



Module 8: Databases

Module overview

Topics

- Amazon Relational Database Service (Amazon RDS)
- Amazon DynamoDB
- Amazon Redshift
- Amazon Aurora



**Knowledge
check**

Module objectives

After completing this module, you should be able to:

- Explain Amazon Relational Database Service (Amazon RDS)
- Identify the functionality in Amazon RDS
- Explain Amazon DynamoDB
- Identify the functionality in Amazon DynamoDB
- Explain Amazon Redshift
- Explain Amazon Aurora
- Perform tasks in an RDS database, such as launching, configuring, and interacting

Section 1: Amazon Relational Database Service

Module 8: Databases

Amazon Relational Database Service



Amazon Relational Database Service (Amazon RDS)

Challenges of relational databases

- Server maintenance and energy footprint
- Software installation and patches
- Database backups and high availability
- Limits on scalability
- Data security
- Operating system (OS) installation and patches



Unmanaged versus managed services

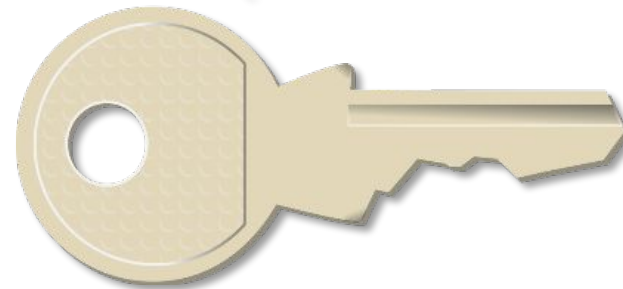
Unmanaged:

Scaling, fault tolerance, and availability are managed by you.



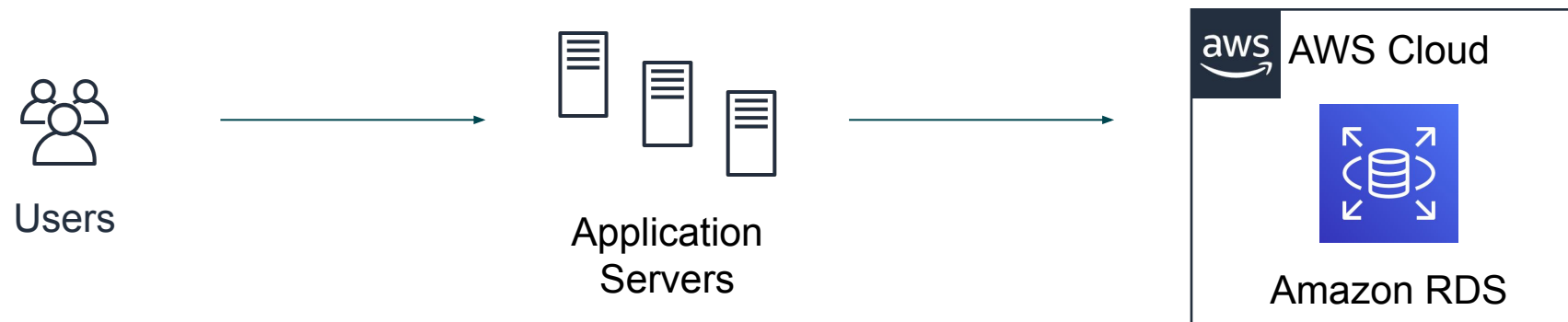
Managed:

Scaling, fault tolerance, and availability are typically built into the service.

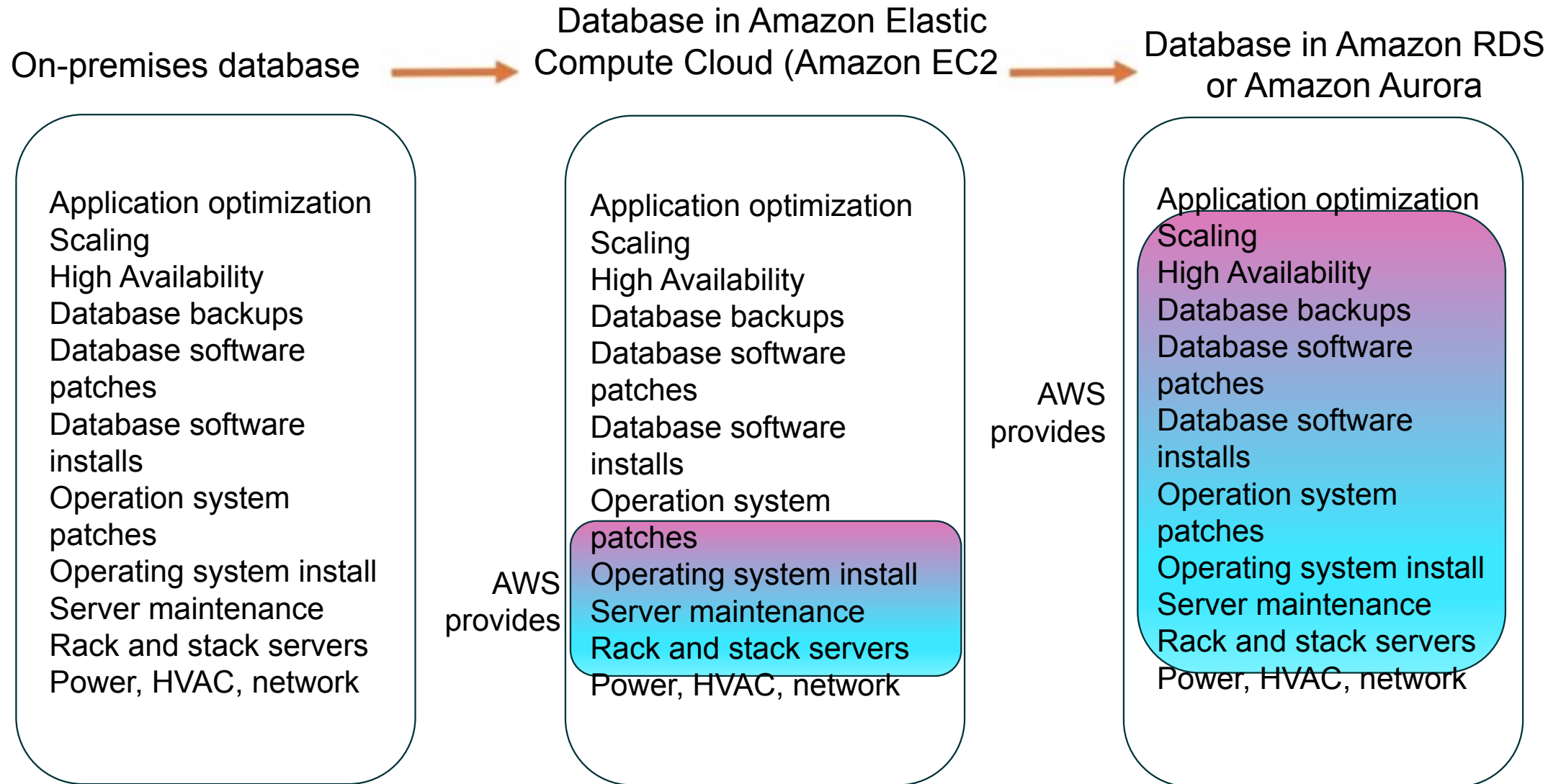


Amazon RDS

Managed service that sets up and operates a relational database in the cloud.



From on-premises databases to Amazon RDS



Managed services responsibilities

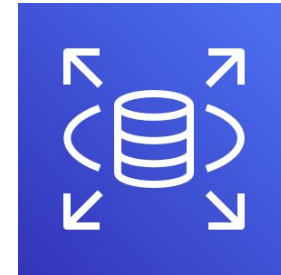
You manage:

- Application optimization



AWS manages:

- OS installation and patches
- Database software installation and patches
- Database backups
- High availability
- Scaling
- Power and racking and stacking servers
- Server maintenance



Amazon RDS

Amazon RDS DB instances

Amazon RDS



Amazon RDS DB
main instance

DB Instance Class

- CPU
- Memory
- Network performance

DB Instance Storage

- Magnetic
- General Purpose (solid state drive, or SSD)
- Provisioned IOPS

MySQL

Amazon Aurora

Microsoft SQL Server

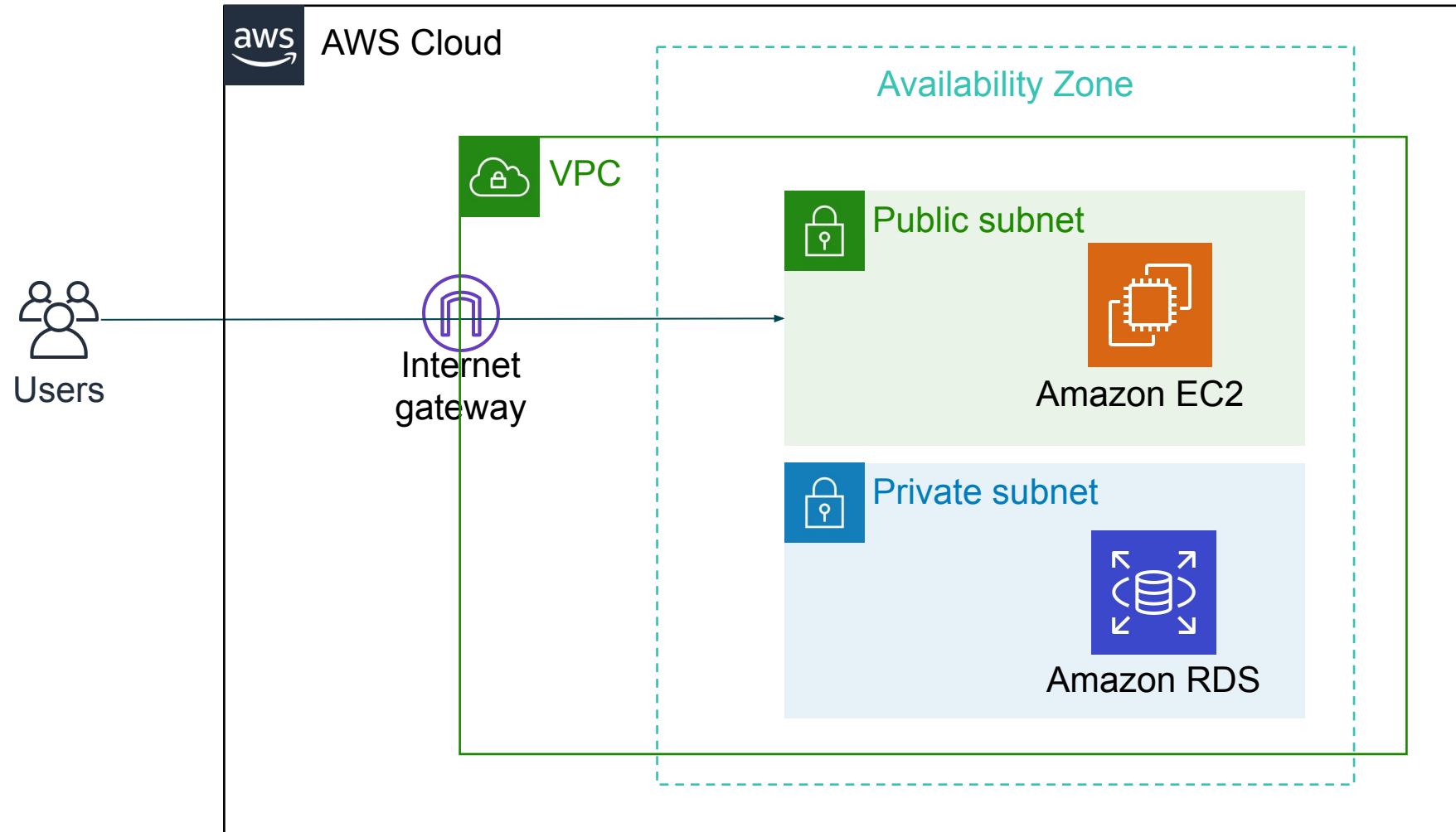
PostgreSQL

MariaDB

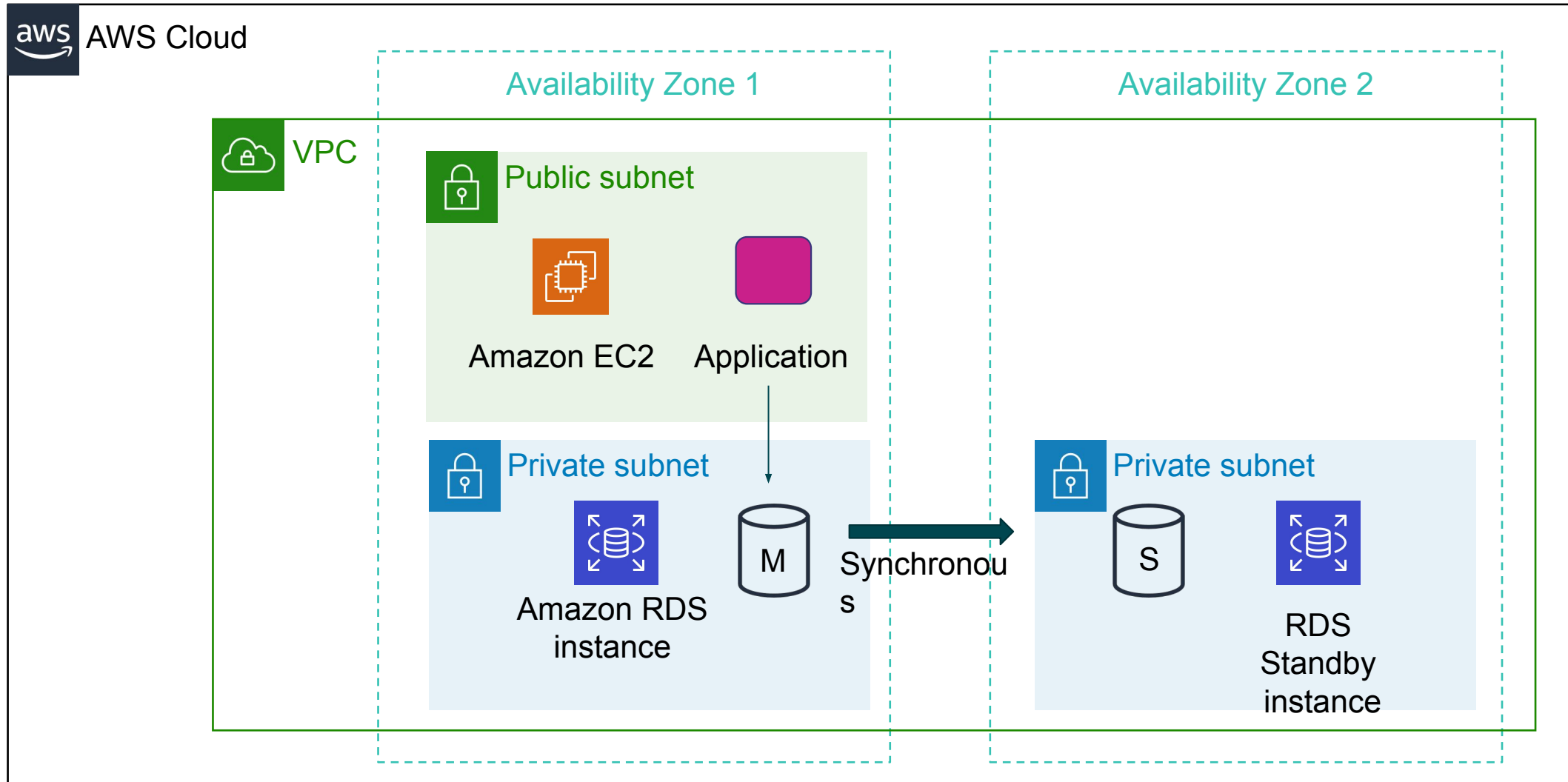
Oracle

DB engines

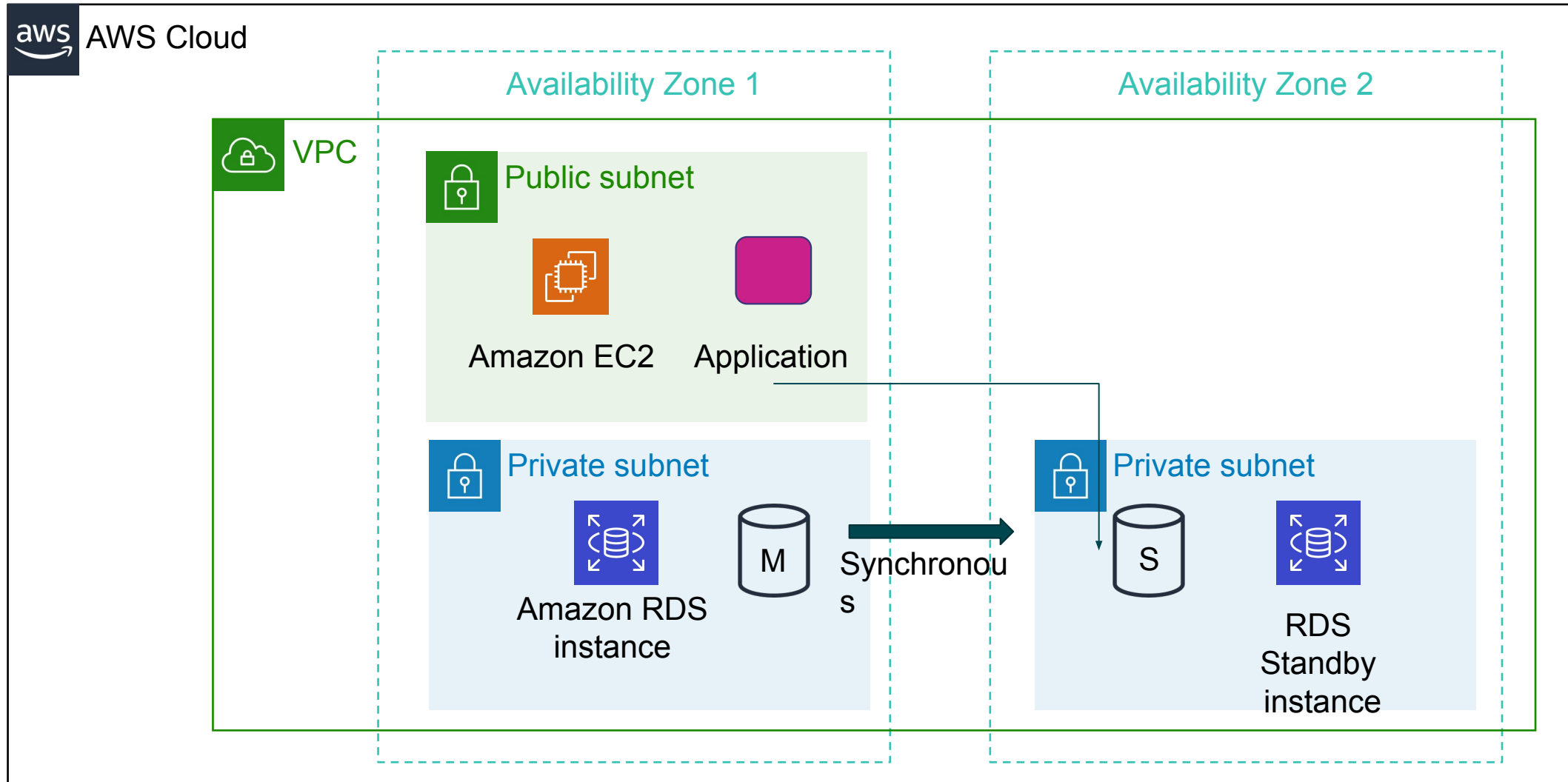
Amazon RDS in a virtual private cloud (VPC)



High availability with Multi-AZ deployment (1 of 2)



High availability with Multi-AZ deployment (2 of 2)



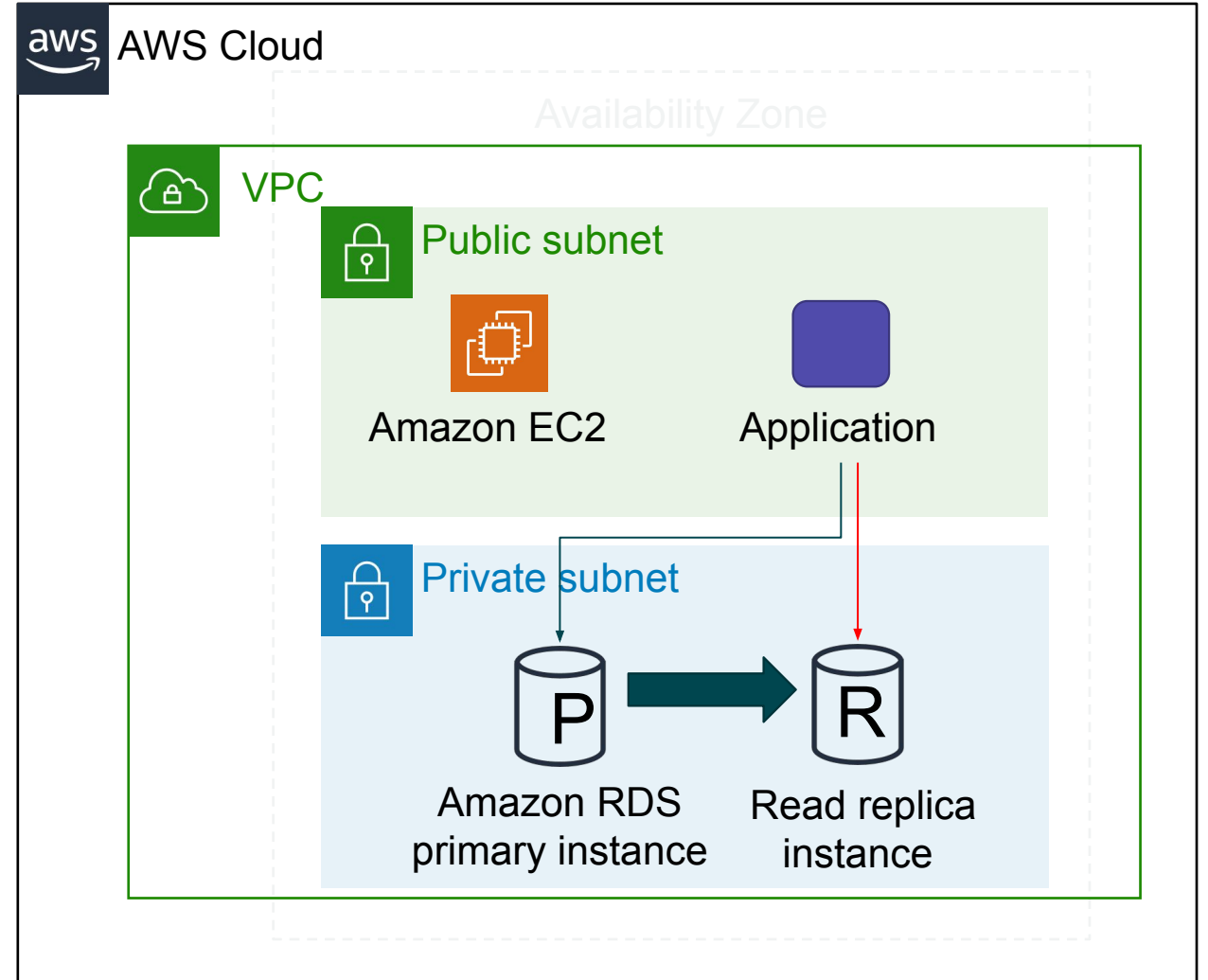
Amazon RDS read replicas

Features

- Offers asynchronous replication
- Can be promoted to primary if needed

Functionality

- Use for read-heavy database workloads
- Offload read queries



Use cases

Web and mobile applications

- ✓ High throughput
- ✓ Massive storage scalability
- ✓ High availability

Ecommerce applications

- ✓ Low-cost database
- ✓ Data security
- ✓ Fully managed solution

Mobile and online games

- ✓ Rapidly grow capacity
- ✓ Automatic scaling
- ✓ Database monitoring

When to Use Amazon RDS

Use Amazon RDS when your application requires:

- Complex transactions or complex queries
- A medium to high query or write rate – Up to 30,000 IOPS (15,000 reads + 15,000 writes)
- No more than a single worker node or shard
- High durability

Do not use Amazon RDS when your application requires:

- Massive read/write rates (for example, 150,000 write/second)
- Sharding due to high data size or throughput demands
- Simple GET or PUT requests and queries that a NoSQL database can handle
- Relational database management system (RDBMS) customization

Amazon RDS: Clock-hour billing and database characteristics

Clock-hour billing –

- Resources incur charges when running

Database characteristics –

- Physical capacity of database:
 - Engine
 - Size
 - Memory class

Amazon RDS: DB purchase type and multiple DB instances

DB purchase type –

- On-Demand Instances
 - Compute capacity by the hour
- Reserved Instances
 - Low, one-time, upfront payment for database instances that are reserved with a 1-year or 3-year term

Number of DB instances –

- Provision multiple DB instances to handle peak loads

Amazon RDS: Storage

Provisioned storage –

- No charge
 - Backup storage of up to 100 percent of database storage for an active database
- Charge (*GB/month*)
 - Backup storage for terminated DB instances

Additional storage –

- Charge (*GB/month*)
 - Backup storage in addition to provisioned storage

Amazon RDS: Deployment type and data transfer

Requests –

- The number of input and output requests that are made to the database

Deployment type—Storage and I/O charges vary, depending on whether you deploy to –

- Single Availability Zone
- Multiple Availability Zones

Data transfer –

- No charge for inbound data transfer
- Tiered charges for outbound data transfer

Section 1 key takeaways



- With Amazon RDS, you can set up, operate, and scale relational databases in the cloud.
- Features –
 - Managed service
 - Accessible via the console, AWS Command Line Interface (AWS CLI), or application programming interface (API) calls
 - Scalable (compute and storage)
 - Automated redundancy and backup are available
 - Supported database engines:
 - Amazon Aurora, PostgreSQL, MySQL, MariaDB, Oracle, Microsoft SQL Server

Section 2: Amazon DynamoDB

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Relational versus non-relational databases

	Relational (SQL)	Non-Relational			
Data Storage	Rows and columns	Key-value, document, graph			
Schemas	Fixed	Dynamic			
Querying	Uses SQL	Focuses on collection of documents			
Scalability	Vertical	Horizontal			
Example					<div><pre>{ ISBN: 3111111223439, Title: "Withering Depths", Author: "Jackson, Mateo", Format: "Paperback" }</pre></div>

What is Amazon DynamoDB?

Fast and flexible NoSQL database service for any scale



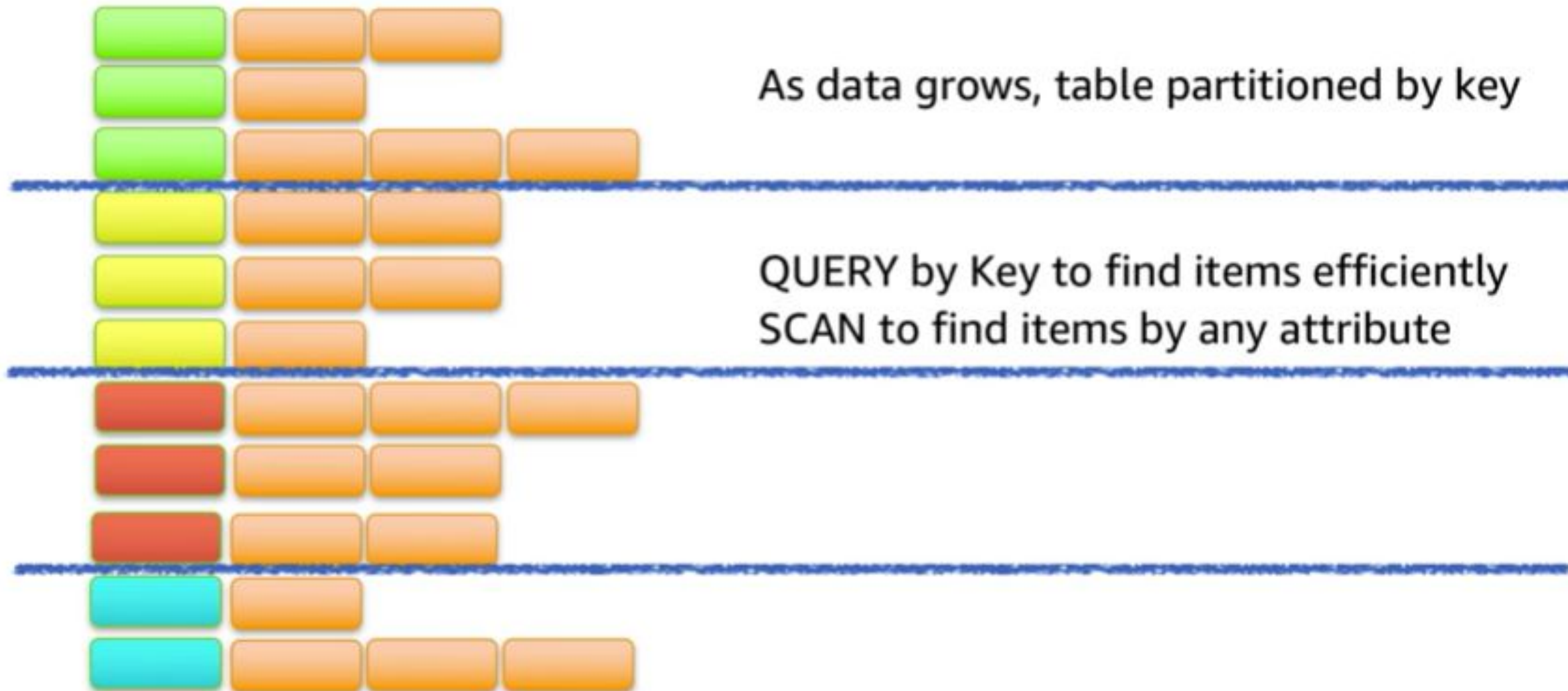
Amazon DynamoDB

- NoSQL database tables
- Virtually unlimited storage
- Items can have differing attributes
- Low-latency queries
- Scalable read/write throughput

Amazon DynamoDB core components

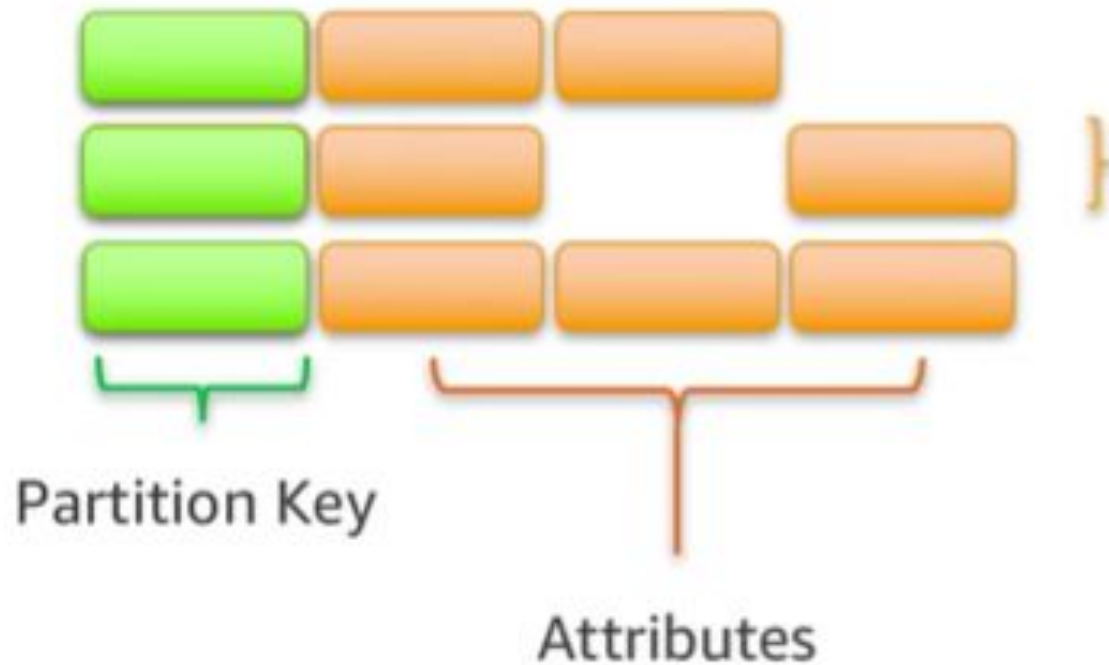
- Tables, items, and attributes are the core DynamoDB components
- DynamoDB supports two different kinds of primary keys: Partition key and partition and sort key

Partitioning

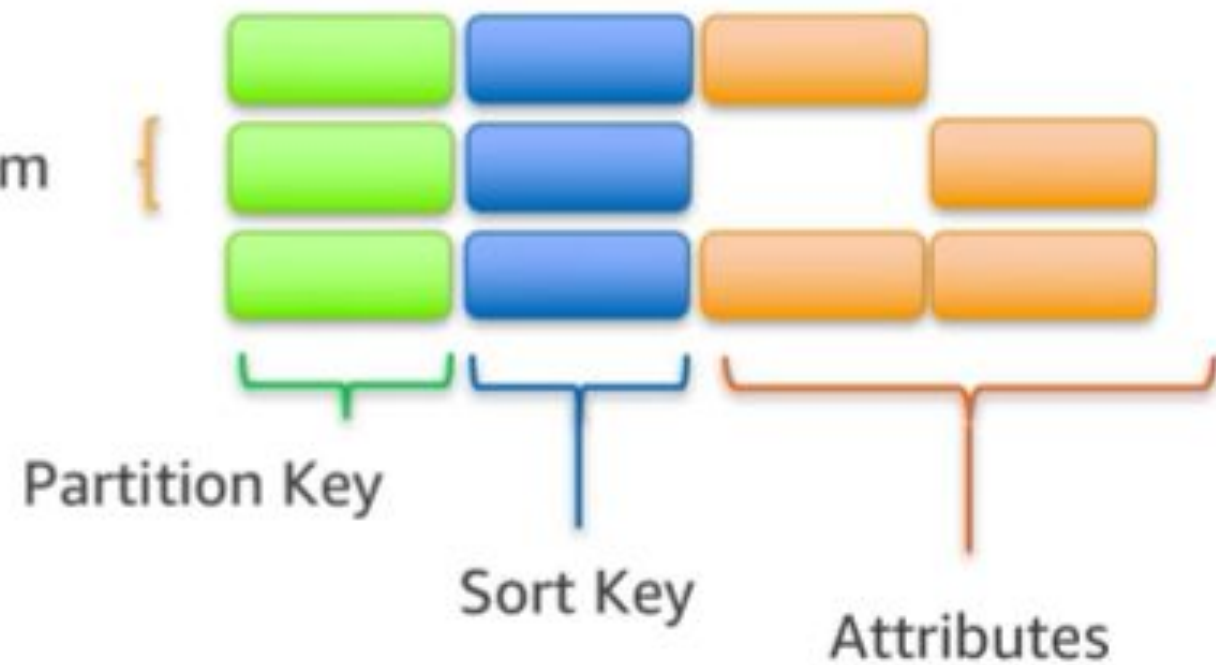


Items in a table must have a key

Single Key



Compound Key



Section 2 key takeaways



Amazon DynamoDB:

- Runs exclusively on SSDs.
- Supports document and key-value store models.
- Replicates your tables automatically across your choice of AWS Regions.
- Works well for mobile, web, gaming, adtech, and Internet of Things (IoT) applications.
- Is accessible via the console, the AWS CLI, and API calls.
- Provides consistent, single-digit millisecond latency at any scale.
- Has no limits on table size or throughput.

Section 3: Amazon Redshift

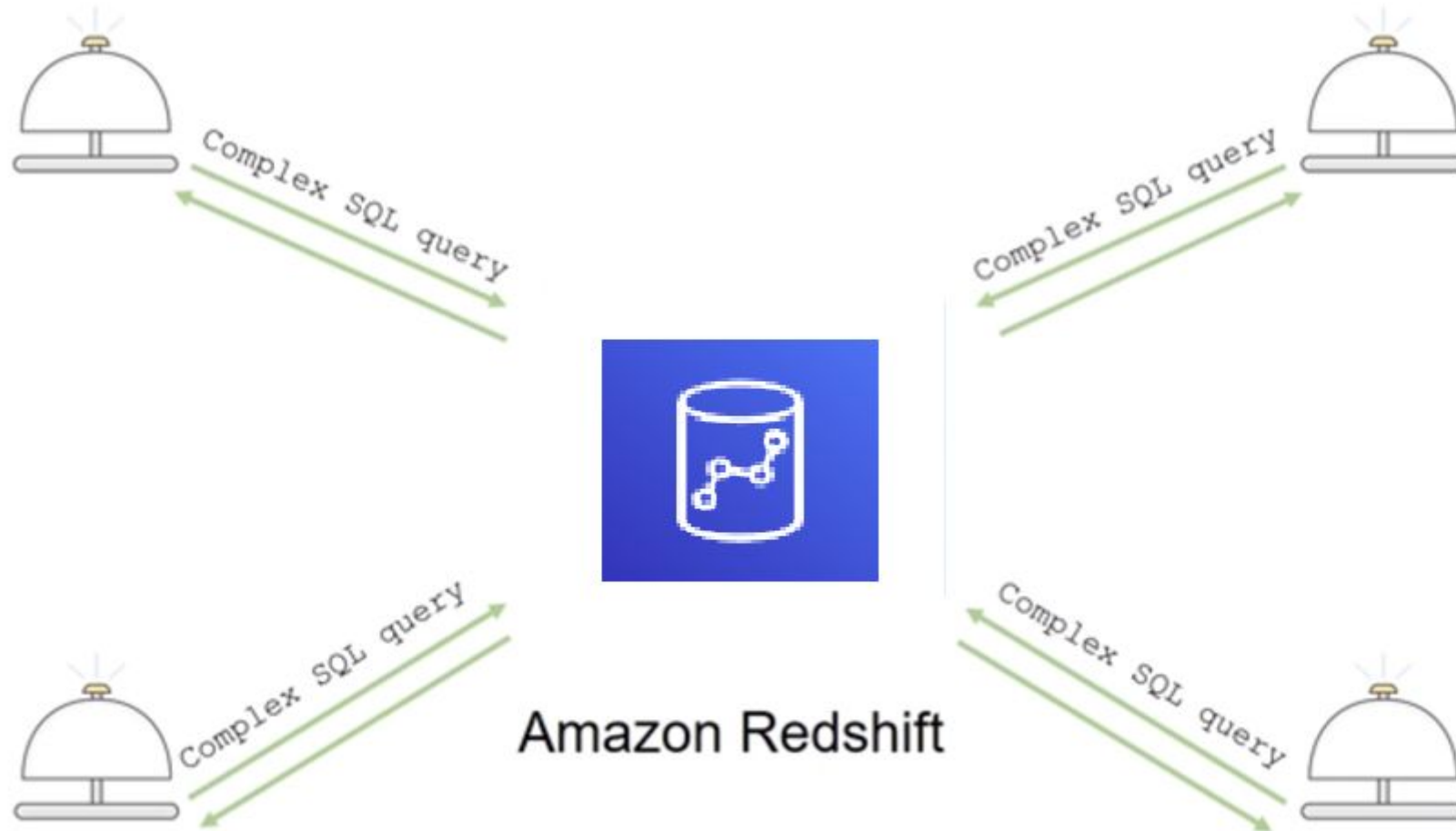
Module 8: Databases

Amazon Redshift

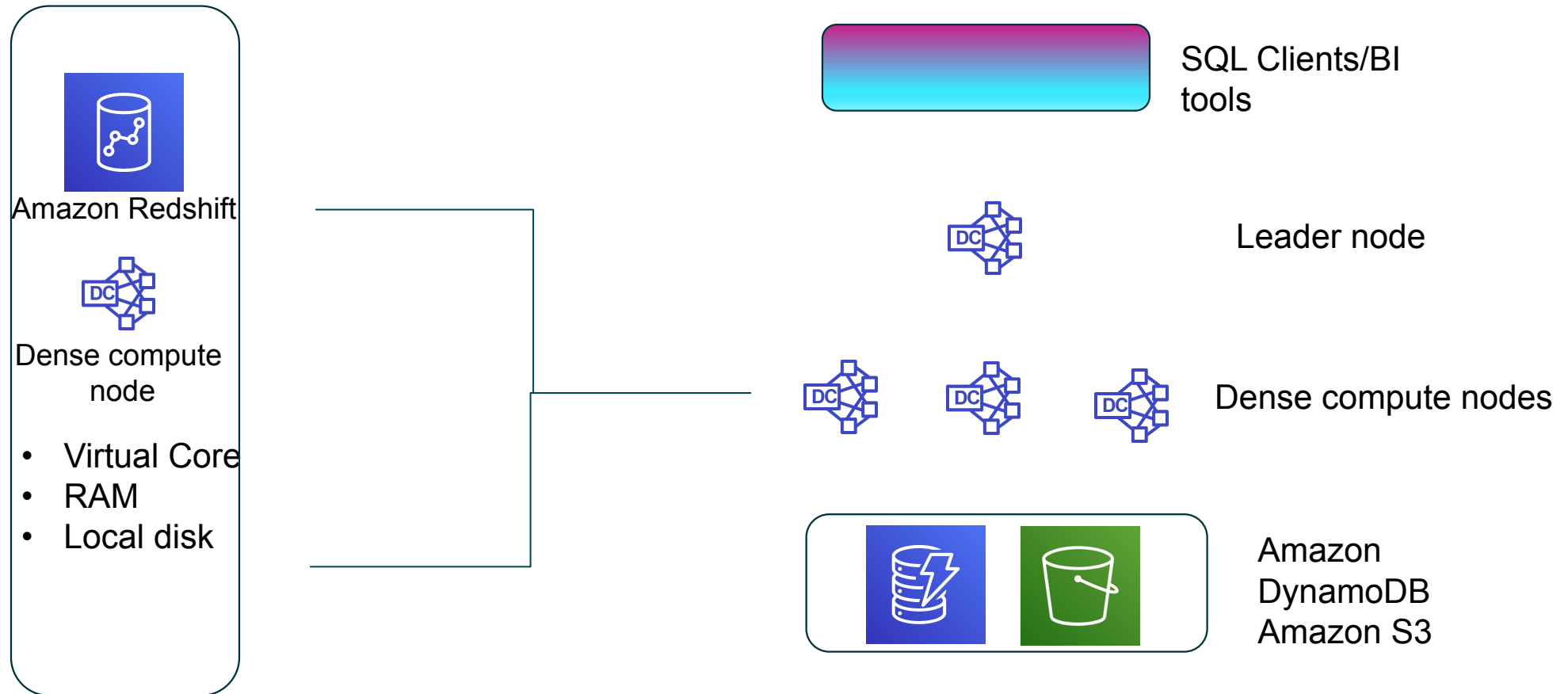


Amazon Redshift

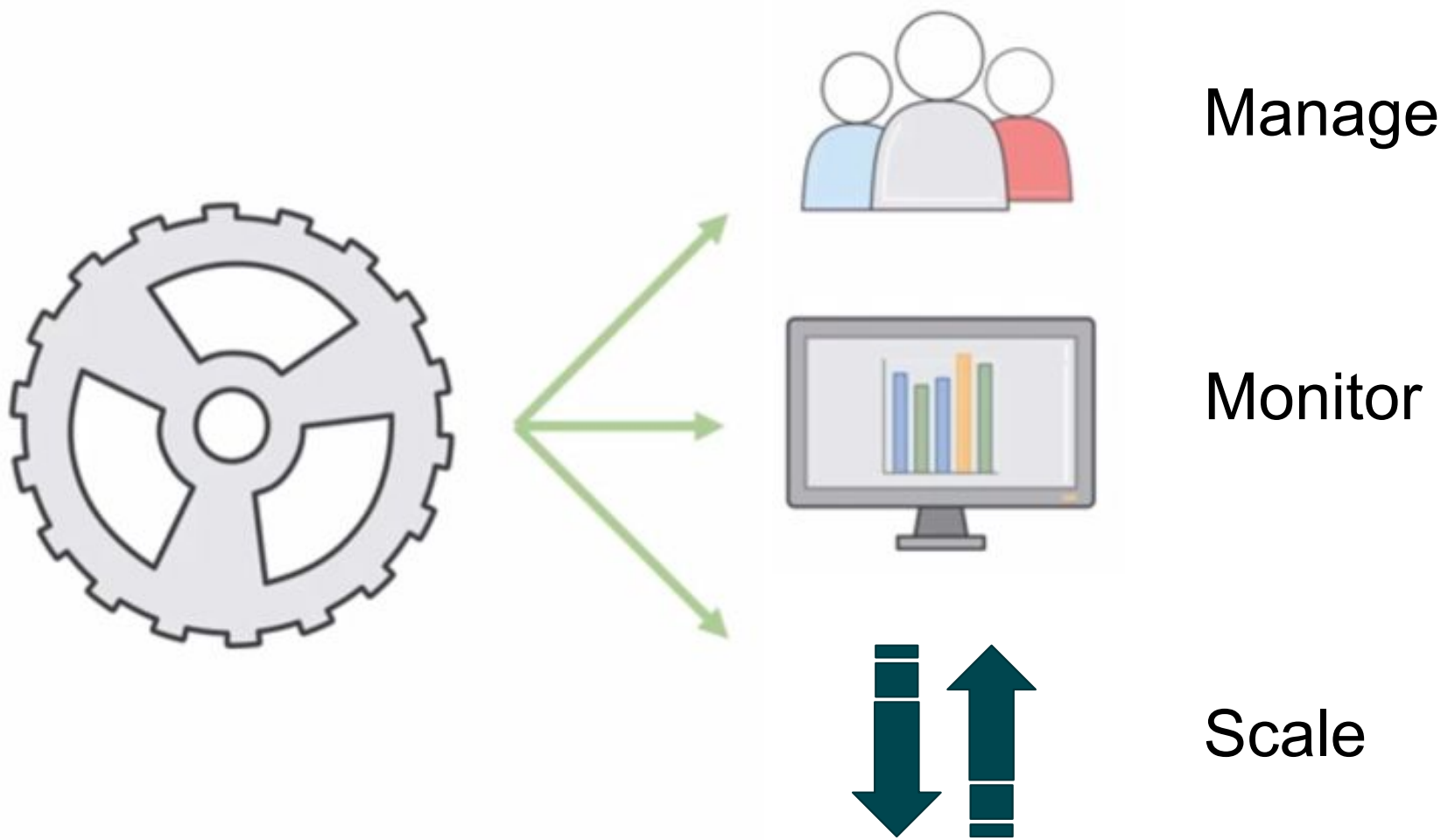
Introduction to Amazon Redshift



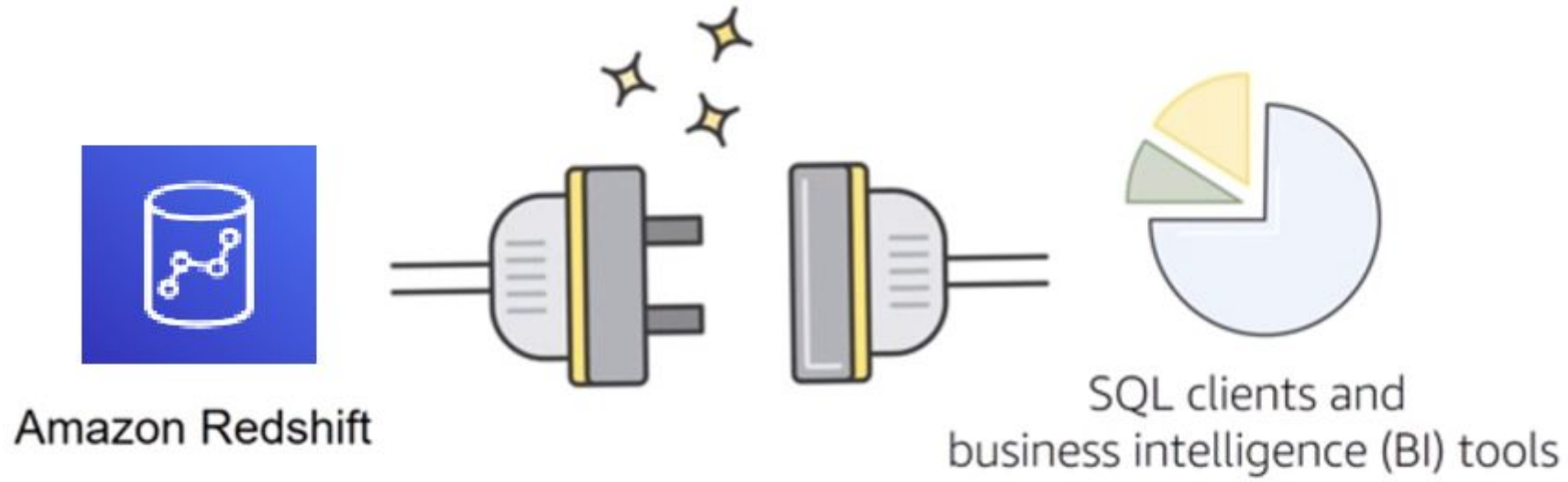
Parallel processing architecture



Automation and scaling

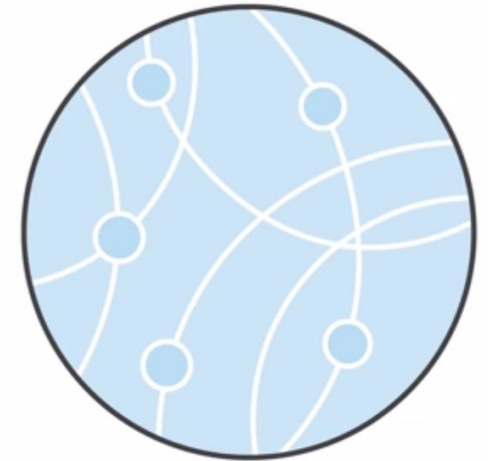


Compatibility



Amazon Redshift use cases (1 of 2)

- Enterprise data warehouse (EDW)
 - Migrate at a pace that customers are comfortable with
 - Experiment without large upfront cost or commitment
 - Respond faster to business needs
- Big data
 - Low price point for small customers
 - Managed service for ease of deployment and maintenance
 - Focus more on data and less on database management



Amazon Redshift use cases (2 of 2)

- Software as a service (SaaS)
 - Scale the data warehouse capacity as demand grows
 - Add analytic functionality to applications
 - Reduce hardware and software costs



Section 3 key takeaways



Amazon Redshift features:

- Fast, fully managed data warehouse service
- Easily scale with no downtime
- Columnar storage and parallel processing architectures
- Automatically and continuously monitors cluster
- Encryption is built in

Section 4: Amazon Aurora

Module 8: Databases



Amazon Aurora



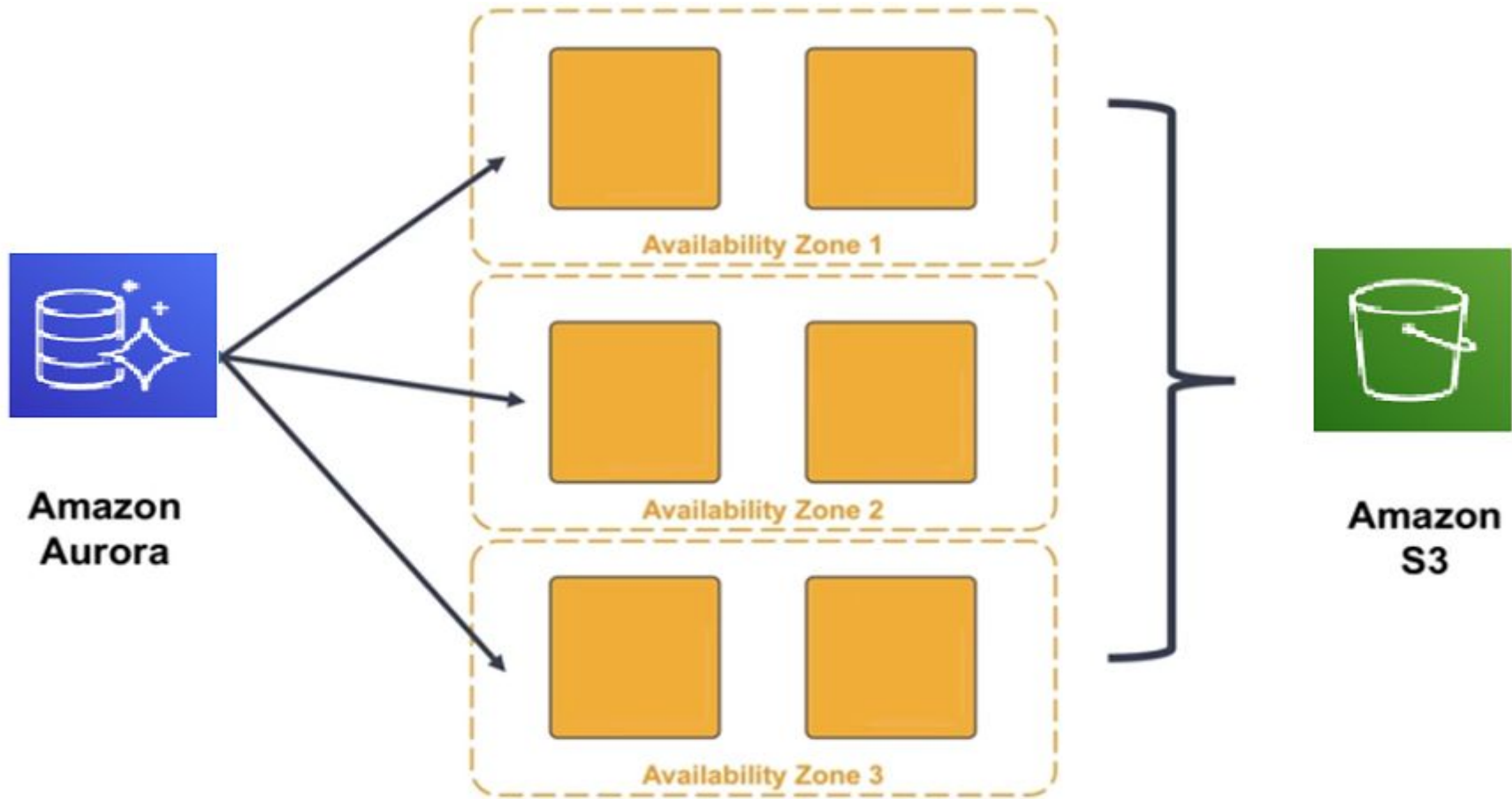
Amazon Aurora

- Enterprise-class relational database
- Compatible with MySQL or PostgreSQL
- Automate time-consuming tasks (such as provisioning, patching, backup, recovery, failure detection, and repair).

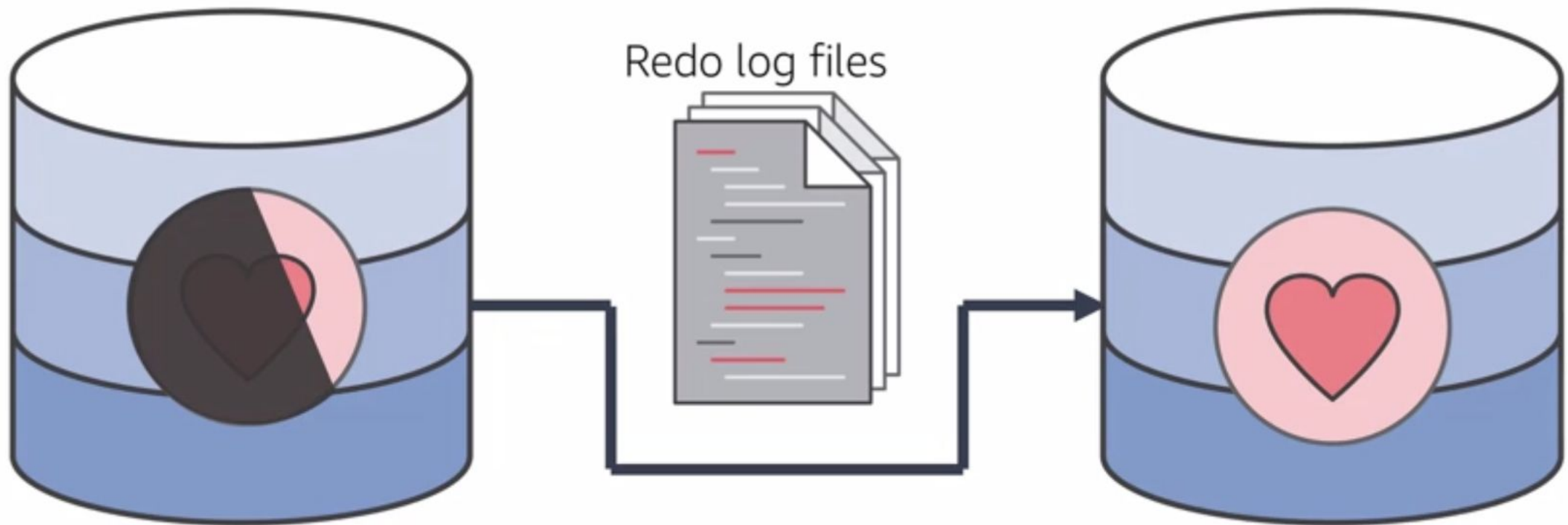
Amazon Aurora service benefits



High availability



Resilient design



Section 4 key takeaways

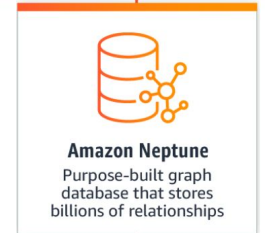


Amazon Aurora features:

- High performance and scalability
- High availability and durability
- Multiple levels of security
- Compatible with MySQL and PostgreSQL
- Fully managed

Amazon Neptune

What is Amazon Neptune?



- **Amazon Neptune is a graph database service used as a web service to build and run applications that require connected datasets.**
- **The graph database engine helps to store billions of connections and provides milliseconds latency for querying them.**
- It offers a choice from graph models and languages for querying data.
- **It is highly available across three AZs and automatically fails over any of the 15 low latency read replicas.**
- It provides fault-tolerant storage by replicating two copies of data across three availability zones.
- It provides continuous backup to Amazon S3 and point-in-time recovery from storage failures.
- It automatically scales storage capacity and provides encryption at rest and in transit.



Amazon
ElastiCache

ElastiCache provides web applications with an in-memory data store in the cloud.

- Works as an in-memory data store and cache
- Offers high performance
- Is fully managed
- Is scalable
- Supports Redis and Memcached

Module wrap-up

Module 8: Databases

Module summary

In summary, in this module, you learned how to:

- Explain Amazon Relational Database Service (Amazon RDS)
- Identify the functionality in Amazon RDS
- Explain Amazon DynamoDB
- Identify the functionality in Amazon DynamoDB
- Explain Amazon Redshift
- Explain Amazon Aurora
- Perform tasks in an RDS database, such as launching, configuring, and interacting

Complete the knowledge check



Sample exam question

Which of the following is a fully-managed NoSQL database service?

Choice	Response
A	Amazon Relational Database Service (Amazon RDS)
B	Amazon DynamoDB
C	Amazon Aurora
D	Amazon Redshift

Sample exam question answer

Which of the following is a fully-managed NoSQL database service?

The correct answer is B.

The keywords in the question are “NoSQL database service”.

Additional resources

- AWS Database page: <https://aws.amazon.com/products/databases/>
- Amazon RDS page: <https://aws.amazon.com/rds/>
- Overview of Amazon database services:
<https://docs.aws.amazon.com/whitepapers/latest/aws-overview/database.html>
- Getting started with AWS databases:
<https://aws.amazon.com/products/databases/learn/>

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