Amazon RDS

COSC 516 – Cloud Databases

Amazon RDS

Amazon RDS (Relational Database Service) is a collection of managed services that simplify operation and scaling of cloud databases.

Supports seven popular database engines:
- Amazon Aurora (MySQL compatible), Amazon Aurora (PostgreSQL compatible)
- MySQL, MariaDB, PostgreSQL, Oracle, SQL Server

Use cases:
- Migrating from on-premise and legacy databases to the cloud
- Reducing maintenance costs by moving to managed databases
- Support growing web and mobile applications

What is a Managed Database Service?

In a *managed database service* a cloud provider is responsible for:

- Provisioning the hardware and software to run the database
- Ensuring the hardware is always running and working properly
- Installing, configuring, and updating the database server software
- Security, compliance, and software patching
- Provides facilities for performance, scaling, monitoring, backup, and recovery

Connect
Connect your app to any of the 7 Amazon RDS engines

Amazon Relational Database Service
Set up, operate, and scale a relational database in the cloud with just a few clicks

Security and compliance

Data durability and redundancy

Performance and scalability

Monitoring and alerting

Automated patching and upgrades

Backup and recovery

Amazon RDS managed features

Focus on innovation

Migrate without rearchitecting apps

Less time managing databases

Improve database and infrastructure efficiency

Decrease capital and operational expenses

Manageability

Monitoring and Metrics: Use the RDS Management Console to view operational metrics.

- Additional monitoring and metrics services: Amazon CloudWatch, Enhanced Monitoring, and Performance Insights.

Event Notifications: Amazon RDS can notify via email or SMS of events.

Security

Encryption of Data at Rest: Data stored in underlying database storage as well as backups and replicas are encrypted. Keys may be managed by AWS Key Management Service (KMS).

Encryption of Data in Transit: using SSL/TLS

Access Control: using AWS Identity and Access Management (IAM) to control user actions on RDS resources.

Network Isolation: using Amazon Virtual Private Cloud (VPC) to isolate DB instances in virtual network and connect using industry-standard encrypted IPSec VPN. May use firewall rules to control access.

Storage

General Purpose (SSD) Storage: Consistent baseline of 3 IOPS per provisioned GB and burst up to 3,000 IOPS above the baseline.

Suitable for a broad range of database workloads.

Provisioned IOPS (SSD) Storage: Specify an IOPS rate for the DB instance for predictable and consistent I/O performance.

Optimized for I/O-intensive transactional (OLTP) database workloads.

Scalability

Compute Scaling: Adjust compute and memory resources up or down within minutes. Maximum of 32 vCPUs and 244 GiB of RAM.

Storage Scaling: Aurora automatically resizes volume up to 64 TB. Other engines require user scaling. Scaling requires no downtime.

Read Replicas: DB instance may have read replicas to support heavy read-only traffic and reduce load on primary instance.

Read Replicas

A *read replica* is a database server performing read-only requests for increased performance and availability. The replica is updated from the primary database server using asynchronous replication.
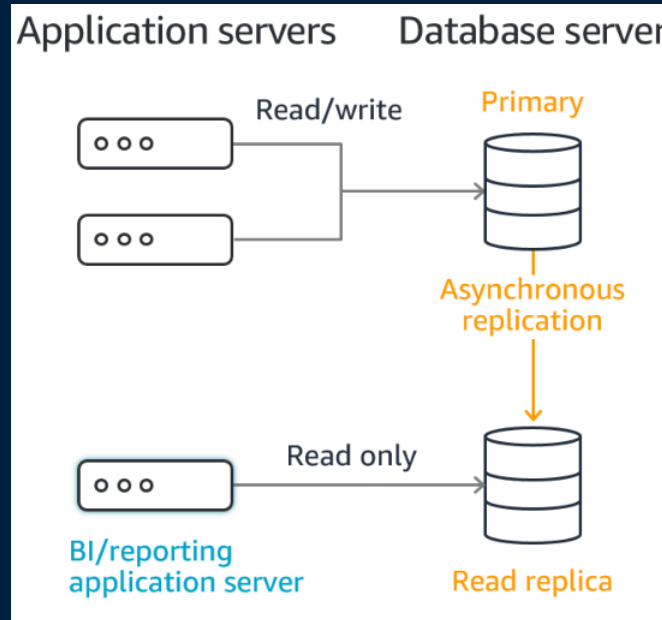
Availability Zone

An availability zone (AZ) is a distinct location within a region isolated from failures in other AZs. AZ runs on physically distinct, independent infrastructure.
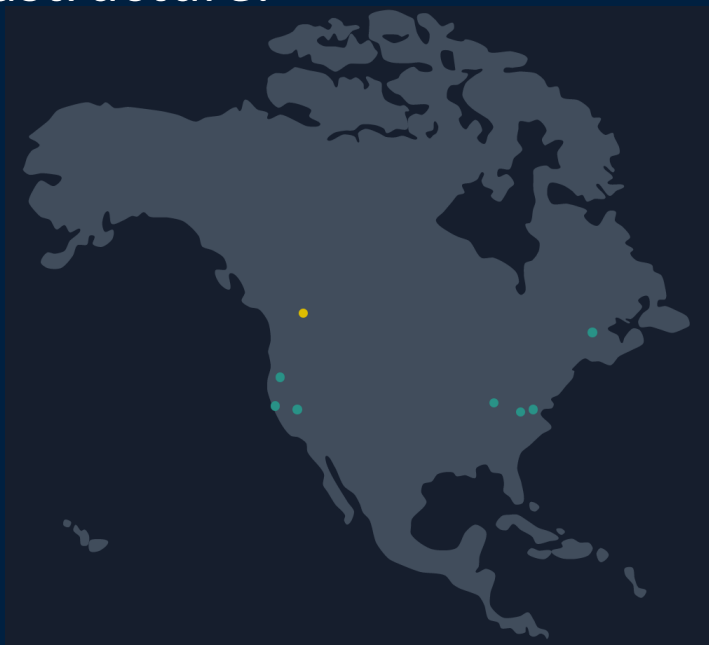
Region	AZs
US West (Oregon)	4
US West (N. Cal)	3
US East (N. Virginia)	6
US East (Ohio)	3
GovCloud (US-East)	3
GovCloud (US-West)	3
Canada (Central)	3
Canada (West)	Coming

Source: Amazon https://aws.amazon.com/about-aws/global-infrastructure/regions_az/

Amazon Region Map

AWS Cloud has 84 Availability Zones within 26 geographic regions.

Source: Amazon https://aws.amazon.com/about-aws/global-infrastructure/

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Replication and High-Availability

**Automated Backups:** Backs up database automatically. Backups can be retained up to 35 days.

Database Snapshots: User-initiated backups stored in Amazon S3. Can use snapshot to create or restore a database instance.

Multi-AZ Deployments: Synchronously replicates data to a standby instance in a different Availability Zone (AZ).

Automatic Host Replacement: Automatically replaces compute instance hosting database if hardware failure.

Multi-AZ

A *Multi-AZ* deployment synchronously replicates a DB instance in a different AZ. On failure, automatically fails over to standby instance.

Source: Amazon https://aws.amazon.com/rds/features/multi-az/
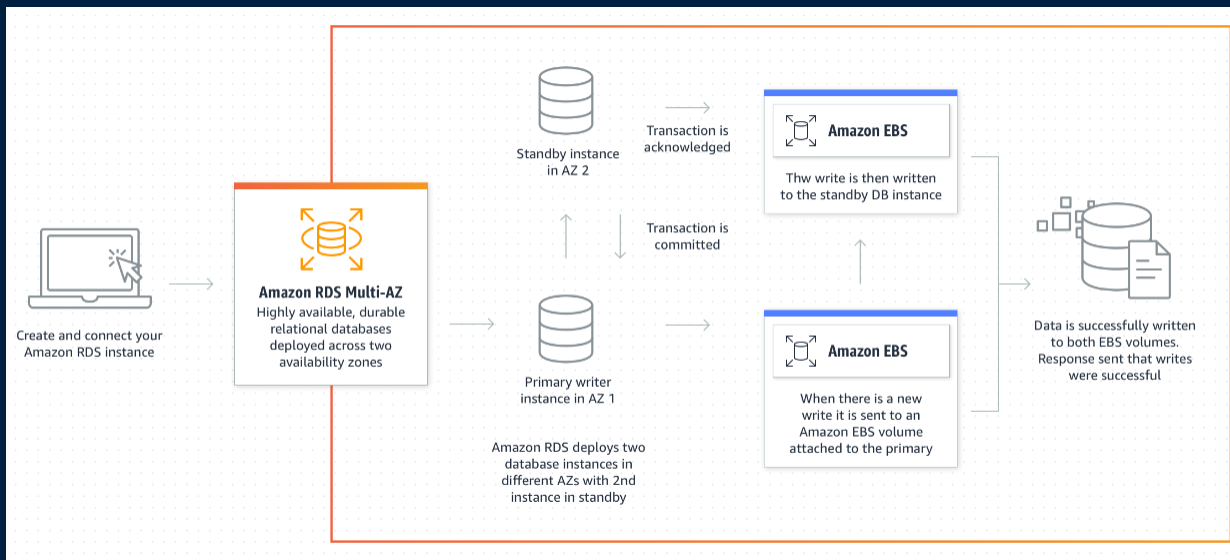
MySQL and MariaDB

MySQL is most popular open source database. RDS supports MySQL Community Edition 5.6, 5.7, and 8.0.

MariaDB is an open source database created by the original MySQL developers that is compatible with MySQL.

Amazon Aurora

Amazon Aurora is a scalable database designed for the cloud.
Features:

- Protocol compatible with MySQL and PostgreSQL
  - AWS says 5x more throughput the MySQL and 3x more than PostgreSQL
- Storage auto-scaling
- Read replicas share underlying storage (better performance, space utilization)
- Automated multi-region replication
- Continuous backups

Amazon Aurora Serverless is on-demand, auto-scaling for Aurora that does not require managing any database instances.

- Useful for variable and unpredictable workloads

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Instances

DB instance type defines compute, memory, and storage capabilities.

- E.g. db.t3 is general-purpose burstable instance type (baseline performance but can burst CPU usage as required). db.m6g is general-purpose instance powered by AWS Graviton2 processors.

A **DB instance class** consists of DB instance type and size.

- Sizes: micro, small, medium, large, xlarge
- E.g. db.t3.micro is db.t3 instance type with smallest configuration of resources (1 vCPU, 1 GiB RAM). Available with free tier.

Pricing depends on the DB instance class.

Cost

Cost is based on usage. There is no up-front commitment.

Reserved instances allow for a discount by reserving a instance for a one or three year term.

Cost depends on instance type. Check Amazon RDS Pricing for latest pricing.

The Amazon RDS Free Tier allows 750 hours of Amazon RDS Single-AZ db.t2.micro, db.t3.micro, and db.t4g.micro instances usage running MySQL, MariaDB, PostgreSQL databases each month and 20 GB of General Purpose (SSD) DB storage.

MySQL Cost – Canada (Central) Region

Single Deployment	Price Per Hour
db.t4g.micro	$0.018
db.t4g.small	$0.035
db.t4g.medium	$0.07
db.t4g.large	$0.141
db.t4g.xlarge	$0.282
db.t4g.2xlarge	$0.563
db.t3.micro	$0.019
db.t3.small	$0.037
db.t3.medium	$0.074
db.t3.large	$0.148
db.t3.xlarge	$0.296
db.t3.2xlarge	$0.592
db.m6g.large	$0.168
db.m6g.xlarge	$0.336
db.m6g.2xlarge	$0.672

Multi-AZ Deployment	Price Per Hour
db.t4g.micro	$0.035
db.t4g.small	$0.07
db.t4g.medium	$0.141
db.t4g.large	$0.282
db.t4g.xlarge	$0.563
db.t4g.2xlarge	$1.126
db.t3.micro	$0.037
db.t3.small	$0.074
db.t3.medium	$0.148
db.t3.large	$0.296
db.t3.xlarge	$0.592
db.t3.2xlarge	$1.184
db.m6g.large	$0.336
db.m6g.xlarge	$0.672
db.m6g.2xlarge	$1.344

MySQL Cost – Canada (Central) Region (2)

Database Storage:

- General purpose: $0.127 per GB/month
- Provisioned: $0.138 per GB/month
- Also pay for backup and snapshot storage

Data Transfer:

- In: Free
- Out: First 10 TB/month - $0.09 per GB
  - Lower costs if transferring to other Amazon services or regions

Aurora Cost – Canada (Central) Region

On-Demand instance:

Standard Instances	Price Per Hour
db.t4g.medium	$0.079
db.t4g.large	$0.158

Database Storage: General purpose: $0.11 per GB/month

I/O rate: $0.22 per 1 million requests

Data Transfer:

- In: Free
- Out: First 10 TB/month - $0.09 per GB
  - 100 GB free per month per account (applies to all AWS services)

Conclusion

Amazon RDS is a managed, relational database service for the cloud.
- It supports seven popular database engines: Amazon Aurora (MySQL and PostgreSQL compatible), MySQL, MariaDB, PostgreSQL, Oracle, SQL Server.

A managed database service handles hardware and software provisioning, maintenance, and availability.

Makes it easy to deploy and scale databases and reduces maintenance time and costs. Amazon RDS is useful for organizations that already have relational databases that want to move to the cloud.
- Database engines function the same as on-premise.
- Costs are a factor that need to be managed.

Objectives

- List the database engines supported by Amazon RDS.
- Compare a managed database service such as Amazon RDS versus deploying a database instance on a cloud server.
- Discuss use cases where a managed database service is valuable.
- Implement security features for Amazon RDS, specifically connecting with SSL.
- Understand when to use general-purpose versus provisioned storage.
- Define read replica and explain when a read replica is useful.
- Define availability zone and region.
- Explain why a database deployed as Multi-AZ has improved durability and availability.
- Explain DB instance type and class and how that relates to resources.
- Compare and contrast Amazon RDS MySQL versus Aurora.
- Understand cloud database costing and how to determine instance pricing.