

Project Report: Java-Based Quiz Application

(QuizApp)

1. Introduction

The **QuizApp** is a **Java-based quiz application** built using **JFrame** for the graphical user interface and **MySQL** as the backend database. The project is hosted on two separate **VirtualBox Virtual Machines (VMs)** for **application logic** and **database management**. The application enables users to take quizzes, track scores, and manage quiz questions through an admin panel.

2. System Requirements

- **VirtualBox** (For VM creation and networking)
- **Debian Linux (or any Linux distribution)** for VMs
- **Java Development Kit (JDK 11 or later)**
- **MySQL Server (MariaDB)**
- **Visual Studio Code or IntelliJ IDEA**
- **MySQL Workbench (Optional for database management)**

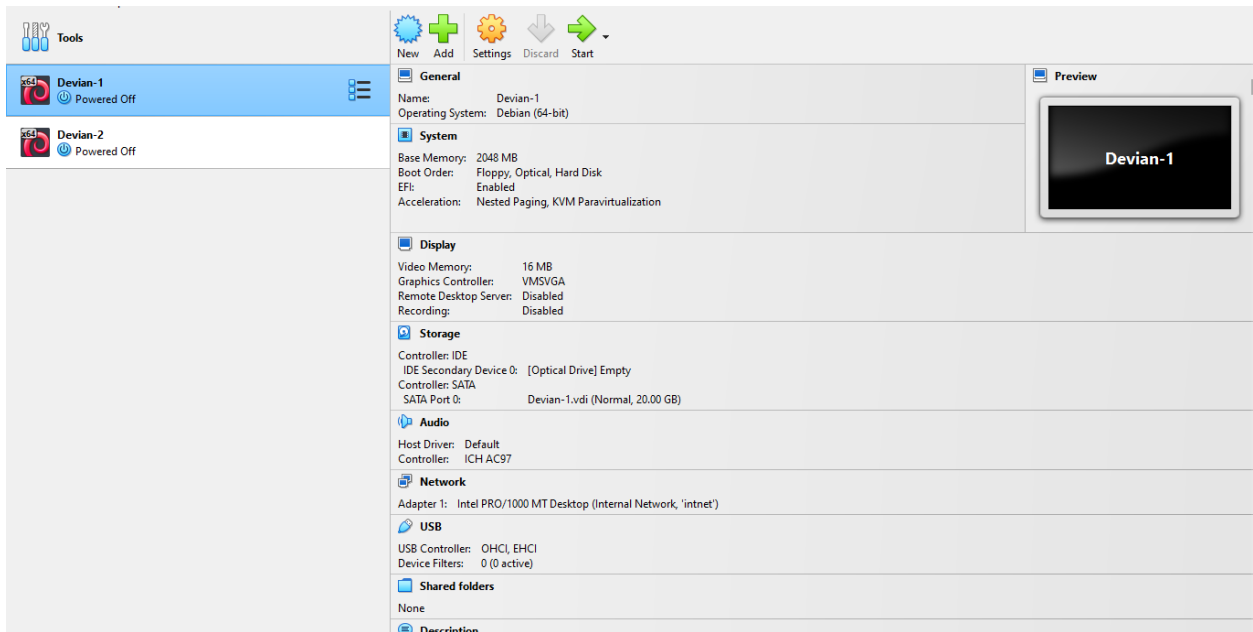
3. Installation of VirtualBox and Creation of VMs

Step 1: Install VirtualBox

1. Download VirtualBox from [VirtualBox Official Site](https://www.virtualbox.org/)
2. Install it on system following the on-screen instructions.

Step 2: Create Virtual Machines

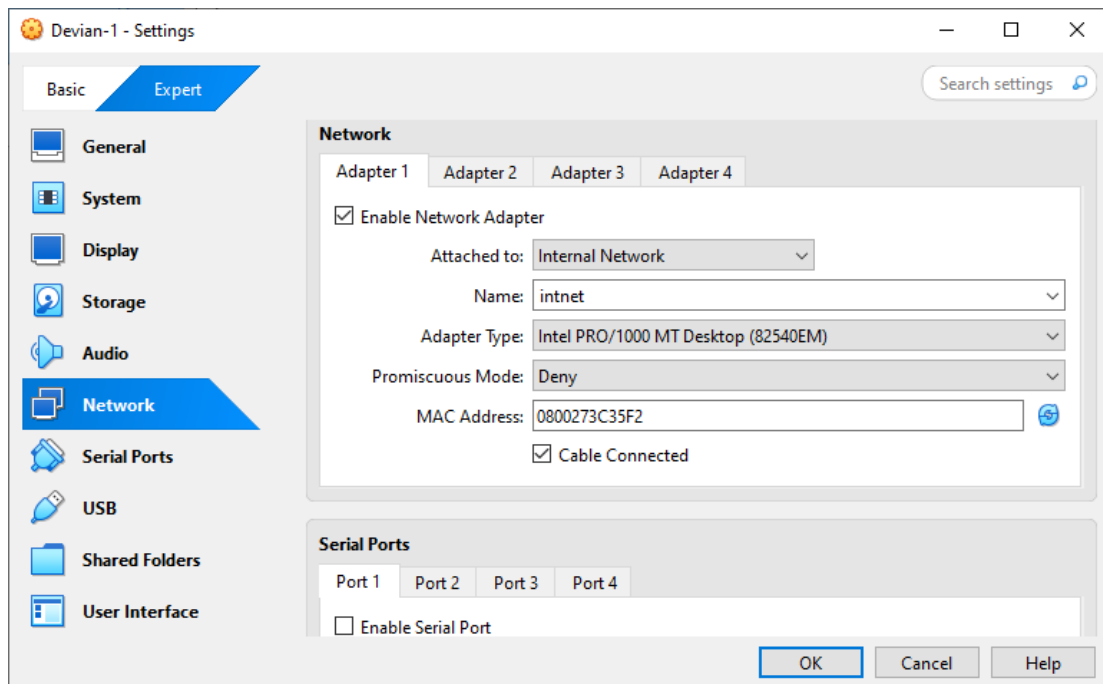
1. Open **VirtualBox** and click **New**.
2. Name the VM as **Debian-1 (Application Server)** and select:
 - **Type:** Linux
 - **Version:** Debian (64-bit)
 - **Memory Size:** 2GB or more
 - **Storage:** Create a 20GB Virtual Hard Disk (VDI)
3. Repeat the same for **Debian-2 (Database Server)**.



4. Network Configuration to Connect VMs

Step 1: Configure Internal Network

1. Select **VM1 (QuizApp-Application Server)** → Go to **Settings** → **Network**.
2. Set **Adapter 1** to **Internal Network**.
3. Repeat the process for **VM2 (QuizApp-Database Server)**.



Step 2: Assign Static IPs

Modify network configurations in both VMs:

```
sudo nano /etc/network/interfaces
```

For **VM1**:

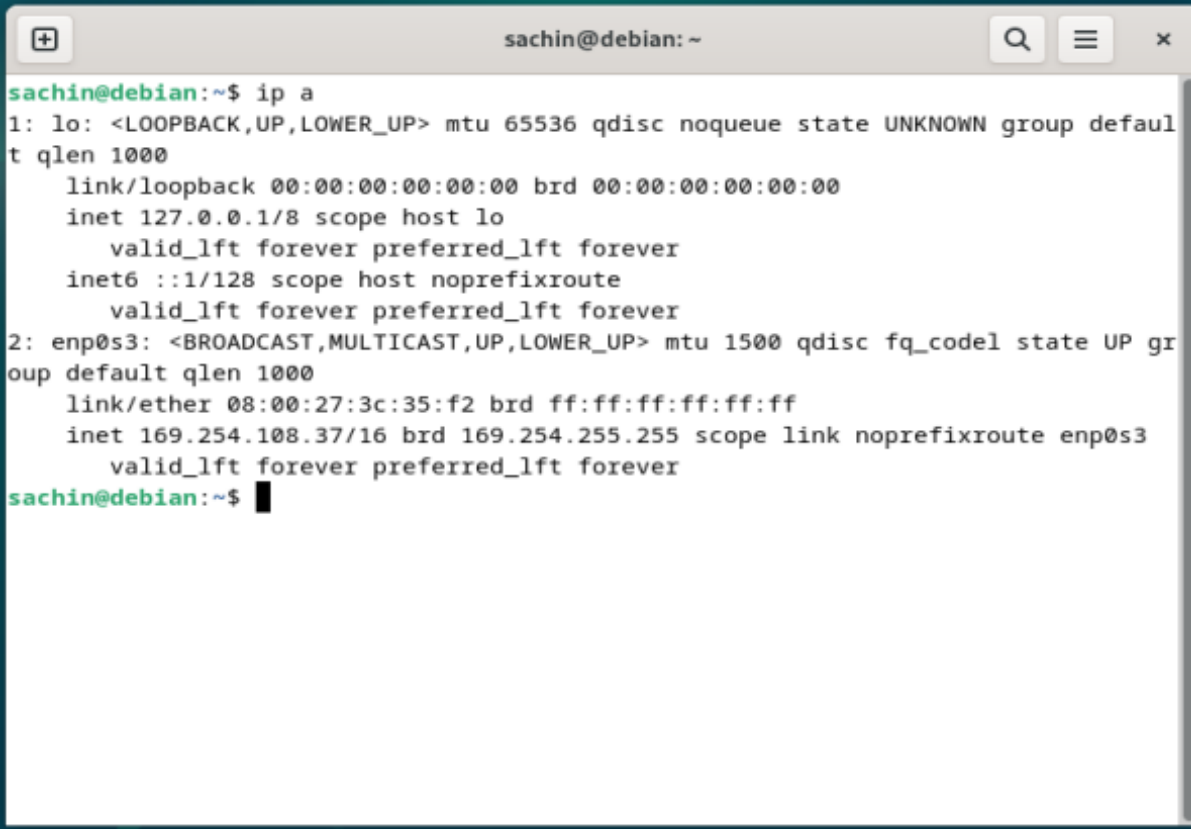
```
auto eth0
```

```
iface eth0 inet static
```

```
    address 192.168.1.101
```

```
    netmask 255.255.255.0
```

```
    gateway 192.168.1.1
```

A terminal window titled 'sachin@debian: ~' with search, menu, and close icons in the title bar. The terminal shows the output of the 'ip a' command. It displays details for the loopback interface 'lo' (127.0.0.1) and the ethernet interface 'enp0s3' (169.254.108.37).

```
sachin@debian:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:3c:35:f2 brd ff:ff:ff:ff:ff:ff
    inet 169.254.108.37/16 brd 169.254.255.255 scope link noprefixroute enp0s3
        valid_lft forever preferred_lft forever
sachin@debian:~$
```

```
sachin@debian: ~  
t qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host noprefixroute  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:cb:61:bf brd ff:ff:ff:ff:ff:ff  
    inet 169.254.113.165/16 brd 169.254.255.255 scope link noprefixroute enp0s3  
        valid_lft forever preferred_lft forever  
sachin@debian:~$ ping 169.254.108.37  
PING 169.254.108.37 (169.254.108.37) 56(84) bytes of data.  
64 bytes from 169.254.108.37: icmp_seq=1 ttl=64 time=1.51 ms  
64 bytes from 169.254.108.37: icmp_seq=2 ttl=64 time=0.974 ms  
64 bytes from 169.254.108.37: icmp_seq=3 ttl=64 time=0.684 ms  
64 bytes from 169.254.108.37: icmp_seq=4 ttl=64 time=0.849 ms  
64 bytes from 169.254.108.37: icmp_seq=5 ttl=64 time=0.955 ms  
64 bytes from 169.254.108.37: icmp_seq=6 ttl=64 time=0.828 ms  
64 bytes from 169.254.108.37: icmp_seq=7 ttl=64 time=0.949 ms  
64 bytes from 169.254.108.37: icmp_seq=8 ttl=64 time=0.750 ms  
64 bytes from 169.254.108.37: icmp_seq=9 ttl=64 time=0.880 ms  
64 bytes from 169.254.108.37: icmp_seq=10 ttl=64 time=0.846 ms
```

For VM2:

auto eth0

iface eth0 inet static

address 192.168.1.102

netmask 255.255.255.0

gateway 192.168.1.1

Restart networking:

sudo systemctl restart networking

```
sachin@debian: ~  
sachin@debian:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host noprefixroute  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:cb:61:bf brd ff:ff:ff:ff:ff:ff  
    inet 169.254.113.165/16 brd 169.254.255.255 scope link noprefixroute enp0s3  
        valid_lft forever preferred_lft forever  
sachin@debian:~$
```

```
sachin@debian: ~  
sachin@debian:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host noprefixroute  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:3c:35:f2 brd ff:ff:ff:ff:ff:ff  
    inet 169.254.108.37/16 brd 169.254.255.255 scope link noprefixroute enp0s3  
        valid_lft forever preferred_lft forever  
sachin@debian:~$ ping 169.254.113.165  
PING 169.254.113.165 (169.254.113.165) 56(84) bytes of data.  
64 bytes from 169.254.113.165: icmp_seq=1 ttl=64 time=0.680 ms  
64 bytes from 169.254.113.165: icmp_seq=2 ttl=64 time=0.767 ms  
64 bytes from 169.254.113.165: icmp_seq=3 ttl=64 time=0.872 ms  
64 bytes from 169.254.113.165: icmp_seq=4 ttl=64 time=0.891 ms  
64 bytes from 169.254.113.165: icmp_seq=5 ttl=64 time=0.916 ms  
64 bytes from 169.254.113.165: icmp_seq=6 ttl=64 time=0.846 ms  
64 bytes from 169.254.113.165: icmp_seq=7 ttl=64 time=0.932 ms  
64 bytes from 169.254.113.165: icmp_seq=8 ttl=64 time=0.859 ms
```

5. Deployment of QuizApp on VMs

Step 1: Install Dependencies on VM1 (Application Server)

sudo apt update

```
sudo apt install default-jdk -y
```

Download and configure **MySQL Connector for Java**:

```
wget https://repo1.maven.org/maven2/mysql/mysql-connector-java/8.0.28/mysql-connector-  
java-8.0.28.jar
```

Step 2: Install MySQL on VM2 (Database Server)

```
sudo apt update
```

```
sudo apt install mysql-server -y
```

Configure MySQL for remote access:

```
sudo nano /etc/mysql/mysql.conf.d/mysqld.cnf
```

Change:

```
bind-address = 0.0.0.0
```

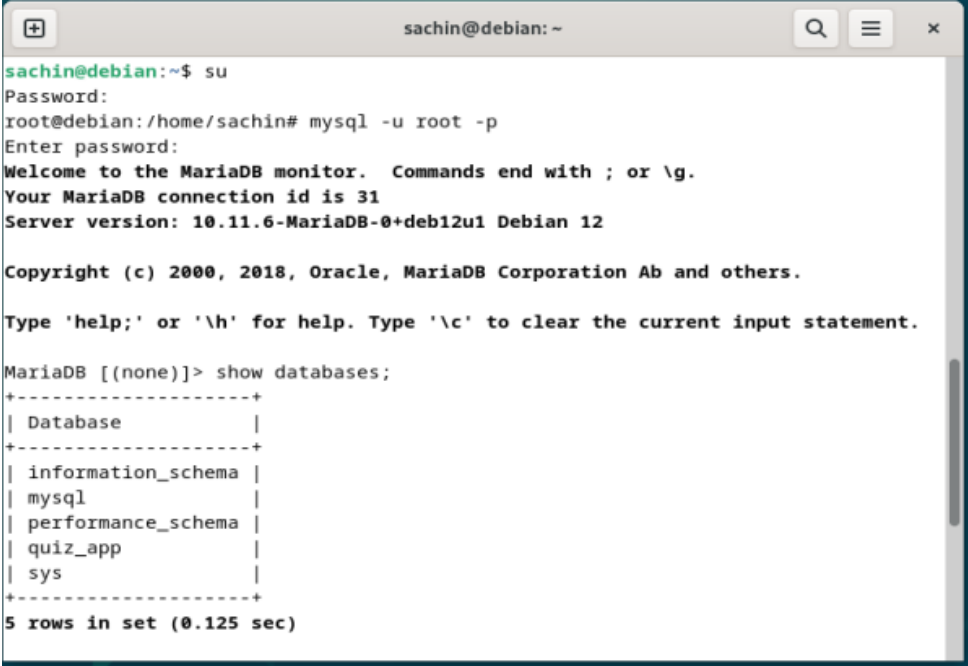
Restart MySQL:

```
sudo systemctl restart mysql
```

Grant privileges:

```
GRANT ALL PRIVILEGES ON quiz_app.* TO 'root'@'169.254.108.37' IDENTIFIED BY 'password';
```

```
FLUSH PRIVILEGES;
```



```
sachin@debian: ~  
sachin@debian:~$ su  
Password:  
root@debian:/home/sachin# mysql -u root -p  
Enter password:  
Welcome to the MariaDB monitor.  Commands end with ; or \g.  
Your MariaDB connection id is 31  
Server version: 10.11.6-MariaDB-0+deb12u1 Debian 12  
  
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 |  
| mysql |  
| performance_schema |  
| quiz_app |  
| sys |  
+-----+  
5 rows in set (0.125 sec)
```

6. QuizApp Folder Structure

The application follows **MVC (Model-View-Controller)** architecture.

```
MariaDB [quiz_app]> show tables;
+-----+
| Tables_in_quiz_app |
+-----+
| admins              |
| high_scores         |
| players             |
| questions           |
| reports             |
+-----+
5 rows in set (0.000 sec)
```

7. Running the Application

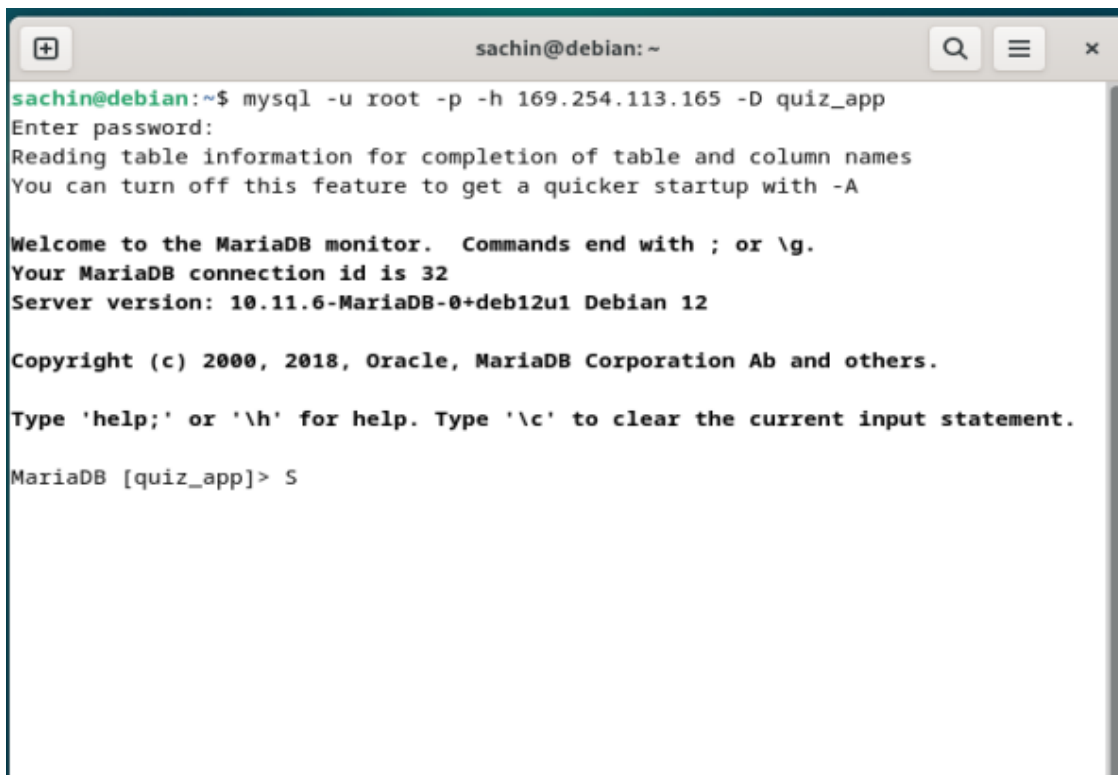
Step 1: Start MySQL on VM2

```
mysql -u root -p
```

Step 2: Compile and Run the Application on VM1

```
javac -cp ./mysql-connector-java-8.0.28.jar src/App.java
```

```
java -cp ./mysql-connector-java-8.0.28.jar App
```



```
sachin@debian: ~
sachin@debian:~$ mysql -u root -p -h 169.254.113.165 -D quiz_app
Enter password:
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 32
Server version: 10.11.6-MariaDB-0+deb12u1 Debian 12

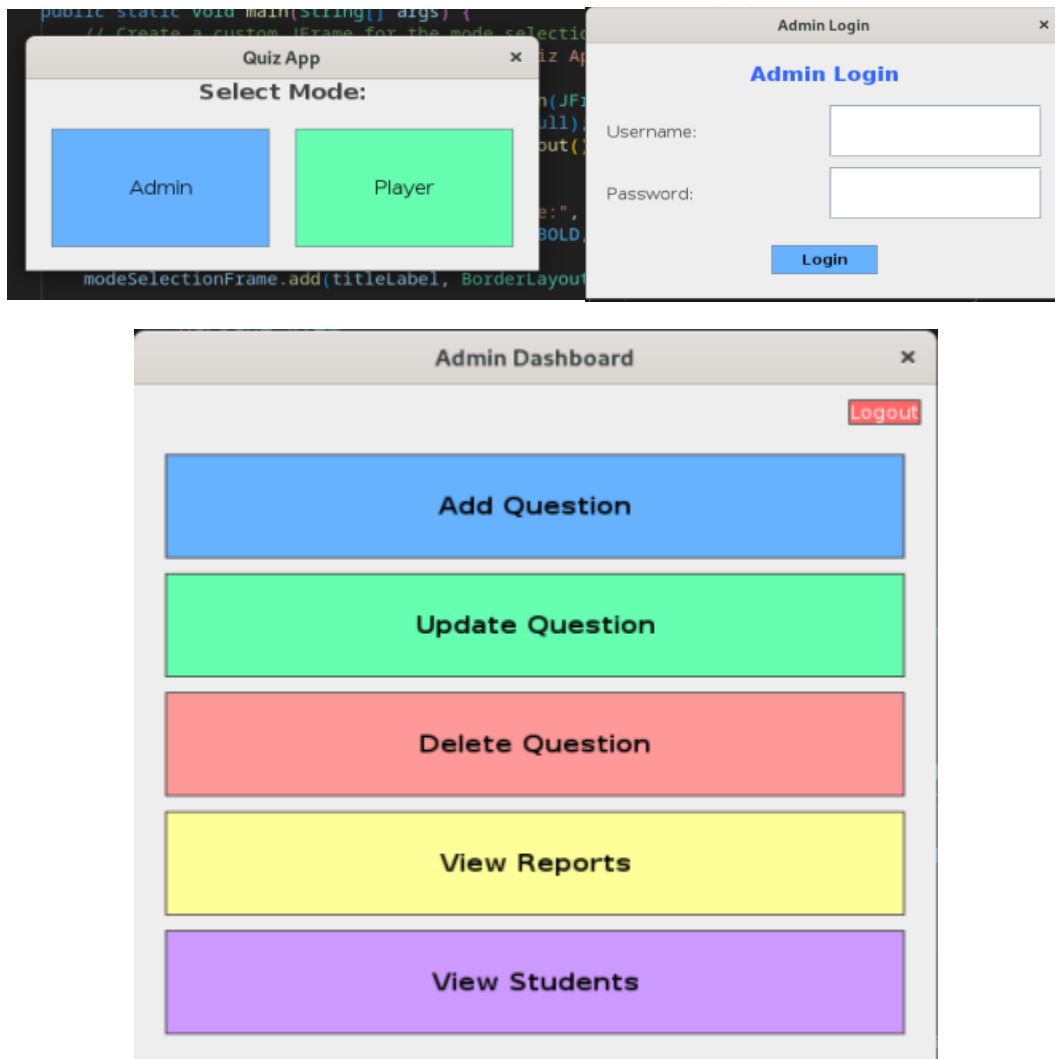
Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

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

MariaDB [quiz_app]> 
```

8. Key Features & Functionality

- **User Login & Registration** (PlayerDAO, PlayerController)
- **Quiz Management** (QuestionDAO, QuizController)
- **Admin Dashboard** (AdminController, Add/Delete Questions)
- **Score Reports & Leaderboard** (ReportDAO, HighScoreDAO)
- **Secure Password Hashing** (PasswordUtils.java)



9. Challenges Faced & Solutions

Issue: MySQL Connection Refused

- Fixed by updating bind-address = 0.0.0.0.

- Opened **port 3306** in the firewall.

```
sudo ufw allow 3306/tcp
```

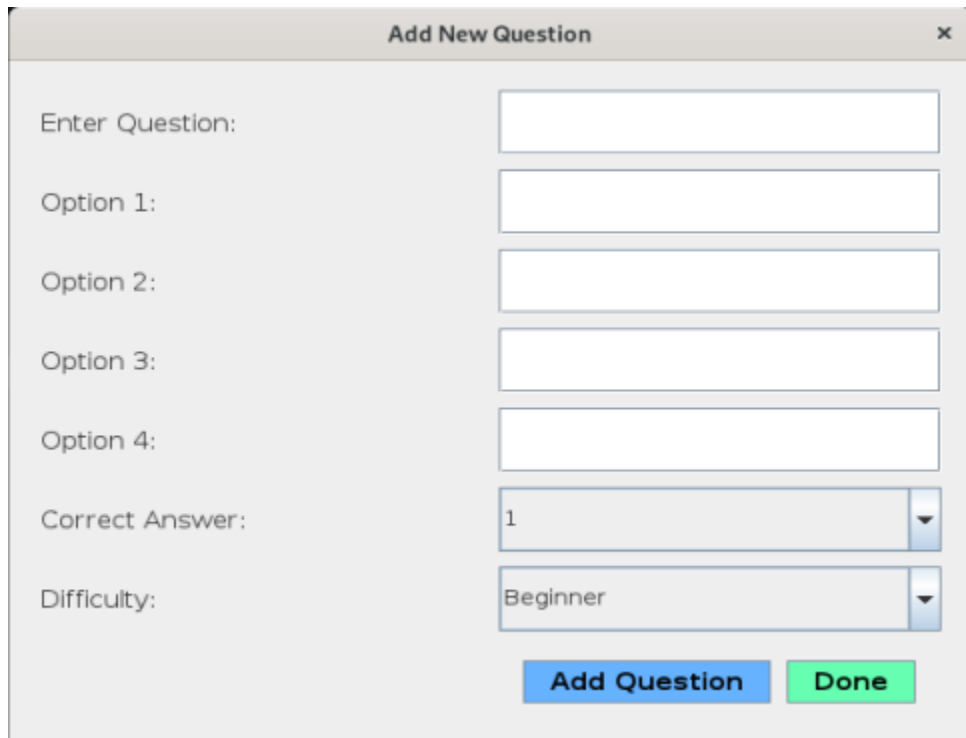
```
sudo ufw reload
```

Issue: Network Issues Between VMs

- Ensured both VMs were on the same **Internal Network**.
- Assigned **static IP addresses** to both VMs.

10. Conclusion

The **QuizApp** successfully demonstrates a **distributed system setup**, integrating a **Java application with a remote database** hosted on separate VirtualBox VMs.



The screenshot shows a window titled "Add New Question" with a close button (X) in the top right corner. The window contains the following fields and controls:

- Enter Question:** A text input field.
- Option 1:** A text input field.
- Option 2:** A text input field.
- Option 3:** A text input field.
- Option 4:** A text input field.
- Correct Answer:** A dropdown menu with "1" selected.
- Difficulty:** A dropdown menu with "Beginner" selected.
- Buttons:** Two buttons at the bottom: "Add Question" (blue) and "Done" (green).

View Students

Student ID	Name	Email
1	sachin	sachin@gmail.com
2	Raj Mishra	rajmishra@gmail.com

Back

View Reports

Enter Player ID to View Reports:

View ReportsBack

Reports

Report ID: 1
Correct Answers: 2
Score: 20
Difficulty: Intermediate

Register New Player

Back

Username:

minal@gmail.com

Password:

Name:

Minal Singh

Level:

Advanced

Register

```
sachin@debian: ~  
| players      |  
| questions    |  
| reports      |  
+-----+  
5 rows in set (0.000 sec)  
  
MariaDB [quiz_app]> select * from players;  
+-----+-----+-----+-----+-----+-----+  
--+  
| player_id | username          | password | name      | level      | score |  
+-----+-----+-----+-----+-----+-----+  
--+  
| 1 | sachin@gmail.com | 123456 | sachin    | Beginner   | 0 |  
| 2 | rajmishra@gmail.com | 12345 | Raj Mishra | Intermediate | 0 |  
| 3 | minal@gmail.com | 12345678 | Minal Singh | Advanced   | 0 |  
+-----+-----+-----+-----+-----+-----+  
--+  
3 rows in set (0.001 sec)  
  
MariaDB [quiz_app]>
```

Player Dashboard

Start Quiz

View Report

Logout

Quiz - Advanced Level

___ is used to find and fix bugs in the Java programs.

☐ JVM

☐ JRE

☐ JDK

☐ JDB

Next

Quiz - Advanced Level

In which memory a String is stored, when we create a string using new operator?

☐ Stack

☒ String memory

☐ Heap memory

☐ Random storage space

Next

Message

Quiz Over! Your Score: 10

OK

sachin@debian: ~

player_id	username	password	name	level	score
1	sachin@gmail.com	123456	sachin	Beginner	
2	rajmishra@gmail.com	12345	Raj Mishra	Intermediate	
3	minal@gmail.com	12345678	Minal Singh	Advanced	

3 rows in set (0.001 sec)

MariaDB [quiz_app]> select * from reports;

report_id	player_id	correct_answers	score	difficulty
1	2	2	20	Intermediate
2	3	1	10	Advanced

2 rows in set (0.000 sec)

MariaDB [quiz_app]>

11. References

1. Java JDBC Documentation (<https://docs.oracle.com/javase/tutorial/jdbc/basics/index.html>)
2. VirtualBox Networking Guide (<https://www.virtualbox.org/manual/ch06.html>)
3. MySQL Administration Guide (<https://dev.mysql.com/doc/refman/8.4/en/tutorial.html>)

Appendix

1. **Video Presentation Link :**
<https://drive.google.com/file/d/1zVjpoStiEZxm7My8wdX0YmkPxeaGuu8x/view?usp=sharing>
2. **PPT Link:**
https://docs.google.com/presentation/d/1CCbHlrMiOCFHyNH0o5fRjLY6gZT1ACGF/edit?usp=drive_link&oid=110909031381492795570&rtpof=true&sd=true
3. **System Architecture Diagram:**
https://drive.google.com/file/d/1pfjKadke4axnql3tp-6ZwTUfVyrNsg0w/view?usp=drive_link
4. **GitHub Repository Link:**
<https://github.com/sachinsingh2156/Java-based-quiz-app-Using-virtualization.git>