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	Nivedita
	<Enter your name above this line to indicate that you are in agreement>

Instructions
Every screenshot requested in this workbook is compulsory and carries 0.5 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 file should be renamed in the format BATCH_FIRSTNAME_LASTNAME_PROJECT1. For example: IITR_FSD_VIJAY_DWIVEDI_PROJECT1.docx

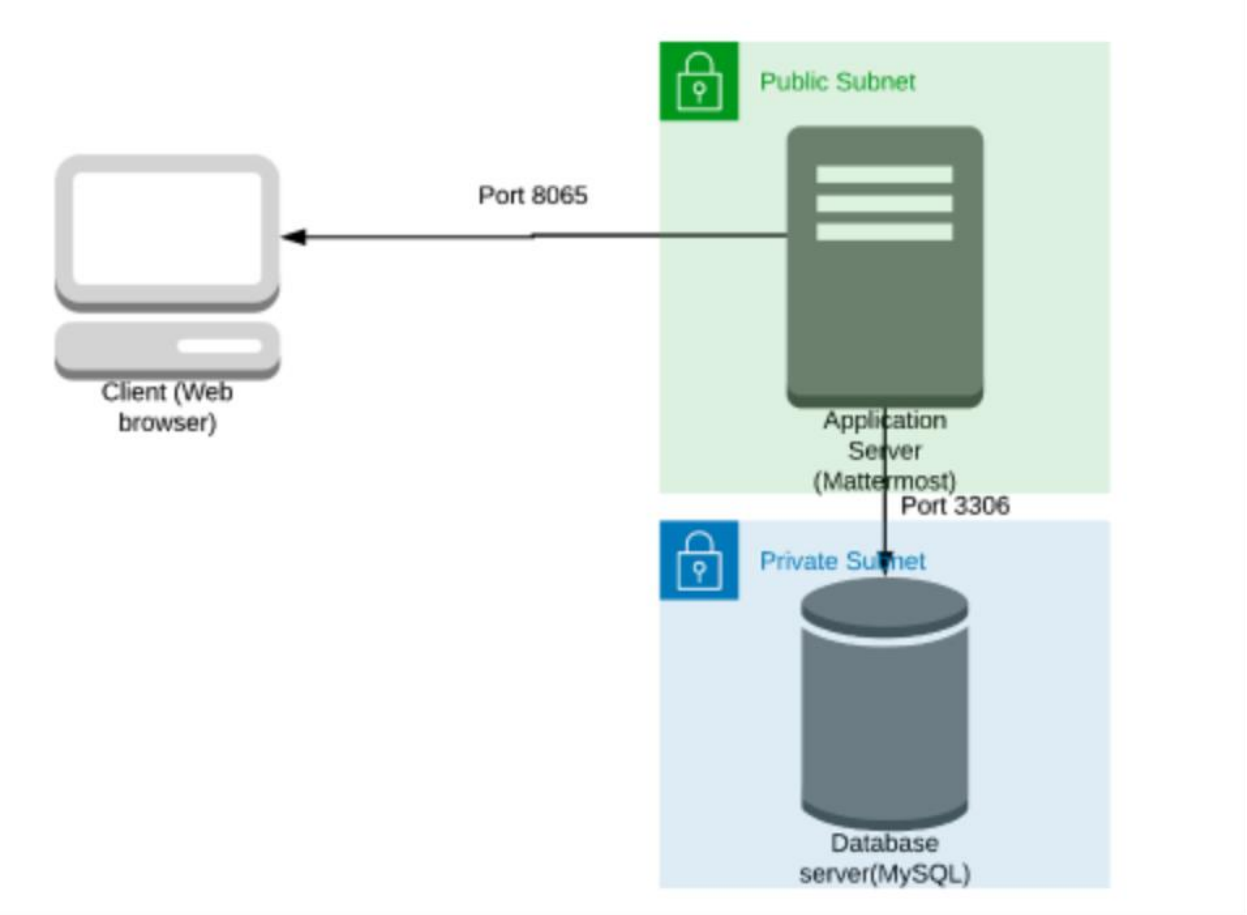
Resource Clean Up
Cloud is always pay per use model and all resources/services that we consume are chargeable. Cleaning up when you've completed your lab or project is always necessary. This is true whether you're doing a lab or implementing a project at your workplace.
After completing the lab, make sure to delete each resource created in reverse chronological order.

Scenario

Team communication and instant messaging solutions are an integral part of any business environment today. As of 2020, the total number of users of Slack and Microsoft Teams exceeded 20 million.

Some organizations might have compliance policies in place which do not allow them to use services managed by third parties. They will prefer solutions that can be managed and hosted on servers controlled by them. The same will extend to communication solutions as well.

Architecture diagram



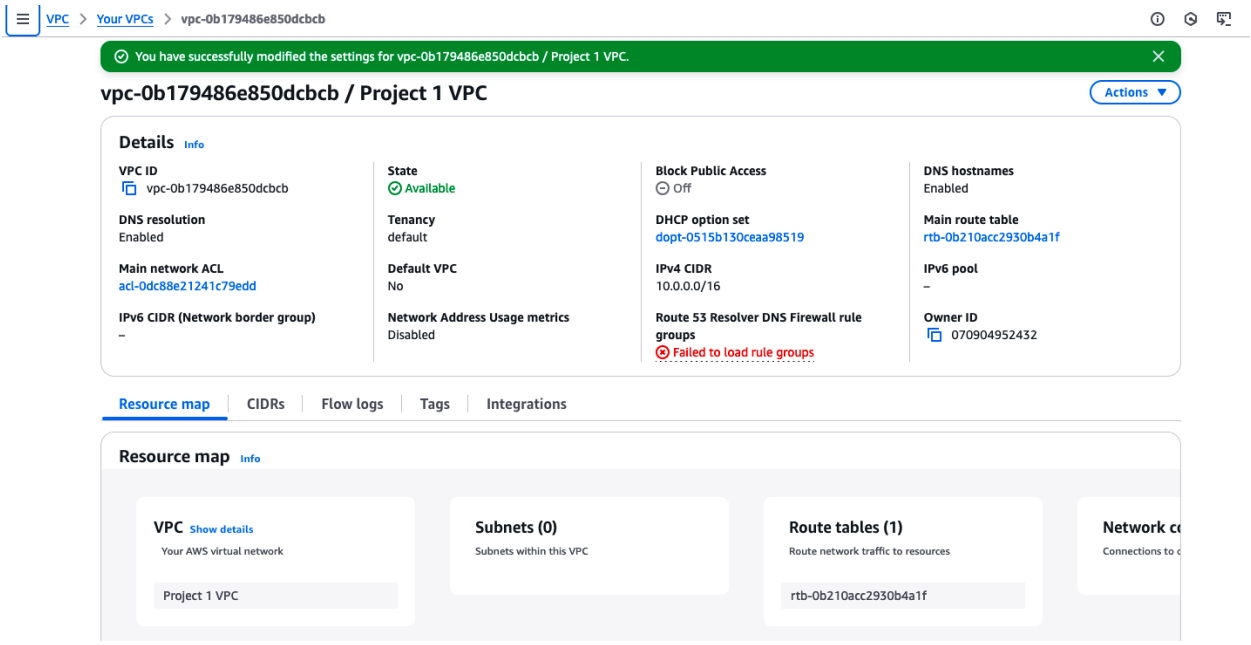
Architecture Implementation	
1	Implement 2 different subnets (one public and the other private) in a custom VPC
2	Install and configure MySQL on an Amazon Linux 2 instance on the private subnet using the instructions provided. (Hint: Use a bastion host and a NAT gateway)

3	Install and configure Mattermost on an Amazon Linux 2 instance on the public subnet using the provided instructions.
4	Configure the security groups to allow the ports as shown in the architecture.
5	Test the installation by accessing the IP of the public instance in a browser via the port 8065.

Step 1: VPC and Subnet Creation

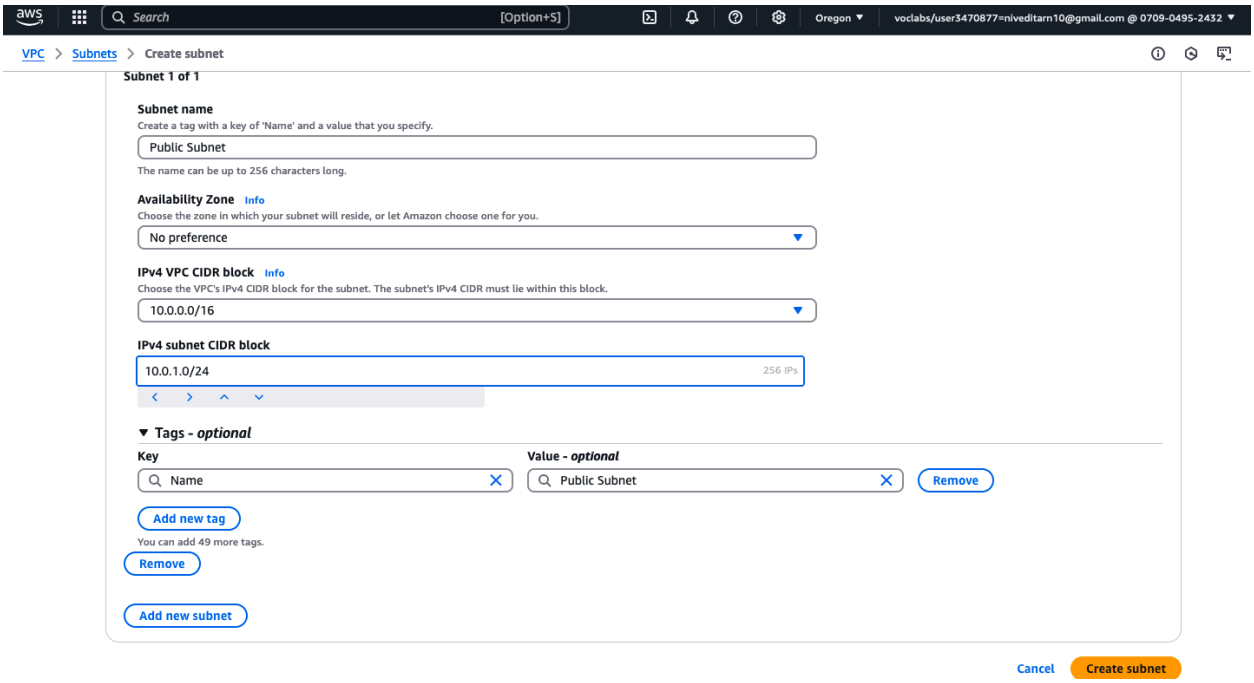
Step number	A
Step name	Creation of VPC
Instructions	1) Navigate to VPC using the Services button at the top of the screen 2) Select "Your VPCs" on the left side of the screen 3) Click on "Create VPC" 4) Enter the following fields : Name: Project 1 VPC IPv4 CIDR Block : 10.0.0.0/16 The rest of the options can be ignored 5) Select "Create VPC" 6) Select the VPC and click on Actions->Edit DNS hostnames 7) Enable DNS hostnames and click on Save
Expected screenshots	1) Created VPC with properties visible

<Insert Screenshot a(1) here>



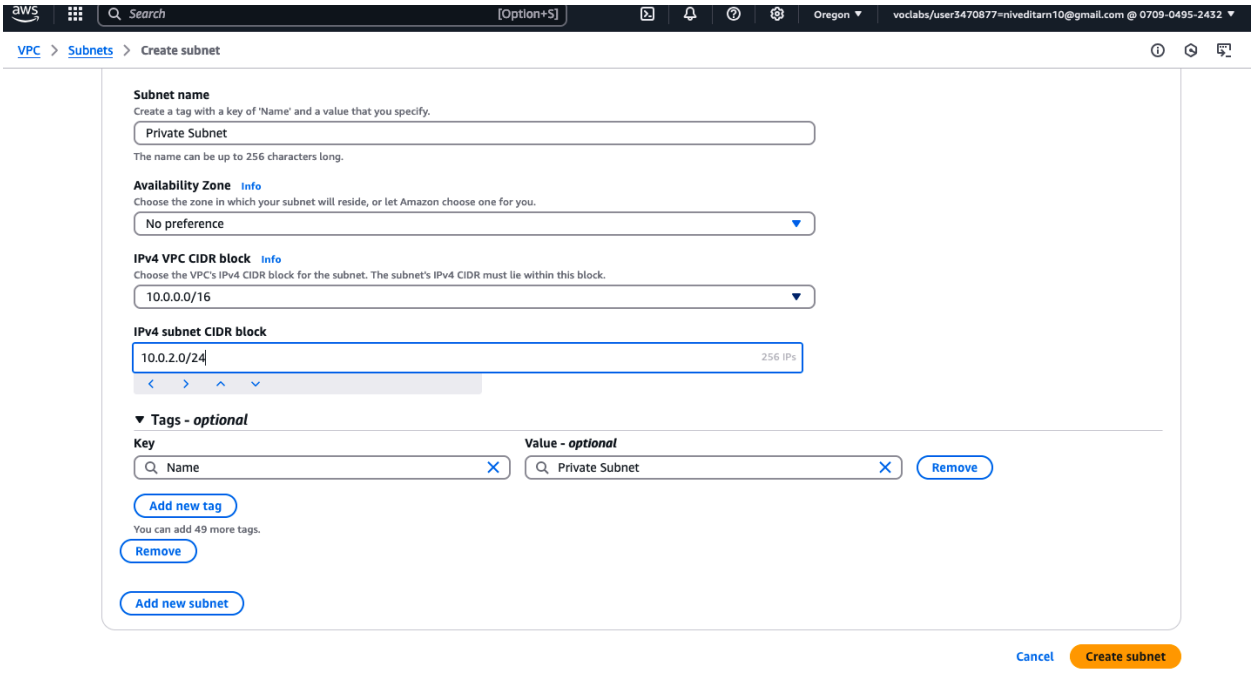
Step number	b
Step name	Creation of public subnet
Instructions	1) Navigate to VPC->Subnets 2) Click on "Create Subnet" 3) Enter the following fields Name tag : Public Subnet VPC : Select the Project 1 VPC IPv4 CIDR block : 10.0.1.0/24 The other options can be ignored 4) Click on Create 5) Once the subnet has been created, select the subnet and click on Actions->Modify Auto-assign IP settings 6) Enable the option "Auto assign IPv4" and select Save
Expected screenshots	1) Subnet Creation screen

<Insert Screenshot b(1) here>



Step number	C
Step name	Creation of private subnet
Instructions	1) Navigate to VPC->Subnets 2) Click on "Create Subnet" 3) Enter the following fields Name tag : Private Subnet VPC : Select the Project 1 VPC IPv4 CIDR block : 10.0.2.0/24 The other options can be ignored 4) Click on Create
Expected screenshots	1) Subnet Creation screen

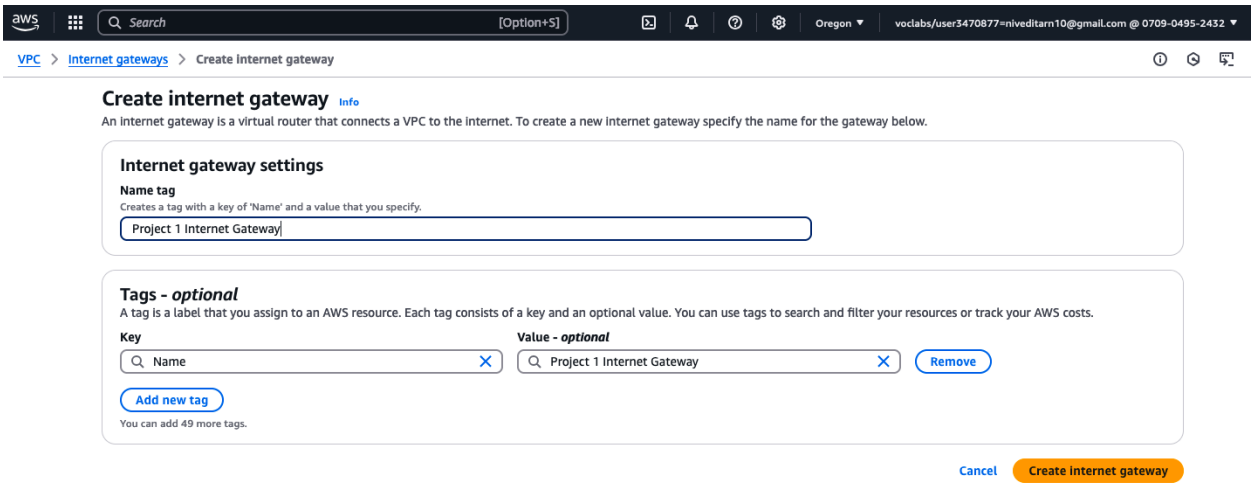
<Insert Screenshot c(1) here>



Step 2 : Internet Gateway and VPC

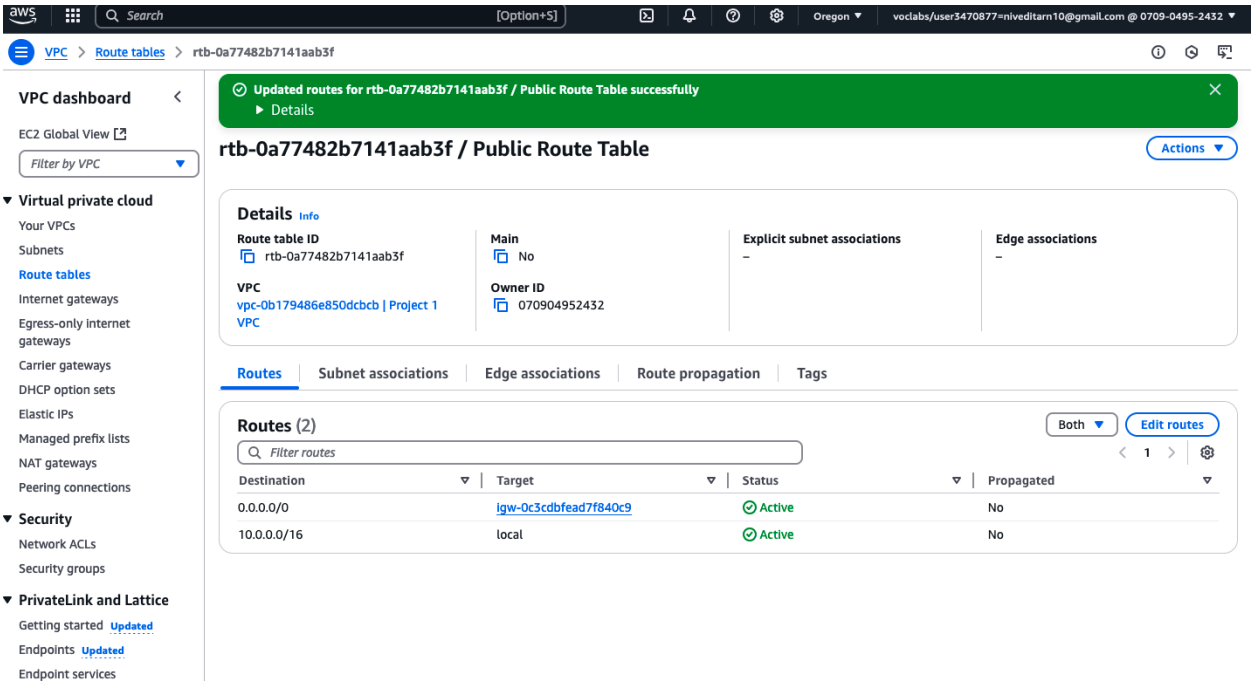
Step number	a
Step name	Creation and Configuration of Internet Gateway
Instructions	1) Navigate to VPCs->Internet Gateway 2) Click on "Create Internet Gateway" 3) Enter the name tag "Project 1 Internet Gateway" and click on "Create Internet Gateway" 4) After the gateway is created, select it and click on Actions->Attach to VPC 5) Select the Project 1 VPC and click on "Attach Internet Gateway"
Expected screenshots	1) Creation of Internet Gateway

<Insert Screenshot a(1) here >

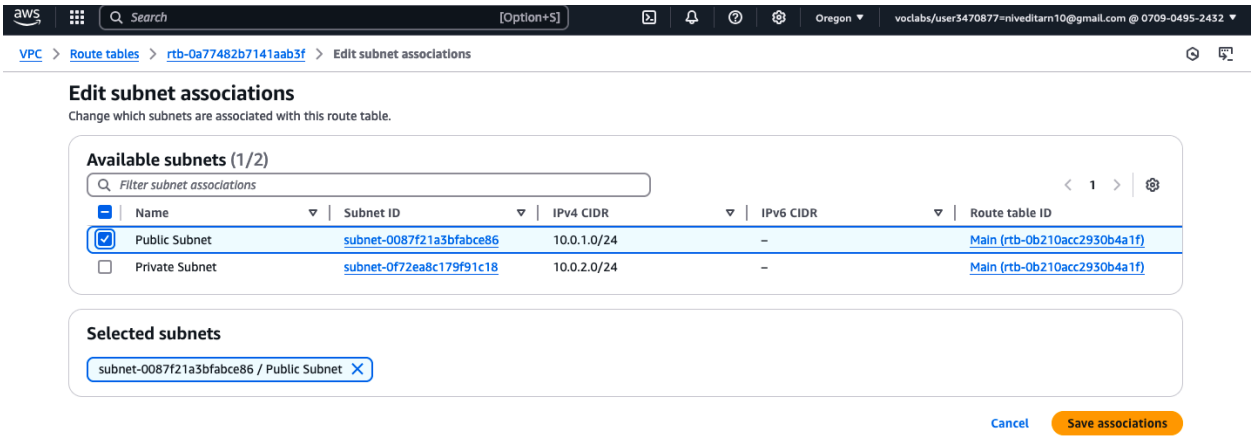


Step number	b
Step name	Creation of public route table
Instructions	1) Navigate to VPC -> Route Tables and click on Create Route table 2) Enter the name tag "Public Route Table", select the Project 1 VPC from the dropdown and click on Create 3) Once the route table is created, select it and select the Routes tab below the list of route tables 4) Click in Edit Routes and add the following route (Don't edit the existing one) - Destination : 0.0.0.0/0 - Target : Select Internet Gateway and the select the Project 1 Internet Gateway Click on Save Routes 5) Select the Subnet Associations tab and click on Edit Subnet Associations 6) Select the Public Subnet from the list and click on Save
Expected screenshots	1) Route list of the route table 2) Subnet Associations of the route table

<Insert Screenshot b(1) here>

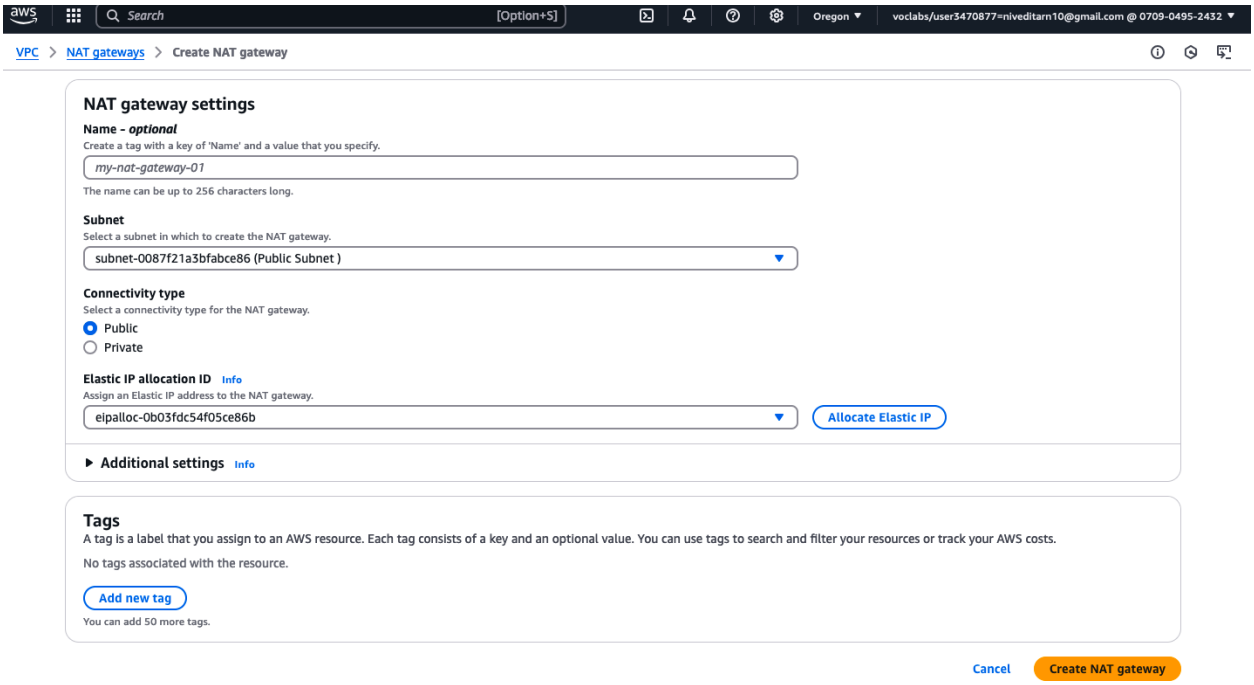


<Insert Screenshot b(2) here>

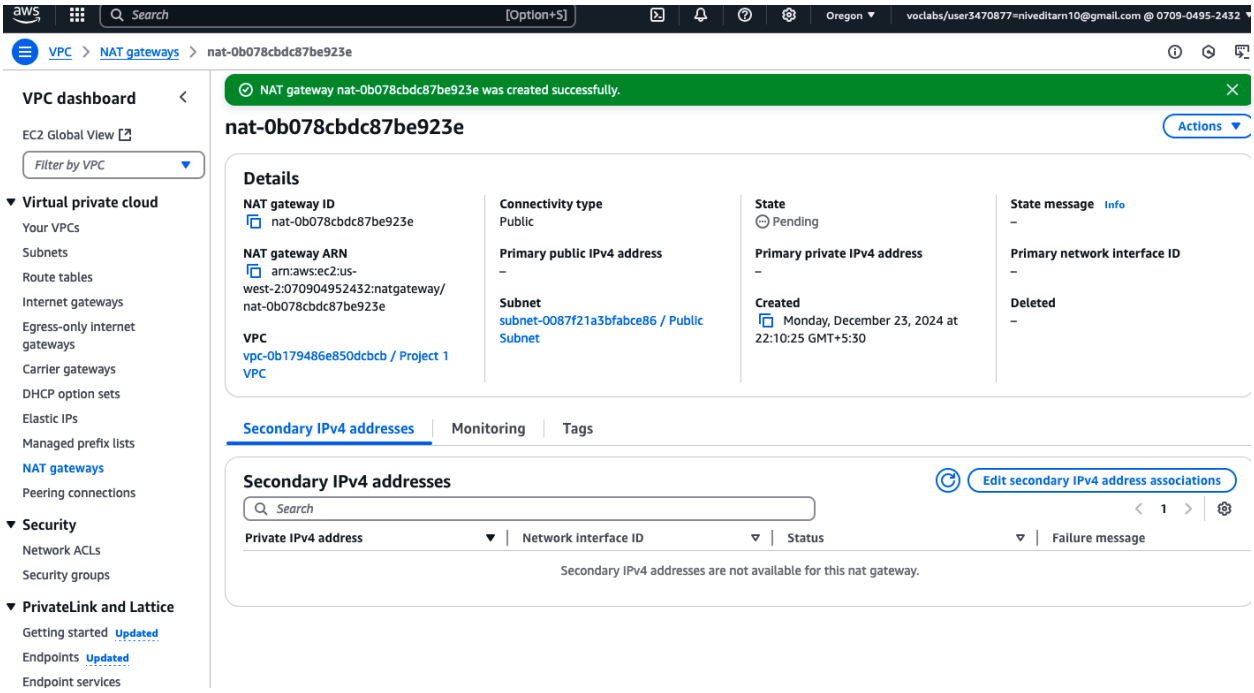


Step number	c
Step name	Creation of NAT gateway
Instructions	1) Navigate to VPC using the Services button at the top of the screen 2) Select NAT Gateway at the left side of the screen 3) Click on Create NAT Gateway - Deploy it in the public subnet - Connectivity type : Public - Allocate an elastic IP by clicking on “Allocate Elastic IP” 4) Click on “Create NAT Gateway” to create the gateway
Expected screenshots	1) NAT gateway creation details 2) Gateway after creation

<Insert Screenshot c(1) here>

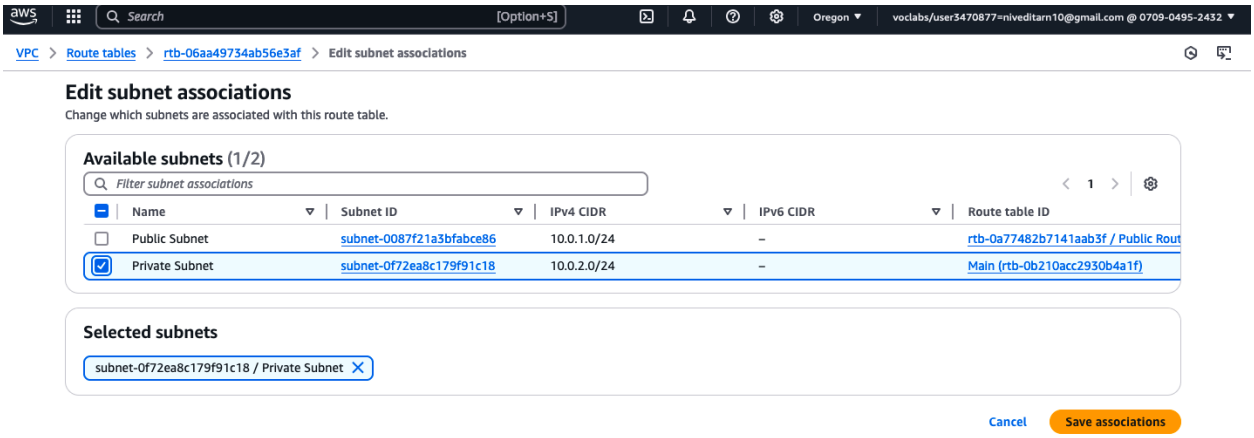


<Insert Screenshot c(2) here>

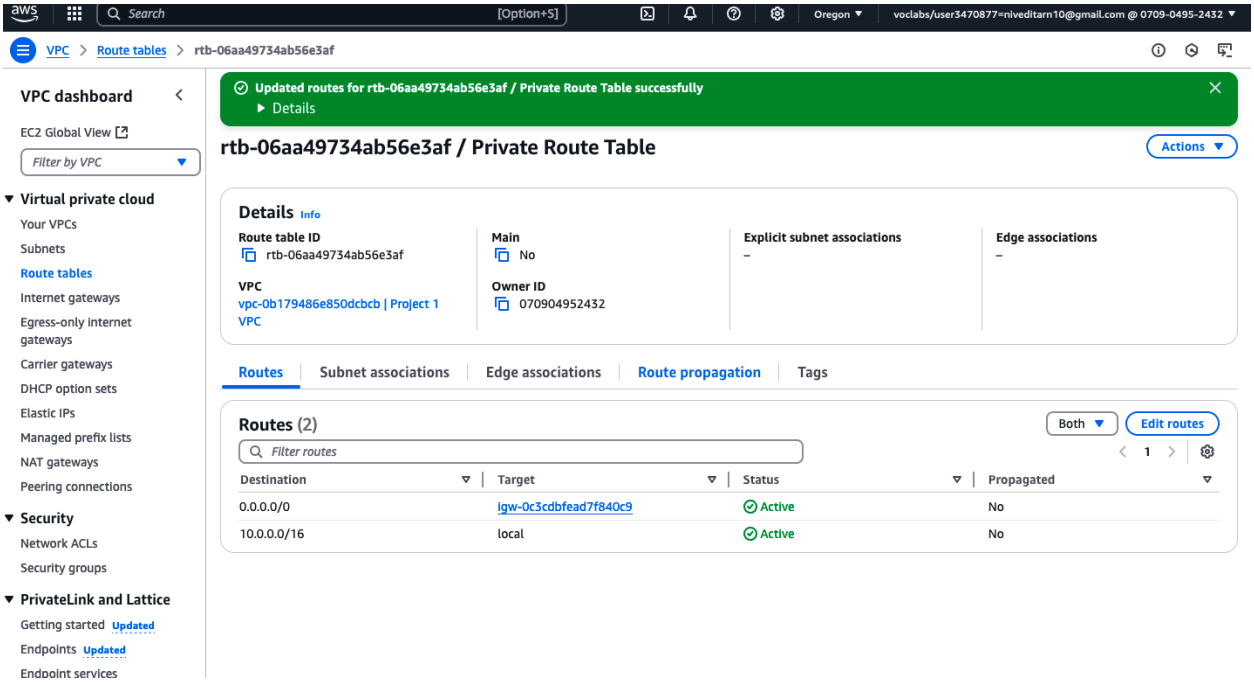


Step number	d
Step name	Creation of private route tables
Instructions	1) Navigate to VPC -> Route Tables and click on Create Route table 2) Enter the name tag "Private Route Table", select the Project 1 VPC from the dropdown and click on Create 3) Once the route table is created, select it and select the Routes tab below the list of route tables 4) Click in Edit Routes and add the following route (Don't edit the existing one) - Destination : 0.0.0.0/0 - Target: Select NAT Gateway and select the NAT Gateway created in the previous step Click on Save Routes 5) Select the Subnet Associations tab and click on Edit Subnet Associations 6) Select the private Subnet from the list and click on Save
Expected screenshots	1) Route list of the route table 2) Subnet association of the route table

<Insert Screenshot for d(1) here >



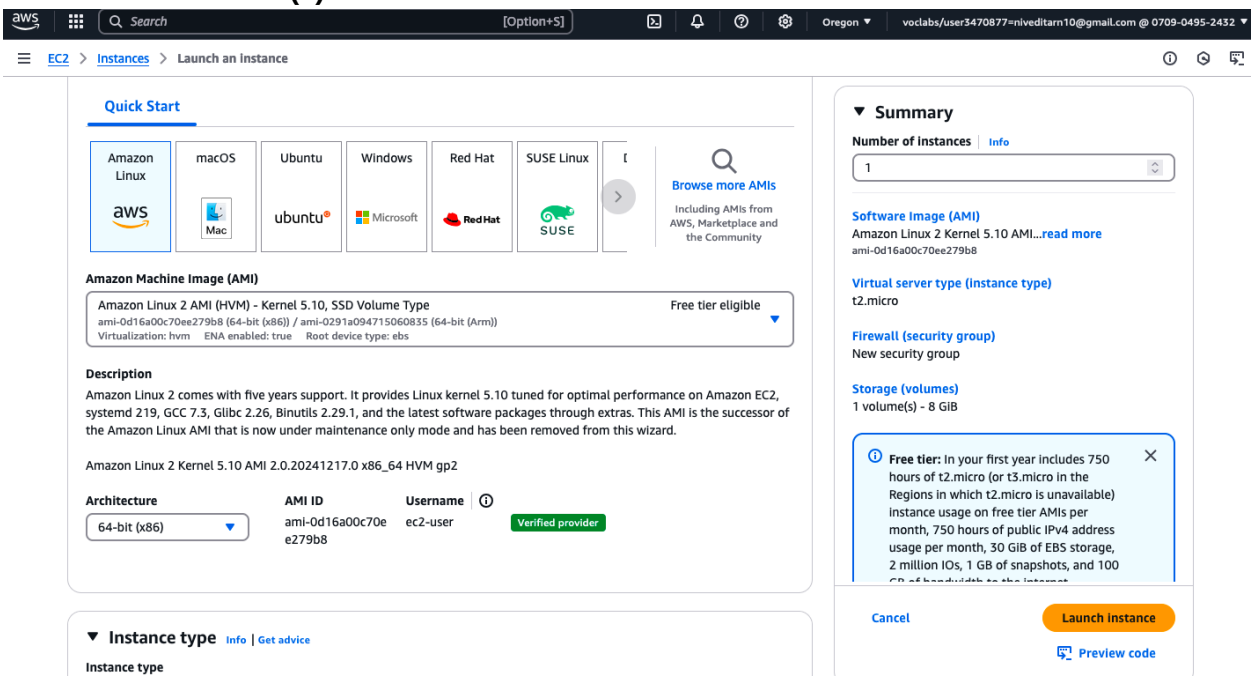
<Insert Screenshot for d(2) here>



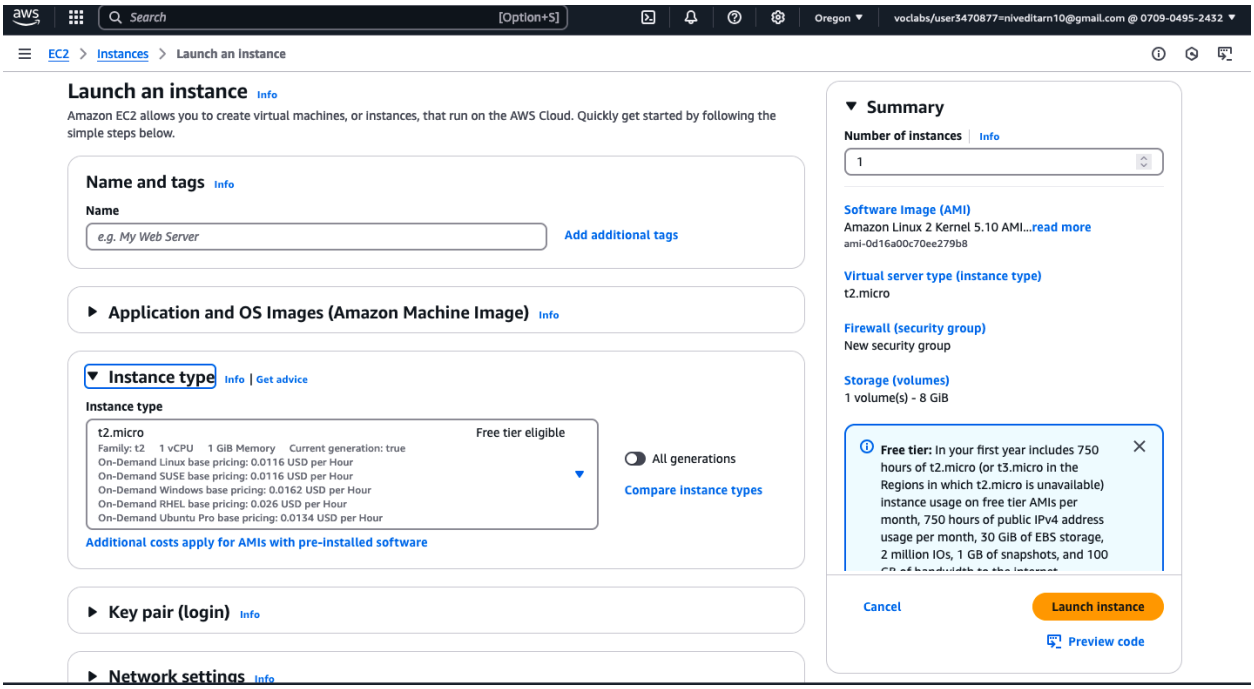
Step 3 : Creation of database and application servers

Step number	a
Step name	Creation of application server
Instructions	1) Navigate to EC2 using the Services button at the top of the screen 2) Select Instances at the left side of the screen 3) Click on Launch Instance - Select the AMI Amazon 2 Linux - Select the instance type t2.micro - Select Network as "Project 1 VPC" and subnet as "Public Subnet" - For the security group, open the ports 80,443, 22 and 8065 for source set to "Anywhere" 4) Launch the instance after creating a new pem file and downloading it
Expected screenshots	1) AMI used 2) Instance configuration screen 3) Security group rules 4) Instance after creation

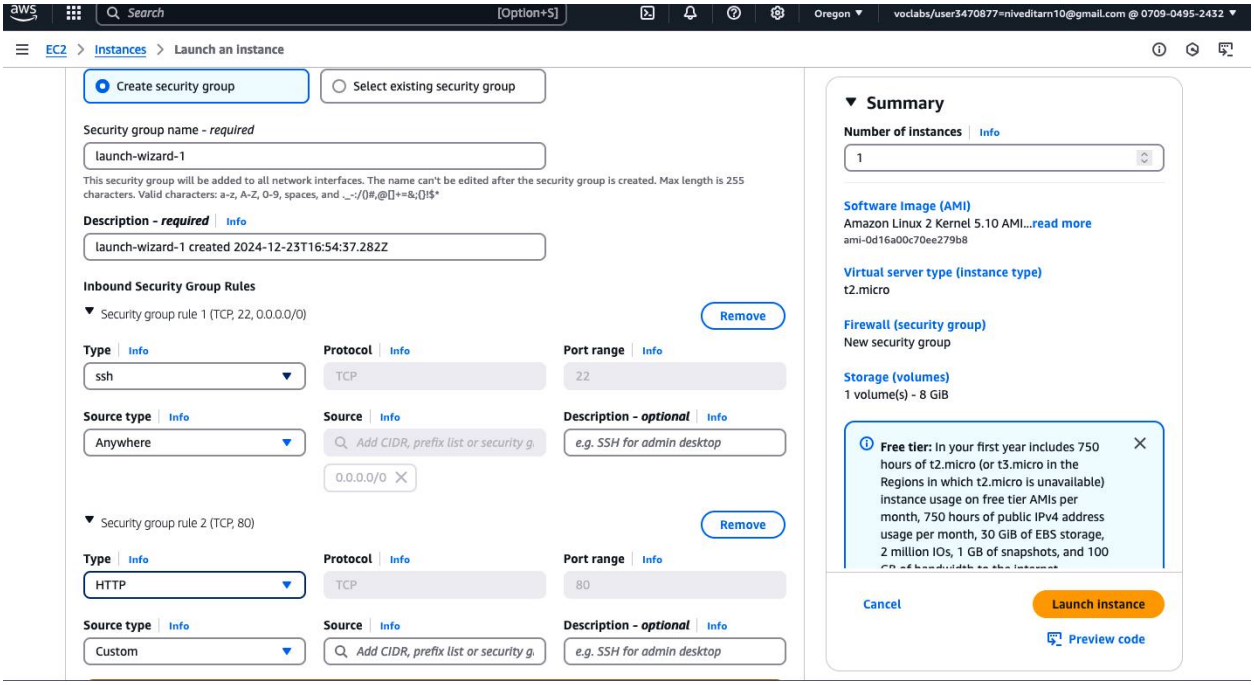
<Insert screenshot a(1) here>



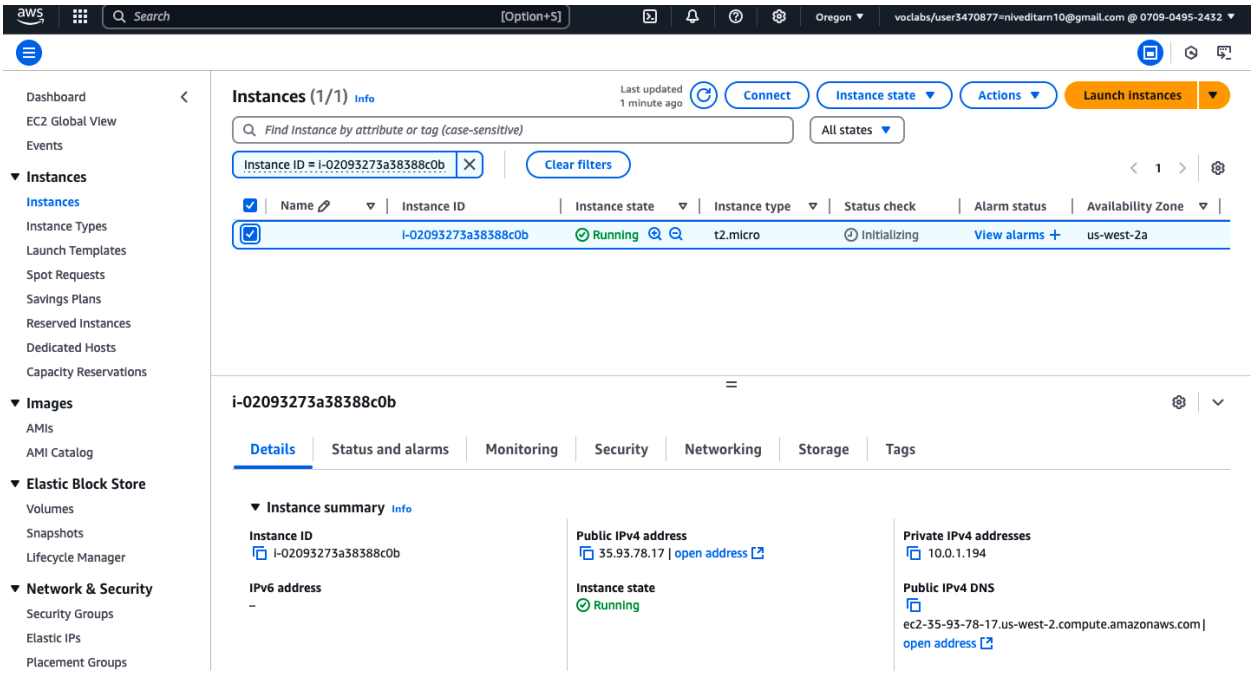
<Insert screenshot a(2) here>



<Insert screenshot a(3) here>



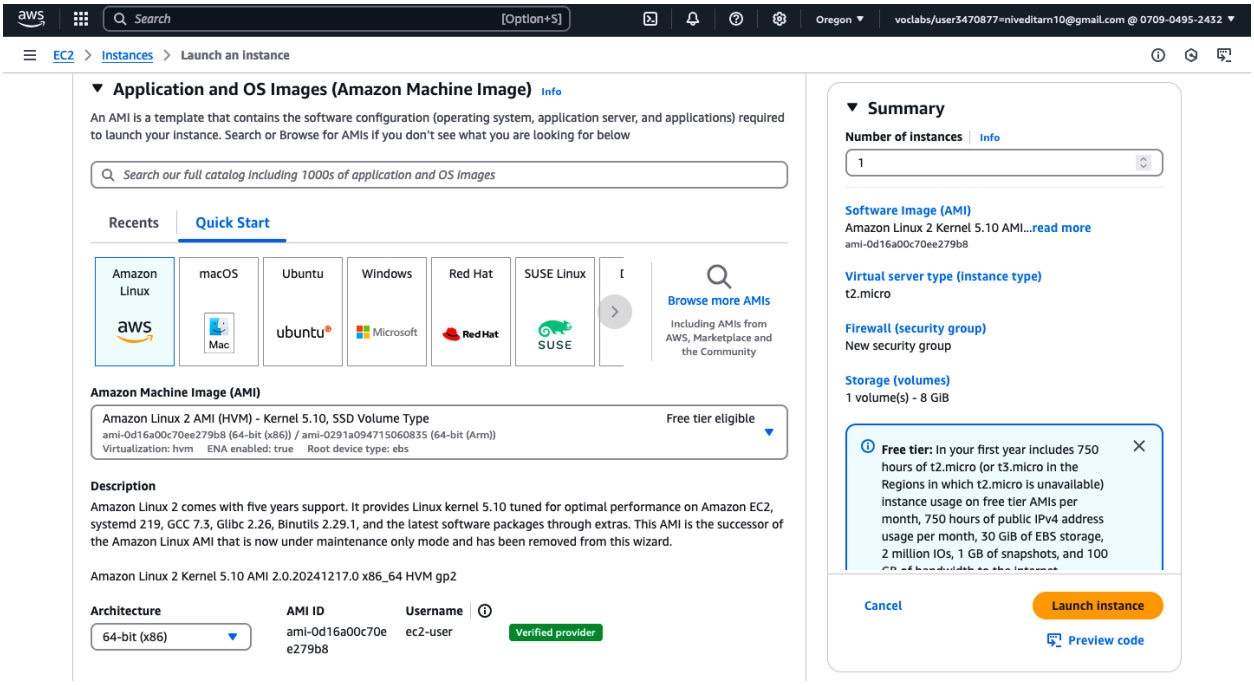
<Insert screenshot a(4) here>



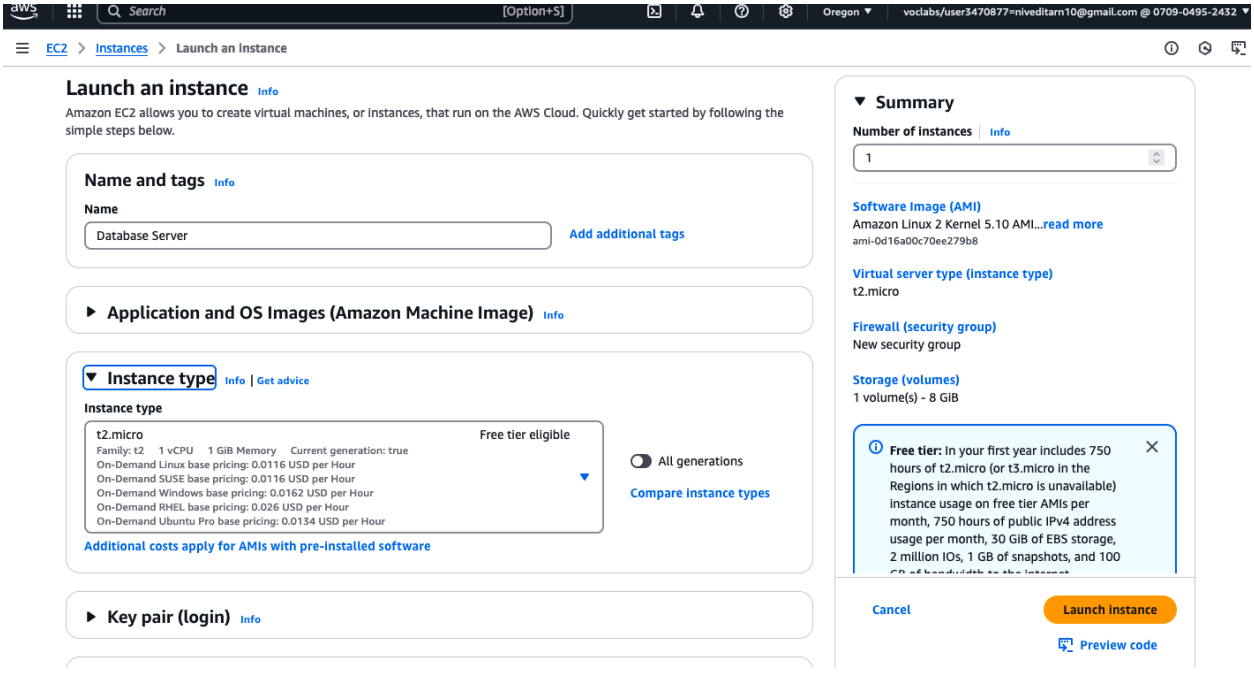
Step number	b
Step name	Creation of database server
Instructions	1) Navigate to EC2 using the Services button at the top of the screen 2) Select Instances at the left side of the screen 3) Click on Launch Instance - Select the AMI Amazon 2 Linux - Select the instance type t2.micro - Select Network as "Project 1 VPC" and subnet as "Private Subnet" - For the security group, open the ports 80, 443,22 and 3306 for source set to "Anywhere" 4) Launch the instance by selecting the same pem file created in the previous step

Expected screenshots	1) AMI used 2) Instance configuration screen 3) Security group rules 4) Instance after creation

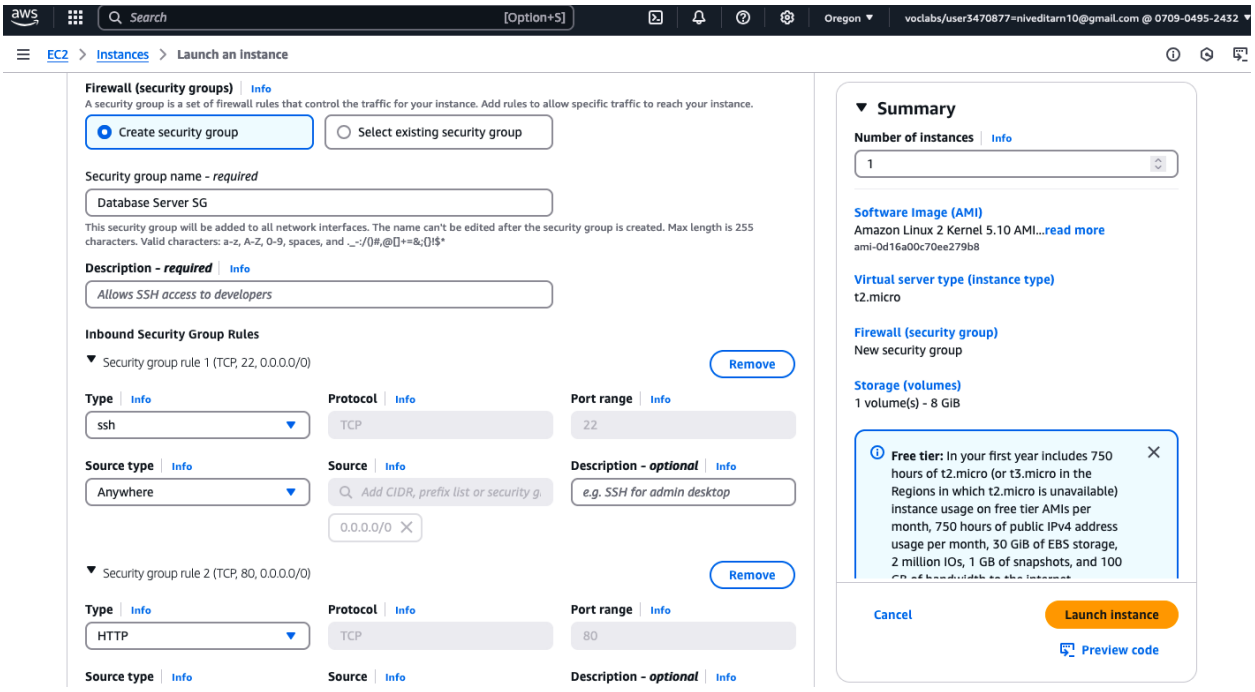
<Insert screenshot b(1) here>



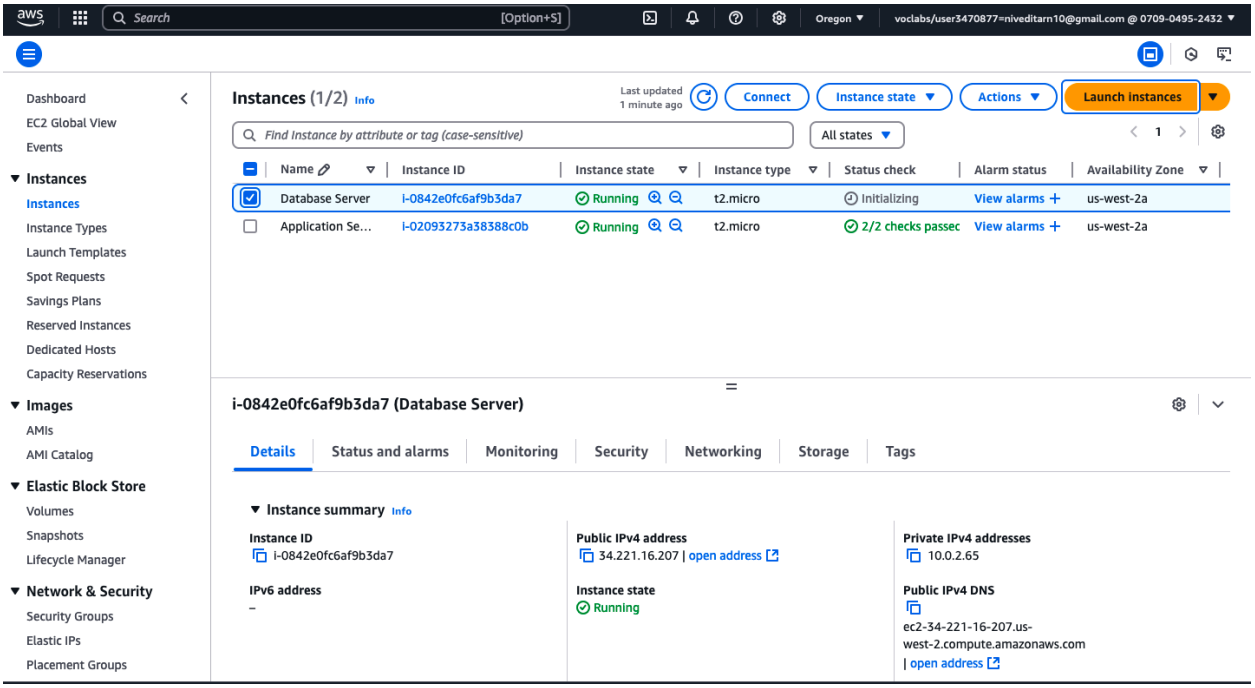
<Insert screenshot b(2) here>



<Insert screenshot b(3) here>



<Insert screenshot b(4) here>



Step 4: Application and Database Installation and Testing

Step number	a

Step name	Installation and configuration of MySQL
Instructions	1) Copy the database pem file into the application server using the below command *scp -i <application server pem file> <database server pem file > ec2-user@<application server public IP>:/home/ec2-user* 2) Log into the application server using SSH/Putty 3) From the application server, log into the database server using the pem file copied in step 1and the private IP address of the database server with the following command *ssh -i <database server pem file> ec2-user@<private IP of database server>* 4) Enter the following commands to install and configure MySQL on the database server *sudo yum update* *wget http://dev.mysql.com/get/mysql57-community-release-el7-9.noarch.rpm* *sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm -y* *sudo yum install mysql-community-server -y --nogpgcheck* *sudo systemctl start mysqld.service* Run the below command to retrieve a temporary password for MySQL *sudo grep 'temporary password' /var/log/mysqld.log | rev | cut -d" " -f1 | rev | tr -d "."* Log in to MySQL with the below command and enter the above password when prompted *mysql -u root -p* Enter the below command after you login to MySQL *ALTER USER 'root'@'localhost' IDENTIFIED BY 'Password42!';* Type 'exit' into the MySQL prompt and press Enter to exit out of the MySQL environment. Enter the below commands to complete the setup. Ignore any warning messages you receive. *wget https://d6opu47qoi4ee.cloudfront.net/install_mysql_linux.sh* *chmod 777 install_mysql_linux.sh* *sudo ./install_mysql_linux.sh* 5) Type *exit* to exit the database server and go back to the application server
Expected screenshots	1) Installation of MySQL 2) Retrieving the temporary password 3) Executing the provided script

<Insert screenshot a(1) here>

```
[ec2-user@ip-10-0-2-65 ~]$ wget http://dev.mysql.com/get/mysql57-community-release-el7-9.noarch.rpm
-bash: wget http://dev.mysql.com/get/mysql57-community-release-el7-9.noarch.rpm: No such file or directory
[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm -y
-bash: sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm: command not found
[ec2-user@ip-10-0-2-65 ~]$ sudo wget https://dev.mysql.com/get/mysql57-community-release-el7-11.noarch.rpm
--2024-12-23 18:15:32--  https://dev.mysql.com/get/mysql57-community-release-el7-11.noarch.rpm
Resolving dev.mysql.com (dev.mysql.com)... 23.6.106.166, 2600:1409:9800:98b::2e31, 2600:1409:9800:993::2e31
Connecting to dev.mysql.com (dev.mysql.com)|23.6.106.166|:443... connected.
HTTP request sent, awaiting response... 302 Moved Temporarily
Location: https://repo.mysql.com//mysql57-community-release-el7-11.noarch.rpm [following]
--2024-12-23 18:15:33--  https://repo.mysql.com//mysql57-community-release-el7-11.noarch.rpm
Resolving repo.mysql.com (repo.mysql.com)... 23.198.151.232, 2600:1409:9800:f91::1d68, 2600:1409:9800:f8c::1d68
Connecting to repo.mysql.com (repo.mysql.com)|23.198.151.232|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 25680 (25K) [application/x-redhat-package-manager]
Saving to: 'mysql57-community-release-el7-11.noarch.rpm'

100%[======================================>] 25,680      --.-K/s   in 0.008s

2024-12-23 18:15:33 (3.21 MB/s) - 'mysql57-community-release-el7-11.noarch.rpm' saved [25680/25680]

[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm -y
-bash: sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm: command not found
[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-11.noarch.rpm
Failed to set locale, defaulting to C
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
Examining mysql57-community-release-el7-11.noarch.rpm: mysql57-community-release-el7-11.noarch
Marking mysql57-community-release-el7-11.noarch.rpm to be installed
Resolving Dependencies
--> Running transaction check
---> Package mysql57-community-release.noarch 0:el7-11 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package           Arch   Version
                                Repository                                  Size
================================================================================
Installing:
 mysql57-community-release
                   noarch el7-11 /mysql57-community-release-el7-11.noarch  31 k

Transaction Summary
================================================================================
Install  1 Package

Total size: 31 k
Installed size: 31 k
Is this ok [y/d/N]: y
Downloading packages:
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : mysql57-community-release-el7-11.noarch                     1/1
  Verifying  : mysql57-community-release-el7-11.noarch                     1/1

Installed:
  mysql57-community-release.noarch 0:el7-11

Complete!
[ec2-user@ip-10-0-2-65 ~]$
```

<Insert screenshot a(2) here>
<Insert screenshot a(3) here>

Step number	b
Step name	Installation and configuration of Mattermost
Instructions	1) Enter the following commands after logging into the application server via SSH to install and

	configure Mattermost *wget https://d6opu47qoi4ee.cloudfront.net/install_mattermost_linux.sh* *sudo yum install dos2unix -y* *sudo dos2unix install_mattermost_linux.sh* *chmod 700 install_mattermost_linux.sh* *sudo ./install_mattermost_linux.sh <private IP of MySQL server>* Example : sudo *./install_mattermost_linux* 173.65.34.7 *sudo chown -R mattermost:mattermost /opt/mattermost* *sudo chmod -R g+w /opt/mattermost* *cd /opt/mattermost* *sudo -u mattermost ./bin/mattermost* 2) Check whether the server has been successfully deployed by navigating to the following URL in your web browser. The web page might take a couple of minutes to load. <public IP of the application server>:8065
Expected screenshots	1) Executing the script 2) Starting the Mattermost server 3) Accessing the application via web browser

<Insert screenshot b(1) here>

```
[ec2-user@ip-10-0-2-65 ~]$ wget http://dev.mysql.com/get/mysql57-community-release-el7-9.noarch.rpm
-bash: wget http://dev.mysql.com/get/mysql57-community-release-el7-9.noarch.rpm: No such file or directory
[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm -y
-bash: sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm: command not found
[ec2-user@ip-10-0-2-65 ~]$ sudo wget https://dev.mysql.com/get/mysql57-community-release-el7-11.noarch.rpm
--2024-12-23 18:15:32--  https://dev.mysql.com/get/mysql57-community-release-el7-11.noarch.rpm
Resolving dev.mysql.com (dev.mysql.com)... 23.6.106.166, 2600:1409:9800:98b::2e31, 2600:1409:9800:993::2e31
Connecting to dev.mysql.com (dev.mysql.com)|23.6.106.166|:443... connected.
HTTP request sent, awaiting response... 302 Moved Temporarily
Location: https://repo.mysql.com//mysql57-community-release-el7-11.noarch.rpm [following]
--2024-12-23 18:15:33--  https://repo.mysql.com//mysql57-community-release-el7-11.noarch.rpm
Resolving repo.mysql.com (repo.mysql.com)... 23.198.151.232, 2600:1409:9800:f91::1d68, 2600:1409:9800:f8c::1d68
Connecting to repo.mysql.com (repo.mysql.com)|23.198.151.232|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 25680 (25K) [application/x-redhat-package-manager]
Saving to: 'mysql57-community-release-el7-11.noarch.rpm'

100%[======================================>] 25,680      --.-K/s   in 0.008s

2024-12-23 18:15:33 (3.21 MB/s) - 'mysql57-community-release-el7-11.noarch.rpm' saved [25680/25680]

[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm -y
-bash: sudo yum localinstall mysql57-community-release-el7-9.noarch.rpm: command not found
[ec2-user@ip-10-0-2-65 ~]$ sudo yum localinstall mysql57-community-release-el7-11.noarch.rpm
Failed to set locale, defaulting to C
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
Examining mysql57-community-release-el7-11.noarch.rpm: mysql57-community-release-el7-11.noarch
Marking mysql57-community-release-el7-11.noarch.rpm to be installed
Resolving Dependencies
--> Running transaction check
---> Package mysql57-community-release.noarch 0:el7-11 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package            Arch   Version
                                Repository                                  Size
================================================================================
Installing:
 mysql57-community-release
                    noarch el7-11 /mysql57-community-release-el7-11.noarch  31 k

Transaction Summary
================================================================================
Install  1 Package

Total size: 31 k
Installed size: 31 k
Is this ok [y/d/N]: y
Downloading packages:
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : mysql57-community-release-el7-11.noarch                     1/1
  Verifying  : mysql57-community-release-el7-11.noarch                     1/1

Installed:
  mysql57-community-release.noarch 0:el7-11

Complete!
[ec2-user@ip-10-0-2-65 ~]$
```

<Insert screenshot b(2) here>

```
[ec2-user@ip-10-0-2-65 ~]$ wget https://d6opu47qoi4ee.cloudfront.net/install_mattermost_linux.sh
--2024-12-23 18:52:50--  https://d6opu47qoi4ee.cloudfront.net/install_mattermost_linux.sh
Resolving d6opu47qoi4ee.cloudfront.net (d6opu47qoi4ee.cloudfront.net)... 3.165.166.122, 3.165.166.43, 3.165.166.103, ...
Connecting to d6opu47qoi4ee.cloudfront.net (d6opu47qoi4ee.cloudfront.net)|3.165.166.122|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 592 [text/x-sh]
Saving to: 'install_mattermost_linux.sh.1'

100%[======================================>] 592         --.-K/s   in 0s

2024-12-23 18:52:51 (146 MB/s) - 'install_mattermost_linux.sh.1' saved [592/592]

[ec2-user@ip-10-0-2-65 ~]$ sudo yum install dos2unix -y
Failed to set locale, defaulting to C
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
amzn2-core                                               | 3.6 kB     00:00
62 packages excluded due to repository priority protections
Resolving Dependencies
--> Running transaction check
---> Package dos2unix.x86_64 0:6.0.3-7.amzn2.0.3 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package          Arch          Version                Repository         Size
================================================================================
Installing:
 dos2unix         x86_64        6.0.3-7.amzn2.0.3      amzn2-core         75 k

Transaction Summary
================================================================================
Install  1 Package

Total download size: 75 k
Installed size: 190 k
Downloading packages:
dos2unix-6.0.3-7.amzn2.0.3.x86_64.rpm                      |  75 kB   00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : dos2unix-6.0.3-7.amzn2.0.3.x86_64                           1/1
  Verifying  : dos2unix-6.0.3-7.amzn2.0.3.x86_64                           1/1

Installed:
  dos2unix.x86_64 0:6.0.3-7.amzn2.0.3

Complete!
[ec2-user@ip-10-0-2-65 ~]$ sudo dos2unix install_mattermost_linux.sh
dos2unix: converting file install_mattermost_linux.sh to Unix format ...
[ec2-user@ip-10-0-2-65 ~]$ chmod 700 install_mattermost_linux.sh
[ec2-user@ip-10-0-2-65 ~]$ sudo ./install_mattermost_linux.sh 10.0.2.65
rm: cannot remove '/opt/mattermost': No such file or directory
--2024-12-23 18:55:12--  https://releases.mattermost.com/5.19.0/mattermost-5.19.0-linux-amd64.tar.gz
Resolving releases.mattermost.com (releases.mattermost.com)... 18.172.170.51, 18.172.170.100, 18.172.170.92, ...
Connecting to releases.mattermost.com (releases.mattermost.com)|18.172.170.51|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 155314485 (148M) [application/x-gzip]
Saving to: 'mattermost-5.19.0-linux-amd64.tar.gz'

100%[======================================>] 155,314,485 33.4MB/s   in 4.8s
```

<Insert screenshot b(3) here>

Step 5: Answer the following questions

Answer the following questions

Q1 What is the default setting for DNS hostnames when a new VPC is created?

a) Enabled

b) Disabled

c) Can be set during VPC creation

d) Depends on the region used

Enter your answer here: b

Q2 What is the term used for the machine when we use it to log into the database server?

a) Bastion Host

b) NAT Gateway

c) Tunnel Interface

d) SSH Gateway

Enter your answer here | a

Q3 The database server security group in this exercise has to keep port 3306 open. Which protocol uses this port to communicate?

a) HTTPS

b) RDP

c) TCP

d) SCP

Enter your answer here | c

Q4 Which port is being used by Mattermost to communicate with the client application

a) 8080

b) 80

c) 443

d) 8065

Enter your answer here | d

Q5 Which of the following is a reason why we cannot set the CIDR block for the public subnet to 10.0.2.0/16, assuming the values for the other CIDR blocks are the same as mentioned in the instructions?

a) CIDR block overlaps with existing block

b) CIDR block is not a valid CIDR

c) CIDR block does not fall within the VPC

d) There is no reason, this is a perfectly valid CIDR

Enter your answer here | c

Q 6 Assume that you have been asked to create 3 EC2 instances - application server, the database server and NAT instance. Each of these instances have their own security groups with a set of ports to be kept open. One of those ports is entirely unnecessary for the given architecture to function. Which of the ports given in the option below could it be?

a) Port 22 on the NAT instances

b) Port 3306 on the database server

c) Port 443 on the NAT instance

d) Port 22 on the application server

Enter your answer here: a

Q 7 Describe the steps you would take to increase security of the servers you have deployed so that they are not reachable from external sources

1. The NAT instance should only accept connections from the private subnet.
2. The database server security group should be set to only receive incoming from the public subnet

Q 8 Describe the steps required to deploy the given application in an autoscaling environment

1. **Create and configure EC2 instance for given application. Details**
    a. Select the AMI (Amazon Machine Image) for application.

b. Specify the instance type (e.g., t2.micro, t3.medium).
c. Configure storage as per the application's requirements.

2. **Add User Data.**
3. Define Security Groups
4. Now Set Up an Auto Scaling Group using above launch template

Grades distribution	
MCQs	6 (1 mark each)
Subjective questions	20 marks (10+10)
Implementation screenshots	24 marks (1 marks each)
Total	50 marks