Amazon Simple Queue Service

Developer Guide

Amazon Simple Queue Service: Developer Guide

Table of Contents

What is Amazon Simple Queue Service?

Amazon Simple Queue Service (Amazon SQS) offers a reliable, highly-scalable hosted queue for storing messages as they travel between applications or microservices. It moves data between distributed application components and helps you decouple these components. Amazon SQS provides familiar middleware constructs such as dead-letter queues and poison-pill management. It also provides a generic web services API and can be accessed by any programming language that the AWS SDK supports. Amazon SQS supports both standard (p. 48) and FIFO queues (p. 51).

Topics

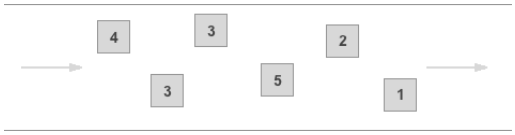
What Can I Use Amazon SQS For?

Use Amazon SQS for cases such as the following:

- **Decoupling the components of an application** – You have a queue of work items and want to track the successful completion of each item independently. Amazon SQS tracks the ACK/FAIL results, so the application doesn't have to maintain a persistent checkpoint or cursor. After a configured visibility timeout, Amazon SQS deletes acknowledged messages and redelivers failed messages.
- **Configuring individual message delay** – You have a job queue and you need to schedule individual jobs with a delay. With standard queues, you can configure individual messages to have a delay of up to 15 minutes.
- **Dynamically increasing concurrency or throughput at read time** – You have a work queue and want to add more consumers until the backlog is cleared. Amazon SQS requires no pre-provisioning.
- **Scaling transparently** – You buffer requests and the load changes as a result of occasional load spikes or the natural growth of your business. Because Amazon SQS can process each buffered request independently, Amazon SQS can scale transparently to handle the load without any provisioning instructions from you.

What Type of Queue Do I Need?

Standard Queue	FIFO Queue
Available in all regions. **Unlimited Throughput** – Standard queues support a nearly unlimited number of transactions per second (TPS) per API action.	Available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions. **High Throughput** – FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). When you

Standard Queue	FIFO Queue
At-Least-Once Delivery – A message is delivered at least once, but occasionally more than one copy of a message is delivered. **Best-Effort Ordering** – Occasionally, messages might be delivered in an order different from which they were sent.	batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request. **Exactly-Once Processing** – A message is delivered once and remains available until a consumer processes and deletes it. Duplicates aren't introduced into the queue. **First-In-First-Out Delivery** – The order in which messages are sent and received is strictly preserved.
	
Send data between applications when the throughput is important, for example: • Decouple live user requests from intensive background work: let users upload media while resizing or encoding it. • Allocate tasks to multiple worker nodes: process a high number of credit card validation requests. • Batch messages for future processing: schedule multiple entries to be added to a database.	Send data between applications when the order of events is important, for example: • Ensure that user-entered commands are executed in the right order. • Display the correct product price by sending price modifications in the right order. • Prevent a student from enrolling in a course before registering for an account.

What Are the Main Features of Amazon SQS?

Amazon SQS provides the following major features:

- **Redundant infrastructure** – Standard queues support at-least-once message delivery, while FIFO queues support exactly-once message processing. Amazon SQS provides highly-concurrent access to messages and high availability for producing and consuming messages.
- **Multiple producers and consumers** – Multiple parts of your system can send or receive messages at the same time. Amazon SQS locks the message during processing, keeping other parts of your system from processing the message simultaneously.
- **Configurable settings per queue** – All of your queues don't have to be exactly alike. For example, you can optimize one queue for messages that require a longer processing time than others.
- **Variable message size** – Your messages can be up to 262,144 bytes (256 KB) in size. You can store the contents of larger messages using the Amazon Simple Storage Service (Amazon S3) or Amazon DynamoDB, with Amazon SQS holding a pointer to the Amazon S3 object. For more information, see Managing Amazon SQS Messages with Amazon S3. You can also split a large message into smaller ones.
- **Access control** – You control who can send messages to a queue, and who can receive messages from a queue.
- **Delay queues** – You can set a default delay on a queue, so that delivery of all enqueued messages is postponed for the specified duration. You can set the delay value when you create a queue with

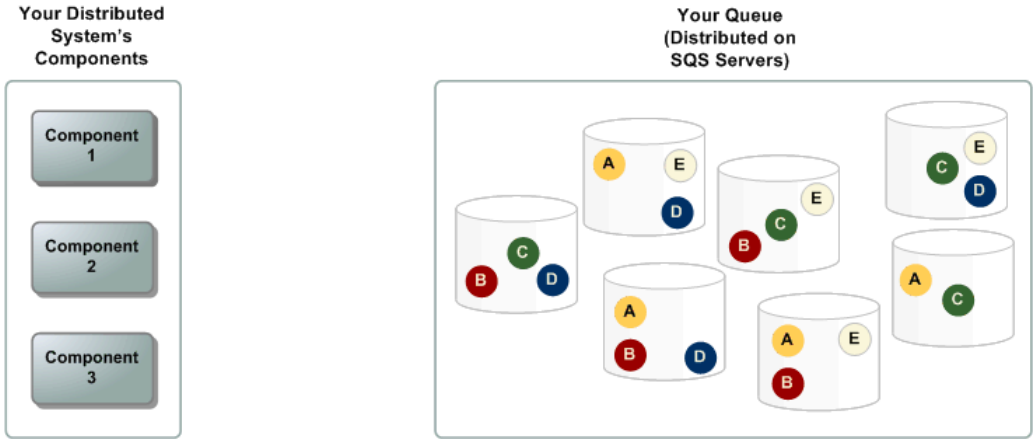
`CreateQueue`, and you can update the value with `SetQueueAttributes`. If you update the value, the new value affects only messages enqueued after the update.

What Is the Basic Architecture of Amazon SQS?

There are three main actors in the overall system:

- The components of your distributed system
- Queues
- Messages in the queues

In the following diagram, your system has several components that send messages to the queue and receive messages from the queue. The diagram shows that a single queue, which has its messages (A-E), is redundantly saved across multiple Amazon SQS servers.



We Want to Hear from You

We welcome your feedback. To contact us, visit the Amazon SQS Discussion Forum.

Amazon Simple Queue Service Developer Guide

New and Frequently Viewed Amazon SQS Topics

Latest update: March 7, 2018

Amazon Simple Queue Service Developer Guide

Latest Topics on Service Features	Most Frequently Viewed Topics
1. Enable Compatibility Between AWS Services and Encrypted Queues (p. 165)	1. Visibility Timeout (p. 60)
2. Using JMS with Amazon SQS (p. 90)	2. FIFO (First-In-First-Out) Queues (p. 51)
3. Tagging Your Amazon SQS Queues (p. 66)	3. Amazon SQS Long Polling (p. 75)
4. Configuring SSE for an existing Amazon SQS queue (p. 25)	4. Using Amazon SQS Dead-Letter Queues (p. 62)
5. Creating an Amazon SQS queue with SSE (p. 21)	5. Amazon SQS Limits (p. 118)
6. Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160)	6. Standard Queues (p. 48)
7. Create a Queue Using AWS CloudFormation (p. 19)	7. Using Amazon SQS Message Attributes (p. 67)
8. Recommendations for FIFO (First-In-First-Out) Queues (p. 115)	8. How Amazon SQS Queues Work (p. 47)
9. Moving from a Standard Queue to a FIFO Queue (p. 57)	9. Getting Started with Amazon SQS (p. 8)
10. FIFO (First-In-First-Out) Queues (p. 51)	10. Creating Custom Policies Using the Amazon SQS Access Policy Language (p. 148)

Amazon Simple Queue Service API Reference

Latest Topics on Service Features	Most Frequently Viewed Topics
1. `ListQueueTags`	1. `ReceiveMessage`
2. `UntagQueue`	2. `SendMessage`
3. `TagQueue`	3. `GetQueueAttributes`
4. `SetQueueAttributes` (SSE, FIFO)	4. `CreateQueue`
5. `GetQueueAttributes` (SSE, FIFO)	5. `ChangeMessageVisibility`
6. `CreateQueue` (SSE, FIFO)	6. `DeleteMessage`
7. `ChangeMessageVisibility` (FIFO)	7. `SetQueueAttributes`
8. `ReceiveMessage` (FIFO)	8. `CommonErrors`
9. `SendMessageBatch` (FIFO)	9. `GetQueueUrl`
10. `SendMessage` (FIFO)	10. `SendMessageBatch`

Setting Up Amazon SQS

Before you can use Amazon SQS for the first time, you must complete the following steps.

Step 1: Create an AWS Account

To access any AWS service, you first need to create an AWS account, an Amazon.com account that can use AWS products. You can use your AWS account to view your activity and usage reports and to manage authentication and access.

To avoid using your AWS account root user for Amazon SQS actions, it is a best practice to create an IAM user for each person who needs administrative access to Amazon SQS.

To set up a new account

1. Open https://aws.amazon.com/, and then choose **Create an AWS Account**.

   Note
   This might be unavailable in your browser if you previously signed into the AWS Management Console. In that case, choose **Sign in to a different account**, and then choose **Create a new AWS account**.
2. Follow the online instructions.

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

Step 2: Create an IAM User

To create an IAM user for yourself and add the user to an Administrators group

1. Use your AWS account email address and password to sign in as the *AWS account root user* to the IAM console at https://console.aws.amazon.com/iam/.

   Note
   We strongly recommend that you adhere to the best practice of using the **`Administrator`** user below and securely lock away the root user credentials. Sign in as the root user only to perform a few account and service management tasks.
2. In the navigation pane of the console, choose **Users**, and then choose **Add user**.
3. For **User name**, type **`Administrator`**.
4. Select the check box next to **AWS Management Console access**, select **Custom password**, and then type the new user's password in the text box. You can optionally select **Require password reset** to force the user to select a new password the next time the user signs in.
5. Choose **Next: Permissions**.
6. On the **Set permissions for user** page, choose **Add user to group**.
7. Choose **Create group**.
8. In the **Create group** dialog box, type **`Administrators`**.

9. For **Filter**, choose **Job function**.
10. In the policy list, select the check box for **AdministratorAccess**. Then choose **Create group**.
11. Back in the list of groups, select the check box for your new group. Choose **Refresh** if necessary to see the group in the list.
12. Choose **Next: Review** to see the list of group memberships to be added to the new user. When you are ready to proceed, choose **Create user**.

You can use this same process to create more groups and users, and to give your users access to your AWS account resources. To learn about using policies to restrict users' permissions to specific AWS resources, go to Access Management and Example Policies.

Step 3: Get Your Access Key ID and Secret Access Key

To use Amazon SQS API actions (for example, using Java or through the AWS Command Line Interface), you need an access key ID and a secret access key.

> **Note**
> The access key ID and secret access key are specific to AWS Identity and Access Management. Don't confuse them with credentials for other AWS services, such as Amazon EC2 key pairs.

To get the access key ID and secret access key for an IAM user

Access keys consist of an access key ID and secret access key, which are used to sign programmatic requests that you make to AWS. If you don't have access keys, you can create them from the AWS Management Console. We recommend that you use IAM access keys instead of AWS account root user access keys. IAM lets you securely control access to AWS services and resources in your AWS account.

The only time that you can view or download the secret access keys is when you create the keys. You cannot recover them later. However, you can create new access keys at any time. You must also have permissions to perform the required IAM actions. For more information, see Permissions Required to Access IAM Resources in the *IAM User Guide*.

1. Open the IAM console.
2. In the navigation pane of the console, choose **Users**.
3. Choose your IAM user name (not the check box).
4. Choose the **Security credentials** tab and then choose **Create access key**.
5. To see the new access key, choose **Show**. Your credentials will look something like this:

   - Access key ID: AKIAIOSFODNN7EXAMPLE
   - Secret access key: wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
6. To download the key pair, choose **Download .csv file**. Store the keys in a secure location.

   Keep the keys confidential in order to protect your AWS account, and never email them. Do not share them outside your organization, even if an inquiry appears to come from AWS or Amazon.com. No one who legitimately represents Amazon will ever ask you for your secret key.

Related topics

- What Is IAM? in the *IAM User Guide*
- AWS Security Credentials in *AWS General Reference*

Step 4: Get Ready to Use the Example Code

This guide shows how to work with Amazon SQS using the AWS Management Console and using Java. If you want to use the example code, you must install the Java Standard Edition Development Kit and make some configuration changes to the example code.

You can write code in other programming languages. For more information, see the documentation of the AWS SDKs.

Note
You can explore Amazon SQS without writing code with tools such as the AWS Command Line Interface (AWS CLI) or Windows PowerShell. You can find AWS CLI examples in the Amazon SQS section of the *AWS CLI Command Reference*. You can find Windows PowerShell examples in the Amazon Simple Queue Service section of the *AWS Tools for PowerShell Cmdlet Reference*.

Next Steps

Now that you're prepared for working with Amazon SQS, can get started (p. 8) with managing Amazon SQS queues and messages using the AWS Management Console. You can also try the more advanced Amazon SQS tutorials (p. 16).

Getting Started with Amazon SQS

This section helps you become more familiar with Amazon SQS by showing you how to manage queues and messages using the AWS Management Console.

Note
The *Amazon Simple Queue Service Getting Started Guide* has been retired. If you want to work with Amazon SQS programmatically, see the Amazon SQS Tutorials (p. 16) and Making Query API Requests (p. 168) sections.

Prerequisites

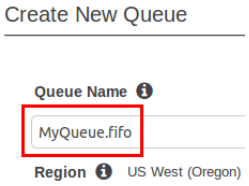
Before you begin, complete the steps in Setting Up Amazon SQS (p. 5).

Step 1: Create a Queue

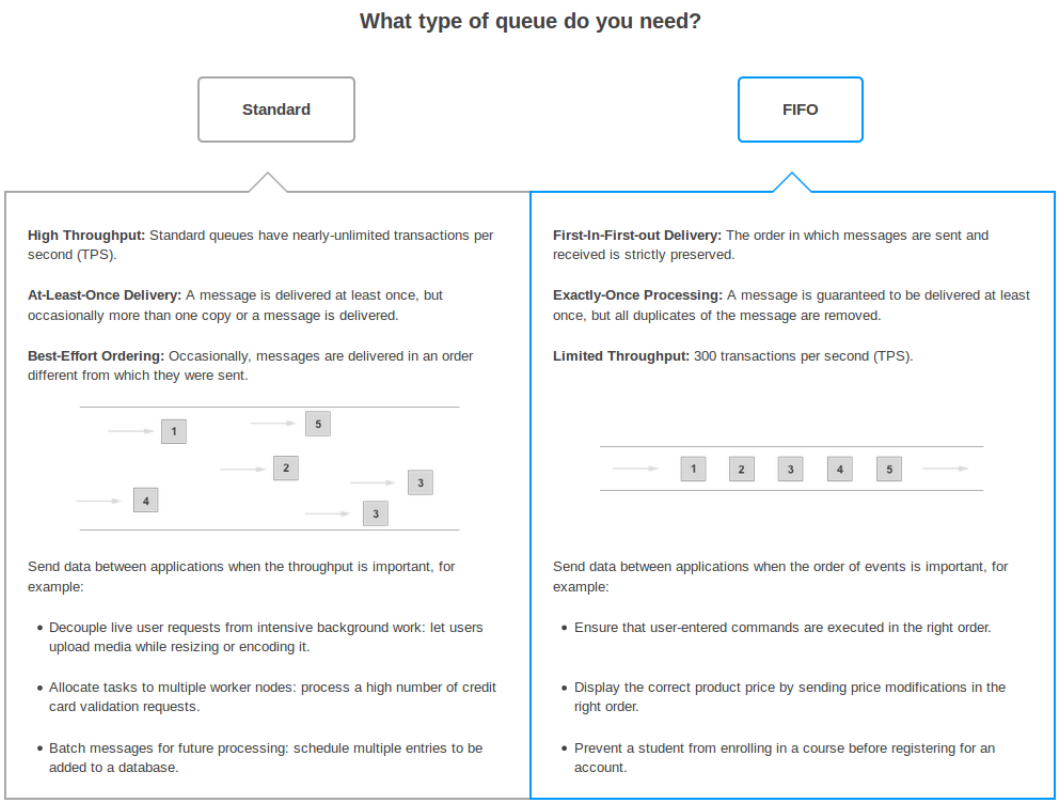
The first and most common Amazon SQS task is creating queues. The following example demonstrates how to create and configure a queue.

1. Sign in to the Amazon SQS console.
2. Choose **Create New Queue.**
3. On the **Create New Queue** page, ensure that you're in the correct region and then type the **Queue Name**.

   Note
   The name of a FIFO queue must end with the `.fifo` suffix. FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions.

4. **Standard** is selected by default. Choose **FIFO**.

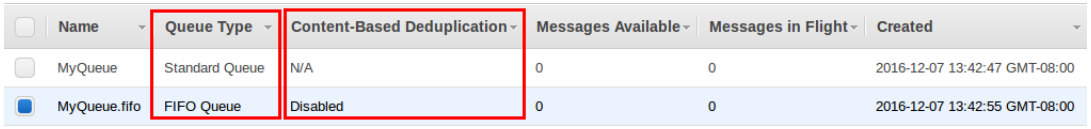


5. To create your queue with the default parameters, choose **Quick-Create Queue**.

   Your new queue is created and selected in the queue list.

   > **Note**
   > When you create a queue, it can take a short time for the queue to propagate throughout Amazon SQS..

   The **Queue Type** column helps you distinguish standard queues from FIFO queues at a glance. For a FIFO queue, the **Content-Based Deduplication** column displays whether you have enabled exactly-once processing (p. 54).



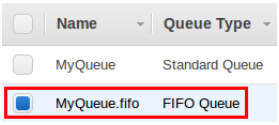
Name	Queue Type	Content-Based Deduplication	Messages Available	Messages in Flight	Created
MyQueue	Standard Queue	N/A	0	0	2016-12-07 13:42:47 GMT-08:00
MyQueue.fifo	FIFO Queue	Disabled	0	0	2016-12-07 13:42:55 GMT-08:00

   Your queue's **Name**, **URL**, and **ARN** are displayed on the **Details** tab.

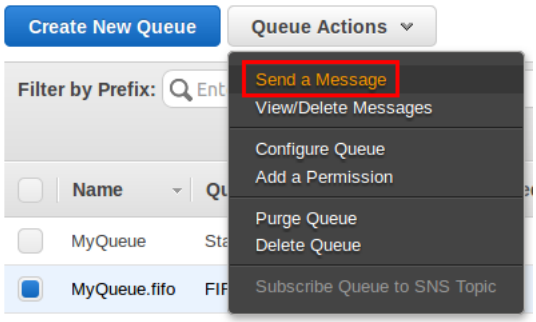
Step 2: Send a Message

After you create your queue, you can send a message to it. The following example demonstrates sending a message to an existing queue.

1. From the queue list, select the queue that you've created.

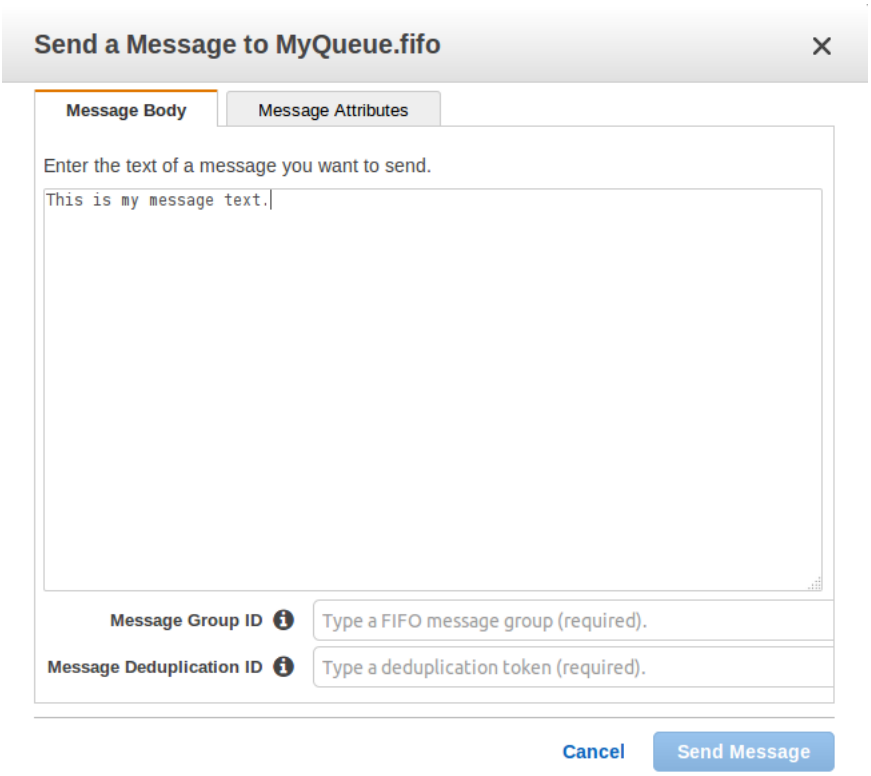


2. From **Queue Actions**, select **Send a Message**.



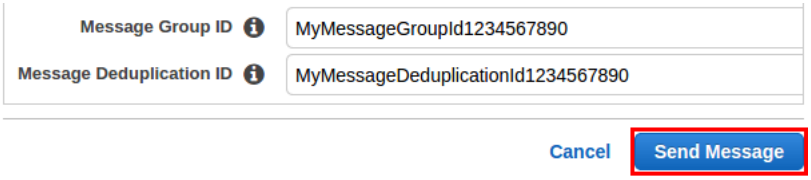
The **Send a Message to *QueueName*** dialog box is displayed.

The following example shows the **Message Group ID** and **Message Deduplication ID** parameters specific to FIFO queues (content-based deduplication (p. 54) is disabled).



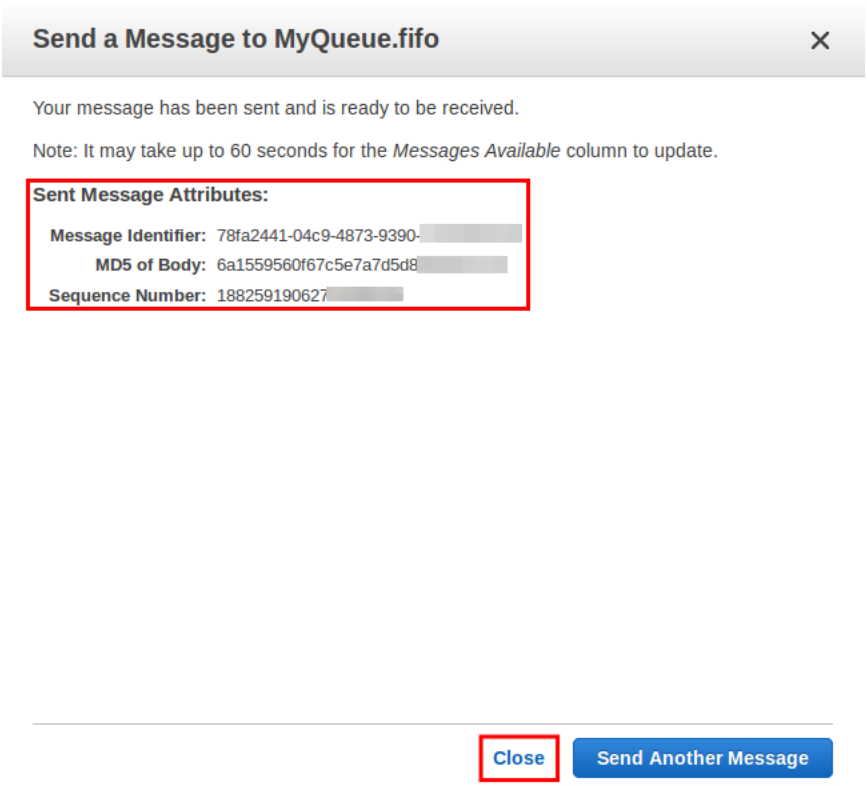
3. To send a message to a FIFO queue, type the **Message Body**, the **Message Group ID** `MyMessageGroupId1234567890`, and the **Message Deduplication ID** `MyMessageDeduplicationId1234567890`, and then choose **Send Message**. For more information, see FIFO Queue Logic (p. 52).

   Note
   The message group ID is always required. However, if content-based deduplication is enabled, the message deduplication ID is optional.



Your message is sent and the **Send a Message to *QueueName*** dialog box is displayed, showing the attributes of the sent message.

The following example shows the **Sequence Number** attribute specific to FIFO queues.



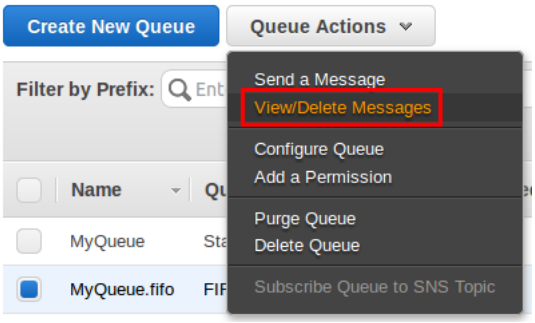
4. Choose **Close**.

Step 3: Receive and Delete Your Message

After you send a message into a queue, you can consume it (retrieve it from the queue). When you request a message from a queue, you can't specify which message to get. Instead, you specify the maximum number of messages (up to 10) that you want to get.

The following example demonstrates receiving and deleting a message.

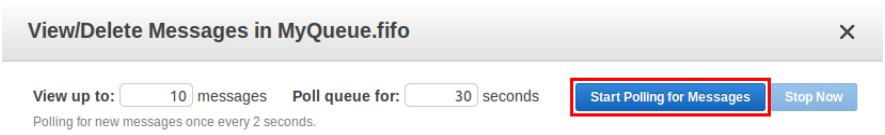
1. From the queue list, select the queue that you have created.
2. From **Queue Actions**, select **View/Delete Messages**.



The **View/Delete Messages in *QueueName*** dialog box is displayed.

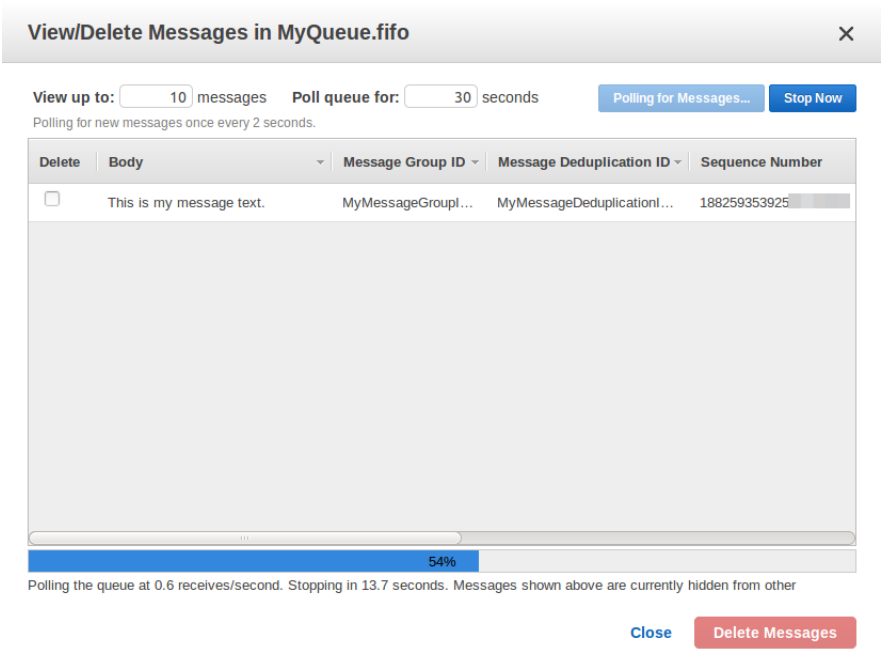
Note
The first time you take this action, an information screen is displayed. To hide the screen, check the **Don't show this again** checkbox.

3. Choose **Start Polling for messages.**

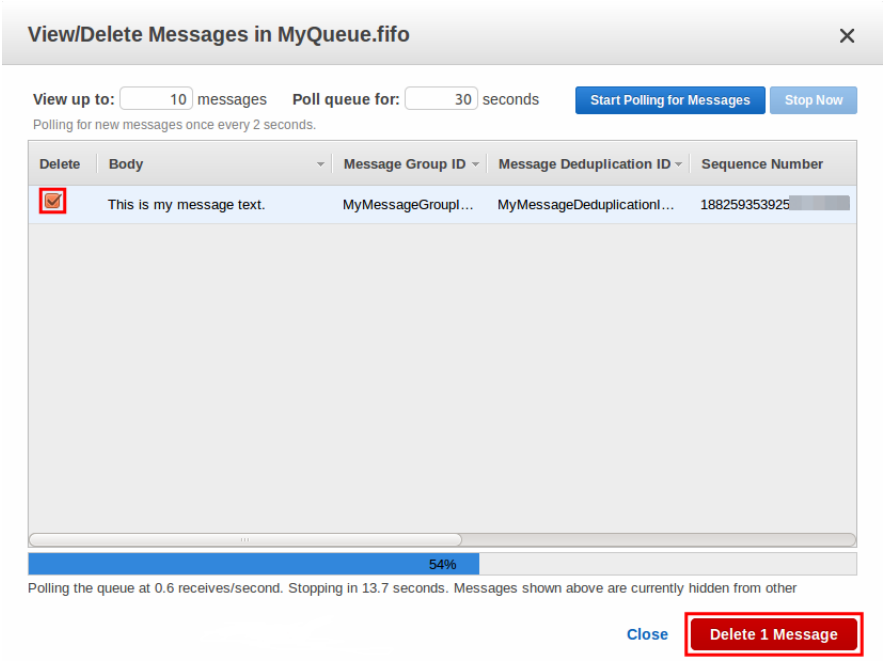


Amazon SQS begins to poll the messages in the queue. The dialog box displays a message from the queue. A progress bar at the bottom of the dialog box displays the status of the message's visibility timeout.

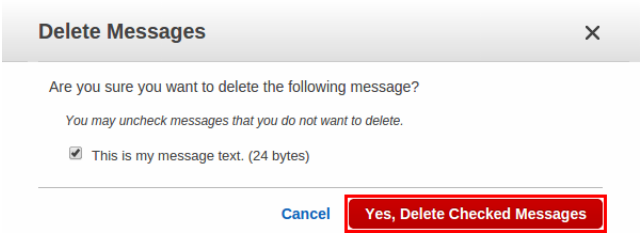
The following example shows the **Message Group ID**, **Message Deduplication ID**, and **Sequence Number** columns specific to FIFO queues.



4. *Before* the visibility timeout expires, select the message that you want to delete and then choose **Delete *1* Message**.



The **Delete Messages** dialog box is displayed.



5. Confirm that the message you want to delete is checked and choose **Yes, Delete Checked Messages**.

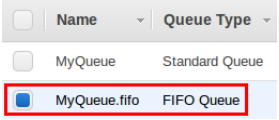
   The selected message is deleted.

   When the progress bar is filled in, the visibility timeout (p. 60) expires and the message becomes visible to consumers.
6. Select **Close**.

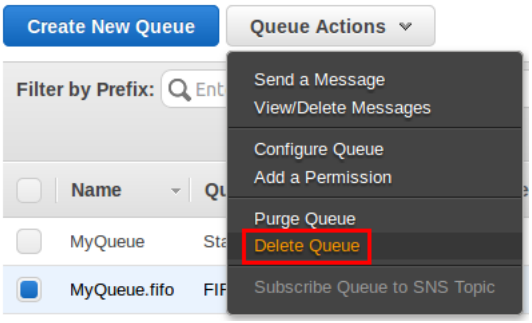
Step 4: Delete Your Queue

If you don't use an Amazon SQS queue (and don't foresee using it in the near future), it is a best practice to delete it from Amazon SQS. The following example demonstrates deleting a queue.

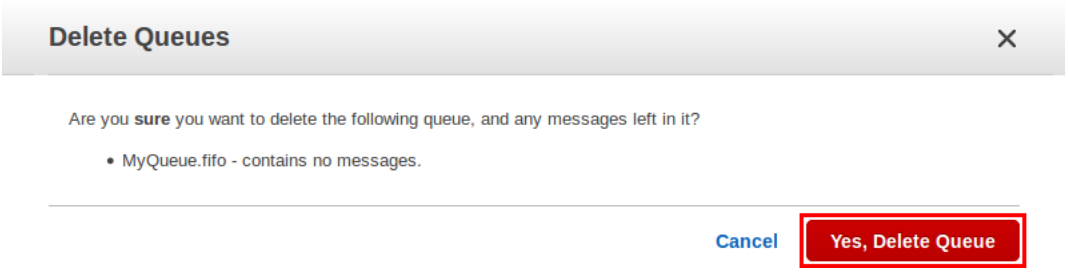
1. From the queue list, select the queue that you have created.



2. From **Queue Actions**, select **Delete Queue**.



The **Delete Queues** dialog box is displayed.



3. Choose **Yes, Delete Queue**.

   The queue is deleted.

Next Steps

Now that you've created a queue and learned how to send, receive, and delete messages and how to delete a queue, you might want to try the following:

- Enable server-side encryption for a new queue (p. 21) (or for an existing queue (p. 25)).
- Add permissions to a queue. (p. 29)
- Purge a queue. (p. 41)
- Configure a dead-letter queue. (p. 38)
- Subscribe a queue to an Amazon SNS topic. (p. 43)
- Add, update, or remove tags for a queue (p. 45).
- Learn more about Amazon SQS workflows and processes: Read How Queues Work (p. 47), Best Practices (p. 113), and Limits (p. 118). You can also explore the Amazon SQS Articles & Tutorials. If you ever have any questions, browse the Amazon SQS FAQs or participate in the Amazon SQS Developer Forums.
- Learn how to interact with Amazon SQS programmatically: Read Working with APIs (p. 168) and explore the Sample Code and Libraries and the developer centers:
  - Java
  - JavaScript
  - PHP
  - Python
  - Ruby
  - Windows & .NET
- Learn about keeping an eye on costs and resources: Start by reading the Monitoring and Logging (p. 121) section.

- Learn about protecting your data and access to it: Start by reading the Security (p. 134) section.

Amazon SQS Tutorials

This guide shows how to work with Amazon SQS using the AWS Management Console and using Java. If you want to use the example code, you must install the Java Standard Edition Development Kit and make some configuration changes to the example code.

You can write code in other programming languages. For more information, see the documentation of the AWS SDKs.

> **Note**
> You can explore Amazon SQS without writing code with tools such as the AWS Command Line Interface (AWS CLI) or Windows PowerShell. You can find AWS CLI examples in the Amazon SQS section of the *AWS CLI Command Reference*. You can find Windows PowerShell examples in the Amazon Simple Queue Service section of the *AWS Tools for PowerShell Cmdlet Reference*.

Topics

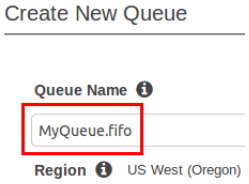
Tutorial: Creating an Amazon SQS Queue

The first and most common Amazon SQS task is creating queues. The following example demonstrates how to create and configure a queue.

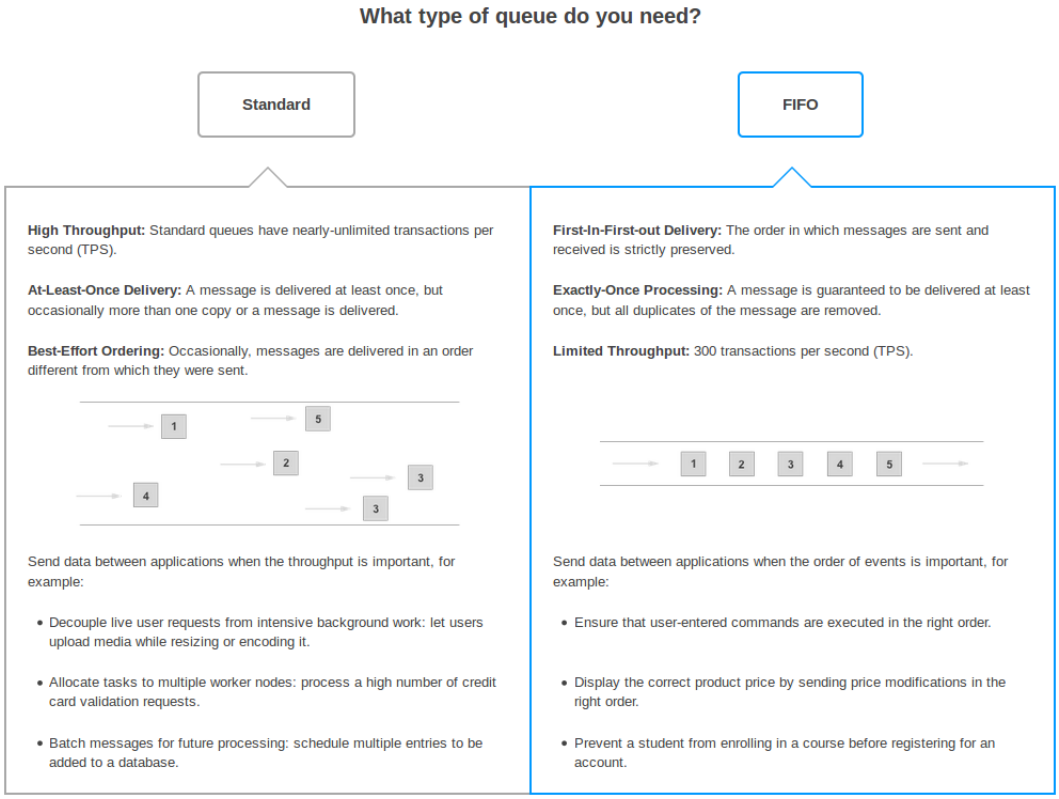
AWS Management Console

1. Sign in to the Amazon SQS console.
2. Choose **Create New Queue.**
3. On the **Create New Queue** page, ensure that you're in the correct region and then type the **Queue Name**.

   > **Note**
   > The name of a FIFO queue must end with the `.fifo` suffix. FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions.



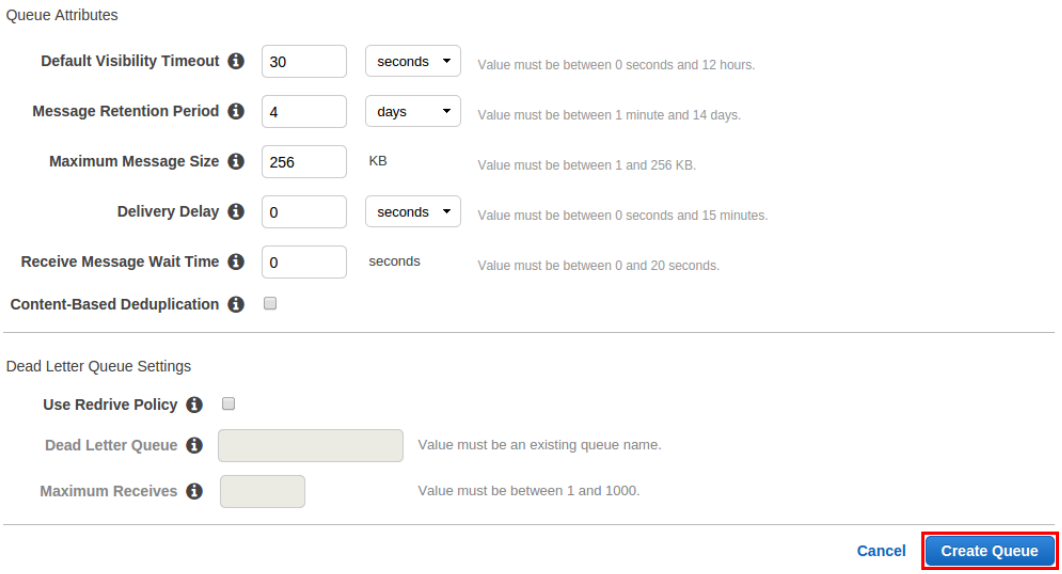
4. **Standard** is selected by default. Choose **FIFO**.



5. Create your queue.

   - To create your queue with the default parameters, choose **Quick-Create Queue**.
   - To configure your queue's parameters, choose **Configure Queue**. When you finish configuring the parameters, choose **Create Queue**. For more information about creating a queue with SSE, see Creating an Amazon SQS queue with SSE (p. 21).

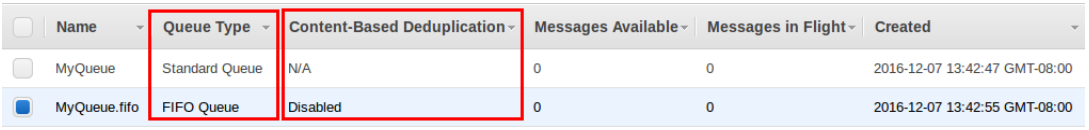
     The following example shows the **Content-Based Deduplication** parameter specific to FIFO queues.



Your new queue is created and selected in the queue list.

> **Note**
> When you create a queue, it can take a short time for the queue to propagate throughout Amazon SQS.

The **Queue Type** column helps you distinguish standard queues from FIFO queues at a glance. For a FIFO queue, the **Content-Based Deduplication** column displays whether you have enabled exactly-once processing (p. 54).



Name	Queue Type	Content-Based Deduplication	Messages Available	Messages in Flight	Created
MyQueue	Standard Queue	N/A	0	0	2016-12-07 13:42:47 GMT-08:00
MyQueue.fifo	FIFO Queue	Disabled	0	0	2016-12-07 13:42:55 GMT-08:00

Your queue's **Name**, **URL**, and **ARN** are displayed on the **Details** tab.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

To create a standard queue

1. Copy the example program (p. 49).

   The following section of the code creates the `MyQueue` queue:

```
// Create a queue
System.out.println("Creating a new SQS queue called MyQueue.\n");
final CreateQueueRequest createQueueRequest = new CreateQueueRequest("MyQueue");
final String myQueueUrl = sqs.createQueue(createQueueRequest).getQueueUrl();
```

2. Compile and run the example.

   The queue is created.

To create a FIFO queue

1. Copy the example program (p. 54).

   The following section of the code creates the `MyFifoQueue.fifo` queue:

```
// Create a FIFO queue
System.out.println("Creating a new Amazon SQS FIFO queue called " + "MyFifoQueue.fifo.
\n");
final Map<String, String> attributes = new HashMap<String, String>();

// A FIFO queue must have the FifoQueue attribute set to True
attributes.put("FifoQueue", "true");
```

```
// If the user doesn't provide a MessageDeduplicationId, generate a
 MessageDeduplicationId based on the content.
attributes.put("ContentBasedDeduplication", "true");

// The FIFO queue name must end with the .fifo suffix
final CreateQueueRequest createQueueRequest = new
 CreateQueueRequest("MyFifoQueue.fifo").withAttributes(attributes);
final String myQueueUrl = sqs.createQueue(createQueueRequest).getQueueUrl();
```

2. Compile and run the example.

   The queue is created.

AWS CloudFormation

You can use the AWS CloudFormation console and a JSON (or YAML) template to create an Amazon SQS queue. For more information, see Working with AWS CloudFormation Templates and the `AWS::SQS::Queue` Resource in the *AWS CloudFormation User Guide*.

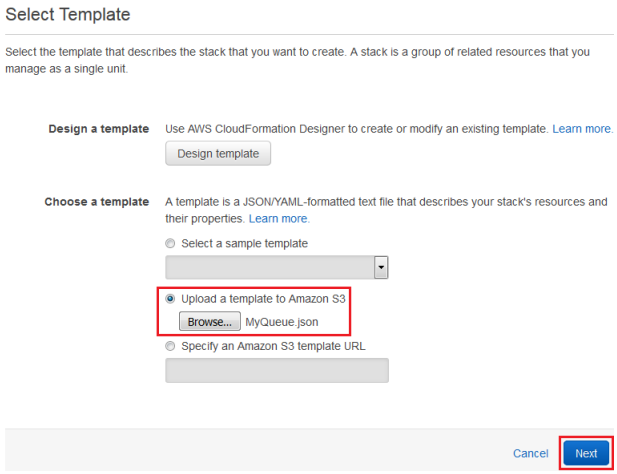
1. Copy the following JSON code to a file named `MyQueue.json`. To create a standard queue, omit the `FifoQueue` and `ContentBasedDeduplication` properties. For more information on content-based deduplication, see Exactly-Once Processing (p. 54).

   Note
   The name of a FIFO queue must end with the `.fifo` suffix. FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions.

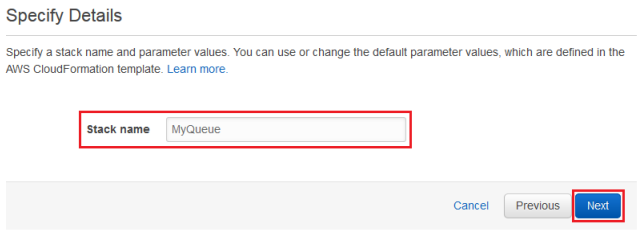
```
{
   "AWSTemplateFormatVersion": "2010-09-09",
   "Resources": {
      "MyQueue": {
         "Properties": {
            "QueueName": "MyQueue.fifo",
            "FifoQueue": true,
            "ContentBasedDeduplication": true
             },
         "Type": "AWS::SQS::Queue"
         }
      },
   "Outputs": {
      "QueueName": {
         "Description": "The name of the queue",
         "Value": {
            "Fn::GetAtt": [
               "MyQueue",
               "QueueName"
            ]
         }
      },
      "QueueURL": {
         "Description": "The URL of the queue",
         "Value": {
            "Ref": "MyQueue"
         }
      },
      "QueueARN": {
         "Description": "The ARN of the queue",
         "Value": {
            "Fn::GetAtt": [
               "MyQueue",
               "Arn"
            ]
```

```
            }
        }
    }
}
```

2. Sign in to the AWS CloudFormation console, and then choose **Create Stack**.
3. On the **Select Template** page, choose **Upload a template to Amazon S3**, choose your `MyQueue.json` file, and then choose **Next**.

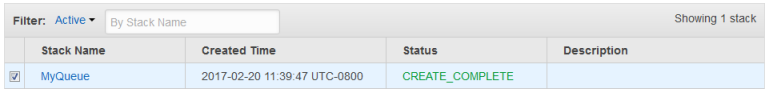


4. On the **Specify Details** page, type `MyQueue` for **Stack Name**, and then choose **Next**.

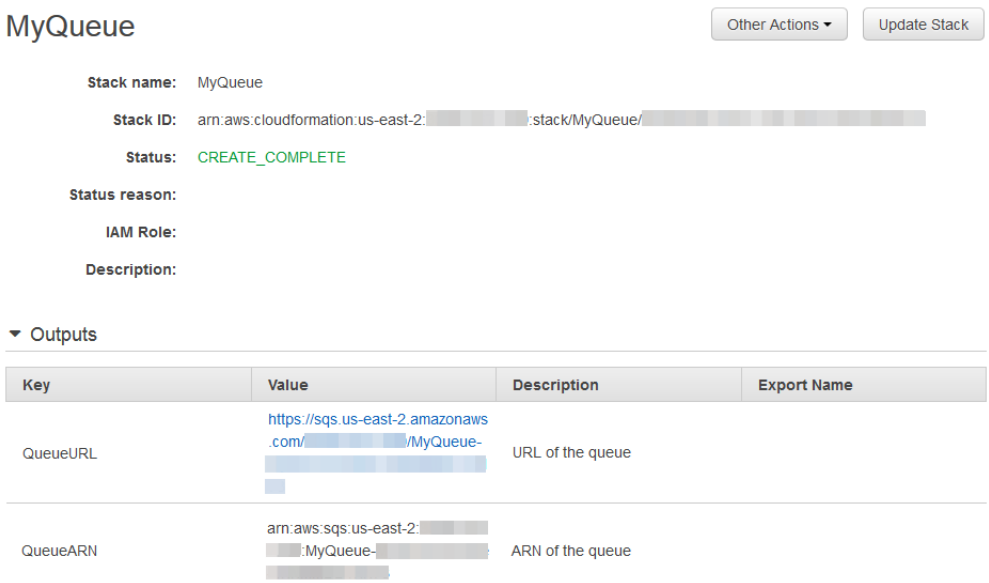


5. On the **Options** page, choose **Next**.
6. On the **Review** page, choose **Create**.

   AWS CloudFormation begins to create the `MyQueue` stack and displays the **CREATE_IN_PROGRESS** status. When the process is complete, AWS CloudFormation displays the **CREATE_COMPLETE** status.



7. (Optional) To display the name, URL, and ARN of the queue, choose the name of the stack and then on the next page expand the **Outputs** section.



Tutorial: Creating an Amazon SQS Queue with Server-Side Encryption

Server-side encryption (SSE) for Amazon SQS is available in the US East (N. Virginia), US East (Ohio), and US West (Oregon) regions. You can enable server-side encryption (SSE) for a queue to protect its data. For more information about using SSE, see Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160).

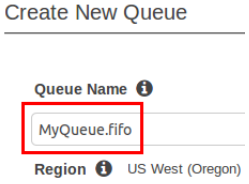
Important
All requests to queues with SSE enabled must use HTTPS and Signature Version 4.

The following example demonstrates how to create an Amazon SQS queue with SSE enabled. Although the example uses a FIFO queue, SSE works with both standard and FIFO queues.

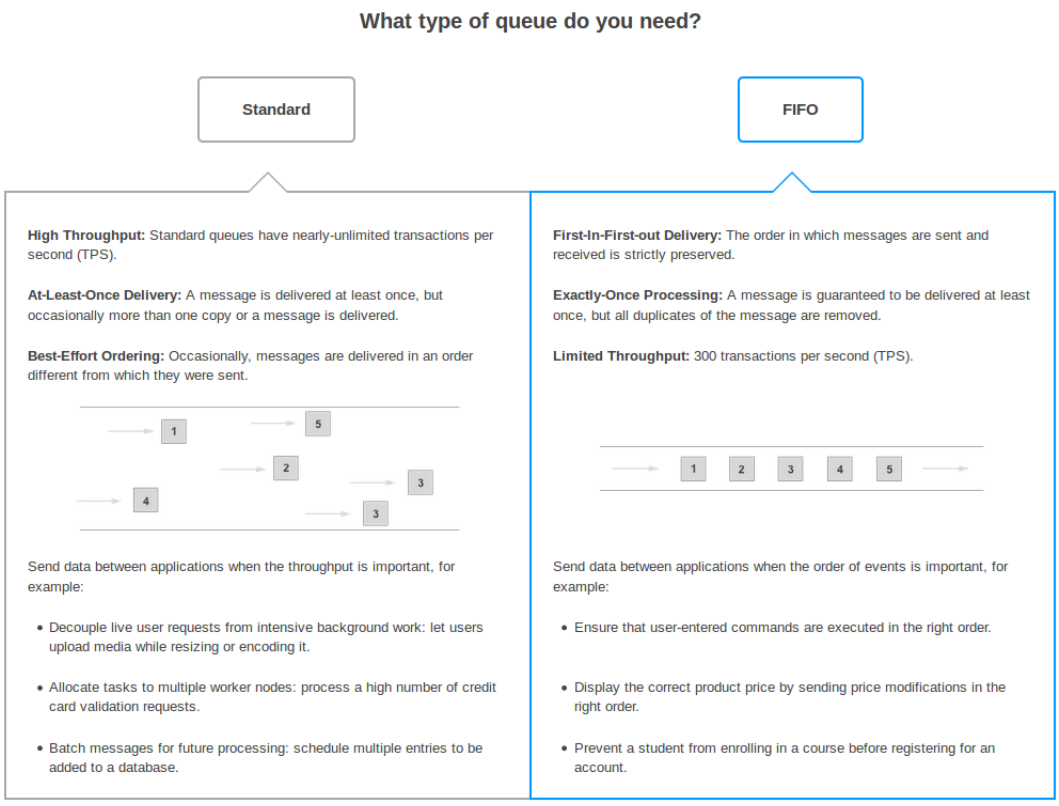
AWS Management Console

1. Sign in to the Amazon SQS console.
2. Choose **Create New Queue.**
3. On the **Create New Queue** page, ensure that you're in the correct region and then type the **Queue Name**.

   Note
   The name of a FIFO queue must end with the `.fifo` suffix. FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions.



4. **Standard** is selected by default. Choose **FIFO**.

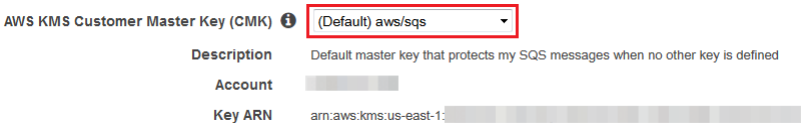


5. Choose **Configure Queue**, and then choose **Use SSE**.
6. Specify the customer master key (CMK) ID. For more information, see Key Terms (p. 162).

   For each CMK type, the **Description**, **Account**, and **Key ARN** of the CMK are displayed.

   Important
   If you aren't the owner of the CMK, or if you log in with an account that doesn't have the `kms:ListAliases` and `kms:DescribeKey` permissions, you won't be able to view information about the CMK on the Amazon SQS console.
   Ask the owner of the CMK to grant you these permissions. For more information, see the AWS KMS API Permissions: Actions and Resources Reference in the *AWS Key Management Service Developer Guide*.

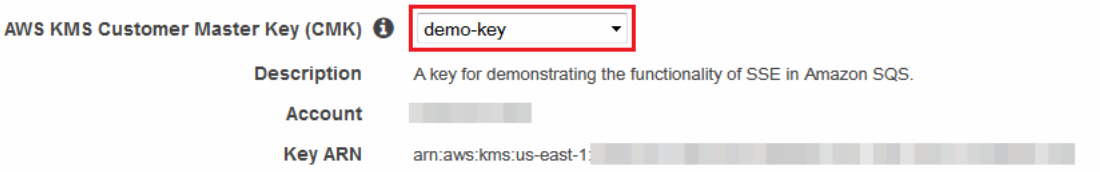
   - The AWS-managed CMK for Amazon SQS is selected by default.



   Note
   Keep the following in mind:

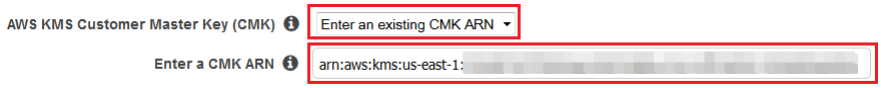
   - If you don't specify a custom CMK, Amazon SQS uses the AWS-managed CMK for Amazon SQS. For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.
   - The first time you use the AWS Management Console to specify the AWS-managed CMK for Amazon SQS for a queue, AWS KMS creates the AWS-managed CMK for Amazon SQS.

  - Alternatively, the first time you use the `SendMessage` or `SendMessageBatch` API action on a queue with SSE enabled, AWS KMS creates the AWS-managed CMK for Amazon SQS.
- To use a custom CMK from your AWS account, select it from the list.

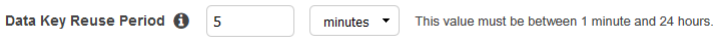


Note
For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.

- To use a custom CMK ARN from your AWS account or from another AWS account, select **Enter an existing CMK ARN** from the list and type or copy the CMK.

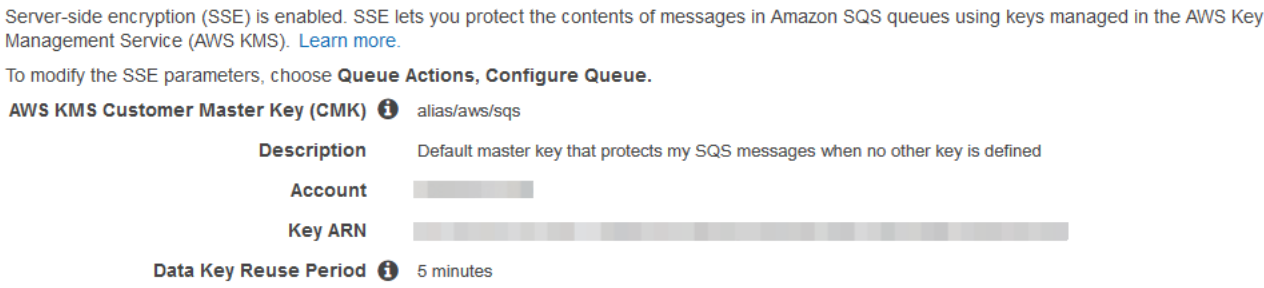


7. (Optional) For **Data key reuse period**, specify a value between 1 minute and 24 hours. The default is 5 minutes. For more information, see How Does the Data Key Reuse Period Work? (p. 162).



8. Choose **Create Queue**.

   Your new queue is created with SSE. The encryption status, alias of the CMK, **Description**, **Account**, **Key ARN**, and the **Data Key Reuse Period** are displayed on the **Encryption** tab.



Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

Before you can use SSE, you must configure AWS KMS key policies to allow encryption of queues and encryption and decryption of messages. You must also ensure that the key policies of the customer master key (CMK) allow the necessary permissions. For more information, see What AWS KMS Permissions Do I Need to Use SSE for Amazon SQS? (p. 164).

1. Obtain the customer master key (CMK) ID. For more information, see Key Terms (p. 162).

   Note
   Keep the following in mind:

   - If you don't specify a custom CMK, Amazon SQS uses the AWS-managed CMK for Amazon SQS. For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.

- The first time you use the AWS Management Console to specify the AWS-managed CMK for Amazon SQS for a queue, AWS KMS creates the AWS-managed CMK for Amazon SQS.
- Alternatively, the first time you use the `SendMessage` or `SendMessageBatch` API action on a queue with SSE enabled, AWS KMS creates the AWS-managed CMK for Amazon SQS.

2. To enable server-side encryption, specify the CMK ID by setting the `KmsMasterKeyId` attribute of the `CreateQueue` or `SetQueueAttributes` action.

   The following code example creates a new queue with SSE using the AWS-managed CMK for Amazon SQS:

```
final AmazonSQS sqs = AmazonSQSClientBuilder.defaultClient();
final CreateQueueRequest createRequest = new CreateQueueRequest("MyQueue");
final Map<String, String> attributes = new HashMap<String, String>();

// Enable server-side encryption by specifying the alias ARN of the
// AWS-managed CMK for Amazon SQS.
final String kmsMasterKeyAlias = "arn:aws:kms:us-east-2:123456789012:alias/aws/sqs";
attributes.put("KmsMasterKeyId", kmsMasterKeyAlias);

// (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse
attributes.put("KmsDataKeyReusePeriodSeconds", "60");

final CreateQueueResult createResult = client.createQueue(createRequest);
```

   The following code example creates a new queue with SSE using a custom CMK:

```
final AmazonSQS sqs = AmazonSQSClientBuilder.defaultClient();
final CreateQueueRequest createRequest = new CreateQueueRequest("MyQueue");
final Map<String, String> attributes = new HashMap<String, String>();

// Enable server-side encryption by specifying the alias ARN of the custom CMK.
final String kmsMasterKeyAlias = "arn:aws:kms:us-east-2:123456789012:alias/MyAlias";
attributes.put("KmsMasterKeyId", kmsMasterKeyAlias);

// (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse
// a data key to encrypt or decrypt messages before calling AWS KMS again.
attributes.put("KmsDataKeyReusePeriodSeconds", "864000");

final CreateQueueResult createResult = client.createQueue(createRequest);
```

3. (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse a data key (p. 162) to encrypt or decrypt messages before calling AWS KMS again. Set the `KmsDataKeyReusePeriodSeconds` attribute of the `CreateQueue` or `SetQueueAttributes` action. Possible values may be between 60 seconds (1 minute) and 86,400 seconds (24 hours). If you don't specify a value, the default value of 300 seconds (5 minutes) is used.

   The first code example above sets the data key reuse time period to 60 seconds (1 minute). The second code example sets it to 86,400 seconds (24 hours). The following code example sets the data key reuse period to 60 seconds (1 minute):

```
// (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse
// a data key to encrypt or decrypt messages before calling AWS KMS again.
attributes.put("KmsDataKeyReusePeriodSeconds", "60");
```

For information about how to retrieve the attributes of a queue, see Examples in the *Amazon Simple Queue Service API Reference*.

To retrieve the CMK ID or the data key reuse period for a particular queue, use the `KmsMasterKeyId` and `KmsDataKeyReusePeriodSeconds` attributes of the `GetQueueAttributes` action.

For information about how to switch a queue to a different CMK with the same alias, see Updating an Alias in the *AWS Key Management Service Developer Guide*.

Tutorial: Configuring Server-Side Encryption (SSE) for an Existing Amazon SQS Queue

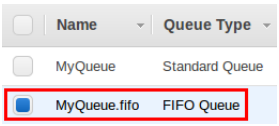
Server-side encryption (SSE) for Amazon SQS is available in the US East (N. Virginia), US East (Ohio), and US West (Oregon) regions. You can enable SSE for a queue to protect its data. For more information about using SSE, see Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160).

Important
All requests to queues with SSE enabled must use HTTPS and Signature Version 4.
When you disable SSE, messages remain encrypted. You must receive and decrypt a message to view its contents.

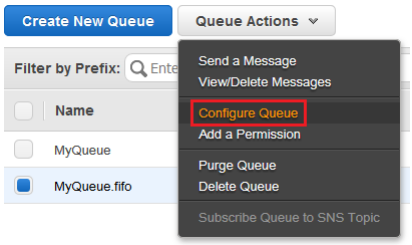
The following example demonstrates enabling, disabling, and configuring SSE for an existing Amazon SQS queue.

AWS Management Console

1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



3. From **Queue Actions**, select **Configure Queue**.



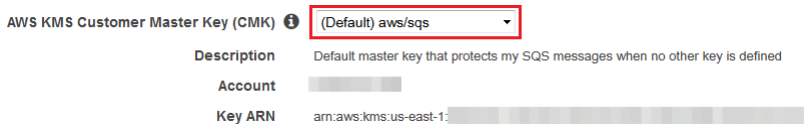
The **Configure** ***QueueName*** dialog box is displayed.

4. To enable or disable SSE, use the **Use SSE** check box.
5. Specify the customer master key (CMK) ID. For more information, see Key Terms (p. 162).

   For each CMK type, the **Description**, **Account**, and **Key ARN** of the CMK are displayed.

   Important
   If you aren't the owner of the CMK, or if you log in with an account that doesn't have the `kms:ListAliases` and `kms:DescribeKey` permissions, you won't be able to view information about the CMK on the Amazon SQS console.
   Ask the owner of the CMK to grant you these permissions. For more information, see the AWS KMS API Permissions: Actions and Resources Reference in the *AWS Key Management Service Developer Guide*.

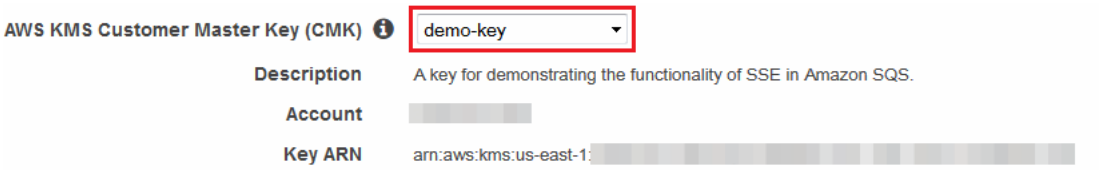
   - To use the AWS-managed CMK for Amazon SQS, select it from the list.



Note
Keep the following in mind:

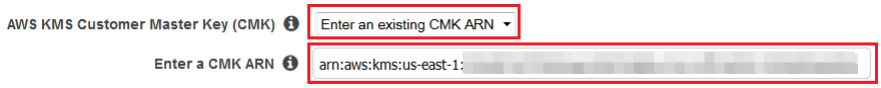
- If you don't specify a custom CMK, Amazon SQS uses the AWS-managed CMK for Amazon SQS. For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.
- The first time you use the AWS Management Console to specify the AWS-managed CMK for Amazon SQS for a queue, AWS KMS creates the AWS-managed CMK for Amazon SQS.
- Alternatively, the first time you use the `SendMessage` or `SendMessageBatch` API action on a queue with SSE enabled, AWS KMS creates the AWS-managed CMK for Amazon SQS.

- To use a custom CMK from your AWS account, select it from the list.

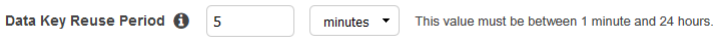


Note
For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.

- To use a custom CMK ARN from your AWS account or from another AWS account, select **Enter an existing CMK ARN** from the list and type or copy the CMK.



6. (Optional) For **Data key reuse period**, specify a value between 1 minute and 24 hours. The default is 5 minutes. For more information, see How Does the Data Key Reuse Period Work? (p. 162).



7. Choose **Save Changes**.

   Your changes are applied to the queue.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

Before you can use SSE, you must configure AWS KMS key policies to allow encryption of queues and encryption and decryption of messages. You must also ensure that the key policies of the customer master key (CMK) allow the necessary permissions. For more information, see What AWS KMS Permissions Do I Need to Use SSE for Amazon SQS? (p. 164).

1. Obtain the customer master key (CMK) ID. For more information, see Key Terms (p. 162).

   Note
   Keep the following in mind:

- If you don't specify a custom CMK, Amazon SQS uses the AWS-managed CMK for Amazon SQS. For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.
- The first time you use the AWS Management Console to specify the AWS-managed CMK for Amazon SQS for a queue, AWS KMS creates the AWS-managed CMK for Amazon SQS.
- Alternatively, the first time you use the `SendMessage` or `SendMessageBatch` API action on a queue with SSE enabled, AWS KMS creates the AWS-managed CMK for Amazon SQS.

2. To enable server-side encryption, specify the CMK ID by setting the `KmsMasterKeyId` attribute of the `CreateQueue` or `SetQueueAttributes` action.

   The following code example enables SSE for an existing queue using the AWS-managed CMK for Amazon SQS:

```
final SetQueueAttributesRequest setAttributesRequest = new SetQueueAttributesRequest();
setAttributesRequest.setQueueUrl(queueUrl);

// Enable server-side encryption by specifying the alias ARN of the
// AWS-managed CMK for Amazon SQS.
final String kmsMasterKeyAlias = "arn:aws:kms:us-east-2:123456789012:alias/aws/sqs";
attributes.put("KmsMasterKeyId", kmsMasterKeyAlias);

final SetQueueAttributesResult setAttributesResult =
 client.setQueueAttributes(setAttributesRequest);
```

   To disable server-side encryption for an existing queue, set the `KmsMasterKeyId` attribute to an empty string using the `SetQueueAttributes` action.

   Important
   `null` isn't a valid value for `KmsMasterKeyId`.

3. (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse a data key (p. 162) to encrypt or decrypt messages before calling AWS KMS. Set the `KmsDataKeyReusePeriodSeconds` attribute of the `CreateQueue` or `SetQueueAttributes` action. Possible values may be between 60 seconds (1 minute) and 86,400 seconds (24 hours). If you don't specify a value, the default value of 300 seconds (5 minutes) is used.

   The following code example sets the data key reuse period to 60 seconds (1 minute):

```
// (Optional) Specify the length of time, in seconds, for which Amazon SQS can reuse
// a data key to encrypt or decrypt messages before calling AWS KMS again.
attributes.put("KmsDataKeyReusePeriodSeconds", "60");
```

For information about how to retrieve the attributes of a queue, see Examples in the *Amazon Simple Queue Service API Reference*.

To retrieve the CMK ID or the data key reuse period for a particular queue, use the `KmsMasterKeyId` and `KmsDataKeyReusePeriodSeconds` attributes of the `GetQueueAttributes` action.

For information about how to switch a queue to a different CMK with the same alias, see Updating an Alias in the *AWS Key Management Service Developer Guide*.

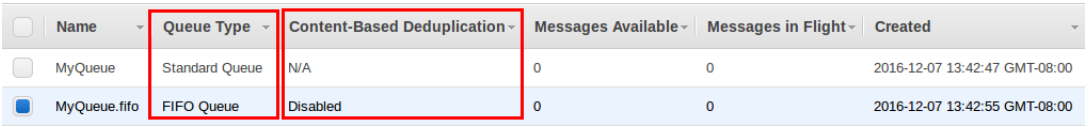
Tutorial: Listing All Amazon SQS Queues in a Region

When you create a queue, it can take a short time for the queue to propagate throughout Amazon SQS. The following example demonstrates confirming your queue's existence by listing all queues in the current region.

AWS Management Console

1. Sign in to the Amazon SQS console.
2. Your queues in the current region are listed.

   The **Queue Type** column helps you distinguish standard queues from FIFO queues at a glance. For a FIFO queue, the **Content-Based Deduplication** column displays whether you have enabled exactly-once processing (p. 54).



Name	Queue Type	Content-Based Deduplication	Messages Available	Messages in Flight	Created
MyQueue	Standard Queue	N/A	0	0	2016-12-07 13:42:47 GMT-08:00
MyQueue.fifo	FIFO Queue	Disabled	0	0	2016-12-07 13:42:55 GMT-08:00

   Your queue's **Name**, **URL**, and **ARN** are displayed on the **Details** tab.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

Note
This action is identical for standard and FIFO queues.

1. Copy the standard queue example program (p. 49) or the FIFO queue example program (p. 54).

   The following section of the code list all queues in the current region:

```
// List queues
System.out.println("Listing all queues in your account.\n");
for (final String queueUrl : sqs.listQueues().getQueueUrls()) {
    System.out.println("  QueueUrl: " + queueUrl);
}
System.out.println();
```

2. Compile and run the example.

   All queues in the current region created using API version 2012-11-05 are listed. The response include the following items:

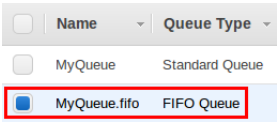
   - The unique *queue URL*.
   - The *request ID* that Amazon SQS assigned to your request.

Tutorial: Adding Permissions to an Amazon SQS Queue

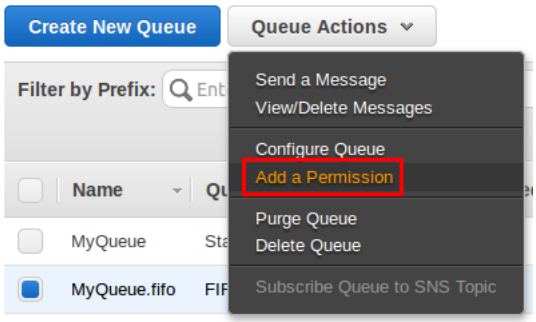
You can specify to whom you allow (or explicitly deny) the ability to interact with your queue in specific ways by adding permissions to a queue. The following example demonstrates adding the permission for anyone to get a queue's URL.

AWS Management Console

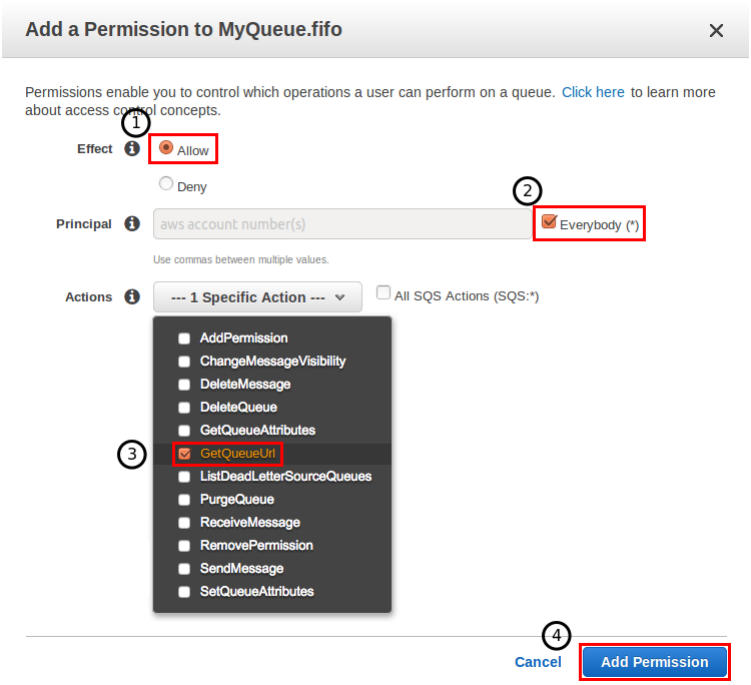
1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



3. From **Queue Actions**, select **Add a Permission**.



   The **Add a Permission** dialog box is displayed.
4. In this example, you allow anyone to get the queue's URL:



a. Ensure that next to **Effect**, **Allow** is selected.

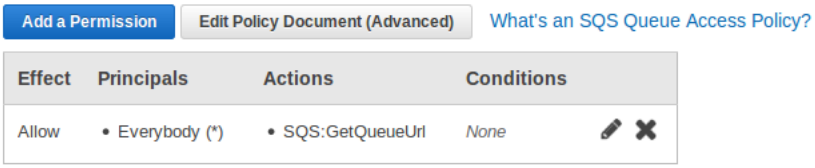
b. Next to **Principal**, check the **Everybody** box.

c. From the **Actions** drop-down list, select **GetQueueUrl** box.

d. Choose **Add Permission**.

The permission is added to the queue.

Your queues's policy **Effect**, **Principals**, **Actions**, and **Conditions** are displayed on your queue's **Permissions** tab.

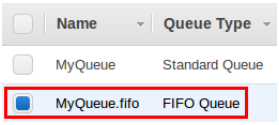


Tutorial: Sending a Message to an Amazon SQS Queue

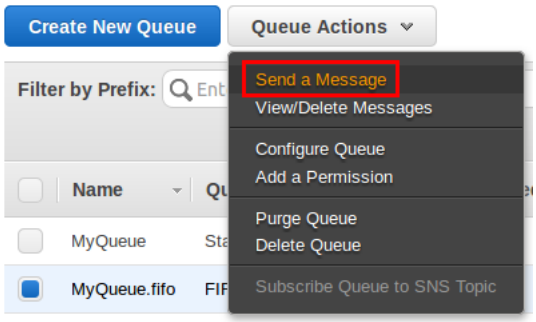
After you create your queue, you can send a message to it. The following example demonstrates sending a message to an existing queue.

AWS Management Console

1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.

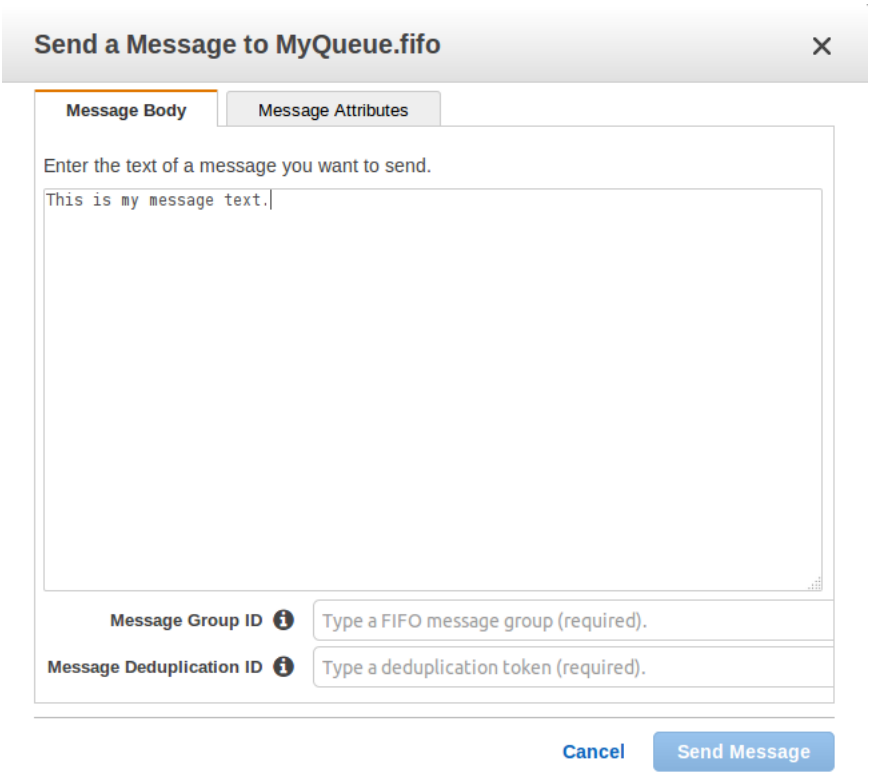


3. From **Queue Actions**, select **Send a Message**.



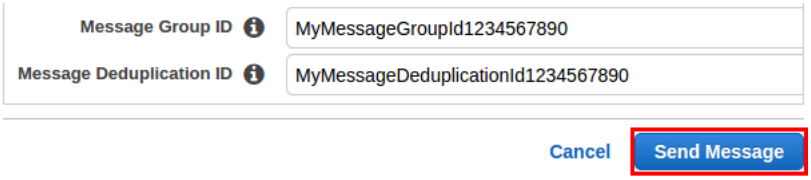
The **Send a Message to *`QueueName`*** dialog box is displayed.

The following example shows the **Message Group ID** and **Message Deduplication ID** parameters specific to FIFO queues (content-based deduplication (p. 54) is disabled).



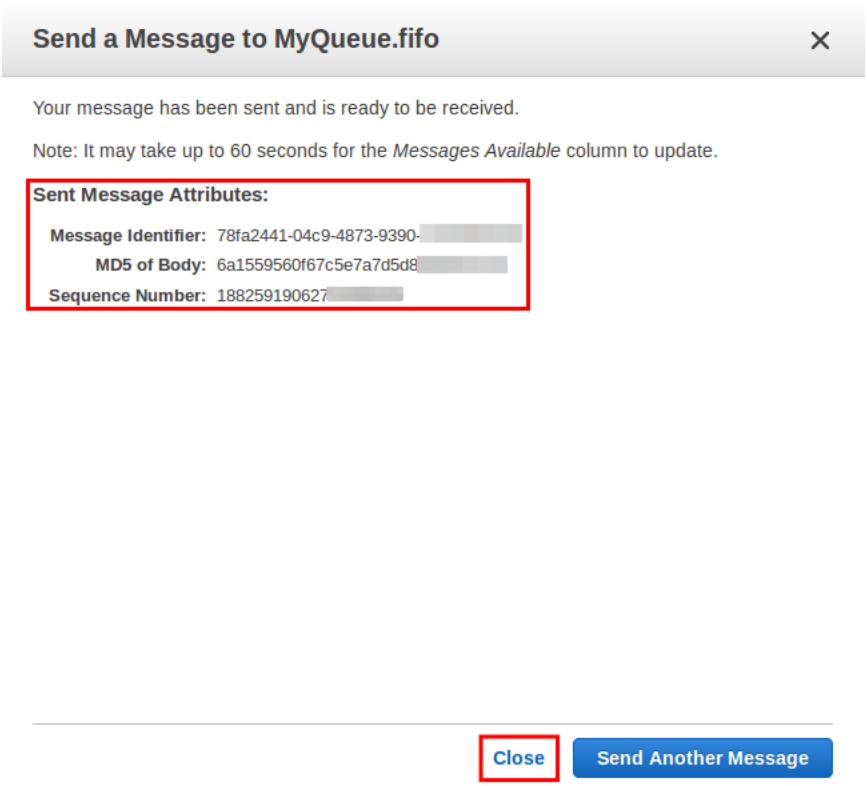
4. To send a message to a FIFO queue, type the **Message Body**, the **Message Group ID** `MyMessageGroupId1234567890`, and the **Message Deduplication ID** `MyMessageDeduplicationId1234567890`, and then choose **Send Message**. For more information, see FIFO Queue Logic (p. 52).

   Note
   The message group ID is always required. However, if content-based deduplication is enabled, the message deduplication ID is optional.



Your message is sent and the **Send a Message to *QueueName*** dialog box is displayed, showing the attributes of the sent message.

The following example shows the **Sequence Number** attribute specific to FIFO queues.



5. Choose **Close**.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

To send a message to a standard queue

1. Copy the example program (p. 49).

   The following section of the code sends the `This is my message text.` message to your queue:

```
// Send a message
System.out.println("Sending a message to MyQueue.\n");
sqs.sendMessage(new SendMessageRequest(myQueueUrl, "This is my message text."));
```

2. Compile and run the example.

   The message is sent to the queue. The response includes the following items:

   - The message ID (p. 58) Amazon SQS assigns to the message.
   - An MD5 digest of the message body, used to confirm that Amazon SQS received the message correctly (for more information, see RFC1321).
   - The *request ID* that Amazon SQS assigned to your request.

To send a message to a FIFO queue

1. Copy the example program (p. 54).

   The following section of the code sends the `This is my message text.` message to your queue:

```
// Send a message
System.out.println("Sending a message to MyFifoQueue.fifo.\n");
final SendMessageRequest sendMessageRequest = new SendMessageRequest(myQueueUrl, "This
 is my message text.");

// When you send messages to a FIFO queue, you must provide a non-empty MessageGroupId.
sendMessageRequest.setMessageGroupId("messageGroup1");

// Uncomment the following to provide the MessageDeduplicationId
//sendMessageRequest.setMessageDeduplicationId("1");
final SendMessageResult sendMessageResult = sqs.sendMessage(sendMessageRequest);
final String sequenceNumber = sendMessageResult.getSequenceNumber();
final String messageId = sendMessageResult.getMessageId();
System.out.println("SendMessage succeed with messageId " + messageId + ", sequence
 number " + sequenceNumber + "\n");
```

2. Compile and run the example.

   The message is sent to your queue.

Tutorial: Receiving and Deleting a Message from an Amazon SQS Queue

After you send a message into a queue, you can consume it from the queue. When you request a message from a queue, you can't specify which message to get. Instead, you specify the maximum number of messages (up to 10) that you want to get.

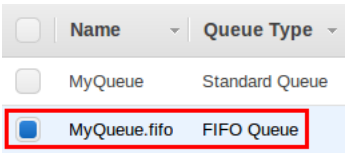
> **Note**
> Because Amazon SQS is a distributed system, a queue with very few messages might display an empty response to a receive request. In this case, you can rerun the request to get your message. Depending on your application's needs, you might have to use short or long polling (p. 75) to receive messages.

Amazon SQS doesn't automatically delete a message after receiving it for you, in case you don't successfully receive the message (for example, the consumers can fail or lose connectivity). To delete a message, you must send a separate request which acknowledges that you no longer need the message because you've successfully received and processed it.

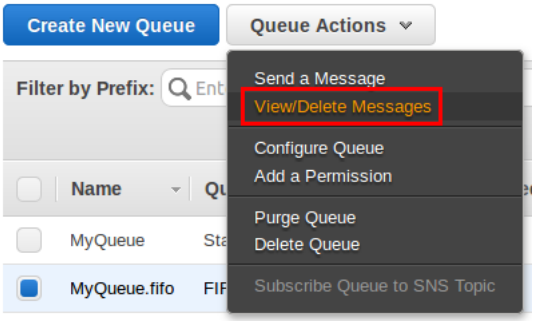
The following example demonstrates receiving and deleting a message.

AWS Management Console

1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



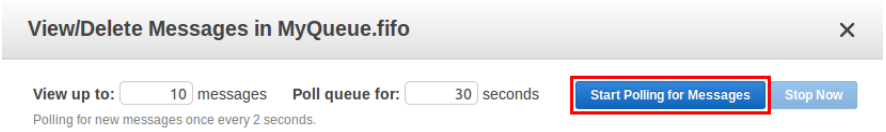
3. From **Queue Actions**, select **View/Delete Messages**.



The **View/Delete Messages in *QueueName*** dialog box is displayed.

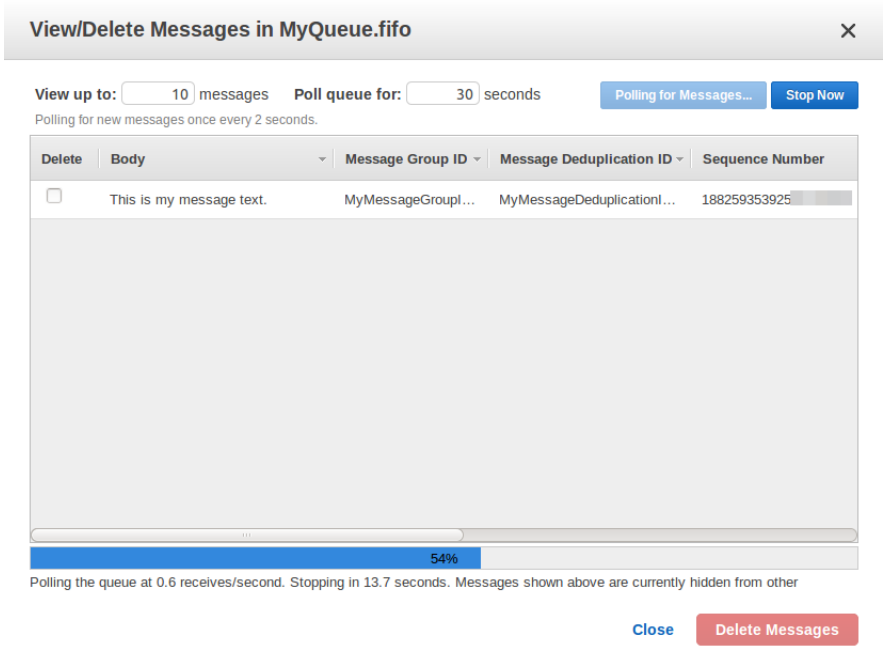
> **Note**
> The first time you take this action, an information screen is displayed. To hide the screen, check the **Don't show this again** checkbox.

4. Choose **Start Polling for messages.**

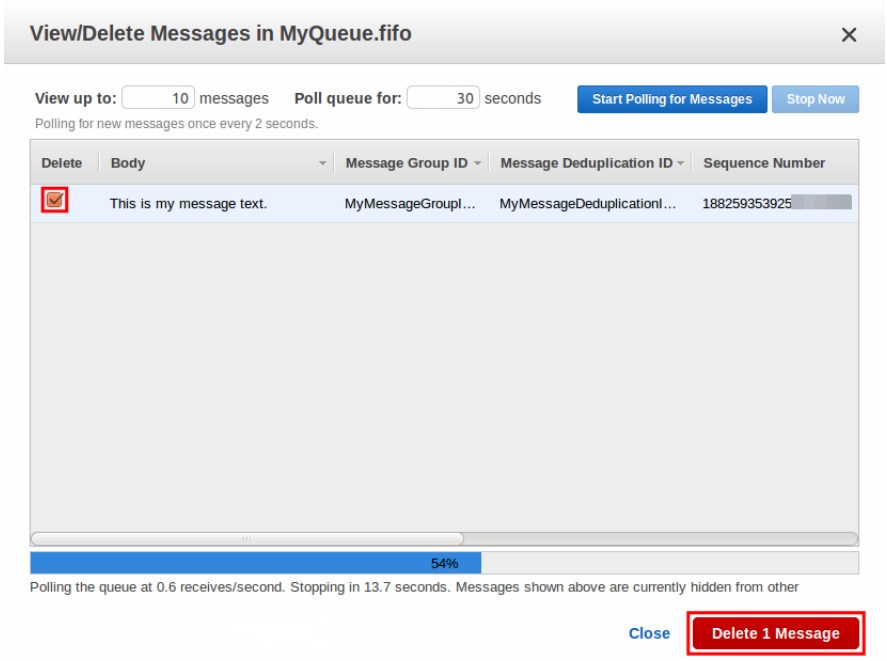


Amazon SQS begins to poll the messages in the queue. The dialog box displays a message from the queue. A progress bar at the bottom of the dialog box displays the status of the message's visibility timeout.

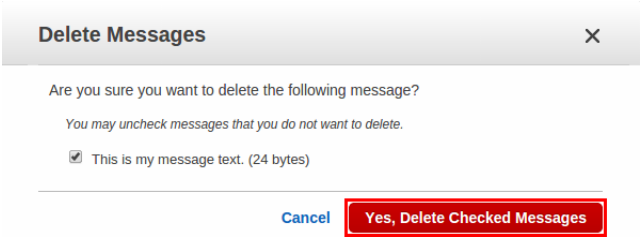
The following example shows the **Message Group ID**, **Message Deduplication ID**, and **Sequence Number** columns specific to FIFO queues.



5. *Before* the visibility timeout expires, select the message that you want to delete and then choose **Delete *1* Message**.



The **Delete Messages** dialog box is displayed.



6. Confirm that the message you want to delete is checked and choose **Yes, Delete Checked Messages**.

   The selected message is deleted.

   When the progress bar is filled in, the visibility timeout (p. 60) expires and the message becomes visible to consumers.
7. Select **Close**.

Java

To specify the message to delete, provide the receipt handle (p. 58) that Amazon SQS returned when you received the message. You can delete only one message per action. To delete an entire queue, you must use the `DeleteQueue` action. (You can delete an entire queue even if the queue has messages in it.)

Note
If you don't have the receipt handle for the message, you can call the `ReceiveMessage` action to receive the message again. Each time you receive the message, you get a different receipt handle. Use the latest receipt handle when using the `DeleteMessage` action. Otherwise, your message might not be deleted from the queue.

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

To receive and delete a message from a standard queue

1. Copy the example program (p. 49).

   The following section of the code receives a message from your queue:

```
// Receive messages
System.out.println("Receiving messages from MyQueue.\n");
final ReceiveMessageRequest receiveMessageRequest = new
 ReceiveMessageRequest(myQueueUrl);
final List<Message> messages = sqs.receiveMessage(receiveMessageRequest).getMessages();
for (final Message message : messages) {
    System.out.println("Message");
    System.out.println("  MessageId:     " + message.getMessageId());
    System.out.println("  ReceiptHandle: " + message.getReceiptHandle());
    System.out.println("  MD5OfBody:     " + message.getMD5OfBody());
    System.out.println("  Body:          " + message.getBody());
    for (final Entry<String, String> entry : message.getAttributes().entrySet()) {
        System.out.println("Attribute");
        System.out.println("  Name:  " + entry.getKey());
        System.out.println("  Value: " + entry.getValue());
    }
}
System.out.println();
```

   The following section of the code deletes the message:

```
// Delete the message
System.out.println("Deleting a message.\n");
final String messageReceiptHandle = messages.get(0).getReceiptHandle();
sqs.deleteMessage(new DeleteMessageRequest(myQueueUrl, messageReceiptHandle));
```

2. Compile and run the example.

   The queue is polled and returns 0 or more messages. The example prints the following items:

   - The message ID (p. 58) that you received when you sent the message to the queue.
   - The receipt handle (p. 58) that you later use to delete the message.
   - An MD5 digest of the message body (for more information, see RFC1321).
   - The message body.
   - The *request ID* that Amazon SQS assigned to your request

   If no messages are received in this particular call, the response includes only the request ID.

   The message is deleted. The response includes the request ID that Amazon SQS assigned to your request.

To receive and delete a message from a FIFO queue

1. Copy the example program (p. 54).

   The following section of the code receives a message from your queue:

```
// Receive messages
System.out.println("Receiving messages from MyFifoQueue.fifo.\n");
final ReceiveMessageRequest receiveMessageRequest = new
 ReceiveMessageRequest(myQueueUrl);

// Uncomment the following to provide the ReceiveRequestDeduplicationId
//receiveMessageRequest.setReceiveRequestAttemptId("1");
final List<Message> messages = sqs.receiveMessage(receiveMessageRequest).getMessages();
for (final Message message : messages) {
    System.out.println("Message");
    System.out.println("  MessageId:     " + message.getMessageId());
    System.out.println("  ReceiptHandle: " + message.getReceiptHandle());
    System.out.println("  MD5OfBody:     " + message.getMD5OfBody());
    System.out.println("  Body:          " + message.getBody());
    for (final Entry<String, String> entry : message.getAttributes().entrySet()) {
        System.out.println("Attribute");
        System.out.println("  Name:  " + entry.getKey());
        System.out.println("  Value: " + entry.getValue());
    }
}
System.out.println();
```

   The following section of the code deletes the message:

```
// Delete the message
System.out.println("Deleting the message.\n");
final String messageReceiptHandle = messages.get(0).getReceiptHandle();
sqs.deleteMessage(new DeleteMessageRequest(myQueueUrl, messageReceiptHandle));
```

2. Compile and run the example.

The message is received and deleted.

Tutorial: Configuring an Amazon SQS Dead-Letter Queue

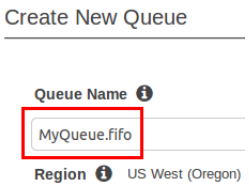
A dead-letter queue is a queue that other (source) queues can target for messages that can't be processed (consumed) successfully. The following example demonstrates how to create a queue and to configure a dead-letter queue for it. For more information, see Using Amazon SQS Dead-Letter Queues (p. 62).

Important
The dead-letter queue of a FIFO queue must also be a FIFO queue. Similarly, the dead-letter queue of a standard queue must also be a standard queue.

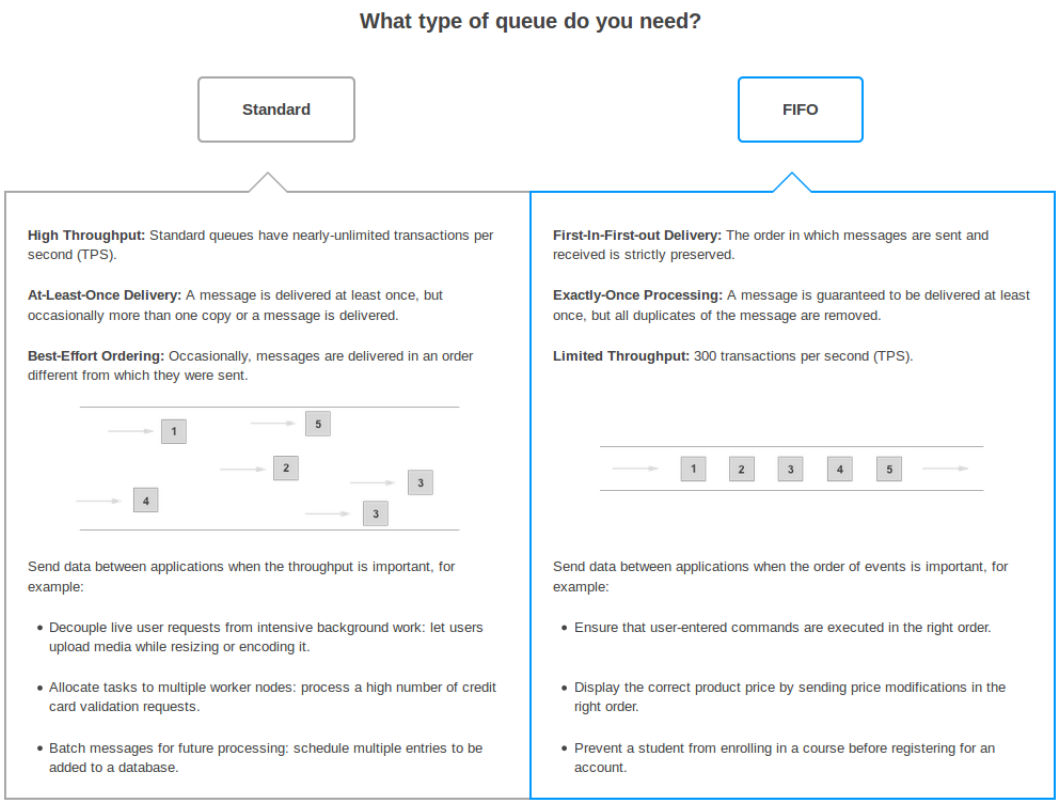
AWS Management Console

1. Sign in to the Amazon SQS console.
2. Choose **Create New Queue.**
3. On the **Create New Queue** page, ensure that you're in the correct region and then type the **Queue Name**.

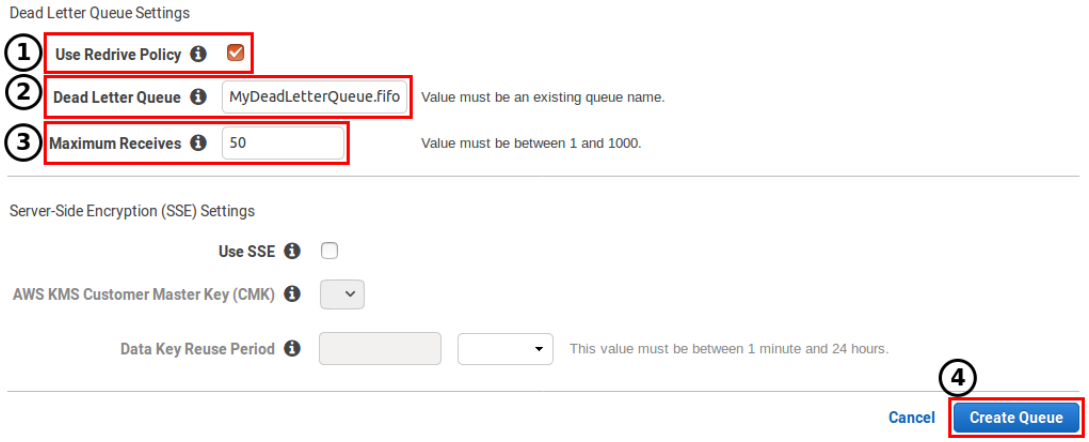
   Note
   The name of a FIFO queue must end with the `.fifo` suffix. FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions.



4. **Standard** is selected by default. Choose **FIFO**.



5. Choose **Configure Queue**.
6. In this example, you enable the redrive policy for your new queue, set the `MyDeadLetterQueue.fifo` queue as the dead-letter queue, and set the number of maximum receives to `50`.



   a. To configure the dead-letter queue, choose **Use Redrive Policy**.
   b. Enter the name of the existing **Dead Letter Queue** to which you want sources queues to send messages.
   c. To configure the number of times that a message can be received before being sent to a dead-letter queue, set **Maximum Receives** to a value between 1 and 1,000.

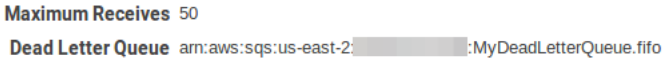
      Note
      The **Maximum Receives** setting applies only to individual messages.

   d. Choose **Create Queue**.

Your new queue is configured to use a dead-letter queue, created, and selected in the queue list.

Note
When you create a queue, it can take a short time for the queue to propagate throughout Amazon SQS.

Your queue's **Maximum Receives** and **Dead Letter Queue** ARN are displayed on the **Redrive Policy** tab.



Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

To configure a dead-letter queue

1. Copy the example program for a standard queue (p. 49) or a FIFO queue (p. 54).
2. Set a string that contains JSON-formatted parameters and values for the `RedrivePolicy` queue attribute:

```
final String redrivePolicy = "{\"maxReceiveCount\":\"5\", \"deadLetterTargetArn\":
\"arn:aws:sqs:us-east-2:123456789012:MyDeadLetterQueue\"}";
```

3. Use the `CreateQueue` or `SetQueueAttributesRequest` API action to set the `RedrivePolicy` queue attribute:

```
final SetQueueAttributesRequest queueAttributes = new SetQueueAttributesRequest();
final Map<String,String> attributes = new HashMap<String,String>();
attributes.put("RedrivePolicy", redrivePolicy);
queueAttributes.setAttributes(attributes);
queueAttributes.setQueueUrl(myQueueUrl);
sqs.setQueueAttributes(queueAttributes);
```

4. Compile and run your program.

   The dead-letter queue is configured.

Sample Request

```
https://sqs.us-east-2.amazonaws.com/123456789012/MySourceQueue
?Action=SetQueueAttributes
&Attribute.1.Value=%7B%22maxReceiveCount%22%3A%225%22%2C+%22deadLetterTargetArn%22%3A%22arn
%3Aaws%3Asqs%3Aus-east-2%3A123456789012%3AMyDeadLetterQueue%22%7D
&Attribute.1.Name=RedrivePolicy
&Version=2012-11-05
```

Note
Queue names and queue URLs are case-sensitive.

Sample Response

```
<SetQueueAttributesResponse xmlns="https://queue.amazonaws.com/doc/2012-11-05/">
```

```
   <ResponseMetadata>
      <RequestId>40945605-b328-53b5-aed4-1cc24a7240e8</RequestId>
   </ResponseMetadata>
</SetQueueAttributesResponse>
```

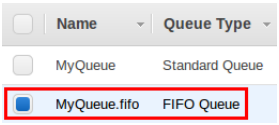
Tutorial: Purging Messages from an Amazon SQS Queue

If you don't want to delete an Amazon SQS queue but need to delete all the messages from it, you can purge the queue. The following example demonstrates purging a queue.

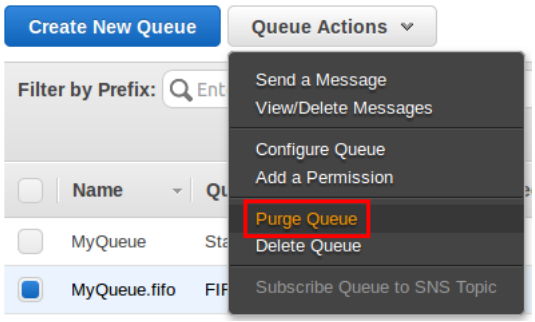
Important
When you purge a queue, you can't retrieve any messages deleted from it.
The message deletion process takes up to 60 seconds. We recommend waiting for 60 seconds regardless of your queue's size.

AWS Management Console

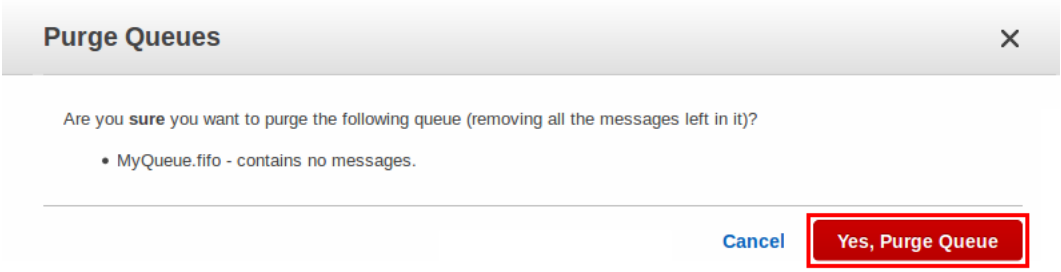
1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



3. From **Queue Actions**, select **Purge Queue**.



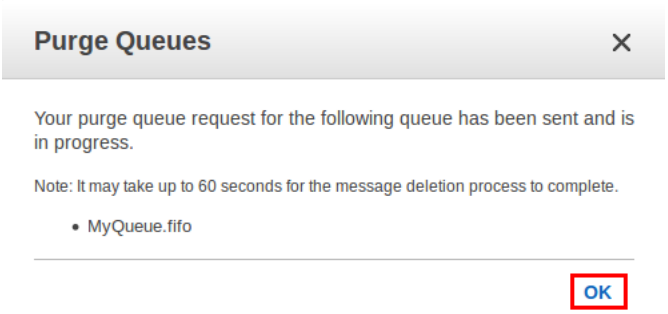
The **Purge Queues** dialog box is displayed.



4. Choose **Yes, Purge Queue**.

   All messages are purged from the queue.

   The **Purge Queues** confirmation dialog box is displayed.



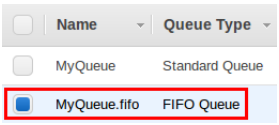
5. Choose **OK**.

Tutorial: Deleting an Amazon SQS Queue

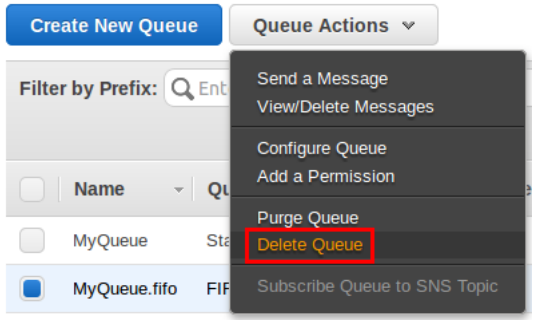
If you don't use an Amazon SQS queue (and don't foresee using it in the near future), it is a best practice to delete it from Amazon SQS. The following example demonstrates deleting a queue.

AWS Management Console

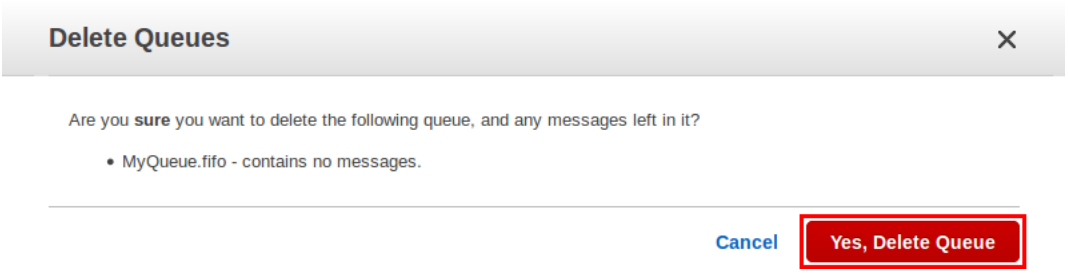
1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



3. From **Queue Actions**, select **Delete Queue**.



The **Delete Queues** dialog box is displayed.



4. Choose **Yes, Delete Queue**.

   The queue is deleted.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

Note
This action is identical for standard and FIFO queues.

1. Copy the standard queue example program (p. 49) or the FIFO queue example program (p. 54).

   The following section of the code deletes the queue:

```
// Delete the queue
System.out.println("Deleting the test queue.\n");
sqs.deleteQueue(new DeleteQueueRequest(myQueueUrl));
```

2. Compile and run the example.

   The queue is deleted.

Tutorial: Subscribing an Amazon SQS Queue to an Amazon SNS Topic

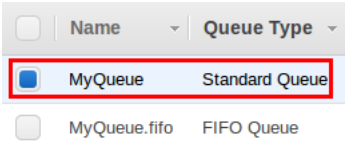
You can subscribe one or more Amazon SQS queues to an Amazon SNS topic from a list of topics available for the selected queue. Amazon SQS manages the subscription and any necessary permissions. When you publish a message to a topic, Amazon SNS sends the message to every subscribed queue. For more information about Amazon SNS, see What is Amazon Simple Notification Service? in the *Amazon Simple Notification Service Developer Guide*.

The following example demonstrates subscribing an existing Amazon SQS queue to an existing Amazon SNS topic.

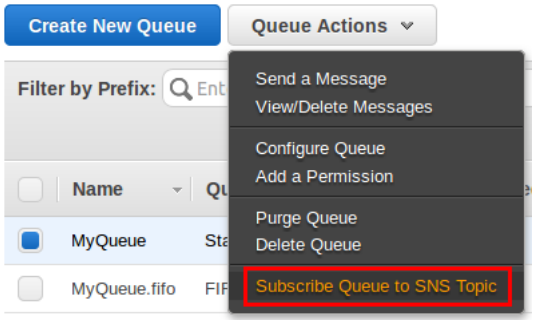
Note
Amazon SNS isn't currently compatible with FIFO queues.
For information about using Amazon SNS with encrypted Amazon SQS queues, see Enable Compatibility Between AWS Services and Encrypted Queues (p. 165).
When you subscribe an Amazon SQS queue to an Amazon SNS topic, Amazon SNS uses HTTPS to forward messages to Amazon SQS.

AWS Management Console

1. Sign in to the Amazon SQS console.
2. From the list of queues, choose the queue (or queues) to which you want to subscribe an Amazon SNS topic.

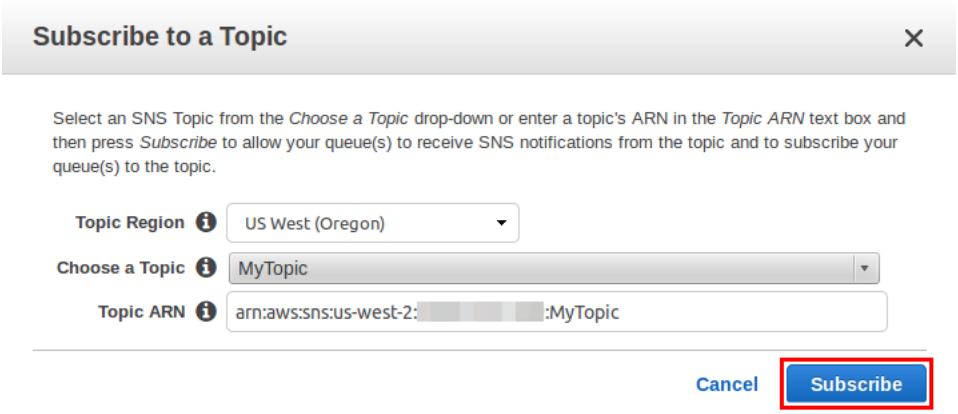


3. From **Queue Actions**, select **Subscribe Queue to SNS Topic** (or **Subscribe Queues to SNS Topic**).



The **Subscribe to a Topic** dialog box is displayed.

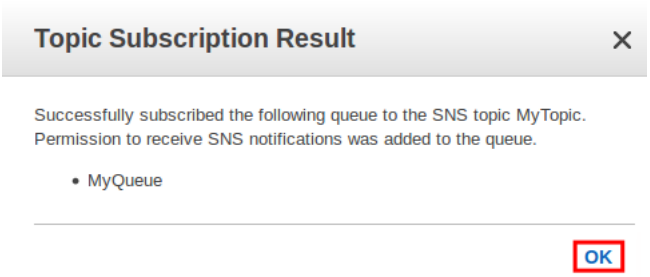
4. From the **Choose a Topic** drop-down list, select an Amazon SNS topic to which you want to subscribe your queue (or queues), select the **Topic Region** (optional), and then choose **Subscribe**.



Note
Typing a different **Topic ARN** is useful when you want to subscribe a queue to an Amazon SNS topic from an AWS account other than the one you used to create your Amazon SQS queue.
This is also useful if the Amazon SNS topic isn't listed in the **Choose a Topic** drop-down list.

The **Topic Subscription Result** dialog box is displayed.

5. Review the list of Amazon SQS queues that are subscribed to the Amazon SNS topic and choose **OK**.



The queue is subscribed to the topic.

Note
If your Amazon SQS queue and Amazon SNS topic are in different AWS accounts, the owner of the topic must first confirm the subscription. For more information, see Confirm the Subscription in the *Amazon Simple Notification Service Developer Guide*.
To list your subscriptions, unsubscribe from topics, and delete topics, use the Amazon SNS console. For more information, see Clean Up.

To verify the results of the subscription, you can publish to the topic and then view the message that the topic sends to the queue. For more information, see Sending Amazon SNS Messages to Amazon SQS Queues in the *Amazon Simple Notification Service Developer Guide*.

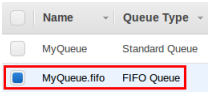
Tutorial: Adding, Updating, and Removing Cost Allocation Tags for an Amazon SQS Queue

You can add cost allocation tags to your Amazon SQS queues to help organize and identify them. For a detailed overview of using Amazon SQS queue tags, see Tagging Your Amazon SQS Queues (p. 66).

AWS Management Console

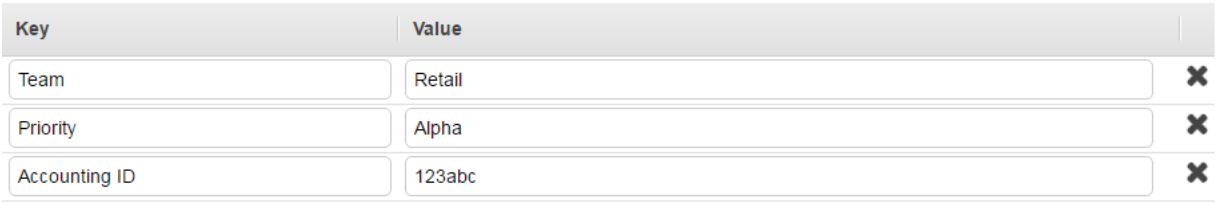
The following steps assume that you already created an Amazon SQS queue (p. 16).

1. Sign in to the Amazon SQS console.
2. From the queue list, select a queue.



3. Choose the **Tags** tab.

   The tags added to the queue are listed.



4. Choose **Add/Edit Tags**.
5. Modify queue tags:

   - To add a tag, choose **Add New Tag**, enter a **Key** and **Value**, and then choose **Apply Changes**.
   - To update a tag, change its **Key** and **Value** and then choose **Apply Changes**.
   - To remove a tag, choose ✖ next to a key-value pair and then choose **Apply Changes**.

   The queue tag changes are applied.

Java

Before you begin working with the example code, specify your AWS credentials. For more information, see Set up AWS Credentials and Region for Development in the *AWS SDK for Java Developer Guide*.

To add, update, and remove tags from a queue

1. Copy the example program for a standard queue (p. 49) or a FIFO queue (p. 54).
2. To list the tags added to a queue, use the `ListQueueTags` API action:

```
final ListQueueTagsRequest listQueueTagsRequest = new ListQueueTagsRequest(queueUrl);
final ListQueueTagsResult listQueueTagsResult =
 SQSClientFactory.newSQSClient().listQueueTags(listQueueTagsRequest);
System.out.println(String.format("ListQueueTags: \tTags for queue %s are %s.\n",
 QUEUE_NAME, listQueueTagsResult.getTags()))
```

3. To add or update the values of the queue's tags using the tag's key, use the `TagQueue` API action:

```
final Map<String, String> addedTags = new HashMap<>();
addedTags.put("Team", "Development");
addedTags.put("Priority", "Beta");
addedTags.put("Accounting ID", "456def");
final TagQueueRequest tagQueueRequest = new TagQueueRequest(queueUrl, addedTags);

System.out.println(String.format("TagQueue: \t\tAdd tags %s to queue %s.\n", addedTags,
 QUEUE_NAME));
SQSClientFactory.newSQSClient().tagQueue(tagQueueRequest);
```

4. To remove a tag from the queue using the tag's key, use the `UntagQueue` API action:

```
final List<String> tagKeys = Arrays.asList("Accounting ID");
final UntagQueueRequest untagQueueRequest = new UntagQueueRequest(queueUrl, tagKeys);
System.out.println(String.format("UntagQueue: \tRemove tags %s from queue %s.\n",
 tagKeys, QUEUE_NAME));
SQSClientFactory.newSQSClient().untagQueue(untagQueueRequest);
```

5. Compile and run your program.

   The existing tags are listed, three are updated, and one tag is removed from the queue.

How Amazon SQS Queues Work

This section describes the types of Amazon SQS queues and their basic properties. It also describes the identifiers of queues and messages, and various queue and message management workflows.

Topics

Basic Prerequisites

The following basic prerequisites help you get started with Amazon SQS queues:

- You must assign a name to each of your queues. You can get a list of all your queues or a subset of your queues that share the same initial characters in their names. For example, you can get a list of all your queues whose names start with `T3`.
- A queue can be empty if you haven't sent any messages to it or if you have deleted all the messages from it.
- You can delete a queue at any time, whether it's empty or not. By default, a queue retains messages for four days. However, you can configure a queue to retain messages for up to 14 days after the message is sent.

  Note
  Unless your application specifically requires repeatedly creating queues and leaving them inactive or storing large amounts of data in your queue, consider using Amazon S3 for storing your data.

The following table lists the API actions you can use to work with queues.

To do this...	Use this action
Create a queue	CreateQueue
Get the URL of an existing queue	GetQueueUrl
List your queues	ListQueues

To do this...	Use this action
Delete a queue	DeleteQueue

Standard Queues

Amazon SQS offers *standard* as the default queue type. Standard queues support a nearly unlimited number of transactions per second (TPS) per API action. Standard queues support at-least-once message delivery. However, occasionally (because of the highly distributed architecture that allows nearly unlimited throughput), more than one copy of a message might be delivered out of order. Standard queues provide best-effort ordering which ensures that messages are generally delivered in the same order as they're sent.

You can use standard message queues in many scenarios, as long as your application can process messages that arrive more than once and out of order, for example:

- **Decouple live user requests from intensive background work** – Let users upload media while resizing or encoding it.
- **Allocate tasks to multiple worker nodes** – Process a high number of credit card validation requests.
- **Batch messages for future processing** – Schedule multiple entries to be added to a database.

For best practices of working with standard queues, see General Recommendations (p. 113).

Topics

Message Ordering

A standard queue makes a best effort to preserve the order of messages, but more than one copy of a message might be delivered out of order. If your system requires that order be preserved, we recommend using a *FIFO (First-In-First-Out) queue* (p. 51) or adding sequencing information in each message so you can reorder the messages when they're received.

At-Least-Once Delivery

Amazon SQS stores copies of your messages on multiple servers for redundancy and high availability. On rare occasions, one of the servers that stores a copy of a message might be unavailable when you receive or delete a message.

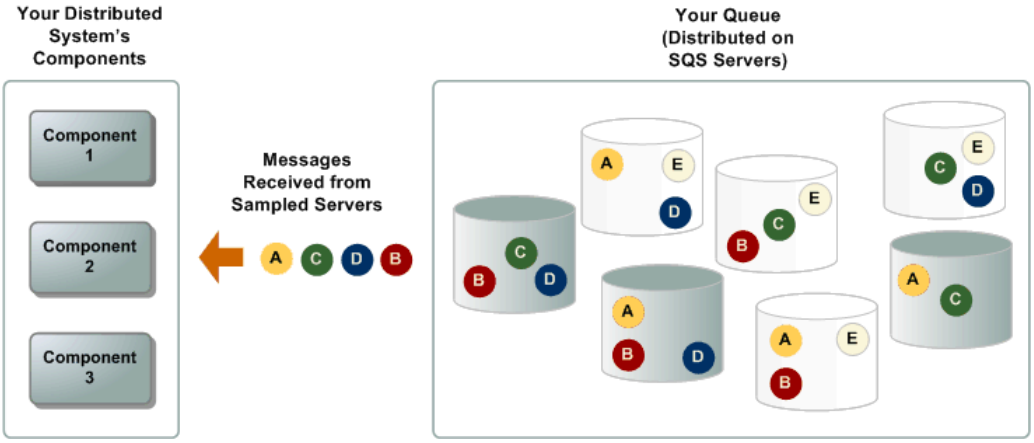
If this occurs, the copy of the message isn't deleted on that unavailable server, and you might get that message copy again when you receive messages. Design your applications to be *idempotent* (they should not be affected adversely when processing the same message more than once).

Consuming Messages Using Short Polling

The process of consuming messages from a queue depends on whether you use short polling (the default behavior) or long polling. For more information about long polling, see Amazon SQS Long Polling (p. 75).

When you consume messages from a queue using short polling, Amazon SQS samples a subset of its servers (based on a weighted random distribution) and returns messages from only those servers. Thus, a particular receive request might not return all of your messages. However, if you have fewer than 1,000 messages in your queue, a subsequent request will return your messages. If you keep consuming from your queues, Amazon SQS samples all of its servers, and you receive all of your messages.

The following figure shows the short-polling behavior of messages returned from a standard queue after one of your system components makes a receive request. Amazon SQS samples several of its servers (in gray) and returns messages A, C, D, and B from these servers. Message E isn't returned for this request, but is returned for a subsequent request.



Working Java Example for Standard Queues

Prerequisites

Ensure that the `aws-java-sdk-sqs.jar` package is in your Java build class path. The following example shows this dependency in a Maven project `pom.xml` file.

```
<dependencies>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-sqs</artifactId>
        <version>LATEST</version>
    </dependency>
</dependencies>
```

SQSSimpleJavaClientExample.java

The following example Java code creates a queue and sends, receives, and deletes a message.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
```

```
 * permissions and limitations under the License.
 *
 */

import com.amazonaws.AmazonClientException;
import com.amazonaws.AmazonServiceException;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClientBuilder;
import com.amazonaws.services.sqs.model.*;

import java.util.List;
import java.util.Map.Entry;

/**
 * This sample demonstrates how to make basic requests to Amazon SQS using the
 * AWS SDK for Java.
 * <p>
 * Prerequisites: You must have a valid Amazon Web Services developer account,
 * and be signed up to use Amazon SQS. For more information about Amazon SQS,
 * see https://aws.amazon.com/sqs
 * <p>
 * Make sure that your credentials are located in ~/.aws/credentials
 */
public class SQSSimpleJavaClientExample {

    public static void main(String[] args) throws Exception {

        /*
         * Create a new instance of the builder with all defaults (credentials
         * and region) set automatically. For more information, see
         * Creating Service Clients in the AWS SDK for Java Developer Guide.
         */
        final AmazonSQS sqs = AmazonSQSClientBuilder.defaultClient();

        System.out.println("===========================================");
        System.out.println("Getting Started with Amazon SQS Standard Queues");
        System.out.println("===========================================\n");

        try {
            // Create a queue
            System.out.println("Creating a new SQS queue called MyQueue.\n");
            final CreateQueueRequest createQueueRequest =
                    new CreateQueueRequest("MyQueue");
            final String myQueueUrl = sqs.createQueue(createQueueRequest)
                    .getQueueUrl();

            // List queues
            System.out.println("Listing all queues in your account.\n");
            for (final String queueUrl : sqs.listQueues().getQueueUrls()) {
                System.out.println("  QueueUrl: " + queueUrl);
            }
            System.out.println();

            // Send a message
            System.out.println("Sending a message to MyQueue.\n");
            sqs.sendMessage(new SendMessageRequest(myQueueUrl,
                    "This is my message text."));

            // Receive messages
            System.out.println("Receiving messages from MyQueue.\n");
            final ReceiveMessageRequest receiveMessageRequest =
                    new ReceiveMessageRequest(myQueueUrl);
            final List<Message> messages = sqs.receiveMessage(receiveMessageRequest)
                    .getMessages();
            for (final Message message : messages) {
                System.out.println("Message");
```

```
                System.out.println("  MessageId:     "
                        + message.getMessageId());
                System.out.println("  ReceiptHandle: "
                        + message.getReceiptHandle());
                System.out.println("  MD5OfBody:     "
                        + message.getMD5OfBody());
                System.out.println("  Body:          "
                        + message.getBody());
                for (final Entry<String, String> entry : message.getAttributes()
                        .entrySet()) {
                    System.out.println("Attribute");
                    System.out.println("  Name:  " + entry
                            .getKey());
                    System.out.println("  Value: " + entry
                            .getValue());
                }
            }
            System.out.println();

            // Delete the message
            System.out.println("Deleting a message.\n");
            final String messageReceiptHandle = messages.get(0).getReceiptHandle();
            sqs.deleteMessage(new DeleteMessageRequest(myQueueUrl,
                    messageReceiptHandle));

            // Delete the queue
            System.out.println("Deleting the test queue.\n");
            sqs.deleteQueue(new DeleteQueueRequest(myQueueUrl));
        } catch (final AmazonServiceException ase) {
            System.out.println("Caught an AmazonServiceException, which means " +
                    "your request made it to Amazon SQS, but was " +
                    "rejected with an error response for some reason.");
            System.out.println("Error Message:    " + ase.getMessage());
            System.out.println("HTTP Status Code: " + ase.getStatusCode());
            System.out.println("AWS Error Code:   " + ase.getErrorCode());
            System.out.println("Error Type:       " + ase.getErrorType());
            System.out.println("Request ID:       " + ase.getRequestId());
        } catch (final AmazonClientException ace) {
            System.out.println("Caught an AmazonClientException, which means " +
                    "the client encountered a serious internal problem while " +
                    "trying to communicate with Amazon SQS, such as not " +
                    "being able to access the network.");
            System.out.println("Error Message: " + ace.getMessage());
        }
    }
}
```

FIFO (First-In-First-Out) Queues

FIFO queues are available in the US East (N. Virginia), US East (Ohio), US West (Oregon), and EU (Ireland) regions. In addition to having all the capabilities of the standard queue (p. 48), *FIFO (First-In-First-Out)* queues are designed to enhance messaging between applications when the order of operations and events is critical, or where duplicates can't be tolerated. FIFO queues also provide exactly-once processing but have a limited number of transactions per second (TPS):

- FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second).
- When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.

FIFO queues are designed to enhance messaging between applications when the order of operations and events is critical, for example:

- Ensure that user-entered commands are executed in the right order.
- Display the correct product price by sending price modifications in the right order.
- Prevent a student from enrolling in a course before registering for an account.

> **Note**
> The name of a FIFO queue must end with the `.fifo` suffix. The suffix counts towards the 80-character queue name limit. To determine whether a queue is FIFO (p. 51), you can check whether the queue name ends with the suffix.

For best practices of working with FIFO queues, see Recommendations for FIFO (First-In-First-Out) Queues (p. 115) and General Recommendations (p. 113).

For information about compatibility of clients and services with FIFO queues, see Compatibility (p. 57).

Topics

Message Ordering

The FIFO queue improves upon and complements the standard queue (p. 48). The most important features of this queue type are *FIFO (First-In-First-Out) delivery* and *exactly-once processing*: The order in which messages are sent and received is strictly preserved and a message is delivered once and remains available until a consumer processes and deletes it; duplicates aren't introduced into the queue. In addition, FIFO queues support *message groups* that allow multiple ordered message groups within a single queue.

FIFO Queue Logic

Key Terms

The following key terms can help you better understand the functionality of FIFO queues. For detailed descriptions, see the *Amazon Simple Queue Service API Reference*.

Message Deduplication ID

The token used for deduplication of sent messages. If a message with a particular message deduplication ID is sent successfully, any messages sent with the same message deduplication ID are accepted successfully but aren't delivered during the 5-minute deduplication interval.

> **Note**
> Message deduplication applies to an entire queue, not to individual message groups. Amazon SQS continues to keep track of the message deduplication ID even after the message is received and deleted.

Message Group ID

The tag that specifies that a message belongs to a specific message group. Messages that belong to the same message group are always processed one by one, in a strict order relative to the message group (however, messages that belong to different message groups might be processed out of order).

Receive Request Attempt ID

The token used for deduplication of `ReceiveMessage` calls.

Sequence Number

The large, non-consecutive number that Amazon SQS assigns to each message.

Sending Messages

If multiple messages are sent in succession to a FIFO queue, each with a distinct message deduplication ID, Amazon SQS stores the messages and acknowledges the transmission. Then, each message can be received and processed in the exact order in which the messages were transmitted.

In FIFO queues, messages are ordered based on message group ID. If multiple hosts (or different threads on the same host) send messages with the same message group ID to a FIFO queue, Amazon SQS stores the messages in the order in which they arrive for processing. To ensure that Amazon SQS preserves the order in which messages are sent and received, ensure that each producer uses a unique message group ID to send all its messages.

FIFO queue logic applies only per message group ID. Each message group ID represents a distinct ordered message group within an Amazon SQS queue. For each message group ID, all messages are sent and received in strict order. However, messages with different message group ID values might be sent and received out of order. You must associate a message group ID with a message. If you don't provide a message group ID, the action fails. If you require a single group of ordered messages, provide the same message group ID for messages sent to the FIFO queue.

Receiving Messages

You can't request to receive messages with a specific message group ID.

When receiving messages from a FIFO queue with multiple message group IDs, Amazon SQS first attempts to return as many messages with the same message group ID as possible. This allows other consumers to process messages with a different message group ID.

Note
It is possible to receive up to 10 messages in a single call using the `MaxNumberOfMessages` request parameter of the `ReceiveMessage` API action. These messages retain their FIFO order and can have the same message group ID. Thus, if there are fewer than 10 messages available with the same message group ID, you might receive messages from another message group ID, in the same batch of 10 messages, but still in FIFO order.

Retrying Multiple Times

FIFO queues allow the producer or consumer to attempt multiple retries:

- If the producer detects a failed `SendMessage` action, it can retry sending as many times as necessary, using the same message deduplication ID. Assuming that the producer receives at least one acknowledgement before the deduplication interval expires, multiple retries neither affect the ordering of messages nor introduce duplicates.

- If the consumer detects a failed `ReceiveMessage` action, it can retry as many times as necessary, using the same receive request attempt ID. Assuming that the consumer receives at least one acknowledgement before the visibility timeout expires, multiple retries don't affect the ordering of messages.
- When you receive a message with a message group ID, no more messages for the same message group ID are returned unless you delete the message or it becomes visible.

Exactly-Once Processing

Unlike standard queues, FIFO queues don't introduce duplicate messages. FIFO queues help you avoid sending duplicates to a queue. If you retry the `SendMessage` action within the 5-minute deduplication interval, Amazon SQS doesn't introduce any duplicates into the queue.

To configure deduplication, you must do one of the following:

- Enable content-based deduplication. This instructs Amazon SQS to use a SHA-256 hash to generate the message deduplication ID using the body of the message—but not the attributes of the message. For more information, see the documentation on the `CreateQueue`, `GetQueueAttributes`, and `SetQueueAttributes` actions in the *Amazon Simple Queue Service API Reference*.
- Explicitly provide the message deduplication ID (or view the sequence number) for the message. For more information, see the documentation on the `SendMessage`, `SendMessageBatch`, and `ReceiveMessage` actions in the *Amazon Simple Queue Service API Reference*.

Working Java Example for FIFO Queues

Prerequisites

Ensure that the `aws-java-sdk-sqs.jar` package is in your Java build class path. The following example shows this dependency in a Maven project `pom.xml` file.

```
<dependencies>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-sqs</artifactId>
        <version>LATEST</version>
    </dependency>
</dependencies>
```

SQSFIFOJavaClientExample.java

The following example Java code creates a queue and sends, receives, and deletes a message.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
```

```
 *
 */

import com.amazonaws.AmazonClientException;
import com.amazonaws.AmazonServiceException;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClientBuilder;
import com.amazonaws.services.sqs.model.*;

import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.Map.Entry;

public class SQSFIFOJavaClientExample {
    public static void main(String[] args) throws Exception {

        /*
         * Create a new instance of the builder with all defaults (credentials
         * and region) set automatically. For more information, see
         * Creating Service Clients in the AWS SDK for Java Developer Guide.
         */
        final AmazonSQS sqs = AmazonSQSClientBuilder.defaultClient();

        System.out.println("===========================================");
        System.out.println("Getting Started with Amazon SQS FIFO Queues");
        System.out.println("===========================================\n");

        try {

            // Create a FIFO queue
            System.out.println("Creating a new Amazon SQS FIFO queue called " +
                    "MyFifoQueue.fifo.\n");
            final Map<String, String> attributes = new HashMap<String, String>();

            // A FIFO queue must have the FifoQueue attribute set to True
            attributes.put("FifoQueue", "true");

            /*
             * If the user doesn't provide a MessageDeduplicationId, generate a
             * MessageDeduplicationId based on the content.
             */
            attributes.put("ContentBasedDeduplication", "true");

            // The FIFO queue name must end with the .fifo suffix
            final CreateQueueRequest createQueueRequest =
                    new CreateQueueRequest("MyFifoQueue.fifo")
                            .withAttributes(attributes);
            final String myQueueUrl = sqs.createQueue(createQueueRequest).getQueueUrl();

            // List queues
            System.out.println("Listing all queues in your account.\n");
            for (final String queueUrl : sqs.listQueues().getQueueUrls()) {
                System.out.println("  QueueUrl: " + queueUrl);
            }
            System.out.println();

            // Send a message
            System.out.println("Sending a message to MyFifoQueue.fifo.\n");
            final SendMessageRequest sendMessageRequest =
                    new SendMessageRequest(myQueueUrl,
                            "This is my message text.");

            /*
             * When you send messages to a FIFO queue, you must provide a
             * non-empty MessageGroupId.
```

```
             */
            sendMessageRequest.setMessageGroupId("messageGroup1");

            // Uncomment the following to provide the MessageDeduplicationId
            //sendMessageRequest.setMessageDeduplicationId("1");
            final SendMessageResult sendMessageResult = sqs
                    .sendMessage(sendMessageRequest);
            final String sequenceNumber = sendMessageResult.getSequenceNumber();
            final String messageId = sendMessageResult.getMessageId();
            System.out.println("SendMessage succeed with messageId "
                    + messageId + ", sequence number " + sequenceNumber + "\n");

            // Receive messages
            System.out.println("Receiving messages from MyFifoQueue.fifo.\n");
            final ReceiveMessageRequest receiveMessageRequest =
                    new ReceiveMessageRequest(myQueueUrl);

            // Uncomment the following to provide the ReceiveRequestDeduplicationId
            //receiveMessageRequest.setReceiveRequestAttemptId("1");
            final List<Message> messages = sqs.receiveMessage(receiveMessageRequest)
                    .getMessages();
            for (final Message message : messages) {
                System.out.println("Message");
                System.out.println("  MessageId:     "
                        + message.getMessageId());
                System.out.println("  ReceiptHandle: "
                        + message.getReceiptHandle());
                System.out.println("  MD5OfBody:     "
                        + message.getMD5OfBody());
                System.out.println("  Body:          "
                        + message.getBody());
                for (final Entry<String, String> entry : message.getAttributes()
                        .entrySet()) {
                    System.out.println("Attribute");
                    System.out.println("  Name:  " + entry.getKey());
                    System.out.println("  Value: " + entry.getValue());
                }
            }
            System.out.println();

            // Delete the message
            System.out.println("Deleting the message.\n");
            final String messageReceiptHandle = messages.get(0).getReceiptHandle();
            sqs.deleteMessage(new DeleteMessageRequest(myQueueUrl,
                    messageReceiptHandle));

            // Delete the queue
            System.out.println("Deleting the queue.\n");
            sqs.deleteQueue(new DeleteQueueRequest(myQueueUrl));
        } catch (final AmazonServiceException ase) {
            System.out.println("Caught an AmazonServiceException, which means " +
                    "your request made it to Amazon SQS, but was " +
                    "rejected with an error response for some reason.");
            System.out.println("Error Message:    " + ase.getMessage());
            System.out.println("HTTP Status Code: " + ase.getStatusCode());
            System.out.println("AWS Error Code:   " + ase.getErrorCode());
            System.out.println("Error Type:       " + ase.getErrorType());
            System.out.println("Request ID:       " + ase.getRequestId());
        } catch (final AmazonClientException ace) {
            System.out.println("Caught an AmazonClientException, which means " +
                    "the client encountered a serious internal problem while " +
                    "trying to communicate with Amazon SQS, such as not " +
                    "being able to access the network.");
            System.out.println("Error Message: " + ace.getMessage());
        }
    }
```

```
}
```

Moving from a Standard Queue to a FIFO Queue

If you have an existing application that uses standard queues and you want to take advantage of the ordering or exactly-once processing features of FIFO queues, you need to configure the queue and your application correctly.

> **Note**
> You can't convert an existing standard queue into a FIFO queue. To make the move, you must either create a new FIFO queue for your application or delete your existing standard queue and recreate it as a FIFO queue.

Moving Checklist

Use the following checklist to ensure that your application works correctly with a FIFO queue.

- FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.
- FIFO queues don't support per-message delays, only per-queue delays. If your application sets the same value of the `DelaySeconds` parameter on each message, you must modify your application to remove the per-message delay and set `DelaySeconds` on the entire queue instead.
- Every message sent to a FIFO queue requires a message group ID. If you don't need multiple ordered message groups, specify the same message group ID for all your messages.
- Before sending messages to a FIFO queue, confirm the following:
  - If your application can send messages with identical message bodies, you can modify your application to provide a unique message deduplication ID for each sent message.
  - If your application sends messages with unique message bodies, you can enable content-based deduplication.
- You don't have to make any code changes to your consumer. However, if it takes a long time to process messages and your visibility timeout is set to a high value, consider adding a receive request attempt ID to each `ReceiveMessage` action. This allows you to retry receive attempts in case of networking failures and prevents queues from pausing due to failed receive attempts.

For more information, see the *Amazon Simple Queue Service API Reference*.

Compatibility

Clients

The Amazon SQS Buffered Asynchronous Client doesn't currently support FIFO queues.

Services

If your application uses multiple AWS services, or a mix of AWS and external services, it is important to understand which service functionality doesn't support FIFO queues.

Some AWS or external services that send notifications to Amazon SQS might not be compatible with FIFO queues, despite allowing you to set a FIFO queue as a target.

The following features of AWS services aren't currently compatible with FIFO queues:

- Auto Scaling Lifecycle Hooks

- AWS IoT Rule Actions
- AWS Lambda Dead-Letter Queues

For information about compatibility of other services with FIFO queues, see your service documentation.

Queue and Message Identifiers

General Identifiers

Queue Name and URL

When you create a new queue, you must specify a queue name that is unique within the scope of all your queues. Amazon SQS assigns each queue you create an identifier called a *queue URL* that includes the queue name and other Amazon SQS components. Whenever you want to perform an action on a queue, you provide its queue URL.

The name of a FIFO queue must end with the `.fifo` suffix. The suffix counts towards the 80-character queue name limit. To determine whether a queue is FIFO (p. 51), you can check whether the queue name ends with the suffix.

The following is the queue URL for a queue named `MyQueue` owned by a user with the AWS account number `123456789012`.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue
```

Important
In your system, always store the entire queue URL exactly as Amazon SQS returns it to you when you create the queue (for example, `https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue`). Don't build the queue URL from its separate components each time you need to specify the queue URL in a request because Amazon SQS can change the components that make up the queue URL.

You can also get the queue URL for a queue by listing your queues. For more information, see `ListQueues`.

Message ID

Each message receives a system-assigned *message ID* that Amazon SQS returns to you in the `SendMessage` response. This identifier is useful for identifying messages. (However, to delete a message you need the message's *receipt handle*.) The maximum length of a message ID is 100 characters.

Receipt Handle

Every time you receive a message from a queue, you receive a *receipt handle* for that message. This handle is associated with the action of receiving the message, not with the message itself. To delete the message or to change the message visibility, you must provide the receipt handle (not the message ID). Thus, you must always receive a message before you can delete it (you can't put a message into the queue and then recall it). The maximum length of a receipt handle is 1024 characters.

Important
If you receive a message more than once, each time you receive it, you get a different receipt handle. You must provide the most recently received receipt handle when you request to delete the message (otherwise, the message might not be deleted).

The following is an example of a receipt handle (broken across three lines).

```
MbZj6wDWli+JvwwJaBV+3dcjk2YW2vA3+STFFljTM8tJJg6HRG6PYSasuWXPJB+Cw
Lj1FjgXUv1uSj1gUPAWV66FU/WeR4mq2OKpEGYWbnLmpRCJVAyeMjeU5ZBdtcQ+QE
auMZc8ZRv37sIW2iJKq3M9MFx1YvV11A2x/KSbkJ0=
```

Additional Identifiers for FIFO Queues

For more information about the following identifiers, see Exactly-Once Processing (p. 54) and the *Amazon Simple Queue Service API Reference*.

Message Deduplication ID

The token used for deduplication of sent messages. If a message with a particular message deduplication ID is sent successfully, any messages sent with the same message deduplication ID are accepted successfully but aren't delivered during the 5-minute deduplication interval.

Message Group ID

The tag that specifies that a message belongs to a specific message group. Messages that belong to the same message group are always processed one by one, in a strict order relative to the message group (however, messages that belong to different message groups might be processed out of order).

Sequence Number

The large, non-consecutive number that Amazon SQS assigns to each message.

Resources Required to Process Messages

To help you estimate the resources you need to process queued messages, Amazon SQS can determine the approximate number of delayed, visible, and not visible messages in a queue. For more information about visibility, see Visibility Timeout (p. 60).

> **Note**
> For standard queues, the result is approximate because of the distributed architecture of Amazon SQS. In most cases, the count should be close to the actual number of messages in the queue.
> For FIFO queues, the result is exact.

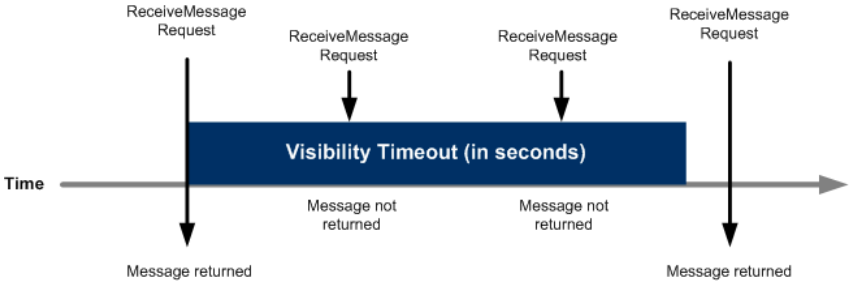
The following table lists the API action to use.

To do this...	Use this action	Use this `AttributeName`
Get the approximate number of messages in the queue.	`GetQueueAttributes`	`ApproximateNumberOfMessages`
Get the approximate number of messages that are pending to be added to the queue.	`GetQueueAttributes`	`ApproximateNumberOfMessagesDelayed`
Get the approximate number of messages in the queue that are not visible (messages in flight).	`GetQueueAttributes`	`ApproximateNumberOfMessagesNotVisible`

Visibility Timeout

When a consumer receives and processes a message from a queue, the message remains in the queue. Amazon SQS doesn't automatically delete the message. Because Amazon SQS is a distributed system, there's no guarantee that the consumer actually receives the message (for example, due to a connectivity issue, or due to an issue in the consumer application). Thus, the consumer must delete the message from the queue after receiving and processing it.

Immediately after the message is received, it remains in the queue. To prevent other consumers from processing the message again, Amazon SQS sets a *visibility timeout*, a period of time during which Amazon SQS prevents other consumers from receiving and processing the message. The default visibility timeout for a message is 30 seconds. The maximum is 12 hours.



Note
For standard queues, the visibility timeout isn't a guarantee against receiving a message twice. For more information, see At-Least-Once Delivery (p. 48).
FIFO queues allow the producer or consumer to attempt multiple retries:

- If the producer detects a failed `SendMessage` action, it can retry sending as many times as necessary, using the same message deduplication ID. Assuming that the producer receives at least one acknowledgement before the deduplication interval expires, multiple retries neither affect the ordering of messages nor introduce duplicates.
- If the consumer detects a failed `ReceiveMessage` action, it can retry as many times as necessary, using the same receive request attempt ID. Assuming that the consumer receives at least one acknowledgement before the visibility timeout expires, multiple retries don't affect the ordering of messages.
- When you receive a message with a message group ID, no more messages for the same message group ID are returned unless you delete the message or it becomes visible.

Topics

Inflight Messages

A message is considered to be *in flight* after it's received from a queue by a consumer, but not yet deleted from the queue.

For standard queues, there can be a maximum of 120,000 inflight messages per queue. If you reach this limit, Amazon SQS returns the `OverLimit` error message. To avoid reaching the limit, you should delete

messages from the queue after they're processed. You can also increase the number of queues you use to process your messages.

For FIFO queues, there can be a maximum of 20,000 inflight messages per queue. If you reach this limit, Amazon SQS returns no error messages.

Setting the Visibility Timeout

The visibility timeout begins when Amazon SQS returns a message. During this time, the consumer processes and deletes the message. However, if the consumer fails before deleting the message and your system doesn't call the `DeleteMessage` action for that message before the visibility timeout expires, the message becomes visible to other consumers and the message is received again. If a message must be received only once, your consumer should delete it within the duration of the visibility timeout.

Every Amazon SQS queue has the default visibility timeout setting of 30 seconds. You can change this setting for the entire queue. Typically, you should set the visibility timeout to the maximum time that it takes your application to process and delete a message from the queue. When receiving messages, you can also set a special visibility timeout for the returned messages without changing the overall queue timeout. For more information, see the best practices in the Processing Messages in a Timely Manner (p. 113) section.

If you don't know how long it takes to process a message, specify the initial visibility timeout (for example, 2 minutes) and the period of time after which you can check whether the message is processed (for example, 1 minute). If the message isn't processed, extend the visibility timeout (for example, to 3 minutes).

Changing the Visibility Timeout for a Message

When you receive a message from a queue and begin to process it, the visibility timeout for the queue may be insufficient (for example, you might need to process and delete a message). You can shorten or extend a message's visibility by specifying a new timeout value using the `ChangeMessageVisibility` API action.

For example, if the default timeout for a queue is 60 seconds, 15 seconds have elapsed since you received the message, and you send a `ChangeMessageVisibility` call with `VisibilityTimeout` set to 10 seconds, the 10 seconds begin to count from the time that you make the `ChangeMessageVisibility` call. Thus, any attempt to change the visibility timeout or to delete that message 10 seconds after you initially change the visibility timeout (a total of 25 seconds) might result in an error.

> **Note**
> The new timeout period takes effect from the time you call the `ChangeMessageVisibility` API action. In addition, the new timeout period applies only to the particular receipt of the message. `ChangeMessageVisibility` doesn't affect the timeout of later receipts of the message or later queues.

Terminating the Visibility Timeout for a Message

When you receive a message from a queue, you might find that you actually don't want to process and delete that message. Amazon SQS allows you to terminate the visibility timeout for a specific message. This makes the message immediately visible to other components in the system and available for processing.

To terminate a message's visibility timeout after calling `ReceiveMessage`, call `ChangeMessageVisibility` with `VisibilityTimeout` set to 0 seconds.

Visibility Timeout API Actions

The following table lists the API actions you can use to manipulate the visibility timeout. Use each action's `VisibilityTimeout` parameter to set or get the value.

Task	API Action
Set the visibility timeout for a queue	`SetQueueAttributes`
View the visibility timeout for a queue	`GetQueueAttributes`
Set the visibility timeout for received messages without affecting the visibility timeout of the entire queue	`ReceiveMessage`
Extend or terminate a message's visibility timeout	`ChangeMessageVisibility`
Extend or terminate the visibility timeout for up to 10 messages	`ChangeMessageVisibilityBatch`

Using Amazon SQS Dead-Letter Queues

Amazon SQS supports *dead-letter queues*. A dead-letter queue is a queue that other (source) queues can target for messages that can't be processed (consumed) successfully. Dead-letter queues are useful for debugging your application or messaging system. Dead-letter queues allow you to isolate problematic messages to determine why their processing doesn't succeed.

Topics

How Do Dead-Letter Queues Work?

Sometimes, messages can’t be processed because of a variety of possible issues, such as erroneous conditions within the producer or consumer application or an unexpected state change that causes an issue with your application code. For example, if a user places a web order with a particular product ID, but the product ID is deleted, the web store's code fails and displays an error, and the message with the order request is sent to a dead-letter queue.

Occasionally, producers and consumers might fail to interpret aspects of the protocol that they use to communicate, causing message corruption or loss. Also, the consumer’s hardware errors might corrupt message payload.

The *redrive policy* specifies the *source queue*, the *dead-letter queue*, and the conditions under which Amazon SQS moves messages from the former to the latter if the consumer of the source queue fails to process a message a specified number of times. For example, if the source queue has a redrive policy with `maxReceiveCount` set to 5, and the consumer of the source queue receives a message 5 times without ever deleting it, Amazon SQS moves the message to the dead-letter queue.

To specify a dead-letter queue, you can use the AWS Management Console or an API action (p. 38). You must do this for each queue that sends messages to a dead-letter queue. Multiple queues can target a single dead-letter queue. For more information, see Configuring an Amazon SQS Dead-Letter Queue (p. 38) and the `RedrivePolicy` attribute of the `CreateQueue` or `SetQueueAttributes` API action.

Important
The dead-letter queue of a FIFO queue must also be a FIFO queue. Similarly, the dead-letter queue of a standard queue must also be a standard queue.
You must use the same AWS account to create the dead-letter queue and the other queues that send messages to the dead-letter queue. Also, dead-letter queues must reside in the same region as the other queues that use the dead-letter queue. For example, if you create a queue in the US East (Ohio) region and you want to use a dead-letter queue with that queue, the second queue must also be in the US East (Ohio) region.
The expiration of a message is always based on its original enqueue timestamp. When a message is moved to a dead-letter queue (p. 62), the enqueue timestamp remains unchanged. For example, if a message spends 1 day in the original queue before being moved to a dead-letter queue, and the retention period of the dead-letter queue is set to 4 days, the message is deleted from the dead-letter queue after 3 days. Thus, it is a best practice to always set the retention period of a dead-letter queue to be longer than the retention period of the original queue.

What are the Benefits of Dead-Letter Queues?

The main task of a dead-letter queue is handling message failure. A dead-letter queue lets you set aside and isolate messages that can't be processed correctly to determine why their processing didn't succeed. Setting up a dead-letter queue allows you to do the following:

- Configure an alarm for any messages delivered to a dead-letter queue.
- Examine logs for exceptions that might have caused messages to be delivered to a dead-letter queue.
- Analyze the contents of messages delivered to a dead-letter queue to diagnose software or the producer's or consumer's hardware issues.
- Determine whether you have given your consumer sufficient time to process messages.

How Do Different Queue Types Handle Message Failure?

Standard Queues

Standard queues (p. 48) keep processing messages until the expiration of the retention period. This ensures continuous processing of messages, which minimizes the chances of your queue being blocked by messages that can't be processed. It also ensures fast recovery for your queue.

In a system that processes thousands of messages, having a large number of messages that the consumer repeatedly fails to acknowledge and delete might increase costs and place extra load on the hardware. Instead of trying to process failing messages until they expire, it is better to move them to a dead-letter queue after a few processing attempts.

Note
Standard queues allow a high number of in-flight messages. If the majority of your messages can't be consumed and aren't sent to a dead-letter queue, your rate of processing valid messages can slow down. Thus, to maintain the efficiency of your queue, you must ensure that your application handles message processing correctly.

FIFO Queues

FIFO queues (p. 51) ensure exactly-once processing by consuming messages in sequence from a message group. Thus, although the consumer can continue to retrieve ordered messages from another message group, the first message group remains unavailable until the message blocking the queue is processed successfully.

Note
FIFO queues allow a lower number of in-flight messages. Thus, to ensure that your FIFO queue doesn't get blocked by a message, you must ensure that your application handles message processing correctly.

When Should I Use a Dead-Letter Queue?


Do use dead-letter queues with standard queues. You should always take advantage of dead-letter queues when your applications don't depend on ordering. Dead-letter queues can help you troubleshoot incorrect message transmission operations.

Note
Even when you use dead-letter queues, you should continue to monitor your queues and retry sending messages that fail for transient reasons.


Do use dead-letter queues to decrease the number of messages and to reduce the possibility of exposing your system to *poison-pill messages* (messages that can be received but can't be processed).


Don't use a dead-letter queue with standard queues when you want to be able to keep retrying the transmission of a message indefinitely. For example, don't use a dead-letter queue if your program must wait for a dependent process to become active or available.


Don't use a dead-letter queue with a FIFO queue if you don't want to break the exact order of messages or operations. For example, don't use a dead-letter queue with instructions in an Edit Decision List (EDL) for a video editing suite, where changing the order of edits changes the context of subsequent edits.

Getting Started with Dead-Letter Queues

For information about how to create a dead-letter queue using the AWS Management Console or using the Query API action, see the Configuring an Amazon SQS Dead-Letter Queue (p. 38) tutorial.

You can configure an Amazon SQS queue as a dead-letter queue using the following API actions.

Task	API Action
Configure a dead-letter queue for a new queue.	`CreateQueue`
Configure a dead-letter queue for an existing queue.	`SetQueueAttributes`
Determine whether a queue uses a dead-letter queue.	`GetQueueAttributes`

Troubleshooting Dead-Letter Queues

In some cases, Amazon SQS dead-letter queues might not always behave as expected. This section gives an overview of common issues and shows how to resolve them.

Viewing Messages using the AWS Management Console Might Cause Messages to be Moved to a Dead-Letter Queue

Amazon SQS counts viewing a message in the AWS Management Console against the corresponding queue's redrive policy. Thus, if you view a message in the AWS Management Console the number of times specified in the corresponding queue's redrive policy, the message is moved to the corresponding queue's dead-letter queue.

To adjust this behavior, you can do one of the following:

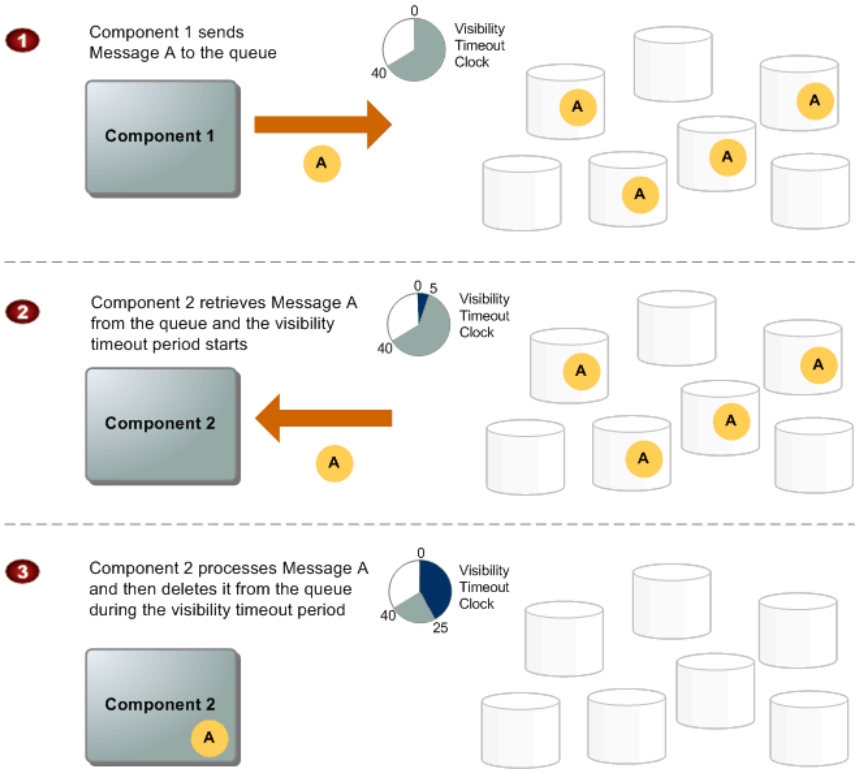
- Increase the **Maximum Receives** setting for the corresponding queue's redrive policy.
- Avoid viewing the corresponding queue's messages in the AWS Management Console.

The `NumberOfMessagesSent` and `NumberOfMessagesReceived` for a Dead-Letter Queue Don't Match

If you send a message to a dead-letter queue manually, it is captured by the `NumberOfMessagesSent` metric. However, a message is sent to a dead-letter queue as a result of a failed processing attempt, it isn't captured by this metric. Thus, it is possible for the values of `NumberOfMessagesSent` and `NumberOfMessagesReceived` to be different.

Message Lifecycle

The following diagram describes the lifecycle of an Amazon SQS message, from creation to deletion. In this example, a queue already exists.



Message Lifecycle

1	Component 1 sends Message A to a queue, and the message is distributed across the Amazon SQS servers redundantly.
2	When Component 2 is ready to process a message, it consumes messages from the queue, and Message A is returned. While Message A is being processed, it remains in the queue and isn't returned to subsequent receive requests for the duration of the visibility timeout.
3	Component 2 deletes Message A from the queue to prevent the message from being received and processed again once the visibility timeout expires.

Note
Amazon SQS automatically deletes messages that have been in a queue for more than maximum message retention period. The default message retention period is 4 days. However, you can set the message retention period to a value from 60 seconds to 1,209,600 seconds (14 days) using the SetQueueAttributes action.

Tagging Your Amazon SQS Queues

To organize and identify your Amazon SQS queues for cost allocation, you can add metadata *tags* that identify a queue's purpose, owner, or environment. This is especially useful when you have many queues.

You can use cost allocation tags to organize your AWS bill to reflect your own cost structure. To do this, sign up to get your AWS account bill to include tag keys and values. For more information, see Setting Up a Monthly Cost Allocation Report in the *AWS Billing and Cost Management User Guide*.

Overview

Each tag consists of a key-value pair that you define. For example, you can easily identify your *production* and *testing* queues if you tag your queues as follows:

Queue	Key	Value
`MyQueueA`	`QueueType`	`Production`
`MyQueueB`	`QueueType`	`Testing`

Note
When you use queue tags, keep the following guidelines in mind:

- We don't recommend adding more than 50 tags to a queue.
- Tags don't have any semantic meaning. Amazon SQS interprets tags as character strings.
- Tags are case-sensitive.
- A new tag with a key identical to that of an existing tag overwrites the existing tag.
- Tagging API actions are limited to 5 TPS per AWS account. If your application requires a higher throughput, file a technical support request.

For a full list of tag restrictions, see Limits Related to Queues (p. 118).

You can't add tags to a new queue when you create it using the AWS Management Console (you *can* add tags after the queue is created). However, you can add, update, or remove queue tags at any time using the Amazon SQS API actions.

Getting Started with Tagging

For information on how to manage Amazon SQS queue tags using the AWS Management Console or API actions, see the Adding, Updating, and Removing Tags from an Amazon SQS Queue (p. 45) tutorial.

You can list, add, update, or remove tags for an Amazon SQS queue using the following API actions:

Task	API Action
Add tags to a queue or update the tags added to a queue	`TagQueue`
Remove tags from a queue	`UntagQueue`
List the tags added to a queue	`ListQueueTags`

Using Amazon SQS Message Attributes

Amazon SQS provides support for *message attributes*. Message attributes allow you to provide structured metadata items (such as timestamps, geospatial data, signatures, and identifiers) about the message. Message attributes are optional and separate from, but sent along with, the message body. This

information can be used by the consumer of the message to help decide how to handle the message without having to first process the message body. Each message can have up to 10 attributes. To specify message attributes, you can use the AWS Management Console, AWS software development kits (SDKs), or Query API.

Topics

Message Attribute Items and Validation

Each message attribute consists of the following items:

- **Name** – The message attribute name can contain the following characters: `A-Z`, `a-z`, `0-9`, underscore(_), hyphen(-), and period (`.`). The name must not start or end with a period, and it should not have successive periods. The name is case-sensitive and must be unique among all attribute names for the message. The name can be up to 256 characters long. The name can't start with `AWS.` or `Amazon.` (or any variations in casing) because these prefixes are reserved for use by Amazon Web Services.
- **Type** – The supported message attribute data types are String, Number, and Binary. You can also provide custom information about the type. The data type has the same restrictions on the content as the message body. The data type is case-sensitive, and it can be up to 256 bytes long. For more information, see the Message Attribute Data Types and Validation (p. 68) section.
- **Value** – The user-specified message attribute value. For string data types, the value attribute has the same restrictions on the content as the message body. For more information, see `SendMessage` in the *Amazon Simple Queue Service API Reference*.

Name, type, and value must not be empty or null. In addition, the message body should not be empty or null. All parts of the message attribute, including name, type, and value, are included in the message size restriction, which is currently 256 KB (262,144 bytes).

Message Attribute Data Types and Validation

Message attribute data types identify how the message attribute values are handled by Amazon SQS. For example, if the type is a number, Amazon SQS validates that it's a number.

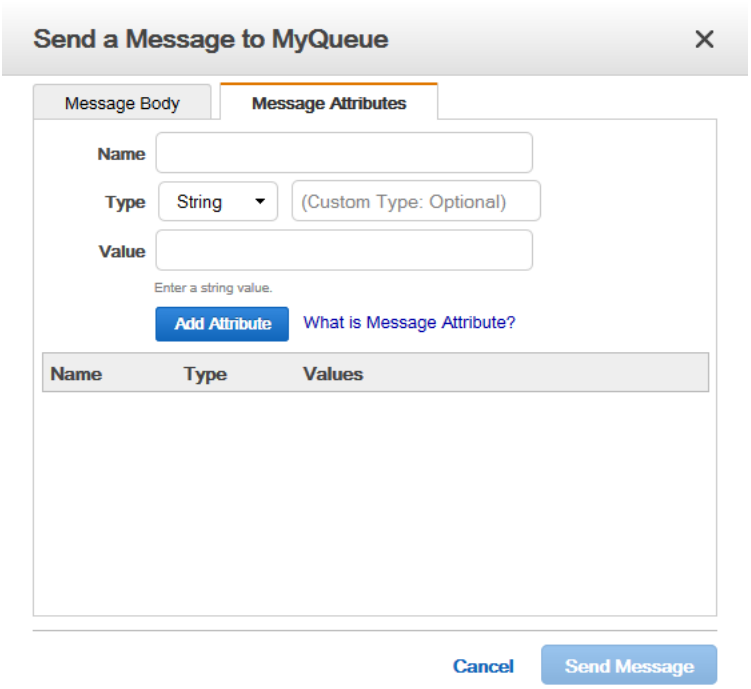
Amazon SQS supports the logical data types `Binary`, `Number`, and `String` with optional custom type labels in the format `.custom-type`.

- **Binary** – Binary type attributes can store any binary data, for example, compressed data, encrypted data, or images.
- **Number** – Numbers are positive or negative integers or floating point numbers. Numbers have sufficient range and precision to encompass most of the possible values that integers, floats, and doubles typically support. A number can have up to 38 digits of precision, and it can be between 10^-128 and 10^+126. Leading and trailing zeroes are trimmed.
- **String** – Strings are Unicode with UTF-8 binary encoding. For more information, see ASCII Printable Characters.

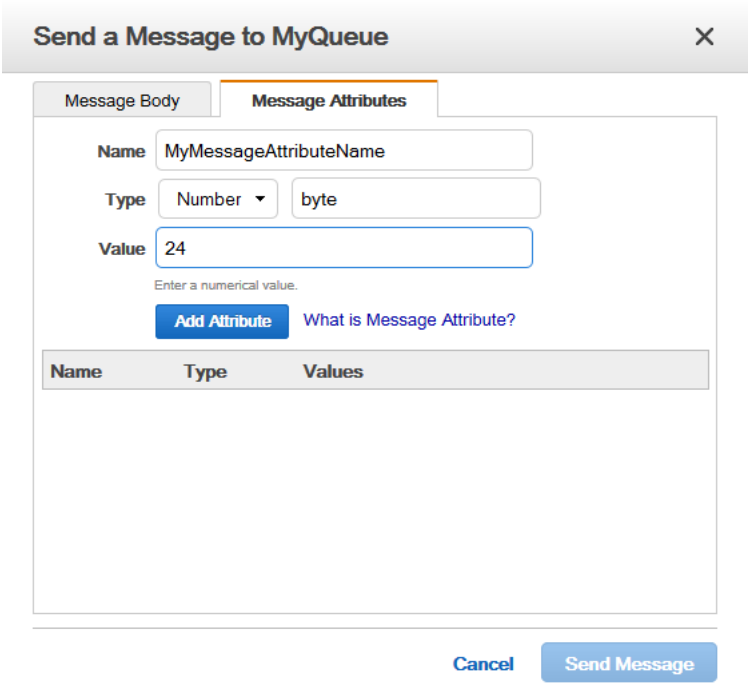
You can append a custom type label to any supported data type to create custom data types. This capability is similar to *type traits* in programming languages. For example, if you have an application that needs to know which type of number is being sent in the message, you can create custom types similar to the following: `Number.byte`, `Number.short`, `Number.int`, and `Number.float`. Another example using the binary data type is to use `Binary.gif` and `Binary.png` to distinguish among different image file types in a message or batch of messages. The appended data is optional and opaque to Amazon SQS, which means that the appended data isn't interpreted, validated, or used by Amazon SQS. The Custom Type extension has the same restrictions on allowed characters as the message body.

Using Message Attributes with the AWS Management Console

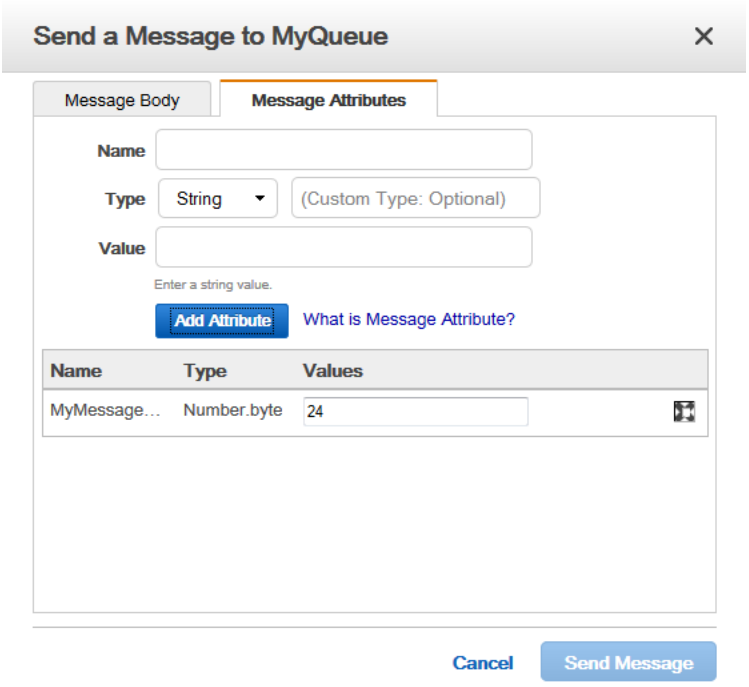
You can use the AWS Management Console to configure message attributes. In the Amazon SQS console, select a queue, choose the **Queue Actions** drop-down list, and then select **Send a Message**. The console expects the user to input a Base-64-encoded value for sending a Binary type.



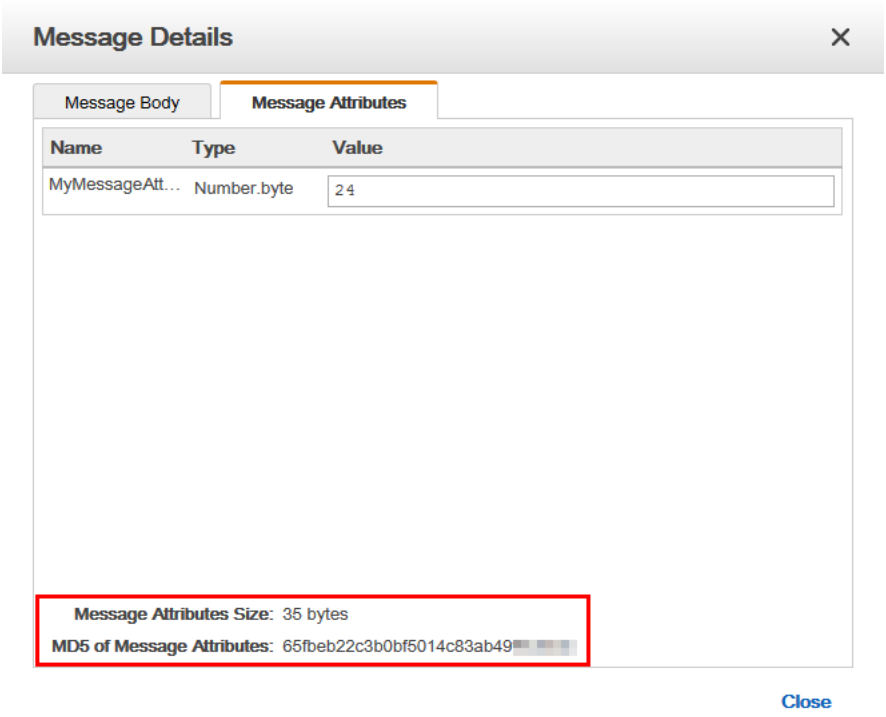
On the **Message Attributes** tab, enter a name, select the type, and enter a value for the message attribute. Optionally, you can also append custom information to the type. For example, the following screen shows the *Number* type selected with *byte* added for customization. For more information about custom data for the supported data types, see the Message Attribute Data Types and Validation (p. 68) section.



To add an attribute, choose **Add Attribute**. The attribute information appears in the **Name**, **Type**, and **Values** list.



You can also use the console to view information about the message attributes for received messages. In the console, select a queue, and from the **Queue Actions** drop-down list select **View/Delete Messages**. In the list of messages, choose **Message Details** to view the information. For example, you can see the message attribute size and MD5 message digest.



Using Message Attributes with the AWS SDKs

The AWS SDKs provide APIs in several languages for using message attributes with Amazon SQS. This section includes some Java examples that show how to work with message attributes. These examples can be integrated with the `SimpleQueueServiceSample.java` sample from the SDK for Java. MessageBody and MessageAttributes checksums are automatically calculated and compared with the data Amazon SQS returns by the latest SDK for Java. For more information about the SDK for Java, see Getting Started with the AWS SDK for Java.

The following three Java examples show how to use the MessageAttributeValue data type to set the `String`, `Number`, and `Binary` parameters for the message attributes:

String

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("attributeName", new
 MessageAttributeValue().withDataType("String").withStringValue("string-value-attribute-
value"));
```

Number

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("attributeName", new
 MessageAttributeValue().withDataType("Number").withStringValue("230.000000000000000001"));
```

Binary

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
```

```
messageAttributes.put("attributeName", new
 MessageAttributeValue().withDataType("Binary").withBinaryValue(ByteBuffer.wrap(new
 byte[10])));
```

The following three examples show how to use the optional custom type for the message attributes:

String—Custom

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("AccountId", new
 MessageAttributeValue().withDataType("String.AccountId").withStringValue("000123456"));
```

Number—Custom

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("AccountId", new
 MessageAttributeValue().withDataType("Number.AccountId").withStringValue("000123456"));
```

Note
Because the `Type` is a number, the result in the `ReceiveMessage` call is `123456`.

Binary—Custom

```
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("PhoneIcon", new
 MessageAttributeValue().withDataType("Binary.JPEG").withBinaryValue(ByteBuffer.wrap(new
 byte[10])));
```

To send a message using one of the previous message attribute examples, your code should look similar to the following:

```
SendMessageRequest request = new SendMessageRequest();
request.withMessageBody("A test message body.");
request.withQueueUrl("MyQueueUrlStringHere");
request.withMessageAttributes(messageAttributes);
sqs.sendMessage(request);
```

Using Message Attributes with the Amazon SQS Query API

To specify message attributes with the Query API, you call the SendMessage, SendMessageBatch, or ReceiveMessage actions.

Note
The structure of *AUTHPARAMS* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

A Query API request for this example looks similar to the following:

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue
...
?Action=SendMessage
&MessageBody=This+is+a+test+message
```

```
&MessageAttribute.1.Name=test_attribute_name_1
&MessageAttribute.1.Value.StringValue=test_attribute_value_1
&MessageAttribute.1.Value.DataType=String
&MessageAttribute.2.Name=test_attribute_name_2
&MessageAttribute.2.Value.StringValue=test_attribute_value_2
&MessageAttribute.2.Value.DataType=String
&Expires=2014-05-05T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

Note
Queue names and queue URLs are case-sensitive.

The Query API response should look similar to the following:

```
HTTP/1.1 200 OK
...
<SendMessageResponse>
    <SendMessageResult>
        <MD5OfMessageBody>
            fafb00f5732ab283681e124bf8747ed1
        </MD5OfMessageBody>
        <MD5OfMessageAttributes>
        3ae8f24a165a8cedc005670c81a27295
        </MD5OfMessageAttributes>
        <MessageId>
            5fea7756-0ea4-451a-a703-a558b933e274
        </MessageId>
    </SendMessageResult>
    <ResponseMetadata>
        <RequestId>
            27daac76-34dd-47df-bd01-1f6e873584a0
        </RequestId>
    </ResponseMetadata>
</SendMessageResponse>
```

When using `SendMessageBatch`, the message attributes need to be specified on each individual message in the batch.

A Query API request for this example looks similar to the following:

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue
...
?Action=SendMessageBatch
&SendMessageBatchRequestEntry.1.Id=test_msg_001
&SendMessageBatchRequestEntry.1.MessageBody=test%20message%20body%201
&SendMessageBatchRequestEntry.2.Id=test_msg_002
&SendMessageBatchRequestEntry.2.MessageBody=test%20message%20body%202
&SendMessageBatchRequestEntry.2.DelaySeconds=60
&SendMessageBatchRequestEntry.2.MessageAttribute.1.Name=test_attribute_name_1
&SendMessageBatchRequestEntry.2.MessageAttribute.1.Value.StringValue=test_attribute_value_1
&SendMessageBatchRequestEntry.2.MessageAttribute.1.Value.DataType=String
&Expires=2014-05-05T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

The Query API response should look similar to the following:

```
HTTP/1.1 200 OK
...
<SendMessageBatchResponse>
```

```
<SendMessageBatchResult>
    <SendMessageBatchResultEntry>
        <Id>test_msg_001</Id>
        <MessageId>0a5231c7-8bff-4955-be2e-8dc7c50a25fa</MessageId>
        <MD5OfMessageBody>0e024d309850c78cba5eabbeff7cae71</MD5OfMessageBody>
    </SendMessageBatchResultEntry>
    <SendMessageBatchResultEntry>
        <Id>test_msg_002</Id>
        <MessageId>15ee1ed3-87e7-40c1-bdaa-2e49968ea7e9</MessageId>
        <MD5OfMessageBody>7fb8146a82f95e0af155278f406862c2</MD5OfMessageBody>
        <MD5OfMessageAttributes>295c5fa15a51aae6884d1d7c1d99ca50</MD5OfMessageAttributes>
    </SendMessageBatchResultEntry>
</SendMessageBatchResult>
<ResponseMetadata>
    <RequestId>ca1ad5d0-8271-408b-8d0f-1351bf547e74</RequestId>
</ResponseMetadata>
</SendMessageBatchResponse>
```

MD5 Message-Digest Calculation

If you want to calculate the MD5 me ssage digest for Amazon SQS message attributes and you're either using the Query API or one of the AWS SDKs that doesn't support MD5 message digest for Amazon SQS message attributes, then you must use the following information about the algorithm to calculate the MD5 message digest of the message attributes.

> **Note**
> Currently the AWS SDK for Java supports MD5 message digest for Amazon SQS message attributes. This is available in the `MessageMD5ChecksumHandler` class. If you're using the SDK for Java, then you don't need to use the following information.

The high-level steps of the algorithm to calculate the MD5 message digest for Amazon SQS message attributes are:

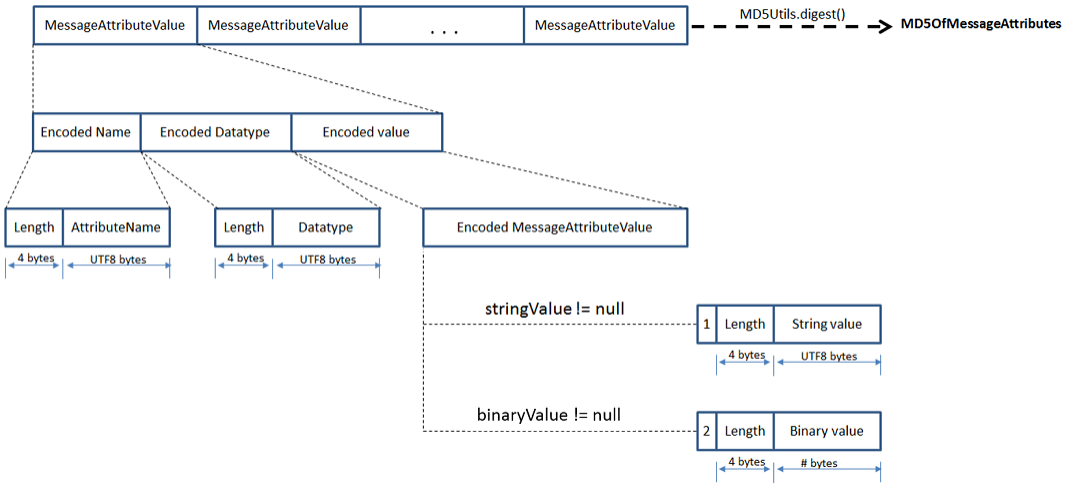
1. Sort all message attributes by name in ascending order.
2. Encode the individual parts of each attribute (name, type, and value) into a buffer.
3. Compute the message digest of the entire buffer.

To encode a single Amazon SQS message attribute:

1. Encode the name (length of name [4 bytes] + UTF-8 bytes of the name).
2. Encode the type (length of type [4 bytes] + UTF-8 bytes of the type).
3. Encode the transport type (string or binary) of the value [1 byte].
    a. For the *string* transport type, encode 1.
    b. For the *binary* transport type, encode 2.

    > **Note**
    > The string and number logical data types use the *string* transport type. The binary logical data type uses the *binary* transport type.
4. Encode the attribute value.
    a. For a *string* transport type, encode the attribute value (length [4 bytes] + the UTF-8 bytes of the value).
    b. For a *binary* transport type, encode the attribute value (length [4 bytes] + use the raw bytes directly).

The following diagram shows the encoding of the MD5 message digest for a single message attribute:



Amazon SQS Long Polling

Long polling helps reduce your cost of using Amazon SQS by reducing the number of empty responses (when there are no messages available to return in reply to a `ReceiveMessage` request sent to an Amazon SQS queue) and eliminating false empty responses (when messages are available in the queue but aren't included in the response):

- Long polling reduces the number of empty responses by allowing Amazon SQS to wait until a message is available in the queue before sending a response. Unless the connection times out, the response to the `ReceiveMessage` request contains at least one of the available messages, up to the maximum number of messages specified in the `ReceiveMessage` action.
- Long polling eliminates false empty responses by querying all (rather than a limited number) of the servers.
- Long polling returns messages as soon any message becomes available.

Topics

The Differences Between Short and Long Polling

Amazon SQS uses *short polling* by default, querying only a subset of the servers (based on a weighted random distribution) to determine whether any messages are available for inclusion in the response.

Short polling occurs when the `WaitTimeSeconds` parameter of a `ReceiveMessage` call is set to `0` in one of two ways:

- The `ReceiveMessage` call sets `WaitTimeSeconds` to `0`.
- The `ReceiveMessage` call doesn't set `WaitTimeSeconds` and the queue attribute `ReceiveMessageWaitTimeSeconds` is set to `0`.

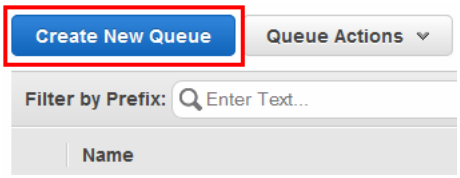
Note
For the `WaitTimeSeconds` parameter of `ReceiveMessage`, a value set between `1` and `20` has priority over any value set for the queue attribute `ReceiveMessageWaitTimeSeconds`.

Enabling Long Polling using the AWS Management Console

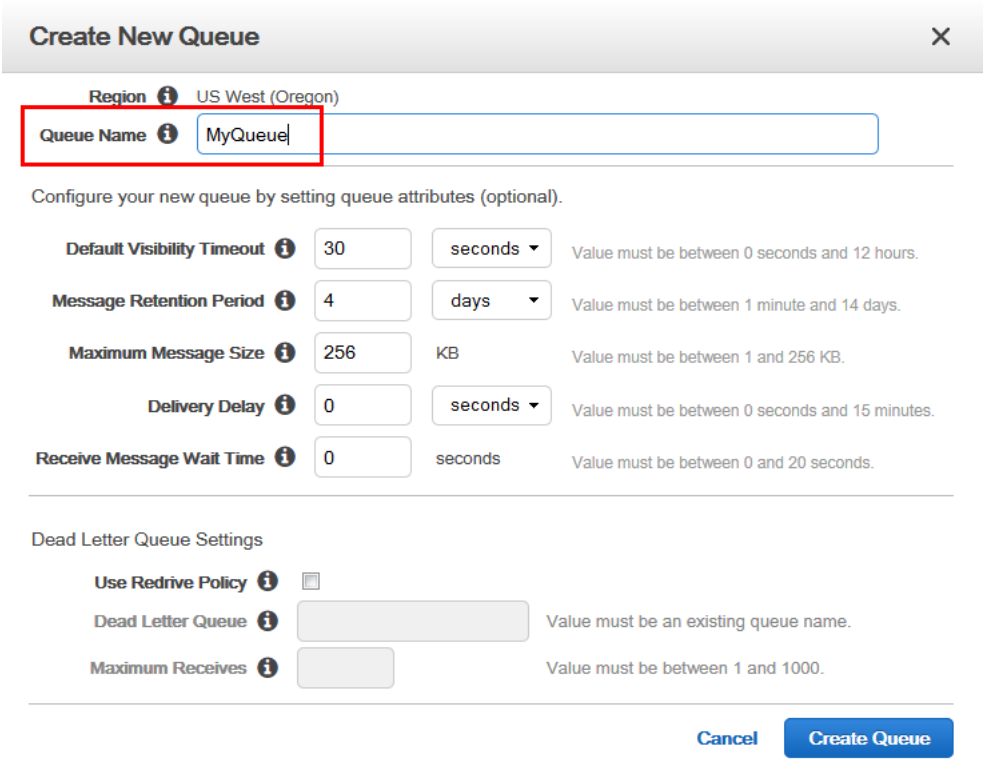
You can enable long polling using the AWS Management Console by setting a **Receive Message Wait Time** to a value greater than `0`.

To enable long polling with the AWS Management Console for a new queue

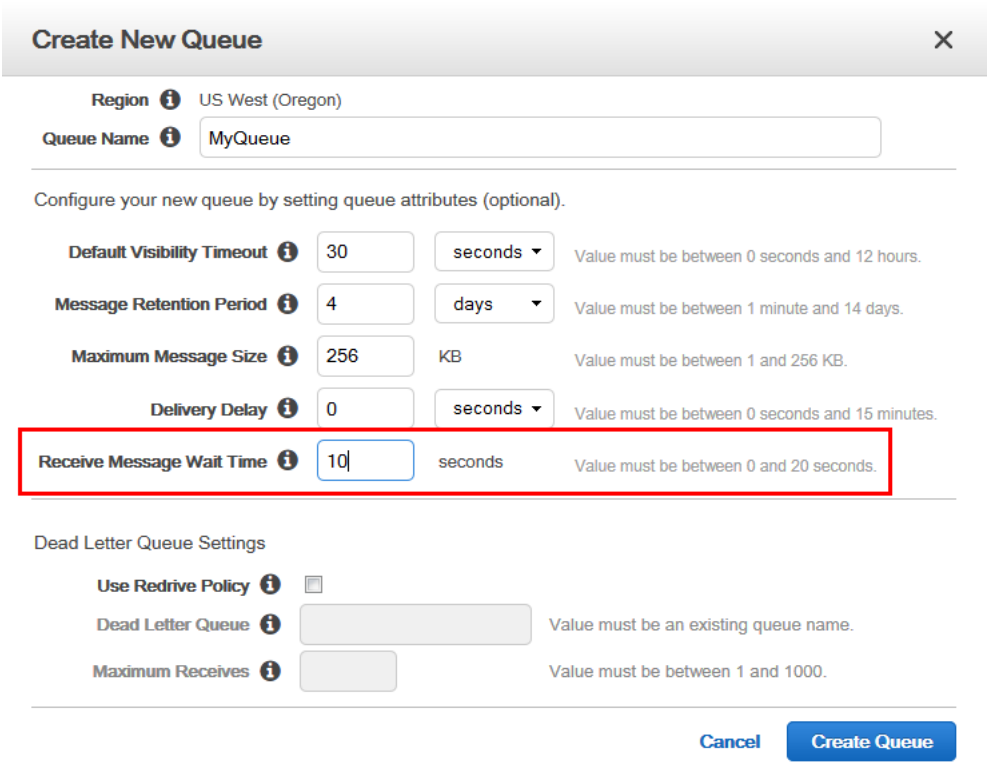
1. Sign in to the Amazon SQS console.
2. Select **Create New Queue**.



3. In the **Create New Queue** dialog box, type the **Queue Name**.



4. For **Receive Message Wait Time**, type a positive integer value, from `1` to `20` seconds.

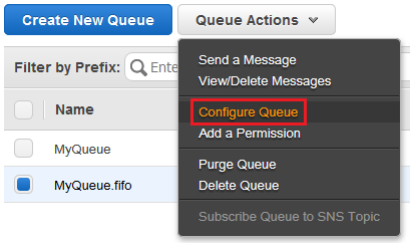


5. Choose **Create Queue**.

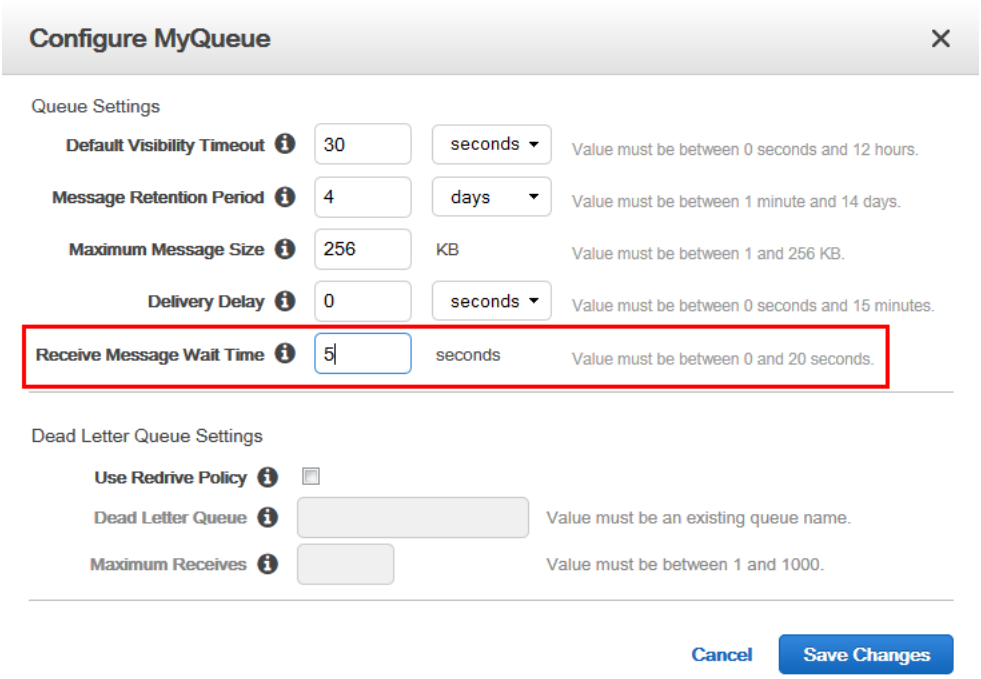
You can use the AWS Management Console to change the **Receive Message Wait Time** setting for an existing queue.

To set a new Receive Message Wait Time value for an existing queue

1. Select a queue.
2. From the **Queue Actions** drop-down list, select **Configure Queue**.



3. For **Receive Message Wait Time**, type a positive integer value.



4. Choose **Save Changes**.

Enabling Long Polling Using the API

The following table lists the API actions to use.

Use this action	Use...
`ReceiveMessage`	`WaitTimeSeconds` parameter
`CreateQueue`	`ReceiveMessageWaitTimeSeconds` attribute
`SetQueueAttributes`	`ReceiveMessageWaitTimeSeconds` attribute

Important
If you decide to implement long polling with multiple queues, we recommend using one thread for each queue instead of trying to use a single thread for polling all of the queues.
When you use one thread for each queue, your application can process the messages in each of the queues as they become available. A single thread for multiple queues might cause your application to become blocked from processing available messages in the other queues while waiting (up to 20 seconds) for a queue that doesn't have any available messages.

In most cases, when using long polling, set the timeout value to a maximum of 20 seconds. If the 20-second maximum doesn't work for your application, set a shorter timeout for long polling (the minimum is 1 second). If you don't use an AWS SDK to access Amazon SQS, or if you configure an AWS SDK to have a shorter timeout, you may need to modify your Amazon SQS client to allow for longer requests or to use a shorter timeout for long polling.

Enabling Long Polling Using the Query API

The following example enables long polling by calling the `ReceiveMessage` action with the `WaitTimeSeconds` parameter set to 10 seconds.

The structure of *AUTHPARAMS* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue/
?Action=ReceiveMessage
&WaitTimeSeconds=10
&MaxNumberOfMessages=5
&VisibilityTimeout=15
&AttributeName=All;
&Expires=2013-10-25T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

The following example shows another way to enable long polling. Here, the `ReceiveMessageWaitTimeSeconds` attribute for the `SetQueueAttributes` action is set to 20 seconds.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue/
?Action=SetQueueAttributes
&Attribute.Name=ReceiveMessageWaitTimeSeconds
&Attribute.Value=20
&Expires=2013-10-25T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

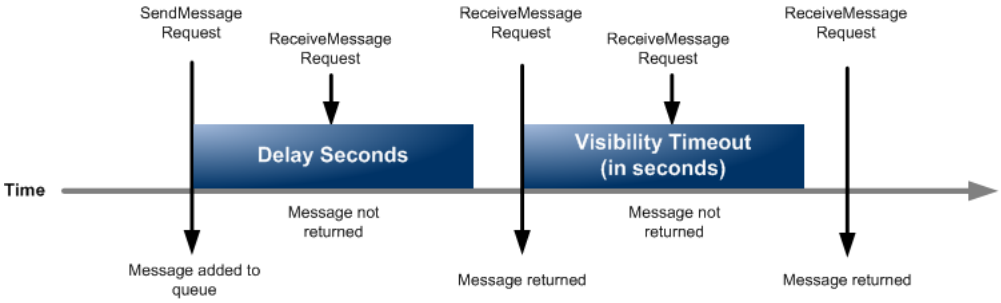
Amazon SQS Delay Queues

Topics

Delay queues let you postpone the delivery of new messages in a queue for the specified number of seconds. If you create a delay queue, any message that you send to that queue is invisible to consumers for the duration of the delay period. You can use the `CreateQueue` action to create a delay queue by setting the `DelaySeconds` attribute to any value between `0` and `900` (15 minutes). You can also change an existing queue into a delay queue using the `SetQueueAttributes` action to set the queue's `DelaySeconds` attribute.

> **Note**
> For standard queues, the per-queue delay setting *isn't retroactive*: If you change the `DelaySeconds` attribute, it doesn't affect the delay of messages already in the queue.
> For FIFO queues, the per-queue delay setting *is retroactive*: If you change the `DelaySeconds` attribute, it affects the delay of messages already in the queue.

Delay queues are similar to visibility timeouts because both features make messages unavailable to consumers for a specific period of time. The difference between delay queues and visibility timeouts is that for delay queues a message is hidden when it's first added to queue, whereas for visibility timeouts a message is hidden only after a message is consumed from the queue. The following figure illustrates the relationship between delay queues and visibility timeouts.



Note
A message is considered to be *in flight* after it's received from a queue by a consumer, but not yet deleted from the queue.
For standard queues, there can be a maximum of 120,000 inflight messages per queue. If you reach this limit, Amazon SQS returns the `OverLimit` error message. To avoid reaching the limit, you should delete messages from the queue after they're processed. You can also increase the number of queues you use to process your messages.
For FIFO queues, there can be a maximum of 20,000 inflight messages per queue. If you reach this limit, Amazon SQS returns no error messages.

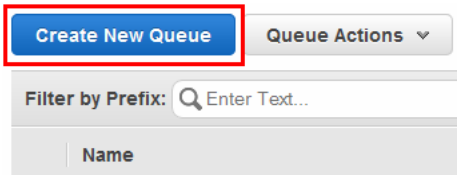
To set delay seconds on individual messages, rather than for an entire queue, use message timers. If you send a message with a message timer, Amazon SQS uses the message timer's delay seconds value instead of the delay queue's delay seconds value. For more information, see Amazon SQS Message Timers (p. 83).

Creating Delay Queues with the AWS Management Console

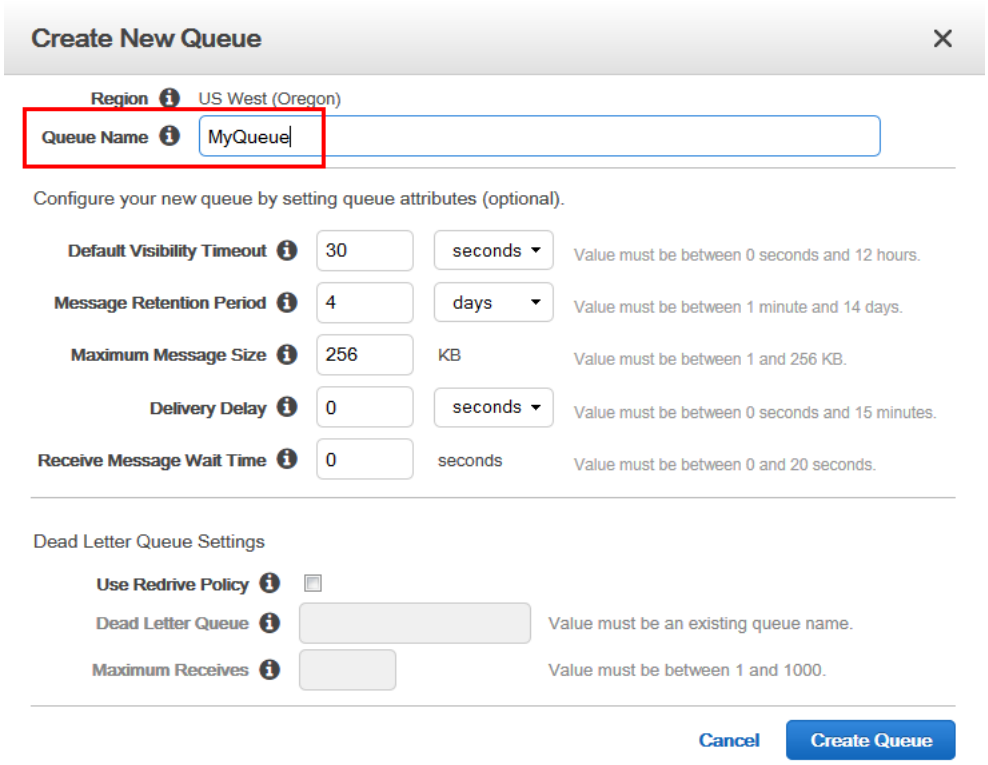
You can create a delay queue using the AWS Management Console by setting a **Delivery Delay** to a value greater than `0`.

To create a delay queue with the AWS Management Console

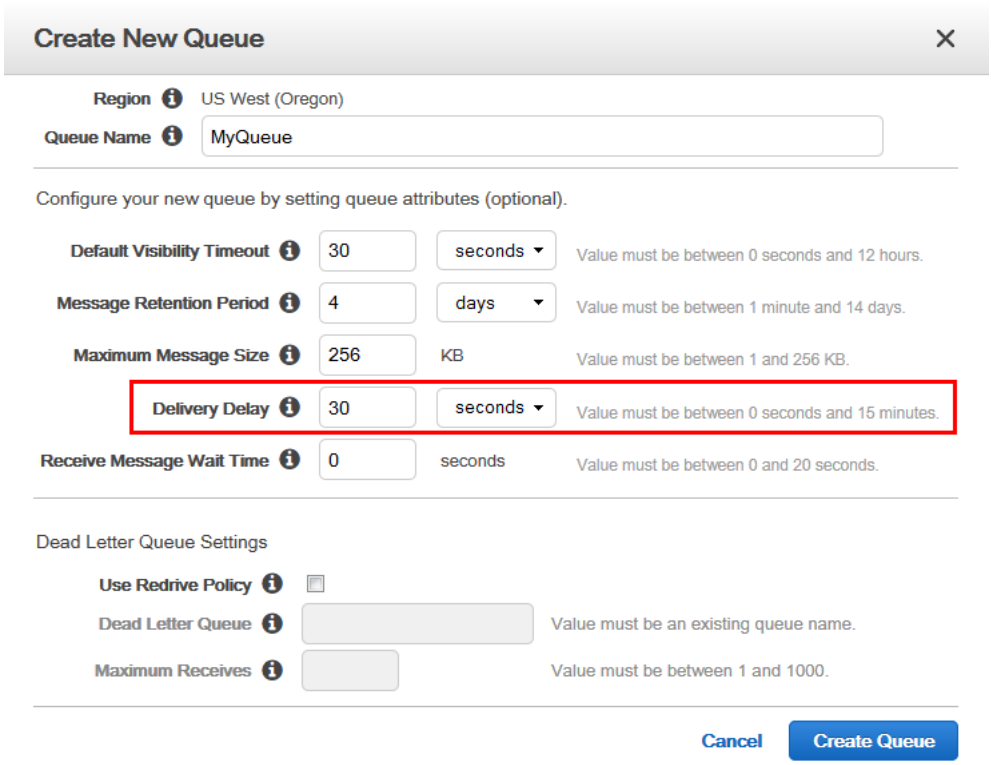
1. Sign in to the Amazon SQS console.
2. Choose **Create New Queue**.



3. In the **Create New Queue** dialog box, type your **Queue Name**.



4. For **Delivery Delay**, type a positive integer value.

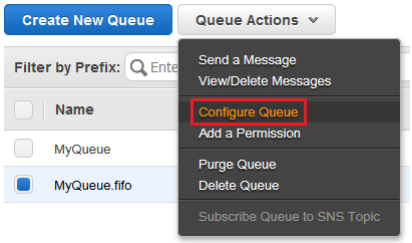


5. Choose **Create Queue**.

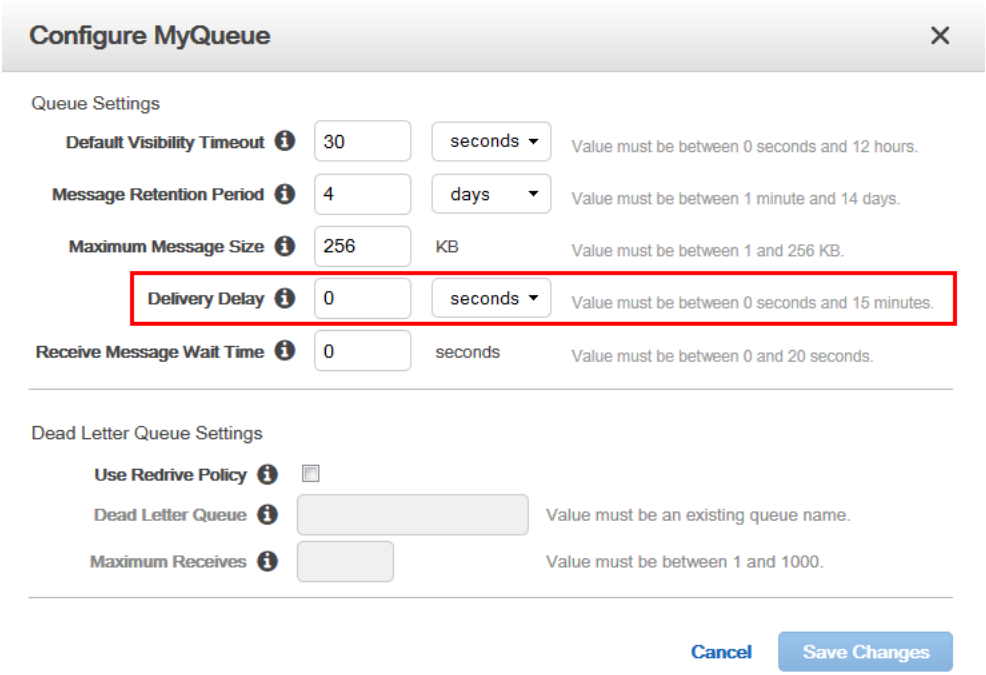
You can use the AWS Management Console to change the **Delivery Delay** setting for an existing queue by selecting the **Configure Queue** action with an existing queue selected.

To set a new delivery delay value for an existing queue

1. Select an existing queue and then from the **Queue Actions** drop-down box select **Configure Queue**.



2. Change the **Delivery Delay** value to a positive integer.



3. Choose **Save Changes**.

Creating Delay Queues with the Query API

The following Query API example calls the `CreateQueue` action to create a delay queue that hides each message from consumers for the first 45 seconds that the message is in the queue.

The structure of *`AUTHPARAMS`* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

```
https://sqs.us-east-2.amazonaws.com/
?Action=CreateQueue
&QueueName=MyQueue
&Attribute.1.Name=DelaySeconds
&Attribute.1.Value=45
&Expires=2015-12-20T22%3A52%3A43PST
&Version=2012-11-05
```

```
&AUTHPARAMS
```

Note
Queue names and queue URLs are case-sensitive.

You can also change an existing queue into a delay queue by changing the DelaySeconds attribute from its default value of 0 to a positive integer value that is less than or equal to 900. The following example calls `SetQueueAttributes` to set the `DelaySeconds` attribute of a queue named `MyQueue` to 45 seconds.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue/
?Action=SetQueueAttributes
&DelaySeconds=45
&Expires=2015-12-20T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

Amazon SQS Message Timers

Amazon SQS message timers allow you to specify an initial invisibility period for a message that you add to a queue. For example, if you send a message with the `DelaySeconds` parameter set to `45`, the message isn't visible to consumers for the first `45` seconds during which the message stays in the queue. The default value for `DelaySeconds` is `0`.

Note
FIFO queues don't support timers on individual messages.
A message is considered to be *in flight* after it's received from a queue by a consumer, but not yet deleted from the queue.
For standard queues, there can be a maximum of 120,000 inflight messages per queue. If you reach this limit, Amazon SQS returns the `OverLimit` error message. To avoid reaching the limit, you should delete messages from the queue after they're processed. You can also increase the number of queues you use to process your messages.

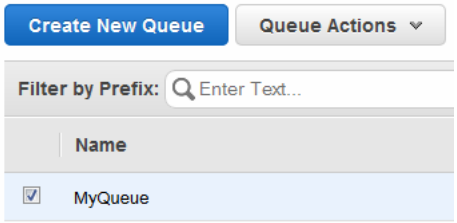
To set a delay period that applies to all messages in a queue, use delay queues (p. 79). A message timer setting for an individual message overrides any `DelaySeconds` value that applies to the entire delay queue.

Topics

Creating Message Timers Using the Console

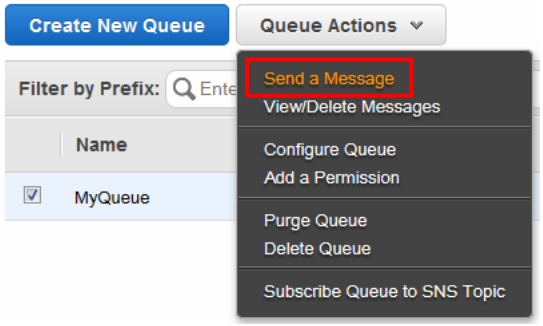
To send a message with a message timer using the AWS Management Console

1. Sign in to the Amazon SQS console.
2. Select a queue.

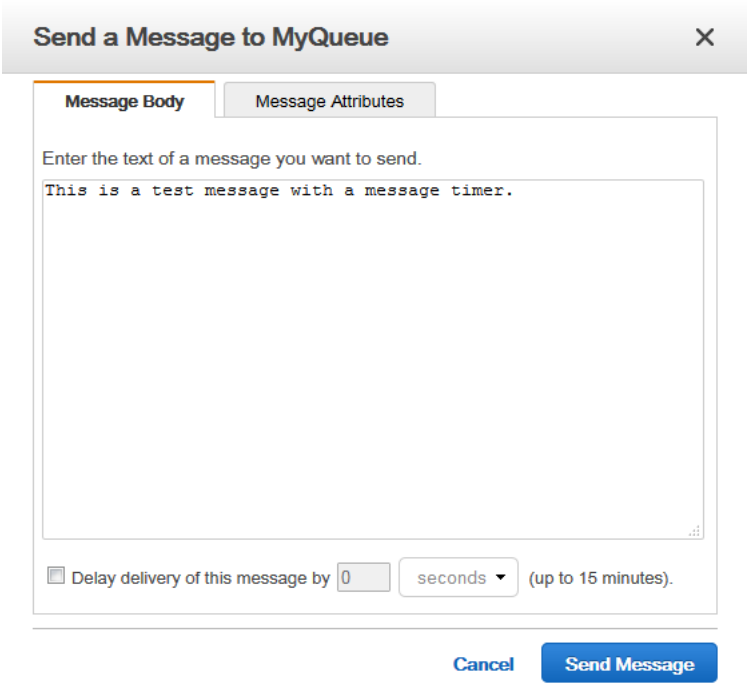


3. From the **Queue Actions** drop-down list, select **Send a Message**.

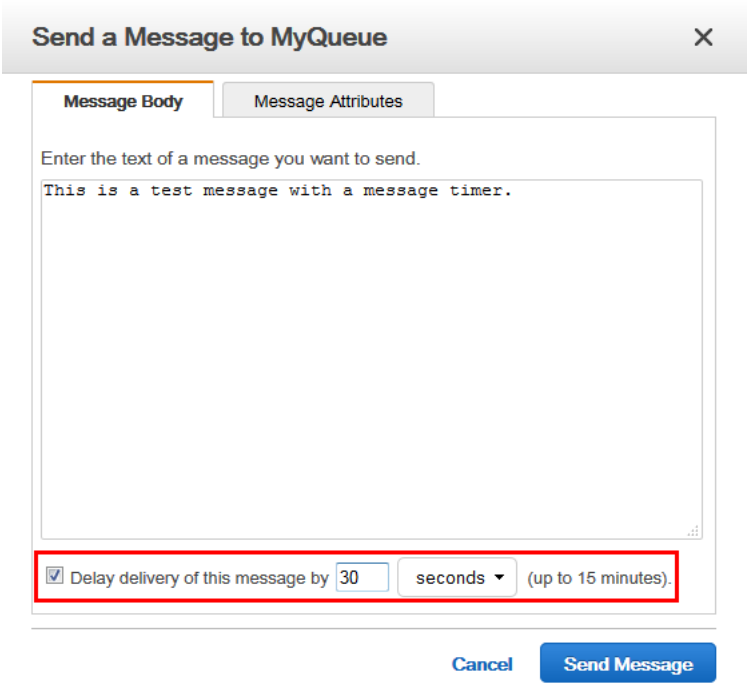
   Note
   The **Queue Actions** drop-down list is available only if a queue is selected.



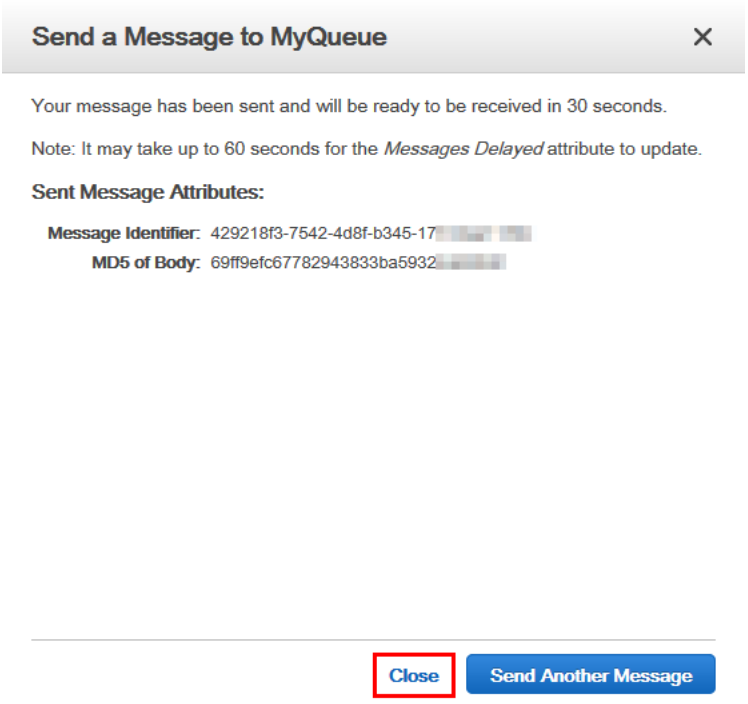
4. In the **Send a Message to MyQueue** dialog box, type a message.



5. In the **Delay delivery of this message by** text box, enter a delay value (for example, `30`) .



6. Choose **Send Message**.
7. In the **Send a Message to MyQueue** confirmation box, choose **Close**.



Creating Message Timers Using the Query API

The following Query API example applies a 45-second initial visibility delay for a single message sent with `SendMessage`.

The structure of *AUTHPARAMS* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue/
?Action=SendMessage
&MessageBody=This+is+a+test+message
&DelaySeconds=45
&Expires=2015-12-18T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

Note
Queue names and queue URLs are case-sensitive.

You can also use the Query API `SendMessageBatch` action to send up to 10 messages with message timers. You can assign a different `DelaySeconds` value to each message or assign no value at all. If you don't set a value for DelaySeconds, the message might still be subject to a delay if you're adding the message to a delay queue. For more information about delay queues, see Amazon SQS Delay Queues (p. 79). The following example uses `SendMessageBatch` to send three messages: one message without a message timer and two messages with different values for `DelaySeconds`.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue/
?Action=SendMessageBatch
&SendMessageBatchRequestEntry.1.Id=test_msg_no_message_timer
&SendMessageBatchRequestEntry.1.MessageBody=test%20message%20body%201
&SendMessageBatchRequestEntry.2.Id=test_msg_delay_45_seconds
&SendMessageBatchRequestEntry.2.MessageBody=test%20message%20body%202
&SendMessageBatchRequestEntry.2.DelaySeconds=45
&SendMessageBatchRequestEntry.3.Id=test_msg_delay_2_minutes
&SendMessageBatchRequestEntry.3.MessageBody=test%20message%20body%203
&SendMessageBatchRequestEntry.3.DelaySeconds=120
&Expires=2015-12-18T22%3A52%3A43PST
&Version=2012-11-05
&AUTHPARAMS
```

Managing Large Amazon SQS Messages Using Amazon S3

You can use Amazon S3 and the Amazon SQS Extended Client Library for Java to manage Amazon SQS messages. This is especially useful for storing and consuming messages up to 2 GB in size. You can use the Amazon SQS Extended Client Library for Java library to do the following:

- Specify whether messages are always stored in Amazon S3 or only when the size of a message exceeds 256 KB.
- Send a message that references a single message object stored in an Amazon S3 bucket.
- Get the corresponding message object from an Amazon S3 bucket.
- Delete the corresponding message object from an Amazon S3 bucket.

Note
The SDK for Java and Amazon SQS Extended Client Library for Java require the J2SE Development Kit 8.0 or later.
You can use the Amazon SQS Extended Client Library for Java to manage Amazon SQS messages using Amazon S3. However, you can't do this using the AWS CLI, the Amazon SQS console, the Amazon SQS HTTP API, or any of the AWS SDKs—except for the SDK for Java.

Working Java Example for Using Amazon S3 for Large Amazon SQS Messages

Prerequisites

Ensure that the `amazon-sqs-java-extended-client-lib.jar`, `aws-java-sdk-sqs.jar`, and `aws-java-sdk-s3.jar` packages are in your Java build class path. The following example shows these dependencies in a Maven project `pom.xml` file.

```
<dependencies>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>amazon-sqs-java-extended-client-lib</artifactId>
        <version>1.0.1</version>
    </dependency>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-sqs</artifactId>
        <version>LATEST</version>
    </dependency>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-s3</artifactId>
        <version>LATEST</version>
    </dependency>
</dependencies>
```

SQSExtendedClientExample.java

The following example code creates an Amazon S3 bucket with a random name and adds a lifecycle rule to permanently delete objects after 14 days. Next, the code creates a queue named `MyQueue` and sends a random message more than 256 KB in size to the queue; the message is stored in the Amazon S3 bucket. Finally, the code consumes the message, returns information about the message, and deletes the message, the queue, and the bucket.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

import com.amazon.sqs.javamessaging.AmazonSQSExtendedClient;
import com.amazon.sqs.javamessaging.ExtendedClientConfiguration;
import com.amazonaws.services.s3.AmazonS3;
import com.amazonaws.services.s3.AmazonS3ClientBuilder;
import com.amazonaws.services.s3.model.*;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClientBuilder;
import com.amazonaws.services.sqs.model.*;
import org.joda.time.DateTime;
```

```
import org.joda.time.format.DateTimeFormat;

import java.util.Arrays;
import java.util.List;
import java.util.UUID;

public class SQSExtendedClientExample {

    // Create an Amazon S3 bucket with a random name.
    private static final String s3BucketName = UUID.randomUUID() + "-"
            + DateTimeFormat.forPattern("yyMMdd-hhmmss").print(new DateTime());

    public static void main(String[] args) {

        /*
         * Create a new instance of the builder with all defaults (credentials
         * and region) set automatically. For more information, see
         * Creating Service Clients in the AWS SDK for Java Developer Guide.
         */
        final AmazonS3 s3 = AmazonS3ClientBuilder.defaultClient();

        /*
         * Set the Amazon S3 bucket name, and then set a lifecycle rule on the
         * bucket to permanently delete objects 14 days after each object's
         * creation date.
         */
        final BucketLifecycleConfiguration.Rule expirationRule =
                new BucketLifecycleConfiguration.Rule();
        expirationRule.withExpirationInDays(14).withStatus("Enabled");
        final BucketLifecycleConfiguration lifecycleConfig =
                new BucketLifecycleConfiguration().withRules(expirationRule);

        // Create the bucket and allow message objects to be stored in the bucket.
        s3.createBucket(s3BucketName);
        s3.setBucketLifecycleConfiguration(s3BucketName, lifecycleConfig);
        System.out.println("Bucket created and configured.");

        /*
         * Set the Amazon SQS extended client configuration with large payload
         * support enabled.
         */
        final ExtendedClientConfiguration extendedClientConfig =
                new ExtendedClientConfiguration()
                        .withLargePayloadSupportEnabled(s3, s3BucketName);

        final AmazonSQS sqsExtended =
                new AmazonSQSExtendedClient(AmazonSQSClientBuilder
                        .defaultClient(), extendedClientConfig);

        /*
         * Create a long string of characters for the message object which will
         * be stored in the bucket.
         */
        int stringLength = 300000;
        char[] chars = new char[stringLength];
        Arrays.fill(chars, 'x');
        final String myLongString = new String(chars);

        // Create a message queue for this example.
        final String QueueName = "MyQueue" + UUID.randomUUID().toString();
        final CreateQueueRequest createQueueRequest =
                new CreateQueueRequest(QueueName);
        final String myQueueUrl = sqsExtended
                .createQueue(createQueueRequest).getQueueUrl();
        System.out.println("Queue created.");
```

```
        // Send the message.
        final SendMessageRequest myMessageRequest =
                new SendMessageRequest(myQueueUrl, myLongString);
        sqsExtended.sendMessage(myMessageRequest);
        System.out.println("Sent the message.");

        // Receive the message.
        final ReceiveMessageRequest receiveMessageRequest =
                new ReceiveMessageRequest(myQueueUrl);
        List<Message> messages = sqsExtended
                .receiveMessage(receiveMessageRequest).getMessages();

        // Print information about the message.
        for (Message message : messages) {
            System.out.println("\nMessage received.");
            System.out.println("  ID: " + message.getMessageId());
            System.out.println("  Receipt handle: " + message.getReceiptHandle());
            System.out.println("  Message body (first 5 characters): "
                    + message.getBody().substring(0, 5));
        }

        // Delete the message, the queue, and the bucket.
        final String messageReceiptHandle = messages.get(0).getReceiptHandle();
        sqsExtended.deleteMessage(new DeleteMessageRequest(myQueueUrl,
                messageReceiptHandle));
        System.out.println("Deleted the message.");

        sqsExtended.deleteQueue(new DeleteQueueRequest(myQueueUrl));
        System.out.println("Deleted the queue.");

        deleteBucketAndAllContents(s3);
        System.out.println("Deleted the bucket.");
    }

    private static void deleteBucketAndAllContents(AmazonS3 client) {

        ObjectListing objectListing = client.listObjects(s3BucketName);

        while (true) {
            for (S3ObjectSummary objectSummary : objectListing
                    .getObjectSummaries()) {
                client.deleteObject(s3BucketName, objectSummary.getKey());
            }

            if (objectListing.isTruncated()) {
                objectListing = client.listNextBatchOfObjects(objectListing);
            } else {
                break;
            }
        }

        final VersionListing list = client.listVersions(
                new ListVersionsRequest().withBucketName(s3BucketName));

        for (S3VersionSummary s : list.getVersionSummaries()) {
            client.deleteVersion(s3BucketName, s.getKey(), s.getVersionId());
        }

        client.deleteBucket(s3BucketName);
    }
}
```

Using JMS with Amazon SQS

The Amazon SQS Java Messaging Library is a JMS interface for Amazon SQS that lets you take advantage of Amazon SQS in applications that already use JMS. The interface lets you use Amazon SQS as the JMS provider with minimal code changes. Together with the AWS SDK for Java, the Amazon SQS Java Messaging Library lets you create JMS connections and sessions, as well as producers and consumers that send and receive messages to and from Amazon SQS queues.

The library supports sending and receiving messages to a queue (the JMS point-to-point model) according to the JMS 1.1 specification. The library supports sending text, byte, or object messages synchronously to Amazon SQS queues. The library also supports receiving objects synchronously or asynchronously.

For information about features of the Amazon SQS Java Messaging Library that support the JMS 1.1 specification, see Supported JMS 1.1 Implementations (p. 111) and the Amazon SQS FAQs.

Topics

Prerequisites

Before you begin, you must have the following prerequisites:

- **SDK for Java**

  There are two ways to include the SDK for Java in your project:

  - Download and install the SDK for Java.
  - Use Maven to get the Amazon SQS Java Messaging Library.

    Note
    The SDK for Java is included as a dependency.
    The SDK for Java and Amazon SQS Extended Client Library for Java require the J2SE Development Kit 8.0 or later.

  For information about downloading the SDK for Java, see SDK for Java.

- **Amazon SQS Java Messaging Library**

  If you don't use Maven, you must add the package file `amazon-sqs-java-messaging-lib.jar` to the Java build class path. For information about downloading the library, see Amazon SQS Java Messaging Library.

  Note
  The Amazon SQS Java Messaging Library includes support for Maven and the Spring Framework.
  For code samples that use Maven, the Spring Framework, and the Amazon SQS Java Messaging Library, see Working Java Example for Using JMS with Amazon SQS Standard Queues (p. 97).

```
<dependency>
  <groupId>com.amazonaws</groupId>
```

```
  <artifactId>amazon-sqs-java-messaging-lib</artifactId>
  <version>1.0.4</version>
  <type>jar</type>
</dependency>
```

- **Amazon SQS Queue**

  Create a queue using the AWS Management Console for Amazon SQS, the `CreateQueue` API, or the wrapped Amazon SQS client included in the Amazon SQS Java Messaging Library.

  - For information about creating a queue with Amazon SQS using either the AWS Management Console or the `CreateQueue` API, see Creating a Queue (p. 16).
  - For information about using the Amazon SQS Java Messaging Library, see Getting Started with the Amazon SQS Java Messaging Library (p. 91).

Getting Started with the Amazon SQS Java Messaging Library

To get started using JMS with Amazon SQS, use the code examples in this section. The following sections show how to create a JMS connection and a session, and how to send and receive a message.

The wrapped Amazon SQS client object included in the Amazon SQS Java Messaging Library checks if an Amazon SQS queue exists. If the queue doesn't exist, the client creates it.

Creating a JMS Connection

1. Create a connection factory and call the `createConnection` method against the factory.

   ```
   // Create a new connection factory with all defaults (credentials and region) set
    automatically
   SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
           new ProviderConfiguration(),
           AmazonSQSClientBuilder.defaultClient()
           );

   // Create the connection.
   SQSConnection connection = connectionFactory.createConnection();
   ```

   The `SQSConnection` class extends `javax.jms.Connection`. Together with the JMS standard connection methods, `SQSConnection` offers additional methods, such as `getAmazonSQSClient` and `getWrappedAmazonSQSClient`. Both methods let you perform administrative operations not included in the JMS specification, such as creating new queues. However, the `getWrappedAmazonSQSClient` method also provides a wrapped version of the Amazon SQS client used by the current connection. The wrapper transforms every exception from the client into an `JMSException`, allowing it to be more easily used by existing code that expects `JMSException` occurrences.
2. You can use the client objects returned from `getAmazonSQSClient` and `getWrappedAmazonSQSClient` to perform administrative operations not included in the JMS specification (for example, you can create an Amazon SQS queue).

   If you have existing code that expects JMS exceptions, then you should use `getWrappedAmazonSQSClient`:

   - If you use `getWrappedAmazonSQSClient`, the returned client object transforms all exceptions into JMS exceptions.
   - If you use `getAmazonSQSClient`, the exceptions are all Amazon SQS exceptions.

Creating an Amazon SQS Queue

The wrapped client object checks if an Amazon SQS queue exists.

If a queue doesn't exist, the client creates it. If the queue does exist, the function doesn't return anything. For more information, see the "Create the queue if needed" section in the TextMessageSender.java (p. 99) example.

To create a standard queue

```
// Get the wrapped client
AmazonSQSMessagingClientWrapper client = connection.getWrappedAmazonSQSClient();

// Create an SQS queue named MyQueue, if it doesn't already exist
if (!client.queueExists("MyQueue")) {
    client.createQueue("MyQueue");
}
```

To create a FIFO queue

```
// Get the wrapped client
AmazonSQSMessagingClientWrapper client = connection.getWrappedAmazonSQSClient();

// Create an Amazon SQS FIFO queue named MyQueue.fifo, if it doesn't already exist
if (!client.queueExists("MyQueue.fifo")) {
    Map<String, String> attributes = new HashMap<String, String>();
    attributes.put("FifoQueue", "true");
    attributes.put("ContentBasedDeduplication", "true");
    client.createQueue(new
 CreateQueueRequest().withQueueName("MyQueue.fifo").withAttributes(attributes));
}
```

Note
The name of a FIFO queue must end with the `.fifo` suffix.
For more information on the `ContentBasedDeduplication` attribute, see Exactly-Once Processing (p. 54).

Sending Messages Synchronously

1. When the connection and the underlying Amazon SQS queue are ready, create a nontransacted JMS session with `AUTO_ACKNOWLEDGE` mode.

   ```
   // Create the nontransacted session with AUTO_ACKNOWLEDGE mode
   Session session = connection.createSession(false, Session.AUTO_ACKNOWLEDGE);
   ```

2. To send a text message to the queue, create a JMS queue identity and a message producer.

   ```
   // Create a queue identity and specify the queue name to the session
   Queue queue = session.createQueue("MyQueue");

   // Create a producer for the 'MyQueue'
   MessageProducer producer = session.createProducer(queue);
   ```

3. Create a text message and send it to the queue.

   - To send a message to a standard queue, you don't need to set any additional parameters.

     ```
     // Create the text message
     ```

```
TextMessage message = session.createTextMessage("Hello World!");

// Send the message
producer.send(message);
System.out.println("JMS Message " + message.getJMSMessageID());
```

- To send a message to a FIFO queue, you must set the message group ID. You can also set a message deduplication ID. For more information, see Key Terms (p. 52).

```
// Create the text message
TextMessage message = session.createTextMessage("Hello World!");

// Set the message group ID
message.setStringProperty("JMSXGroupID", "Default");

// You can also set a custom message deduplication ID
// message.setStringProperty("JMS_SQS_DeduplicationId", "hello");
// Here, it's not needed because content-based deduplication is enabled for the queue

// Send the message
producer.send(message);
System.out.println("JMS Message " + message.getJMSMessageID());
System.out.println("JMS Message Sequence Number " +
 message.getStringProperty("JMS_SQS_SequenceNumber"));
```

Receiving Messages Synchronously

1. To receive messages, create a consumer for the same queue and invoke the `start` method.

   You can call the `start` method on the connection at any time. However, the consumer doesn't begin to receive messages until you call it.

```
// Create a consumer for the 'MyQueue'
MessageConsumer consumer = session.createConsumer(queue);
// Start receiving incoming messages
connection.start();
```

2. Call the `receive` method on the consumer with a timeout set to 1 second, and then print the contents of the received message.

   - After receiving a message from a standard queue, you can access the contents of the message.

```
// Receive a message from 'MyQueue' and wait up to 1 second
Message receivedMessage = consumer.receive(1000);

// Cast the received message as TextMessage and display the text
if (receivedMessage != null) {
    System.out.println("Received: " + ((TextMessage) receivedMessage).getText());
}
```

   - After receiving a message from a FIFO queue, you can access the contents of the message and other, FIFO-specific message attributes, such as the message group ID, message deduplication ID, and sequence number. For more information, see Key Terms (p. 52).

```
// Receive a message from 'MyQueue' and wait up to 1 second
Message receivedMessage = consumer.receive(1000);

// Cast the received message as TextMessage and display the text
if (receivedMessage != null) {
    System.out.println("Received: " + ((TextMessage) receivedMessage).getText());
```

```
    System.out.println("Group id: " +
 receivedMessage.getStringProperty("JMSXGroupID"));
    System.out.println("Message deduplication id: " +
 receivedMessage.getStringProperty("JMS_SQS_DeduplicationId"));
    System.out.println("Message sequence number: " +
 receivedMessage.getStringProperty("JMS_SQS_SequenceNumber"));
}
```

3. Close the connection and the session.

```
// Close the connection (and the session).
connection.close();
```

The output looks similar to the following:

```
JMS Message ID:8example-588b-44e5-bbcf-d816example2
Received: Hello World!
```

Note
You can use the Spring Framework to initialize these objects.
For additional information, see `SpringExampleConfiguration.xml`, `SpringExample.java`, and the other helper classes in `ExampleConfiguration.java` and `ExampleCommon.java` in the Working Java Example for Using JMS with Amazon SQS Standard Queues (p. 97) section.

For complete examples of sending and receiving objects, see TextMessageSender.java (p. 99) and SyncMessageReceiver.java (p. 100).

Receiving Messages Asynchronously

In the example in Getting Started with the Amazon SQS Java Messaging Library (p. 91), a message is sent to `MyQueue` and received synchronously.

The following example shows how to receive the messages asynchronously through a listener.

1. Implement the `MessageListener` interface.

```
class MyListener implements MessageListener {

    @Override
    public void onMessage(Message message) {
        try {
            // Cast the received message as TextMessage and print the text to screen.
            System.out.println("Received: " + ((TextMessage) message).getText());
        } catch (JMSException e) {
            e.printStackTrace();
        }
    }
}
```

   The `onMessage` method of the `MessageListener` interface is called when you receive a message. In this listener implementation, the text stored in the message is printed.

2. Instead of explicitly calling the `receive` method on the consumer, set the message listener of the consumer to an instance of the `MyListener` implementation. The main thread waits for one second.

```
// Create a consumer for the 'MyQueue'.
MessageConsumer consumer = session.createConsumer(queue);
```

```
// Instantiate and set the message listener for the consumer.
consumer.setMessageListener(new MyListener());

// Start receiving incoming messages.
connection.start();

// Wait for 1 second. The listener onMessage() method is invoked when a message is
 received.
Thread.sleep(1000);
```

The rest of the steps are identical to the ones in the Getting Started with the Amazon SQS Java Messaging Library (p. 91) example. For a complete example of an asynchronous consumer, see `AsyncMessageReceiver.java` in Working Java Example for Using JMS with Amazon SQS Standard Queues (p. 97).

The output for this example looks similar to the following:

```
JMS Message ID:8example-588b-44e5-bbcf-d816example2
Received: Hello World!
```

Using Client Acknowledge Mode

The example in Getting Started with the Amazon SQS Java Messaging Library (p. 91) uses `AUTO_ACKNOWLEDGE` mode where every received message is acknowledged automatically (and therefore deleted from the underlying Amazon SQS queue).

1. To explicitly acknowledge the messages after they're processed, you must create the session with `CLIENT_ACKNOWLEDGE` mode.

   ```
   // Create the non-transacted session with CLIENT_ACKNOWLEDGE mode.
   Session session = connection.createSession(false, Session.CLIENT_ACKNOWLEDGE);
   ```

2. When the message is received, display it and then explicitly acknowledge it.

   ```
   // Cast the received message as TextMessage and print the text to screen. Also
    acknowledge the message.
   if (receivedMessage != null) {
       System.out.println("Received: " + ((TextMessage) receivedMessage).getText());
       receivedMessage.acknowledge();
       System.out.println("Acknowledged: " + message.getJMSMessageID());
   }
   ```

   Note
   In this mode, when a message is acknowledged, all messages received before this message are implicitly acknowledged as well. For example, if 10 messages are received, and only the 10th message is acknowledged (in the order the messages are received), then all of the previous nine messages are also acknowledged.

The rest of the steps are identical to the ones in the Getting Started with the Amazon SQS Java Messaging Library (p. 91) example. For a complete example of a synchronous consumer with client acknowledge mode, see `SyncMessageReceiverClientAcknowledge.java` in Working Java Example for Using JMS with Amazon SQS Standard Queues (p. 97).

The output for this example looks similar to the following:

```
JMS Message ID:4example-aa0e-403f-b6df-5e02example5
```

```
Received: Hello World!
Acknowledged: ID:4example-aa0e-403f-b6df-5e02example5
```

Using Unordered Acknowledge Mode

When using `CLIENT_ACKNOWLEDGE` mode, all messages received before an explicitly-acknowledged message are acknowledged automatically. For more information, see Using Client Acknowledge Mode (p. 95).

The Amazon SQS Java Messaging Library provides another acknowledgement mode. When using `UNORDERED_ACKNOWLEDGE` mode, all received messages must be individually and explicitly acknowledged by the client, regardless of their reception order. To do this, create a session with `UNORDERED_ACKNOWLEDGE` mode.

```
// Create the non-transacted session with UNORDERED_ACKNOWLEDGE mode.
Session session = connection.createSession(false, SQSSession.UNORDERED_ACKNOWLEDGE);
```

The remaining steps are identical to the ones in the Using Client Acknowledge Mode (p. 95) example. For a complete example of a synchronous consumer with `UNORDERED_ACKNOWLEDGE` mode, see `SyncMessageReceiverUnorderedAcknowledge.java`.

In this example, the output looks similar to the following:

```
JMS Message ID:dexample-73ad-4adb-bc6c-4357example7
Received: Hello World!
Acknowledged: ID:dexample-73ad-4adb-bc6c-4357example7
```

Using the Amazon SQS Java Message Service (JMS) Client with Other Amazon SQS Clients

Using the Amazon SQS Java Message Service (JMS) Client with the AWS SDK limits Amazon SQS message size to 256 KB. However, you can create a JMS provider using any Amazon SQS client. For example, you can use the JMS Client with the Amazon SQS Extended Client Library for Java to send an Amazon SQS message that contains a reference to a message payload (up to 2 GB) in Amazon S3. For more information, see Managing Large Amazon SQS Messages Using Amazon S3 (p. 86).

The following Java code example creates the JMS provider for the Extended Client Library:

```
AmazonS3 s3 = new AmazonS3Client(credentials);
Region s3Region = Region.getRegion(Regions.US_WEST_2);
s3.setRegion(s3Region);

// Set the Amazon S3 bucket name, and set a lifecycle rule on the bucket to
// permanently delete objects a certain number of days after each object's creation date.
// Next, create the bucket, and enable message objects to be stored in the bucket.
BucketLifecycleConfiguration.Rule expirationRule = new BucketLifecycleConfiguration.Rule();
expirationRule.withExpirationInDays(14).withStatus("Enabled");
BucketLifecycleConfiguration lifecycleConfig = new
 BucketLifecycleConfiguration().withRules(expirationRule);

s3.createBucket(s3BucketName);
s3.setBucketLifecycleConfiguration(s3BucketName, lifecycleConfig);
System.out.println("Bucket created and configured.");

// Set the SQS extended client configuration with large payload support enabled.
ExtendedClientConfiguration extendedClientConfig = new ExtendedClientConfiguration()
    .withLargePayloadSupportEnabled(s3, s3BucketName);
```

```
AmazonSQS sqsExtended = new AmazonSQSExtendedClient(new AmazonSQSClient(credentials),
 extendedClientConfig);
Region sqsRegion = Region.getRegion(Regions.US_WEST_2);
sqsExtended.setRegion(sqsRegion);
```

The following Java code example creates the connection factory:

```
// Create the connection factory using the environment variable credential provider.
// Pass the configured Amazon SQS Extended Client to the JMS connection factory.
SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
        new ProviderConfiguration(),
        sqsExtended
        );

// Create the connection.
SQSConnection connection = connectionFactory.createConnection();
```

Working Java Example for Using JMS with Amazon SQS Standard Queues

The following code examples show how to use JMS with Amazon SQS standard queues. For more information about working with FIFO queues, see To create a FIFO queue (p. 92), Sending Messages Synchronously (p. 92), and Receiving Messages Synchronously (p. 93). (Receiving messages synchronously is the same for standard and FIFO queues. However, messages in FIFO queues contain more attributes.)

ExampleConfiguration.java

The following Java code example sets the default queue name, the region, and the credentials to be used with the other Java examples.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

public class ExampleConfiguration {
    public static final String DEFAULT_QUEUE_NAME = "SQSJMSClientExampleQueue";

    public static final Region DEFAULT_REGION = Region.getRegion(Regions.US_EAST_2);

    private static String getParameter( String args[], int i ) {
        if( i + 1 >= args.length ) {
            throw new IllegalArgumentException( "Missing parameter for " + args[i] );
        }
        return args[i+1];
    }

    /**
```

```
    * Parse the command line and return the resulting config. If the config parsing fails
    * print the error and the usage message and then call System.exit
    *
    * @param app the app to use when printing the usage string
    * @param args the command line arguments
    * @return the parsed config
    */
   public static ExampleConfiguration parseConfig(String app, String args[]) {
       try {
           return new ExampleConfiguration(args);
       } catch (IllegalArgumentException e) {
           System.err.println( "ERROR: " + e.getMessage() );
           System.err.println();
           System.err.println( "Usage: " + app + " [--queue <queue>] [--region <region>]
[--credentials <credentials>] ");
           System.err.println( "  or" );
           System.err.println( "       " + app + " <spring.xml>" );
           System.exit(-1);
           return null;
       }
   }

   private ExampleConfiguration(String args[]) {
       for( int i = 0; i < args.length; ++i ) {
           String arg = args[i];
           if( arg.equals( "--queue" ) ) {
               setQueueName(getParameter(args, i));
               i++;
           } else if( arg.equals( "--region" ) ) {
               String regionName = getParameter(args, i);
               try {
                   setRegion(Region.getRegion(Regions.fromName(regionName)));
               } catch( IllegalArgumentException e ) {
                   throw new IllegalArgumentException( "Unrecognized region " +
regionName );
               }
               i++;
           } else if( arg.equals( "--credentials" ) ) {
               String credsFile = getParameter(args, i);
               try {
                   setCredentialsProvider( new
PropertiesFileCredentialsProvider(credsFile) );
               } catch (AmazonClientException e) {
                   throw new IllegalArgumentException("Error reading credentials from " +
credsFile, e );
               }
               i++;
           } else {
               throw new IllegalArgumentException("Unrecognized option " + arg);
           }
       }
   }

   private String queueName = DEFAULT_QUEUE_NAME;
   private Region region = DEFAULT_REGION;
   private AWSCredentialsProvider credentialsProvider = new
DefaultAWSCredentialsProviderChain();

   public String getQueueName() {
       return queueName;
   }

   public void setQueueName(String queueName) {
       this.queueName = queueName;
   }
```

```
    public Region getRegion() {
        return region;
    }

    public void setRegion(Region region) {
        this.region = region;
    }

    public AWSCredentialsProvider getCredentialsProvider() {
        return credentialsProvider;
    }

    public void setCredentialsProvider(AWSCredentialsProvider credentialsProvider) {
        // Make sure they're usable first
        credentialsProvider.getCredentials();
        this.credentialsProvider = credentialsProvider;
    }
}
```

TextMessageSender.java

The following Java code example creates a text message producer.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

public class TextMessageSender {
    public static void main(String args[]) throws JMSException {
        ExampleConfiguration config = ExampleConfiguration.parseConfig("TextMessageSender",
 args);

        ExampleCommon.setupLogging();

        // Create the connection factory based on the config
        SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
                new ProviderConfiguration(),
                AmazonSQSClientBuilder.standard()
                        .withRegion(config.getRegion().getName())
                        .withCredentials(config.getCredentialsProvider())
                );

        // Create the connection
        SQSConnection connection = connectionFactory.createConnection();

        // Create the queue if needed
        ExampleCommon.ensureQueueExists(connection, config.getQueueName());

        // Create the session
        Session session = connection.createSession(false, Session.AUTO_ACKNOWLEDGE);
        MessageProducer producer =
 session.createProducer( session.createQueue( config.getQueueName() ) );
```

```
        sendMessages(session, producer);

        // Close the connection. This closes the session automatically
        connection.close();
        System.out.println( "Connection closed" );
    }

    private static void sendMessages( Session session, MessageProducer producer ) {
        BufferedReader inputReader = new BufferedReader(
            new InputStreamReader( System.in, Charset.defaultCharset() ) );

        try {
            String input;
            while( true ) {
                System.out.print( "Enter message to send (leave empty to exit): " );
                input = inputReader.readLine();
                if( input == null || input.equals("" ) ) break;

                TextMessage message = session.createTextMessage(input);
                producer.send(message);
                System.out.println( "Send message " + message.getJMSMessageID() );
            }
        } catch (EOFException e) {
            // Just return on EOF
        } catch (IOException e) {
            System.err.println( "Failed reading input: " + e.getMessage() );
        } catch (JMSException e) {
            System.err.println( "Failed sending message: " + e.getMessage() );
            e.printStackTrace();
        }
    }
}
```

SyncMessageReceiver.java

The following Java code example creates a synchronous message consumer.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

public class SyncMessageReceiver {
public static void main(String args[]) throws JMSException {
    ExampleConfiguration config = ExampleConfiguration.parseConfig("SyncMessageReceiver",
 args);

    ExampleCommon.setupLogging();

    // Create the connection factory based on the config
    SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
            new ProviderConfiguration(),
```

```
            AmazonSQSClientBuilder.standard()
                    .withRegion(config.getRegion().getName())
                    .withCredentials(config.getCredentialsProvider())
            );

    // Create the connection
    SQSConnection connection = connectionFactory.createConnection();

    // Create the queue if needed
    ExampleCommon.ensureQueueExists(connection, config.getQueueName());

    // Create the session
    Session session = connection.createSession(false, Session.CLIENT_ACKNOWLEDGE);
    MessageConsumer consumer =
 session.createConsumer( session.createQueue( config.getQueueName() ) );

    connection.start();

    receiveMessages(session, consumer);

    // Close the connection. This closes the session automatically
    connection.close();
    System.out.println( "Connection closed" );
}

private static void receiveMessages( Session session, MessageConsumer consumer ) {
    try {
        while( true ) {
            System.out.println( "Waiting for messages");
            // Wait 1 minute for a message
            Message message = consumer.receive(TimeUnit.MINUTES.toMillis(1));
            if( message == null ) {
                System.out.println( "Shutting down after 1 minute of silence" );
                break;
            }
            ExampleCommon.handleMessage(message);
            message.acknowledge();
            System.out.println( "Acknowledged message " + message.getJMSMessageID() );
        }
    } catch (JMSException e) {
        System.err.println( "Error receiving from SQS: " + e.getMessage() );
        e.printStackTrace();
    }
}
}
```

AsyncMessageReceiver.java

The following Java code example creates an asynchronous message consumer.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
```

```
 */

public class AsyncMessageReceiver {
    public static void main(String args[]) throws JMSException, InterruptedException {
        ExampleConfiguration config =
 ExampleConfiguration.parseConfig("AsyncMessageReceiver", args);

        ExampleCommon.setupLogging();

        // Create the connection factory based on the config
        SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
                new ProviderConfiguration(),
                AmazonSQSClientBuilder.standard()
                        .withRegion(config.getRegion().getName())
                        .withCredentials(config.getCredentialsProvider())
                );

        // Create the connection
        SQSConnection connection = connectionFactory.createConnection();

        // Create the queue if needed
        ExampleCommon.ensureQueueExists(connection, config.getQueueName());

        // Create the session
        Session session = connection.createSession(false, Session.CLIENT_ACKNOWLEDGE);
        MessageConsumer consumer =
 session.createConsumer( session.createQueue( config.getQueueName() ) );

        ReceiverCallback callback = new ReceiverCallback();
        consumer.setMessageListener( callback );

        // No messages are processed until this is called
        connection.start();

        callback.waitForOneMinuteOfSilence();
        System.out.println( "Returning after one minute of silence" );

        // Close the connection. This closes the session automatically
        connection.close();
        System.out.println( "Connection closed" );
    }


    private static class ReceiverCallback implements MessageListener {
        // Used to listen for message silence
        private volatile long timeOfLastMessage = System.nanoTime();

        public void waitForOneMinuteOfSilence() throws InterruptedException {
            for(;;) {
                long timeSinceLastMessage = System.nanoTime() - timeOfLastMessage;
                long remainingTillOneMinuteOfSilence =
                    TimeUnit.MINUTES.toNanos(1) - timeSinceLastMessage;
                if( remainingTillOneMinuteOfSilence < 0 ) {
                    break;
                }
                TimeUnit.NANOSECONDS.sleep(remainingTillOneMinuteOfSilence);
            }
        }


        @Override
        public void onMessage(Message message) {
            try {
                ExampleCommon.handleMessage(message);
                message.acknowledge();
                System.out.println( "Acknowledged message " + message.getJMSMessageID() );
```

```
                timeOfLastMessage = System.nanoTime();
            } catch (JMSException e) {
                System.err.println( "Error processing message: " + e.getMessage() );
                e.printStackTrace();
            }
        }
    }
}
```

SyncMessageReceiverClientAcknowledge.java

The following Java code example creates a synchronous consumer with client acknowledge mode.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */
/**
 * An example class to demonstrate the behavior of CLIENT_ACKNOWLEDGE mode for received
 messages. This example
 * complements the example given in {@link SyncMessageReceiverUnorderedAcknowledge} for
 UNORDERED_ACKNOWLEDGE mode.
 *
 * First, a session, a message producer, and a message consumer are created. Then, two
 messages are sent. Next, two messages
 * are received but only the second one is acknowledged. After waiting for the visibility
 time out period, an attempt to
 * receive another message is made. It's shown that no message is returned for this attempt
 since in CLIENT_ACKNOWLEDGE mode,
 * as expected, all the messages prior to the acknowledged messages are also acknowledged.
 *
 * This ISN'T the behavior for UNORDERED_ACKNOWLEDGE mode. Please see {@link
 SyncMessageReceiverUnorderedAcknowledge}
 * for an example.
 */
public class SyncMessageReceiverClientAcknowledge {

    // Visibility time-out for the queue. It must match to the one set for the queue for
 this example to work.
    private static final long TIME_OUT_SECONDS = 1;

    public static void main(String args[]) throws JMSException, InterruptedException {
        // Create the configuration for the example
        ExampleConfiguration config =
 ExampleConfiguration.parseConfig("SyncMessageReceiverClientAcknowledge", args);

        // Setup logging for the example
        ExampleCommon.setupLogging();

        // Create the connection factory based on the config
        SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
                new ProviderConfiguration(),
                AmazonSQSClientBuilder.standard()
```

```
                        .withRegion(config.getRegion().getName())
                        .withCredentials(config.getCredentialsProvider())
                );

        // Create the connection
        SQSConnection connection = connectionFactory.createConnection();

        // Create the queue if needed
        ExampleCommon.ensureQueueExists(connection, config.getQueueName());

        // Create the session  with client acknowledge mode
        Session session = connection.createSession(false, Session.CLIENT_ACKNOWLEDGE);

        // Create the producer and consume
        MessageProducer producer =
session.createProducer(session.createQueue(config.getQueueName()));
        MessageConsumer consumer =
session.createConsumer(session.createQueue(config.getQueueName()));

        // Open the connection
        connection.start();

        // Send two text messages
        sendMessage(producer, session, "Message 1");
        sendMessage(producer, session, "Message 2");

        // Receive a message and don't acknowledge it
        receiveMessage(consumer, false);

        // Receive another message and acknowledge it
        receiveMessage(consumer, true);

        // Wait for the visibility time out, so that unacknowledged messages reappear in
the queue
        System.out.println("Waiting for visibility timeout...");
        Thread.sleep(TimeUnit.SECONDS.toMillis(TIME_OUT_SECONDS));

        // Attempt to receive another message and acknowledge it. This results in receiving
no messages since
        // we have acknowledged the second message. Although we didn't explicitly
acknowledge the first message,
        // in the CLIENT_ACKNOWLEDGE mode, all the messages received prior to the
explicitly acknowledged message
        // are also acknowledged. Therefore, we have implicitly acknowledged the first
message.
        receiveMessage(consumer, true);

        // Close the connection. This closes the session automatically
        connection.close();
        System.out.println("Connection closed.");
    }

    /**
     * Sends a message through the producer.
     *
     * @param producer Message producer
     * @param session Session
     * @param messageText Text for the message to be sent
     * @throws JMSException
     */
    private static void sendMessage(MessageProducer producer, Session session, String
messageText) throws JMSException {
        // Create a text message and send it
        producer.send(session.createTextMessage(messageText));
    }
```

```
    /**
     * Receives a message through the consumer synchronously with the default timeout
 (TIME_OUT_SECONDS).
     * If a message is received, the message is printed. If no message is received, "Queue
 is empty!" is
     * printed.
     *
     * @param consumer Message consumer
     * @param acknowledge If true and a message is received, the received message is
 acknowledged.
     * @throws JMSException
     */
    private static void receiveMessage(MessageConsumer consumer, boolean acknowledge)
 throws JMSException {
        // Receive a message
        Message message = consumer.receive(TimeUnit.SECONDS.toMillis(TIME_OUT_SECONDS));

        if (message == null) {
            System.out.println("Queue is empty!");
        } else {
            // Since this queue has only text messages, cast the message object and print
 the text
            System.out.println("Received: " + ((TextMessage) message).getText());

            // Acknowledge the message if asked
            if (acknowledge) message.acknowledge();
        }
    }
}
```

SyncMessageReceiverUnorderedAcknowledge.java

The following Java code example creates a synchronous consumer with unordered acknowledge mode.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

/**
 * An example class to demonstrate the behavior of UNORDERED_ACKNOWLEDGE mode for received
 messages. This example
 * complements the example given in {@link SyncMessageReceiverClientAcknowledge} for
 CLIENT_ACKNOWLEDGE mode.
 *
 * First, a session, a message producer, and a message consumer are created. Then, two
 messages are sent. Next, two messages
 * are received but only the second one is acknowledged. After waiting for the visibility
 time out period, an attempt to
 * receive another message is made. It's shown that the first message received in the prior
 attempt is returned again
 * for the second attempt. In UNORDERED_ACKNOWLEDGE mode, all the messages must be
 explicitly acknowledged no matter what
```

```
 * the order they're received.
 *
 * This ISN'T the behavior for CLIENT_ACKNOWLEDGE mode. Please see {@link
 SyncMessageReceiverClientAcknowledge}
 * for an example.
 */
public class SyncMessageReceiverUnorderedAcknowledge {

    // Visibility time-out for the queue. It must match to the one set for the queue for
 this example to work.
    private static final long TIME_OUT_SECONDS = 1;

    public static void main(String args[]) throws JMSException, InterruptedException {
        // Create the configuration for the example
        ExampleConfiguration config =
 ExampleConfiguration.parseConfig("SyncMessageReceiverUnorderedAcknowledge", args);

        // Setup logging for the example
        ExampleCommon.setupLogging();

        // Create the connection factory based on the config
        SQSConnectionFactory connectionFactory = new SQSConnectionFactory(
                new ProviderConfiguration(),
                AmazonSQSClientBuilder.standard()
                        .withRegion(config.getRegion().getName())
                        .withCredentials(config.getCredentialsProvider())
                );

        // Create the connection
        SQSConnection connection = connectionFactory.createConnection();

        // Create the queue if needed
        ExampleCommon.ensureQueueExists(connection, config.getQueueName());

        // Create the session  with unordered acknowledge mode
        Session session = connection.createSession(false,
 SQSSession.UNORDERED_ACKNOWLEDGE);

        // Create the producer and consume
        MessageProducer producer =
 session.createProducer(session.createQueue(config.getQueueName()));
        MessageConsumer consumer =
 session.createConsumer(session.createQueue(config.getQueueName()));

        // Open the connection
        connection.start();

        // Send two text messages
        sendMessage(producer, session, "Message 1");
        sendMessage(producer, session, "Message 2");

        // Receive a message and don't acknowledge it
        receiveMessage(consumer, false);

        // Receive another message and acknowledge it
        receiveMessage(consumer, true);

        // Wait for the visibility time out, so that unacknowledged messages reappear in
 the queue
        System.out.println("Waiting for visibility timeout...");
        Thread.sleep(TimeUnit.SECONDS.toMillis(TIME_OUT_SECONDS));

        // Attempt to receive another message and acknowledge it. This results in receiving
 the first message since
        // we have acknowledged only the second message. In the UNORDERED_ACKNOWLEDGE mode,
 all the messages must
```

```
        // be explicitly acknowledged.
        receiveMessage(consumer, true);

        // Close the connection. This closes the session automatically
        connection.close();
        System.out.println("Connection closed.");
    }

    /**
     * Sends a message through the producer.
     *
     * @param producer Message producer
     * @param session Session
     * @param messageText Text for the message to be sent
     * @throws JMSException
     */
    private static void sendMessage(MessageProducer producer, Session session, String
 messageText) throws JMSException {
        // Create a text message and send it
        producer.send(session.createTextMessage(messageText));
    }

    /**
     * Receives a message through the consumer synchronously with the default timeout
 (TIME_OUT_SECONDS).
     * If a message is received, the message is printed. If no message is received, "Queue
 is empty!" is
     * printed.
     *
     * @param consumer Message consumer
     * @param acknowledge If true and a message is received, the received message is
 acknowledged.
     * @throws JMSException
     */
    private static void receiveMessage(MessageConsumer consumer, boolean acknowledge)
 throws JMSException {
        // Receive a message
        Message message = consumer.receive(TimeUnit.SECONDS.toMillis(TIME_OUT_SECONDS));

        if (message == null) {
            System.out.println("Queue is empty!");
        } else {
            // Since this queue has only text messages, cast the message object and print
 the text
            System.out.println("Received: " + ((TextMessage) message).getText());

            // Acknowledge the message if asked
            if (acknowledge) message.acknowledge();
        }
    }
}
```

SpringExampleConfiguration.xml

The following XML code example is a bean configuration file for SpringExample.java (p. 108).

```
<!--
    Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.

    Licensed under the Apache License, Version 2.0 (the "License").
    You may not use this file except in compliance with the License.
    A copy of the License is located at

    https://aws.amazon.com/apache2.0
```

```
    or in the "license" file accompanying this file. This file is distributed
    on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
    express or implied. See the License for the specific language governing
    permissions and limitations under the License.
-->

<?xml version="1.0" encoding="UTF-8"?>
<beans
    xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:util="http://www.springframework.org/schema/util"
    xmlns:p="http://www.springframework.org/schema/p"
    xsi:schemaLocation="
        http://www.springframework.org/schema/beans http://www.springframework.org/schema/
beans/spring-beans-3.0.xsd
        http://www.springframework.org/schema/util http://www.springframework.org/schema/
util/spring-util-3.0.xsd
    ">

    <bean id="CredentialsProviderBean"
 class="com.amazonaws.auth.DefaultAWSCredentialsProviderChain"/>

    <bean id="ClientBuilder" class="com.amazonaws.services.sqs.AmazonSQSClientBuilder"
 factory-method="standard">
        <property name="region" value="us-east-2"/>
        <property name="credentials" ref="CredentialsProviderBean"/>
    </bean>

    <bean id="ProviderConfiguration"
 class="com.amazon.sqs.javamessaging.ProviderConfiguration">
        <property name="numberOfMessagesToPrefetch" value="5"/>
    </bean>

    <bean id="ConnectionFactory" class="com.amazon.sqs.javamessaging.SQSConnectionFactory">
        <constructor-arg ref="ProviderConfiguration" />
        <constructor-arg ref="ClientBuilder" />
    </bean>

    <bean id="Connection" class="javax.jms.Connection"
        factory-bean="ConnectionFactory"
        factory-method="createConnection"
        init-method="start"
        destroy-method="close" />

    <bean id="QueueName" class="java.lang.String">
        <constructor-arg value="SQSJMSClientExampleQueue"/>
    </bean>
</beans>
```

SpringExample.java

The following Java code example uses the bean configuration file to initialize your objects.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
```

```
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

public class SpringExample {
    public static void main(String args[]) throws JMSException {
        if( args.length != 1 || !args[0].endsWith(".xml")) {
            System.err.println( "Usage: " + SpringExample.class.getName() + " <spring
 config.xml>" );
            System.exit(1);
        }

        File springFile = new File( args[0] );
        if( !springFile.exists() || !springFile.canRead() ) {
            System.err.println( "File " + args[0] + " doesn't exist or isn't readable.");
            System.exit(2);
        }

        ExampleCommon.setupLogging();

        FileSystemXmlApplicationContext context =
            new FileSystemXmlApplicationContext( "file://" +
 springFile.getAbsolutePath() );

        Connection connection;
        try {
            connection = context.getBean(Connection.class);
        } catch( NoSuchBeanDefinitionException e ) {
            System.err.println( "Can't find the JMS connection to use: " +
 e.getMessage() );
            System.exit(3);
            return;
        }

        String queueName;
        try {
            queueName = context.getBean("QueueName", String.class);
        } catch( NoSuchBeanDefinitionException e ) {
            System.err.println( "Can't find the name of the queue to use: " +
 e.getMessage() );
            System.exit(3);
            return;
        }

        if( connection instanceof SQSConnection ) {
            ExampleCommon.ensureQueueExists( (SQSConnection) connection, queueName );
        }

        // Create the session
        Session session = connection.createSession(false, Session.CLIENT_ACKNOWLEDGE);
        MessageConsumer consumer =
 session.createConsumer( session.createQueue( queueName) );

        receiveMessages(session, consumer);

        // The context can be setup to close the connection for us
        context.close();
        System.out.println( "Context closed" );
    }

    private static void receiveMessages( Session session, MessageConsumer consumer ) {
        try {
            while( true ) {
                System.out.println( "Waiting for messages");
```

```
                // Wait 1 minute for a message
                Message message = consumer.receive(TimeUnit.MINUTES.toMillis(1));
                if( message == null ) {
                    System.out.println( "Shutting down after 1 minute of silence" );
                    break;
                }
                ExampleCommon.handleMessage(message);
                message.acknowledge();
                System.out.println( "Acknowledged message" );
            }
        } catch (JMSException e) {
            System.err.println( "Error receiving from SQS: " + e.getMessage() );
            e.printStackTrace();
        }
    }
}
```

ExampleCommon.java

The following Java code example checks if an Amazon SQS queue exists and then creates one if it doesn't. It also includes example logging code.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

public class ExampleCommon {
    /**
     * A utility function to check the queue exists and create it if needed. For most
     * use cases this is usually done by an administrator before the application is run.
     */
    public static void ensureQueueExists(SQSConnection connection, String queueName) throws
 JMSException {
        AmazonSQSMessagingClientWrapper client = connection.getWrappedAmazonSQSClient();

        /**
         * In most cases, you can do this with just a createQueue call, but GetQueueUrl
         * (called by queueExists) is a faster operation for the common case where the
 queue
         * already exists. Also many users and roles have permission to call GetQueueUrl
         * but don't have permission to call CreateQueue.
         */
        if( !client.queueExists(queueName) ) {
            client.createQueue( queueName );
        }
    }

    public static void setupLogging() {
        // Setup logging
        BasicConfigurator.configure();
        Logger.getRootLogger().setLevel(Level.WARN);
    }
```

```
    public static void handleMessage(Message message) throws JMSException {
        System.out.println( "Got message " + message.getJMSMessageID() );
        System.out.println( "Content: ");
        if( message instanceof TextMessage ) {
            TextMessage txtMessage = ( TextMessage ) message;
            System.out.println( "\t" + txtMessage.getText() );
        } else if( message instanceof BytesMessage ){
            BytesMessage byteMessage = ( BytesMessage ) message;
            // Assume the length fits in an int - SQS only supports sizes up to 256k so
 that
            // should be true
            byte[] bytes = new byte[(int)byteMessage.getBodyLength()];
            byteMessage.readBytes(bytes);
            System.out.println( "\t" +  Base64.encodeAsString( bytes ) );
        } else if( message instanceof ObjectMessage ) {
            ObjectMessage objMessage = (ObjectMessage) message;
            System.out.println( "\t" + objMessage.getObject() );
        }
    }
}
```

Supported JMS 1.1 Implementations

The Amazon SQS Java Messaging Library supports the following JMS 1.1 implementations. For more information about the supported features and capabilities of the Amazon SQS Java Messaging Library, see the Amazon SQS FAQ.

Supported Common Interfaces

- `Connection`
- `ConnectionFactory`
- `Destination`
- `Session`
- `MessageConsumer`
- `MessageProducer`

Supported Message Types

- `ByteMessage`
- `ObjectMessage`
- `TextMessage`

Supported Message Acknowledgment Modes

- `AUTO_ACKNOWLEDGE`
- `CLIENT_ACKNOWLEDGE`
- `DUPS_OK_ACKNOWLEDGE`
- `UNORDERED_ACKNOWLEDGE`

> **Note**
> The `UNORDERED_ACKNOWLEDGE` mode isn't part of the JMS 1.1 specification. This mode helps Amazon SQS allow a JMS client to explicitly acknowledge a message.

JMS-Defined Headers and Reserved Properties

For Sending Messages

When you send messages, you can set the following headers and properties for each message:

- `JMSXGroupID` (required for FIFO queues, not allowed for standard queues)
- `JMS_SQS_DeduplicationId` (optional for FIFO queues, not allowed for standard queues)

After you send messages, Amazon SQS sets the following headers and properties for each message:

- `JMSMessageID`
- `JMS_SQS_SequenceNumber` (only for FIFO queues)

For Receiving Messages

When you receive messages, Amazon SQS sets the following headers and properties for each message:

- `JMSDestination`
- `JMSMessageID`
- `JMSRedelivered`
- `JMSXDeliveryCount`
- `JMSXGroupID` (only for FIFO queues)
- `JMS_SQS_DeduplicationId` (only for FIFO queues)
- `JMS_SQS_SequenceNumber` (only for FIFO queues)

Best Practices for Amazon SQS

These best practices can help you make the most of Amazon SQS.

Topics

General Recommendations

The following guidelines can help you reduce costs and process messages efficiently using Amazon SQS.

Working with Messages

Processing Messages in a Timely Manner

Setting the visibility timeout depends on how long it takes your application to process and delete a message. For example, if your application requires 10 seconds but you set the visibility timeout to 15 minutes, you might have to wait too long to process a message. Alternatively, if your application requires 10 seconds but you set the visibility timeout to 2 seconds, a duplicate might be received by another receiver.

To ensure that there is sufficient time to process a message, use one of the following strategies:

- If you know (or can reasonably estimate) how long it takes to process a message, extend the message's *visibility timeout* to the maximum time it takes to process and delete the message. For more information, see Configuring the Visibility Timeout (p. 61) and Changing a Message's Visibility Timeout (p. 61).
- If you don't know how long it takes to process a message, specify the initial visibility timeout (for example, 2 minutes) and the period of time after which you can check whether the message is processed (for example, 1 minute). If the message isn't processed, extend the visibility timeout (for example, to 3 minutes).

  Note
  If you need to extend the visibility timeout for longer than 12 hours, consider using AWS Step Functions.

Handling Request Errors

To handle request errors, use one of the following strategies:

- If you use an AWS SDK, you already have automatic *retry and backoff* logic at your disposal. For more information, see Error Retries and Exponential Backoff in AWS in the *Amazon Web Services General Reference*.
- If you don't use the AWS SDK features for retry and backoff, allow a pause (for example, 200 ms) before retrying the ReceiveMessage action after receiving no messages, a timeout, or an error message from Amazon SQS. For subsequent use of `ReceiveMessage` that gives the same results, allow a longer pause (for example, 400 ms).

Capturing Problematic Messages

To capture all messages that can't be processed, and to ensure the correctness of CloudWatch metrics, configure a dead-letter queue (p. 62).

- The redrive policy redirects messages to a dead-letter queue after the source queue fails to process a message a specified number of times.
- Using a dead-letter queue decreases the number of messages and reduces the possibility of exposing you to *poison pill* messages (messages that are received but can't be processed).
- Including a poison pill message in a queue can distort the `ApproximateAgeOfOldestMessage` (p. 126) CloudWatch metric by giving an incorrect age of the poison pill message. Configuring a dead-letter queue helps avoid false alarms when using this metric.

Setting Up Dead-Letter Queue Retention

The expiration of a message is always based on its original enqueue timestamp. When a message is moved to a dead-letter queue (p. 62), the enqueue timestamp remains unchanged. For example, if a message spends 1 day in the original queue before being moved to a dead-letter queue, and the retention period of the dead-letter queue is set to 4 days, the message is deleted from the dead-letter queue after 3 days. Thus, it is a best practice to always set the retention period of a dead-letter queue to be longer than the retention period of the original queue.

Avoiding Inconsistent Message Processing

To avoid inconsistent message processing by standard queues, avoid setting the number of maximum receives to 1 when you configure a dead-letter queue.

> **Important**
> In some unlikely scenarios, if you set the number of maximum receives to 1, any time a `ReceiveMessage` call fails, a message might be moved to a dead-letter queue without being received.

Reducing Costs

Batching Message Actions

To reduce costs, batch your message actions:

- To send, receive, and delete messages, and to change the message visibility timeout for multiple messages with a single action, use the Amazon SQS batch API actions (p. 173).
- To combine client-side buffering with request batching, use long polling together with the buffered asynchronous client (p. 174) included with the AWS SDK for Java.

> **Note**
> The Amazon SQS Buffered Asynchronous Client doesn't currently support FIFO queues.

Using the Appropriate Polling Mode

To take advantage of additional potential reduced cost or near-instantaneous response, use one of the following polling modes:

- Long polling lets you consume messages from your Amazon SQS queue as soon as they become available.

  - To reduce the cost of using Amazon SQS and to decrease the number of empty receives to an empty queue (responses to the `ReceiveMessage` action which return no messages), enable long polling. For more information, see Amazon SQS Long Polling (p. 75).
  - To increase efficiency when polling for multiple threads with multiple receives, decrease the number of threads.
  - Long polling is preferable over short polling in most cases.
- Short polling returns responses immediately, even if the polled Amazon SQS queue is empty.
  - To satisfy the requirements of an application that expects immediate responses to the `ReceiveMessage` request, use short polling.
  - Short polling is billed the same as long polling.

Moving from a Standard Queue to a FIFO Queue

- If you're not setting the `DelaySeconds` parameter on each message, you can move to a FIFO queue by providing a message group ID for every sent message. For more information, see Moving from a Standard Queue to a FIFO Queue (p. 57).

Recommendations for FIFO (First-In-First-Out) Queues

The following guidelines can help you use the message deduplication ID and message group ID optimally. For more information, see the `SendMessage` and `SendMessageBatch` actions in the *Amazon Simple Queue Service API Reference*.

Using the Message Deduplication ID

The message deduplication ID is the token used for deduplication of sent messages. If a message with a particular message deduplication ID is sent successfully, any messages sent with the same message deduplication ID are accepted successfully but aren't delivered during the 5-minute deduplication interval.

> **Note**
> Message deduplication applies to an entire queue, not to individual message groups.
> Amazon SQS continues to keep track of the message deduplication ID even after the message is received and deleted.

Providing the Message Deduplication ID

The producer should provide message deduplication ID values for each message send in the following scenarios:

- Messages sent with identical message bodies that Amazon SQS must treat as unique.
- Messages sent with identical content but different message attributes that Amazon SQS must treat as unique.
- Messages sent with different content (for example, retry counts included in the message body) that Amazon SQS must treat as duplicates.

Enabling Deduplication for a Single-Producer/Consumer System

If you have a single producer and a single consumer and the messages are unique because an application-specific message ID is included in the body of the message, follow these guidelines:

- Enable content-based deduplication for the queue (each of your messages has a unique body). The producer can omit the message deduplication ID.
- Although the consumer isn't required to provide a receive request attempt ID for each request, it's a best practice because it allows fail-retry sequences to execute faster.
- You can retry send or receive requests because they don't interfere with the ordering of messages in FIFO queues.

Designing for Outage Recovery Scenarios

The deduplication process in FIFO queues is time-sensitive. When designing your application, ensure that both the producer and the consumer can recover in case of a client or network outage.

- The producer must be aware of the deduplication interval of the queue. Amazon SQS has a *minimum* deduplication interval of 5 minutes. Retrying `SendMessage` requests after the deduplication interval expires can introduce duplicate messages into the queue. For example, a mobile device in a car sends messages whose order is important. If the car loses cellular connectivity for a period of time before receiving an acknowledgement, retrying the request after regaining cellular connectivity can create a duplicate.
- The consumer must have a visibility timeout that minimizes the risk of being unable to process messages before the visibility timeout expires. You can extend the visibility timeout while the messages are being processed by calling the `ChangeMessageVisibility` action. However, if the visibility timeout expires, another consumer can immediately begin to process the messages, causing a message to be processed multiple times. To avoid this scenario, configure a dead-letter queue (p. 62).

Using the Message Group ID

The message group ID is the tag that specifies that a message belongs to a specific message group. Messages that belong to the same message group are always processed one by one, in a strict order relative to the message group (however, messages that belong to different message groups might be processed out of order).

Interleaving Multiple Ordered Message Groups

To interleave multiple ordered message groups within a single FIFO queue, use message group ID values (for example, session data for multiple users). In this scenario, multiple consumers can process the queue, but the session data of each user is processed in a FIFO manner.

> **Note**
> When messages that belong to a particular message group ID are invisible, no other consumer can process messages with the same message group ID.

Avoiding Processing Duplicates in a Multiple-Producer/Consumer System

To avoid processing duplicate messages in a system with multiple producers and consumers where throughput and latency are more important than ordering, the producer should generate a unique message group ID for each message.

Note
In this scenario, duplicates are eliminated. However, the ordering of message can't be guaranteed.
Any scenario with multiple producers and consumers increases the risk of inadvertently delivering a duplicate message if a worker doesn't process the message within the visibility timeout and the message becomes available to another worker.

Using the Receive Request Attempt ID

The receive request attempt ID is the large, non-consecutive number that Amazon SQS assigns to each message.

During a long-lasting network outage that causes connectivity issues between your SDK and Amazon SQS, it's a best practice to provide the receive request attempt ID and to retry with the same receive request attempt ID if the SDK operation fails.

Amazon SQS Limits

This topic lists limits within Amazon Simple Queue Service (Amazon SQS).

Topics

Limits Related to Queues

The following table lists limits related to queues.

Limit	Description
Inflight messages per queue	For standard queues, there can be a maximum of 120,000 inflight messages per queue. If you reach this limit, Amazon SQS returns the `OverLimit` error message. To avoid reaching the limit, you should delete messages from the queue after they're processed. You can also increase the number of queues you use to process your messages.
	For FIFO queues, there can be a maximum of 20,000 inflight messages per queue. If you reach this limit, Amazon SQS returns no error messages.
Queue name	A queue name can have up to 80 characters. The following characters are accepted: alphanumeric characters, hyphens (-), and underscores (_). **Note** Queue names are case-sensitive (for example, `Test-queue` and `test-queue` are different queues).
	The name of a FIFO queue must end with the `.fifo` suffix. The suffix counts towards the 80-character queue name limit. To determine whether a queue is FIFO (p. 51), you can check whether the queue name ends with the suffix.
Queue tag	We don't recommend adding more than 50 tags to a queue.
	The tag `Key` is required, but the tag `Value` is optional.
	The tag `Key` and tag `Value` are case-sensitive.
	The tag `Key` and tag `Value` can include Unicode alphanumeric characters in UTF-8 and whitespaces. The following special characters are allowed: `_ . : / = + - @`
	The tag `Key` or `Value` must not include the reserved prefix `aws:` (you can't delete tag keys or values with this prefix).

Limit	Description
	The maximum tag `Key` length is 128 Unicode characters in UTF-8. The tag `Key` must not be empty or null.
	The maximum tag `Value` length is 256 Unicode characters in UTF-8. The tag `Value` may be empty or null.
	Tagging API actions are limited to 5 TPS per AWS account. If your application requires a higher throughput, file a technical support request.

Limits Related to Messages

The following table lists limits related to messages.

Limit	Description
Message attributes	A message can contain up to 10 metadata attributes.
Message batch	A single message batch request can include a maximum of 10 messages. For more information, see Configuring AmazonSQSBufferedAsyncClient (p. 175) in the Amazon SQS Batch API Actions (p. 173) section.
Message content	A message can include only XML, JSON, and unformatted text. The following Unicode characters are allowed: `#x9` | `#xA` | `#xD` | `#x20` to `#xD7FF` | `#xE000` to `#xFFFD` | `#x10000` to `#x10FFFF` Any characters not included in this list are rejected. For more information, see the W3C specification for characters.
Message retention	By default, a message is retained for 4 days. The minimum is 60 seconds (1 minute). The maximum is 1,209,600 seconds (14 days).
Message throughput	Standard queues support a nearly unlimited number of transactions per second (TPS) per API action.
	• FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). • When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.
Message size	The minimum message size is 1 byte (1 character). The maximum is 262,144 bytes (256 KB). To send messages larger than 256 KB, you can use the Amazon SQS Extended Client Library for Java. This library allows you to send an Amazon SQS message that contains a reference to a message payload in Amazon S3. The maximum payload size is 2 GB.

Limit	Description
Message visibility timeout	The default visibility timeout for a message is 30 seconds. The maximum is 12 hours.
Policy information	The maximum limit is 8,192 bytes, 20 statements, 50 principals, or 10 conditions. For more information, see Limits Related to Policies (p. 120).

Limits Related to Policies

The following table lists limits related to policies.

Name	Maximum Size
Bytes	8192
Conditions	10
Principals	50
Statements	20

Monitoring and Logging Amazon SQS Queues

This section provides information about monitoring and logging Amazon SQS queues.

Topics

Monitoring Amazon SQS using CloudWatch

Amazon SQS and Amazon CloudWatch are integrated so you can use CloudWatch to view and analyze metrics for your Amazon SQS queues. You can view and analyze your queues' metrics from the Amazon SQS console (p. 121), the CloudWatch console (p. 122), using the AWS CLI (p. 123), or using the CloudWatch API (p. 123). You can also set CloudWatch alarms (p. 123) for Amazon SQS metrics.

CloudWatch metrics for your Amazon SQS queues are automatically collected and pushed to CloudWatch every five minutes. These metrics are gathered on all queues that meet the CloudWatch guidelines for being *active*. CloudWatch considers a queue to be active for up to six hours if it contains any messages or if any API action accesses it.

> **Note**
> There is no charge for the Amazon SQS metrics reported in CloudWatch. They're provided as part of the Amazon SQS service.
> Detailed monitoring (or one-minute metrics) is currently unavailable for Amazon SQS. Making requests to CloudWatch at this resolution might return no data.
> CloudWatch metrics are supported for both standard and FIFO queues.

Topics

Access CloudWatch Metrics for Amazon SQS

Amazon SQS and Amazon CloudWatch are integrated so you can use CloudWatch to view and analyze metrics for your Amazon SQS queues. You can view and analyze your queues' metrics from the Amazon SQS console (p. 121), the CloudWatch console (p. 122), using the AWS CLI (p. 123), or using the CloudWatch API (p. 123). You can also set CloudWatch alarms (p. 123) for Amazon SQS metrics.

Amazon SQS Console

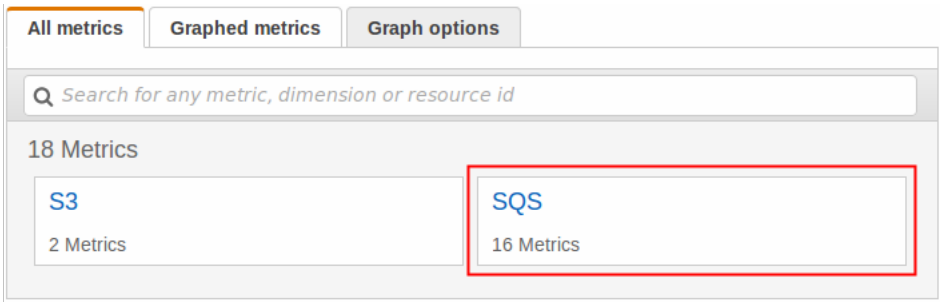
1. Sign in to the Amazon SQS console.
2. In the list of queues, choose (check) the boxes for the queues that you want to access metrics for. You can show metrics for up to 10 queues.

3. Choose the **Monitoring** tab.

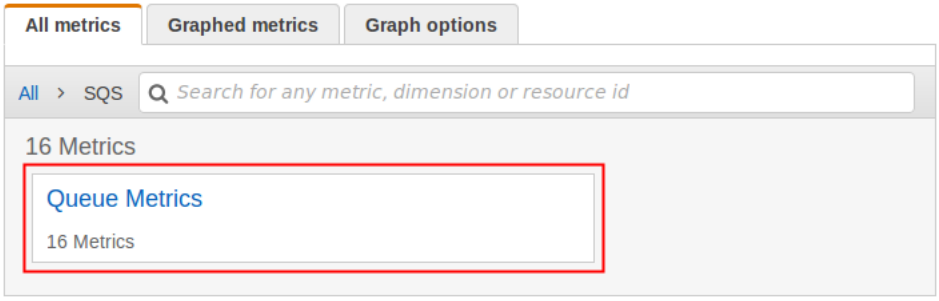
   Various graphs are displayed in the **SQS metrics** section.
4. To understand what a particular graph represents, hover over ⓘ next to the desired graph, or see Available CloudWatch Metrics for Amazon SQS (p. 126).
5. To change the time range for all of the graphs at the same time, for **Time Range**, choose the desired time range (for example, **Last Hour**).
6. To view additional statistics for an individual graph, choose the graph.
7. In the **CloudWatch Monitoring Details** dialog box, select a **Statistic**, (for example, **Sum**). For a list of supported statistics, see Available CloudWatch Metrics for Amazon SQS (p. 126).
8. To change the time range and time interval that an individual graph displays (for example, to show a time range of the last 24 hours instead of the last 5 minutes, or to show a time period of every hour instead of every 5 minutes), with the graph's dialog box still displayed, for **Time Range**, choose the desired time range (for example, **Last 24 Hours**). For **Period**, choose the desired time period within the specified time range (for example, **1 Hour**). When you're finished looking at the graph, choose **Close**.
9. (Optional) To work with additional CloudWatch features, on the **Monitoring** tab, choose **View all CloudWatch metrics**, and then follow the instructions in the Amazon CloudWatch Console (p. 122) procedure.

Amazon CloudWatch Console

1. Sign in to the CloudWatch console.
2. On the navigation panel, choose **Metrics**.
3. Select the **SQS** metric namespace.

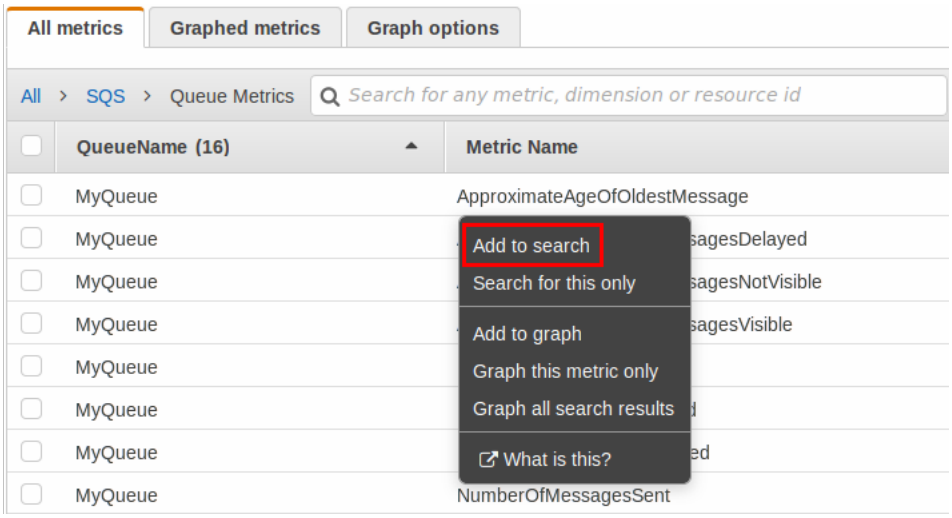


4. Select the **Queue Metrics** metric dimension.



5. You can now examine your Amazon SQS metrics:

   - To sort the metrics, use the column heading.
   - To graph a metric, select the check box next to the metric.
   - To filter by metric, choose the metric name and then choose **Add to search**.



For more information and additional options, see Graph Metrics and Using Amazon CloudWatch Dashboards in the *Amazon CloudWatch User Guide*.

AWS Command Line Interface

To access Amazon SQS metrics using the AWS CLI, run the `get-metric-statistics` command.

For more information, see Get Statistics for a Metric in the *Amazon CloudWatch User Guide*.

CloudWatch API

To access Amazon SQS metrics using the CloudWatch API, use the `GetMetricStatistics` API action.

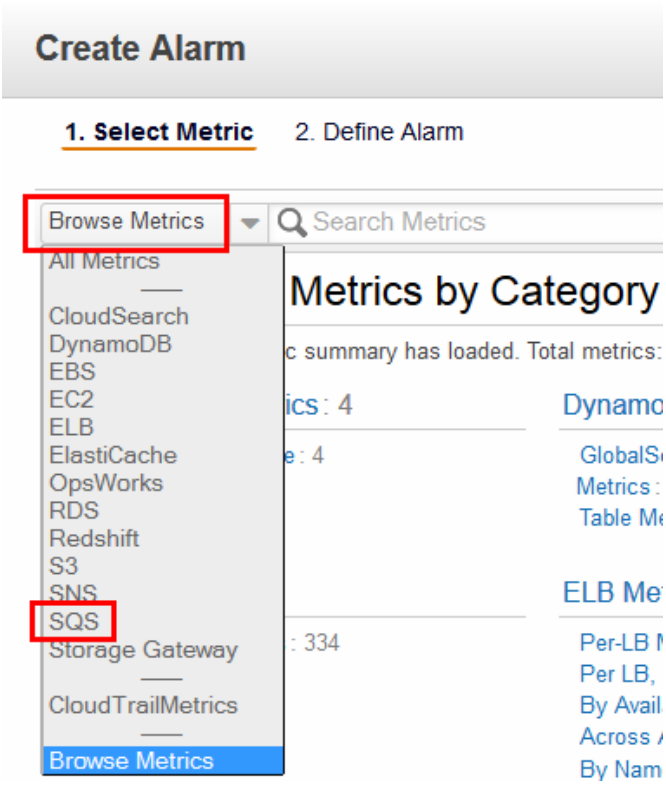
For more information, see Get Statistics for a Metric in the *Amazon CloudWatch User Guide*.

Setting CloudWatch Alarms for Amazon SQS Metrics

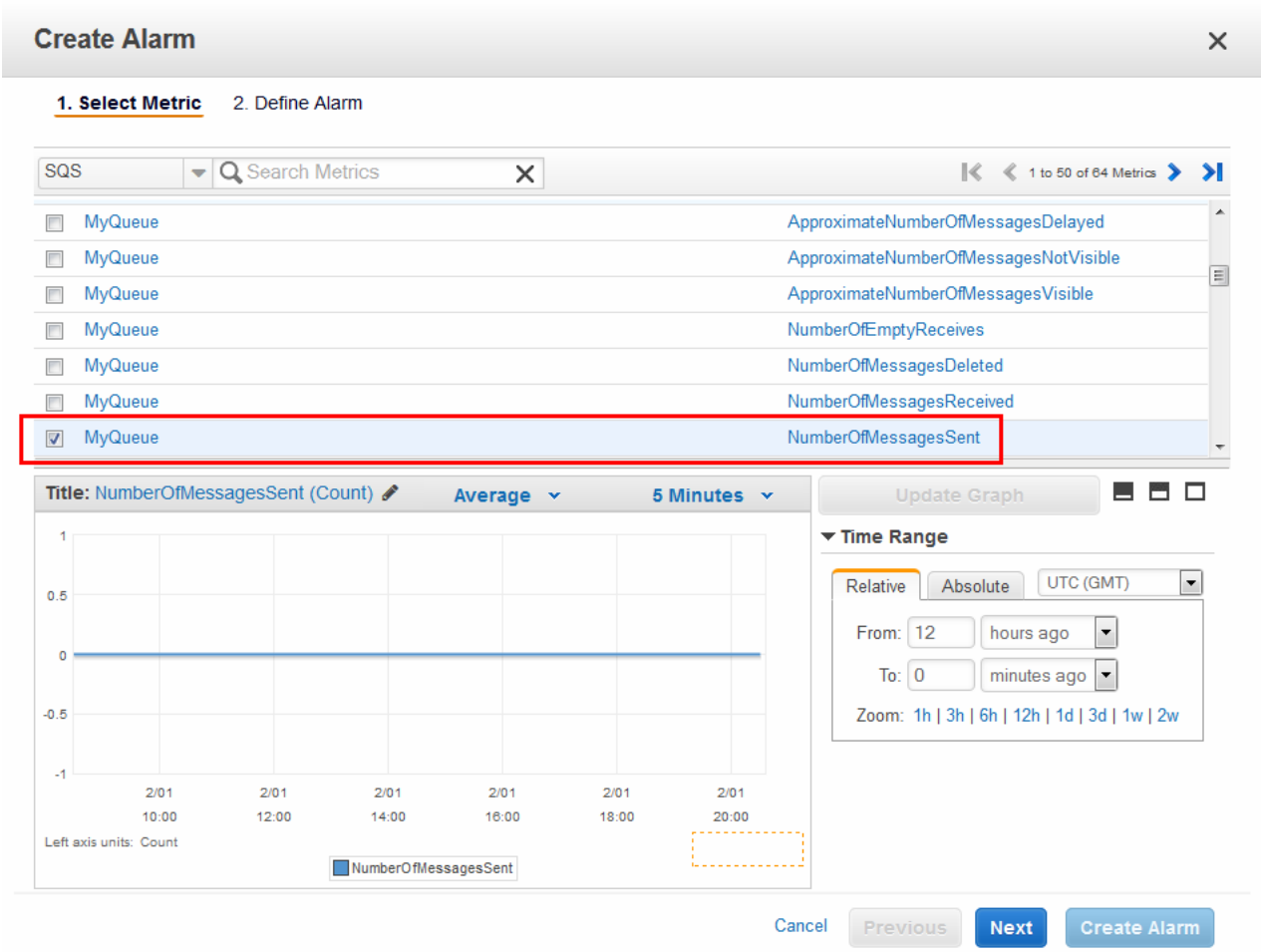
CloudWatch allows you to trigger alarms when a threshold is met for a metric. For example, you can set an alarm for the `NumberOfMessagesSent` metric so that when the number of messages exceeds a specified limit over a specified time period, then an email notification can be sent to inform you of the event.

Amazon CloudWatch Console

1. Sign in to the AWS Management Console and open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Alarms**, and then choose **Create Alarm**. The **Create Alarm** dialog box displays.
3. On the **Select Metric** page, choose **Browse Metrics**, **SQS**:

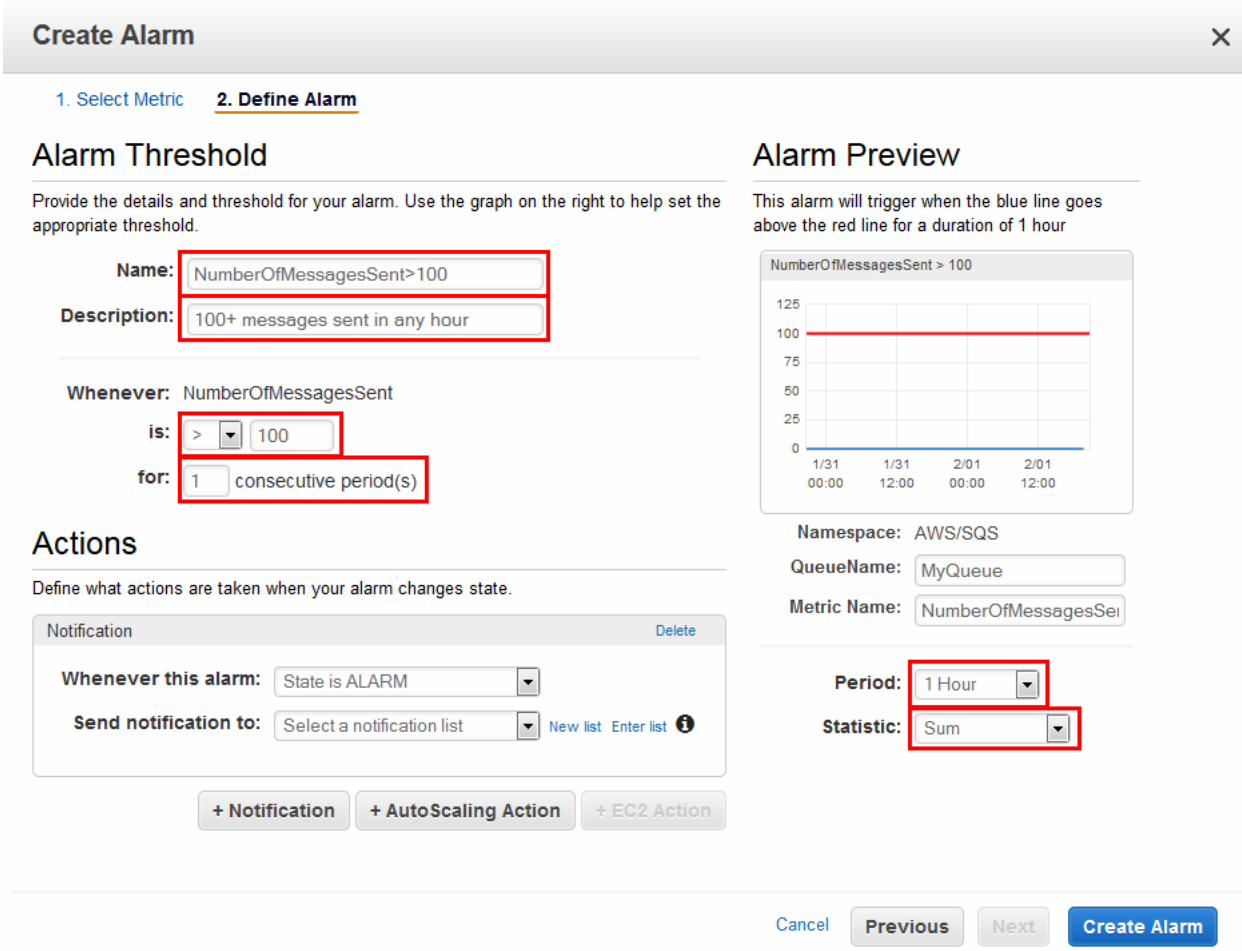


4. For **SQS > Queue Metrics**, choose (check) the box that you want to set an alarm for the combination of **QueueName** and **Metric Name**. (For a list of available metrics, see Available CloudWatch Metrics for Amazon SQS (p. 126)). For example, choosing (checking) the box for **MyQueue**, **NumberOfMessagesSent** sets an alarm based on the number of messages sent to the `MyQueue` queue.



5. Choose **Next**. The **Define Alarm** page displays.
6. For **Alarm Threshold**, fill in the **Name** and **Description** boxes. For **is**, **for**, **Period**, and **Statistic**, specify the conditions for the alarm. For example, let's say you chose (checked) the box for **MyQueue**, **NumberOfMessagesSent** on the **Select Metric** page, and you want to alarm when more than 100 messages are sent in any hour to the `MyQueue` queue. You'd then set the following:

   - Set **is** to **> 100**.
   - Set **for** to **1**.
   - Set **Period** to **1 Hour**.
   - Set **Statistic** to **Sum**.



7. For **Actions** and **Whenever this alarm**, choose **State is ALARM**. For **Send notification to**, if you want CloudWatch to send you an email when the alarm state is reached, either select an existing Amazon SNS topic or choose **New list**. If you choose **New list**, you can set the name and list comma-separated email addresses for a new topic. This list is saved; it appears for future alarms.

   Note
   If you choose **New list** to create a new Amazon SNS topic, the email addresses must be verified before they receive any notifications. Emails are sent only when the alarm enters an alarm state. If this alarm state change happens before the email addresses are verified, they won't receive a notification.

8. Choose **Create Alarm**. CloudWatch creates the alarm and then displays the alarms list.

For more information, see Creating Amazon CloudWatch Alarms.

Available CloudWatch Metrics for Amazon SQS

Amazon SQS sends the following metrics to CloudWatch.

Note
For standard queues, the result is approximate because of the distributed architecture of Amazon SQS. In most cases, the count should be close to the actual number of messages in the queue.
For FIFO queues, the result is exact.

Amazon SQS Metrics

The `AWS/SQS` namespace includes the following metrics.

Metric	Description
`ApproximateAgeOfOldestMessage`	The approximate age of the oldest non-deleted message in the queue. Units: *Seconds* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)
`ApproximateNumberOfMessagesDelayed`	The number of messages in the queue that are delayed and not available for reading immediately. This can happen when the queue is configured as a delay queue or when a message has been sent with a delay parameter. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)
`ApproximateNumberOfMessagesNotVisible`	The number of messages that are "in flight." Messages are considered in flight if they have been sent to a client but have not yet been deleted or have not yet reached the end of their visibility window. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)
`ApproximateNumberOfMessagesVisible`	The number of messages available for retrieval from the queue. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)
`NumberOfEmptyReceives`	The number of `ReceiveMessage` API calls that did not return a message. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)

Metric	Description
`NumberOfMessagesDeleted`	The number of messages deleted from the queue. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console) Amazon SQS emits the `NumberOfMessagesDeleted` metric for every successful deletion operation that uses a valid receipt handle, including duplicate deletions. The following scenarios might cause the value of the `NumberOfMessagesDeleted` metric to be higher than expected: • Calling the `DeleteMessage` action on different receipt handles that belong to the same message: If the message is not processed before the visibility timeout expires, the message becomes available to other consumers that can process it and delete it again, increasing the value of the `NumberOfMessagesDeleted` metric. • Calling the `DeleteMessage` action on the same receipt handle: If the message is processed and deleted but you call the `DeleteMessage` action again using the same receipt handle, a success status is returned, increasing the value of the `NumberOfMessagesDeleted` metric.
`NumberOfMessagesReceived`	The number of messages returned by calls to the `ReceiveMessage` API action. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)
`NumberOfMessagesSent`	The number of messages added to a queue. Units: *Count* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console)

Metric	Description
`SentMessageSize`	The size of messages added to a queue. Units: *Bytes* Valid Statistics: Average, Minimum, Maximum, Sum, Data Samples (displays as Sample Count in the Amazon SQS console) Note that `SentMessageSize` does not display as an available metric in the CloudWatch console until at least one message is sent to the corresponding queue.

Dimensions for Amazon SQS Metrics

The only dimension that Amazon SQS sends to CloudWatch is `QueueName`. This means that all available statistics are filtered by `QueueName`.

Logging Amazon SQS API Actions Using AWS CloudTrail

Amazon SQS is integrated with CloudTrail, a service that captures API calls made by or on behalf of Amazon SQS in your AWS account and delivers the log files to the specified Amazon S3 bucket. CloudTrail captures API calls made from the Amazon SQS console or from the Amazon SQS API. You can use the information collected by CloudTrail to determine which requests are made to Amazon SQS, the source IP address from which the request is made, who made the request, when it is made, and so on. To learn more about CloudTrail, including how to configure and enable it, see the *AWS CloudTrail User Guide*.

CloudTrail is supported for both standard and FIFO queues.

Amazon SQS Information in CloudTrail

When CloudTrail logging is enabled in your AWS account, API calls made to Amazon SQS actions are tracked in log files. Amazon SQS 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.

The following actions are supported:

- AddPermission
- CreateQueue
- DeleteQueue
- PurgeQueue
- RemovePermission
- SetQueueAttributes

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 root 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.

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 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 for CloudTrail.

You can also aggregate Amazon SQS log files from multiple AWS regions and multiple AWS accounts into a single Amazon S3 bucket. For more information, see Receiving CloudTrail Log Files from Multiple Regions.

Understanding Amazon SQS Log File Entries

CloudTrail log files 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 aren't guaranteed to be in any particular order. That is, they're not an ordered stack trace of the public API calls.

AddPermission

The following example shows a CloudTrail log entry for AddPermission:


```
{
  "Records": [
    {
      "eventVersion": "1.01",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },
      "eventTime": "2014-07-16T00:44:19Z",
      "eventSource": "sqs.amazonaws.com",
      "eventName": "AddPermission",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (X11; Linux x86_64; rv:24.0) Gecko/20100101 Firefox/24.0",
      "requestParameters": {
        "actions": [
          "SendMessage"
        ],
        "aWSAccountIds": [
          "123456789012"
        ],
        "label": "label",
        "queueUrl": "https://test-sqs.amazon.com/123456789012/hello1"
      },
      "responseElements": null,
      "requestID": "334ccccd-b9bb-50fa-abdb-80f274981d60",
      "eventID": "0552b000-09a3-47d6-a810-c5f9fd2534fe"
    }
  ]
}
```

CreateQueue

The following example shows a CloudTrail log entry for CreateQueue:


```
{
  "Records": [
    {
      "eventVersion": "1.01",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },
      "eventTime": "2014-07-16T00:42:42Z",
      "eventSource": "sqs.amazonaws.com",
      "eventName": "CreateQueue",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (X11; Linux x86_64; rv:24.0) Gecko/20100101 Firefox/24.0",
      "requestParameters": {
        "queueName": "hello1"
      },
      "responseElements": {
        "queueUrl": "https://test-sqs.amazon.com/123456789012/hello1"
      },
      "requestID": "49ebbdb7-5cd3-5323-8a00-f1889011fee9",
      "eventID": "68f4e71c-4f2f-4625-8378-130ac89660b1"
    }
  ]
}
```


DeleteQueue

The following example shows a CloudTrail log entry for DeleteQueue:


```
{
  "Records": [
    {
      "eventVersion": "1.01",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },
      "eventTime": "2014-07-16T00:44:47Z",
      "eventSource": "sqs.amazonaws.com",
      "eventName": "DeleteQueue",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (X11; Linux x86_64; rv:24.0) Gecko/20100101 Firefox/24.0",
      "requestParameters": {
        "queueUrl": "https://test-sqs.amazon.com/123456789012/hello1"
      },
      "responseElements": null,
      "requestID": "e4c0cc05-4faa-51d5-aab2-803a8294388d",
      "eventID": "af1bb158-6443-4b4d-abfd-1b867280d964"
```

```
    }
  ]
}
```

RemovePermission

The following example shows a CloudTrail log entry for RemovePermission:

```
{
  "Records": [
    {
      "eventVersion": "1.01",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },
      "eventTime": "2014-07-16T00:44:36Z",
      "eventSource": "sqs.amazonaws.com",
      "eventName": "RemovePermission",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (X11; Linux x86_64; rv:24.0) Gecko/20100101 Firefox/24.0",
      "requestParameters": {
        "label": "label",
        "queueUrl": "https://test-sqs.amazon.com/123456789012/hello1"
      },
      "responseElements": null,
      "requestID": "48178821-9c2b-5be0-88bf-c41e5118162a",
      "eventID": "fed8a623-3fe9-4e64-9543-586d9e500159"
    }
  ]
}
```

SetQueueAttributes

The following example shows a CloudTrail log entry for SetQueueAttributes:

```
{
  "Records": [
    {
      "eventVersion": "1.01",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },
      "eventTime": "2014-07-16T00:43:15Z",
      "eventSource": "sqs.amazonaws.com",
      "eventName": "SetQueueAttributes",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (X11; Linux x86_64; rv:24.0) Gecko/20100101 Firefox/24.0",
      "requestParameters": {
        "attributes": {
          "VisibilityTimeout": "100"
```

```
        },
        "queueUrl": "https://test-sqs.amazon.com/123456789012/hello1"
      },
      "responseElements": null,
      "requestID": "7f15d706-f3d7-5221-b9ca-9b393f349b79",
      "eventID": "8b6fb2dc-2661-49b1-b328-94317815088b"
    }
  ]
}
```

Amazon SQS Security

This section provides information about Amazon SQS security, authentication and access control, and the access policy language.

Topics

Authentication and Access Control for Amazon SQS

Access to Amazon SQS requires credentials that AWS can use to authenticate your requests. These credentials must have permissions to access AWS resources, such an Amazon SQS queues and messages. The following sections provide details on how you can use AWS Identity and Access Management (IAM) and Amazon SQS to help secure your resources by controlling access to them.

Topics

Authentication

You can access AWS as any of the following types of identities:

- **AWS account root user** – When you first create an AWS account, you begin with a single sign-in identity that has complete access to all AWS services and resources in the account. This identity is called the AWS account *root user* and is accessed by signing in with the email address and password that you used to create the account. We strongly recommend that you do not use the root user for your everyday tasks, even the administrative ones. Instead, adhere to the best practice of using the root user only to create your first IAM user. Then securely lock away the root user credentials and use them to perform only a few account and service management tasks.
- **IAM user** – An IAM user is an identity within your AWS account that has specific custom permissions (for example, permissions to create a queue in Amazon SQS). You can use an IAM user name and password to sign in to secure AWS webpages like the AWS Management Console, AWS Discussion Forums, or the AWS Support Center.

  In addition to a user name and password, you can also generate access keys for each user. You can use these keys when you access AWS services programmatically, either through one of the several SDKs or by using the AWS Command Line Interface (CLI). The SDK and CLI tools use the access keys to cryptographically sign your request. If you don't use AWS tools, you must sign the request yourself. Amazon SQS supports *Signature Version 4*, a protocol for authenticating inbound API requests. For

more information about authenticating requests, see Signature Version 4 Signing Process in the *AWS General Reference*.

- **IAM role** – An IAM role is an IAM identity that you can create in your account that has specific permissions. It is similar to an *IAM user*, but it is not associated with a specific person. An IAM role enables you to obtain temporary access keys that can be used to access AWS services and resources. IAM roles with temporary credentials are useful in the following situations:

  - **Federated user access** – Instead of creating an IAM user, you can use existing user identities from AWS Directory Service, your enterprise user directory, or a web identity provider. These are known as *federated users*. AWS assigns a role to a federated user when access is requested through an identity provider. For more information about federated users, see Federated Users and Roles in the *IAM User Guide*.

  - **AWS service access** – You can use an IAM role in your account to grant an AWS service permissions to access your account's resources. For example, you can create a role that allows Amazon Redshift to access an Amazon S3 bucket on your behalf and then load data from that bucket into an Amazon Redshift cluster. For more information, see Creating a Role to Delegate Permissions to an AWS Service in the *IAM User Guide*.

  - **Applications running on Amazon EC2** – You can use an IAM role to manage temporary credentials for applications that are running on an EC2 instance and making AWS API requests. This is preferable to storing access keys within the EC2 instance. To assign an AWS role to an EC2 instance and make it available to all of its applications, you create an instance profile that is attached to the instance. An instance profile contains the role and enables programs that are running on the EC2 instance to get temporary credentials. For more information, see Using an IAM Role to Grant Permissions to Applications Running on Amazon EC2 Instances in the *IAM User Guide*.

Access Control

Amazon SQS has its own resource-based permissions system that uses policies written in the same language used for AWS Identity and Access Management (IAM) policies. This means that you can achieve similar things with Amazon SQS policies and IAM policies.

> **Note**
> It is important to understand that all AWS accounts can delegate their permissions to users under their accounts. Cross-account access allows you to share access to your AWS resources without having to manage additional users. For information about using cross-account access, see Enabling Cross-Account Access in the *IAM User Guide*.
> Currently, Amazon SQS supports only a limited subset of the condition keys available in IAM. For more information, see Actions and Resource Reference (p. 158).

The following sections describe how to manage permissions for Amazon SQS. We recommend that you read the overview first.

- Overview of Managing Access Permissions to Your Amazon Simple Queue Service Resource (p. 136)
- Using Identity-Based Policies (IAM) Policies for Amazon SQS (p. 140)
- Creating Custom Policies Using the Amazon SQS Access Policy Language (p. 148)
- Using Temporary Security Credentials (p. 156)
- Actions and Resource Reference (p. 158)

Overview of Managing Access Permissions to Your Amazon Simple Queue Service Resource

Every AWS resource is owned by an AWS account, and permissions to create or access a resource are governed by permissions policies. An account administrator can attach permissions policies to IAM identities (users, groups, and roles), and some services (such as Amazon SQS) also support attaching permissions policies to resources.

> **Note**
> An *account administrator* (or administrator user) is a user with administrative privileges. For more information, see IAM Best Practices in the *IAM User Guide*.

When granting permissions, you specify what users get permissions, the resource they get permissions for, and the specific actions that you want to allow on the resource.

Topics

Amazon Simple Queue Service Resource and Operations

In Amazon SQS, the only resource is the *queue*. In a policy, use an Amazon Resource Name (ARN) to identify the resource that the policy applies to. The following resource has a unique ARN associated with it:

Resource Type	ARN Format
Queue	`arn:aws:sqs:region:account_id:queue_name`

The following are examples of the ARN format for queues:

- An ARN for a queue named `my_queue` in the US East (Ohio) region, belonging to AWS Account 123456789012:

```
arn:aws:sqs:us-east-2:123456789012:my_queue
```

- An ARN for a queue named `my_queue` in each of the different regions that Amazon SQS supports:

```
arn:aws:sqs:*:123456789012:my_queue
```

- An ARN that uses `*` or `?` as a wildcard for the queue name. In the following examples, the ARN matches all queues prefixed with `my_prefix_`:

```
arn:aws:sqs:*:123456789012:my_prefix_*
```

You can get the ARN value for an existing queue by calling the `GetQueueAttributes` action. The value of the `QueueArn` attribute is the ARN of the queue. For more information about ARNs, see IAM ARNs in the *IAM User Guide*.

Amazon SQS provides a set of API actions that work with the queue resource. For more information, see Actions and Resource Reference (p. 158).

Understanding Resource Ownership

The AWS account owns the resources that are created in the account, regardless of who created the resources. Specifically, the resource owner is the AWS account of the *principal entity* (that is, the root account, an IAM user, or an IAM role) that authenticates the resource creation request. The following examples illustrate how this works:

- If you use the root account credentials of your AWS account to create an Amazon SQS queue, your AWS account is the owner of the resource (in Amazon SQS, the resource is the Amazon SQS queue).
- If you create an IAM user in your AWS account and grant permissions to create a queue to the user, the user can create the queue. However, your AWS account (to which the user belongs) owns the queue resource.
- If you create an IAM role in your AWS account with permissions to create an Amazon SQS queue, anyone who can assume the role can create a queue. Your AWS account (to which the role belongs) owns the queue resource.

Managing Access to Resources

A *permissions policy* describes the permissions granted to accounts. The following section explains the available options for creating permissions policies.

> **Note**
> This section discusses using IAM in the context of Amazon SQS. It doesn't provide detailed information about the IAM service. For complete IAM documentation, see What is IAM? in the *IAM User Guide*. For information about IAM policy syntax and descriptions, see AWS IAM Policy Reference in the *IAM User Guide*.

Policies attached to an IAM identity are referred to as *identity-based* policies (IAM polices) and policies attached to a resource are referred to as *resource-based* policies.

Identity-Based Policies (IAM Policies and Amazon SQS Policies)

There are two ways to give your users permissions to your Amazon SQS queues: using the Amazon SQS policy system and using the IAM policy system. You can use either system, or both, to attach policies to users or roles. In most cases, you can achieve the same result using either system. For example, you can do the following:

- **Attach a permission policy to a user or a group in your account** – To grant user permissions to create an Amazon SQS queue, attach a permissions policy to a user or group that the user belongs to.
- **Attach a permission policy to a user in another AWS account** – To grant user permissions to create an Amazon SQS queue, attach an Amazon SQS permissions policy to a user in another AWS account.
- **Attach a permission policy to a role (grant cross-account permissions)** – To grant cross-account permissions, attach an identity-based permissions policy to an IAM role. For example, the AWS account A administrator can create a role to grant cross-account permissions to AWS account B (or an AWS service) as follows:
  - The account A administrator creates an IAM role and attaches a permissions policy—that grants permissions on resources in account A—to the role.
  - The account A administrator attaches a trust policy to the role that identifies account B as the principal who can assume the role.
  - The account B administrator delegates the permission to assume the role to any users in account B. This allows users in account B to create or access queues in account A.

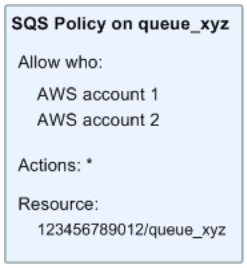
Note
If you want to grant the permission to assume the role to an AWS service, the principal in the trust policy can also be an AWS service principal.

For more information about using IAM to delegate permissions, see Access Management in the *IAM User Guide*.

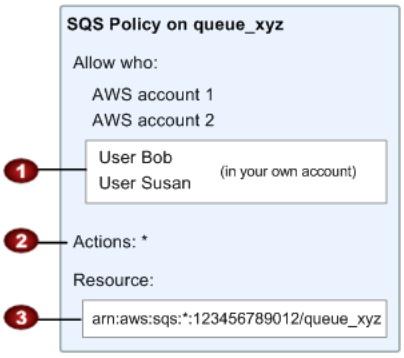
While Amazon SQS works with IAM policies, it has its own policy infrastructure. You can use an Amazon SQS policy with a queue to specify which AWS Accounts have access to the queue. You can specify the type of access and conditions (for example, a condition that grants permissions to use `SendMessage`, `ReceiveMessage` if the request is made before December 31, 2010). The specific actions you can grant permissions for are a subset of the overall list of Amazon SQS actions. When you write an Amazon SQS policy and specify `*` to "allow all Amazon SQS actions," it means that a user can perform all actions in this subset.

The following diagram illustrates the concept of one of these basic Amazon SQS policies that covers the subset of actions. The policy is for `queue_xyz`, and it gives AWS Account 1 and AWS Account 2 permissions to use any of the allowed actions with the specified queue.

Note
The resource in the policy is specified as `123456789012/queue_xyz`, where `123456789012` is the AWS Account ID of the account that owns the queue.



With the introduction of IAM and the concepts of *Users* and *Amazon Resource Names (ARNs)*, a few things have changed about SQS policies. The following diagram and table describe the changes.



1	In addition to specifying which AWS Accounts have access to a queue, you can specify which users *in your own AWS Account* have access to the queue. If the users are in different accounts, see Tutorial: Delegate Access Across AWS Accounts Using IAM Roles in the *IAM User Guide*.
2	The subset of actions included in `*` has expanded. For a list of allowed actions, see Actions and Resource Reference (p. 158).

3	You can specify the resource using the Amazon Resource Name (ARN), the standard means of specifying resources in IAM policies. For information about the ARN format for Amazon SQS queues, see Amazon Simple Queue Service Resource and Operations (p. 136).

For example, according to the Amazon SQS policy in the preceding figure, anyone who possesses the security credentials for AWS Account 1 or AWS Account 2 can access `queue_xyz`. In addition, Users Bob and Susan in your own AWS Account (with ID `123456789012`) can access the queue.

Before the introduction of IAM, Amazon SQS automatically gave the creator of a queue full control over the queue (that is, access to all of the possible Amazon SQS actions on that queue). This is no longer true, unless the creator uses AWS security credentials. Any user who has permissions to create a queue must also have permissions to use other Amazon SQS actions in order to do anything with the created queues.

The following is an example policy that allows a user to use all Amazon SQS actions, but only with queues whose names are prefixed with the literal string `bob_queue_`.

```
{
   "Version": "2012-10-17",
   "Statement": [{
      "Effect": "Allow",
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:*:123456789012:bob_queue_*"
   }]
}
```

For more information, see Using Identity-Based Policies (IAM) Policies for Amazon SQS (p. 140), and Identities (Users, Groups, and Roles) in the *IAM User Guide*.

Resource-Based Policies

Other AWS services, such as Amazon S3, support resource-based permissions policies. For example, to manage access permissions for an S3 bucket, you can attach a policy the S3 bucket.

Amazon SQS doesn't support resource-level permissions in identity-based policies (attached to a user or role), in which you can specify resources on which users are allowed to perform specified actions. For more information, see Overview of AWS IAM Permissions in the *IAM User Guide*.

Specifying Policy Elements: Actions, Effects, Resources, and Principals

For each Amazon Simple Queue Service resource (p. 136), the service defines a set of API actions. To grant permissions for these API actions, Amazon SQS defines a set of actions that you can specify in a policy.

> **Note**
> Performing an API action can require permissions for more than one action. When granting permissions for specific actions, you also identify the resource for which the actions are allowed or denied.

The following are the most basic policy elements:

- **Resource** – In a policy, you use an Amazon Resource Name (ARN) to identify the resource to which the policy applies.
- **Action** – You use action keywords to identify resource actions that you want to allow or deny. For example, the `sqs:CreateQueue` permission allows the user to perform the Amazon Simple Queue Service `CreateQueue` action.

- **Effect** – You specify the effect when the user requests the specific action—this can be either allow or deny. If you don't explicitly grant access to a resource, access is implicitly denied. You can also explicitly deny access to a resource, which you might do to make sure that a user can't access it, even if a different policy grants access.
- **Principal** – In identity-based policies (IAM policies), the user that the policy is attached to is the implicit principal. For resource-based policies, you specify the user, account, service, or other entity that you want to receive permissions (applies to resource-based policies only).

To learn more about Amazon SQS policy syntax and descriptions, see AWS IAM Policy Reference in the *IAM User Guide*.

For a table of all Amazon Simple Queue Service API actions and the resources that they apply to, see Actions and Resource Reference (p. 158).

Specifying Conditions in a Policy

When you grant permissions, you can use the Amazon SQS access policy language to specify the conditions for when a policy should take effect. For example, you might want a policy to be applied only after a specific date. For more information about specifying conditions in a policy language, see Condition in the *IAM User Guide*.

To express conditions, you use predefined condition keys. There are no condition keys specific to Amazon SQS. However, there are AWS-wide condition keys that you can use with Amazon SQS. Currently, Amazon SQS supports only a limited subset of the condition keys available in IAM:

- `aws:CurrentTime`
- `aws:EpochTime`
- `aws:SecureTransport`
- `aws:SourceArn`
- `aws:SourceIP`
- `aws:UserAgent`
- `aws:MultiFactorAuthAge`
- `aws:MultiFactorAuthPresent`
- `aws:TokenAge`

Using Identity-Based Policies (IAM) Policies for Amazon SQS

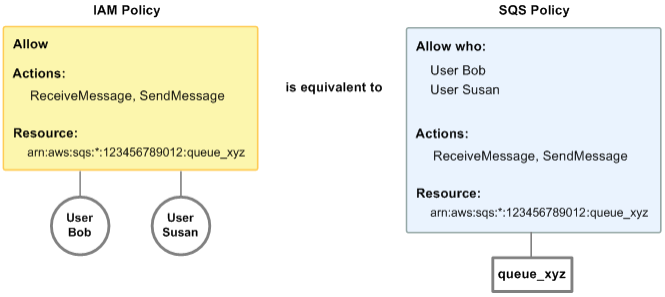
This topic provides examples of identity-based policies in which an account administrator can attach permissions policies to IAM identities (users, groups, and roles).

> **Important**
> We recommend that you first review the introductory topics that explain the basic concepts and options available for you to manage access to your Amazon Simple Queue Service resources. For more information, see Overview of Managing Access Permissions to Your Amazon Simple Queue Service Resource (p. 136).
> With the exception of `ListQueues`, all Amazon SQS API actions support resource-level permissions. For more information, see Actions and Resource Reference (p. 158).

Using Amazon SQS and IAM Policies

There are two ways to give your users permissions to your Amazon SQS resources: using the Amazon SQS policy system and using the IAM policy system. You can use one or the other, or both. For the most part, you can achieve the same result with either one.

For example, the following diagram shows an IAM policy and an Amazon SQS policy equivalent to it. The IAM policy grants the rights to the Amazon SQS `ReceiveMessage` and `SendMessage` actions for the queue called `queue_xyz` in your AWS Account, and the policy is attached to users named Bob and Susan (Bob and Susan have the permissions stated in the policy). This Amazon SQS policy also gives Bob and Susan rights to the `ReceiveMessage` and `SendMessage` actions for the same queue.



Note
This example shows simple policies without conditions. You can specify a particular condition in either policy and get the same result.

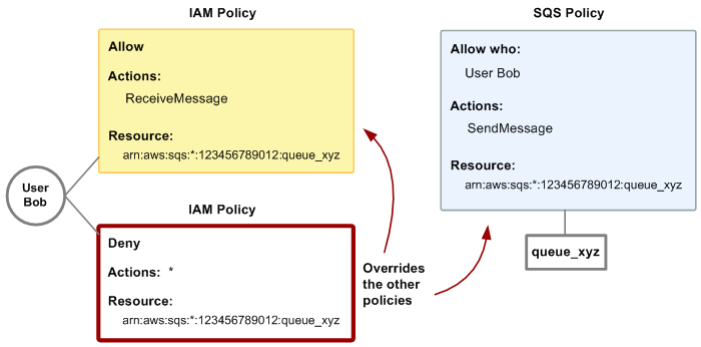
There is one major difference between IAM and Amazon SQS policies: the Amazon SQS policy system lets you grant permission to other AWS Accounts, whereas IAM doesn't.

It is up to you how you use both of the systems together to manage your permissions. The following examples show how the two policy systems work together.

- In the first example, Bob has both an IAM policy and an Amazon SQS policy that apply to his account. The IAM policy grants his account permission for the `ReceiveMessage` action on `queue_xyz`, whereas the Amazon SQS policy gives his account permission for the `SendMessage` action on the same queue. The following diagram illustrates the concept.

  If Bob sends a `ReceiveMessage` request to `queue_xyz`, the IAM policy allows the action. If Bob sends a `SendMessage` request to `queue_xyz`, the Amazon SQS policy allows the action.

- In the second example, Bob abuses his access to `queue_xyz`, so it becomes necessary to remove his entire access to the queue. The easiest thing to do is to add a policy that denies him access to all actions for the queue. This policy overrides the other two because an explicit `deny` always overrides an `allow`. For more information about policy evaluation logic, see Creating Custom Policies Using the Amazon SQS Access Policy Language (p. 148). The following diagram illustrates the concept.



You can also add an additional statement to the Amazon SQS policy that denies Bob any type of access to the queue. It has the same effect as adding an IAM policy that denies Bob access to the queue. For examples of policies that cover Amazon SQS actions and resources, see Customer-Managed Policy Examples (p. 144). For more information about writing Amazon SQS policies, see Creating Custom Policies Using the Amazon SQS Access Policy Language (p. 148).

Permissions Required to Use the Amazon SQS Console

A user who wants to work with the Amazon SQS console must have the minimum set of permissions to work with the Amazon SQS queues in the user's AWS account. For example, the user must have the permission to call the `ListQueues` action to be able to list queues, or the permission to call the `CreateQueue` action to be able to create queues. In addition to Amazon SQS permissions, to subscribe an Amazon SQS queue to an Amazon SNS topic, the console also requires permissions for Amazon SNS actions.

If you create an IAM policy that is more restrictive than the minimum required permissions, the console might not function as intended for users with that IAM policy.

You don't need to allow minimum console permissions for users that make calls only to the AWS CLI or Amazon SQS API actions.

AWS-Managed (Predefined) Policies for Amazon SQS

AWS addresses many common use cases by providing standalone AWS-managed IAM policies. These AWS-managed policies simplify working with permissions by granting the permissions necessary for common use cases. For more information, see AWS Managed Policies in the *IAM User Guide*.

The following AWS-managed policies (that you can attach to users in your account) are specific to Amazon SQS:

- **AmazonSQSReadOnlyAccess** – Grants read-only access to Amazon SQS queues using the AWS Management Console.
- **AmazonSQSFullAccess** – Grants full access to Amazon SQS queues using the AWS Management Console.

You can search and review available policies on the IAM console. You can also create your own custom IAM policies to allow permissions for Amazon SQS actions and queues. You can attach these custom policies to the IAM users or groups that require permissions.

Writing Amazon SQS Policies

The following examples provide an introductory breakdown of a permissions policy.

Example 1: Allow a User to Create Queues

In the following example, we create a policy for Bob that lets him access all Amazon SQS actions, but only with queues whose names are prefixed with the literal string `bob_queue_`.

Amazon SQS doesn't automatically grant the creator of a queue permissions to use the queue. Therefore, we must explicitly grant Bob permissions to use all Amazon SQS actions in addition to `CreateQueue` action in the IAM policy.

```
{
   "Version": "2012-10-17",
   "Statement": [{
      "Effect": "Allow",
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:*:123456789012:bob_queue_*"
   }]
}
```

Example 2: Allow Developers to Write Messages to a Shared Queue

In the following example, we create a group for developers and attach a policy that lets the group use the Amazon SQS `SendMessage` action, but only with the queue that belongs to the specified AWS account and is named `MyCompanyQueue`.

```
{
   "Version": "2012-10-17",
   "Statement": [{
      "Effect": "Allow",
      "Action": "sqs:SendMessage",
      "Resource": "arn:aws:sqs:*:123456789012:MyCompanyQueue"
   }]
}
```

You can use `*` instead of `SendMessage` to grant the following actions to a principal on a shared queue: `ChangeMessageVisibility`, `DeleteMessage`, `GetQueueAttributes`, `GetQueueUrl`, `ReceiveMessage`, and `SendMessage`.

> **Note**
> Although `*` includes access provided by other permission types, Amazon SQS considers permissions separately. For example, it is possible to grant both `*` and `SendMessage` permissions to a user, even though a `*` includes the access provided by `SendMessage`. This concept also applies when you remove a permission. If a principal has only a `*` permission, requesting to remove a `SendMessage` permission *doesn't* leave the principal with an *everything-but* permission. Instead, the request has no effect, because the principal doesn't possess an explicit `SendMessage` permission. To leave the principal with onlt the `ReceiveMessage` permission, first add the `ReceiveMessage` permission and then remove the `*` permission.

Example 3: Allow Managers to Get the General Size of Queues

In the following example, we create a group for managers and attach a policy that lets the group use the Amazon SQS `GetQueueAttributes` action with all of the queues that belong to the specified AWS account.

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

```
}
```

Example 4: Allow a Partner to Send Messages to a Specific Queue

You can accomplish this task using an Amazon SQS policy or an IAM policy. If your partner has an AWS account, it might be easier to use an Amazon SQS policy. However, any user in the partner's company who possesses the AWS security credentials can send messages to the queue. If you want to limit access to a particular user or application, you must treat the partner like a user in your own company and use an IAM policy instead of an Amazon SQS policy.

This example performs the following actions:

1. Create a group called WidgetCo to represent the partner company.
2. Create a user for the specific user or application at the partner's company who needs access.
3. Add the user to the group.
4. Attach a policy that gives the group access only to the `SendMessage` action for only the queue named `WidgetPartnerQueue`.

```
{
   "Version": "2012-10-17",
   "Statement": [{
         "Effect": "Allow",
         "Action": "sqs:SendMessage",
         "Resource": "arn:aws:sqs:*:123456789012:WidgetPartnerQueue"
   }]
}
```

Customer-Managed Policy Examples

This section shows example policies for common Amazon SQS use cases.

You can use the console to verify the effects of each policy as you attach the policy to the user. Initially, the user doesn't have permissions and won't be able to do anything in the console. As you attach policies to the user, you can verify that the user can perform various actions in the console.

> **Note**
> We recommend that you use two browser windows: one to grant permissions and the other to sign into the AWS Management Console using the user's credentials to verify permissions as you grant them to the user.

Example 1: Grant One Permission to One AWS Account

The following example policy grants AWS account number `111122223333` the `SendMessage` permission for the queue named `444455556666/queue1` in the US East (Ohio) region.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_SendMessage",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333"
         ]
      },
      "Action": "sqs:SendMessage",
      "Resource": "arn:aws:sqs:us-east-2:444455556666:queue1"
```

```
   }]
}
```

Example 2: Grant Two Permissions to One AWS Account

The following example policy grants AWS account number `111122223333` both the `SendMessage` and `ReceiveMessage` permission for the queue named `444455556666/queue1`.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_Send_Receive",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333"
         ]
      },
      "Action": [
         "sqs:SendMessage",
         "sqs:ReceiveMessage"
      ],
      "Resource": "arn:aws:sqs:*:444455556666:queue1"
   }]
}
```

Example 3: Grant All Permissions to Two AWS Accounts

The following example policy grants two different AWS accounts numbers (`111122223333` and `444455556666`) permission to use all actions to which Amazon SQS allows shared access for the queue named `123456789012/queue1` in the US East (Ohio) region.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_AllActions",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333",
            "444455556666"
         ]
      },
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:us-east-2:123456789012:queue1"
   }]
}
```

Example 4: Grant Cross-Account Permissions to a Role and a User Name

The following example policy grants `role1` and `username1` under AWS account number `111122223333` cross-account permission to use all actions to which Amazon SQS allows shared access for the queue named `123456789012/queue1` in the US East (Ohio) region.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
```

```
      "Sid":"Queue1_AllActions",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "arn:aws:iam::111122223333:role/role1",
            "arn:aws:iam::111122223333:user/username1"
         ]
      },
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:us-east-2:123456789012:queue1"
   }]
}
```

Example 5: Grant a Permission to All Users

The following example policy grants all users (anonymous users) `ReceiveMessage` permission for the queue named `111122223333/queue1`.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_AnonymousAccess_ReceiveMessage",
      "Effect": "Allow",
      "Principal": "*",
      "Action": "sqs:ReceiveMessage",
      "Resource": "arn:aws:sqs:*:111122223333:queue1"
   }]
}
```

Example 6: Grant a Time-Limited Permission to All Users

The following example policy grants all users (anonymous users) `ReceiveMessage` permission for the queue named `111122223333/queue1`, but only between 12:00 p.m. (noon) and 3:00 p.m. on January 31, 2009.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_AnonymousAccess_ReceiveMessage_TimeLimit",
      "Effect": "Allow",
      "Principal": "*",
      "Action": "sqs:ReceiveMessage",
      "Resource": "arn:aws:sqs:*:111122223333:queue1",
      "Condition" : {
         "DateGreaterThan" : {
            "aws:CurrentTime":"2009-01-31T12:00Z"
         },
         "DateLessThan" : {
            "aws:CurrentTime":"2009-01-31T15:00Z"
         }
      }
   }]
}
```

Example 7: Grant All Permissions to All Users in a CIDR Range

The following example policy grants all users (anonymous users) permission to use all possible Amazon SQS actions that can be shared for the queue named `111122223333/queue1`, but only if the request comes from the `192.168.143.0/24` CIDR range.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_AnonymousAccess_AllActions_WhitelistIP",
      "Effect": "Allow",
      "Principal": "*",
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:*:111122223333:queue1",
      "Condition" : {
         "IpAddress" : {
            "aws:SourceIp":"192.168.143.0/24"
         }
      }
   }]
}
```

Example 8: Whitelist and Blacklist Permissions for Users in Different CIDR Ranges

The following example policy has two statements:

- The first statement grants all users (anonymous users) in the `192.168.143.0/24` CIDR range (except for `192.168.143.188`) permission to use the `SendMessage` action for the queue named `111122223333`/queue1.
- The second statement blacklists all users (anonymous users) in the `10.1.2.0/24` CIDR range from using the queue.

```
{
   "Version": "2012-10-17",
   "Id": "Queue1_Policy_UUID",
   "Statement": [{
      "Sid":"Queue1_AnonymousAccess_SendMessage_IPLimit",
      "Effect": "Allow",
      "Principal": "*",
      "Action": "sqs:SendMessage",
      "Resource": "arn:aws:sqs:*:111122223333:queue1",
      "Condition" : {
         "IpAddress" : {
            "aws:SourceIp":"192.168.143.0/24"
         },
         "NotIpAddress" : {
            "aws:SourceIp":"192.168.143.188/32"
         }
      }
   }, {
      "Sid":"Queue1_AnonymousAccess_AllActions_IPLimit_Deny",
      "Effect": "Deny",
      "Principal": "*",
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:*:111122223333:queue1",
      "Condition" : {
         "IpAddress" : {
            "aws:SourceIp":"10.1.2.0/24"
         }
      }
   }]
}
```

Creating Custom Policies Using the Amazon SQS Access Policy Language

If you want to allow Amazon SQS access based only on an AWS account ID and basic permissions (such as for `SendMessage` or `ReceiveMessage`), you don't need to write your own policies. You can just use the Amazon SQS `AddPermission` action.

If you want to explicitly deny or allow access based on more specific conditions (such as the time the request comes in or the IP address of the requester), you need to write your own Amazon SQS policies and upload them to the AWS system using the Amazon SQS `SetQueueAttributes` action.

Key Concepts

To write your own policies, you must be familiar with JSON and a number of key concepts.

allow

The result of a **statement** (p. 149) that has **effect** (p. 148) set to `allow`.

action

The activity that the **principal** (p. 149) has permission to perform, typically a request to AWS.

default-deny

The result of a **statement** (p. 149) that that has no **allow** (p. 148) or **explicit deny** (p. 148) settings.

condition

Any restriction or detail about a **permission** (p. 148). Typical conditions are related to date and time and IP addresses.

effect

The result that you want the **statement** (p. 149) of a **policy** (p. 149) to return at evaluation time. You specify the `deny` or `allow` value when you write the policy statement. There can be three possible results at policy evaluation time: **default-deny** (p. 148), **allow** (p. 148), and **explicit deny** (p. 148).

explicit deny

The result of a **statement** (p. 149) that has **effect** (p. 148) set to `deny`.

evaluation

The process that Amazon SQS uses to determine whether an incoming request should be denied or allowed based on a **policy** (p. 149).

issuer

The user who writes a **policy** (p. 149) to grant permissions to a resource. The issuer, by definition is always the resource owner. AWS doesn't permit Amazon SQS users to create policies for resources they don't own.

key

The specific characteristic that is the basis for access restriction.

permission

The concept of allowing or disallowing access to a resource using a **condition** (p. 148) and a **key** (p. 148).

policy

The document that acts as a container for one or more statements (p. 149).

Amazon SQS uses the policy to determine whether to grant access to a user for a resource.

principal

The user who receives **permission** (p. 148) in the **policy** (p. 149).

resource

The object that the **principal** (p. 149) requests access to.

statement

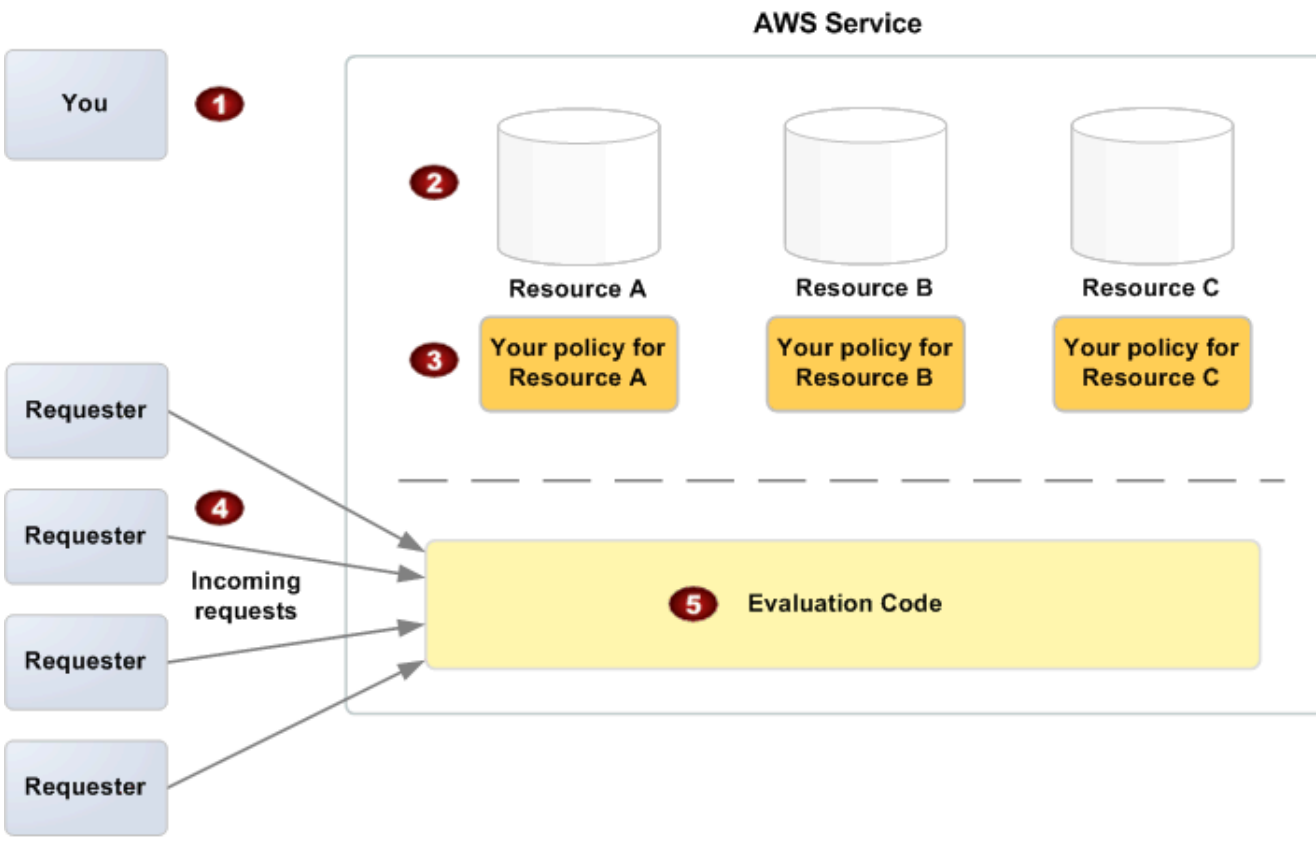
The formal description of a single permission, written in the access policy language as part of a broader **policy** (p. 149) document.

requester

The user who sends a request for access to a **resource** (p. 149).

Architecture

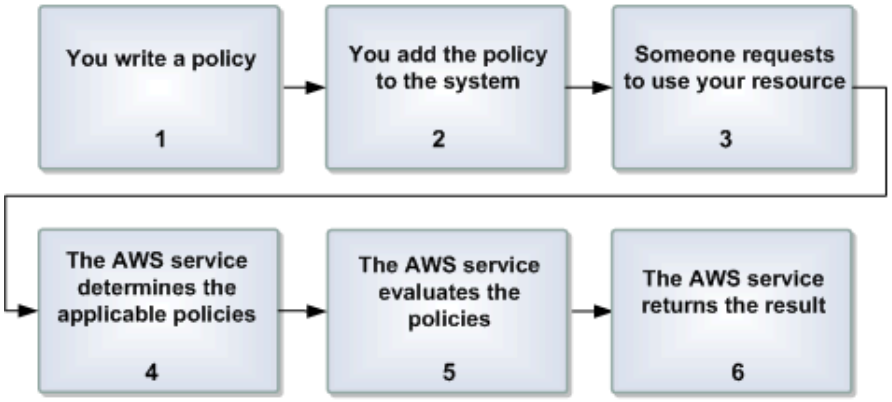
The following figure and table describe the access control for your Amazon SQS resources.



1	You, the resource owner.
2	Your resources contained within the AWS service (for example, Amazon SQS queues).
3	Your policies. It is a good practice to have one policy per resource The AWS service itself provides an API you use to upload and manage your policies.
4	Requesters and their incoming requests to the AWS service.
5	The access policy language evaluation code. This is the set of code within the AWS service that evaluates incoming requests against the applicable policies and determines whether the requester is allowed access to the resource.

Process Workflow

The following figure and table describe the general workflow of access control with the Amazon SQS access policy language.



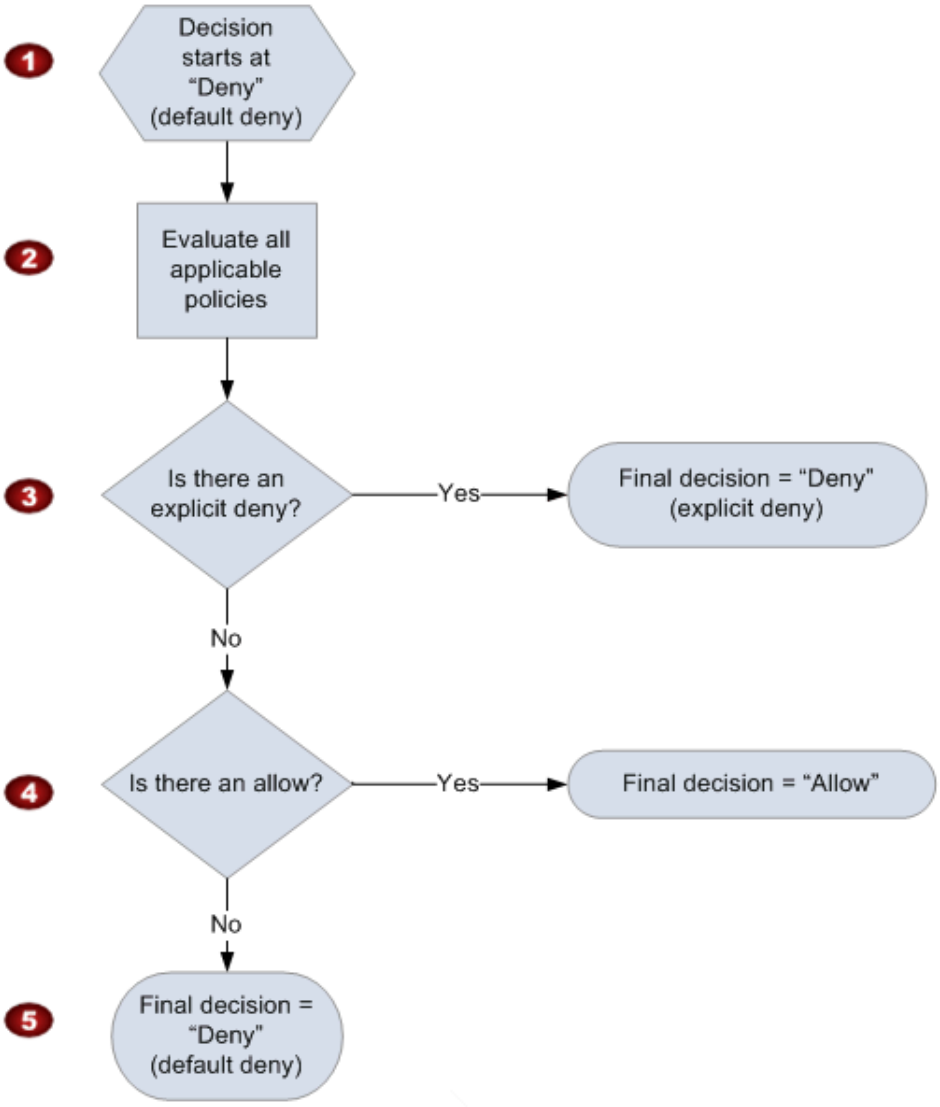
1	You write an Amazon SQS policy for your queue.
2	You upload your policy to AWS. The AWS service provides an API that you use to upload your policies. For example, you use the Amazon SQS `SetQueueAttributes` action to upload a policy for a particular Amazon SQS queue.
3	Someone sends a request to use your Amazon SQS queue.
4	Amazon SQS examines all available Amazon SQS policies and determines which ones are applicable.
5	Amazon SQS evaluates the policies and determines whether the requester is allowed to use your queue.
6	Based on the policy evaluation result, Amazon SQS either returns an `Access denied` error to the requester or continues to process the request.

Evaluation Logic

At evaluation time, Amazon SQS determines whether a request from someone other than the resource owner should be allowed or denied. The evaluation logic follows several basic rules:

- By default, all requests to use your resource coming from anyone but you are denied.
- An **allow** (p. 148) overrides any **default-deny** (p. 148).
- An **explicit deny** (p. 148) overrides any **allow** (p. 148).
- The order in which the policies are evaluated isn't important.

The following figure and table describe in detail how Amazon SQS evaluates decisions about access permissions.

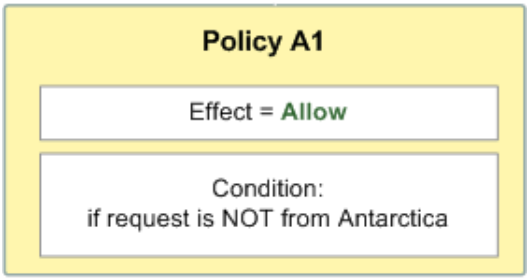


1	The decision starts with a **default-deny** (p. 148).
2	The enforcement code evaluates all the policies that are applicable to the request (based on the resource, principal, action, and conditions). The order in which the enforcement code evaluates the policies isn't important
3	The enforcement code looks for an **explicit deny** (p. 148) instruction that can apply to the request. If it finds even one, the enforcement code returns a decision of *deny* and the process finishes.
4	If no **explicit deny** (p. 148) instruction is found, the enforcement code looks for any **allow** (p. 148) instructions that can apply to the request. If it finds even one, the enforcement code returns a decision of *allow* and the process finishes (the service continues to process the request).
5	If no **allow** (p. 148) instruction is found, then the final decision is *deny* (because there is no **explicit deny** (p. 148) or **allow** (p. 148), this is considered a **default-deny** (p. 148).

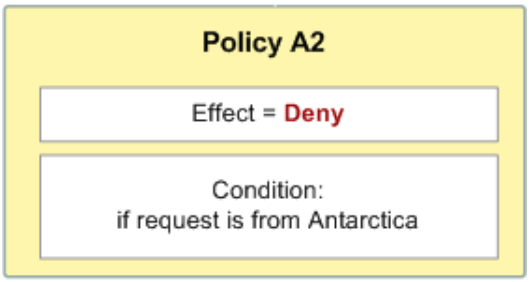
Relationships Between Explicit and Default Denials

If an Amazon SQS policy doesn't directly apply to a request, the request results in a **default-deny** (p. 148). For example, if a user requests permission to use Amazon SQS but the only policy that applies to the user can use DynamoDB, the requests results in a **default-deny** (p. 148).

If a condition in a statement isn't met, the request results in a **default-deny** (p. 148). If all conditions in a statement are met, the request results in either an **allow** (p. 148) or an **explicit deny** (p. 148) based on the value of the **effect** (p. 148) element of the policy. Policies don't specify what to do if a condition isn't met, so the default result in this case is a **default-deny** (p. 148). For example, you want to prevent requests that come from Antarctica. You write Policy A1 that allows a request only if it doesn't come from Antarctica. The following diagram illustrates the Amazon SQS policy.

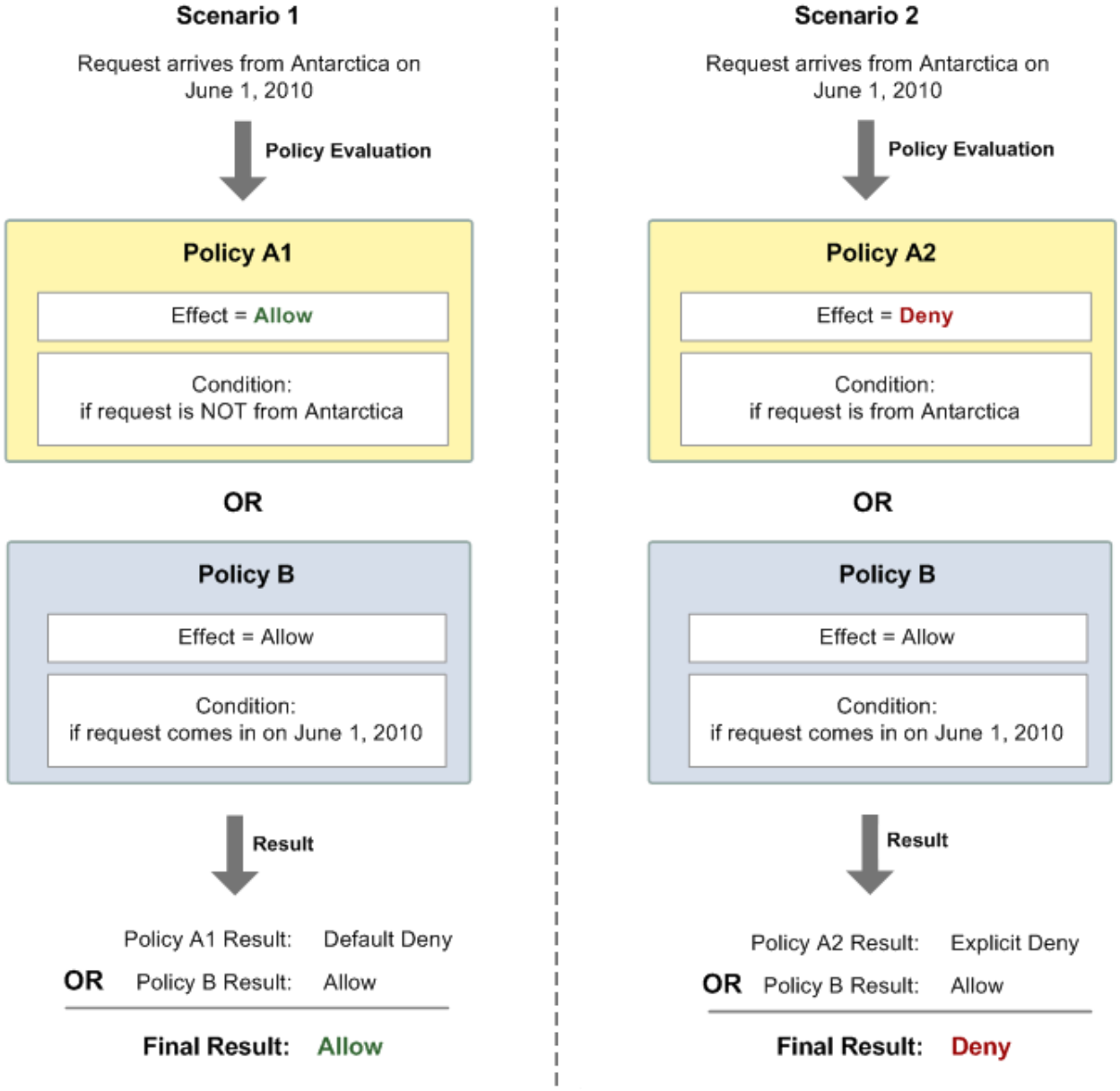


If a user sends a request from the U.S., the condition is met (the request isn't from Antarctica), and the request results in an **allow** (p. 148). However, if a user sends a request from Antarctica, the condition isn't met and the request defaults to a **default-deny** (p. 148). You can change the result to an **explicit deny** (p. 148) by writing Policy A2 that explicitly denies a request if it comes from Antarctica. The following diagram illustrates the policy.



If a user sends a request from Antarctica, the condition is met and the request results in an **explicit deny** (p. 148).

The distinction between a **default-deny** (p. 148) and an **explicit deny** (p. 148) is important because an **allow** (p. 148) can overwrite the former but not the latter. For example, Policy B allows requests if they arrive on June 1, 2010. The following diagram compares combining this policy with Policy A1 and Policy A2.



In Scenario 1, Policy A1 results in a **default-deny** (p. 148) and Policy B results in an **allow** (p. 148) because the policy allows requests that come in on June 1, 2010. The **allow** (p. 148) from Policy B overrides the **default-deny** (p. 148) from Policy A1, and the request is allowed.

In Scenario 2, Policy B2 results in an **explicit deny** (p. 148) and Policy B results in an **allow** (p. 148). The **explicit deny** (p. 148) from Policy A2 overrides the **allow** (p. 148) from Policy B, and the request is denied.

Amazon SQS Access Policy Examples

The following are examples of typical Amazon SQS access control policies.

Example 1: Give Permission to One Account

The following example Amazon SQS policy gives AWS account 111122223333 permission to send to and receive from `queue2` owned by AWS account 444455556666.

```
{
   "Version": "2012-10-17",
   "Id": "UseCase1",
   "Statement" : [{
      "Sid": "1",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333"
         ]
      },
      "Action": [
         "sqs:SendMessage",
         "sqs:ReceiveMessage"
      ],
      "Resource": "arn:aws:sqs:us-east-2:444455556666:queue2"
   }]
}
```

Example 2: Give Permission to One or More Accounts

The following example Amazon SQS policy gives one or more AWS accounts access to queues owned by your account for a specific time period. It is necessary to write this policy and to upload it to Amazon SQS using the `SetQueueAttributes` action because the `AddPermission` action doesn't permit specifying a time restriction when granting access to a queue.

```
{
   "Version": "2012-10-17",
   "Id": "UseCase2",
   "Statement" : [{
      "Sid": "1",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333",
            "444455556666"
         ]
      },
      "Action": [
         "sqs:SendMessage",
         "sqs:ReceiveMessage"
      ],
      "Resource": "arn:aws:sqs:us-east-2:444455556666:queue2",
      "Condition": {
         "DateLessThan": {
            "AWS:CurrentTime": "2009-06-30T12:00Z"
         }
      }
   }]
}
```

Example 3: Give Permission to Requests from Amazon EC2 Instances

The following example Amazon SQS policy gives access to requests that come from Amazon EC2 instances. This example builds on the "Example 2: Give Permission to One or More Accounts (p. 155)" example: it restricts access to before June 30, 2009 at 12 noon (UTC), it restricts access to the IP range `10.52.176.0/24`. It is necessary to write this policy and to upload it to Amazon SQS using the

SetQueueAttributes action because the AddPermission action doesn't permit specifying an IP address restriction when granting access to a queue.

```
{
   "Version": "2012-10-17",
   "Id": "UseCase3",
   "Statement" : [{
      "Sid": "1",
      "Effect": "Allow",
      "Principal": {
         "AWS": [
            "111122223333"
         ]
      },
      "Action": [
         "sqs:SendMessage",
         "sqs:ReceiveMessage"
      ],
      "Resource": "arn:aws:sqs:us-east-2:444455556666:queue2",
      "Condition": {
         "DateLessThan": {
            "AWS:CurrentTime": "2009-06-30T12:00Z"
         },
         "IpAddress": {
            "AWS:SourceIp": "10.52.176.0/24"
         }
      }
   }]
}
```

Example 4: Deny Access to a Specific Account

The following example Amazon SQS policy denies a specific AWS account access to your queue. This example builds on the "Example 1: Give Permission to One Account (p. 155)" example: it denies access to the specified AWS account. It is necessary to write this policy and to upload it to Amazon SQS using the SetQueueAttributes action because the AddPermission action doesn't permit deny access to a queue (it allows only granting access to a queue).

```
{
   "Version": "2012-10-17",
   "Id": "UseCase4",
   "Statement" : [{
      "Sid": "1",
      "Effect": "Deny",
      "Principal": {
         "AWS": [
            "111122223333"
         ]
      },
      "Action": [
         "sqs:SendMessage",
         "sqs:ReceiveMessage"
      ],
      "Resource": "arn:aws:sqs:us-east-2:444455556666:queue2"
   }]
}
```

Using Temporary Security Credentials

In addition to creating IAM users with their own security credentials, IAM also allows you to grant temporary security credentials to any user, allowing the user to access your AWS services and resources.

You can manage users who have AWS accounts (IAM users). You can also manage users for your system who don't have AWS accounts (federated users). In addition, applications that you create to access your AWS resources can also be considered to be "users."

You can use these temporary security credentials to make requests to Amazon SQS. The API libraries compute the necessary signature value using those credentials to authenticate your request. If you send requests using expired credentials, Amazon SQS denies the request.

Note
You can't set a policy based on temporary credentials.

To get started with temporary security credentials

1. Use IAM to create temporary security credentials:
   - Security token
   - Access Key ID
   - Secret Access Key
2. Prepare your string to sign with the temporary Access Key ID and the security token.
3. Use the temporary Secret Access Key instead of your own Secret Access Key to sign your Query API request.

Note
When you submit the signed Query API request, use the temporary Access Key ID instead of your own Access Key ID and to include the security token. For more information on IAM support for temporary security credentials, see Granting Temporary Access to Your AWS Resources in the *IAM User Guide*.

To call an Amazon SQS Query API action using temporary security credentials

1. Request a temporary security token using AWS Identity and Access Management. For more information, see Creating Temporary Security Credentials to Enable Access for IAM Users in the *IAM User Guide*.

   IAM returns a security token, an Access Key ID, and a Secret Access Key.
2. Prepare your query using the temporary Access Key ID instead of your own Access Key ID and include the security token. Sign your request using the temporary Secret Access Key instead of your own.
3. Submit your signed query string with the temporary Access Key ID and the security token.

   The following example demonstrates how to use temporary security credentials to authenticate an Amazon SQS request. The structure of *AUTHPARAMS* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

```
https://sqs.us-east-2.amazonaws.com/
?Action=CreateQueue
&DefaultVisibilityTimeout=40
&QueueName=MyQueue
&Attribute.1.Name=VisibilityTimeout
&Attribute.1.Value=40
&Expires=2015-12-18T22%3A52%3A43PST
&SecurityToken=wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
&AWSAccessKeyId=AKIAIOSFODNN7EXAMPLE
&Version=2012-11-05
&AUTHPARAMS
```

   The following example uses temporary security credentials to send two messages with `SendMessageBatch`.

```
https://sqs.us-east-2.amazonaws.com/
?Action=SendMessageBatch
&SendMessageBatchRequestEntry.1.Id=test_msg_001
&SendMessageBatchRequestEntry.1.MessageBody=test%20message%20body%201
&SendMessageBatchRequestEntry.2.Id=test_msg_002
&SendMessageBatchRequestEntry.2.MessageBody=test%20message%20body%202
&SendMessageBatchRequestEntry.2.DelaySeconds=60
&Expires=2015-12-18T22%3A52%3A43PST
&SecurityToken=je7MtGbClwBF/2Zp9Utk/h3yCo8nvbEXAMPLEKEY
&AWSAccessKeyId=AKIAI44QH8DHBEXAMPLE
&Version=2012-11-05
&AUTHPARAMS
```

Amazon SQS API Permissions: Actions and Resource Reference

When you set up Access Control (p. 135) and write permissions policies that you can attach to an IAM identity, you can use the following table as a reference. The list includes each Amazon Simple Queue Service API action, the corresponding actions for which you can grant permissions to perform the action, and the AWS resource for which you can grant the permissions.

Specify the actions in the policy's `Action` field, and the resource value in the policy's `Resource` field. To specify an action, use the `sqs:` prefix followed by the API action name (for example, `sqs:CreateQueue`).

Currently, Amazon SQS supports only a limited subset of the condition keys available in IAM:

- `aws:CurrentTime`
- `aws:EpochTime`
- `aws:SecureTransport`
- `aws:SourceArn`
- `aws:SourceIP`
- `aws:UserAgent`
- `aws:MultiFactorAuthAge`
- `aws:MultiFactorAuthPresent`
- `aws:TokenAge`

Amazon Simple Queue Service API and Required Permissions for Actions

AddPermission

Action(s): `sqs:AddPermission`

Resource: `arn:aws:sqs:`*`region`*`:`*`account_id`*`:`*`queue_name`*

ChangeMessageVisibility

Action(s): `sqs:ChangeMessageVisibility`

Resource: `arn:aws:sqs:`*`region`*`:`*`account_id`*`:`*`queue_name`*

ChangeMessageVisibilityBatch

Action(s): `sqs:ChangeMessageVisibilityBatch`

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

CreateQueue

Action(s): sqs:CreateQueue

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

DeleteMessage

Action(s): sqs:DeleteMessage

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

DeleteMessageBatch

Action(s): sqs:DeleteMessageBatch

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

DeleteQueue

Action(s): sqs:DeleteQueue

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

GetQueueAttributes

Action(s): sqs:GetQueueAttributes

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

GetQueueUrl

Action(s): sqs:GetQueueUrl

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

ListDeadLetterSourceQueues

Action(s): sqs:ListDeadLetterSourceQueues

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

ListQueues

Action(s): sqs:ListQueues

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

ListQueueTags

Action(s): sqs:ListQueueTags

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

PurgeQueue

Action(s): sqs:PurgeQueue

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

ReceiveMessage

Action(s): sqs:ReceiveMessage

Resource: arn:aws:sqs:*region*:*account_id*:*queue_name*

RemovePermission

Action(s): `sqs:RemovePermission`

Resource: `arn:aws:sqs:region:account_id:queue_name`

SendMessage and SendMessageBatch

Action(s): `sqs:SendMessage`

Resource: `arn:aws:sqs:region:account_id:queue_name`

SetQueueAttributes

Action(s): `sqs:SetQueueAttributes`

Resource: `arn:aws:sqs:region:account_id:queue_name`

TagQueue

Action(s): `sqs:TagQueue`

Resource: `arn:aws:sqs:region:account_id:queue_name`

UntagQueue

Action(s): `sqs:UntagQueue`

Resource: `arn:aws:sqs:region:account_id:queue_name`

Protecting Data Using Server-Side Encryption (SSE) and AWS KMS

This section provides an overview of using server-side encryption with AWS KMS and information about configuring IAM and AWS KMS key policies for SSE.

Topics

Benefits of Server-Side Encryption

Server-side encryption (SSE) for Amazon SQS is available in the US East (N. Virginia), US East (Ohio), and US West (Oregon) regions. SSE lets you transmit sensitive data in encrypted queues. SSE protects the contents of messages in Amazon SQS queues using keys managed in the AWS Key Management Service (AWS KMS).

SSE encrypts messages as soon as Amazon SQS receives them. The messages are stored in encrypted form and Amazon SQS decrypts messages only when they are sent to an authorized consumer.

Important
All requests to queues with SSE enabled must use HTTPS and Signature Version 4.
Some features of AWS services that can send notifications to Amazon SQS using the AWS Security Token Service `AssumeRole` API action are compatible with SSE but work *only with standard queues:*

- Auto Scaling Lifecycle Hooks
- AWS Lambda Dead-Letter Queues

Other features of AWS services or third-party services that send notifications to Amazon SQS aren't compatible with SSE, despite allowing you to set an encrypted queue as a target:

- AWS IoT Rule Actions

For information about compatibility of other services with encrypted queues, see Enable Compatibility Between AWS Services and Encrypted Queues (p. 165) and your service documentation.

AWS KMS combines secure, highly available hardware and software to provide a key management system scaled for the cloud. When you use Amazon SQS with AWS KMS, the data keys (p. 162) that encrypt your message data are also encrypted and stored with the data they protect.

The following are benefits of using AWS KMS:

- You can create and manage customer master keys (CMKs) (p. 162) yourself.
- You can also use the AWS-managed CMK for Amazon SQS, which is unique for each account and region.
- The AWS KMS security standards can help you meet encryption-related compliance requirements.

For more information, see What is AWS Key Management Service? in the *AWS Key Management Service Developer Guide* and the AWS Key Management Service Cryptographic Details whitepaper.

What Does SSE for Amazon SQS Encrypt?

SSE encrypts the body of a message in an Amazon SQS queue.

SSE doesn't encrypt the following:

- Queue metadata (queue name and attributes)
- Message metadata (message ID, timestamp, and attributes)
- Per-queue metrics

Encrypting a message makes its contents unavailable to unauthorized or anonymous users. This doesn't affect the normal functioning of Amazon SQS:

- A message is encrypted only if it is sent after the encryption of a queue is enabled. Amazon SQS doesn't encrypt backlogged messages.
- Any encrypted message remains encrypted even if the encryption of its queue is disabled.

Moving a message to a dead-letter queue (p. 62) doesn't affect its encryption:

- When Amazon SQS moves a message from an encrypted source queue to a unencrypted dead-letter queue, the message remains encrypted.

- When Amazon SQS moves a message from a unencrypted source queue to an encrypted dead-letter queue, the message remains unencrypted.

Key Terms

The following key terms can help you better understand the functionality of SSE. For detailed descriptions, see the *Amazon Simple Queue Service API Reference*.

Data Key

The data encryption key (DEK) responsible for encrypting the contents of Amazon SQS messages.

For more information, see Data Keys in the *AWS Key Management Service Developer Guide* and Envelope Encryption in the *AWS Encryption SDK Developer Guide*.

Data Key Reuse Period

The length of time, in seconds, for which Amazon SQS can reuse a data key to encrypt or decrypt messages before calling AWS KMS again. An integer representing seconds, between 60 seconds (1 minute) and 86,400 seconds (24 hours). The default is 300 (5 minutes). For more information, see How Does the Data Key Reuse Period Work? (p. 162).

Note
In the unlikely event of being unable to reach AWS KMS, Amazon SQS continues to use the cached data key until a connection is reestablished.

Customer Master Key ID

The alias, alias ARN, key ID, or key ARN of an AWS-managed customer master key (CMK) or a custom CMK—in your account or in another account. While the alias of the AWS-managed CMK for Amazon SQS is always `alias/aws/sqs`, the alias of a custom CMK can, for example, be `alias/MyAlias`. You can use these CMKs to protect the messages in Amazon SQS queues.

Note
Keep the following in mind:

- If you don't specify a custom CMK, Amazon SQS uses the AWS-managed CMK for Amazon SQS. For instructions on creating custom CMKs, see Creating Keys in the *AWS Key Management Service Developer Guide*.
- The first time you use the AWS Management Console to specify the AWS-managed CMK for Amazon SQS for a queue, AWS KMS creates the AWS-managed CMK for Amazon SQS.
- Alternatively, the first time you use the `SendMessage` or `SendMessageBatch` API action on a queue with SSE enabled, AWS KMS creates the AWS-managed CMK for Amazon SQS.

You can create CMKs, define the policies that control how CMKs can be used, and audit CMK usage using the **Encryption Keys** section of the AWS KMS console or using AWS KMS API actions. For more information about CMKs, see Customer Master Keys in the *AWS Key Management Service Developer Guide*. For more examples of CMK identifiers, see KeyId in the *AWS Key Management Service API Reference*.

Important
There are additional charges for using AWS KMS. For more information, see How Do I Estimate My AWS KMS Usage Costs? (p. 163) and AWS Key Management Service Pricing.

How Does the Data Key Reuse Period Work?

Amazon SQS uses a single customer master key (either the AWS-managed CMK for Amazon SQS or a custom CMK) to provide envelope encryption and decryption of multiple Amazon SQS messages during

the *data key reuse period*. To make the most of the data key reuse period (p. 162), keep the following in mind:

- A shorter reuse period provides better security but results in more calls to AWS KMS, which might incur charges beyond the Free Tier.
- Although the data key is cached separately for encryption and for decryption, the reuse period applies to both copies of the data key.
- Principals (AWS accounts or IAM users) don't share data keys (messages sent by unique principals always get unique data keys). Thus, the volume of calls to AWS KMS is a multiple of the number of unique principals in use during the data key reuse period:
  - When you send messages using the `SendMessage` or `SendMessageBatch` action, Amazon SQS typically calls the AWS KMS `GenerateDataKey` and `Decrypt` actions once per every data key reuse period.

    Note
    For each data key that AWS KMS generates, SSE calls the `Decrypt` action to verify the integrity of the data key before using it.
  - When you receive messages using the `ReceiveMessage` action, Amazon SQS typically calls the AWS KMS `Decrypt` action once per every data key reuse period.

How Do I Estimate My AWS KMS Usage Costs?

To predict costs and better understand your AWS bill, you might want to know how often Amazon SQS uses your customer master key (CMK).

Note
Although the following formula can give you a very good idea of expected costs, actual costs might be higher because of the distributed nature of Amazon SQS.

To calculate the number of API requests (`R`) *per queue*, use the following formula:

```
R = B / D * (2 * P + C)
```

`B` is the billing period (in seconds).

`D` is the data key reuse period (p. 162) (in seconds).

`P` is the number of producing principals that send to the Amazon SQS queue.

`C` is the number of consuming principals that receive from the Amazon SQS queue.

Important
In general, producing principals incur double the cost of consuming principals. For more information, see How Does the Data Key Reuse Period Work? (p. 162).
If the producer and consumer have different IAM users, the cost increases.

The following are example calculations. For exact pricing information, see AWS Key Management Service Pricing.

Example 1: Calculating the Number of AWS KMS API Calls for 2 Principals and 1 Queue

This example assumes the following:

- The billing period is January 1-31 (2,678,400 seconds).

- The data key reuse period is set to 5 minutes (300 seconds).
- There is 1 queue.
- There is 1 producing principal and 1 consuming principal.

```
2,678,400 / 300 * (2 * 1 + 1) = 26,784
```

Example 2: Calculating the Number of AWS KMS API Calls for Multiple Producers and Consumers and 2 Queues

This example assumes the following:

- The billing period is February 1-28 (2,419,200 seconds).
- The data key reuse period is set to 24 hours (86,400 seconds).
- There are 2 queues.
- The first queue has 3 producing principals and 1 consuming principal.
- The second queue has 5 producing principals and 2 consuming principals.

```
(2,419,200 / 86,400 * (2 * 3 + 1)) + (2,419,200 / 86,400 * (2 * 5 + 2)) = 532
```

What AWS KMS Permissions Do I Need to Use SSE for Amazon SQS?

Before you can use SSE, you must configure AWS KMS key policies to allow encryption of queues and encryption and decryption of messages. For examples and more information about AWS KMS permissions, see AWS KMS API Permissions: Actions and Resources Reference in the *AWS Key Management Service Developer Guide*.

> **Note**
> You can also manage permissions for KMS keys using IAM policies. For more information, see Using IAM Policies with AWS KMS.
> While you can configure global permissions to send to and receive from Amazon SQS, AWS KMS requires explicitly naming the full ARN of CMKs in specific regions in the `Resource` section of an IAM policy.

You must also ensure that the key policies of the customer master key (CMK) allow the necessary permissions. To do this, name the principals which produce and consume encrypted messages in Amazon SQS as users in the CMK key policy.

Alternatively, you can specify the required AWS KMS actions and CMK ARN in an IAM policy assigned to the principals which produce and consume encrypted messages in Amazon SQS. For more information, see Managing Access to AWS KMS CMKs in the *AWS Key Management Service Developer Guide*

Example 1: Allow a User to Send Single or Batched Messages to an Encrypted Queue

The producer must have the `kms:GenerateDataKey` and `kms:Decrypt` permissions for the customer master key (CMK).

```
{
   "Version": "2012-10-17",
```

```
      "Statement": [{
         "Effect": "Allow",
         "Action": [
            "kms:GenerateDataKey",
            "kms:Decrypt"
         ],
         "Resource": "arn:aws:kms:us-
east-2:123456789012:key/1234abcd-12ab-34cd-56ef-1234567890ab"
         }, {
         "Effect": "Allow",
         "Action": [
            "sqs:SendMessage",
            "sqs:SendMessageBatch"
         ],
         "Resource": "arn:aws:sqs:*:123456789012:MyQueue"
      }]
}
```

Example 2: Allow a User to Receive Messages from an Encrypted Queue

The consumer must have the `kms:Decrypt` permission for any customer master key (CMK) that is used to encrypt the messages in the specified queue. If the queue acts as a dead-letter queue (p. 62), the consumer must also have the `kms:Decrypt` permission for any CMK that is used to encrypt the messages in the source queue.

```
{
   "Version": "2012-10-17",
      "Statement": [{
         "Effect": "Allow",
         "Action": [
            "kms:Decrypt"
         ],
         "Resource": "arn:aws:kms:us-
east-2:123456789012:key/1234abcd-12ab-34cd-56ef-1234567890ab"
         }, {
         "Effect": "Allow",
         "Action": [
            "sqs:ReceiveMessage"
         ],
         "Resource": "arn:aws:sqs:*:123456789012:MyQueue"
      }]
}
```

Example 3: Enable Compatibility Between AWS Services Such as Amazon CloudWatch Events, Amazon S3, and Amazon SNS and Encrypted Queues

To allow Amazon CloudWatch Events, Amazon S3 event notifications, or Amazon SNS topic subscriptions to work with encrypted queues, you must perform the following steps:

1. Create a customer master key (CMK).
2. To allow the AWS service feature to have the `kms:GenerateDataKey` and `kms:Decrypt` permissions, add the following statement to the policy of the CMK.

   Note

   - For Amazon CloudWatch Events, use `events`

- For Amazon S3 event notifications, use `s3`
- For Amazon SNS topic subscriptions, use `sns`

```
{
   "Version": "2012-10-17",
      "Statement": [{
         "Effect": "Allow",
         "Principal": {
            "Service": "service.amazonaws.com"
         },
         "Action": [
            "kms:GenerateDataKey*",
            "kms:Decrypt"
         ],
         "Resource": "*"
       }]
}
```

3. Create a new SSE queue (p. 21) or configure an existing SSE queue (p. 25) using the ARN of your CMK.

Learn More

- Subscribe to a Topic in the *Amazon Simple Notification Service Developer Guide*
- Creating a CloudWatch Events Rule That Triggers on an Event in the *Amazon CloudWatch Events User Guide*
- Configuring Amazon S3 Event Notifications in the *Amazon Simple Storage Service Developer Guide*

Getting Started with SSE

For information about how to manage SSE using the AWS Management Console or using API actions, see the following tutorials:

- Creating an Amazon SQS queue with SSE (p. 21)
- Configuring SSE for an existing Amazon SQS queue (p. 25)
- Enable Compatibility Between AWS Services and Encrypted Queues (p. 165)

You can enable and disable SSE for an Amazon SQS queue using the following API actions.

Task	API Action
Create a new queue with SSE enabled.	`CreateQueue`
Enable SSE for an existing queue.	`SetQueueAttributes`
Determine whether SSE is enabled for an existing queue.	`GetQueueAttributes`

Errors

When you work with Amazon SQS and AWS KMS, you might encounter errors. The following list describes the errors and possible troubleshooting solutions.

KMSAccessDeniedException

The ciphertext references a key that doesn't exist or that you don't have access to.

HTTP Status Code: 400

KMSDisabledException

The request was rejected because the specified CMK isn't enabled.

HTTP Status Code: 400

KMSInvalidStateException

The request was rejected because the state of the specified resource isn't valid for this request. For more information, see How Key State Affects Use of a Customer Master Key in the *AWS Key Management Service Developer Guide*.

HTTP Status Code: 400

KMSNotFoundException

The request was rejected because the specified entity or resource can't be found.

HTTP Status Code: 400

KMSOptInRequired

The AWS access key ID needs a subscription for the service.

HTTP Status Code: 403

KMSThrottlingException

The request was denied due to request throttling. For more information about throttling, see Limits in the *AWS Key Management Service Developer Guide*.

HTTP Status Code: 400

Working with Amazon SQS APIs

This section provides information about constructing Amazon SQS endpoints, making Query API requests using the `GET` and `POST` methods, and using batch API actions. For detailed information about Amazon SQS API actions—including parameters, errors, examples, and data types —see the *Amazon Simple Queue Service API Reference*.

To access Amazon SQS using a variety of programming languages, you can also use AWS SDKs which contain the following automatic functionality:

- Cryptographically signing your service requests
- Retrying requests
- Handling error responses

For command-line tool information, see the Amazon SQS sections in the *AWS CLI Command Reference* and the *AWS Tools for PowerShell Cmdlet Reference*.

Topics

Making Query API Requests

In this section you'll learn how to construct an Amazon SQS endpoint, make `GET` and `POST` requests and interpret responses.

Topics

Constructing an Endpoint

In order to work with Amazon SQS queues, you must construct an endpoint. For information about region-specific Amazon SQS endpoints, see the *Amazon Web Services General Reference*.

Every Amazon SQS endpoint is independent. For example, if two queues are named `MyQueue` and one has the endpoint `sqs.us-east-2.amazonaws.com` while the other has the endpoint `sqs.eu-west-2.amazonaws.com`, the two queues don't share any data with each other.

The following is an example of an endpoint which makes a request to create a queue.

```
https://sqs.eu-west-2.amazonaws.com/
```

```
?Action=CreateQueue
&DefaultVisibilityTimeout=40
&QueueName=MyQueue
&Version=2012-11-05
&AUTHPARAMS
```

Note
Queue names and queue URLs are case-sensitive.
The structure of *AUTHPARAMS* depends on the signature of the API request. For more information, see Signing AWS API Requests in the *Amazon Web Services General Reference*.

Making a GET Request

An Amazon SQS `GET` request is structured as a URL which consists of the following:

- **Endpoint** – The resource that the request is acting on (the queue name and URL (p. 58)), for example: `https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue`
- **Action** – The API action that you want to perform on the endpoint. A question mark (`?`) separates the endpoint from the action, for example: `?Action=SendMessage&MessageBody=Your%20Message%20Text`
- **Parameters** – Any request parameters—each parameter is separated by an ampersand (`&`), for example: `&Version=2012-11-05&AUTHPARAMS`

The following is an example of a `GET` request that sends a message to an Amazon SQS queue.

```
https://sqs.us-east-2.amazonaws.com/123456789012/MyQueue
?Action=SendMessage&MessageBody=Your%20message%20text
&Version=2012-11-05
&AUTHPARAMS
```

Note
Queue names and queue URLs are case-sensitive.
Because `GET` requests are URLs, you must URL-encode all parameter values. Because spaces aren't allowed in URLs, each space is URL-encoded as `%20`. (The rest of the example isn't URL-encoded to make it easier to read.)

Making a POST Request

An Amazon SQS `POST` requests send query parameters as a form in the body of an HTTP request.

The following is an example of a HTTP header with `Content-Type` set to `application/x-www-form-urlencoded`.

```
POST /MyQueue HTTP/1.1
Host: sqs.us-east-2.amazonaws.com
Content-Type: application/x-www-form-urlencoded
```

The header is followed by a `form-urlencoded` `POST` request that sends a message to an Amazon SQS queue. Each parameter is separated by an ampersand (`&`).

```
Action=SendMessage
&MessageBody=Your+Message+Text
&Expires=2017-10-15T12%3A00%3A00Z
&Version=2012-11-05
```

```
&AUTHPARAMS
```

Note
Only the `Content-Type` HTTP header is required. The *AUTHPARAMS* is the same as for the `GET` request.
Your HTTP client might add other items to the HTTP request, according to the client's HTTP version.

Authenticating Requests

Authentication is the process of identifying and verifying the party that sends a request. During the first stage of authentication, AWS verifies the identity of the producer and whether the producer is registered to use AWS (for more information, see Create an AWS Account (p. 5) and Create an IAM User (p. 5)). Next, AWS abides by the following procedure:

1. The producer (sender) obtains the necessary credential.
2. The producer sends a request and the credential to the consumer (receiver).
3. The consumer uses the credential to verify whether the producer sent the request.
4. One of the following happens:
   - If authentication succeeds, the consumer processes the request.
   - If authentication fails, the consumer rejects the request and returns an error.

Basic Authentication Process with HMAC-SHA

When you access Amazon SQS using the Query API, you must provide the following items to authenticate your request:

- The **AWS Access Key ID** that identifies your AWS account, which AWS uses to look up your Secret Access Key.
- The **HMAC-SHA request signature**, calculated using your Secret Access Key (a shared secret known only to you and AWS—for more information, see RFC2104). The AWS SDK handles the signing process; however, if you submit a query request over HTTP or HTTPS, you must include a signature in every query request.

  1. Derive a Signature Version 4 Signing Key. For more information, see Deriving the Signing Key with Java.

     Note
     Amazon SQS supports Signature Version 4, which provides improved SHA256-based security and performance over previous versions. When you create new applications that use Amazon SQS, use Signature Version 4.

  2. Base64-encode the request signature. The following sample Java code does this:

```
package amazon.webservices.common;

// Define common routines for encoding data in AWS requests.
public class Encoding {

    /* Perform base64 encoding of input bytes.
     * rawData is the array of bytes to be encoded.
     * return is the base64-encoded string representation of rawData.
     */
    public static String EncodeBase64(byte[] rawData) {
        return Base64.encodeBytes(rawData);
    }
```

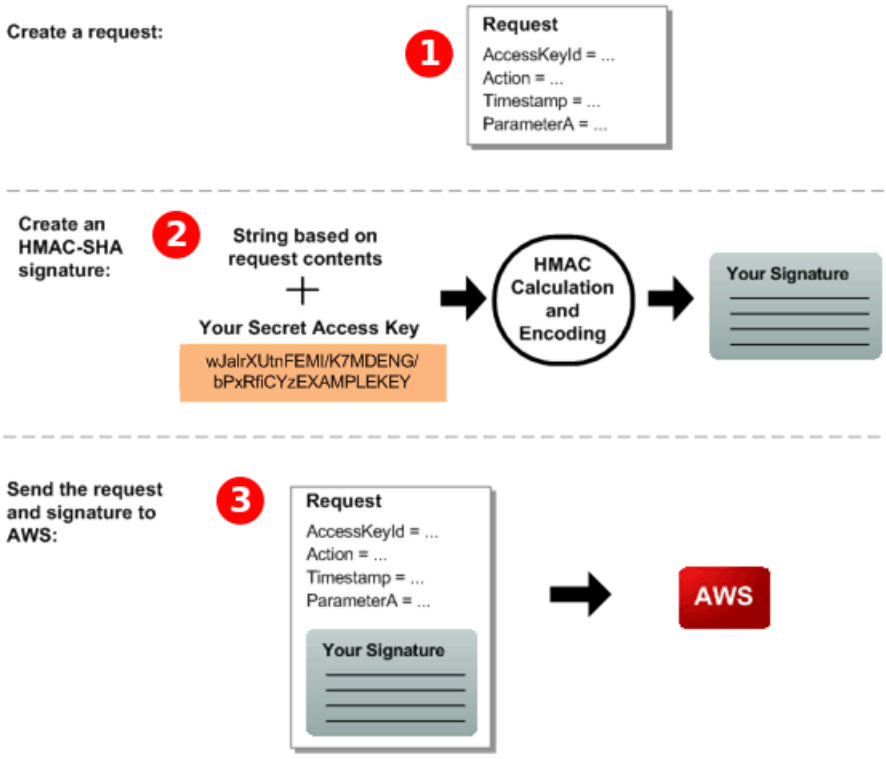
```
}
```

- The **timestamp (or expiration)** of the request. The timestamp that you use in the request must be a `dateTime` object, with the complete date, including hours, minutes, and seconds. For example: `2007-01-31T23:59:59Z` Although this isn't required, we recommend providing the object using the Coordinated Universal Time (Greenwich Mean Time) time zone.

  Note
  Make sure that your server time is set correctly. If you specify a timestamp (rather than an expiration), the request automatically expires 15 minutes after the specified time (AWS doesn't process requests with timestamps more than 15 minutes earlier than the current time on AWS servers).
  If you use .NET, you must not send overly specific timestamps (because of different interpretations of how extra time precision should be dropped). In this case, you should manually construct `dateTime` objects with precision of no more than one millisecond.

Part 1: The Request from the User

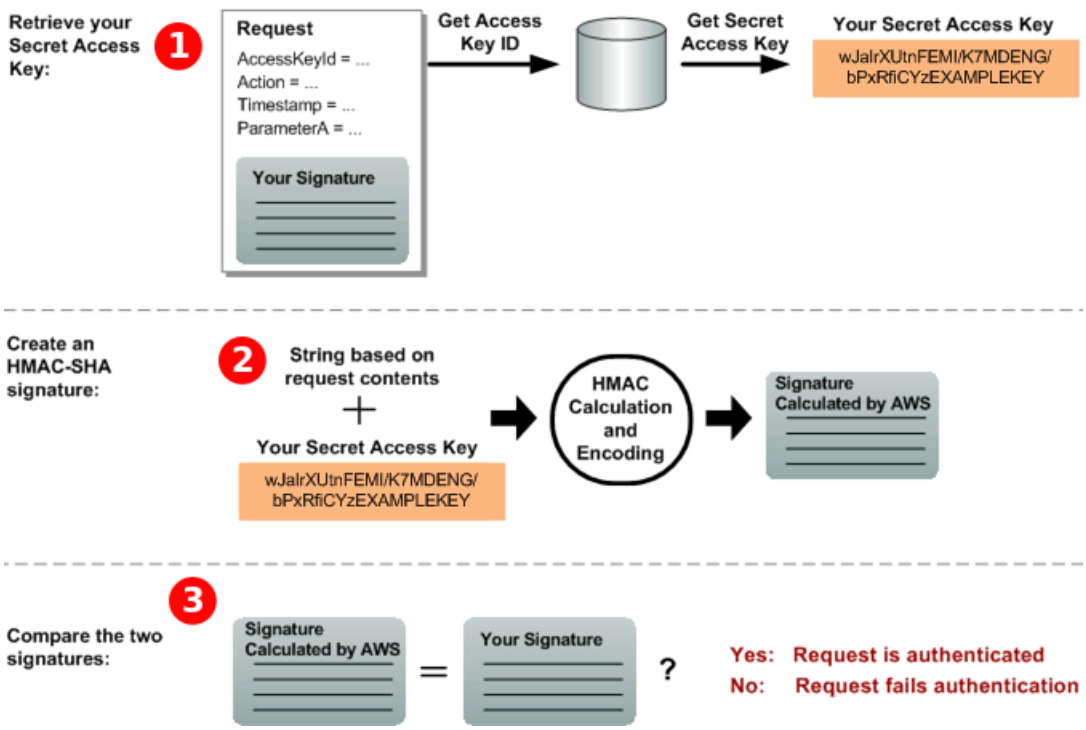
The following is the process you must follow to authenticate AWS requests using an HMAC-SHA request signature.



1. Construct a request to AWS.
2. Calculate a keyed-hash message authentication code (HMAC-SHA) signature using your Secret Access Key.
3. Include the signature and your Access Key ID in the request, and then send the request to AWS.

Part 2: The Response from AWS

AWS begins the following process in response.



1. AWS uses the Access Key ID to look up your Secret Access Key.
2. AWS generates a signature from the request data and the Secret Access Key, using the same algorithm that you used to calculate the signature you sent in the request.
3. One of the following happens:
   - If the signature that AWS generates matches the one you send in the request, AWS considers the request to be authentic.
   - If the comparison fails, the request is discarded, and AWS returns an error.

Interpreting Responses

In response to an action request, Amazon SQS returns an XML data structure that contains the results of the request. For more information, see the individual API actions in the *Amazon Simple Queue Service API Reference*.

Successful Response Structure

If the request is successful, the main response element is named after the action, with `Response` appended (*`ActionName`*`Response`).

This element contains the following child elements:

- ***`ActionName`*`Result`** – Contains an action-specific element. For example, the `CreateQueueResult` element contains the `QueueUrl` element which, in turn, contains the URL of the created queue.
- **`ResponseMetadata`** – Contains the `RequestId` which, in turn, contains the UUID of the request.

The following is an example successful response in XML format:

```
<CreateQueueResponse
```

```
   xmlns=https://sqs.us-east-2.amazonaws.com/doc/2012-11-05/
   xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
   xsi:type=CreateQueueResponse>
   <CreateQueueResult>
      <QueueUrl>https://sqs.us-east-2.amazonaws.com/770098461991/queue2</QueueUrl>
   </CreateQueueResult>
   <ResponseMetadata>
      <RequestId>cb919c0a-9bce-4afe-9b48-9bdf2412bb67</RequestId>
   </ResponseMetadata>
</CreateQueueResponse>
```

Error Response Structure

If a request is unsuccessful, Amazon SQS always returns the main response element `ErrorResponse`. This element contains an `Error` element and a `RequestId` element.

The `Error` element contains the following child elements:

- **`Type`** – Specifies whether the error was a producer or consumer error.
- **`Code`** – Specifies the type of error.
- **`Message`** – Specifies the error condition in a readable format.
- **`Detail`** – (Optional) Specifies additional details about the error.

The `RequestId` element contains the UUID of the request.

The following is an example error response in XML format:

```
<ErrorResponse>
   <Error>
      <Type>Sender</Type>
      <Code>InvalidParameterValue</Code>
      <Message>
         Value (quename_nonalpha) for parameter QueueName is invalid.
         Must be an alphanumeric String of 1 to 80 in length.
      </Message>
   </Error>
   <RequestId>42d59b56-7407-4c4a-be0f-4c88daeea257</RequestId>
</ErrorResponse>
```

Amazon SQS Batch API Actions

To reduce costs or manipulate up to 10 messages with a single API call, you can use the following batch API actions:

- `SendMessageBatch`
- `DeleteMessageBatch`
- `ChangeMessageVisibilityBatch`

You can take advantage of batch functionality using the Query API, or an AWS SDK that supports the Amazon SQS batch actions.

> **Note**
> The total size of all messages that you send in a single `SendMessageBatch` call can't exceed 262,144 bytes (256 KB).
> You can't set permissions for `SendMessageBatch`, `DeleteMessageBatch`, or `ChangeMessageVisibilityBatch` explicitly. Setting permissions for `SendMessage`,

`DeleteMessage`, or `ChangeMessageVisibility` sets permissions for the corresponding batch versions of the actions.
The Amazon SQS console doesn't support batch API actions.

Topics

Enabling Client-Side Buffering and Request Batching

The AWS SDK for Java includes `AmazonSQSBufferedAsyncClient` which accesses Amazon SQS. This client allows for simple request batching using client-side buffering—calls made from the client are first buffered and then sent as a batch request to Amazon SQS.

Client-side buffering allows up to 10 requests to be buffered and sent as a batch request, decreasing your cost of using Amazon SQS and reducing the number of sent requests. `AmazonSQSBufferedAsyncClient` buffers both synchronous and asynchronous calls. Batched requests and support for long polling (p. 75) can also help increase throughput. For more information, see Increasing Throughput using Horizontal Scaling and API Action Batching (p. 177).

Because `AmazonSQSBufferedAsyncClient` implements the same interface as `AmazonSQSAsyncClient`, migrating from `AmazonSQSAsyncClient` to `AmazonSQSBufferedAsyncClient` typically requires only minimal changes to your existing code.

Note
The Amazon SQS Buffered Asynchronous Client doesn't currently support FIFO queues.

Using AmazonSQSBufferedAsyncClient

Before you begin, complete the steps in Setting Up Amazon SQS (p. 5).

You can create a new `AmazonSQSBufferedAsyncClient` based on `AmazonSQSAsyncClient`, for example:

```
// Create the basic Amazon SQS async client
final AmazonSQSAsync sqsAsync = new AmazonSQSAsyncClient();

// Create the buffered client
final AmazonSQSAsync bufferedSqs = new AmazonSQSBufferedAsyncClient(sqsAsync);
```

After you create the new `AmazonSQSBufferedAsyncClient`, you can make calls to it as you do with `AmazonSQSAsyncClient`, for example:

```
final CreateQueueRequest createRequest = new CreateQueueRequest().withQueueName("MyQueue");

final CreateQueueResult res = bufferedSqs.createQueue(createRequest);

final SendMessageRequest request = new SendMessageRequest();
final String body = "Your message text" + System.currentTimeMillis();
request.setMessageBody( body );
request.setQueueUrl(res.getQueueUrl());

final SendMessageResult sendResult = bufferedSqs.sendMessageAsync(request);

final ReceiveMessageRequest receiveRq = new ReceiveMessageRequest()
    .withMaxNumberOfMessages(1)
    .withQueueUrl(queueUrl);
final ReceiveMessageResult rx = bufferedSqs.receiveMessage(receiveRq);
```

Configuring AmazonSQSBufferedAsyncClient

`AmazonSQSBufferedAsyncClient` is preconfigured with settings that work for most use cases. You can further configure `AmazonSQSBufferedAsyncClient`, for example:

1. Create an instance of the `QueueBufferConfig` class with the required configuration parameters.
2. Provide the instance to the `AmazonSQSBufferedAsyncClient` constructor.

```
// Create the basic Amazon SQS async client
final AmazonSQSAsync sqsAsync = new AmazonSQSAsyncClient();

final QueueBufferConfig config = new QueueBufferConfig()
    .withMaxInflightReceiveBatches(5)
    .withMaxDoneReceiveBatches(15);

// Create the buffered client
final AmazonSQSAsync bufferedSqs = new AmazonSQSBufferedAsyncClient(sqsAsync, config);
```

QueueBufferConfig Configuration Parameters

Parameter	Default Value	Description
`longPoll`	`true`	When `longPoll` is set to `true`, `AmazonSQSBufferedAsyncClient` attempts to use long polling when it consumes messages.
`longPollWaitTimeoutSeconds`	20 s	The maximum amount of time (in seconds) which a `ReceiveMessage` call blocks off on the server, waiting for messages to appear in the queue before returning with an empty receive result. **Note** When long polling is disabled, this setting has no effect.
`maxBatchOpenMs`	200 ms	The maximum amount of time (in milliseconds) that an outgoing call waits for other calls with which it batches messages of the same type. The higher the setting, the fewer batches are required to perform the same amount of work (however, the first call in a batch has to spend a longer time waiting). When you set this parameter to `0`, submitted requests don't wait for other requests, effectively disabling batching.

Parameter	Default Value	Description
`maxBatchSize`	10 requests per batch	The maximum number of messages that are batched together in a single request. The higher the setting, the fewer batches are required to carry out the same number of requests. **Note** 10 requests per batch is the maximum allowed value for Amazon SQS.
`maxBatchSizeBytes`	256 KB	The maximum size of a message batch, in bytes, that the client attempts to send to Amazon SQS. **Note** 256 KB is the maximum allowed value for Amazon SQS.
`maxDoneReceiveBatches`	10 batches	The maximum number of receive batches that `AmazonSQSBufferedAsyncClient` prefetches and stores client-side. The higher the setting, the more receive requests can be satisfied without having to make a call to Amazon SQS (however, the more messages are prefetched, the longer they remain in the buffer, causing their own visibility timeout to expire). **Note** `0` indicates that all message prefetching is disabled and messages are consumed only on demand.
`maxInflightOutboundBatches`	5 batches	The maximum number of active outbound batches that can be processed at the same time. The higher the setting, the faster outbound batches can be sent (subject to limits such as CPU or bandwidth) and the more threads are consumed by `AmazonSQSBufferedAsyncClient`.

Parameter	Default Value	Description
`maxInflightReceiveBatches`	10 batches	The maximum number of active receive batches that can be processed at the same time. The higher the setting, the more messages can be received (subject to limits such as CPU or bandwidth), and the more threads are consumed by `AmazonSQSBufferedAsyncClient`. **Note** `0` indicates that all message prefetching is disabled and messages are consumed only on demand.
`visibilityTimeoutSeconds`	-1	When this parameter is set to a positive, non-zero value, the visibility timeout set here overrides the visibility timeout set on the queue from which messages are consumed. **Note** `-1` indicates that the default setting is selected for the queue. You can't set visibility timeout to `0`.

Increasing Throughput using Horizontal Scaling and API Action Batching

Amazon SQS queues can deliver very high throughput. Standard queues support a nearly unlimited number of transactions per second (TPS) per API action. FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.

To achieve high throughput, you must scale message producers and consumers horizontally (add more producers and consumers).

Horizontal Scaling

Because you access Amazon SQS through an HTTP request-response protocol, the *request latency* (the interval between initiating a request and receiving a response) limits the throughput that you can achieve from a single thread using a single connection. For example, if the latency from an Amazon EC2-based client to Amazon SQS in the same region averages 20 ms, the maximum throughput from a single thread over a single connection averages 50 TPS.

Horizontal scaling involves increasing the number of message producers (which make `SendMessage` requests) and consumers (which make `ReceiveMessage` and `DeleteMessage` requests) in order to increase your overall queue throughput. You can scale horizontally in three ways:

- Increase the number of threads per client
- Add more clients
- Increase the number of threads per client and add more clients

When you add more clients, you achieve essentially linear gains in queue throughput. For example, if you double the number of clients, you also double the throughput.

> **Note**
> As you scale horizontally, you must ensure that the Amazon SQS queue that you use has enough connections or threads to support the number of concurrent message producers and consumers that send requests and receive responses. For example, by default, instances of the AWS SDK for Java `AmazonSQSClient` class maintain at most 50 connections to Amazon SQS. To create additional concurrent producers and consumers, you must adjust the maximum number of allowable producer and consumer threads on an `AmazonSQSClientBuilder` object, for example:

```
final AmazonSQS sqsClient = AmazonSQSClientBuilder.standard()
        .withClientConfiguration(new ClientConfiguration()
                .withMaxConnections(producerCount + consumerCount))
        .build();
```

> For `AmazonSQSAsyncClient`, you also must make sure that enough threads are available.

API Action Batching

Batching performs more work during each round trip to the service (for example, when you send multiple messages with a single `SendMessageBatch` request). The Amazon SQS batch API actions are `SendMessageBatch`, `DeleteMessageBatch`, and `ChangeMessageVisibilityBatch`. To take advantage of batching without changing your producers or consumers, you can use the Amazon SQS Buffered Asynchronous Client (p. 174).

> **Note**
> Because `ReceiveMessage` can process 10 messages at a time, there is no `ReceiveMessageBatch` action.

Batching distributes the latency of the batch action over the multiple messages in a batch request, rather than accept the entire latency for a single message (for example, a `SendMessage` request). Because each round trip carries more work, batch requests make more efficient use of threads and connections, improving throughput.

You can combine batching with horizontal scaling to provide throughput with fewer threads, connections, and requests than individual message requests. You can use batched Amazon SQS API actions to send, receive, or delete up to 10 messages at a time. Because Amazon SQS charges by the request, batching can substantially reduce your costs.

Batching can introduce some complexity for your application (for example, you application must accumulate messages before sending them, or it sometimes must wait longer for a response). However, batching can be still effective in the following cases:

- Your application generates many messages in a short time, so the delay is never very long.
- A message consumer fetches messages from a queue at its discretion, unlike typical message producers that need to send messages in response to events they don't control.

Important
A batch request might succeed even though individual messages in the batch failed. After a batch request, always check for individual message failures and retry the action if necessary.

Working Java Example for Single-Operation and Batch Requests

Prerequisites

Ensure that the `aws-java-sdk-sqs.jar`, `aws-java-sdk-ec2.jar`, and `commons-logging.jar` packages are in your Java build class path. The following example shows these dependencies in a Maven project `pom.xml` file.

```
<dependencies>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-sqs</artifactId>
        <version>LATEST</version>
    </dependency>
    <dependency>
        <groupId>com.amazonaws</groupId>
        <artifactId>aws-java-sdk-ec2</artifactId>
        <version>LATEST</version>
    </dependency>
    <dependency>
        <groupId>commons-logging</groupId>
        <artifactId>commons-logging</artifactId>
        <version>LATEST</version>
    </dependency>
</dependencies>
```

SimpleProducerConsumer.java

The following Java code example implements a simple producer-consumer pattern. The main thread spawns a number of producer and consumer threads that process 1 KB messages for a specified time. This example includes producers and consumers that make single-operation requests and those that make batch requests.

```
/*
 * Copyright 2010-2018 Amazon.com, Inc. or its affiliates. All Rights Reserved.
 *
 * Licensed under the Apache License, Version 2.0 (the "License").
 * You may not use this file except in compliance with the License.
 * A copy of the License is located at
 *
 *  https://aws.amazon.com/apache2.0
 *
 * or in the "license" file accompanying this file. This file is distributed
 * on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 *
 */

import com.amazonaws.AmazonClientException;
import com.amazonaws.ClientConfiguration;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClientBuilder;
import com.amazonaws.services.sqs.model.*;
import org.apache.commons.logging.Log;
import org.apache.commons.logging.LogFactory;

import java.math.BigInteger;
```

```
import java.util.ArrayList;
import java.util.List;
import java.util.Random;
import java.util.Scanner;
import java.util.concurrent.TimeUnit;
import java.util.concurrent.atomic.AtomicBoolean;
import java.util.concurrent.atomic.AtomicInteger;

/**
 * Start a specified number of producer and consumer threads, and produce-consume
 * for the least of the specified duration and 1 hour. Some messages can be left
 * in the queue because producers and consumers might not be in exact balance.
 */
public class SimpleProducerConsumer {

    // The maximum runtime of the program.
    private static final int MAX_RUNTIME_MINUTES = 60;
    private static Log log = LogFactory.getLog(SimpleProducerConsumer.class);

    public static void main(String[] args) throws InterruptedException {

        final Scanner input = new Scanner(System.in);

        System.out.print("Enter the queue name: ");
        final String queueName = input.nextLine();

        System.out.print("Enter the number of producers: ");
        final int producerCount = input.nextInt();

        System.out.print("Enter the number of consumers: ");
        final int consumerCount = input.nextInt();

        System.out.print("Enter the number of messages per batch: ");
        final int batchSize = input.nextInt();

        System.out.print("Enter the message size in bytes: ");
        final int messageSizeByte = input.nextInt();

        System.out.print("Enter the run time in minutes: ");
        final int runTimeMinutes = input.nextInt();

        /*
         * Create a new instance of the builder with all defaults (credentials
         * and region) set automatically. For more information, see Creating
         * Service Clients in the AWS SDK for Java Developer Guide.
         */
        final ClientConfiguration clientConfiguration = new ClientConfiguration()
                .withMaxConnections(producerCount + consumerCount);

        final AmazonSQS sqsClient = AmazonSQSClientBuilder.standard()
                .withClientConfiguration(clientConfiguration)
                .build();

        final String queueUrl = sqsClient
                .getQueueUrl(new GetQueueUrlRequest(queueName)).getQueueUrl();

        // The flag used to stop producer, consumer, and monitor threads.
        final AtomicBoolean stop = new AtomicBoolean(false);

        // Start the producers.
        final AtomicInteger producedCount = new AtomicInteger();
        final Thread[] producers = new Thread[producerCount];
        for (int i = 0; i < producerCount; i++) {
            if (batchSize == 1) {
                producers[i] = new Producer(sqsClient, queueUrl, messageSizeByte,
                        producedCount, stop);
```

```
            } else {
                producers[i] = new BatchProducer(sqsClient, queueUrl, batchSize,
                        messageSizeByte, producedCount,
                        stop);
            }
            producers[i].start();
        }

        // Start the consumers.
        final AtomicInteger consumedCount = new AtomicInteger();
        final Thread[] consumers = new Thread[consumerCount];
        for (int i = 0; i < consumerCount; i++) {
            if (batchSize == 1) {
                consumers[i] = new Consumer(sqsClient, queueUrl, consumedCount,
                        stop);
            } else {
                consumers[i] = new BatchConsumer(sqsClient, queueUrl, batchSize,
                        consumedCount, stop);
            }
            consumers[i].start();
        }

        // Start the monitor thread.
        final Thread monitor = new Monitor(producedCount, consumedCount, stop);
        monitor.start();

        // Wait for the specified amount of time then stop.
        Thread.sleep(TimeUnit.MINUTES.toMillis(Math.min(runTimeMinutes,
                MAX_RUNTIME_MINUTES)));
        stop.set(true);

        // Join all threads.
        for (int i = 0; i < producerCount; i++) {
            producers[i].join();
        }

        for (int i = 0; i < consumerCount; i++) {
            consumers[i].join();
        }

        monitor.interrupt();
        monitor.join();
    }

    private static String makeRandomString(int sizeByte) {
        final byte[] bs = new byte[(int) Math.ceil(sizeByte * 5 / 8)];
        new Random().nextBytes(bs);
        bs[0] = (byte) ((bs[0] | 64) & 127);
        return new BigInteger(bs).toString(32);
    }

    /**
     * The producer thread uses {@code SendMessage}
     * to send messages until it is stopped.
     */
    private static class Producer extends Thread {
        final AmazonSQS sqsClient;
        final String queueUrl;
        final AtomicInteger producedCount;
        final AtomicBoolean stop;
        final String theMessage;

        Producer(AmazonSQS sqsQueueBuffer, String queueUrl, int messageSizeByte,
                 AtomicInteger producedCount, AtomicBoolean stop) {
            this.sqsClient = sqsQueueBuffer;
            this.queueUrl = queueUrl;
```

```
            this.producedCount = producedCount;
            this.stop = stop;
            this.theMessage = makeRandomString(messageSizeByte);
        }

        /*
         * The producedCount object tracks the number of messages produced by
         * all producer threads. If there is an error, the program exits the
         * run() method.
         */
        public void run() {
            try {
                while (!stop.get()) {
                    sqsClient.sendMessage(new SendMessageRequest(queueUrl,
                            theMessage));
                    producedCount.incrementAndGet();
                }
            } catch (AmazonClientException e) {
                /*
                 * By default, AmazonSQSClient retries calls 3 times before
                 * failing. If this unlikely condition occurs, stop.
                 */
                log.error("Producer: " + e.getMessage());
                System.exit(1);
            }
        }
    }

    /**
     * The producer thread uses {@code SendMessageBatch}
     * to send messages until it is stopped.
     */
    private static class BatchProducer extends Thread {
        final AmazonSQS sqsClient;
        final String queueUrl;
        final int batchSize;
        final AtomicInteger producedCount;
        final AtomicBoolean stop;
        final String theMessage;

        BatchProducer(AmazonSQS sqsQueueBuffer, String queueUrl, int batchSize,
                      int messageSizeByte, AtomicInteger producedCount,
                      AtomicBoolean stop) {
            this.sqsClient = sqsQueueBuffer;
            this.queueUrl = queueUrl;
            this.batchSize = batchSize;
            this.producedCount = producedCount;
            this.stop = stop;
            this.theMessage = makeRandomString(messageSizeByte);
        }

        public void run() {
            try {
                while (!stop.get()) {
                    final SendMessageBatchRequest batchRequest =
                            new SendMessageBatchRequest().withQueueUrl(queueUrl);

                    final List<SendMessageBatchRequestEntry> entries =
                            new ArrayList<SendMessageBatchRequestEntry>();
                    for (int i = 0; i < batchSize; i++)
                        entries.add(new SendMessageBatchRequestEntry()
                                .withId(Integer.toString(i))
                                .withMessageBody(theMessage));
                    batchRequest.setEntries(entries);

                    final SendMessageBatchResult batchResult =
```

```
                        sqsClient.sendMessageBatch(batchRequest);
                    producedCount.addAndGet(batchResult.getSuccessful().size());

                    /*
                     * Because SendMessageBatch can return successfully, but
                     * individual batch items fail, retry the failed batch items.
                     */
                    if (!batchResult.getFailed().isEmpty()) {
                        log.warn("Producer: retrying sending "
                                + batchResult.getFailed().size() + " messages");
                        for (int i = 0, n = batchResult.getFailed().size();
                             i < n; i++) {
                            sqsClient.sendMessage(new
                                    SendMessageRequest(queueUrl, theMessage));
                            producedCount.incrementAndGet();
                        }
                    }
                }
            } catch (AmazonClientException e) {
                /*
                 * By default, AmazonSQSClient retries calls 3 times before
                 * failing. If this unlikely condition occurs, stop.
                 */
                log.error("BatchProducer: " + e.getMessage());
                System.exit(1);
            }
        }
    }

    /**
     * The consumer thread uses {@code ReceiveMessage} and {@code DeleteMessage}
     * to consume messages until it is stopped.
     */
    private static class Consumer extends Thread {
        final AmazonSQS sqsClient;
        final String queueUrl;
        final AtomicInteger consumedCount;
        final AtomicBoolean stop;

        Consumer(AmazonSQS sqsClient, String queueUrl, AtomicInteger consumedCount,
                 AtomicBoolean stop) {
            this.sqsClient = sqsClient;
            this.queueUrl = queueUrl;
            this.consumedCount = consumedCount;
            this.stop = stop;
        }

        /*
         * Each consumer thread receives and deletes messages until the main
         * thread stops the consumer thread. The consumedCount object tracks the
         * number of messages that are consumed by all consumer threads, and the
         * count is logged periodically.
         */
        public void run() {
            try {
                while (!stop.get()) {
                    try {
                        final ReceiveMessageResult result = sqsClient
                                .receiveMessage(new
                                        ReceiveMessageRequest(queueUrl));

                        if (!result.getMessages().isEmpty()) {
                            final Message m = result.getMessages().get(0);
                            sqsClient.deleteMessage(new
                                    DeleteMessageRequest(queueUrl,
                                    m.getReceiptHandle()));
```

```
                        consumedCount.incrementAndGet();
                    }
                } catch (AmazonClientException e) {
                    log.error(e.getMessage());
                }
            }
        } catch (AmazonClientException e) {
            /*
             * By default, AmazonSQSClient retries calls 3 times before
             * failing. If this unlikely condition occurs, stop.
             */
            log.error("Consumer: " + e.getMessage());
            System.exit(1);
        }
    }
}

/**
 * The consumer thread uses {@code ReceiveMessage} and {@code
 * DeleteMessageBatch} to consume messages until it is stopped.
 */
private static class BatchConsumer extends Thread {
    final AmazonSQS sqsClient;
    final String queueUrl;
    final int batchSize;
    final AtomicInteger consumedCount;
    final AtomicBoolean stop;

    BatchConsumer(AmazonSQS sqsClient, String queueUrl, int batchSize,
                  AtomicInteger consumedCount, AtomicBoolean stop) {
        this.sqsClient = sqsClient;
        this.queueUrl = queueUrl;
        this.batchSize = batchSize;
        this.consumedCount = consumedCount;
        this.stop = stop;
    }

    public void run() {
        try {
            while (!stop.get()) {
                final ReceiveMessageResult result = sqsClient
                        .receiveMessage(new ReceiveMessageRequest(queueUrl)
                                .withMaxNumberOfMessages(batchSize));

                if (!result.getMessages().isEmpty()) {
                    final List<Message> messages = result.getMessages();
                    final DeleteMessageBatchRequest batchRequest =
                            new DeleteMessageBatchRequest()
                                    .withQueueUrl(queueUrl);

                    final List<DeleteMessageBatchRequestEntry> entries =
                            new ArrayList<DeleteMessageBatchRequestEntry>();
                    for (int i = 0, n = messages.size(); i < n; i++)
                        entries.add(new DeleteMessageBatchRequestEntry()
                                .withId(Integer.toString(i))
                                .withReceiptHandle(messages.get(i)
                                        .getReceiptHandle()));
                    batchRequest.setEntries(entries);

                    final DeleteMessageBatchResult batchResult = sqsClient
                            .deleteMessageBatch(batchRequest);
                    consumedCount.addAndGet(batchResult.getSuccessful().size());

                    /*
                     * Because DeleteMessageBatch can return successfully,
                     * but individual batch items fail, retry the failed
```

```
                         * batch items.
                         */
                        if (!batchResult.getFailed().isEmpty()) {
                            final int n = batchResult.getFailed().size();
                            log.warn("Producer: retrying deleting " + n
                                    + " messages");
                            for (BatchResultErrorEntry e : batchResult
                                    .getFailed()) {

                                sqsClient.deleteMessage(
                                        new DeleteMessageRequest(queueUrl,
                                                messages.get(Integer
                                                        .parseInt(e.getId()))
                                                        .getReceiptHandle()));

                                consumedCount.incrementAndGet();
                            }
                        }
                    }
                }
            } catch (AmazonClientException e) {
                /*
                 * By default, AmazonSQSClient retries calls 3 times before
                 * failing. If this unlikely condition occurs, stop.
                 */
                log.error("BatchConsumer: " + e.getMessage());
                System.exit(1);
            }
        }
    }

    /**
     * This thread prints every second the number of messages produced and
     * consumed so far.
     */
    private static class Monitor extends Thread {
        private final AtomicInteger producedCount;
        private final AtomicInteger consumedCount;
        private final AtomicBoolean stop;

        Monitor(AtomicInteger producedCount, AtomicInteger consumedCount,
                AtomicBoolean stop) {
            this.producedCount = producedCount;
            this.consumedCount = consumedCount;
            this.stop = stop;
        }

        public void run() {
            try {
                while (!stop.get()) {
                    Thread.sleep(1000);
                    log.info("produced messages = " + producedCount.get()
                            + ", consumed messages = " + consumedCount.get());
                }
            } catch (InterruptedException e) {
                // Allow the thread to exit.
            }
        }
    }
}
```

Monitoring Volume Metrics from the Example Run

Amazon SQS automatically generates volume metrics for sent, received, and deleted messages. You can access those metrics and others through the **Monitoring** tab for your queue or on the CloudWatch console.

Note
The metrics can take up to 15 minutes after the queue starts to become available.

Related Amazon SQS Resources

The following table lists related resources that you might find useful as you work with this service.

Resource	Description
Amazon Simple Queue Service API Reference	Descriptions of API actions, parameters, and data types and a list of errors that the service returns.
Amazon SQS in the *AWS CLI Command Reference*	Descriptions of the AWS CLI commands that you can use to work with queues.
Regions and Endpoints	Information about Amazon SQS regions and endpoints
Product Page	The primary web page for information about Amazon SQS.
Discussion Forum	A community-based forum for developers to discuss technical questions related to Amazon SQS.
AWS Premium Support Information	The primary web page for information about AWS Premium Support, a one-on-one, fast-response support channel to help you build and run applications on AWS infrastructure services.

Amazon SQS Release Notes

The following table lists Amazon SQS feature releases and improvements. For changes to the *Amazon Simple Queue Service Developer Guide*, see Amazon SQS Document History (p. 191).

Date	Feature Release
January 23, 2018	Amazon S3 Event Notifications are compatible with Amazon SQS SSE. For more information, see the updated Enable Compatibility Between AWS Services and Encrypted Queues (p. 165) section.
January 2, 2018	The following features of AWS services are compatible with Amazon SQS SSE: • Amazon CloudWatch Events Notifications • Amazon SNS Topic Subscriptions
October 19, 2017	You can track cost allocation by adding, updating, removing, and listing metadata tags for Amazon SQS queues using the `TagQueue`, `UntagQueue`, and `ListQueueTags` actions and the AWS Management Console. For more information, see Tagging Your Amazon SQS Queues (p. 66) and the Adding, Updating, and Removing Tags from an Amazon SQS Queue (p. 45) tutorial.
September 1, 2017	The complete set of Amazon SQS actions is displayed in the **Actions** list on the **Add a Permission to *`MyQueue`*** dialog box. For more information, see the Adding Permissions to an Amazon SQS Queue (p. 29) tutorial.
June 14, 2017	FIFO (First-In-First-Out) queues are available in the US East (N. Virginia) region, in addition to the EU (Ireland), US East (Ohio), and US West (Oregon) regions. For more information about how FIFO queues work and how to get started using them, see FIFO (First-In-First-Out) Queues (p. 51).
June 8, 2017	FIFO (First-In-First-Out) queues are available in the EU (Ireland) region, in addition to the US East (Ohio) and US West (Oregon) regions. For more information about how FIFO queues work and how to get started using them, see FIFO (First-In-First-Out) Queues (p. 51).
May 23, 2017	Server-side encryption (SSE) for Amazon SQS is available in the US East (N. Virginia) region, in addition to the US East (Ohio) and US West (Oregon) regions. For more information on server-side encryption and how to get started using it, see Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160).
May 19, 2017	• You can use the Amazon SQS Extended Client Library for Java together with the Amazon SQS Java Message Service (JMS) Client. • The Amazon SQS Java Messaging Library has been updated to `1.0.3`. For more information, see Using JMS with Amazon SQS (p. 90). • Updated the Using JMS with Amazon SQS (p. 90) section.
May 1, 2017	AWS has expanded its HIPAA compliance program to include Amazon SQS as a HIPAA Eligible Service.
April 28, 2017	Server-side encryption (SSE) for Amazon SQS is available in the US East (Ohio) and US West (Oregon) regions. SSE lets you protect the contents of messages in Amazon SQS queues using keys managed in the AWS Key Management Service (AWS KMS). For more information on server-side encryption and how to get

Date	Feature Release
	started using it, see Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160). For tutorials, see the following: • Creating an Amazon SQS queue with SSE (p. 21) • Configuring SSE for an existing Amazon SQS queue (p. 25) SSE adds the `KmsMasterKeyId` and `KmsDataKeyReusePeriodSeconds` attributes to the `CreateQueue`, `GetQueueAttributes`, and `SetQueueAttributes` actions. **Important** Some features of AWS services that can send notifications to Amazon SQS using the AWS Security Token Service `AssumeRole` API action are compatible with SSE but work *only with standard queues:* • Auto Scaling Lifecycle Hooks • AWS Lambda Dead-Letter Queues Other features of AWS services or third-party services that send notifications to Amazon SQS aren't compatible with SSE, despite allowing you to set an encrypted queue as a target: • AWS IoT Rule Actions For information about compatibility of other services with encrypted queues, see Enable Compatibility Between AWS Services and Encrypted Queues (p. 165) and your service documentation.
April 24, 2017	• The Amazon SQS Extended Client Library for Java and Amazon SQS Java Message Service (JMS) Client support FIFO queues. • The Amazon SQS Java Messaging Library has been updated to `1.0.2`. • Updated the Using JMS with Amazon SQS (p. 90) section.
March 28, 2017	AWS CloudFormation lets your create FIFO queues. Added the Create a Queue Using AWS CloudFormation (p. 19) tutorial.

Date	Feature Release
November 17, 2016	*FIFO (First-In-First-Out) queues* or *standard queues* (the new name for existing queues) are available in the US West (Oregon) and US East (Ohio) regions. For more information about how FIFO queues work and how to get started using them, see the following: • FIFO (First-In-First-Out) Queues (p. 51) • Moving from a Standard Queue to a FIFO Queue (p. 57) • Recommendations for FIFO (First-In-First-Out) Queues (p. 115) For revised Amazon SQS tutorials, see the following: • Creating an Amazon SQS Queue (p. 16) • Sending a Message to an Amazon SQS Queue (p. 30) • Receiving and Deleting a Message from an Amazon SQS Queue (p. 33) FIFO queues add the following API functionality: • The `FifoQueue` and `ContentBasedDeduplication` attributes for the `CreateQueue`, `GetQueueAttributes`, and `SetQueueAttributes` actions. • The `MessageDeduplicationId` and `MessageGroupId` request parameters for the `SendMessage` and `SendMessageBatch` actions and attributes for the `ReceiveMessage` action. • The `ReceiveRequestAttemptId` request parameter for the `ReceiveMessage` action. • The `SequenceNumber` response parameter for the `SendMessage` and `SendMessageBatch` actions and the `SequenceNumber` attribute for the `ReceiveMessage` action. **Important** As of November 17, 2016, Amazon SQS no longer publishes a WSDL. The Amazon SQS Buffered Asynchronous Client doesn't currently support FIFO queues. Some AWS or external services that send notifications to Amazon SQS might not be compatible with FIFO queues, despite allowing you to set a FIFO queue as a target. The following features of AWS services aren't currently compatible with FIFO queues: • Auto Scaling Lifecycle Hooks • AWS IoT Rule Actions • AWS Lambda Dead-Letter Queues For information about compatibility of other services with FIFO queues, see your service documentation. FIFO queues don't support timers on individual messages.
August 31, 2016	The `ApproximateAgeOfOldestMessage` CloudWatch metric lets you find the approximate age of the oldest non-deleted message in the queue. For more information, see Available CloudWatch Metrics for Amazon SQS (p. 126).

Date	Feature Release
February 12, 2016	You can view CloudWatch metrics from within the Amazon SQS console for up to 10 of your queues at a time. For more information, see Monitoring Amazon SQS using CloudWatch (p. 121).
October 27, 2015	The Amazon SQS Extended Client Library for Java lets you manage Amazon SQS messages with Amazon S3. For more information, see Managing Large Amazon SQS Messages Using Amazon S3 (p. 86) in the *Amazon Simple Queue Service Developer Guide*.
December 29, 2014	Amazon SQS lets you use JMS (Java Message Service) with Amazon SQS queues. For more information, see Using JMS with Amazon SQS (p. 90) in the *Amazon Simple Queue Service Developer Guide*.
December 8, 2014	Amazon SQS lets you delete the messages in a queue using the `PurgeQueue` API action. For more information, see PurgeQueue in the *Amazon Simple Queue Service API Reference*.
July 16, 2014	Amazon SQS lets you log API actions using AWS CloudTrail. For more information, see Logging Amazon SQS API Actions Using AWS CloudTrail (p. 129).
May 6, 2014	Amazon SQS provides support for message attributes. For more information, see Using Amazon SQS Message Attributes (p. 67).
January 29, 2014	Amazon SQS provides support for dead-letter queues. For more information, see Using Amazon SQS Dead-Letter Queues (p. 62).
November 21, 2012	You can subscribe an Amazon SQS queue to an Amazon SNS topic using the AWS Management Console for Amazon SQS, which simplifies the process. For more information, see Subscribing an Amazon SQS Queue to an Amazon SNS Topic (p. 43).
November 5, 2012	The 2012-11-05 API version of Amazon SQS adds support for Signature Version 4, which provides improved security and performance. For more information about Signature Version 4, see Basic Authentication Process with HMAC-SHA (p. 170).
November 5, 2012	The AWS SDK for Java includes a buffered asynchronous client, AmazonSQSBufferedAsyncClient, for accessing Amazon SQS. This client allows for easier request batching by enabling client-side buffering, where calls made from the client are first buffered and then sent as a batch request to Amazon SQS. For more information about client-side buffering and request batching, see Enabling Client-Side Buffering and Request Batching (p. 174).
November 5, 2012	The 2012-11-05 API version of Amazon SQS adds long polling support. Long polling allows Amazon SQS to wait for a specified amount time for a message to be available instead of returning an empty response if one isn't available. For more information about long polling, see Amazon SQS Long Polling (p. 75).

Amazon SQS Document History

The following table lists changes to the *Amazon Simple Queue Service Developer Guide*. For Amazon SQS feature releases and improvements, see Amazon SQS Release Notes (p. 188).

Date	Documentation Update
March 7, 2018	Updated the New and Frequently Viewed Amazon SQS Topics (p. 4) section.

March 2, 2018	• Added the `sqs:ListQueueTags`, `sqs:TagQueue`, and `sqs:UntagQueue` permissions to the Actions and Resource Reference (p. 158) section.
	• Clarified the permissions for the following API actions:
	  • `ChangeMessageVisibilityBatch` (`sqs:ChangeMessageVisibility`)
	  • `DeleteMessageBatch` (`sqs:DeleteMessage`)
	  • `SendMessageBatch` (`sqs:SendMessage`)

February 28, 2018	Corrected image display in GitHub.
February 27, 2018	In addition to HTML, PDF, and Kindle, the *Amazon Simple Queue Service Developer Guide* is available on GitHub. To leave feedback, choose the GitHub icon in the upper right-hand corner. 
February 26, 2018	• Made regions consistent in all examples. • Optimized links to the AWS console and product webpages.
February 23, 2018	• Rewrote the Making Query API Requests (p. 168) section. • Corrected the Java code samples in the Enabling Client-Side Buffering and Request Batching (p. 174) section. • Replaced `http://` with `https://` in all examples of Amazon SQS endpoints.
February 21, 2018	• Corrected the Java code sample in the Using AmazonSQSBufferedAsyncClient (p. 174) section. • Clarified the information in the Purging Messages from an Amazon SQS Queue (p. 41) section.

February 20, 2018	• Clarified the information in the Moving from a Standard Queue to a FIFO Queue (p. 57) section.
	• Optimized the Java code sample in the following sections:
	  • Creating a Queue (p. 18)
	  • Creating a Queue with Server-Side Encryption (SSE) (p. 23)
	  • Configuring SSE for an Existing Queue (p. 26)
	  • Listing All Queues in a Region (p. 28)
	  • Sending a Message to a Queue (p. 32)
	  • Receiving and Deleting a Message from a Queue (p. 36)
	  • Configuring a Dead-Letter Queue (p. 40)
	  • Adding, Updating, and Removing Cost Allocation Tags for a Queue (p. 45)

February 19, 2018	Optimized the example Java code and corrected `pom.xml` prerequisites in the following sections: • Working Java Example for Using Amazon S3 for Large Amazon SQS Messages (p. 87) • Working Java Example for Standard Queues (p. 49)

Date	Documentation Update
	• Working Java Example for FIFO Queues (p. 54)
February 16, 2018	Simplified the example Java code and added `pom.xml` prerequisites to the following sections: • Working Java Example for Standard Queues (p. 49) • Working Java Example for FIFO Queues (p. 54)
February 15, 2018	Updated the Related Amazon SQS Resources (p. 187) section.
February 14, 2018	• Clarified the information in the Consuming Messages Using Short Polling (p. 48) section. • Restructured the Amazon SQS Limits (p. 118) section.
February 13, 2018	• Clarified the following statement in the Overview of Amazon SQS Queue Tagging (p. 67) section: You can't add tags to a new queue when you create it using the AWS Management Console (you *can* add tags after the queue is created). However, you can add, update, or remove queue tags at any time using the Amazon SQS API actions. • Clarified and corrected the information in the Setting the Visibility Timeout (p. 61) and Processing Messages in a Timely Manner (p. 113) sections. • Updated the Related Amazon SQS Resources (p. 187) section. • Added the We Want to Hear from You (p. 3) section.
February 9, 2018	• Made the Java example in the Working Java Example for Single-Operation and Batch Requests (p. 179) section self-contained and added `pom.xml` prerequisites. • Added an explanation for monitoring the example run (p. 186).
February 8, 2018	Rewrote the Java example in the Working Java Example for Single-Operation and Batch Requests (p. 179) section.
February 7, 2018	Rewrote the following sections: • Increasing Throughput using Horizontal Scaling and API Action Batching (p. 177)
February 6, 2018	Rewrote the following sections: • Amazon SQS Batch API Actions (p. 173) • Enabling Client-Side Buffering and Request Batching (p. 174)
February 5, 2018	Clarified the information in the Configuring an Amazon SQS Dead-Letter Queue (p. 38) section.
February 2, 2018	Created the New and Frequently Viewed Amazon SQS Topics (p. 4) section.

February 1, 2018	• Clarified the information in the Receiving Messages (FIFO) (p. 53) section.
	• Corrected the code examples in—and renamed—the following sections:
	  • Working Java Example for Standard Queues (p. 49)
	  • Working Java Example for FIFO Queues (p. 54)
	  • Working Java Example for Using Amazon S3 for Large Amazon SQS Messages (p. 87)
	  • Working Java Example for Using JMS with Amazon SQS Standard Queues (p. 97)

Date	Documentation Update
January 31, 2018	Clarified the information in the following sections: • Allow Developers to Write Messages to a Shared Queue (p. 143) • Amazon SQS Batch API Actions (p. 173) • Benefits of Server-Side Encryption (p. 160) • Getting Started with SSE (p. 166) • How Do Dead-Letter Queues Work? (p. 62)
January 30, 2018	Rewrote the following sections: • Basic Authentication Process with HMAC-SHA (p. 170) • Interpreting Responses (p. 172)
January 29, 2018	Rewrote the following sections: • Making Query API Requests (p. 168) • Constructing an Endpoint (p. 168) • Making a GET Request (p. 169) • Authenticating Requests (p. 170)
January 25, 2018	• Added links to explain why client constructors are deprecated in the AWS SDK for Java throughout this guide. For more information, see Creating Service Clients in the *AWS SDK for Java Developer Guide*. • Clarified the following statement in the Monitoring Amazon SQS using CloudWatch (p. 121) section: Detailed monitoring (or one-minute metrics) is currently unavailable for Amazon SQS. Making requests to CloudWatch at this resolution might return no data.
January 24, 2018	Clarified the wording for Amazon SQS API actions throughout this guide.
January 22, 2018	Added the Enable Compatibility Between AWS Services and Encrypted Queues (p. 165) section.
January 19, 2018	Clarified the information in the How Do Dead-Letter Queues Work? (p. 62) section.

January 18, 2018	• Rewrote the code in the the section called "Creating a JMS Connection" (p. 91) section, replacing the deprecated `AmazonSQSClient` constructor with `AmazonSQSClientBuilder`. Use the following syntax to create a new connection factory with all defaults (such as credentials and region) set:
	`final SQSConnectionFactory connectionFactory = new SQSConnectionFactory( new ProviderConfiguration(), AmazonSQSClientBuilder.defaultClient());`
	• Rewrote the code in the Horizontal Scaling (p. 177) section. Use the following syntax to adjust the maximum number of allowable producer and consumer threads on an `AmazonSQSClientBuilder` object:
	`final AmazonSQS sqsClient = AmazonSQSClientBuilder.standard() .withClientConfiguration(new ClientConfiguration() .withMaxConnections(producerCount + consumerCount)) .build();`

Date	Documentation Update

January 17, 2018	• Rewrote and simplified the code in the Working Java Example for Standard Queues (p. 49) and Working Java Example for FIFO Queues (p. 54) sections, replacing the deprecated `AmazonSQSClient` constructor with `AmazonSQSClientBuilder`. Use the following syntax to create a new instance of the builder with all defaults (such as credentials and region) set:
	`final AmazonSQS sqs = AmazonSQSClientBuilder.defaultClient();`
	• Rewrote and simplified the code in the Working Java Example for Using Amazon S3 for Large Amazon SQS Messages (p. 87) section, replacing the deprecated `AmazonS3Client` constructor with `AmazonS3ClientBuilder`:
	`final AmazonSQS s3 = AmazonS3ClientBuilder.defaultClient();`

January 16, 2018	• Added more cross-references to Message ID (p. 58) and Receipt Handle (p. 58) throughout this guide. • Rewrote the Managing Large Amazon SQS Messages Using Amazon S3 (p. 86) section.
January 15, 2018	• In the Managing Large Amazon SQS Messages Using Amazon S3 (p. 86) and Using JMS with Amazon SQS (p. 90) sections, clarified the following explanation: The SDK for Java and Amazon SQS Extended Client Library for Java require the J2SE Development Kit 8.0 or later. • Added sub-sections to the Best Practices for Amazon SQS (p. 113) section and clarified and reorganized the content. • Added the following explanation to the Setting Up Dead-Letter Queue Retention (p. 114) section: The expiration of a message is always based on its original enqueue timestamp. When a message is moved to a dead-letter queue (p. 62), the enqueue timestamp remains unchanged. For example, if a message spends 1 day in the original queue before being moved to a dead-letter queue, and the retention period of the dead-letter queue is set to 4 days, the message is deleted from the dead-letter queue after 3 days. Thus, it is a best practice to always set the retention period of a dead-letter queue to be longer than the retention period of the original queue. • Clarified the information in the How Do Dead-Letter Queues Work? (p. 62) section. • Added the following explanation to the Visibility Timeout (p. 60) section: The default visibility timeout for a message is 30 seconds. The maximum is 12 hours.
January 3, 2018	Clarified the following explanations throughout this guide: • Standard queues support a nearly unlimited number of transactions per second (TPS) per API action. • FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.

Date	Documentation Update
December 7, 2017	• Added the following note to the Using Identity-Based Policies (IAM) Policies for Amazon SQS (p. 140) section: With the exception of `ListQueues`, all Amazon SQS API actions support resource-level permissions. For more information, see Actions and Resource Reference (p. 158). • Added the "Introducing Amazon Simple Queue Service (SQS) FIFO Queues" video to the FIFO (First-In-First-Out) Queues (p. 51) section. • Added the "Introducing Amazon Simple Queue Service (SQS) Server-Side Encryption" video to the Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160) section. • Added the "Introducing Cost Allocation Tags for Amazon Simple Queue Service (SQS)" video to the Tagging Your Amazon SQS Queues (p. 66) section.
December 6, 2017	• Suggested using Step Functions instead of Amazon SWF for visibility timeouts longer than 12 hours in the Best Practices for Amazon SQS (p. 113) section. • Clarified the following explanation in the Limits Related to Messages (p. 119) section: The default visibility timeout for a message is 30 seconds. The maximum is 12 hours. • Added the following note to the Subscribing an Amazon SQS Queue to an Amazon SNS Topic (p. 43) section: If your Amazon SQS queue and Amazon SNS topic are in different AWS accounts, the owner of the topic must first confirm the subscription. For more information, see Confirm the Subscription in the *Amazon Simple Notification Service Developer Guide*. • Added the following note to the Key Terms (p. 52) section: Amazon SQS continues to keep track of the message deduplication ID even after the message is received and deleted. • Clarified and reorganized the information in the Making Query API Requests (p. 168) and Monitoring Amazon SQS using CloudWatch (p. 121) sections.
December 1, 2017	Clarified and reorganized the information in the Monitoring Amazon SQS using CloudWatch (p. 121) section.
October 30, 2017	• Corrected and reorganized the table of contents. • Rewrote the Visibility Timeout (p. 60) section.
October 27, 2017	Clarified the explanation of throughput for FIFO queues in the FIFO (First-In-First-Out) Queues (p. 51) section.
September 29, 2017	Added a note about the Amazon SQS Buffered Asynchronous Client to the Increasing Throughput using Horizontal Scaling and API Action Batching (p. 177) section.
September 19, 2017	Corrected the diagrams in the Using Amazon SQS and IAM Policies (p. 141) section.
August 29, 2017	Clarified the information in the Changing the Visibility Timeout for a Message (p. 61) section.
August 17, 2017	Clarified the permissions for the `SendMessage` and `SendMessageBatch` API actions in Actions and Resource Reference (p. 158).
August 15, 2017	Updated information about dead-letter queues in the General Recommendations (p. 113) section.

Date	Documentation Update
August 9, 2017	• The Amazon SQS Java Messaging Library has been updated to `1.0.4`. For more information, see Using JMS with Amazon SQS (p. 90). • Updated the Using JMS with Amazon SQS (p. 90) section.
July 27, 2017	Changed the deprecated `AmazonSQSClient` constructor to `AmazonSQSClientBuilder` and revised the corresponding region specification in the Working Java Example for Standard Queues (p. 49) section.
July 25, 2017	Clarified the throughput for standard and FIFO queues throughout this guide: • Standard queues support a nearly unlimited number of transactions per second (TPS) per API action. • FIFO queues support up to 300 messages per second (300 send, receive, or delete operations per second). • When you batch (p. 173) 10 messages per operation (maximum), FIFO queues can support up to 3,000 messages per second. To request a limit increase, file a support request.
July 20, 2017	Clarified the compatibility between Amazon SQS SSE queues and AWS and third-party service features throughout this guide: Some features of AWS services that can send notifications to Amazon SQS using the AWS Security Token Service `AssumeRole` API action are compatible with SSE but work *only with standard queues:* • Auto Scaling Lifecycle Hooks • AWS Lambda Dead-Letter Queues Other features of AWS services or third-party services that send notifications to Amazon SQS aren't compatible with SSE, despite allowing you to set an encrypted queue as a target: • AWS IoT Rule Actions For information about compatibility of other services with encrypted queues, see Enable Compatibility Between AWS Services and Encrypted Queues (p. 165) and your service documentation.
June 23, 2017	Corrected the information in the Limits Related to Messages (p. 119) section.
June 20, 2017	Clarified the information in the Using Amazon SQS Dead-Letter Queues (p. 62) section.
June 2, 2017	• Restructured and updated the Using Amazon SQS Dead-Letter Queues (p. 62) section. • Created the Configuring an Amazon SQS Dead-Letter Queue (p. 38) section.
June 1, 2017	Updated the What is Amazon Simple Queue Service? (p. 1) section.
May 24, 2017	• Restructured the Using JMS with Amazon SQS (p. 90) section. • Created the Using the JMS Client with Other Amazon SQS Clients (p. 96) section.

Date	Documentation Update
May 23, 2017	Server-side encryption (SSE) for Amazon SQS is available in the US East (N. Virginia) region, in addition to the US East (Ohio) and US West (Oregon) regions. For more information on server-side encryption and how to get started using it, see Protecting Data Using Server-Side Encryption (SSE) and AWS KMS (p. 160).
May 19, 2017	• You can use the Amazon SQS Extended Client Library for Java together with the Amazon SQS Java Message Service (JMS) Client. • The Amazon SQS Java Messaging Library has been updated to `1.0.3`. For more information, see Using JMS with Amazon SQS (p. 90). • Updated the Using JMS with Amazon SQS (p. 90) section.
April 25, 2017	Restructured and updated the Amazon SQS Long Polling (p. 75) section.
February 6, 2017	Updated the Authentication and Access Control (p. 134) section with new content.
December 16, 2016	Retired the *Amazon Simple Queue Service Getting Started Guide* and incorporated some of its content into the following sections of this guide: • Setting Up Amazon SQS (p. 5) • Getting Started with Amazon SQS (p. 8) • Amazon SQS Tutorials (p. 16)
December 2, 2016	Restructured and updated the Authentication and Access Control (p. 134) section.
November 2, 2016	Renamed the Walkthroughs section to Amazon SQS Tutorials (p. 16).
May 27, 2016	Added the Best Practices for Amazon SQS (p. 113) section.
May 12, 2016	Added the Amazon SQS Limits (p. 118) section.
December 7, 2015	Updated Amazon SQS console screenshots.
August 4, 2014	Updated information about access keys. For more information, see Authenticating Requests (p. 170).

AWS Glossary

For the latest AWS terminology, see the AWS Glossary in the *AWS General Reference*.