HU Extension Assignment 07 E-90 Cloud Computing

Handed out: 10/17/2015 Due by 11:59 PM on Friday, 10/23/2015

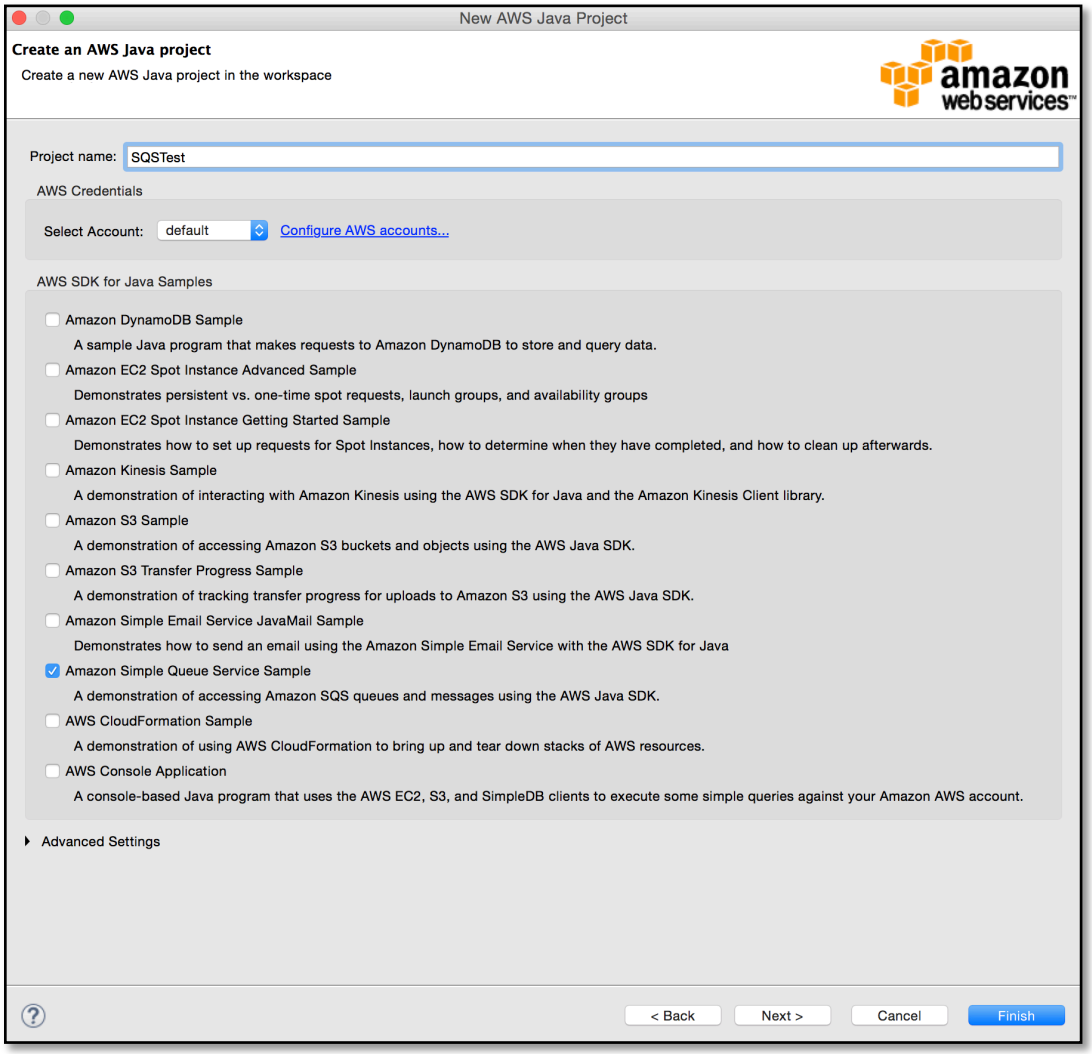
FINAL

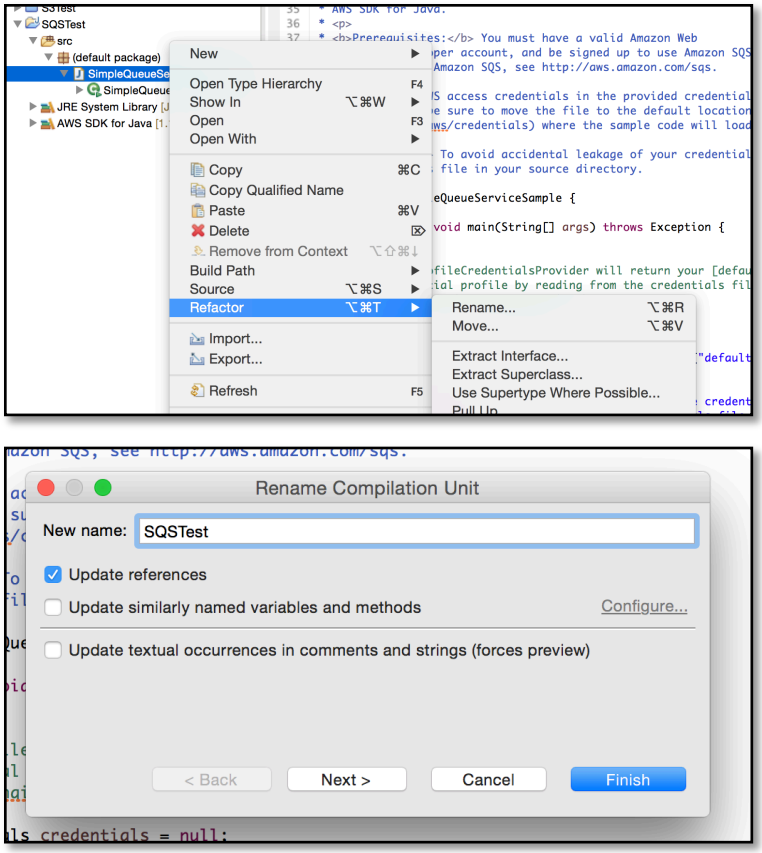
Place all of your narratives and illustrations in a single Word or PDF document named E90_LastNameFirstNameHW07.docx [.pdf]. Use this assignment as the initial template. Please implement code solutions as a separate class in one (Java, C#, Ruby, Python,..) project. Add your steps and your code below problem statements used for that problem. Upload your homework file and your working code (e.g., filename.java) into your Assignment 7 folder. Do not include executables. Please also do not zip your files.

Problem 1)

1) Create a queue using Amazon's SQS Service. Set the visibility timeout to 20 seconds.

Create a SQSTest project, use "Amazon Simple Queue Service Sample" as the template. Rename the class name to "SQSTest". Java file is "SQSTest.java".





Load the credential information. Set the region to “US_EAST_1”.

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

    /*
     * The ProfileCredentialsProvider will return your [default]
     * credential profile by reading from the credentials file located at
     * (/Users/hqiu/.aws/credentials).
     */
    AWSCredentials credentials = null;
    try {
        credentials = new ProfileCredentialsProvider("default").getCredentials();
    } catch (Exception e) {
        throw new AmazonClientException(
                "Cannot load the credentials from the credential profiles file. " +
                        "Please make sure that your credentials file is at the correct " +
                        "location (/Users/hqiu/.aws/credentials), and is in valid format.",
                        e);
    }

    AmazonSQS sqs = new AmazonSQSClient(credentials);
    Region usEast1 = Region.getRegion(Regions.US_EAST_1);
    sqs.setRegion(usEast1);
```

Create the SQS queue using “CreateQueueRequest()”. Set the attribute “visibility timeout” to 20 seconds. Set the attribute using “addAttributeEntry()”. Get and list the QueueURL.

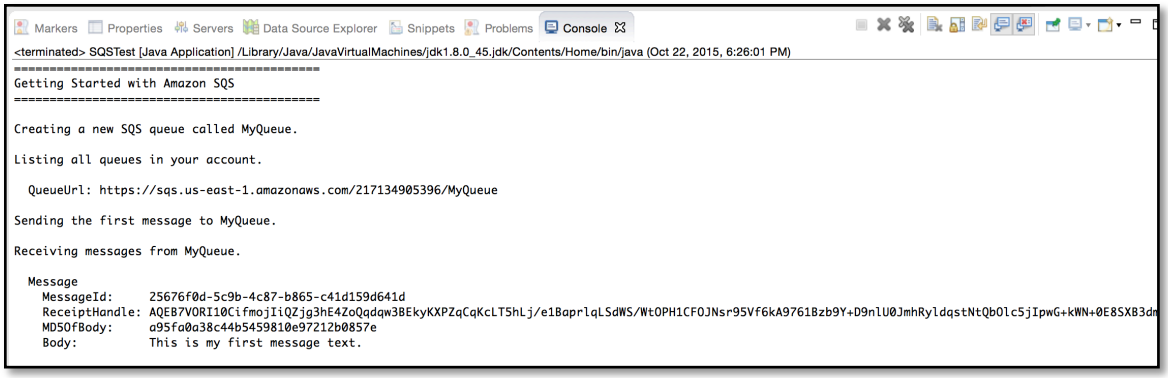
```
try {
    // Create a queue
    System.out.println("Creating a new SQS queue called MyQueue.\n");
    CreateQueueRequest createQueueRequest = new CreateQueueRequest("MyQueue");

    // Set the visibility timeout to 20 seconds
    createQueueRequest.addAttributesEntry("VisibilityTimeout", "20");

    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();
```

2) Insert a message and verify that you can retrieve and delete the message.

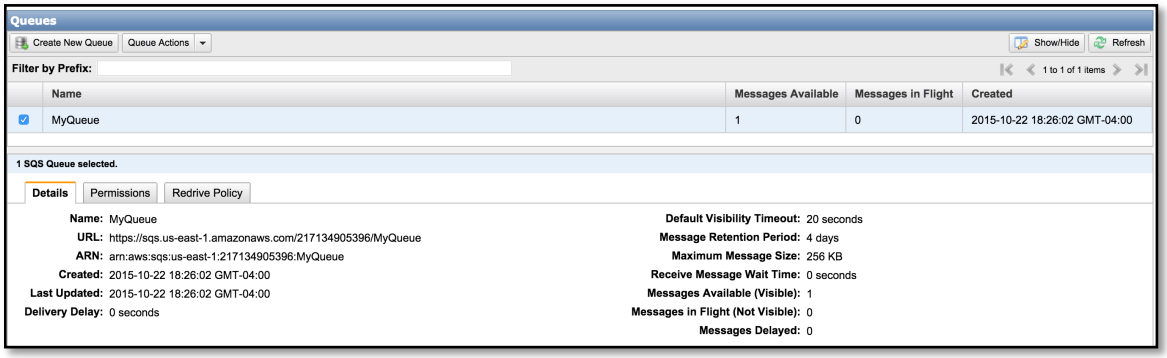
Send and receive the message. I encapsulate the receive message procedure into API called “receiveMessage()”. Thus we can reuse it later. Here I receive the message three times. The first time we can get the message. After that, the message is invisible from other users since the “Visibility Timeout” is 20 seconds. After 30 seconds, we can see and get the message again. At last, delete the message using “DeleteMessageRequest()”.

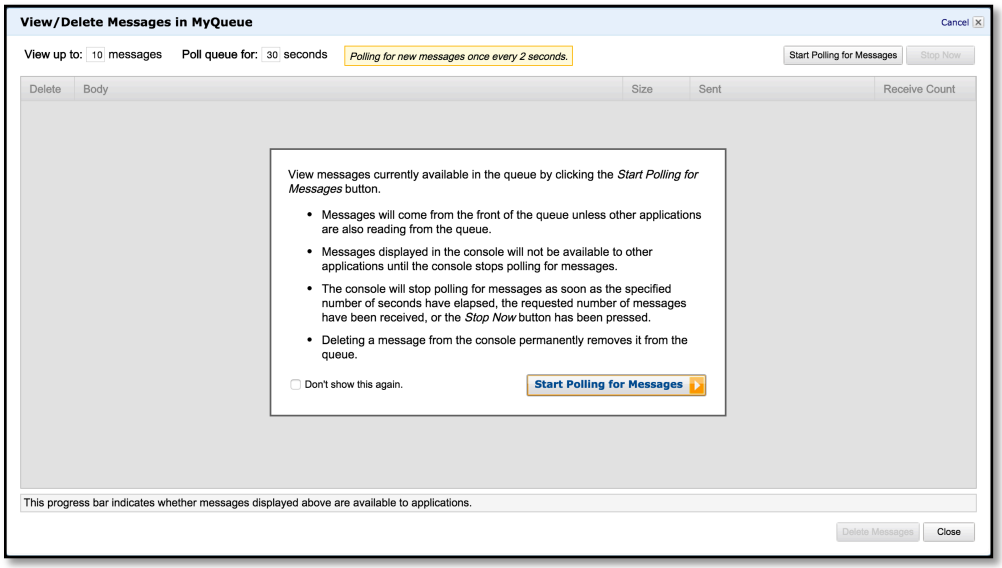
```
// Send a message
System.out.println("Sending the first message to MyQueue.\n");
sqs.sendMessage(new SendMessageRequest(myQueueUrl, "This is my first message text."));

// Receive messages
List<Message> messages = receiveMessage(sqs, myQueueUrl);

// Receive the messages again
messages = receiveMessage(sqs, myQueueUrl);

// Wait for 30 seconds until the message reappears in the queue
Thread.sleep(30000L);

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

```
private static List<Message> receiveMessage(AmazonSQS sqs, String myQueueUrl) {

    System.out.println("Receiving messages from MyQueue.\n");
    ReceiveMessageRequest receiveMessageRequest = new ReceiveMessageRequest(myQueueUrl);
    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();

    return messages;
}
```

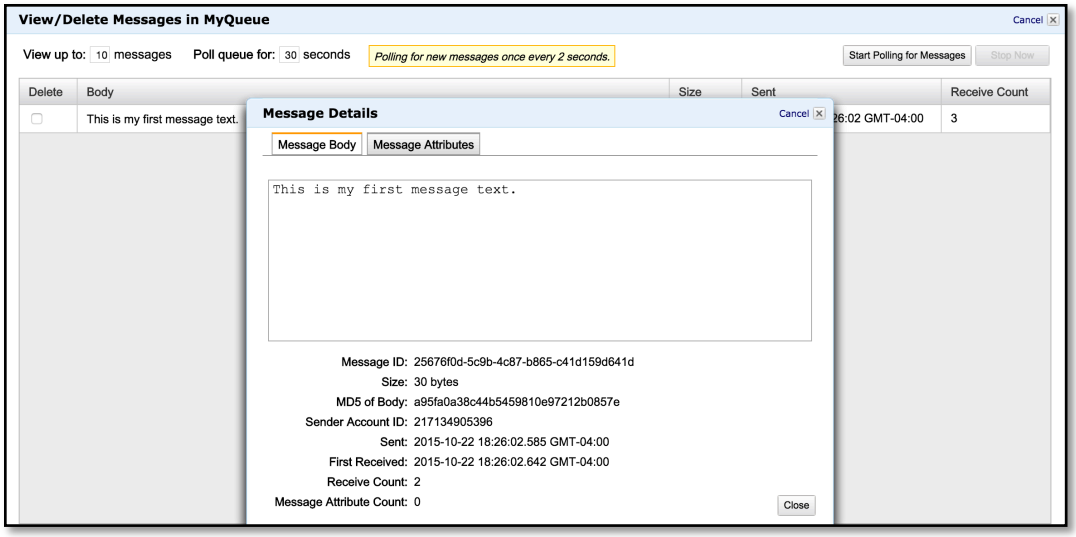


Check the message from the AWS console. Select “SQS” service. Check the queue in “Queues”. Select “Queue Actions” and then choose “View/Delete Messages” and click “Start Polling for Messages”.

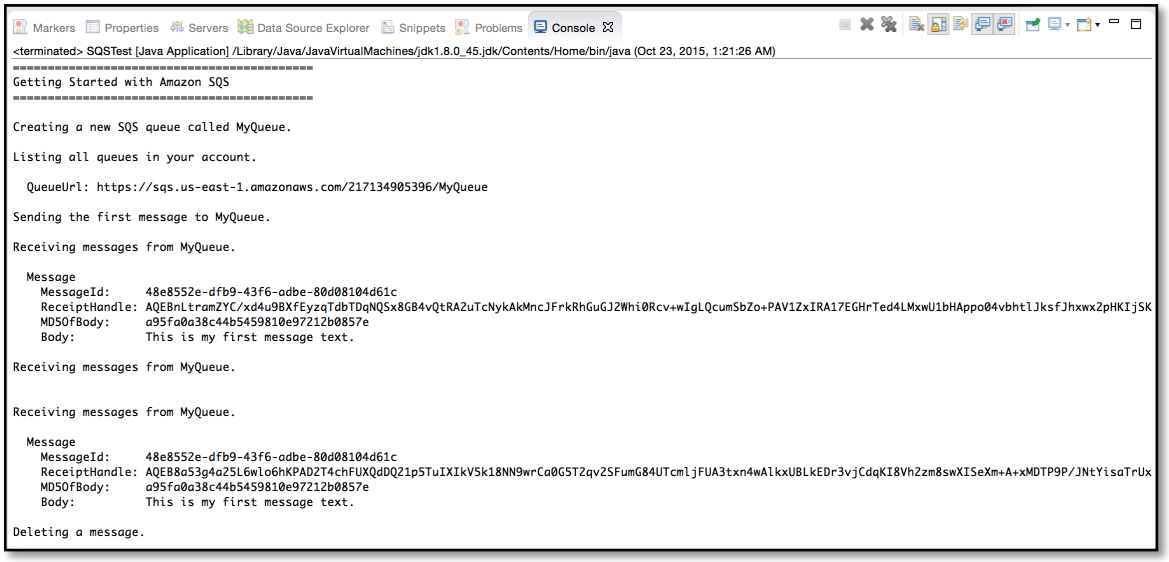




We successfully send the message into the queue.



Results from Eclipse console. The first time we get the message. The second time we couldn't get anything since the message is invisible. After 30 seconds, we can get the message from the queue again.



3) Subsequently insert another message, and retrieve that second message. Do not delete the second message but rather wait for 30 seconds (use Java `Thread.sleep()` or whatever you find suitable for that purpose).
4) Show that the message reappeared in the queue.

We have done the same thing in step 2). Here we receive the message three times. The first time we can retrieve the message. Then the message in invisible from other users and we couldn't retrieve anything, until it passes the "visibility timeout". After 30 seconds, it passes the "visibility timeout" and the message reappeared in the queue. In the AWS console, there are two columns "Message Available" and "Message in Flight". The "Message in Flight" will record the number of invisible messages.

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

// Retrieve the second message
messages = receiveMessage(sqs, myQueueUrl);

// Retrieve the second message again
messages = receiveMessage(sqs, myQueueUrl);

// Wait for 30 seconds, receive the messages again
Thread.sleep(30000L);
messages = receiveMessage(sqs, myQueueUrl);
```

```
Markers  Properties  Servers  Data Source Explorer  Snippets  Problems  Console
<terminated> SQSTest [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_45.jdk/Contents/Home/bin/java (Oct 23, 2015, 1:21:26 AM)
Sending the second message to MyQueue.

Receiving messages from MyQueue.

  Message
    MessageId:     92ed4b16-3f9b-4ac6-87f9-4da680011140
    ReceiptHandle: AQEBaF2indm/Ay8eQIm0+SY/+BtvWEnRQUqe9HZv3gKKubZi6SFXu5KaDFePWtFMs8T4ylvrSEM5Qmfv6tlNEQjYKYkaryis+cxauQCLeE40IfJS07KS5k/rRtGemcbG0+Q4ofMDaw6u9yZz
    MD5OfBody:     8e881d3de27f22d57b6ec75028ca1bac
    Body:          This is my second message text.

Receiving messages from MyQueue.


Receiving messages from MyQueue.

  Message
    MessageId:     92ed4b16-3f9b-4ac6-87f9-4da680011140
    ReceiptHandle: AQEBzMhlOVma/BM0zr0KAVN/Ze4xkCgsnl86wL14cakv1o1CFPIUbOORS9hJ3yv6qRuya3AmKnh8XNtlhe3rsHx8ISxnBxYu2w3mRpggM9PvpcTH2S+xy3sHUiuaBB7VPG/pAJNGM1SENnaR
    MD5OfBody:     8e881d3de27f22d57b6ec75028ca1bac
    Body:          This is my second message text.

Sending five messages to MyQueue.
```

5) Add five more messages to the queue and then execute `GetQueueAttributes` call. Retrieve and display all attributes of your queue. In particular report on the average number of messages in the queue.

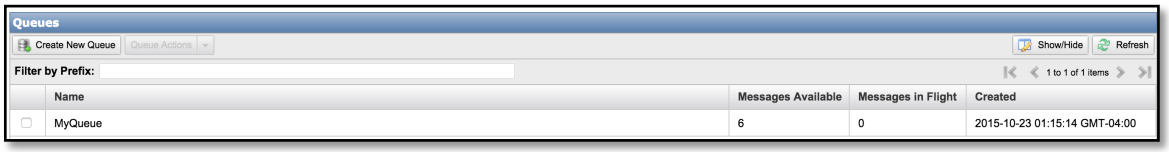
Add five more messages.

```
// Send five more messages to the queue
System.out.println("Sending five messages to MyQueue.\n");
for (int i = 1; i <= 5; i++) {
    String messageStr = "This is my " + i + "/5 message text.";
    sqs.sendMessage(new SendMessageRequest(myQueueUrl, messageStr));
}

// Receive all the messages
// messages = receiveMessage(sqs, myQueueUrl);
// Thread.sleep(30000L);
```

Get all attributes of the queue, especially report on the approximate number of messages. Set the parameters in "withAttributeNames()" to "All" to get all the attributes. We can also set it to a particular attribute name.

```
// Retrieve all attributes of the queue.
GetQueueAttributesRequest getQARequest = new GetQueueAttributesRequest().withQueueUrl(myQueueUrl);
GetQueueAttributesResult getQAResult =  sqs.getQueueAttributes(getQARequest.withAttributeNames("All"));
Map <String,String> attributeMap = getQAResult.getAttributes();

// Display all attributes, especially the average number of messages in the queue.
System.out.println();
System.out.println("Number of messages in queue " + myQueueUrl + " is " +
        attributeMap.get("ApproximateNumberOfMessages"));

System.out.println("Number of invisible messages in queue is " +
        attributeMap.get("ApproximateNumberOfMessagesNotVisible"));

System.out.println("\nDisplay all the attributes:");
for (String key : attributeMap.keySet()) {
    System.out.println("  " + key + " is: " + attributeMap.get(key));
}
```

We add 7 messages and delete 1 before. So we get 6 messages here.



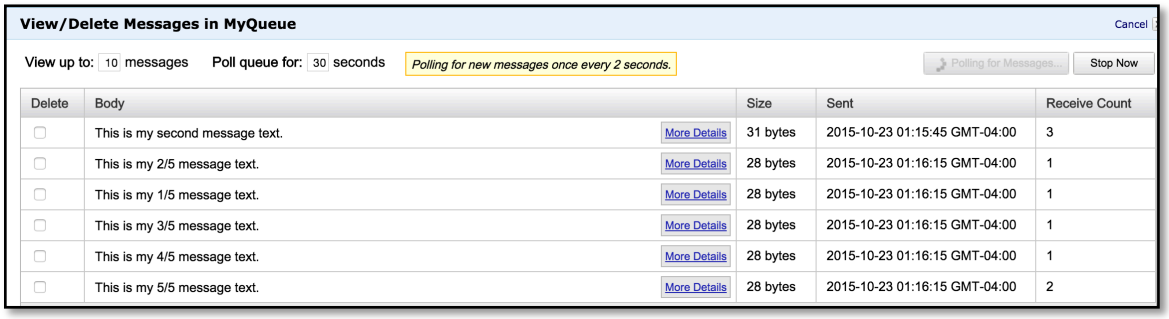
Queues

Create New Queue | Queue Actions | Show/Hide | Refresh

Filter by Prefix:

1 to 1 of 1 items

Name	Messages Available	Messages in Flight	Created
MyQueue	6	0	2015-10-23 01:15:14 GMT-04:00



View/Delete Messages in MyQueue — Cancel

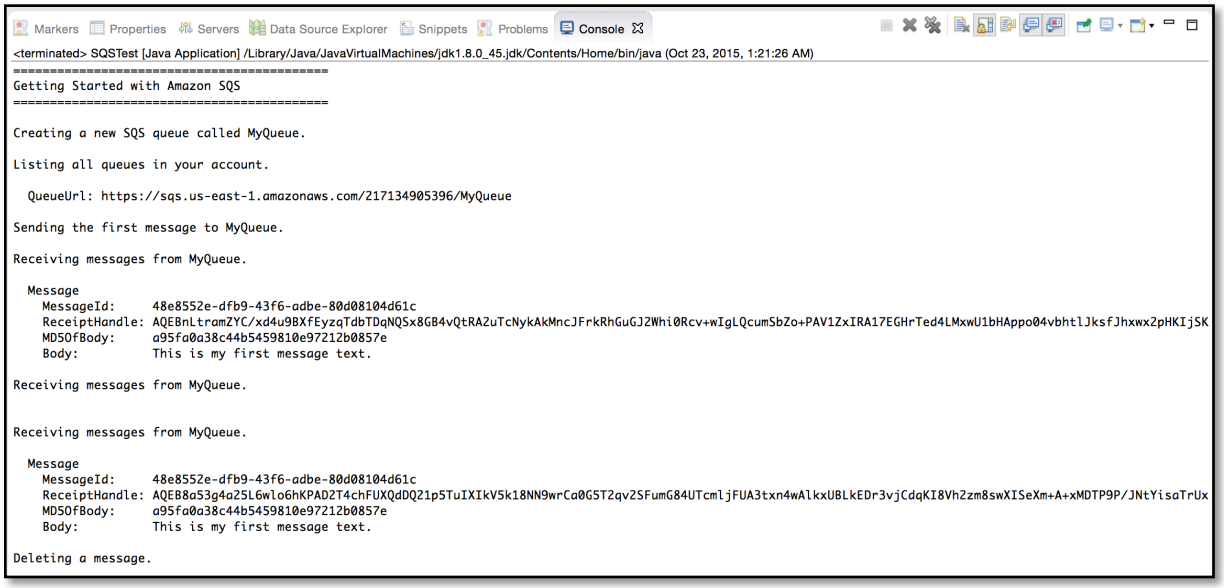
View up to: 10 messages Poll queue for: 30 seconds *Polling for new messages once every 2 seconds.* Polling for Messages... Stop Now

Delete	Body		Size	Sent	Receive Count
	This is my second message text.	More Details	31 bytes	2015-10-23 01:15:45 GMT-04:00	3
	This is my 2/5 message text.	More Details	28 bytes	2015-10-23 01:16:15 GMT-04:00	1
	This is my 1/5 message text.	More Details	28 bytes	2015-10-23 01:16:15 GMT-04:00	1
	This is my 3/5 message text.	More Details	28 bytes	2015-10-23 01:16:15 GMT-04:00	1
	This is my 4/5 message text.	More Details	28 bytes	2015-10-23 01:16:15 GMT-04:00	1
	This is my 5/5 message text.	More Details	28 bytes	2015-10-23 01:16:15 GMT-04:00	2

6) Finally, delete the queue.
Do all of this using either Java, C# or some other AWS API you find convenient.

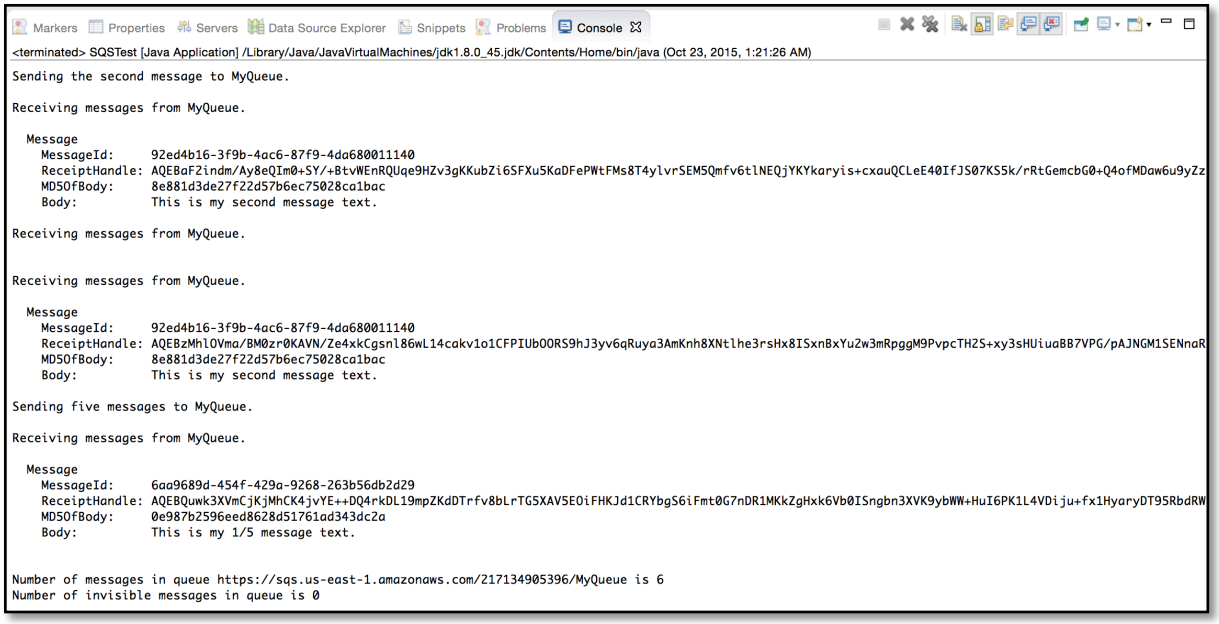
```
// Delete a queue
System.out.println("\nDeleting the test queue.\n");
sqs.deleteQueue(new DeleteQueueRequest(myQueueUrl));
```

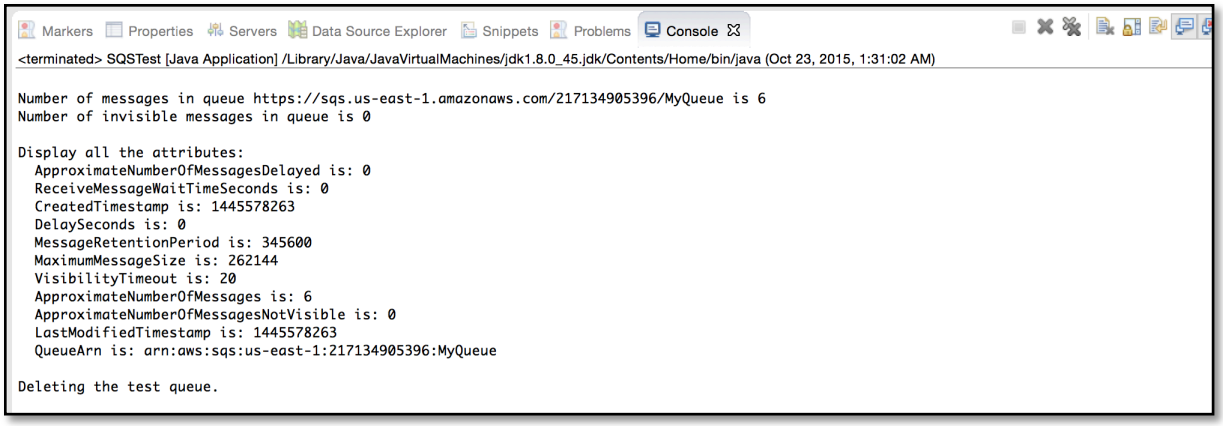
All results from Eclipse console.



Markers | Properties | Servers | Data Source Explorer | Snippets | Problems | Console

```
<terminated> SQSTest [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_45.jdk/Contents/Home/bin/java (Oct 23, 2015, 1:21:26 AM)
===========================================
Getting Started with Amazon SQS
===========================================

Creating a new SQS queue called MyQueue.

Listing all queues in your account.

  QueueUrl: https://sqs.us-east-1.amazonaws.com/217134905396/MyQueue

Sending the first message to MyQueue.

Receiving messages from MyQueue.

  Message
    MessageId:     48e8552e-dfb9-43f6-adbe-80d08104d61c
    ReceiptHandle: AQEBnLtramZYC/xd4u9BXfEyzqTdbTDqNQSx8GB4vQtRA2uTcNykAkMncJFrkRhGuGJ2Whi0Rcv+wIgLQcumSbZo+PAV1ZxIRA17EGHrTed4LMxwU1bHAppo04vbhtlJksfJhxwx2pHKIjSK
    MD5OfBody:     a95fa0a38c44b5459810e97212b0857e
    Body:          This is my first message text.

Receiving messages from MyQueue.


Receiving messages from MyQueue.

  Message
    MessageId:     48e8552e-dfb9-43f6-adbe-80d08104d61c
    ReceiptHandle: AQEB8a53g4a25L6wlo6hKPAD2T4chFUXQdDQ21p5TuIXIkV5k18NN9wrCa0G5T2qv2SFumG84UTcmljFUA3txn4wAlkxUBLkEDr3vjCdqKI8Vh2zm8swXISeXm+A+xMDTP9P/JNtYisaTrUx
    MD5OfBody:     a95fa0a38c44b5459810e97212b0857e
    Body:          This is my first message text.

Deleting a message.
```





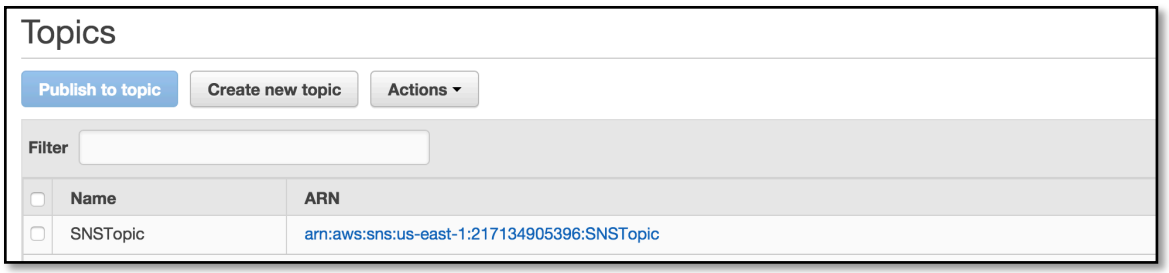
Points: 25

Problem 2)

1) Create an SNS topic.

Use AWS CLI "create-topic". Verify from the AWS console at the same time.

```
hqiu@bos-mpdei>> aws sns create-topic --name SNSTopic
{
    "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic"
}
hqiu@bos-mpdei>> aws sns list-topics
{
    "Topics": [
        {
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic"
        }
    ]
}
```

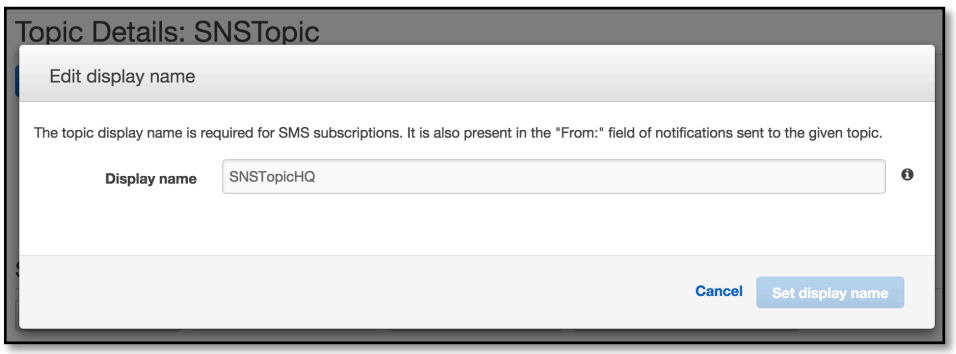


2) Subscribe one of your emails and one of your phones.

To subscribe the phone, we should set the "DisplayName" of the queue in advance.

```
hqiu@bos-mpdei>> aws sns set-topic-attributes --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --at
tribute-name DisplayName --attribute-value SNSTopicHQ
hqiu@bos-mpdei>> aws sns get-topic-attributes --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic
{
    "Attributes": {
        "SubscriptionsConfirmed": "0",
        "DisplayName": "SNSTopicHQ",
        "SubscriptionsDeleted": "0",
        "EffectiveDeliveryPolicy": "{\"http\":{\"defaultHealthyRetryPolicy\":{\"minDelayTarget\":20,\"maxD
elayTarget\":20,\"numRetries\":3,\"numMaxDelayRetries\":0,\"numNoDelayRetries\":0,\"numMinDelayRetries\":0
,\"backoffFunction\":\"linear\"},\"disableSubscriptionOverrides\":false}}",
        "Owner": "217134905396",
        "Policy": "{\"Version\":\"2008-10-17\",\"Id\":\"__default_policy_ID\",\"Statement\":[{\"Sid\":\"__
default_statement_ID\",\"Effect\":\"Allow\",\"Principal\":{\"AWS\":\"*\"},\"Action\":[\"SNS:Subscribe\",\"
SNS:ListSubscriptionsByTopic\",\"SNS:DeleteTopic\",\"SNS:GetTopicAttributes\",\"SNS:Publish\",\"SNS:Remove
Permission\",\"SNS:AddPermission\",\"SNS:Receive\",\"SNS:SetTopicAttributes\"],\"Resource\":\"arn:aws:sns:
us-east-1:217134905396:SNSTopic\",\"Condition\":{\"StringEquals\":{\"AWS:SourceOwner\":\"217134905396\"}}}
]}",
        "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
        "SubscriptionsPending": "0"
    }
}
```

Check from the AWS console. Select SNS service. Navigate to the display name through "Topics->Actions->Edit topic display name".



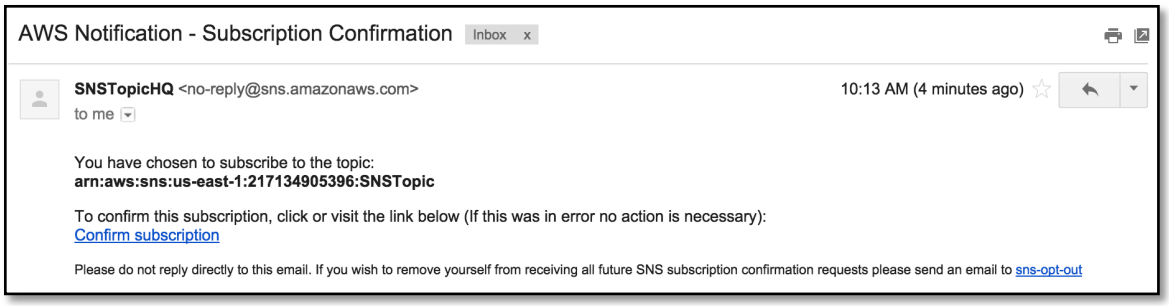
Subscribe email and phone. For mobile phone, the protocol is “sms”. For email, the protocol is “email”.

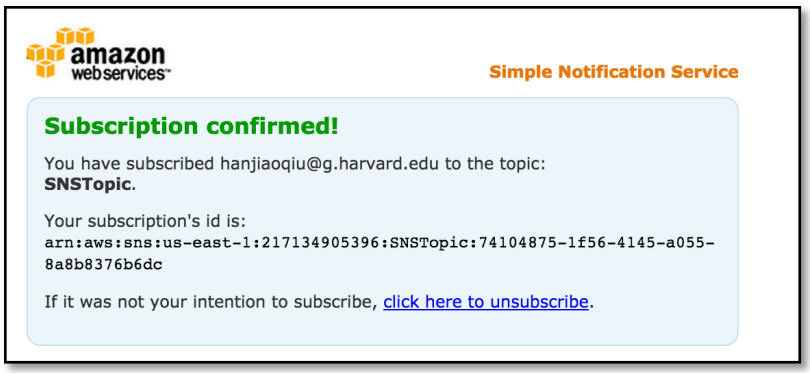
```
hqiu@bos-mpdei>> aws sns set-topic-attributes --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --at
tribute-name DisplayName --attribute-value SNSTopicHQ
hqiu@bos-mpdei>> aws sns subscribe --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --protocol emai
l --notification-endpoint hanjiaoqiu@g.harvard.edu
{
    "SubscriptionArn": "pending confirmation"
}
hqiu@bos-mpdei>> aws sns subscribe --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --protocol emai
l --notification-endpoint qiuhanjiao@gmail.com
{
    "SubscriptionArn": "pending confirmation"
}
hqiu@bos-mpdei>> aws sns subscribe --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --protocol sms
--notification-endpoint 1-617-955-7630
{
    "SubscriptionArn": "pending confirmation"
}
```

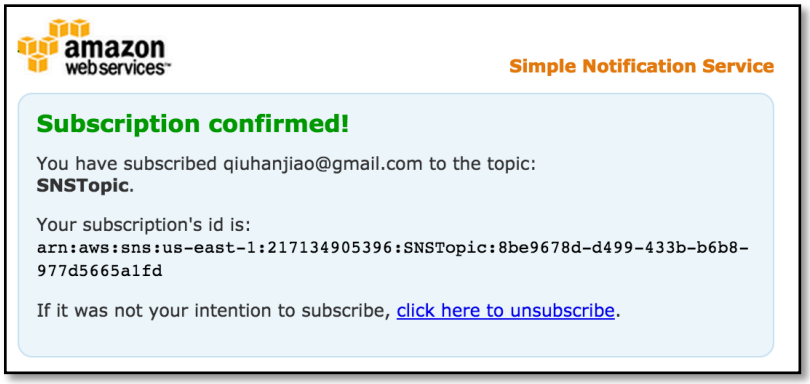
```
hqiu@bos-mpdei>> aws sns list-subscriptions
{
    "Subscriptions": [
        {
            "Owner": "217134905396",
            "Endpoint": "16179557630",
            "Protocol": "sms",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "PendingConfirmation"
        },
        {
            "Owner": "217134905396",
            "Endpoint": "hanjiaoqiu@g.harvard.edu",
            "Protocol": "email",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "PendingConfirmation"
        },
        {
            "Owner": "217134905396",
            "Endpoint": "qiuhanjiao@gmail.com",
            "Protocol": "email",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "PendingConfirmation"
        }
    ]
}
```

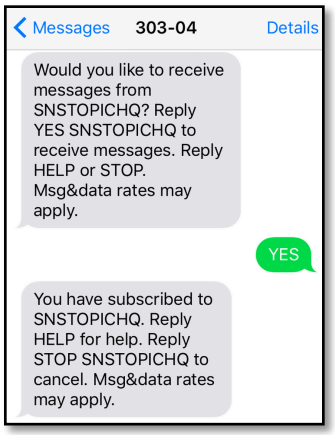
3) Confirm subscription to the topic manually from both the email and the phone.

Go to mailbox, click “confirm subscription”.

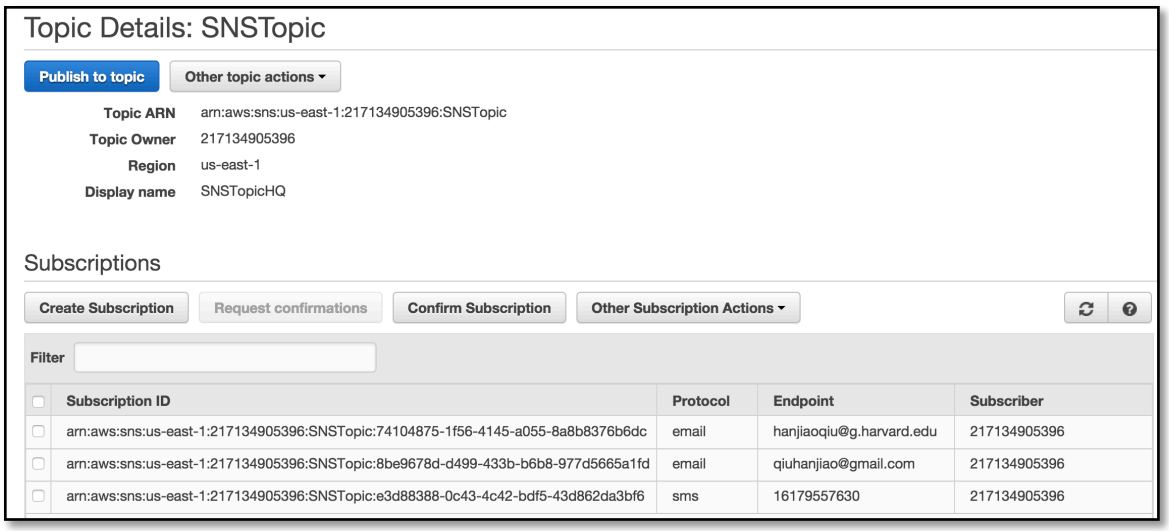








We can also check the subscribers from AWS console. Select "SNS home->Subscriptions". After we confirm the subscription, the subscription ID of each account is showed below. It corresponds to the subscription's ID during the confirmation. For example, the subscription's ID for qiuhanjiao@gmail.com is "arn:aws:sns:us-east-1:217134905396:SNSTopic:8be9678d-d499-433b-b6b8-977d5665a1fd".



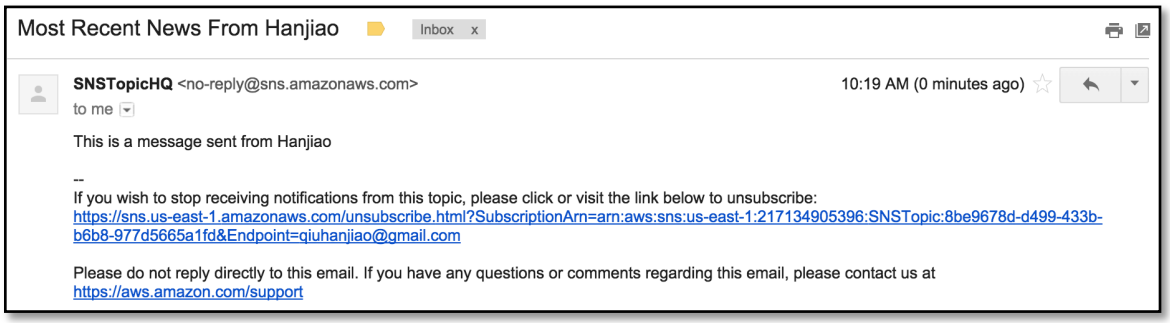
4) Demonstrate that you can send the same message to both media.

Send two messages to all the media, using AWS CLI "aws sns publish".

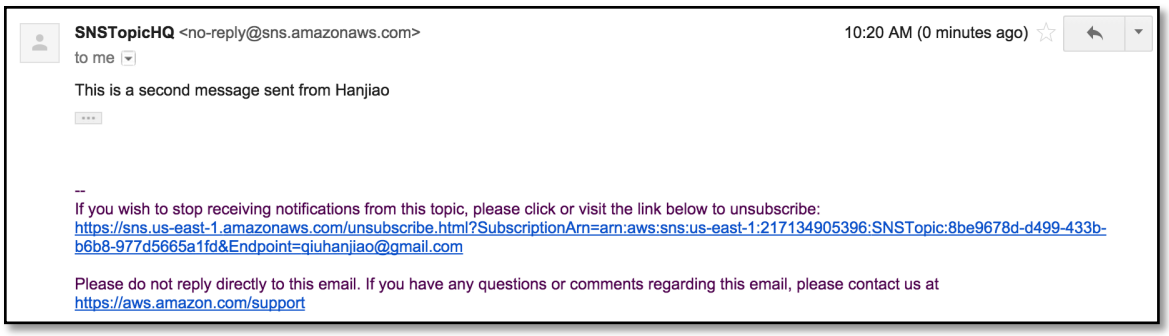
```
hqiu@bos-mpdei>> aws sns publish --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --subject "Most R
ecent News From Hanjiao" --message "This is a message sent from Hanjiao"
{
    "MessageId": "d00da64f-e098-5838-9cc6-e8eba4d607ca"
}
hqiu@bos-mpdei>> aws sns publish --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic --subject "Most R
ecent News From Hanjiao" --message "This is a second message sent from Hanjiao"
{
    "MessageId": "3fee6571-07c9-57d4-9de9-2bd543ba4fc4"
}
```

5) Capture your actions on the email side.

Get the first message "This is a message sent from Hanjiao".



Get the second message "This is a second message sent from Hanjiao".

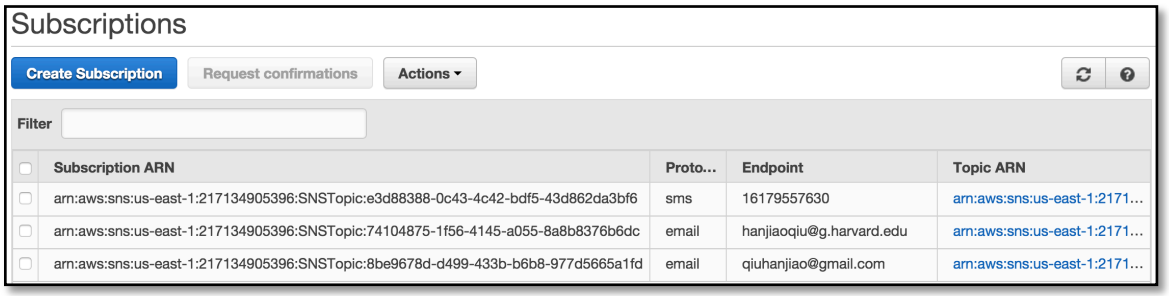


6) Capture all subscription arn-s and all message arn-s.

List all subscriptions.

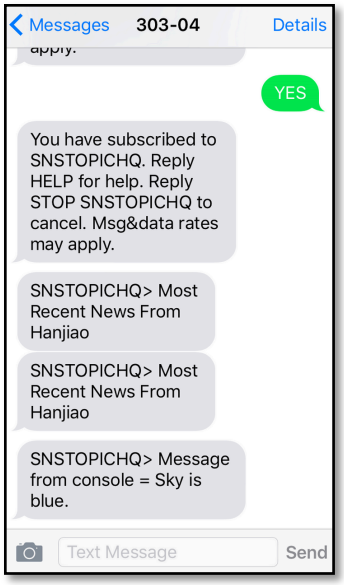
```
hqiu@bos-mpdei>> aws sns list-subscriptions
{
    "Subscriptions": [
        {
            "Owner": "217134905396",
            "Endpoint": "16179557630",
            "Protocol": "sms",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic:e3d88388-0c43-4c42-bdf5-43d862
da3bf6"
        },
        {
            "Owner": "217134905396",
            "Endpoint": "hanjiaoqiu@g.harvard.edu",
            "Protocol": "email",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic:74104875-1f56-4145-a055-8a8b83
76b6dc"
        },
        {
            "Owner": "217134905396",
            "Endpoint": "qiuhanjiao@gmail.com",
            "Protocol": "email",
            "TopicArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic",
            "SubscriptionArn": "arn:aws:sns:us-east-1:217134905396:SNSTopic:8be9678d-d499-433b-b6b8-977d56
65a1fd"
        }
    ]
}
```

Check from AWS console.



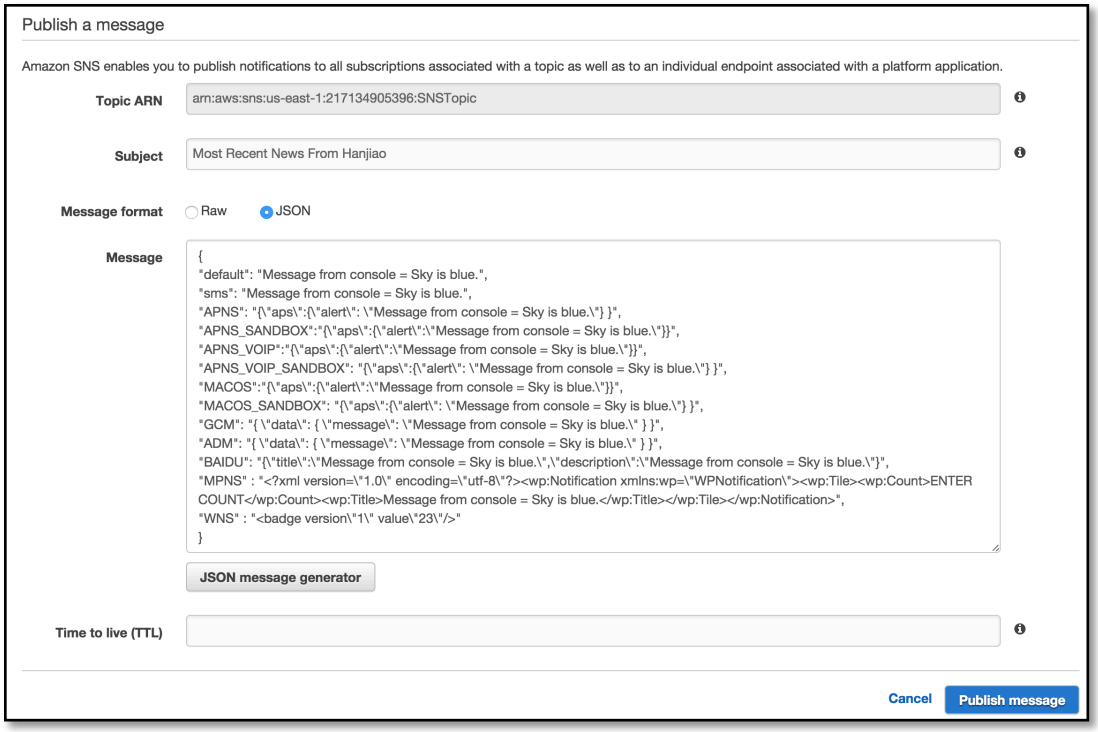
7) [Optional] if you can, take a picture of your SMS message on your phone – or forward it to your email and demo it that way.
Please, perform all tasks using AWS CLI. Only if AWS CLI really could not do the work (you must explain) you are allowed to use the AWS Management Console.

Get the message from mobile phone.



In the above graph, the first two messages only show the subject name. They haven't shown the content. The last message shows the content. I get it from the AWS console following the steps below. The message has to be the JSON format.

Select the topic, click on "Publish to topic". Enter the subject name, then click on "JSON" message generator. Only select "SMS" like below. Click "Generate JSON" after finish.



Publish the message, we will receive the content on our phone.

Unsubscribe the email and phone.

```
hqiu@bos-mpdei>> aws sns unsubscribe --subscription-arn arn:aws:sns:us-east-1:217134905396:SNSTopic:e3d883
88-0c43-4c42-bdf5-43d862da3bf6
hqiu@bos-mpdei>> aws sns unsubscribe --subscription-arn arn:aws:sns:us-east-1:217134905396:SNSTopic:741048
75-1f56-4145-a055-8a8b8376b6dc
hqiu@bos-mpdei>> aws sns unsubscribe --subscription-arn arn:aws:sns:us-east-1:217134905396:SNSTopic:8be967
8d-d499-433b-b6b8-977d5665a1fd
```

Delete the topic.

```
hqiu@bos-mpdei>> aws sns delete-topic --topic-arn arn:aws:sns:us-east-1:217134905396:SNSTopic
```

Points: 15

Problem 3)

Do the same work as in Problem 2, but use Java/C# or any other programming language supported by SNS this time.
Attached files: CreateTopic.java and Publish.java have practically all elements you need.
Source code: CreateTopic.java, Publish.java, OptIn.java.

```
public static void main(String[] args) throws Exception {
    AWSCredentials credentials = null;
    try {
        credentials = new ProfileCredentialsProvider("default").getCredentials();
    } catch (Exception e) {
        throw new AmazonClientException(
                "Cannot load the credentials from the credential profiles file. " +
                        "Please make sure that your credentials file is at the correct " +
                        "location (/Users/hqiu/.aws/credentials), and is in valid format.",
                        e);
    }
```

1) Create a "SNS Topic" named "MyTopicHQ". Get the "Topic Arn".

```
AmazonSNS sns = new AmazonSNSClient(credentials);
try {
    // Create a Topic
    System.out.println("Creating MyTopicHQ.\n");
    CreateTopicRequest createTopicRequest = new CreateTopicRequest().withName("MyTopicHQ");

    // Retrieve Amazon Resource Name
    String myTopicArn = sns.createTopic(createTopicRequest).getTopicArn();
    System.out.println("Topic created: " + myTopicArn);

    Thread.sleep(1000);
    // List Topics
    System.out.println("List topics: ");
    for (Topic topic : sns.listTopics().getTopics()) {
        System.out.println(" TopicArn: " + topic.getTopicArn());
    }
```

2) Subscribe the emails and phones.

```
// Set Topic Name for subscribing my phone
String topicName = "TopicHQ";
System.out.println("\nSet topic name: " + topicName + "\n");
SetTopicName(sns, myTopicArn, topicName);

// Subscribe my email and phone to MyTopicHQ
subscribeEmail(sns, myTopicArn, "hanjiaoqiu@g.harvard.edu");
subscribeEmail(sns, myTopicArn, "qiuhanjiao@gmail.com");
subscribePhone(sns, myTopicArn, "1-617-955-7630");
```

Set the "DisplayName" needed by subscribing phones.

```
private static void SetTopicName(AmazonSNS sns, String myTopicArn, String topicName) {
    SetTopicAttributesRequest setTARequest = new SetTopicAttributesRequest().withTopicArn(myTopicArn);
    setTARequest.withAttributeName("DisplayName").setAttributeValue(topicName);
    sns.setTopicAttributes(setTARequest);
}
```

The protocol to subscribe emails is "email". The protocol to subscribe phone is "sms".

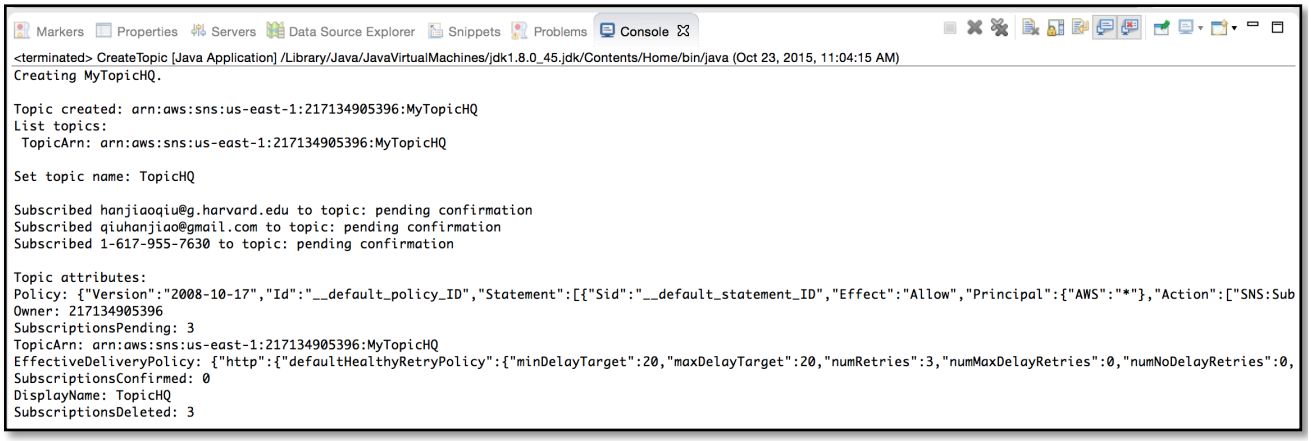
```
private static void subscribeEmail(AmazonSNS sns, String myTopicArn, String email) {
    SubscribeRequest subReq = new SubscribeRequest(myTopicArn, "email", email);
    SubscribeResult subRes = sns.subscribe(subReq);
    String subscribedTopicArn = subRes.getSubscriptionArn();
    System.out.println("Subscribed " + email + " to topic: " + subscribedTopicArn);
}

private static void subscribePhone(AmazonSNS sns, String myTopicArn, String phone) {
    SubscribeRequest subReq = new SubscribeRequest(myTopicArn, "sms", phone);
    SubscribeResult subRes = sns.subscribe(subReq);
    String subscribedTopicArn = subRes.getSubscriptionArn();
    System.out.println("Subscribed " + phone + " to topic: " + subscribedTopicArn);
}
```

Display all the attributes of the SNS Topic.

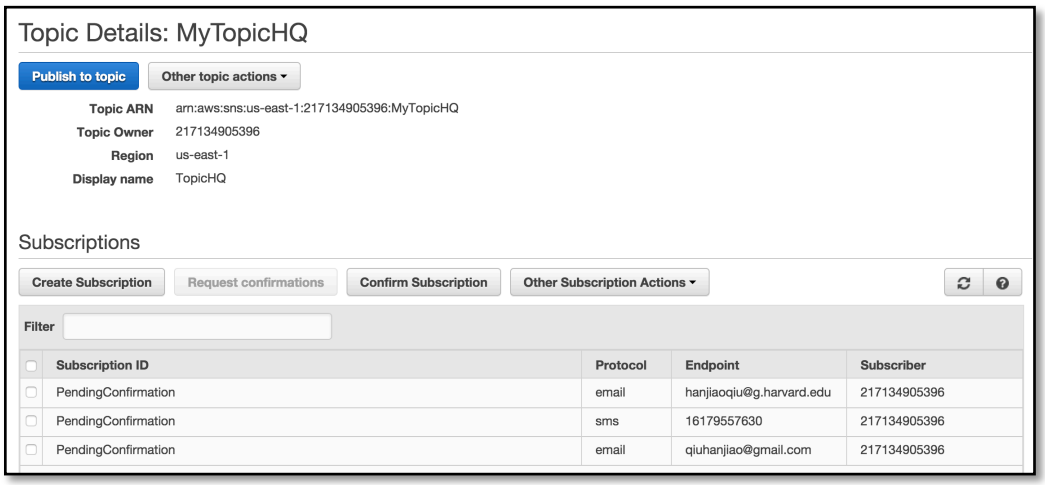
```
// Fetch Topic attributes
System.out.println("\nTopic attributes: ");
fetchAttr(sns, myTopicArn);
```

```
private static void fetchAttr(AmazonSNS sns, String myTopicArn) {
    GetTopicAttributesRequest getTARequest = new GetTopicAttributesRequest().withTopicArn(myTopicArn);
    GetTopicAttributesResult getTAResult = sns.getTopicAttributes(getTARequest);
    Map<String, String> attributes = new HashMap<String, String>();
    attributes = getTAResult.getAttributes();
    for (String key : attributes.keySet()) {
        System.out.println(key + ": " + attributes.get(key));
    }
}
```

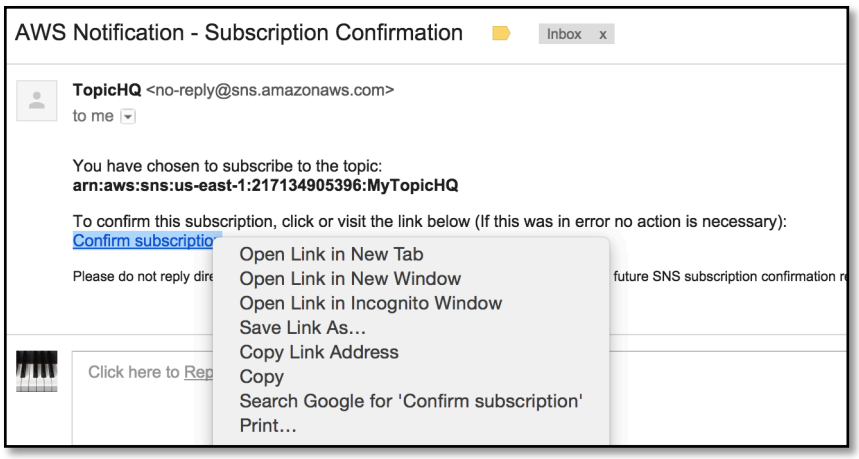
The results from Eclipse console. We have three pending subscriptions. And it also shows we've unsubscribed three users in previous step.



Check from the AWS console.



3) Confirm subscription. Get the token from the confirmation email. Right click the "Confirm subscription", choose "Copy Link Address". Then we will get a string. Copy the "tokenID" field out and paste that into our code.

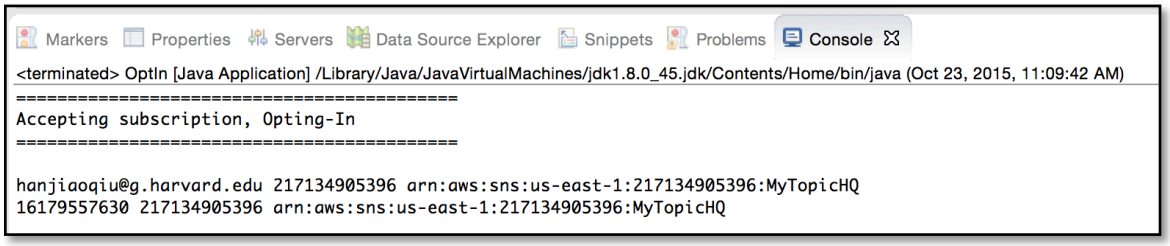


Confirm the subscription.

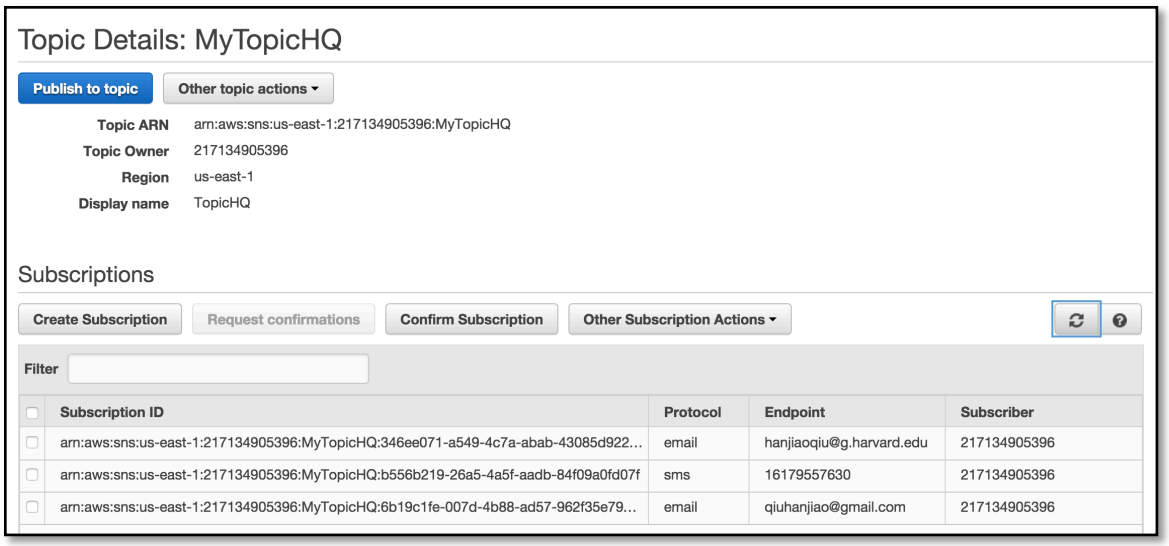
```
try {
    String topicArn = "arn:aws:sns:us-east-1:217134905396:MyTopicHQ";
    // Endpoint=qiuhanjiao@gmail.com
    String token = "2336412f37fb687f5d51e6e241d7700bdeeb300d6040051d539adc048f86c09b33fe3d34f6ce360db1f7390c59c4481fe1db4cde12e

    // Endpoint=hanjiaoqiu@g.harvard.edu
    // String token = "2336412f37fb687f5d51e6e241d7700bdeeb300d6040041e70e47fd455e1b00a6bf96ce9758e95ecfa10f1a59287405fc855880
    ConfirmSubscriptionResult conSubRes = sns.confirmSubscription(
            new ConfirmSubscriptionRequest(topicArn, token));
    String subscribedTopicArn = conSubRes.getSubscriptionArn();
```

```
// List Topic subscriptions
ListSubscriptionsResult listSubResult = sns.listSubscriptions();
List<Subscription> subscriptions = listSubResult.getSubscriptions();
for (Subscription sub : subscriptions) {
    System.out.println(sub.getEndpoint() + " " + sub.getOwner() +
            " " + sub.getTopicArn());
}
```

Results from Eclipse console.

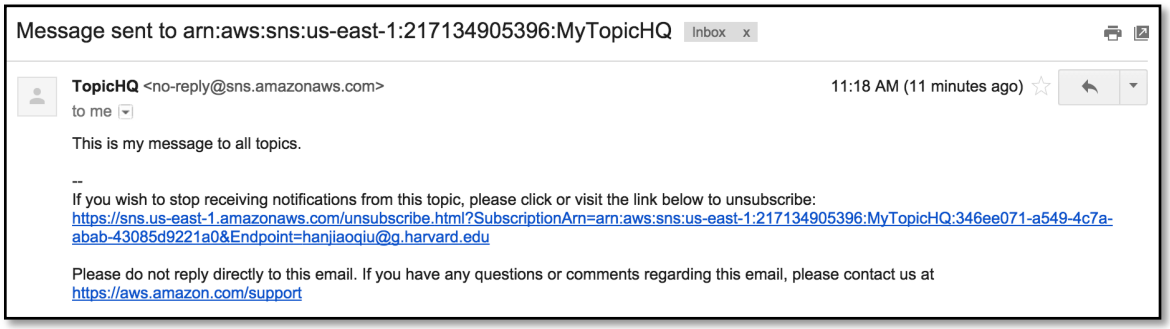


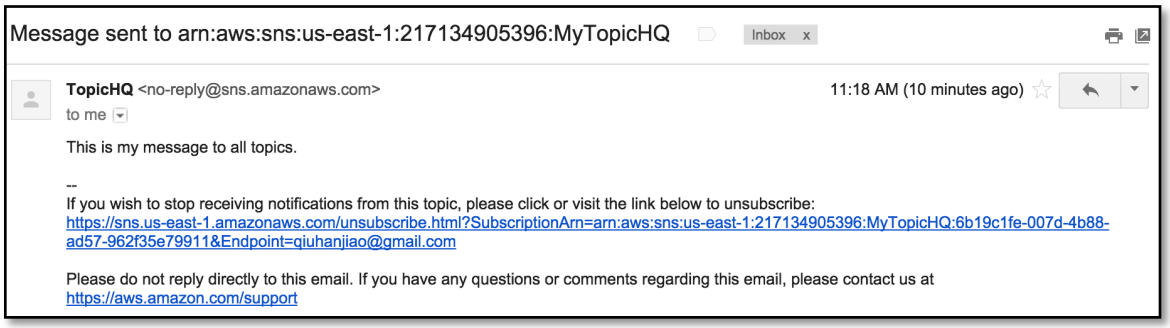
Check from the AWS console. I confirm my phone through replying the text message instead of using the Java program. We get all three accounts subscribed here.

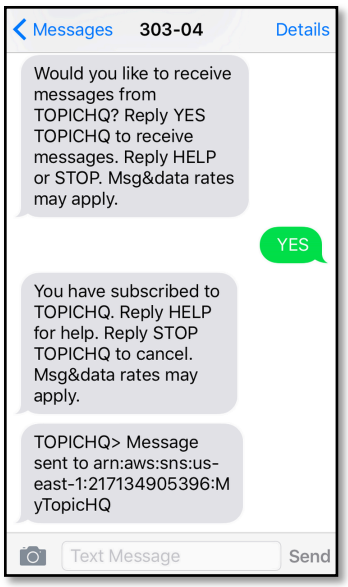


4) Publish messages to all subscriptions. Capture the actions on both email and phone side.

```
for (Topic topic : topicList) {
    String myTopicArn = topic.getTopicArn();
    sns.publish(new PublishRequest()
            .withTopicArn(myTopicArn)
            .withMessage("This is my message to all topics.")
            .withSubject("Message sent to " + myTopicArn));
}
```





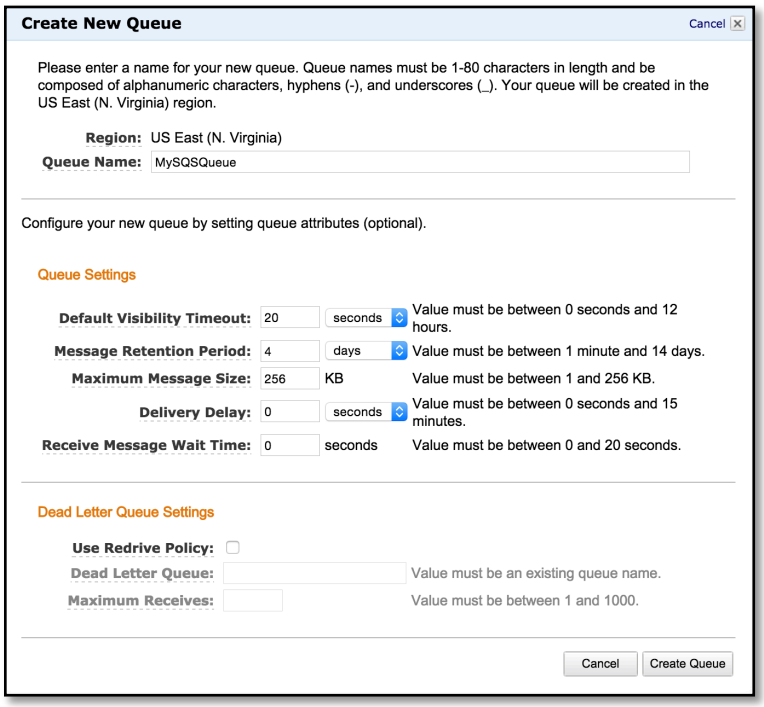


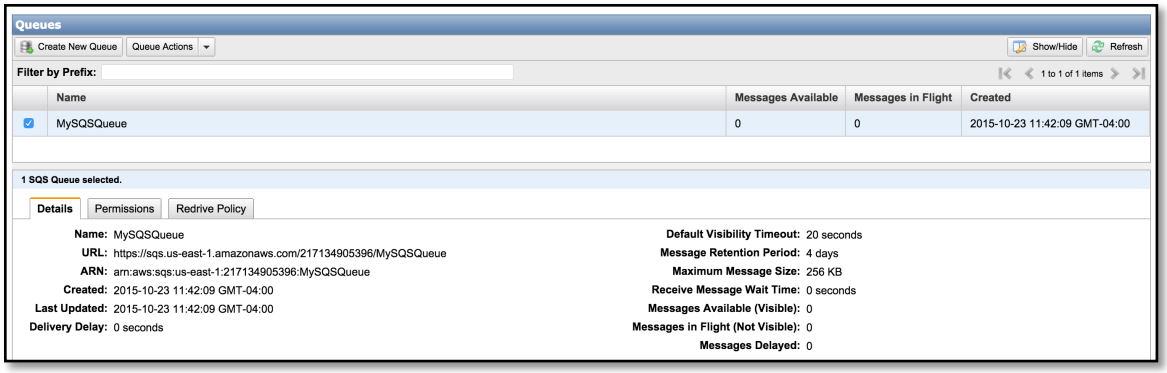
Points: 20

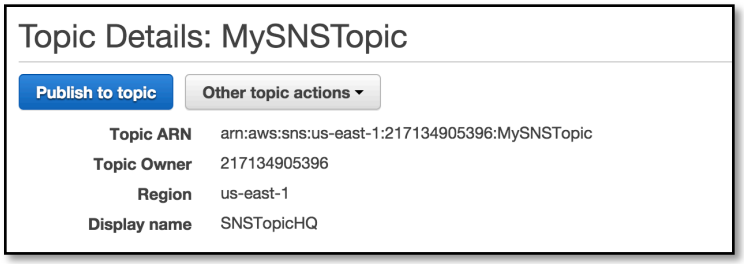
Problem 4)

Demonstrate that you can send a message from an SNS Topic to an SQS queue using SNS and SQS Consoles. Please note that you will have to "Subscribe" SQS Queue to an SNS Topic on both sides, the Topic side and Queue side. In other words, on the side of SQS Console you do not confirm subscription the way you did it when the protocol was email, but rather "Subscribe to the Topic". Capture all relevant screen shots.

1) Create the SQS queue and SNS topic. Get the ARN of the queue and the topic.



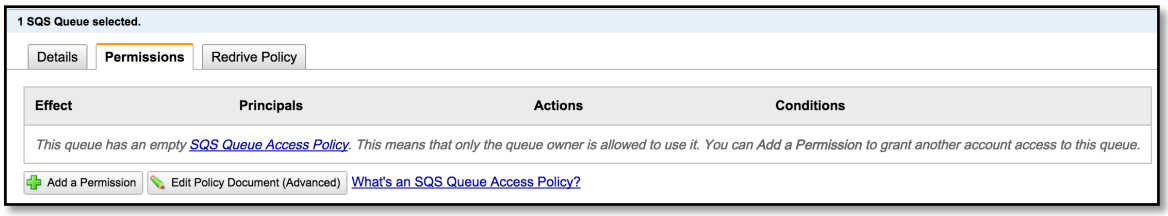




MySQSQueue: arn:aws:sqs:us-east-1:217134905396:MySQSQueue
MySNSTopic: arn:aws:sns:us-east-1:217134905396:MySNSTopic

2) Give permission to Amazon SNS topic to send messages to the Amazon SQS queue.

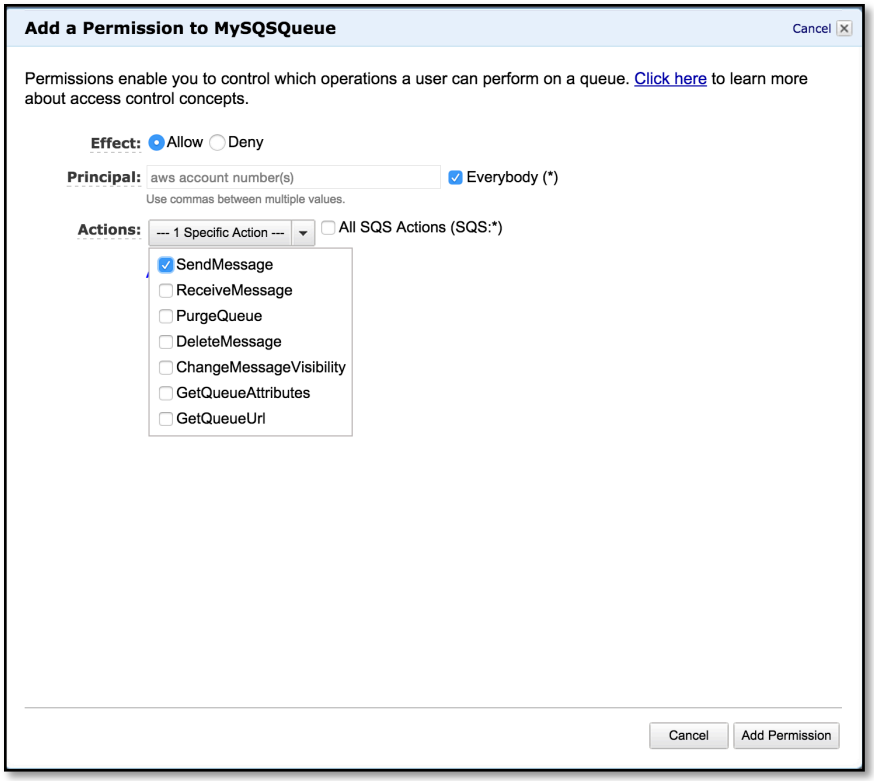
First set a SendMessage policy on a queue. Select the box for the queue "MySQSQueue", click the "Permissions" tab, and then click "Add a Permission."

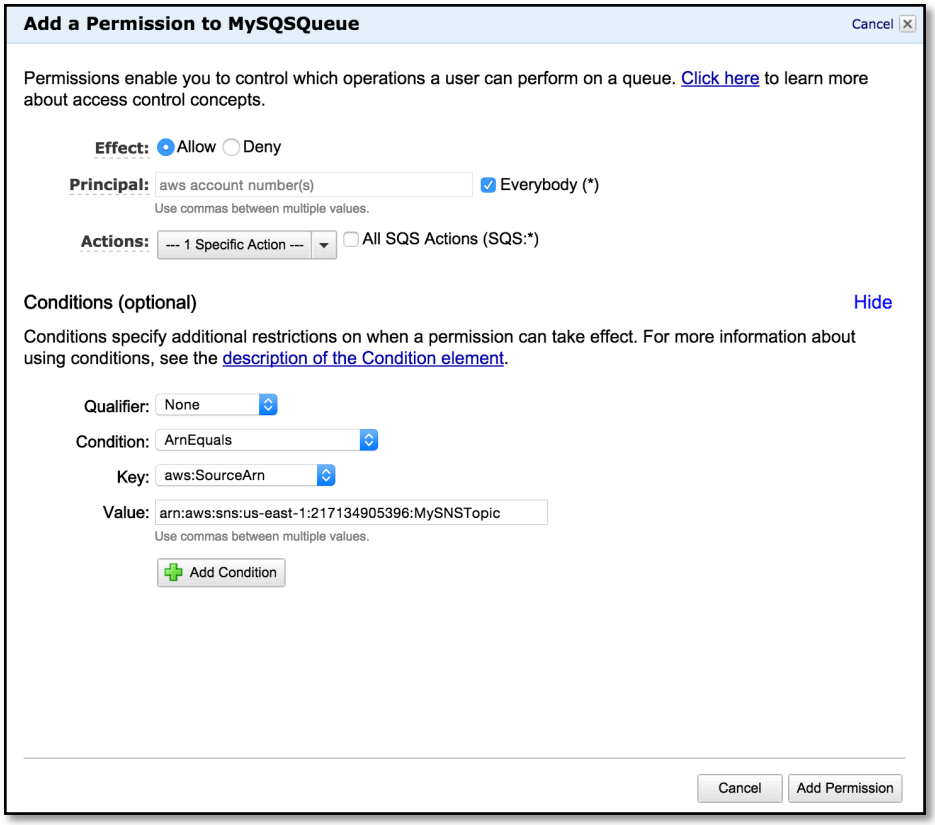


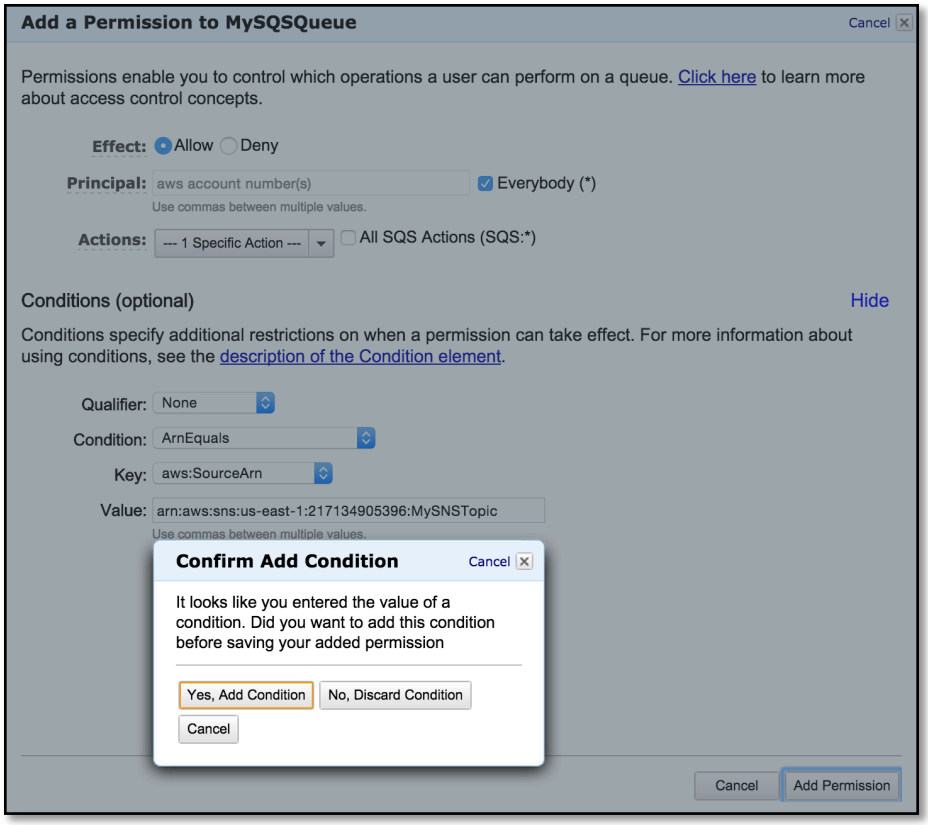
In the "Add a Permission" dialog box, select "Allow" for Effect, select Everybody (*) for Principal, and then select "SendMessage" from the "Actions" drop-down.

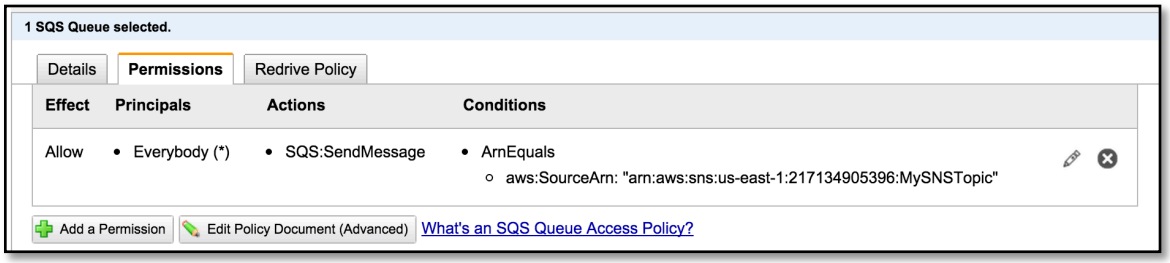
Add a condition that allows the action for the topic. Click "Add Conditions (optional)", select "ArnEquals" for Condition, select "aws:SourceArn" for Key, and paste in the SNS topic ARN for Value. Click "Yes. Add Condition". The new condition should appear at the bottom of the box.

Click Add Permission.


Add a Permission to MySQSQueue
Cancel
Permissions enable you to control which operations a user can perform on a queue. Click here to learn more about access control concepts.
Effect: Allow Deny
Principal: aws account number(s) Everybody (*)
Use commas between multiple values.
Actions: --- 1 Specific Action --- All SQS Actions (SQS:*)
SendMessage
ReceiveMessage
PurgeQueue
DeleteMessage
ChangeMessageVisibility
GetQueueAttributes
GetQueueUrl
Cancel
Add Permission


Add a Permission to MySQSQueue
Cancel
Permissions enable you to control which operations a user can perform on a queue. Click here to learn more about access control concepts.
Effect: Allow Deny
Principal: aws account number(s) Everybody (*)
Use commas between multiple values.
Actions: --- 1 Specific Action --- All SQS Actions (SQS:*)
Conditions (optional)
Hide
Conditions specify additional restrictions on when a permission can take effect. For more information about using conditions, see the description of the Condition element.
Qualifier: None
Condition: ArnEquals
Key: aws:SourceArn
Value: arn:aws:sns:us-east-1:217134905396:MySNSTopic
Use commas between multiple values.
Add Condition
Cancel
Add Permission

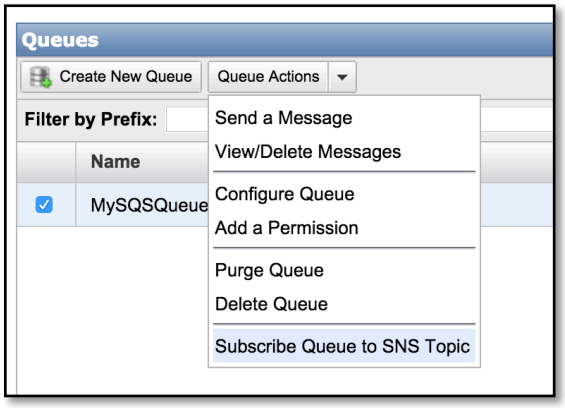


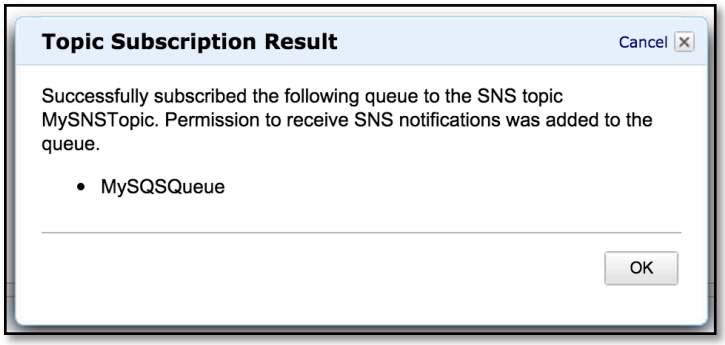


3) Subscribe the queue to the Amazon SNS topic. In the navigate pane, select the topic. Click “Create Subscription”.

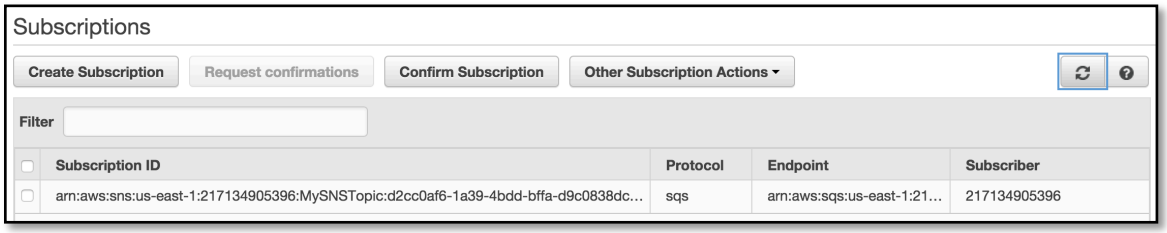
Select "Amazon SQS" for Protocol, paste in the ARN for MySQSQueue.

On MySQSQueue side, Select "Subscribe Queue to SNS Topic" from the Queue Actions drop-down list.



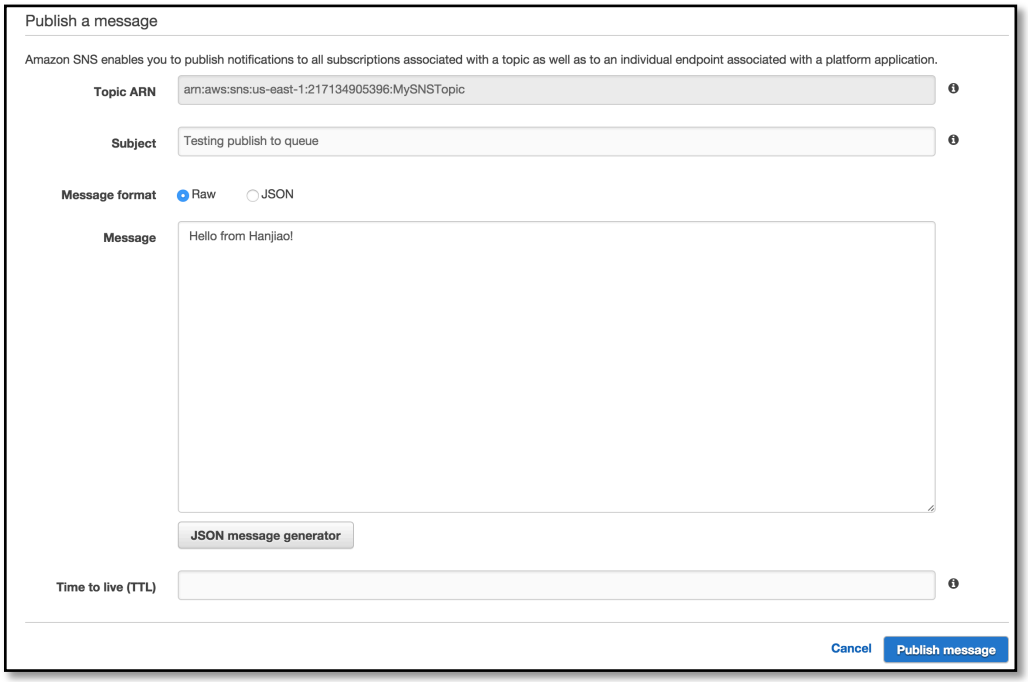


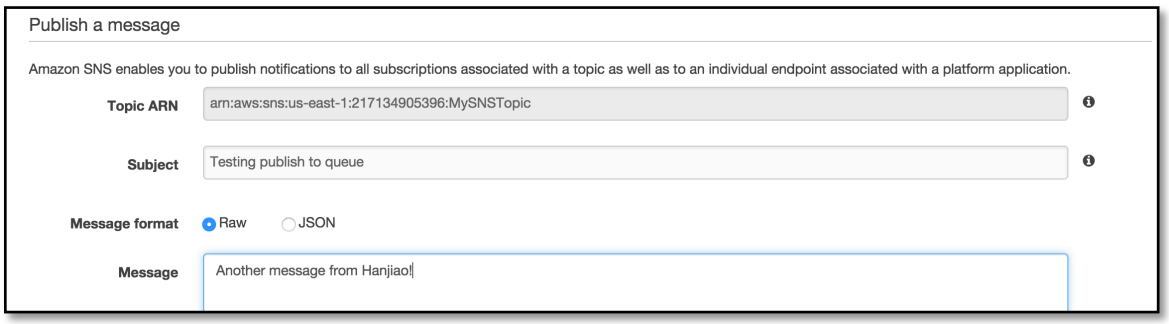
The subscription ID appears in the "Subscriptions" list of MySNSTopic.



4) Publish to a topic using the Amazon SNS console. In the navigation pane, select the topic and click "Publish to Topic".

In the Subject box, enter a subject (for example, Testing publish to queue) in the Message box, enter some text (for example, Hello from Hanjiao!), and click "Publish Message". Publish another message "Another message from Hanjiao".

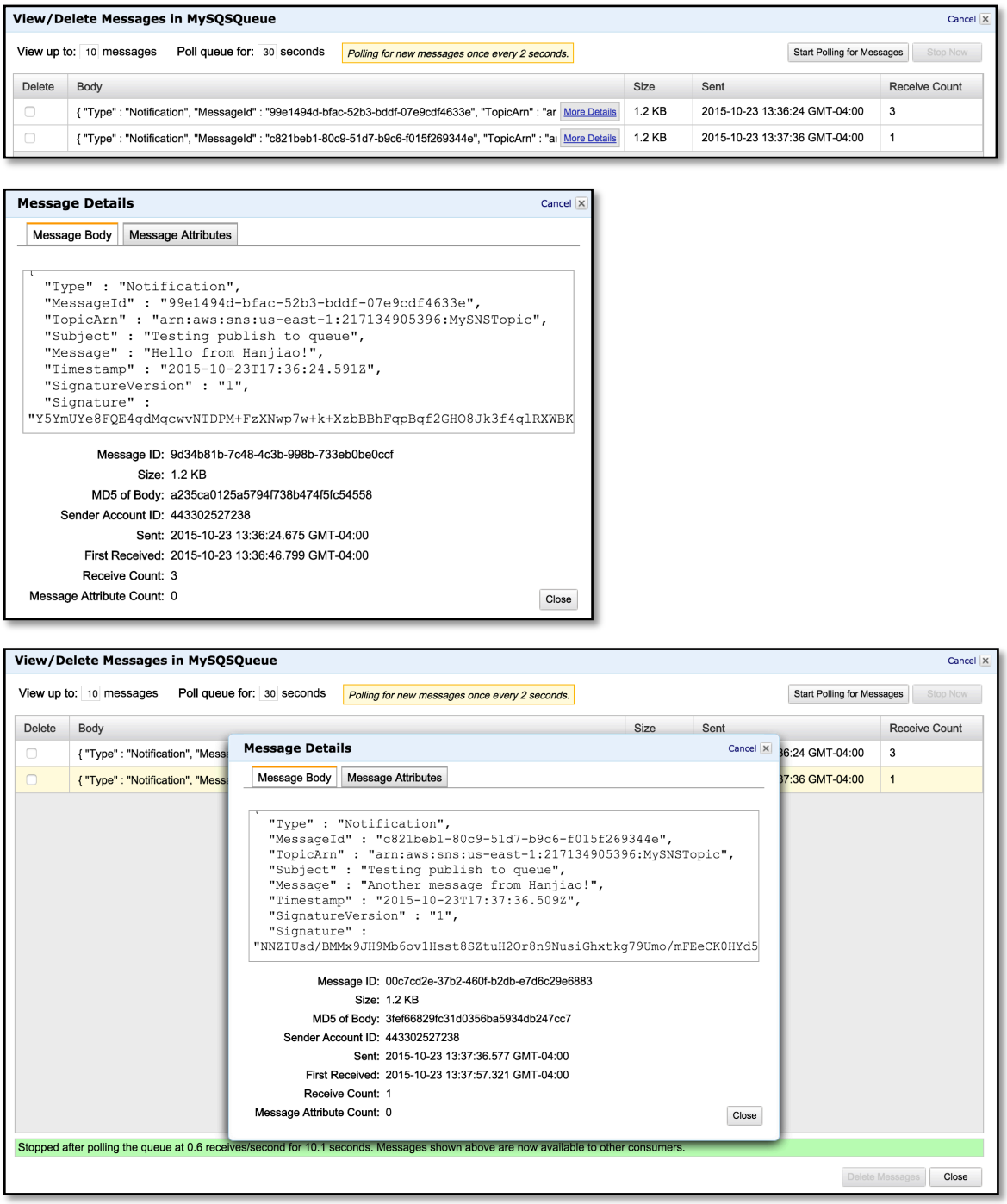




5) View the message from the topic using the Amazon SQS console.

From the "Queue Action" drop-down, select "View/Delete Messages" and click "Start Polling for Messages". Two messages appear in the box. In the "Body"

column, click “More Details”. The Message Details box contains a JSON document that contains the subject and message.



Points: 15

Problem 5)

Implement above task programmatically using Java, C# or any other AWS SNS supported language. This problem might require some literature (Internet) searching.

Java source code file: SNSToSQS.java

1) Create a SQS instance and a SNS Topic instance.

```
AmazonSQS sqs = new AmazonSQSClient(credentials);
AmazonSNS sns = new AmazonSNSClient(credentials);
```

Get the QueueArn and TopicArn. The QueueArn can be get from the queue attributes.

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

// Retrieve SQS Amazon Resource Name
GetQueueAttributesRequest getQARequest = new GetQueueAttributesRequest().withQueueUrl(myQueueUrl);
GetQueueAttributesResult getQAResult =  sqs.getQueueAttributes(getQARequest.withAttributeNames("QueueArn"));
Map <String,String> attributeMap = getQAResult.getAttributes();
String myQueueArn = attributeMap.get("QueueArn");
System.out.println("Queue created: " + myQueueArn);
```

```
// Create a SNS Topic
System.out.println("Creating HqiuSNSTopic.\n");
CreateTopicRequest createTopicRequest = new CreateTopicRequest().withName("HqiuSNSTopic");

// Retrieve SNS Amazon Resource Name
String myTopicArn = sns.createTopic(createTopicRequest).getTopicArn();
System.out.println("Topic created: " + myTopicArn);
```

2) Subscribe the SQS queue to the SNS Topic. There are two different ways to do this.

The first method is to use the “Topics” class. It provides the method “subscribeQueue()” to do the subscription in only one step. The second method is like problem 2, which invokes “subscribe()” method of “sns client” class. The protocol type is “sqs”. Both the methods work.

```
// Subscribe SQS queue to SNS topic on both sides
// Method 1:
Topics.subscribeQueue(sns, sqs, myTopicArn, myQueueUrl);

// Method 2:
// Send subscribe request
// SubscribeRequest subReq = new SubscribeRequest(myTopicArn, "sqs", myQueueArn);
// SubscribeResult subRes = sns.subscribe(subReq);

System.out.println("\nSubscribed " + myQueueArn + " to topic: " + myTopicArn + "\n");
```

3) Set policy on both topic (to allow subscriptions) and queue (to allow messages to be published to it).

```
// Set policy on topic to allow open subscriptions
Policy snsPolicy = new Policy().withStatements(
        new Statement(Effect.Allow)
        .withPrincipals(Principal.AllUsers)
        .withActions(SNSActions.Subscribe));
sns.setTopicAttributes(new SetTopicAttributesRequest(myTopicArn, "Policy", snsPolicy.toJson()));

// Set the queue policy to allow SNS to publish messages
Policy sqsPolicy = new Policy().withStatements(
        new Statement(Effect.Allow)
        .withPrincipals(Principal.AllUsers)
        .withResources(new Resource(myQueueArn))
        .withActions(SQSActions.SendMessage)
        .withConditions(ConditionFactory.newSourceArnCondition(myTopicArn)));

HashMap<String, String> queueAttributes = new HashMap<String, String>();
queueAttributes.put("Policy", sqsPolicy.toJson());
sqs.setQueueAttributes(new SetQueueAttributesRequest(myQueueUrl,queueAttributes));
```

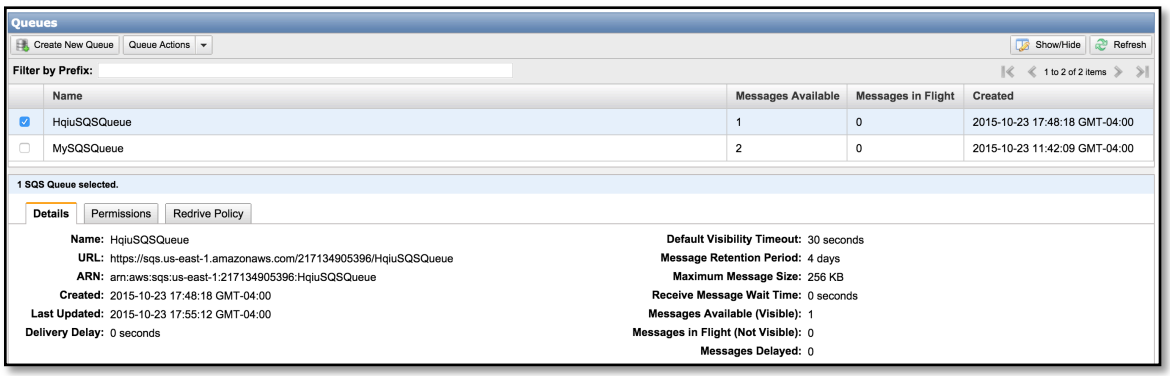
4) Public messages to SNS topic. Check the message in the SQS.

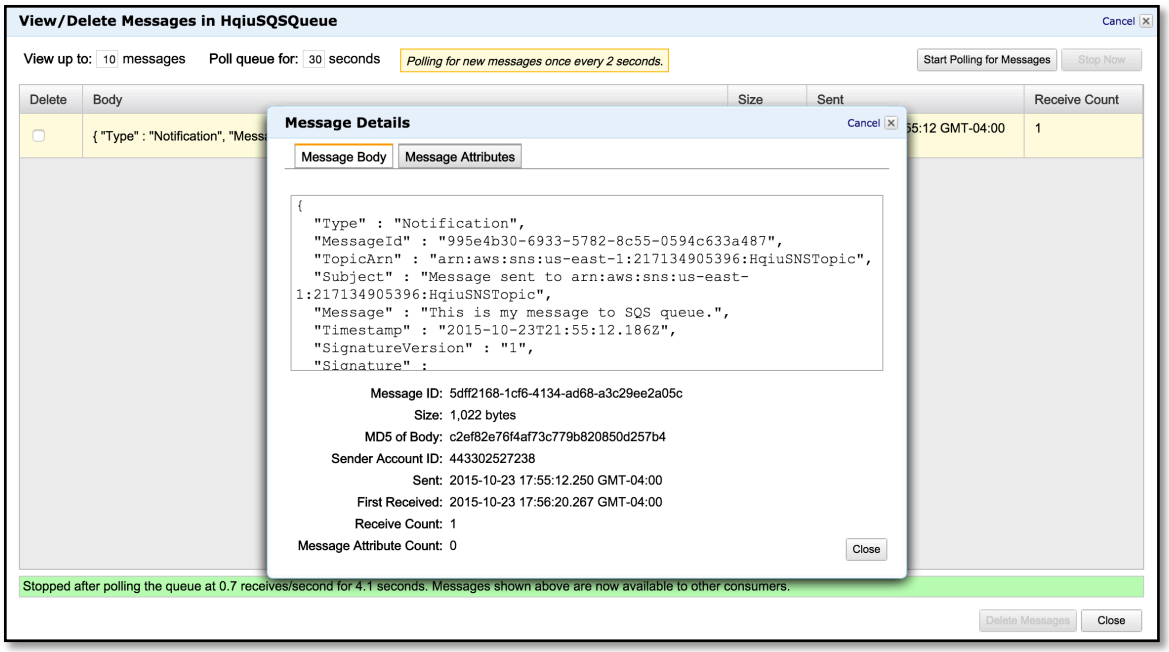
```
// Public message from SNS Topic to SQS queue
sns.publish(new PublishRequest()
        .withTopicArn(myTopicArn)
        .withMessage("This is my message to SQS queue.")
        .withSubject("Message sent to " + myTopicArn));
```

```
// Receive messages from SQS queue
List<Message> messages = receiveMessage(sqs, myQueueUrl);
```

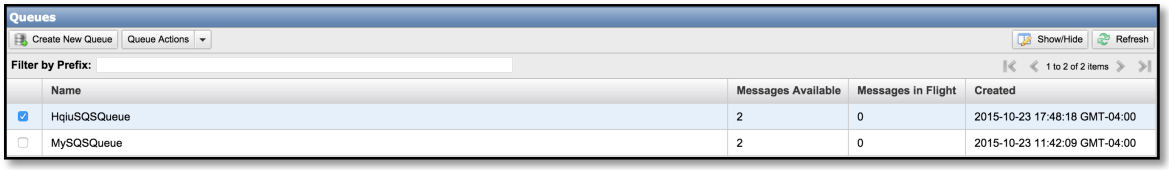
```
private static List<Message> receiveMessage(AmazonSQS sqs, String myQueueUrl) {

    System.out.println("\nReceiving messages from MyQueue.\n");
    ReceiveMessageRequest receiveMessageRequest = new ReceiveMessageRequest(myQueueUrl);
    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();

    return messages;
}
```

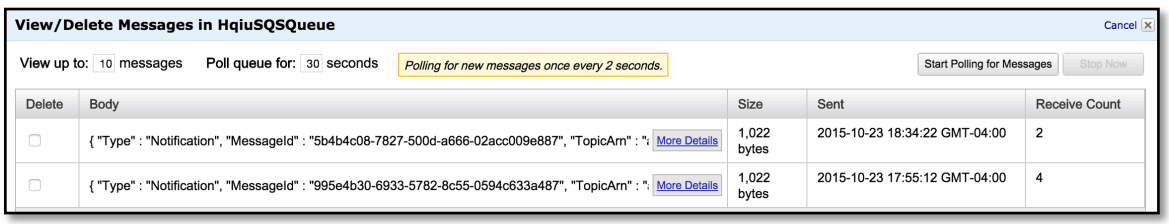
Check from AWS SNS and SQS console. HqiuSQSQueue has subcribed HqiuSNSTopic. I first use method 1 to do the subscription and send one message.



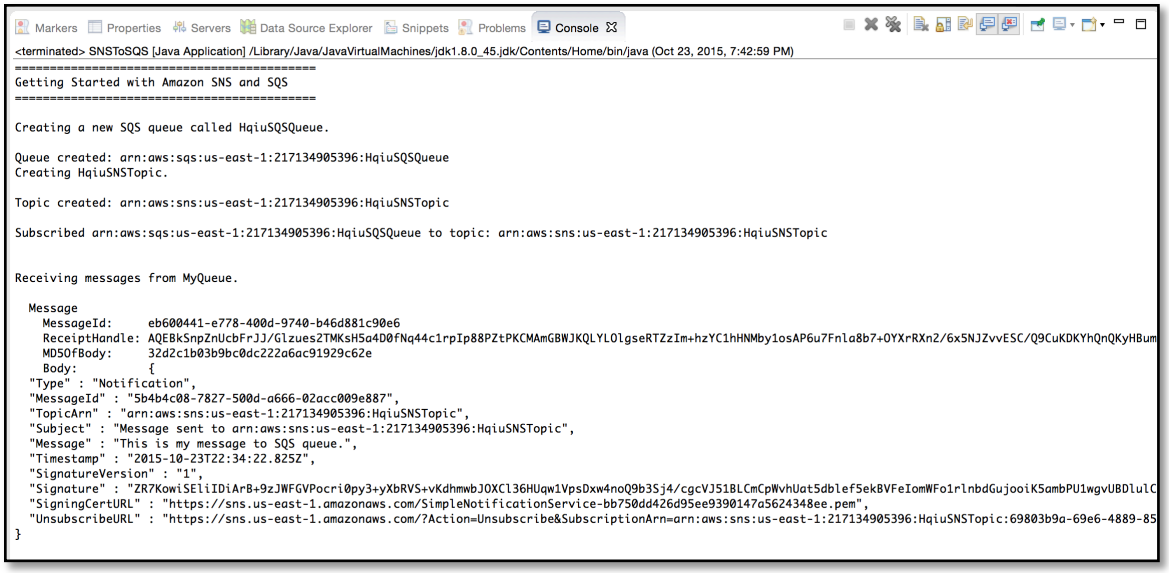


We can get the message “This is my message to SQS queue” from HqiuSQSQueue. Then I unsubscribe HqiuSQSQueue and redo the subscription through Method 2. I send the message again. The HqiuSQSQueue successfully get the message.





Results from Eclipse console.


Markers
Properties
Servers
Data Source Explorer
Snippets
Problems
Console
<terminated> SNSToSQS [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_45.jdk/Contents/Home/bin/java (Oct 23, 2015, 7:42:59 PM)
==========
Getting Started with Amazon SNS and SQS
==========
Creating a new SQS queue called HqiuSQSQueue.
Queue created: arn:aws:sqs:us-east-1:217134905396:HqiuSQSQueue
Creating HqiuSNSTopic.
Topic created: arn:aws:sns:us-east-1:217134905396:HqiuSNSTopic
Subscribed arn:aws:sqs:us-east-1:217134905396:HqiuSQSQueue to topic: arn:aws:sns:us-east-1:217134905396:HqiuSNSTopic
Receiving messages from MyQueue.
Message
MessageId: eb600441-e778-400d-9740-b46d881c90e6
ReceiptHandle: AQEBkSnpZnUcbFrJJ/Glzues2TMKsH5a4D0fNq44c1rpIp88PZtPKCMAmGBWJKQLYLOlgseRTZzIm+hzYC1hHNMby1osAP6u7Fnla8b7+OYXrRXn2/6x5NJZvvESC/Q9CuKDKYhQnQKyHBum
MD5OfBody: 32d2c1b03b9bc0dc222a6ac91929c62e
Body: {
"Type" : "Notification",
"MessageId" : "5b4b4c08-7827-500d-a666-02acc009e887",
"TopicArn" : "arn:aws:sns:us-east-1:217134905396:HqiuSNSTopic",
"Subject" : "Message sent to arn:aws:sns:us-east-1:217134905396:HqiuSNSTopic",
"Message" : "This is my message to SQS queue.",
"Timestamp" : "2015-10-23T22:34:22.825Z",
"SignatureVersion" : "1",
"Signature" : "ZR7KowiSEliIDiArB+9zJWFGVPocri0py3+yXbRVS+vKdhmwbJOXCl36HUqw1VpsDxw4noQ9b3Sj4/cgcVJ51BLCmCpWvhUat5dblef5ekBVFeIomWFo1rlnbdGujooiK5ambPU1wgvUBDlulC
"SigningCertURL" : "https://sns.us-east-1.amazonaws.com/SimpleNotificationService-bb750dd426d95ee9390147a5624348ee.pem",
"UnsubscribeURL" : "https://sns.us-east-1.amazonaws.com/?Action=Unsubscribe&SubscriptionArn=arn:aws:sns:us-east-1:217134905396:HqiuSNSTopic:69803b9a-69e6-4889-85
}

Points: 25