MySQL Day 15

Day 15: Failover, Load Balancing & HA Architecture (MySQL DBA)

Author : Ajit Yadav (MSSQL , MYSQL , POSTGRESQL DBA)

Day 15 Objectives

By the end of this day, you will understand:
✓ How automatic failover works
✓ What load balancing is in databases
✓ How High Availability (HA) architecture is designed
✓ How to remove Single Point of Failure (SPOF)
✓ How production HA setups look in real companies

📌1What is Failover ?

🔳 Failover = Switching to Standby Server Automatically

When Primary Server fails, system switches to Replica.

Types of Failover:

Type	Description
Manual	DBA switches manually
Automatic	Tool handles it
Semi-Auto	Alert + manual approval

Primary Down ❌
↓
Replica Promoted ✓
↓
App Redirected

📌 2 What is Load Balancing?

🔷 **Load Balancing = Distribute Traffic**

App → One MySQL Server ❌

App → Load Balancer → Multiple DB Servers ✓

Benefits:

✓ Improves performance

✓ Handles more users

✓ Prevents overload

✓ Increases availability

📌 3 Read/Write Splitting

In real production:

Operation	Server
INSERT / UPDATE	Primary
SELECT	Replicas

Architecture:

Application
|
Load Balancer
|

| Primary | Replica |

✓ Writes → Primary
✓ Reads → Replicas

📌 4 High Availability (HA) Architecture

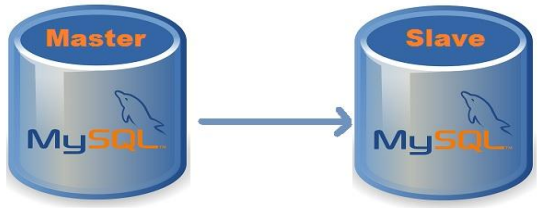
🔷 HA = System Always Available (24/7)
Main Goal:

❗ No Downtime Even if One Server Fails

Common MySQL HA Designs

◈ A. Primary–Replica HA

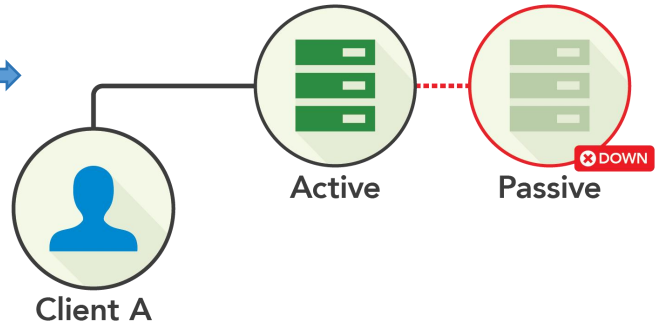
Primary → Replica1
→ Replica2



✓ Simple
✗ Manual failover

◈ B. Active–Passive Cluster

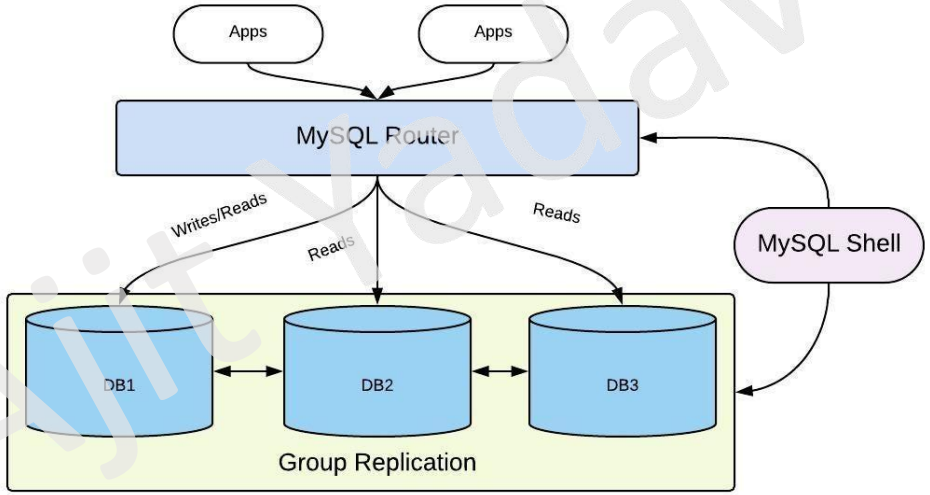
Primary (Active)
Standby (Passive)



✓ Automatic failover
✓ One active at a time

◈ C. Multi-Node Cluster (Advanced)

Node1 ↔ Node2 ↔ Node3



✓ No single master
✓ High complexity

📌 5 Failover Management Tools (Industry Standard)

Tool	Purpose
Orchestrator	MySQL failover automation
ProxySQL	Smart routing + load balancing
HAProxy	Traffic load balancing
Keepalived	Virtual IP failover

📌 6 How Automatic Failover Works (Flow)

1. Monitor Primary
2. Detect Failure
3. Promote Replica
4. Update Routing
5. Resume Traffic

Time: 10–30 seconds (good setup)

📌 7 Split-Brain Problem (Important Topic)

❗ What is Split-Brain?

Two servers think they are PRIMARY

Server A = Primary
Server B = Primary

Result → Data corruption ❌

Prevention:

- ✓ Fencing
- ✓ Quorum
- ✓ Leader election
- ✓ Heartbeat checks

Always use cluster manager.

📌 8 Production-Level HA Architecture (Real World)

◈ Standard Setup:

Users
|
App Servers
|
Load Balancer (HA)
|
Proxy Layer
|
Primary DB ↔ Replicas
|
Backup Server

Includes:

- ✓ Monitoring
- ✓ Alerting
- ✓ Backup
- ✓ Failover
- ✓ DR site

📌 9 Monitoring in HA Systems

You must monitor:

Component	Tool
MySQL	Performance Schema
Replication	SHOW SLAVE STATUS
Failover	Orchestrator
System	Prometheus

📌 10 DR (Disaster Recovery) vs HA

Feature	HA	DR
Purpose	Avoid downtime	Recover from disaster
Location	Same DC	Different DC
Speed	Seconds	Minutes/Hours

📌 11 Hands-On Practice (Recommended)

Note :
This Topic we have see in the upcoming next HA practicle .
in this we just learn a theory part .

Lab Setup:

1 Create:

a) Primary

b) Replicas

2 Configure replication

3 Install failover tool

4 Stop Primary:

systemctl stop mysql

5 Observe auto failover

6 Check app connectivity

📌 12 Questions

✔ Basic

- ✓ What is failover?
- ✓ Difference between HA and DR?
- ✓ What is SPOF?

✔ Intermediate

- ✓ How read/write splitting works?
- ✓ What is split-brain?
- ✓ How do you design HA?

✔ Advanced

- ✓ How to avoid data loss in failover?
- ✓ How GTID helps in HA?
- ✓ How to handle replication lag?