AWS Certified Developer Associate
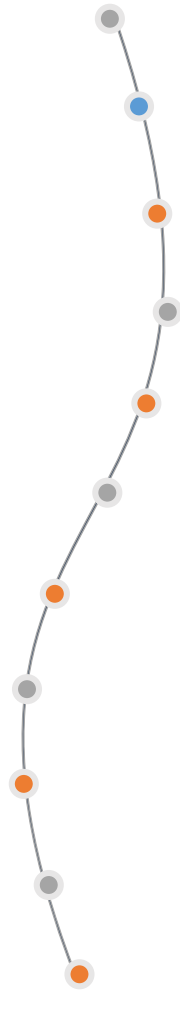
Lesson 7: AWS Application Services

What You'll Learn

Describe the basic concepts of SQS

Describe the architecture and features of SQS

Identify the properties of SQS Queues

Standard Queue and FIFO Queue

Define Visibility Timeout

Describe Message Lifecycle

Compare Dead Letter with Delay Queues

Define SQS Long Polling

Describe the working of SNS and SWF

Compare SWF with SQS

Identify other application services

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Basic Concepts of SQS

SQS Overview
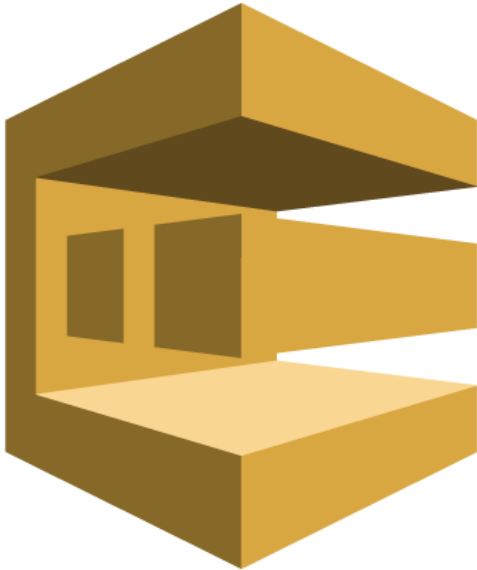
Reliable, Fast, and Fully Managed Queue Service

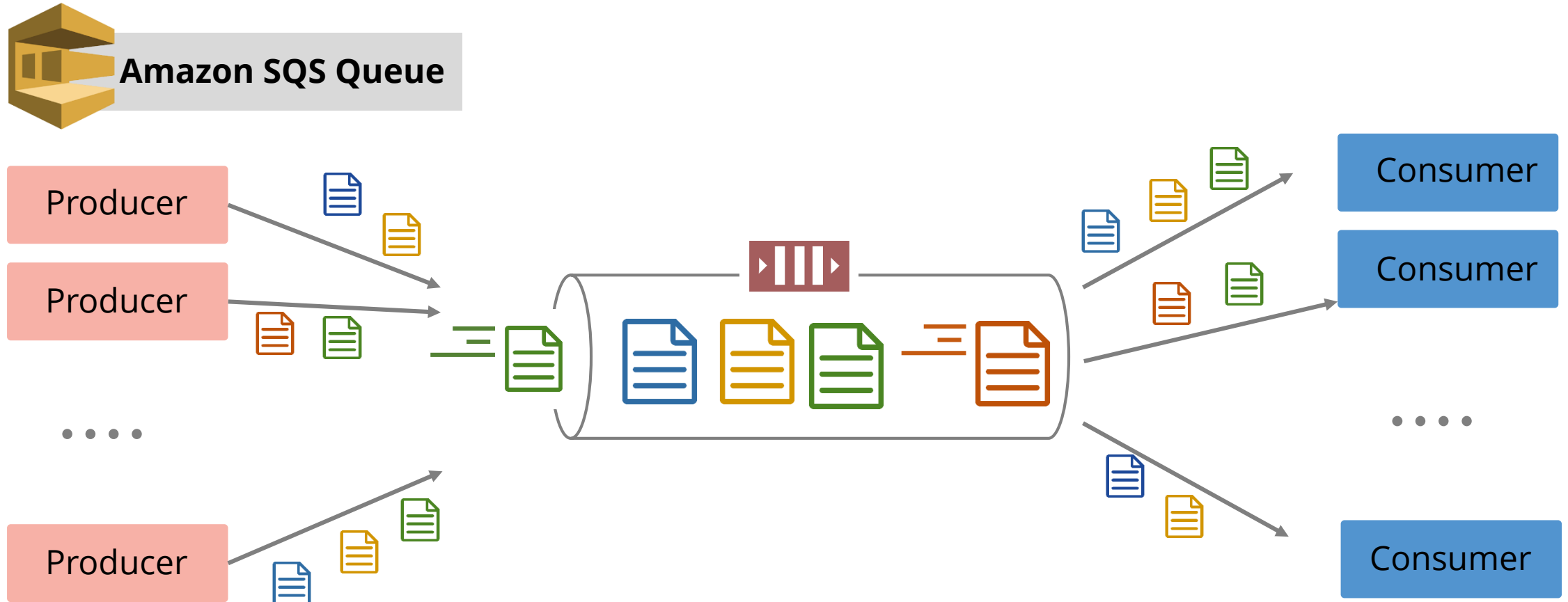- Enables decoupling application components

- Highly scalable and durable

- Messages are kept in SQS queue during server failure

- Any system can pull messages from SQS

- Provides message-oriented APIs

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SQS Architecture

Amazon SQS Queue

Producer

Producer

Producer

Consumer

Consumer

Consumer

Features of SQS

Stores messages across multiple servers

Guarantees delivery of messages at least once

Supports messages up to 256 KB

Helps to delay delivery by 0 sec to 15 min

Compliant with Payment Card Industry Data Security Standards

SQS Queues

SQS Queues

- Must assign a unique name for each queue
- Messages are retained for 4–14 days
- Provide option for both standard and FIFO queues
- Deliver each message at least once
- Deliver copy of messages in rare occasions
- Design your application to be idempotent

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Queue and Message Identifiers

http://sqs.us-east-1.amazonaws.com/123456789/simplilearn

Region   **AWS ID** **Queue Name**

Message ID is an identifier for the message

The SendMessage command returns a message ID

Cannot delete the message ID

MbZj6wDWli+JvwwJaBV+3dcjk2YW2vA3+STFFljTM8tJJg6HRG6PYSasuWXPJB+CwLj1FjgXUv1uSj1gUPAWV66FU/WeR4mq2OK
pEGYWbnLmpRCJVAyeMjeU5ZBdtcQ+QEauMZc8ZRv37sIW2iJKq3M9MFx1YvV11A2x/KSbkJ0=

Receipt Handle

FIFO Queue

SQS FIFO was introduced lately to AWS. It ensures the delivery of a message exactly once and follows the order with first in first out principle.

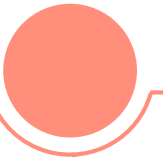FIFO has limited throughput when compared to standard queue

FIFO queues can support up to 300 messages per second (300 SendMessage, ReceiveMessage, or DeleteMessage operations per second)

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Standard vs. FIFO Queues

Standard

They are usually language dependent
They are mainly static source code analyzers
Each tool looks for certain features
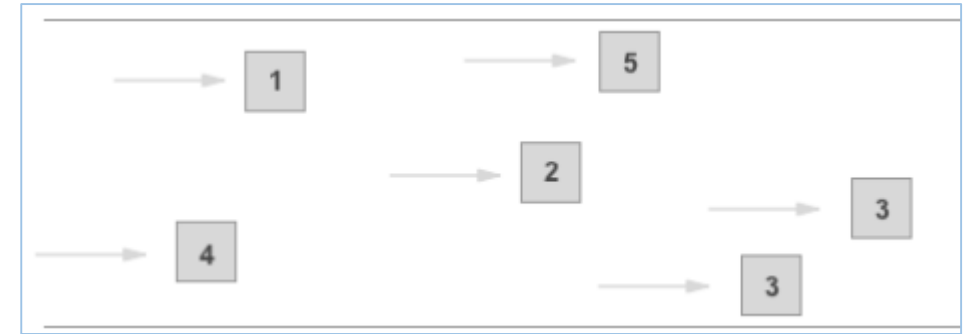
FIFO

- Some tools run quickly and give high-level assessments
- Other tools provide very detailed analysis
- Differences between tools can give you insights into your code

Knowledge Check

What are the main advantages of using SQS? (Choose 2)

a. Decouples application components

b. Allows communication between instances

c. Guarantees delivery of a message at least once

d. Supports push notifications

What are the main advantages of using SQS? (Choose 2)

a. Decouples application components

b. Allows communication between instances

c. Guarantees delivery of a message at least once

d. Supports push notifications

The correct answer is **Decouples application components & Guarantees delivery of a message at least once**

Explanation: SQS architecture enables decoupling of your application components. In case your application server is unavailable, the messages are kept in the SQS queue to process later, without being lost completely. By default, SQS stores messages across multiple Amazon SQS servers for high availability and durability. It guarantees delivery of your message at least once.

SQS – Deep Dive

Visibility Timeout

Scenario 1

Component 1   **Component 1**

Receive Message   Delete Message

| 0:00 | 10:00 | 13:00 | 15:00 |

Scenario 2

Component 1   **Component 1**

Receive Message   Receive Message

| 0:00 | 10:00 | 15:00 | 15:01 |
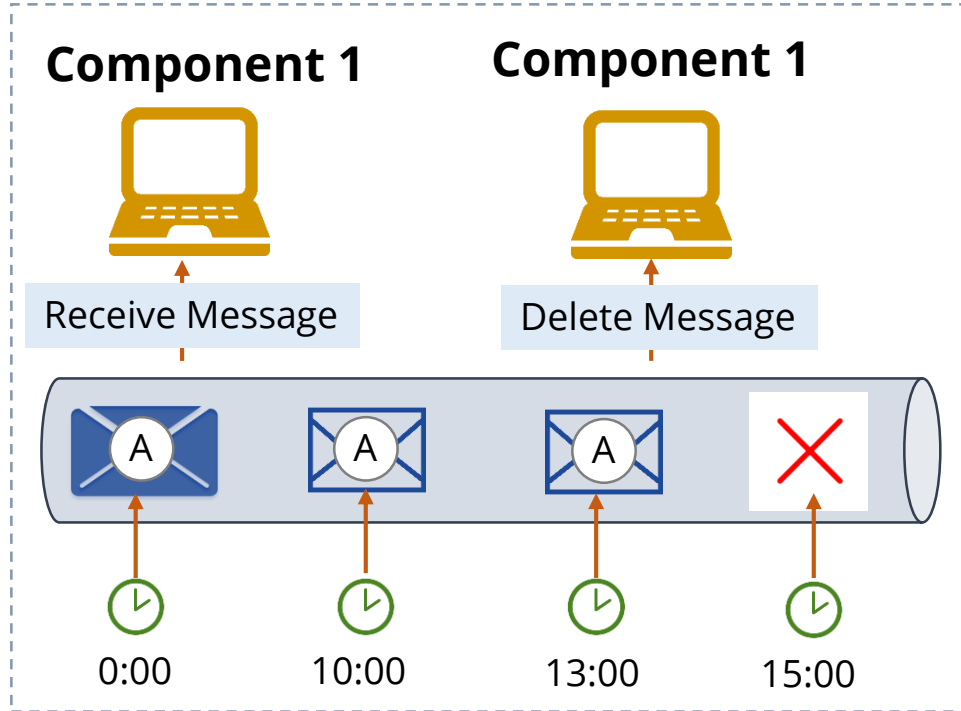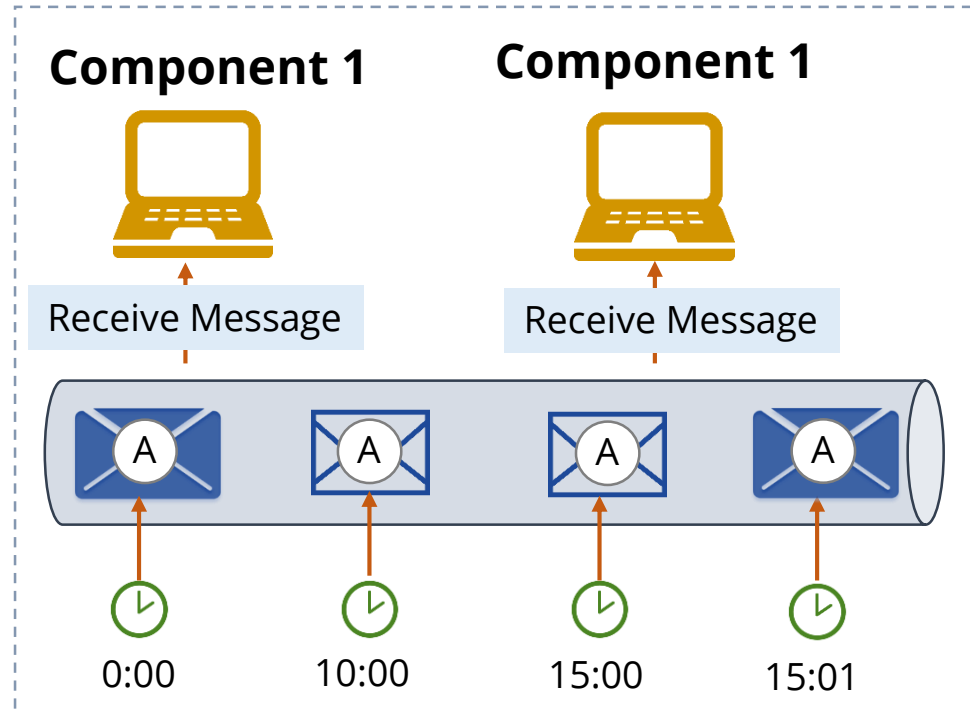
Message will be in queue while processing

SQS locks the message until processing is complete

Managing Visibility Timeout

30 seconds default visibility timeout for each queue

Can modify visibility timeout for individual messages
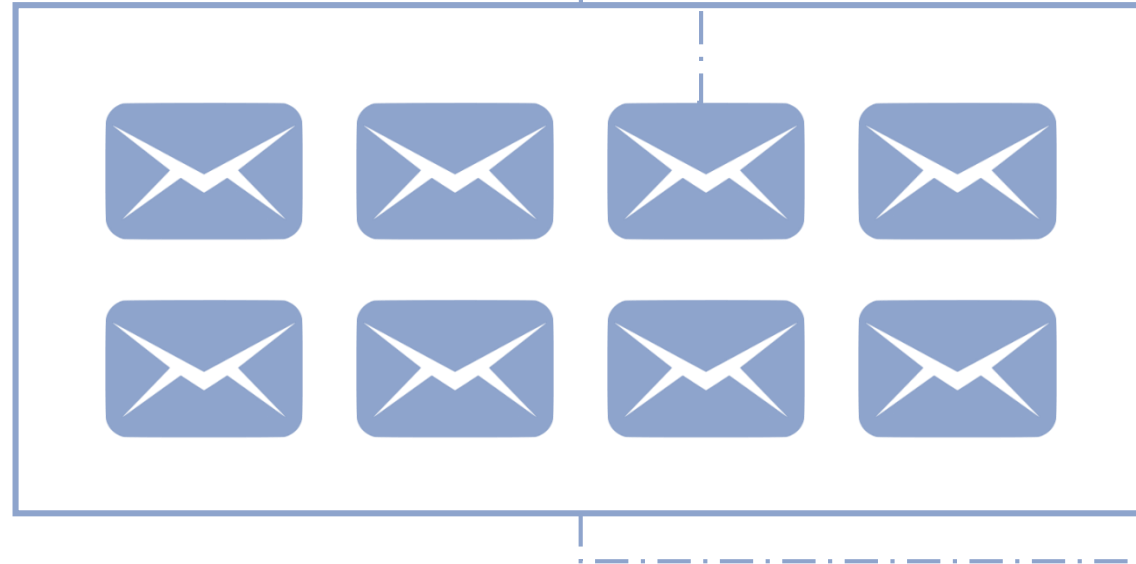
SQS limits inflight messages to 120,000 per queue

ChangeMessageVisibility   **VisibilityTimeout**   **ReceiveMessage**

Message Lifecycle

1 Component 1 sends Message A to the queue

Visibility Timeout Clock

0 / 40

Send Message → Component 1 → A

2 Component 2 retrieves Message A from the queue and the visibility timeout period starts

Visibility Timeout Clock

0 / 5 / 40

Receive Message → Component 2 ← A

3 Component 2 processes Message A and then deletes it from the queue during the visibility timeout period

Visibility Timeout Clock

0 / 25 / 25

Delete Message → Component 2 A

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Dead Letter and Delay Queues

Dead Letter	Delay Queues

Queue

Dead Letter Queue

- Used to receive messages from other queues
- Stores messages that cannot be processed successfully
- Multiple SQS queues can send messages to the same dead letter queue
- Should be created under the same AWS account and in the same region

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Dead Letter and Delay Queues

Dead Letter	Delay Queues

Time

Send Message Request

Receive Message Request

Delay Seconds

Message not returned

Message added to queue

Receive Message Request

Receive Message Request

Visibility Timeout (in seconds)

Message not returned

Message returned

Receive Message Request

Message returned

- Helps to postpone the delivery of a message for a period
- Two ways of use:
  - CreateQueue API with DelaySeconds
  - SetQueueAttributes API with DelaySeconds attribute
- Makes the messages invisible after delivery

SQS Long Polling

Message polling interval can be between 0 to 20 seconds

In short poll, interval is 0 seconds

Helps to eliminate empty or false responses

More efficient as it reduces the number of requests

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SQS – Important Facts

1. Does not support First In First Out
2. Ensures delivery of messages "at least once"
3. Maximum message size is 256 KB in any text format
4. Original billing was done on 64 KB "chunks" of messages
5. Consumer should pull or poll messages from the SQS queues
6. Provides first 1 million messages per month for free
7. Subsequent messages charged at $.50 per 1 million
8. Single request can have multiple messages (up to 10)
9. Supports auto scaling

Knowledge Check

Identify the valid minimum and maximum long polling intervals. (Choose 2)

a. 0

b. 1

c. 20

d. 30

KNOWLEDGE CHECK

Identify the valid minimum and maximum long polling intervals. (Choose 2)

a. 0

b. 1

c. 20

d. 30

The correct answer is   **1 & 20**

Explanation: In long polling, you can set the polling interval from 1 second to 20 seconds maximum for receiving the request from the queues.

Simple Notification Service – Overview

Simple Notification Service

Fully Managed Notification Service

Sends individual/batch messages
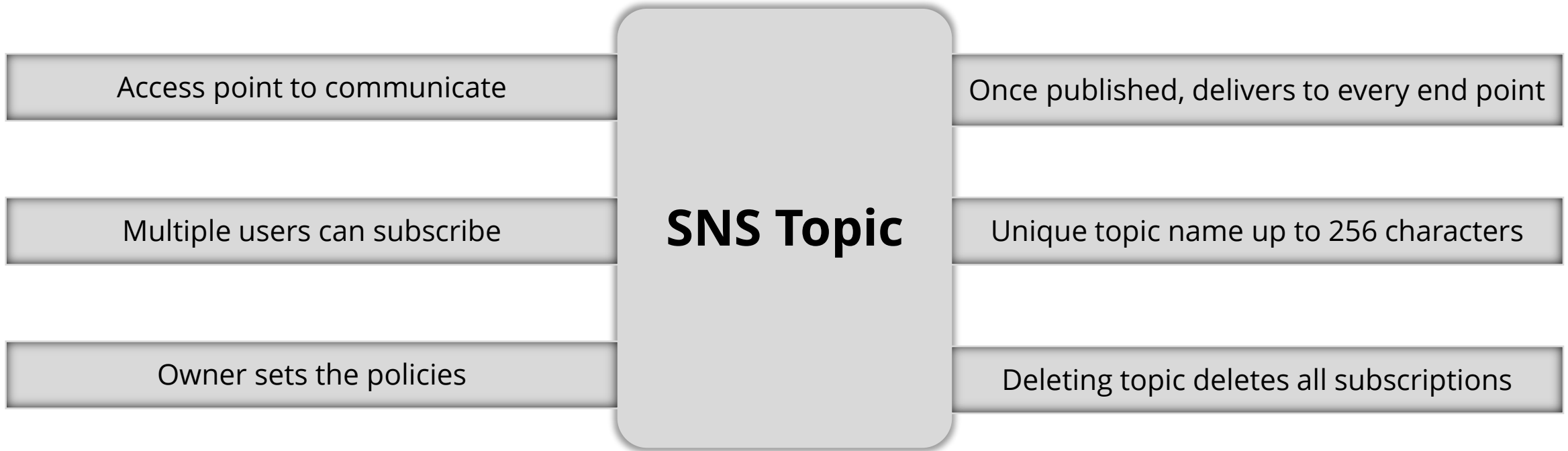
Delivery notification through SMS/Email/HTTP

Uses push mechanism

Supports publishers and consumers

Each topic has a unique name or end point

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SNS – Core Components

Access point to communicate		Once published, delivers to every end point
Multiple users can subscribe	**SNS Topic**	Unique topic name up to 256 characters
Owner sets the policies		Deleting topic deletes all subscriptions

```
arn:aws:sns:us-west-2:111122223333:MyTopic
```

Topic end point

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Sending Messages

Supported Protocols:

- Mobile Push
- SQS
- HTTP & HTTPS
- Email
- SMS
- Lambda

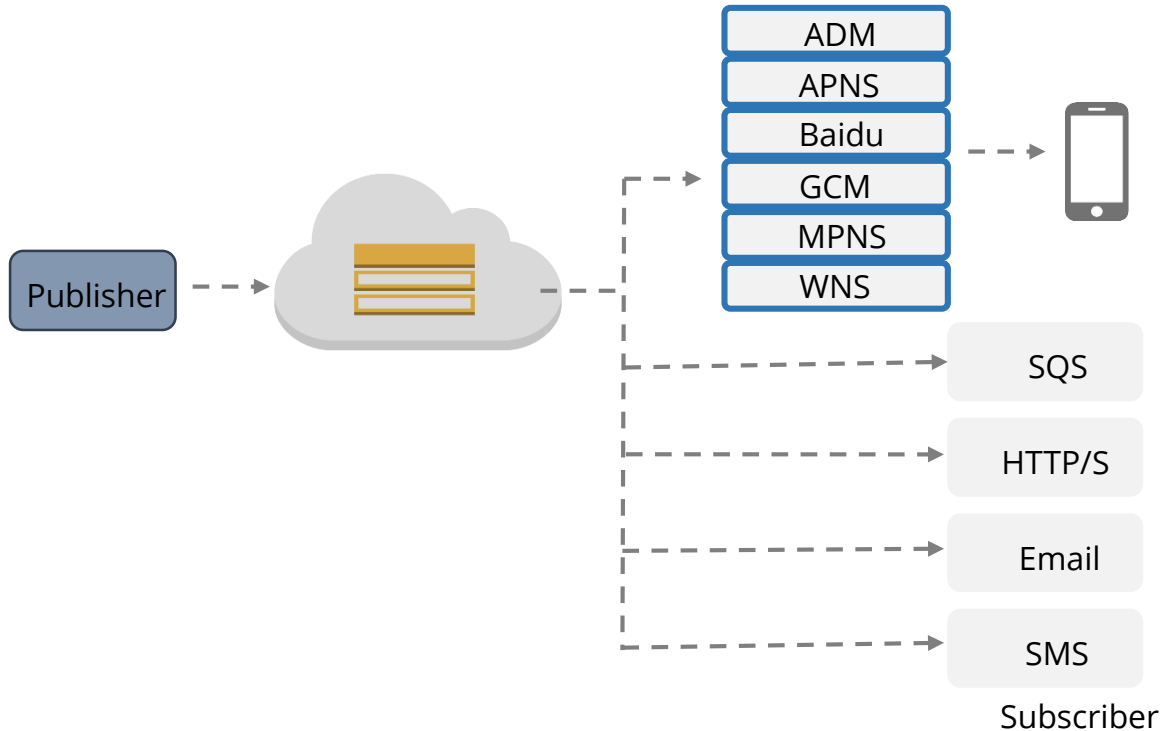**Mobile Device**

Desktop

SQS and SNS

1. Get ARN for SQS queue and SNS topic

2. Give send-message permission to SNS

3. Subscribe SQS queue to SNS topic

SNS Through Other Services

Publisher

ADM
APNS
Baidu
GCM
MPNS
WNS

SQS

HTTP/S

Email

SMS

Subscriber

One SMS can contain up to 160 ASCII/70 Unicode characters

SMS should have opt out option

Uses HTTP post request to deliver the notification

Lambda functions can be invoked by SNS messages

Configure topic attributes to collect delivery information

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Message Format

MessageId

Timestamp

TopicArn

Type

UnsubscribeURL

Message

Subject

Signature

SignatureVersion

```
POST / HTTP/1.1
x-amz-sns-message-type: Notification
x-amz-sns-message-id: 22b80b92-fdea-4c2c-8f9d-bdfb0c7bf324
x-amz-sns-topic-arn: arn:aws:sns:us-west-2:123456789012:MyTopic
x-amz-sns-subscription-arn: arn:aws:sns:us-west-2:123456789012:MyTopic:c9135db0-26c4-47ec-8998-413945fb5a96
Content-Length: 773
Content-Type: text/plain; charset=UTF-8
Host: myhost.example.com
Connection: Keep-Alive
User-Agent: Amazon Simple Notification Service Agent

{
  "Type" : "Notification",
  "MessageId" : "22b80b92-fdea-4c2c-8f9d-bdfb0c7bf324",
  "TopicArn" : "arn:aws:sns:us-west-2:123456789012:MyTopic",
  "Subject" : "My First Message",
  "Message" : "Hello world!",
  "Timestamp" : "2012-05-02T00:54:06.655Z",
  "SignatureVersion" : "1",
  "Signature" : "EXAMPLEw6JRNwm1LFQL4ICB0bnXrdB8ClRMTQFGBqwLpGbM78tJ4etTwC5zU7O3tS6tGpey3ejedNdOJ+1fkIp9F2/Ln
  "SigningCertURL" : "https://sns.us-west-2.amazonaws.com/SimpleNotificationService-f3ecfb7224c7233fe7bb5f59:
  "UnsubscribeURL" : "https://sns.us-west-2.amazonaws.com/?Action=Unsubscribe&SubscriptionArn=arn:aws:sns:us-
}
```

Knowledge Check

Which are the delivery protocols supported by SNS? (Choose 2)

a. TCP/IP

b. HTTP

c. SMS

d. UDP

Which are the delivery protocols supported by SNS? (Choose 2)

a. TCP/IP

b. HTTP

c. SMS

d. UDP

The correct answer is **HTTP & SMS**

Explanation: You can send SNS messages over one or more protocols. Supported protocols include Mobile Push, SQS, HTTP and HTTPS, Email, SMS, and Lambda.

Other Application Services – Overview

Simple Workflow Service
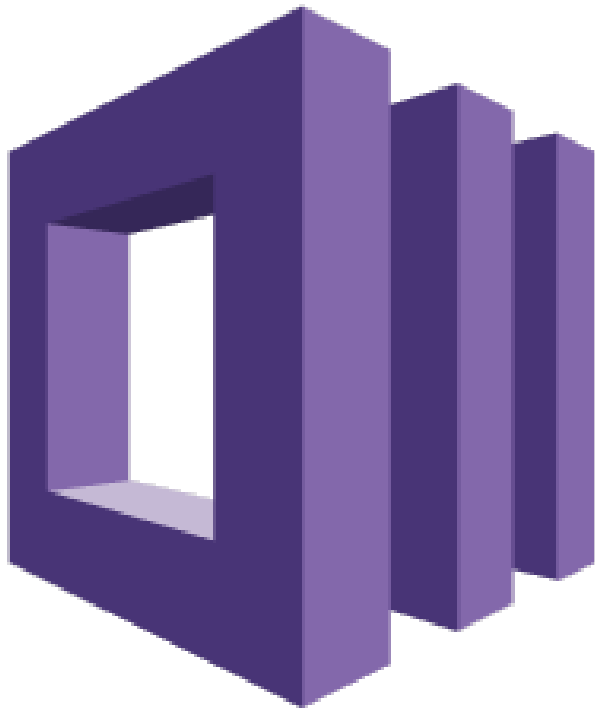
SWF

- Task coordination and state tracking system

- Helps to build, run, and scale workflows

- Supports any programing language

- Supports asynchronous and distributed applications

- Provides programing model and infrastructure

SWF – Core Components

The decider implements the application's business logic

Gets Decision Tasks / Return Decisions
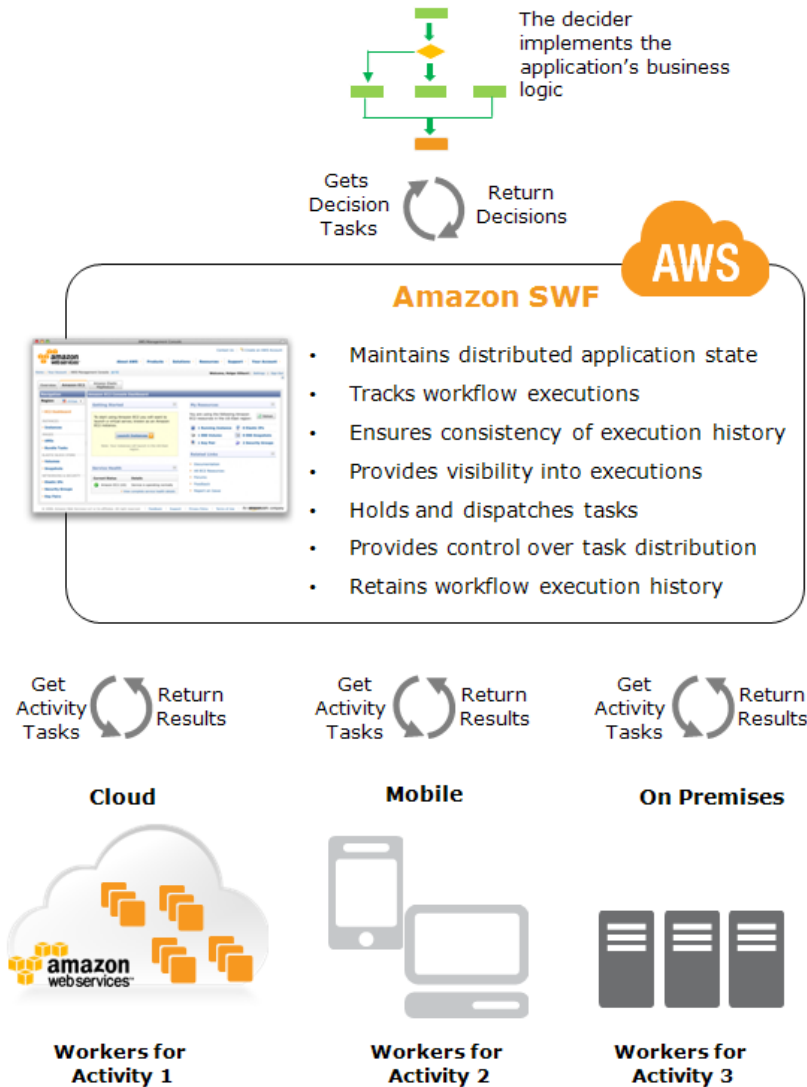
Amazon SWF

- Maintains distributed application state
- Tracks workflow executions
- Ensures consistency of execution history
- Provides visibility into executions
- Holds and dispatches tasks
- Provides control over task distribution
- Retains workflow execution history

Get Activity Tasks / Return Results

Cloud — Workers for Activity 1

Mobile — Workers for Activity 2

On Premises — Workers for Activity 3

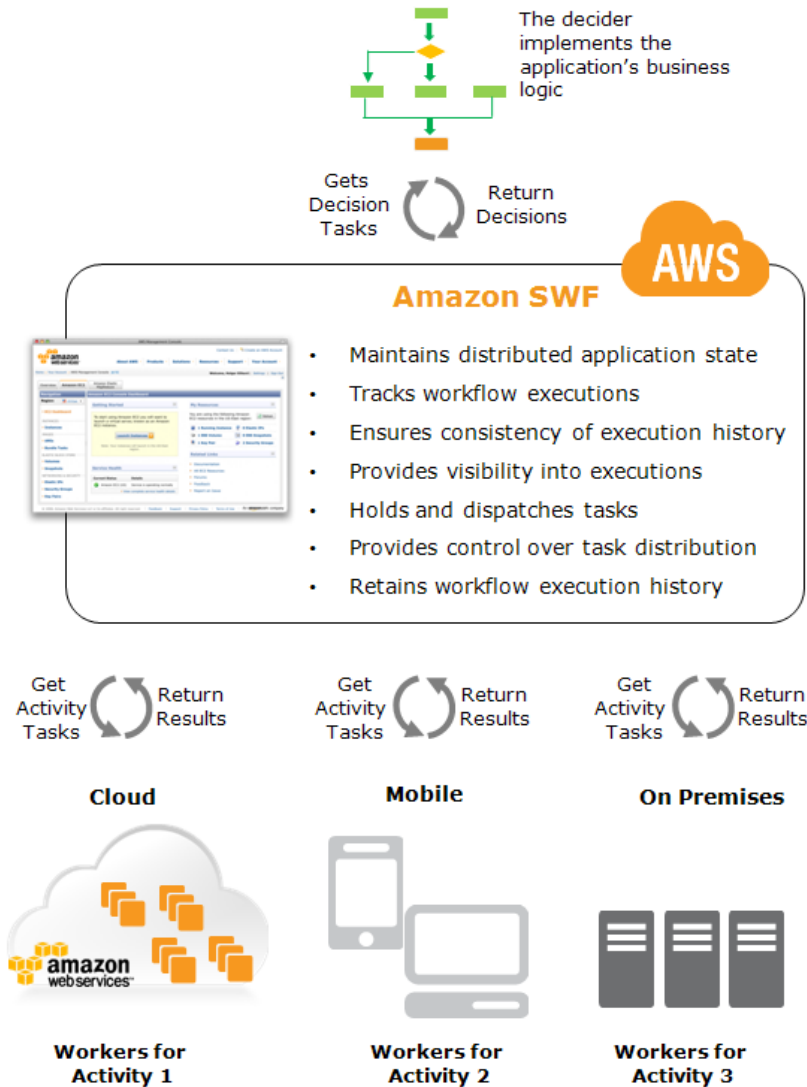## 1. Workflow

- Most important element in SWF
- Consists of a set of activities to complete business objectives
- Runs on AWS resource called Domain
- Should define and register activities needed to complete the workflow
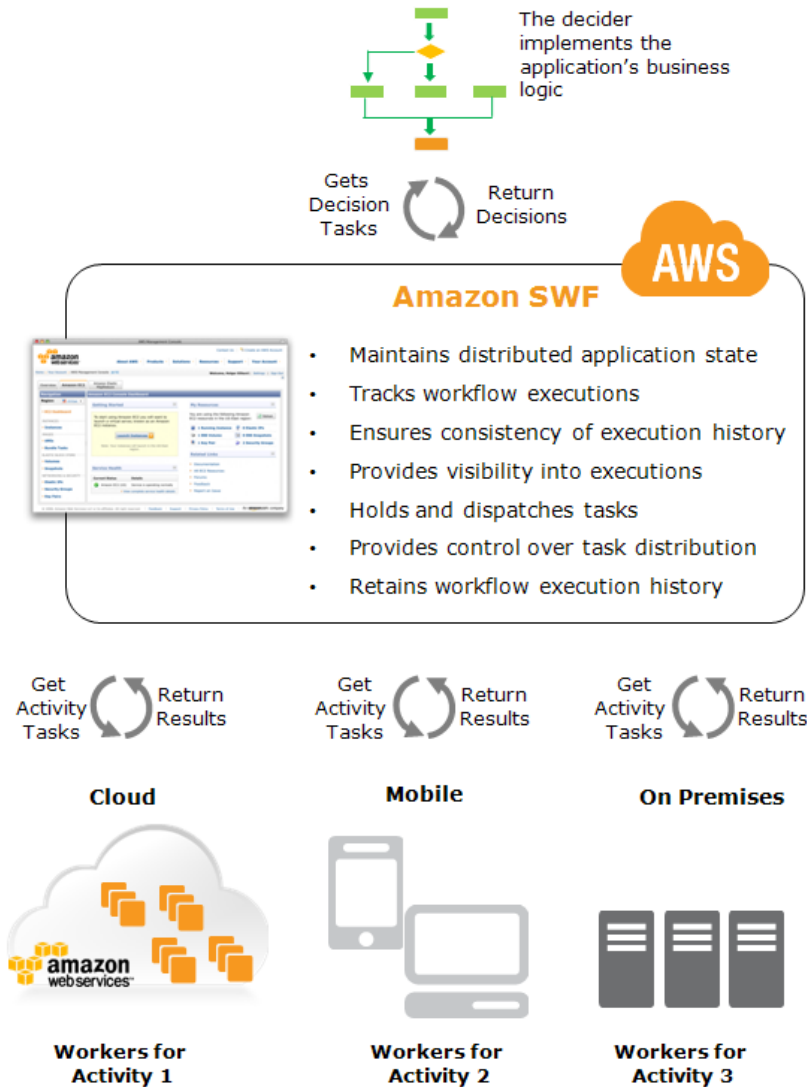- Some activities need to be performed multiple times

SWF – Core Components

The decider implements the application's business logic

Gets Decision Tasks — Return Decisions

AWS

Amazon SWF

- Maintains distributed application state
- Tracks workflow executions
- Ensures consistency of execution history
- Provides visibility into executions
- Holds and dispatches tasks
- Provides control over task distribution
- Retains workflow execution history

Get Activity Tasks — Return Results

Get Activity Tasks — Return Results

Get Activity Tasks — Return Results

Cloud

Mobile

On Premises

amazon web services

Workers for Activity 1

Workers for Activity 2

Workers for Activity 3

2. Activity Worker

- A software application that processes activity tasks
- Can perform multiple activity tasks
- Can be developed in different programing languages

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SWF – Core Components

Amazon SWF

- Maintains distributed application state
- Tracks workflow executions
- Ensures consistency of execution history
- Provides visibility into executions
- Holds and dispatches tasks
- Provides control over task distribution
- Retains workflow execution history

The decider implements the application's business logic

Gets Decision Tasks — Return Decisions

Get Activity Tasks — Return Results

Cloud

Mobile

On Premises

Workers for Activity 1

Workers for Activity 2

Workers for Activity 3

3. Decider

- Contains coordination logic in a workflow
- Schedules activity tasks
- Provides need input to activity workers
- Addresses any events raised
- Completes workflow

SWF Vs SQS
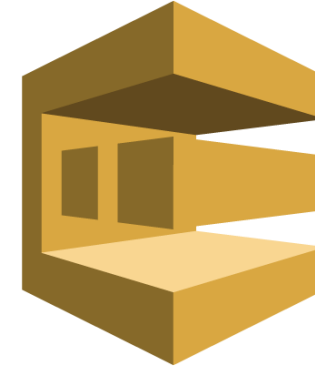
SWF	SQS
Provides task-oriented APIs	Provides message-oriented APIs
Ensures task is assigned only once	May deliver same message multiple times
Keeps track of all application events and states	Needs to build application to track
Task runs up to one year	Task runs up to 14 days
Supports hybrid infrastructure, multiple programming languages, and operating systems	

Other Application Services

Simple Email Service (SES)

- Cost effective scalable email service

- Built to serve Amazon's large-scale customer base

- Supports inbound/outbound email messages

ElastiCache

- A media transcoder in the cloud

- Converts media files to be compatible

- Improves performance of web applications

Knowledge Check

Select two valid elements of SWF

a. Activity workers

b. Triggers

c. Topics

d. Domains

Select two valid elements of SWF

a. Activity workers

b. Triggers

c. Topics

d. Domains

The correct answer is **Activity workers & Domains**

Explanation: Activity workers or software programs can be developed in different programing languages or can run on different operating systems. Workflow is a logical flow, but it runs on an AWS resource called Domain. Each AWS account can have multiple domains, and each domain can have multiple work flows.

Practice Assignment: AWS Application Services

To create an SQS Queue, and then send, receive, and delete messages from the queue and delete the queue

Create SQS Queue

You are in the process of setting up a queue for your multimedia company, you would like to test the queue operations by performing the queue activities, such as creating a queue, sending messages to a queue, receiving messages in your queue, and deleting a queue by creating a test queue called TestQueue prior to using queues for all your queue services in your company.

Prerequisites:
- AWS account

Task:
To create an SQS Queue, and then send, receive, and delete messages from the queue and delete the queue.

Quiz

QUIZ 1	What parameter or option should you use to change visibility timeout?

a. VisibilityTime

b. VisibilityTimeout

c. SendMessage

d. VisibilityTimeoutInterval

QUIZ 1

What parameter or option should you use to change visibility timeout?

a. VisibilityTime

b. VisibilityTimeout

c. SendMessage

d. VisibilityTimeoutInterval

The correct answer is **VisibilityTimeout**

Explanation: To change the message visibility, use ChangeMessageVisibility call with the VisibilityTimeout option or parameter.

QUIZ

2

What is the advantage of long polling?

a. Reduces consumers

b. Reduces empty responses

c. Reduces application threads

d. Reduces SQS queues

QUIZ 2	What is the advantage of long polling?

a. Reduces consumers

b. Reduces empty responses

c. Reduces application threads

d. Reduces SQS queues

The correct answer is **Reduces empty responses**

Explanation: Long polling helps you to eliminate empty or false responses and optimizes resource utilization; and SQS queries all of the servers.

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QUIZ 3	Does SQS support FIFO for message delivery?

a. Yes

b. No

| **QUIZ 3** | Does SQS support FIFO for message delivery? |

a.   Yes

b.   No

The correct answer is   **YES**

Explanation: SQS now guarantees the order or priority of messages being processed or delivered using FIFO queue.

QUIZ 4	FIFO queues support only per-queue delays and not per-message delays, whereas standard queues support per-message delays. True or False.

a. True

b. False

FIFO queues support only per-queue delays and not per-message delays, whereas standard queues support per-message delays. True or False.

a. True

b. False

The correct answer is   **True**

Explanation: FIFO queues support only per-queue delays; however, standard queues support per-message delays.

QUIZ **5**	Which is NOT the SNS message field?

a. TopicArn

b. Subject

c. Type

d. Title

QUIZ 5

Which is NOT the SNS message field?

a. TopicArn

b. Subject

c. Type

d. Title

The correct answer is   **Title**

Explanation: There is no such aspect called title in SNS message fields. You can have subject field – if one was included as an optional parameter to the publish an API call along with the message.

QUIZ **6**	Does SWF allow human input during workflow execution?

    a.   Yes

    b.   No

QUIZ 6	Does SWF allow human input during workflow execution?

a. Yes

b. No

The correct answer is **Yes**

Explanation: Activity worker is a software application that receives activity tasks, executes them, and then provides results. Sometimes the task can be performed by a human, but he or she will still have to use the software to provide the results.

Key Takeaways

- SQS enables your applications to be decoupled by passing data between different components

- SQS ensures delivery of each message at least once. SQS does not guarantee the order or priority of messages being processed

- SQS locks the message for a specific time called visibility timeout. You can modify the visibility timeout for individual messages between 0 seconds to 12 hours

- Long polling helps you to eliminate empty responses and save resource utilization. In long polling, set the polling interval between 1 second to 20 seconds

- SNS-supported protocols include Mobile Push, SQS, HTTP and HTTPS, Email, SMS, and Lambda

- A single SMS message can contain up to 160 ASCII characters or 70 Unicode characters, SNS supports a maximum message size of 256 KB in a JSON format

- SWF Activity workers or software programs can be developed in different programing languages or can run on different operating systems

This concludes "Application Services".

The next lesson is "Cost Management"