HOSTING APPLICATION ON 3 TIER ARCHITECTURE USING AWS :

Introduction:

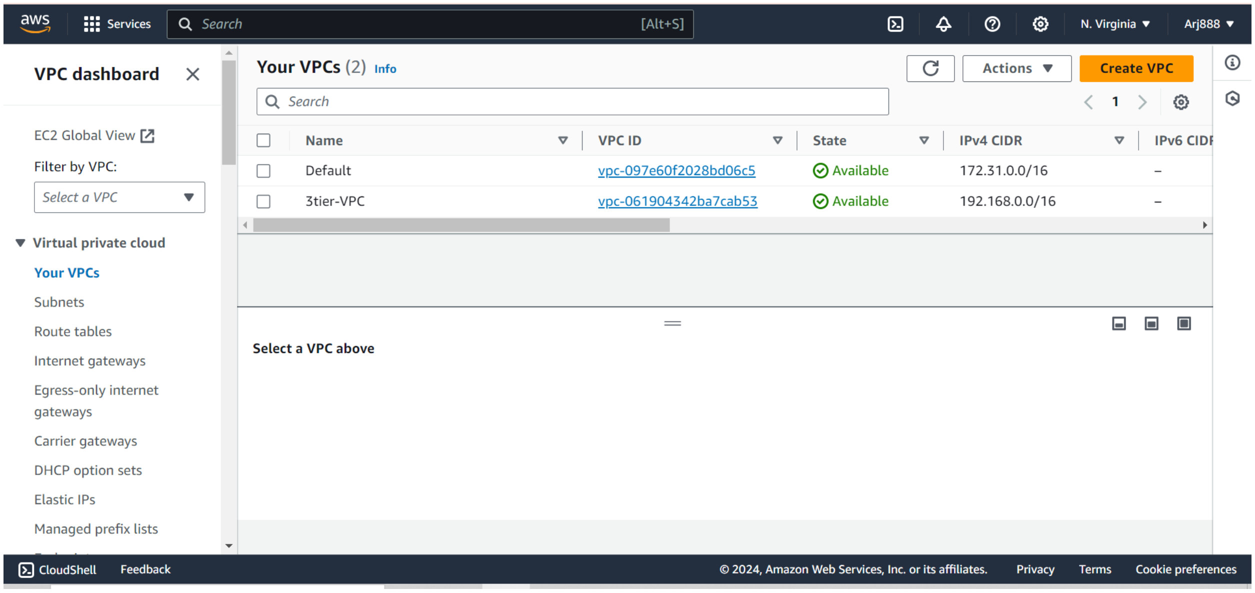
In this project, I create a 3-tier architecture for host application and database. Three-tier architecture is a well-established software application architecture that organizes applications into three logical and physical computing tiers: the jump-server tier, or user interface; the application tier, where data is processed; and the database tier, where application data is stored and managed.

Prerequisite:

1. Basic understanding of AWS and Mysql.
2. SHH key.
3. Knowledge about linux commands.

Step 1: Create Architecture using VP

- Select a region as you require.
- Create VPC set name and give CIDR to the VPC.

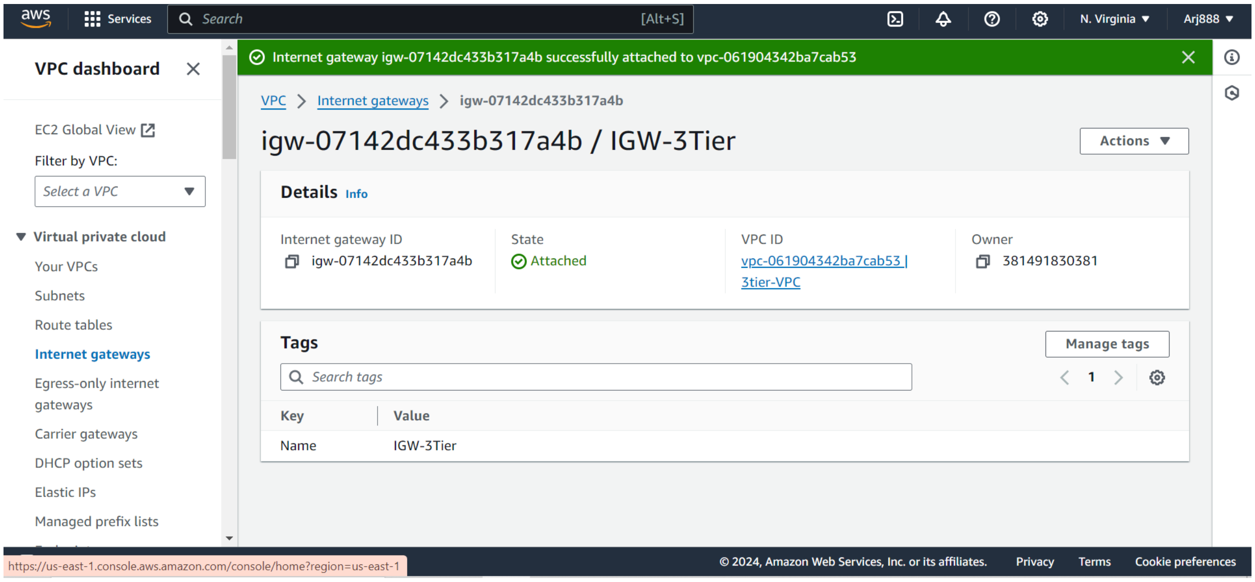


Your VPCs (2) Info

☐	Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR
☐	Default	vpc-097e60f2028bd06c5	✓ Available	172.31.0.0/16	–
☐	3tier-VPC	vpc-061904342ba7cab53	✓ Available	192.168.0.0/16	–

Select a VPC above

- Create Internet gateways and attach to new created VPC



Internet gateway igw-07142dc433b317a4b successfully attached to vpc-061904342ba7cab53

VPC > Internet gateways > igw-07142dc433b317a4b

igw-07142dc433b317a4b / IGW-3Tier

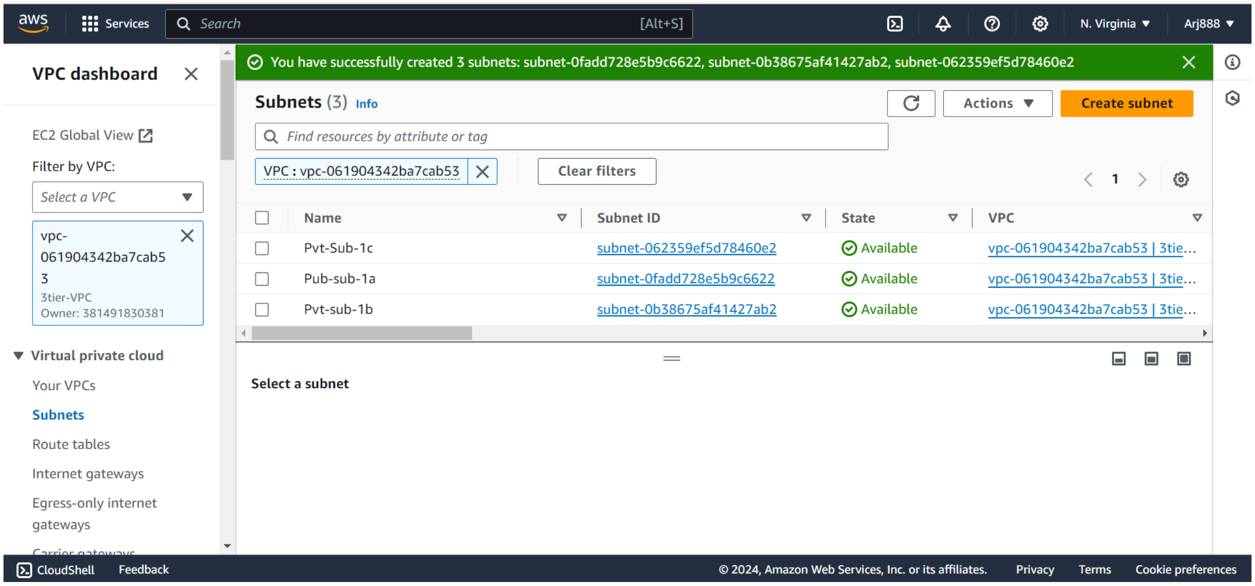
Details Info

Internet gateway ID: igw-07142dc433b317a4b
State: ✓ Attached
VPC ID: vpc-061904342ba7cab53 | 3tier-VPC
Owner: 381491830381

Tags

Key	Value
Name	IGW-3Tier

- Create 3 subnets in different Availability zones



You have successfully created 3 subnets: subnet-0fadd728e5b9c6622, subnet-0b38675af41427ab2, subnet-062359ef5d78460e2

Subnets (3) Info

Find resources by attribute or tag

VPC : vpc-061904342ba7cab53

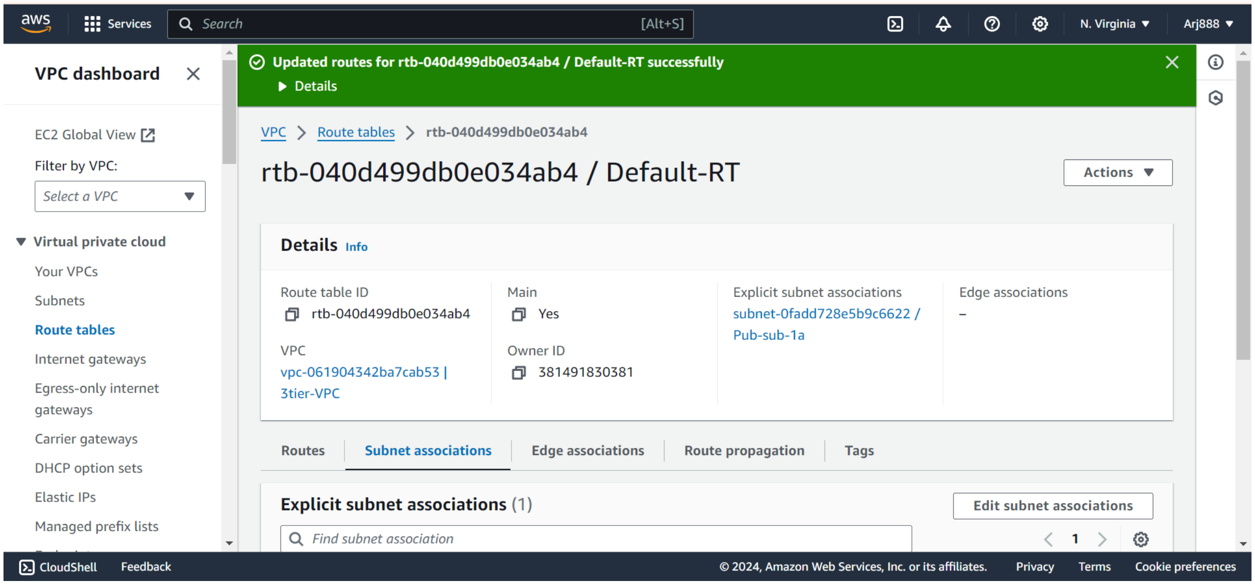
Filter by VPC: Select a VPC

vpc-061904342ba7cab53
3tier-VPC
Owner: 381491830381

Name	Subnet ID	State	VPC
Pvt-Sub-1c	subnet-062359ef5d78460e2	Available	vpc-061904342ba7cab53 | 3tie…
Pub-sub-1a	subnet-0fadd728e5b9c6622	Available	vpc-061904342ba7cab53 | 3tie…
Pvt-sub-1b	subnet-0b38675af41427ab2	Available	vpc-061904342ba7cab53 | 3tie…

Select a subnet

- Route internet gateway In default route tables
- Associate public subnets in default route tables



Updated routes for rtb-040d499db0e034ab4 / Default-RT successfully

Details

VPC > Route tables > rtb-040d499db0e034ab4

rtb-040d499db0e034ab4 / Default-RT

Details Info

Filter by VPC: Select a VPC

Route table ID: rtb-040d499db0e034ab4

Main: Yes

Explicit subnet associations: subnet-0fadd728e5b9c6622 / Pub-sub-1a

Edge associations: –

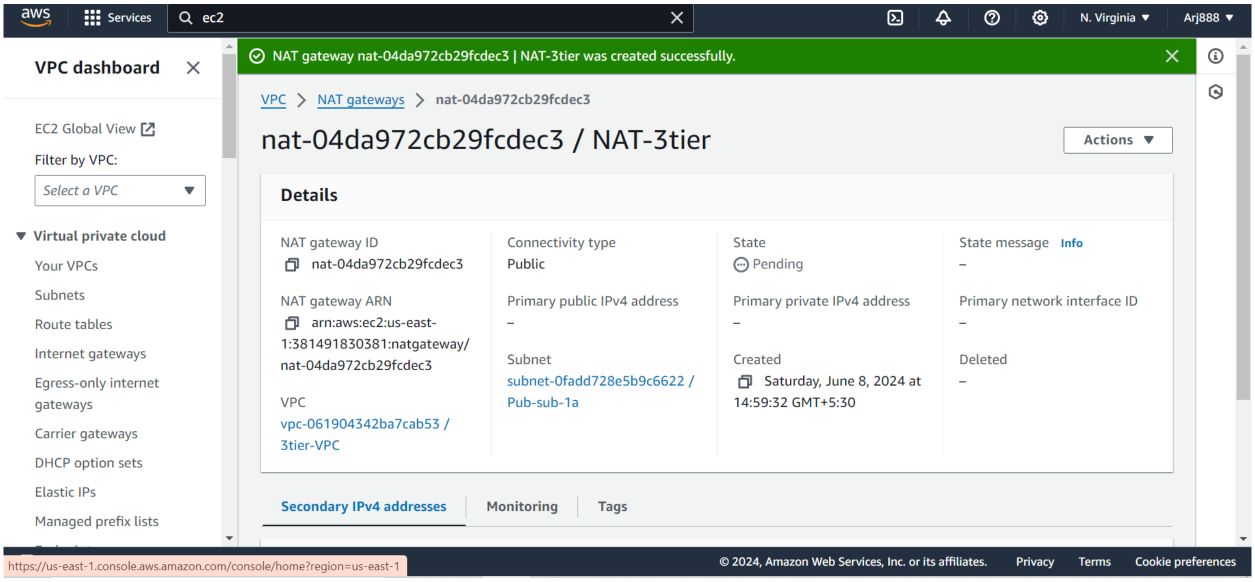
VPC: vpc-061904342ba7cab53 | 3tier-VPC

Owner ID: 381491830381

Explicit subnet associations (1)

Find subnet association

- create NAT gateway in public subnet.
- create new Route table for give internet access to private subnets. route NAT gateway in this route table and associate with private subnets



NAT gateway nat-04da972cb29fcdec3 | NAT-3tier was created successfully.

nat-04da972cb29fcdec3 / NAT-3tier

Details

NAT gateway ID: nat-04da972cb29fcdec3

Connectivity type: Public

State: Pending

State message Info: –

NAT gateway ARN: arn:aws:ec2:us-east-1:381491830381:natgateway/nat-04da972cb29fcdec3

Primary public IPv4 address: –

Primary private IPv4 address: –

Primary network interface ID: –

VPC: vpc-061904342ba7cab53 / 3tier-VPC

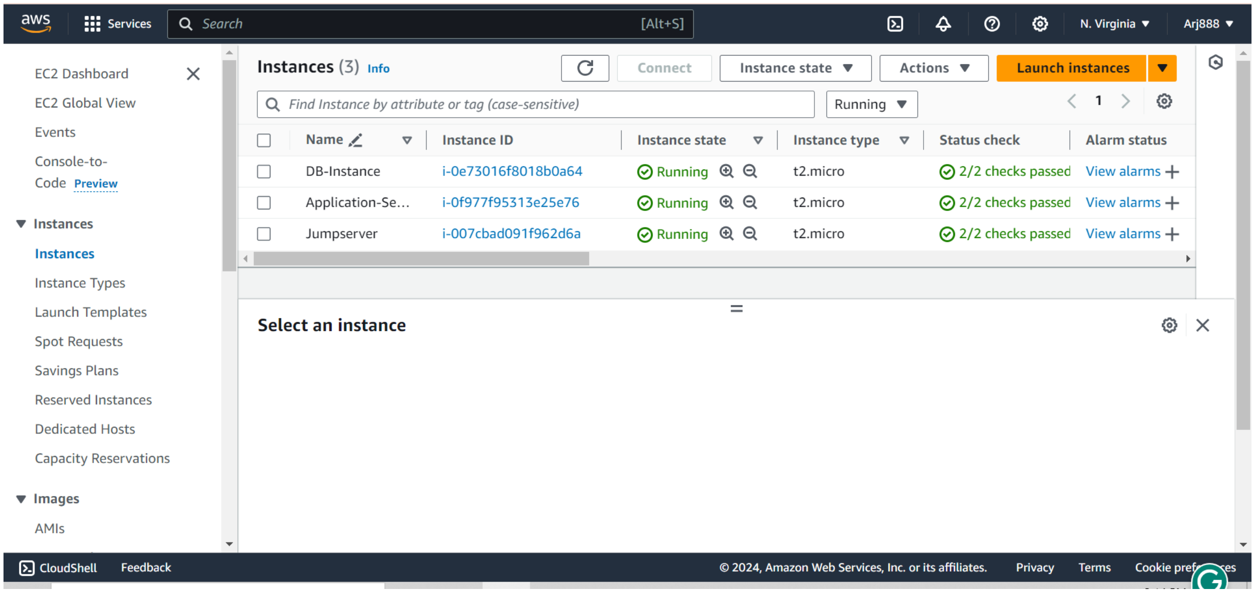
Subnet: subnet-0fadd728e5b9c6622 / Pub-sub-1a

Created: Saturday, June 8, 2024 at 14:59:32 GMT+5:30

Deleted: –

2 step: Create 3 instance using EC2 service

- Create 1st instance in public subnet and allow port 80 in the security group for nginx (Give name - jumpserver)
- Create 2nd Instance in private subnet (pvt-sub-1b) and allow port 8080 in the security group for tomcat (Give name - Application-server)
- Create 3rd instance in private subnet (pvt-sub-1c) and allow port 3306 in the security group for mariadb (Give name - DB-instance)

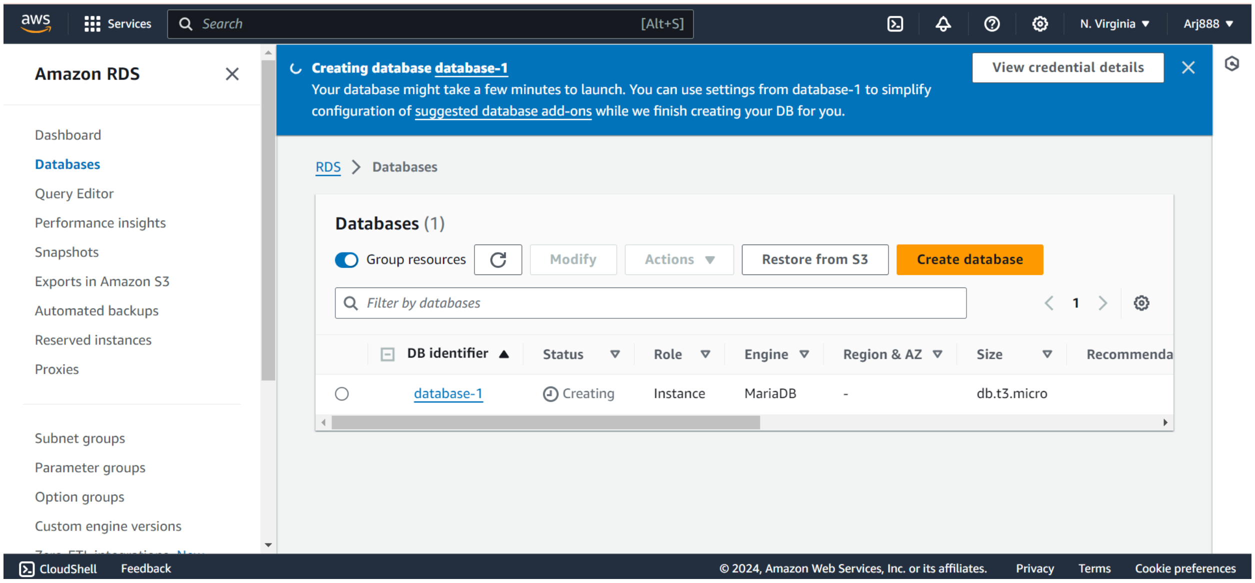


Instances (3) Info

☐	Name	Instance ID	Instance state	Instance type	Status check	Alarm status
☐	DB-Instance	i-0e73016f8018b0a64	✓ Running	t2.micro	✓ 2/2 checks passed	View alarms +
☐	Application-Se...	i-0f977f95313e25e76	✓ Running	t2.micro	✓ 2/2 checks passed	View alarms +
☐	Jumpserver	i-007cbad091f962d6a	✓ Running	t2.micro	✓ 2/2 checks passed	View alarms +

3 step: Create database using RDS (Relational Database Service)

- Create database. (Give Name - database-1)
- Select MariaDB engine
- In Database create user and give a password.
- Create security group in this security group allow port 3306 and add this security group in database



Creating database database-1

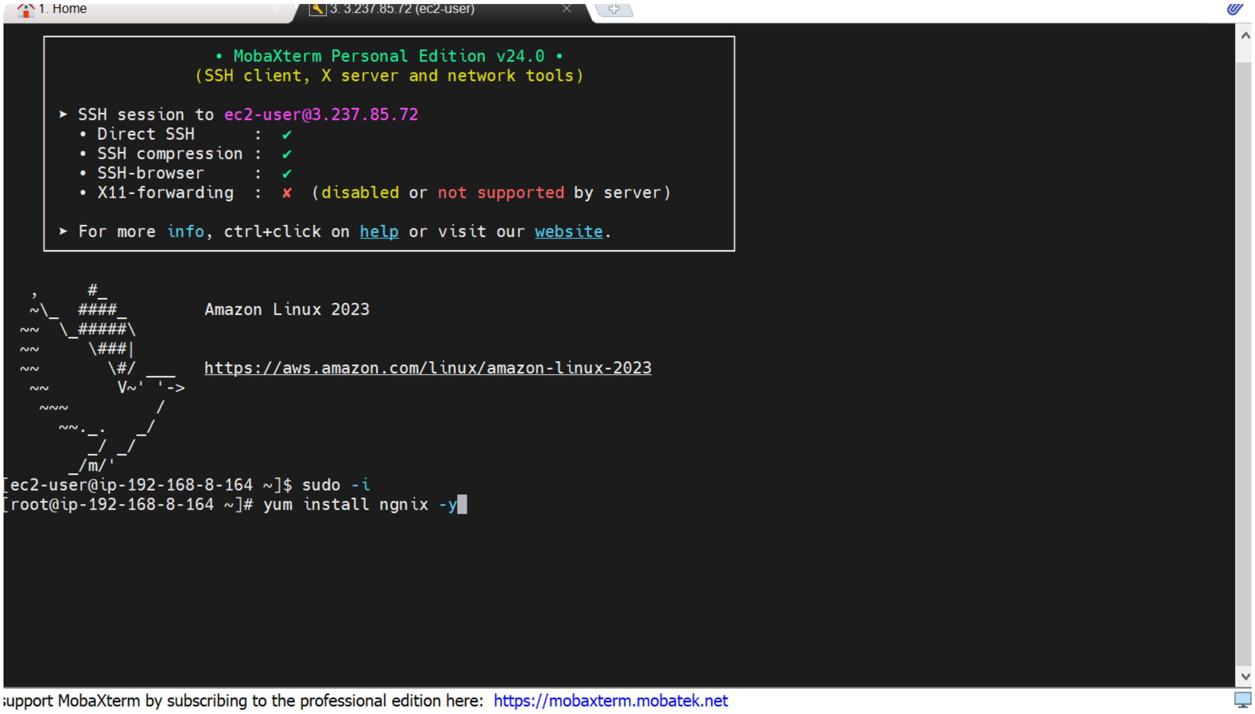
Your database might take a few minutes to launch. You can use settings from database-1 to simplify configuration of suggested database add-ons while we finish creating your DB for you.

Databases (1)

DB identifier	Status	Role	Engine	Region & AZ	Size	Recommenda
database-1	Creating	Instance	MariaDB	-	db.t3.micro	

4 Step: Configure Jump server

- Connect ec2-instance in cli mode of local machine using mobaxterm
- Install nginx for reverse proxy to the application server.
- Go to nginx.conf file (cd /etc/nginx/nginx.conf)



```
                 • MobaXterm Personal Edition v24.0 •
               (SSH client, X server and network tools)

 ➤ SSH session to ec2-user@3.237.85.72
   • Direct SSH      :  ✔
   • SSH compression :  ✔
   • SSH-browser     :  ✔
   • X11-forwarding  :  ✘  (disabled or not supported by server)

 ➤ For more info, ctrl+click on help or visit our website.


   ,     #_
   ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
[ec2-user@ip-192-168-8-164 ~]$ sudo -i
[root@ip-192-168-8-164 ~]# yum install ngnix -y
```

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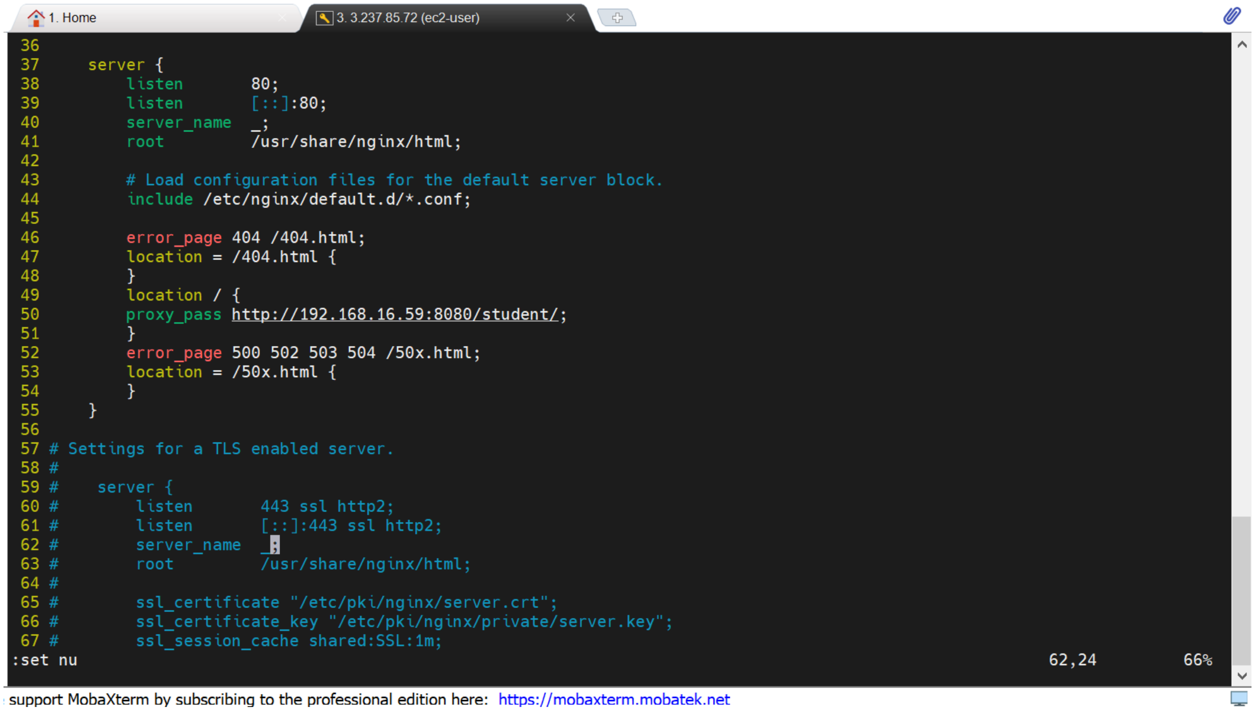
- Add data in nginx.conf on 49 line number using vim editor

location / {
proxy_pass
http://privateIPoftomcat:8080/student/;

}

- Restart nginx.service



```

    server {
        listen       80;
        listen       [::]:80;
        server_name  _;
        root         /usr/share/nginx/html;

        # Load configuration files for the default server block.
        include /etc/nginx/default.d/*.conf;

        error_page 404 /404.html;
        location = /404.html {
        }
        location / {
        proxy_pass http://192.168.16.59:8080/student/;
        }
        error_page 500 502 503 504 /50x.html;
        location = /50x.html {
        }
    }

# Settings for a TLS enabled server.
#
#    server {
#        listen       443 ssl http2;
#        listen       [::]:443 ssl http2;
#        server_name  _;
#        root         /usr/share/nginx/html;
#
#        ssl_certificate "/etc/pki/nginx/server.crt";
#        ssl_certificate_key "/etc/pki/nginx/private/server.key";
#        ssl_session_cache shared:SSL:1m;
:set nu                                                              62,24         66%
```

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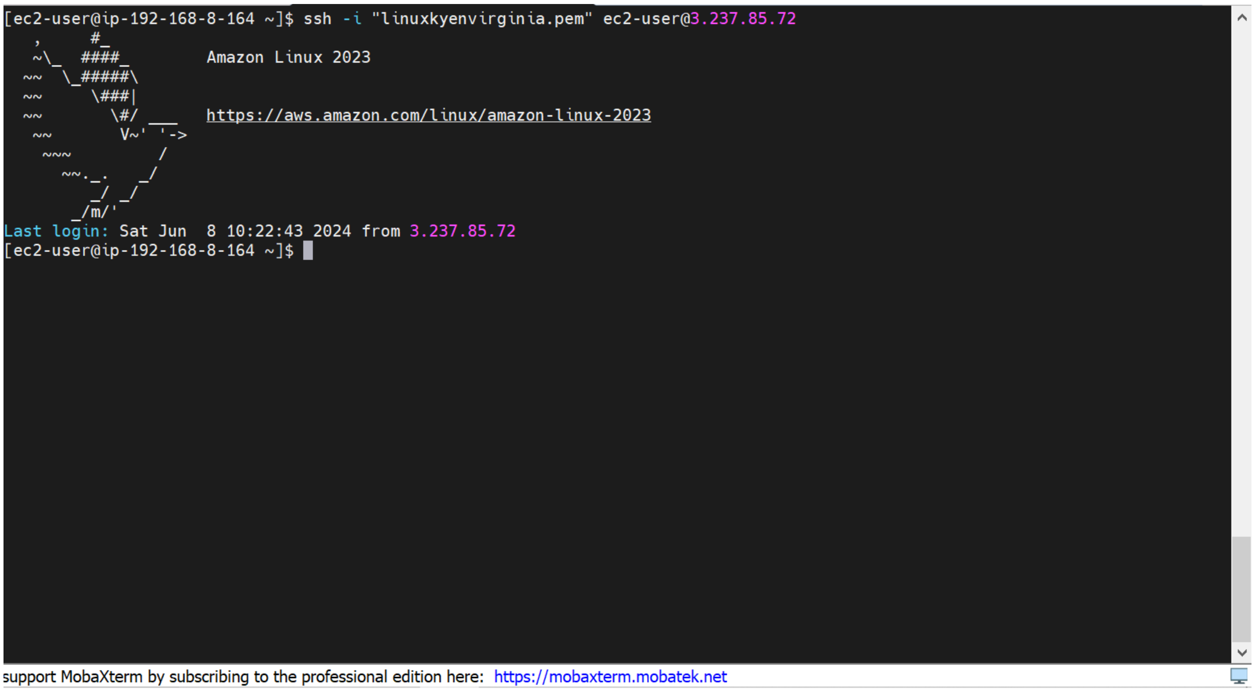
5 step: Configure Application Server

- Make ssh from Jump server to application server.
- Install Java for running tomcat server
- Download apache tomcat File (curl -O https://dlcdn.apache.org/tomcat/tomcat-8/v8.5.100/bin/apache-tomcat-8.5.100.tar.gz) and extract in /opt



```
[ec2-user@ip-192-168-8-164 ~]$ ssh -i "linuxkyenvirginia.pem" ec2-user@3.237.85.72
   ,     #_
   ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
Last login: Sat Jun  8 10:22:43 2024 from 3.237.85.72
[ec2-user@ip-192-168-8-164 ~]$ 
```

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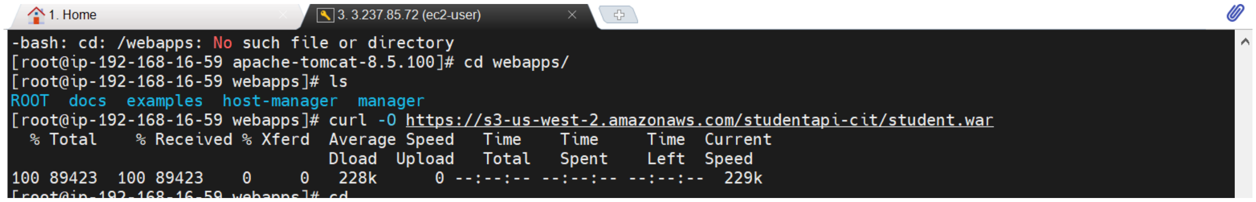
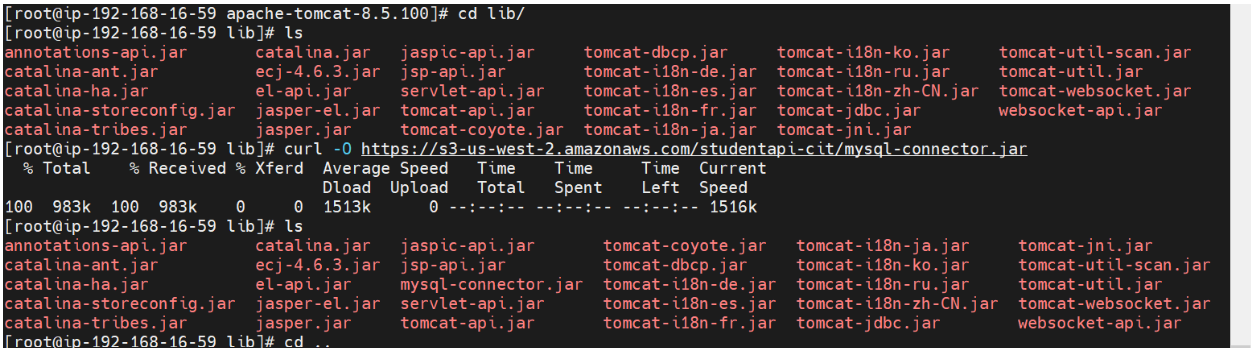
- Go to apache-tomcat file (use command - cd /opt/apache-tomcat-8.5.100)
- Go to webapps directory (cd webapps/) and download your application file



```
-bash: cd: /webapps: No such file or directory
[root@ip-192-168-16-59 apache-tomcat-8.5.100]# cd webapps/
[root@ip-192-168-16-59 webapps]# ls
ROOT  docs  examples  host-manager  manager
[root@ip-192-168-16-59 webapps]# curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/student.war
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 89423  100 89423    0     0   228k      0 --:--:-- --:--:-- --:--:--  229k
[root@ip-192-168-16-59 webapps]# cd
```

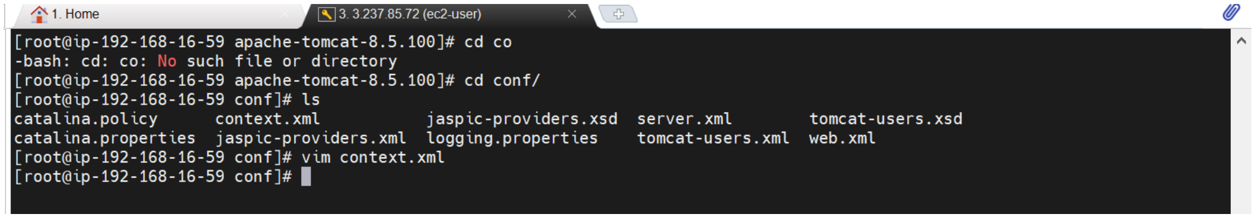
- Then go to /lib directory and Download connector to connect the database to application
- Check connector was download use ls command.



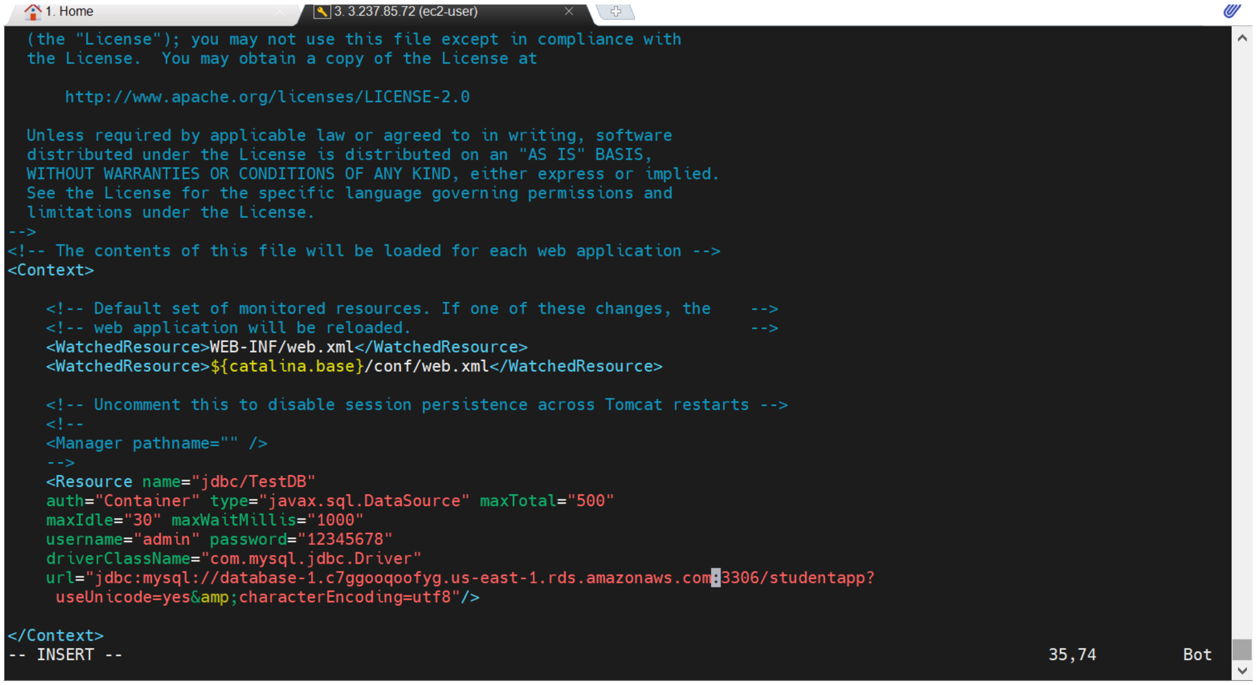
```
[root@ip-192-168-16-59 apache-tomcat-8.5.100]# cd lib/
[root@ip-192-168-16-59 lib]# ls
annotations-api.jar       catalina.jar   jaspic-api.jar     tomcat-dbcp.jar     tomcat-i18n-ko.jar     tomcat-util-scan.jar
catalina-ant.jar          ecj-4.6.3.jar  jsp-api.jar        tomcat-i18n-de.jar  tomcat-i18n-ru.jar     tomcat-util.jar
catalina-ha.jar           el-api.jar     servlet-api.jar    tomcat-i18n-es.jar  tomcat-i18n-zh-CN.jar  tomcat-websocket.jar
catalina-storeconfig.jar  jasper-el.jar  tomcat-api.jar     tomcat-i18n-fr.jar  tomcat-jdbc.jar        websocket-api.jar
catalina-tribes.jar       jasper.jar     tomcat-coyote.jar  tomcat-i18n-ja.jar  tomcat-jni.jar
[root@ip-192-168-16-59 lib]# curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/mysql-connector.jar
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  983k  100  983k    0     0  1513k      0 --:--:-- --:--:-- --:--:-- 1516k
[root@ip-192-168-16-59 lib]# ls
annotations-api.jar       catalina.jar   jaspic-api.jar       tomcat-coyote.jar   tomcat-i18n-ja.jar     tomcat-jni.jar
catalina-ant.jar          ecj-4.6.3.jar  jsp-api.jar          tomcat-dbcp.jar     tomcat-i18n-ko.jar     tomcat-util-scan.jar
catalina-ha.jar           el-api.jar     mysql-connector.jar  tomcat-i18n-de.jar  tomcat-i18n-ru.jar     tomcat-util.jar
catalina-storeconfig.jar  jasper-el.jar  servlet-api.jar      tomcat-i18n-es.jar  tomcat-i18n-zh-CN.jar  tomcat-websocket.jar
catalina-tribes.jar       jasper.jar     tomcat-api.jar       tomcat-i18n-fr.jar  tomcat-jdbc.jar        websocket-api.jar
[root@ip-192-168-16-59 lib]# cd ..
```

- Go to /conf directory and make changes in context.xml file using vim editor.
- Add given data in context.xml file make changes like admin name , password, endpoint of rds and database name.

<Resource name="jdbc/TestDB"
auth="Container" type="javax.sql.DataSource" maxTotal="500"
maxIdle="30" maxWaitMillis="1000"
username="
admin" password="**12345678**"
driverClassName="com.mysql.jdbc.Driver"
url="jdbc:mysql://
endpoint:3306/**databasename**?
useUnicode=yes&characterEncoding=utf8"/>



```
[root@ip-192-168-16-59 apache-tomcat-8.5.100]# cd co
-bash: cd: co: No such file or directory
[root@ip-192-168-16-59 apache-tomcat-8.5.100]# cd conf/
[root@ip-192-168-16-59 conf]# ls
catalina.policy      context.xml           jaspic-providers.xsd  server.xml        tomcat-users.xsd
catalina.properties  jaspic-providers.xml  logging.properties    tomcat-users.xml  web.xml
[root@ip-192-168-16-59 conf]# vim context.xml
[root@ip-192-168-16-59 conf]# 
```



```
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      http://www.apache.org/licenses/LICENSE-2.0

  Unless required by applicable law or agreed to in writing, software
  distributed under the License is distributed on an "AS IS" BASIS,
  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
  See the License for the specific language governing permissions and
  limitations under the License.
-->
<!-- The contents of this file will be loaded for each web application -->
<Context>

    <!-- Default set of monitored resources. If one of these changes, the    -->
    <!-- web application will be reloaded.                                   -->
    <WatchedResource>WEB-INF/web.xml</WatchedResource>
    <WatchedResource>${catalina.base}/conf/web.xml</WatchedResource>

    <!-- Uncomment this to disable session persistence across Tomcat restarts -->
    <!--
    <Manager pathname="" />
    -->
    <Resource name="jdbc/TestDB"
    auth="Container" type="javax.sql.DataSource" maxTotal="500"
    maxIdle="30" maxWaitMillis="1000"
    username="admin" password="12345678"
    driverClassName="com.mysql.jdbc.Driver"
    url="jdbc:mysql://database-1.c7ggooqoofyg.us-east-1.rds.amazonaws.com:3306/studentapp?
     useUnicode=yes&amp;characterEncoding=utf8"/>

</Context>
-- INSERT --                                                                                 35,74         Bot
```
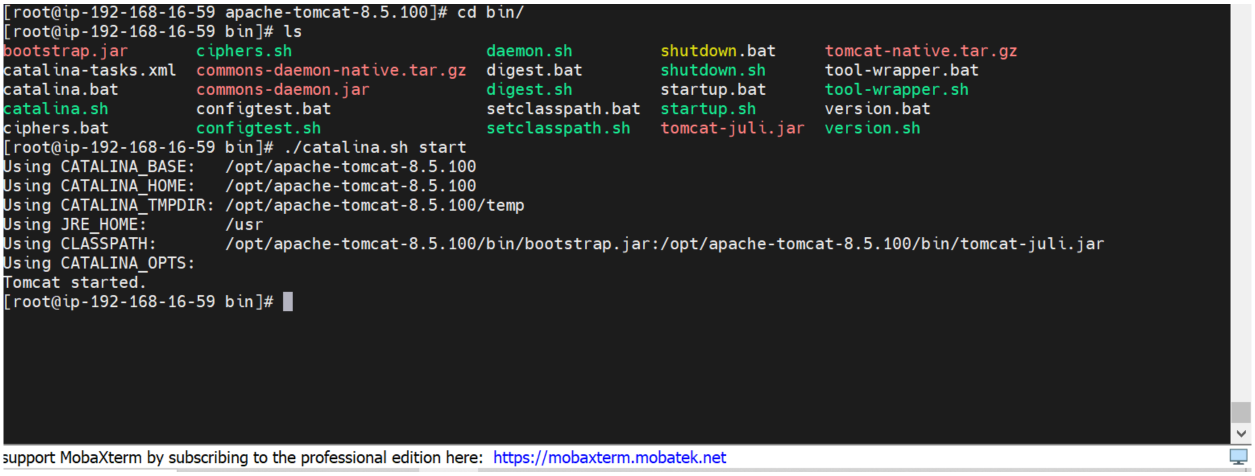

- In /bin directory strart tomacat using catalina.sh file (use command - ./catalina.sh start)



```
[root@ip-192-168-16-59 apache-tomcat-8.5.100]# cd bin/
[root@ip-192-168-16-59 bin]# ls
bootstrap.jar       ciphers.sh                  daemon.sh         shutdown.bat     tomcat-native.tar.gz
catalina-tasks.xml  commons-daemon-native.tar.gz  digest.bat        shutdown.sh      tool-wrapper.bat
catalina.bat        commons-daemon.jar          digest.sh         startup.bat      tool-wrapper.sh
catalina.sh         configtest.bat              setclasspath.bat  startup.sh       version.bat
ciphers.bat         configtest.sh               setclasspath.sh   tomcat-juli.jar  version.sh
[root@ip-192-168-16-59 bin]# ./catalina.sh start
Using CATALINA_BASE:   /opt/apache-tomcat-8.5.100
Using CATALINA_HOME:   /opt/apache-tomcat-8.5.100
Using CATALINA_TMPDIR: /opt/apache-tomcat-8.5.100/temp
Using JRE_HOME:        /usr
Using CLASSPATH:       /opt/apache-tomcat-8.5.100/bin/bootstrap.jar:/opt/apache-tomcat-8.5.100/bin/tomcat-juli.jar
Using CATALINA_OPTS:
Tomcat started.
[root@ip-192-168-16-59 bin]#
```

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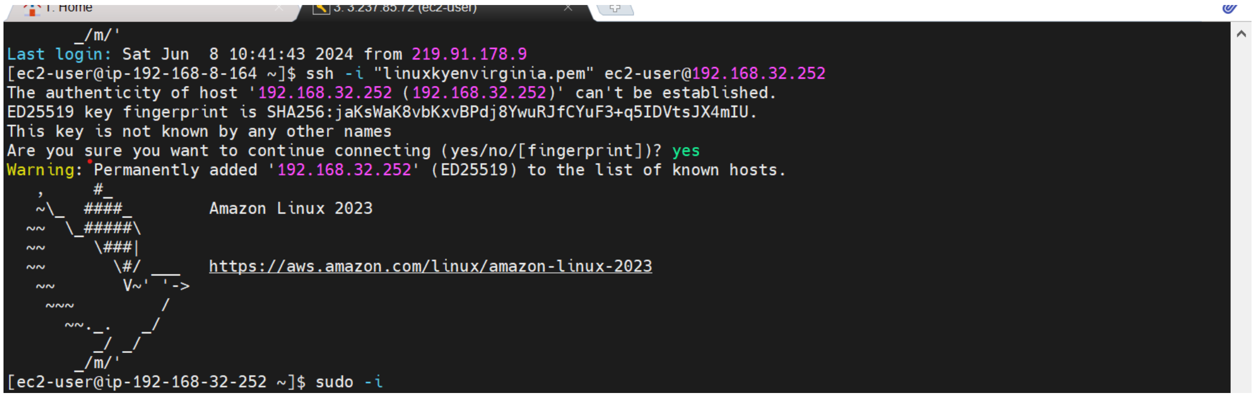
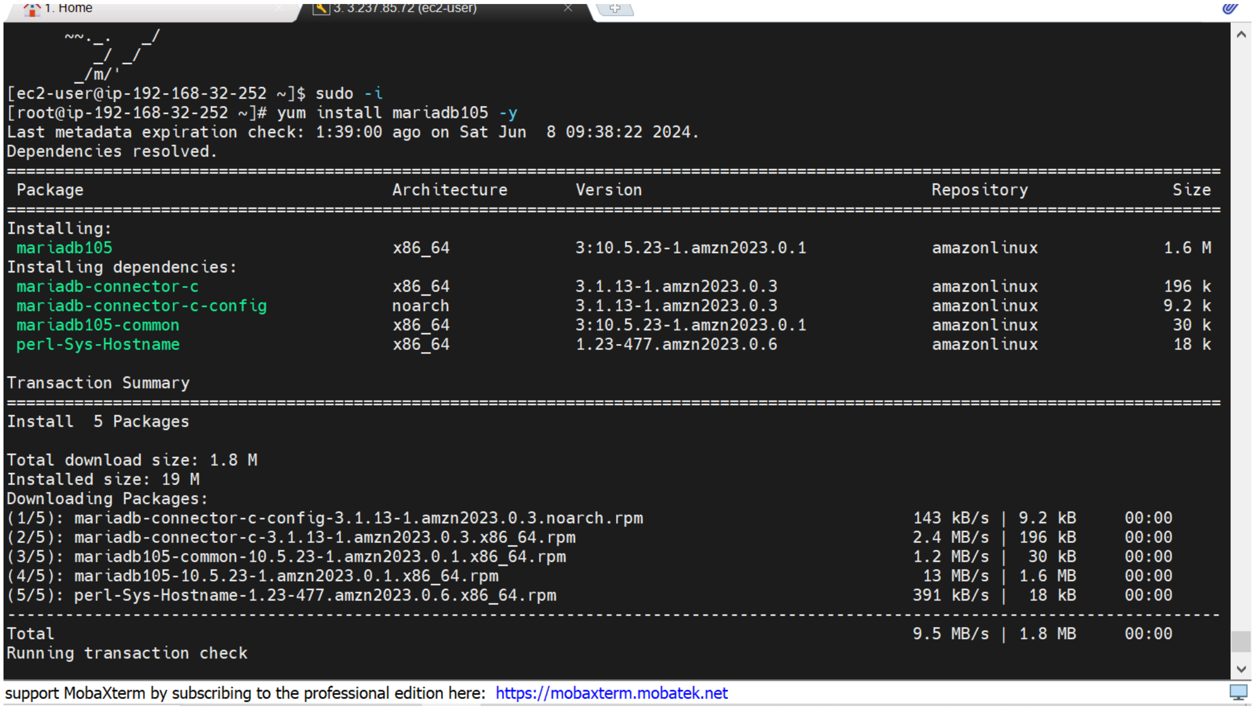
6 Step : Configure DB-server

- Make ssh Jump server to DB-server.
- Install mariadb for get access of RDS database (use command :- yum install mariadb105 -y)
- Access RDS using command mysql -h endpointofrds -u username -p password
- Create database using mysql queries (give name- studentapp)
- Use studentapp database and create tables using queries.



```
       _/m/'
Last login: Sat Jun  8 10:41:43 2024 from 219.91.178.9
[ec2-user@ip-192-168-8-164 ~]$ ssh -i "linuxkyenvirginia.pem" ec2-user@192.168.32.252
The authenticity of host '192.168.32.252 (192.168.32.252)' can't be established.
ED25519 key fingerprint is SHA256:jaKsWaK8vbKxvBPdj8YwuRJfCYuF3+q5IDVtsJX4mIU.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.32.252' (ED25519) to the list of known hosts.
   ,     #_
   ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
[ec2-user@ip-192-168-32-252 ~]$ sudo -i
```



```
      ~~._.   _/
         _/ _/
       _/m/'
[ec2-user@ip-192-168-32-252 ~]$ sudo -i
[root@ip-192-168-32-252 ~]# yum install mariadb105 -y
Last metadata expiration check: 1:39:00 ago on Sat Jun  8 09:38:22 2024.
Dependencies resolved.
================================================================================================================================
 Package                                       Architecture       Version                                  Repository        Size
================================================================================================================================
Installing:
 mariadb105                                    x86_64             3:10.5.23-1.amzn2023.0.1                 amazonlinux      1.6 M
Installing dependencies:
 mariadb-connector-c                           x86_64             3.1.13-1.amzn2023.0.3                    amazonlinux      196 k
 mariadb-connector-c-config                    noarch             3.1.13-1.amzn2023.0.3                    amazonlinux      9.2 k
 mariadb105-common                             x86_64             3:10.5.23-1.amzn2023.0.1                 amazonlinux       30 k
 perl-Sys-Hostname                             x86_64             1.23-477.amzn2023.0.6                    amazonlinux       18 k

Transaction Summary
================================================================================================================================
Install  5 Packages

Total download size: 1.8 M
Installed size: 19 M
Downloading Packages:
(1/5): mariadb-connector-c-config-3.1.13-1.amzn2023.0.3.noarch.rpm                           143 kB/s | 9.2 kB     00:00
(2/5): mariadb-connector-c-3.1.13-1.amzn2023.0.3.x86_64.rpm                                  2.4 MB/s | 196 kB     00:00
(3/5): mariadb105-common-10.5.23-1.amzn2023.0.1.x86_64.rpm                                   1.2 MB/s |  30 kB     00:00
(4/5): mariadb105-10.5.23-1.amzn2023.0.1.x86_64.rpm                                           13 MB/s | 1.6 MB     00:00
(5/5): perl-Sys-Hostname-1.23-477.amzn2023.0.6.x86_64.rpm                                    391 kB/s |  18 kB     00:00
--------------------------------------------------------------------------------------------------------------------------------
Total                                                                                        9.5 MB/s | 1.8 MB     00:00
Running transaction check
```

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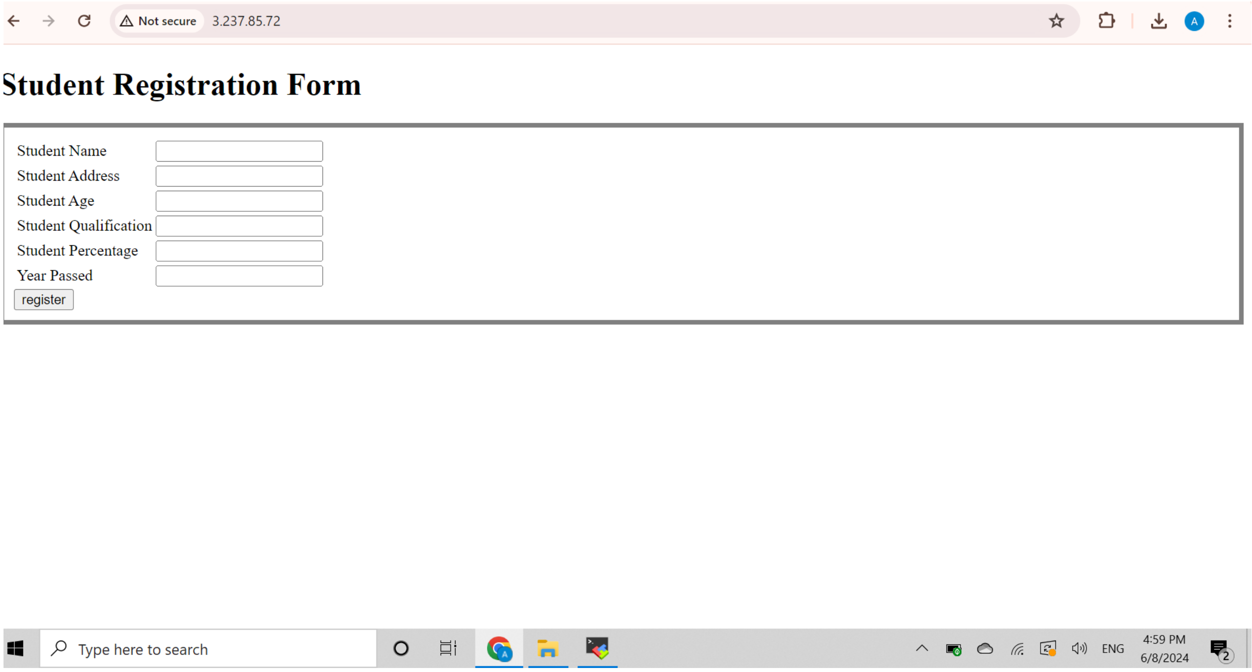
7 Step: Heat Public IP address of Jump Server



Student Registration Form

Student Name	
Student Address	
Student Age	
Student Qualification	
Student Percentage	
Year Passed	

register

Summury:

In this 3-tier application project, I have hosted an application using **nginx** for reverse proxy in jump server and use **tomcat** java-based web server to host the application. RDS is used to create database used engine is **mariadb** for store application database and also use AWS services like **EC2**, **VPC** etc.