Adding A Database Layer

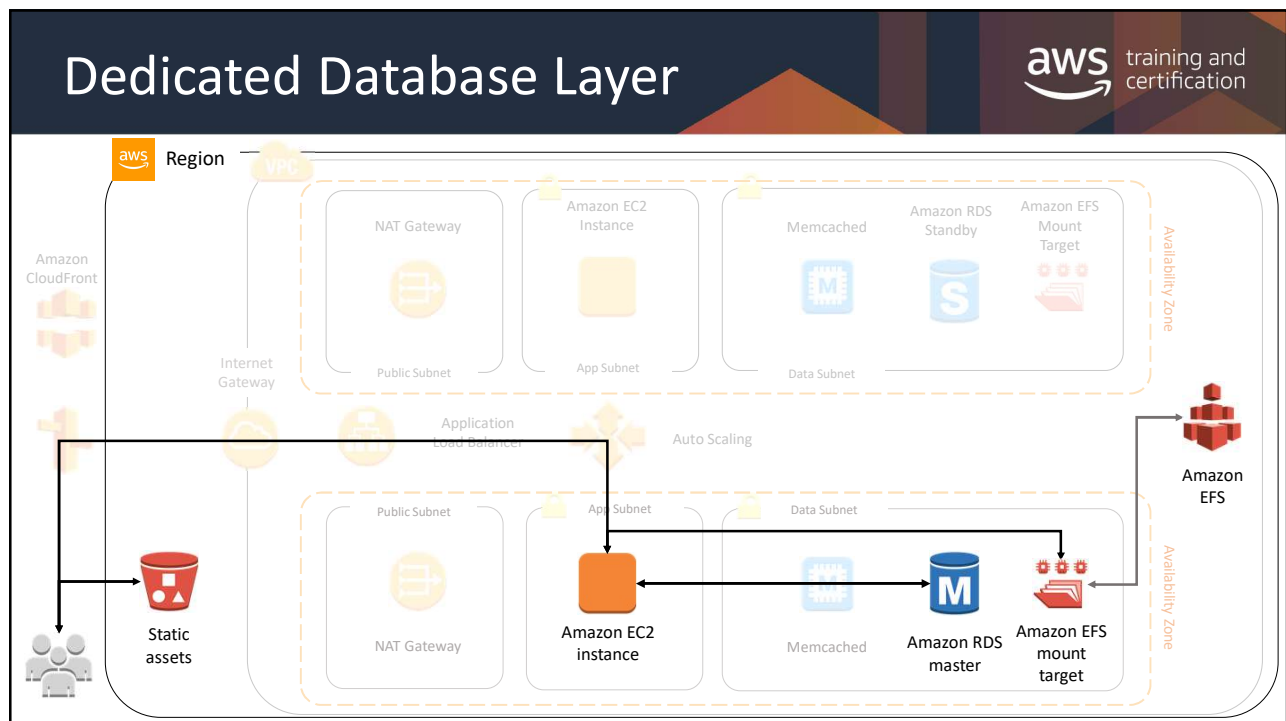**Module 6**

0

Dedicated Database Layer

1

Module 6

The architectural need

You need a database that is highly available and easy to scale that is separate from your application servers.

Module Overview

- Comparing database types
- Managed vs. unmanaged services
- Amazon Relational Database Service (Amazon RDS) and Amazon DynamoDB

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Database Layer Considerations
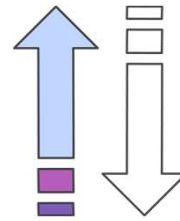
3

What Should You Consider?
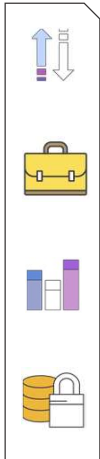
Scalability

Total storage requirements

Object size and type

Durability

How much throughput do we need?
Will the solution we choose be able to scale up later
if needed?

4

What Should You Consider?
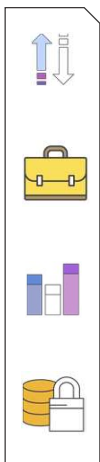
Scalability

Total storage requirements

Object size and type

Durability

How large does our database need to be?
Will we have GB, TB, or PB of data?

5

What Should You Consider?
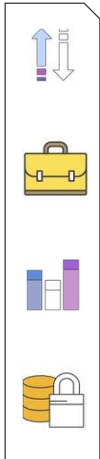
Scalability

Total storage requirements

Object size and type

Durability

Do we need to store simple data structures, large data objects, or both?

6

What Should You Consider?
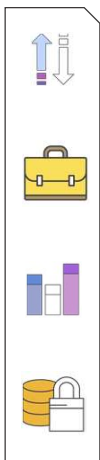
Scalability

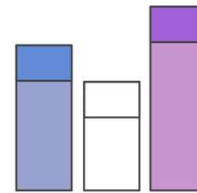Total storage requirements

Object size and type

Durability

What level of data durability, data availability, and recoverability do you require?
Do you have a related regulatory obligation?

7

Database Types

Two types of database options are available for your architectures.

Relational
Traditional examples:
Microsoft SQL Server Oracle Database, MySQL

Non-Relational
Traditional examples:
MongoDB Cassandra Redis

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Database Type: Relational

ISBN	Title	Author	Format
9182932465265	Cloud Computing Concepts	Wilson, Joe	Paperback

Sales	Revenue	Author		Author	AccountNumber
1143	10503	Wilson, Joe		Wilson, Joe	8017330011
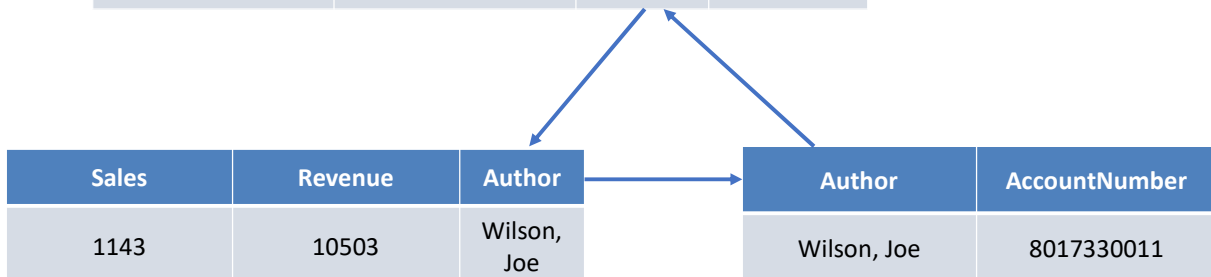
9

Database Type: Relational

When to choose a relational database:

- You require strict schema rules and data quality enforcement

- Your database doesn't need extreme read/write capacity

- If you have a relational dataset that does not require extreme performance, an RDBMS can be the best, lowest effort solution.
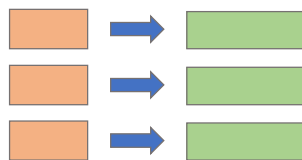
10

Database Type: Non-Relational

Key-Value

Document

```
{
      ISBN: 9182932465265,
      Title: "Cloud Computing Concepts",
      Author: "Wilson, Joe",
      Format: "Paperback"
}
```

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Database Type: Non-Relational

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When to choose a non-relational database:

- You need your database to scale horizontally

- Your data does not lend itself well to traditional schemas

- Your read/write rates exceed those that can be economically supported through traditional SQL DB

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Compare and Contrast Structured Data Storage

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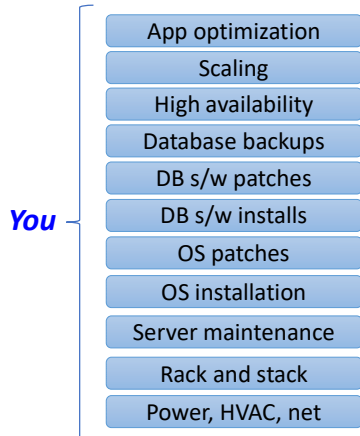|	Relational/SQL	NoSQL
Data Storage	Rows and columns	Key value, documents, and graphs
Schemas	Fixed	Dynamic
Querying	SQL-based querying	Focused on collection of documents
Scalability	Vertical	Horizontal

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Unmanaged Databases

App optimization
Scaling
High availability
Database backups
DB s/w patches
You — DB s/w installs
OS patches
OS installation
Server maintenance
Rack and stack
Power, HVAC, net

If you host your databases **on-premises**

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Unmanaged Databases

App optimization
Scaling
High availability
Database backups
DB s/w patches
You — DB s/w installs
OS patches
OS installation
Server maintenance
Rack and stack
Power, HVAC, net

If you host your databases **on-premises**

OS installation
Server maintenance
Rack and stack
Power, HVAC, net

If you host your databases in **Amazon EC2**

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Unmanaged Databases

You

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack & stack
- Power, HVAC, net

If you host your databases **on-premises**

You

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches

- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

aws

If you host your databases in **Amazon EC2**

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Managed Databases

You → App optimization

- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

aws
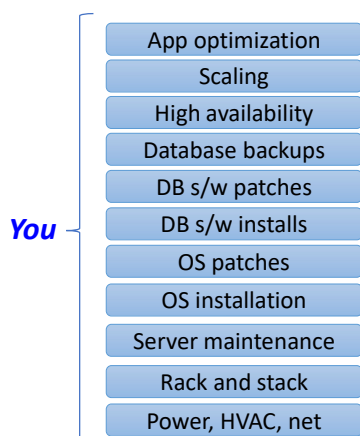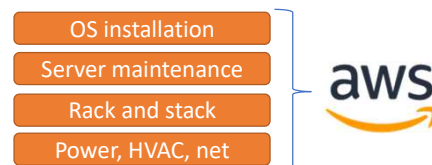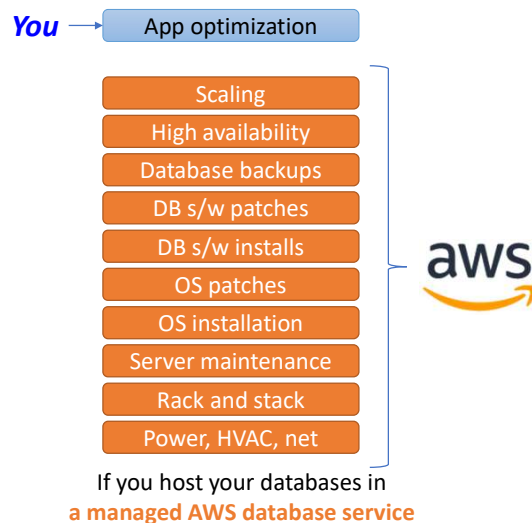
If you host your databases in **a managed AWS database service**

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Amazon RDS and Amazon DynamoDB

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Amazon Database Options

Amazon
RDS

Amazon
Redshift

Amazon
DynamoDB

Amazon
ElastiCache

Amazon
Neptune

Relational Databases

Non-Relational Databases

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Our Focus

Relational

Amazon
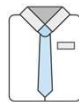RDS

Non-Relational

Amazon
DynamoDB

20

Amazon RDS
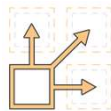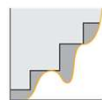
Relational

Amazon
RDS

Fully managed relational database service

Provisions new instances in a few minutes

Scaling vertically with a few mouse clicks

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Amazon RDS in General

Relational

Amazon RDS

Works well for applications that:

Have more complex data

Need to combine and join data sets

Require enforced syntax rules

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Amazon RDS and Amazon Aurora

Amazon Aurora is a fully managed, MySQL- and PostgreSQL-compatible, relational database engine.

- Up to five times the throughput of MySQL

- Up to three times the throughput of PostgreSQL

- Replicates data six ways across three Availability Zones

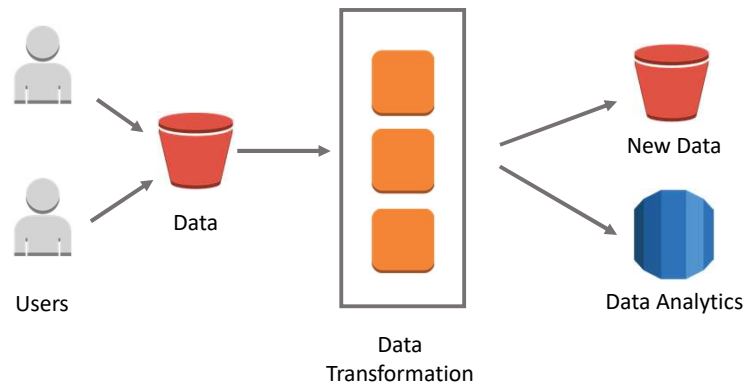- Requires very little change to your existing application

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Amazon RDS Use Case

Analytics

Users

Data

Data
Transformation

New Data
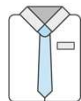
Data Analytics

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Amazon DynamoDB

Non-Relational

Amazon
DynamoDB

Fully managed non-relational database service

Event-driven programming (serverless computing)

Extreme horizontal scaling capability

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Amazon DynamoDB

Non-Relational

Amazon DynamoDB
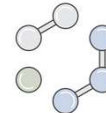
Works well for applications that:

Have simple high-volume data
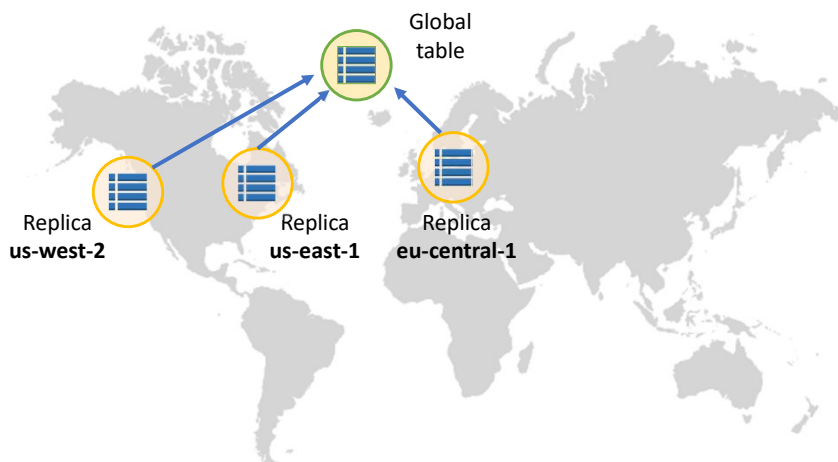
Need to scale quickly and with ease

Don't need complex joins

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Amazon DynamoDB has Global Tables

Global table

Replica
us-west-2

Replica
us-east-1

Replica
eu-central-1

Non-Relational

Amazon DynamoDB

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Amazon DynamoDB Use Cases

Temporary Data (Online Cart)

Users — Web store — Shopping cart — Order processing
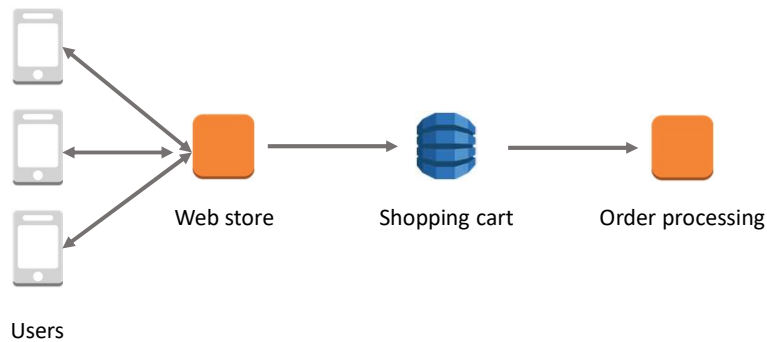
28

Amazon DynamoDB Consistency Options

Eventually Consistent

Strongly Consistent

Replica
Replica
Replica
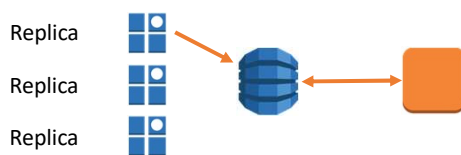
Uses .5x Read Capacity Unit

Replica
Replica
Replica
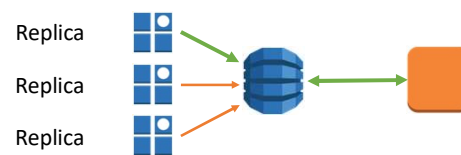
Uses 1x Read Capacity Unit

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Security Controls for
Amazon RDS and DynamoDB

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Security Controls for Amazon RDS

A few things to think about:

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Security Controls for Amazon RDS

A few things to think about:

Access to the DB itself – Who has visibility and can run actions on the database?

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Security Controls for Amazon RDS

A few things to think about:

Access to the DB itself – Who has visibility and can run actions on the database?

Encryption at rest – Data that is encrypted at rest includes the underlying storage for a DB instance, its automated backups, read replicas, and snapshots.

33

Security Controls for Amazon RDS

A few things to think about:

Access to the DB itself – Who has visibility and can run actions on the database?

Encryption at rest – Data that is encrypted at rest includes the underlying storage for a DB instance, its automated backups, read replicas, and snapshots.

Encryption in transit – Encryption in transit can be accomplished with SSL.

34

Security Controls for Amazon RDS

A few things to think about:

Access to the DB itself – Who has visibility and can run actions on the database?

Encryption at rest – Data that is encrypted at rest includes the underlying storage for a DB instance, its automated backups, read replicas, and snapshots.

Encryption in transit – Encryption in transit can be accomplished with SSL.

Event notifications – You can receive notifications of a variety of important events that can occur on your Amazon RDS instance.

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Security Controls for DynamoDB

A few things to think about:

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Security Controls for DynamoDB

A few things to think about:

Definable access permissions – With DynamoDB, you can grant access to everything from the **table** to the **item** to even the **attributes** of your database.

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Security Controls for DynamoDB

aws training and certification

A few things to think about:

Definable access permissions – With DynamoDB, you can grant access to everything from the **table** to the **item** to even the **attributes** of your database.

Encryption at rest – DynamoDB offers fully managed encryption at rest.

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Security Controls for DynamoDB

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A few things to think about:

Definable access permissions – With DynamoDB, you can grant access to everything from the **table** to the **item** to even the **attributes** of your database.

Encryption at rest – DynamoDB offers fully managed encryption at rest.

SSL/TLS – By default, communications to and from DynamoDB use the HTTPS protocol, which protects network traffic by using SSL/TLS encryption.

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Migrating Data into your AWS Databases

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AWS Database Migration Service (AWS DMS)

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AWS Database Migration Service

Supports migration to and from most commercial and open source databases

Can be used to migrate between databases on Amazon EC2, Amazon RDS, and on-premises

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Migration Options

AWS Database
Migration Service

One-time migration

Ongoing migration

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Using AWS Snowball Edge with AWS DMS

AWS Database
Migration Service

When migrating data is unfeasible:

- Database is too large
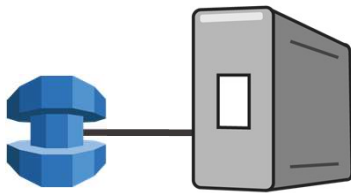- Connection is too slow
- Privacy and security concerns

We recommend AWS Snowball Edge

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Using AWS Snowball Edge with AWS DMS

AWS DMS has a Snowball Edge integration point.

You can migrate one or more databases using the Snowball Edge device.

AWS
DMS

Snowball
Edge

- Multi-terabyte storage

- Without using network bandwidth

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AWS Schema Conversion Tool

A standalone application that enables you to convert your existing database schema from one database engine to another.

Source Database	Target Database
Microsoft SQL Server	Amazon Aurora, MySQL, PostgreSQL
MySQL	PostgreSQL
Oracle	Amazon Aurora, MySQL, PostgreSQL
Oracle Data Warehouse	Amazon Redshift
PostgreSQL	Amazon Aurora, MySQL
Teradata	Amazon Redshift

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Lab M06-01: Deploying a Web Application on AWS

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Lab M06-01: Deploying a Web Application on AWS

"I want to host a web application and database."

Technologies used:
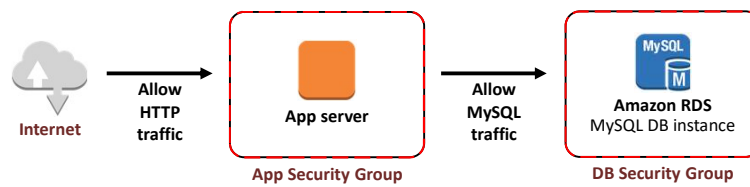
- Amazon EC2
- Amazon RDS
- Security groups

47

Lab M06-01: Deploying a Web Application on AWS

Security Configuration

- App Security Group: Permit access from the internet
- DB Security Group: Permit access from *App Security Group*

"Build the fence, then put resources inside the fence."
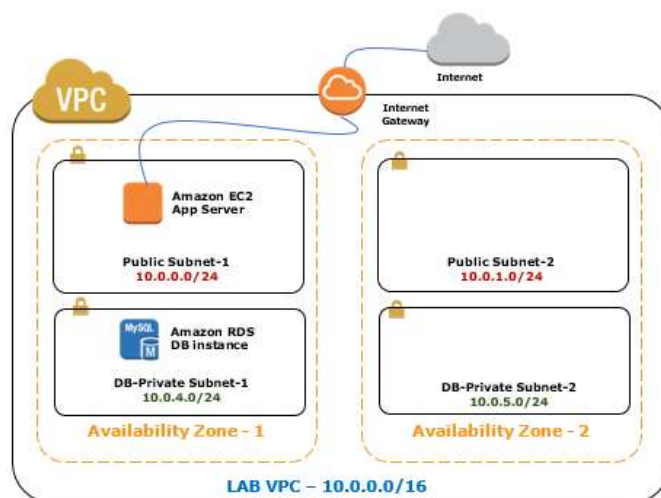
48

Lab M06-01: Deploying a Web Application on AWS

You will then:

- Deploy a Database server
- Deploy an Application server
- Test the Application
- Access the Database server

Duration: 40m

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Thank You

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