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# AWS Architect Certification Training

# COURSE OUTLINE

## Module 04

Introduction To AWS

Security Management In AWS

Object Storage Options

**Amazon EC2**

Load Balancing, Auto-scaling And Route 53

Database Services And Analytics

Networking And Monitoring Services

Application Services And AWS Lambda

Configuration Management And Automation

AWS Architectural Designs – I

# Topics

Following are the topics covered in this module:

- Amazon Elastic Compute Cloud (EC2) and its benefits
- Amazon Machine Image (AMI)
- Security Groups In AWS
- Authentication Through Key-Pair
- Hosting a Website inside EC2
- Creating A Custom AMI
- Hardware Tenancy – Shared v/s Dedicated
- Networking Layer In EC2: VPC
- Elastic Network Interface and its Attributes
- Different Categories Of IP Address
- Public IP v/s Elastic IP
- AWS Storage Services and How to select them
- Instance Store
- Elastic Block Store (EBS), its features and Volume types
- Solid State Drive: General Purpose SSD and Provisioned IOPS
- Hard Disk Drive: Throughput Optimised HDD and Cold HDD
- Snapshots
- Elastic File System (EFS) and its Features
- EBS v/s EFS
- Cost Optimization

# Objectives

After completing this module, you should be able to:

- Work with EC2
- Understand Amazon Machine Image (AMI)
- Describe Security Groups, Key Pairs and Tenancy
- Differentiate between Elastic IP and Public IP
- Analyze various EC2 box configuration available
- Use different AWS Storage Services
- Optimize the cost in EC2

# What Is EC2?

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# What Is EC2?

- EC2 is a web service that provides servers in the cloud which are customized as per need
- It is highly ***scalable*** and works on ***pay-as-you-go*** model

# Benefits Of EC2

# What Is AMI?

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# What Is AMI?

AMI

AMI provides the ***information*** required to launch the EC2 instance

AMI includes the ***pre-configured templates*** of the operating system that runs on the AWS

Users can launch multiple instances with the ***same configuration*** from a single AMI

# Security Groups In AWS

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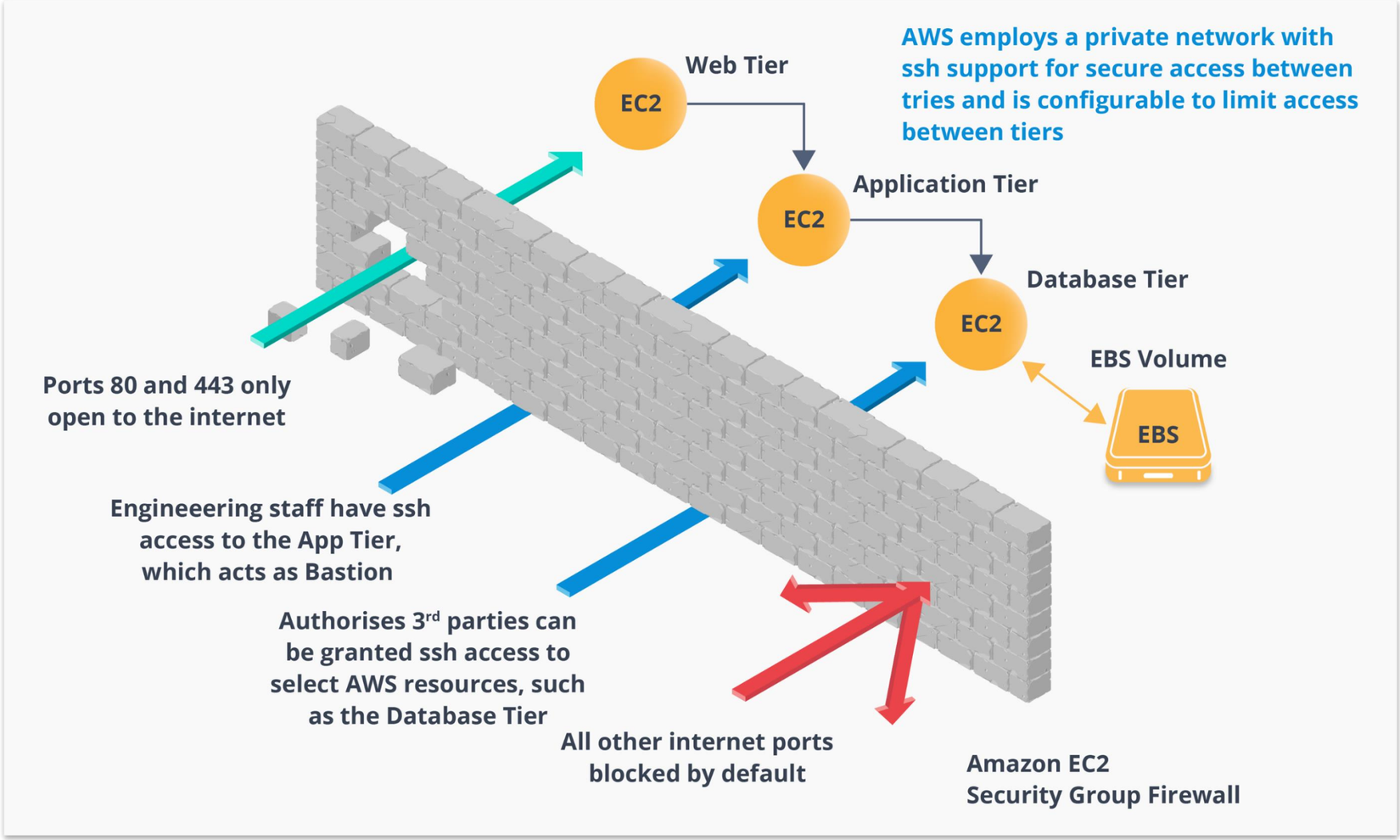
# Security Groups In AWS

1. A Security Group acts as a ***virtual firewall*** that controls the traffic for one or more instances
2. The traffic can be either ***inbound or outbound*** from an instance
3. It secures the instance through ***IP protocol***, port access and through the source or the destination address
4. Instances associated with the security group cannot talk to each other, if there is no ***explicit rule*** to allow it
5. Can be attached to an ***Elastic Network Interface***(ENI)

# Security Groups – Example



# Authentication Through Key-Pair

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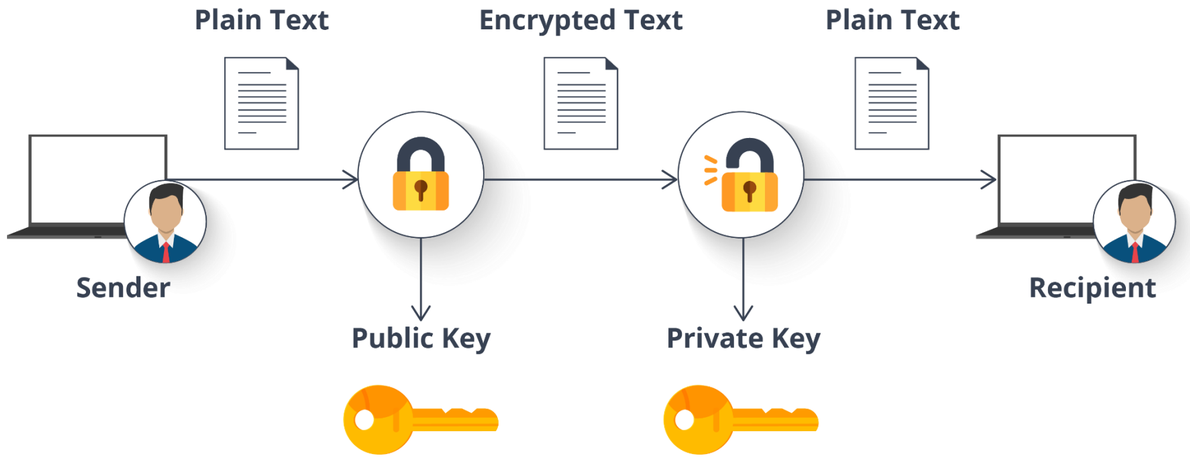
# What Is A Key-Pair?

- ***Public key*** + ***Private Key*** = ***Key Pair***
- Amazon EC2 uses public and private key cryptography to encrypt and decrypt information while connecting to EC2
- Public key is used to encrypt a data, while recipient uses private key to decrypt the same
- AWS issues ***.pem*** file, client needs to convert it to a format which is recognized by client software




To provide an authentication to an instance, a key is required

# DEMO – Host Your Website Inside Your EC2 Instance

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# Demo: Host Your Website Inside Your EC2 Instance

1. Connect to EC2 instance from any SSH terminal
2. Install Apache server
3. Create a Website
4. Create a Host file
5. Enable the host file
6. Test your website

***Note***: Refer to the Demo-1 in LMS to see the detailed steps

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# DEMO – Creating A Custom AMI

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# DEMO: Creating A Custom AMI

1. Now let us create an image of the instance which we have created in the previous demo
2. Select the existing EC2 instance, for which you have to create the AMI image
3. In actions, select image and then click on create image
4. To verify whether your image is created properly, create an EC2 instance from the AMI

***Note:*** Refer to the Demo-2 in LMS to see the detailed steps

# Hardware Tenancy

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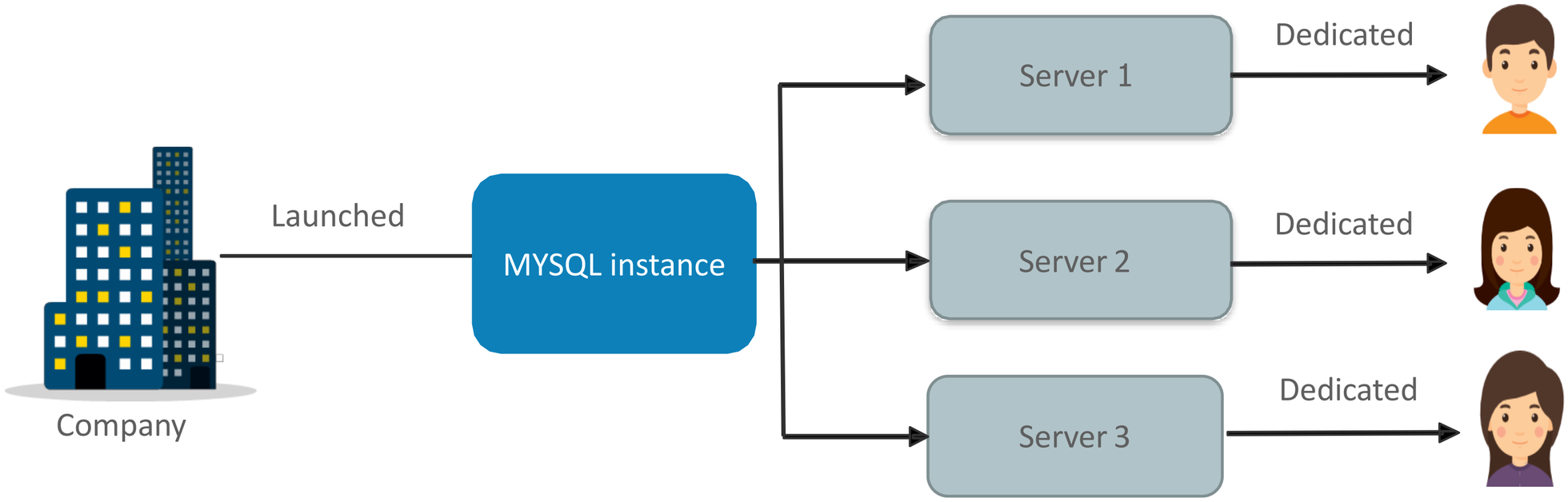
# Hardware Tenancy – Shared v/s Dedicated

***Tenancy*** determines the owner of a resource
AWS provides two types of tenancy to comply with your Organization Regulatory Security

| Shared | Dedicated |
| --- | --- |
| A **single physical machine runs multiple instances which are launched by several AWS customers** | When **an instance is launched, it will ensure that it will run only on single-tenant hardware** |
| All the **customers are served from the same common hardware infrastructure** | Each customer **gets his own machine to run their instance** |

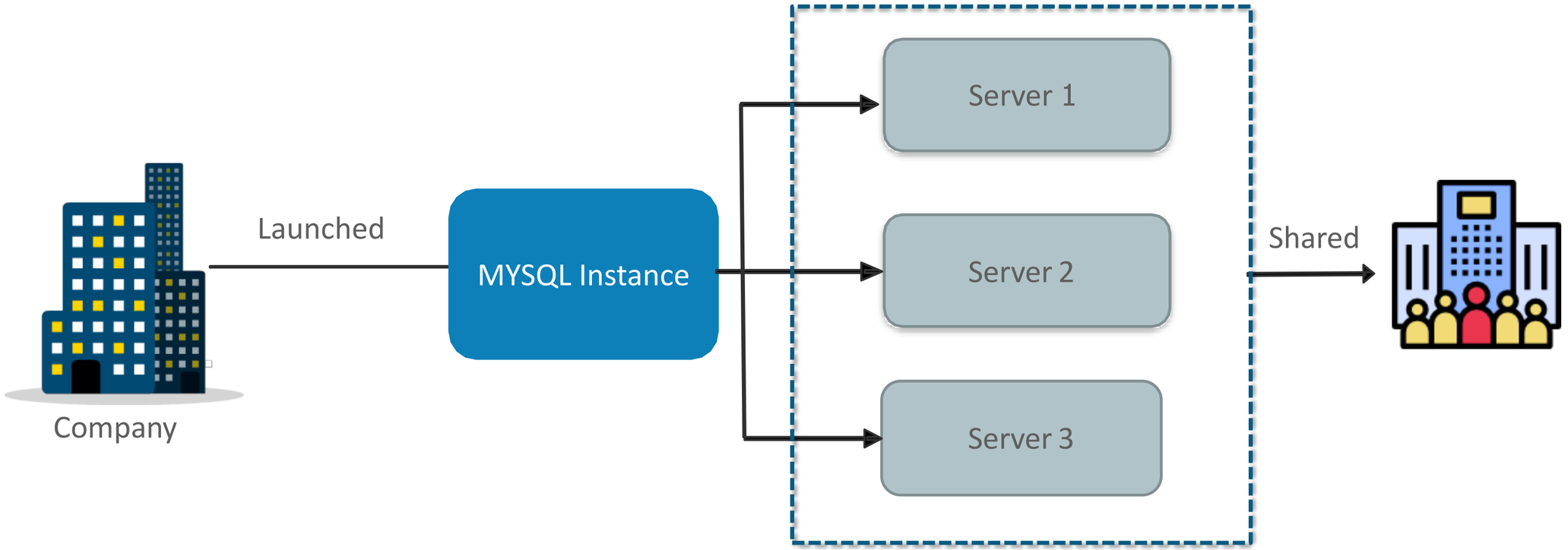
# Hardware Tenancy – Dedicated

If you are opting for ***Dedicated Instance***, Each user will get separate hardware.



# Hardware Tenancy – Shared

For ***Shared Instance***, Servers will be shared across users.



# Networking Layer In EC2

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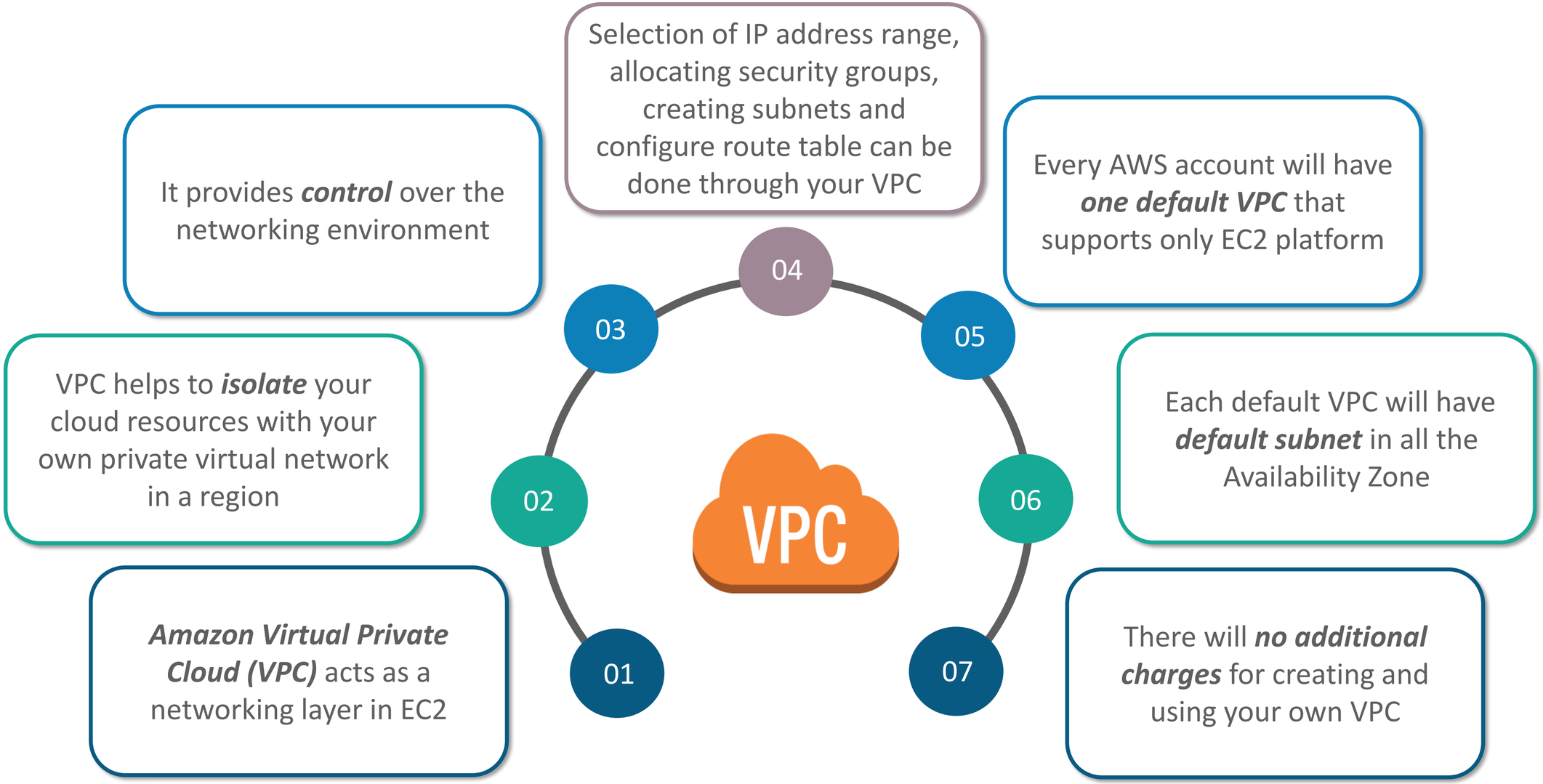
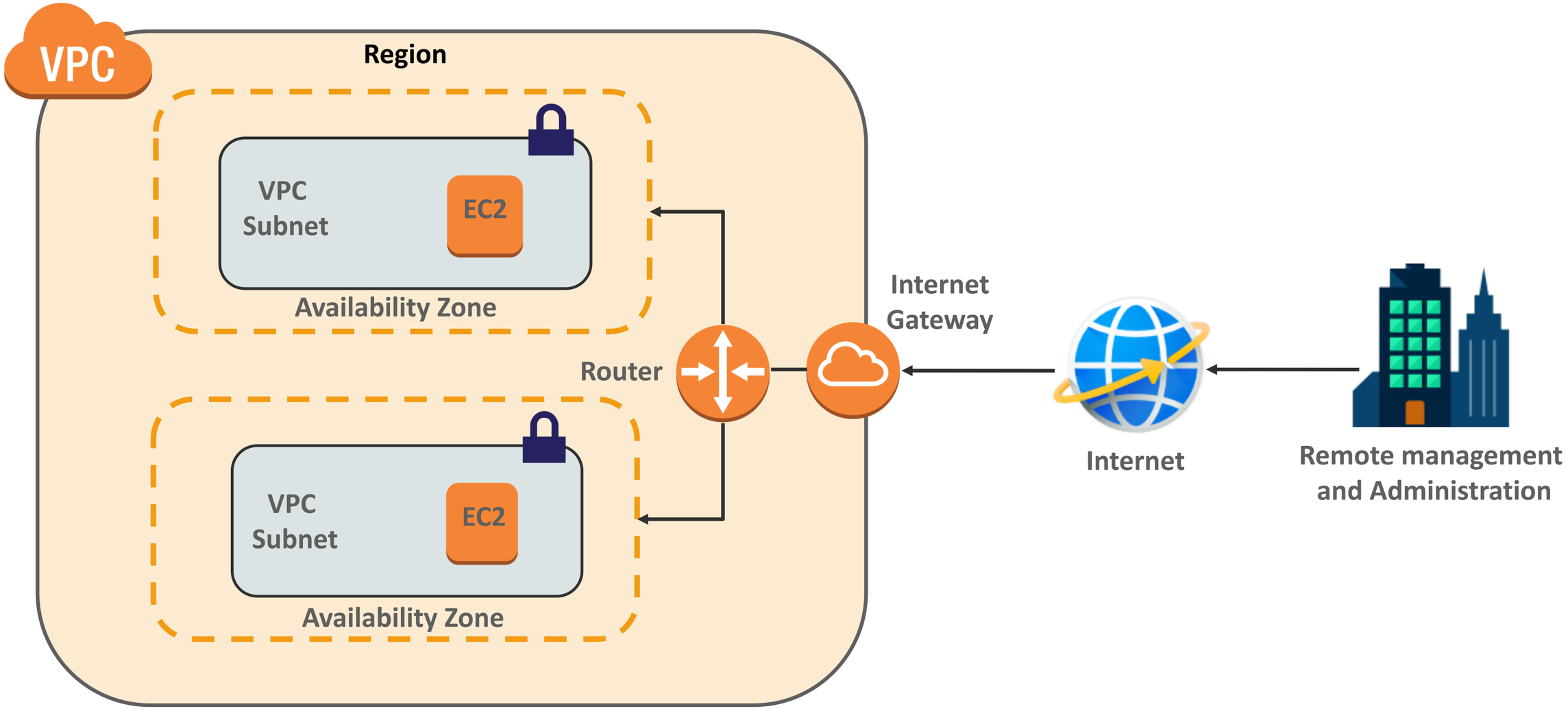
# Networking Layer In EC2

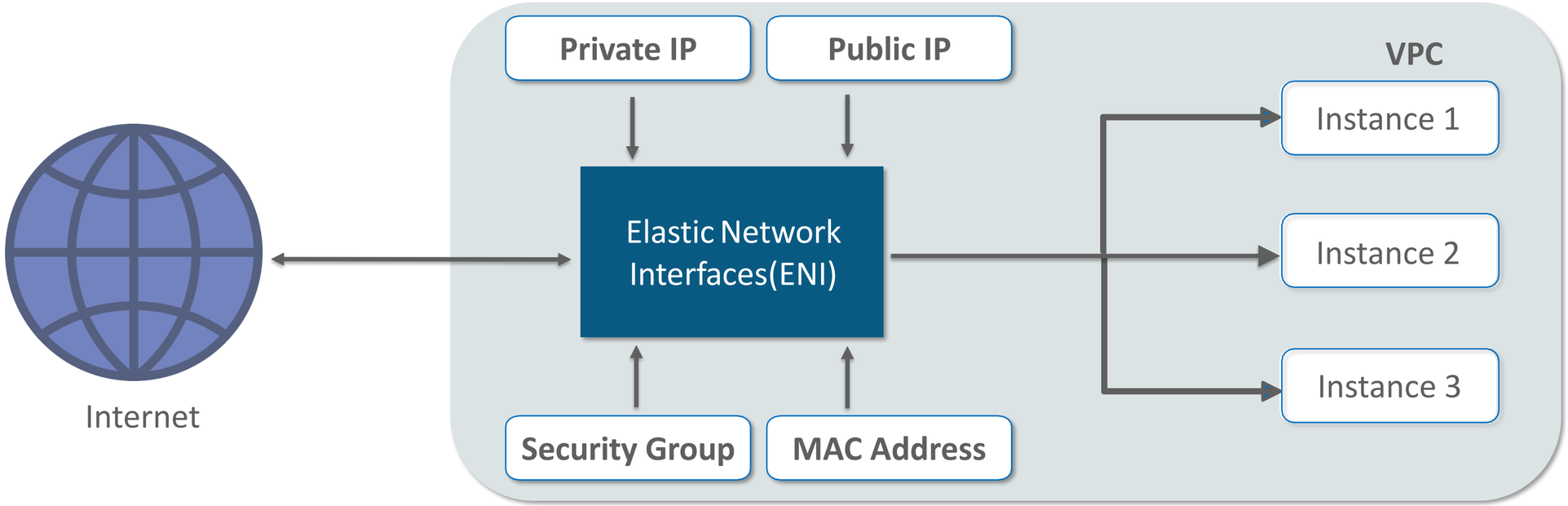


# AWS VPC

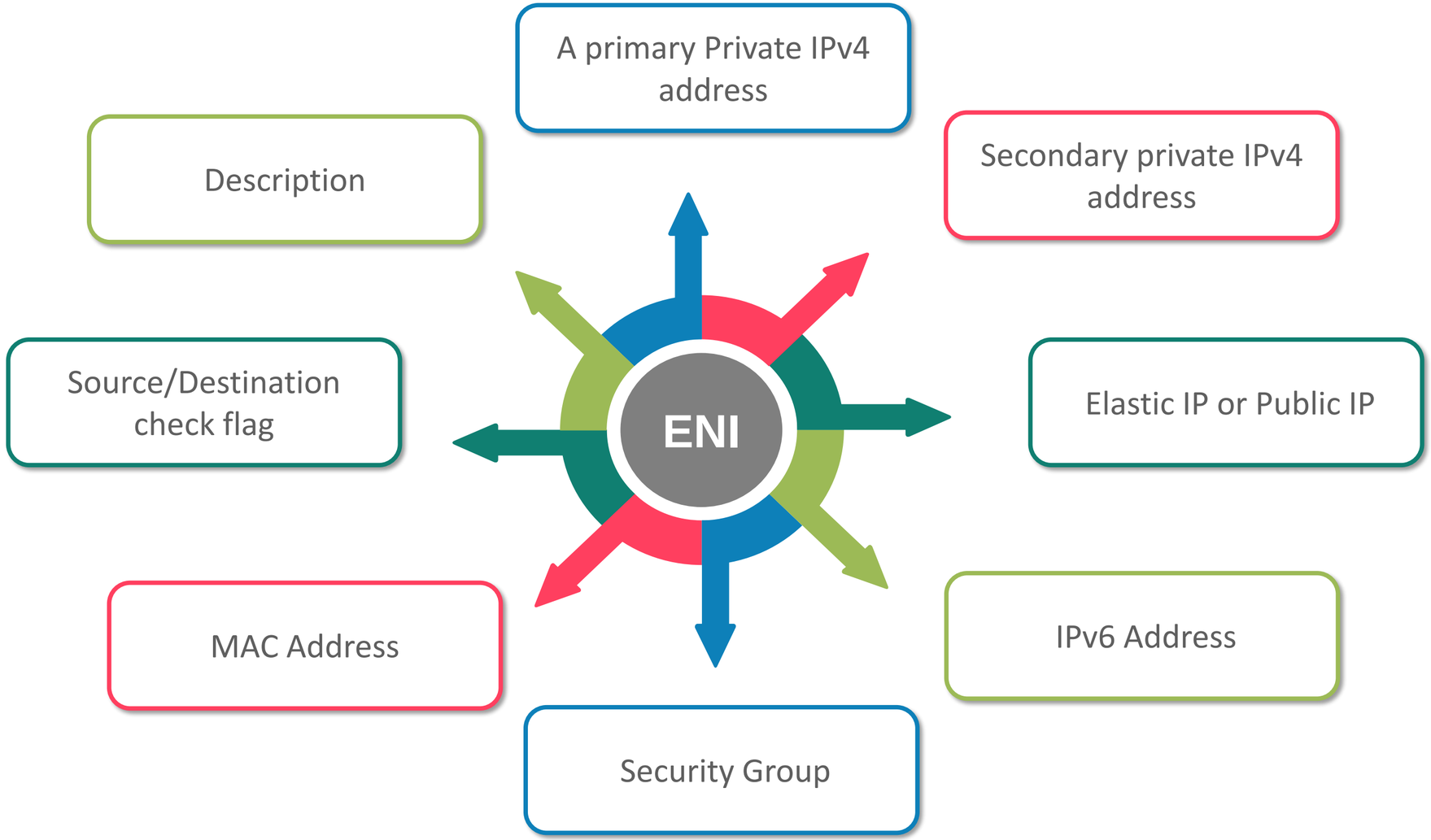


# What Is An Elastic Network Interface?

An ***Elastic Network Interface (ENI)*** is a virtual network interface which acts as a ***point of interface*** between VM and network by attaching a public IP, private IP, security groups and many more to your instance

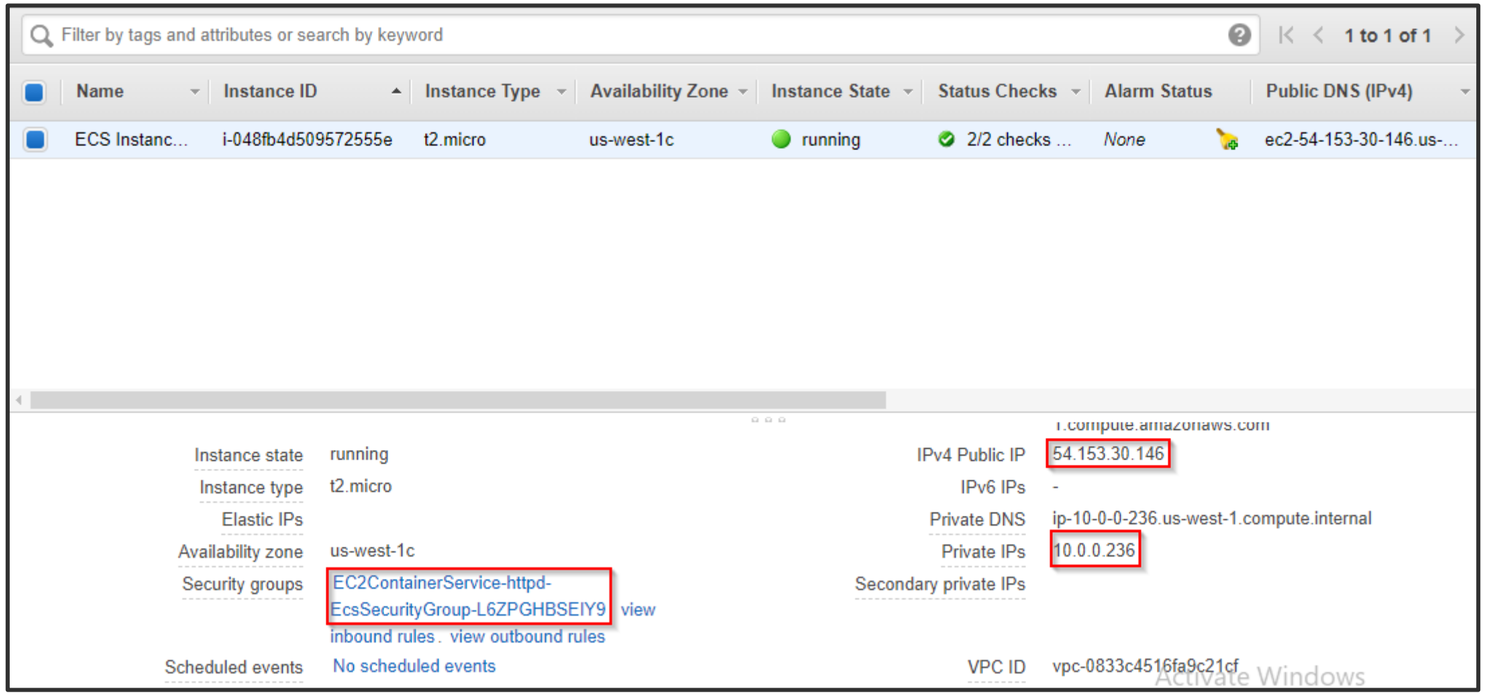


# Attributes Of Elastic Network Interfaces (ENI)



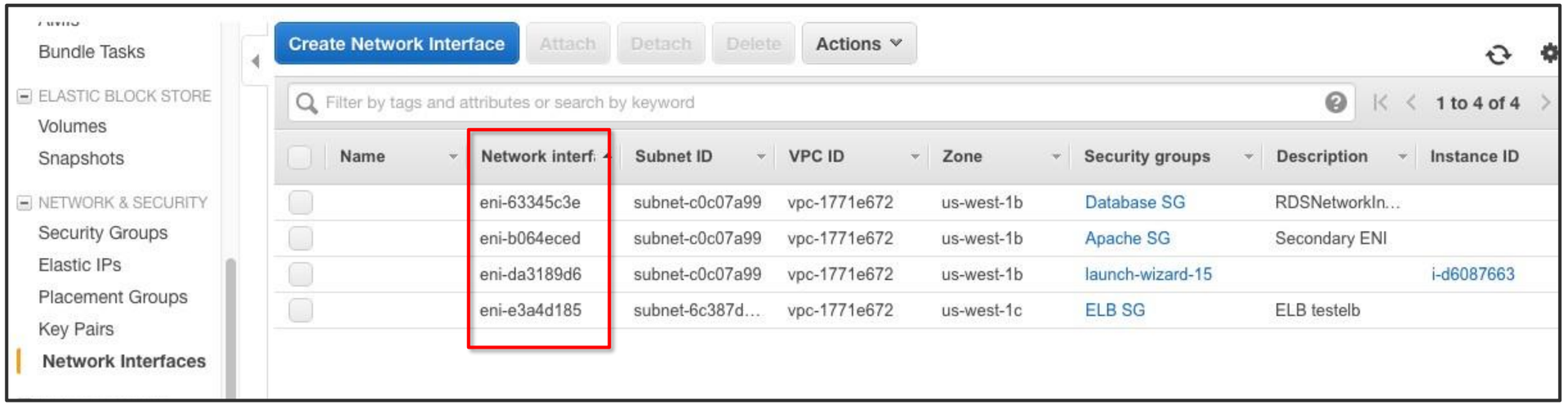
# Elastic Network Interface

Every EC2 instance has a default ENI attached to it.



# Why It Is Elastic?

- Virtual network interface can be attached to multiple instance in a VPC
- An ENI detached from an EC2 instance can be attached to another instance
- Can be created using the Amazon EC2 console or the command line

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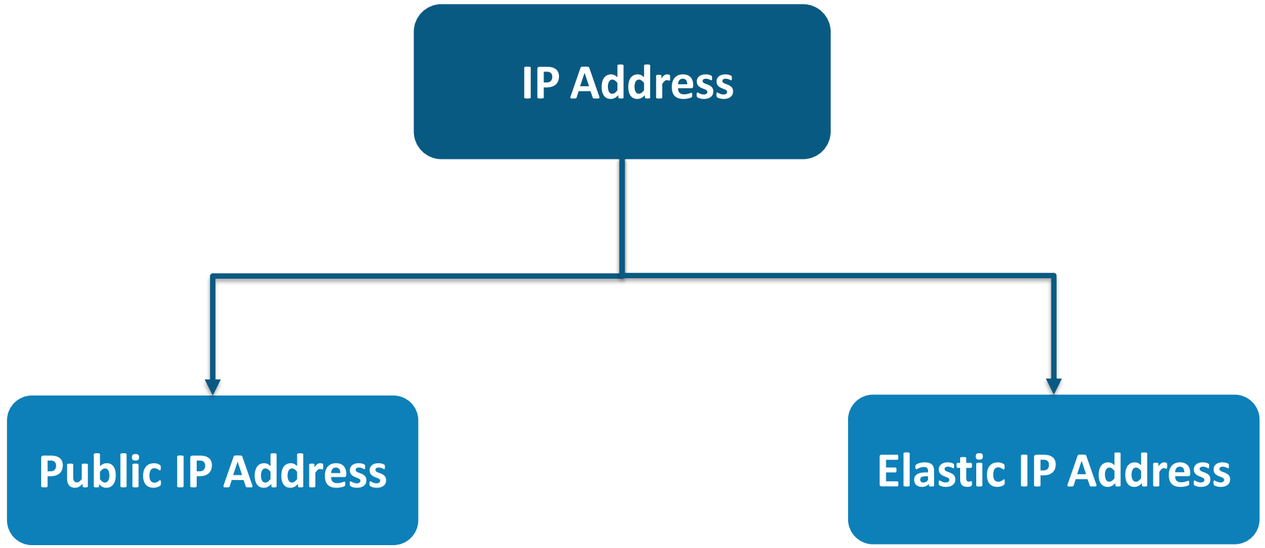
# Different Categories Of IP Address

In AWS, specific ***IP Address*** is given to each Instance which helps to ***communicate*** it to the server and to establish the connection between the machines



# Difference Between Public And Elastic IP

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# Public IP v/s Elastic IP

| Public **IP** | Elastic **IP** |
| --- | --- |
| Public IP gets changed when we restart the instance | Elastic IP does not get changed when we restart the instance |
| Assigned to the instance from the Amazon's pools of IP address automatically | Assigned to the account manually |
| No Extra **cost** | Hourly charges are **applied for every EIP that are not attached to a running instance** |

# Elastic IP Address

01 Elastic IP addresses are static IP addresses that ***does not change*** while restarting the instance

02 An Elastic IP address is ***allocated*** to your account unless you release it

03 You are limited to ***5 EIPs per region***, but request can be given for more EIPs

04 Elastic IP can be created under ***EC2 – Classic*** or ***EC2 – VPC***

If you have an Elastic IP in your account and it's not in use, then **you will be charged** for it

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# DEMO – Create An Elastic IP

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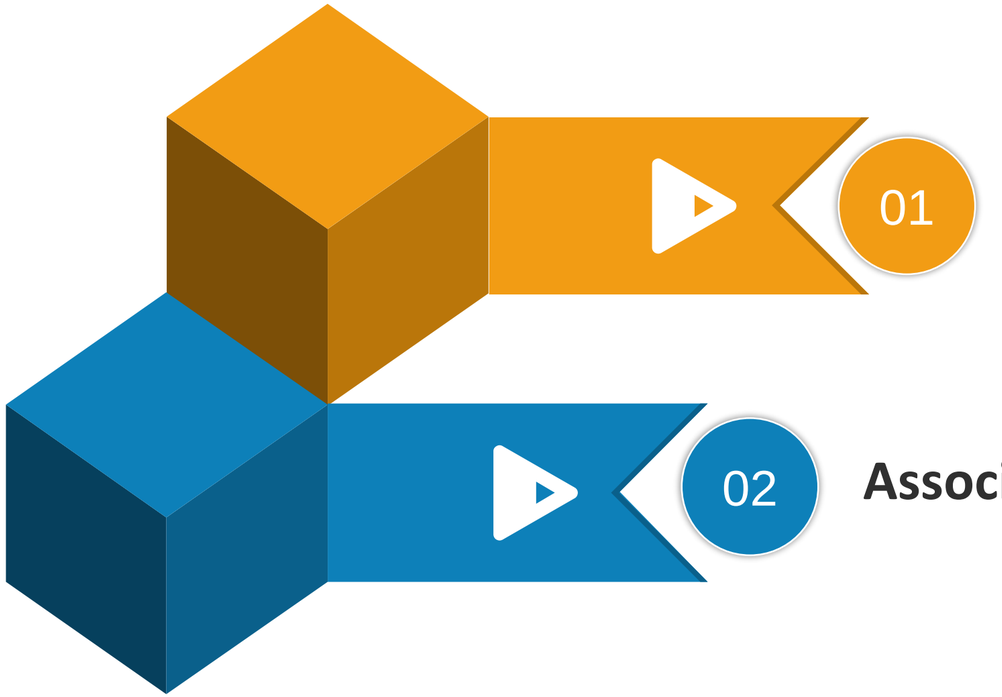
# Demo: Create An Elastic IP



01 **Allocate a new Elastic IP**

02 **Associate the address to your instance**

***Note:*** Refer to the Demo-3 in LMS to see the detailed steps

# AWS Storage Services

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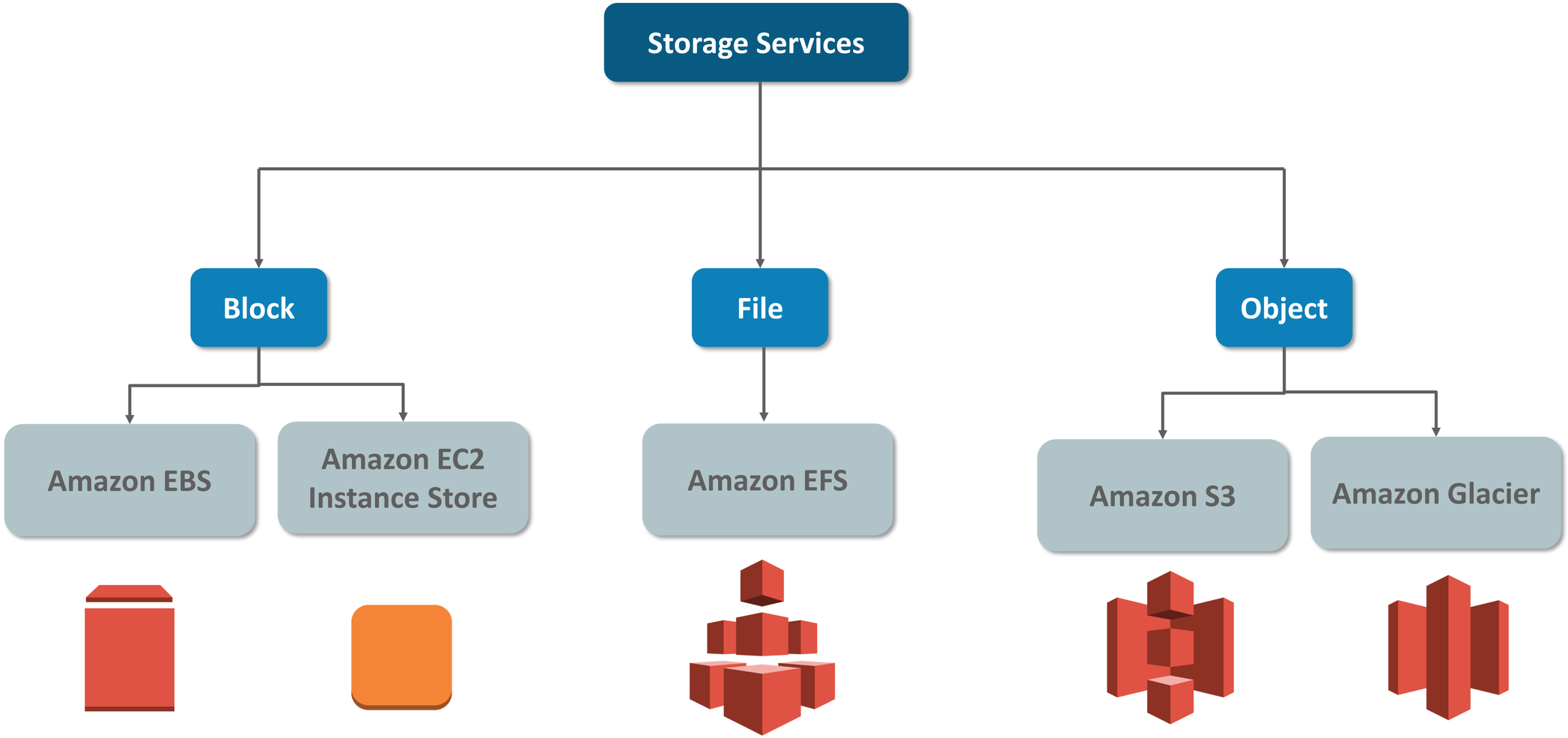
# AWS Storage Services

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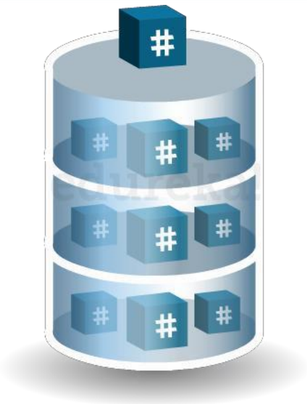
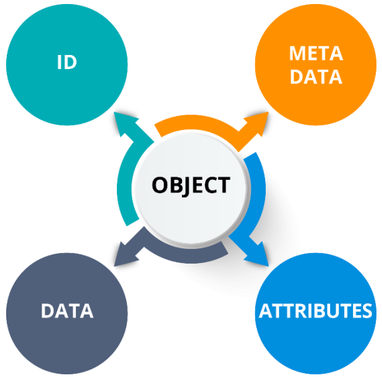
# Storage Services

## Block

- Data is split into evenly sized blocks of data
- Keeps track of the data location without any data format
- It is used as a persistent and unformatted storage





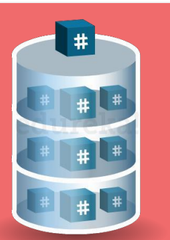

## Object

- Object are the discrete pieces of data
- Direct access to the data without traversing through directories
- It consist of data, metadata and object identifier

## File

- Data structures that keep track of the related set of data
- File have metadata (file name ,type and date)

# How To Select The Storage Service?



## BLOCK STORAGE

***Accessed by:***

Only one instance at a time but an instance can have many block storage attached to it

***Storage Services:***

EBS, Instance store

***Use cases:***

Structured database

Virtual volumes


## OBJECT STORAGE

***Accessed by:***

The Users who have the access to the bucket through http or https or API

***Storages Services:***

S3, Glacier

***Use cases:***

Archival data

Public cloud storage

Analytics

## FILE STORAGE

***Accessed by:***

Multiple instance through NFS protocols

***Storages Services:***

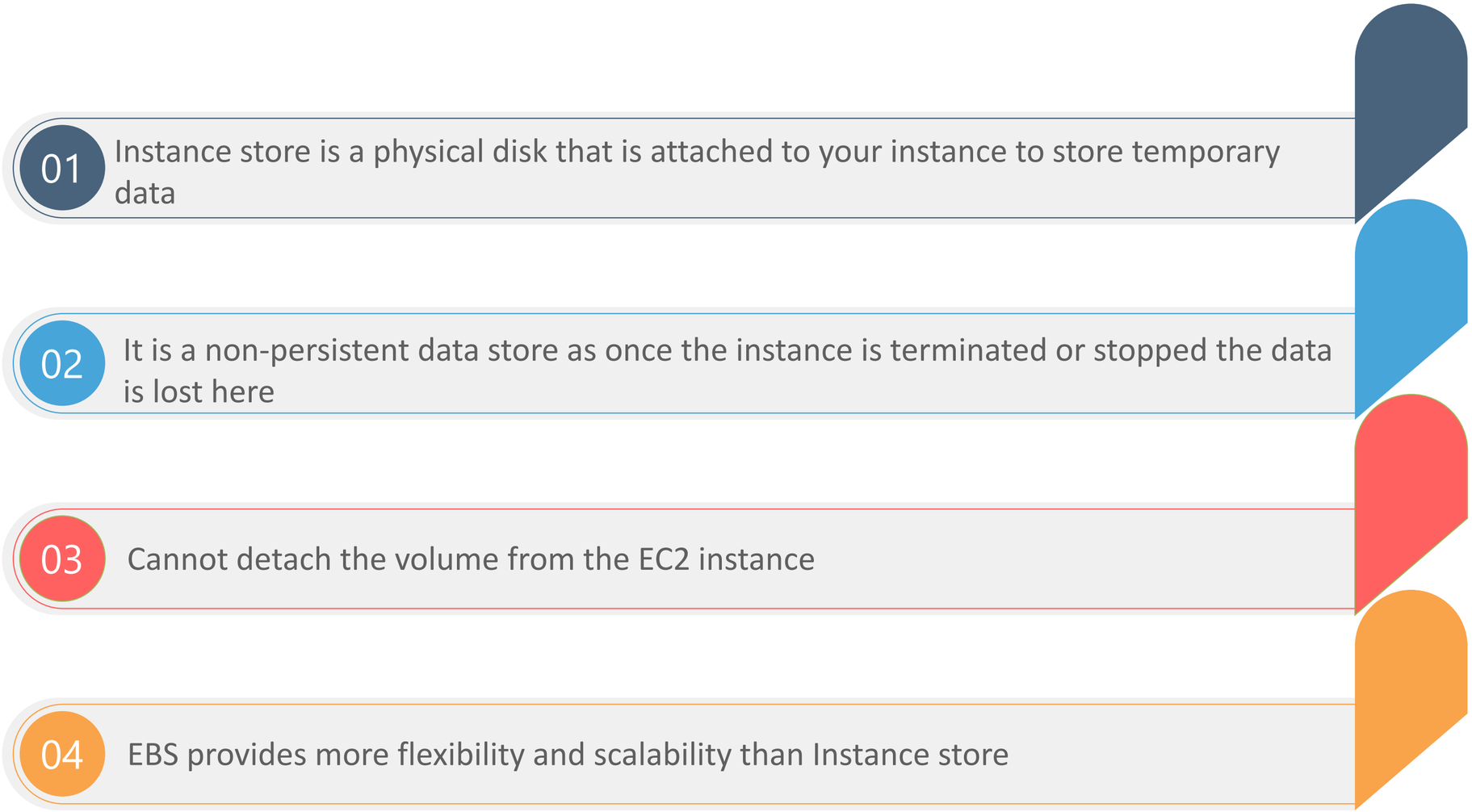
EFS

***Use cases:***

Document sharing

Clustered database

# Instance Store



# Instance Store

Instance type that has instance store

**Default**

- m5d family
- c5d family
- r5d family
- z1d family
- r3 family
- I3 family
- I2 family

**Attached Externally**

- m3 family
- m2 family
- m1 family
- g2 family
- c1 family
- c3 family

**Cannot Be Attached**

- t family
- m4 family
- m5 family
- c4 family
- c5 family
- r4 family
- r5 family

# Elastic Block Store

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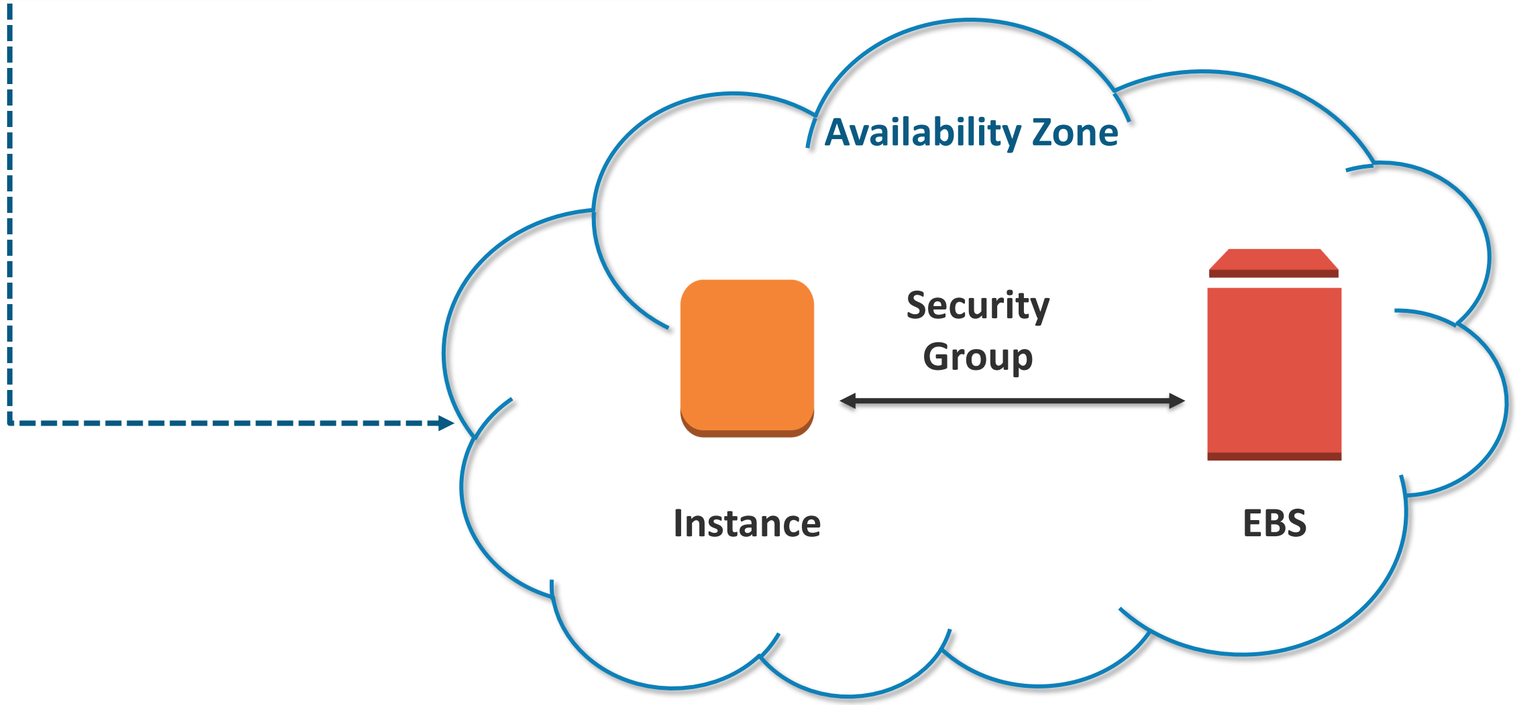
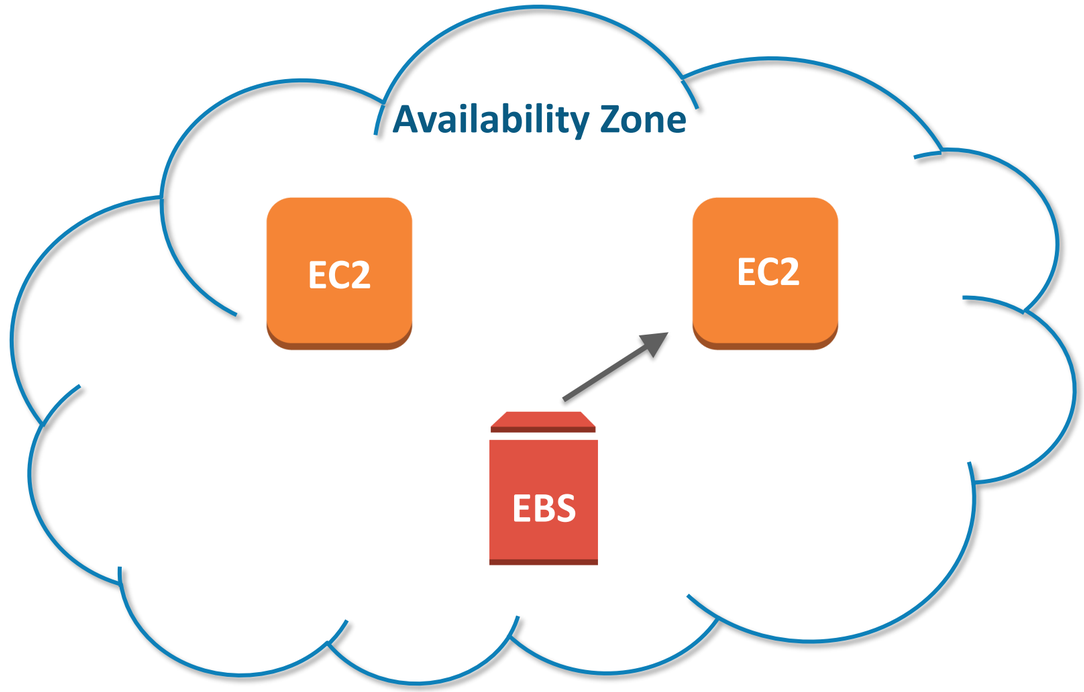
# What Is EBS?

- EBS is the ***logical volumes*** to use it with the EC2 instances
- This type of storage is used, when the data needs to be ***accessed quickly*** and required for the long-time
- Lifetime of the EBS is ***not dependent*** on the EC2 instance
- Volume and instance must be in the ***same Availability Zone***



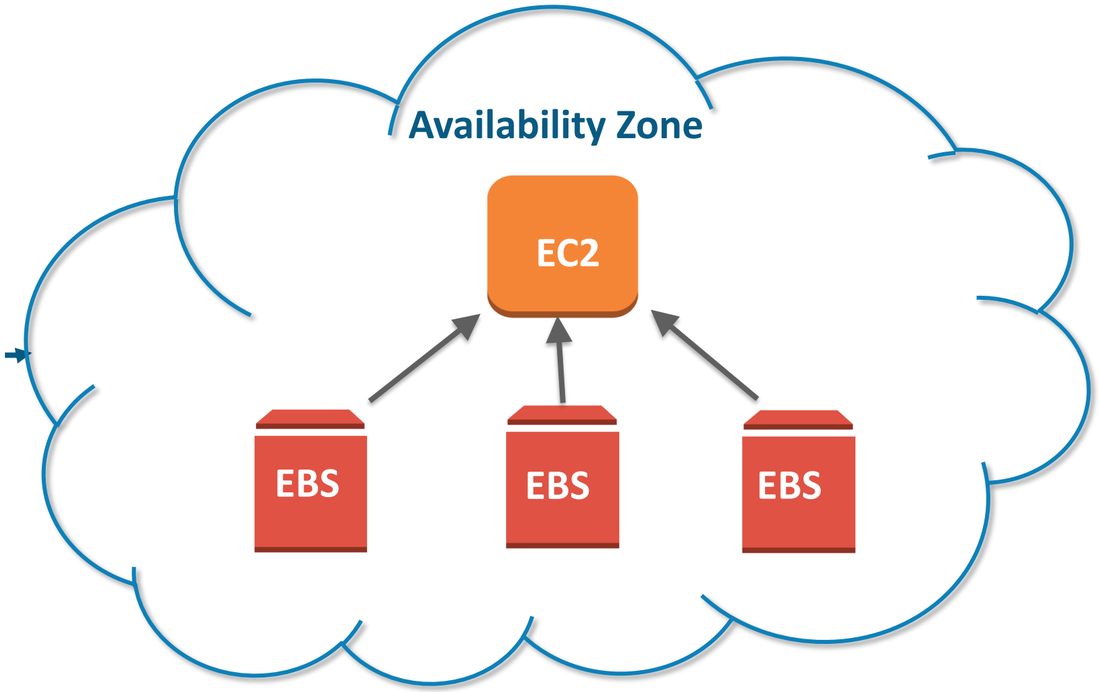
# EBS

- A volume can be attached with only one instance at a time
- It can be detached and attached between the instances in the same Availability Zone



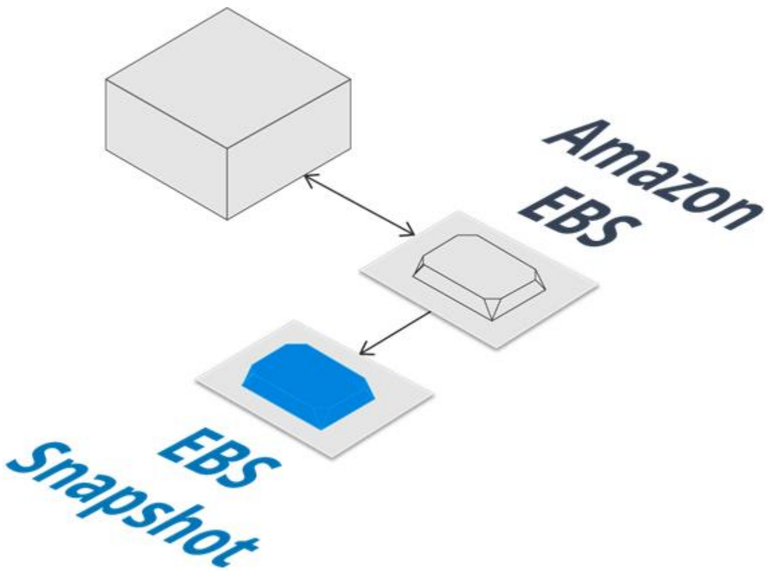
# EBS

Any number of EBS Volumes can be attached with the EC2 instance



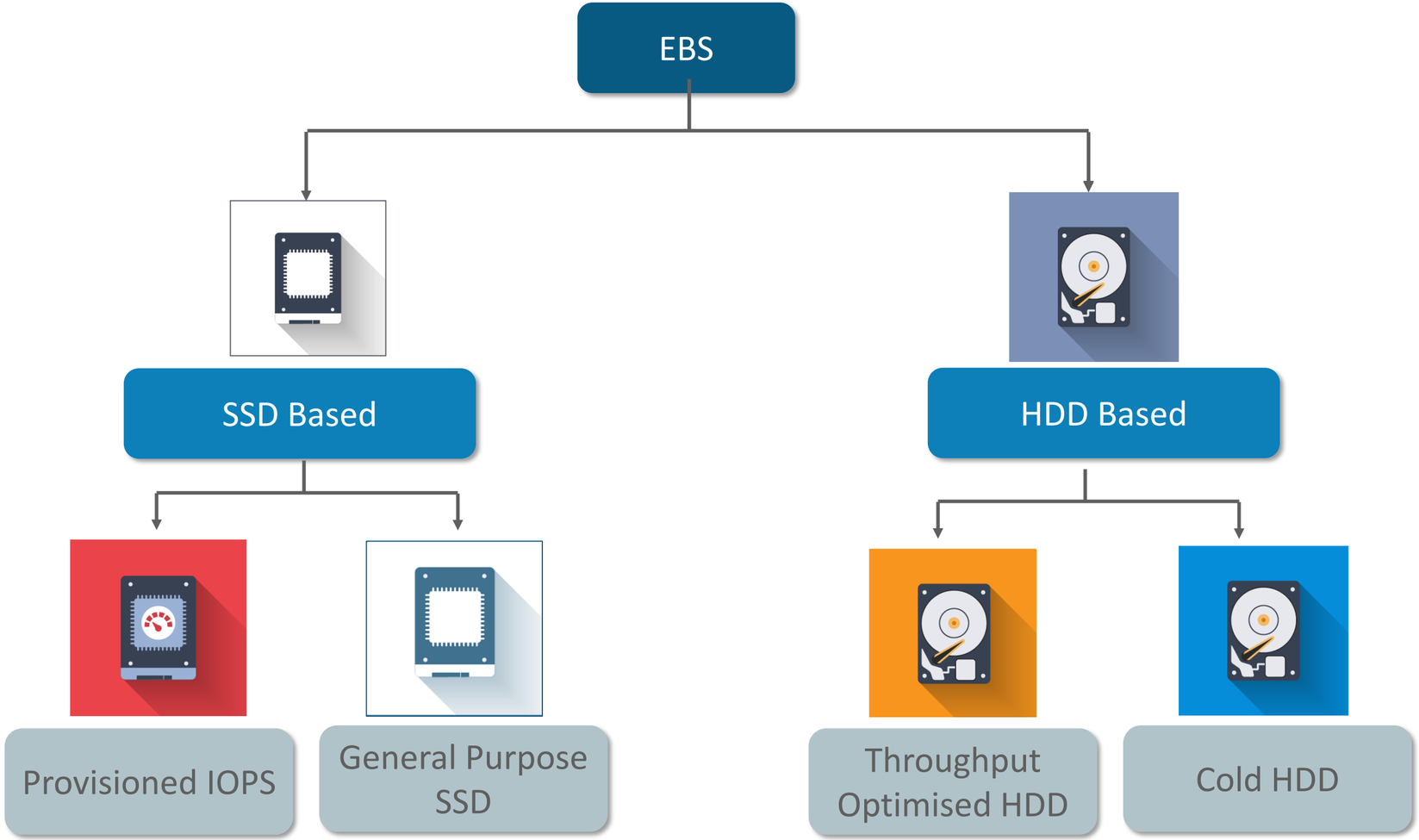
# EBS Features

EBS is a persistent storage for EC2




| Feature | Details |
|---|---|
| High performance file system | Mount EBS as drives and format as required |
| Flexible size | Volumes from 1GB to 1TB in size |
| Secure | Private to your instances |
| Available | Replicated within an Availability Zone |
| Backups | Volumes can be snapshotted for point in time restore |
| Monitoring | Detailed metrics captured via Cloud Watch |

# EBS Volume Types

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# Solid State Drive And It’s Types

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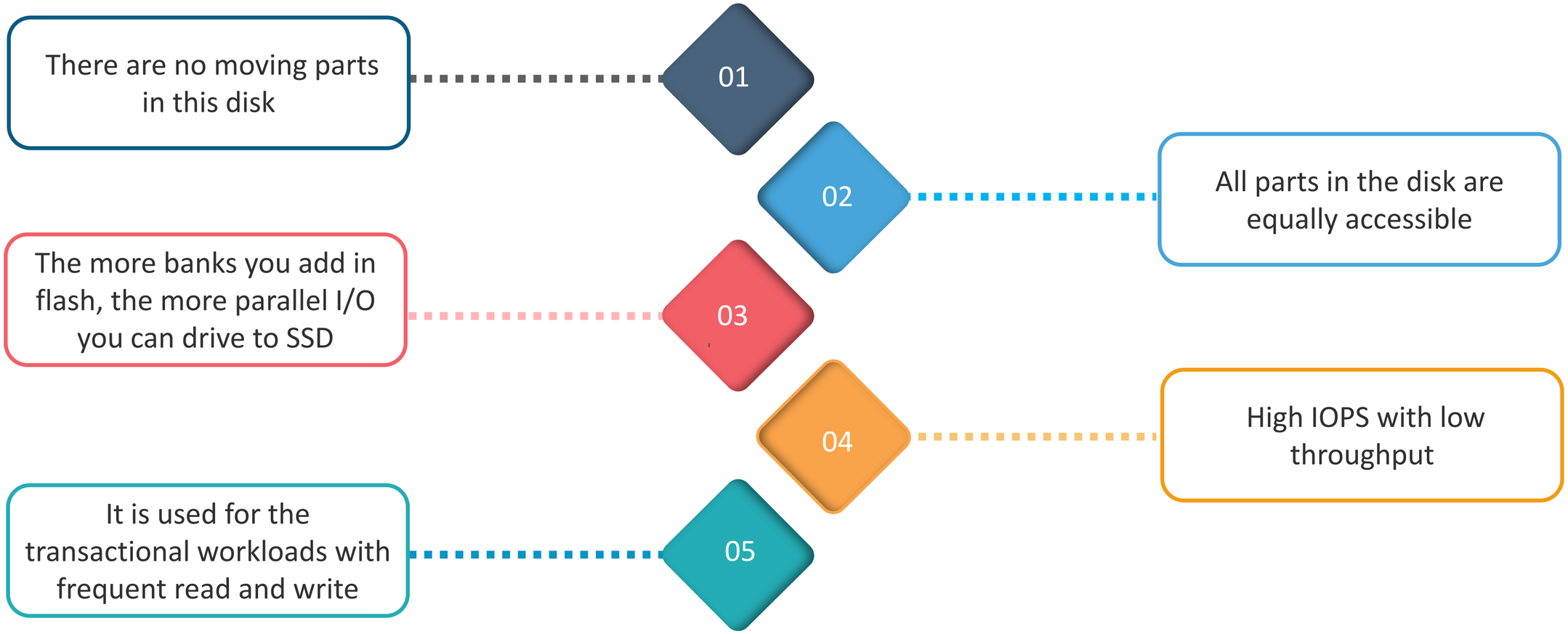
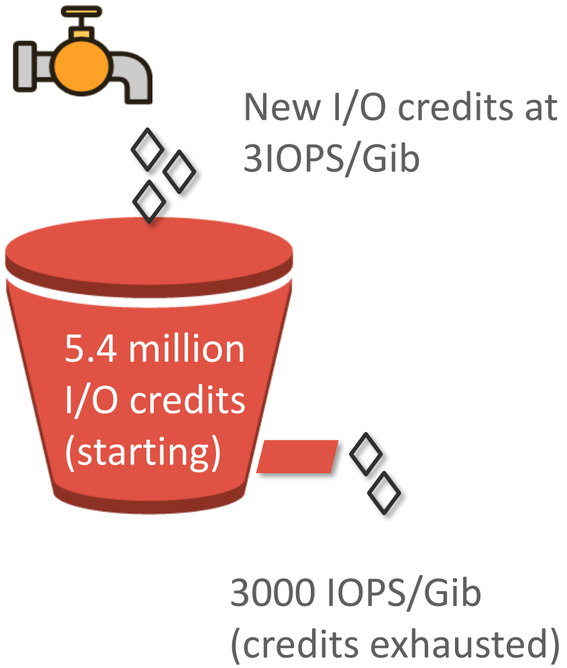
# Solid State Drive(SSD)



# General Purpose SSD(gp2)

- gp2 consists of the token bucket, which is constantly accumulating 3IOPS/GiB/sec
- The bucket can consist a maximum of 5.4 million I/O credits
- It starts the execution only after the bucket is full
- Once the bucket is full, it executes 3000 IOPS /Gib which is called a BURST
- Cost efficient model data type

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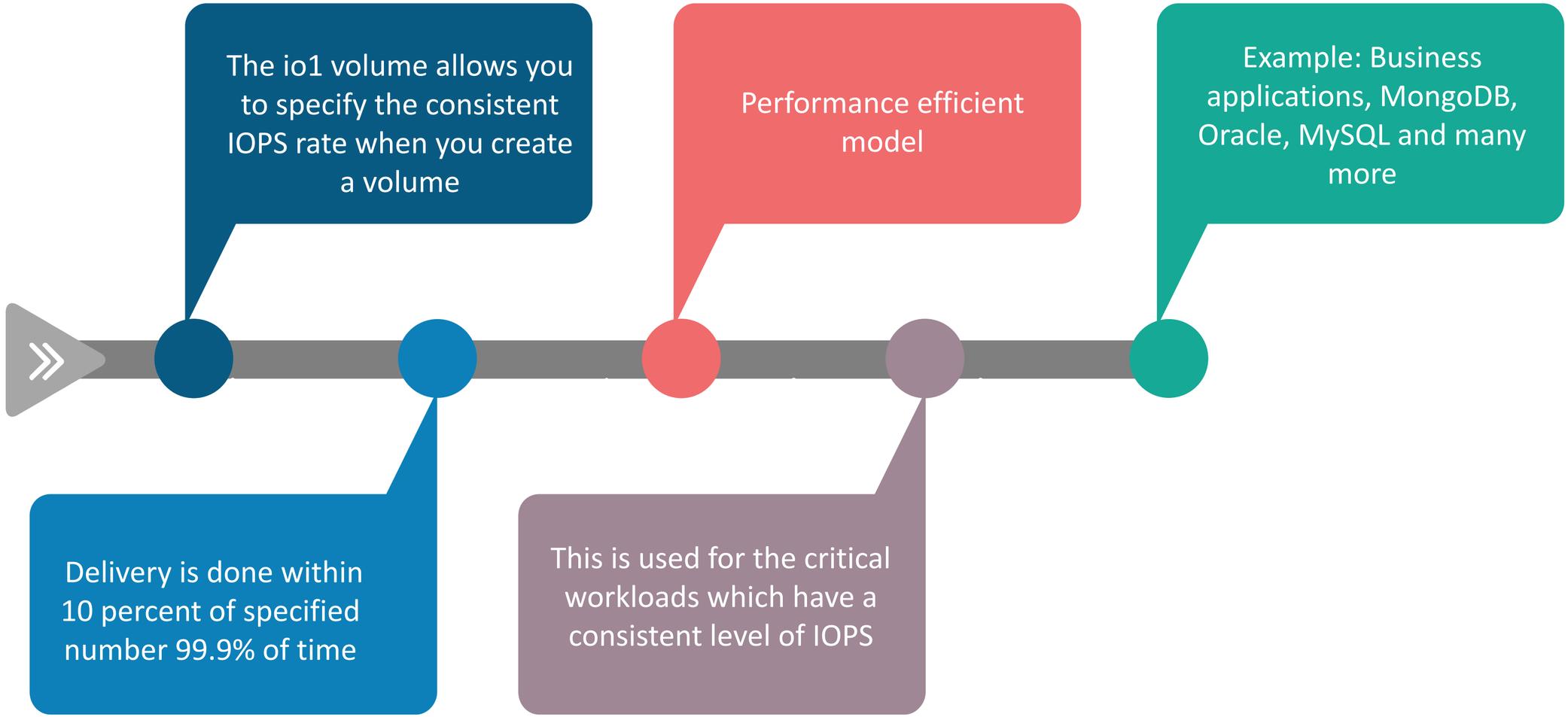
# Provisioned IOPS(io1)



# Hard Disk Drive And It’s Types

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# Hard Disk Drive (HDD)

HDD is the spinning magnetic hard disk

High throughput with less IOPS can be achieved


Here, the head has to be placed exactly in the place where you need to read or write

It is used for large streaming workloads

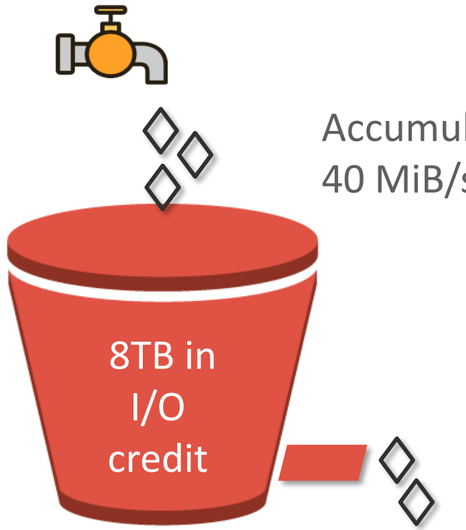
But when we place the head at the exact place, we can read the sequential data

# Throughput Optimised HDD (st1)

st1 consist of the bucket, which scales with the volume

Bigger the volume, bigger the bucket

The throughput of the volume will be increased with the size




Accumulate at
40 MiB/s per TiB

Spend up to
250 MiB/s

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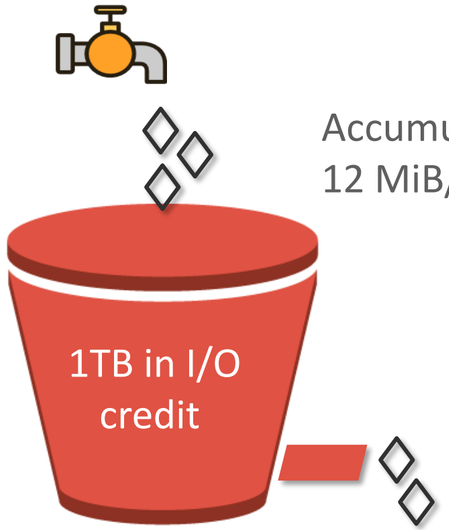
# Cold HDD (sc1)

sc1 is a low cost magnetic disk

It is used for the ***infrequent access*** of the data

Cost effective model compared to st1




Accumulate at
12 MiB/s per TiB

Spend up to 80
MiB/s

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# DEMO – Attaching An EBS Volume Externally

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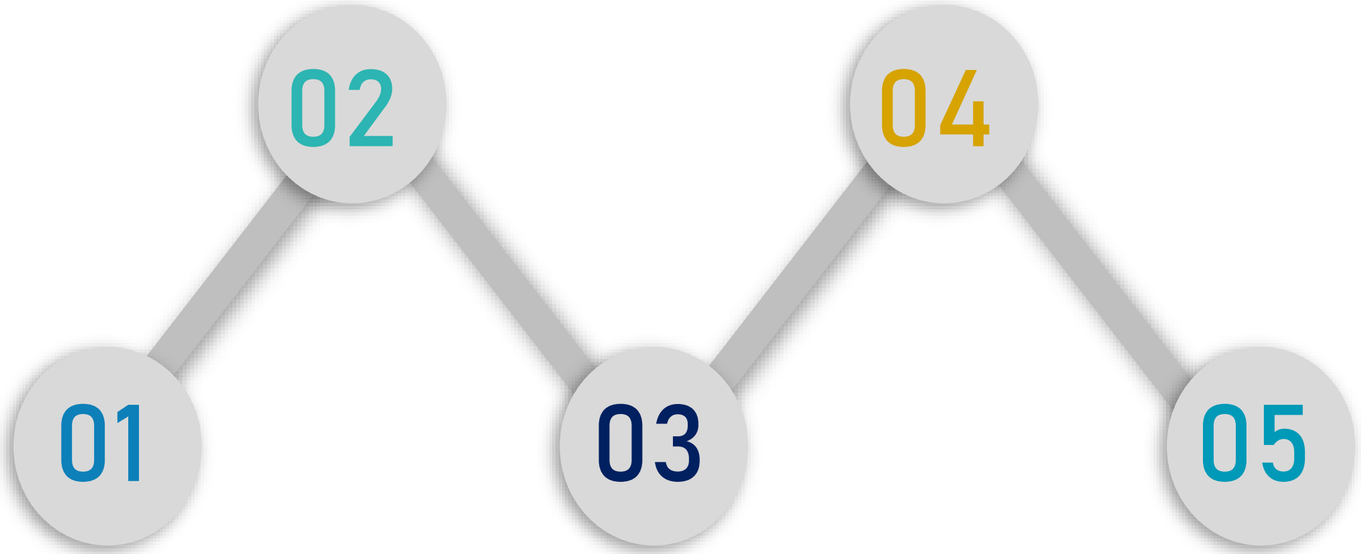
# DEMO: Attaching An EBS Volume Externally




***Note:*** Refer to the Demo-4 in LMS to see the detailed steps

# Snapshots

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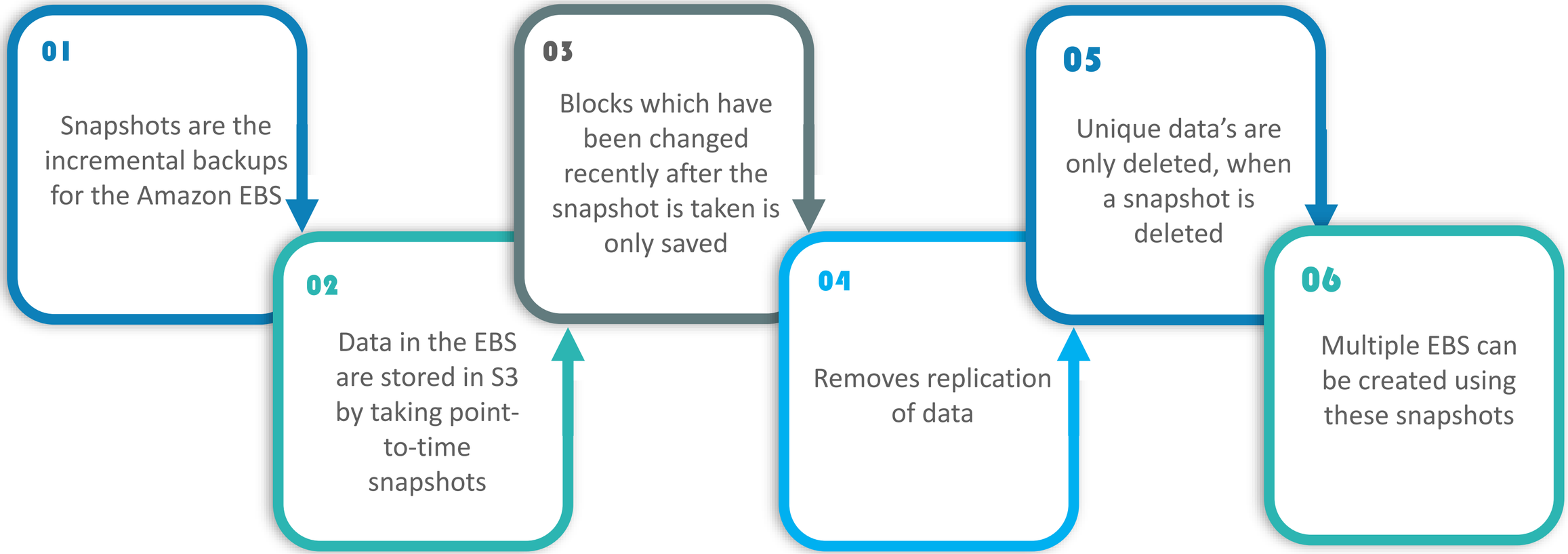
# Snapshots



# Demo – Create A Snapshot

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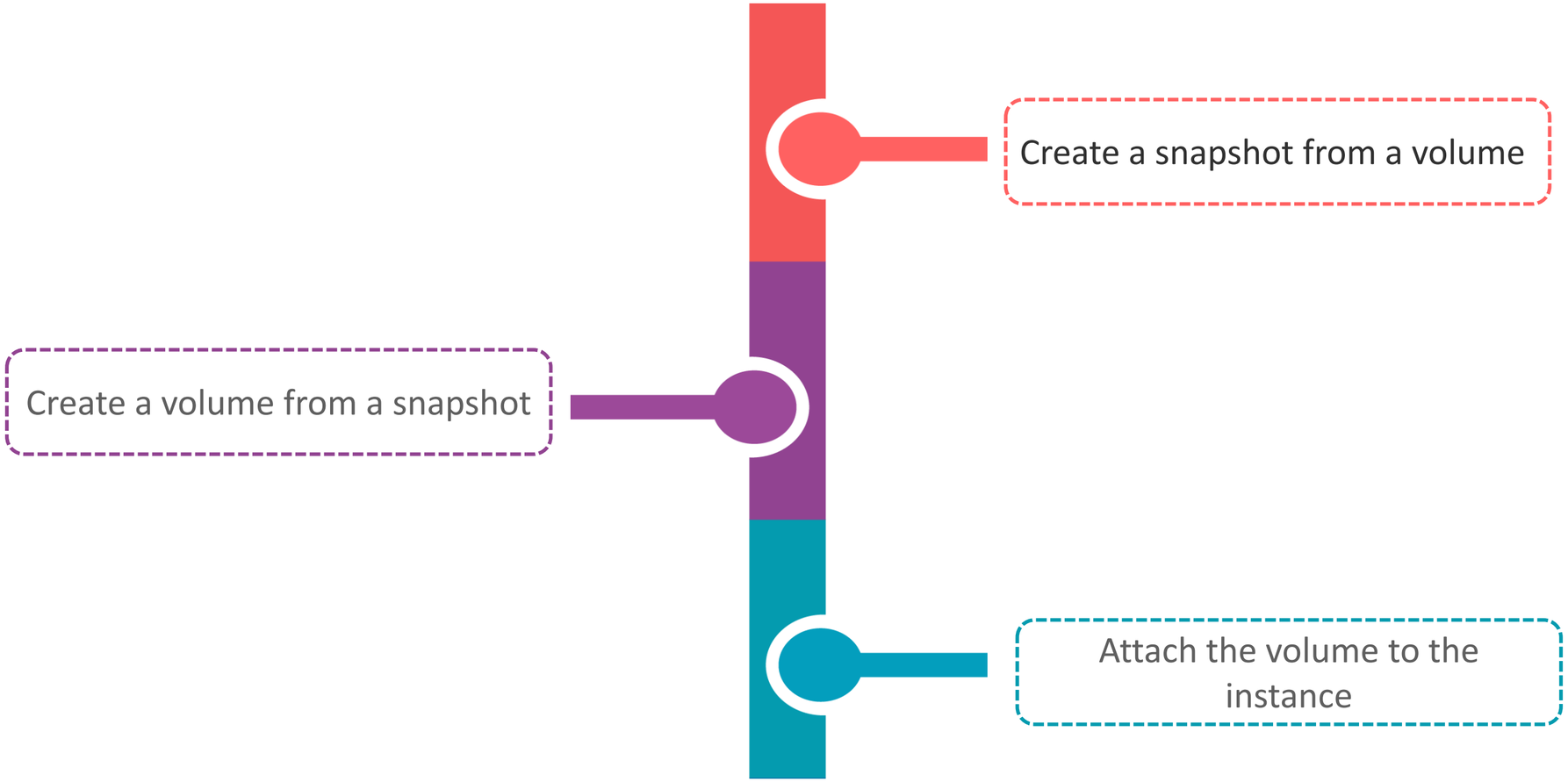
# Demo: Create A Snapshot




***Note:*** Refer to the Demo-5 in LMS to see the detailed steps

# Elastic File System (EFS)

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# Disadvantage Of On-Premise File Storage

**IT Administrator**

- Estimate demand
- Procure hardware
- Set aside physical space
- Set up and maintain hardware (and network)
- Manage access and security

**Application Owner or Developer**

- Provide demand forecasts/business case
- Add lead times and extra coordination to your schedule
- Limit your flexibility and agility

**Business Owner**

- Make up-front capital investments, over-buy, stay on a constant upgrade/refresh cycle
- Sacrifice business agility
- Distract your people from your business's mission

# What Is Amazon EFS?

**01**

A fully managed file system for Amazon EC2 Instances

02

Exposes a file system interface that works with standard operating system APIs

03

Provides file system access semantics (consistency)

04

Sharable across thousands of Instances

05

Designed to grow elastically to petabyte scale

06

Built for performance across a wide variety of workloads

07

Highly available and durable

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# EFS Features

Simple

Elastic

Scalable

Highly Durable and Available

- Fully managed
  - No hardware, network, file layer
  - Create a scalable file system in seconds
- Seamless integration with existing tools and apps
  - NFS v4.1—widespread, open
  - Standard file system access semantics
  - Works with standard OS file system APIs
- Simple pricing = simple forecasting

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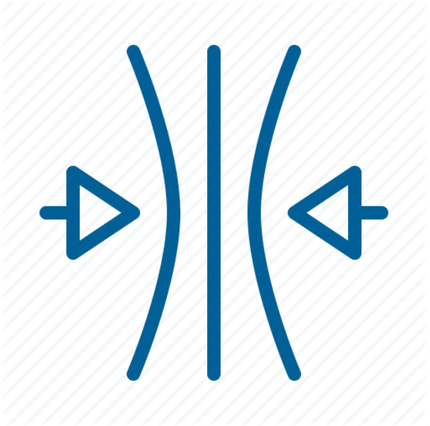
# EFS Features

Simple

Elastic

Scalable

Highly Durable and Available



- File systems grow and shrink automatically as you add and remove files
- No need to provision storage capacity or performance
- You pay only for the storage space you use, with no minimum fee

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# EFS Features

Simple

Elastic

Scalable

Highly Durable and Available

- File systems can grow to petabyte scale
- Throughput and IOPS scale automatically as file systems grow
- Consistent low latencies regardless of file system size
- Support for thousands of concurrent NFS connections

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# EFS Features

Simple

Elastic

Scalable

Highly Durable and Available

- Designed to sustain AZ offline conditions
- Superior to traditional Network Attached Storage(NAS) availability models
- Appropriate for production/tier 0 applications

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# DEMO – Attaching An EFS Volume

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# DEMO: Attaching an EFS Volume

1. Go to AWS console, under storage select the EFS
2. Create a file system in it
3. Mount the file system to the EC2 instance

***Note:*** Refer to the Demo-6 in LMS to see the detailed steps

# Difference Between EBS And EFS

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# EBS v/s EFS

| Features | EBS | EFS |
|---|---|---|
| **Storage Size** | Maximum storage size of 16 TB | No limitation |
| **File Size** | No Limitation | Single file can have maximum **52TiB** |
| **Performance** | Without stopping instance volume can be scaled manually | It supports up to 7000 file system operations per second |
| **Data Store** | Data is stored in same Availability Zone and can be replicated within the same AZs | Data is stored in region and replicated within the region |
| **Date Access** | Can Be accesses from only one EC2 | Can be accessed from 1-10 EC2 instance from multi AZs parallel |
| **Availability *Zone Failure*** | Without point-in-time backup it will fail | Can survive |
| **Permissions** | Supports ex3 and ext4 and other various file systems | EFS can be used as NFS for on-premise servers too using AWS Direct Connect |
| **Encryption** | KMS Managed Keys | SKMS Managed Keys and AES 256 |

# Cost Optimization

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# Cost Optimization

On Demand Instances

Reserved Instances

Spot Instances

- Instance are provided here ***On-demand***
- ***Pay only*** for EC2 instance ***you use***
- There will not be any upfront charges
- ***Prices will be decided by AWS*** and it will be displayed on the AWS Website
- It is ***charged in hours or seconds*** for the services you are using
- It frees you from the ***planning, purchasing and maintaining*** hardware

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# Cost Optimization

On Demand Instances

Reserved Instances

Spot Instances

- ***Capacity reservation*** for EC2 instance is ***done priory***
- The reserved instance is for customers with **predictable workloads**
- ***Payment option*** available in reserved instance: ***all upfront, partial upfront or no upfront***
- It is 75% cheaper than On-Demand Instance
- ***Price*** of the reserved instance ***varies with the Availability Zone***

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# Cost Optimization

On Demand Instances

Reserved Instances

Spot Instances

- In spot instance, the **spot price** that is in ***effect for the time*** period your instances are running is paid
- The spot instances offer spare Compute capacity that optimizes your cost and scales your application throughput up to 10x in the same budget
- This is suitable for the ***workloads which are not critical and are tolerant of interruption***

# Quiz

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# Quiz

1. You need to create an Amazon Machine Image (AMI) for a customer for an application which does not appear to be part of the standard AWS AMI template that you can see in the AWS console. What are the alternative possibilities for creating an AMI on AWS?
   a. You can purchase an AMIs from a third party or can create your own AMI
   b. You can purchase an AMIs from a third party but cannot create your own AMI
   c. Only AWS can create AMIs and you need to request them to create one for you
   d. Only AWS can create AMIs and you need to wait till it becomes available

# Answers

A

1. You need to create an Amazon Machine Image (AMI) for a customer for an application which does not appear to be part of the standard AWS AMI template that you can see in the AWS console. What are the alternative possibilities for creating an AMI on AWS?

   a. You can purchase an AMIs from a third party or can create your own AMI

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   c. Only AWS can create AMIs and you need to request them to create one for you

   d. Only AWS can create AMIs and you need to wait till it becomes available

**Answer A:** AMI can also be purchased from third-part which are available in MarketPlace

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# Quiz

2. When you launch a virtual machine on EC2 what is that virtual machine called?

    a. AMI

    b. Instance

    c. Spot Instance

    d. All of the above

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# Answers

A

2. When you launch a virtual machine on EC2 what is that virtual machine called?

   a. AMI

   b. Instance

   c. Spot Instance

   d. All of the above

**Answer B:** AMIs are the templates from which the instances are derived, Spot Instance is a pricing option

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# Quiz

3. What is the difference between a dedicated host and a dedicated instance?

    a. Dedicated host means, your instance is served by a single machine; dedicated instance means, your instance is accessed by a single user

    b. Dedicated host means, is accessed by a single user; dedicated instance means, a single machine

    c. Dedicated host means your instance is served by a single machine; dedicated instance means instance is accessed by multiple users

    d. Both are same

# Answers

A

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   a. Dedicated host means, your instance is served by a single machine; dedicated instance means, your instance is accessed by a single user

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   c. Dedicated host means your instance is served by a single machine; dedicated instance means instance is accessed by multiple users

   d. Both are same

**Answer A:** Dedicated Host hardware is always single tenancy. i.e. Single machine is reserved for the customer.

# Quiz

4. What will happen when an EC2 instance in a VPC (Virtual Private Cloud) is stopped and started that is associated with Elastic IP?

   a. The Elastic IP will stay associated with the instance
   b. The data on EBS (Elastic Block Store) devices will stay untouched
   c. The ENI (Elastic Network Interface) connection state will not change
   d. All of the above

# Answers

A

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   a. The Elastic IP will stay associated with the instance

   b. The data on EBS (Elastic Block Store) devices will stay untouched

   c. The ENI (Elastic Network Interface) connection state will not change

   d. All of the above

**Answer D:** The elastic IP is the static IP therefore it will stay connected, the data on EBS will be charged according to the amount of storage, therefore the data will not be lost.

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# Quiz

5. Every account in AWS is limited to only 5 Elastic IP addresses by default why?
    a. Public (IPV4) internet addresses are a scarce resource
    b. Only 5 network interfaces per instance
    c. Hardware restrictions
    d. For security reasons

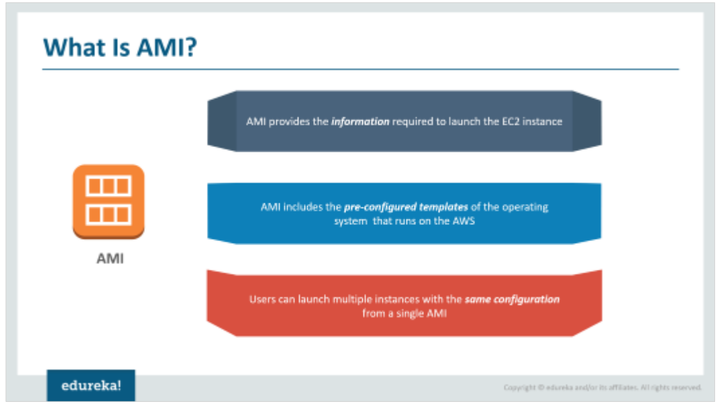
# Answers

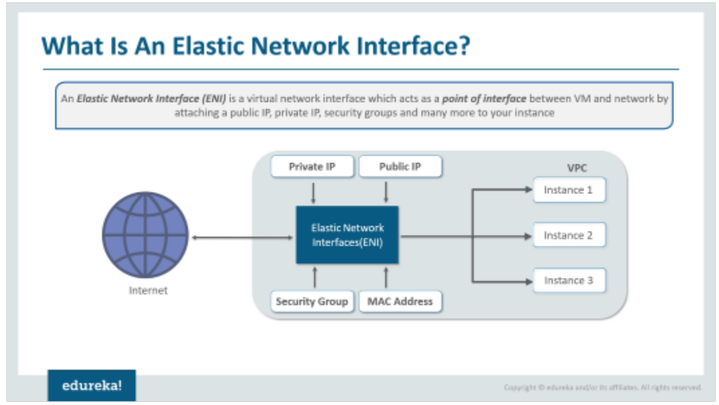
A

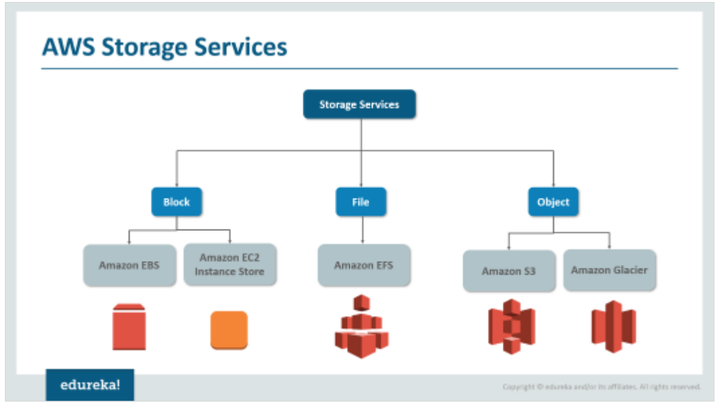
5. Every account in AWS is limited to only 5 Elastic IP addresses by default why?
   a. Public (IPV4) internet addresses are a scarce resource
   b. Only 5 network interfaces per instance
   c. Hardware restrictions
   d. For security reasons

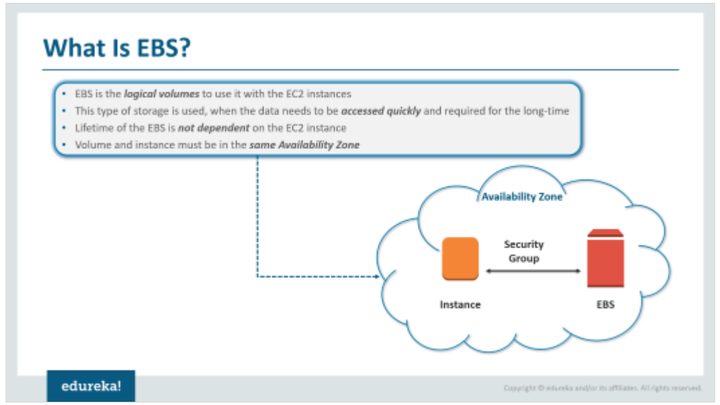
**Answer A:** Elastic IPs are static IPs, that is an IP which is exclusively assigned to you, usually an IP which is assigned to your instance, the moment your session gets over it gets detached from your instance and goes back into the pool of IP addresses, in this case it stays attached to your instance until you detach it, and since IP addresses are finite, they should be used efficiently and that is why by default Amazon limits the no. of Elastic IP addresses to 5 per account.

# Summary

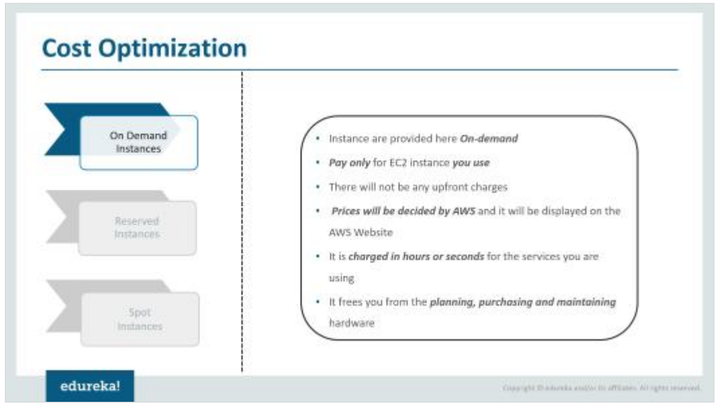




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# Thank You

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