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. 5) and FIFO queues (p. 6).

Topics

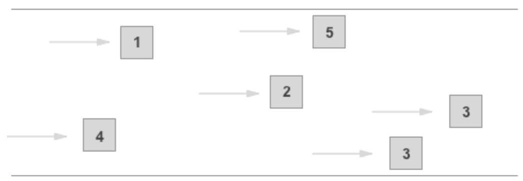
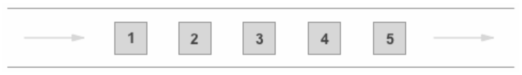
What can I use Amazon SQS for?

Use Amazon SQS when you need each unique message to be consumed only once and 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 does not 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 readers 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
High Throughput – Standard queues have nearly-unlimited transactions per second (TPS). **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.	**First-In-First-Out Delivery** – The order in which messages are sent and received is strictly preserved. **Exactly-Once Processing** – A message is delivered once and remains available until a consumer processes and deletes it. Duplicates are not introduced into the queue. **Limited Throughput** – 300 transactions per second (TPS).
	
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 sending and retrieving messages.
- **Multiple writers and readers** – 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 can 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.

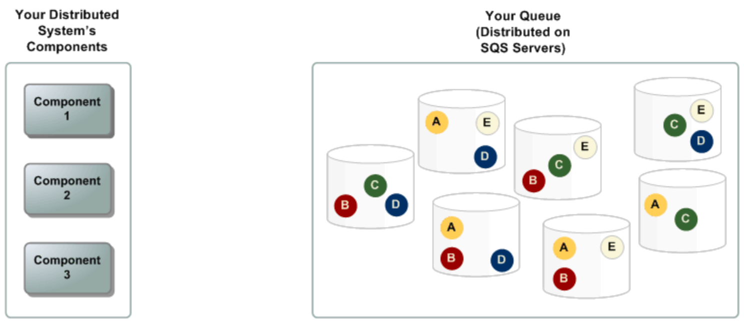
- **Access control** – You control who can send messages to a queue, and who can receive messages from a queue.
- **Delay queues** – You can set a default delay on a queue, so that delivery of all enqueued messages is postponed for the specified duration. You can set the delay value when you create a 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.
- **PCI compliance** – Amazon SQS supports the processing, storage, and transmission of credit card data by a merchant or service provider, and has been validated as compliant with Payment Card Industry (PCI) Data Security Standard (DSS). For more information about PCI DSS, including how to request a copy of the AWS PCI Compliance Package, see PCI DSS Level 1.

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 (labeled A-E), is redundantly saved across multiple Amazon SQS servers.


Your Distributed System's Components
Component 1
Component 2
Component 3
Your Queue (Distributed on SQS Servers)
A
B
C
D
E

How Amazon SQS Queues Work

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

Topics

Basic Prerequisites

The following basic prerequisites will 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 could 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
Delete a queue	DeleteQueue

Standard Queues

Amazon SQS offers *standard* as the default queue type. A standard queue allows you to have a nearly-unlimited number of transactions per second. 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. 67).

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 either using a *FIFO (First-In-First-Out) queue* (p. 6) 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.

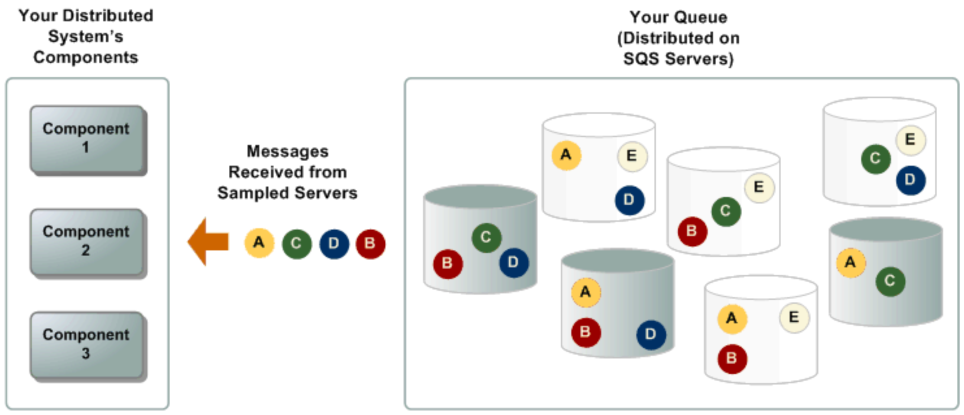
If this occurs, the copy of the message will not be deleted on that unavailable server, and you might get that message copy again when you receive messages. You should design your applications to be *idempotent* (they should not be affected adversely when processing the same message more than once).

Retrieving Messages Using Short Polling

The behavior of retrieving messages from the queue depends on whether you use short (standard) polling, the default behavior, or long polling. For more information about long polling, see Amazon SQS Long Polling (p. 29).

When you retrieve messages from the queue using short polling, Amazon SQS samples a subset of the servers (based on a weighted random distribution) and returns messages from just these servers. Thus, a particular receive request might not return all of your messages. However, if you have a small number of messages in your queue (fewer than 1,000), one particular request might not return any of your messages, whereas a subsequent request will. If you keep retrieving from your queues, Amazon SQS will sample all of the servers, and you'll receive all your messages.

The following figure shows the short-polling behavior of messages returned after one of your system components makes a receive request. Amazon SQS samples several of the servers (in gray) and returns the messages from those servers (Message A, C, D, and B). Message E isn't returned to this particular request, but it will be returned to a subsequent request.


Your Distributed System's Components
Component 1
Component 2
Component 3
Messages Received from Sampled Servers
A C D B
Your Queue (Distributed on SQS Servers)
A E D
E C B
C E D
C B D
A B D
A E B
A C

FIFO (First-In-First-Out) Queues

In addition to having all the capabilities of the standard queue (p. 5), *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 are limited to 300 transactions per second (TPS).

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.

For best practices of working with FIFO queues, see Recommendations for FIFO (First-In-First-Out) Queues (p. 68) and General Recommendations (p. 67).

Note
The following clients don't currently support FIFO queues:

- Amazon SQS Buffered Asynchronous Client

- Amazon SQS Extended Client Library for Java
- Amazon SQS Java Message Service (JMS) Client

Topics

Message Ordering

The FIFO queue improves upon and complements the standard queue (p. 5). 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 are not introduced into the queue. In addition, FIFO queues support *message groups* that allow multiple ordered message groups within a single queue.

FIFO Queue Logic

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 sender 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.

Retrying Multiple Times

FIFO queues allow the sender or receiver to attempt multiple retries:

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

- If the receiver detects a failed `ReceiveMessage` action, it can retry as many times as necessary, using the same receive request attempt ID. Assuming that the receiver receives at least one acknowledgement before the visibility timeout expires, multiple retries do not affect the ordering of messages.
- When you receive a message with a message group ID, no more 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 do not 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 does not 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*.

Getting Started with FIFO Queues

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

```java
package sqs.fifo.samples;

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

import com.amazonaws.AmazonClientException;
import com.amazonaws.AmazonServiceException;
import com.amazonaws.auth.AWSCredentials;
import com.amazonaws.auth.BasicAWSCredentials;
import com.amazonaws.auth.profile.ProfileCredentialsProvider;
import com.amazonaws.regions.Region;
import com.amazonaws.regions.Regions;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClient;
import com.amazonaws.services.sqs.model.CreateQueueRequest;
import com.amazonaws.services.sqs.model.DeleteMessageRequest;
import com.amazonaws.services.sqs.model.DeleteQueueRequest;
import com.amazonaws.services.sqs.model.Message;
import com.amazonaws.services.sqs.model.ReceiveMessageRequest;
import com.amazonaws.services.sqs.model.SendMessageRequest;
import com.amazonaws.services.sqs.model.SendMessageResult;

public class SQSFIFOJavaClientSample {
    public static void main(String[] args) throws Exception {
        /*
         * The ProfileCredentialsProvider returns your [default]
         * credential profile by reading from the credentials file located at
         * (~/.aws/credentials).
         */
        AWSCredentials credentials = null;
        try {
            credentials = new ProfileCredentialsProvider().getCredentials();
        } catch (Exception e) {
            throw new AmazonClientException(
                    "Can't load the credentials from the credential profiles
 file. " +
                    "Please make sure that your credentials file is at the
 correct " +
                    "location (~/.aws/credentials), and is a in valid
 format.",
                    e);
        }

        AmazonSQSClient sqs = new AmazonSQSClient(credentials);
        sqs.setEndpoint("https://sqs.us-east-2.amazonaws.com");


 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");
            Map<String, String> attributes = new HashMap<String, String>();
            // A FIFO queue must have the FifoQueue attribute set to True
            attributes.put("FifoQueue", "true");
            // Generate a MessageDeduplicationId based on the content, if the
 user doesn't provide a MessageDeduplicationId
            attributes.put("ContentBasedDeduplication", "true");
            // The FIFO queue name must end with the .fifo suffix
            CreateQueueRequest createQueueRequest = new
 CreateQueueRequest("MyFifoQueue.fifo").withAttributes(attributes);
            String myQueueUrl =
 sqs.createQueue(createQueueRequest).getQueueUrl();

            // List queues
            System.out.println("Listing all queues in your account.\n");
            for (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");
            SendMessageRequest sendMessageRequest = new
 SendMessageRequest(myQueueUrl, "This is my message text.");
            // You must provide a non-empty MessageGroupId when sending
 messages to a FIFO queue
```

```
            sendMessageRequest.setMessageGroupId("messageGroup1");
            // Uncomment the following to provide the MessageDeduplicationId
            //sendMessageRequest.setMessageDeduplicationId("1");
            SendMessageResult sendMessageResult =
 sqs.sendMessage(sendMessageRequest);
            String sequenceNumber = sendMessageResult.getSequenceNumber();
            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");
            ReceiveMessageRequest receiveMessageRequest = new
 ReceiveMessageRequest(myQueueUrl);
            // Uncomment the following to provide the
 ReceiveRequestDeduplicationId
            //receiveMessageRequest.setReceiveRequestAttemptId("1");
            List<Message> messages =
 sqs.receiveMessage(receiveMessageRequest).getMessages();
            for (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 (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");
            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 (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 (AmazonClientException ace) {
            System.out.println("Caught an AmazonClientException, which means
 the client encountered " +
                    "a serious internal problem while trying to communicate
 with 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 are limited to 300 transactions per second (TPS). If your application generates a high throughput of messages, consider using a standard queue instead.
- 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 for your receiver. 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 will allow you to retry receive attempts in case of networking failures and will prevent queues from pausing due to failed receive attempts.

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

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.

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

```
http://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, `http://sqs.us-east-2.amazonaws.com/123456789012/queue2`). 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.

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

Additional Identifiers for FIFO Queues

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. For more information, see Exactly-Once Processing (p. 8) and the *Amazon Simple Queue Service API Reference*.

Sequence Number

The *sequence number* is a large, non-consecutive number that Amazon SQS assigns to each message. The length of the sequence number is 128 bits. The sequence number continues to increase for a particular message group ID. For more information, see the *Amazon Simple Queue Service API Reference*.

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. 13).

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

Topics

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 it's a distributed system, there is no guarantee that the component will actually receive the message (the connection can break or a component can fail to receive the message). 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 receivers from process the message again, Amazon SQS sets a *visibility timeout*, a period of time during which Amazon SQS prevents other consuming components from receiving and processing the message.

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. 5).
FIFO queues allow the sender or receiver to attempt multiple retries:

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

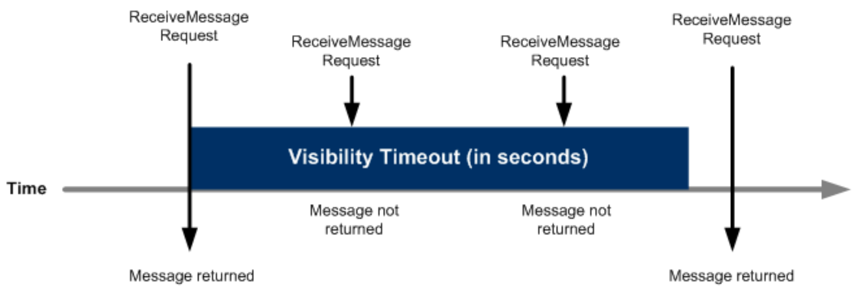
Inflight Messages

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.

The following figure illustrates the visibility timeout.



Configuring the Visibility Timeout

The visibility timeout clock starts ticking once Amazon SQS returns the message. During that time, the component processes and deletes the message. But what happens if the component fails before deleting the message? If your system doesn't call DeleteMessage for that message before the visibility timeout expires, the message again becomes visible to the ReceiveMessage calls placed by the components in your system and it will be received again. If a message should only be received once, your system should delete it within the duration of the visibility timeout.

Each queue starts with a default setting of 30 seconds for the visibility timeout. You can change that setting for the entire queue. Typically, you'll set the visibility timeout to the average time it takes 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.

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 a Message's Visibility Timeout

When you receive a message for 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` action.

For example, if the timeout for a queue is 60 seconds, 15 seconds have elapsed, and you send a `ChangeMessageVisibility` call with `VisibilityTimeout` set to 10 seconds, the total timeout value will be the elapsed time (15 seconds) plus the new timeout value (10 seconds), a total of 25 seconds. Sending a call after 25 seconds will result in an error.

Note
The new timeout period will take effect from the time you call the `ChangeMessageVisibility` action. In addition, the new timeout period will apply only to the particular receipt of the message. The `ChangeMessageVisibility` action does not affect the timeout of later receipts of the message or later queues.

Terminating a Message's Visibility Timeout

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.

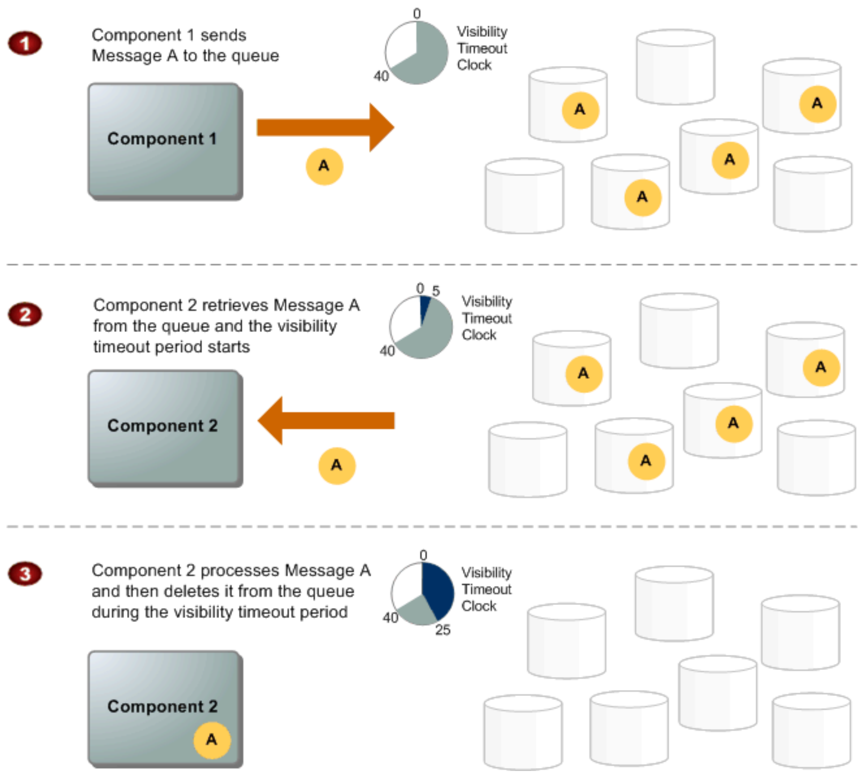
API Actions Related to Visibility Timeout

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

To do this...	Use this action
Set the visibility timeout for a queue	SetQueueAttributes
Get the visibility timeout for a queue	GetQueueAttributes
Set the visibility timeout for the received messages without affecting the queue's visibility timeout	ReceiveMessage
Extending or terminating a message's visibility timeout	ChangeMessageVisibility
Extending or terminating the visibility timeout for up to ten messages.	ChangeMessageVisibilityBatch

Message Lifecycle

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


1
Component 1 sends Message A to the queue
Component 1
A
0
40
Visibility Timeout Clock
2
Component 2 retrieves Message A from the queue and the visibility timeout period starts
Component 2
0
5
40
Visibility Timeout Clock
3
Component 2 processes Message A and then deletes it from the queue during the visibility timeout period
Component 2
0
40
25
Visibility Timeout Clock

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 retrieves 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 120,9600 seconds (14 days) using the SetQueueAttributes action.

Using Amazon SQS Dead Letter Queues

Amazon SQS provides support for *dead letter queues*. A dead letter queue is a queue that other (source) queues can target for messages that cannot be processed successfully. You can set aside and isolate these messages in the dead letter queue to determine why their processing did not succeed.

Note
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.

To specify a dead letter queue, you can use the AWS Management Console or the query API. You must do this for each queue that will send messages to a dead letter queue. Multiple queues can target a single dead letter queue.

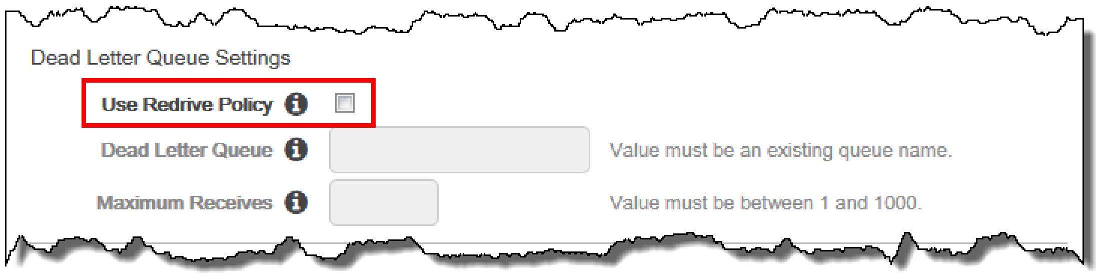
> **Important**
> You must use the same AWS account to create the dead letter queue and the other queues that will send messages to the dead letter queue. Also, dead letter queues must reside in the same region as the other queues that use the dead letter queue. For example, if you create a queue in the US East (Ohio) region and you want to use a dead letter queue with that queue, then both queues must be in the US East (Ohio) region.

Topics

Setting up a Dead Letter Queue with the AWS Management Console

You can use the AWS Management Console to send messages that could not be processed successfully to a specified dead letter queue.

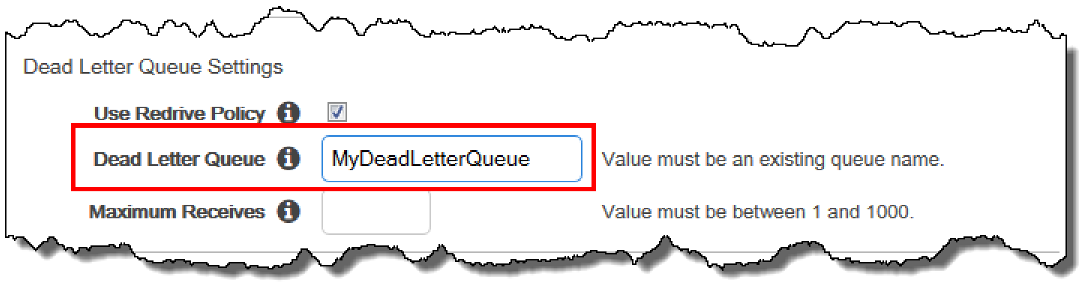
1. For existing and newly-created source queues, select **Use Redrive Policy**.



Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

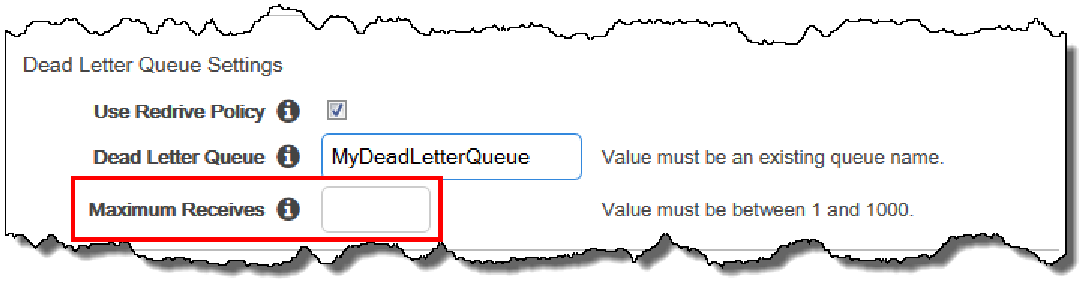
2. Type the name of the queue to which source queues will send messages.



Dead Letter Queue Settings

Use Redrive Policy	☑	
Dead Letter Queue	MyDeadLetterQueue	Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

3. Set **Maximum Receives** to a value between 1 and 1,000.



Dead Letter Queue Settings

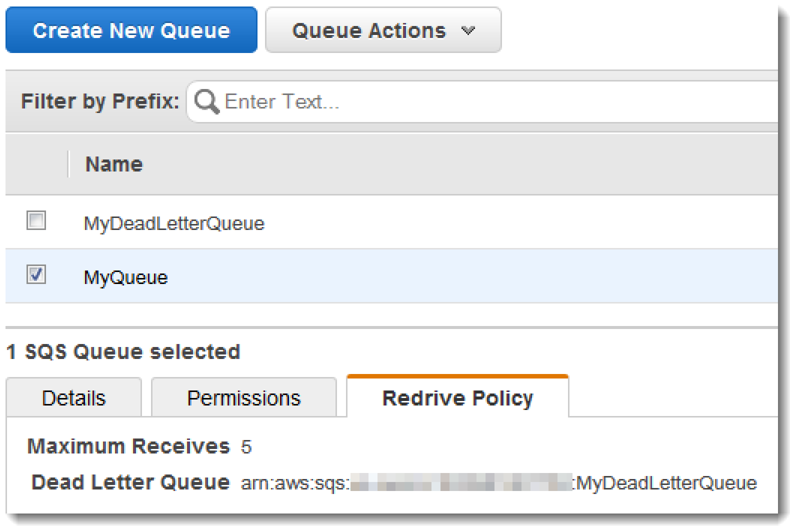
Use Redrive Policy ✓

Dead Letter Queue: MyDeadLetterQueue — Value must be an existing queue name.

Maximum Receives — Value must be between 1 and 1000.

Note
The **Maximum Receives** setting (the number of times that a message can be received before being sent to a dead letter queue) applies only to individual messages.

The following figure shows *MyQueue* with a **Redrive Policy** configured to send messages to *MyDeadLetterQueue*.



MyDeadLetterQueue

✓ MyQueue

1 SQS Queue selected

Details | Permissions | **Redrive Policy**

Maximum Receives 5

Dead Letter Queue arn:aws:sqs:[redacted]:MyDeadLetterQueue

Using a Dead Letter Queue with the Amazon SQS API

To specify a dead letter queue using the query API, call either the `CreateQueue` or `SetQueueAttributes` actions and set the `maxReceiveCount` and `deadLetterTargetArn` parameters for the `RedrivePolicy` queue attribute.

You can set `maxReceiveCount` to a value between 1 and 1,000. The `deadLetterTargetArn` value is the Amazon Resource Name (ARN) of the queue that will receive the dead letter messages.

The following Java example shows how to use `SetQueueAttributes` to set the `maxReceiveCount` and `deadLetterTargetArn` parameters for the `RedrivePolicy` queue attribute. This example is based on the `SimpleQueueServiceSample.java` sample from the AWS SDK for Java.

First, set a string that contains JSON-formatted parameters and values for the `RedrivePolicy` queue attribute:

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

Next, use `SetQueueAttributesRequest` to set the `RedrivePolicy` queue attribute:

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

An API query request for this example should look similar to the following:

```
http://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
&Version=2012-11-05
&Attribute.1.Name=RedrivePolicy
```

Note
Queue names and queue URLs are case-sensitive.

The API query response should look similar to the following:

```
<SetQueueAttributesResponse xmlns="http://queue.amazonaws.com/
doc/2012-11-05/">
    <ResponseMetadata>
        <RequestId>40945605-b328-53b5-aed4-1cc24a7240e8</RequestId>
    </ResponseMetadata>
</SetQueueAttributesResponse>
```

Issue: Viewing Messages with the Amazon SQS Console Can Cause the Messages to be Moved to a Dead Letter Queue

Amazon SQS counts viewing a message in the Amazon SQS console against the corresponding queue's redrive policy. Thus, if you view a message in the Amazon SQS 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 either increase the **Maximum Receives** setting for the corresponding queue's redrive policy, or avoid viewing the corresponding queue's messages in the Amazon SQS console.

To reproduce this behavior:

1. In the Amazon SQS console, create queues named *MyQueueA* and *MyQueueB*.
2. From the list of queues, select **MyQueueA**. Then choose **Queue Actions**, **Configure Queue**.

   The **Configure MyQueueA** dialog box is displayed.
3. For **Dead Letter Queue Settings**, select **Use Redrive Policy**.

   For **Dead Letter Queue**, type **`MyQueueB`**. (*MyQueueB* will become the dead letter queue for *MyQueueA*.)

   For **Maximum Receives**, type **2** and then choose **Save Changes**. (After a message is viewed twice, it will be sent to *MyQueueB*, the dead letter queue.)
4. With **MyQueueA** still selected in the list of queues, choose **Queue Actions**, **Send a Message**.

   The **Send a Message to MyQueueA** dialog box is displayed.
5. On the **Message Body** tab, type any message text, and then choose **Send Message**.

   Choose **Send Another Message**, and then send another message to *MyQueueA*. Then choose **Close**.
6. With **MyQueueA** still selected in the list of queues, choose **Queue Actions**, **View/Delete Messages**.

   The **Start Polling for Messages** dialog box is displayed.
7. Choose **Start Polling for Messages**. The messages you sent are displayed.
8. Wait for 1 minute, and then choose **Start Polling for Messages** again. The messages you sent are displayed again. (The **Receive Count** for both messages becomes **2**. This is equal to the **Maximum Receives** value that you specified.)
9. Wait for 1 minute, and then choose **Start Polling for Messages** again. This time, the messages you sent are no longer displayed. (You have already viewed the messages twice. This is equal to the **Maximum Receives** value that you specified.) Choose **Close**.
10. In the list of queues, clear **MyQueueA**. Then, select *MyQueueB*, and choose **Queue Actions**, **View/Delete Messages**.

    Choose **Start Polling for Messages**. The messages you sent are displayed. (*MyQueueB* becomes the dead letter queue for *MyQueueA*.)

Issue: NumberOfMessagesSent and NumberOfMessagesReceived for the Dead Letter Queue Do Not Match

If you send a message to a dead letter queue manually, it will be captured by the `NumberOfMessagesSent` metric.

However, if a message is sent to a dead letter queue as a result of a failed processing attempt, it won't be captured by the `NumberOfMessagesSent` metric. In this case, it's possible for the values of the `NumberOfMessagesSent` and `NumberOfMessagesReceived` metrics to be different.

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 receiver 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 cannot 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 on 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. 21) 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.

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 will validate that it's a number.

Amazon SQS supports the following logical data types (with optional custom type labels):

String	.<Custom Type> (Optional)
Number	.<Custom Type> (Optional)
Binary	.<Custom Type> (Optional)

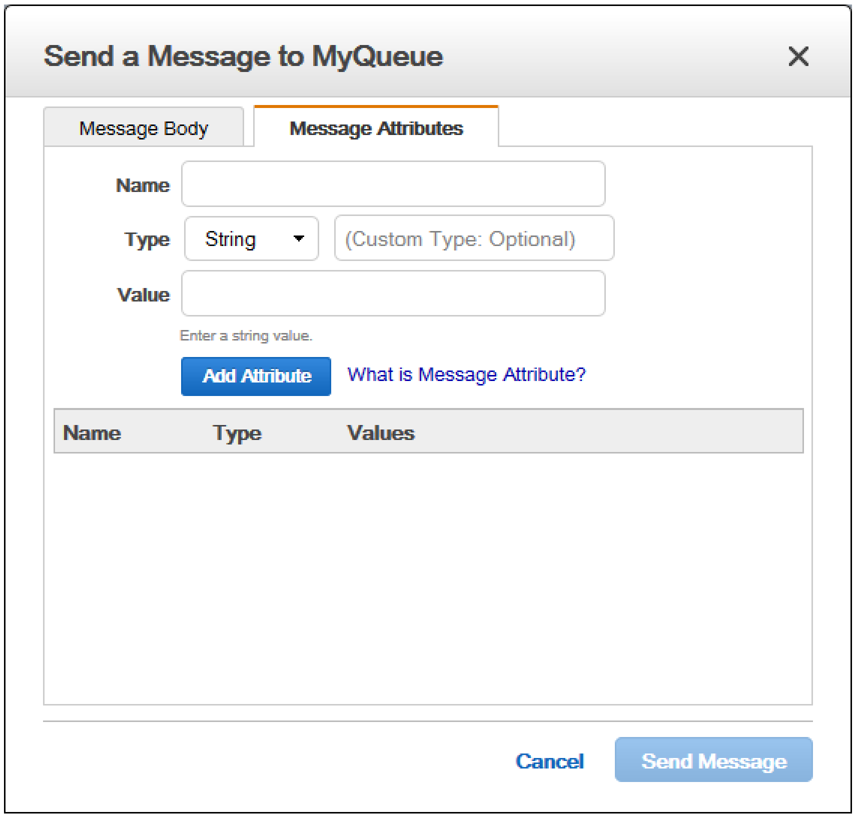
- **String** – Strings are Unicode with UTF-8 binary encoding. For a list of code values, see http://en.wikipedia.org/wiki/ASCII#ASCII_printable_characters.
- **Number** – Numbers are positive or negative integers or floating point numbers. Numbers have sufficient range and precision to encompass most 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 to 10^+126. Leading and trailing zeroes are trimmed.

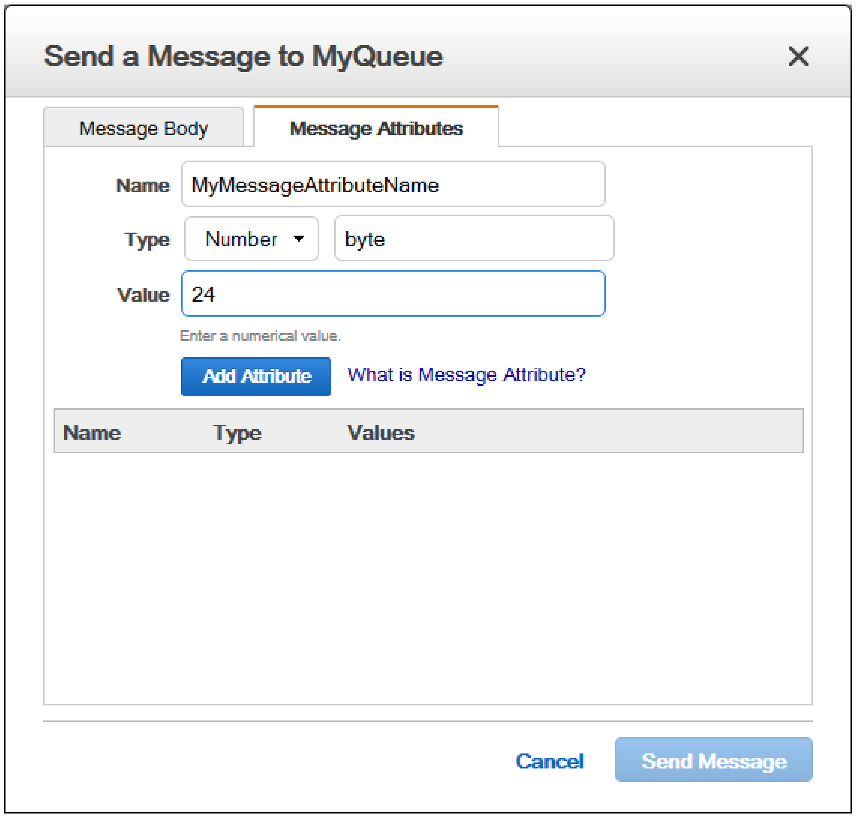
- **Binary** – Binary type attributes can store any binary data, for example, compressed data, encrypted data, or images.
- *Custom Type* – You can append a custom type label to the supported data types (String, Number, and Binary) to create custom data types. This capability is similar to *type traits* in programming languages. For example, if you have an application that needs to know which type of number is being sent in the message, then you could 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, click 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. 21) section.



Send a Message to MyQueue

Message Body | Message Attributes

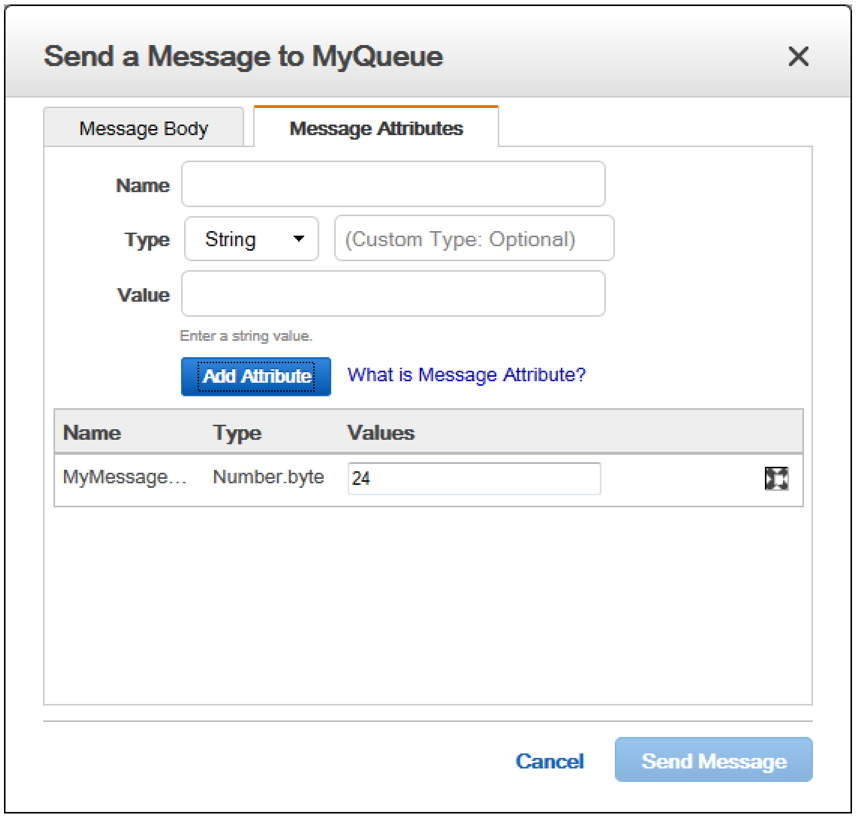
Name: MyMessageAttributeName

Type: Number | byte

Value: 24

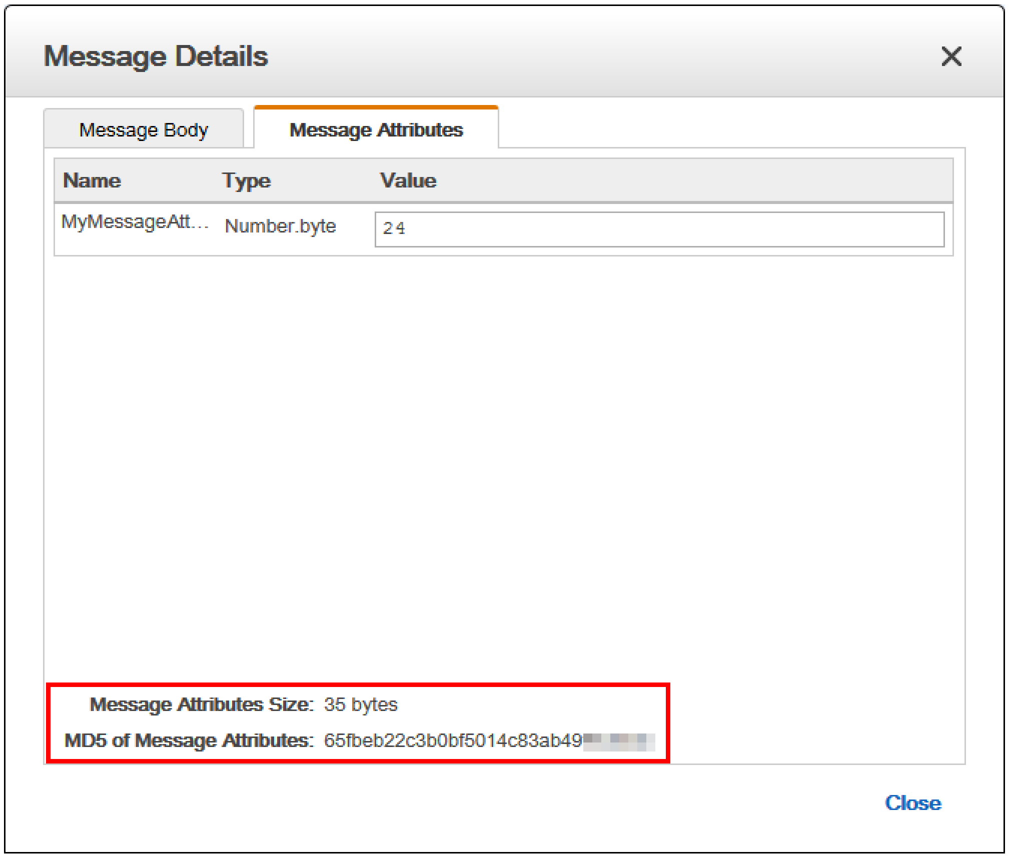
Enter a numerical value.

To add an attribute, click **Add Attribute**. The attribute information will then appear in the **Name**, **Type**, and **Values** list.



Name	Type	Values
MyMessage…	Number.byte	24

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



Name	Type	Value
MyMessageAtt...	Number.byte	24

Message Attributes Size: 35 bytes

MD5 of Message Attributes: 65fbeb22c3b0bf5014c83ab49[redacted]

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 method 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

```
// NOTE Because the type is a number, the result in the receive message call
 will be 123456.
Map<String, MessageAttributeValue> messageAttributes = new HashMap<>();
messageAttributes.put("AccountId", new
 MessageAttributeValue().withDataType("Number.AccountId").withStringValue("000123456"));
```

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.

A query API request for this example will look similar to the following:

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

```
POST http://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
&Version=2012-11-05
&Expires=2014-05-05T22%3A52%3A43PST
&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 will look similar to the following:

```
POST http://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
&Version=2012-11-05
&Expires=2014-05-05T22%3A52%3A43PST
&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 message digest for Amazon SQS message attributes and you're either using the query API or one of the AWS SDKs that does not 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 do not 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:

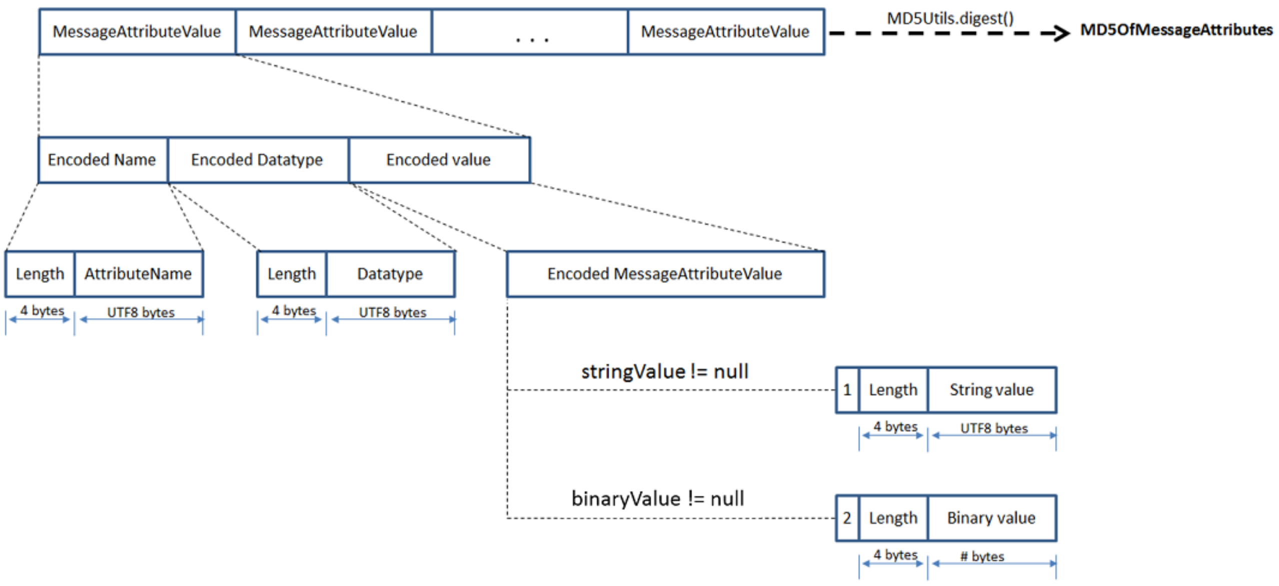
1. Sort all message attributes by name in ascending order.
2. Encode the individual parts of each attribute (name, type, and value) into a buffer.
3. Compute the message digest of the entire buffer.

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

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`.

Topics

Benefits of 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):

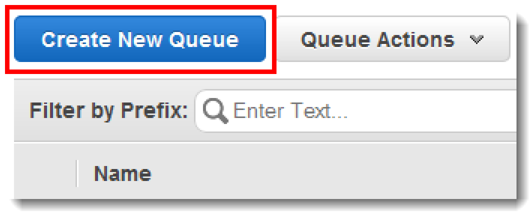
- Long polling reduces the number of empty responses by allowing Amazon SQS to wait until a message is available in the queue before sending a response. Unless the connection times out, the response to the `ReceiveMessage` request contains at least one of the available messages, up to the maximum number 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.

Enabling Long Polling with the AWS Management Console

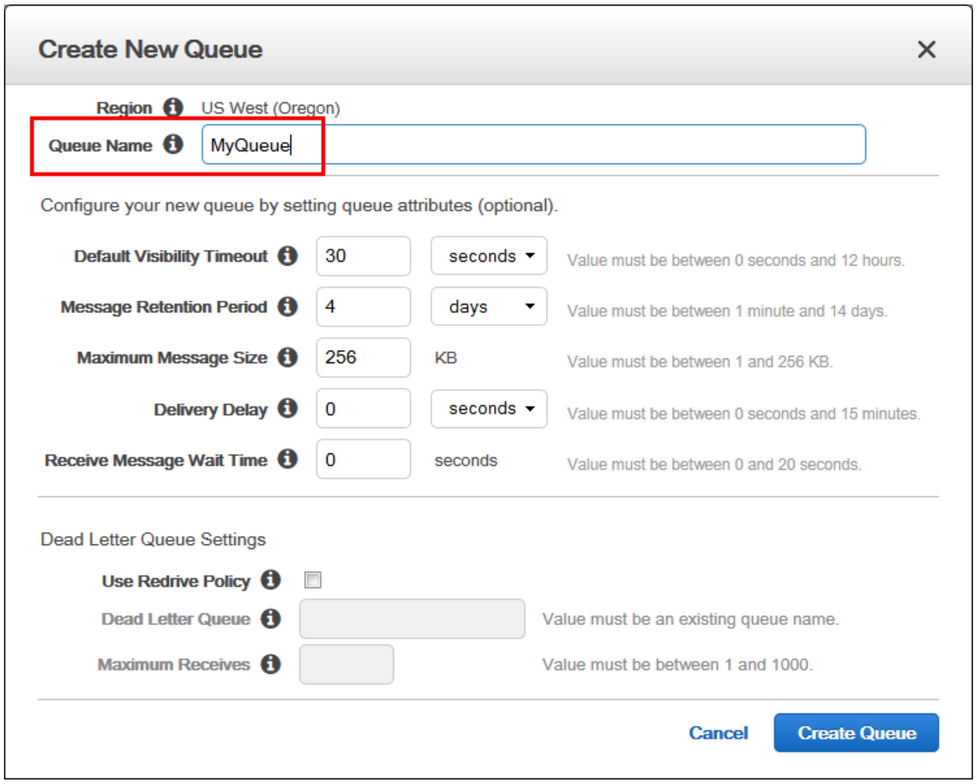
You can enable long polling using the AWS Management Console by setting a **Receive Message Wait Time** to a value greater than `0`.

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

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. Select **Create New Queue**.



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


Create New Queue

Region	US West (Oregon)		
Queue Name	MyQueue		

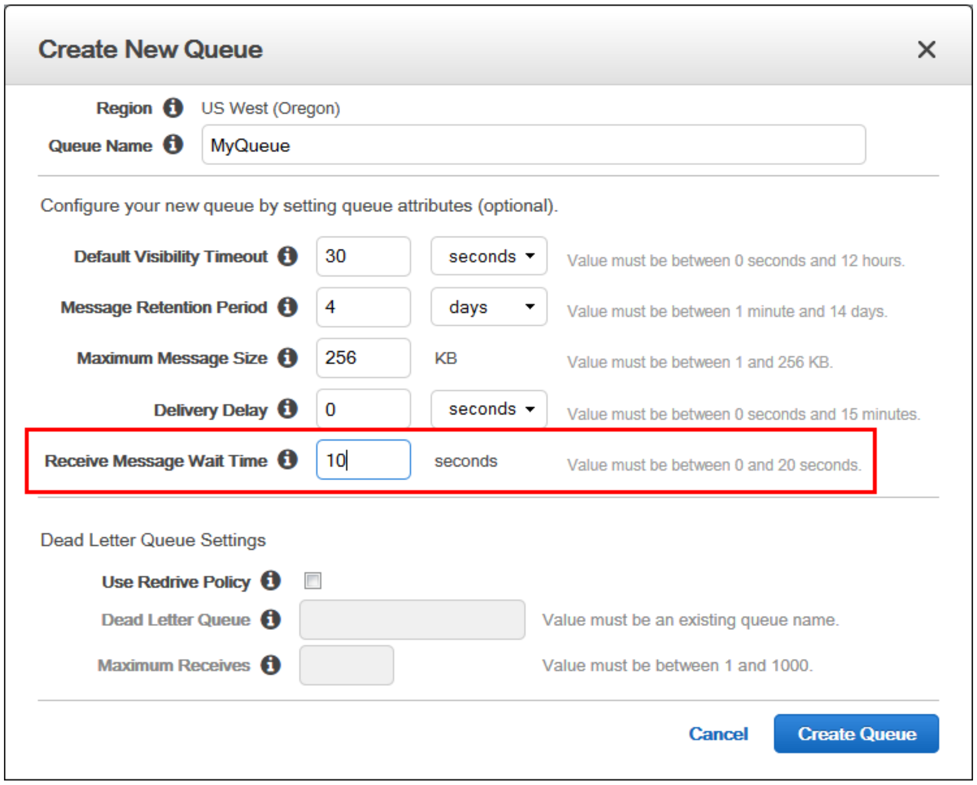
Configure your new queue by setting queue attributes (optional).

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	0	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

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


Create New Queue

Region	US West (Oregon)		
Queue Name	MyQueue		

Configure your new queue by setting queue attributes (optional).

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	10	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

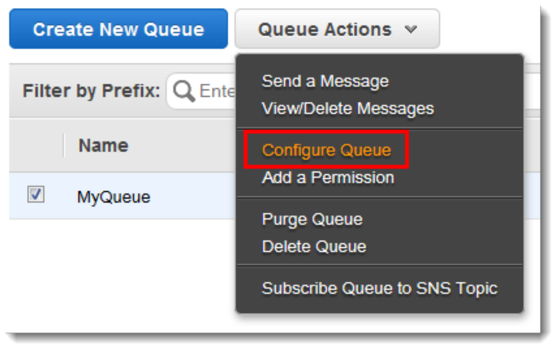
Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

5. Choose **Create Queue**.

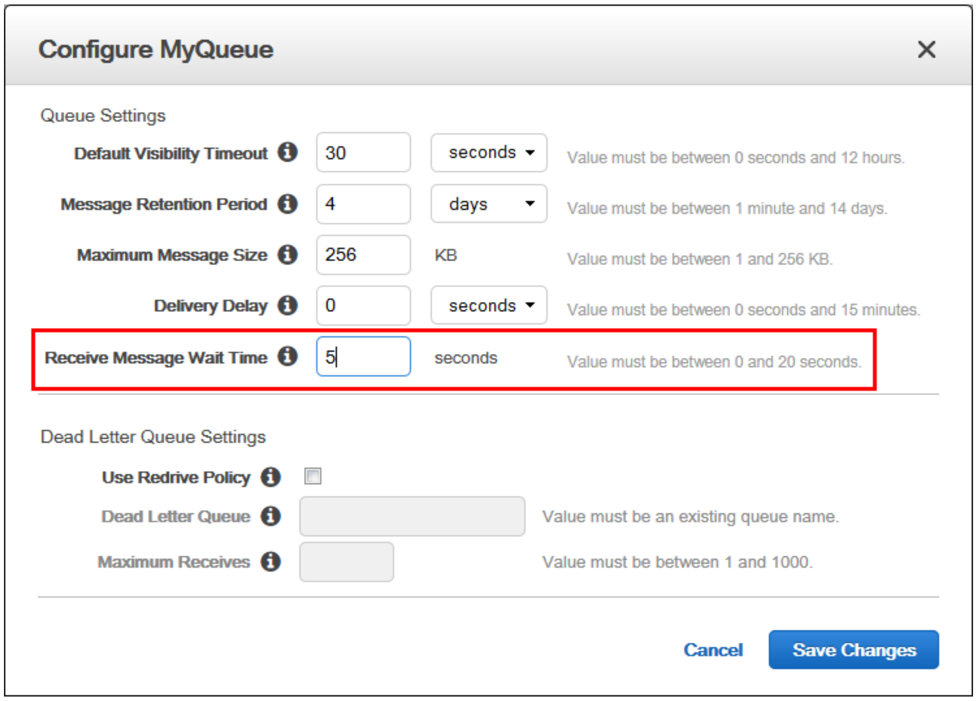
You can use the AWS Management Console to change the **Receive Message Wait Time** setting for an existing queue.

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.



Configure MyQueue

Queue Settings

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	5	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

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

Use this action	Use...
`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.

How you structure `AUTHPARAMS` depends on how you sign your API request. For information on `AUTHPARAMS` in Signature Version 4, see Examples of Signed Signature Version 4 Requests in the *Amazon Web Services General Reference*.

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

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

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

Amazon SQS Delay Queues

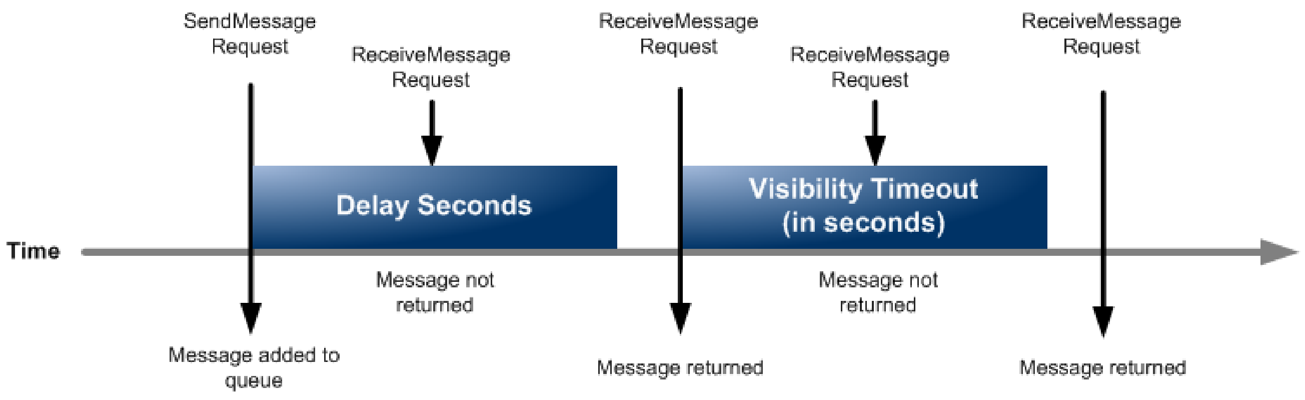
Topics

- Creating Delay Queues with the AWS Management Console (p. 34)
- Creating Delay Queues with the Query API (p. 37)

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 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 retrieved 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.

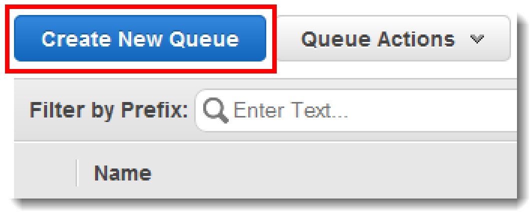
To set delay seconds on individual messages, rather than for an entire queue, use message timers. If you send a message with a message timer, Amazon SQS uses the message timer's delay seconds value instead of the delay queue's delay seconds value. For more information, see Amazon SQS Message Timers (p. 38).

Creating Delay Queues with the AWS Management Console

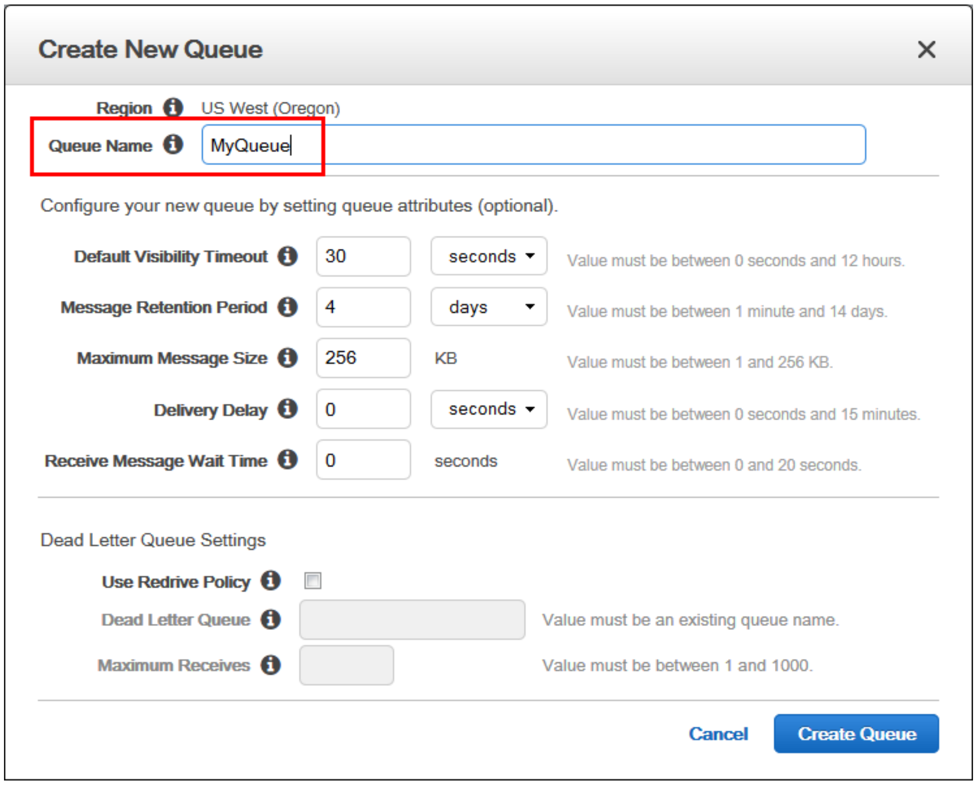
You can create a delay queue using the AWS Management Console by setting a **Delivery Delay** to a value greater than `0`.

To create a delay queue with the AWS Management Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. Choose **Create New Queue**.



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



Create New Queue

Region US West (Oregon)
Queue Name MyQueue

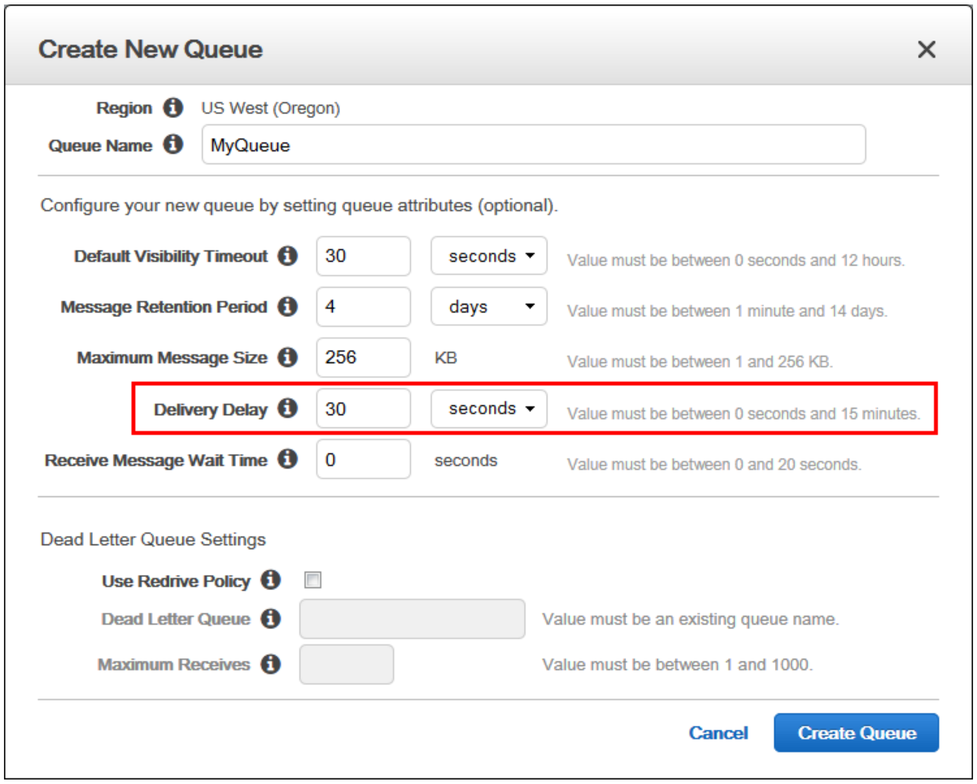
Configure your new queue by setting queue attributes (optional).

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	0	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

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



Create New Queue

Region	US West (Oregon)		
Queue Name	MyQueue		

Configure your new queue by setting queue attributes (optional).

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	30	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	0	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

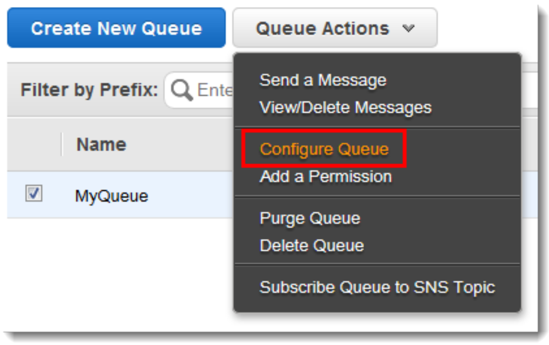
Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

5. Choose **Create Queue**.

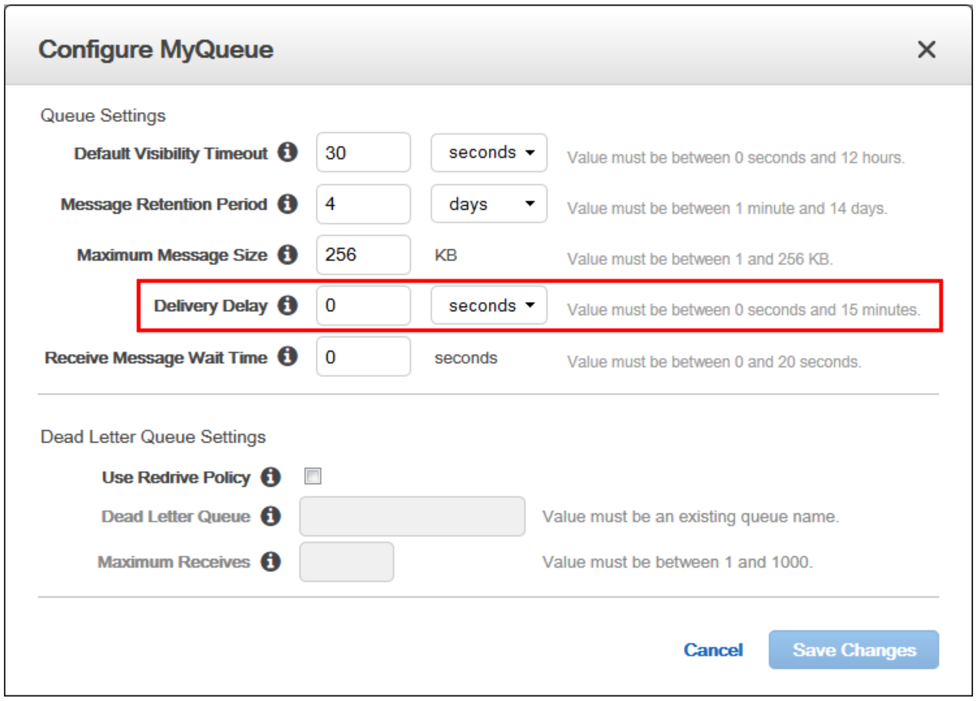
You can use the AWS Management Console to change the **Delivery Delay** setting for an existing queue by selecting the **Configure Queue** action with an existing queue selected.

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.



Queue Settings

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	0	seconds	Value must be between 0 and 20 seconds.

Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

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.

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

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

```
http://sqs.us-east-2.amazonaws.com/123456789012/testQueue/
?Action=SetQueueAttributes
```

```
&Attribute.Name=DelaySeconds
&Attribute.Value=45
&Version=2012-11-05
&Expires=2015-12-20T22%3A52%3A43PST
&AUTHPARAMS
```

Amazon SQS Message Timers

Amazon SQS message timers allow you to specify an initial invisibility period for a message that you're add to a queue. For example, if you send a message with the `DelaySeconds` parameter set to `45`, the message won't be 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. 33). A message timer setting for an individual message overrides any `DelaySeconds` value that applies to the entire delay queue.

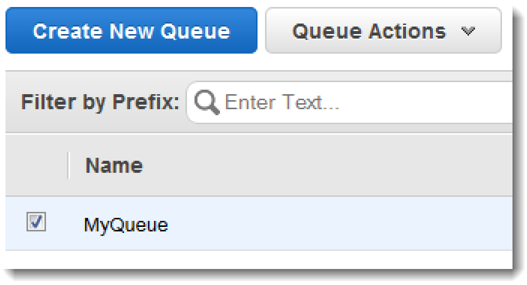
Topics

- Creating Message Timers Using the Console (p. 38)
- Creating Message Timers Using the Query API (p. 41)

Creating Message Timers Using the Console

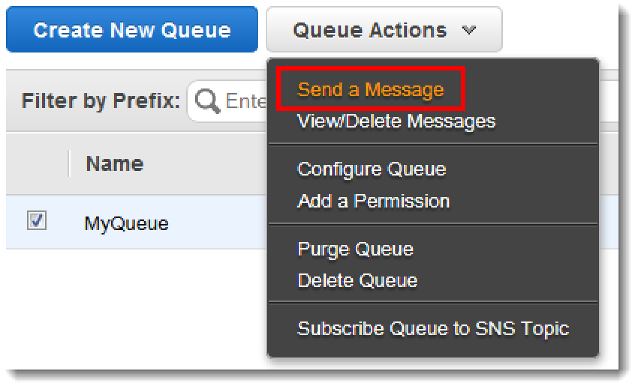
To send a message with a message timer using the AWS Management Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. Select a queue.

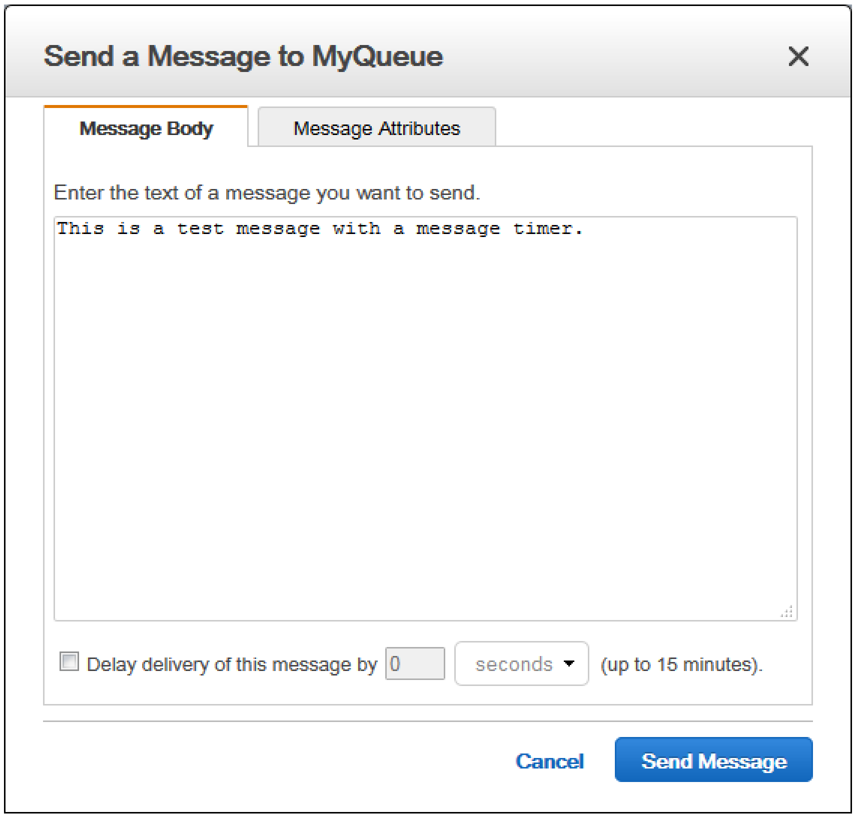


3. From the **Queue Actions** drop-down list, select **Send a Message**.

   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.

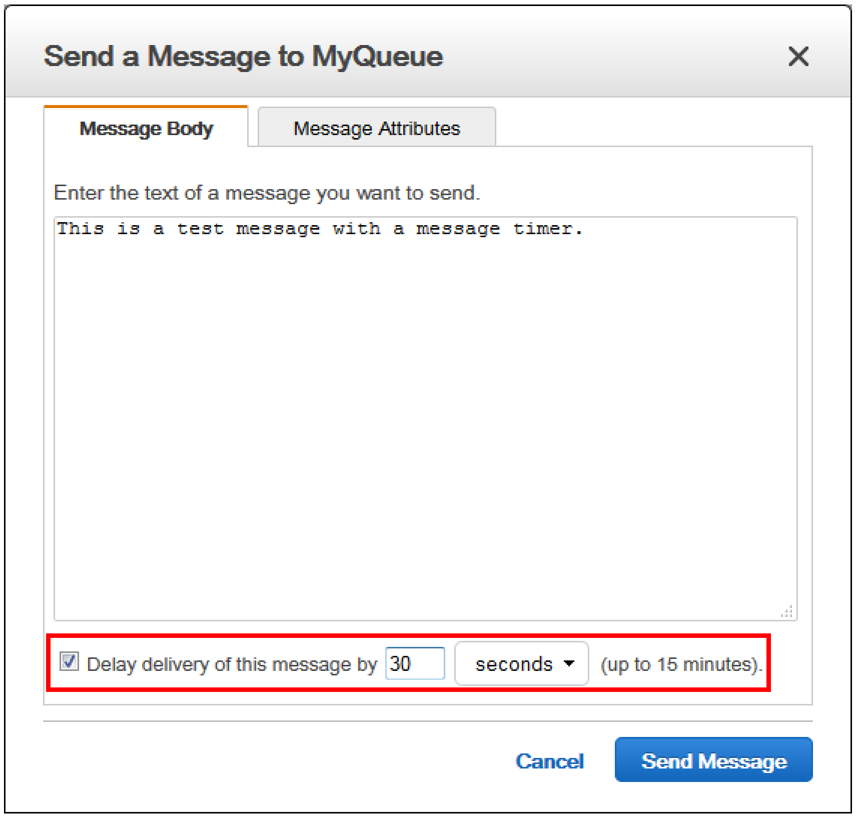


Enter the text of a message you want to send.

```
This is a test message with a message timer.
```

Delay delivery of this message by 0 seconds (up to 15 minutes).

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

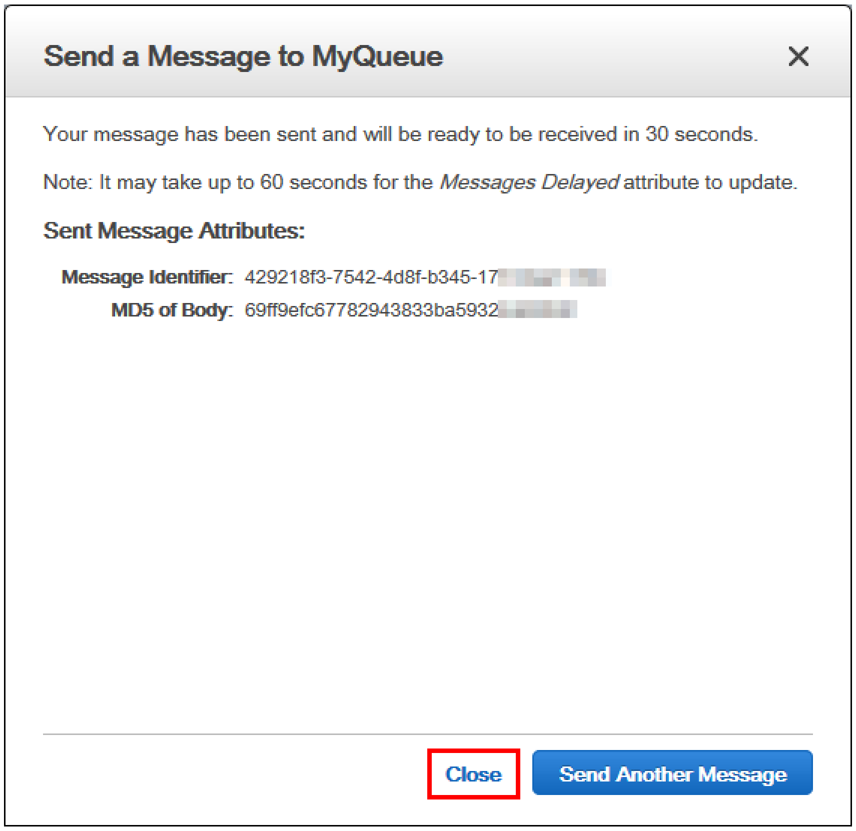


Enter the text of a message you want to send.

```
This is a test message with a message timer.
```

☑ Delay delivery of this message by 30 seconds (up to 15 minutes).

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



Send a Message to MyQueue

Your message has been sent and will be ready to be received in 30 seconds.

Note: It may take up to 60 seconds for the *Messages Delayed* attribute to update.

Sent Message Attributes:

Message Identifier: 429218f3-7542-4d8f-b345-17[redacted]
MD5 of Body: 69ff9efc67782943833ba5932[redacted]

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`.

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

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

Note
Queue names and queue URLs are case-sensitive.

You can also use the Query API `SendMessageBatch` action to send up to ten messages with message timers. You can assign a different `DelaySeconds` value to each message or assign no value at all. If you do not 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. 33). The following example uses `SendMessageBatch` to send three messages: one message without a message timer and two messages with different values for `DelaySeconds`.

```
http://sqs.us-east-2.amazonaws.com/123456789012/testQueue/
?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
&Version=2012-11-05
&Expires=2015-12-18T22%3A52%3A43PST
&AUTHPARAMS
```

Managing Large Amazon SQS Messages Using Amazon S3

You can manage Amazon SQS messages with Amazon S3. This is especially useful for storing and retrieving messages with a message size of up to 2 GB. To manage Amazon SQS messages with Amazon S3, use the Amazon SQS Extended Client Library for Java. Specifically, you use this library to:

- Specify whether messages are always stored in Amazon S3 or only when a message's size 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
You can use the Amazon SQS Extended Client Library for Java only to manage Amazon SQS messages with Amazon S3. you cannot use the AWS CLI, the Amazon SQS console, the Amazon SQS HTTP API, or any of the AWS SDKs (except for the SDK for Java one, as described later in this topic).
The Amazon SQS Extended Client Library for Java doesn't currently support FIFO queues.

Prerequisites

To manage Amazon SQS messages with Amazon S3, you need the following:

- **AWS SDK for Java** – There are two different ways to include the SDK for Java in your project. You can either download and install the SDK for Java, or if you use Maven to obtain the Amazon SQS Extended Client Library for Java, then 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 7.0 or later. For information about downloading the SDK for Java, see SDK for Java. For more information about using Maven, see the note following this list.
- **Amazon SQS Extended Client Library for Java** – If you do not use Maven, then you must add the package file, `amazon-sqs-java-extended-client-lib.jar`, to the Java build class path. For information about downloading, see Amazon SQS Extended Client Library for Java.
- **Amazon S3 bucket** – You must create a new Amazon S3 bucket or use an existing bucket to store messages. We recommend that you create a new bucket for this purpose. To control bucket space and charges to your AWS account, you should also set a lifecycle configuration rule on the bucket to

permanently delete message objects after a certain period of time following their creation date. For instructions, see Managing Lifecycle Configuration or the example (p. 43) following this section.

Note
The Amazon SQS Extended Client Library for Java includes support for Maven as follows:

```
<dependency>
    <groupId>com.amazonaws</groupId>
    <artifactId>amazon-sqs-java-extended-client-lib</artifactId>
    <version>1.0.0</version>
</dependency>
```

Using the Amazon SQS Extended Client Library for Java

After you have met the prerequisites (p. 42), use the following Java code example to get started managing Amazon SQS messages with Amazon S3.

This example creates an Amazon S3 bucket with a random name and adds a lifecycle rule to permanently delete objects after 14 days. It then creates a queue and sends to the queue a random message that is over 256 KB in size. The message is stored in the Amazon S3 bucket. The example then retrieves the message and prints out information about the retrieved message. The example then deletes the message, queue, and bucket.

```
import java.util.Arrays;
import java.util.Iterator;
import java.util.List;
import java.util.UUID;
import com.amazon.sqs.javamessaging.AmazonSQSExtendedClient;
import com.amazonaws.services.sqs.AmazonSQS;
import com.amazonaws.services.sqs.AmazonSQSClient;
import org.joda.time.DateTime;
import org.joda.time.format.DateTimeFormat;
import com.amazonaws.AmazonClientException;
import com.amazonaws.auth.AWSCredentials;
import com.amazonaws.auth.profile.ProfileCredentialsProvider;
import com.amazonaws.regions.Region;
import com.amazonaws.regions.Regions;
import com.amazonaws.services.s3.AmazonS3;
import com.amazonaws.services.s3.AmazonS3Client;
import com.amazonaws.services.s3.model.BucketLifecycleConfiguration;
import com.amazonaws.services.s3.model.ListVersionsRequest;
import com.amazonaws.services.s3.model.ObjectListing;
import com.amazonaws.services.s3.model.S3ObjectSummary;
import com.amazonaws.services.s3.model.S3VersionSummary;
import com.amazonaws.services.s3.model.VersionListing;
import com.amazonaws.services.sqs.model.CreateQueueRequest;
import com.amazonaws.services.sqs.model.DeleteMessageRequest;
import com.amazonaws.services.sqs.model.DeleteQueueRequest;
import com.amazonaws.services.sqs.model.Message;
import com.amazonaws.services.sqs.model.ReceiveMessageRequest;
import com.amazonaws.services.sqs.model.SendMessageRequest;
import com.amazon.sqs.javamessaging.ExtendedClientConfiguration;

public class SQSExtendedClientExample {
  private static final String s3BucketName = UUID.randomUUID() + "-"
    + DateTimeFormat.forPattern("yyMMdd-hhmmss").print(new DateTime());

  public static void main(String[] args) {

    AWSCredentials credentials = null;

    try {
      credentials = new
 ProfileCredentialsProvider("default").getCredentials();
    } catch (Exception e) {
      throw new AmazonClientException(
        "Cannot load the AWS credentials from the expected AWS credential
 profiles file. "
        + "Make sure that your credentials file is at the correct "
        + "location (/home/$USER/.aws/credentials) and is in a valid
 format.", e);
    }

    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.
    //   Then 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);

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

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

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

    // Receive messages, and then print general information about them.
    ReceiveMessageRequest receiveMessageRequest = new
 ReceiveMessageRequest(myQueueUrl);
    List<Message> messages =
 sqsExtended.receiveMessage(receiveMessageRequest).getMessages();

    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.
    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 (Iterator<?> iterator =
 objectListing.getObjectSummaries().iterator(); iterator.hasNext(); ) {
        S3ObjectSummary objectSummary = (S3ObjectSummary) iterator.next();
        client.deleteObject(s3BucketName, objectSummary.getKey());
      }

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

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

    for (Iterator<?> iterator = list.getVersionSummaries().iterator();
 iterator.hasNext(); ) {
      S3VersionSummary s = (S3VersionSummary) iterator.next();
      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. 66) and the Amazon SQS FAQs.

Note
The Amazon SQS Java Message Service (JMS) Client doesn't currently support FIFO queues.

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. (The SDK for Java is included as a dependency. The SDK for Java and Amazon SQS Java Messaging Library require J2SE Development Kit 6.0 or later.)

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

- **Amazon SQS Java Messaging Library**

  If you do not 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 Code Examples (p. 52).

```
<dependency>
  <groupId>com.amazonaws</groupId>
  <artifactId>amazon-sqs-java-messaging-lib</artifactId>
  <version>1.0.0</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.

  For information about using the Amazon SQS Java Messaging Library, see Getting Started with the Amazon SQS Java Messaging Library (p. 47).

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 does not exist, the client creates it.

Creating a JMS Connection

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

   Note
   The EnvironmentVariableCredentialsProvider class in the following example assumes that the `AWS_ACCESS_KEY_ID` (or `AWS_ACCESS_KEY`) and `AWS_SECRET_KEY` (or `AWS_SECRET_ACCESS_KEY`) environment variables are set.
   For more information on providing the required credentials to the factory, see Interface AWSCredentialsProvider.

```
// Create the connection factory using the environment variable credential
 provider.
// Connections this factory creates can talk to the queues in us-east-2
 region.
SQSConnectionFactory connectionFactory =
    SQSConnectionFactory.builder()
        .withRegion(Region.getRegion(Regions.US_EAST_2))
        .withAWSCredentialsProvider(new
 EnvironmentVariableCredentialsProvider())
        .build();

// 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 is expecting 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 will be Amazon SQS exceptions.

Creating an Amazon SQS Queue

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

If a queue does not exist, the client creates it. If the queue does exist, then the function does not return anything. For more information, see the "Create the queue if needed" section in the TextMessageSender.java (p. 54) example.

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

// Create an SQS queue named 'TestQueue' – if it does not already exist.
if (!client.queueExists("TestQueue")) {
    client.createQueue("TestQueue");
}
```

Sending Messages Synchronously

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

```
// Create the non-transacted 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 with name 'TestQueue' in the session
Queue queue = session.createQueue("TestQueue");

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

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

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

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

Receiving Messages Synchronously

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

   You can call the `start` method on the connection at any time. However, the consumer will not begin to receiving messages until you call it.

```
// Create a consumer for the 'TestQueue'.
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 print the content of the received message.

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

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

3. Close the connection and the session.

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

The output will look 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 `SpringExampleConfig.xml`, `SpringExample.java`, and the other helper classes in `ExampleConfiguration.java` and `ExampleCommon.java` in Code Examples (p. 52).

For complete examples of sending and receiving objects, see TextMessageSender.java (p. 54) and SyncMessageReceiver.java (p. 55).

Receiving Messages Asynchronously

In the example in Getting Started with the Amazon SQS Java Messaging Library (p. 47), a message is sent to `TestQueue` 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.
               if (message != null) {
                   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 sleeps for one second.

   ```
   // Create a consumer for the 'TestQueue'.
   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 will be 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. 47) example. For a complete example of an asynchronous receiver, see `AsyncMessageReceiver.java` in Code Examples (p. 52).

The output for this example will look 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. 47) 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, then all messages received prior to 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 9 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. 47) example. For a complete example of a synchronous receiver with client acknowledge mode, see `SyncMessageReceiverClientAcknowledge.java` in Code Examples (p. 52).

The output for this example will look 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. 51).

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.

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. 51) example. For a complete example of a synchronous receiver with `UNORDERED_ACKNOWLEDGE` mode, see `SyncMessageReceiverUnorderedAcknowledge.java`.

In this example, the output will look similar to the following:

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

Important
When you use the JMS library with `UNORDERED_ACKNOWLEDGE` mode, visibility timeout (p. 13) always takes effect. However, in the case of asynchronous message processing (p. 50), visibility timeout takes effect only when the message listener `onMessage()` returns successfully.

Code Examples

The following code examples show how to use JMS with Amazon SQS.

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.

```
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 sender.

```
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 =
                SQSConnectionFactory.builder()
                    .withRegion(config.getRegion())

 .withAWSCredentialsProvider(config.getCredentialsProvider())
                    .build();

        // 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 will close 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 receiver.

```
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 =
            SQSConnectionFactory.builder()
                .withRegion(config.getRegion())
                .withAWSCredentialsProvider(config.getCredentialsProvider())
                .build();

    // 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 will close 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 receiver.

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

          ExampleCommon.setupLogging();

          // 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 will be processed until this is called
          connection.start();

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

          // Close the connection. This will close 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 receiver with client acknowledge mode.

```
/**
 * 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 =
                SQSConnectionFactory.builder()
                        .withRegion(config.getRegion())

 .withAWSCredentialsProvider(config.getCredentialsProvider())
                        .build();

        // 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 will
result in receiving no messages since
        // we have acknowledged the second message. Although we did not
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 will close 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 receiver with unordered acknowledge mode.

```
/**
 * 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 =
                SQSConnectionFactory.builder()
                        .withRegion(config.getRegion())

.withAWSCredentialsProvider(config.getCredentialsProvider())
                        .build();

        // 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 will
result 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 will close 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();
        }
    }
}
```

SpringExampleConfig.xml

The following XML code example is a bean configuration file for SpringExample.java (p. 63).

```
<?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="ConnectionFactoryBuilder"
 class="com.amazon.sqs.javamessaging.SQSConnectionFactory$Builder">
     <property name="regionName" value="us-east-2"/>
     <property name="numberOfMessagesToPrefetch" value="5"/>
     <property name="awsCredentialsProvider" ref="CredentialsProviderBean"/>
    </bean>

 <bean id="ConnectionFactory"
 class="com.amazon.sqs.javamessaging.SQSConnectionFactory"
  factory-bean="ConnectionFactoryBuilder"
  factory-method="build" />

 <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.

```
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] + " does not 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( "Could not 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( "Could not 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 does not. It also includes example logging code.

```
public class ExampleCommon {
    /**
     * A utility function to check the queue exists and create it if needed.
 For most
     * use cases this will usually be done by an administrator before the
 application
     * is run.
     */
    public static void ensureQueueExists(SQSConnection connection, String
 queueName) throws JMSException {
        AmazonSQSMessagingClientWrapper client =
 connection.getWrappedAmazonSQSClient();

        /**
         * For most cases this could be done 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 do not 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 FAQs.

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

The Amazon SQS JMS client sets the following JMS-defined headers:

- `JMSDestination`
- `JMSMessageID`
- `JMSRedelivered`

The Amazon SQS JMS client sets the following JMS reserved property:

- `JMSXDeliveryCount`

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.

Processing Messages

- To ensure that there is sufficient time to process a message, you should 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. 14) and Changing a Message's Visibility Timeout (p. 15).
  - 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 Amazon Simple Workflow Service.
- To handle request errors, you should 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 do not 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).

- To capture all messages that cannot be processed, and to ensure the correctness of CloudWatch metrics, you should configure a dead letter queue (p. 16).
  - 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 cannot be processed).
  - Including a poison pill message in a queue can distort the `ApproximateAgeOfOldestMessage` (p. 90) 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.

Reducing Costs

- 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. 114).
  - To combine client-side buffering with request batching, use long polling together with the buffered asynchronous client (p. 116) included with the AWS SDK for Java.

    Note
    The Amazon SQS Buffered Asynchronous Client doesn't currently support FIFO queues.
- To take advantage of additional potential reduced cost or near-instantaneous response, use one of the following polling modes:
  - Long polling lets you retrieve 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. 29).
    - 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. 11).

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

- If you have a single sender and a single receiver and the messages are unique because an application-specific message ID is included in the body of the message, you should follow these guidelines:
  - Enable content-based deduplication for the queue (each of your messages has a unique body). The sender can omit the message deduplication ID.
  - Although the receiver 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.
- The sender 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.
- The deduplication process in FIFO queues is time-sensitive. When designing your application, you should ensure that both the sender and the receiver can recover in case of a client or network outage.
  - The sender 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 receiver 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 receiver 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. 16).

Using the Message Group ID

- To interleave multiple ordered message groups within a single FIFO queue, you should use message group ID values (for example, session data for multiple users). In this scenario, multiple readers 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 receiver can process messages with the same message group ID.
- To avoid processing duplicate messages in a system with multiple readers and writers where throughput and latency are more important than ordering, the sender should generate a unique message group ID for each message.

  Note
  In this scenario, duplicates are eliminated. However, the ordering of message cannot be guaranteed.

Any scenario with multiple readers and writers increases the risk of inadvertently delivering a duplicate message if a worker does not process the message within the visibility timeout and the message becomes available to another worker.

Using the Receive Request Attempt ID

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.

Tutorials

This section provides tutorials that you can use to explore Amazon SQS features and functionality.

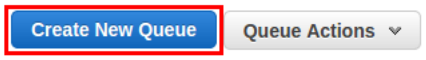
Topics

Tutorial: Creating an Amazon SQS Queue

The first and most common Amazon SQS task is creating queues. The following example demonstrates creating and configuring a queue.

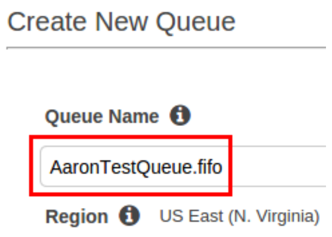
To create an Amazon SQS queue using the AWS Management Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
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.

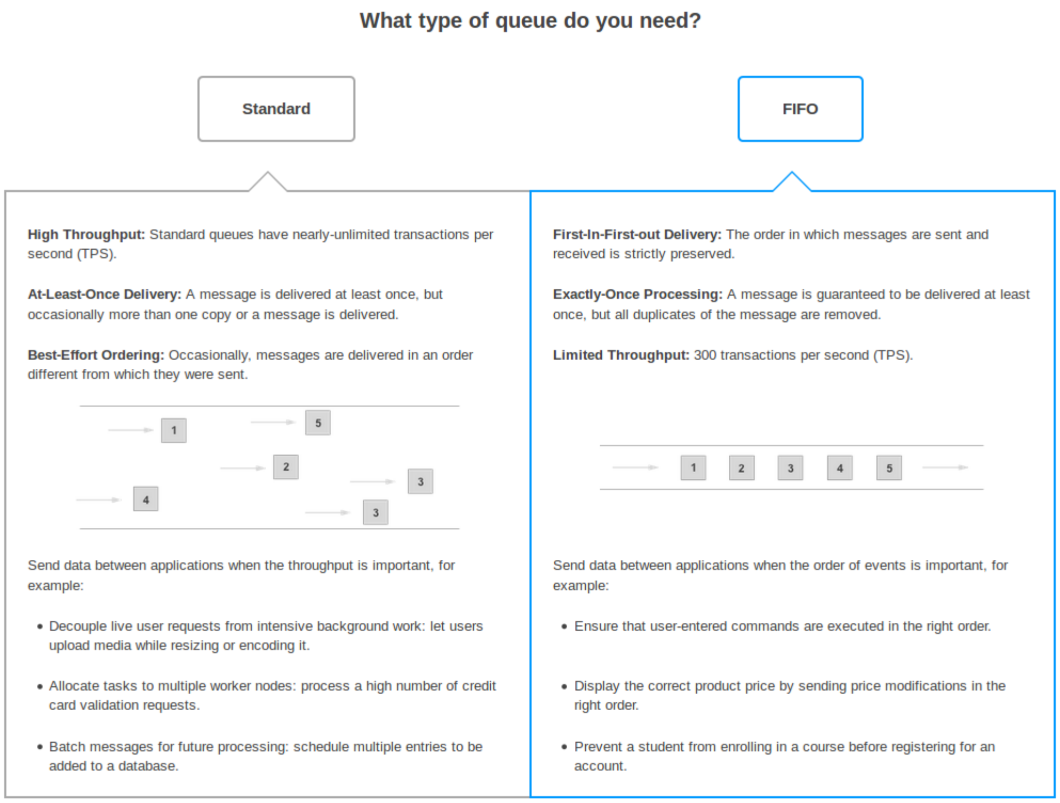


Create New Queue

Queue Name: AaronTestQueue.fifo

Region: US East (N. Virginia)

4. Review the descriptions of Standard Queue (p. 5) and FIFO Queue (p. 6), and then select a queue type. **Standard** is selected by default.


What type of queue do you need?

High Throughput: Standard queues have nearly-unlimited transactions per second (TPS).

At-Least-Once Delivery: A message is delivered at least once, but occasionally more than one copy or a message is delivered.

Best-Effort Ordering: Occasionally, messages are delivered in an order different from which they were sent.

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.

First-In-First-out Delivery: The order in which messages are sent and received is strictly preserved.

Exactly-Once Processing: A message is guaranteed to be delivered at least once, but all duplicates of the message are removed.

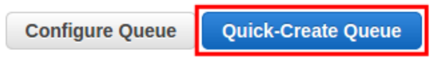
Limited Throughput: 300 transactions per second (TPS).

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.

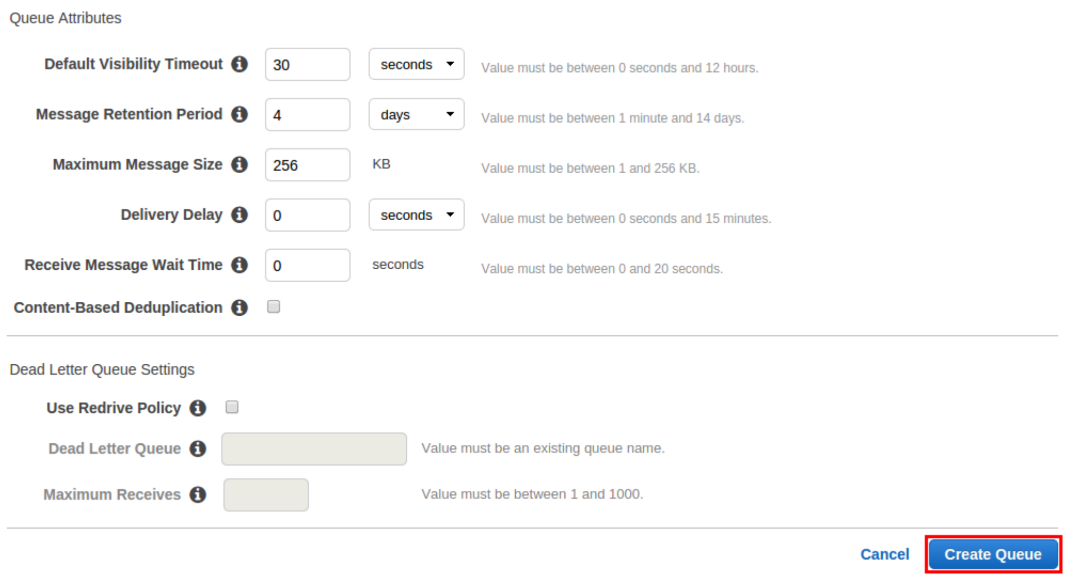
5. Create your queue.

   - 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**.

     Note
     The following example shows the **content-based deduplication** parameter specific to FIFO queues.


Queue Attributes

Default Visibility Timeout	30	seconds	Value must be between 0 seconds and 12 hours.
Message Retention Period	4	days	Value must be between 1 minute and 14 days.
Maximum Message Size	256	KB	Value must be between 1 and 256 KB.
Delivery Delay	0	seconds	Value must be between 0 seconds and 15 minutes.
Receive Message Wait Time	0	seconds	Value must be between 0 and 20 seconds.
Content-Based Deduplication	☐		

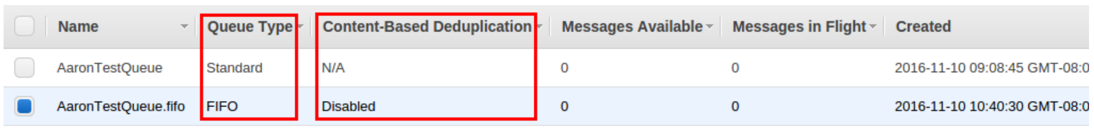
Dead Letter Queue Settings

Use Redrive Policy	☐	
Dead Letter Queue		Value must be an existing queue name.
Maximum Receives		Value must be between 1 and 1000.

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

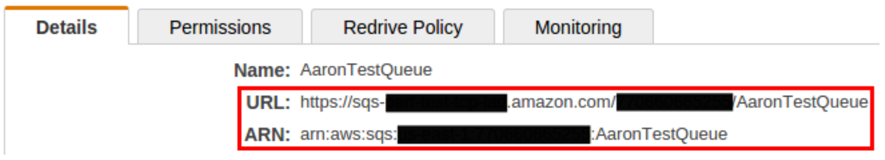
- The **Queue Type** column helps you distinguish standard queues from FIFO queues at a glance.

  If you create a FIFO queue, the **Content-Based Deduplication** column displays whether you have enabled exactly-once processing (p. 8).



	Name	Queue Type	Content-Based Deduplication	Messages Available	Messages in Flight	Created
☐	AaronTestQueue	Standard	N/A	0	0	2016-11-10 09:08:45 GMT-08:0
☑	AaronTestQueue.fifo	FIFO	Disabled	0	0	2016-11-10 10:40:30 GMT-08:0

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



Name: AaronTestQueue
URL: https://sqs-[redacted].amazon.com/[redacted]/AaronTestQueue
ARN: arn:aws:sqs:[redacted]:AaronTestQueue

To create an Amazon SQS queue using Java

1. Copy the example Java program (p. 8).

   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");
Map<String, String> attributes = new HashMap<String, String>();
// A FIFO queue must have the FifoQueue attribute set to True
attributes.put("FifoQueue", "true");
// Generate a MessageDeduplicationId based on the content, if the user
 doesn't provide a MessageDeduplicationId
```

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

2. Compile and run the example.

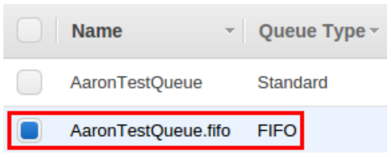
   The queue is created.

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.

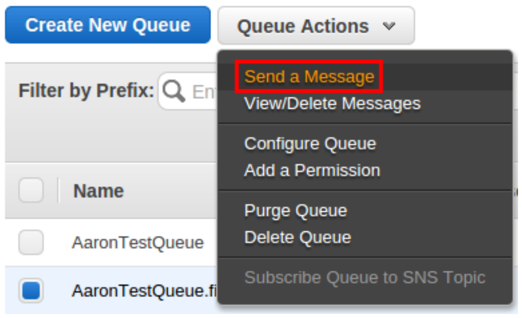
To send a message to Amazon SQS queue using the AWS Management Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. From the queue list, select a queue.



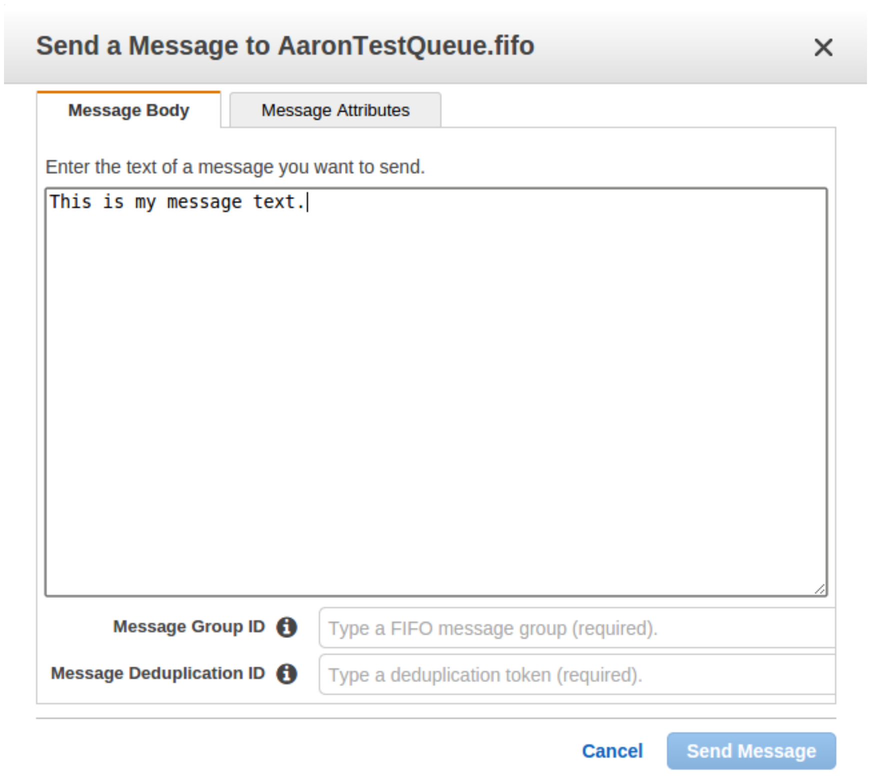
Name	Queue Type
AaronTestQueue	Standard
AaronTestQueue.fifo	FIFO

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



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

Note
The following example shows the **message group ID** and **message deduplication ID** parameters specific to FIFO queues (**content-based deduplication** is disabled).


Send a Message to AaronTestQueue.fifo

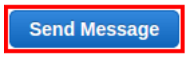
Message Body
Message Attributes
Enter the text of a message you want to send.

```
This is my message text.
```

Message Group ID
Type a FIFO message group (required).
Message Deduplication ID
Type a deduplication token (required).
Cancel
Send Message

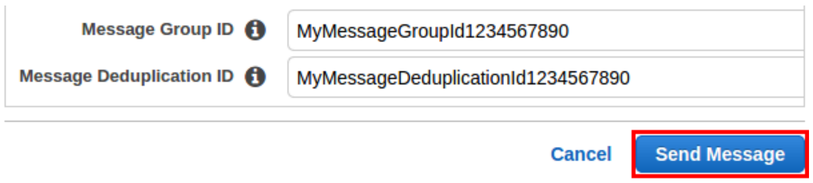
4. Send your message.

   - To send a message to a standard queue (p. 5), type text into the **Message Body** and then choose **Send Message**.



   - To send a message to a FIFO queue (p. 6), type text into the **Message Body**, type the **Message Group ID** and the **Message Deduplication ID** and then choose **Send Message**. For more information, see FIFO Queue Logic (p. 7).

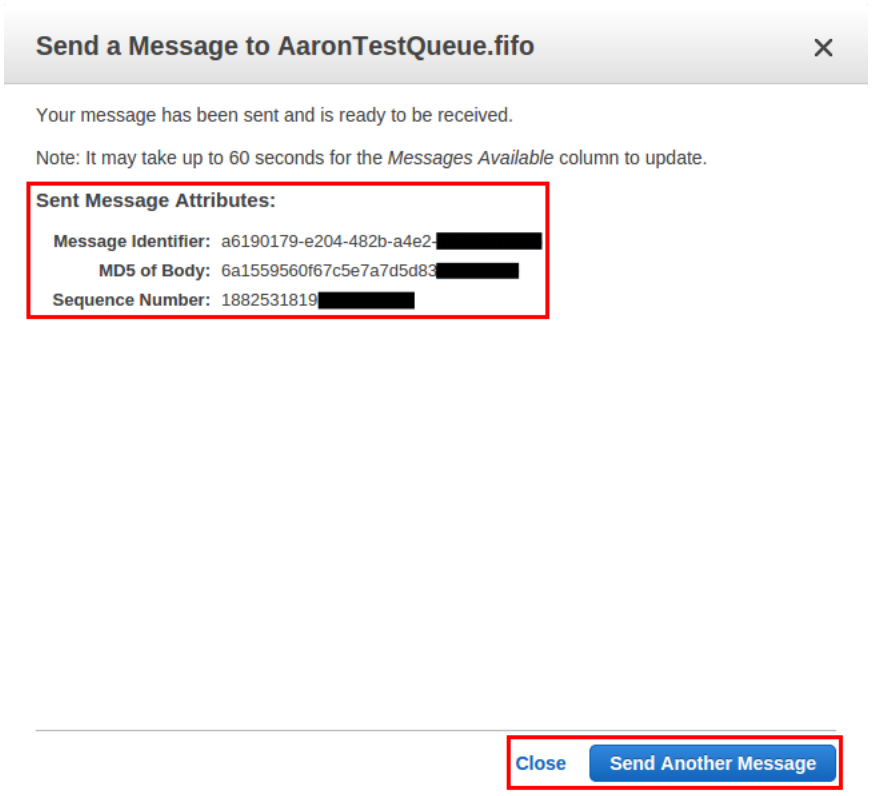
     Note
     The **message group ID** is always required. However, if **content-based deduplication** is enabled, the **message deduplication ID** is optional.


Message Group ID: MyMessageGroupId1234567890

Message Deduplication ID: MyMessageDeduplicationId1234567890

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

Note
The following example shows the **sequence number** attribute specific to FIFO queues.



Send a Message to AaronTestQueue.fifo

Your message has been sent and is ready to be received.

Note: It may take up to 60 seconds for the *Messages Available* column to update.

Sent Message Attributes:

Message Identifier: a6190179-e204-482b-a4e2-[redacted]
MD5 of Body: 6a1559560f67c5e7a7d5d83[redacted]
Sequence Number: 1882531819[redacted]

5. Choose **Close**. You can also choose **Send Another Message**.

To send a message to Amazon SQS queue using Java

1. Copy the example Java program (p. 8).

   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");
SendMessageRequest sendMessageRequest = new SendMessageRequest(myQueueUrl,
 "This is my message text.");
// You must provide a non-empty MessageGroupId when sending messages to a
 FIFO queue
sendMessageRequest.setMessageGroupId("messageGroup1");
// Uncomment the following to provide the MessageDeduplicationId
//sendMessageRequest.setMessageDeduplicationId("1");
SendMessageResult sendMessageResult = sqs.sendMessage(sendMessageRequest);
String sequenceNumber = sendMessageResult.getSequenceNumber();
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

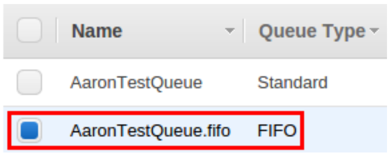
After you send a message into a queue, you can receive it (retrieve it from the queue). When you request a message from a queue, you can't specify which message to get. Instead, you specify the maximum number of messages (up to 10) that you want to get.

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. 29) to receive messages.

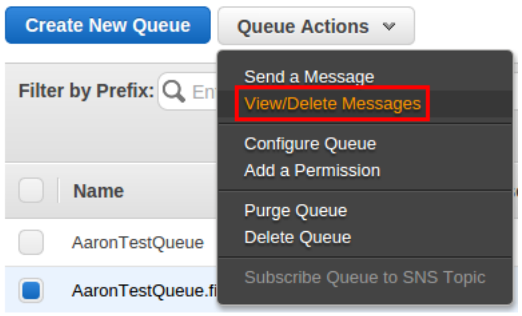
Amazon SQS doesn't automatically delete a message after retrieving it for you, in case you don't successfully receive the message (for example, the receiver could fail or lose connectivity). To delete a message, you must send a separate request which acknowledges that you no longer need the message because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

To receive and delete a message from an Amazon SQS queue using the AWS Management Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. From the queue list, select a queue.



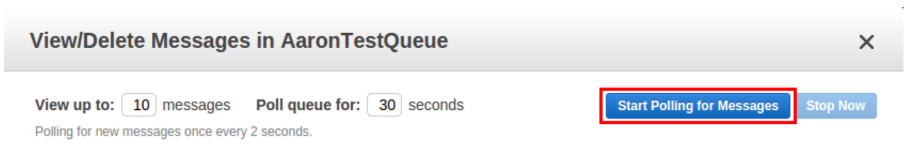
3. From the **Queue Actions** drop-down list, select **View/Delete Messages**.



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 and then choose **Start Polling for Messages**.

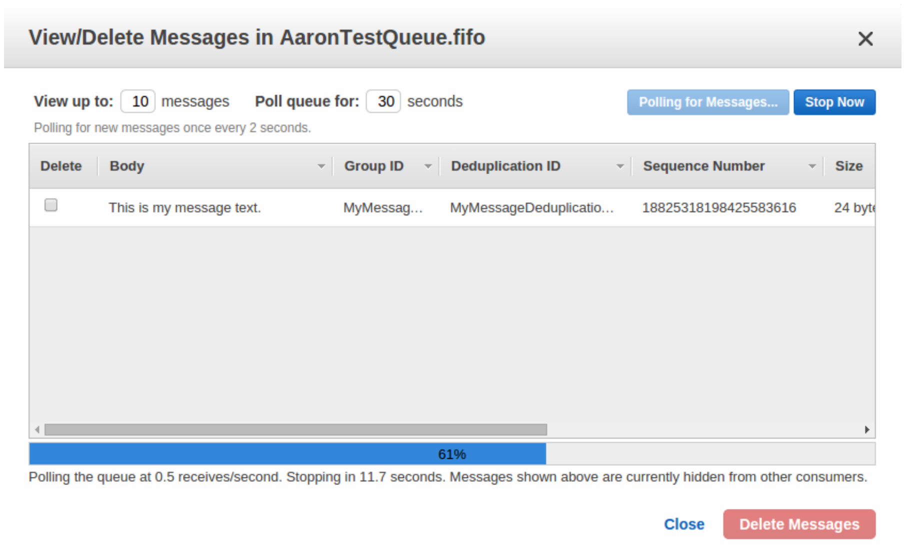
4. Choose **Start Polling for messages.**


View/Delete Messages in AaronTestQueue
View up to: 10 messages
Poll queue for: 30 seconds
Polling for new messages once every 2 seconds.
Start Polling for Messages
Stop Now

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.

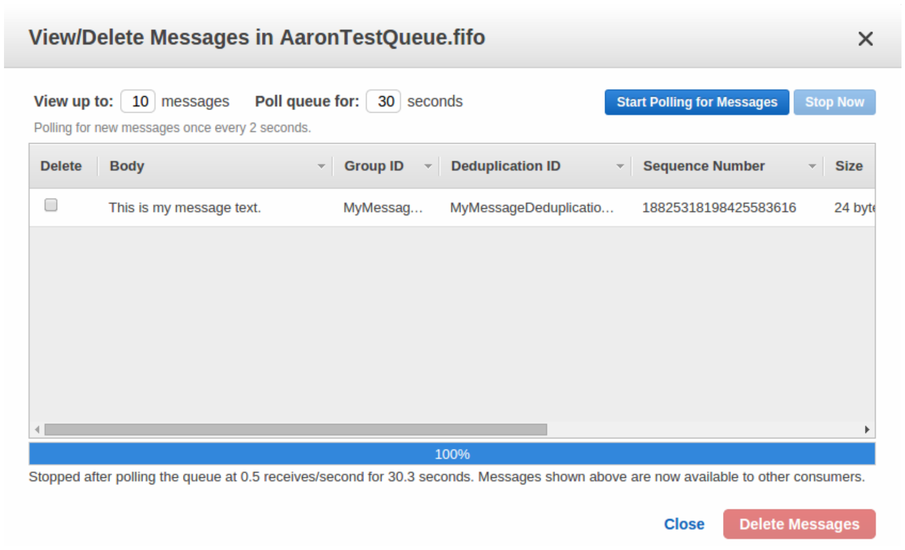
- For both standard queues (p. 5) and FIFO queues (p. 6), the message **Body**, **Size**, date **Sent**, and **Receive Count** columns display message information.
- For FIFO queues (p. 6), the **Message Group ID**, **Message Deduplication ID**, and **sequence number** columns display additional information.


View/Delete Messages in AaronTestQueue.fifo
View up to: 10 messages
Poll queue for: 30 seconds
Polling for new messages once every 2 seconds.
Polling for Messages...
Stop Now
61%
Close
Delete Messages

Delete	Body	Group ID	Deduplication ID	Sequence Number	Size
☐	This is my message text.	MyMessag...	MyMessageDeduplicatio...	18825318198425583616	24 byt

Polling the queue at 0.5 receives/second. Stopping in 11.7 seconds. Messages shown above are currently hidden from other consumers.

When the progress bar is filled in, the visibility timeout (p. 13) expires and the message becomes visible to consumers.


View/Delete Messages in AaronTestQueue.fifo

View up to: 10 messages Poll queue for: 30 seconds

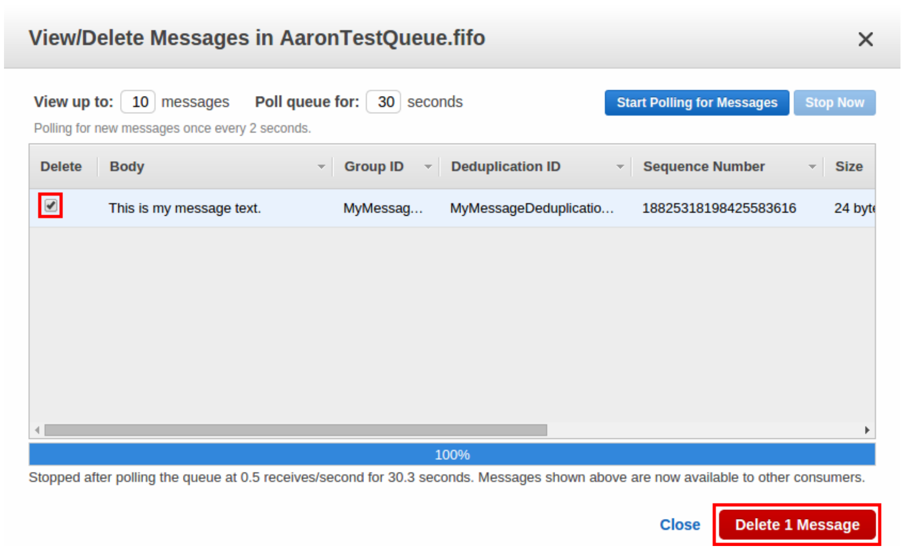
Polling for new messages once every 2 seconds.

Delete	Body	Group ID	Deduplication ID	Sequence Number	Size
☐	This is my message text.	MyMessag...	MyMessageDeduplicatio...	18825318198425583616	24 byt

100%

Stopped after polling the queue at 0.5 receives/second for 30.3 seconds. Messages shown above are now available to other consumers.

5. Select the message (or messages) that you want to delete and then select **Delete *1* Message**.


View/Delete Messages in AaronTestQueue.fifo

View up to: 10 messages Poll queue for: 30 seconds

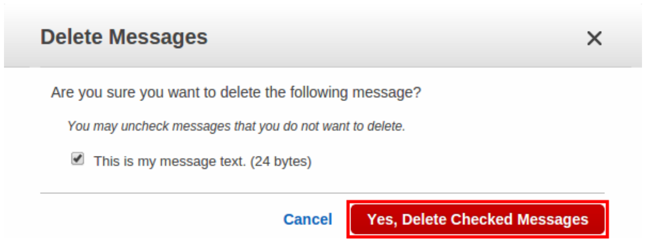
Polling for new messages once every 2 seconds.

Delete	Body	Group ID	Deduplication ID	Sequence Number	Size
✓	This is my message text.	MyMessag...	MyMessageDeduplicatio...	18825318198425583616	24 byt

100%

Stopped after polling the queue at 0.5 receives/second for 30.3 seconds. Messages shown above are now available to other consumers.

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


Delete Messages

Are you sure you want to delete the following message?

You may uncheck messages that you do not want to delete.

✓ This is my message text. (24 bytes)

6. Confirm that the messages you want to delete are checked, and select **Yes, Delete Checked Messages**.

   The selected messages are deleted.

7. Select **Close**.

To receive and delete a message from an Amazon SQS queue using Java

1. Copy the example Java program (p. 8).

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

```
// Receive messages
System.out.println("Receiving messages from MyFifoQueue.fifo.\n");
ReceiveMessageRequest receiveMessageRequest = new
 ReceiveMessageRequest(myQueueUrl);
// Uncomment the following to provide the ReceiveRequestDeduplicationId
//receiveMessageRequest.setReceiveRequestAttemptId("1");
List&lt;Message> messages =
 sqs.receiveMessage(receiveMessageRequest).getMessages();
for (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 (Entry&lt;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");
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: Subscribing one or more Amazon SQS Queues to an Amazon SNS Topic

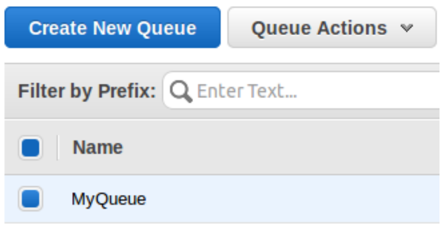
You can subscribe one or more Amazon SQS queues to an Amazon SNS topic from a list of topics available for the selected queue. Amazon SQS manages the subscription and any necessary permissions. When you publish an Amazon SQS message to a topic, Amazon SNS sends the message to any subscribed queues. For 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.

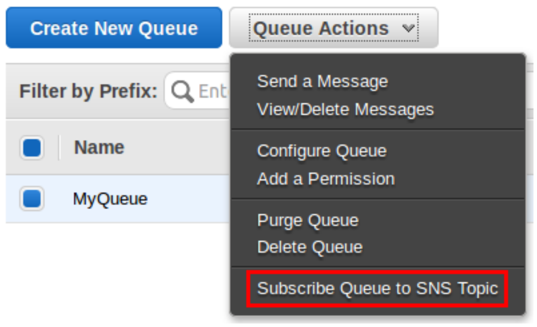
Note
When you subscribe an Amazon SQS queue to an Amazon SNS topic, Amazon SNS uses HTTPS to forward messages to Amazon SQS.
Amazon SNS isn't currently compatible with FIFO queues.

To subscribe one or more Amazon SQS queues to an Amazon SNS topic using the AWS Management Console

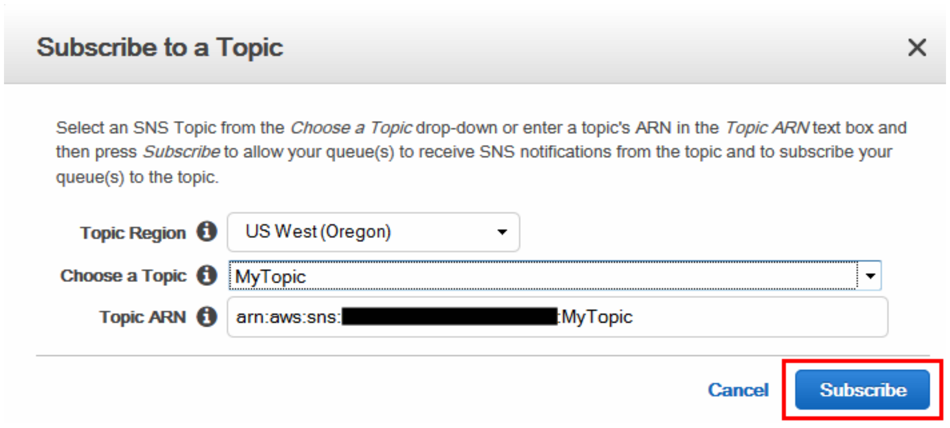
1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
2. From the list of queues, choose the queue (or queues) to which you want to subscribe an Amazon SNS topic.



3. From the **Queue Actions** drop-down list, 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**.


Subscribe to a Topic

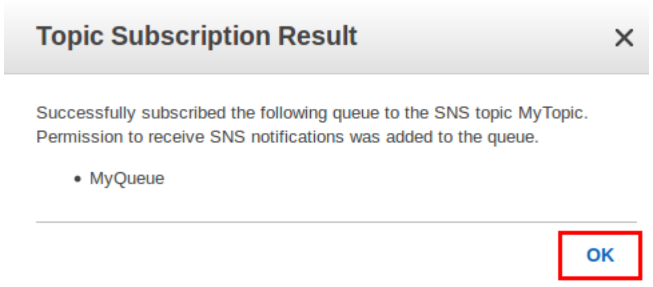
Select an SNS Topic from the *Choose a Topic* drop-down or enter a topic's ARN in the *Topic ARN* text box and then press *Subscribe* to allow your queue(s) to receive SNS notifications from the topic and to subscribe your queue(s) to the topic.

Topic Region: US West (Oregon)
Choose a Topic: MyTopic
Topic ARN: arn:aws:sns:[redacted]:MyTopic

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**.


Topic Subscription Result

Successfully subscribed the following queue to the SNS topic MyTopic.
Permission to receive SNS notifications was added to the queue.

- MyQueue

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*.

Monitoring and Logging

This section provides information on 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, the CloudWatch console, the command line, or programmatically.

CloudWatch metrics for your Amazon SQS queues are automatically collected and pushed to CloudWatch every five minutes. (Detailed monitoring, or one-minute metrics, is currently unavailable for Amazon SQS.) These metrics are gathered on all queues that meet the CloudWatch guidelines for being active. A queue is considered active by CloudWatch for up to six hours from the last activity (for example, any API call) on the queue.

Note
There is no charge for the Amazon SQS metrics reported in CloudWatch. They're provided as part of the Amazon SQS service.

CloudWatch metrics are supported for both standard and FIFO queues.

Topics

Common Monitoring Tasks

Use the following decision matrix to determine which set of instructions to follow to complete your desired task.

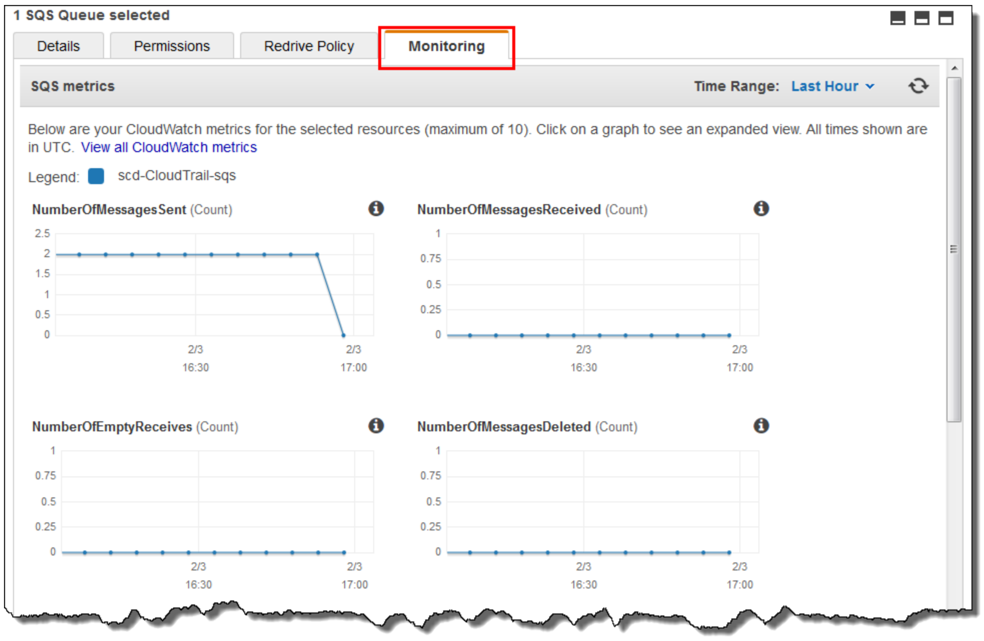
Task	Instructions
Quickly display a default view of CloudWatch metrics over time for up to 10 queues at once.	Access Metrics Using the Amazon SQS Console (p. 84)
Further customize the default views of CloudWatch metrics. Set alarms when metrics meet or exceed specified conditions. Create complex dashboards that display metrics for multiple Amazon SQS queues together.	Access Metrics Using the CloudWatch Console (p. 86) Set CloudWatch Alarms for Amazon SQS Metrics (p. 87)
Access CloudWatch metrics from the command line or programmatically.	Access Metrics Using the AWS CLI (p. 87) Access Metrics Using the CloudWatch CLI (p. 87) Access Metrics Using the CloudWatch API (p. 87)

Access CloudWatch Metrics for Amazon SQS

You can access metrics for Amazon SQS using the Amazon SQS console, the CloudWatch console, the AWS CLI, CloudWatch's own CLI, or programmatically using the CloudWatch API. The following procedures show you how to access the metrics using these different options.

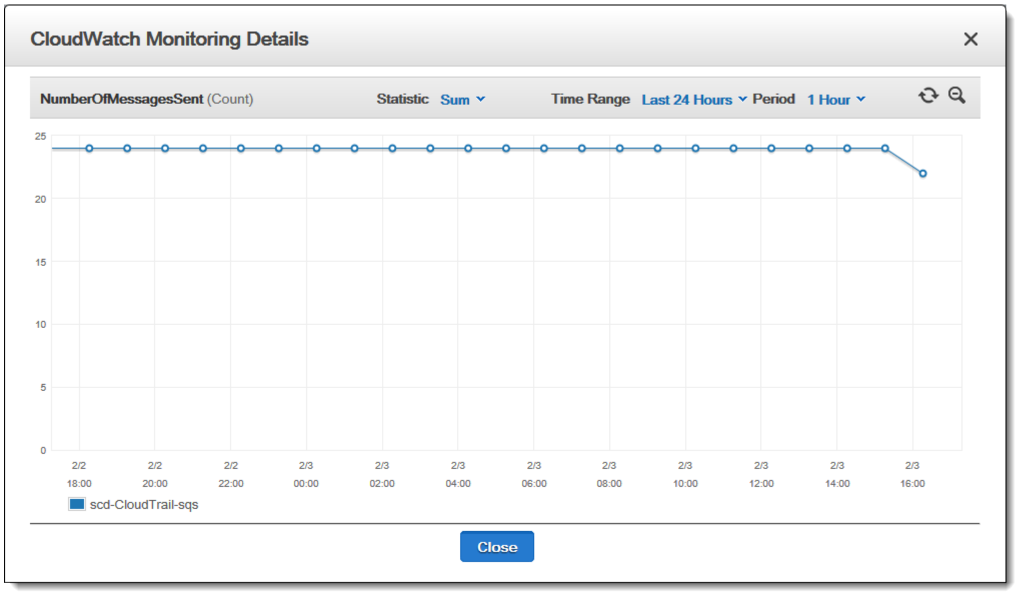
Access Metrics Using the Amazon SQS Console

1. Sign in to the AWS Management Console and open the Amazon SQS console at https://console.aws.amazon.com/sqs/.
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.


1 SQS Queue selected
Details
Permissions
Redrive Policy
Monitoring
SQS metrics
Time Range: Last Hour
Legend: scd-CloudTrail-sqs
NumberOfMessagesSent (Count)
NumberOfMessagesReceived (Count)
NumberOfEmptyReceives (Count)
NumberOfMessagesDeleted (Count)

Below are your CloudWatch metrics for the selected resources (maximum of 10). Click on a graph to see an expanded view. All times shown are in UTC. View all CloudWatch metrics

4. To understand what a particular graph represents, hover over the information icon next to the desired graph, or see Available CloudWatch Metrics for Amazon SQS (p. 90).
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. After the graph displays in a larger dialog box, for **Statistic**, choose the desired statistic (for example, **Sum**). For a list of supported statistics, see Available CloudWatch Metrics for Amazon SQS (p. 90).



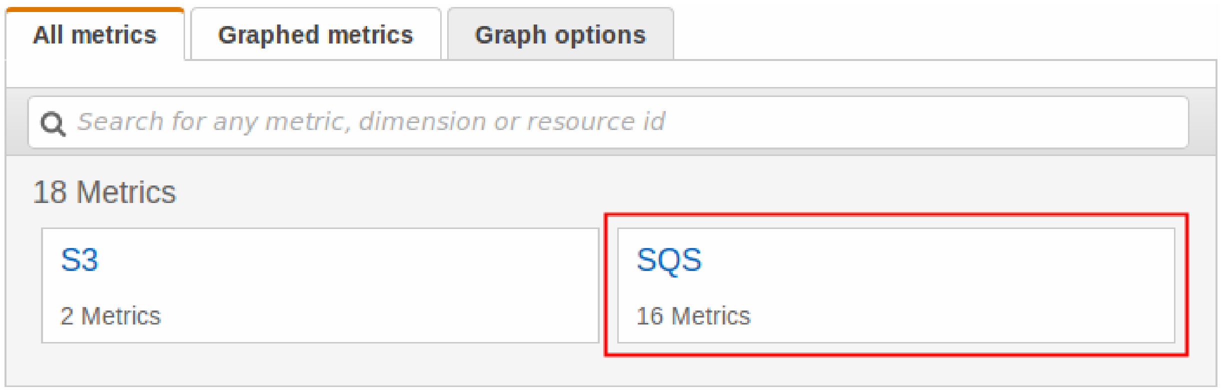
7. To change the time range and time interval that an individual graph displays (for example, to show a time range of the last 24 hours instead of the last 5 minutes, or to show a time period of every hour instead of every 5 minutes), with the graph's dialog box still displayed, for **Time Range**, choose 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**.

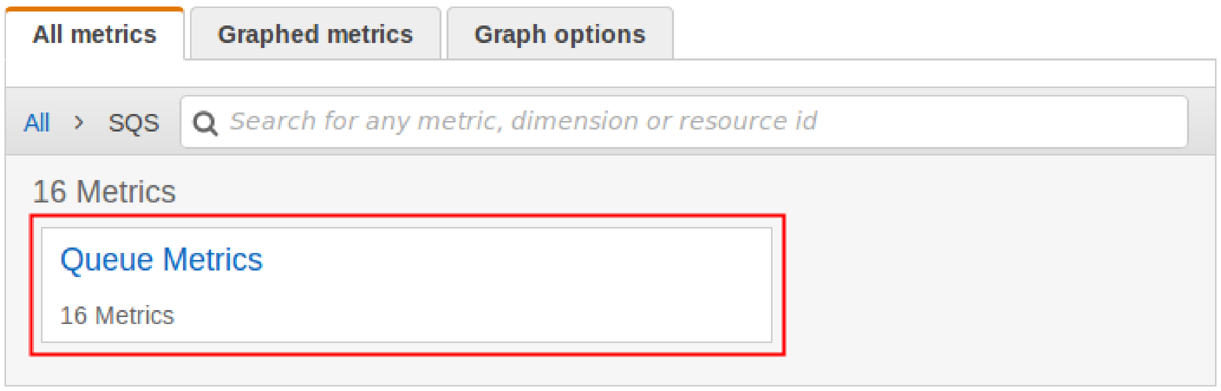
8. To work with additional CloudWatch features, on the **Monitoring** tab, choose **View all CloudWatch metrics**, and then follow the instructions in the Access Metrics Using the CloudWatch Console (p. 86) procedure.

Access Metrics Using the 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 **Metrics**.
3. Select the **SQS** metric namespace.

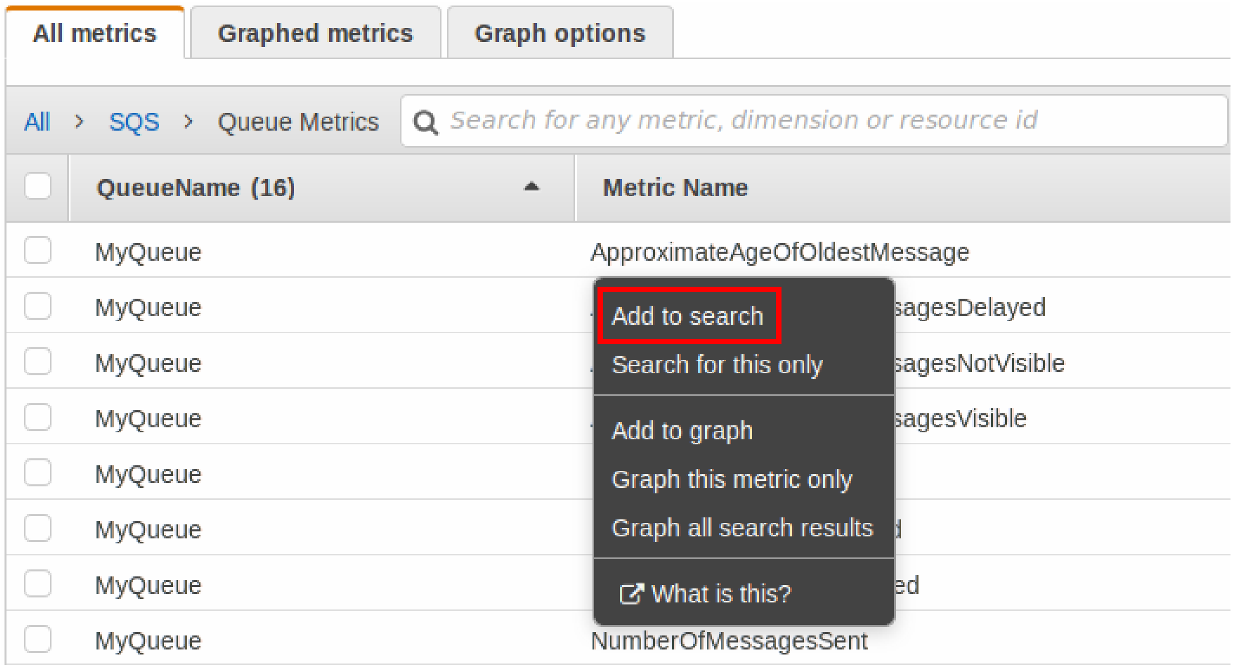


4. Select the **Queue Metrics** metric dimension.



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**.



QueueName (16)	Metric Name
MyQueue	ApproximateAgeOfOldestMessage
MyQueue	sagesDelayed
MyQueue	sagesNotVisible
MyQueue	sagesVisible
MyQueue	
MyQueue	d
MyQueue	ed
MyQueue	NumberOfMessagesSent

For more information and additional options, see Graph Metrics and Using Amazon CloudWatch Dashboards.

Access Metrics Using the AWS CLI

Run the `get-metric-statistics` command. For more information, see Get Statistics for a Metric.

Access Metrics Using the CloudWatch CLI

Run the `mon-get-stats` command.

Access Metrics Using the CloudWatch API

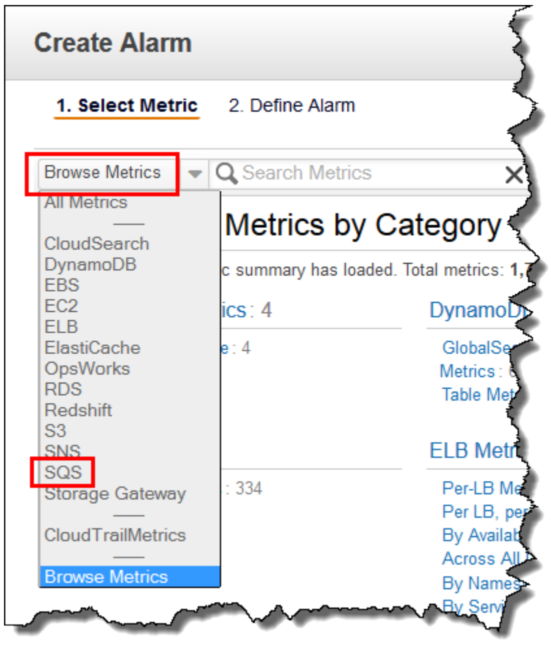
Call the `GetMetricStatistics` operation. For more information, see Get Statistics for a Metric.

Set CloudWatch Alarms for Amazon SQS Metrics

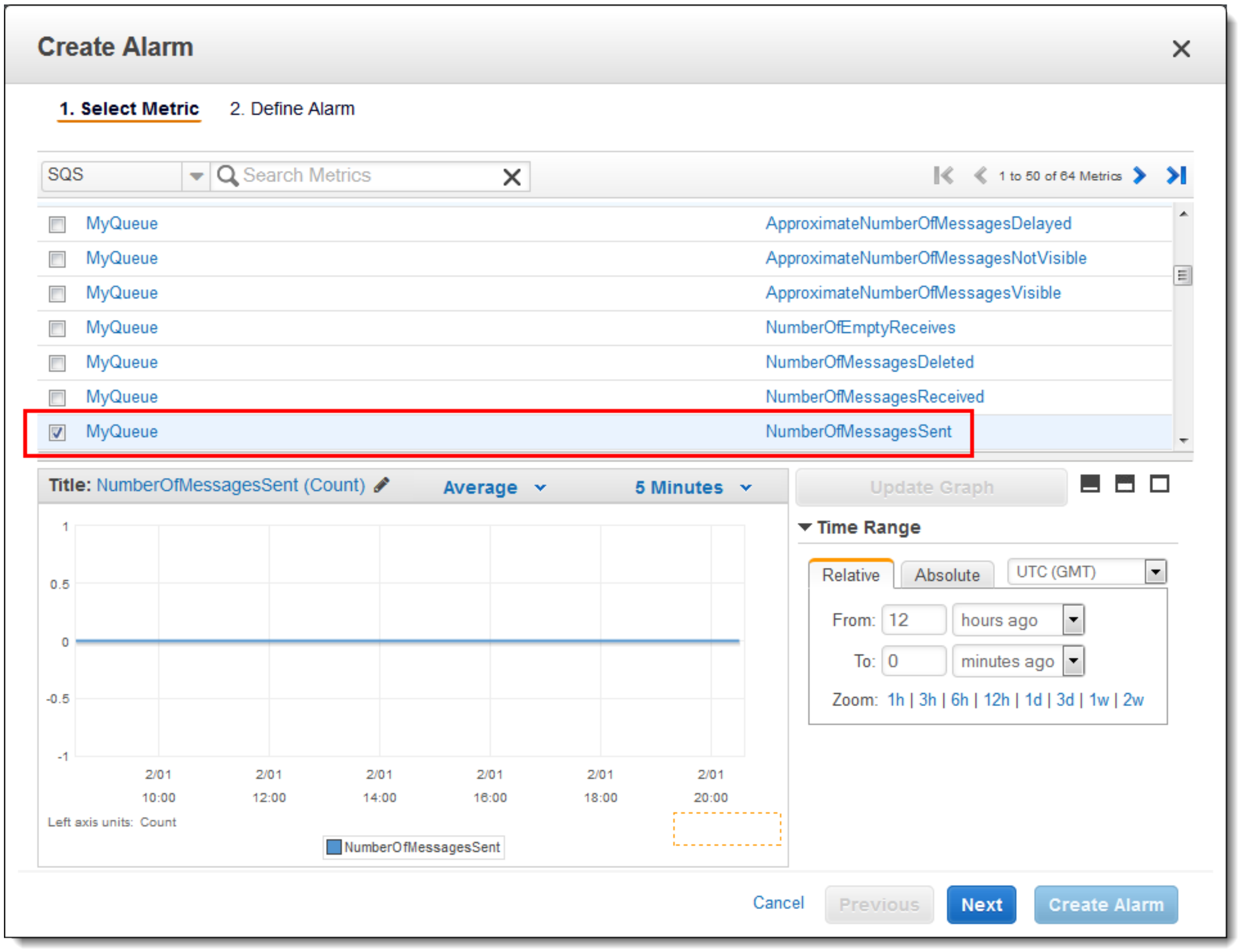
CloudWatch allows you to trigger alarms when a threshold is met for a metric. For example, you could set an alarm for the `NumberOfMessagesSent` metric so that when the number of messages exceeds a specified limit over a specified time period, then an email notification could be sent to inform you of the event.

To set an alarm (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. 90)). For example, choosing (checking) the box for **MyQueue**, **NumberOfMessagesSent** sets an alarm based on the number of messages sent to the `MyQueue` queue.



SQS

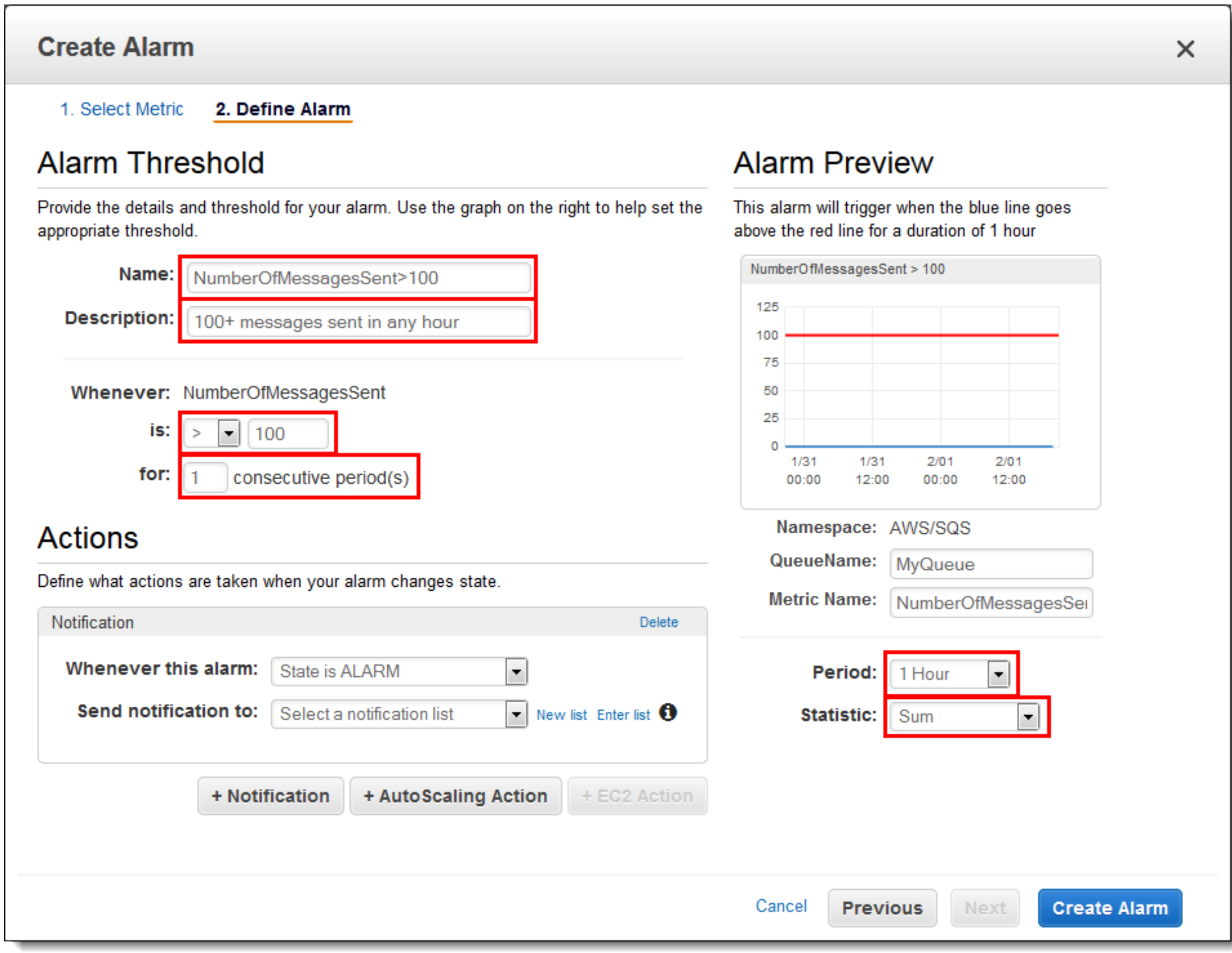
☐	MyQueue	ApproximateNumberOfMessagesDelayed
☐	MyQueue	ApproximateNumberOfMessagesNotVisible
☐	MyQueue	ApproximateNumberOfMessagesVisible
☐	MyQueue	NumberOfEmptyReceives
☐	MyQueue	NumberOfMessagesDeleted
☐	MyQueue	NumberOfMessagesReceived
☑	MyQueue	NumberOfMessagesSent

Title: NumberOfMessagesSent (Count) Average 5 Minutes

UTC (GMT)
From: 12 hours ago
To: 0 minutes ago

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**.


Create Alarm

1. Select Metric 2. Define Alarm

Alarm Threshold

Provide the details and threshold for your alarm. Use the graph on the right to help set the appropriate threshold.

Name: NumberOfMessagesSent>100
Description: 100+ messages sent in any hour

Whenever: NumberOfMessagesSent
is: > 100
for: 1 consecutive period(s)

Actions

Define what actions are taken when your alarm changes state.

Notification
Whenever this alarm: State is ALARM
Send notification to: Select a notification list

Alarm Preview

This alarm will trigger when the blue line goes above the red line for a duration of 1 hour

Namespace: AWS/SQS
QueueName: MyQueue
Metric Name: NumberOfMessagesSe
Period: 1 Hour
Statistic: 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 will be saved and appear for future alarms.

   Note
   If you choose **New list** to create a new Amazon SNS topic, the email addresses must be verified before they'll receive 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)
`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)
`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 by using Amazon S3 server-side encryption (SSE).

You can choose to have CloudTrail publish Amazon SNS notifications when new log files are delivered if you want to take quick action upon log file delivery. For more information, see Configuring Amazon SNS Notifications 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 are not 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": "http://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": "http://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": "http://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": "http://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": "http://test-sqs.amazon.com/123456789012/hello1"
      },
      "responseElements": null,
      "requestID": "7f15d706-f3d7-5221-b9ca-9b393f349b79",
      "eventID": "8b6fb2dc-2661-49b1-b328-94317815088b"
    }
  ]
}
```

Working with Amazon SQS APIs

This section provides information on working with Amazon SQS APIs.

Topics

Making API Requests

Topics

This section describes how to make requests to Amazon SQS. The topics acquaint you with the basic differences between the interfaces, the components of a request, how to authenticate a request, and the content of responses.

We also provide SDKs that enable you to access Amazon SQS from your preferred programming language. The SDKs contain functionality that automatically takes care of tasks such as:

- Cryptographically signing your service requests
- Retrying requests
- Handling error responses

For a list of available SDKs, see Tools for Amazon Web Services

Important
As of August 8, 2011, Amazon SQS no longer supports SOAP requests.

Endpoints

For information about Amazon SQS regions and endpoints, see Regions and Endpoints in the *Amazon Web Services General Reference*.

Every Amazon SQS endpoint is entirely independent. For example, two queues named MyQueue, one in `sqs.us-east-1.amazonaws.com` and one in `sqs.eu-west-1.amazonaws.com`, would be completely independent and would not share any data. Queue names and queue URLs are case-sensitive.

The following are general examples of query requests that create queues in different regions. The structure of `AUTHPARAMS` depends on how you sign your API request.

Example of Creating a Queue in EU (Ireland)

```
http://sqs.eu-west-1.amazonaws.com/
?Action=CreateQueue
&DefaultVisibilityTimeout=40
&QueueName=MyQueue
&Version=2012-11-05
&AUTHPARAMS
```

Making Query Requests

Topics

Amazon SQS supports Query requests for calling service actions. Query requests are simple HTTP or HTTPS requests, using the GET or POST method. Query requests must contain an `Action` parameter to indicate the action to be performed. The response is an XML document that conforms to a schema.

Structure of a GET Request

This guide presents the Amazon SQS GET requests as URLs, which can be used directly in a browser. The URL consists of:

- **Endpoint—**The resource the request is acting on (in the case of Amazon SQS, the endpoint is a queue)
- **Action—**The action you want to perform on the endpoint; for example: sending a message
- **Parameters—**Any request parameters

The following is an example GET request to send a message to an Amazon SQS queue.

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

```
http://sqs.us-east-2.amazonaws.com/123456789012/queue1?
Action=SendMessage&MessageBody=Your%20Message%20Text&Version=2012-11-05
&AUTHPARAMS
```

Important
Because the GET requests are URLs, you must URL encode the parameter values. For example, in the preceding example request, the value for the `MessageBody` parameter is actually `Your Message Text`. However, spaces are not allowed in URLs, so each space is URL encoded as "`%20`". The rest of the example has not been URL encoded to make it easier for you to read.

Note
Queue names and queue URLs are case-sensitive.

To make the GET examples even easier to read, this guide presents them in the following parsed format.

```
http://sqs.us-east-2.amazonaws.com/123456789012/queue1
?Action=SendMessage
&MessageBody=Your%20Message%20Text
&Version=2012-11-05
&Expires=2011-10-15T12:00:00Z
&AUTHPARAMS
```

Note
In the example Query requests we present in this guide, we use a false AWS Access Key ID and false signature, each with `EXAMPLE` appended. We do this to indicate that you

shouldn't expect the signature in the example to be accurate based on the request parameters presented in the example. The one exception to this is in the instructions for creating Query request signatures. The example there shows a real signature based on a particular AWS Access Key ID we specify and the request parameters in the example (for more information, see Query Request Authentication (p. 108)).

In Amazon SQS, all parameters except `MessageBody` always have values that have no spaces. The value you provide for `MessageBody` in SendMessage requests can have spaces. In this guide, any example `SendMessage` Query requests with a `MessageBody` that includes spaces is displayed with the spaces URL encoded (as `%20`). For clarity, the rest of the URL isn't displayed in a URL encoded format.

The first line represents the *endpoint* of the request. This is the resource the request acts on. The preceding example acts on a queue, so the request's endpoint is the queue's identifier, known as the *queue URL*. For more details about the queue URL, see Queue Name and URL (p. 11).

After the endpoint is a question mark (?), which separates the endpoint from the parameters. Each parameter is separated by an ampersand (&).

The `Action` parameter indicates the action to perform (for a list of the actions, see API Actions in the Amazon SQS API Reference). For a list of the other parameters that are common to all Query requests, see Common Parameters in the Amazon SQS API Reference.

Structure of a POST Request

Amazon SQS also accepts POST requests. With a POST request, you send the query parameters as a form in the HTTP request body as described in the following procedure.

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

To create a POST request

1. Assemble the query parameter names and values into a form.

   This means you put the parameters and values together like you'd for a GET request (with an ampersand separating each name-value pair). The following example shows a `SendMessage` request with the line breaks we use in this guide to make the information easier to read.

```
Action=SendMessage
&MessageBody=Your Message Text
&Version=2012-11-05
&Expires=2011-10-15T12:00:00Z
&AUTHPARAMS
```

2. Form-URL-encode the form according to the *Form Submission* section of the HTML specification (for more information, see http://www.w3.org/MarkUp/html-spec/html-spec_toc.html#SEC8.2.1).

```
Action=SendMessage
&MessageBody=Your+Message+Text
&Version=2012-11-05
&Expires=2011-10-15T12%3A00%3A00Z
&AUTHPARAMS
```

3. Add the request signature to the form (for more information, see Query Request Authentication (p. 108)).

```
Action=SendMessage
```

```
&MessageBody=Your+Message+Text
&Version=2012-11-05
&Expires=2011-10-15T12%3A00%3A00Z
&AUTHPARAMS
```

4. Provide the resulting form as the body of the POST request.
5. Include the `Content-Type` HTTP header with the value set to `application/x-www-form-urlencoded`.

The following example shows the final POST request.

```
POST /queue1 HTTP/1.1
Host: sqs.us-east-2.amazonaws.com
Content-Type: application/x-www-form-urlencoded

Action=SendMessage
&MessageBody=Your+Message+Text
&Version=2012-11-05
&Expires=2011-10-15T12%3A00%3A00Z
&AUTHPARAMS
```

Amazon SQS requires no other HTTP headers in the request besides `Content-Type`. The authentication signature you provide is the same signature you'd provide if you sent a GET request (for information about the signature, see Query Request Authentication (p. 108)).

Note
Your HTTP client typically adds other items to the HTTP request as required by the version of HTTP the client uses. We don't include those additional items in the examples in this guide.

Related Topics

- Query Request Authentication (p. 108)
- Responses (p. 109)

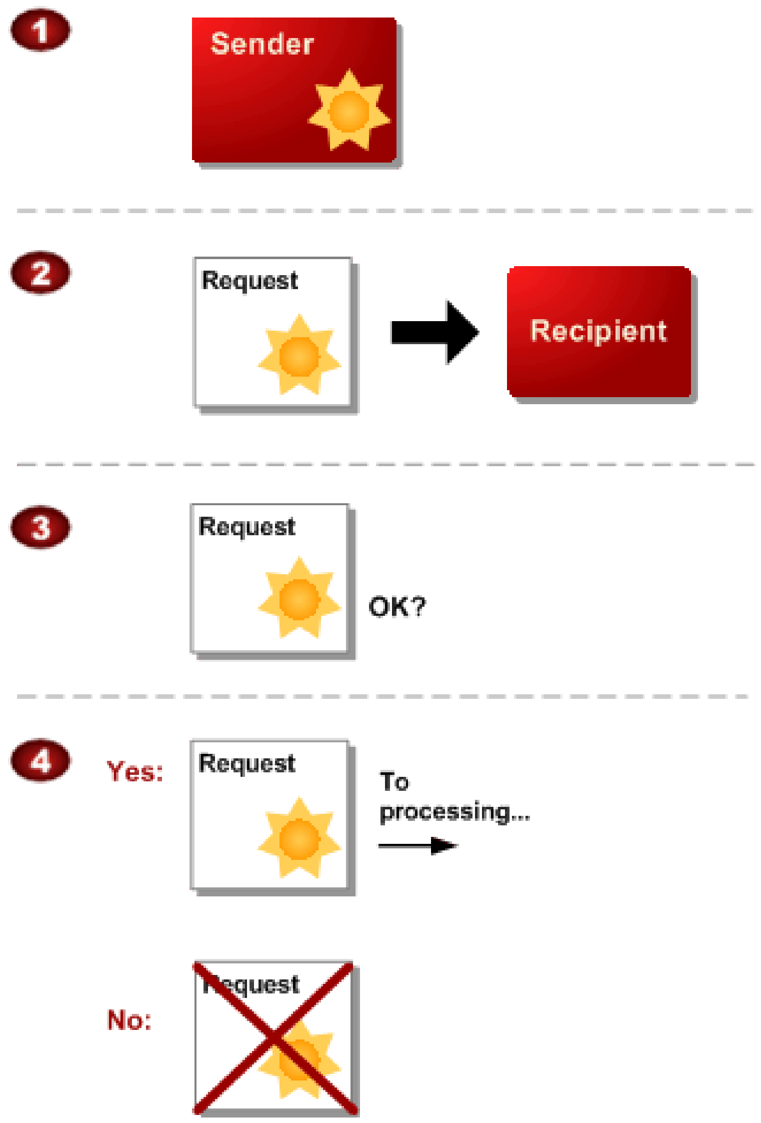
Request Authentication

Topics

The topics in this section describe how Amazon SQS authenticates your requests. In this section you can learn about the basics of authentication, how your AWS account and access keys support authentication, and how to create a signature. This section also covers the request authentication requirements for Query requests.

What Is Authentication?

Authentication is a process for identifying and verifying who is sending a request. The following diagram shows a simplified version of an authentication process.



General Process of Authentication

1	The sender obtains the necessary credential.
2	The sender sends a request with the credential to the recipient.
3	The recipient uses the credential to verify the sender truly sent the request.
4	If yes, the recipient processes the request. If no, the recipient rejects the request and responds accordingly.

During authentication, AWS verifies both the identity of the sender and whether the sender is registered to use services offered by AWS. If either test fails, the request isn't processed further.

The subsequent sections describe how Amazon SQS implements authentication to protect your data.

Your AWS Account

To access any web services offered by AWS, you must first create an AWS account at http://aws.amazon.com. An AWS account is simply an Amazon.com account that is enabled to use AWS products; you can use an existing Amazon.com account login and password when creating the AWS account.

Alternately, you could create a new AWS-enabled Amazon.com account by using a new login and password. The e-mail address you provide as the account login must be valid. You'll be asked to provide a credit card or other payment method to cover the charges for any AWS products you use.

From your AWS account you can view your AWS account activity and view usage reports.

For more information, see Creating an AWS Account in the Amazon Simple Queue Service Getting Started Guide.

Related Topics

- Your Access Keys (p. 104)

Your Access Keys

For API access, you need an access key ID and secret access key. Use IAM user access keys instead of AWS root account access keys. IAM lets you securely control access to AWS services and resources in your AWS account. For more information about creating access keys, see How Do I Get Security Credentials? in the *AWS General Reference*.

Related Topics

- HMAC-SHA Signatures (p. 104)
- Query Request Authentication (p. 108)

HMAC-SHA Signatures

Topics

The topics in this section describe how Amazon SQS uses HMAC-SHA signatures to authenticate Query requests.

Required Authentication Information

When accessing Amazon SQS using the Query API, you must provide the following items so the request can be authenticated:

- **AWS Access Key ID—**Your AWS account is identified by your Access Key ID, which AWS uses to look up your Secret Access Key.
- **Signature—**Each request must contain a valid HMAC-SHA request signature, or the request is rejected.

  You calculate the request signature by using your Secret Access Key, which is a shared secret known only to you and AWS.

- **Date—**Each request must contain the time stamp of the request. You can provide an expiration date and time for the request instead of or in addition to the time stamp.

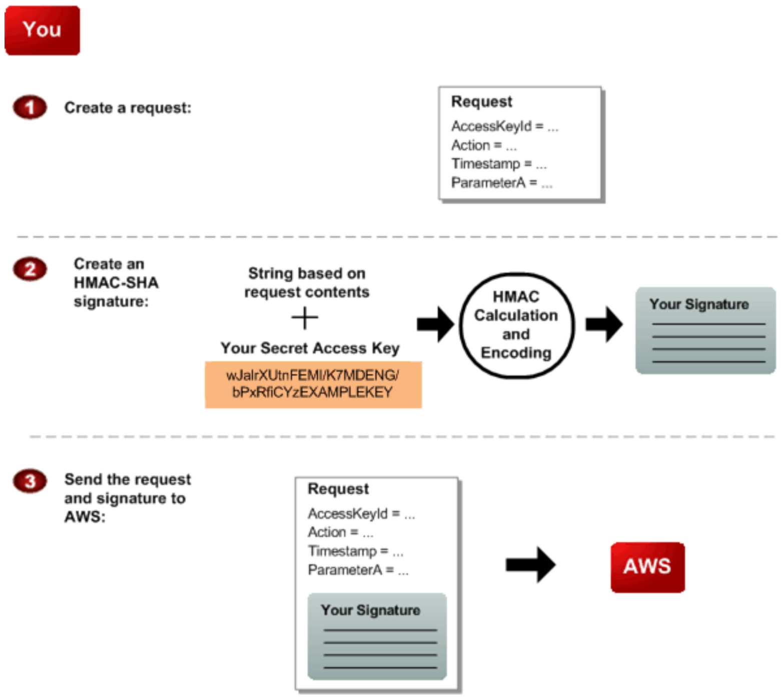
Related Topics

- Your Access Keys (p. 104)

Basic Authentication Process

Following is the series of tasks required to authenticate requests to AWS using an HMAC-SHA request signature. It's assumed you have already created an AWS account and created an Access Key ID and Secret Access Key. For more information about those, see Your AWS Account (p. 104) and Your Access Keys (p. 104).

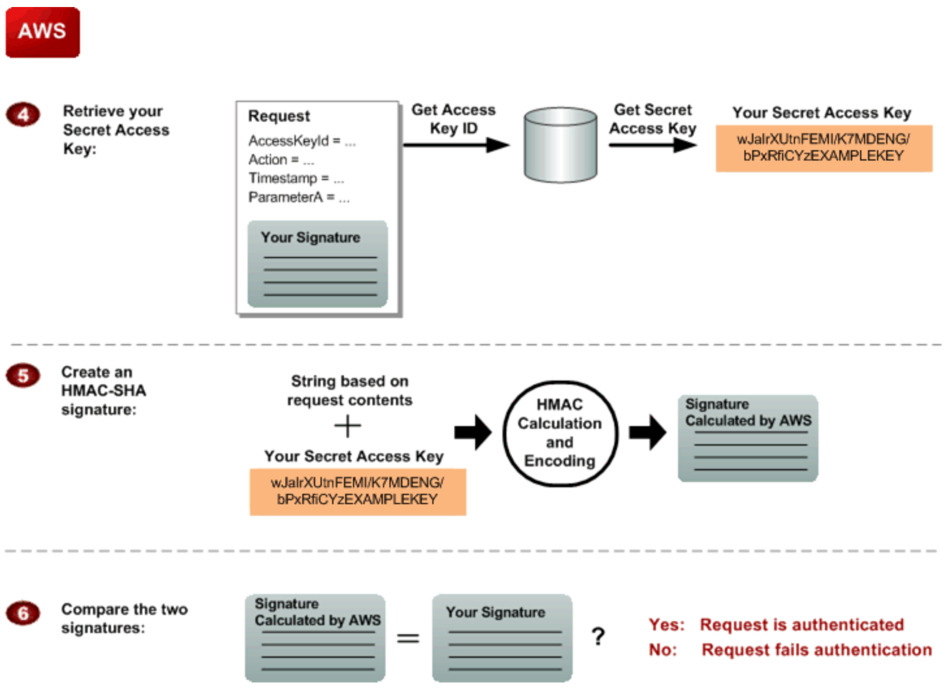
You perform the first three tasks.



Process for Authentication: Tasks You Perform

1	You construct a request to AWS.
2	You calculate a keyed-hash message authentication code (HMAC-SHA) signature using your Secret Access Key (for information about HMAC, see http://www.faqs.org/rfcs/rfc2104.html)
3	You include the signature and your Access Key ID in the request, and then send the request to AWS.

AWS performs the next three tasks.


AWS
4 Retrieve your Secret Access Key:
Request
AccessKeyId = ...
Action = ...
Timestamp = ...
ParameterA = ...
Your Signature
Get Access Key ID
Get Secret Access Key
Your Secret Access Key
wJalrXUtnFEMI/K7MDENG/bPxRfiCYzEXAMPLEKEY
5 Create an HMAC-SHA signature:
String based on request contents
Your Secret Access Key
wJalrXUtnFEMI/K7MDENG/bPxRfiCYzEXAMPLEKEY
HMAC Calculation and Encoding
Signature Calculated by AWS
6 Compare the two signatures:
Signature Calculated by AWS
=
Your Signature
?
Yes: Request is authenticated
No: Request fails authentication

Process for Authentication: Tasks AWS Performs

4	AWS uses the Access Key ID to look up your Secret Access Key.
5	AWS generates a signature from the request data and the Secret Access Key using the same algorithm you used to calculate the signature you sent in the request.
6	If the signature generated by AWS matches the one you sent in the request, the request is considered authentic. If the comparison fails, the request is discarded, and AWS returns an error response.

About the String to Sign

Each AWS request you send must include an HMAC-SHA request signature calculated with your Secret Access Key. The details are covered in Query Request Authentication (p. 108).

About the Time Stamp

The time stamp (or expiration time) you use in the request must be a `dateTime` object, with the complete date plus hours, minutes, and seconds (for more information, see http://www.w3.org/TR/xmlschema-2/#dateTime). For example: 2007-01-31T23:59:59Z. Although it's not required, we recommend you provide the time stamp in the Coordinated Universal Time (Greenwich Mean Time) time zone.

If you specify a time stamp (instead of an expiration time), the request automatically expires 15 minutes after the time stamp (in other words, AWS does not process a request if the request time stamp is more than 15 minutes earlier than the current time on AWS servers). Make sure your server's time is set correctly.

Important
If you're using .NET you must not send overly specific time stamps, due to different interpretations of how extra time precision should be dropped. To avoid overly specific time stamps, manually construct `dateTime` objects with no more than millisecond precision.

Java Sample Code for Base64 Encoding

Request signatures must be base64 encoded. The following Java sample code shows how to perform base64 encoding.

```
package amazon.webservices.common;
/**
* This class defines common routines for encoding data in AWS requests.
*/
public class Encoding {
/**
* Performs base64-encoding of input bytes.
*
* @param rawData * Array of bytes to be encoded.
* @return * The base64 encoded string representation of rawData.
*/
public static String EncodeBase64(byte[] rawData) {
return Base64.encodeBytes(rawData);
}
}
```

Java Sample Code for Calculating SHA256 Signatures

For an example of how to derive a Signature Version 4 Signing Key, see Deriving the Signing Key with Java.

> **Note**
> While both Signature Version 2 and Signature Version 4 support SHA256, only Signature Version 2 supports SHA1.

Query Request Authentication

When you programmatically call the functionality exposed by the Amazon SQS API, all calls sent to Amazon SQS must be signed. If you use an AWS SDK, the SDK handles the signing process for you so that you do not have to manually complete the tasks. On the other hand, if you submit a Query request over HTTP/HTTPS, then you must include a signature in every Query request.

Amazon SQS supports signature version 4. Signature version 4 provides improved security and performance over previous versions. If you're creating new applications that use Amazon SQS, then you should use signature version 4.

For information on how to create the signature using signature version 4, see Signature Version 4 Signing Process in the AWS General Reference.

Responses

Topics

In response to an action request, Amazon SQS returns an XML data structure that contains the results of the request. This data conforms to the Amazon SQS schema. For more information, see the API version in the *Amazon SQS API Reference*.

Structure of a Successful Response

If the request succeeded, the main response element is named after the action, but with "Response" appended. For example, `CreateQueueResponse` is the response element returned for a successful `CreateQueue` request. This element contains the following child elements:

- `ResponseMetadata`, which contains the `RequestId` child element
- An optional element containing action-specific results; for example, the `CreateQueueResponse` element includes an element called `CreateQueueResult`

The XML schema describes the XML response message for each Amazon SQS action.

The following is an example of a successful response.

```
<CreateQueueResponse
  xmlns=http://sqs.us-east-2.amazonaws.com/doc/2012-11-05/
  xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
  xsi:type=CreateQueueResponse>
     <CreateQueueResult>
        <QueueUrl>
        http://sqs.us-east-2.amazonaws.com/770098461991/queue2
        </QueueUrl>
     </CreateQueueResult>
     <ResponseMetadata>
        <RequestId>cb919c0a-9bce-4afe-9b48-9bdf2412bb67</RequestId>
     </ResponseMetadata>
</CreateQueueResponse>
```

Structure of an Error Response

If a request is unsuccessful, the main response element is called `ErrorResponse` regardless of the action that was called. This element contains an `Error` element and a `RequestId` element. Each `Error` includes:

- A `Type` element that identifies whether the error was a receiver or sender error
- A `Code` element that identifies the type of error that occurred
- A `Message` element that describes the error condition in a human-readable form
- A `Detail` element that might give additional details about the error or might be empty

The following is an example of an error response.

```
<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>
```

Related Topics

- Making Query Requests (p. 99)

Shared Queues

Topics

Amazon SQS includes methods to share your queues so others can use them, using permissions set in an access control policy. A *permission* gives access to another user to use your queue in some particular way. A *policy* is the actual document that contains the permissions you've granted.

Amazon SQS offers two methods for setting a policy: a simple API and an advanced API. In the simple API, Amazon SQS generates an access control policy for you. In the advanced API, you create the access control policy.

Simple API for Shared Queues

The simple API for sharing a queue has two operations:

- `AddPermission`
- `RemovePermission`

With the simple API, Amazon SQS writes the policy in the required language for you based on the information you include in the `AddPermission` operation. However, the policy that Amazon SQS generates is limited in scope. You can grant permissions to principals, but you can't specify restrictions.

Advanced API for Shared Queues

With the advanced API, you write the policy yourself directly in the access policy language and upload the policy with the `SetQueueAttributes` operation. The advanced API allows you to deny access or to apply finer access restrictions (for example, based on time or based on IP address).

If you choose to write your own policies, you need to understand how policies are structured. For complete reference information about policies, see Creating Custom Policies Using the Access Policy Language (p. 135). For examples of policies, see Amazon SQS Policy Examples (p. 148).

Understanding Resource-Level Permissions

A permission is the type of access you give to a *principal* (the user receiving the permission). You give each permission a label that identifies that permission. If you want to delete that permission in the future, you use that label to identify the permission. If you want to see what permissions are on a queue, use the `GetQueueAttributes` operation. Amazon SQS returns the entire policy (containing all the permissions).

Amazon SQS supports the permission types shown in the following table.

Permission	Description
*	This permission type grants the following actions to a principal on a shared queue: change a message's visibility, delete messages, get a queue's attributes, get a queue's URL, receive messages, and send messages.

Permission	Description
`ChangeMessageVisibility`	This grants permission to extend or terminate the read lock timeout of a specified message. `ChangeMessageVisibilityBatch` inherits permissions associated with `ChangeMessageVisibility`. For more information about visibility timeout, see Visibility Timeout (p. 13). For more information, see the `ChangeMessageVisibility` operation.
`DeleteMessage`	This grants permission to delete messages from the queue. `DeleteMessageBatch` inherits permissions associated with `DeleteMessage`. For more information, see the `DeleteMessage` operation.
`GetQueueAttributes`	This grants permission to get all of the queue attributes except the policy, which can only be accessed by the queue's owner. For more information, see the `GetQueueAttributes` operation.
`GetQueueUrl`	This grants permission to get a queue's URL. For more information, see the `GetQueueUrl` operation.
`ReceiveMessage`	This grants permission to receive messages in the queue. For more information, see the `ReceiveMessage` operation.
`SendMessage`	This grants permission to send messages to the queue. `SendMessageBatch` inherits permissions associated with `SendMessage`. For more information, see the `SendMessage` operation.

Note
Setting permissions for `SendMessage`, `DeleteMessage`, or `ChangeMessageVisibility` also sets permissions for the corresponding batch versions of those actions: `SendMessageBatch`, `DeleteMessageBatch`, and `ChangeMessageVisibilityBatch`. Setting permissions explicitly on `SendMessageBatch`, `DeleteMessageBatch`, and `ChangeMessageVisibilityBatch` isn't allowed.

Permissions for each of the different permission types are considered separate permissions by Amazon SQS, even though `*` includes the access provided by the other permission types. For example, it's possible to grant both `*` and `SendMessage` permissions to a user, even though a `*` includes the access provided by `SendMessage`.

This concept applies when you remove a permission. If a principal has only a `*` permission, requesting to remove a `SendMessage` permission does not leave the principal with an "everything but" permission. Instead, the request does nothing, because the principal did not previously possess an explicit `SendMessage` permission.

If you want to remove `*` and leave the principal with just the `ReceiveMessage` permission, first add the `ReceiveMessage` permission, then remove the `*` permission.

Tip
You give each permission a label that identifies that permission. If you want to delete that permission in the future, you use that label to identify the permission.

Note
If you want to see what permissions are on a queue, use the `GetQueueAttributes` operation. The entire policy (containing all the permissions) is returned.

Granting Anonymous Access to a Queue

You can allow shared queue access to anonymous users. Such access requires no signature or Access Key ID.

To allow anonymous access you must write your own policy, setting the `Principal` to `*`. For information about writing your own policies, see Creating Custom Policies Using the Access Policy Language (p. 135).

Caution
Keep in mind that the queue owner is responsible for all costs related to the queue. Therefore you probably want to limit anonymous access in some other way (by time or IP address, for example).

Programming Languages

AWS provides libraries, sample code, tutorials, and other resources for software developers who prefer to build applications using language-specific APIs instead of Amazon SQS's Query API. These libraries provide basic functions (not included in Amazon SQS's Query API), such as request authentication, request retries, and error handling so you can get started more easily. Libraries and resources are available for the following languages:

- Go
- Java
- JavaScript
- PHP
- Python
- Ruby
- Windows and .NET
- C++

For mobile application development, see:

- AWS Mobile SDK for Android
- AWS Mobile SDK for iOS
- AWS SDK for Unity

Note
There are also command-line tools available for interacting with Amazon SQS:

- The AWS Command Line Interface (AWS CLI). For more information, see Getting Set Up with the AWS Command Line Interface and the Amazon SQS section of the AWS CLI Reference.
- The AWS Tools for Windows PowerShell. For more information, see Setting up the AWS Tools for Windows PowerShell and the Amazon Simple Queue Service section of the AWS Tools for Windows PowerShell Cmdlet Reference.

Amazon SQS Batch API Actions

Topics

In the 2009-02-01 API version of Amazon SQS, only the `ReceiveMessage` action supports batch processing (processing more than one message with a single call).

From the 2011-10-01 API version of Amazon SQS, you can use batch functionality to send and delete messages and to change the message visibility timeout:

- To send up to ten messages at once, use the `SendMessageBatch` action.
- To delete up to ten messages with one API call, use the `DeleteMessageBatch` action.
- To change the visibility timeout value for up to ten messages, use the `ChangeMessageVisibilityBatch` action.

To reduce costs, take advantage of batch functionality by using the Query API or a Software Development Kit (SDK) that supports the new Amazon SQS batch actions.

Note
The Amazon SQS console does not support batch API actions.

For details and examples of the following three batch API actions, see the *Amazon Simple Queue Service API Reference*:

- ChangeMessageVisibilityBatch
- DeleteMessageBatch
- SendMessageBatch

Maximum Message Size for SendMessageBatch

You can send a message as large as 262,144 bytes (256 KB) with `SendMessageBatch`. However, the total size of all the messages that you send in a single call to `SendMessageBatch` cannot exceed 262,144 bytes (256 KB).

Client-Side Buffering and Request Batching

The AWS SDK for Java (http://aws.amazon.com/sdkforjava/) includes a buffered asynchronous client, AmazonSQSBufferedAsyncClient, for accessing Amazon SQS. This new 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.

Client-side buffering allows up to 10 requests to be buffered and sent as a batch request instead of sending each request separately. As a result, your cost of using Amazon SQS decreases as you reduce the number of requests sent to the service. AmazonSQSBufferedAsyncClient buffers both synchronous and asynchronous calls. Batched requests and support for long polling can also help increase throughput (the number of messages transmitted per second). For more information, see Amazon SQS Long Polling (p. 29) and Increasing Throughput with Horizontal Scaling and Batching (p. 119).

Migrating from the asynchronous client, AmazonSQSAsyncClient, to the buffered asynchronous client, AmazonSQSBufferedAsyncClient, should require only minimal changes to your existing code. This is because AmazonSQSBufferedAsyncClient implements the same interface as AmazonSQSAsyncClient.

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

Getting Started with AmazonSQSBufferedAsyncClient

Before you begin using the example code in this section, you must first install the AWS SDK for Java and set up your AWS credentials. For instructions, see Getting Started in the *AWS SDK for Java Developer Guide*.

The following code sample shows how to create a new AmazonSQSBufferedAsyncClient based on the AmazonSQSAsyncClient.

```
// Create the basic Amazon SQS async client
AmazonSQSAsync sqsAsync = new AmazonSQSAsyncClient();

// Create the buffered client
AmazonSQSAsync bufferedSqs = new AmazonSQSBufferedAsyncClient(sqsAsync);
```

After you have created the new AmazonSQSBufferedAsyncClient, you can make calls to it as you do with the AmazonSQSAsyncClient, as the following code sample demonstrates.

```
CreateQueueRequest createRequest = new
 CreateQueueRequest().withQueueName("MyTestQueue");

CreateQueueResult res = bufferedSqs.createQueue(createRequest);

SendMessageRequest request = new SendMessageRequest();
String body = "test message_" + System.currentTimeMillis();
request.setMessageBody( body );
request.setQueueUrl(res.getQueueUrl());

SendMessageResult sendResult = bufferedSqs.sendMessage(request);

ReceiveMessageRequest receiveRq = new ReceiveMessageRequest()
    .withMaxNumberOfMessages(1)
    .withQueueUrl(queueUrl);
ReceiveMessageResult rx = bufferedSqs.receiveMessage(receiveRq);
```

Advanced Configuration

AmazonSQSBufferedAsyncClient is pre-configured with settings that will work for most use cases. If you'd like to configure it yourself, you can use the `QueueBufferConfig` class to do so. Just create an instance of `QueueBufferConfig` with the settings you want and supply it to the AmazonSQSBufferedAsyncClient constructor, as the following sample code shows.

```
// Create the basic Amazon SQS async client
AmazonSQSAsync sqsAsync = new AmazonSQSAsyncClient();

QueueBufferConfig config = new QueueBufferConfig()
    .withMaxInflightReceiveBatches(5)
    .withMaxDoneReceiveBatches(15);

// Create the buffered client
AmazonSQSAsync bufferedSqs = new AmazonSQSBufferedAsyncClient(sqsAsync,
 config);
```

The parameters you can use for configuring `QueueBufferConfig` are as follows:

- `longPoll`—if this parameter is set to `true`, AmazonBufferedAsyncClient attempts to use long-polling when retrieving messages. The default value is `true`.

- `longPollWaitTimeoutSeconds`—the maximum amount of time, in seconds, that a receive message call blocks on the server waiting for messages to appear in the queue before returning with an empty receive result. This setting has no impact if long polling is disabled. The default value of this setting is 20 seconds.

- `maxBatchOpenMs`—the maximum amount of time, in milliseconds, that an outgoing call waits for other calls of the same type to batch with. The higher the setting, the fewer batches are required to perform the same amount of work. Of course, the higher the setting, the more the first call in a batch has to spend waiting. If this parameter is set to zero, submitted requests do not wait for other requests, effectively disabling batching. The default value of this setting is 200 milliseconds.

- `maxBatchSize`—the maximum number of messages that will be batched together in a single batch request. The higher the setting, the fewer batches will be required to carry out the same number of requests. The default value of this setting is 10 requests per batch, which is also the maximum batch size currently allowed by Amazon SQS.

- `maxBatchSizeBytes`—the maximum size of a message batch, in bytes, that the client attempts to send to Amazon SQS. The default value is 256 KB, which is also the maximum message and batch size currently allowed by Amazon SQS.

- `maxDoneReceiveBatches`—the maximum number of receive batches AmazonBufferedAsyncClient prefetches and stores on the client side. The higher the setting, the more receive requests can be satisfied without having to make a call to Amazon SQS server. However, the more messages are pre-fetched, the longer they'll sit in the buffer, which means that their visibility timeout will be expiring. If this parameter is set to zero, all pre-fetching of messages is disabled and messages are retrieved only on demand. The default value is 10 batches.

- `maxInflightOutboundBatches`—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 other limits, such as CPU or bandwidth). The higher the setting, the more threads are consumed by the AmazonSQSBufferedAsyncClient. The default value is 5 batches.

- `maxInflightReceiveBatches`—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 other limits, such as CPU or bandwidth, are hit). Although, the higher the setting, the more threads will be consumed by the AmazonSQSBufferedAsyncClient. If this parameter is set to 0, all pre-fetching of messages is disabled and messages are only retrieved on demand. The default value is 10 batches.

- `visibilityTimeoutSeconds`—if this parameter is set to a positive nonzero value, this visibility timeout overrides the visibility timeout set on the queue from which messages are retrieved. A visibility timeout of zero seconds isn't supported. The default value is -1, which means the default queue setting is used.

Increasing Throughput with Horizontal Scaling and Batching

Amazon SQS queues can deliver very high throughput (many thousands of messages per second). The key to achieving this throughput is to horizontally scale message producers and consumers. In addition, you can use the batching actions in the Amazon SQS API to send, receive, or delete up to 10 messages at a time. In conjunction with horizontal scaling, batching achieves a given throughput with fewer threads, connections, and requests than would be required by individual message requests. Because Amazon SQS charges by the request instead of by the message, batching can also substantially reduce costs.

This appendix discusses horizontal scaling and batching in more detail. It then walks through a simple example that you can try out yourself. It also briefly discusses Amazon SQS throughput metrics that you can monitor by using CloudWatch.

Horizontal Scaling

Because you access Amazon SQS through an HTTP request-response protocol, the request latency (the time interval between initiating a request and receiving a response) limits the throughput that you can achieve from a single thread over a single connection. For example, if the latency from an Amazon Elastic Compute Cloud (Amazon EC2) based client to Amazon SQS in the same region averages around 20 ms, the maximum throughput from a single thread over a single connection will average 50 operations per second.

Horizontal scaling means increasing the number of your message producers (making SendMessage requests) and consumers (making ReceiveMessage and DeleteMessage requests) in order to increase your overall queue throughput. You can scale horizontally by increasing the number of threads on a client, adding clients, or both. You should achieve essentially linear gains in queue throughput as you add more clients. For example, if you double the number of clients, you'll get twice the throughput.

Important
As you scale horizontally, you need to 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 will be sending requests and receiving 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'll need to adjust that limit. For example, in the AWS SDK for Java, you can adjust the maximum number of allowable producer and consumer threads on an `AmazonSQSClient` object with this line of code:

```
AmazonSQS sqsClient = new AmazonSQSClient(credentials,
                            new
 ClientConfiguration().withMaxConnections(producerCount +
 consumerCount));
```

For the SDK for Java asynchronous client AmazonSQSAsyncClient, you'll also need to make sure there are enough threads available. For more information, consult the documentation for the SDK library that you're using.

Batching

The batching actions in the Amazon SQS API (SendMessageBatch and DeleteMessageBatch) can further optimize throughput by processing up to ten messages at a time. ReceiveMessage can process ten messages at a time, so there is no `ReceiveMessageBatch` action.

The basic idea of batching is to perform more work in each round trip to the service (e.g., sending multiple messages with a single `SendMessageBatch` request), and to distribute the latency of the batch operation over the multiple messages in the batch request, as opposed to accepting 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 and so improve throughput. Amazon SQS charges by the request, so the cost can be greatly reduced when fewer requests are processing the same number of messages. Moreover, fewer threads and connections reduce client-side resource utilization and can reduce client-side cost by doing the same work with smaller or fewer hosts.

Batching does introduce a bit of complication for the application. For example, the application has to accumulate the messages before sending them and it will sometimes have to wait longer for a response, but batching can be effective in the following circumstances:

- Your application is generating a lot of messages in a short time, so the delay is never very long.
- A message consumer fetches messages from a queue at its discretion, as opposed to typical message producers that need to send messages in response to events they do not control.

Important
A batch request (`SendMessageBatch` or `DeleteMessageBatch`) may succeed even though individual messages in the batch have failed. After a batch request, you should always check for individual message failures and retry them if necessary.

Example

The example presented in this section implements a simple producer-consumer pattern. The complete example is available as a free download at https://s3.amazonaws.com/cloudformation-examples/sqs-producer-consumer-sample.tar. The resources that are deployed by each template are described later in this section.

The code for the samples is available on the provisioned instances in /tmp/sqs-producer-consumer-sample/src. The command line for the configured run is in /tmp/sqs-producer-consumer-sample/command.log.

The main thread spawns a number of producer and consumer threads that process 1 KB messages for a specified time. The example includes producers and consumers that make single-operation requests and others that make batch requests.

In the program, each producer thread sends messages until the main thread stops the producer thread. The `producedCount` object tracks the number of messages produced by all producer threads. Error handling is simple: if there is an error, the program exits the `run()` method. Requests that fail on transient errors are, by default, retried three times by the AmazonSQSClient, so very few such errors are surfaced. The retry count can be configured as necessary to reduce the number of exceptions that are thrown. The `run()` method on the message producer is implemented as follows:

```
try {
  while (!stop.get()) {
    sqsClient.sendMessage(new SendMessageRequest(queueUrl, theMessage));
    producedCount.incrementAndGet();
  }
} catch (AmazonClientException e) {
  // By default AmazonSQSClient retries calls 3 times before failing,
  // so when this rare condition occurs, simply stop.
  log.error("Producer: " + e.getMessage());
  System.exit(1);
}
```

The batch producer is much the same. One noteworthy difference is the need to retry failed individual batch entries:

```
SendMessageBatchResult batchResult =
 sqsClient.sendMessageBatch(batchRequest);

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));
}
```

The consumer run() method is as follows:

```
while (!stop.get()) {
     result = sqsClient.receiveMessage(new ReceiveMessageRequest(queueUrl));

     if (!result.getMessages().isEmpty()) {
       m = result.getMessages().get(0);
       sqsClient.deleteMessage(new DeleteMessageRequest(queueUrl,

 m.getReceiptHandle()));
       consumedCount.incrementAndGet();
     }
}
```

Each consumer thread receives and deletes messages until it's stopped by the main thread. The `consumedCount` object tracks the number of messages that are consumed by all consumer threads, and the count is periodically logged. The batch consumer is similar, except that up to ten messages are received at a time, and it uses DeleteMessageBatch instead of DeleteMessage.

Running the Example

You can use the AWS CloudFormation templates provided to run the example code in three different configurations: single host with the single operation requests, two hosts with the single operation requests, one host with the batch requests.

Important
The complete sample is available in a single .tar file. The resources that are deployed by each template are described later in this section.
The code for the samples is available on the provisioned instance(s) in /tmp/sqs-producer-consumer-sample/src. The command line for the configured run is in /tmp/sqs-producer-consumer-sample/command.log.
The default duration (20 minutes) is set to provide three or four 5-minute CloudWatch data points of volume metrics. The Amazon EC2 cost for each run will be the m1.large instance cost. The Amazon SQS cost varies based on the API call rate for each sample, and that should range between approximately 38,000 API calls / min for the batching sample and 380,000 API calls / min for the two host single API sample. For example, a run of the single API sample on a single host should cost approximately 1 instance hour of an m1.large (large standard on demand instance, $0.32 as of July 2012) and 20 min x 190,000 API calls / min x $1 / 1,000,000 API calls = $3.80 for Amazon SQS operations with the default 20 min duration (as of July 2012, check current pricing).

If you want to deploy the AWS CloudFormation stack in a region other than the US East (N. Virginia) region, in the Region box of the AWS CloudFormation console, click the region that you want.

To run the example

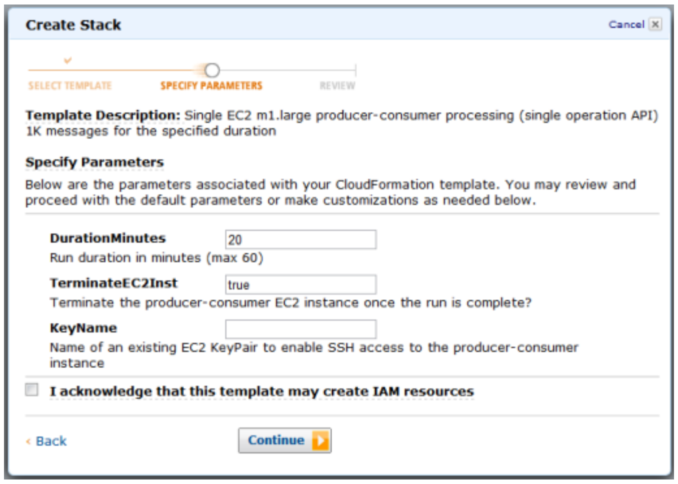
1. Click the link below that corresponds to the stack that you want to launch:

   - Single Operation API, One Host: The SQS_Sample_Base_Producer_Consumer.template sample template uses the single operation form of Amazon SQS API requests: `SendMessage`, `ReceiveMessage`, and `DeleteMessage`. A single m1.large Amazon EC2 instance animates 16 producer threads and 32 consumer threads.

     To view the template, see https://s3.amazonaws.com/cloudformation-templates-us-east-1/SQS_Sample_Base_Producer_Consumer.template
   - Single Operation API, Two Hosts: SQS_Sample_Base_Producer_Consumer_x2.template sample template uses the single operation form of Amazon SQS API requests, but instead of a single m1.large Amazon EC2 instance, it uses two, each with 16 producer threads and 32 consumer threads for a total of 32 producers and 64 consumers. It illustrates Amazon SQS' elasticity with throughput increasing proportionally to the greater number of producers and consumers.

     To view the template, see https://s3.amazonaws.com/cloudformation-templates-us-east-1/SQS_Sample_Base_Producer_Consumer_x2.template
   - Batch API, One Host: The SQS_Sample_Batch_Producer_Consumer.template sample template uses the batch form of Amazon SQS API requests on a single m1.large Amazon EC2 instance with 12 producer threads and 20 consumer threads.

     To view the template, see https://s3.amazonaws.com/cloudformation-templates-us-east-1/SQS_Sample_Batch_Producer_Consumer.template
2. If you're prompted, sign in to the AWS Management Console.
3. In the **Create Stack** wizard, on the **Select Template** page, click **Continue**.
4. On the **Specify Parameters** page, specify how long the program should run, whether or not you want to automatically terminate the Amazon EC2 instances when the run is complete, and provide an Amazon EC2 key pair so that you can access the instances that are running the sample. Here is an example:



Template Description: Single EC2 m1.large producer-consumer processing (single operation API) 1K messages for the specified duration

Specify Parameters

Below are the parameters associated with your CloudFormation template. You may review and proceed with the default parameters or make customizations as needed below.

DurationMinutes 20
Run duration in minutes (max 60)

TerminateEC2Inst true
Terminate the producer-consumer EC2 instance once the run is complete?

KeyName
Name of an existing EC2 KeyPair to enable SSH access to the producer-consumer instance

☐ **I acknowledge that this template may create IAM resources**

5. Select the **I acknowledge that this template may create IAM resources** check box. All templates create an AWS Identity and Access Management (IAM) user so that the producer-consumer program can access the queue.
6. When all the settings are as you want them, click **Continue**.
7. On the **Review** page, review the settings. If they're as you want them, click **Continue**. If not, click **Back** and make the necessary changes.
8. On the final page of the wizard, click **Close**. Stack deployment may take several minutes.

To follow the progress of stack deployment, in the AWS CloudFormation console, click the sample stack. In the lower pane, click the **Events** tab. After the stack is created, it should take less than 5 minutes for the sample to start running. When it does, you can see the queue in the Amazon SQS console.

To monitor queue activity, you can do the following:

- Access the client instance, and open its output log file (/tmp/sqs-producer-consumer-sample/output.log) for a tally of messages produced and consumed so far. This tally is updated once per second.
- In the Amazon SQS console, observe changes in the **Message Available** and **Messages in Flight** numbers.

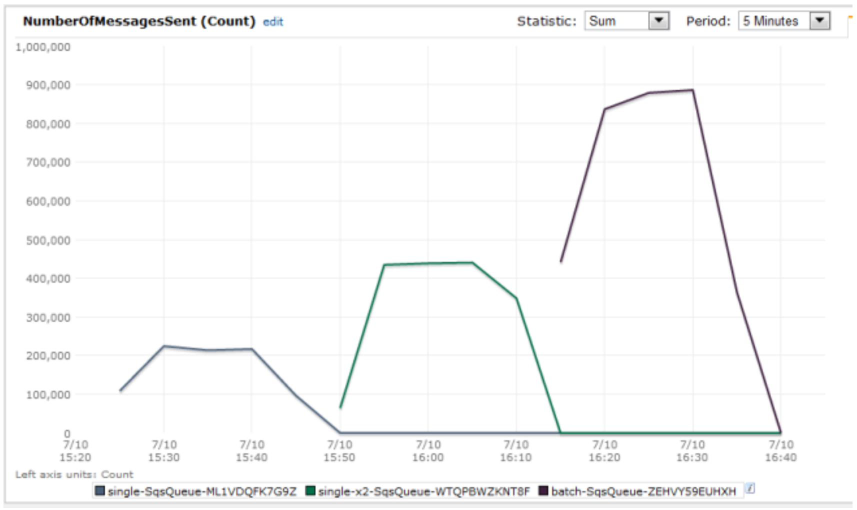
In addition, after a delay of up to 15 minutes after the queue is started, you can monitor the queue in CloudWatch as described later in this topic.

Although the templates and samples have safeguards to prevent excessive use of resources, it's best to delete your AWS CloudFormation stacks when you're done running the samples. To do so, in the Amazon SQS console, click the stack that you want to delete, and then click **Delete Stack**. When the resources are all deleted, CloudWatch metrics will all drop to zero.

Monitoring Volume Metrics from Example Run

Amazon SQS automatically generates volume metrics for messages sent, received, and deleted. You can access those metrics and others through the CloudWatch console. The metrics can take up to 15 minutes after the queue starts to become available. To manage the search result set, click **Search**, and then select the check boxes that correspond to the queues and metrics that you want to monitor.

Here is the NumberOfMessageSent metric for consecutive runs of the three samples. Your results may vary somewhat, but the results should be qualitatively similar:



- The `NumberOfMessagesReceived` and `NumberOfMessagesDeleted` metrics show the same pattern, but we have omitted them from this graph to reduce clutter.
- The first sample (single operation API on a single m1.large) delivers approximately 210,000 messages over 5 minutes, or about 700 messages per second, with the same throughput for receive and delete operations.
- The second sample (single operation API on two m1.large instances) delivers roughly double that throughput: approximately 440,000 messages in 5 minutes, or about 1,450 messages per second, with the same throughput for receive and delete operations.

- The last sample (batch API on a single m1.large) delivers over 800,000 messages in 5 minutes, or about 2,500 messages per second, with the same throughput for received and deleted messages. With a batch size of 10, these messages are processed with far fewer requests and therefore at lower cost.

Security

This section provides information on 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.

- Authentication (p. 125)
- Access Control (p. 127)

Authentication

You can access AWS as any of the following types of identities:

- **AWS account root user** – When you sign up for AWS, you provide an email address and password that is associated with your AWS account. These are your *root credentials* and they provide complete access to all of your AWS resources.

Important
For security reasons, we recommend that you use the root credentials only to create an *administrator user*, which is an *IAM user* with full permissions to your AWS account. Then, you can use this administrator user to create other IAM users and roles with limited permissions. For more information, see IAM Best Practices and Creating an Admin User and Group in the *IAM User Guide*.

- **IAM user** – An IAM user is simply 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 the 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 another IAM identity 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 preexisting 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*.

  - **Cross-account access** – You can use an IAM role in your account to grant another AWS account permissions to access your account's resources. For an example, see Tutorial: Delegate Access Across AWS Accounts Using IAM 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 stored in the 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** – Instead of storing access keys within the EC2 instance for use by applications running on the instance and making AWS API requests, you can use an IAM role to manage temporary credentials for these applications. To assign an AWS role to an EC2 instance and make it available to all of its applications, you can create an instance profile that is attached to the instance. An instance profile contains the role and enables programs running on the EC2 instance to get temporary credentials. For more information, see Using Roles for Applications on Amazon EC2 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 the same things with Amazon SQS policies that you can with IAM policies, such as using variables in IAM policies. For more information, see IAM Policy Variables Overview in the *IAM User Guide*.

The main difference between using Amazon SQS policies versus IAM policies is that you can grant another AWS Account permission to your queues with an Amazon SQS policy, and you can't do that with an IAM policy.

> **Note**
> When you grant other AWS accounts access to your AWS resources, be aware that all AWS accounts can delegate their permissions to users under their accounts. This is known as cross-account access. 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 How IAM Roles Differ from Resource-Based Policies in *IAM User Guide*.

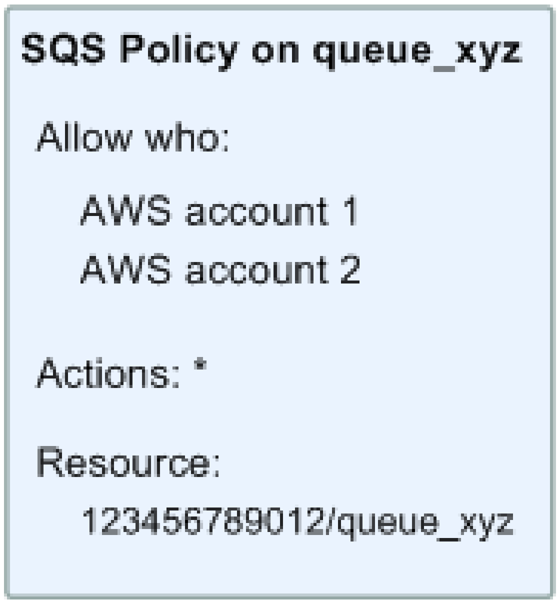
Working with Amazon SQS Policies

Topics

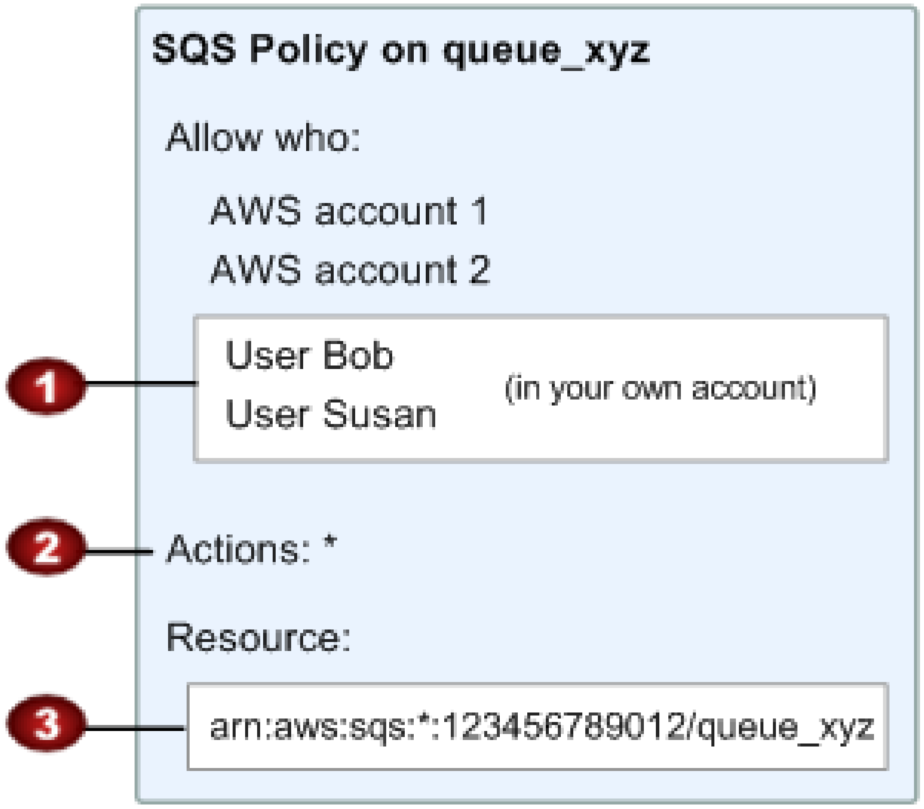
IAM-Related Features of Amazon SQS Policies

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, permission to use `SendMessage`, `ReceiveMessage`, if the request is before December 31, 2010). The specific actions you can grant permission for are a subset of the overall list of Amazon SQS actions. When you write an Amazon SQS policy and specify `*` to mean "all the Amazon SQS actions", that means all actions in that 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 permission to use any of the allowed actions with the queue. Notice that 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.



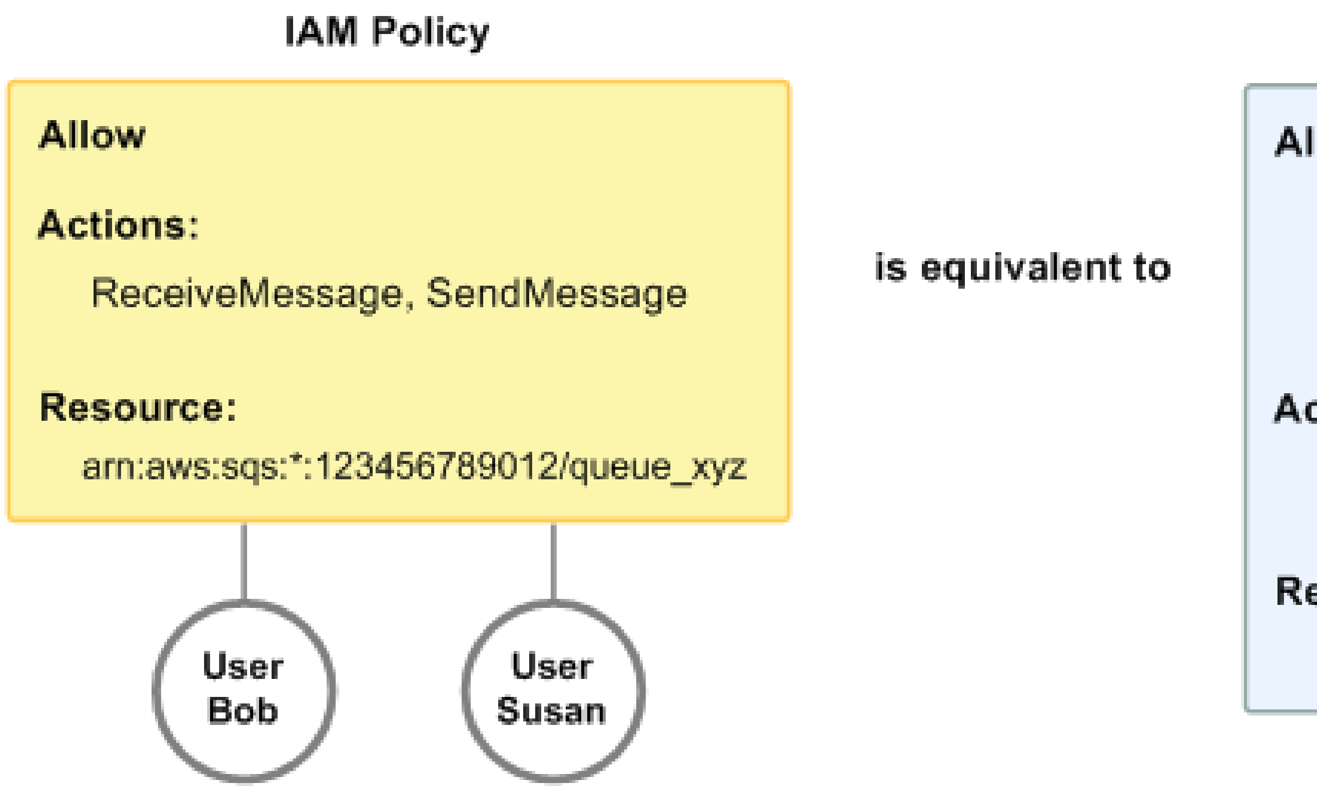
1	In addition to specifying which AWS Accounts have access to the queue, you can specify which Users *in your own AWS Account* have access to the queue. The Users can't be in another AWS Account.
2	The subset of actions included in "*" has expanded (for a list of allowed actions, see Amazon SQS Actions (p. 133)).
3	You can specify the resource using the *Amazon Resource Name (ARN)*, which is how you must specify resources in IAM policies. For information about the ARN format for Amazon SQS queues, see Amazon SQS ARNs (p. 132). You can still use the original format instead (<account_ID>/<queue_name>).

So for example, according to the Amazon SQS policy shown in the preceding figure, anyone possessing the security credentials for AWS Account 1 or AWS Account 2 could access queue_xyz. Also, 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 (e.g., access to all possible Amazon SQS actions with that queue). This is no longer true, unless the creator is using the AWS security credentials. Any User who has permission to create a queue must also have permission to use other Amazon SQS actions in order to do anything with the queues they create.

IAM and Amazon SQS Policies Together

There are two ways you can give your Users permissions for your Amazon SQS resources: through the Amazon SQS policy system or the IAM policy system. You can use one or the other, or both. For the most part, you can achieve the same results with either. For example, the following diagram shows an IAM policy and an Amazon SQS policy that are equivalent. The IAM policy allows the Amazon SQS `ReceiveMessage` and `SendMessage` actions for the queue called queue_xyz in your AWS Account, and it's attached to the Users Bob and Susan (which means Bob and Susan have the permissions stated in the policy). The Amazon SQS policy also gives Bob and Susan permission to access `ReceiveMessage` and `SendMessage` for the same queue.



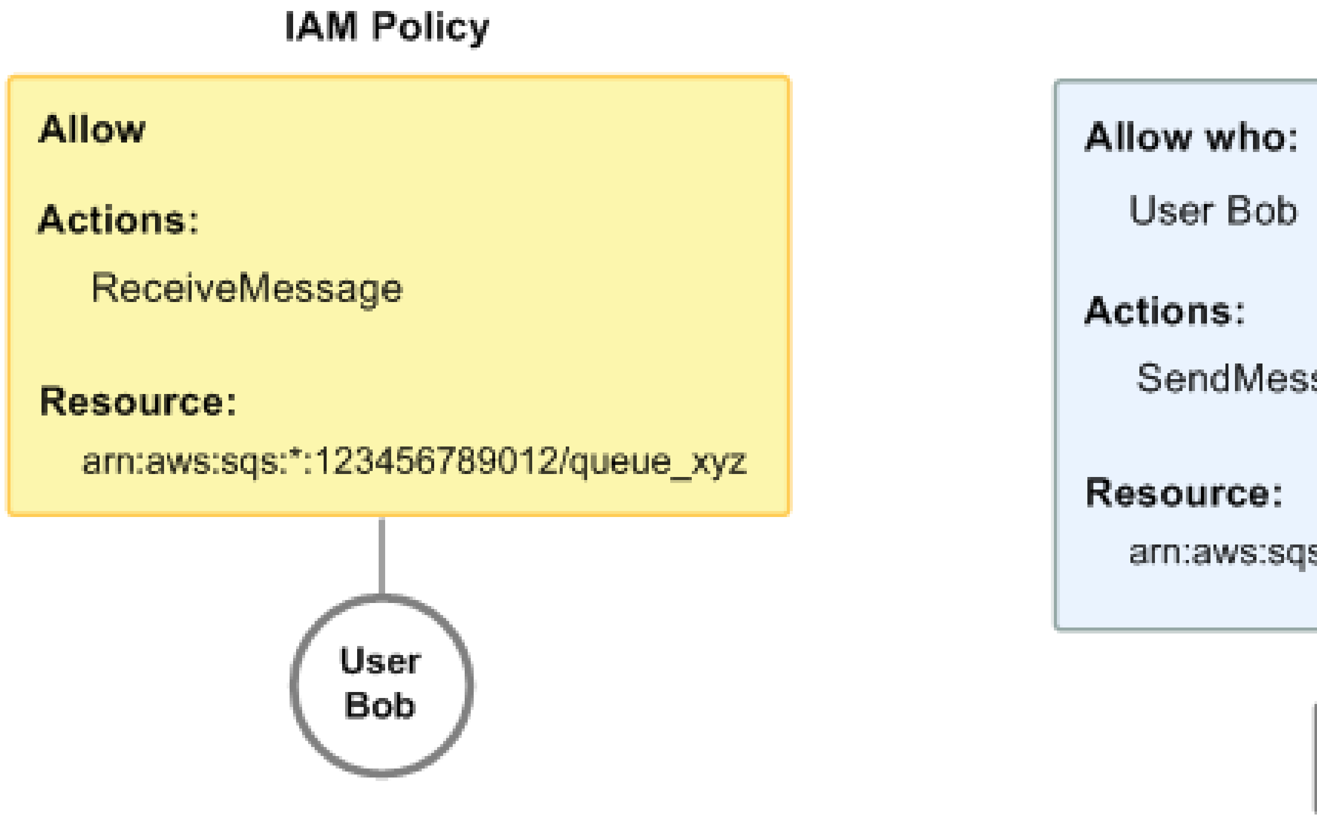
Note
The preceding example shows simple policies with no conditions. You could specify a particular condition in either policy and get the same result.

There is one 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's up to you how you use both of the systems together to manage your permissions, based on your needs. The following examples show how the two policy systems work together.

1

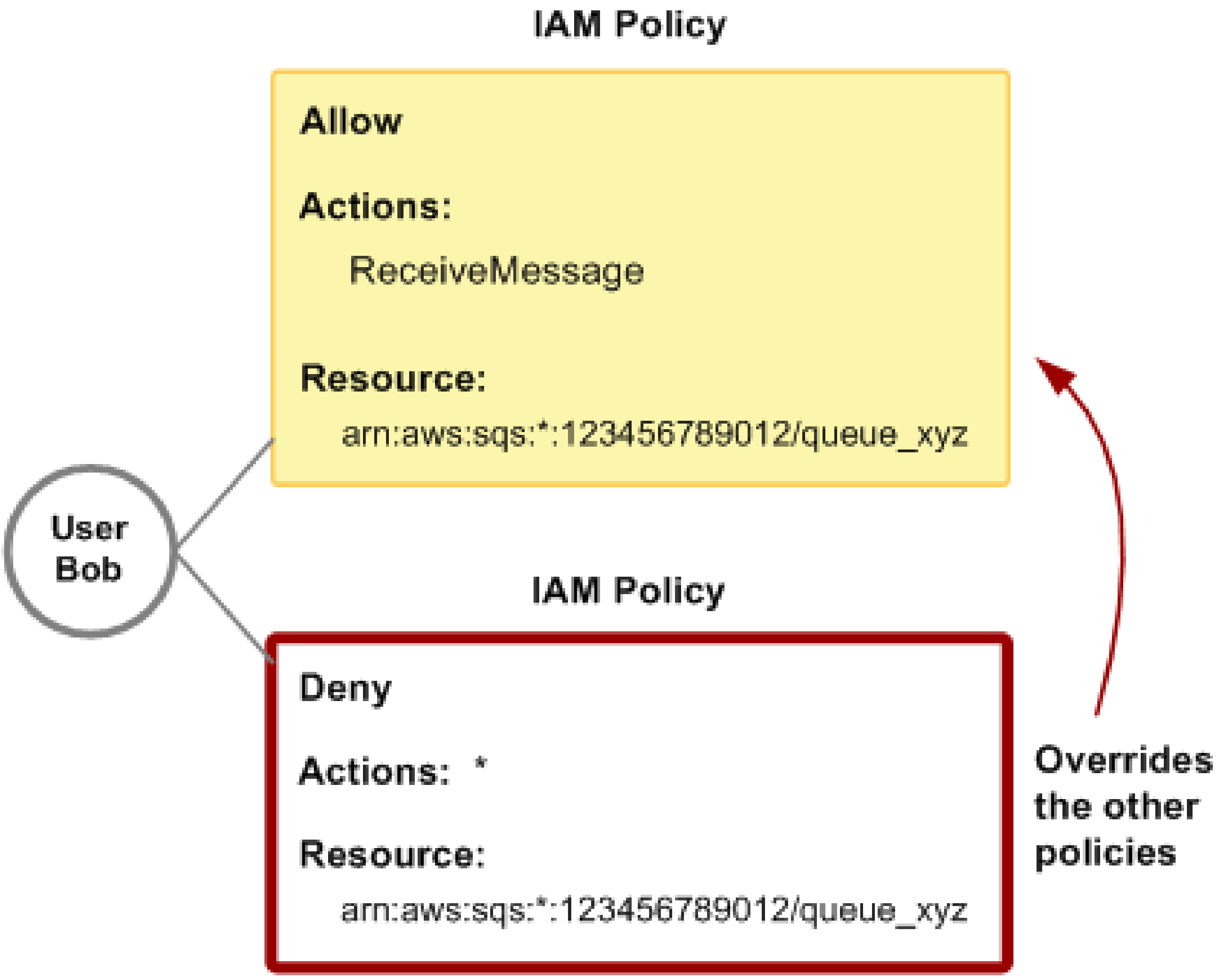
In this example, Bob has both an IAM policy and an Amazon SQS policy that apply to him. The IAM policy gives him permission to use `ReceiveMessage` on queue_xyz, whereas the Amazon SQS policy gives him permission to use `SendMessage` on the same queue. The following diagram illustrates the concept.



If Bob were to send a request to receive a message from queue_xyz, the IAM policy would allow the action. If Bob were to send a request to send a message to queue_xyz, the Amazon SQS policy would allow the action.

2

In this example, we build on example 1 (where Bob has two policies that apply to him). Let's say that Bob abuses his access to queue_xyz, so you want to remove his entire access to that queue. The easiest thing to do is add a policy that denies him access to all actions on the queue. This third policy overrides the other two, because an explicit deny always overrides an allow (for more information about policy evaluation logic, see Evaluation Logic (p. 141)). The following diagram illustrates the concept.


IAM Policy
Allow
Actions:
ReceiveMessage
Resource:
arn:aws:sqs:*:123456789012/queue_xyz
User Bob
IAM Policy
Deny
Actions: *
Resource:
arn:aws:sqs:*:123456789012/queue_xyz
Overrides the other policies

Alternatively, you could add an additional statement to the Amazon SQS policy that denies Bob any type of access to the queue. It would have the same effect as adding a IAM policy that denies him access to the queue.

For examples of policies that cover Amazon SQS actions and resources, see Example IAM Policies for Amazon SQS (p. 134). For more information about writing Amazon SQS policies, see the Amazon Simple Queue Service Developer Guide.

Amazon SQS ARNs

For Amazon SQS, queues are the only resource type you can specify in a policy. The following is the Amazon Resource Name (ARN) format for queues:

```
arn:aws:sqs:region:account_ID:queue_name
```

Note
The name of a FIFO queue must end with the `.fifo` suffix. The suffix counts towards the 80-character queue name limit.

For more information about ARNs, see IAM Identifiers in the *IAM User Guide*.

The following is 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
```

The following is an ARN for a queue named `my_queue` in each of the different regions that Amazon SQS supports.

```
arn:aws:sqs:*:123456789012:my_queue
```

You can use `*` and ? wildcards in the queue name. For example, the following can refer to all queues that Bob has created, which he has prefixed with `bob_`.

```
arn:aws:sqs:*:123456789012:bob_*
```

For your convenience, Amazon SQS has a queue attribute called `Arn` whose value is the queue's ARN. You can get the value by using the Amazon SQS `GetQueueAttributes` action.

Amazon SQS Actions

All Amazon SQS actions that you specify in a policy must be prefixed with the lowercase string `sqs:`. For example, `sqs:CreateQueue`.

Before the introduction of IAM, you could use an Amazon SQS policy with a queue to specify which AWS Accounts have access to the queue. You could also specify the type of access (e.g., `sqs:SendMessage`, `sqs:ReceiveMessage`, etc.). The specific actions you could grant permission for were a subset of the overall set of Amazon SQS actions. When you wrote an Amazon SQS policy and specified * to mean "all the Amazon SQS actions", that meant all actions in that subset. That subset originally included:

- `sqs:ChangeMessageVisibility`
- `sqs:DeleteMessage`
- `sqs:GetQueueAttributes` (for all attributes except `Policy`)
- `sqs:GetQueueUrl`
- `sqs:ReceiveMessage`
- `sqs:SendMessage`

With the introduction of IAM, that list of actions expanded to include the following actions:

- `sqs:CreateQueue`
- `sqs:DeleteQueue`
- `sqs:ListQueues`
- `sqs:PurgeQueue`

The actions related to granting and removing permissions from a queue (`sqs:AddPermission` and `sqs:RemovePermission`) are reserved and so don't appear in the preceding two lists. This means that *Users* in the AWS Account can't use those actions. However, the *AWS Account* can use those actions.

Amazon SQS Keys

Amazon SQS implements the following policy keys, but no others.

For a list of context keys supported by each AWS service and a list of AWS-wide policy keys, see AWS Service Actions and Condition Context Keys and Available Keys for Conditions in the *IAM User Guide*.

Example IAM Policies for Amazon SQS

This section shows several simple IAM policies for controlling User access to Amazon SQS.

Note
In the future, Amazon SQS might add new actions that should logically be included in one of the following policies, based on the policy's stated goals.

1: Allow a User to create and use his or her own queues

In this example, we create a policy for Bob that lets him access all Amazon SQS actions, but only with queues whose names begin with the literal string `bob_queue`.

Note
Amazon SQS doesn't automatically grant the creator of a queue permission to subsequently use the queue. Therefore, in our IAM policy, we must explicitly grant Bob permission to use all the Amazon SQS actions in addition to `CreateQueue`.

```
{
   "Version": "2012-10-17",
   "Statement":[{
      "Effect":"Allow",
      "Action":"sqs:*",
      "Resource":"arn:aws:sqs:*:123456789012:bob_queue*"
      }
   ]
}
```

2: Allow developers to write messages to a shared test queue

In this 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 AWS Account's queue named *CompanyTestQueue*.

```
{
   "Version": "2012-10-17",
   "Statement":[{
      "Effect":"Allow",
      "Action":"sqs:SendMessage",
      "Resource":"arn:aws:sqs:*:123456789012:CompanyTestQueue"
      }
   ]
}
```

3: Allow managers to get the general size of queues

In this 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 AWS Account's queues.

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

4: Allow a partner to send messages to a particular queue

You could do this with an Amazon SQS policy or an IAM policy. Using an Amazon SQS policy might be easier if the partner has an AWS Account. However, anyone in the partner's company who possesses the AWS security credentials could send messages to the queue (and not just a particular User). We will assume you want to limit access to a particular user (or application), so you need to treat the partner like a User within your own company, and use a IAM policy instead of an Amazon SQS policy.

In this example, we create a group called WidgetCo that represents the partner company, then create a User for the specific user (or application) at the partner company who needs access, and then put the User in the group.

We then attach a policy that gives the group `SendMessage` access on the specific queue named *WidgetPartnerQueue*.

We also want to prevent the WidgetCo group from doing anything else with queues, so we add a statement that denies permission to any Amazon SQS actions besides `SendMessage` on any queue besides WidgetPartnerQueue. This is only necessary if there's a broad policy elsewhere in the system that gives Users wide access to Amazon SQS.

```
{
   "Version": "2012-10-17",
   "Statement":[{
         "Effect":"Allow",
         "Action":"sqs:SendMessage",
         "Resource":"arn:aws:sqs:*:123456789012:WidgetPartnerQueue"
      },
      {
         "Effect":"Deny",
         "NotAction":"sqs:SendMessage",
         "NotResource":"arn:aws:sqs:*:123456789012:WidgetPartnerQueue"
      }
   ]
}
```

Creating Custom Policies Using the Access Policy Language

Topics

This section is for Amazon SQS users who want to write their own access control policies. You don't need to write your own policies if you want to allow access based only on AWS account ID and basic permissions (e.g., SendMessage, ReceiveMessage). In that case, you can just use the Amazon SQS `AddPermission` action. If you want to explicitly deny access or allow it based on finer conditions (such as the time the request comes in or the IP address of the requester), you need to write your own policies and upload them to the AWS system using the Amazon SQS `SetQueueAttributes` action.

> **Note**
> To write your own policies, you must be familiar with JSON. For more information, see http://json.org.

The main portion of this section includes basic concepts you need to understand, how to write a policy, and the logic AWS uses to evaluate policies and decide whether to give the requester access to the resource. Although most of the information in this section is service-agnostic, there are some SQS-specific details you need to know. For more information, see Special Information for Amazon SQS Policies (p. 153).

When to Use Access Control

You have a great deal of flexibility in how you grant or deny access to a resource. However, the typical use cases are fairly simple:

- You want to grant another AWS account a particular type of access to your queue (e.g., SendMessage). For more information, see Use Case 1 (p. 145).
- You want to grant another AWS account access to your queue for a specific period of time. For more information, see Use Case 2 (p. 145).
- You want to grant another AWS account access to your queue only if the requests come from your Amazon EC2 instances. For more information, see Use Case 3 (p. 146).
- You want to *deny* another AWS account access to your queue. For more information, see Use Case 4 (p. 147).

Key Concepts

The following sections describe the concepts you need to understand to use the access policy language. They're presented in a logical order, with the first terms you need to know at the top of the list.

Permission

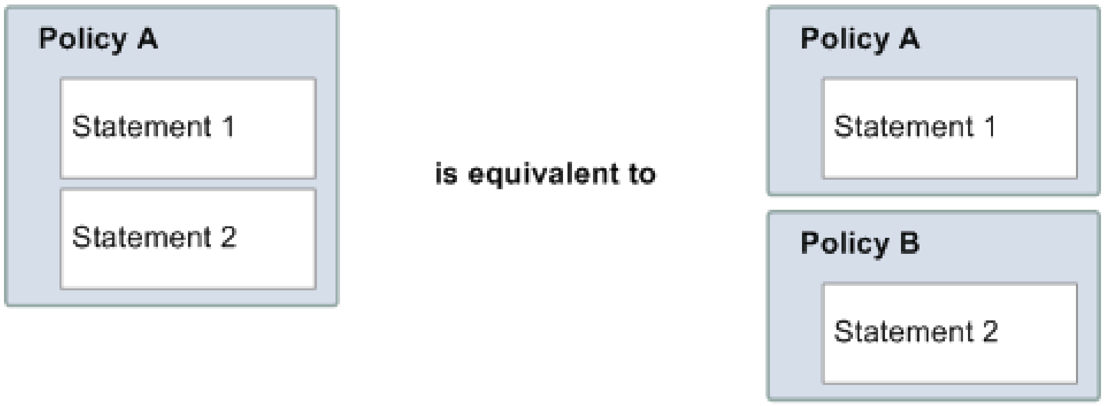
A *permission* is the concept of allowing or disallowing some kind of access to a particular resource. Permissions essentially follow this form: "A is/isn't allowed to do B to C where D applies." For example, *Jane* (A) has permission to *receive messages* (B) from *John's Amazon SQS queue* (C), as long as *she asks to receive them before midnight on May 30, 2009* (D). Whenever Jane sends a request to Amazon SQS to use John's queue, the service checks to see if she has permission and if the request satisfies the conditions John set forth in the permission.

Statement

A *statement* is the formal description of a single permission, written in the access policy language. You always write a statement as part of a broader container document known as a *policy* (see the next concept).

Policy

A *policy* is a document (written in the access policy language) that acts as a container for one or more statements. For example, a policy could have two statements in it: one that states that Jane can use John's queue, and another that states that Bob cannot use John's queue. As shown in the following figure, an equivalent scenario would be to have two policies, one containing the statement that Jane can use John's queue, and another containing the statement that Bob cannot use John's queue.



The AWS service implementing access control (e.g., Amazon SQS) uses the information in the statements (whether they're contained in a single policy or multiple) to determine if someone requesting access to a resource should be granted that access. We often use the term *policy* interchangeably with *statement*, as they generally represent the same concept (an entity that represents a permission).

Issuer

The *issuer* is the user who writes a policy to grant permissions for a resource. The issuer (by definition) is always the resource owner. AWS does not permit AWS service users to create policies for resources they don't own. If John is the resource owner, AWS authenticates John's identity when he submits the policy he's written to grant permissions for that resource.

Principal

The *principal* is the user who receives the permission in the policy. The principal is A in the statement "A has permission to do B to C where D applies." In a policy, you can set the principal to "anyone" (i.e., you can specify a wildcard to represent all people). You might do this, for example, if you don't want to restrict access based on the actual identity of the requester, but instead on some other identifying characteristic such as the requester's IP address.

Action

The *action* is the activity the principal has permission to perform. The action is B in the statement "A has permission to do B to C where D applies." Typically, the action is just the operation in the request to AWS. For example, Jane sends a request to Amazon SQS with `Action=ReceiveMessage`. You can specify one or multiple actions in a policy.

Resource

The *resource* is the object the principal is requesting access to. The resource is C in the statement "A has permission to do B to C where D applies."

Conditions and Keys

The *conditions* are any restrictions or details about the permission. The condition is D in the statement "A has permission to do B to C where D applies." The part of the policy that specifies the conditions can be the most detailed and complex of all the parts. Typical conditions are related to:

- Date and time (e.g., the request must arrive before a specific day)
- IP address (e.g., the requester's IP address must be part of a particular CIDR range)

A *key* is the specific characteristic that is the basis for access restriction. For example, the date and time of request.

You use both *conditions* and *keys* together to express the restriction. The easiest way to understand how you actually implement a restriction is with an example: If you want to restrict access to before May 30, 2010, you use the condition called `DateLessThan`. You use the key called `AWS:CurrentTime` and set it to the value `2010-05-30T00:00:00Z`. AWS defines the conditions and keys you can use. The AWS service itself (e.g., Amazon SQS) might also define service-specific keys. For more information about the available keys, see Amazon SQS Keys (p. 133).

Requester

The *requester* is the user who sends a request to an AWS service and asks for access to a particular resource. The requester sends a request to AWS that essentially says: "Will you allow me to do B to C where D applies?"

Evaluation

Evaluation is the process the AWS service uses to determine if an incoming request should be denied or allowed based on the applicable policies. For information about the evaluation logic, see Evaluation Logic (p. 141).

Effect

The *effect* is the result that you want a policy statement to return at evaluation time. You specify this value when you write the statements in a policy, and the possible values are *deny* and *allow*.

For example, you could write a policy that has a statement that *denies* all requests that come from Antarctica (effect=deny given that the request uses an IP address allocated to Antarctica). Alternately, you could write a policy that has a statement that *allows* all requests that *don't* come from Antarctica (effect=allow, given that the request doesn't come from Antarctica). Although the two statements sound like they do the same thing, in the access policy language logic, they're different. For more information, see Evaluation Logic (p. 141).

Although there are only two possible values you can specify for the effect (allow or deny), there can be three different results at policy evaluation time: *default deny*, *allow*, or *explicit deny*. For more information, see the following concepts and Evaluation Logic (p. 141).

Default Deny

A *default deny* is the default result from a policy in the absence of an allow or explicit deny.

Allow

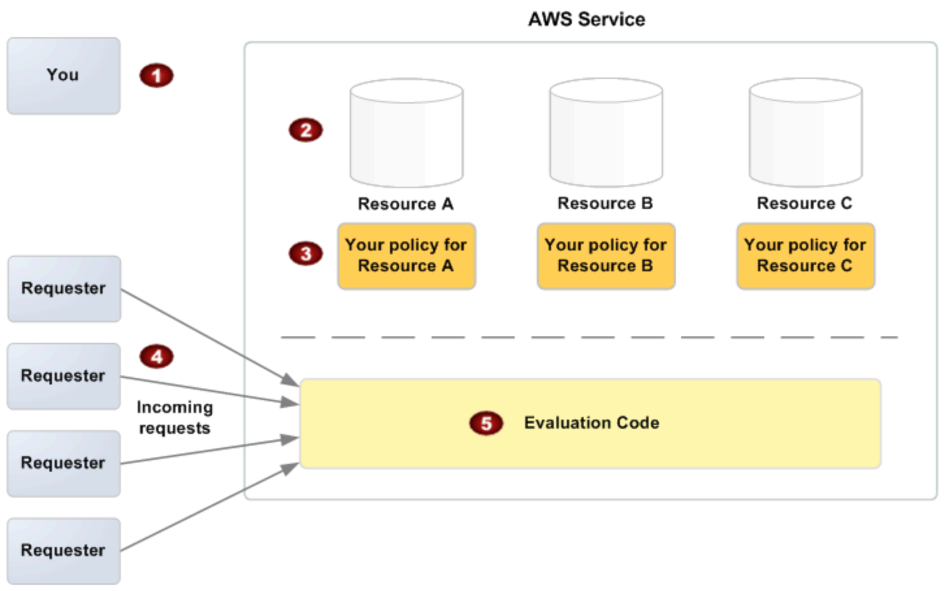
An *allow* results from a statement that has effect=allow, assuming any stated conditions are met. Example: Allow requests if they're received before 1:00 p.m. on April 30, 2010. An allow overrides all default denies, but never an explicit deny.

Explicit Deny

An *explicit deny* results from a statement that has effect=deny, assuming any stated conditions are met. Example: Deny all requests if they're from Antarctica. Any request that comes from Antarctica will always be denied no matter what any other policies might allow.

Architectural Overview

The following figure and table describe the main components that interact to provide access control for your resources.

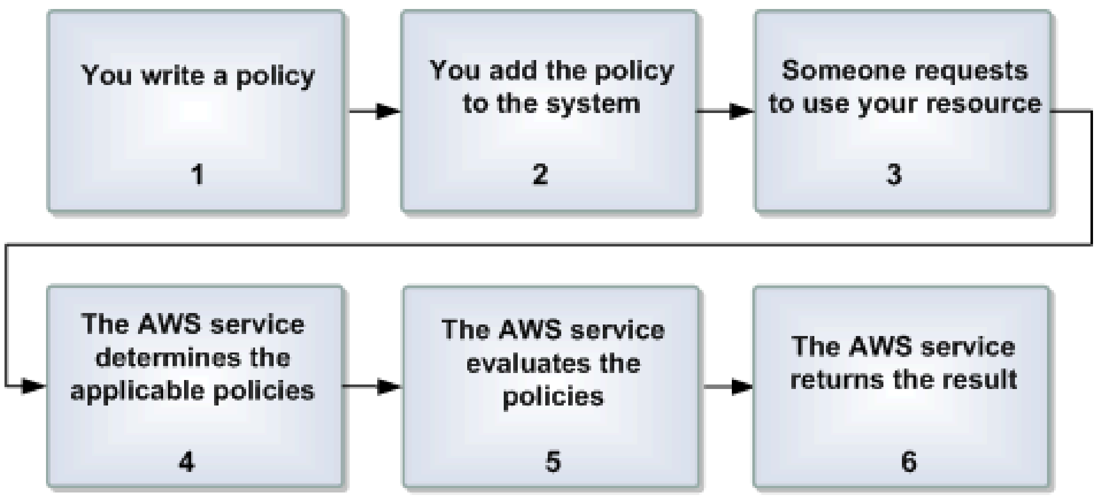


1	You, the resource owner.
2	Your resources (contained within the AWS service; e.g., Amazon SQS queues).
3	Your policies. Typically you have one policy per resource, although you could have multiple. The AWS service itself provides an API you use to upload and manage your policies.
4	Requesters and their 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. For information about how the service makes the decision, see Evaluation Logic (p. 141).

For the typical process of how the components work together, see Using the Access Policy Language (p. 140).

Using the Access Policy Language

The following figure and table describe the general process of how access control works with the access policy language.


You write a policy
1
You add the policy to the system
2
Someone requests to use your resource
3
The AWS service determines the applicable policies
4
The AWS service evaluates the policies
5
The AWS service returns the result
6

Process for Using Access Control with the Access Policy Language

1	You write a policy for your resource. For example, you write a policy to specify permissions for your Amazon SQS queues.
2	You upload your policy to AWS. The AWS service itself provides an API 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 resource. For example, a user sends a request to Amazon SQS to use one of your queues.
4	The AWS service determines which policies are applicable to the request. For example, Amazon SQS looks at all the available Amazon SQS policies and determines which ones are applicable (based on what the resource is, who the requester is, etc.).
5	The AWS service evaluates the policies. For example, Amazon SQS evaluates the policies and determines if the requester is allowed to use your queue or not. For information about the decision logic, see Evaluation Logic (p. 141).
6	The AWS service either denies the request or continues to process it. For example, based on the policy evaluation result, the service either returns an "Access denied" error to the requester or continues to process the request.

Related Topics

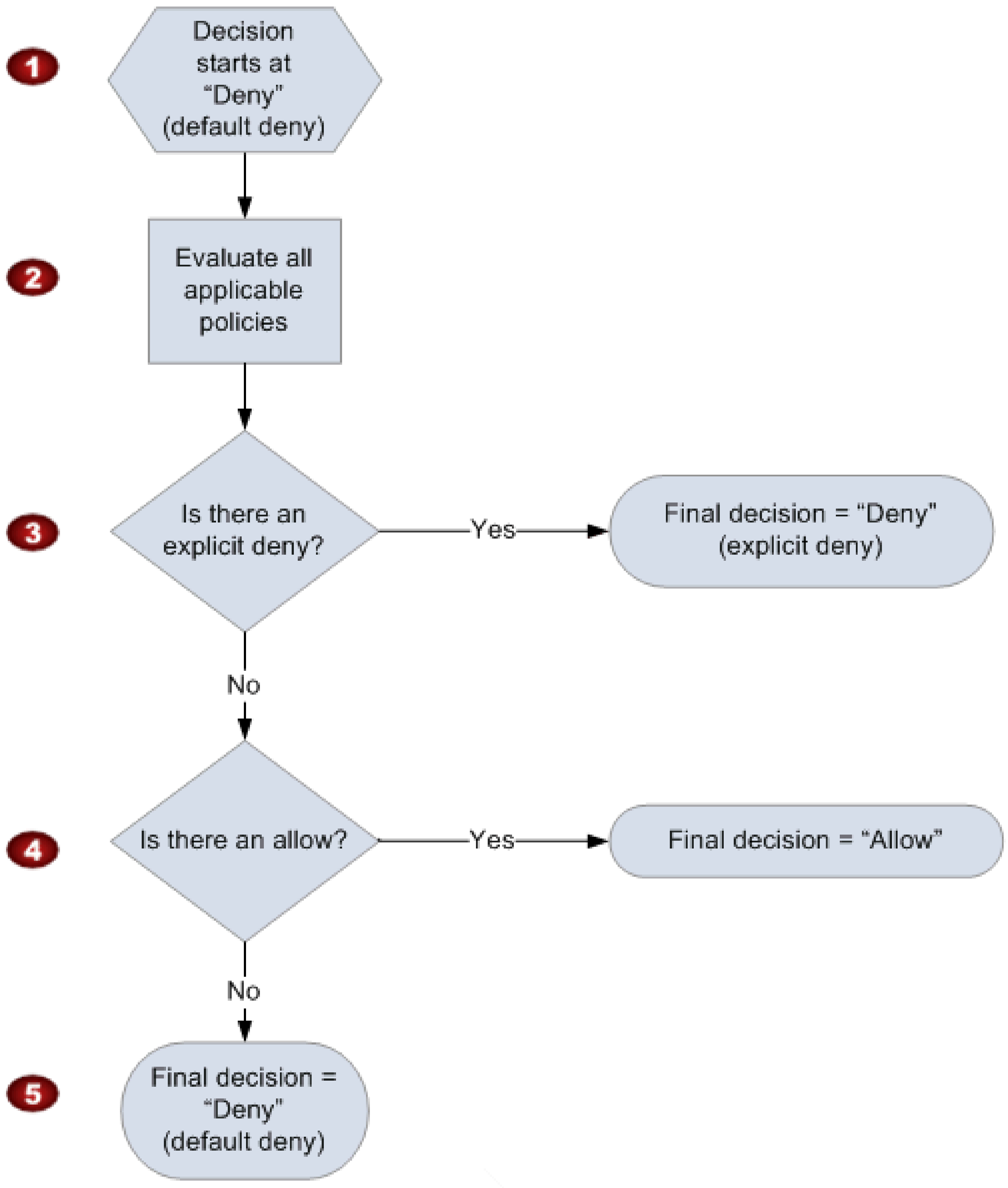
- Architectural Overview (p. 139)

Evaluation Logic

The goal at evaluation time is to decide whether a given request from someone other than you (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're denied
- An allow overrides any default denies
- An explicit deny overrides any allows
- The order in which the policies are evaluated isn't important

The following flow chart and discussion describe in more detail how the decision is made.


1
Decision starts at "Deny" (default deny)
2
Evaluate all applicable policies
3
Is there an explicit deny?
Yes
Final decision = "Deny" (explicit deny)
No
4
Is there an allow?
Yes
Final decision = "Allow"
No
5
Final decision = "Deny" (default deny)

1	The decision starts with a default deny.
2	The enforcement code then 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.

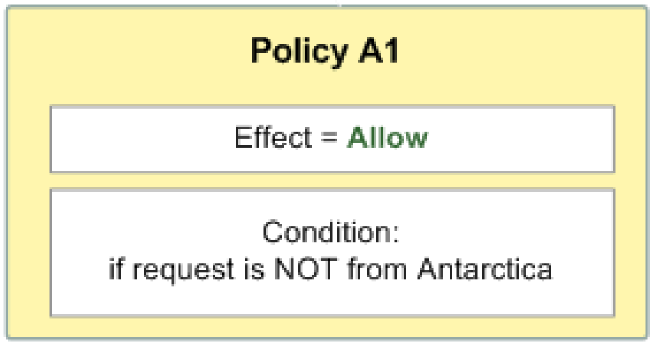
3	In all those policies, the enforcement code looks for an explicit deny instruction that would apply to the request. If it finds even one, the enforcement code returns a decision of "deny" and the process is finished (this is an explicit deny; for more information, see Explicit Deny (p. 139)).
4	If no explicit deny is found, the enforcement code looks for any "allow" instructions that would apply to the request. If it finds even one, the enforcement code returns a decision of "allow" and the process is done (the service continues to process the request).
5	If no allow is found, then the final decision is "deny" (because there was no explicit deny or allow, this is considered a *default deny* (for more information, see Default Deny (p. 138)).

The Interplay of Explicit and Default Denials

A policy results in a default deny if it doesn't directly apply to the request. For example, if a user requests to use Amazon SQS, but the only policy that applies to the user states that the user can use Amazon DynamoDB, then that policy results in a default deny.

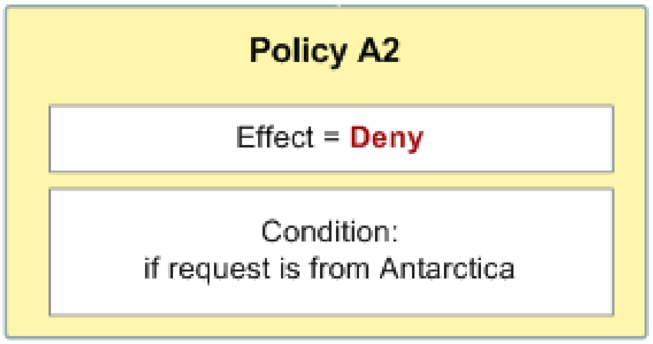
A policy also results in a default deny if a condition in a statement isn't met. If all conditions in the statement are met, then the policy results in either an allow or an explicit deny, based on the value of the Effect element in the policy. Policies don't specify what to do if a condition isn't met, and so the default result in that case is a default deny.

For example, let's say you want to prevent requests coming in from Antarctica. You write a policy (called Policy A1) that allows a request only if it doesn't come from Antarctica. The following diagram illustrates the policy.



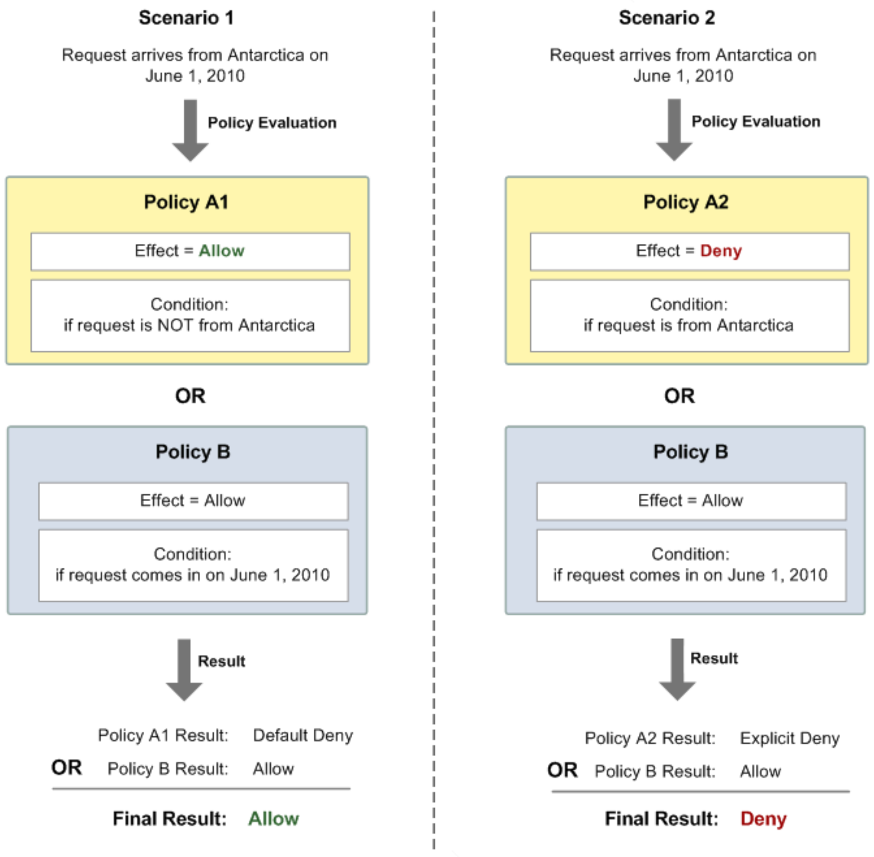
If someone sends a request from the U.S., the condition is met (the request isn't from Antarctica). Therefore, the request is allowed. But, if someone sends a request from Antarctica, the condition isn't met, and the policy's result is therefore a default deny.

You could turn the result into an explicit deny by rewriting the policy (named Policy A2) as in the following diagram. Here, the policy explicitly denies a request if it comes from Antarctica.



If someone sends a request from Antarctica, the condition is met, and the policy's result is therefore an explicit deny.

The distinction between a default deny and an explicit deny is important because a default deny can be overridden by an allow, but an explicit deny can't. For example, let's say there's another policy that allows requests if they arrive on June 1, 2010. How does this policy affect the overall outcome when coupled with the policy restricting access from Antarctica? We will compare the overall outcome when coupling the date-based policy (we will call Policy B) with the preceding policies A1 and A2. Scenario 1 couples Policy A1 with Policy B, and Scenario 2 couples Policy A2 with Policy B. The following figure and discussion show the results when a request comes in from Antarctica on June 1, 2010.


Scenario 1
Request arrives from Antarctica on June 1, 2010
Policy Evaluation
Policy A1
Effect = Allow
Condition:
if request is NOT from Antarctica
OR
Policy B
Effect = Allow
Condition:
if request comes in on June 1, 2010
Result
Policy A1 Result: Default Deny
OR Policy B Result: Allow
Final Result: Allow
Scenario 2
Request arrives from Antarctica on June 1, 2010
Policy Evaluation
Policy A2
Effect = Deny
Condition:
if request is from Antarctica
OR
Policy B
Effect = Allow
Condition:
if request comes in on June 1, 2010
Result
Policy A2 Result: Explicit Deny
OR Policy B Result: Allow
Final Result: Deny

In Scenario 1, Policy A1 returns a default deny, as described earlier in this section. Policy B returns an allow because the policy (by definition) allows requests that come in on June 1, 2010. The allow from Policy B overrides the default deny from Policy A1, and the request is therefore allowed.

In Scenario 2, Policy B2 returns an explicit deny, as described earlier in this section. Again, Policy B returns an allow. The explicit deny from Policy A2 overrides the allow from Policy B, and the request is therefore denied.

Basic Use Cases for Access Control

This section gives a few examples of typical use cases for access control.

Use Case 1

Let's say you have a set of queues in the Amazon SQS system. In the simplest case, you want to allow one or more AWS accounts a particular type of access to a queue (e.g., SendMessage, ReceiveMessage).

You can do this by simply using the Amazon SQS API action `AddPermission`. It takes a few input parameters and automatically creates a policy in the Amazon SQS system for that queue. For this use case, you don't need to read this appendix or learn how to write a policy yourself, because Amazon SQS can automatically create the policy for you.

The following example shows a policy that gives AWS account ID 1111-2222-3333 permission to send and receive from a queue you own named queue2. In this example, your AWS account ID is 4444-5555-6666.

```
{
   "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",
      }
   ]
}
```

Use Case 2

In this use case, you want to allow one or more AWS accounts access to your queues *only for a specific time period*.

You need to know how to write your own policy for the queue because the Amazon SQS `AddPermission` action doesn't let you specify a time restriction when granting someone access to your queue. In this case, you'd write your own policy and then upload it to the AWS system with the `SetQueueAttributes` action. Effectively the action sets your policy as an attribute of the queue.

The following example is the same as in use case 1, except it also includes a condition that restricts access to before June 30, 2009, at noon (UTC).

```
{
   "Version":"2012-10-17",
   "Id":"UseCase2",
   "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"
            }
         }
      }
   ]
}
```

Use Case 3

In this use case, you want to allow access to your queues *only if the requests come from your Amazon EC2 instances*.

Again, you need to know how to write your own policy because the Amazon SQS `AddPermission` action doesn't let you specify an IP address restriction when granting access to your queue.

The following example builds on the example in use case 2, and also includes a condition that restricts access to the IP address range 10.52.176.0/24. So in this example, a request from AWS account 1111-2222-3333 to send or receive messages from queue2 would be allowed only if it came in before noon on June 30, 2009, *and* it came from the 10.52.176.0/24 address range.

```
{
   "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"
            }
         }
      }
   ]
}
```

Use Case 4

In this use case, you want to specifically *deny* a certain AWS account access to your queues.

Again, you need to know how to write your own policy because the Amazon SQS `AddPermission` action doesn't let you *deny* access to a queue; it only lets you *grant* access.

The following example is the same as in the original use case (#1), except it *denies* access to the specified AWS account.

```
{
   "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",
      }
   ]
}
```

From these use cases, you can see that if you want to restrict access based on special conditions or deny someone access entirely, you need to read this appendix and learn how to write your own policies. You can also see that the policies themselves are not that complex and the access policy language is straightforward.

Amazon SQS Policy Examples

This section shows example policies for common Amazon SQS use cases.

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"
    }
  ]
}
```

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"
    }
  ]
}
```

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"
    }
  ]
}
```

Grant a Role and a User Name Cross-Account Permission

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"
    }
  ]
}
```

Grant a Permission to All Users

The following example policy grants all 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"
    }
  ]
}
```

Grant a Time-Limited Permission to All Users

The following example policy grants all 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"
        }
      }
    }
  ]
}
```

Grant All Permissions to All Users in a CIDR Range

The following example policy grants all 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"
        }
      }
    }
  ]
}
```

Whitelist and Blacklist Permissions for Users in Different CIDR Ranges

The following example policy has two statements:

- The first statement grants all 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 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"
        }
      }
    }
  ]
}
```

Enable a Connection Between an Amazon SNS Topic and an Amazon SQS Queue

The following example policy enables a connection between the Amazon Simple Notification Service topic specified by the Amazon Resource Name (ARN) `arn:aws:sns:us-east-2:111122223333:test-topic` and the queue named `arn:aws:sqs:us-east-2:111122223333:test-topic-queue`.

Note
Amazon SNS isn't currently compatible with FIFO queues.

```
{
  "Version": "2012-10-17",
  "Id": "SNStoSQS",
  "Statement": [
    {
      "Sid":"rule1",
      "Effect": "Allow",
      "Principal": "*",
      "Action": "sqs:*",
      "Resource": "arn:aws:sqs:us-east-2:111122223333:test-topic-queue",
      "Condition" : {
        "ArnEquals" : {
          "aws:SourceArn":"arn:aws:sns:us-east-2:111122223333:test-topic"
        }
      }
    }
  ]
}
```

Special Information for Amazon SQS Policies

The following list gives information specific to the Amazon SQS implementation of access control.

- Amazon SQS allows you to share only certain types of permissions (for more information, see Understanding Resource-Level Permissions (p. 111))
- Each policy must cover only a single queue (when writing a policy, don't include statements that cover different queues)
- Each policy must have a unique policy ID (`Id`)
- Each statement in a policy must have a unique statement ID (`sid`)
- Amazon SQS does not implement any special keys to use when you write conditions; the only keys available are the general AWS-wide keys.

The following table lists the maximum limits for policy information.

Name	Maximum Limit
Bytes	8192
Statements	20
Principals	50
Conditions	10

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 this user to access your AWS services and resources. You can manage users who have AWS accounts; these users are IAM users. You can also manage users for your system who do not have AWS accounts; these users are called federated users. Additionally, "users" can also be applications that you create to access your AWS resources.

You can use these temporary security credentials in making 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.

First, use IAM to create temporary security credentials, which include a security token, an Access Key ID, and a Secret Access Key. Second, prepare your string to sign with the temporary Access Key ID and the security token. Third, use the temporary Secret Access Key instead of your own Secret Access Key to sign your Query API request. Finally, when you submit the signed Query API request, don't forget to use the temporary Access Key ID instead of your own Access Key ID and include the security token. For more information about IAM support for temporary security credentials, see Temporary Security Credentials in the *IAM User Guide*.

To call an Amazon SQS Query API action using Temporary Security Credentials

1. Request a temporary security token with AWS Identity and Access Management. For more information, see Requesting Temporary Security Credentials in IAM User Guide.
   IAM returns a security token, an Access Key ID, and a Secret Access Key.
2. Prepare your Query as you normally would, but use the temporary Access Key ID in place 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.

How you structure the AUTHPARAMS depends on how you're signing your API request. For information on AUTHPARAMS in Signature Version 4, see Examples of Signed Signature Version 4 Requests.

```
http://sqs.us-east-2.amazonaws.com/
?Action=CreateQueue
&DefaultVisibilityTimeout=40
&QueueName=testQueue
&Attribute.1.Name=VisibilityTimeout
&Attribute.1.Value=40
&Version=2012-11-05
&Expires=2015-12-18T22%3A52%3A43PST
&SecurityToken=SecurityTokenValue
&AWSAccessKeyId= Access Key ID provided by AWS Security Token Service
&AUTHPARAMS
```

The following example uses Temporary Security Credentials to send two messages with `SendMessageBatch`.

```
http://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
&Version=2012-11-05
&Expires=2015-12-18T22%3A52%3A43PST
&SecurityToken=SecurityTokenValue
&AWSAccessKeyId=Access Key ID provided by AWS Security Token Service
&AUTHPARAMS
```

Limits in Amazon SQS

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
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.
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.

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 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 will be 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 size	The minimum message size is 1,024 bytes (1 KB). 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. **Note** The Amazon SQS Extended Client Library for Java doesn't currently support FIFO queues.
Message visibility timeout	The maximum visibility timeout for a message 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. 156).

Limits Related to Policies

The following table lists limits related to policies.

Name	Maximum Size
Bytes	8192
Statements	20
Principals	50
Conditions	10

Related Amazon SQS Resources

The following table lists related resources that you'll find useful as you work with this service.

Resource	Description
Amazon Simple Queue Service Getting Started Guide	The *Developer Guide* provides a detailed discussion of the service. It includes an architectural overview, programming reference, and API reference.
Amazon Simple Queue Service API Reference	The *API Reference* gives the complete descriptions of the API actions, parameters, and data types as well as a list of errors that the service returns.
Amazon SQS Release Notes	The release notes give a high-level overview of the current release. They specifically note any new features, corrections, and known issues.
Product information for Amazon SQS	The primary web page for information about Amazon SQS.
Discussion Forums	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.

Document History

The following table describes the important changes to the documentation since the last release of the *Amazon Simple Queue Service Developer Guide*.

- **API version:** 2012-11-05
- **Latest documentation update:** November 17, 2016

Change	Description	Date Changed
New feature	You can use Amazon SQS to create *FIFO (First-In-First-Out) queues* or *standard queues* (the new name for existing queues). For more information on how FIFO queues work and how to get started using them, see the following: • FIFO (First-In-First-Out) Queues (p. 6) • Moving From a Standard Queue to a FIFO Queue (p. 11) • Recommendations for FIFO (First-In-First-Out) Queues (p. 68) For revised Amazon SQS tutorials, see the following: • Creating an Amazon SQS Queue (p. 71) • Sending a Message to an Amazon SQS Queue (p. 74) • Receiving and Deleting a Message from an Amazon SQS Queue (p. 77) 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.	November 17, 2016

Change	Description	Date Changed
	• 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 following clients don't currently support FIFO queues: • Amazon SQS Buffered Asynchronous Client • Amazon SQS Extended Client Library for Java • Amazon SQS Java Message Service (JMS) Client FIFO queues don't support timers on individual messages. Amazon SNS isn't currently compatible with FIFO queues.	
Update	The Walkthroughs section has been renamed to Tutorials (p. 71).	November 2, 2016
New feature	You can use the `ApproximateAgeOfOldestMessage` CloudWatch metric to find the approximate age of the oldest non-deleted message in the queue. For more information, see Available CloudWatch Metrics for Amazon SQS (p. 90).	August 31, 2016
Update	Added the Best Practices for Amazon SQS (p. 67) section.	May 27, 2016
Update	Added the Limits in Amazon SQS (p. 155) section.	May 12, 2016
New feature	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. 83).	February 12, 2016
Update	Updated Amazon SQS console screenshots.	December 7, 2015
New feature	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. 42) in the *Amazon Simple Queue Service Developer Guide*.	October 27, 2015
New feature	Amazon SQS lets you use JMS (Java Message Service) with Amazon SQS queues. For more information, see Using JMS with Amazon SQS (p. 46) in the *Amazon Simple Queue Service Developer Guide*.	December 29, 2014
New feature	Amazon SQS lets you delete the messages in a queue by using the `PurgeQueue` API. For more information, see PurgeQueue in the *Amazon SQS API Reference*.	December 8, 2014
Update	Updated information about access keys. For more information, see Your Access Keys (p. 104).	August 4, 2014

Change	Description	Date Changed
New feature	Amazon SQS lets you log API calls by using AWS CloudTrail. For more information, see Logging Amazon SQS API Actions Using AWS CloudTrail (p. 92).	July 16, 2014
New feature	Amazon SQS provides support for message attributes. For more information, see Using Amazon SQS Message Attributes (p. 20).	May 6, 2014
New feature	Amazon SQS provides support for dead letter queues. For more information, see Using Amazon SQS Dead Letter Queues (p. 16).	January 29, 2014
New console feature	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 Tutorial: Subscribing one or more Amazon SQS Queues to an Amazon SNS Topic (p. 80).	November 21, 2012
New feature	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 Query Request Authentication (p. 108).	November 5, 2012
New feature	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 Client-Side Buffering and Request Batching (p. 116).	November 5, 2012
New feature	The 2012-11-05 API version of Amazon SQS adds long polling support. Long polling allows for 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. 29).	November 5, 2012