Relational Database Services -RDS

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Relational Database Services

Amazon Relational Database Service (Amazon RDS) is a web service that makes it easier to set up, operate, and scale a relational database in the AWS Cloud. It provides cost-efficient, resizable capacity for an industry-standard relational database and manages common database administration tasks.

Amazon RDS is available on several database instance types - optimized for memory, performance or I/O - and provides you with six familiar database engines to choose from

- MySQL
- MariaDB
- PostGreSQL
- MS SQL Server
- Oracle
- Aurora

Benefits of RDS:

- Easy to Administer
- Highy Scalable
- Available & Durable
- Fast
- Secure
- Inexpensive

AWS Also provides the AWS Database Migraton Service, a service which makes it easy and inexpensive to migrate your databases to AWS Cloud.

A relational database can be categorized as either an Online Transaction processing (OLTP) or Online Analytical Processing (OLAP) database system, depending on how the tables are organized and how the application uses the relational database.

OLTP refers to transaction oriented applications that are frequently writing and changing data.

OLAP is typically the domain of data warehouses and refers to reporting or analyzing large data sets.

Data Warehouses:

A data warehouse is a central repository for data that can come from one or more sources. This data repository is often a specialized type of relational database that can be used for reporting and analysis via OLAP. Organizations typically use data warehouses to compile reports and search the database using highly complex queries.

Database comparison On-Premise vs EC2 vs RDS:

Responsibility	Database On-Premise	Database on Amazon EC2	Database on Amazon RDS
App Optimization	You	You	You
Scaling	You	You	AWS
High Availability	You	You	AWS
Backups	You	You	AWS
DB Engine Patches	You	You	AWS
Software Installation	You	You	AWS
OS Patches	You	You	AWS
OS Installation	You	AWS	AWS
Server Maintenance	You	AWS	AWS
Rack and Stack	You	AWS	AWS
Power and Cooling	You	AWS	AWS

MySQL:

MySQL is one of the most popular open-source database in the world, and it si used to power a wide range of applications, from small personal blogs to some of the largest websites in the world. Amazon RDS MySQL allows you to connect using standard MySQL tools such as MySQL Workbench or SQLYog tools.

PostgreSQL:

PostgreSQL is a widely used open-source database engine with a very rich set of features and advanced functionality. Amazon RDS PostgreSQL can be managed using standard tools like pgadmin and supports standard JDBC/ODBC Drivers.

MariaDB:

MariaDB is a popular opensource database engine built by the creators of MySQL and enhanced with enterprise tools and functionality.

Oracle:

Oracle is one of the most popular relational databases used in the enterprise and is fully supported by Amazon RDS. Amazon RDS Supports access to schemas on a DB Instance using any Standard SQL Client Application, such as Oracle SQL Plus.

Microsoft SQL Server:

MS SQL server is another very popular relational database used in the enterprise. Amazon RDS allows DB Administrators to connect to their SQL Server DB Instance in the cloud using Native tool like SQL Server Management studio.

Licensing: AWS Offers two licensing models for Oracle and Microsoft SQL server as they are commercial software products.

1. License Included
2. Bring Your Own License (BYOL)

Aurora:

Amazon Aurora is a fully managed service, is MySQL & PostgreSQL compatible, and provides for increases reliability and performance over standard MySQL deployments. Amazon Aurora can deliver up to five times better performance compared to MySQL. We can use the same code, tools, and applications that we use with existing MySQL databases with amazon aurora.

- 2 copies of your data is contained in each availability zone, with minimum of 3 availability zones. 6 copies of your data.
- Aurora is designed to transparently handle the loss of up to two copies of data without affecting database write availability and upto three copies without affecting read availability.
- Aurora storage is also self-healing. Data blocks and disks continuously scanned for errors and repaired automatically.
- We can create 2 types of replications for aurora
    - Aurora Read Replicas (Currently 15)
    - MySQL Read Replicas (Currently 15)

Storage Options:

Amazon RDS uses Amazon Elastic Block Storage (EBS) volumes for database and log storage. Depending on the amount of storage requested, Amazon RDS automatically stripes across multiple Amazon EBS volumes to enhance performance.

- General Purpose SSD
- Provisioned IOPS SSD

RDS -Storage Auto Scaling

- Helps you increase storage on your RDS DB Instance Dynamically
- When RDS detects you are running out of free database storage, it scales automatically.
- You have to set maximum Storage threshold
- Automatically Modify storage if:
    - Free storage is less than 10% of allocated storage
    - Low-Storage lasts at least 5 minutes
    - 6 hours have passed since last modification
- Useful for applications with unpredictable workloads
- Supports all RDS database engines.

Backup and Recovery

Amazon RDS provides two mechanisms for backing up the database:

1. Automated Backups
2. Manual snapshots

- Backups are automatically enabled in RDS
- **Automated Backups:**
    - Daily full backup of the database (during the maintenance window)
    - Transaction logs are backed-up by RDS every 5 minutes
    - Ability to restore to any point in time (from oldest backup to 5 minutes ago)
    - Default 7 days retention (can be increased to 35 days)
- **Manual snapshots** trigged by the user and **Retention** is as long as you want.

Recovery: We can use automated backup or manual snapshot to recover the database.

- Amazon RDS allows you to recover database using automated backups or manual snapshots.
- You cannot restore from a DB snapshot to an existing DB instance: a new DB instance is created when you restore.
- When using automated backups, Amazon RDS combines the daily backups performed during your predefined maintenance window in conjunction with transaction logs to enable you to restore your DB instance to any point during your retention period, typically up to the last 5 minutes.

Multi-AZ:

Amazon RDS Multi-AZ deployments provide enhanced availability and durability for RDS database (DB) instances, making them a natural fit for production database workloads.

When you provision a Multi-AZ DB Instance, Amazon RDS automatically creates a primary DB Instance and synchronously replicates the data to a standby instance in a different Availability Zone (AZ).

In case of an infrastructure failure, Amazon RDS performs an automatic failover to the standby (or to a read replica in the case of Amazon Aurora), so that you can resume database operations as soon as the failover is complete. Since the endpoint for your DB Instance remains the same after a failover, your application can resume database operation without the need for manual administrative intervention.

Benefits of Multi-AZ:

- Enhanced durability
- Increased availability
- Automatic Failover
- Synchronous Replication
- Not Used for Scaling

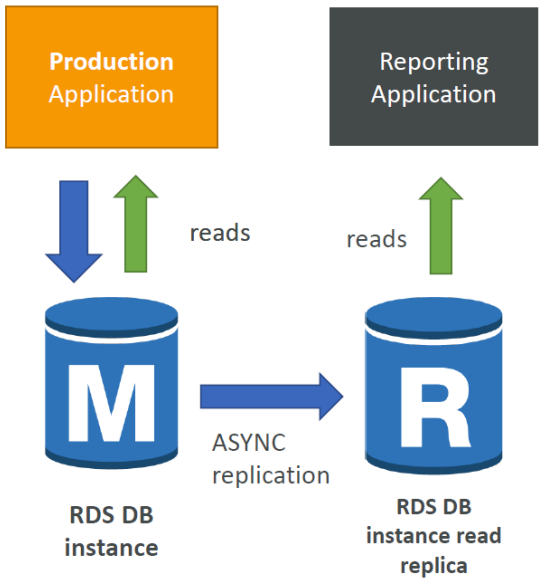
Failover Conditions:

- Loss of availability in primary Availability Zone
- Loss of network connectivity to primary
- Compute unit failure on primary
- Storage failure on Primary

Read Replicas:

DB engines' built-in replication functionality to create a special type of DB instance called a read replica from a source DB instance. Updates made to the source DB instance are asynchronously copied to the read replica.

You can reduce the load on your source DB instance by routing read queries from your applications to the read replica. Using read replicas, you can elastically scale out beyond the capacity constraints of a single DB instance for read-heavy database workloads.



Key Points:

- You can create max 5 Read replicas per DB Instance, but you can create replica of an existing Read Replica.
- Replication is ASYNCRONOUS, so reads are eventually consistent
- Replicas can be promoted to their own DB
- Read replicas are used for SELECT (=read) only kind of statements (not INSERT, UPDATE, DELETE)