**Relational Database Services (RDS)**

**In-Depth Guide to RDS, DBMS, SQL, and MariaDB**

**1. Introduction to Amazon RDS**

Amazon Relational Database Service (RDS) is a managed database solution provided by AWS that simplifies the setup, operation, and scaling of relational databases in the cloud. It supports various database engines, including MySQL, PostgreSQL, MariaDB, Oracle, and Microsoft SQL Server.

**1.1 Key Features of RDS:**

* **Automated Management:** AWS handles backups, patching, and monitoring.
* **Scalability:** Storage and compute capacity can be adjusted dynamically.
* **High Availability:** Multi-AZ deployments ensure minimal downtime.
* **Security:** Integration with IAM, encryption, and VPC for secure access.
* **Read Replicas:** Improves performance for read-heavy applications.
* **Performance Insights:** Analyses database activity for optimization.

**1.2 RDS Deployment Options**

* **Single-AZ Deployment:** Cost-effective but has downtime during maintenance.
* **Multi-AZ Deployment:** Ensures high availability with automatic failover.
* **Read Replicas:** Used for scaling read-heavy workloads.
* **Aurora RDS:** AWS’s cloud-native relational database with higher performance.

**1.3 RDS Pricing Models**

* **On-Demand Pricing:** Pay per hour with no long-term commitments.
* **Reserved Instances:** Lower cost for long-term commitments.
* **Serverless RDS:** Scales automatically based on demand.

**2. Advantages of Amazon RDS**

**2.1 Ease of Management**

* **Automated Backups:** Daily snapshots for easy recovery.
* **Monitoring & Logging:** AWS CloudWatch, CloudTrail, and Performance Insights.
* **Maintenance Window:** Allows scheduled updates with minimal impact.

**2.2 High Availability and Disaster Recovery**

* **Multi-AZ Deployments:** Standby instance automatically takes over in case of failure.
* **Automated Failover:** Ensures business continuity.
* **Point-in-Time Recovery:** Restores database to any time within retention period.

**2.3 Security and Compliance**

* **IAM Integration:** Fine-grained access control.
* **Encryption:** Data encrypted at rest and in transit.
* **VPC Isolation:** Controls access via private networking.
* **Compliance Standards:** Meets regulatory requirements (GDPR, HIPAA, PCI-DSS, etc.).

**2.4 Performance Optimization**

* **Provisioned IOPS:** Ensures high performance with SSD-backed storage.
* **Read Replicas:** Distributes read operations across multiple instances.
* **Automatic Storage Scaling:** Adjusts based on workload.

**3. Introduction to DBMS (Database Management System)**

A Database Management System (DBMS) is software used to store, retrieve, and manage data in a structured manner. It serves as an intermediary between the database and users or applications.

**3.1 Types of DBMS**

* **Relational DBMS (RDBMS):** Uses tables with rows and columns (e.g., MySQL, PostgreSQL, MariaDB).
* **NoSQL DBMS:** Handles unstructured data (e.g., MongoDB, Cassandra).
* **Hierarchical DBMS:** Organizes data in a tree-like structure (e.g., IBM IMS).
* **Network DBMS:** Uses graph-based structures for complex data relationships (e.g., IDS, IDMS).

**3.2 Key Functions of DBMS**

* **Data Storage & Retrieval:** Efficiently stores and fetches data.
* **Concurrency Control:** Manages multiple users accessing data simultaneously.
* **Data Integrity:** Ensures consistency and accuracy of data.
* **Backup & Recovery:** Provides data redundancy and recovery mechanisms.
* **Security Management:** Implements authentication and authorization.

**3.3 Comparison of DBMS vs. File System**

| **Feature** | **DBMS** | **File System** |
| --- | --- | --- |
| Structure | Organized tables | Flat files |
| Querying | Uses SQL | Manual search |
| Security | High | Low |
| Backup & Recovery | Automated | Manual |

**4. Introduction to MariaDB**

MariaDB is an open-source relational database management system (RDBMS) that is a fork of MySQL. It offers enhanced performance, security, and compatibility with MySQL.

**4.1 Key Features of MariaDB**

* **Open-Source & Community-Driven:** No licensing fees.
* **Performance Improvements:** Faster execution of complex queries.
* **Storage Engines:** Supports InnoDB, MyISAM, Aria, and more.
* **Security Enhancements:** Stronger authentication mechanisms.

**4.2 Installing MariaDB**

sudo apt update

sudo apt install mariadb-server -y

**4.3 Configuring MariaDB**

* **Start MariaDB Service:**

sudo systemctl start mariadb

sudo systemctl enable mariadb

* **Secure Installation:**

sudo mysql\_secure\_installation

**4.4 Connecting to MariaDB**

mysql -u -h (paste endpoint of rds) root -p

SHOW DATABASES;

**4.5 Creating a Database in MariaDB**

CREATE DATABASE student\_db;  
\*\* create database sample; create database sample;

**5. Structured Query Language (SQL)**

SQL (Structured Query Language) is the standard language for managing relational databases. It consists of multiple components:

**5.1 SQL Categories**

* **Data Definition Language (DDL):** CREATE, ALTER, DROP
* **Data Manipulation Language (DML):** INSERT, UPDATE, DELETE
* **Data Query Language (DQL):** SELECT
* **Data Control Language (DCL):** GRANT, REVOKE
* **Transaction Control Language (TCL):** COMMIT, ROLLBACK

**5.2 Common SQL Commands**

* **Create a Table:**

CREATE TABLE students (

id INT PRIMARY KEY,

name VARCHAR(50),

age INT,

grade CHAR(1)

);

* **Insert Data:**

INSERT INTO students (id, name, age, grade) VALUES (1, 'John Doe', 20, 'A');

* **Retrieve Data:**

SELECT \* FROM students WHERE grade = 'A';

* **Update Data:**

UPDATE students SET age = 21 WHERE id = 1;

* **Delete Data:**

DELETE FROM students WHERE id = 1;

**🎯 Conclusion**

This guide provides an in-depth understanding of Amazon RDS, its advantages, and its role in cloud-based database management. We also explored fundamental database concepts, SQL operations, and MariaDB’s capabilities. Mastering these topics will help in efficient database design, performance optimization, and security best practices.

**RDS Practicle-**

[**Create an Amazon RDS DB instance - Amazon Relational Database Service**](https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_Tutorials.WebServerDB.CreateDBInstance.html)[**Install a web server on your EC2 instance - Amazon Relational Database Service**](https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_Tutorials.WebServerDB.CreateWebServer.html)

**If sample database not created … use this commands**  
  
> mysql -h <RDS Endpoint> -u admin -plinux0308   
[to enter in your RDS Mysql DB]

> show databases;

> create database sample;   
[to create new database .. sample]

> show databases;

> SHOW TABLES;

> **SELECT \* FROM EMPLOYEES;**