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Post Graduate Program in Cloud

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AWS Solution Architect: Associate Level

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Databases on AWS

Learning Objectives

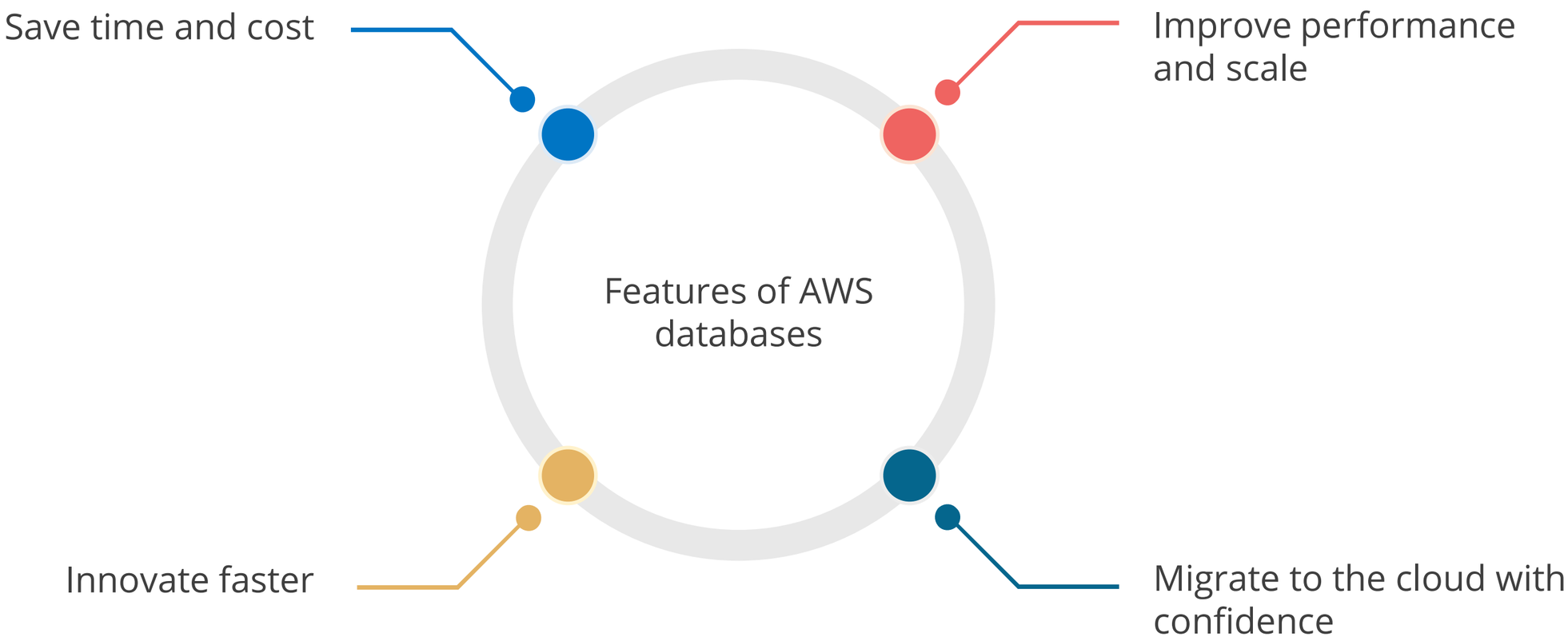
By the end of the lesson, you will be able to:

- List the different databases that can be operated in AWS
- Explain RDS and its uses
- Identify the costs associated with databases
- Discuss the uses of Amazon DynamoDB, RedShift, Aurora, and ElastiCache

Introduction to Databases

Databases Overview

AWS provides the broadest selection of purpose-built databases allowing you to save, grow, and innovate faster.



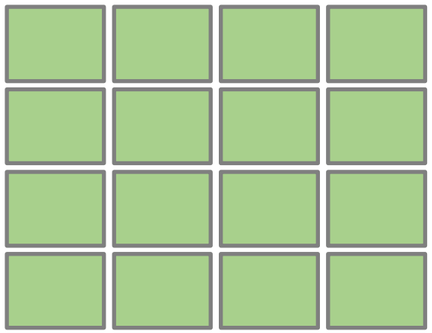
Types of AWS Databases

Database type	Use cases	AWS Service
Relational	Traditional applications, ERP, CRM, and e-commerce	Amazon Aurora, Amazon RDS, and Amazon Redshift
Key-value	High-traffic web applications, e-commerce systems, and gaming applications	Amazon DynamoDB
In-memory	Caching, session management, gaming leaderboards, and geospatial applications	Amazon ElastiCache

Relational Databases

The most common form of databases is relational databases or SQL databases. A relational database is a collection of data items organized as a set of formally-described tables which is used to store structured data. It is also known as the relational model.

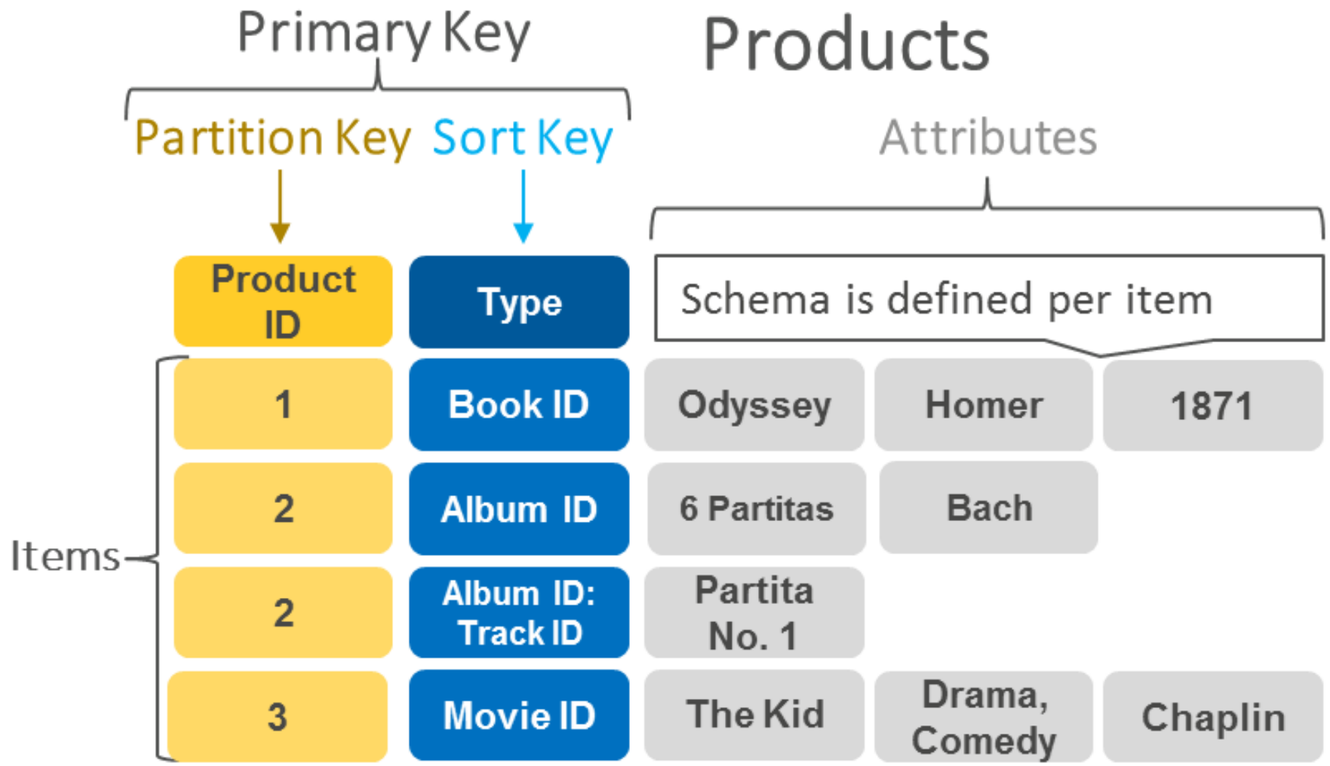
Structured data



Relational database

Key-Value Database

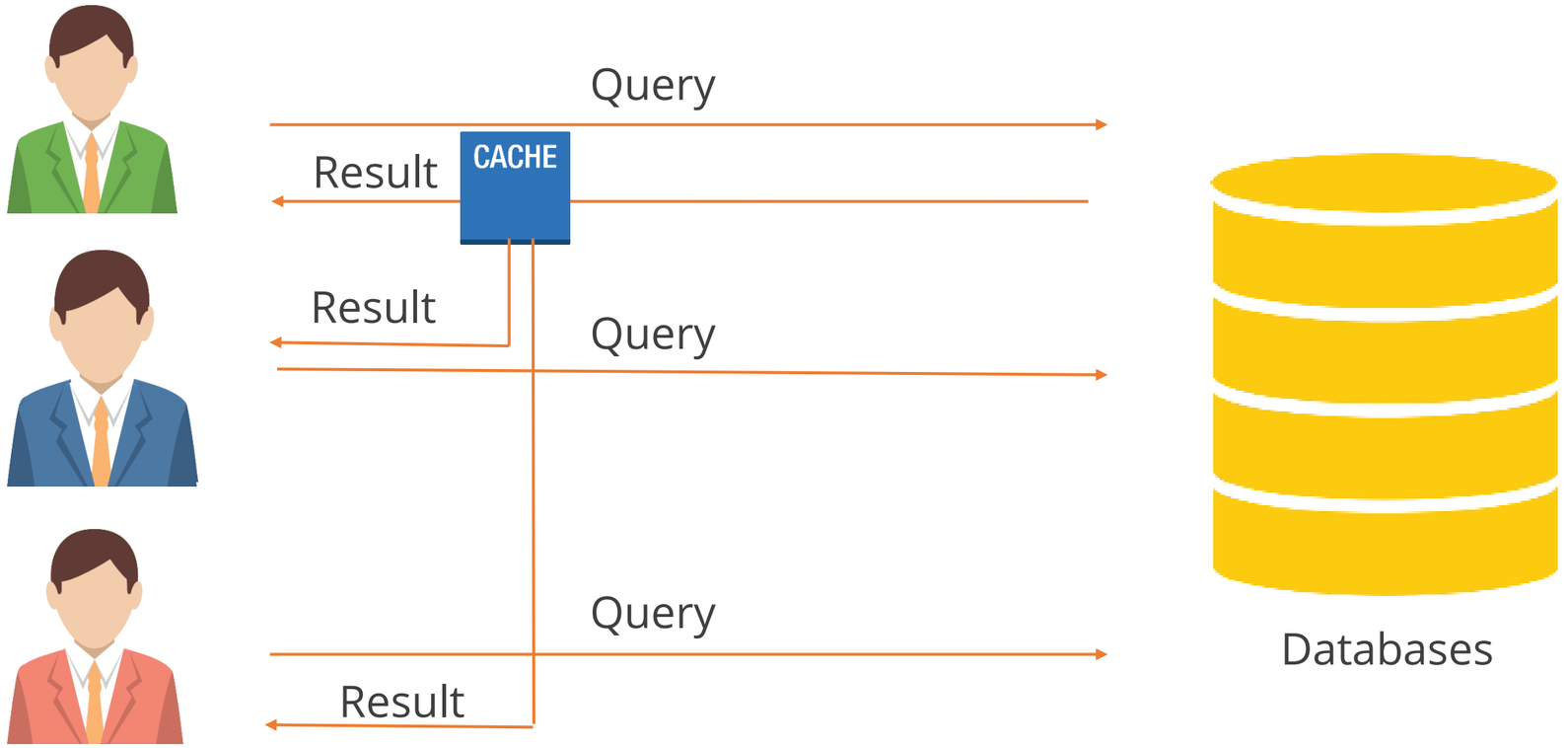
A key-value database is a type of non-relational database that uses a simple key-value method to store data.



Source: https://aws.amazon.com/nosql/key-value/#:~:text=The%20key%2Dvalue%20database%20defined&text=Key%2Dvalue%20databases%20are%20highly,more%20storage%20space%20is%20required.

In-Memory Databases

In-memory databases are cache-based databases that store results in memory to reduce the load on your database infrastructure and to improve user response time.



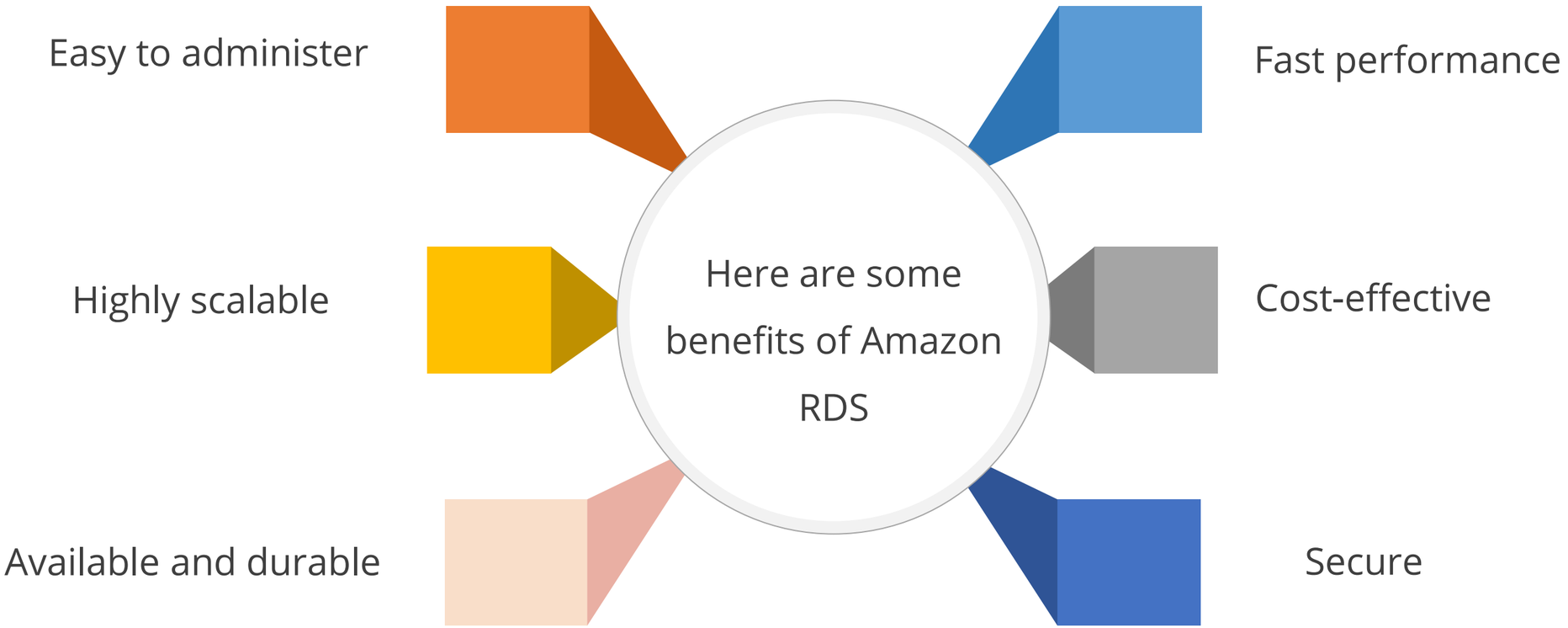
Amazon Relational Database Service (RDS)

Amazon RDS

Amazon Relational Database Service (Amazon RDS) is a web service that makes it easy to set up, operate, and scale a relational database in the AWS cloud.

Amazon RDS

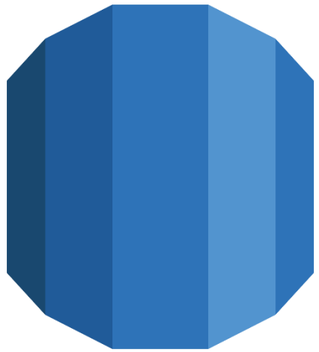
Benefits of Amazon RDS



Scalability

Users can scale the compute and memory resources powering their deployment up or down, up to a maximum of 32 vCPUs and 244 GiB of RAM. The compute scaling operations typically complete in a few minutes.

RDS Instance



RDS Instance

RDS Instance

32 vCPUs
and
244 GiB of RAM

Amazon RDS Database Engines

Amazon RDS

Limitations of Amazon RDS for Microsoft SQL

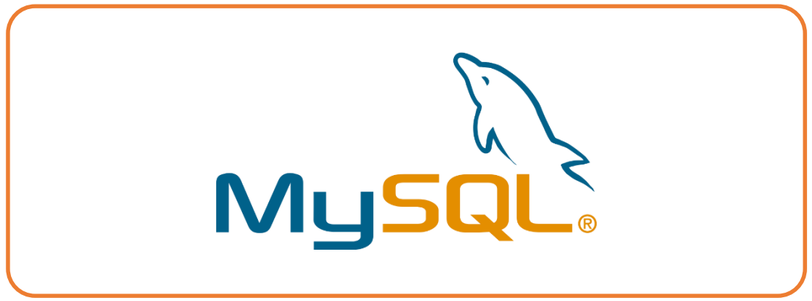
The following server-level roles of Microsoft SQL are not currently available in Amazon RDS:

- bulkadmin
- dbcreator
- diskadmin
- securityadmin
- serveradmin
- sysadmin

Limitations of Amazon RDS for MySQL

The following features of MySQL are not currently available in Amazon RDS:

- Authentication plugin
- Error logging to the system log
- Group replication plugin
- InnoDB tablespace encryption
- MariaDB audit plugin (not supported for Amazon RDS MySQL version 8.0 only). The MariaDB audit plugin is supported for Amazon RDS MySQL version 5.5, 5.6, and 5.7.
- Password strength plugin
- Persisted system variables
- Replication filters
- Semisynchronous replication
- Transportable tablespace
- X Plugin



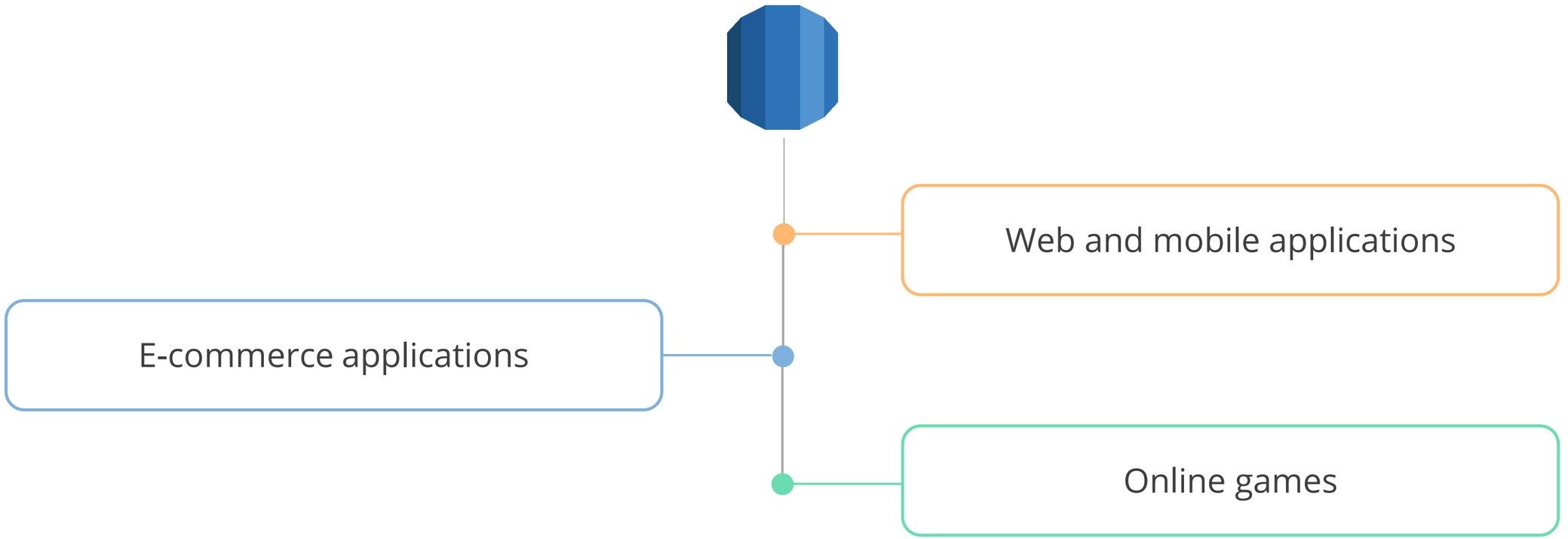
Limitations of Amazon RDS for Oracle

The following privileges of Oracle are not currently available in Amazon RDS:

- Alter database
- Alter system
- Create any directory
- Drop any directory
- Grant any privilege
- Grant any role

Use Cases of Amazon RDS

You can use Amazon RDS in the following cases:



Amazon RDS Backups

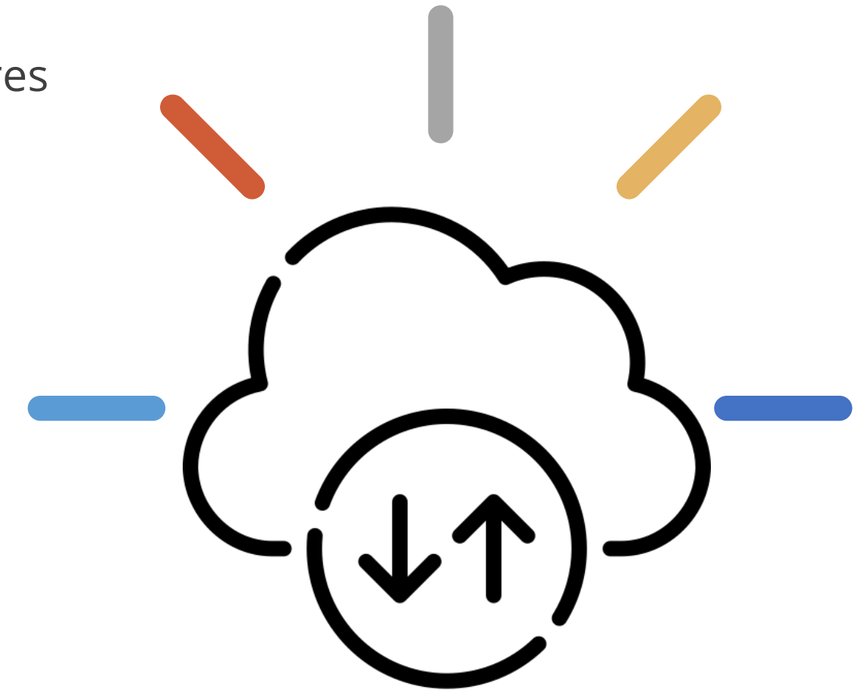
By default, Amazon RDS creates and saves automated backups of your DB Instance securely in Amazon S3 for a user-specified retention period.

The types of Amazon RDS backups are:

Database snapshots

Point-in-time restores

Snapshot copies



Automated backups

Snapshot sharing

Multi-Availability Zone Deployments

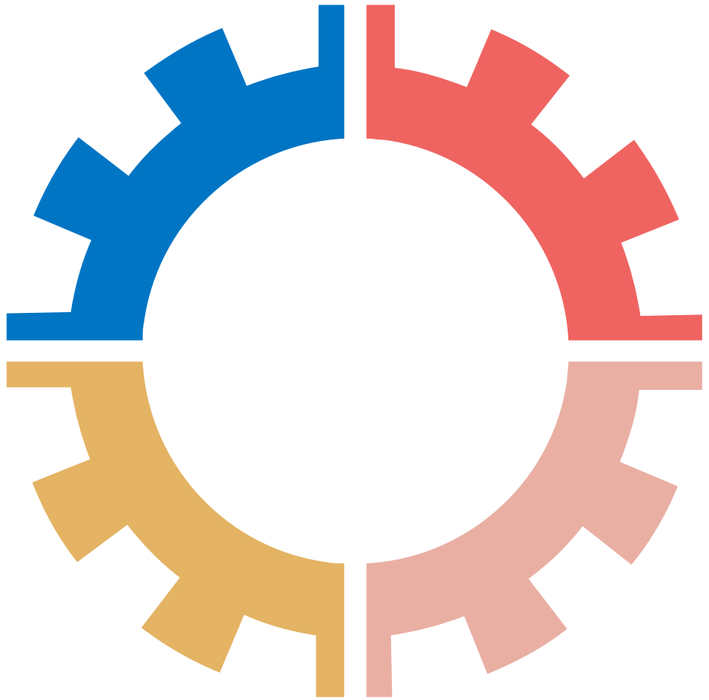
Multi-Availability Zone deployments synchronously replicate the data to a standby instance in a different Availability Zone.

Benefits of Multi-Availability Zone Deployments

Here are some benefits of Multi-Availability Zone deployments:

Enhanced durability

Increased availability

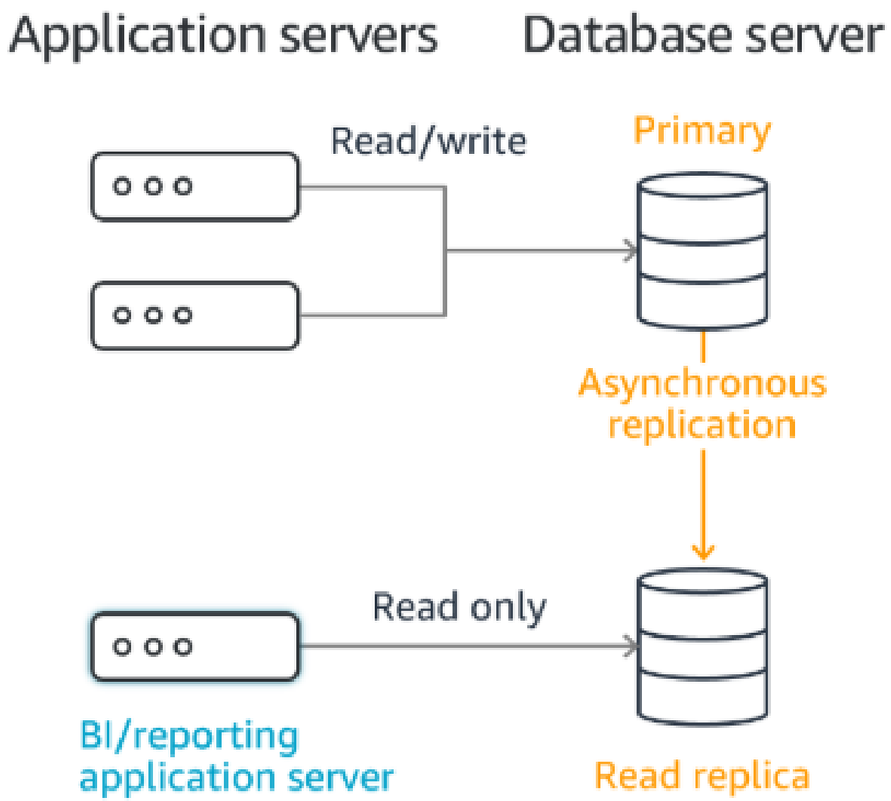


Data security

Automatic failover

Read Replicas

Amazon RDS Read Replicas provide enhanced performance and durability for RDS database (DB) Instances.



Source: https://aws.amazon.com/rds/features/read-replicas/

Benefits of Read Replicas

Here are some benefits of Read Replicas:

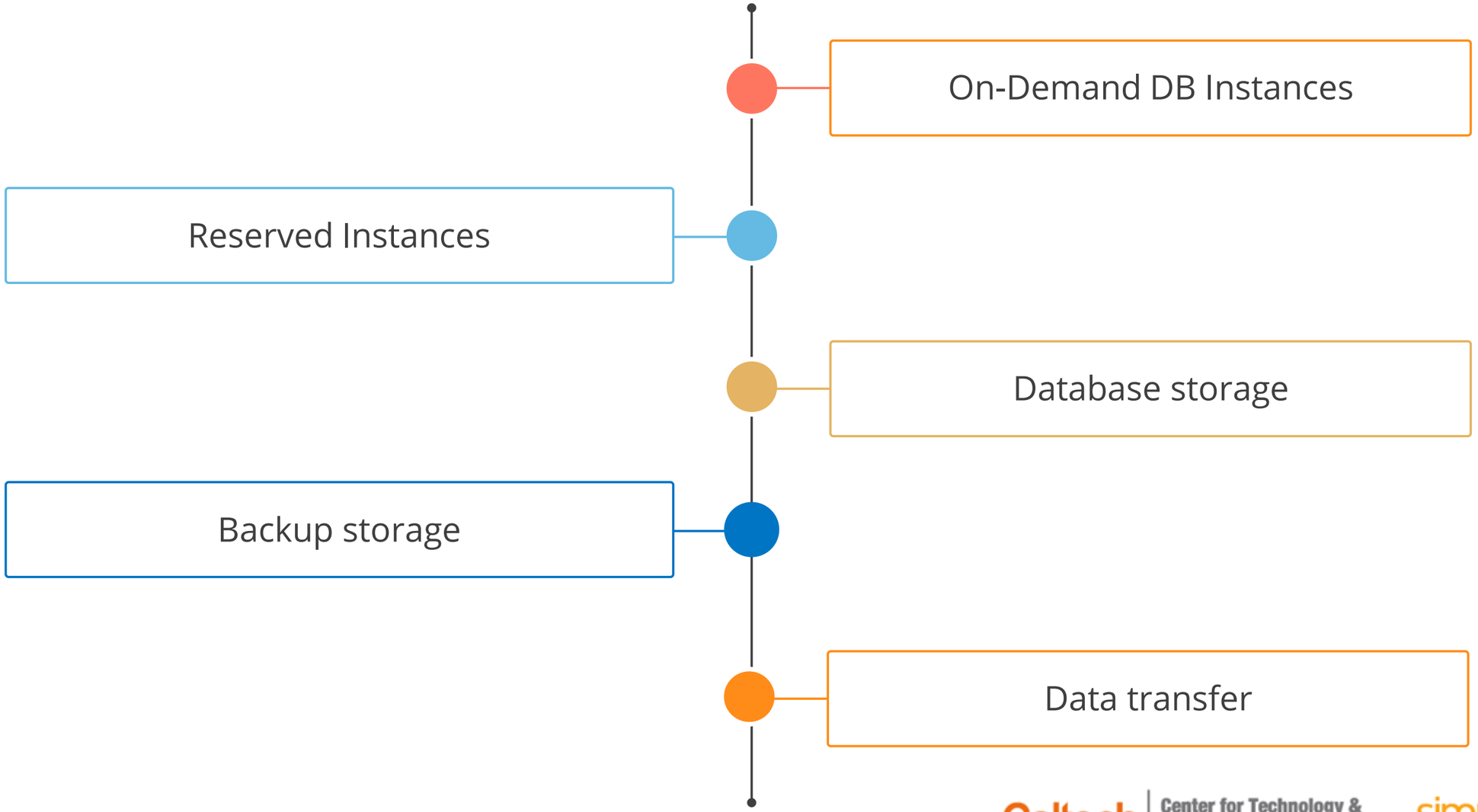
Increased availability

Enhanced performance

Designed for security

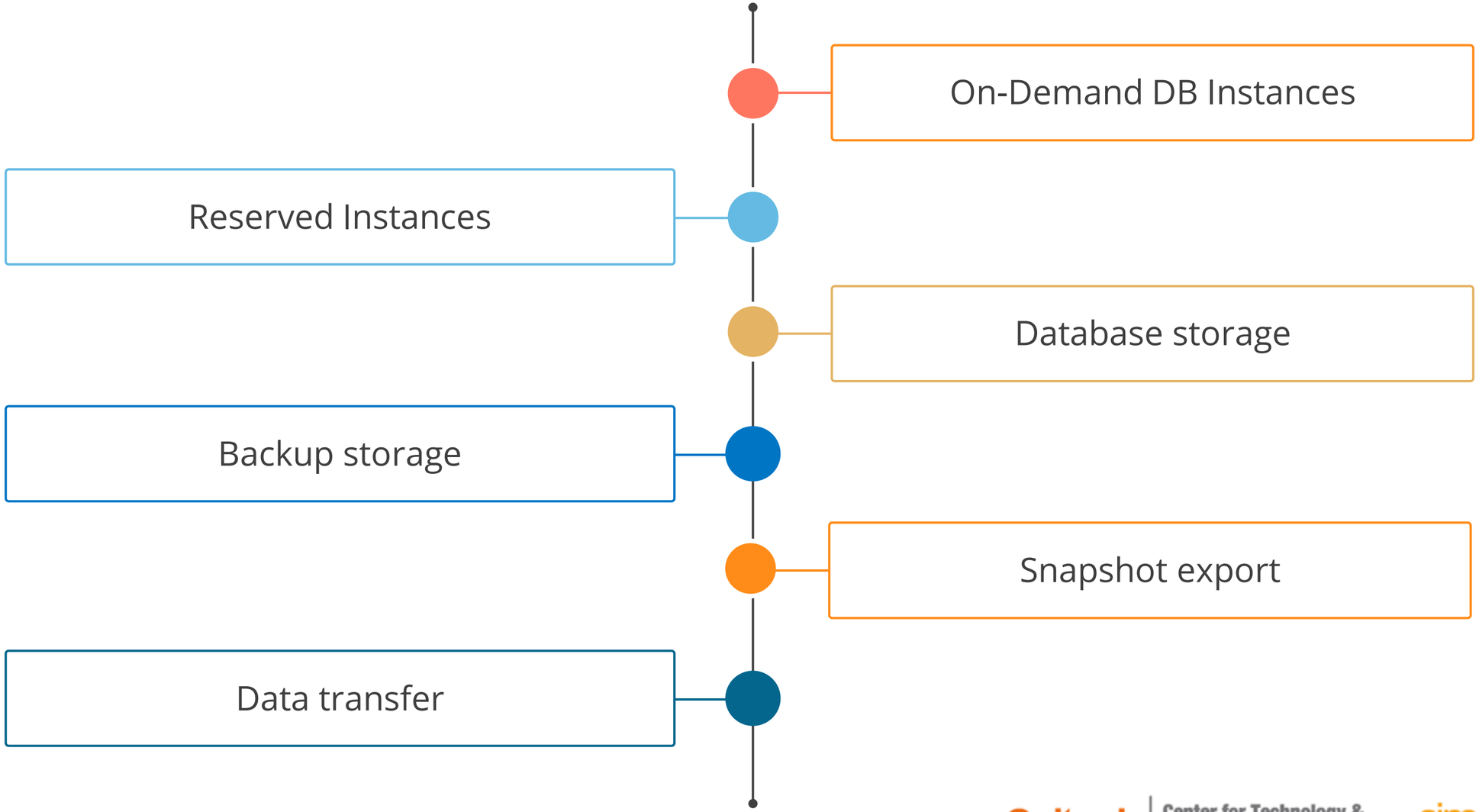
Amazon RDS Costs

The following are the costs associated with Amazon RDS for Microsoft SQL Server:



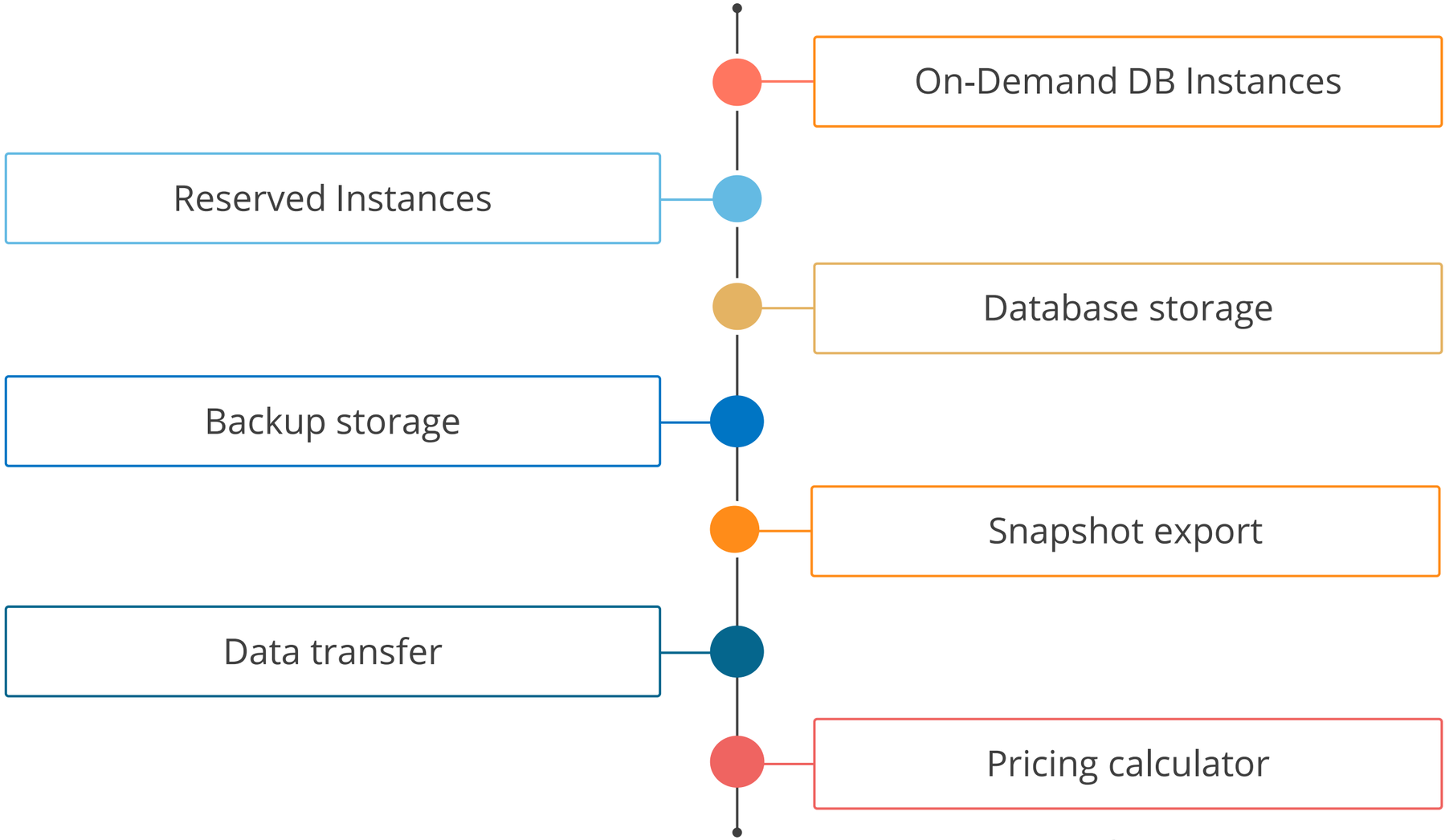
Amazon RDS Costs

The following are the costs associated with Amazon RDS for MySQL and PostgreSQL:



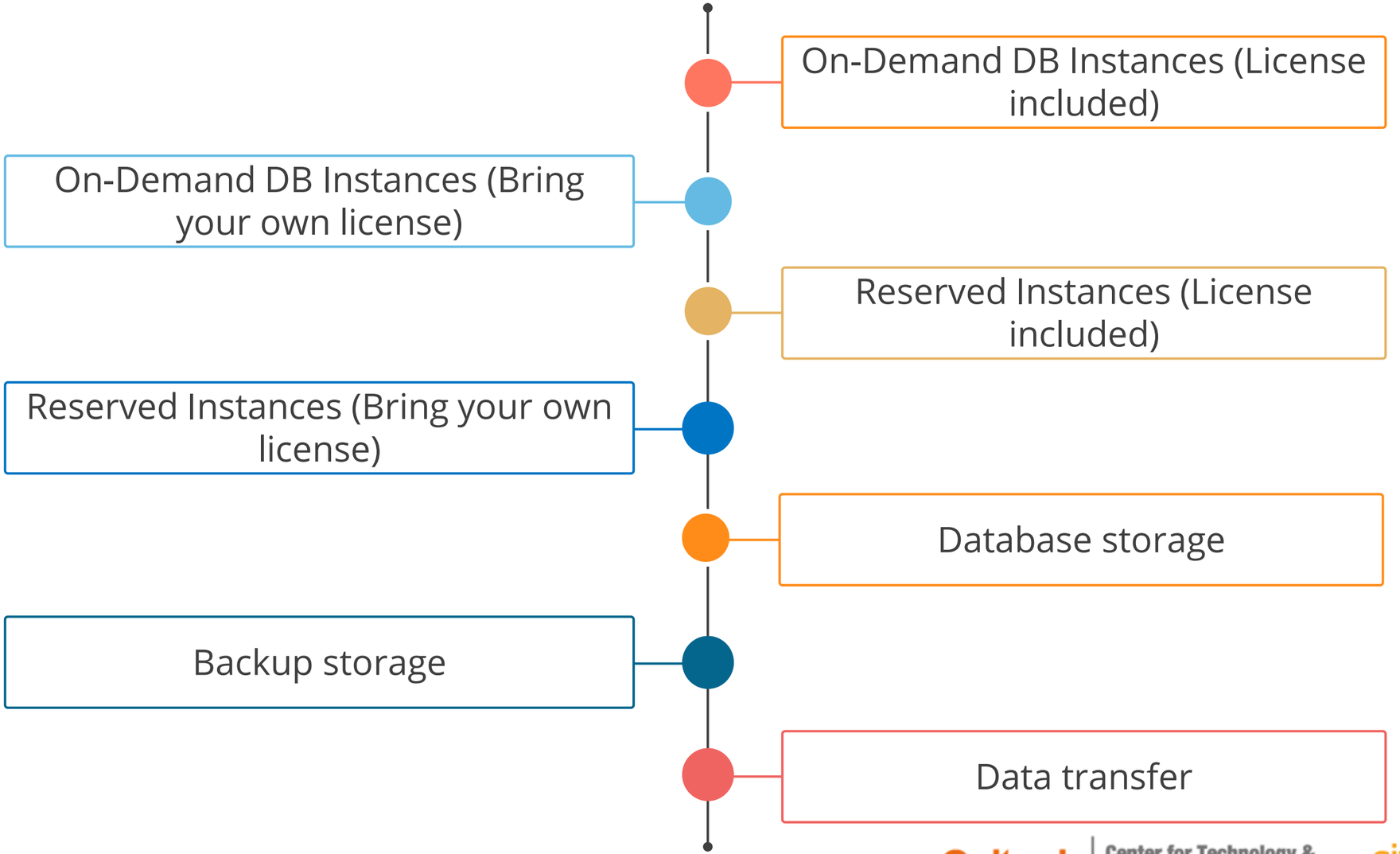
Amazon RDS Costs

The following are the costs associated with Amazon RDS for MariaDB:



Amazon RDS Costs

The following are the costs associated with Amazon RDS for Oracle:



Assisted Practice

Create an RDS Database Instance

Duration: 15 min.

Problem Statement:

You are given a project to create an RDS Database instance.

Assisted Practice: Guidelines to Create an RDS Database Instance

Steps to perform:

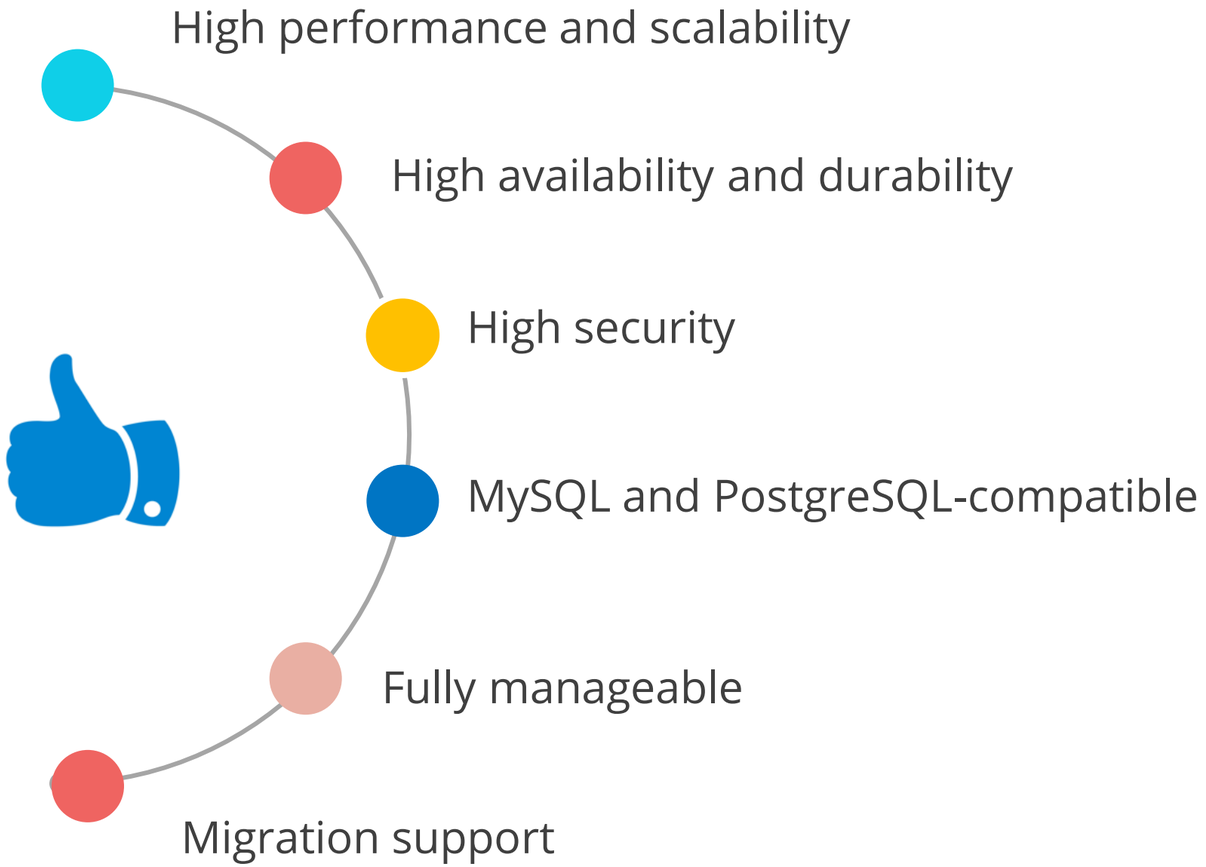
1. Open the AWS console
2. Create the Database in the AWS console

Amazon Aurora

Amazon Aurora

Amazon Aurora is a MySQL and PostgreSQL-compatible relational database. It combines the speed and availability of high-end commercial databases with the simplicity and cost-effectiveness of open-source databases.

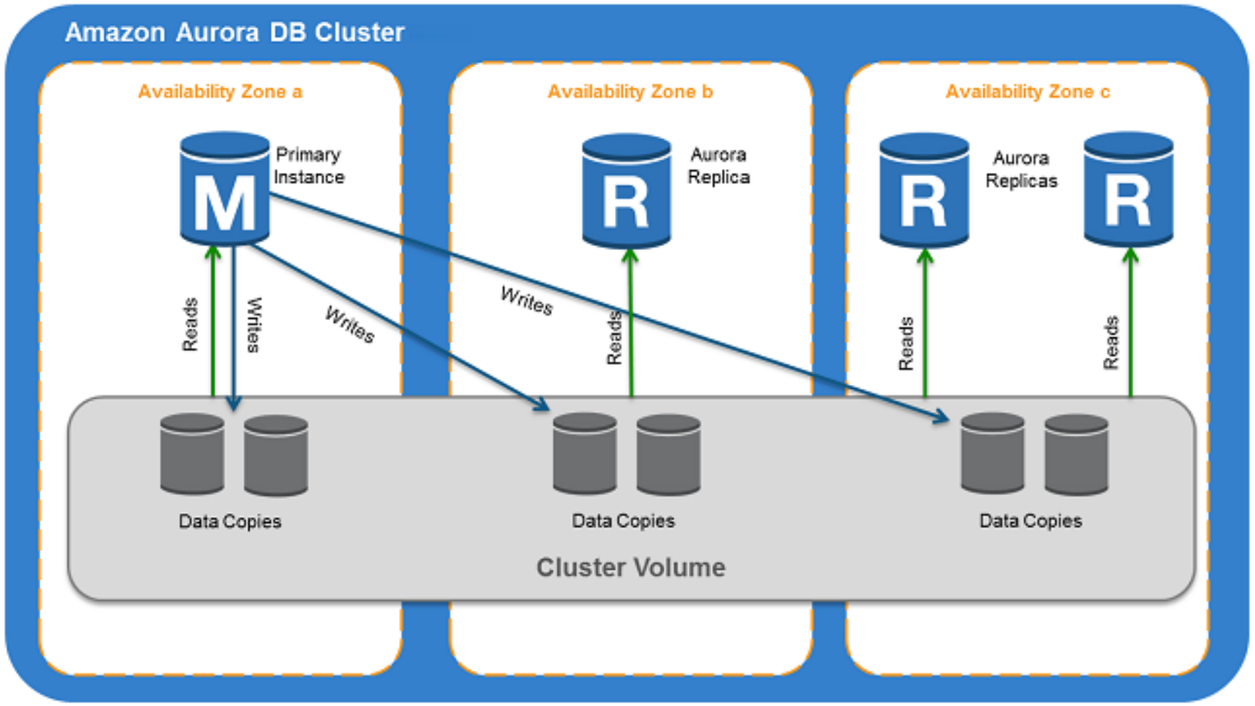
Benefits of Amazon Aurora



Amazon Aurora DB Cluster

An Amazon Aurora DB cluster consists of one or more DB Instances and a cluster volume that manages the data for those DB Instances.

Relationship between a cluster volume, a primary DB Instance, and Aurora Replicas in an Aurora DB cluster:



Source: https://docs.aws.amazon.com/AmazonRDS/latest/AuroraUserGuide/Aurora.Overview.html

Amazon Aurora Serverless

Amazon Aurora Serverless is an on-demand, auto-scaling configuration for Amazon Aurora (MySQL and PostgreSQL-compatible editions), where the database will automatically start up, shut down, and scale capacity up or down based on your application's needs.

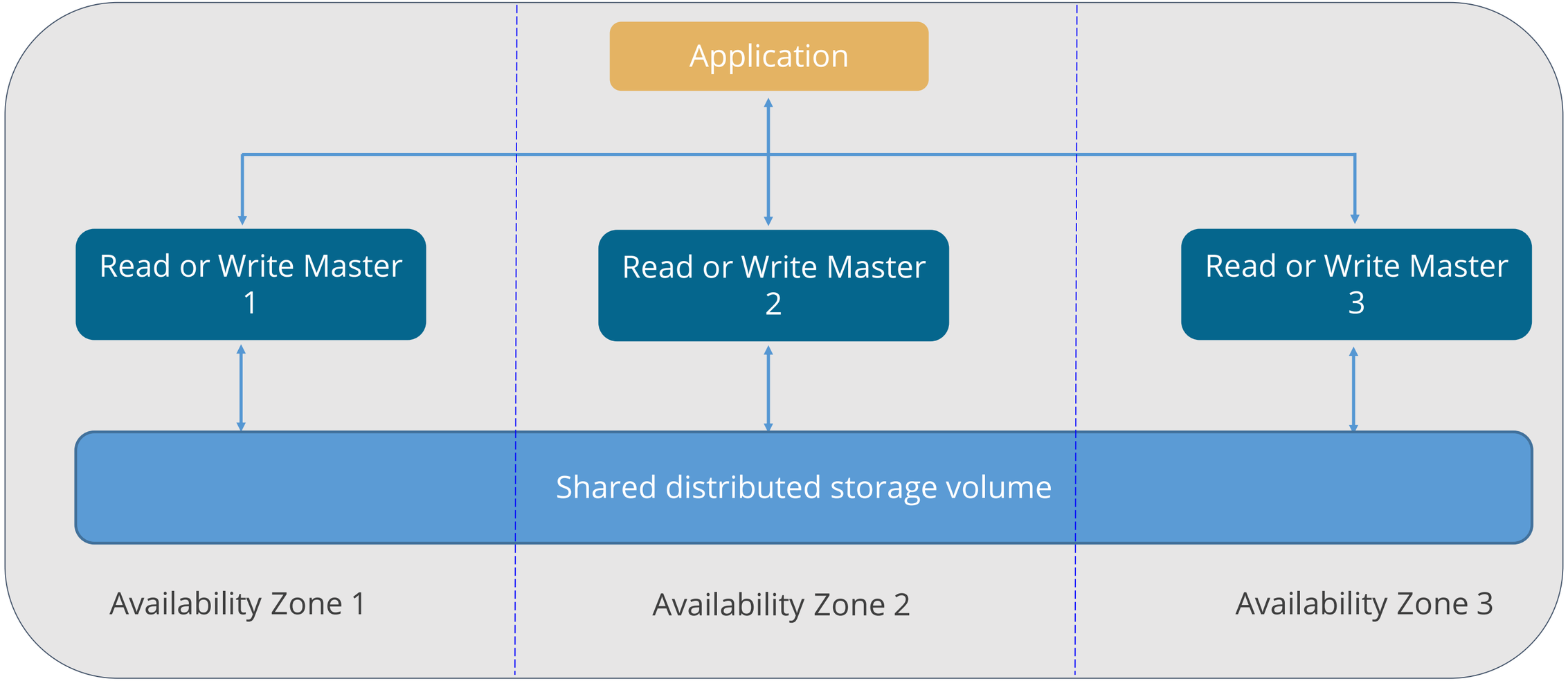
Amazon Aurora Serverless

Benefits of Aurora Serverless

Here are some benefits of Aurora Serverless:

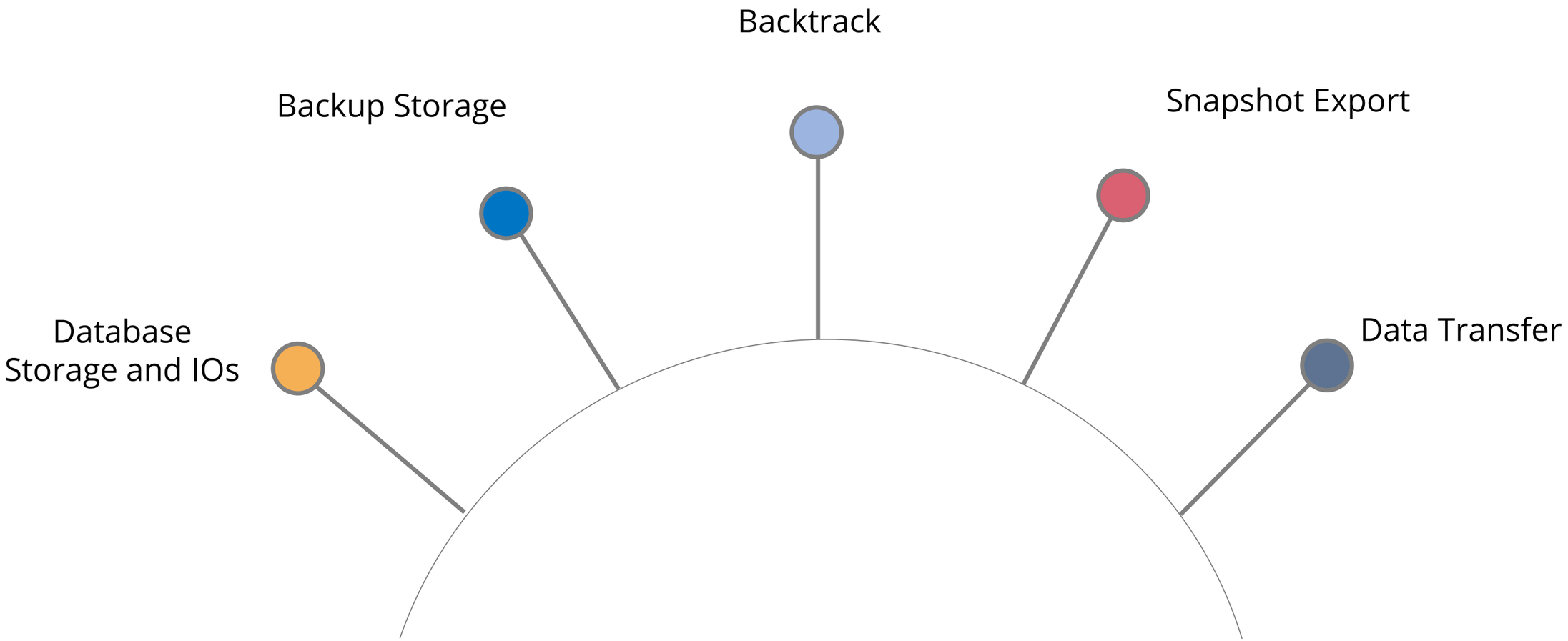
Aurora Multi-Master

Aurora Multi-Master allows you to create multiple read or write master instances across multiple Availability Zones.



Amazon Aurora Costs

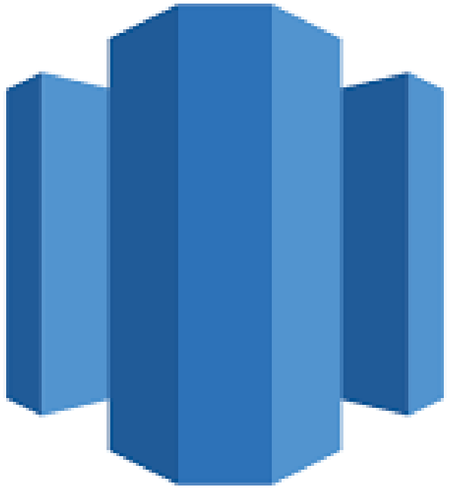
The following are the costs associated with Amazon Aurora:



Amazon Redshift

Amazon Redshift

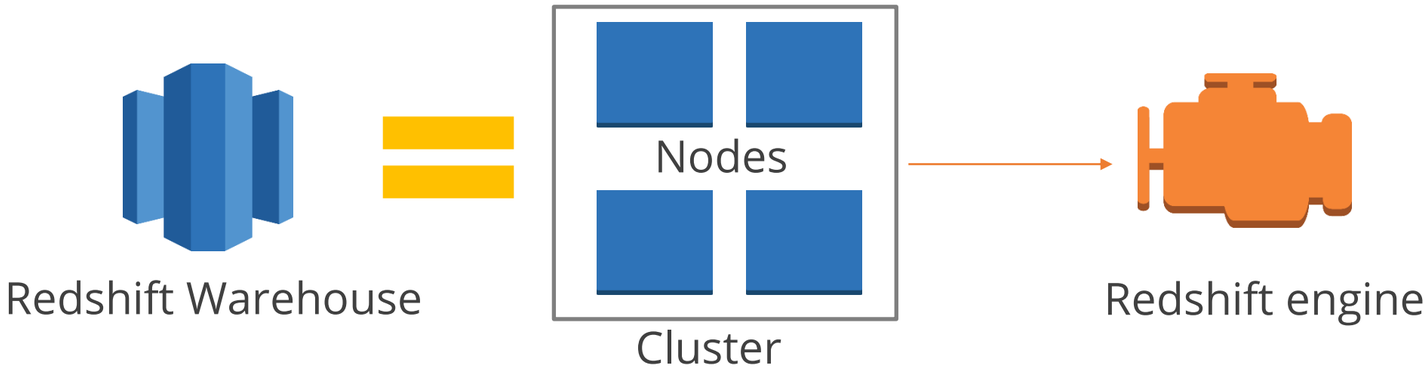
Amazon Redshift is a fully managed, petabyte-scale data warehouse service in the cloud.

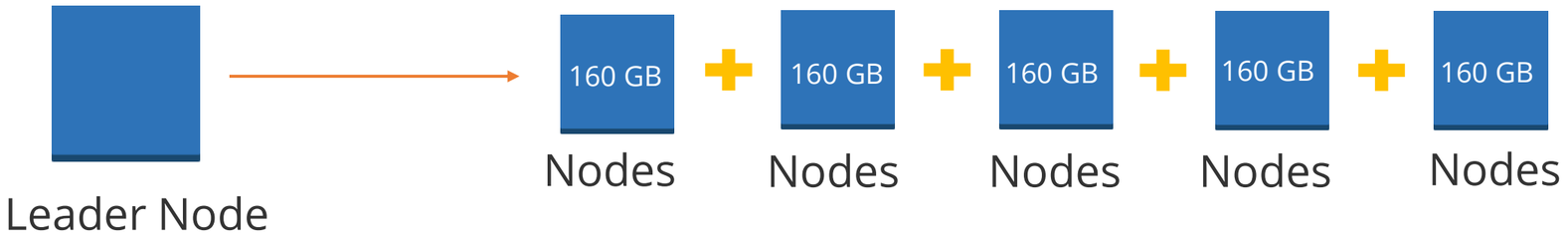


Amazon Redshift

Amazon Redshift Clusters

An Amazon Redshift data warehouse is a collection of computing resources called nodes. Nodes are organized into a group called cluster. Each cluster runs an Amazon Redshift engine and contains one or more databases.

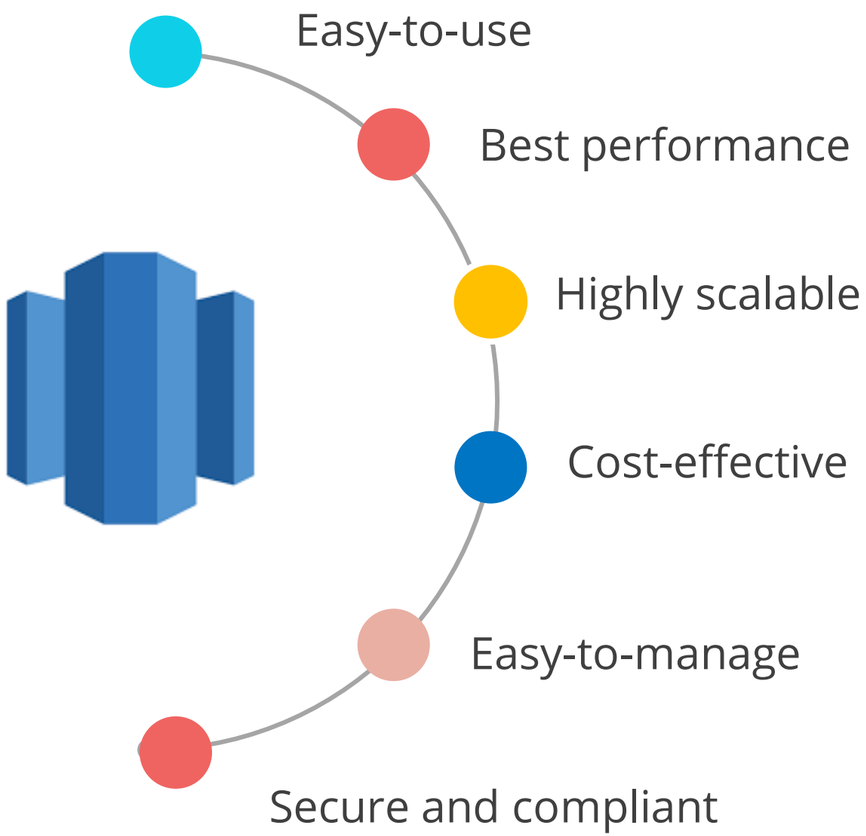




Massive Parallel Processing

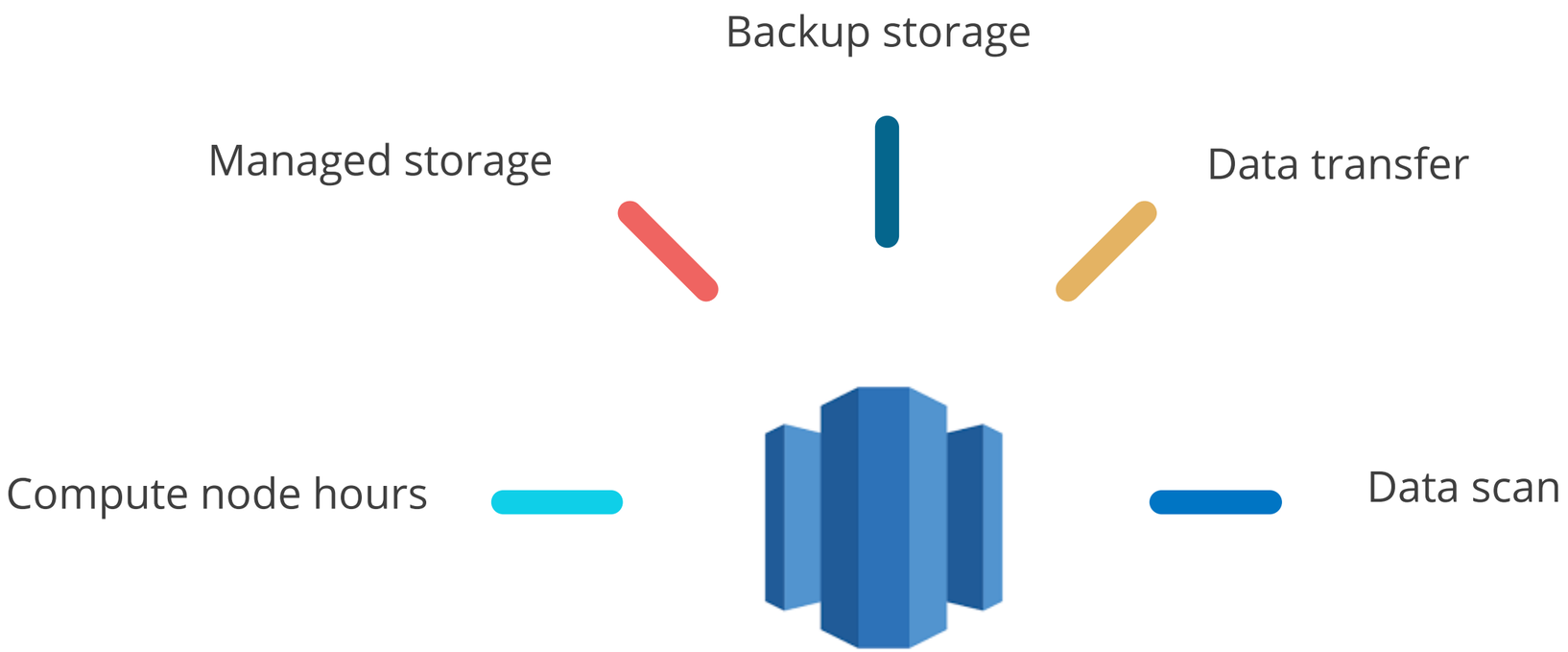
Benefits of Amazon Redshift

Here are some benefits of Amazon Redshift:



Amazon Redshift Costs

The following are the costs associated with Amazon Redshift:



Assisted Practice

Create an Amazon Redshift Cluster

Duration: 10 min.

Problem Statement:

You are given a project to create an Amazon Redshift cluster.

Assisted Practice: Guidelines to Create an Amazon Redshift Cluster

Steps to perform:

1. Open the AWS console
2. Create an Amazon Redshift cluster

Amazon DynamoDB

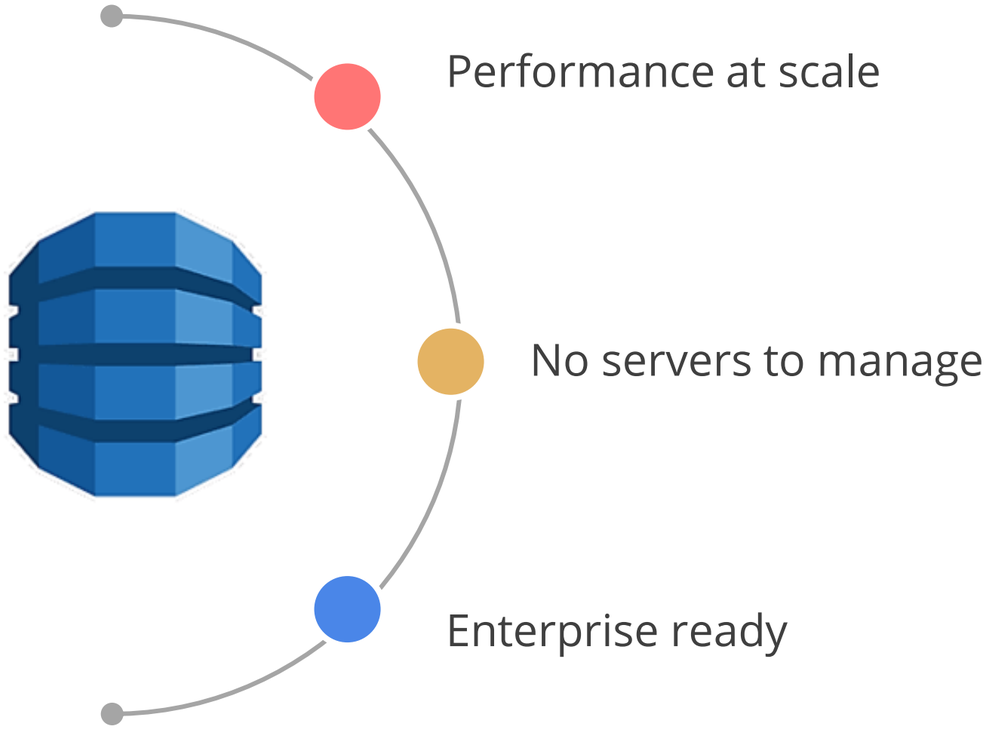
Amazon DynamoDB

Amazon DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability.

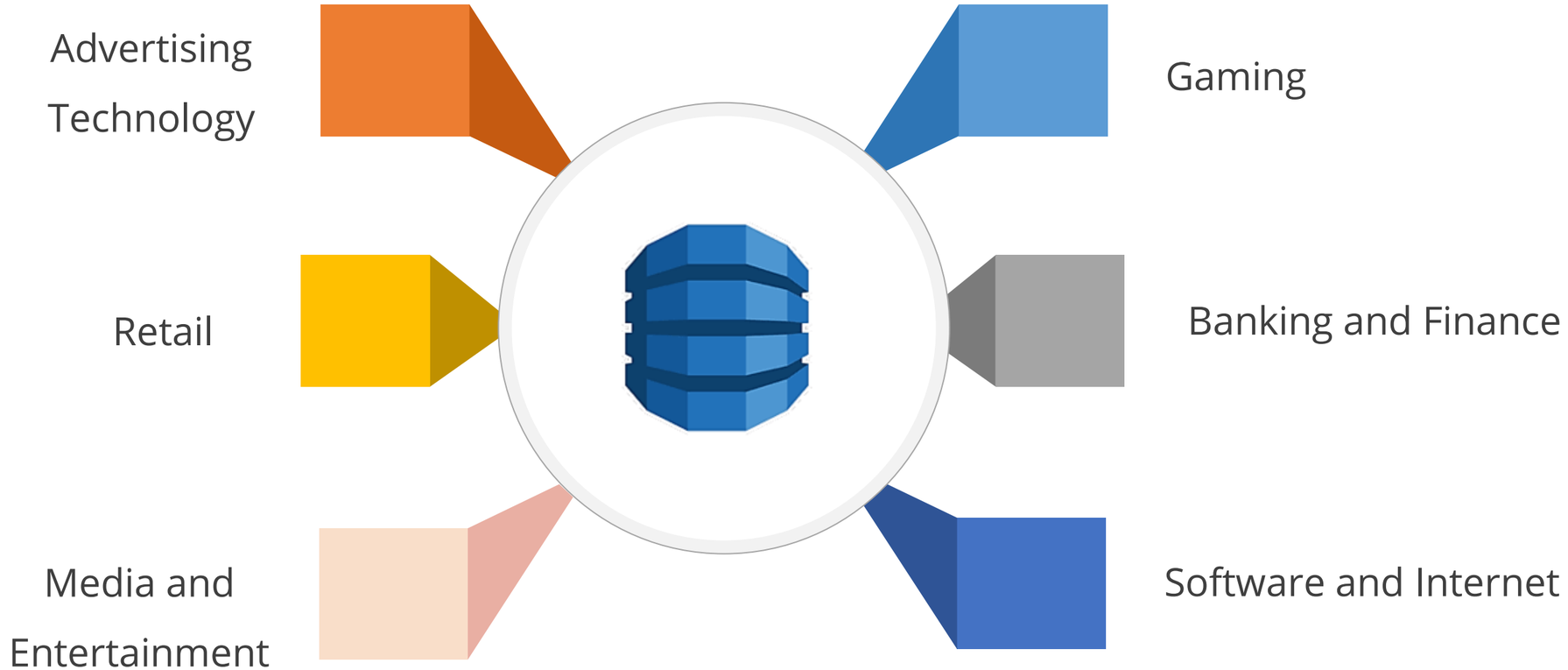
Amazon DynamoDB

Benefits of Amazon DynamoDB

Here are some benefits of Amazon DynamoDB:

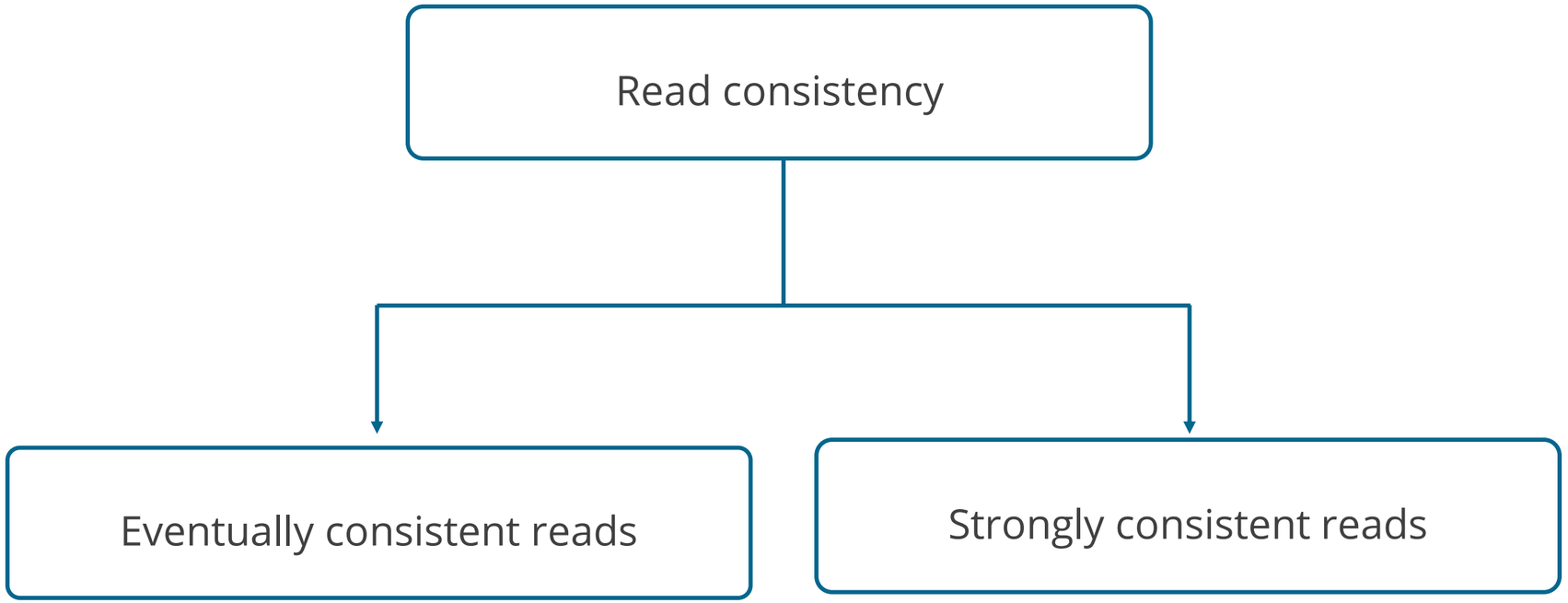


Use Cases of Amazon DynamoDB

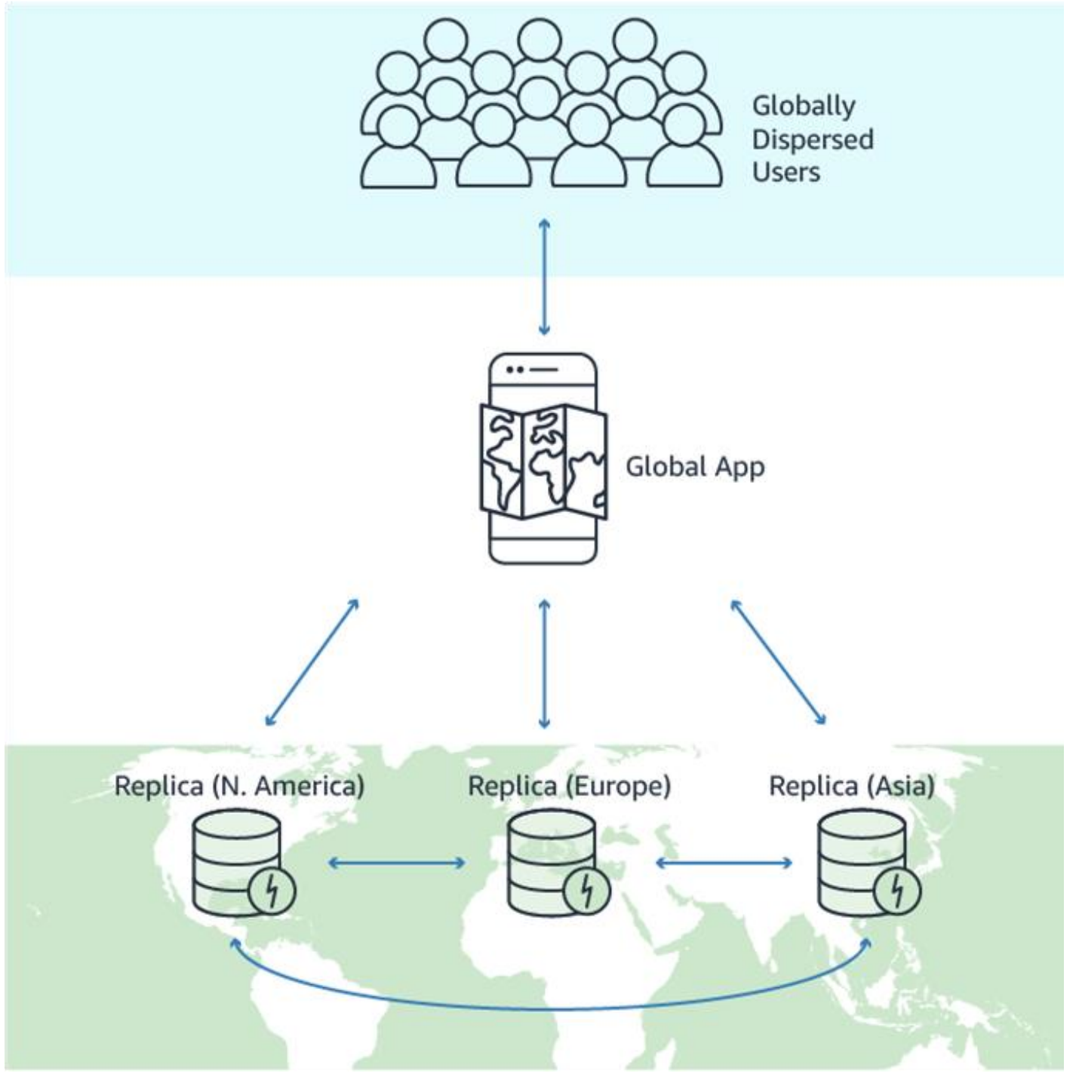


Amazon DynamoDB: Read Consistency

Amazon DynamoDB offers two types of read consistency:



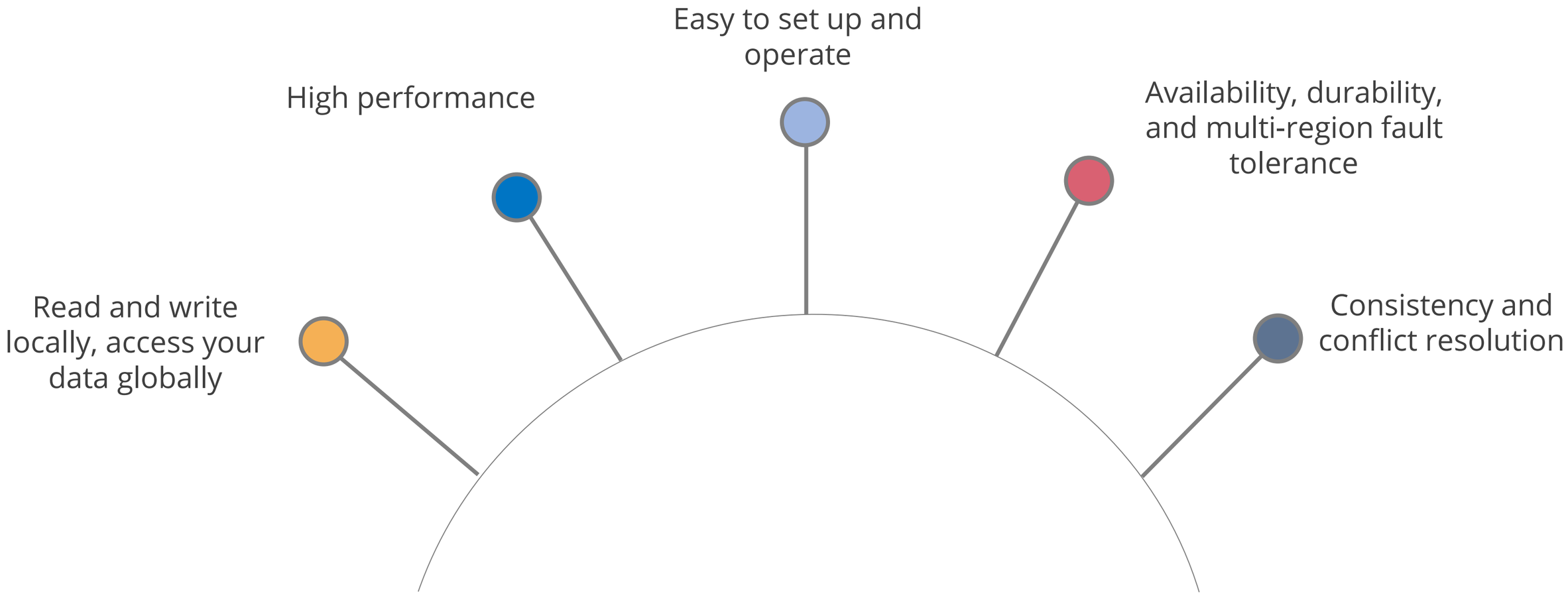
Amazon DynamoDB Global Tables



- Global tables are built on the global Amazon DynamoDB footprint to provide you with a fully managed, multi-region, and multi-master database
- They delivers fast, local, read, and write performance for massively scaled, global applications.
- Global tables replicate your DynamoDB tables automatically across your choice of AWS Regions.

Source: https://aws.amazon.com/dynamodb/global-tables/

Benefits of Amazon DynamoDB Global Tables



Case Study: Duolingo

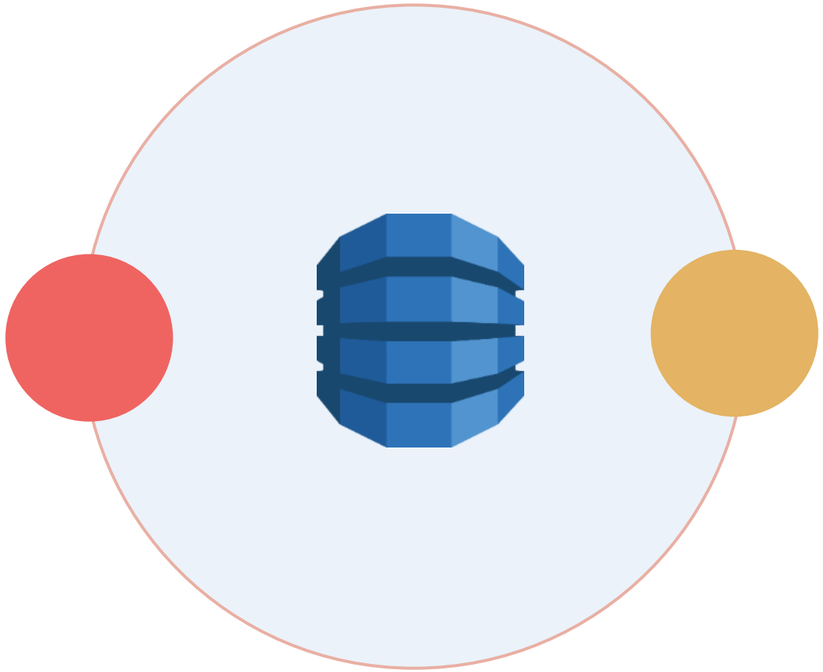
Duolingo uses Amazon DynamoDB to store 31 billion items for its online learning site that delivers lessons in 80 languages.

- 31 billion items
- 80 different languages
- 24,000 read units per second and 3300 write units per second

Amazon DynamoDB Costs

The following are the costs associated with Amazon DynamoDB:

On-Demand capacity mode



Provisioned capacity mode

Assisted Practice

Create a Table Using the DynamoDB Console

Duration: 15 min.

Problem Statement:

You are given a project to create a table using the DynamoDB console.

Assisted Practice: Guidelines to Create a Table Using the DynamoDB Console

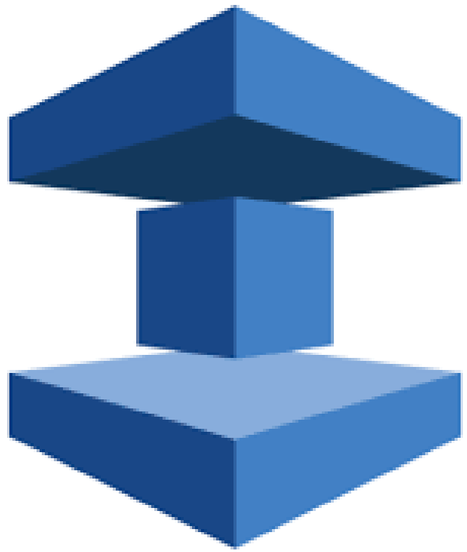
Steps to perform:

1. Open the AWS console
2. Create the Database table using the DynamoDB console

Amazon ElastiCache

Amazon ElastiCache

Amazon ElastiCache is a web service that makes it easy to deploy, operate, and scale an in-memory data store or cache in the cloud.

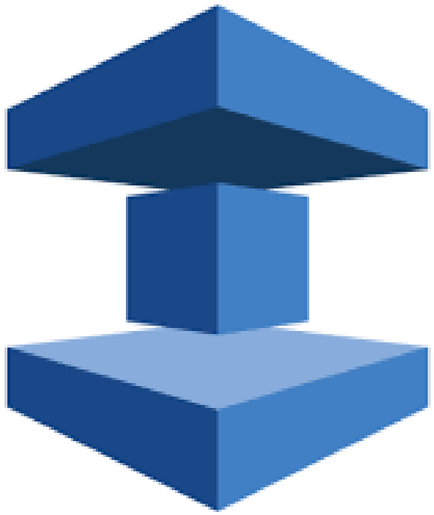


Amazon ElastiCache

Amazon ElastiCache Overview

Amazon ElastiCache provides:

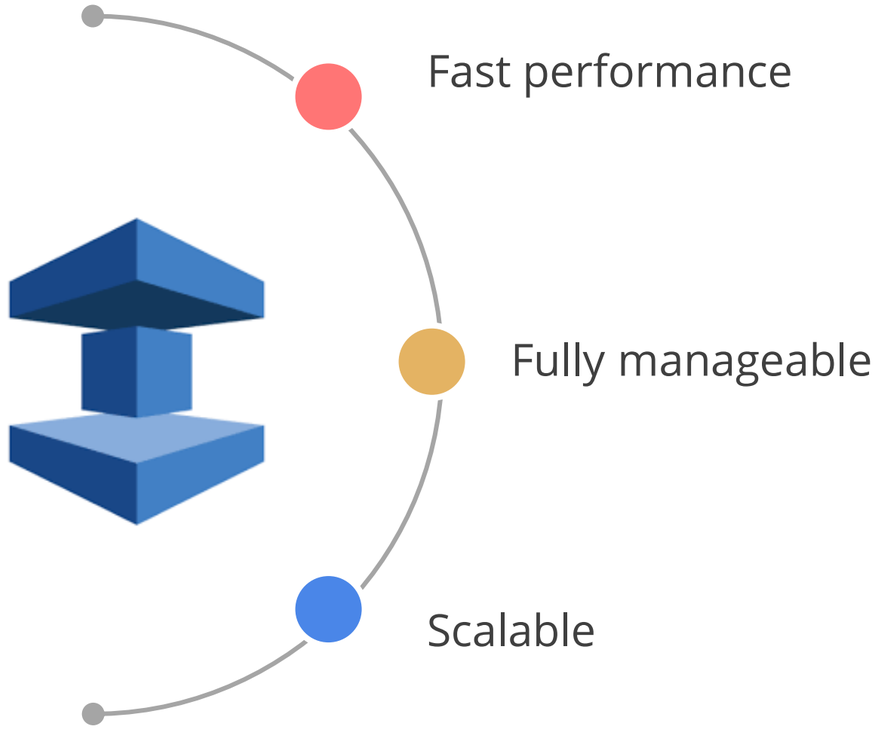
- Ease of management via AWS Management Console
- Compatibility with the specific engine protocol
- Detailed monitoring statistics for the engine nodes at no extra cost via Amazon CloudWatch
- Pay-per-use model for resource consumption



Amazon ElastiCache

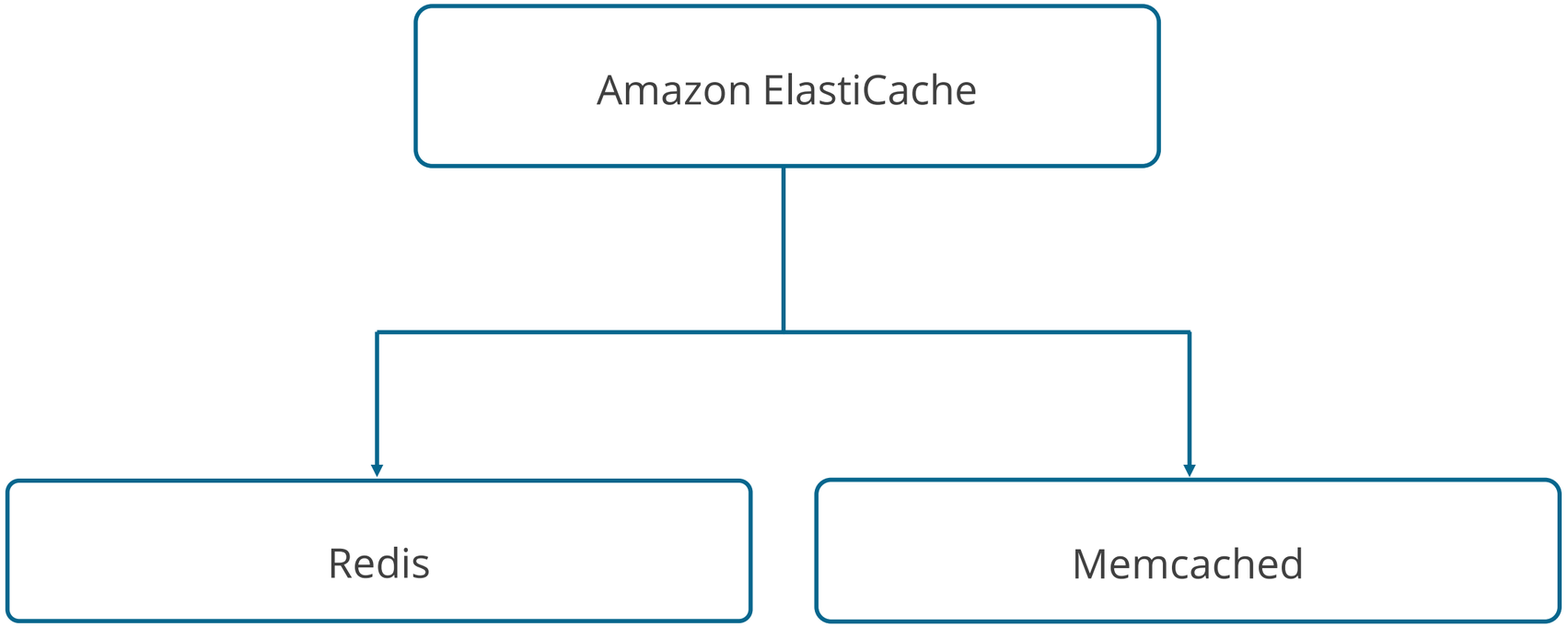
Benefits of Amazon ElastiCache

Here are some benefits of Amazon ElastiCache:



Amazon ElastiCache: Data Engines

Amazon ElastiCache offers two different types of data engines:



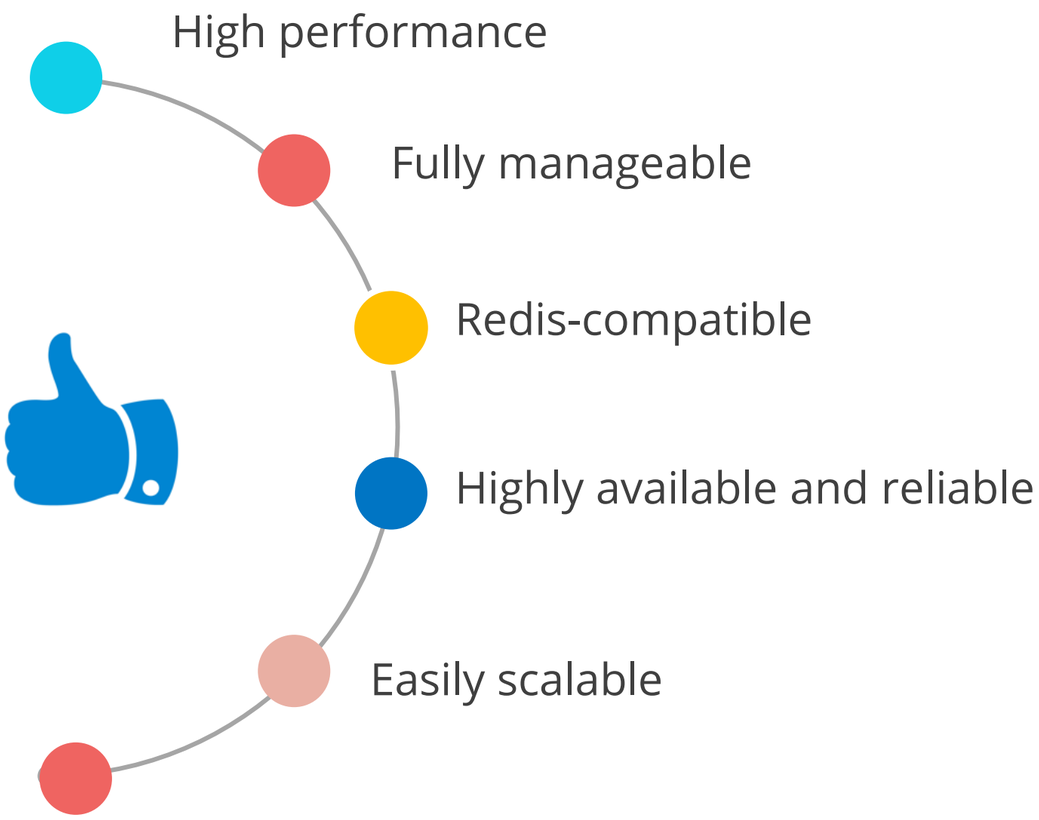
Amazon ElastiCache for Redis

Amazon ElastiCache for Redis is a Redis-compatible in-memory data store service that is easy-to-use. It is fully manageable, scalable, and secure, making it more capable to support the high-performance use cases such as web, mobile applications, gaming, advertising technology, and IoT.

Amazon ElastiCache for Redis

Benefits of Amazon ElastiCache for Redis

Here are some benefits of Amazon ElastiCache for Redis:



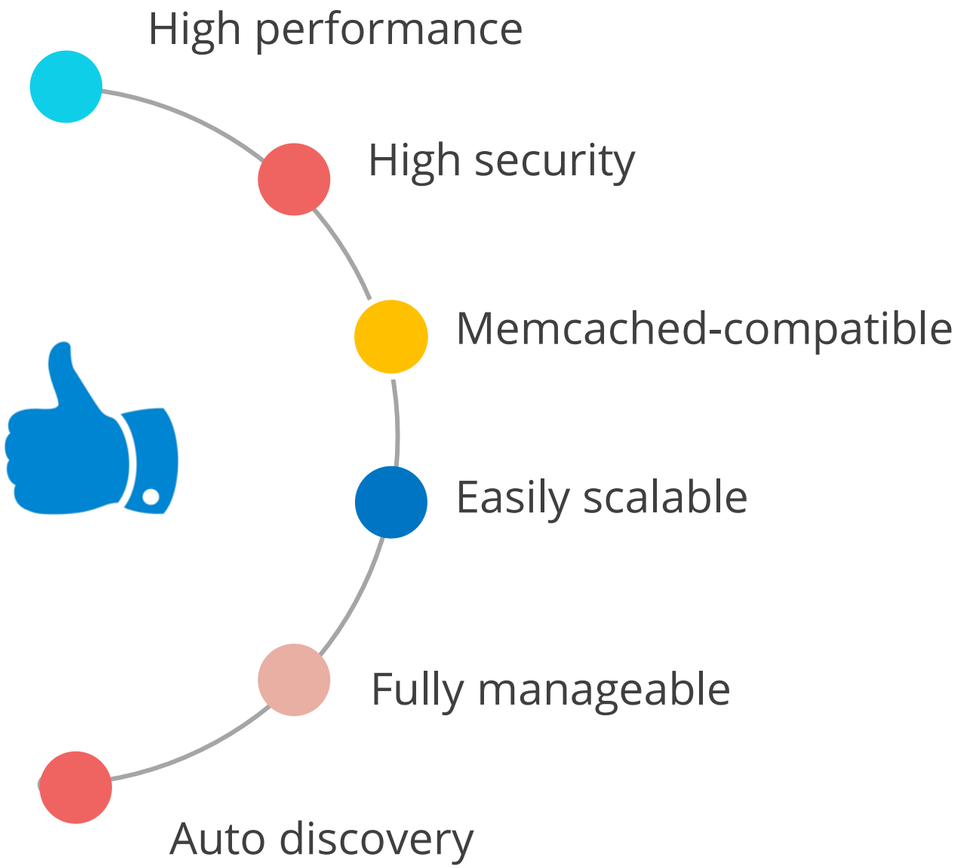
Amazon ElastiCache for Memcached

Amazon ElastiCache for Memcached is a Memcached-compatible in-memory key-value store service that can be used as a cache or a data store.

Amazon ElastiCache for Memcached

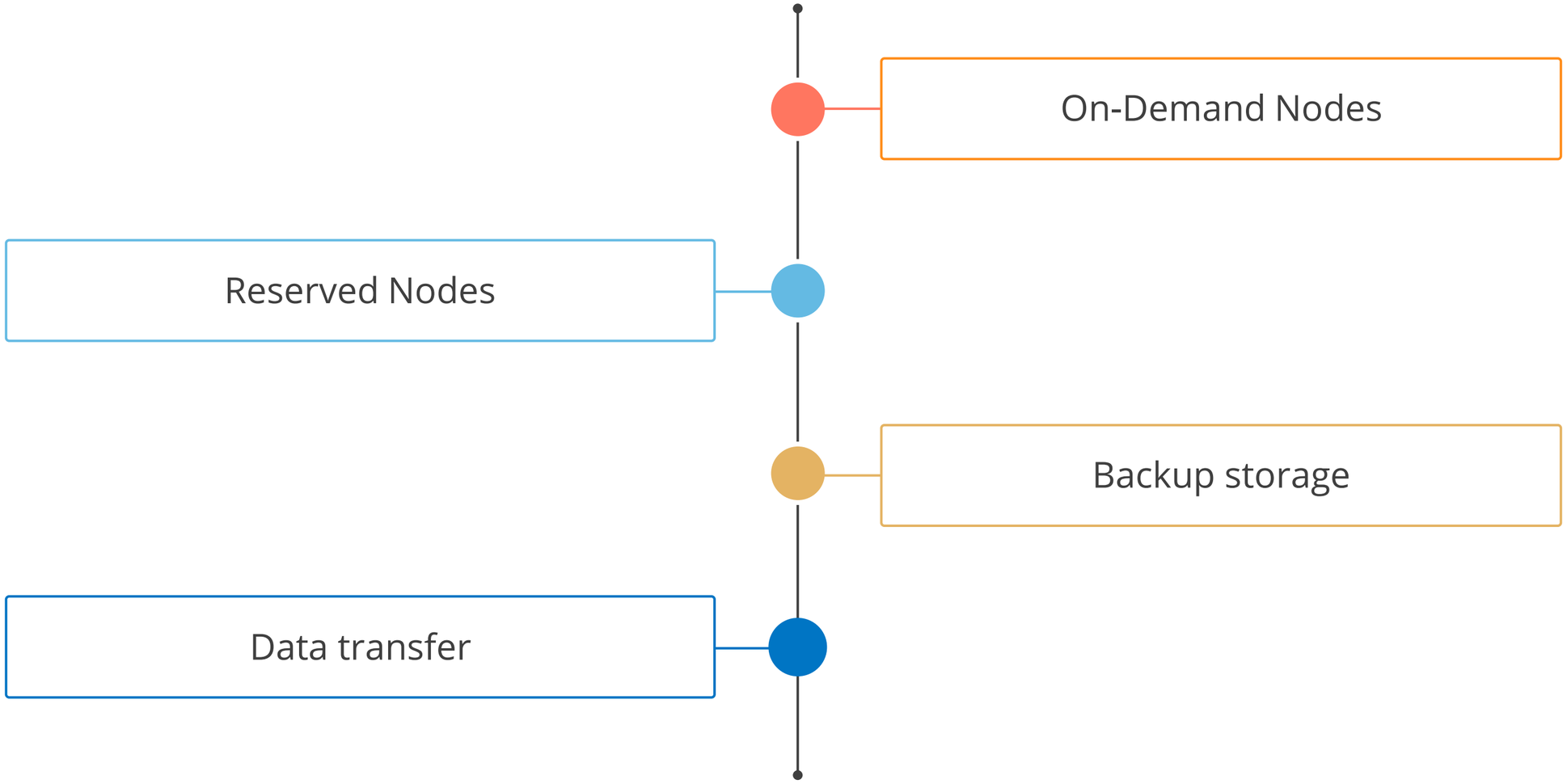
Benefits of Amazon ElastiCache for Memcached

Here are some benefits of Amazon ElastiCache for Memcached:



Amazon ElastiCache Costs

The following are the costs associated with Amazon ElastiCache:



Key Takeaways

- AWS provides the broadest selection of purpose-built databases allowing you to save, grow, and innovate faster.
- Amazon Relational Database Service (Amazon RDS) is a web service that makes it easy to set up, operate, and scale a relational database in the AWS cloud.
- Amazon RDS is available on Amazon Aurora, Oracle, Microsoft SQL Server, PostgreSQL, MySQL, and MariaDB.
- Amazon DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability.
- Amazon ElastiCache is a web service that makes it easy to deploy, operate, and scale an in-memory data store or cache in the cloud.

Lesson-End Project

Duration: 45 min.

Create and Query a Database Table with Amazon DynamoDB

Problem Statement:

You are working in an online entertainment provider company. As you have knowledge of cloud computing, you have been asked to create and query a Database Table on the cloud.

Perform the following:

- Open the AWS console
- Create the Database Table using the DynamoDB console
- Add data to the Database Table
- Query the Database Table
- Delete an existing item
- Delete the Database Table