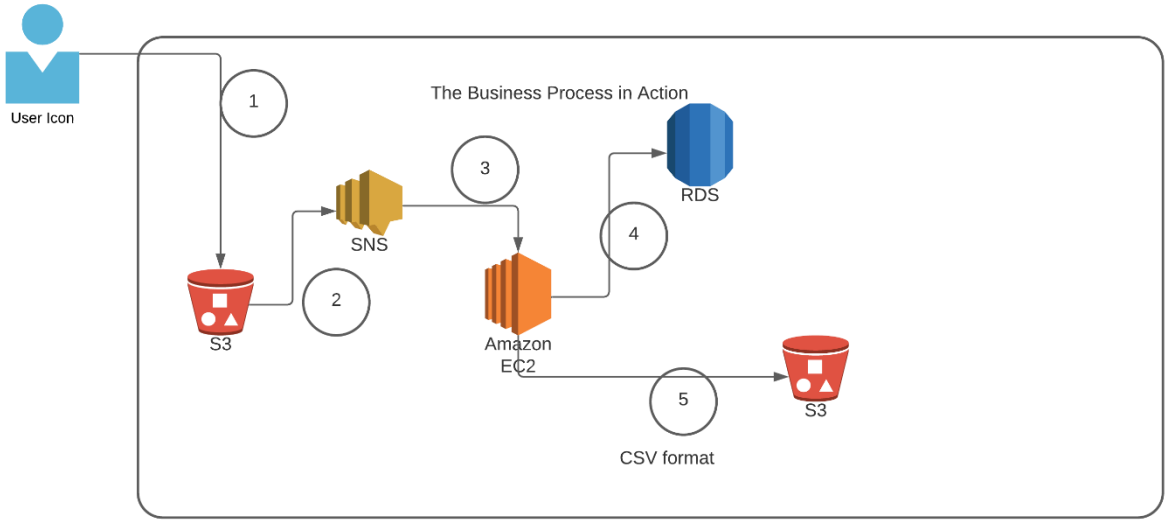
Declaration	
Questions in this exercise are intentionally complex and could be convoluted or confusing. This is by design and to simulate real life situations where customers seldom give crystal clear requirements and ask unambiguous questions.	

I have read the above statement and agree to these conditions	
I AGREE	Pranavraj S
	<Enter your name above this line to indicate that you are in agreement>

Instructions
Every screenshot requested in this workbook is compulsory and carries 1 marks
Your AWS account ID must be clearly visible in every screenshot using the AWS console; missing id or using someone else's id is not permitted. Such cases will be considered as plagiarism and severe penalty will be imposed.
All screenshots must be in the order mentioned under "Expected Screenshots" for every step
DO NOT WAIT UNTIL THE LAST MINUTE. The program office will not extend the project submission deadline under any circumstances.
The file should be renamed in the format BATCH_FIRSTNAME_LASTNAME_PROJECT1. For example: PGPCCMAY18_VIJAY_DWIVEDI_PROJECT1.pdf

Resource Clean Up
Cloud is always pay per use model and all resources/services that we consume are chargeable. Cleaning up when you've completed your lab or project is always necessary. This is true whether you're doing a lab or implementing a project at your workplace.
After completing the lab, make sure to delete each resource created in reverse chronological order. Each AWS Academy session lasts for 4 hours by default, although you can extend a session to run longer by pressing the start button to reset your session timer. At the end of each session, any resources you created in the account will be preserved. Some AWS resources, such as EC2 instances, may be automatically shut down, while other resources, such as RDS instances will be left running.

Architecture diagram

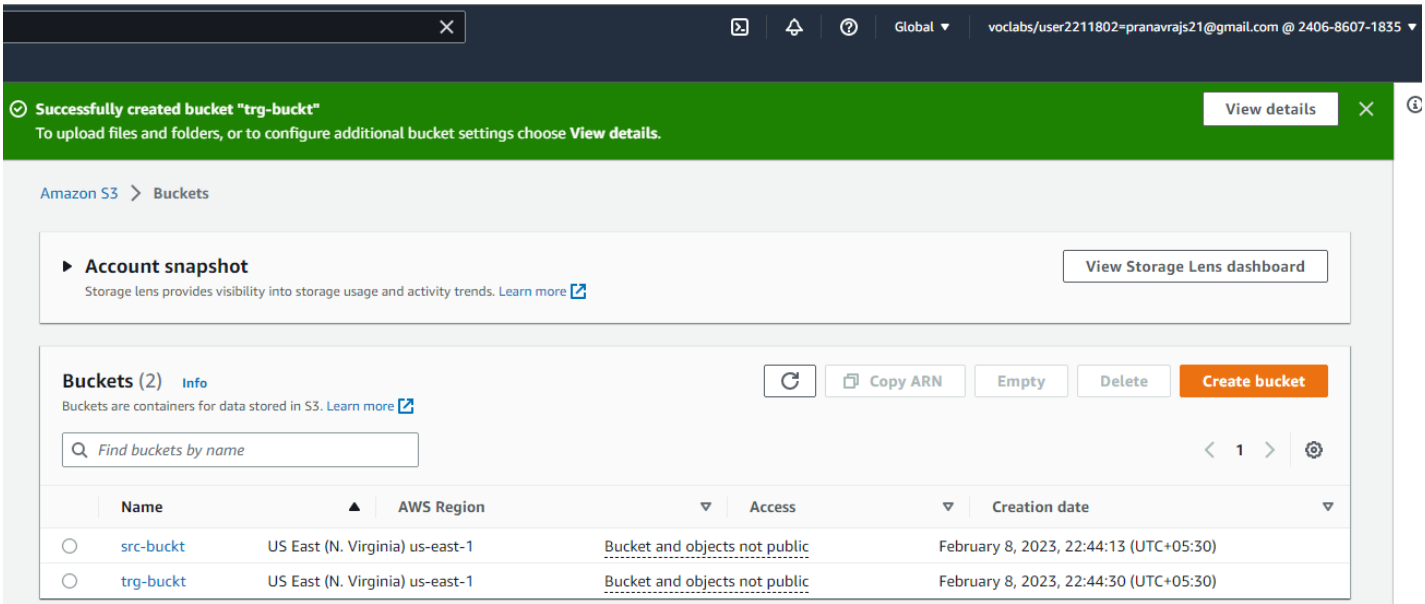


Architecture Implementation	
1	The customer uploads the invoice data to S3 bucket in a text format as per their guidelines and policies. This bucket will have a policy to auto delete any content that is more than 1 day old (24 hours).
2	An event will trigger in the bucket that will place a message in SNS topic
3	A custom program running in EC2 will subscribe to the SNS topic and get the message placed by S3 event
4	The program will use S3 API to read from the bucket, parse the content of the file and create a CSV record and save the details in an RDS database
5	The program will use S3 API to write CSV record to destination S3 bucket as new S3 object.
Note	The custom program codebase and sample invoice have been shared along with this workbook on the LMS.

Step 1: SNS and S3 topic creation

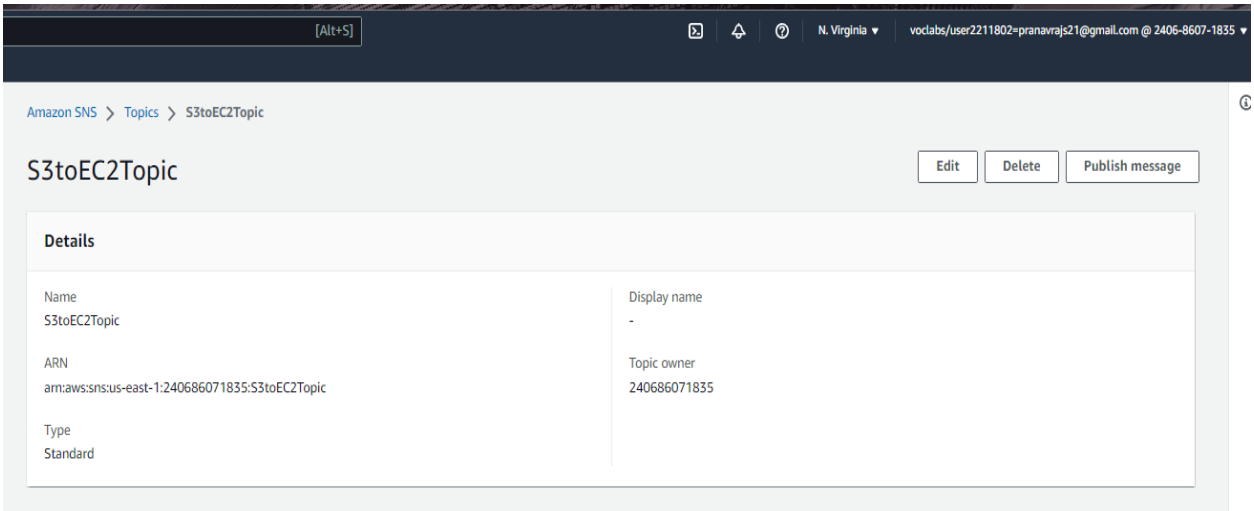
Step number	a
Step name	Creation of Source and target buckets
Instructions	1) Navigate to S3 using the Services button at the top of the screen 2) Select "Create Bucket" 3) Enter a source bucket name and use the default options for the rest of the fields 4) Click on "Create Bucket' 5) Repeat the above steps to create a target bucket
Expected screenshots	1) Screen showing created S3 source and target buckets

<Insert screenshot for a(1) here>



Step number	b
Step name	Creation of SNS subscription
Instructions	1) Navigate to SNS -> Topics 2) Click on "Create Topic" 3) Enter the following fields Name : S3toEC2Topic The other options can be ignored for now 4) Click on Create Topic
Expected screenshots	1) Creation of SNS topic

<Insert screenshot for b(1) here>

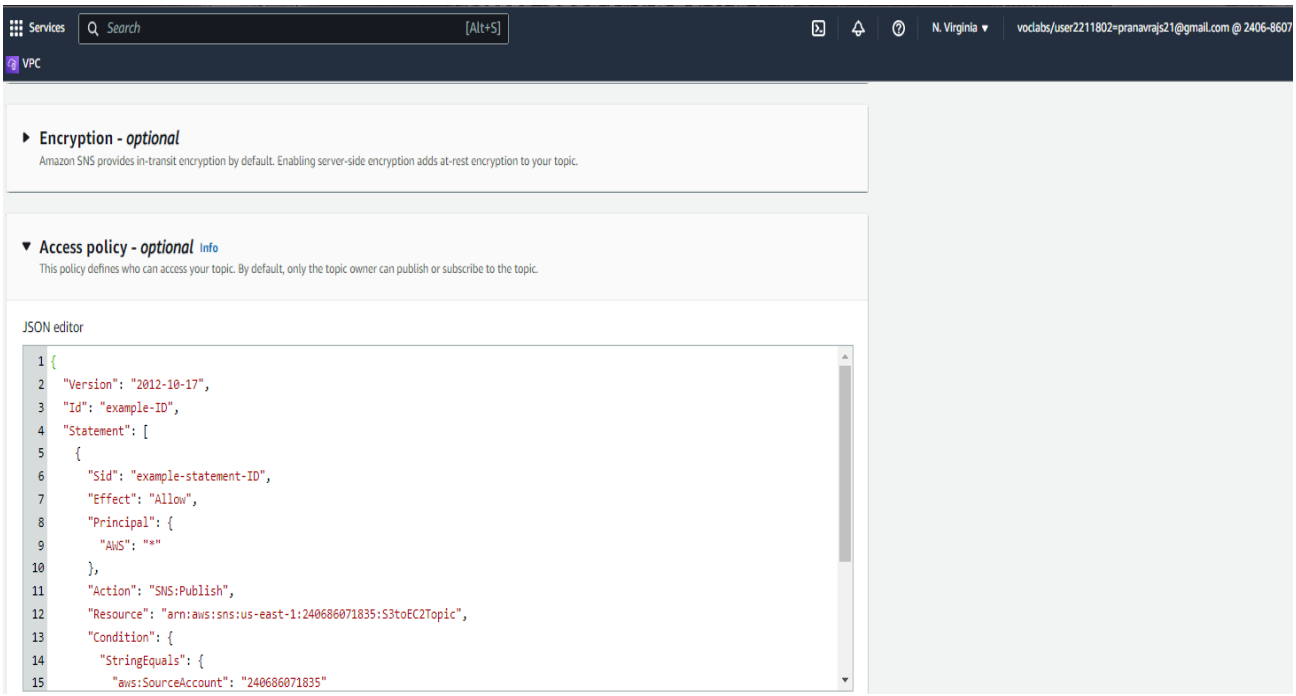


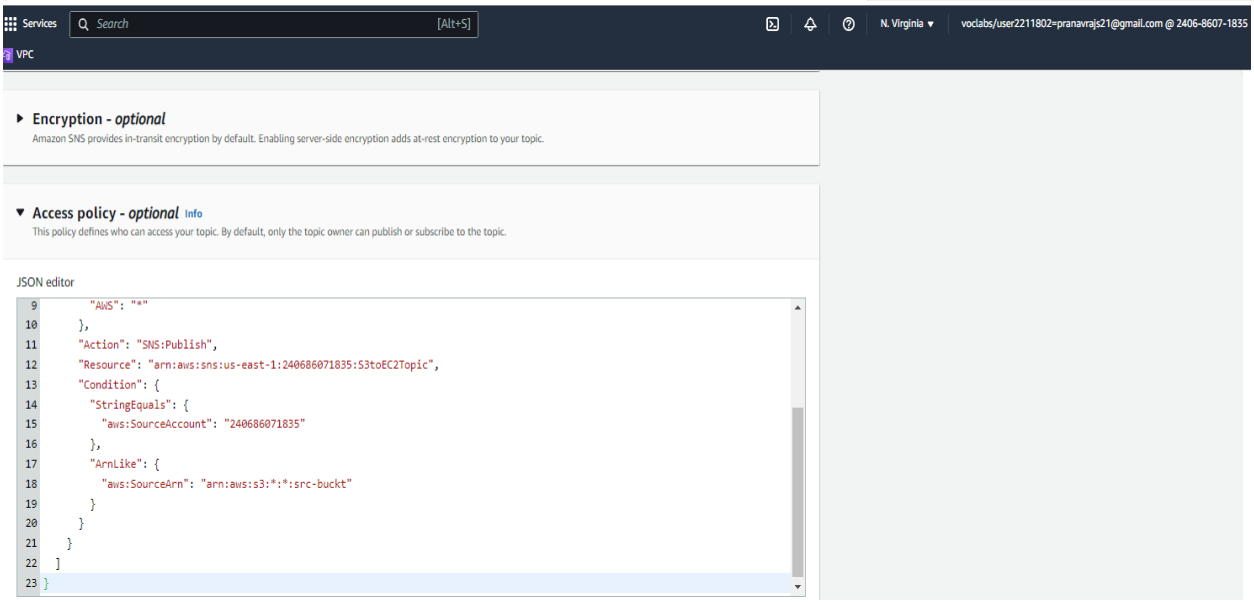
Step number	c
Step name	Modification of SNS Access Policy

Instructions	1) Navigate to SNS -> Topics and select the topic created in the previous step
	2) Note down the ARN shown in the topic details
	2) Click on Edit and select "Access Policy".
	3) Replace the text in the JSON editor with the following
	{
	"Version": "2012-10-17",
	"Id": "example-ID",
	"Statement": [
	{
	"Sid": "example-statement-ID",
	"Effect": "Allow",
	"Principal": {
	"AWS":"*"
	},
	"Action": [
	"SNS:Publish"
	],
	"Resource": "**SNS-topic-ARN**",
	"Condition": {
	"ArnLike": { "aws:SourceArn": "arn:aws:s3:*:*:**bucket-name**" },
	"StringEquals": { "aws:SourceAccount": "**bucket-owner-account-id**" }
	}
	}
	]
	}
	
	4) Replace the bold text with the SNS topic ARN, source bucket name and your AWS account ID respectively.
	5) Click on Save Changes

Expected screenshots	1) JSON Editor screen

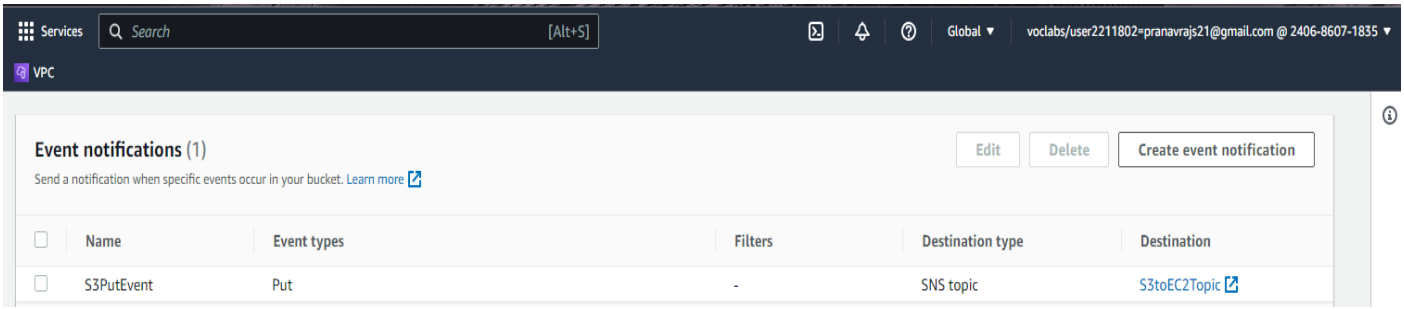
<Insert screenshot for c(1) here>





Step number	d
Step name	Configuring SNS notifications for S3
Instructions	1) Navigate to S3 and select the source bucket created in Step 1 (a) 2) Select Properties and scroll down to Event Notifications and select it 3) Select "Create Event Notification" 4) Fillup the details as follows Name : S3PutEvent Select PUT from the list of radio buttons Destination : Select SNS Topic SNS : Select S3ToEC2Topic 5) Save Changes
Expected screenshots	1) Event Configuration Screen

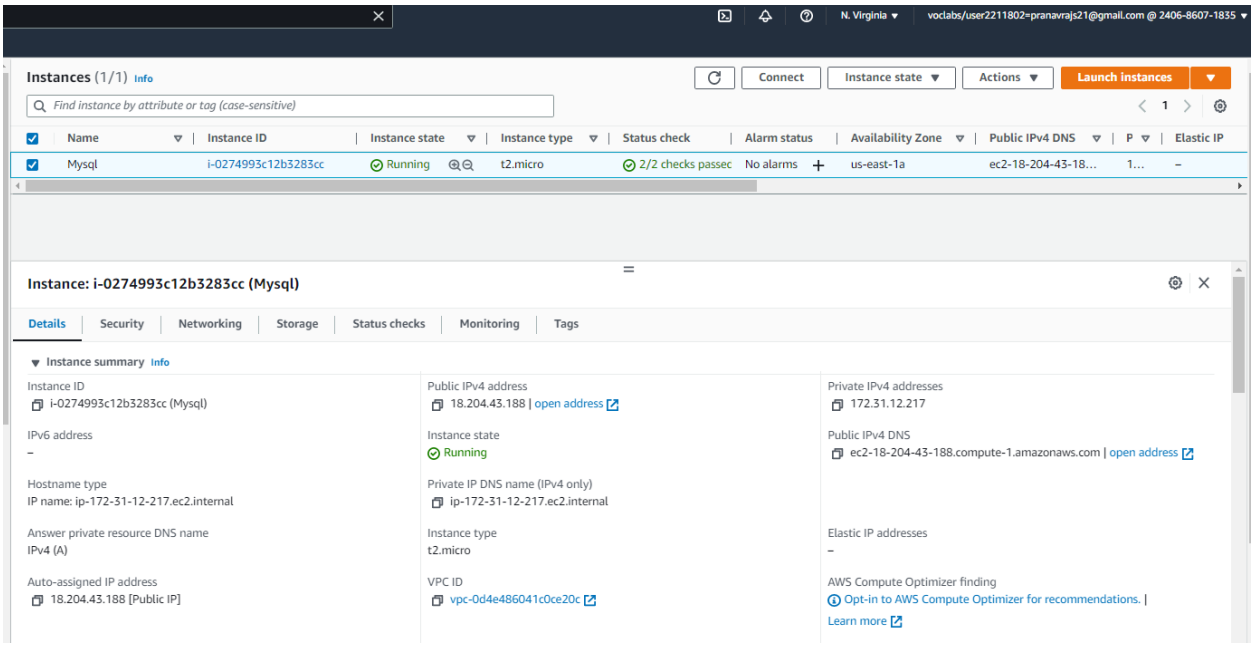
<Insert screenshot for d(1) here>



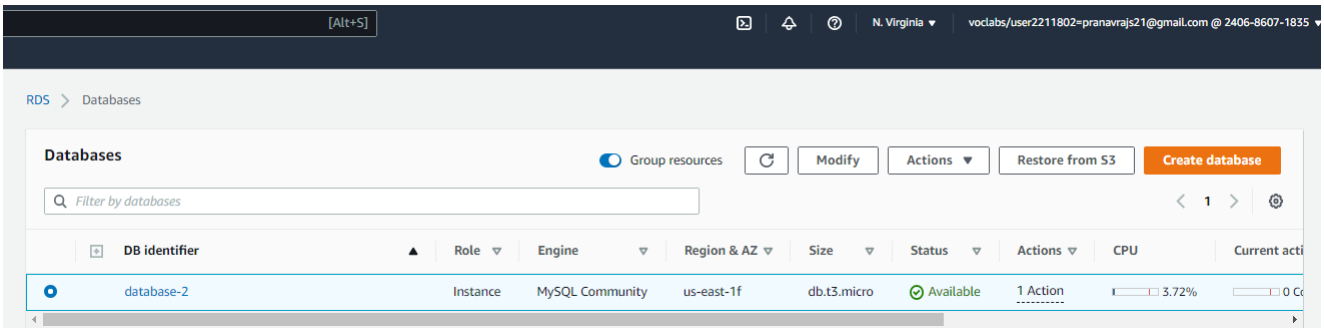
Step 2: Run the custom program in the EC2 instance

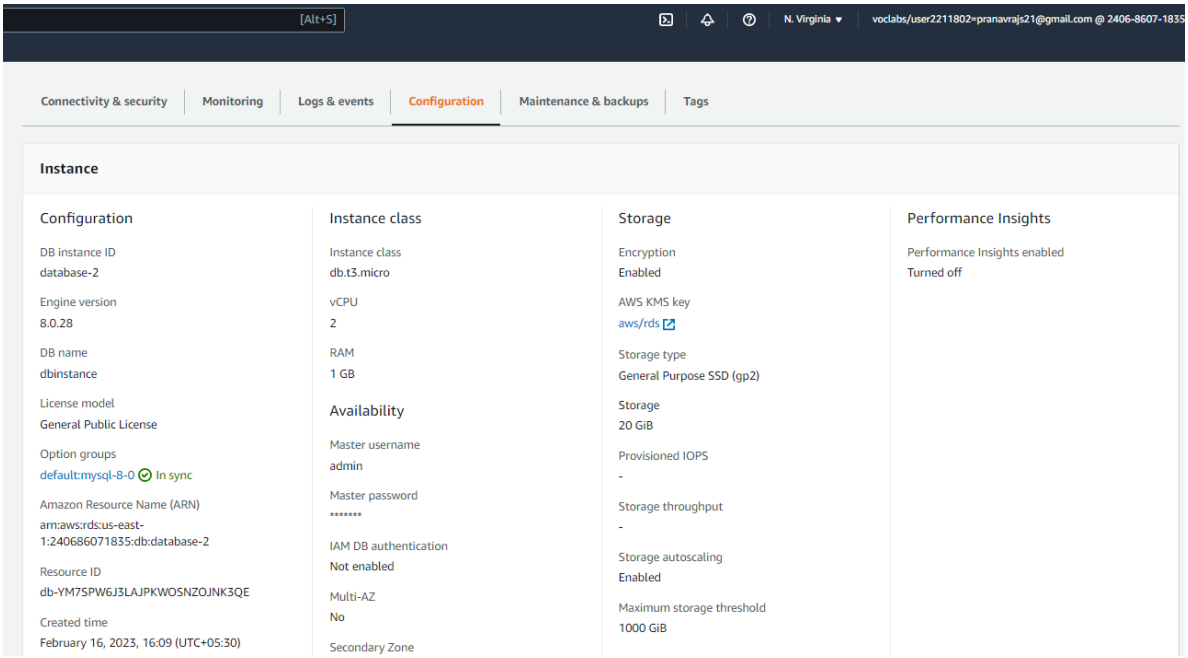
Step number	a
Step name	Creation of the EC2 instance and RDS instance
Instructions	1) Navigate to EC2 -> Instances 2) Create an EC2 instance with the following parameters AMI : Amazon Linux 2 VPC : Default Security group : Ports 22 and 8080 should be opened 3) Navigate to RDS 4) Create an RDS instance with the following parameters: Engine type : MySql Template : Dev/Test Set the username and password as required DB Instance class : Burstable Instance type : t3.micro Public Access : Yes VPC Security group : Create New () Under Additional Configuration, add an initial database name. Take note of this name as it will be required later. Uncheck “Enable Enhanced Monitoring” Ensure that the security group created by the RDS deployment has port 3306 open for all incoming connections from all sources.
Expected screenshots	1) List of instances after creation of EC2 instance 2) List of RDS instances

<Insert screenshot for a(1) here>



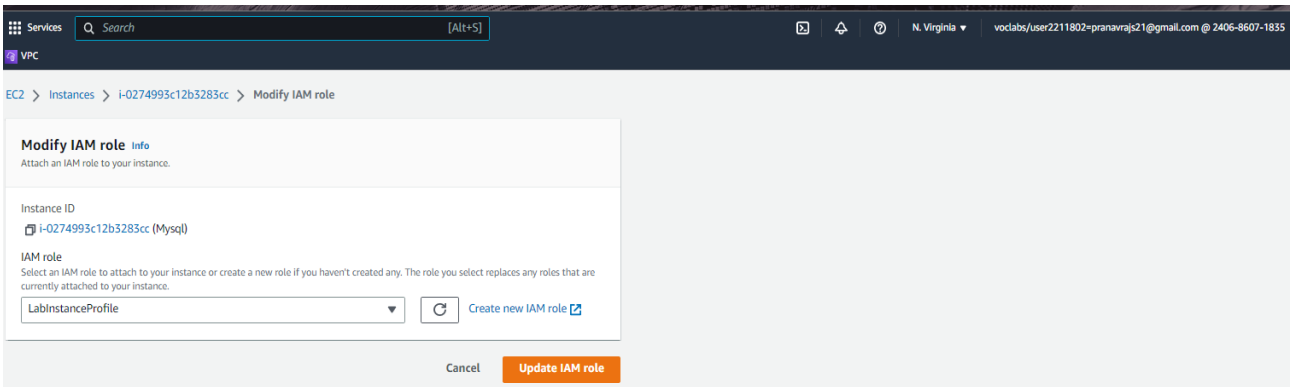
<Insert screenshot for a(2) here>





Step number	b
Step name	Assignment of IAM role for EC2 instance
Instructions	1) Navigate back to EC2- > Instances 2) Select the EC2 instance created in the previous step and select Actions-> Security -> Modify IAM role 3) Select the role LabInstanceProfile from the dropdown and click on Save
Expected screenshots	1) Modify IAM role screen

<Insert screenshot for b(1) here>



Step number	c	
Step name	Configuration and Uploading of custom program	
Instructions	1) Download the file **docproc-new.zip** on your machine 2) Unzip the downloaded file 3) Enter the unzipped folder and open the file views.py in the API folder using a text editor 4) In line number 19-24, modify the target bucket name to the one created in Step 2 (a) and modify the hostname, username, password and database variables to the values set while creating the RDS database and save the file 5) Copy the folder docproc-new to the home folder of the EC2 instance created in Step 3(a) using scp. Use the command given below *scp -i <pem> -r ./docproc-new ec2-user@<ip>:/home/ec2-user*	
Expected screenshots	1) Modifying of the views.py file to point to the target bucket	2)Copying the folder to the EC2 instance

<Insert screenshot for c(1) here>

```
# -*- coding: utf-8 -*-

# ******************************************************************************
# Author - Nirmallya Mukherjee
# To run the application use the following
# ubuntu@ip-172-31-17-36:/opt/docproc$ python manage.py runserver 0:8080
# ******************************************************************************

from django.http import HttpResponse
from django.views.decorators.csrf import csrf_exempt
from botocore.exceptions import ClientError
from boto3.dynamodb.conditions import Key, Attr
import json
import boto3
import datetime
import mysql.connector


hostname = 'database-2.cn16wga0itt2.us-east-1.rds.amazonaws.com'
username = 'admin'
password = 'password'
database = 'dbinstance'

s3_target_bucket = 'trg-buckt'
```

<Insert screenshot for c(2) here>

```
pranav@DESKTOP-OORBH20:~$ ls -la gl.pem
-r-------- 1 pranav pranav 1678 Feb  8 22:54 gl.pem
pranav@DESKTOP-OORBH20:~$ scp -i gl.pem -r ./docproc-new ec2-user@44.200.38.208:/home/ec2-user
urls.py                                                       100%  798     2.6KB/s   00:00
settings.py                                                   100% 3129     9.4KB/s   00:00
__init__.py                                                   100%    0     0.0KB/s   00:00
wsgi.py                                                       100%  392     1.2KB/s   00:00
db.sqlite3                                                    100%   37KB  59.4KB/s   00:00
admin.py                                                      100%  128     0.4KB/s   00:00
models.py                                                     100%  122     0.4KB/s   00:00
tests.py                                                      100%  125     0.4KB/s   00:00
views.py                                                      100% 7118    23.1KB/s   00:00
__init__.py                                                   100%    0     0.0KB/s   00:00
__init__.py                                                   100%    0     0.0KB/s   00:00
apps.py                                                       100%  146     0.5KB/s   00:00
manage.py                                                     100%  805     2.5KB/s   00:00
```

```
pranav@DESKTOP-OORBH20:~$ ssh -i gl.pem ec2-user@44.200.38.208

       __|  __|_  )
       _|  (     /   Amazon Linux 2 AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-2/
14 package(s) needed for security, out of 14 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-12-217 ~]$ ls
docproc-new
[ec2-user@ip-172-31-12-217 ~]$
```

```
pranav@DESKTOP-OORBH20:~$ ls -la GL.pem
-r-------- 1 pranav pranav 1674 Feb  6 22:16 GL.pem
pranav@DESKTOP-OORBH20:~$ scp -i GL.pem -r ./docproc-new ec2-user@100.26.158.169:/home/ec2-user
urls.py                                       100%  798     3.2KB/s   00:00
settings.py                                   100% 3120    12.4KB/s   00:00
__init__.py                                   100%    0     0.0KB/s   00:00
wsgi.py                                       100%  392     1.6KB/s   00:00
db.sqlite3                                    100%   37KB  76.5KB/s   00:00
admin.py                                      100%  128     0.5KB/s   00:00
models.py                                     100%  122     0.5KB/s   00:00
tests.py                                      100%  125     0.5KB/s   00:00
views.py                                      100% 7120    28.7KB/s   00:00
__init__.py                                   100%    0     0.0KB/s   00:00
__init__.py                                   100%    0     0.0KB/s   00:00
apps.py                                       100%  146     0.6KB/s   00:00
manage.py                                     100%  805     3.2KB/s   00:00
```

```
       __|  __|_  )
       _|  (     /   Amazon Linux 2 AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-2/
14 package(s) needed for security, out of 14 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-60-49 ~]$ ls
docproc-new
```

Step 3: Creation and Verification of SNS subscription and Generation of CSV file

Step number	a
Step name	Starting the EC2 custom program
Instructions	1) Log into the EC2 instance using SSH 2) Run the followng commands after successful SSH to start the server sudo cp -r docproc-new /opt sudo chown ec2-user:ec2-user -R /opt cd /opt/docproc-new sudo yum update sudo yum install python-pip -y python -m pip install --upgrade pip setuptools sudo pip install virtualenv virtualenv ~/.virtualenvs/djangodev source ~/.virtualenvs/djangodev/bin/activate pip install django pip install boto3 pip install mysql-connector-python-rf python manage.py runserver 0:8080 **Keep this terminal window open throughout the rest of the exercise**
Expected screenshots	1) Server in waiting state

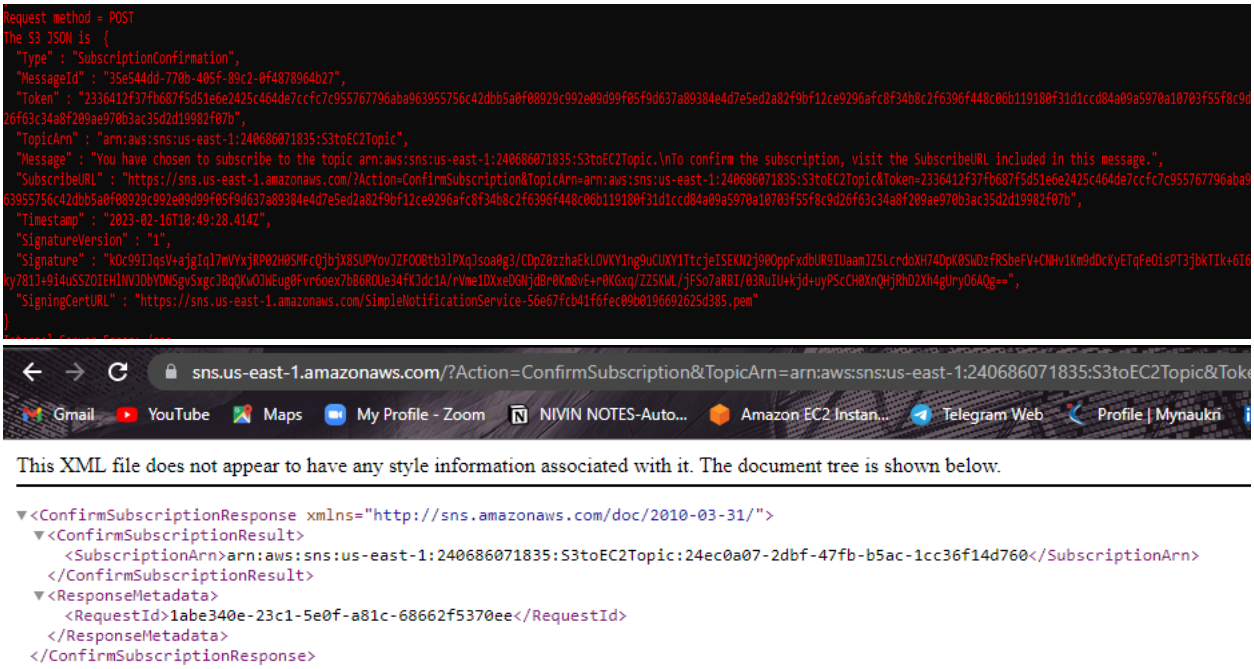
<Insert screenshot for a(1) here>

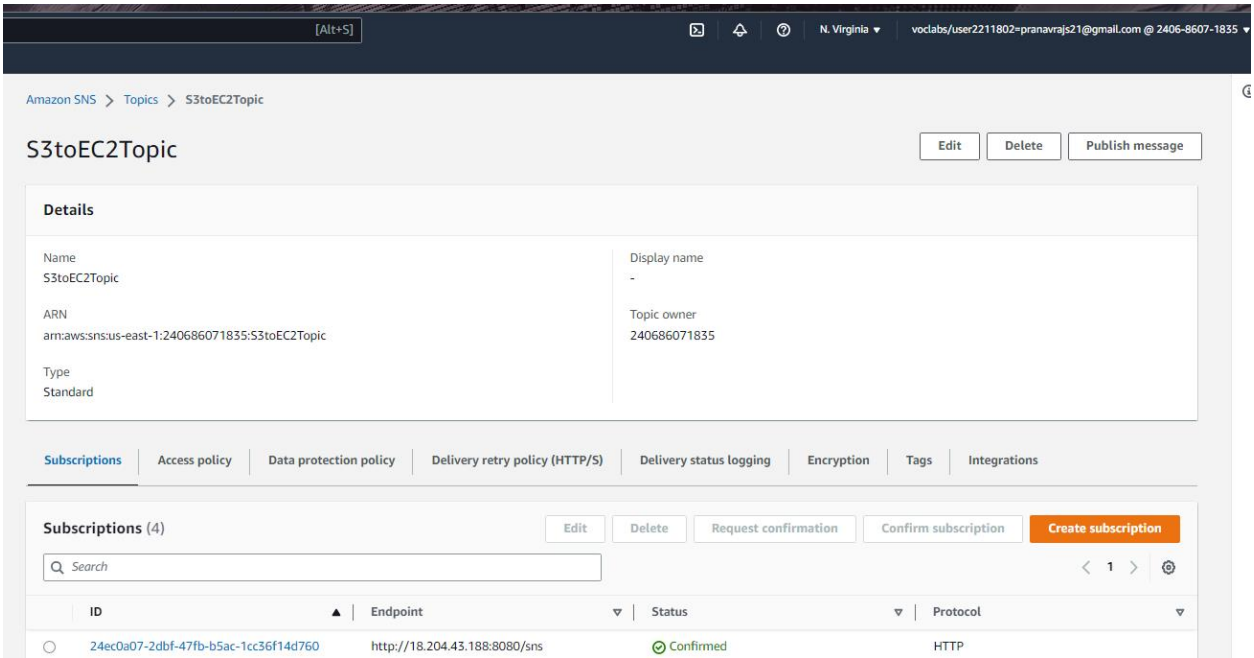
```
Collecting six>=1.5
  Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)
Installing collected packages: jmespath, futures, six, python-dateutil, urllib3, botocore, s3transfer, boto3
Successfully installed boto3-1.17.112 botocore-1.20.112 futures-3.4.0 jmespath-0.10.0 python-dateutil-2.8.2 s3transf
r-0.4.2 six-1.16.0 urllib3-1.26.14
(djangodev) [ec2-user@ip-172-31-12-217 docproc-new]$ pip install mysql-connector-python-rf
DEPRECATION: Python 2.7 reached the end of its life on January 1st, 2020. Please upgrade your Python as Python 2.7 i
 no longer maintained. pip 21.0 will drop support for Python 2.7 in January 2021. More details about Python 2 suppor
 in pip can be found at https://pip.pypa.io/en/latest/development/release-process/#python-2-support pip 21.0 will re
ove support for this functionality.
Collecting mysql-connector-python-rf
  Downloading mysql-connector-python-rf-2.2.2.tar.gz (11.9 MB)
     |[redacted]| 11.9 MB 25.1 MB/s
Building wheels for collected packages: mysql-connector-python-rf
  Building wheel for mysql-connector-python-rf (setup.py) ... done
  Created wheel for mysql-connector-python-rf: filename=mysql_connector_python_rf-2.2.2-cp27-cp27mu-linux_x86_64.whl
size=249459 sha256=afca79be8939fea29bef6933305b87dc45a1c2f323ab4691421ecad707ab3046
  Stored in directory: /home/ec2-user/.cache/pip/wheels/3b/b5/d4/5d0e3338625186ab2fbf75908b58178b859aa8e1fd1291a0fa
Successfully built mysql-connector-python-rf
Installing collected packages: mysql-connector-python-rf
Successfully installed mysql-connector-python-rf-2.2.2
(djangodev) [ec2-user@ip-172-31-12-217 docproc-new]$ python manage.py runserver 0:8080
Performing system checks...

System check identified no issues (0 silenced).
February 08, 2023 - 18:09:21
Django version 1.11.29, using settings 'docproc.settings'
Starting development server at http://0:8080/
Quit the server with CONTROL-C.
```

Step number	b
Step name	Creation of SNS subscription
Instructions	1) Navigate to SNS in the AWS Console and select the topic S3ToEC2Topic 2) Click on Create Subscription 3) Enter the following details Protocol : HTTP Endpoint : http://<host>:8080/sns where <host> in the public IP of the EC2 instance Click on Create Subscription 4) In the EC2 terminal window, look for the field "SubscribeURL" and copy the entire link given **Note: If a message is seen "ValueError: No JSON object could be decoded", it can be safely ignored** 5) Paste that link into a browser window to verify the SNS subscription (Ignore any messages received in the web browser)
Expected screenshots	1) Subscription URL in EC2 terminal Window

<Insert screenshot for b(1) here>

http:// 18.204.43.188:8080/sns

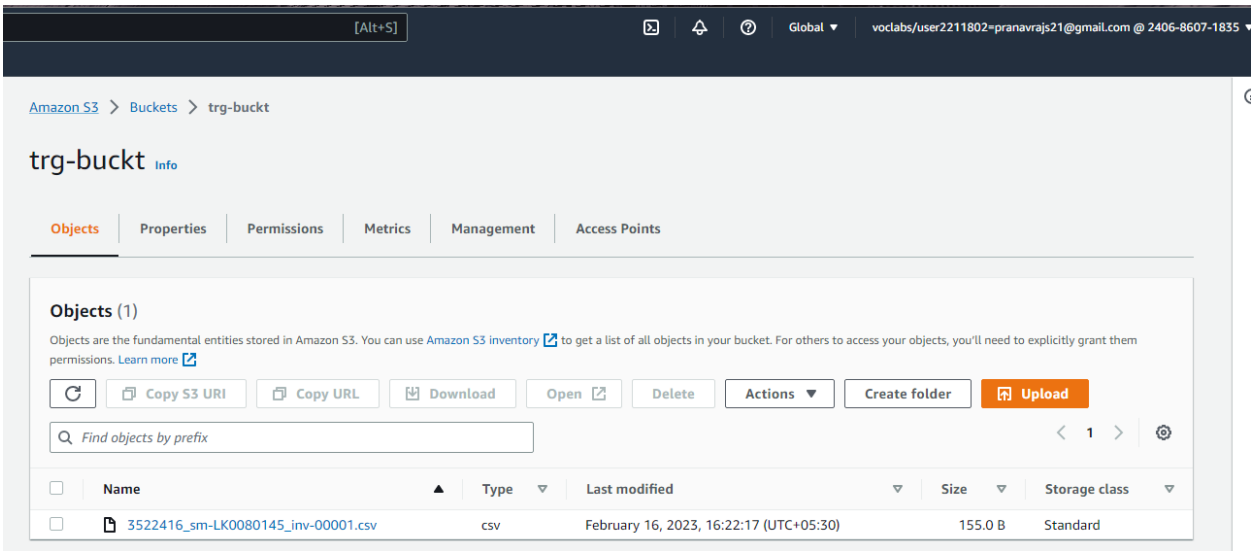




Step number	c
Step name	Generation of CSV file
Instructions	1) Download the file **docproc-invoice.txt** provided with this workbook 2) Navigate to S3 in the AWS Console 3) Upload the sample invoice file to the source S3 bucket using the default options 4) Verify that a CSV file is generated in the target S3 bucket. This may take a few minutes 5) (Optional) Login to the RDS instance using your preferred MySQL client and check the table created inside the specified database.
Expected screenshots	1) Generated CSV file in the target S3 bucket

<Insert screenshot c(1) here>

Target bucket = trg-buckt



Answer the following questions

Q1 Which of the following properties of an AWS resource is sufficient and necessary to uniquely identify it across all of AWS?

a) ARN

b) Region and ARN

c) ARN and Account number

d) Depends on the resource used

Enter your answer here | ARN |

Q2 Which of the following step numbers in Step 1 allowed S3 to publish to the SNS topic created?

a) 1(a)

b) 1(c)

c) 1(d)

d) 1(b)

Enter your answer here | 1(c) |

Q3 Which port is being used by SNS to send the notification to the custom program?

a) 8081

b) 80

c) 8080

d) 8065

Enter your answer here | 8080 |

Q4 How many IAM roles can be attached to an EC2 instance at a time?

a) 2

b) 3

c) 1

d) Depends on the policies required

Enter your answer here | 1 |

Q5 As a product manager, how would you describe the benefits of this architecture to an client, as compared to an equivalent on-premises architecture?

- Advantage of cloud solution over on-premise solutions is the ease in accessibility. As long as you or your clients are connected to the internet, data and application accessibility is easy. Furthermore, the data can be accessed from any location with internet access and from any smart device. It means that there is more flexibility in data access and usage, and any changes from your user's end are updated automatically and in real-time.

- Biggest advantages of cloud computing is its ability to be deployed quickly without long installation processes.
  Customers of cloud software vendors will be able to start using the vendors' application within minutes.
  Quick deployment gives companies an edge over the competition, and as such, is very popular among competitive companies.

- Instead of having to invest heavily in data centers and servers before you know how you're going to use them,you can pay only when you consume computing resources, and pay only for how much you consume.

- Data is the backbone of your business. Losing it can be crippling, both for your efficiency and your reputation. With on-premises storage, a malfunction in the system can cause you to lose your data permanently.While a cloud-based system will keep your data backed up.

- Amazon Simple Notification Service (SNS) sends notifications two ways, A2A and A2P.
  A2A provides high-throughput, push-based, many-to-many messaging between distributed systems, microservices, and event-driven serverless applications.
  These applications include Amazon Simple Queue Service (SQS), Amazon Kinesis Data Firehose, AWS Lambda, and other HTTPS endpoints.
  A2P functionality lets you send messages to your customers with SMS texts, push notifications, and email.

- If you decide you want to use on-premises storage, you'll also need to have IT staff to maintain and manage your servers.
  This could mean you have to hire new staff members or devote more of your current staff's time to maintaining the servers.
  This extra support can add to your costs and reduce the efficiency of your IT department as they will have increased responsibilities associated with the on-premises servers.

Grades distribution	
MCQs	10 (2.5 mark each)
Subjective questions	6 marks
Implementation screenshots	24 marks (2 marks each)
Total	40 marks