

# 3 Tier Web Application Project

The Three-Tier Architecture Stands As One Of The Predominant And Widely Adopted Architectural Paradigms In The Software Industry. It Essentially Revolves Around The Concept Of Dissecting Our Software Application Into Three Distinct And Interconnected Components, Each Playing A Specific And Crucial Role In The Overall Functionality Of The System. These Three Primary Layers, Known As The Web/Presentation Layer, The Application Layer, And The Data Layer, Collectively Form A Robust And Organized Framework For Designing And Managing Complex Software Systems.

**1. Presentation/Web Layer:** This Is The Topmost Level Of The Application, Responsible For The User Interface And User Interaction. It Consists Of Web Pages, Mobile Applications, Or Desktop Applications That Users Interact With.

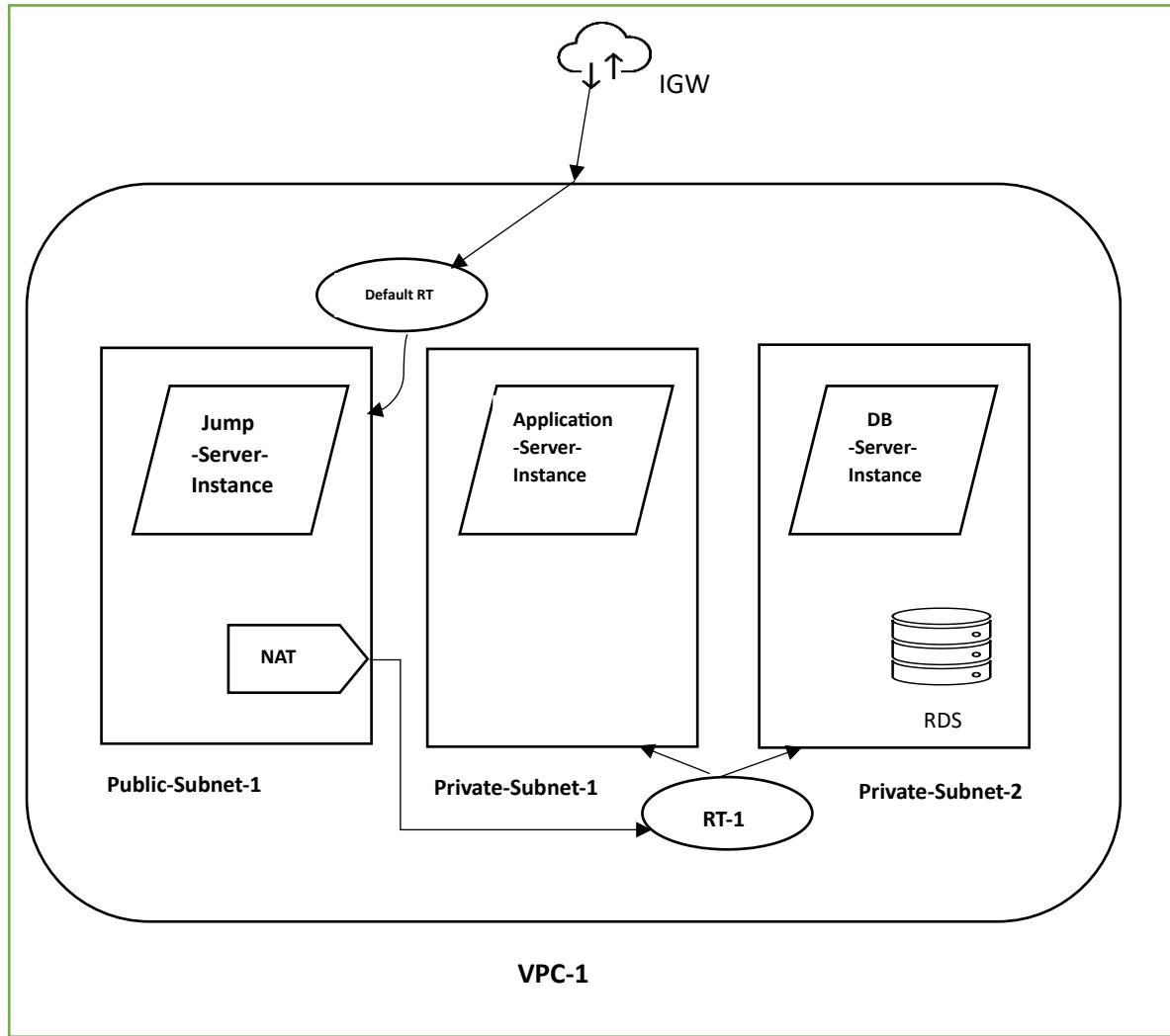
**2. Application Logic Layer:** This Middle Tier Handles The Core Functionality Of The Application. It Processes Inputs From The Presentation Tier, Makes Logical Decisions, Performs Calculations, And Interacts With The Data Tier.

**3. Data Layer:** This Bottom Tier Is Responsible For Data Storage, Retrieval, And Management. It Consists Of Databases And Data Access Layers.

- ❖ Creating a 3-tier application in AWS helps to :
- ❖ **Scale Easily** : You can adjust each part of the app separately to handle more or less traffic.
- ❖ **Enhance Security** : Protect each part of the app separately, ensuring sensitive data is well-guarded.
- ❖ **Simplify Updates** : Make changes to one part without affecting the others.
- ❖ **Boost Flexibility** : Use different AWS services best suited for each part of the app.
- ❖ **Increase Reliability** : Ensure your app is always available and can recover from failures quickly.
- ❖ **Improve Performance** : Speed up your app by using caching and other optimizations.
- ❖ **Manage Costs** : Pay only for what you use and optimize expenses based on your needs.

This approach makes your application more robust, efficient, and easier to manage.

### Architecture of 3 Tier Application :



❖ Log Into AWS Console

❖ VPC Service → Create VPC → VPC Settings → Resources To Create → VPC Only → VPC-1 → IPV4 CIDR Block → 192.168.0.0/16 → Create VPC

**Create VPC** Info

A VPC is an isolated portion of the AWS Cloud populated by AWS objects, such as Amazon EC2 instances.

**VPC settings**

**Resources to create** Info  
Create only the VPC resource or the VPC and other networking resources.

VPC only  VPC and more

**Name tag - optional**  
Creates a tag with a key of 'Name' and a value that you specify.

vpc-1

**IPv4 CIDR block** Info  
 IPv4 CIDR manual input  IPAM-allocated IPv4 CIDR block

192.168.0.0/16

CIDR block size must be between /16 and /28.

**IPv6 CIDR block** Info  
 No IPv6 CIDR block  IPAM-allocated IPv6 CIDR block  Amazon-provided IPv6 CIDR block  IPv6 CIDR owned by me

**Tenancy** Info  
Default

**Tags**  
A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key	Value - optional
Q Name	Q vpc-1

Add tag

You can add up to 49 more tags

**Create VPC**

**VPC dashboard** X

**Your VPCs (1/2)** Info

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP option set	Main route table
-	vpc-0fff1dcfeb08edfa8	Available	172.31.0.0/16	-	dopt-0e18ffa5b0dfcd159	rtb-0
<input checked="" type="checkbox"/> vpc-1	vpc-047baef47106f56b1	Available	192.168.0.0/16	-	dopt-0e18ffa5b0dfcd159	-

**vpc-047baef47106f56b1 / vpc-1**

**Details** Resource map CIDRs Flow logs Tags Integrations

Details	
VPC ID vpc-047baef47106f56b1	State Available
Tenancy Default	DHCP option set dopt-0e18ffa5b0dfcd159
	DNS hostnames Disabled
	Main route table =
	DNS resolution Enabled
	Main network ACL =

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❖ **Create 3 Subnets:**

❖ **Public-Subnet-1, Az - Us-East-1a, Ipv4 CIDR Block - 192.168.0.0/19**

❖ **Private-Subnet-1, Az - Us-East-1b, Ipv4 CIDR Block - 192.168.32.0/19**

❖ **Private-Subnet-2, Az - Us-East-1c, Ipv4 CIDR Block - 192.168.64.0/19**

The screenshot shows the AWS Management Console with the VPC service selected. A new subnet is being created with the following details:

- Subnet name:** public-subnet-1
- Availability Zone:** US East (N. Virginia) / us-east-1a
- IPv4 VPC CIDR block:** 192.168.0.0/16
- IPv4 subnet CIDR block:** 192.168.0.0/19 (8,192 IPs)
- Tags - optional:** A single tag named "Name" with value "public-subnet-1" is added.

The screenshot shows the AWS Management Console with the VPC service selected. A new subnet is being created with the following details:

- Subnet name:** private-subnet-1
- Availability Zone:** US East (N. Virginia) / us-east-1b
- IPv4 VPC CIDR block:** 192.168.0.0/16
- IPv4 subnet CIDR block:** 192.168.32.0/19 (8,192 IPs)
- Tags - optional:** A single tag named "Name" with value "private-subnet-1" is added.

Screenshot of the AWS VPC Subnet creation interface.

**Subnet name:** private-subnet-2

**Availability Zone:** US East (N. Virginia) / us-east-1c

**IPv4 VPC CIDR block:** 192.168.0.0/16

**IPv4 subnet CIDR block:** 192.168.64.0/19 (8,192 IPs)

**Tags - optional:**

- Key: Name, Value: private-subnet-2

**Create subnet** button

Screenshot of the AWS VPC dashboard showing the list of subnets.

**Subnets (3/9) info:**

Name	Subnet ID	State	VPC	IPv4 CIDR	IPv6 CIDR
public-subnet-1	subnet-011e3513a198a3055	Available	vpc-047baef47106f56b1   vpc-1	192.168.0.0/19	-
private-subnet-2	subnet-0fd8694117f0c32d	Available	vpc-047baef47106f56b1   vpc-1	192.168.64.0/19	-
private-subnet-1	subnet-0fcf8652ca2853172	Available	vpc-047baef47106f56b1   vpc-1	192.168.32.0/19	-
-	subnet-0addcb8b5b4142487	Available	vpc-0ffffdcfeb08edfa8	172.31.48.0/20	-
-	subnet-0ecc6d6f88e85e206	Available	vpc-0ffffdcfeb08edfa8	172.31.0.0/20	-
-	subnet-0ec7e897b45c4f6a2	Available	vpc-0ffffdcfeb08edfa8	172.31.64.0/20	-
-	subnet-0db6f27fa6ca7f0d9	Available	vpc-0ffffdcfeb08edfa8	172.31.32.0/20	-

**Subnets:** subnet-011e3513a198a3055, subnet-0fcf8652ca2853172, subnet-0fd8694117f0c32d

❖ Internet Gateways → Create Internet Gateway → Name Tag → IGW-1

The screenshot shows the 'Create internet gateway' wizard in the AWS VPC console. The 'Name tag' field contains 'IGW-1'. Under 'Tags - optional', there is one tag named 'Name' with value 'IGW-1'. The 'Create internet gateway' button is highlighted with a yellow border.

VPC > Internet gateways > Create internet gateway

Create internet gateway [Info](#)

An internet gateway is a virtual router that connects a VPC to the internet. To create a new internet gateway specify the name for the gateway below.

Internet gateway settings

Name tag

Creates a tag with a key of 'Name' and a value that you specify.

IGW-1

Tags - optional

A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key	Value - optional
Q Name	X IGW-1 Remove

Add new tag

You can add 49 more tags.

Cancel **Create internet gateway**

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❖ **Attach Internet Gateway (IGW-1) To VPC-1**

❖ **Select VPC → Actions → Attach To VPC → Select VPC-1**

The screenshot shows the AWS VPC dashboard with the 'Internet gateways' section. A table lists two internet gateways: 'IGW-1' and another entry. The 'IGW-1' row is selected, and a context menu is open over it, with 'Attach to VPC' being the highlighted option.

Name	Internet gateway ID	State	VPC ID
IGW-1	igw-0ca8448b8adf28d20	Detached	-
	igw-0caad76c5b0a610c4	Attached	vpc-0bffffdcfeb08edfa8

**igw-0ca8448b8adf28d20 / IGW-1**

**Details** **Tags**

**Details**

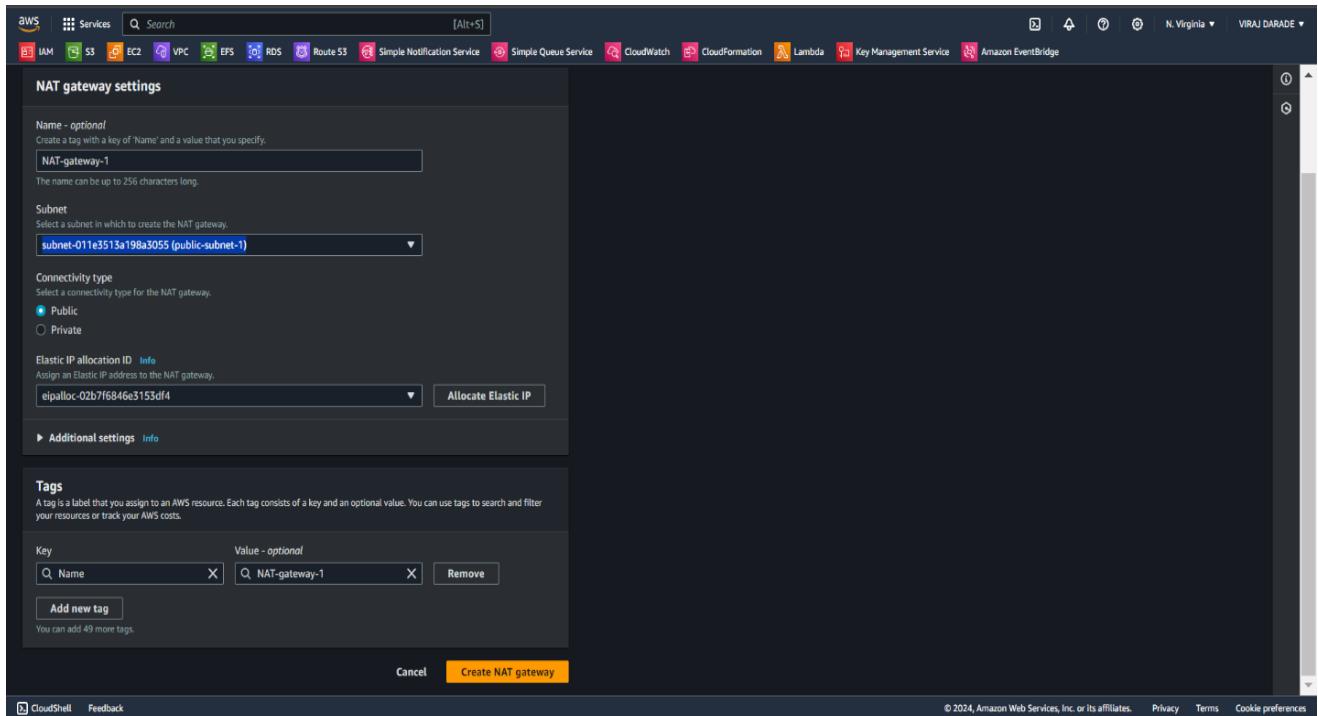
Internet gateway ID igw-0ca8448b8adf28d20	State Detached	VPC ID -	Owner 637423578971
--	-------------------	-------------	-----------------------

The screenshot shows the AWS VPC dashboard with the 'Internet gateways' section. The 'IGW-1' row is selected. The 'Details' tab is currently active, displaying the following information:

Internet gateway ID igw-0ca8448b8adf28d20	State Attached	VPC ID vpc-047baef47106f56b1   vpc-1	Owner 637423578971
--	-------------------	---	-----------------------

❖ **Create NAT Gateway → Name → Subnet (Select The Public Subnet) →**

❖ **Connectivity Type (Public) → Allocate Elastic IP → Create NAT Gateway.**



❖ Create 2 Route Tables & Edit Routes:

❖ Default Rt (By Default Created)

❖ Rt-1, Route - Igw-1, Routes → Edit Routes → Add Route → Destination (0.0.0.0/0) → Internet Gateway (Igw-1) → Save Changes.

❖ Rt-2, Route - Nat Gateway, Routes → Edit Routes → Add Route → Destination (0.0.0.0/0) → Nat Gateway → Save Changes.

Name	Route table ID	Explicit subnet associations	Main	VPC	Owner ID
RT-1	rtb-06df6fb4765bed17c	subnet-011e3515a198a3...	-	vpc-047baef47106f56b1   vpc-1	637423578971
Default RT	rtb-03347dd73449c82a6	-	-	vpc-0bfff3cfcb08edfa8	637423578971

rtb-06df6fb4765bed17c / RT-1																
Details		Routes		Tags												
<a href="#">Edit</a> <a href="#">Actions</a> <a href="#">Create route table</a>		<a href="#">Edit routes</a>														
<b>Routes (2)</b> <table border="1"> <thead> <tr> <th>Destination</th> <th>Target</th> <th>Status</th> <th>Propagated</th> </tr> </thead> <tbody> <tr> <td>0.0.0.0/0</td> <td><a href="#">igw-0ca8448b8adf28d20</a></td> <td>Active</td> <td>No</td> </tr> <tr> <td>192.168.0.0/16</td> <td>local</td> <td>Active</td> <td>No</td> </tr> </tbody> </table>					Destination	Target	Status	Propagated	0.0.0.0/0	<a href="#">igw-0ca8448b8adf28d20</a>	Active	No	192.168.0.0/16	local	Active	No
Destination	Target	Status	Propagated													
0.0.0.0/0	<a href="#">igw-0ca8448b8adf28d20</a>	Active	No													
192.168.0.0/16	local	Active	No													

Name	Route table ID	Explicit subnet associations	Main	VPC	Owner ID
RT-1	rtb-06df6fb4765bed17c	subnet-011e3515a198a3...	-	vpc-047baef47106f56b1   vpc-1	637423578971
Default RT	rtb-03347dd73449c82a6	-	-	vpc-0bfff3cfcb08edfa8	637423578971
RT-2	rtb-016b9f68ee575fd40	2 subnets	-	vpc-047baef47106f56b1   vpc-1	637423578971

rtb-016b9f68ee575fd40 / RT-2																
Details		Routes		Tags												
<a href="#">Edit</a> <a href="#">Actions</a> <a href="#">Create route table</a>		<a href="#">Edit routes</a>														
<b>Routes (2)</b> <table border="1"> <thead> <tr> <th>Destination</th> <th>Target</th> <th>Status</th> <th>Propagated</th> </tr> </thead> <tbody> <tr> <td>0.0.0.0/0</td> <td><a href="#">nat-02856836ae15e0484</a></td> <td>Active</td> <td>No</td> </tr> <tr> <td>192.168.0.0/16</td> <td>local</td> <td>Active</td> <td>No</td> </tr> </tbody> </table>					Destination	Target	Status	Propagated	0.0.0.0/0	<a href="#">nat-02856836ae15e0484</a>	Active	No	192.168.0.0/16	local	Active	No
Destination	Target	Status	Propagated													
0.0.0.0/0	<a href="#">nat-02856836ae15e0484</a>	Active	No													
192.168.0.0/16	local	Active	No													

❖ **Edit Subnet Associations:**

❖ Rt-1 → Subnet Associations → Edit Subnet Association → Public-Subnet-1 → Save Changes.

❖ Rt-2 → Subnet Associations → Edit Subnet Association → Private-Subnet-1 → Save Changes.

❖ Rt-2 → Subnet Associations → Edit Subnet Association → Private-Subnet-2 → Save Changes.

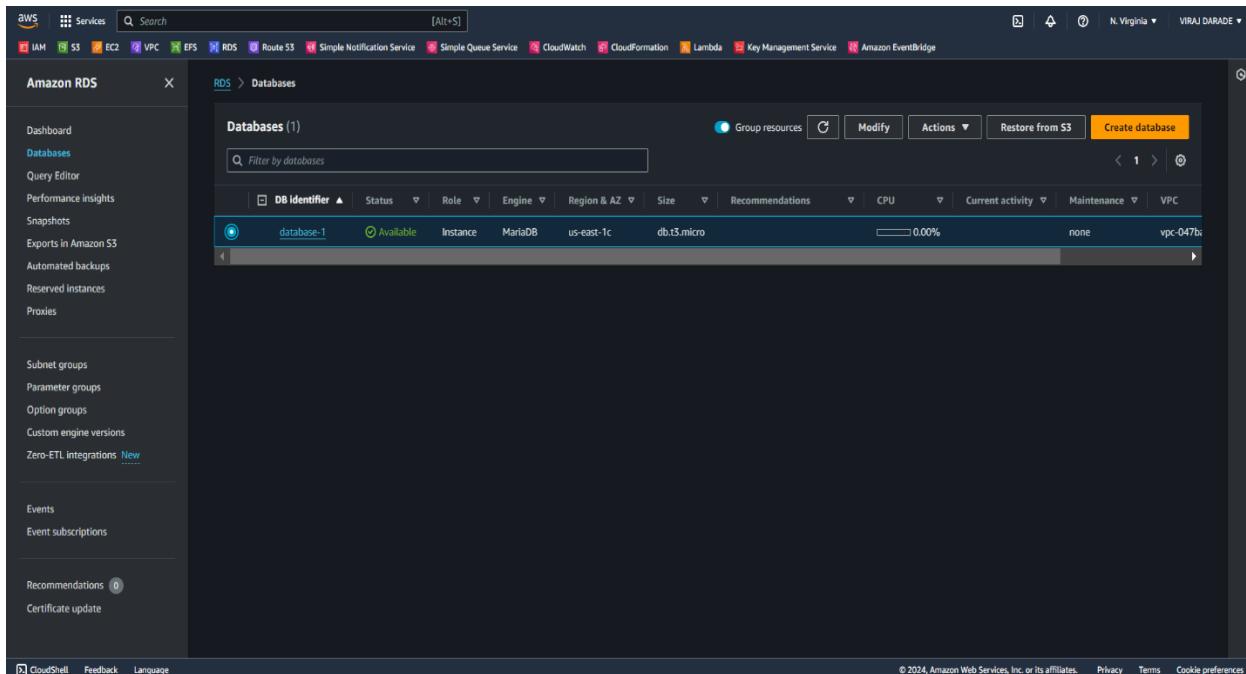
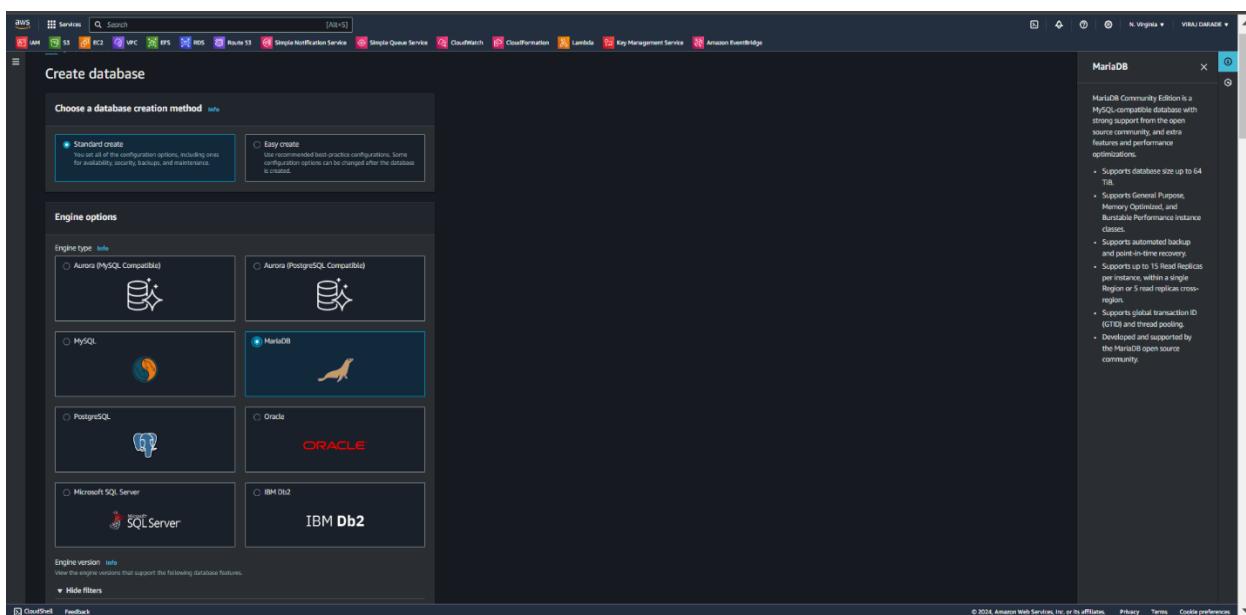
The screenshot shows the AWS VPC dashboard. In the left sidebar, under 'Route tables', 'RT-1' is selected. The main pane displays 'rtb-06df6fb4765bed17c / RT-1' with the 'Subnet associations' tab selected. It lists one association: 'public-subnet-1' with subnet ID 'subnet-011e3513a198a3055' and IPv4 CIDR '192.168.0.0/19'. There are also sections for 'Subnets without explicit associations' (empty) and 'Explicit subnet associations' (empty).

The screenshot shows the AWS VPC dashboard. In the left sidebar, under 'Route tables', 'RT-2' is selected. The main pane displays 'rtb-016b9f58ee575fd40 / RT-2' with the 'Subnet associations' tab selected. It lists two associations: 'private-subnet-1' with subnet ID 'subnet-0fcf8652ca2853172' and IPv4 CIDR '192.168.32.0/19', and 'private-subnet-2' with subnet ID 'subnet-09e86941170x32d' and IPv4 CIDR '192.168.64.0/19'. There are also sections for 'Subnets without explicit associations' (empty) and 'Explicit subnet associations' (empty).

❖ Create Database:

❖ RDS Service → Create Database (Standard Create) → Engine Options (MariaDB) → Username (admin) → Password (1234567890) → Db Instance Class (General Purpose)

→ Storage Type (Gp3) → VPC (VPC-I) → Public Access (No) → Security Group (Allow Ssh & Mysql Ports) → Create Database.

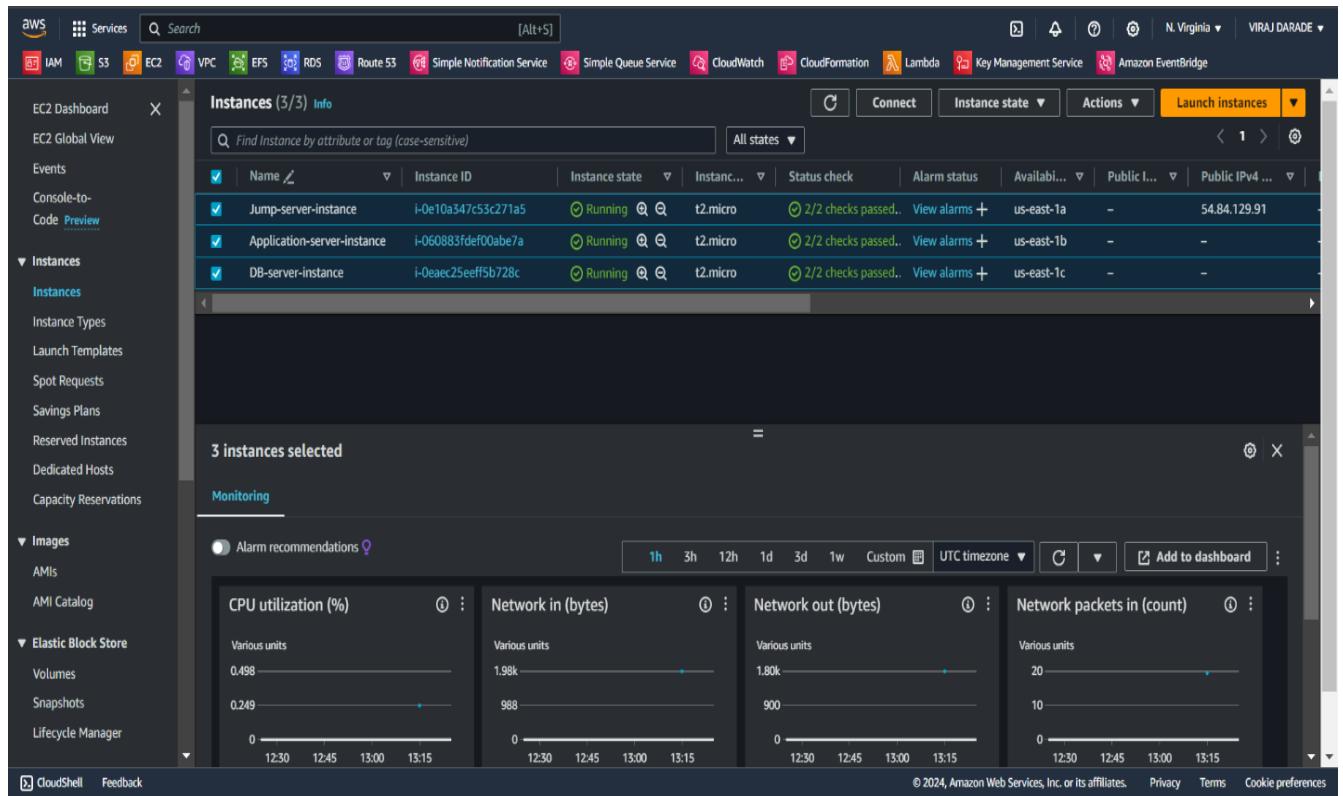


❖ **Create 3 Instances:**

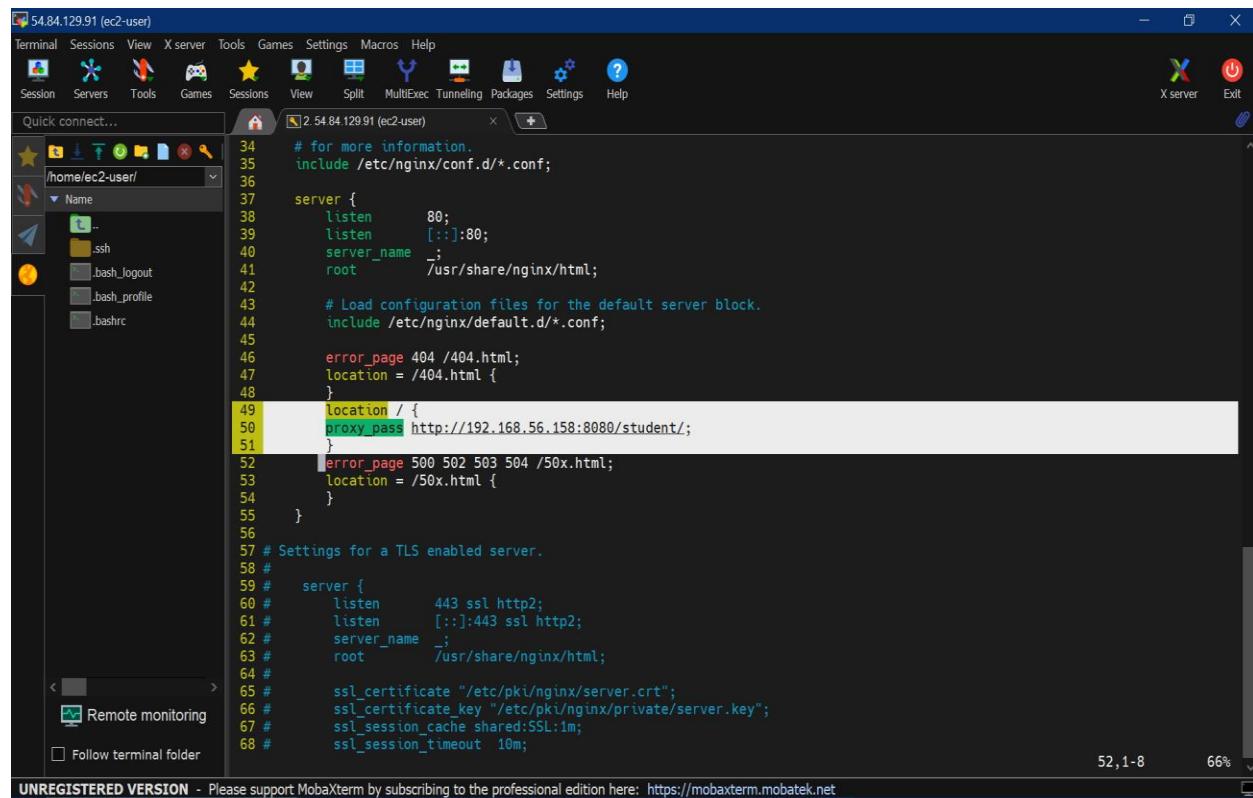
❖ **Jump-Server-Instance, VPC (VPC-1) → Subnet (Public-Subnet-1) → Security Group (Allow Http/Nginx & Ssh Ports) → Allocate Elastic Ip (Yes) → Create Instance.**

❖ **Application-Server-Instance, VPC (VPC-1) → Subnet (Private-Subnet-1) → Security Group (Allow Tomcat & Ssh Ports) → Create Instance.**

❖ **Db-Server-Instance, VPC (VPC-1) → Subnet (Private-Subnet-2) → Security Group (Allow Mysql/Aurora & Ssh Ports) → Create Instance.**



- ❖ Connect Jump-Server-Instance using SSH to MobaXterm
- ❖ Configurations In jump-server (Add IP of Application-Server-Instance)
- ❖ Sudo -i
- ❖ Yum install nginx -y
- ❖ Vim /etc/nginx/nginx.conf
- ❖ ./Set nu
- ❖ At line no. 49: location / {proxy\_pass http://private!Poftomcat:8080/student/;}
- ❖ Systemctl restart nginx. service



```
# more information.
include /etc/nginx/conf.d/*.conf;

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://192.168.56.158:8080/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;
    ssl_session_timeout 10m;
}
```

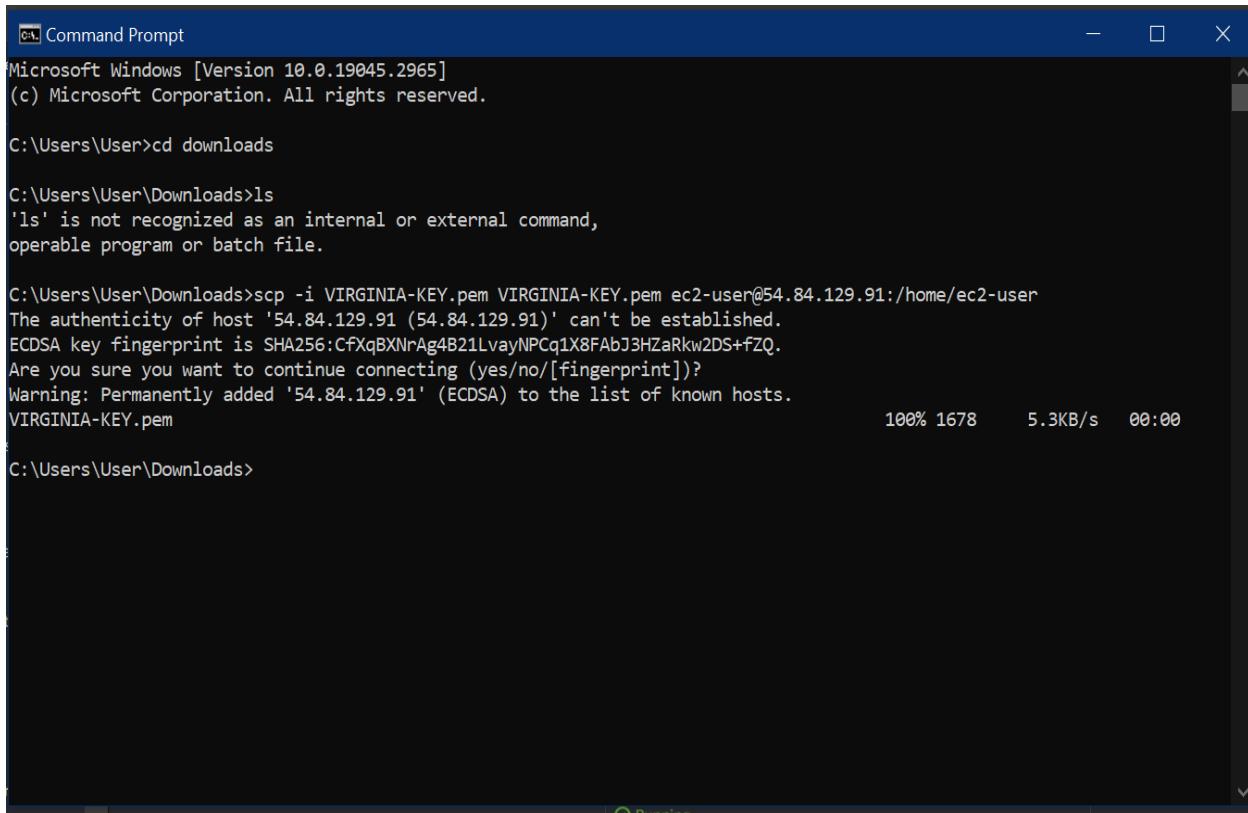
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❖ Configurations In Command Prompt (Copy the key)

❖ Go to the Command Prompt

❖ Cd downloads

❖ **Scp -i key-name.pem key-name.pem ec2-user@public IP (jump-server-instance) :/home/ec2-user**



```
DA Command Prompt
Microsoft Windows [Version 10.0.19045.2965]
(c) Microsoft Corporation. All rights reserved.

C:\Users\User>cd downloads

C:\Users\User\Downloads>ls
'ls' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\User\Downloads>scp -i VIRGINIA-KEY.pem VIRGINIA-KEY.pem ec2-user@54.84.129.91:/home/ec2-user
The authenticity of host '54.84.129.91 (54.84.129.91)' can't be established.
ECDSA key fingerprint is SHA256:CfXqBXNrAg4B21LvayNPCq1X8FAbJ3HZaRkw2DS+fZQ.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
Warning: Permanently added '54.84.129.91' (ECDSA) to the list of known hosts.
VIRGINIA-KEY.pem                                         100% 1678      5.3KB/s   00:00

C:\Users\User\Downloads>
```

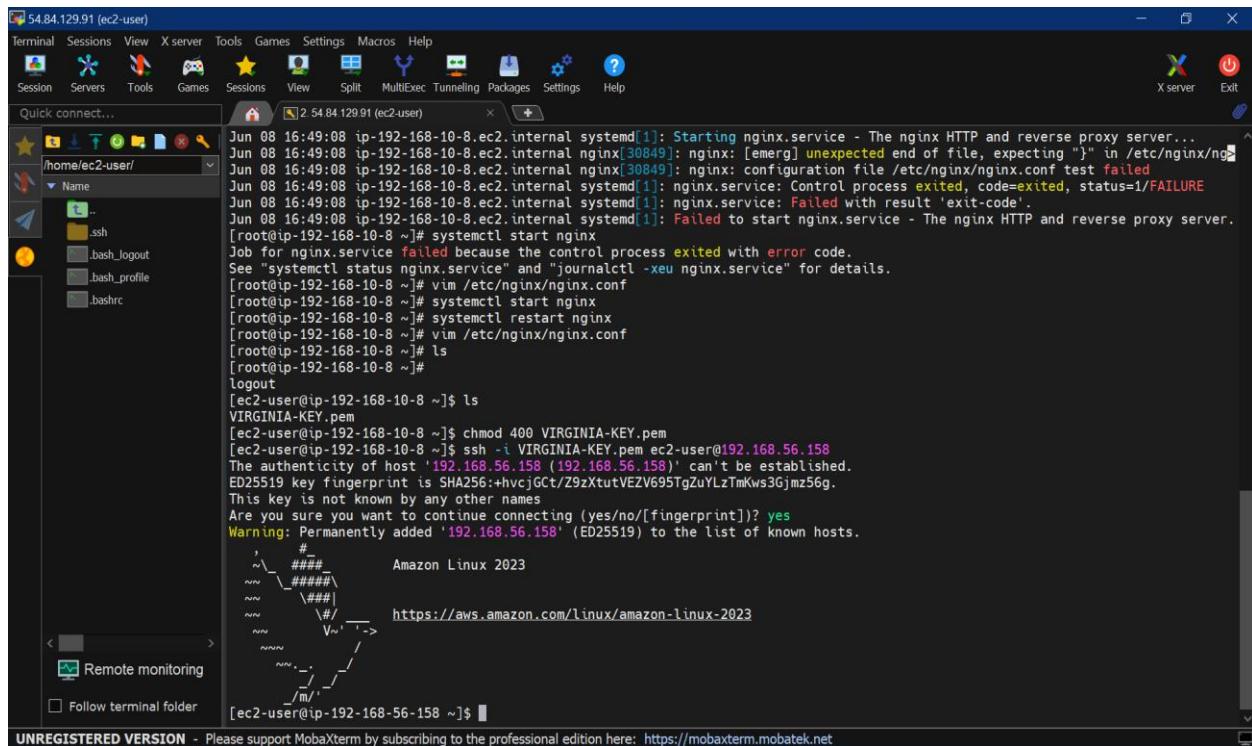
❖ Jump-Server-Instance Configurations:

❖ Go to the Jump-Server-Instance

❖ ls

❖ Chmod 400 "key-name.pem"

❖ ssh -i key-name.pem ec2-user@ (IP of Application-server-instance)



```
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal systemd[1]: Starting nginx.service - The nginx HTTP and reverse proxy server...
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal nginx[30849]: nginx: [emerg] unexpected end of file, expecting ")" in /etc/nginx/nginx.conf:1
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal nginx[30849]: nginx: configuration file /etc/nginx/nginx.conf test failed
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal systemd[1]: nginx.service: Control process exited, code=exited, status=1/FAILURE
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal nginx[1]: nginx.service: Failed with result 'exit-code'.
Jun 08 16:49:08 ip-192-168-10-8.ec2.internal systemd[1]: Failed to start nginx.service - The nginx HTTP and reverse proxy server.
[root@ip-192-168-10-8 ~]# systemctl start nginx
Job for nginx.service failed because the control process exited with error code.
See "systemctl status nginx.service" and "journalctl -xeu nginx.service" for details.
[root@ip-192-168-10-8 ~]# vi /etc/nginx/nginx.conf
[root@ip-192-168-10-8 ~]# systemctl start nginx
[root@ip-192-168-10-8 ~]# systemctl restart nginx
[root@ip-192-168-10-8 ~]# vi /etc/nginx/nginx.conf
[root@ip-192-168-10-8 ~]# ls
[root@ip-192-168-10-8 ~]# logout
[ec2-user@ip-192-168-10-8 ~]$ ls
VIRGINIA-KEY.pem
[ec2-user@ip-192-168-10-8 ~]$ chmod 400 VIRGINIA-KEY.pem
[ec2-user@ip-192-168-10-8 ~]$ ssh -i VIRGINIA-KEY.pem ec2-user@192.168.56.158
The authenticity of host '192.168.56.158 (192.168.56.158)' can't be established.
ED25519 key fingerprint is SHA256:+hvcjGct/Z9zXtutVEZV695TgZuYlZmKws3Gjmz56g.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.56.158' (ED25519) to the list of known hosts.
#
Amazon Linux 2023
https://aws.amazon.com/linux/amazon-linux-2023
[ec2-user@ip-192-168-56-158 ~]$
```

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❖ Application-Server-Instance Configurations:

❖ Sudo -i

❖ Yum install java -y

❖ curl -O https://dlcdn.apache.org/tomcat/tomcat\_8/v8.5.100/bin/apache-tomcat-8.5.100.tar.gz

❖ ls

❖ tar -xvf apache-tomcat-8.5.100.tar.gz -C /opt

❖ cd /opt

❖ cd apache-tomcat-8.5.100/

❖ cd webapps

❖ curl -O https://s3-us-west-2.amazonaws.com/studentapicit/student.war

The screenshot shows a MobaXterm window titled '54.84.129.91 (ec2-user)'. The terminal session displays the following commands and their output:

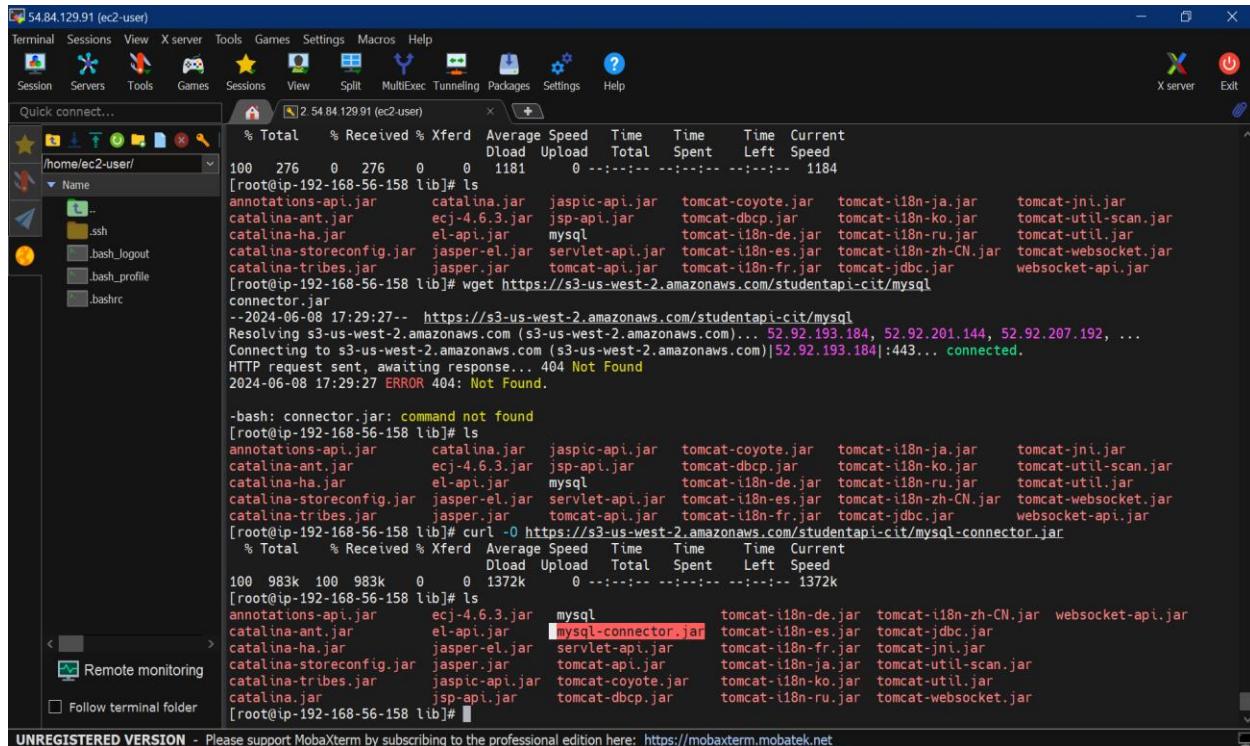
```
apache-tomcat-8.5.100/webapps/manager/images/tomcat.svg
apache-tomcat-8.5.100/webapps/manager/index.jsp
apache-tomcat-8.5.100/webapps/manager/status.xsd
apache-tomcat-8.5.100/webapps/manager/xform.xsl
apache-tomcat-8.5.100/bin/catalina.sh
apache-tomcat-8.5.100/bin/ciphers.sh
apache-tomcat-8.5.100/bin/configtest.sh
apache-tomcat-8.5.100/bin/daemon.sh
apache-tomcat-8.5.100/bin/digest.sh
apache-tomcat-8.5.100/bin/setclasspath.sh
apache-tomcat-8.5.100/bin/shutdown.sh
apache-tomcat-8.5.100/bin/startup.sh
apache-tomcat-8.5.100/bin/tool-wrapper.sh
apache-tomcat-8.5.100/bin/version.sh
[root@ip-192-168-56-158 ~]# ls
apache-tomcat-8.5.100.tar.gz
[root@ip-192-168-56-158 ~]# ls
apache-tomcat-8.5.100.tar.gz
[root@ip-192-168-56-158 ~]# cd /opt
[root@ip-192-168-56-158 opt]# ls
apache-tomcat-8.5.100
[root@ip-192-168-56-158 opt]# cd apache-tomcat-8.5.100/
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# ls
BUILDING.txt CONTRIBUTING.md LICENSE NOTICE README.md RELEASE-NOTES RUNNING.txt bin conf lib logs temp webapps work
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# cd webapps/
[root@ip-192-168-56-158 webapps]# ls
ROOT docs examples host-manager manager
[root@ip-192-168-56-158 webapps]# curl -O https://s3-us-west-2.amazonaws.com/studentapi/cit/student.war
[root@ip-192-168-56-158 opt]# cd apache-tomcat-8.5.100/
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# ls
BUILDING.txt CONTRIBUTING.md LICENSE NOTICE README.md RELEASE-NOTES RUNNING.txt bin conf lib logs temp webapps work
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# cd webapps/
[root@ip-192-168-56-158 webapps]# ls
ROOT docs examples host-manager manager studentapi
[root@ip-192-168-56-158 webapps]#
```

At the bottom of the terminal window, there is a watermark: 'UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>'.

❖ Cd ..//lib

❖ curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/mysqlconnector.jar

❖ ls mysql-connector.jar



The screenshot shows a MobaXterm terminal window titled '54.84.129.91 (ec2-user)'. The terminal session is running as root on a Linux system. The user has navigated to the '/lib' directory and listed its contents. They then used the 'curl' command to download the 'mysqlconnector.jar' file from an AWS S3 bucket. The terminal output shows the download progress and the resulting file being listed.

```
% Total % Received % Xferd Average Speed Time Time Current
          Dload Upload Total Spent Left Speed
100 276    0 276    0    0 1181      0 ---:--- ---:--- 1184
[root@ip-192-168-56-158 lib]# ls
annotations-api.jar   catalina.jar  jaspic-api.jar  tomcat-coyote.jar  tomcat-i18n-jar  tomcat-jni.jar
catalina-ant.jar       ejc-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         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-192-168-56-158 lib]# wget https://s3-us-west-2.amazonaws.com/studentapi-cit/mysqlconnector.jar
--2024-06-08 17:29:27-- https://s3-us-west-2.amazonaws.com/studentapi-cit/mysqlconnector.jar
Resolving s3-us-west-2.amazonaws.com (s3-us-west-2.amazonaws.com)... 52.92.193.184, 52.92.201.144, 52.92.207.192, ...
Connecting to s3-us-west-2.amazonaws.com (s3-us-west-2.amazonaws.com)|52.92.193.184|:443... connected.
HTTP request sent, awaiting response... 404 Not Found
2024-06-08 17:29:27 ERROR 404: Not Found.

-bash: connector.jar: command not found
[root@ip-192-168-56-158 lib]# ls
annotations-api.jar   catalina.jar  jaspic-api.jar  tomcat-coyote.jar  tomcat-i18n-jar  tomcat-jni.jar
catalina-ant.jar       ejc-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         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-192-168-56-158 lib]# curl -O https://s3-us-west-2.amazonaws.com/studentapi-cit/mysqlconnector.jar
% Total % Received % Xferd Average Speed Time Time Current
          Dload Upload Total Spent Left Speed
100 983k 100 983k    0    0 1372k      0 ---:--- ---:--- 1372k
[root@ip-192-168-56-158 lib]# ls
annotations-api.jar   ejc-4.6.3.jar  mysql        tomcat-i18n-de.jar  tomcat-i18n-zh-CN.jar  websocket-api.jar
catalina-ant.jar       el-api.jar   mysql-connector.jar tomcat-i18n-es.jar  tomcat-jdbc.jar
catalina-ha.jar        jasper-el.jar servlet-api.jar  tomcat-i18n-fr.jar  tomcat-jni.jar
catalina-storeconfig.jar jasper.jar   tomcat-api.jar   tomcat-i18n-jar  tomcat-util-scan.jar
catalina-tribes.jar   jaspic-api.jar tomcat-coyote.jar tomcat-i18n-ko.jar  tomcat-util.jar
catalina.jar           jsp-api.jar  tomcat-dbcp.jar  tomcat-i18n-ru.jar  tomcat-websocket.jar
[root@ip-192-168-56-158 lib]# 
```

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❖ Check Username & Password & enter RDS endpoint

❖ Cd ./conf/

❖ Vim context.xml

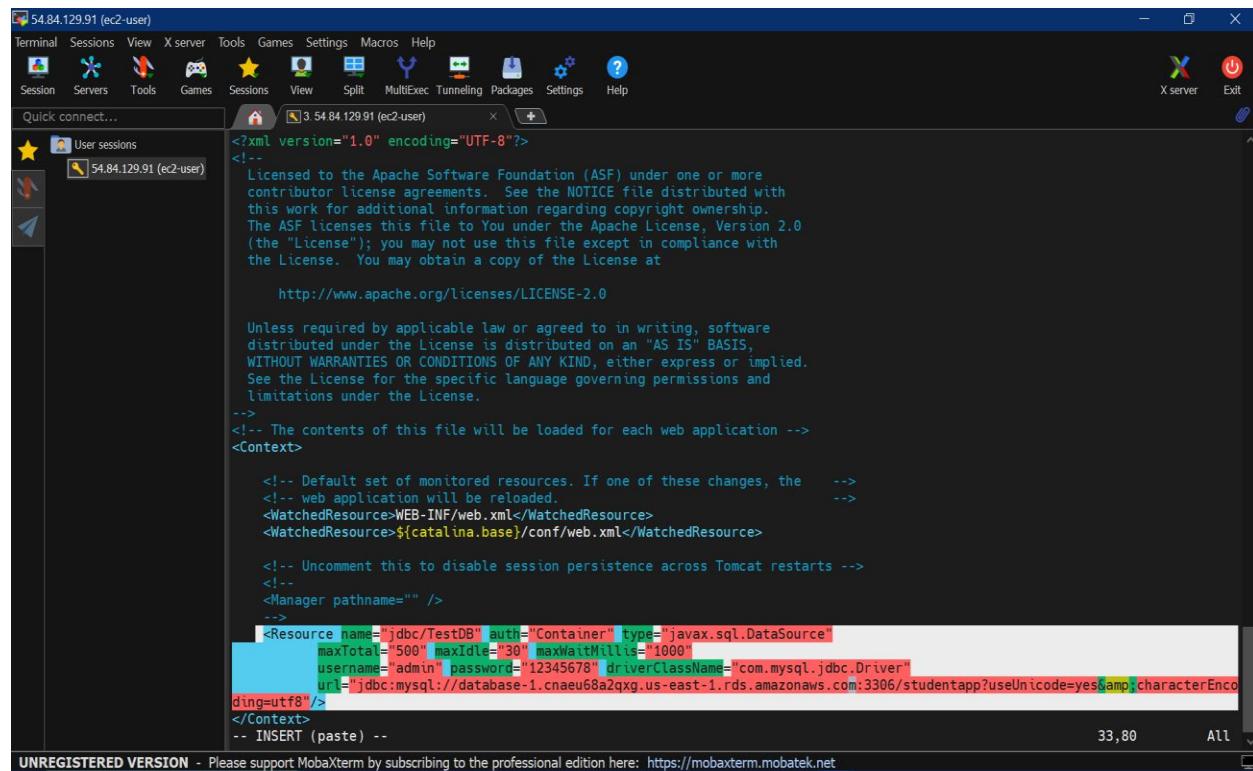
(in context tab [last of page]) <Resource name="jdbc/TestDB"

auth="Container" type="javax.sql.DataSource"

maxTotal="500" maxIdle="30" maxWaitMillis="1000"

username="admin" password="1234567890" driverClassName="com.mysql.jdbc.Driver"

url="jdbc:mysql://endpoint:3306/studentapp?useUnicode=yes&characterEncoding=utf8"/>



The screenshot shows a terminal window titled "54.84.129.91 (ec2-user)" running on MobaXterm. The window displays the Apache Tomcat context.xml configuration file. The file contains XML code defining a database resource named "jdbc/TestDB". The configuration includes parameters for authentication ("Container"), connection pooling ("maxTotal=500", "maxIdle=30", "maxWaitMillis=1000"), and database details ("username=admin", "password=1234567890", "driverClassName=com.mysql.jdbc.Driver", "url=jdbc:mysql://endpoint:3306/studentapp?useUnicode=yes&characterEncoding=utf8"). The code is highlighted in green and red, indicating syntax highlighting for XML tags and Java-like attributes.

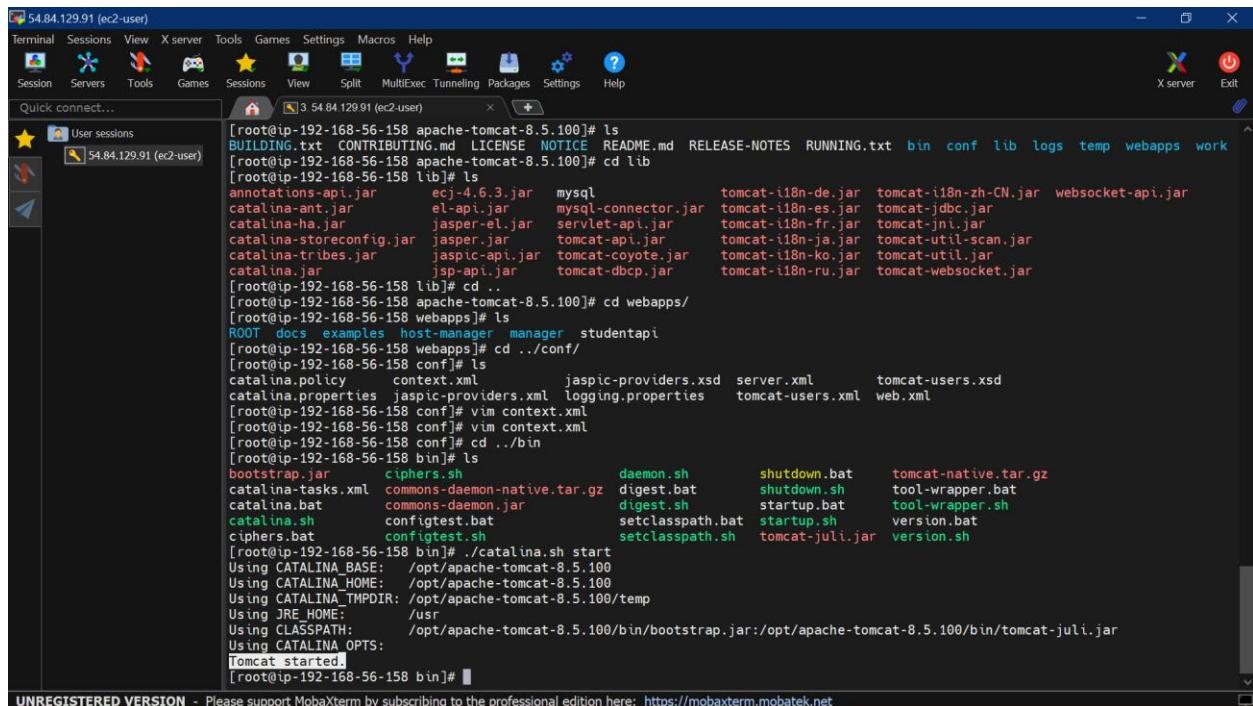
```
<!-- Default set of monitored resources. If one of these changes, the web application will be reloaded. -->
<WatchedResource>WEB-INF/web.xml</WatchedResource>
<WatchedResource>${catalina.base}/conf/web.xml</WatchedResource>

<!-- 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="1234567890" driverClassName="com.mysql.jdbc.Driver"
          url="jdbc:mysql://database-1.chaeu68a2qxg.us-east-1.rds.amazonaws.com:3306/studentapp?useUnicode=yes&characterEncoding=utf8"/>
</Context>
-- INSERT (paste) --
```

❖ Cd ..//bin

❖ ./catalina.sh start

❖ Exit (To Jump-Server-Instance)



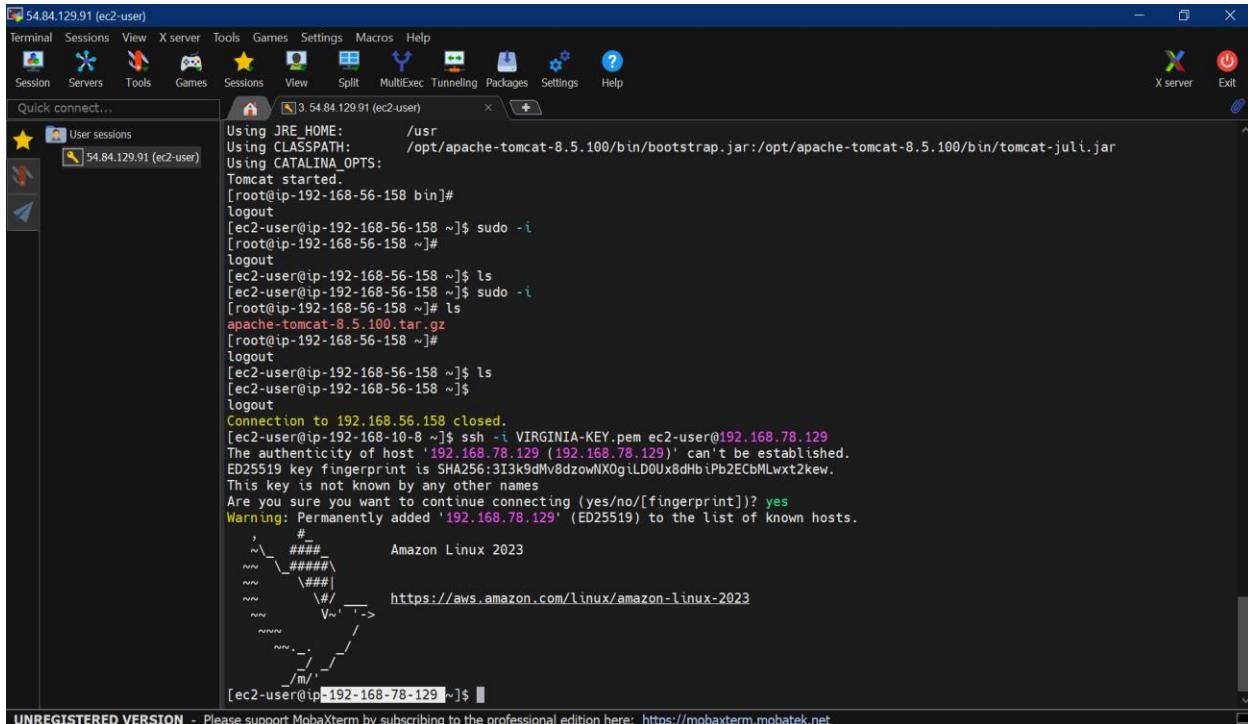
The screenshot shows a MobaXterm terminal window titled '54.84.129.91 (ec2-user)'. The window contains a command-line session for a Tomcat 8.5.100 server. The user runs 'ls' in the root directory, then changes to the 'lib' directory where various Tomcat jar files are listed. Next, they change to the 'webapps' directory and run 'ls' again. They then enter the 'conf' directory and run 'vim context.xml'. After saving, they return to the root directory and run 'cd ..//bin'. Finally, they execute the command './catalina.sh start', which outputs the following log:

```
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# ls
BUILDING.txt CONTRIBUTING.md LICENSE NOTICE README.md RELEASE-NOTES RUNNING.txt bin conf lib logs temp webapps work
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# cd lib
[root@ip-192-168-56-158 lib]# ls
annotations-api.jar      ecj-4.6.3.jar    mysql          tomcat-i18n-de.jar   tomcat-i18n-zh-CN.jar   websocket-api.jar
catalina-ant.jar          el-api.jar       mysql-connector.jar tomcat-i18n-es.jar   tomcat-jdbc.jar
catalina-ha.jar           jasper-el.jar   servlet-api.jar  tomcat-i18n-fr.jar   tomcat-jni.jar
catalina-storeconfig.jar  jasper.jar      tomcat-apt.jar   tomcat-i18n-ja.jar   tomcat-util-scan.jar
catalina-tribes.jar       jaspic-api.jar  tomcat-coyote.jar tomcat-i18n-ko.jar   tomcat-util.jar
catalina.jar              jsp-api.jar     tomcat-dbcp.jar  tomcat-i18n-ru.jar   tomcat-websocket.jar
[root@ip-192-168-56-158 lib]# cd ..
[root@ip-192-168-56-158 apache-tomcat-8.5.100]# cd webapps/
[root@ip-192-168-56-158 webapps]# ls
ROOT docs examples host-manager manager studentapi
[root@ip-192-168-56-158 webapps]# cd ..//conf/
[root@ip-192-168-56-158 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-192-168-56-158 conf]# vim context.xml
[root@ip-192-168-56-158 conf]# vim context.xml
[root@ip-192-168-56-158 conf]# cd ..//bin
[root@ip-192-168-56-158 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-192-168-56-158 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-192-168-56-158 bin]#
```

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❖ In Jump-Server-Instance:

❖ **Ssh -i key-name.pem ec2-user@private IP (DB-server-instance)**



```
54.84.129.91 (ec2-user)
Terminal Sessions View Xserver Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
User sessions
54.84.129.91 (ec2-user)
Session 3: 54.84.129.91 (ec2-user)
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-192-168-56-158 bin]#
logout
[ec2-user@ip-192-168-56-158 ~]$ sudo -i
[root@ip-192-168-56-158 ~]#
logout
[ec2-user@ip-192-168-56-158 ~]$ ls
[ec2-user@ip-192-168-56-158 ~]$ sudo -i
[root@ip-192-168-56-158 ~]# ls
apache-tomcat-8.5.100.tar.gz
[root@ip-192-168-56-158 ~]#
logout
[ec2-user@ip-192-168-56-158 ~]$ ls
[ec2-user@ip-192-168-56-158 ~]$ logout
Connection to 192.168.56.158 closed.
[ec2-user@ip-192-168-10-8 ~]$ ssh -i VIRGINIA-KEY.pem ec2-user@192.168.78.129
The authenticity of host '192.168.78.129 (192.168.78.129)' can't be established.
ED25519 key fingerprint is SHA256:3I3k9dMv8dzowNXOgiLD0Ux8dHbiPb2ECbMLwxt2kew.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.78.129' (ED25519) to the list of known hosts.

,
~\_\#\#\#          Amazon Linux 2023
~~\_\#\#\#\\
~~\#\#\#
~~ \#/   https://aws.amazon.com/linux/amazon-linux-2023
~~ V-,-->
~~ \_/
~~ \_/\_/
~~ \_/\_/
[ec2-user@ip-192-168-78-129 ~]$ 
```

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❖ DB-Server-Instance Configurations: (To install MariaDB)

❖ Yum install mariadb105 -y

❖ Mysql -h RDSEndpoint -u admin -p (1234567890)

The screenshot shows a MobaXterm session titled "54.84.129.91 (ec2-user)". The terminal window displays the following command-line session:

```
[root@ip-192-168-56-158 conf]# logout
[ec2-user@ip-192-168-56-158 apache-tomcat-8.5.100]$
logout
Connection to 192.168.56.158 closed.
[ec2-user@ip-192-168-10-8 ~]$ ssh -i VIRGINIA-KEY.pem ec2-user@192.168.78.129
,#
~~\----#
~~ \----#
~~ \----#
~~ \----# Amazon Linux 2023
~~ \----#
~~ \----#
~~ \----> https://aws.amazon.com/linux/amazon-linux-2023
~~ \----/
~~ \----/
~~ \----/
~~ \----/
~~ \----/
~~ \----/
~~ \----/
Last login: Sat Jun  8 18:04:22 2024 from 192.168.10.8
[ec2-user@ip-192-168-78-129 ~]$ yum install mariadb105 -y
Error: This command has to be run with superuser privileges (under the root user on most systems).
[ec2-user@ip-192-168-78-129 ~]$ sudo -i
[root@ip-192-168-78-129 ~]# yum install mariadb105 -y
Last metadata expiration check: 5:16:38 ago on Sat Jun  8 13:28:10 2024.
Package mariadb105-3:10.5.23-1.amzn2023.0.1.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@ip-192-168-78-129 ~]# mysql -h database-1.cnaeu68a2qxg.us-east-1.rds.amazonaws.com -u admin -p1234567890
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MariaDB connection id is 489
Server version: 10.11.6-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)]>
```

At the bottom of the terminal window, there is a watermark: "UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>".

❖ MariaDB Configurations: (To create Database)

❖ Create database;

❖ Use database;

❖ 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);**

The screenshot shows a terminal window titled '54.84.129.91 (ec2-user)' running on MobaXterm. The user is attempting to create a table named 'students' with the following schema:

```
> 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)  
> );
```

An error message is displayed, indicating a syntax error near '(student\_id INT NOT NULL AUTO\_INCREMENT', specifically the 'AUTO\_INCREMENT' part. The user then tries to drop the table and recreate it without the 'AUTO\_INCREMENT' constraint, but receives a similar error message.

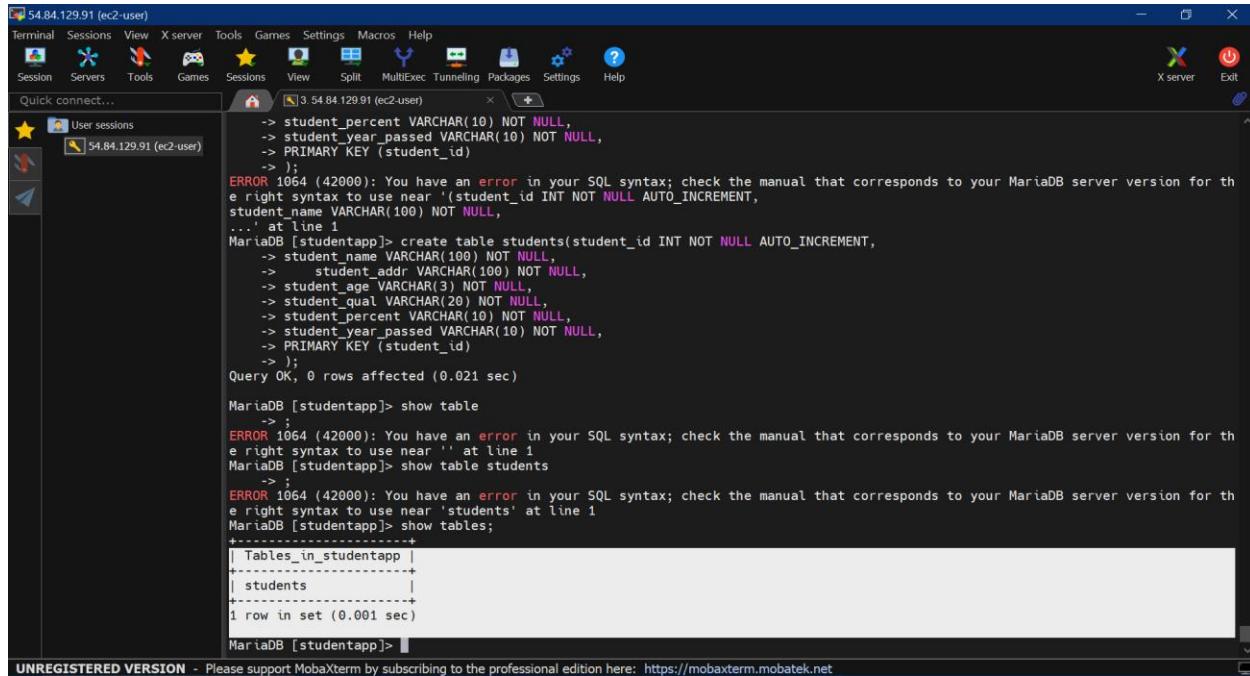
```
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near '(student_id INT NOT NULL AUTO_INCREMENT,  
student_name VARCHAR(100) NOT NULL...' at line 1  
MariaDB [studentapp]> create table students(student_id 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)  
> );  
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near 'student_id INT NOT NULL AUTO_INCREMENT,  
student_name VARCHAR(100) NOT NULL',  
... at line 1  
MariaDB [studentapp]> create table 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 (0.021 sec)
```

At the bottom of the terminal, a watermark reads: UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>

### ❖ MariaDB Configurations: (To show Table)

#### ❖ Show table;

#### ❖ Desc students;



```

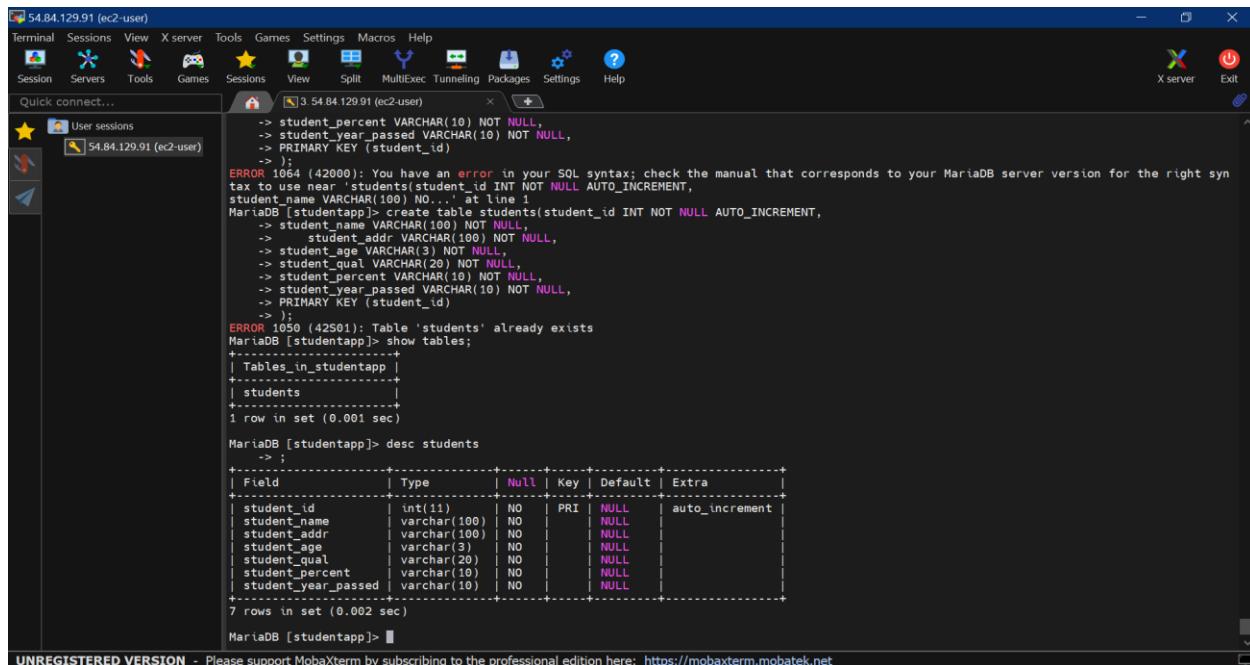
54.84.129.91 (ec2-user)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
User sessions
54.84.129.91 (ec2-user)
MariaDB [studentapp]> create table students(student_id INT NOT NULL 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)
-> );
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near '(student_id INT NOT NULL AUTO_INCREMENT, student_name VARCHAR(100) NOT NULL,)' at line 1
MariaDB [studentapp]> create table 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 (0.021 sec)

MariaDB [studentapp]> show table
-> ;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near '' at line 1
MariaDB [studentapp]> show table students
-> ;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near 'students' at line 1
MariaDB [studentapp]> show tables;
+-----+
| Tables_in_studentapp |
+-----+
| students |
+-----+
1 row in set (0.001 sec)

MariaDB [studentapp]>

```

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```

54.84.129.91 (ec2-user)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
User sessions
54.84.129.91 (ec2-user)
MariaDB [studentapp]> create table students(student_id INT NOT NULL AUTO_INCREMENT,
-> student_name VARCHAR(100) NO...' at line 1
student_name VARCHAR(100) NO...' at line 1
MariaDB [studentapp]> create table 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)
-> );
ERROR 1050 (42S01): Table 'students' already exists
MariaDB [studentapp]> show tables;
+-----+
| Tables_in_studentapp |
+-----+
| students |
+-----+
1 row in set (0.001 sec)

MariaDB [studentapp]> desc students
-> ;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| student_id | int(11) | NO | PRI | NULL | auto_increment |
| student_name | varchar(100) | NO | | NULL | |
| student_addr | varchar(100) | NO | | NULL | |
| student_age | varchar(3) | NO | | NULL | |
| student_qual | varchar(20) | NO | | NULL | |
| student_percent | varchar(10) | NO | | NULL | |
| student_year_passed | varchar(10) | NO | | NULL | |
+-----+-----+-----+-----+-----+
7 rows in set (0.002 sec)

MariaDB [studentapp]>

```

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❖ Go to any web browser & hit the Jump-server-instance public IP



## 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"/>	

❖ Fill the Information in student Registration Form

Please fill all the fields

### Student Registration Form

Student Name	Tony
Student Address	Mumbai
Student Age	30
Student Qualification	MBA
Student Percentage	89
Year Passed	2024

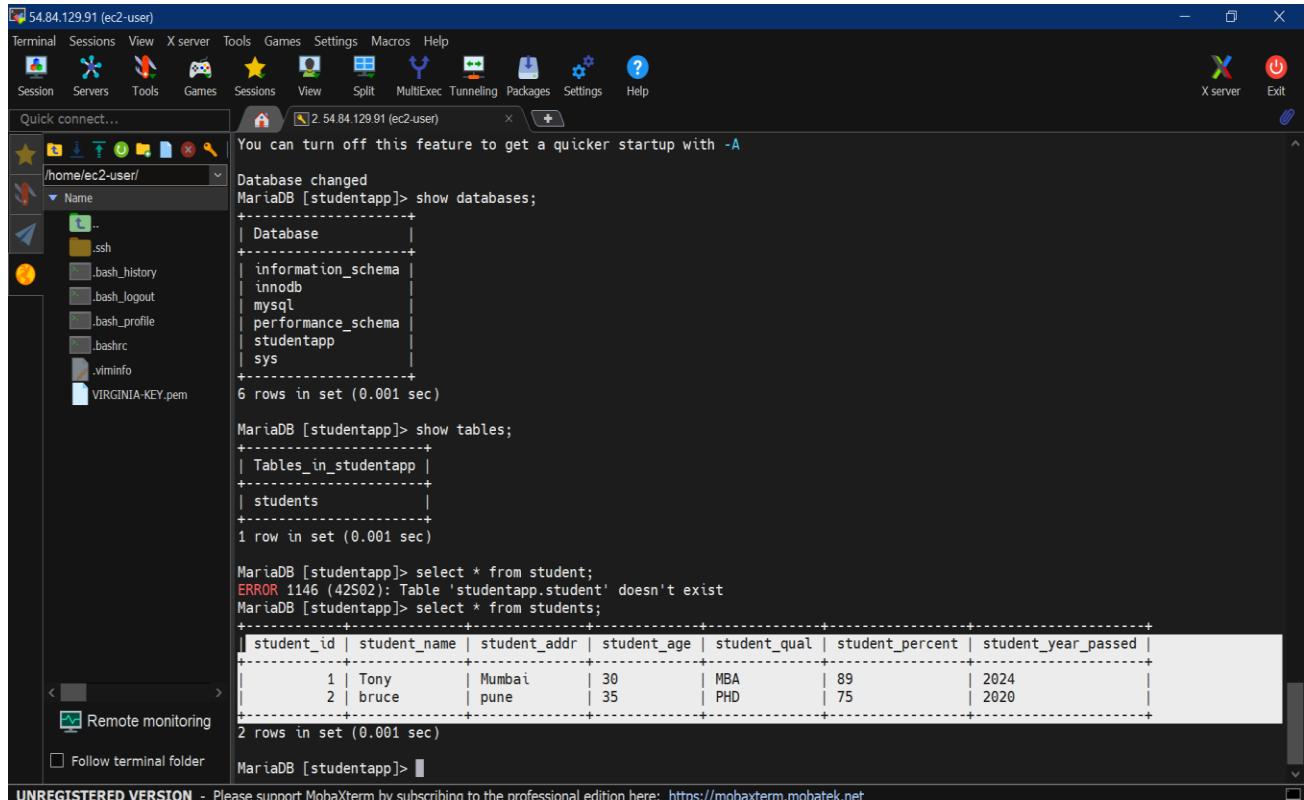
[Register Student](#)

### Students List

Student ID	StudentName	Student Addr	Student Age	Student Qualification	Student Percentage	Student Year Passed	Edit	Delete
1	Tony	Mumbai	30	MBA	89	2024	<a href="#">edit</a>	<a href="#">delete</a>
2	bruce	pune	35	PHD	75	2020	<a href="#">edit</a>	<a href="#">delete</a>

❖ **MariaDB Configurations: (To view student registration form information)**

❖ **Select \* from students;**



The screenshot shows a MobaXterm terminal window titled "54.84.129.91 (ec2-user)". The terminal interface includes a top menu bar with "Terminal", "Sessions", "View", "X server", "Tools", "Games", "Settings", "Macros", "Help", and a bottom status bar with "UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>". The main area displays the following MySQL session:

```
You can turn off this feature to get a quicker startup with -A
Database changed
MariaDB [studentapp]> show databases;
+-----+
| Database |
+-----+
| ..          |
| information_schema |
| innodb      |
| mysql       |
| performance_schema |
| studentapp  |
| sys         |
+-----+
6 rows in set (0.001 sec)

MariaDB [studentapp]> show tables;
+-----+
| Tables_in_studentapp |
+-----+
| students   |
+-----+
1 row in set (0.001 sec)

MariaDB [studentapp]> select * from student;
ERROR 1146 (42S02): Table 'studentapp.student' doesn't exist
MariaDB [studentapp]> select * from students;
+-----+-----+-----+-----+-----+-----+
| student_id | student_name | student_addr | student_age | student_qual | student_percent | student_year_passed |
+-----+-----+-----+-----+-----+-----+
| 1 | Tony | Mumbai | 30 | MBA | 89 | 2024 |
| 2 | bruce | pune | 35 | PHD | 75 | 2020 |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.001 sec)

MariaDB [studentapp]> 
```