AetherMart Project - Milestone 3 Technical README

This document provides the technical setup and configuration details for the high-availability architectures implemented in Milestone 3.

1. Standard Replication (Primary-Replica) Setup

This architecture consists of one primary server and two replica servers.

Prerequisites

- Three running EC2 instances (Ubuntu).
- MariaDB installed on all three instances.
- An AWS Security Group assigned to all three instances with an inbound rule allowing TCP traffic on port 3306 from the security group itself.

Phase A: Configure the Primary Server

1. **Edit 50-server.cnf:**
   ```
   sudo nano /etc/mysql/mariadb.conf.d/50-server.cnf
   ```

2. **Add settings under [mariadbd]:**
   ```
   [mariadbd]
   log-bin = mysql-bin
   server_id = 1
   bind-address = 0.0.0.0
   ```

3. **Restart MariaDB:** `sudo systemctl restart mariadb`
4. **Create Replica User:**
   ```
   CREATE USER 'replica_user'@'%' IDENTIFIED BY 'yash';
   GRANT REPLICATION SLAVE ON *.* TO 'replica_user'@'%';
   FLUSH PRIVILEGES;
   ```

5. **Record Master Status:** Run SHOW MASTER STATUS; and note the File and Position.

Phase B: Configure Replica Servers

Perform these steps on both Replica 1 and Replica 2.

1. **Edit 50-server.cnf:**
2. **Add settings under [mariadbd].** Use a unique server_id for each replica.
   # For Replica 1
   ```
   [mariadbd]
   ```

```
server_id = 2
read_only = 1

# For Replica 2
[mariadbd]
server_id = 3
read_only = 1
```

3. **Restart MariaDB.**
4. **Connect to Primary:** Log in to MariaDB and run CHANGE MASTER TO, using the values from the primary.
```
CHANGE MASTER TO
  MASTER_HOST='<Primary-Server-Private-IP>',
  MASTER_USER='replica_user',
  MASTER_PASSWORD='yash',
  MASTER_LOG_FILE='<File_From_Primary>',
  MASTER_LOG_POS=<Position_From_Primary>;
START SLAVE;
```

5. **Verify:** Run `SHOW SLAVE STATUS\G` and check for ***Slave_IO_Running: Yes*** and ***Slave_SQL_Running: Yes.***

2. MariaDB Galera Cluster Setup

This architecture consists of three multi-primary nodes.

Prerequisites

- Three new, clean EC2 instances (Ubuntu).
- MariaDB installed on all three instances.
- An AWS Security Group assigned to all three instances with the following inbound rules, all with the security group itself as the source:
  - **Custom TCP:** *3306, 4567-4568* (MariaDB & Galera Replication)
  - **Custom TCP:** *4444* (State Snapshot Transfer)

Phase A: Configure All Three Nodes

Perform these steps on all three cluster nodes.

1. **Install Galera Package:**
```
sudo apt update
sudo apt install galera-4 -y
```

2. **Edit *50-server.cnf*:**
3. **Add Galera Configuration.** The *wsrep_cluster_address* must be identical on all nodes. The wsrep_node_address and wsrep_node_name must be unique to each node.

```
[mariadbd]
bind-address = 0.0.0.0

[galera]
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so
wsrep_cluster_address="gcomm://<Node1-IP>,<Node2-IP>,<Node3-IP>"
wsrep_cluster_name="aethermart_cluster"
wsrep_node_address="<This_Nodes_IP>"
wsrep_node_name="<This_Nodes_Name>" # e.g., galera-node-1
binlog_format=row
default_storage_engine=InnoDB
innodb_autoinc_lock_mode=2
```

Phase B: Bootstrap and Start the Cluster

1. **On Node 1 ONLY:** Bootstrap the new cluster.
   `sudo galera_new_cluster`

2. **On Node 2:** Wait ~20 seconds, then start MariaDB.
   `sudo systemctl start mariadb`

3. **On Node 3:** Wait ~20 seconds, then start MariaDB.
   `sudo systemctl start mariadb`

4. **Verify:** On any node, log in to MariaDB and run `SHOW STATUS LIKE 'wsrep_cluster_size';`. The value should be 3.

3. AWS Security Group Configuration Summary

This section details the necessary inbound firewall rules for each high-availability setup. The **Source** for all rules should be the ID of the security group itself to allow internal communication between nodes.

3.1 For Standard Replication

Type	Protocol	Port Range	Source	Description
Custom TCP	TCP	3306	`sg-xxxxxxxx`	Allow internal MariaDB traffic

3.2 For Galera Cluster

Type	Protocol	Port Range	Source	Description
Custom TCP	TCP	3306, 4567-4568	`sg-xxxxxxxx`	Allow MariaDB & Galera Replication
Custom TCP	TCP	4444	`sg-xxxxxxxx`	Allow Galera State Snapshot Transfer