

## Project: 3-tier Student App

### Prerequisite:

- VPC: Amazon Virtual Private Cloud (VPC) is a virtual network that allows users to launch AWS resources in a logically isolated section of the Amazon Web Services (AWS) cloud.
- Subnet: In Amazon Web Services (AWS), is a range of IP address in virtual private network.
- Route Table: A route table in Amazon Web Services (AWS) is a set of rules that determine where network traffic is directed.
- Nat Gateway: A Network Address Translation (NAT) Gateway in Amazon Web Services (AWS) is a managed service that allows instances in a private subnet to connect to the internet or AWS services.
- Internet Gateway: An internet gateway (IGW) in AWS is a logical connection that allows communication between a Virtual Private Cloud (VPC) and the internet.
- RDS: RDS stands for Amazon Relational Database Service, a managed service from Amazon Web Services (AWS) that helps users set up, operate, and scale relational databases in the cloud.

### Create VPC:

- Name: VPC-3-tier
- CIDR: 192.168.0.0/16

### Create Subnet:

#### 1.Subnet-1

- Name: Public-Subnet-Nginx
- CIDR: 192.168.1.0/24

#### 2.Subnet-2

- Name: Private-Subnet-Tomcat
- CIDR: 192.168.3.0/24

#### 3.subnet-3

- Name: Private-Subnet-Database
- CIDR: 192.168.4.0/24

#### 4.subnet-4

- Name: Public-Subnet-LB
- CIDR: 192.168.4.0/24

## Create Internet Gateway:

- Name: IGW-3-tier
- Attach IGW to VPC

## Create Nat Gateway:

- Name: NAT-3-tier
- Create in public subnet

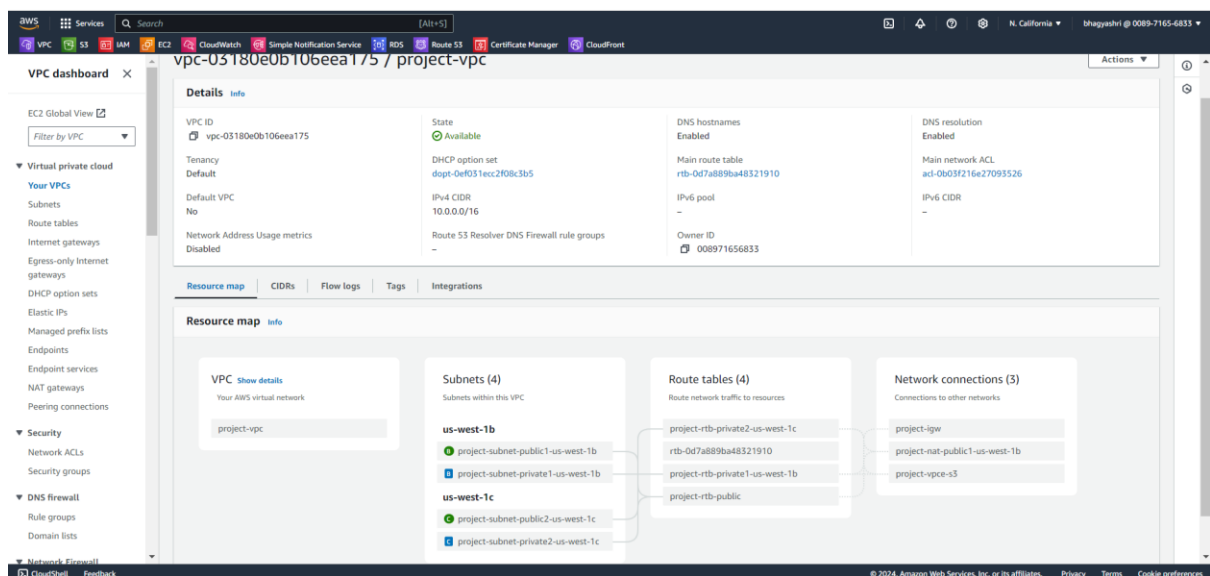
## Create Route Table:

### 1.RT-Public-subnet

- Add public subnet
- Add IGW

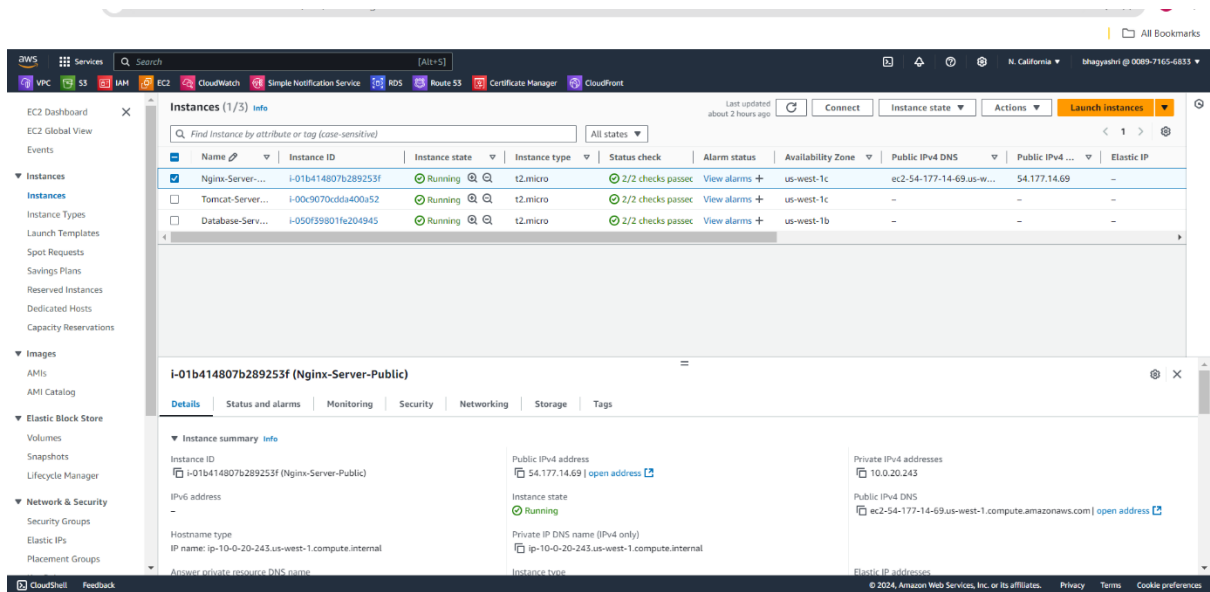
### 2.RT-Private-subnet

- Add private subnets
- Add nat



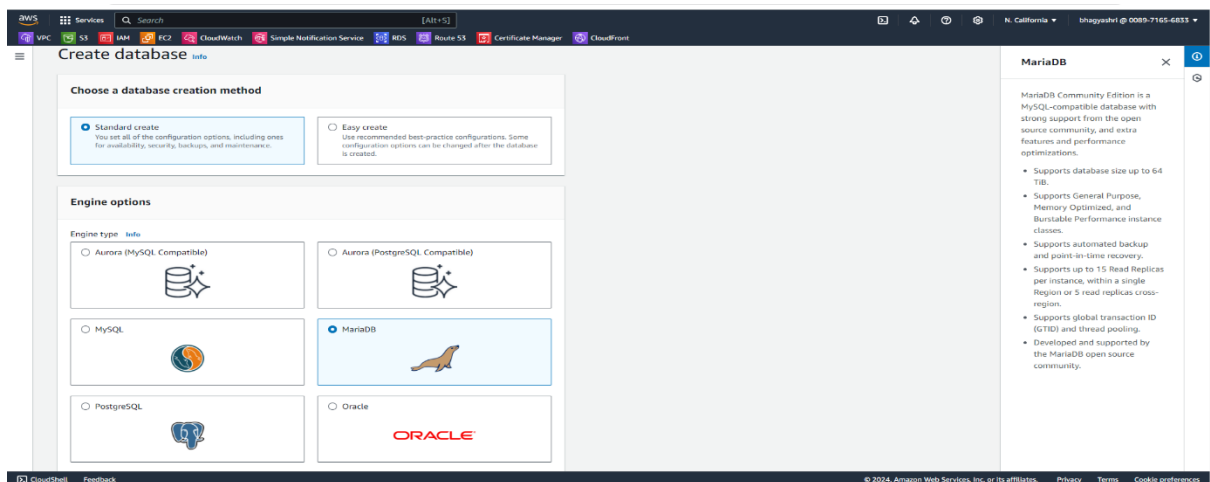
## Create EC2 Instances:

- Nginx-server-public -> create in public subnet -> allow port = 80, 22
- Tomcat-Server-Private -> create in private subnet -> allow port = 8080, 22
- Database-Server-Private -> create in private subnet -> allow port = 3306, 22



## Create Database In RDS:

- Go To RDS
- Created Database
- Standard create
- Free tier
- DB name - database-1
- Username - admin
- Password - Passwd123\$
- VPC – VPC-3-tier
- Connect to instance -> choose database instance
- Public access – no
- A.Z – no preference
- Create database
- Edit security group -> Add 3306 port



**Connect to an EC2 compute resource**

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

☐ Don't connect to an EC2 compute resource  
Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

☒ Connect to an EC2 compute resource  
Set up a connection to an EC2 compute resource for this database.

**EC2 instance** Info  
Choose the EC2 instance to add as the compute resource for this database. A VPC security group is added to this EC2 instance. A VPC security group is also added to the database with an inbound rule that allows the EC2 instance to access the database.

Database-Server-Private

**Some VPC settings can't be changed when a compute resource is added**  
Adding an EC2 compute resource automatically selects the VPC, DB subnet group, and public access settings for this database. To allow the EC2 instance to access the database, a VPC security group `rdc-ec2-X` is added to the database and another called `ec2-rds-X` to the EC2 instance. You can remove the new security group for the database only by removing the compute resource.

**Network type** Info  
To use dual-stack mode, make sure that you associate an IPv4 CIDR block with a subnet in the VPC you specify.

☒ IPv4  
Your resources can communicate only over the IPv4 addressing protocol.

☐ Dual-stack mode  
Your resources can communicate over IPv4, IPv6, or both.

**Virtual private cloud (VPC)** Info  
Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

-4 Subnets, 2 Availability Zones

Only VPCs with a corresponding DB subnet group are listed.

☒ After a database is created, you can't change its VPC.

**DB subnet group** Info  
Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you choose.

-4 Subnets, 2 Availability Zones

**Public access** Info  
RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

☐ Yes

☒ No  
RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

**VPC security group (firewall)** Info  
Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

☐ Choose existing  
Choose existing VPC security groups

☒ Create new  
Create new VPC security group

**New VPC security group name**

Amazon RDS will add a new VPC security group `rdc-ec2-1` to allow connectivity with your compute resource.

**Availability Zone** Info  
Choose one or more Availability Zones to increase availability.

**Certificate authority - optional** Info  
Using a server certificate provides an extra layer of security by validating that the connection is being made to an Amazon database. It does so by checking the server certificate that is automatically installed on all databases that you provision.

Expiry: May 20, 2061

If you don't select a certificate authority, RDS chooses one for you.

**Additional configuration**

## MariaDB

MariaDB Community Edition is a MySQL-compatible database with strong support from the open source community, and extra features and performance optimizations.

- Supports database size up to 64 TiB.
- Supports General Purpose, Memory Optimized, and Burstable Performance instance classes.
- Supports automated backup and point-in-time recovery.
- Supports up to 15 Read Replicas per instance, within a single Region or 5 read replicas cross-region.
- Supports global transaction ID (GTID) and thread pooling.
- Developed and supported by the MariaDB open source community.

**Public access** Info  
RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

☐ Yes

☒ No  
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## Connect To Nginx-Server-Public:

```

aws
Services
Search [Alt+S]

IAM Key Management Service EC2 VPC RDS

Amazon Linux 2023

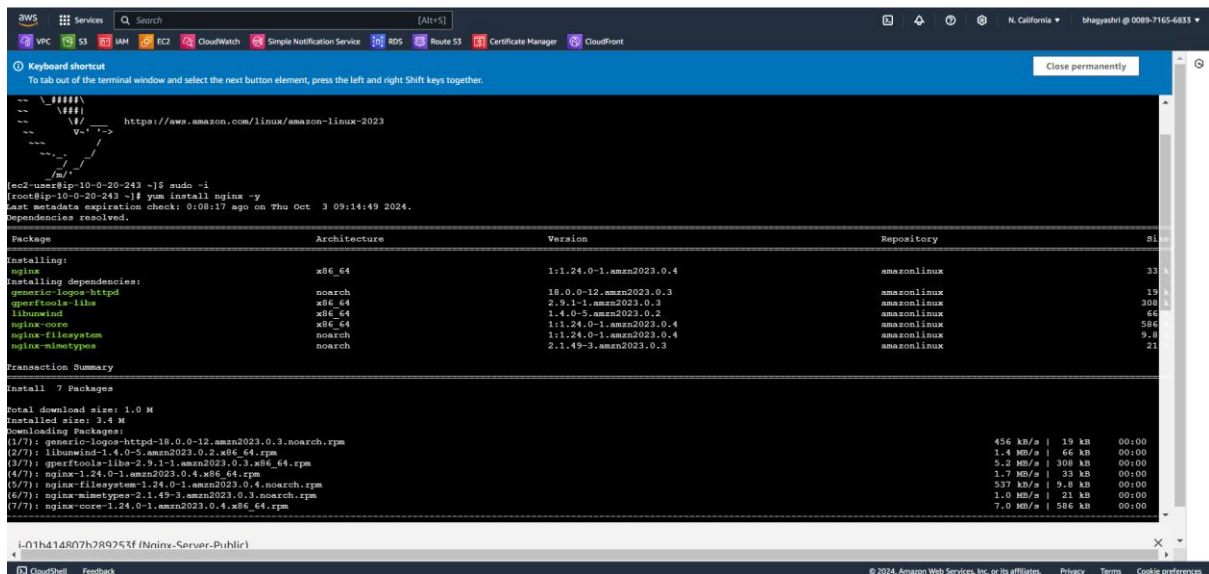
https://aws.amazon.com/linux/amazon-linux-2023

Last login: Wed May 8 07:18:40 2024 from 3.112.23.5
[ec2-user@Nginx-Server ~]$

```

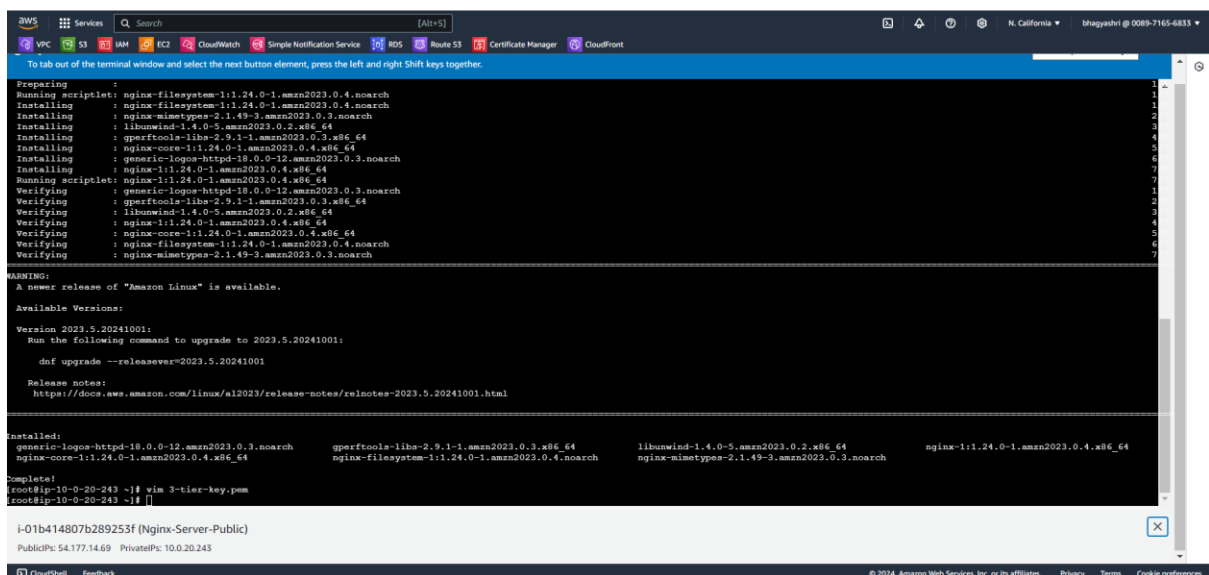
## 1.Change hostname

- `sudo -i`
- `yum install nginx -y`

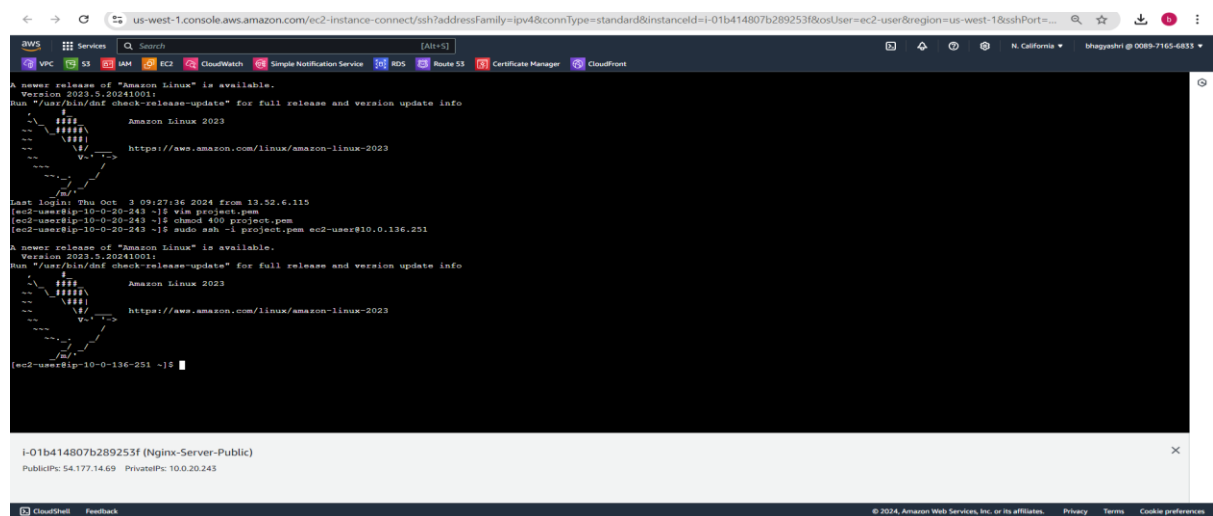


## 2.create file with name3-tier-key.pem

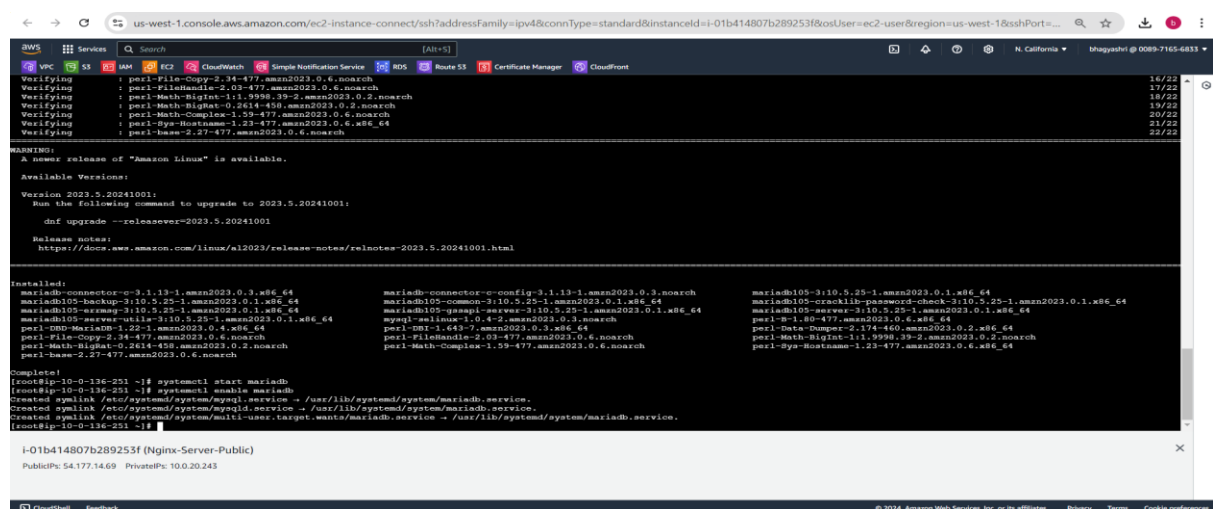
- vim 3-tier-key.pem
- copy private key and paste it here



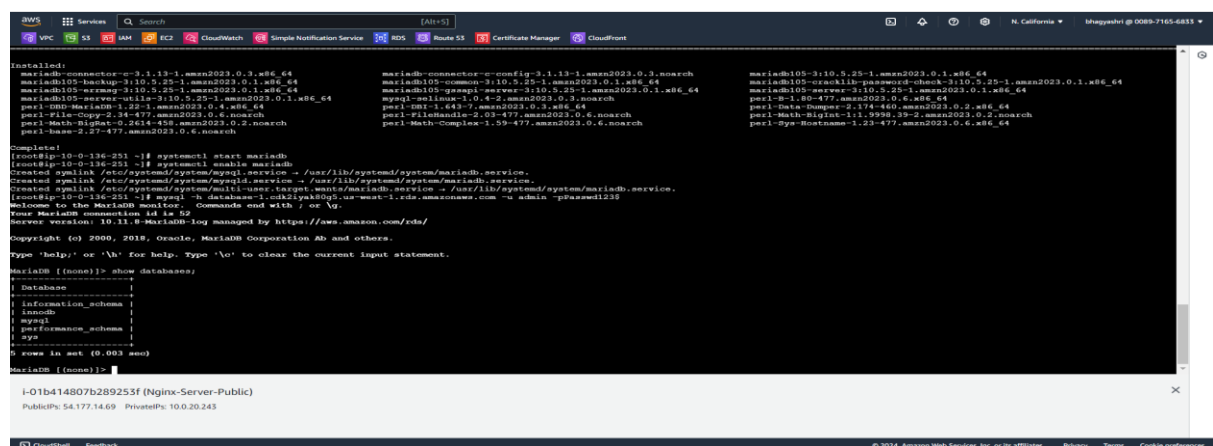
## Now SSH into Database Server:



- `sudo -i`
- `yum install mariadb105-server -y`
- `systemctl start mariadb`
- `systemctl enable mariadb`



## Log into database:



- Run this query to create table:**

- ```
Q AWS Services Search [Alt+S]
VPC S3 IAM EC2 CloudWatch Simple Notification Service RDS Route 53 Certificate Manager CloudFront

Created symlink /etc/systemd/system/mysql.service -> /usr/lib/systemd/system/mariadb.service.
Created symlink /etc/systemd/system/multi-user.target.wants/mariadb.service -> /usr/lib/systemd/system/mariadb.service.
[root@ip-10-0-136-251 ~]# mysql -h database-1.cdk2iyak80p3.us-west-1.rds.amazonaws.com -u admin -pPassword1235
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MariaDB connection id is 52
Server version: 10.11.8-MariaDB-log managed by https://aws.amazon.com/rds/

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> show databases;
+-----+
| Database |
+-----+
| information_schema |
| innodb |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.003 sec)

MariaDB [(none)]> create database studentapp;
Query OK, 1 row affected (0.004 sec)

MariaDB [(none)]> use studentapp;
Database changed

MariaDB [studentapp]> CREATE TABLE if not exists students(student_id INT NOT NULL AUTO_INCREMENT,
-> student_name VARCHAR(100) NOT NULL,
-> student_addr VARCHAR(100) NOT NULL,
-> student_age VARCHAR(3) NOT NULL,
-> student_qual VARCHAR(20) NOT NULL,
-> student_percent VARCHAR(10) NOT NULL,
-> student_year_passed VARCHAR(10) NOT NULL,
-> PRIMARY KEY (student_id)
-> );
Query OK, 0 rows affected (0.013 sec)

MariaDB [studentapp]>
```

i-01b414807b289253f (Nginx-Server-Public)

PublicIPs: 54.177.14.69 PrivateIPs: 10.0.20.243

- [illegible]

## Now SSH into Tomcat Server:

```
logout
(ec2-user@ip-10-0-136-251 ~)$ cd project1.pem
(ec2-user@ip-10-0-136-251 ~)$ chmod 400 project1.pem
(ec2-user@ip-10-0-136-251 ~)$ ssh -i project1.pem ec2-user@54.177.14.69
The authenticity of host '54.177.14.69 (54.177.14.69)' can't be established.
ED25519 key fingerprint is SHA256:ontQ57xw1f1d01B9Dy6mXqlqubz73aT0pEX03iP.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '54.177.14.69' (ED25519) to the list of known hosts.

A newer release of "Amazon Linux" is available.
Version 2023.5.20241001:
Run "/usr/bin/dnf check-release-update" for full release and version update info

Amazon Linux 2023
https://aws.amazon.com/linux/amazon-linux-2023

Last login: Thu Oct 3 09:36:25 2024 from 13.52.6.116
(ec2-user@ip-10-0-20-243 ~)$ ls
project1.pem
(ec2-user@ip-10-0-20-243 ~)$ ssh -i project1.pem ec2-user@10.0.155.131
The authenticity of host '10.0.155.131 (10.0.155.131)' can't be established.
ED25519 key fingerprint is SHA256:u0P2P2x63AwZWLdG/uh+RG43eMS/Oib+y17JREH8as.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.155.131' (ED25519) to the list of known hosts.

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Amazon Linux 2023
https://aws.amazon.com/linux/amazon-linux-2023

(ec2-user@ip-10-0-155-131 ~)$
```

ssh -i 3-tier-key.pem ec2-user@ip-of-tomcat-vm

sudo -i

yum install java -y

```
Version 2023.5.20241001:
Run "/usr/bin/dnf check-release-update" for full release and version update info

Amazon Linux 2023
https://aws.amazon.com/linux/amazon-linux-2023

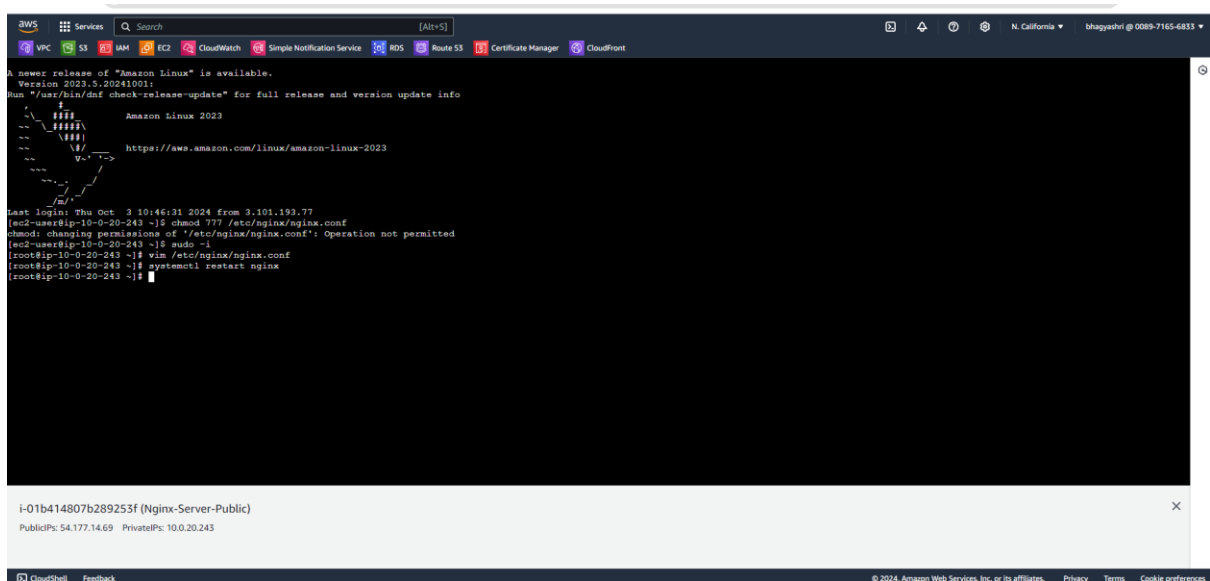
(ec2-user@ip-10-0-155-131 ~)$ sudo -i
(root@ip-10-0-155-131 ~)# yum install java -y
Last metadata expiration check: 0:43:57 ago on Thu Oct 3 09:16:43 2024.
Dependencies resolved.

Package Architecture Version Repository Size
Installing:
java-22-amazon-corretto x86_64 1:22.0.2+9-1.amzn2023.1 amazonlinux 213 k
Installing dependencies:
alsa-lib x86_64 1:2.7.2-1.amzn2023.0.2 amazonlinux 504 k
cairo x86_64 1.17.6-2.amzn2023.0.1 amazonlinux 684 k
dejavu-mono-fonts noarch 2.37-16.amzn2023.0.2 amazonlinux 1.3 M
dejavu-sans-fonts noarch 2.37-16.amzn2023.0.2 amazonlinux 447 k
fontconfig x86_64 2.13.94-2.amzn2023.0.2 amazonlinux 1.0 M
fontconfig-filesystem x86_64 2.13.94-2.amzn2023.0.2 amazonlinux 273 k
fontconfig-filesystem x86_64 2.13.2-5.amzn2023.0.1 amazonlinux 9.5 k
freetype x86_64 5.2.1-9.amzn2023.0.1 amazonlinux 423 k
glib2 x86_64 2.020.1206-2.amzn2023.0.2 amazonlinux 49 k
google-mono-fonts-common noarch 20201206-2.amzn2023.0.2 amazonlinux 15 k
google-mono-sans-vf-fonts noarch 20201206-2.amzn2023.0.2 amazonlinux 452 k
graphite2 x86_64 1.3.14-7.amzn2023.0.2 amazonlinux 97 k
harfbuzz x86_64 7.0.0-2.amzn2023.0.1 amazonlinux 868 k
java-22-amazon-corretto-headless x86_64 1:22.0.2+9-1.amzn2023.1 amazonlinux 97 M
javapackages-filesystem noarch 6.0.0-7.amzn2023.0.6 amazonlinux 12 k
javapackages-core-font-en noarch 2.0-21.amzn2023.0.4 amazonlinux 10 k
libICE x86_64 1.0.10-6.amzn2023.0.2 amazonlinux 71 k
libSM x86_64 1.2.3-8.amzn2023.0.2 amazonlinux 42 k
libX11 x86_64 1.7.2-3.amzn2023.0.4 amazonlinux 637 k
libX11-common noarch 1.7.2-3.amzn2023.0.4 amazonlinux 152 k
libXau x86_64 1.0.9-6.amzn2023.0.2 amazonlinux 31 k
libXext x86_64 1.3.4-6.amzn2023.0.2 amazonlinux 41 k
libXt x86_64 1.7.10-6.amzn2023.0.2 amazonlinux 40 k
libXtst x86_64 1.1.4-8.amzn2023.0.2 amazonlinux 15 k
libXtst-devel x86_64 1.5.2-6.amzn2023.0.2 amazonlinux 28 k
```

- mkdir /opt/tomcat
- curl -O https://dlcdn.apache.org/tomcat/tomcat-9/v9.0.90/bin/apache-tomcat-9.0.90.tar.gz
- tar -xzf apache-tomcat-9.0.90.tar.gz -C /opt/tomcat
- cd /opt/tomcat/apache-tomcat-9.0.90.tar.gz/webapps
- curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/student.war
- cd ../lib
- curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/mysql-connector.jar







## Go to Browser Hit Public-IP:

← → ↻ 🔒 Not secure 54.177.14.69 ☆ Incognito

### Student Registration Form

|                                         |                      |
|-----------------------------------------|----------------------|
| Student Name                            | <input type="text"/> |
| Student Address                         | <input type="text"/> |
| Student Age                             | <input type="text"/> |
| Student Qualification                   | <input type="text"/> |
| Student Percentage                      | <input type="text"/> |
| Year Passed                             | <input type="text"/> |
| <input type="button" value="register"/> |                      |

Database Details - RDS Manag... Instances | EC2 | us-east-1 EC2 Instance Connect abhpraydhole/Project-3-ter 3.84.18.92/viewStudents

← → ↻ 🔒 Not secure 3.84.18.92/viewStudents ☆

[Register Student](#)

### Students List

| Student ID | StudentName | Student Addr | Student Age | Student Qualification | Student Percentage | Student Year Passed | Edit                 | Delete                 |
|------------|-------------|--------------|-------------|-----------------------|--------------------|---------------------|----------------------|------------------------|
| 1          | sueha       | pune         | 20          | bbaca                 | 99                 | 2024                | <a href="#">edit</a> | <a href="#">delete</a> |
| 2          | rikta       | mumbai       | 19          | beom                  | 99                 | 2023                | <a href="#">edit</a> | <a href="#">delete</a> |
| 3          | bhagyashri  | pune         | 20          | bba                   | 98                 | 2024                | <a href="#">edit</a> | <a href="#">delete</a> |

