Title Slide

- Title: Database Backup and Replication
- Subtitle: Concepts, Types, Implementation, and Best Practices
- Visual: Database icon with arrows indicating backup & replication

Learning Objectives

- Understand backup types: full, incremental, differential
- Learn replication strategies: master-slave, master-master
- Implement practical examples in Oracle, MSSQL, MySQL
- Execute step-by-step lab commands
- Monitor and troubleshoot

Why Backup & Replication are Important

- Prevent data loss: hardware failure, human error, malware
- Ensure high availability
- Regulatory compliance
- Visual: Flow diagram of "Database → Backup/Replication → Recovery"

Database Backup Types (with Diagram)

Backup Type	Description	Pros	Cons	Example
Full	Entire DB	Complete recovery	Large, slow	Oracle RMAN, MSSQL, MySQL dump
Incremental	Only changed data	Fast, less storage	Restore needs full+incrementals	Oracle Level 1, MSSQL Differential, MySQL binlogs
Differential	Changes since last full	Faster restore than incremental	Larger than incremental	MSSQL Differential, Oracle Level 1

Oracle Backup Example (Lab Steps)

Full Backup:

```
RMAN> CONNECT TARGET /
RMAN> BACKUP DATABASE;
```

Incremental Backup (Level 1):

```
RMAN> BACKUP INCREMENTAL LEVEL 1 DATABASE;
```

Differential Backup Simulation:

- Level 1 incremental since last full

Visual Diagram: Full backup → Level 1 Incremental → Restore flow

MSSQL Backup Example

Full Backup:

```
BACKUP DATABASE MyDB
TO DISK = 'C:\Backup\MyDB_full.bak';
```

Differential Backup:

```
BACKUP DATABASE MyDB
TO DISK = 'C:\Backup\MyDB_diff.bak'
WITH DIFFERENTIAL;
```

Incremental Backup: Handled using log backups

```
BACKUP LOG MyDB TO DISK='C:\Backup\MyDB_log.trn';
```

Diagram: Backup chain illustration

MySQL Backup Example

Full Backup using mysqldump:

```
mysqldump -u root -p mydb > mydb_full.sql
```

Incremental using binary logs:

```
mysqlbinlog mysql-bin.000001 > binlog.sql
```

Restore Example:

```
mysql -u root -p mydb < mydb_full.sql
```

Diagram: Full + binlog incremental restore flow

Backup Strategies

- Full + Incremental (weekly full + daily incrementals)
- Backup retention policies
- Local + offsite backups
- Automation: RMAN scripts, SQL Agent jobs, cron jobs

- Diagram: Backup schedule timeline

Replication Concepts

- Master-Slave (Primary-Secondary)
- Master-Master (Multi-Master)
- Synchronous vs Asynchronous
- Visual: Arrows showing data replication flow

Oracle Replication Example

Data Guard (Physical Standby):

1. Configure primary and standby database
2. Set up redo log shipping
3. Activate managed recovery

```
ALTER DATABASE RECOVER MANAGED STANDBY DATABASE DISCONNECT FROM SESSION;
```

Visual Diagram: Primary DB → Standby DB → Failover

MSSQL Replication Example

Transactional Replication Steps:

1. Configure Publisher, Distributor, Subscriber
2. Select articles (tables/views)
3. Set schedule
4. Monitor replication agent
   Commands/Tools: SSMS wizard
   Diagram: Publisher → Distributor → Subscriber

MySQL Replication Example

Asynchronous Master-Slave Setup:

1. Enable binary logging on master: `log_bin=mysql-bin`
2. Create replication user:

```
CREATE USER 'repl'@'%' IDENTIFIED BY 'password';
GRANT REPLICATION SLAVE ON *.* TO 'repl'@'%';
```

3. Get master status: `SHOW MASTER STATUS;`
4. Configure slave:

```
CHANGE MASTER TO
  MASTER_HOST='master_ip',
```

```
  MASTER_USER='repl',
  MASTER_PASSWORD='password',
  MASTER_LOG_FILE='mysql-bin.000001',
  MASTER_LOG_POS=107;
START SLAVE;
```

5. Monitor replication: `SHOW SLAVE STATUS\G;`
   Diagram: Master → Slave replication flow

Best Practices

- Test backup & replication regularly
- Encrypt backups & traffic
- Offsite copies
- Monitor replication lag
- Document procedures
  Visual: Checklist diagram

Troubleshooting Common Issues

- Disk space full
- Network latency → replication lag
- Backup failures due to locks or permissions
- Tips: Logging, alerts, automation

Lab / Case Study

- Scenario: Bank DB 2TB, high availability
- Solution:
  - Weekly full + daily incremental
  - Oracle Data Guard standby
  - Monitor replication logs
- Step-by-step commands included

Summary

- Backups: Recovery, replication: Availability
- Choose type based on RTO/RPO
- Automate, monitor, test

References

- Oracle RMAN / Data Guard docs
- MSSQL Backup & Replication guide
- MySQL Replication docs
- Blogs/tutorials on automation