Follow me Shaik Hari Sadia Anjum for more AWS content!

Amazon RDS

Amazon RDS (Relational Database Service) is a fully managed database service by AWS that simplifies database administration tasks such as provisioning, patching, backup, recovery, and scaling. It supports multiple database engines and offers features like automated backups, monitoring, and security.

Amazon RDS Cheat Sheet

- Industry-standard relational database
- RDS manages backups, software patching, automatic failure detection, and recovery.
- You can have automated backups performed when you need them, or manually create your own backup snapshot. You can use these backups to restore a database.
- Supports **Aurora**, **MySQL, MariaDB, PostgreSQL, Oracle, Microsoft SQL Server**.
- You can get high availability with a primary instance and a synchronous secondary instance that you can fail over to when problems occur. You can also use MySQL, MariaDB, or PostgreSQL Read Replicas to increase read scaling.
- Basic building block of RDS is the **DB instance**, which is an isolated database environment in the cloud.
- You can have up to 40 Amazon RDS DB instances.
- Each DB instance runs a **DB engine**.
- You can select the computation and memory capacity of a DB instance, determined by its **DB instance class**. If your needs change over time, you can change DB instances.
- Each DB instance has minimum and maximum storage requirements depending on the storage type and the database engine it supports.
- You can run your DB instance in several AZs, an option called a **Multi-AZ deployment**. Amazon automatically provisions and maintains a secondary standby DB instance in a different AZ. Your primary DB instance is synchronously replicated across AZs to the secondary instance to provide data redundancy, failover support, eliminate I/O freezes, and minimize latency spikes during system backups.

Key Features of Amazon RDS

A. Automated Database Management

- AWS manages routine database tasks such as setup, patching, and monitoring.

B. High Availability and Failover

- **Multi-AZ Deployments**: Provides automatic failover to a standby replica in another AZ.
- **Read Replicas**: Improve performance by offloading read queries.

C. Scalability

- **Vertical Scaling**: Increase instance type (CPU, memory).
- **Horizontal Scaling**: Add Read Replicas to handle more traffic.

D. Automated Backups and Snapshots

- **Automated Backups**: AWS automatically takes daily snapshots and stores transaction logs.
- **Manual Snapshots**: Users can take snapshots for long-term storage.

E. Security

- **Encryption**: Data is encrypted at rest using AWS KMS and in transit using SSL/TLS.
- **IAM Authentication**: Integrate with AWS Identity and Access Management (IAM).
- **Network Isolation**: Deploy RDS in a **VPC (Virtual Private Cloud)** for better security.

F. Monitoring and Logging

- **Amazon CloudWatch**: Monitors performance metrics.
- **RDS Performance Insights**: Helps analyze database performance.
- **Enhanced Monitoring**: Provides OS-level metrics.

Supported Database Engines

Amazon RDS supports several popular relational databases:

1. **Amazon Aurora (AWS's high-performance database)**
2. **MySQL**

3. **PostgreSQL**
4. **MariaDB**
5. **Oracle**
6. **Microsoft SQL Server**
7. **DB2**

Comparison of On Prem Database Vs. Database on EC2		
Feature	On-premises management	Amazon EC2 management
Application optimization	Customer	Customer
Scaling	Customer	Customer
High availability	Customer	Customer
Database backups	Customer	Customer
Database software patching	Customer	Customer
Database software install	Customer	Customer
Operating system (OS) patching	Customer	Customer
OS installation	Customer	Customer
Server maintenance	Customer	AWS
Hardware lifecycle	Customer	AWS
Power, network, and cooling	Customer	AWS

Comparison of Database on EC2 Vs. RDS		
Feature	Amazon EC2 management	Amazon RDS management
Application optimization	Customer	Customer
Scaling	Customer	AWS
High availability	Customer	AWS
Database backups	Customer	AWS
Database software patching	Customer	AWS
Database software install	Customer	AWS
OS patching	Customer	AWS
OS installation	Customer	AWS
Server maintenance	AWS	AWS
Hardware lifecycle	AWS	AWS
Power, network, and cooling	AWS	AWS

RDS Instance Types

RDS provides various instance families optimized for different workloads:

- **General Purpose (T3, T4g, M5, M6g)** – Balanced compute and memory.
- **Memory Optimized (R5, R6g, X2g)** – For database workloads with high memory needs.
- **Burstable (T3, T4g)** – Cost-effective option for workloads with low CPU utilization.

Storage Options

Amazon RDS supports different types of storage:

- **General Purpose SSD (gp2, gp3)** – Balanced price and performance.
- **Provisioned IOPS SSD (io1, io2)** – For high-performance applications.
- **Magnetic (Deprecated)** – Older storage type with lower performance.

Storage Auto-Scaling

- RDS can automatically increase storage as needed.

Amazon RDS Backup & Recovery

A. Automated Backups

- Enabled by default.
- Retention period: **1 to 35 days**.
- Includes full daily snapshot and transaction logs.

B. Manual Snapshots

- Users can create snapshots anytime.
- Useful for long-term backups.

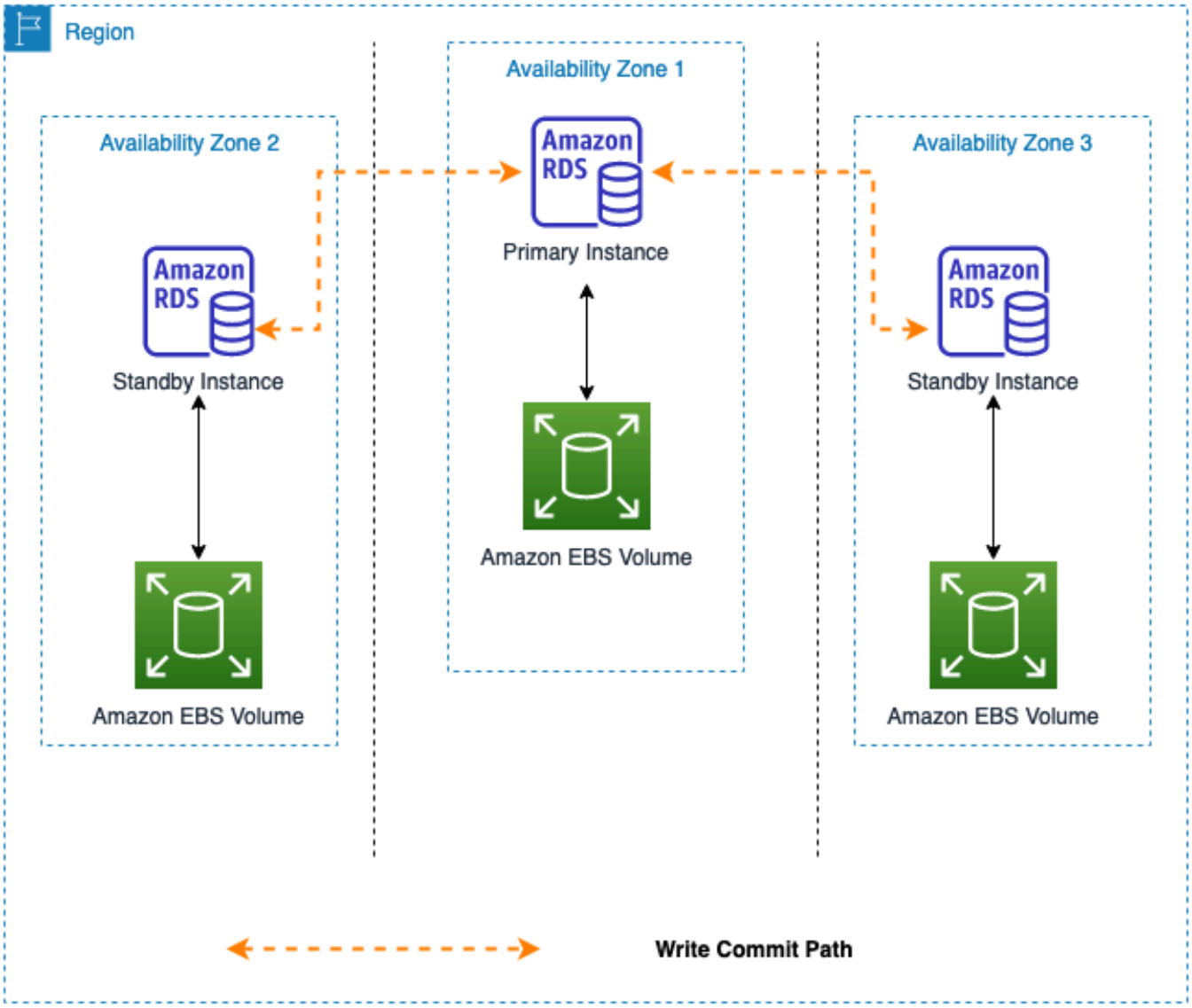
C. Point-in-Time Recovery

- Restore database to a specific point in time using transaction logs.

High Availability with Amazon RDS

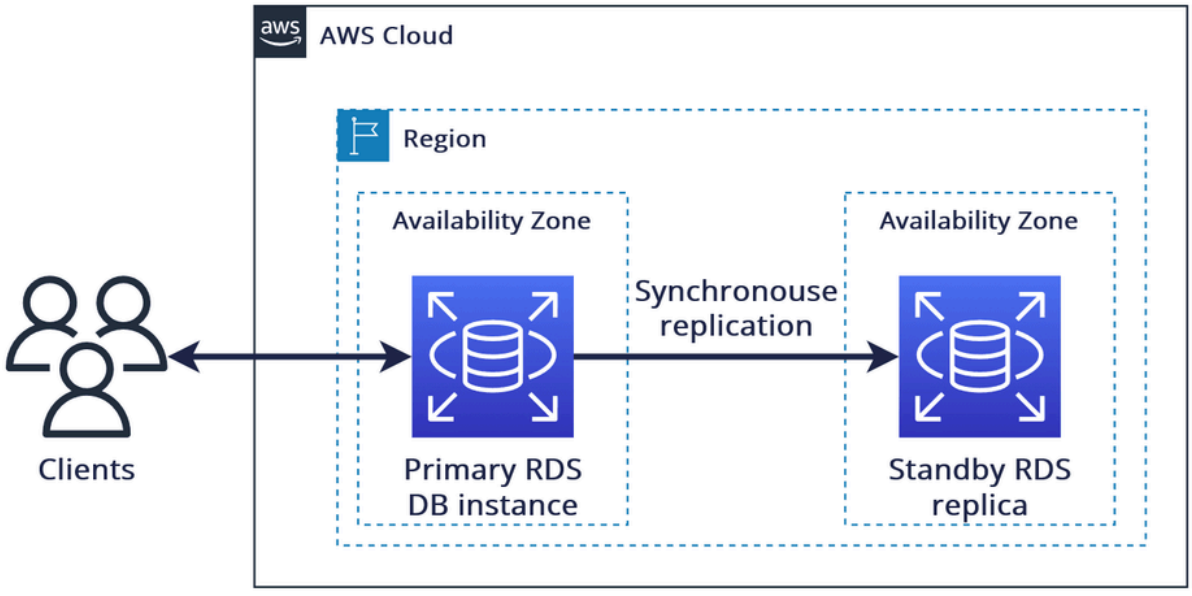
A. Multi-AZ Deployments

- Provides disaster recovery by automatically failing over to a standby instance in another AZ.



B. Read Replicas

- Used for scaling read-heavy workloads.
- Can be created in **the same or different AWS regions**.



Security in Amazon RDS

A. Encryption

- **Data at Rest**: AWS KMS (Key Management Service).
- **Data in Transit**: SSL/TLS encryption.

B. Network Security

- Use **VPC, Subnets, and Security Groups** for access control.
- Restrict access via IAM policies.

C. IAM Authentication

- Users can authenticate using IAM instead of database credentials.

Amazon RDS Pricing

Pricing depends on:

1. **Instance Type** (General, Memory-Optimized, etc.).
2. **Storage Type & Size** (GP3, IO2, etc.).
3. **Backup Storage**.
4. **Data Transfer**.

AWS offers **on-demand and reserved instance pricing** to optimize costs.

Amazon RDS Best Practices

1. **Use Multi-AZ for Production** to ensure high availability.
2. **Enable Automated Backups** for disaster recovery.
3. **Scale Storage and Compute as needed**.
4. **Optimize Performance using Performance Insights**.
5. **Use Read Replicas for scaling read-heavy applications**.
6. **Secure your RDS instance** with VPC, IAM, and encryption.
7. **Monitor with Amazon CloudWatch** to track performance.

Common Use Cases

- **E-commerce websites** using MySQL/PostgreSQL.
- **Enterprise applications** using SQL Server/Oracle.
- **Data warehousing** and analytics.
- **Mobile and web applications** requiring scalable databases.

Amazon RDS vs Other AWS Database Services

Feature	RDS	DynamoDB	Aurora	Redshift
Database Type	Relational	NoSQL	Relational	Data Warehouse
Fully Managed	Yes	Yes	Yes	Yes
Scalability	Vertical, Read Replicas	Automatic	Auto-Scaling	Automatic
Use Case	Web Apps, OLTP	High-speed key-value storage	Cloud-native apps	Analytics

Amazon RDS simplifies database management by automating setup, maintenance, and scaling. It supports major relational databases and offers features like Multi-AZ, Read Replicas, and automatic backups to ensure reliability and performance. It is widely used for web applications, enterprise systems, and data-intensive workloads.