. There is no way to add a lifecycle hook using the AWS Management Console.

For more information about adding lifecycle hooks to your Auto Scaling groups, see the following:

- Adding Lifecycle Hooks (p. 68)
- Considerations When Using Lifecycle Hooks (p. 69)

Adding Lifecycle Hooks

Each Auto Scaling can have multiple lifecycle hooks. However, you can have only a set number of hooks for each AWS account. For more information, see Auto Scaling Account Limits.

To add a lifecycle hook to an Auto Scaling group

1. Create a notification target. You can either create a topic using Amazon SNS, or use an Amazon SQS queue.

   After you create your target, make a note of its Amazon Resource Name (ARN). For example, `arn:aws:sns:us-west-2:123456789012:my-sns-topic`.
2. Create an AWS Identity and Access Management role using the steps in Creating a Role for an AWS Service (AWS Management Console) in the *Using IAM* guide. When you are prompted to select a role type, choose **AWS Service Roles** and then select **AutoScaling Notification Access**.

   After you create your role, make a note of its ARN. For example, `arn:aws:iam::123456789012:role/my-auto-scaling-role`.
3. Create a lifecycle hook, which tells Auto Scaling that you want to perform an action on the instance before it transitions. You create a lifecycle hook using the put-lifecycle-hook command as follows:

   ```
   aws autoscaling put-lifecycle-hook --lifecycle-hook-name my-lifecycle-hook
    --auto-scaling-group-name my-asg --lifecycle-transition autoscaling:EC2_IN
   STANCE_LAUNCHING --notification-target-arn sns-topic-arn --role-arn iam-
   role-arn
   ```

   Note that you can specify the `--heartbeat-timeout` parameter to determine how long Auto Scaling should keep an instance in the `Pending:Wait` or `Terminating:Wait` state.
4. Perform a custom action.
5. (Optional) If you need more time to complete the custom action, use the following record-lifecycle-action-heartbeat command to restart the heartbeat timeout and keep the instance in a waiting state. Note that the lifecycle action token is included in the message sent to your notification target.

   ```
   aws autoscaling record-lifecycle-action-heartbeat --lifecycle-action-token
    bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635 --auto-scaling-group-name my-asg -
   -lifecycle-hook-name my-lifecycle-hook
   ```

   For example, consider a lifecycle hook that uses the default timeout value of 60 minutes. After 30 minutes, if you discover that you need more time to complete your custom action, use the `record-lifecycle-action-heartbeat` command to restart the timeout value, giving you a total of 90 minutes to complete the custom action.
6. When you finish the custom action, let Auto Scaling know it can finish launching or terminating the instance. You use the complete-lifecycle-action command as follows:

   ```
   aws autoscaling complete-lifecycle-action --lifecycle-action-token bcd2f1b8-
   9a78-44d3-8a7a-4dd07d7cf635 --lifecycle-hook-name my-lifecycle-hook --auto-
   scaling-group-name my-asg --lifecycle-action-result CONTINUE
   ```

Considerations When Using Lifecycle Hooks

Adding lifecycle hooks to your Auto Scaling gives you a greater degree of control over how instances launch and terminate. Here are some things to consider when adding a lifecycle hook to your Auto Scaling, to help ensure that the group continues to perform as expected.

Considerations

Keeping Instances in a Wait State

Instances can only remain in a wait state for a finite period of time. The default length of time is 1 hour (3600 seconds). You can adjust this time in the following ways:

- Change the heartbeat timeout for the lifecycle hook. When you create a lifecycle hook, you can optionally define the timeout value. You accomplish this in the CLI with the `--heartbeat-timeout` parameter. In the API, use the `HeartbeatTimeout` parameter.
- Call the complete-lifecycle-action command or `CompleteLifecycleAction` action, which tells Auto Scaling that the instance is ready to continue to the next state.
- Call the record-lifecycle-action-heartbeat command or the `RecordLifecycleActionHeartbeat` action to increment the amount of time the instance remains in a wait state. The amount of time added is equal to the time assigned to the timeout value. For example, if the timeout value is 1 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.

Note
You can only keep an instance in a wait state for a maximum of 48 hours, regardless of how often you call `record-lifecycle-action-heartbeat` or **RecordLifecycleActionHeartbeat**.

Cooldowns and Custom Actions

Each time Auto Scaling launches or terminates an instance, a cooldown (p. 28) takes effect. This cooldown helps ensure that the Auto Scaling group does not launch or terminate more instances than needed.

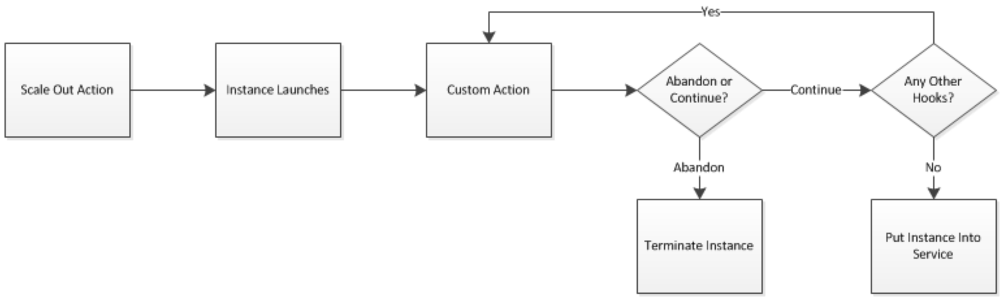
When you put a lifecycle hook on an Auto Scaling group, any scaling actions are suspended until the instance move out of a Wait state. After the instance moves out of a Wait state, the cooldown period starts.

For example, consider an Auto Scaling group for a set of servers in a basic web application. This group has a lifecycle hook that allows for custom actions as a new instance launches. The application experiences an increase in demand, and Auto Scaling launches a new instance to address the need for additional capacity. Because there is a lifecycle hook, the instance is put into a `Pending:Wait` state, which means the instance is not available to handle traffic yet. Until the instance moves into service, all scaling actions are suspended for the Auto Scaling group. When the instance is put into service, the cooldown period starts and, when it expires, additional scaling actions can resume.

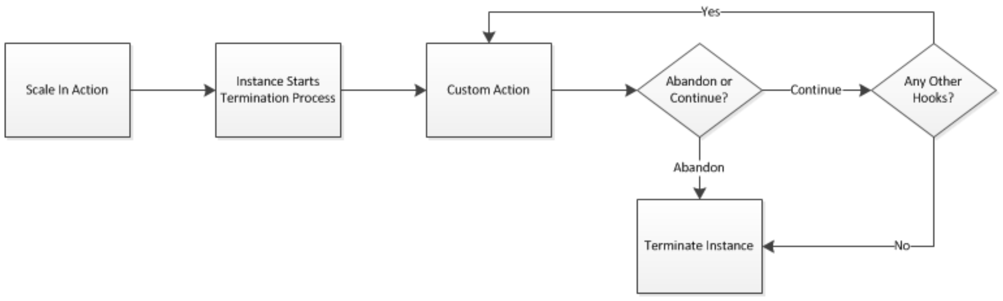
Abandon or Continue

At the conclusion of a lifecycle hook, an instance can have one of two results: `ABANDON` or `CONTINUE`.

If the instance is launching, an `ABANDON` result means that whatever additional actions you wanted to take on the instance were unsuccessful. Instead of putting the instance into service, Auto Scaling terminates the instance and, if necessary, launches a new one. A `CONTINUE` result means that your actions were successful, and Auto Scaling can put the instance into service.



If the instance is terminating, an `ABANDON` result means stop any remaining actions, such as other lifecycle hooks, and move straight to terminating the instance. A `CONTINUE` result means continue with the termination process, but allow any other lifecycle hooks applied to the instance take effect as well.



Note
For terminating instances, both an `ABANDON` result and a `CONTINUE` result cause the instance to terminate. The main difference is whether any other actions are allowed to occur on the instance.

Spot Instances

You can use lifecycle hooks with Spot Instances. However, a lifecycle hook does not prevent an instance from terminating due to a change in the Spot Price, which can happen at any time. In addition, when a Spot Instance terminates, you must still complete the lifecycle action (using the **complete-lifecycle-action** command or the **CompleteLifecycleAction** action).

Examples of How to Use Lifecycle Hooks

Lifecycle hooks can allow you to customize an Auto Scaling to meet the needs of your application's architecture. Here are some examples.

Examples

- Installing Software to Pending Instances (p. 70)
- Filling a Cache of Servers (p. 72)
- Analyzing an Instance Before Termination (p. 73)
- Retrieving Logs from Terminating Instances (p. 74)

Installing Software to Pending Instances

As with a standalone EC2 instance, you have the option of configuring instances launched into an Auto Scaling group using user data. For example, you can specify a configuration script using the UserData field in the AWS Management Console, or the `--userdata` parameter in the AWS CLI or Auto Scaling CLI.

If you have software that can't be installed using a configuration script, or if you need to modify software manually before Auto Scaling adds the instance to the group, add a lifecycle hook to your Auto Scaling group that notifies you when the Auto Scaling group launches an instance. This hook keeps the instance in the `Pending:Wait` state while you install and configure the additional software.

By default, the instance remains in the `Pending:Wait` state for one hour. If you take no action during that time, Auto Scaling assumes that the instance was not configured correctly and terminates it. If you need more time, you can restart the timeout period. For example, if after 30 minutes you discover that you need more time to complete your software installation, you can restart the timeout period, giving you a total of 90 minutes to complete the software installation. If you are ready to add the instance to the Auto Scaling group before the timeout period ends, you can complete the lifecycle action.

Adding Software Using the Auto Scaling CLI

The following steps demonstrate the general process for installing additional software on instances joining an Auto Scaling group.

To add software manually to pending instances using the Auto Scaling CLI

1. Create a notification target to receive the notification that an instance is launching. You can either create a topic using Amazon SNS, or use an Amazon SQS queue.

   After you create your target, make a note of its Amazon Resource Name (ARN). For example, `arn:aws:sns:us-west-2:123456789012:my-sns-topic`.
2. Create an IAM role using the steps in Creating a Role for an AWS Service (AWS Management Console) in the *Using IAM* guide. When prompted to select a role type, choose **AWS Service Roles** and then select **AutoScaling Notification Access**.

   After you create your role, make a note of its ARN. For example, `arn:aws:iam::123456789012:role/my-auto-scaling-role`.
3. Create a lifecycle hook perform an action (in this case, installing additional software) on the instance before it enters service. Create a lifecycle hook using the following `as-put-lifecycle-hook` command:

   ```
   as-put-lifecycle-hook ReadyForSoftwareInstall --auto-scaling-group my-asg
   --lifecycle-transition autoscaling:EC2_INSTANCE_LAUNCHING --notification-
   target sns-topic-arn --notification-role iam-role-arn
   ```
4. When a scale out event occurs, Auto Scaling launches an instance. If the Auto Scaling group uses a configuration script, it is applied. When these steps are complete, the lifecycle hook puts the instance into a `Pending:Wait` state and uses your notification target to inform you that the instance is ready. You can connect to the instance and install additional software. For more information about connecting to an EC2 instance, see Connect to Your Linux Instance in the *Amazon EC2 User Guide for Linux Instances* or Connecting to Your Windows Instance in the *Amazon EC2 User Guide for Microsoft Windows Instances*.
5. (Optional) To keep the instances in the `Pending:Wait` state until you complete the software installation, use the following `as-record-lifecycle-action-heartbeat` command to reset the timeout period for the instance. Note that the lifecycle action token is included in the message sent to your notification target.

```
as-record-lifecycle-action-heartbeat 163445fc-e180-48a4-abcc-dddec19cc2a4
--lifecycle-hook ReadyForSoftwareInstall --auto-scaling-group my-asg
```

6. When you finish installing the additional software, use the following `as-complete-lifecycle-action` command to let Auto Scaling know it can add the instance to the Auto Scaling group:

   ```
   as-complete-lifecycle-action 163445fc-e180-48a4-abcc-dddec19cc2a4 --lifecycle-
   hook ReadyForSoftwareInstall --auto-scaling-group my-asg --lifecycle-action-
   result CONTINUE
   ```

Filling a Cache of Servers

You can use Auto Scaling to fill a cache of servers ahead of an expected increase in demand. For example, you might having a schedule-based scaling policy to coincide with an upcoming marketing effort, or you might have an application that has a monthly spike in traffic. In these types of cases, it can be helpful to have EC2 instances ready in advance, because you can maximize application responsiveness, which in turn provides a better customer experience.

To cache servers, add a lifecycle hook to your Auto Scaling group that notifies you when the Auto Scaling group launches an instance. This hook applies to any new instances launched for the Auto Scaling group and keeps them in the `Pending:Wait` state.

By default, the instance remains in the `Pending:Wait` state for one hour. If you take no action during that time, Auto Scaling assumes that the instance was not configured correctly and terminates it. If you need more time, you can restart the timeout period. For example, if after 30 minutes you are not ready to add the instances to the Auto Scaling group, you can restart the timeout period, giving you a total of 90 minutes to add the instances to the Auto Scaling group. If you are ready to add the instances to the Auto Scaling group before the timeout period ends, you can complete the lifecycle action.

Filling a Cache Using the Auto Scaling CLI

The following steps demonstrate how to create a cache of servers for your Auto Scaling group.

To fill a cache of servers using the Auto Scaling CLI

1. Create a notification target to receive the notification that an instance is launching. You can either create a topic using Amazon SNS, or use an Amazon SQS queue.

   After you create your target, make a note of its Amazon Resource Name (ARN). For example, `arn:aws:sns:us-west-2:123456789012:my-sns-topic`.
2. Create an IAM role using the steps in Creating a Role for an AWS Service (AWS Management Console) in the *Using IAM* guide. When prompted to select a role type, choose **AWS Service Roles** and then select **AutoScaling Notification Access**.

   After you create your role, make a note of its ARN. For example, `arn:aws:iam::123456789012:role/my-auto-scaling-role`.
3. Create a lifecycle hook to perform an action (in this case, waiting until a specific period of time elapses) on the instance before it enters service. Create a lifecycle hook using the following `as-put-lifecycle-hook` command:

```
as-put-lifecycle-hook CachedServers --auto-scaling-group my-asg --lifecycle-
transition autoscaling:EC2_INSTANCE_LAUNCHING --notification-target sns-
topic-arn --notification-role iam-role-arn
```

4. Increase the size of your Auto Scaling group using the following `as-update-auto-scaling-group` command. This command increases the maximum size of the group to 10 and the desired capacity to 8.

```
as-update-auto-scaling-group my-asg --max-size 10 --desired-capacity 8
```

5. (Optional) To keep the instances in the `Pending:Wait` state until you are ready to put them into service, use the following `as-record-lifecycle-action-heartbeat` command. Note that the lifecycle action token is included in the message sent to your notification target.

```
as-record-lifecycle-action-heartbeat bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635
--auto-scaling-group my-asg --lifecycle-hook CachedServers
```

6. When you are ready to put the instances into service, use the following `as-complete-lifecycle-action` command to let Auto Scaling know that it can add the instances to the Auto Scaling group:

```
as-complete-lifecycle-action bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635 --lifecycle-
hook CachedServers --auto-scaling-group my-asg -lifecycle-action-result
CONTINUE
```

Analyzing an Instance Before Termination

A primary benefit of Auto Scaling is the ability to scale the instances for your application dynamically on an as-needed basis. As a result, instances frequently are launched and terminated without any need for manual intervention. However, you might want to understand why an instance is being terminated so that you can better configure your application's architecture. You can accomplish this by adding a lifecycle hook to your Auto Scaling group. This hook puts the instance into a `Terminating:Wait` state, while you connect to the instance and investigate the cause of the termination. The instance remains in this state until its state is set to `Terminating:Proceed`.

By default, the instance remains in the `Terminating:Wait` state for one hour. If you take no action during that time, Auto Scaling continues the termination process. If you need more time, you can restart the timeout period. For example, if after 30 minutes you discover that you need more time to analyze the instance, you can restart the timeout period, giving you a total of 90 minutes to complete your analysis. If you are ready for the instance to terminate before the timeout period ends, you can complete the lifecycle action, which continues the termination process.

When an instance has a terminating status (either `Terminating`, `Terminating:Wait`, or `Terminating:Proceed`), it is not eligible to be put back into service. If you need to troubleshoot an instance and then put it back into service, put it in a standby state before Auto Scaling initiates the termination. For more information, see Troubleshooting Instances in an Auto Scaling Group (p. 95).

Analyzing Instances Using the Auto Scaling CLI

The following steps demonstrate the general process for putting instances in a `Terminating:Wait` state, connecting to the instance, and analyze what might have caused the instance to fail.

To analyze an instance before it terminates using the Auto Scaling CLI

1. Create a notification target to receive the notification that an instance is terminating. You can either create a topic using Amazon SNS, or use an Amazon SQS queue.

   After you create your target, make a note of its Amazon Resource Name (ARN). For example, `arn:aws:sns:us-west-2:123456789012:my-sns-topic`.
2. Create an IAM role using the steps in Creating a Role for an AWS Service (AWS Management Console) in the *Using IAM* guide. When prompted to select a role type, choose **AWS Service Roles** and then select **AutoScaling Notification Access**.

   After you create your role, make a note of its ARN. For example, `arn:aws:iam::123456789012:role/my-auto-scaling-role`.
3. Create a lifecycle hook to perform an action (in this case, analyze the instance) on the instance before it terminates. Create the lifecycle hook using the following **as-put-lifecycle-hook** command:

```
as-put-lifecycle-hook WaitForDiagnostics --auto-scaling-group my-asg --life
cycle-transition autoscaling:EC2_INSTANCE_TERMINATING --notification-target
 sns-topic-arn --notification-role iam-role-arn
```

4. When an instance in the Auto Scaling group is terminated, Auto Scaling puts the instance in a `Terminating:Wait` state and sends a message to the notification target that you created. After you receive this notification, you can connect to the instance to run any diagnostics or analysis that you need. For more information on how to connect to an EC2 instance, see Connect to Your Linux Instance in the *Amazon EC2 User Guide for Linux Instances* or Connecting to Your Windows Instance in the *Amazon EC2 User Guide for Microsoft Windows Instances*.
5. (Optional) To keep the instances in the `Terminating:Wait` state until you complete your analysis, use the following `as-record-lifecycle-action-heartbeat` command to reset the timeout period for the instance. Note that the lifecycle action token is included in the message sent to your notification target.

```
as-record-lifecycle-action-heartbeat 163445fc-e180-48a4-abcc-dddec19cc2a4
-h WaitForDiagnostics -g my-asg
```

6. (Optional) If you are ready for the instance to terminate before the timeout period ends, you can use the following `as-complete-lifecycle-action` command to continue the termination process:

```

as-complete-lifecycle-action 163445fc-e180-48a4-abcc-dddec19cc2a4 --lifecycle-
hook WaitForDiagnostics --auto-scaling-group my-asg --lifecycle-action-result
 CONTINUE
```

Retrieving Logs from Terminating Instances

Typically, when a scale in event occurs and Auto Scaling determines that an instance is no longer necessary, it immediately puts the instance into the `Terminating` state and you can no longer connect to the instance. The instance remains in this state until it fully terminates.

If you might want to access an instance before it is terminated and retrieve log files, you can add a lifecycle hook to your Auto Scaling group. This hook puts the instance into a `Terminating:Wait` state while you connect to the instance and retrieve the log files.

By default, the instance remains in the `Terminating:Wait` state for one hour. If you take no action during that time, Auto Scaling continues the termination process. If you need more time, you can restart the timeout period. For example, if after 30 minutes you discover that you need more time to analyze the instance, you can restart the timeout period, giving you a total of 90 minutes to retrieve the log files. If you are ready for the instance to terminate before the timeout period ends, you can complete the lifecycle action, which continues the termination process.

When an instance has a terminating status (either `Terminating`, `Terminating:Wait`, or `Terminating:Proceed`), it is not eligible to be put back into service. If you need to troubleshoot an instance and then put it back into service, put it in a standby state before Auto Scaling initiates the termination. For more information, see Troubleshooting Instances in an Auto Scaling Group (p. 95).

Retrieving Logs Using the Auto Scaling CLI

The following steps demonstrate the general process to put instances in a `Terminating:Wait` state so that you can connect to the instance and download log files.

To retrieve logs from a terminating server using the Auto Scaling CLI

1. Create a notification target to receive the notification that an instance is terminating. You can either create a topic using Amazon SNS, or use an Amazon SQS queue.

   After you create your target, make a note of its Amazon Resource Name (ARN). For example, `arn:aws:sns:us-west-2:123456789012:my-sns-topic`.
2. Create an IAM role using the steps in Creating a Role for an AWS Service (AWS Management Console) in the *Using IAM* guide. When prompted to select a role type, choose **AWS Service Roles** and then select **AutoScaling Notification Access**.

   After you create your role, make a note of its ARN. For example, `arn:aws:iam::123456789012:role/my-auto-scaling-role`.
3. Create a lifecycle hook to perform an action (in this case, retrieve log files) on the instance before it terminates. Create a lifecycle hook using the following `as-put-lifecycle-hook` command:

   ```
   as-put-lifecycle-hook GetLogs --auto-scaling-group my-asg --lifecycle-
   transition autoscaling:EC2_INSTANCE_TERMINATING --notification-target sns-
   topic-arn --notification-role iam-role-arn
   ```

4. When an instance in the Auto Scaling group is terminated, Auto Scaling puts the instance in a `Terminating:Wait` state and sends a message to the notification target that you created. After you receive this notification, you can connect to the instance to download the logs files that you need. For more information on how to connect to an EC2 instance, see Connect to Your Linux Instance in the *Amazon EC2 User Guide for Linux Instances* or Connecting to Your Windows Instance in the *Amazon EC2 User Guide for Microsoft Windows Instances*.
5. (Optional) To keep the instance in a terminating state until you have all the data you need, use the following `as-record-lifecycle-action-heartbeat` command to reset the timeout period for the instance. Note that the lifecycle action token is included in the message sent to your notification target.

   ```
   as-record-lifecycle-action-heartbeat bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635
   --lifecycle-hook GetLogs --auto-scaling-group my-asg
   ```

6. (Optional) If you are ready for the instance to terminate before the timeout period ends, you can use the following `as-complete-lifecycle-action` command to continue the termination process:

```
as-complete-lifecycle-action bcd2f1b8-9a78-44d3-8a7a-4dd07d7cf635 --lifecycle-
hook GetLogs --auto-scaling-group my-asg -lifecycle-action-result CONTINUE
```

Tagging Auto Scaling Groups and Instances

You can organize and manage your Auto Scaling groups by assigning your own metadata to each group in the form of *tags*. You specify a *key* and a *value* for each tag. A key can be a general category, such as "project", "owner", or "environment", with specific associated values. For example, if one of your projects is named LIMA, you could assign a tag with a key of "project" and a value of "lima" to all Auto Scaling groups that are part of the LIMA project. Similarly, if you want to differentiate between your development environments, you could assign tags with a key of "environment" and a value of "test" to the Auto Scaling groups that are used in your test environment and assign tags with a key of "environment" and a value of "production" to Auto Scaling groups that are used in your production environment. We recommend that you use a consistent set of tags to make it easier to track your Auto Scaling groups.

You can also specify that the tags for your Auto Scaling groups are added to the EC2 instances launched in the group. Tagging your EC2 instances enables you to see instance cost allocation by tag in your AWS bill. For example, you can track the cost of running Auto Scaling instances for project LIMA in a test environment. For more information, see Use Cost Allocation Tags in the *AWS Billing and Cost Management User Guide*.

Contents

Tag Restrictions

The following basic restrictions apply to tags:

- The maximum number of tags per resource is 10.
- The maximum key length is 127 Unicode characters.
- The maximum value length is 255 Unicode characters.
- Tag keys and values are case sensitive.
- 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 against toward your limit of tags per Auto Scaling group.

  Note that when you launch an instance in an Auto Scaling group, Auto Scaling adds a tag to the instance with a key of `aws:autoscaling:groupName` and a value of the name of the Auto Scaling group.

You can create and assign tags to your Auto Scaling group when you either create or update your Auto Scaling group. You can remove Auto Scaling group tags at any time.

Add or Modify Tags for Your Auto Scaling Group

When you add a tag to your Auto Scaling group, you can specify whether it should be added to instances launched in your 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.

Add or Modify Tags Using the Auto Scaling CLI

Use the `as-create-or-update-tags` command to create or modify a tag. For example, the following command adds a tag with a key of "environment" and a value of "test" that will also be added to instances launched in the Auto Scaling group after this change. If a tag with this key already exists, the existing tag is replaced.

```
as-create-or-update-tags --tag "id=my-asg, t=auto-scaling-group, k=environment,
 v=test, p=true"
```

The following is an example response:

```
OK-Created/Updated tags
```

Use the following `as-describe-tags` command to verify that this tag is created.

```
as-describe-tags --filter "key=environment, value=test"
```

The following is an example response:

```
TAG my-asg auto-scaling-group environment test true
```

Alternatively, use the following `as-describe-auto-scaling-groups` command to verify that the tag is added to the Auto Scaling group `my-asg`.

```
as-describe-auto-scaling-groups my-asg --headers
```

The following is an example response:

```
AUTO-SCALING-GROUP  my-asg  my-lc  us-east-1a   1  1   1
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
TAG  RESOURCE-ID  RESOURCE-TYPE       KEY      VALUE  PROPAGATE-AT-LAUNCH
TAG  my-asg  auto-scaling-group  environment  test    true
```

Delete Tags

You can delete a tag associated with your Auto Scaling group at any time.

Delete Tags Using the Auto Scaling CLI

Use the `as-delete-tags` command to delete a tag. For example, the following command deletes a tag with a key of "environment".

```
as-delete-tags --tag "id=my-asg,t=auto-scaling-group,k=environment"
```

Notice that you must specify the tag key, but you don't need to specify the value. If you specify a value and the value is incorrect, the tag is not deleted.

Launching Spot Instances in Your Auto Scaling Group

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. You can set up Auto Scaling to launch Spot Instances instead of On-Demand instances.

Before launching Spot Instances using Auto Scaling, we recommend that you become familiar with launching and managing Spot Instances using Amazon EC2. For more information, see Spot Instances in the *Amazon EC2 User Guide for Linux Instances*.

Here's how Spot Instances work with Auto Scaling:

- **Setting your bid price.** When you use Auto Scaling to launch Spot Instances, you set your bid price in the launch configuration. You can't use a single launch configuration to launch both On-Demand instances and Spot Instances.
- **Changing your bid price.** To change your Spot bid price, you must create a new launch configuration with the new bid price, and then associate it with your Auto Scaling group. Note that the existing instances continue to run as long as the bid price specified in the launch configuration used for those instances is higher than the current Spot market price.
- **Spot market price and your bid price.** If the market price for Spot Instances rises above your Spot bid price for a running instance in your Auto Scaling group, Amazon EC2 terminates your instance. If your Spot bid price exactly matches the Spot market price, whether your bid is fulfilled depends on several factors—such as available Spot Instance capacity.
- **Maintaining your Spot Instances.** When your Spot Instance is terminated, Auto Scaling attempts to launch a replacement instance to maintain the desired capacity for the group. If the bid price is higher than the market price, then a Spot Instance is launched. Otherwise, no instance is launched, but Auto Scaling keeps trying.
- **Auto Scaling and Spot Instance termination.** Auto Scaling can terminate or replaces Spot Instances just as it can terminate or replace On-Demand instances. For more information, see Choosing a Termination Policy for Your Auto Scaling Group (p. 31).

The following example shows you how to create an Auto Scaling group that launches Spot Instances.

Launching Spot Instances Using the Auto Scaling CLI

To create an Auto Scaling group that launches Spot Instances, complete the following tasks:

Tasks

Create a Launch Configuration

To place bids for Spot Instances using Auto Scaling, specify the maximum price you are willing to pay for an instance by using the `--spot-price` option with the `as-create-launch-config` command as follows:

```
as-create-launch-config spot-lc-5cents --image-id ami-1a2bc4d --instance-type
m1.small --spot-price "0.05"
```

The following is example output:

```
OK-Created launch config
```

Create an Auto Scaling Group

Create your Auto Scaling group using the `as-create-auto-scaling-group` command with the launch configuration that you just created. The following command launches 3 Spot Instances.

```
as-create-auto-scaling-group spot-asg --launch-configuration spot-lc-5cents -
-availability-zones "us-east-1a,us-east-1b" --max-size 5 --min-size 1 --desired-
capacity 3
```

The following is example output:

```
OK-Created AutoScalingGroup
```

For more information about the syntax of the `as-create-auto-scaling-group` command, see Create an Auto Scaling Group (p. 23).

Verify and Check Your Instances

Use the `as-describe-scaling-activities` command to list the activities that Auto Scaling performed for your Auto Scaling group as follows:

```
as-describe-scaling-activities --auto-scaling-group spot-asg --headers
```

If not all your bids are fulfilled, the output looks similar to the following example, where one bid is successful and Auto Scaling is waiting for the other two bids:

```
ACTIVITY  ACTIVITY-ID                           END-TIME             GROUP-
NAME      CODE                        MESSAGE
ACTIVITY  31bcbb67-7f50-4b88-ae7e-e564a8c80a90                       spot-asg
        WaitingForSpotInstanceId  Placed Spot instance request: sir-fc8a3014.
Waiting for instance(s)
ACTIVITY  770bbeb5-407c-404c-a826-856f65db1c57                       spot-asg
        WaitingForSpotInstanceId  Placed Spot instance request: sir-69101014.
Waiting for instance(s)
ACTIVITY  597e4ebd-220e-42bc-8ac9-2bae4d20b8d7  2012-05-23T17:40:22Z  spot-asg
        Successful
```

If the output of `as-describe-scaling-activities` includes `Failed` activities, check the response for details. For example, it's possible that the AMI ID is no longer valid or that it's incompatible with the instance type that you selected. If no reason is given, check whether your bid price is above the Spot market price for that Availability Zone.

If you run `as-describe-scaling-activities` again later and the activities are successful, the output looks similar to the following example:

```
ACTIVITY  ACTIVITY-ID                           END-TIME              GROUP-
NAME      CODE
ACTIVITY  90630906-b40f-41a6-967a-cd6534b2dfca  2012-06-01T02:32:15Z  spot-asg
        Successful
ACTIVITY  a1139948-ad0c-4600-9efe-9dab8ce23615  2012-06-01T00:48:02Z  spot-asg
        Successful
ACTIVITY  33001e70-6659-4494-a817-674d1b7a2f58  2012-06-01T02:31:11Z  spot-asg
        Successful
```

Note that you can get more details about the activities and instances by using the `--show-xml` option of `as-describe-scaling-activities` as follows:

```
as-describe-scaling-activities --auto-scaling-group spot-asg --show-xml
```

The following is example output:

```
<DescribeScalingActivitiesResponse xmlns="http://autoscaling.amazon
aws.com/doc/2011-01-01/">
  <DescribeScalingActivitiesResult>
    <NextToken>b5a3b43e-10c6-4b61-8e41-2756db1fb8f5</NextToken>
    <Activities>
      <member>
        <StatusCode>Successful</StatusCode>
        <Progress>0</Progress>
        <ActivityId>90630906-b40f-41a6-967a-cd6534b2dfca</ActivityId>
        <StartTime>2012-06-01T00:48:21.942Z</StartTime>
        <AutoScalingGroupName>spot-asg</AutoScalingGroupName>
        <Cause>At 2012-06-01T00:48:21Z a difference between desired and actual
 capacity changing the desired capacity, increasing the capacity from 2 to
3.</Cause>
        <Details>{}</Details>
        <Description>Launching a new EC2 instance: i-fe30d187</Description>
        <EndTime>2012-06-01T02:32:15Z</EndTime>
      </member>
      <member>
        <StatusCode>Successful</StatusCode>
        <Progress>0</Progress>
        <ActivityId>a1139948-ad0c-4600-9efe-9dab8ce23615</ActivityId>
        <StartTime>2012-06-01T00:47:51.293Z</StartTime>
        <AutoScalingGroupName>spot-asg</AutoScalingGroupName>
        <Cause>At 2012-06-01T00:47:51Z an instance was taken out of service in
 response to a system health-check.</Cause>
        <Details>{}</Details>
        <Description>Terminating EC2 instance: i-88ce28f1</Description>
        <EndTime>2012-06-01T00:48:02Z</EndTime>
      </member>
      <member>
        <StatusCode>Successful</StatusCode>
        <Progress>0</Progress>
        <ActivityId>33001e70-6659-4494-a817-674d1b7a2f58</ActivityId>
        <StartTime>2012-06-01T00:46:19.723Z</StartTime>
        <AutoScalingGroupName>spot-asg</AutoScalingGroupName>
        <Cause>At 2012-06-01T00:46:19Z a difference between desired and actual
 capacity changing the desired capacity, increasing the capacity from 2 to
3.</Cause>
        <Details>{}</Details>
        <Description>Launching a new EC2 instance: i-2c30d155</Description>
        <EndTime>2012-06-01T02:31:11Z</EndTime>
      </member>
      ...
    </Activities>
  </DescribeScalingActivitiesResult>
  <ResponseMetadata>
    <RequestId>d02af4bc-ad8f-11e1-85db-83e1968c7d8d</RequestId>
  </ResponseMetadata>
</DescribeScalingActivitiesResponse>
```

The XML output shows more detail about the Spot Instance and Auto Scaling activity. For example:

- `Cause: At 2012-06-01T00:48:21Z a difference between desired and actual capacity changing the desired capacity, increasing the capacity from 2 to 3. Description: Launching a new EC2 instance: i-fe30d187`

  If an instance is terminated and the number of instances falls below the desired capacity, Auto Scaling launches a new instance so that the total number of your running instances rises back to the level specified for desired capacity.
- `Cause: At 2012-06-01T00:47:51Z an instance was taken out of service in response to a system health-check. Description: Terminating EC2 instance: i-88ce28f1`

  Auto Scaling maintains the desired number of instances by monitoring the health status of the instances in the Auto Scaling group. When Auto Scaling receives notification that an instance is *unhealthy* or terminated, Auto Scaling launches another instance to take the place of the unhealthy instance. For information about how Auto Scaling monitors the health status of instances, see Maintaining a Fixed Number of EC2 Instances in Your Auto Scaling Group (p. 34).

  Note
  Auto Scaling provides the cause of instance termination that is not the result of a scaling activity. This includes instances that have been terminated because the Spot market price exceeded their bid price.

  When Auto Scaling attempts to replace terminated instances resulting from the Spot market price rising above the bid price, Auto Scaling places the bid specified in the current launch configuration and attempts to launch another instance to maintain the desired capacity.

To view information about the instances that Auto Scaling is launching, use the `as-describe-auto-scaling-groups` command as follows:

```
as-describe-auto-scaling-groups spot-asg --headers
```

The following is example output.

```
AUTO-SCALING-GROUP  GROUP-NAME     LAUNCH-CONFIG  AVAILABILITY-ZONES     MIN-
SIZE  MAX-SIZE  DESIRED-CAPACITY
```

```
AUTO-SCALING-GROUP  spot-asg       spot-lc-5cents us-east-1b,us-east-1a  1
      5         3
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-2c30d155   us-east-1a         InService  Healthy  spot-lc-5cents
INSTANCE  i-fe30d187   us-east-1a         InService  Healthy  spot-lc-5cents
INSTANCE  i-c630d1bf   us-east-1a         InService  Healthy  spot-lc-5cents
```

You can see that Auto Scaling launched 3 instances in us-east-1a, as you specified, and they are all running.

For information about `as-describe-auto-scaling-groups`, see Verify Your Auto Scaling Group (p. 24).

In addition to using `as-describe-auto-scaling-groups`, you can use the `as-describe-auto-scaling-instances` command as follows:

```
as-describe-auto-scaling-instances --headers
```

The following is example output:

```
INSTANCE  INSTANCE-ID  GROUP-NAME      AVAILABILITY-ZONE  STATE      STATUS
LAUNCH-CONFIG
INSTANCE  i-2c30d155   spot-asg        us-east-1a         InService  HEALTHY
spot-lc-5cents
INSTANCE  i-c630d1bf   spot-asg        us-east-1a         InService  HEALTHY
spot-lc-5cents
INSTANCE  i-fe30d187   spot-asg        us-east-1a         InService  HEALTHY
spot-lc-5cents
```

(Optional) Get Notifications When the Auto Scaling Group Changes

For information about setting up email notifications in Auto Scaling, see Getting Notifications When Your Auto Scaling Group Changes (p. 106).

(Optional) Update the Bid Price for the Spot Instances

To update the bid price for Spot Instances

1. Create a launch configuration with the same specifications as before, but with a different name and maximum price.

   ```
   as-create-launch-config spot-lc-7cents --image-id ami-1a2b3c4d --instance-
   type m1.small --spot-price "0.07"
   ```

2. Modify your Auto Scaling group to use the new launch configuration, by using the `as-update-auto-scaling-group` command as follows:

   ```
   as-update-auto-scaling-group spot-asg --launch-configuration spot-lc-7cents
   ```

3. View your changes using the `as-describe-scaling-activities` command after you create your Auto Scaling group.

```
as-describe-scaling-activities --auto-scaling-group spot-asg --headers
```

If not all your bids are fulfilled, the output looks similar to the following example:

```
ACTIVITY  ACTIVITY-ID                           END-TIME             GROUP-
NAME      CODE                        MESSAGE
ACTIVITY  5879cc50-1e40-4539-a754-1cb084f1aecd                        spot-
asg        WaitingForSpotInstanceId  Placed Spot instance request: sir-
93828812. Waiting for instance(s)
ACTIVITY  777fbe1b-7a24-4aaf-b7a9-d368d0511878                        spot-
asg        WaitingForSpotInstanceId  Placed Spot instance request: sir-
016cf812. Waiting for instance(s)
ACTIVITY  f4b00f81-eaea-4421-80b4-a2e3a35cc782                        spot-
asg        WaitingForSpotInstanceId  Placed Spot instance request: sir-
cf60ea12. Waiting for instance(s)
ACTIVITY  31bcbb67-7f50-4b88-ae7e-e564a8c80a90                        spot-
asg        WaitingForSpotInstanceId  Placed Spot instance request: sir-
fc8a3014. Waiting for instance(s)
ACTIVITY  770bbeb5-407c-404c-a826-856f65db1c57                        spot-
asg        WaitingForSpotInstanceId  Placed Spot instance request: sir-
69101014. Waiting for instance(s)
ACTIVITY  597e4ebd-220e-42bc-8ac9-2bae4d20b8d7  2012-05-23T17:40:22Z  spot-
asg        Successful

ACTIVITY  eca158b4-a6f9-4ec5-a813-78d42c1738e2  2012-05-23T17:40:22Z  spot-
asg        Successful

ACTIVITY  1a5bd6c6-0b0a-4917-8cf0-eee1044a179f  2012-05-23T17:22:19Z  spot-
asg        Successful

ACTIVITY  c285bf16-d2c4-4ae8-acad-7450655facb5  2012-05-23T17:22:19Z  spot-
asg        Successful

ACTIVITY  127e3608-5911-4111-906e-31fb16d43f2e  2012-05-23T15:38:06Z  spot-
asg        Successful

ACTIVITY  bfb548ad-8bc7-4a78-a7db-3b41f73501fc  2012-05-23T15:38:07Z  spot-
asg        Successful

ACTIVITY  82d2b9bb-3d64-46d9-99b6-054a9ecf5ac2  2012-05-23T15:30:28Z  spot-
asg        Successful

ACTIVITY  95b7589b-f8ac-49bc-8c83-514bf664b4ee  2012-05-23T15:30:28Z  spot-
asg        Successful

ACTIVITY  57bbf77a-99d6-4d94-a6db-76b2307fb9de  2012-05-23T15:16:34Z  spot-
asg        Successful
```

Clean Up

After you're finished using your instances and your Auto Scaling group, it is a good practice to clean up. Use the `as-delete-auto-scaling-group` command as follows with the optional `--force-delete` parameter, which specifies that EC2 instances that are part of the Auto Scaling group are terminated with the Auto Scaling group, even if the instances are still running. Otherwise, you must terminate these instances before you can delete your Auto Scaling group.

```
as-delete-auto-scaling-group spot-asg --force-delete
```

You are prompted as follows to confirm that you want to delete the Auto Scaling group:

```
Are you sure you want to delete this AutoScalingGroup? [Ny]
```

After you confirm that you want to delete the Auto Scaling group, Auto Scaling deletes the group, and displays the following output:

```
OK-Deleted AutoScalingGroup
```

Configuring Your Auto Scaling Groups

After you create an Auto Scaling group within your network architecture, you may find that there are other actions you might want to take. For example, you might want to:

Load balance your Auto Scaling group (p. 86)
: A load balancer is an important part of Auto Scaling, as it allows you to distribute traffic across the instances within the Auto Scaling group. Auto Scaling works particularly well with Elastic Load Balancing; however, you can also use Auto Scaling with the load balancer of your choice.

Attach an existing instance to your Auto Scaling group (p. 90)
: As you continue to refine and improve your application, you might want to launch and configure an EC2 instance and then attach it to your Auto Scaling group. This is particularly useful if you want to test certain changes before you update all of the instances in the Auto Scaling group.

Detach an instances from an Auto Scaling group (p. 92)
: Occasionally, you might find that you want to move instances out of an Auto Scaling group. This could be because you want to move the instances into a different Auto Scaling group, or because you no longer want to use Auto Scaling in that particular area of your application.

Merge Auto Scaling groups from different Availability Zones (p. 93)
: It is not uncommon to start with a couple of Auto Scaling groups, each residing in a single Availability Zone. However, a more efficient implementation would have a single Auto Scaling group that spans multiple Availability Zones. This involves modifying an existing Auto Scaling group and then terminating the obsolete groups.

Temporarily remove instances from an Auto Scaling group (p. 95)
: Sometimes, you might want to move an instance from your application, but still have it managed by the Auto Scaling group. For example, you might want to install a patch to existing instances in your Auto Scaling group, and don't want to relaunch the instances. You might want to update only a few your instances, so you can see in real time which configuration settings work best. Auto Scaling supports temporarily removing instances from receiving traffic, and then putting them back in service when you're ready.

Suspend and resume your Auto Scaling group (p. 98)
: Auto Scaling allows you to retain complete control over your network architecture. If you discover that you need to investigate a configuration or other issue, you can suspend Auto Scaling actions and then resume them again when your investigation concludes.

Shut down an Auto Scaling group (p. 100)
: You can choose to shut down an Auto Scaling group at any time.

If you haven't yet created an Auto Scaling group, you might want to review the following sections:

- What Is Auto Scaling? (p. 1)—Describes the core concepts that you should understand before adding Auto Scaling to your network infrastructure.
- Getting Started with the Auto Scaling CLI (p. 22)—Create an Auto Scaling group and see how it can help your applications become more highly available and fault tolerant.
- Planning Your Auto Scaling Group (p. 26)—Describes how to create launch configurations, build Auto Scaling groups, and perform other tasks associated with creating Auto Scaling groups.

Load Balance Your Auto Scaling Group

When you use Auto Scaling, you can automatically increase the number of EC2 instances you're using when the user demand goes up, and you can decrease the number of EC2 instances when demand goes down. As Auto Scaling dynamically adds and removes EC2 instances, you need to ensure that the traffic coming to your web application is distributed across all of your running EC2 instances. AWS provides the Elastic Load Balancing service to distribute the incoming web traffic (called the *load*) automatically among all the EC2 instances that you are running. Elastic Load Balancing manages incoming requests by optimally routing traffic so that no one instance is overwhelmed. Using Elastic Load Balancing with your auto-scaled web application makes it easy to route traffic among your dynamically changing fleet of EC2 instances.

You can use Elastic Load Balancing to route traffic to EC2 instances in your Auto Scaling group. For more information about Elastic Load Balancing, see What Is Elastic Load Balancing? in the *Elastic Load Balancing Developer Guide*.

Elastic Load Balancing uses load balancers to monitor traffic and handle requests that come through the Internet. To use Elastic Load Balancing with your Auto Scaling group, you first create a load balancer and then register your Auto Scaling group with the load balancer. Your load balancer acts as a single point of contact for all incoming traffic. You can register multiple load balancers with a single Auto Scaling group. For information about registering your load balancer with your Auto Scaling group, see Set Up a Scaled and Load-Balanced Application (p. 87).

Elastic Load Balancing sends data about your load balancers and EC2 instances to Amazon CloudWatch. CloudWatch collects the data and presents it as readable, near-time metrics. After registering the load balancer with your Auto Scaling group, you can configure your Auto Scaling group to use Elastic Load Balancing metrics (such as request latency or request count) to scale your application automatically. For information about Elastic Load Balancing metrics, see Monitor Your Load Balancer Using Amazon CloudWatch. For information about using CloudWatch metrics to scale automatically, see Dynamic Scaling (p. 35).

By default, the Auto Scaling group determines the health state of each instance by periodically checking the results of EC2 instance status checks. Elastic Load Balancing also performs health checks on the EC2 instances that are registered with the load balancer. After you've registered your Auto Scaling group with a load balancer, you can choose to use the results of the Elastic Load Balancing health check in addition to the EC2 instance status checks to determine the health of the EC2 instances in your Auto Scaling group. For information about adding an Elastic Load Balancing health check, see Add an Elastic Load Balancing Health Check to your Auto Scaling Group (p. 88).

If connection draining is enabled for your load balancer, Auto Scaling waits for the in-flight requests to complete or for the maximum timeout to expire, whichever comes first, before terminating instances due to a scaling event or health check replacement. For information about connection draining, see Connection Draining in the *Elastic Load Balancing Developer Guide*.

You can take advantage of the safety and reliability of geographic redundancy by spanning your Auto Scaling groups across multiple Availability Zones within a region and then setting up load balancers to distribute incoming traffic across those Availability Zones. For information about expanding your auto-scaled and load-balanced application to an additional Availability Zone, see Expand Your Scaled and Load-Balanced Application to an Additional Availability Zone (p. 89).

Set Up a Scaled and Load-Balanced Application

You can register your Auto Scaling group with a load balancer to set up an auto-scaled and load-balanced application.

Prerequisites

Before you begin, create a load balancer. You don't need to register your EC2 instances with your load balancer, as Auto Scaling launches the instances and then attaches the group to the load balancer. For more information about creating a load balancer, see Get Started With Elastic Load Balancing in the *Elastic Load Balancing Developer Guide*.

Setting Up an Application Using the Auto Scaling CLI

Complete the following tasks to set up a scaled and load-balanced application.

Tasks

- Create a Launch Configuration (p. 87)
- Create an Auto Scaling Group with a Load Balancer (p. 87)
- (Optional) Verify That Your Auto Scaling Group Launched with a Load Balancer (p. 88)

Create a Launch Configuration

If you already have a launch configuration that you'd like to use, skip this step.

To create the launch configuration

Use the following `as-create-launch-config` command:

```
as-create-launch-config my-lc --image-id ami-514ac838 --instance-type m1.small
```

You should get a confirmation similar to the following example:

```
OK-Created launch config
```

Create an Auto Scaling Group with a Load Balancer

You can attach an existing load balancer to an Auto Scaling group when you create the group.

To create an Auto Scaling group with a load balancer

Use the following `as-create-auto-scaling-group` command with the `--load-balancers` option to create a group with a load balancer:

```
as-create-auto-scaling-group my-lb-asg --launch-configuration my-lc --availab
ility-zones
us-west-2a, us-west-2b --load-balancers my-lb --max-size 5 --min-size 1 --de
sired-capacity 2
```

You should get a confirmation similar to the following example:

```
OK-Created AutoScalingGroup
```

(Optional) Verify That Your Auto Scaling Group Launched with a Load Balancer

After you have created an Auto Scaling group with a load balancer, you can verify that the load balancer has been launched with the group.

To verify that your Auto Scaling group launched with a load balancer

Use the following `as-describe-auto-scaling-groups` command:

```
as-describe-auto-scaling-groups my-lb-asg --headers
```

The following is example output showing a group with a load balancer and two running instances:

```
AUTO-SCALING-GROUP  GROUP-NAME     LAUNCH-CONFIG  AVAILABILITY-ZONES    LOAD-
BALANCERS  MIN-SIZE  MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-lb-asg       my-lc          us-west-2a,us-west-2b  my-
lb           1         5         2                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-78e60b1b   us-west-2b         InService  Healthy  my-lc
INSTANCE  i-941599fe   us-west-2a         InService  Healthy  my-lc
```

Add an Elastic Load Balancing Health Check to your Auto Scaling Group

By default, an Auto Scaling group periodically reviews the results of EC2 instance status to determine the health state of each instance. However, if you have associated your Auto Scaling group with an Elastic Load Balancing load balancer, you can choose to use the Elastic Load Balancing health check. In this case, Auto Scaling determines the health status of your instances by checking the results of both the EC2 instance status check and the Elastic Load Balancing instance health check.

For information about EC2 instance status checks, see Monitor Instances With Status Checks in the *Amazon EC2 User Guide for Linux Instances*. For information about Elastic Load Balancing health checks, see Health Check in the *Elastic Load Balancing Developer Guide*.

Auto Scaling marks an instance unhealthy if the calls to the Amazon EC2 action DescribeInstanceStatus return any state other than `running`, the system status shows `impaired`, or the calls to Elastic Load Balancing action DescribeInstanceHealth returns `OutOfService` in the instance state field.

If there are multiple load balancers associated with your Auto Scaling group, Auto Scaling checks the health state of your EC2 instances by making health check calls to each load balancer. For each call, if the Elastic Load Balancing action returns any state other than `InService`, the instance is marked as unhealthy. After Auto Scaling marks an instance as unhealthy, it remains in that state, even if subsequent calls from other load balancers return an `InService` state for the same instance.

Frequently, new instances need to warm up briefly before they can pass a health check. To provide ample warm-up time, set the health check grace period of the group to cover the expected startup period of your application. Auto Scaling waits until the grace period ends before checking the health status of the instance. The grace period starts after the instance passes the EC2 system status check and instance status check.

The following examples shows you how to add an Elastic Load Balancing health check to your Auto Scaling group, assuming that you have created a load balancer and have registered the load balancer with your Auto Scaling group. If you have not registered the load balancer with your Auto Scaling group, see Set Up a Scaled and Load-Balanced Application (p. 87).

Adding a Health Check Using the Auto Scaling CLI

Use the following `as-update-auto-scaling-group` command to create a health check with a grace period of 300 seconds:

```
as-update-auto-scaling-group my-lb-asg --health-check-type ELB --grace-period 
300
```

You should get a confirmation similar to the following:

```
OK-Updated AutoScalingGroup
```

When Auto Scaling checks the health status, it ignores instances that have been in the `InService` state for less than the number of seconds you specified using `--grace-period`.

Expand Your Scaled and Load-Balanced Application to an Additional Availability Zone

When one Availability Zone becomes unhealthy or unavailable, Auto Scaling launches new instances in an unaffected Availability Zone. When the unhealthy Availability Zone returns to a healthy state, Auto Scaling automatically redistributes the application instances evenly across all of the Availability Zones for your Auto Scaling group. Auto Scaling does this by attempting to launch new instances in the Availability Zone with the fewest instances. If the attempt fails, however, Auto Scaling attempts to launch in other Availability Zones until it succeeds.

An Auto Scaling group can contain EC2 instances that come from one or more Availability Zones within the same region. However, an Auto Scaling group cannot span multiple regions.

You can set up your load balancer to distribute incoming requests across EC2 instances in a single Availability Zone or multiple Availability Zones within a region. The load balancer does not distribute traffic across regions. For critical applications, we recommend that you distribute incoming traffic across multiple Availability Zones by registering your Auto Scaling group in multiple Availability Zones and then enabling your load balancer in each of those Availability Zones. Incoming traffic is load balanced equally across all the Availability Zones enabled for your load balancer.

If your load balancer detects unhealthy EC2 instances in an enabled Availability Zone, it stops routing traffic to those instances. Instead, it spreads the load across the remaining healthy instances. If all instances in an Availability Zone are unhealthy, but you have instances in other Availability Zones, Elastic Load Balancing routes traffic to your registered and healthy instances in those other Availability Zones. It resumes load balancing to the original instances when they have been restored to a healthy state and are registered with your load balancer.

You can expand the availability of your scaled and load-balanced application by adding a new Availability Zone to your Auto Scaling group and then enabling that Availability Zone for your load balancer. After you've enabled the new Availability Zone, the load balancer begins to route traffic equally among all the enabled Availability Zones.

Expanding Applications Using the Auto Scaling CLI

In this example, you expand the availability of your application to an additional Availability Zone.

To expand a scaled, load-balanced application to an additional Availability Zone

1. Update the Auto Scaling group using the following `as-update-auto-scaling-group` command:

   ```
   as-update-auto-scaling-group my-lb-asg --availability-zones us-west-2a, us-
   west-2b, us-west-2c --min-size 3
   ```

   The output should contain a confirmation similar to the following:

   ```
   OK-Updated AutoScalingGroup
   ```

2. Verify that the instances in the new Availability Zone are ready to accept traffic from the load balancer using the following `as-describe-auto-scaling-groups` command:

   ```
   as-describe-auto-scaling-groups my-lb-asg --headers
   ```

   The following is example output that indicates that the instances are ready:

   ```
   AUTO-SCALING-GROUP  GROUP-NAME  LAUNCH-CONFIG  AVAILABILITY-ZONES  LOAD-
   BALANCERS  MIN-SIZE  MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
   AUTO-SCALING-GROUP  my-lb-asg   my-lc          us-west-2c,us-west-2b,us-
   west-2c  my-lb  3         6         3      Default

   INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
   INSTANCE  i-78e60b1b   us-west-2b         InService  Healthy  my-lc
   INSTANCE  i-dd4b2eb2   us-west-2c         InService  Healthy  my-lc
   INSTANCE  i-48a1cf29   us-west-2a         InService  Healthy  my-lc
   ```

3. Update the load balancer to route traffic to the new Availability Zone using the following `elb-enable-zones-for-lb` command. Traffic is routed equally among all the enabled Availability Zones.

   ```
   elb-enable-zones-for-lb my-lb --availability-zones us-west-2c --headers
   ```

   The following is example output:

   ```
   AVAILABILITY_ZONES  AVAILABILITY-ZONES
   AVAILABILITY_ZONES  us-west-2a, us-west-2b, us-west-2c
   ```

Attach EC2 Instances to Your Auto Scaling Group

Auto Scaling provides you with an option to enable Auto Scaling for one or more EC2 instances by attaching them to your existing Auto Scaling group. After the instances are attached, they become a part of the Auto Scaling group.

The instance that you want to attach must meet the following criteria:

- The instance is in the `running` state.

- The AMI used to launch the instance must still exist.
- The instance is not a member of another Auto Scaling group.
- The instance is in the same Availability Zone as the Auto Scaling group.
- If the Auto Scaling group is associated with a load balancer, the instance and the load balancer must both be in EC2-Classic or the same VPC.

When you attach instances, Auto Scaling increases the desired capacity of the group 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.

Note that the example uses an Auto Scaling group with the following configuration:

- Auto Scaling group name = **`my-test-asg`**
- Minimum size = **`1`**
- Maximum size = **`5`**
- Desired capacity = **`2`**
- Availability Zone = **`us-east-1a`**

Attaching an Instance Using the Auto Scaling CLI

To attach an instance to an Auto Scaling group using the Auto Scaling CLI

1. Describe a specific Auto Scaling group using the following `as-describe-auto-scaling-groups` command:

```
as-describe-auto-scaling-groups my-test-asg --headers
```

   The following example response shows that the desired capacity is 2 and the group has 2 running instances:

```
AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
  MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-test-asg  my-test-lc     us-east-1a         1
   5        2                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-a5e87793   us-east-1a         InService  Healthy  my-test-lc
INSTANCE  i-a4e87792   us-east-1a         InService  Healthy  my-test-lc
```

2. Attach an instance to the Auto Scaling group using the following `as-attach-instances` command:

```
as-attach-instances i-a8e09d9c --auto-scaling-group my-test-asg
```

3. To verify that the instance is attached, use the following `as-describe-auto-scaling-groups` command:

```
as-describe-auto-scaling-groups my-test-asg --headers
```

   The following example response shows that the desired capacity has increased by 1 to 3, and that there is a new instance, `i-a8e09d9c`:

```
AUTO-SCALING-GROUP  GROUP-NAME   LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
  MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-test-asg  my-test-lc     us-east-1a          1
    5        3                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-a8e09d9c   us-east-1a         InService  Healthy  my-test-lc
INSTANCE  i-a4e87792   us-east-1a         InService  Healthy  my-test-lc
INSTANCE  i-a5e87793   us-east-1a         InService  Healthy  my-test-lc
```

Detach EC2 Instances From Your Auto Scaling Group

You can remove an instance from an Auto Scaling group. After the instances are detached, you can manage them 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 one. For more information, see Attach EC2 Instances to Your Auto Scaling Group (p. 90).
- Test an Auto Scaling group by creating it using existing instances running your application, and then detach these instances from the Auto Scaling group when your tests are complete.

When you detach instances, you have the option of decrementing the desired capacity for the Auto Scaling group by the number of instances being detached. If you choose not to decrement the capacity, Auto Scaling launches new instances to replace the ones that you detached.

The example uses an Auto Scaling group with the following configuration:

- Auto Scaling group name = `my-test-asg`
- Minimum size = 1
- Maximum size = 5
- Desired capacity = 4
- Availability Zone = `us-east-1a`

Detaching Instances Using the Auto Scaling CLI

Use the following procedure to detach an instance from your Auto Scaling group.

To detach an instance from an existing Auto Scaling group using the Auto Scaling CLI

1. List the current instances using the following `as-describe-auto-scaling-instances` command:

   ```
   as-describe-auto-scaling-instances
   ```

   The following example response shows that the group has 4 running instances:

   ```
   INSTANCE  i-2a2d8978  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
   lc
   INSTANCE  i-5f2e8a0d  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
   lc
   ```

```
INSTANCE  i-a52387f7  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
lc
INSTANCE  i-f42d89a6  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
lc
```

2. Detach an instance and decrement the desired capacity using the following `as-detach-instances` command:

```
as-detach-instances i-2a2d8978 --auto-scaling-group my-test-asg --decrement-
desired-capacity
```

3. Verify that the instance is detached using the following `as-describe-auto-scaling-instances` command:

```
as-describe-auto-scaling-instances
```

   The following example response shows that there are now 3 running instances:

```
INSTANCE  i-5f2e8a0d  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
lc
INSTANCE  i-a52387f7  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
lc
INSTANCE  i-f42d89a6  my-test-asg  us-east-1a  InService  HEALTHY  my-test-
lc
```

Merge Your Auto Scaling Groups into a Single Multi-Zone Group

To merge separate single-zone Auto Scaling groups into a single Auto Scaling group spanning multiple Availability Zones, rezone one of the single-zone groups into a multi-zone group, and then delete the other groups. This process works for groups with or without a load balancer, as long as the new multi-zone group is in one of the same Availability Zones as the original single-zone groups.

The following examples assume that you have two identical groups in two different Availability Zones, `us-west-2a` and `us-west-2c`. These two groups share the following specifications:

- Minimum size = 2
- Maximum size = 5
- Desired capacity = 3

Merge Zones Using the Auto Scaling CLI

Use the following procedure to merge `my-group-a` and `my-group-c` into a single group that covers both `us-west-2a` and `us-west-2c`.

To merge separate single-zone groups into a single multi-zone group

1. Use the following `as-update-auto-scaling-group` command to add the `us-west-2c` Availability Zone to the supported Availability Zones for `my-group-a` and increase the maximum size of this group to allow for the instances from both single-zone groups:

   ```
   as-update-auto-scaling-group my-group-a --availability-zones us-west-2a,
   us-west-2c --max-size 10 --min-size 4
   ```

   The following is an example confirmation:

   ```
   OK-AutoScaling Group updated
   ```

2. Use the following `as-set-desired-capacity` command to increase the size of `my-group-a`:

   ```
   as-set-desired-capacity my-group-a --desired-capacity 6
   ```

3. (Optional) Use the following `as-describe-auto-scaling-groups` command to verify that `my-group-a` is at its new size:

   ```
   as-describe-auto-scaling-groups my-group-a
   ```

4. Use the following `as-update-auto-scaling-group` command to remove the instances from `my-group-c`:

   ```
   as-update-auto-scaling-group my-group-c --min-size 0 --max-size 0
   ```

   The following is an example confirmation:

   ```
   OK-AutoScaling Group updated
   ```

5. (Optional) Use the following `as-describe-auto-scaling-groups` command to verify that no instances remain in `my-group-c`:

   ```
   as-describe-auto-scaling-groups my-group-c --headers
   ```

   The following is example output:

   ```
   AUTO-SCALING-GROUP  GROUP-NAME    LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-
   SIZE  MAX-SIZE  DESIRED-CAPACITY
   AUTO-SCALING-GROUP  my-group-c    my-lc          us-west-2c          0
        0          0
   ```

6. Use the `as-delete-auto-scaling-group` command to delete `my-group-c`:

   ```
   as-delete-auto-scaling-group my-group-c
   ```

   When prompted, enter `y` as follows:

```
Are you sure you want to delete this AutoScalingGroup?  [Ny] y
```

The following is an example confirmation:

```
OK-Deleted AutoScalingGroup
```

Temporarily Removing Instances

You can put instances that are currently in service into a standby state. Instances in this state do not actively handle application traffic, but remain a part of the Auto Scaling group.

By default, Auto Scaling decrements the desired capacity of your Auto Scaling group for every instance put into a standby state. When you return the instance to service, Auto Scaling increments the desired capacity accordingly. This prevents Auto Scaling from launching additional instances while you have instances on standby. You can change this behavior so that Auto Scaling launches additional instances to replace the instances.

Important
You are billed for any instances in your Auto Scaling group—regardless of whether the instance is in service or on standby.

When you return the instances back to service, Auto Scaling detects that you have more instances than you need, and applies any termination policies to reduce the size of your Auto Scaling group.

Contents

Troubleshooting Instances in an Auto Scaling Group

If you want to troubleshoot an instance that is currently in service, put it into a `Standby` state. By putting the instance into a `Standby` state, you can make changes to the instance and then return it to service.

When put an instance into a `Standby` state, you must decide whether you want Auto Scaling to launch a replacement instance. If you don't want a replacement instance, Auto Scaling decrements the desired capacity for the Auto Scaling group when you put an instance in a `Standby` state and increments the desired capacity when you put the instance back in the `InService` state. Otherwise, Auto Scaling launches an additional instance to replace the instance moved into the `Standby` state and follows the group's termination policy when you put the instance back in the `InService` state.

The process described in the following procedures requires that an instance is currently in service (it has a status of `InService`.) If an instance is already starting to terminate—for example, because it failed an Amazon EC2 health check—you won't be able to return it to service. You can, however, put the instance in a `Terminating:Wait` state to analyze why the instance failed. For more information, see Analyzing an Instance Before Termination (p. 73).

Troubleshooting Instances Using the Auto Scaling CLI

The following steps demonstrate the general process for troubleshooting an instance that is currently in service.

To troubleshoot an instance that is currently in service using the Auto Scaling CLI

1. Use the following `as-describe-auto-scaling-instances` command to identify the instance to update.

   ```
   as-describe-auto-scaling-instances
   ```

   The following is an example response.

   ```
   INSTANCE  i-694c873b  my-asg  us-east-1a  InService  HEALTHY  my-lc
   INSTANCE  i-e116ddb3  my-asg  us-east-1a  InService  HEALTHY  my-lc
   ```

2. Move the instance into a `Standby` state using the following `as-enter-standby` command. The `--decrement-desired-capacity` option decreases the desired capacity so that Auto Scaling does not launch a replacement instance.

   ```
   as-enter-standby i-e116ddb3 --auto-scaling-group my-asg --decrement-desired-
   capacity
   ```

   The following is an example response:

   ```
   INSTANCE  0383799c-a411-432e-979b-c8af68222db3  InProgress  At 2014-06-
   06T16:12:28Z instance i-e116ddb3 was moved to standby
   in response to a user request, shrinking the capacity from 2 to 1.
   ```

3. (Optional) Verify that the instance is in a `Standby` state using the following `as-describe-auto-scaling-instances` command:

   ```
   as-describe-auto-scaling-instances i-e116ddb3
   ```

   The following is an example response. Notice that the status of the instance is now `Standby`.

   ```
   INSTANCE  i-e116ddb3  my-asg  us-east-1a  Standby    HEALTHY  my-lc
   ```

4. Connect to the instance and review logs or run diagnostics as needed.

   For more information, see Connect to Your Linux Instance in the *Amazon EC2 User Guide for Linux Instances* or Connecting to Your Windows Instance in the *Amazon EC2 User Guide for Microsoft Windows Instances*.

5. Put the instance back in service using the following `as-exit-standby` command:

   ```
   as-exit-standby i-e116ddb3 --auto-scaling-group my-asg
   ```

   The following is an example response:

   ```
   INSTANCE  94a09ebc-bc7e-44a6-b33d-8ed6f4a652b0  PreInService  At 2014-06-
   06T16:23:00Z instance i-e116ddb3 was moved out of standby in
   response to a user request, increasing the capacity from 1 to 2.
   ```

6. (Optional) Verify that the instance is back in service using the following `as-describe-auto-scaling-instances` command:

   ```
   as-describe-auto-scaling-instances i-e116ddb3
   ```

   The following is an example response. Notice that the status of the instance is back to `InService`.

   ```
   INSTANCE  i-e116ddb3  my-asg  us-east-1a  InService  HEALTHY  my-lc
   ```

Updating or Modifying Instances in an Auto Scaling Group

You can assign a new launch configuration to an Auto Scaling group at any time. This practice is common when you want new instances to use an updated configuration. However, changing the launch configuration for an Auto Scaling group does not update any instances currently in service. You can update these instances by putting them into a `Standby` state, updating the software, and then putting the instances back in service.

When put an instance into a `Standby` state, you must decide whether you want Auto Scaling to launch a replacement instance. If you don't want a replacement instance, Auto Scaling decrements the desired capacity for the Auto Scaling group when you put an instance in a `Standby` state and increments the desired capacity when you put the instance back in the `InService` state. Otherwise, Auto Scaling launches an additional instance to replace the instance moved into the `Standby` state and follows the group's termination policy when you put the instance back in the `InService` state.

Updating an Instance Using the Auto Scaling CLI

The following procedure demonstrates the general process for updating an instance that is currently in service.

To update software on an instance using the Auto Scaling CLI

1. Use the following `as-describe-auto-scaling-instances` command to identify the instance to update.

   ```
   as-describe-auto-scaling-instances
   ```

   The following is an example response.

   ```
   INSTANCE  i-5b73d709  my-asg  us-east-1a  InService  HEALTHY  my-lc
   INSTANCE  i-dd70d48f  my-asg  us-east-1a  InService  HEALTHY  my-lc
   INSTANCE  i-de70d48c  my-asg  us-east-1a  InService  HEALTHY  my-lc
   INSTANCE  i-df70d48d  my-asg  us-east-1a  InService  HEALTHY  my-lc
   ```

2. Move the instance into a `Standby` state using the following `as-enter-standby` command. The `--decrement-desired-capacity` option decreases the desired capacity so that Auto Scaling does not launch a replacement instance.

   ```
   as-enter-standby --instances i-5b73d709 --auto-scaling-group my-asg -
   -decrement-desired-capacity
   ```

The following is an example response.

```
INSTANCE  309f9e29-4f24-44f7-bbd0-2d8a54fa3e39  InProgress  At 2014-06-
13T22:21:25Z instance i-5b73d709 was moved to standby
in response to a user request, shrinking the capacity from 4 to 3.
```

3. (Optional) Verify that the instance is in a `Standby` state using the following `as-describe-auto-scaling-instances` command.

```
as-describe-auto-scaling-instances i-5b73d709
```

The following is an example response. Notice that the status of the instance is now `Standby`.

```
INSTANCE  i-5b73d709  my-asg  us-east-1a  Standby    HEALTHY  my-lc
```

4. Connect to the instance and update the software as needed.

   For more information, see Connect to Your Linux Instance in the *Amazon EC2 User Guide for Linux Instances* or Connecting to Your Windows Instance in the *Amazon EC2 User Guide for Microsoft Windows Instances*.
5. Put the instance back in service using the following `as-exit-standby` command:

```
as-exit-standby --instances i-5b73d709 --auto-scaling-group my-asg
```

The following is an example response:

```
INSTANCE  a31ac4ce-a144-488d-b112-23431e4f6fd2  PreInService  At 2014-06-
13T22:24:49Z instance i-5b73d709 was moved out of standby in
response to a user request, increasing the capacity from 3 to 4.
```

6. (Optional) Verify that the instance is back in service using the following `as-describe-auto-scaling-instances` command:

```
as-describe-auto-scaling-instances i-5b73d709
```

The following is an example response. Notice that the status of the instance is back to `InService`.

```
INSTANCE  i-5b73d709  my-asg  us-east-1a  InService  HEALTHY  my-lc
```

Suspend and Resume Auto Scaling Processes

Auto Scaling enables you to suspend and then resume one or more of the Auto Scaling processes in your Auto Scaling group. This can be very useful when you want to investigate a configuration problem or other issue with your web application and then make changes to your application, without triggering the Auto Scaling process.

Auto Scaling might suspend processes for Auto Scaling groups that repeatedly fail to launch instances. This is known as an *administrative suspension*, and 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 suspended for administrative reasons.

Contents

Auto Scaling Processes

Auto Scaling supports the following processes:

`Launch`
: Adds a new EC2 instance to the group.

  Warning
  If you suspend `Launch`, this disrupts other processes.

`Terminate`
: Removes an EC2 instance from the group.

  Warning
  If you suspend `Terminate`, this disrupts other processes.

`HealthCheck`
: Checks the health of the instances. Auto Scaling marks an instance as unhealthy if Amazon EC2 or Elastic Load Balancing tells Auto Scaling that the instance is unhealthy. This process can override the health status of an instance that you set manually.

`ReplaceUnhealthy`
: Terminates instances that are marked as unhealthy and subsequently creates new instances to replace them. This process works with the `HealthCheck` process, and uses both the `Terminate` and `Launch` processes.

`AZRebalance`
: Balances the number of EC2 instances in the group across the Availability Zones in the region. If you remove an Availability Zone from your Auto Scaling group or an Availability Zone otherwise becomes unhealthy or unavailable, Auto Scaling launches new instances in an unaffected Availability Zone before terminating the unhealthy or unavailable instances. When the unhealthy Availability Zone returns to a healthy state, Auto Scaling automatically redistributes the instances evenly across the Availability Zones for the group.

  Note that if you suspend `AZRebalance` and a scale out or scale in event occurs, Auto Scaling still tries to balance the Availability Zones. For example, during scale out, Auto Scaling launches the instance in the Availability Zone with the fewest instances.

  If you suspend `Launch`, `AZRebalance` neither launches new instances nor terminates existing instances. This is because `AZRebalance` terminates instances only after launching the replacement instances. If you suspend `Terminate`, your Auto Scaling group can grow up to ten percent larger than its maximum size, because Auto Scaling allows this temporarily during rebalancing activities. If Auto Scaling cannot terminate instances, your Auto Scaling group could remain above its maximum size until you resume the `Terminate` process.

`AlarmNotification`
: Accepts notifications from CloudWatch alarms that are associated with the group.

  If you suspend `AlarmNotification`, Auto Scaling does not automatically execute policies that would be triggered by an alarm. If you suspend `Launch` or `Terminate`, Auto Scaling would not be able to execute scale-out or scale-in policies, respectively.

`ScheduledActions`
: Performs scheduled actions that you create.

If you suspend `Launch` or `Terminate`, scheduled actions that involve launching or terminating instances are affected.

`AddToLoadBalancer`
: Adds instances to the load balancer when they are launched.

  If you suspend `AddToLoadBalancer`, Auto Scaling launches the instances but does not add them to the load balancer. If you resume the `AddToLoadBalancer` process, Auto Scaling resumes adding instances to the load balancer when they are launched. However, Auto Scaling does not add the instances that were launched while this process was suspended. You must register those instances manually. For more information, see Registering Your Amazon EC2 Instances with Your Load Balancer in the *Elastic Load Balancing Developer Guide*.

Suspend and Resume Processes Using the Auto Scaling CLI

You can suspend and resume individual processes (using the `--processes` option) or all processes (omit the `--processes` option).

To suspend all processes for an Auto Scaling group

Use the `as-suspend-processes` command as follows:

```
as-suspend-processes my-asg
```

Auto Scaling returns the following message on success:

```
OK-Processes Suspended
```

To resume all suspended processes for an Auto Scaling group

After concluding your investigation, use the `as-resume-processes` command as follows:

```
as-resume-processes my-asg
```

Auto Scaling returns the following message on success:

```
OK-Processes Resumed
```

Shut Down Auto Scaling Processes Using the AWS CLI

To completely shut down the Auto Scaling process, complete the following tasks using the AWS CLI.

Tasks

Delete Your Auto Scaling Group

You can delete your Auto Scaling group if it has no running instances. To ensure that your Auto Scaling group has no running instances, set its minimum size and maximum size to zero using the following update-auto-scaling-group command:

```
aws autoscaling update-auto-scaling-group --auto-scaling-group-name my-asg -
-max-size 0 --min-size 0
```

You can verify that your Auto Scaling group has no running instances using the following describe-auto-scaling-groups command:

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

Auto Scaling might report that the instances are in the `Terminating` state because the termination process can take a few minutes.

After the instances have terminated, use the following delete-auto-scaling-group command to delete the Auto Scaling group:

```
aws autoscaling delete-auto-scaling-group --auto-scaling-group-name my-asg
```

(Optional) Delete the Launch Configuration

Note that you can skip this step if you want to keep the launch configuration for future use.

To delete the launch configuration associated with the Auto Scaling group, use the following delete-launch-configuration command:

```
aws autoscaling delete-launch-configuration --launch-configuration-name my-lc
```

(Optional) Delete the Load Balancer

Note that you can skip this step if your Auto Scaling group is not registered with an Elastic Load Balancing load balancer or you want to keep the load balancer for future use.

To delete a load balancer, use the following delete-load-balancer command:

```
aws elb delete-load-balancer my-load-balancer
```

(Optional) Delete CloudWatch Alarms

Note that you can skip this step if your Auto Scaling group is not associated with any CloudWatch alarms or you want to keep the CloudWatch alarms for future use.

To delete CloudWatch alarms, use the delete-alarms command. For example, use the following command to delete the `AddCapacity` and `RemoveCapacity` alarms:

```
aws cloudwatch delete-alarms --alarm-name AddCapacity RemoveCapacity
```

Monitoring Your Auto Scaling Instances

Auto Scaling instances send metrics to Amazon CloudWatch. Instance metrics are the metrics that an individual EC2 instance sends to CloudWatch. Instance metrics are the same metrics available for any EC2 instance, whether or not it is in an Auto Scaling group.

CloudWatch offers basic or detailed monitoring. Basic monitoring sends aggregated data about each instance to CloudWatch every five minutes. Detailed monitoring offers more frequent aggregated data by sending data from each instance every minute.

Contents

Amazon CloudWatch Alarms

A CloudWatch *alarm* is an object that monitors a single metric over a specific period. A metric is a variable that you want to monitor, such as average CPU usage of the EC2 instances, or incoming network traffic from many different EC2 instances. The alarm changes its state when the value of the metric breaches a defined range and maintains the change for a specified number of periods.

An alarm has three possible states:

- `OK`— When the value of the metric remains within the range that you've specified.
- `ALARM`— When the value of the metric goes out of the range that you've specified and remains outside of the range for a specified time duration.
- `INSUFFICIENT_DATA`— When the metric is not yet available or not enough data is available for the metric to determine the alarm state.

When the alarm changes to the ALARM state and remains in that state for a number of periods, it invokes one or more actions. The actions can be a message sent to an Auto Scaling group to change the desired capacity of the group.

You configure an alarm by identifying the metrics to monitor. For example, you can configure an alarm to watch over the average CPU usage of the EC2 instances in an Auto Scaling group.

You must use CloudWatch to identify metrics and create alarms. For more information, see Creating CloudWatch Alarms in the *Amazon CloudWatch Developer Guide*.

Activating Detailed Instance Monitoring for Auto Scaling

To enable detailed instance monitoring for a new Auto Scaling group, you don't need to take any extra steps. One of your first steps when creating an Auto Scaling group is to create a launch configuration. Each launch configuration contains a flag named *`InstanceMonitoring.Enabled`*. The default value of this flag is `true`, so you don't need to set this flag manually if you want detailed monitoring.

If you have an Auto Scaling group for which you have explicitly selected basic monitoring, the switch to detailed monitoring involves several steps, especially if you have CloudWatch alarms configured to scale the group automatically.

To switch to detailed instance monitoring for an existing Auto Scaling group

1. Create a launch configuration that has the *`InstanceMonitoring.Enabled`* flag enabled. If you are using the AWS CLI, create a launch configuration with the *`--instance-monitoring`* option.
2. Call `UpdateAutoScalingGroup` to update your Auto Scaling group with the launch configuration that you created in the previous step. Auto Scaling enables detailed monitoring for new instances that it creates.
3. Choose one of the following actions to deal with all existing EC2 instances in the Auto Scaling group:

Task	Action
Preserve existing instances	Call `MonitorInstances` from the Amazon EC2 API for each existing instance to enable detailed monitoring.
Terminate existing instances	Call `TerminateInstanceInAutoScalingGroup` from the Auto Scaling API for each existing instance. Auto Scaling uses the updated launch configuration to create replacement instances with detailed monitoring enabled.

4. If you have CloudWatch alarms associated with your Auto Scaling group, call `PutMetricAlarm` from the CloudWatch API to update each alarm so that the alarm's period value is set to 60 seconds.

Activating Basic Instance Monitoring for Auto Scaling

To create a new Auto Scaling group with basic monitoring instead of detailed monitoring, associate your new Auto Scaling group with a launch configuration that has the *`InstanceMonitoring.Enabled`* flag set to `false`.

To switch to basic instance monitoring for an existing Auto Scaling group

1. Create a launch configuration that has the *`InstanceMonitoring.Enabled`* flag disabled. If you are using the CLI, create a launch configuration with the *`--monitoring-disabled`* option.
2. If you previously enabled group metrics with a call to `EnableMetricsCollection`, call `DisableMetricsCollection` on your Auto Scaling group to disable collection of all group metrics. For more information, see Auto Scaling Group Metrics (p. 104).
3. Call `UpdateAutoScalingGroup` to update your Auto Scaling group with the launch configuration that you created in the previous step. Auto Scaling disables detailed monitoring for new instances that it creates.
4. Choose one of the following actions to deal with all existing EC2 instances in the Auto Scaling group:

Task	Action
Preserve existing instances	Call `UnmonitorInstances` from the Amazon EC2 API for each existing instance to disable detailed monitoring.
Terminate existing instances	Call `TerminateInstanceInAutoScalingGroup` from the Auto Scaling API for each existing instance. Auto Scaling uses the updated launch configuration to create replacement instances with detailed monitoring disabled.

5. If you have CloudWatch alarms associated with your Auto Scaling group, call `PutMetricAlarm` from the CloudWatch API to update each alarm so that the alarm's period value is set to 300 seconds.

   Important
   If you do not update your alarms to match the five-minute data aggregations, your alarms continue to check for statistics every minute and might find no data available for as many as four out of every five periods.

For more information about instance metrics for EC2 instances, see the Amazon CloudWatch Developer Guide.

Auto Scaling Group Metrics

Group metrics are metrics that Auto Scaling group sends to CloudWatch to describe the group rather than any of its instances. If you enable group metrics, Auto Scaling sends aggregated data to CloudWatch every minute. If you disable group metrics, Auto Scaling does not send any group metrics data to CloudWatch.

To enable group metrics

1. Enable detailed instance monitoring for the Auto Scaling group by setting the *`InstanceMonitoring.Enabled`* flag in the Auto Scaling group's launch configuration. For more information, see Monitoring Your Auto Scaling Instances (p. 102).
2. Call `EnableMetricsCollection`. Alternatively, you can use the equivalent `aws autoscaling enable-metrics-collection` command that is part of the AWS CLI.

Auto Scaling Group Metrics Table

You may enable or disable each of the following metrics, separately.

Metric	Description
`GroupMinSize`	The minimum size of the Auto Scaling group.
`GroupMaxSize`	The maximum size of the Auto Scaling group.
`GroupDesiredCapacity`	The number of instances that the Auto Scaling group attempts to maintain.
`GroupInServiceInstances`	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.
`GroupPendingInstances`	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.
`GroupStandbyInstances`	The number of instances that are in a `Standby` state. Instances in this state are still running but are not actively in service. This metric is not included by default; you must request it specifically.
`GroupTerminatingInstances`	The number of instances that are in the process of terminating. This metric does not include instances that are in service or pending.
`GroupTotalInstances`	The total number of instances in the Auto Scaling group. This metric identifies the number of instances that are in service, pending, and terminating.

Dimensions for Auto Scaling Group Metrics

The only dimension that Auto Scaling sends to CloudWatch is the name of the Auto Scaling group. This means that all available statistics are filtered by Auto Scaling group name.

Health Checks

Auto Scaling periodically performs health checks on the instances in your group and replaces instances that fail these checks. By default, these health checks use the results of EC2 instance status checks to determine the health of an instance. If you use a load balancer with your Auto Scaling group, you can optionally choose to include the results of Elastic Load Balancing health checks.

Auto Scaling marks an instance as unhealthy if the instance status is any state other than `running`, the system status is `impaired`, or Elastic Load Balancing reports the instance state as `OutOfService`. For more information about Amazon EC2 status checks, see Monitoring the Status of your Instances in the *Amazon EC2 User Guide for Linux Instances*. For more information about Elastic Load Balancing health checks, see Elastic Load Balancing Health Check in the *Elastic Load Balancing Developer Guide*.

You can customize the health check conducted by your Auto Scaling group by specifying additional checks or by having your own health check system and then sending the instance's health information directly from your system to Auto Scaling. For more information, see Set the Health State of An Instance Using the Auto Scaling CLI (p. 106).

After an instance is marked unhealthy because of an Amazon EC2 or Elastic Load Balancing health check, it is scheduled for replacement. For more information, see Maintaining a Fixed Number of EC2 Instances in Your Auto Scaling Group (p. 34) and Add an Elastic Load Balancing Health Check to your Auto Scaling Group (p. 88).

Set the Health State of An Instance Using the Auto Scaling CLI

If you have your own health check system, you can use the information from your health check system to determine how to set the health state of the instances in the Auto Scaling group.

You can specify the health state of an instance in your Auto Scaling group. Note that if you set the health state of an instance to `Unhealthy`, Auto Scaling terminates the instance.

To configure the health state of an instance using the Auto Scaling CLI

1. Use the following `as-set-instance-health` command to set the health status of the specified instance to `Unhealthy`:

   ```
   as-set-instance-health i-123abc45d --status Unhealthy
   ```

   The following is an example response:

   ```
   OK-Instance Health Set
   ```

2. Use the following `as-describe-auto-scaling-groups` command to verify that the instance state is `Unhealthy`:

   ```
   as-describe-auto-scaling-groups  my-test-asg
   ```

   The following is an example response that shows that the instance status is `Unhealthy` and that it is terminating:

   ```
   ...
   INSTANCE  i-123abc45d us-east-1a  Terminating  Unhealthy  my-test-lc
   ...
   ```

Getting Notifications When Your Auto Scaling Group Changes

When you use Auto Scaling to scale your applications automatically, you want to know when Auto Scaling is launching or terminating the EC2 instances in your Auto Scaling group. You can configure your Auto Scaling group to send a notification, whenever the Auto Scaling group changes.

If configured, the Auto Scaling group uses Amazon Simple Notification Service (Amazon SNS) to send the notifications. Amazon SNS coordinates and manages the delivery or sending of notifications to subscribing clients or endpoints. Amazon SNS can deliver notifications as HTTP or HTTPS POST, email (SMTP, either plain-text or in JSON format), or as a message posted to an Amazon SQS queue. For more information, see What Is Amazon SNS in the *Amazon Simple Notification Service Developer Guide*.

To configure your Auto Scaling group to send email notifications whenever your Auto Scaling group changes, complete the following tasks.

Tasks

Configure Amazon SNS

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.

For more information, see Create a Topic in the *Amazon Simple Notification Service Developer Guide*.

Subscribe to the Amazon SNS Topic

To receive notifications your Auto Scaling group sends to the topic, you must subscribe an endpoint to the topic. In this procedure, for the **Endpoint** field, specify the email address where you want to receive the notifications from Auto Scaling.

For more information, see Subscribe to a 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 you open the email from AWS Notifications and click the link to confirm the subscription before you continue with the next step.

You will receive an acknowledgement 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.

When you configure your Auto Scaling group to send email notifications, you must specify the notification types for the Auto Scaling group. Auto Scaling supports sending Amazon SNS notifications when the following events occur:

Notification type	Event
`autoscaling:EC2_INSTANCE_LAUNCH`	Successful instance launch
`autoscaling:EC2_INSTANCE_LAUNCH_ERROR`	Failed instance launch

Notification type	Event
autoscaling:EC2_INSTANCE_TERMINATE	Successful instance termination
autoscaling:EC2_INSTANCE_TERMINATE_ERROR	Failed instance termination
autoscaling:TEST_NOTIFICATION	Validated a configured SNS topic (as a result of calling the PutNotificationConfiguration action)

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.

Configure Notifications Using the Auto Scaling CLI

To configure Amazon SNS notifications for your Auto Scaling group

Use the following `as-put-notification-configuration` command:

```
as-put-notification-configuration my-asg --topic-arn arn --notification-types
autoscaling:EC2_INSTANCE_LAUNCH, autoscaling:EC2_INSTANCE_TERMINATE
```

Auto Scaling returns the following:

```
OK-Put Notification Configuration
```

Test the Notification Configuration

To cause the changes that generate notifications, update the Auto Scaling group by changing the desired capacity of the Auto Scaling group; for example, from 1 instance to 2 instances. After Auto Scaling launches the EC2 instance, you'll receive the email notification with a few minutes.

To change the desired capacity using the Auto Scaling CLI

Use the following `as-set-desired-capacity` command:

```
as-set-desired-capacity my-asg --desired-capacity 2
```

The following is example output:

```
OK-Desired Capacity Set
```

Verify That You Received Notification of the Scaling Event

Check your email for a message from Amazon SNS and open the email. After you receive notification of a scaling event for your Auto Scaling group, you can confirm the scaling event by looking at the description of your Auto Scaling group. You'll need information from the notification email, such as the ID of the instance that was launched or terminated.

To verify that your Auto Scaling group has launched new instance using the Auto Scaling CLI

Use the following `as-describe-auto-scaling-groups` command to confirm that the size of your Auto Scaling group has changed:

```
as-describe-auto-scaling-groups my-asg --headers
```

The following example output shows that the group has two instances. Check for the instance whose ID you received in the notification email.

```
AUTO-SCALING-GROUP  GROUP-NAME    LAUNCH-CONFIG  AVAILABILITY-ZONES  MIN-SIZE
 MAX-SIZE  DESIRED-CAPACITY  TERMINATION-POLICIES
AUTO-SCALING-GROUP  my-asg       my-lc         us-west-2c         1         3
          2                 Default
INSTANCE  INSTANCE-ID  AVAILABILITY-ZONE  STATE      STATUS   LAUNCH-CONFIG
INSTANCE  i-98e204e8   us-west-2c         InService  Healthy  my-test-lc
INSTANCE  i-d998ded1   us-west-2c         InService  Healthy  my-test-lc
```

Delete the Notification Configuration

You can delete your Auto Scaling notification configuration at any time.

To delete Auto Scaling notification configuration using the Auto Scaling CLI

Use the following `as-delete-notification-configuration` command:

```
as-delete-notification-configuration my-asg --topic-arn arn:aws:sns:us-west-
2:123456789012:my-sns-topic
```

After confirming that you want to delete the notification configuration, Auto Scaling returns the following output:

```
OK-Deleted Notification Configuration
```

For information about deleting the Amazon SNS topic associated with your Auto Scaling group, and also deleting all the subscriptions to that topic, see Clean Up in the *Amazon Simple Notification Service Developer Guide*.

Logging Auto Scaling API Calls By Using AWS CloudTrail

Auto Scaling is integrated with CloudTrail, a service that captures API calls made by or on behalf of Auto Scaling in your AWS account and delivers the log files to an Amazon S3 bucket that you specify. CloudTrail captures API calls from the Auto Scaling console or from the Auto Scaling API. Using the information collected by CloudTrail, you can determine what request was made to Auto Scaling, the source IP address from which the request was made, who made the request, when it was made, and so on. For more information about CloudTrail, including how to configure and enable it, see the *AWS CloudTrail User Guide*.

Auto Scaling Information in CloudTrail

When CloudTrail logging is enabled in your AWS account, API calls made to Auto Scaling actions are tracked in log files. Auto Scaling records are written together with other AWS service records in a log file. CloudTrail determines when to create and write to a new file based on a time period and file size.

All of the Auto Scaling actions are logged and are documented in the Auto Scaling API Reference. For example, calls to the **CreateLaunchConfiguration**, **DescribeAutoScalingGroup**, and **UpdateAutoScalingGroup** actions generate entries in the CloudTrail log files.

Every log entry contains information about who generated the request. The user identity information in the log helps you determine whether the request was made with account or IAM user credentials, with temporary security credentials for a role or federated user, or by another AWS service. For more information, see the **userIdentity** field in the CloudTrail Event Reference section in the *AWS CloudTrail User Guide*.

You can store your log files in your bucket for as long as you want, but you can also define Amazon S3 lifecycle rules to archive or delete log files automatically. By default, your log files are encrypted by using Amazon S3 server-side encryption (SSE).

You can choose to have CloudTrail publish Amazon SNS notifications when new log files are delivered if you want to take quick action upon log file delivery. For more information, see Configuring Amazon SNS Notifications in the *AWS CloudTrail User Guide*.

You can also aggregate Auto Scaling log files from multiple AWS regions and multiple AWS accounts into a single Amazon S3 bucket. For more information, see Aggregating CloudTrail Log Files to a Single Amazon S3 Bucket in the *AWS CloudTrail User Guide*.

Understanding Auto Scaling Log File Entries

CloudTrail log files can contain one or more log entries where each entry is made up of multiple JSON-formatted events. A log entry represents a single request from any source and includes information about the requested action, any parameters, the date and time of the action, and so on. The log entries are not guaranteed to be in any particular order. That is, they are not an ordered stack trace of the public API calls.

The following example shows a CloudTrail log entry that demonstrates the **CreateLaunchConfiguration** action.

```
{
    "Records": [
    {
        "eventVersion": "1.01",
        "userIdentity": {
            "type": "IAMUser",
            "principalId": "EX_PRINCIPAL_ID",
            "arn": "arn:aws:iam::123456789012:user/iamUser1",
            "accountId": "123456789012",
            "accessKeyId": "EXAMPLE_KEY_ID",
            "userName": "iamUser1"
            },
        "eventTime": "2014-06-24T16:53:14Z",
        "eventSource": "autoscaling.amazonaws.com",
        "eventName": "CreateLaunchConfiguration",
        "awsRegion": "us-east-1",
        "sourceIPAddress": "192.0.2.0",
        "userAgent": "Amazon CLI/AutoScaling 1.0.61.3 API 2011-01-01",
        "requestParameters": {
            "imageId": "ami-2f726546",
            "instanceType": "m1.small",
            "launchConfigurationName": "launch_configuration_1"
            },
        "responseElements": null,
        "requestID": "07a1becf-fbc0-11e3-bfd8-a5209058e7bb",
        "eventID": "ad30abf7-57db-4a6d-93fa-13deb1fd4cff"
        },
        ...additional entries
    ]
}
```

The following example shows a CloudTrail log entry that demonstrates the **DescribeAutoScalingGroups** action.

```
{
    "Records": [
    {
        "eventVersion": "1.01",
        "userIdentity": {
            "type": "IAMUser",
            "principalId": "EX_PRINCIPAL_ID",
            "arn": "arn:aws:iam::123456789012:user/iamUser1",
            "accountId": "123456789012",
            "accessKeyId": "EXAMPLE_KEY_ID",
            "userName": "iamUser1"
            },
        "eventTime": "2014-06-23T23:20:56Z",
        "eventSource": "autoscaling.amazonaws.com",
        "eventName": "DescribeAutoScalingGroups",
        "awsRegion": "us-east-1",
        "sourceIPAddress": "192.0.2.0",
        "userAgent": "Amazon CLI/AutoScaling 1.0.61.3 API 2011-01-01",
        "requestParameters": {
            "maxRecords": 20
            },
        "responseElements": null,
        "requestID": "0737e2ea-fb2d-11e3-bfd8-a5209058e7bb",
        "eventID": "0353fb04-281e-47d9-93bb-588bf2256538"
        },
        ...additional entries
    ]
}
```

The following example shows a CloudTrail log entry that demonstrates the **UpdateAutoScalingGroups** action.

```
{
    "Records": [
    {
        "eventVersion": "1.01",
        "userIdentity": {
            "type": "IAMUser",
            "principalId": "EX_PRINCIPAL_ID",
            "arn": "arn:aws:iam::123456789012:user/iamUser1",
            "accountId": "123456789012",
            "accessKeyId": "EXAMPLE_KEY_ID",
            "userName": "iamUser1"
            },
        "eventTime": "2014-06-24T16:54:46Z",
        "eventSource": "autoscaling.amazonaws.com",
        "eventName": "UpdateAutoScalingGroup",
        "awsRegion": "us-east-1",
        "sourceIPAddress": "192.0.2.0",
        "userAgent": "Amazon CLI/AutoScaling 1.0.61.3 API 2011-01-01",
        "requestParameters": {
            "maxSize": 8,
            "minSize": 1,
            "autoScalingGroupName": "asg1"
            },
        "responseElements": null,
        "requestID": "3ed07c03-fbc0-11e3-bfd8-a5209058e7bb",
        "eventID": "b52ca0aa-5199-4873-a546-55f7c896a4ce"
        },
        ...additional entries
    ]

}
```

Troubleshooting Auto Scaling

Amazon Web Services provides specific and descriptive errors to help you troubleshoot Auto Scaling problems. The error messages can be retrieved from the description of the Auto Scaling activities. You can use either the Query API or the command line interface (CLI) to retrieve an error message.

Retrieving an Error Message

To retrieve an error message from the description of Auto Scaling activities, use the `as-describe-scaling-activities` command. Alternatively, you can use the `DescribeScalingActivities` API action. For more information about the API action, see DescribeScalingActivities in the *Auto Scaling API Reference*.

The `as-describe-scaling-activities` command takes the following arguments:

`as-describe-scaling-activities [`*`ActivityIds`*` [ `*`ActivityIds`*`...] ]`
`[--auto-scaling-group `*`value`*`][--max-records `*`value`*`][General Options]`

In this example, you'll get the XML description of the Auto Scaling activities for the `MyASGroup` Auto Scaling group.

```
as-describe-scaling-activities  --auto-scaling-group MyASGroup --show-xml
```

Auto Scaling returns the following:

```
<DescribeScalingActivitiesResponse xmlns="http://ec2.amazonaws.com/doc/2011-01-
01/">
<DescribeScalingActivitiesResult>
<Activities>
   <member>
     <StatusCode>Failed</StatusCode>
     <Progress>0</Progress>
     <ActivityId>063308ae-aa22-4a9b-94f4-9fae70b82ad0</ActivityId>
     <StartTime>2012-04-12T17:32:07.882Z</StartTime>
     <AutoScalingGroupName>MyASGroup</AutoScalingGroupName>
     <Cause>At 2012-04-12T17:31:30Z a user request created an AutoScalingGroup
 changing the desired capacity from 0 to 1.  At 2012-04-12T17:32:07Z an instance
 was started in response to a difference between desired and actual capacity,
increasing the capacity from 0 to 1.</Cause>
     <Details>{}</Details>
     <Description>Launching a new EC2 instance.  Status Reason: The image id
'ami-4edb0327' does not exist. Launching EC2 instance failed.</Description>
     <EndTime>2012-04-12T17:32:08Z</EndTime>
     <StatusMessage>The image id 'ami-4edb0327' does not exist. Launching EC2
instance failed.</StatusMessage>
   </member>
</Activities>
  </DescribeScalingActivitiesResult>
  <ResponseMetadata>
   <RequestId>7a641adc-84c5-11e1-a8a5-217eb05262e2</RequestId>
  </ResponseMetadata>
</DescribeScalingActivitiesResponse>
```

The response includes a list of `Activities` associated with the `MyASGroup` Auto Scaling group. The `StatusCode` contains the current status of the activity. The `StatusMessage` contains the error message, which is the verbose description of the activity status.

Troubleshooting Auto Scaling issues involves looking at how your Amazon EC2 AMIs and instances are configured. You can create, access, and manage your AMIs and instances using one of the Amazon EC2 interfaces: the AWS Management Console, the command line interface (CLI), or the Query API.

The following tables list the types of error messages and provide links to the troubleshooting resources that you can use as you work with your Auto Scaling issues.

Troubleshooting Auto Scaling: Amazon EC2 Instance Launch Failure

Issue	Error Message
Auto Scaling group	AutoScalingGroup <Auto Scaling group name> not found. (p. 116)
Availability Zone	The requested Availability Zone is no longer supported. Please retry your request ...... (p. 117)
AWS account	You are not subscribed to this service. Please see http://aws.amazon.com. (p. 117)
Block device mapping	Invalid device name upload. Launching EC2 instance failed. (p. 117)
Block device mapping	Value (<name associated with the instance storage device>) for parameter virtualName is invalid... (p. 118)
Block device mapping	EBS block device mappings not supported for instance-store AMIs. (p. 118)
Instance type and Availability Zone	Your requested instance type (<instance type>) is not supported in your requested Availability Zone (<instance Availability Zone>).... (p. 117)
Key pair	The key pair <key pair associated with your EC2 instance> does not exist. Launching EC2 instance failed. (p. 116)
Launch configuration	The requested configuration is currently not supported. (p. 116)
Placement group	Placement groups may not be used with instances of type 'm1.large'. Launching EC2 instance failed. (p. 118)
Security group	The security group <name of the security group> does not exist. Launching EC2 instance failed. (p. 116)

Troubleshooting Auto Scaling: Amazon EC2 AMIs

Issue	Error Message
AMI ID	The AMI ID <ID of your AMI> does not exist. Launching EC2 instance failed. (p. 119)
AMI ID	AMI <AMI ID> is pending, and cannot be run. Launching EC2 instance failed. (p. 119)
AMI ID	Value (<ami ID>) for parameter virtualName is invalid. (p. 119)
Architecture mismatch	The requested instance type's architecture (i386) does not match the architecture in the manifest for ami-6622f00f (x86_64). Launching ec2 instance failed. (p. 120)
Virtualization type	Non-Windows AMIs with a virtualization type of 'hvm' currently may only be used with Cluster Compute instance types. Launching EC2 instance failed. (p. 119)

Troubleshooting Auto Scaling: Load Balancer Configuration

Issue	Error Message
Cannot find load balancer	Cannot find Load Balancer <your launch environment>. Validating load balancer configuration failed. (p. 120)
Instances in VPC	EC2 instance <instance ID> is not in VPC. Updating load balancer configuration failed. (p. 121)
No active load balancer	There is no ACTIVE Load Balancer named <load balancer name>. Updating load balancer configuration failed. (p. 121)
Security token	The security token included in the request is invalid. Validating load balancer configuration failed. (p. 121)

Troubleshooting Auto Scaling: Capacity Limits

Issue	Error Message
Capacity limits	<number of instances> instance(s) are already running. Launching EC2 instance failed. (p. 122)
Insufficient capacity in Availability Zone	We currently do not have sufficient <instance type> capacity in the Availability Zone you requested (<requested Availability Zone>).... (p. 122)

Troubleshooting Auto Scaling: Amazon EC2 Instance Launch Failure

The following topics provide information about your EC2 instances that fail to launch, potential causes, and the steps you can take to resolve the issues.

When your EC2 instances fail to launch, you might get one or more of the error messages covered in the following topics. To retrieve an error message and to review the error message lists sorted by the type of issue, see Retrieving an Error Message (p. 113).

The security group <name of the security group> does not exist. Launching EC2 instance failed.

- **Cause**: The security group specified in your launch configuration might have been deleted.
- **Solution**:
  1. Use the DescribeSecurityGroups action or ec2-describe-group command to get the list of the security groups associated with your account.
  2. From the list, select the security groups you want to use. To create a new security group use the CreateSecurityGroup action or the ec2-create-group command.
  3. Create a new launch configuration.
  4. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

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 DescribeKeyPairs action or the ec2-describe-kepairs command to get the list of the key pairs available to you.
  2. From the list, select the key pairs you want to use. To create a new key pair, use CreateKeyPair action or ec2-create-keypair command.
  3. Create a new launch configuration.
  4. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

The requested configuration is currently not supported.

- **Cause**: Some fields in your launch configuration might not be currently supported.
- **Solution**:
  1. Create a new launch configuration.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

AutoScalingGroup <Auto Scaling group name> not found.

- **Cause**: The Auto Scaling group might have been deleted.
- **Solution**: Create a new Auto Scaling group.

The requested Availability Zone is no longer supported. Please retry your request ......

- **Error Message**: The requested Availability Zone is no longer supported. Please retry your request by not specifying an Availability Zone or choosing <list of available Availability Zones>. Launching EC2 instance failed.
- **Cause**: The Availability Zone associated with your Auto Scaling group might not be currently available.
- **Solution**: Update your Auto Scaling group with the recommendations in the error message.

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>). Please retry your request by not specifying an Availability Zone or choosing <list of Availability Zones that supports the instance type>. Launching EC2 instance failed.
- **Cause**: The instance type associated with your launch configuration might not be currently available in the Availability Zones specified in your Auto Scaling group.
- **Solution**: Update your Auto Scaling group with the recommendations in the error message.

You are not subscribed to this service. Please see http://aws.amazon.com.

- **Cause**: Your AWS account might have expired.
- **Solution**: Go to http://aws.amazon.com and click **Sign Up Now** to open a new account.

Invalid device name upload. Launching EC2 instance failed.

- **Cause**: The block device mappings in your launch configuration might contain block device names that are not available or currently not supported.
- **Solution**:
  1. Use the AWS Management Console, the DescribeVolumes action, or the ec2-describe-volumes command to see how the volumes are exposed to the instance.
  2. Create a new launch configuration using the device name listed in the volume description.
  3. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-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 configuration by specifying the value of the `virtualName` parameter in the format: `ephemeral<number>`. For information about the device name format, see Instance Store Device Names in the *Amazon EC2 User Guide for Linux Instances*.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

EBS block device mappings not supported for instance-store AMIs.

- **Cause**: The block device mappings specified in the launch configuration are not supported on your instance.
- **Solution**:
  1. Create a new launch configuration with block device mappings supported by your instance type. For more information about block device mapping, see Block Device Mapping in the *Amazon EC2 User Guide for Linux Instances*.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-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 configuration with the supported instance type.
  4. Update your Auto Scaling group with new placement group or the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

Troubleshooting Auto Scaling: Amazon EC2 AMIs

The following topics provide information about the issues associated with your Amazon EC2 AMIs, potential causes, and the steps you can take to resolve the issues.

When your EC2 instances fail to launch due to issues with your AMIs, you might get one or more of the error messages covered in the following topics. To retrieve the error message and review the error message lists sorted by the type of issue, see Retrieving an Error Message (p. 113).

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 configuration.
- **Solution**:
  1. Create a new launch configuration using a valid AMI.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-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 configuration.

Non-Windows AMIs with a virtualization type of 'hvm' currently may only be used with Cluster Compute instance types. Launching EC2 instance failed.

- **Cause**: The Linux/UNIX AMI with hvm virtualization cannot be used to launch a non-cluster compute instance.
- **Solution**:
  1. Create a new launch configuration using an AMI with a virtualization type of paravirtual to launch a non-cluster compute instance.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

Value (<ami ID>) for parameter virtualName is invalid.

- **Cause**: Incorrect value. The `virtualName` parameter refers to the virtual name associated with the device.
- **Solution**:
  1. Create a new launch configuration by specifying the name of the virtual device of your instance for the `virtualName` parameter.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

The requested instance type's architecture (i386) does not match the architecture in the manifest for ami-6622f00f (x86_64). Launching ec2 instance failed.

- **Cause**: The architecture of the `InstanceType` mentioned in your launch configuration does not match the image architecture.
- **Solution**:
  1. Create a new launch configuration using the AMI architecture that matches the architecture of the requested instance type.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

Troubleshooting Auto Scaling: Load Balancer Configuration

This following topics provide 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.

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 error messages covered in the following topics. To retrieve the error message and review the error message lists sorted by the type of issue, see Retrieving an Error Message (p. 113).

Before you begin troubleshooting issues with the load balancer configurations, be sure you've installed the Elastic Load Balancing interface you plan to use to access your load balancer. For more information, see Get Set Up With Elastic Load Balancing Interfaces in the *Elastic Load Balancing Developer Guide*.

Cannot find Load Balancer <your launch environment>. Validating load balancer configuration failed.

- **Cause 1**: The load balancer has been deleted.
- **Solution 1**:
  1. Check to see if your load balancer still exists. You can use either the DescribeLoadBalancer action or the `elb-describe-lbs` command.
  2. If you see your load balancer listed in the response, see **Cause 2**.
  3. If you do not see your load balancer listed in the response, you can either create a new load balancer and then create a new Auto Scaling group or you can create a new Auto Scaling group without the load balancer.
- **Cause 2**: The load balancer name was not specified in the right order when creating the Auto Scaling group.
- **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).

The security token included in the request is invalid. Validating load balancer configuration failed.

- **Cause**: Your AWS account might have expired.
- **Solution**: Check if your AWS account is valid. Go to http://aws.amazon.com and click **Sign Up Now** to open a new account.

Troubleshooting Auto Scaling: Capacity Limits

The following topics provide information about issues with the capacity limits of your Auto Scaling group, potential causes, and the steps you can take to resolve the issues.

When your EC2 instances fail to launch due to issues with the capacity limits of your Auto Scaling group, you might get one or more of the error messages covered in the following topics. To retrieve the error message and review the error message lists sorted by the type of issue, see Retrieving an Error Message (p. 113).

We currently do not have sufficient <instance type> capacity in the Availability Zone you requested (<requested Availability Zone>)....

- **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, Auto Scaling cannot support your instance type in your requested Availability Zone.
- **Solution**:
  1. Create a new launch configuration by following the recommendations in the error message.
  2. Update your Auto Scaling group with the new launch configuration using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.

<number of instances> instance(s) are already running. Launching EC2 instance failed.

- **Cause**: The Auto Scaling group has reached the limit set by the `DesiredCapacity` parameter.
- **Solution**:
  - Update your Auto Scaling group by providing a new value for the `DesiredCapacity` parameter using the UpdateAutoScalingGroup action or the `as-update-auto-scaling-group` command.
  - If you've reached the limit for number of EC2 instances, see Contact Us and place a request to raise your Amazon EC2 instance limit.