What is EC2 ?

What is EC2 ?

Amazon Elastic Compute Cloud (Amazon EC2) is a computing capacity that is scalable in the Amazon Web Services (AWS) Cloud. Using Amazon EC2 eliminates the need to invest in hardware upfront, allowing you to develop and deploy applications more quickly.

What is EC2?

Features of EC2

- Instances are virtual computing environments.

- Amazon Machine Images (AMIs) are preconfigured templates for your instances that package the bits you need for your server (including the operating system and additional software)

- Instance types are different configurations of CPU, memory, storage, and networking capacity for your instances.

- Using key pairs, you can secure login information for your instances (AWS stores the public key, and you store the private key in a secure place)
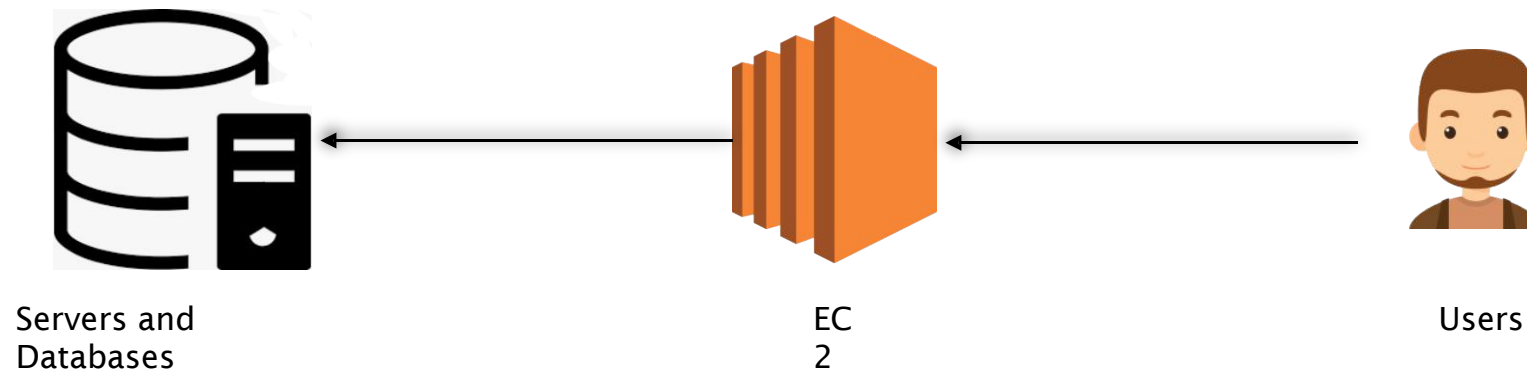
Introduction is EC2 ?

Elastic: It is the level at which a system is able to adapt
to workload changes by provisioning and de-provisioning resources such that the resources
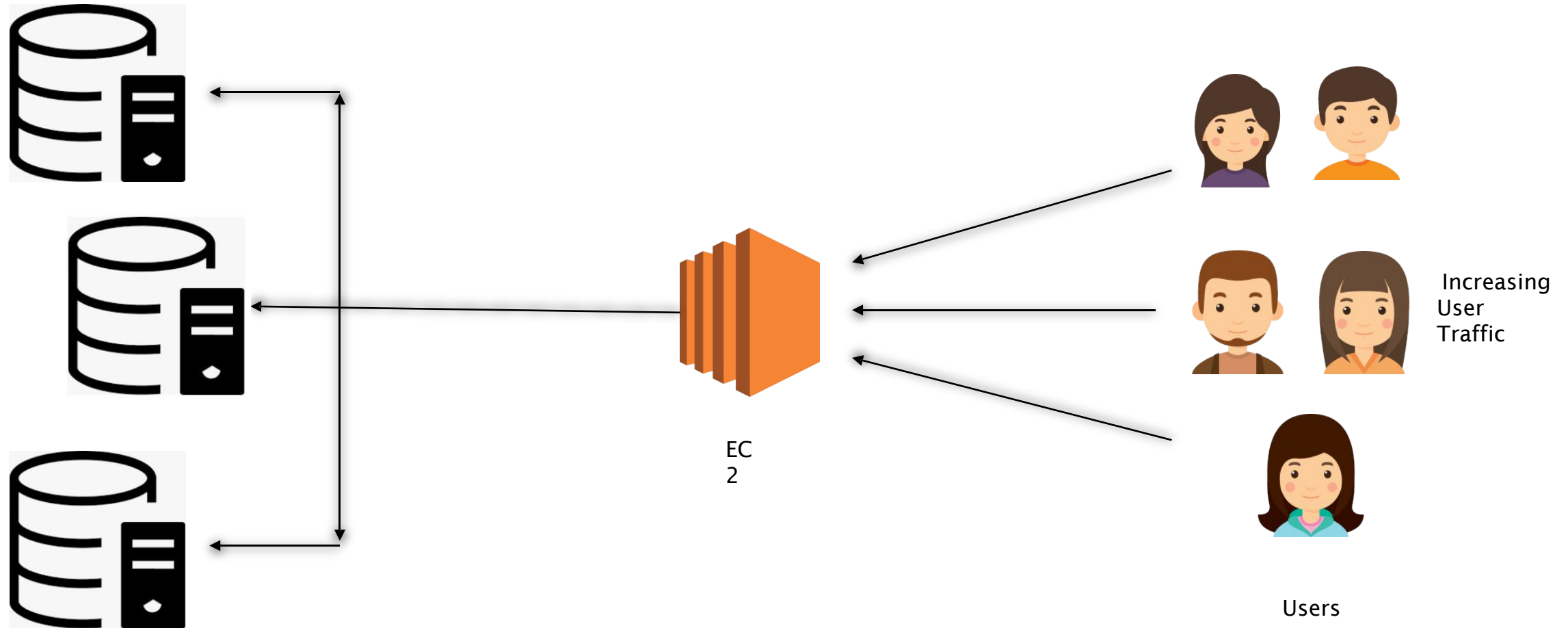
meet the current demand as closely as possible

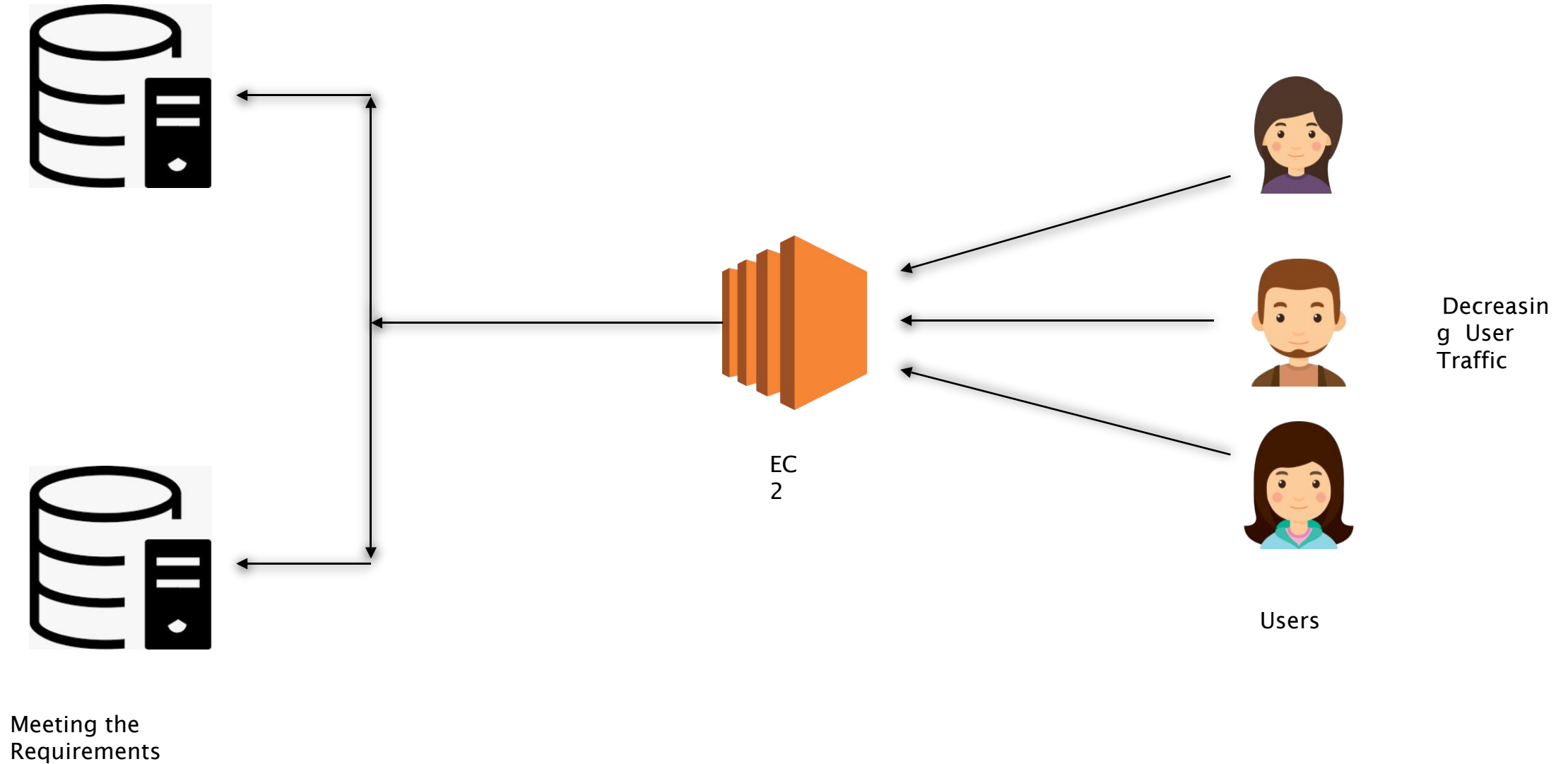ELASTIC COMPUTE CLOUD

Meaning of Elasticity

Servers and
Databases

EC
2

Users

Meaning of Elasticity

EC 2

Increasing User Traffic

Users

Meeting the Requirements

Meaning of Elasticity

EC 2

Decreasing User Traffic

Users

Meeting the Requirements

Regions and Availability Zones

Regions and Availability Zones

Regions
Coming soon

Regions and Availability Zones

Regions are geographical locations where AWS data-centers
reside. Following are AWS region names and their
subdivisions
:

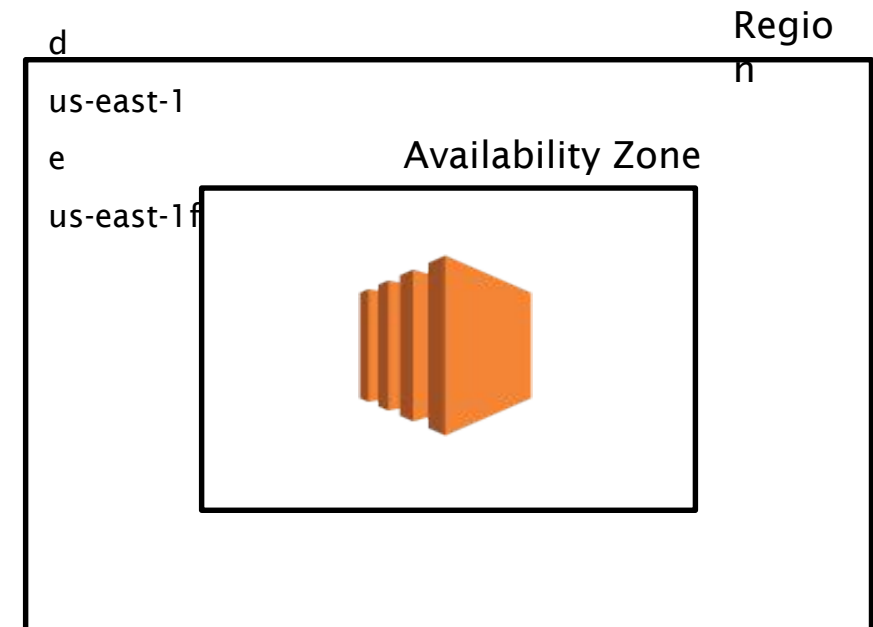> **US East: N. Virginia (us-east-1), Ohio (us-east-2)**

> **US West: N. California (us-west-1), Oregon (us- west-2)**

> **Asia Pacific: Mumbai (ap-south-1), Seoul (ap- northeast-2), etc**

> **EU: Frankfurt (eu-central-1), Ireland (eu-west-1), , etc**

For instance, 'us-east-1' contains 6 data centers or availability zones:

us-east-1 a

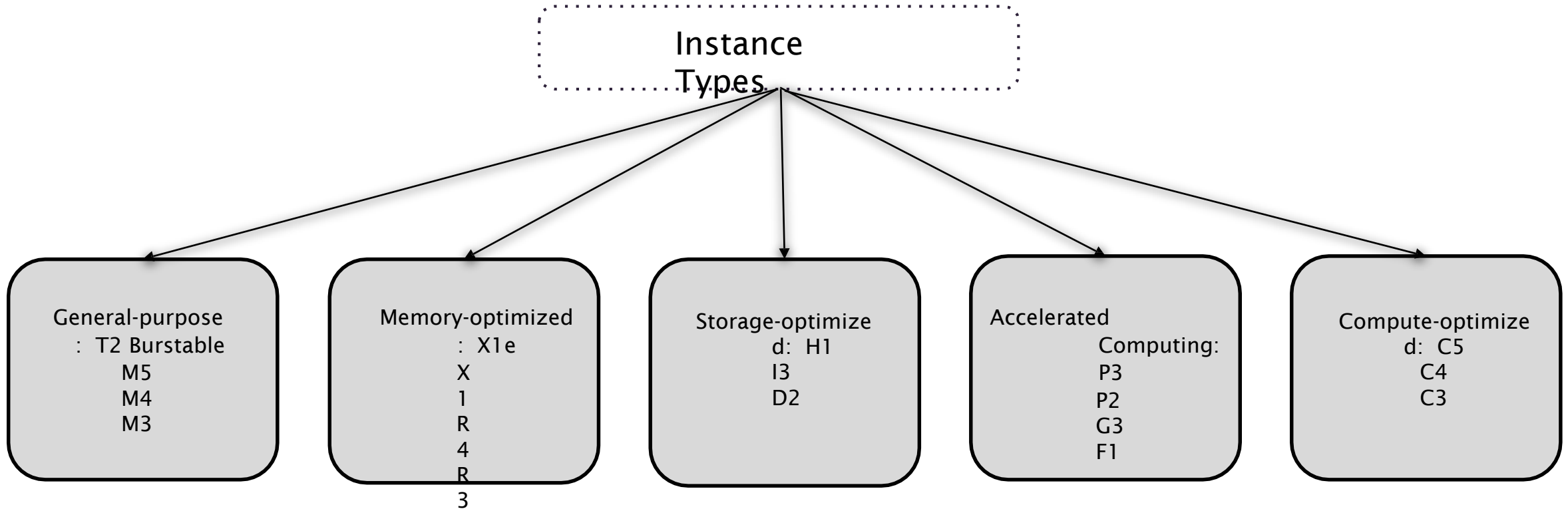us-east-1 b

us-east-1 c

us-east-1 d

us-east-1 e

us-east-1f

Region

Availability Zone

EC2 Instance Types

Instance Types

The instance type determines the hardware of the underlying host computer on which EC2

instances are launched

Instance Types

| General-purpose: T2 Burstable	Memory-optimized: X1e	Storage-optimized: H1	Accelerated Computing:	Compute-optimized: C5
M5	X	I3	P3	C4
M4	1	D2	P2	C3
M3	R		G3	
	4		F1	
	R			
	3			

What is AMI ?

What is an AMI ?

Amazon Machine Image (AMI) contains the information

required to launch an instance.

- Operating system
- Architecture
- Storage for the root device (Instance store or EBS-backed)
- Virtualization type (HVM or PV)

Instances

Xen Hypervisor

ISO

Server
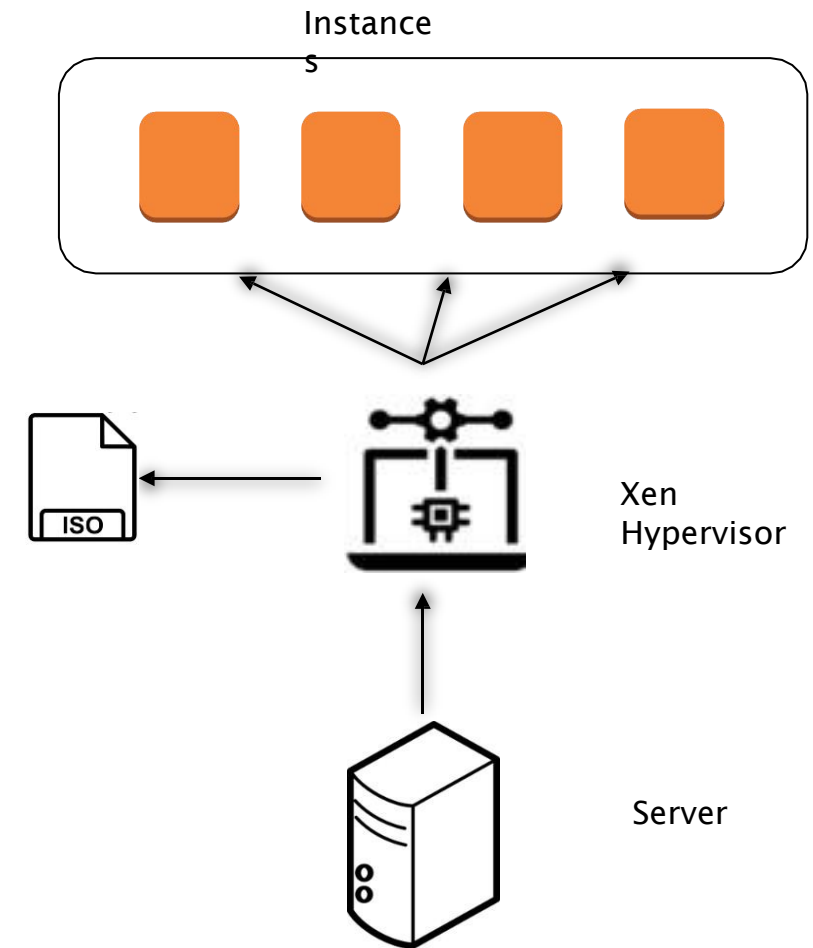
Creating and Copying an AMI

Platforms

Instances

Amazon Linux Python Ruby Perl AWS CLI Apache

AMI

EC2

EC2

EC2

- Create an AMI from an instance
- Launch multiple instances from it
- Copy the AMI
- AMI permissions

AMI (us-east-1)

COPY

AMI (ap-south-1)
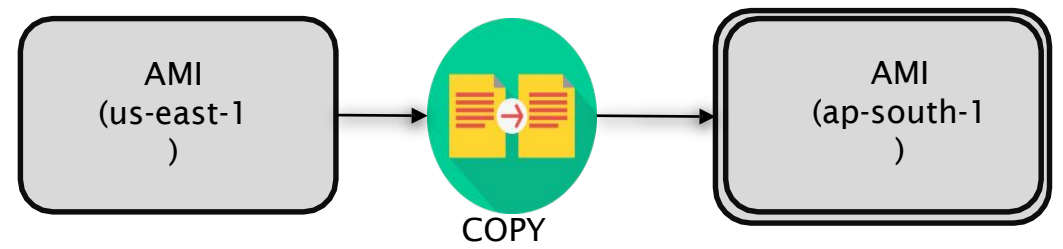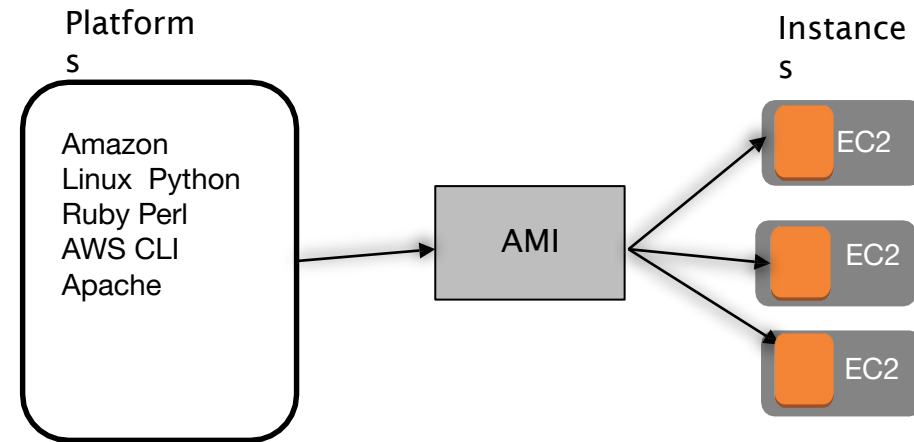
Public IP vs Elastic IP

Public IP

- It is not associated with an AWS account

- No charges for the public IP, even if it is not being used while the instance is running

- Whenever the instance is re-launched, the public IP changes

Elastic IP

- It is associated with the AWS account

- Charges will be applied if the same is done with the elastic IP

- The elastic IP is the same and static for every launch until we manually release it

What is EBS ?

What is EBS ?

EBS (Elastic block storage) is an Amazon block-level storage service that is intended to be used exclusively with separate EC2 instances; no two instances can have the same EBS volume attached to them. EBS provides a high-performance option for many use cases because it is directly attached to the instance, and it is used for various databases (both relational and non- relational) as well as a wide range of applications such as software testing and development.

What is Block Storage

What is EBS ?

Features of EBS

- Amazon Elastic Block Store (Amazon EBS) persistent storage volumes, also known as Amazon EBS volumes

- Regions and Availability Zones are multiple physical locations for your
  resources, such as instances and Amazon EBS volumes.

- Using security groups, you can specify the protocols, ports, and source IP ranges that can reach your instances.

- Elastic IP addresses are static IPv4 addresses used for dynamic cloud
  computing.

Introduction to EBS

File System Basics

In simple terms, one physical volume will
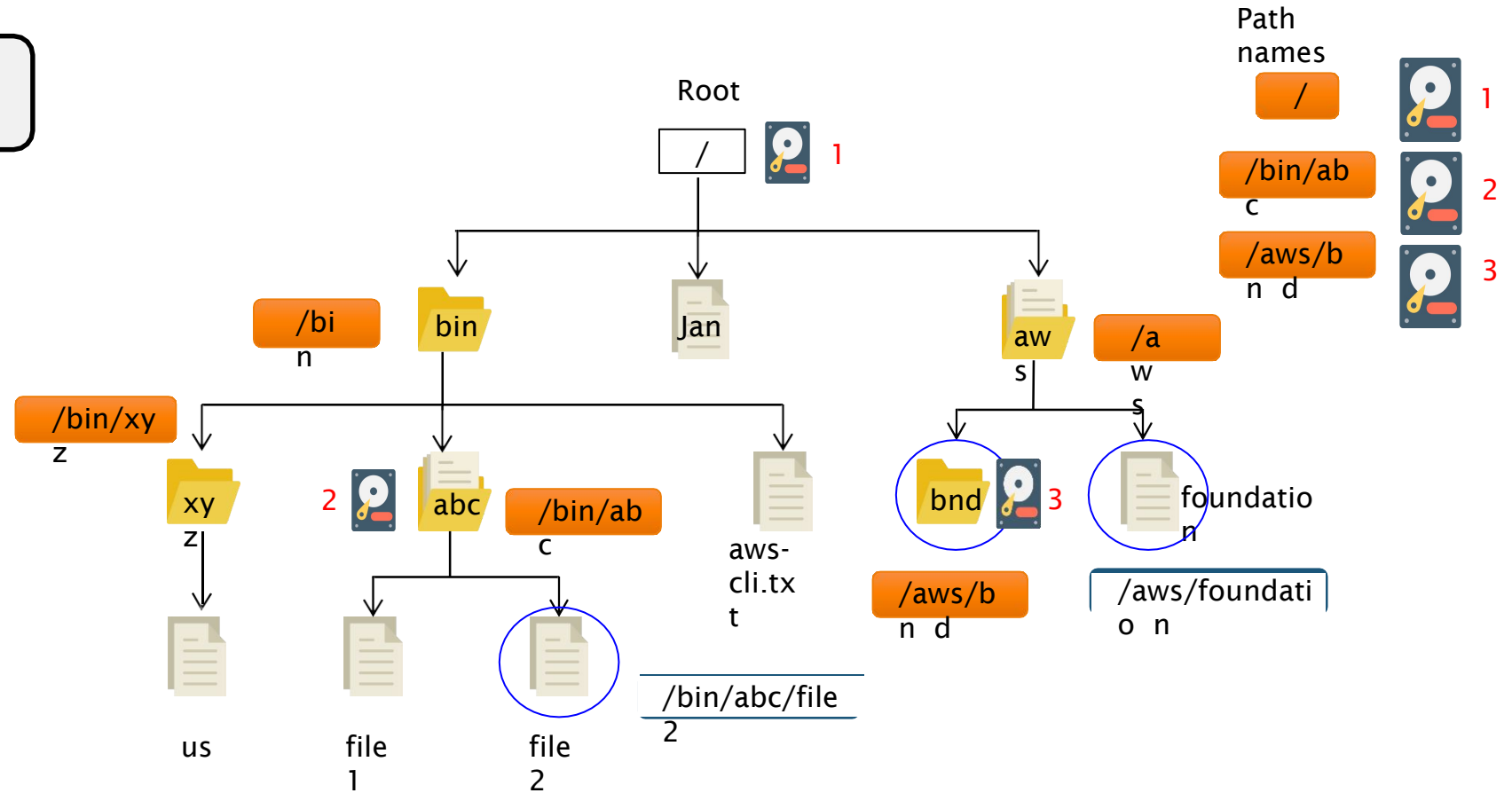be divided into multiple logical volumes

Physical volume

Logical volume

C:

Logical volume

D:

Directory
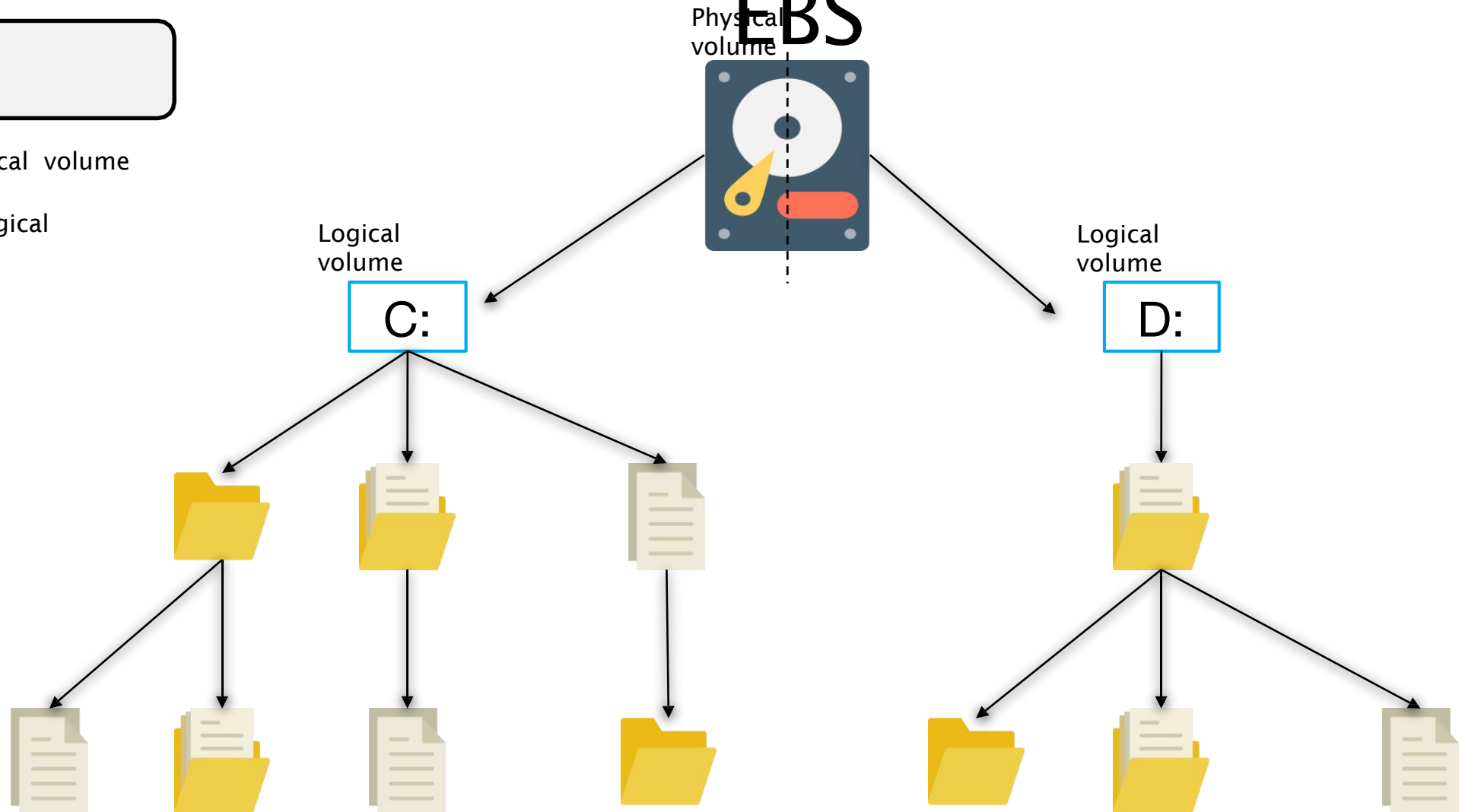
File

Introduction to EBS

File System Basics

A file system tree of a Linux or UNIX system

Root

/   1

/bin
n

bin

Jan

aw
s

/a
w
s

/bin/xy
z

xy
z

2   abc

/bin/ab
c

aws-
cli.tx
t

bnd   3

foundatio
n

/aws/b
n d

/aws/foundati
o n

us

file
1

file
2

/bin/abc/file
2

Path
names

/   1

/bin/ab
c   2

/aws/b
n d   3

EBS Concepts

It is the raw unformatted block-level storage; it is exposed as raw device to the EC2 instance EBS volumes persist independently from the

life of the EC2 instance

An EBS volume is automatically replicated within an availability zone

Throughput: It is the sequential transfer rate that an SSD or HDD will maintain continuously
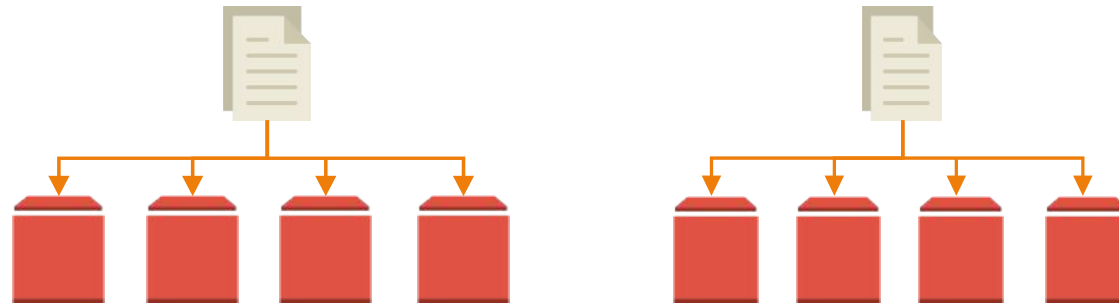
IOPS: It is the measure of the number of I/O operations a drive, SSD, or HDD can handle per second

with each block being read from or written to a RANDOM location in the disk

EC2 Instance

EBS Data Volume
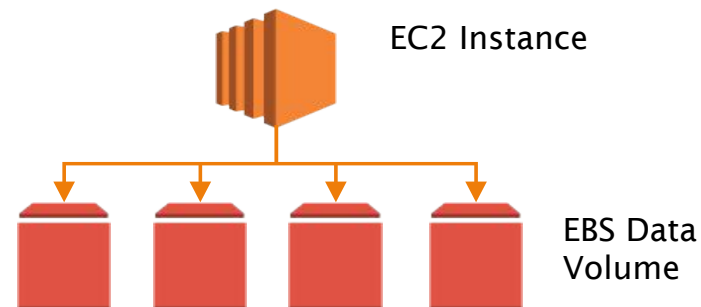
EBS Concepts

Volume Types

GP2: General-purpose SSD

- Baseline performance is 3 IOPS/GB with a min. of 100 IOPS and a max. of 10000 IOPS
- Max. burst performance is 3000 IOPS
- Max. throughput per volume is 160 MB/s (16 KB IO size)

IO1: Provisioned SSD

- From 100 to 32000 IOPS can be provisioned
- Max. throughput per volume is 500 MB/s

ST1: Throughput-optimized HDD

- Baseline performance is 40 MB/s per TB with a max. of 500 MB/s per volume
- Burst performance is 250 MB/s per TB with a max. of 500 MB/s per volume

SC1: Cold Storage HDD

- Baseline performance is 12 MB/s per TB with a max. of 192 MB/s per volume
- Burst performance is 80 MB/s per TB with a max. of 250 MB/s per volume

EBS Concepts

New Feature: EBS Multi-Attach

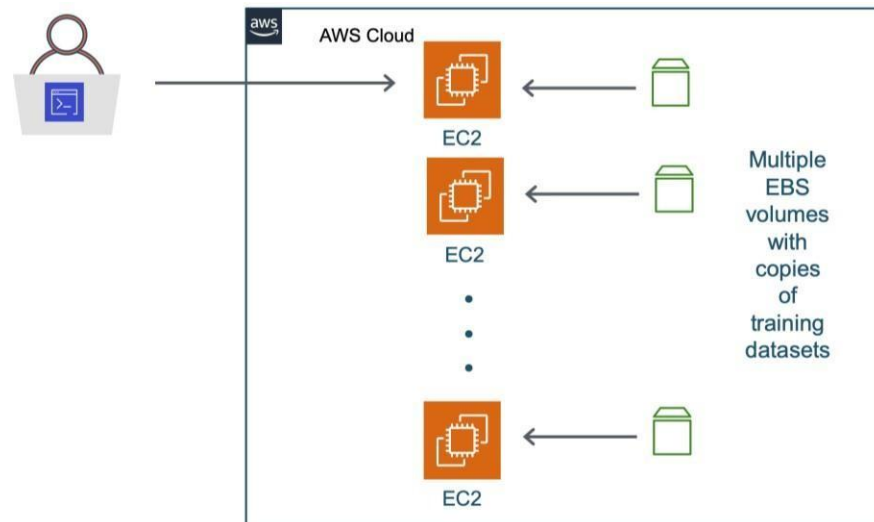Amazon EBS Multi-Attach is now available on Provisioned IOPS io1 volumes
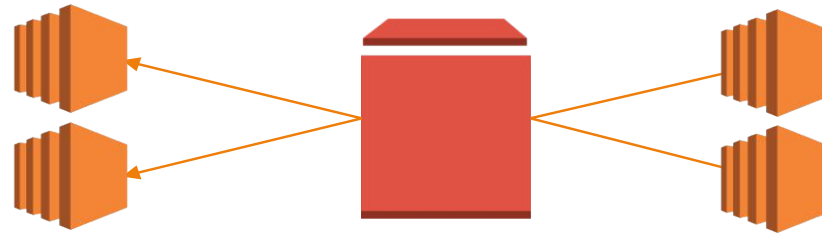
We can now enable Multi-Attach on Amazon EBS Provisioned IOPS io1 volumes to allow a single volume to be concurrently attached to up to 16 AWS Nitro System-based Amazon EC2 instances within the same availability zone
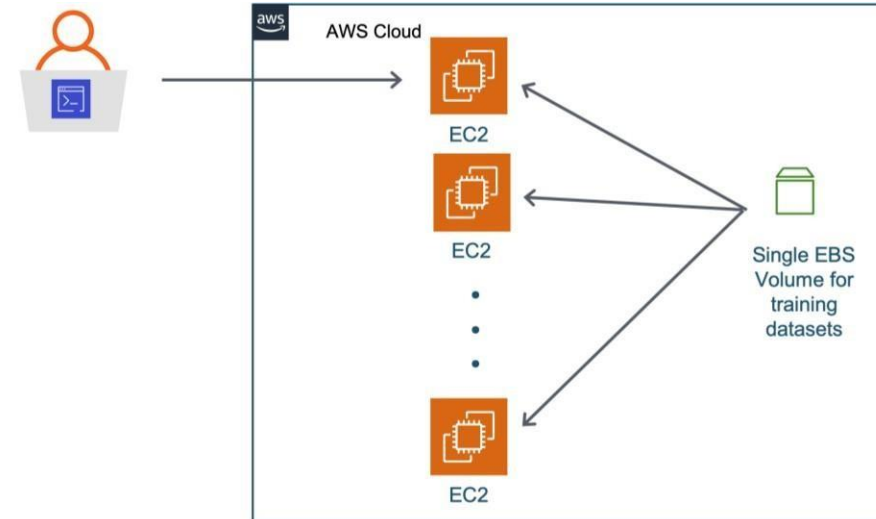
EBS Concepts

New Feature: EBS Multi-Attach
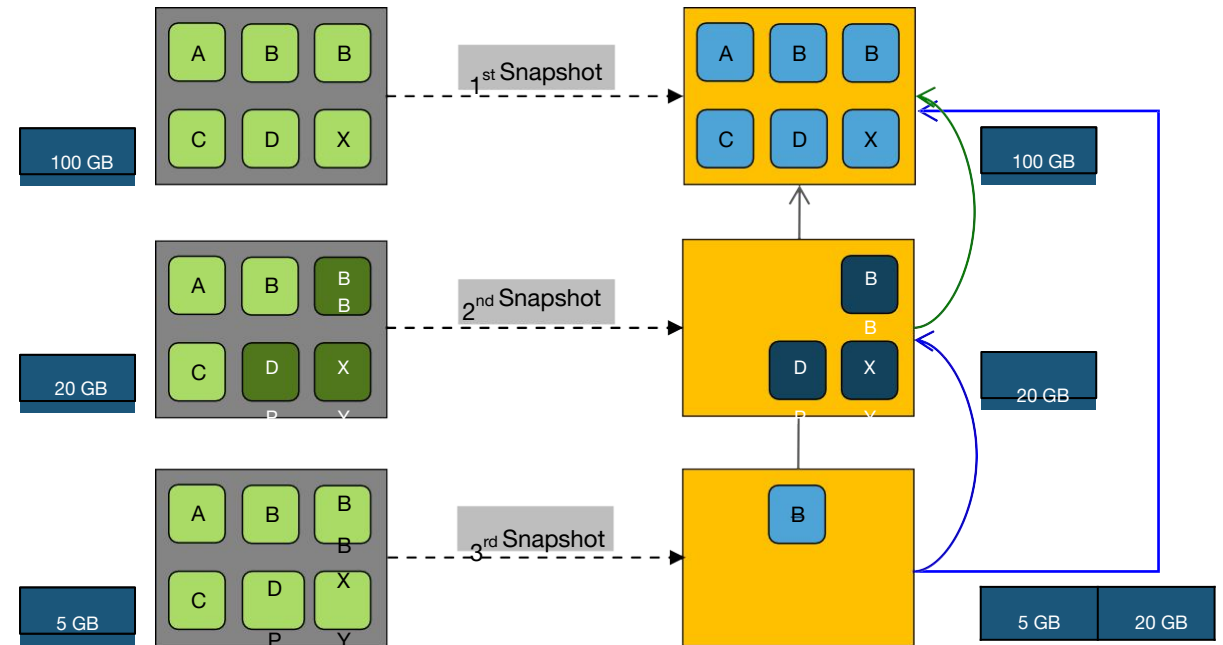
Without Multi-Attach

With Multi-Attach

EBS Snapshots

Snapshot

Snapshots are used to backup data on EBS volumes

All snapshots are incremental backups except for the first one
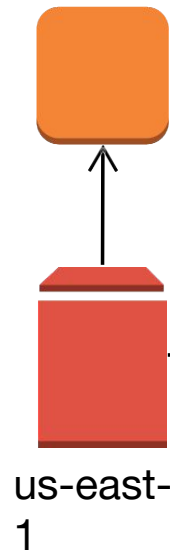
Snapshots are copied to Amazon S3

100 GB

20 GB

5 GB

1st Snapshot

2nd Snapshot

3rd Snapshot

100 GB

20 GB

5 GB   20 GB

EBS Snapshots

Snapshot Copy

- ✓ Copy snapshot to a different region

us-east-1 → Snapshot → us-east-1 → Copy → us-west-2 → Create →
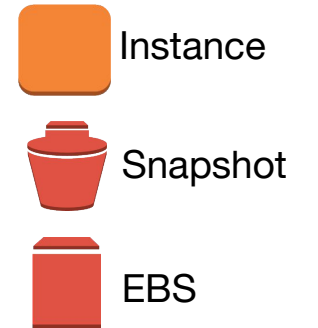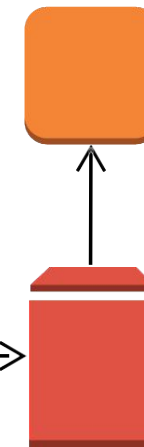
- ✓ Encrypt during copying

Copy and Encrypt → Encrypted

■ Instance
■ Snapshot
■ EBS

EBS Snapshots

New Feature: Data Lifecycle Manager for Snapshots

- Amazon DLM supports Amazon EBS volumes and snapshots

- We can define backup and retention schedules for EBS snapshots by creating lifecycle policies based on tags

- It is free to use

- We no longer need to create custom scripts for backup and restore

EBS Snapshots

Automating the snapshot cycle helps with:

- Protecting valuable data by enforcing a regular backup schedule

- Retaining backups as required by auditors or internal compliance

- Reducing storage costs by deleting outdated backups

Quotas for AWS DLM:

- We can create up to 100 lifecycle policies per region

- We can add up to 45 tags per resource

- We can create one schedule per lifecycle policy

EBS Encryption

☑ Supported by all volume types but not by all instance types

Hello

%^@!

Snapshot

%^@!
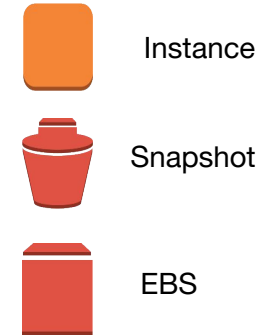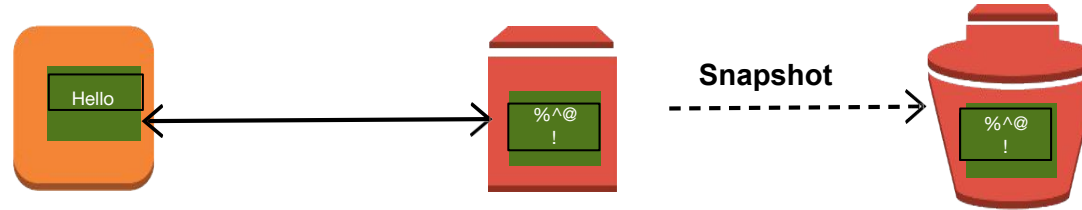
☑ Unencrypted to encrypted

Hello

Hello

Copy and Encrypt

%^@!

%^@!
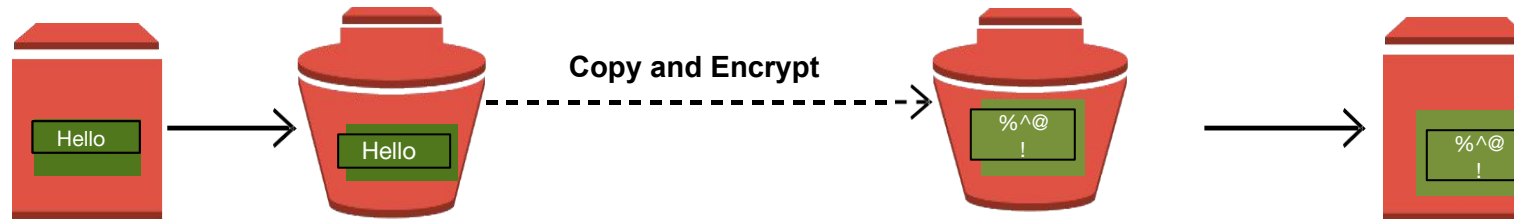
☑ Encrypted to unencrypted
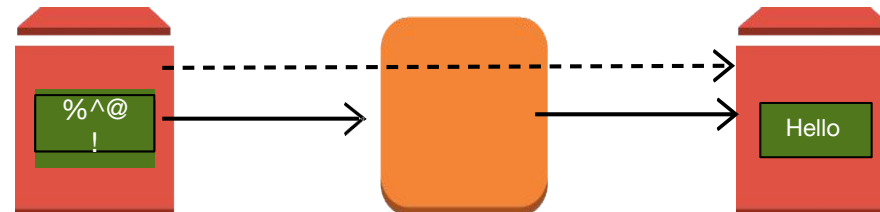
%^@!

Hello

Instance

Snapshot

EBS

Instance Tenancy and Reserved and Spot Instances

Instance Tenancy and Reserved and Spot Instances

Instance Tenancy and Reserved and Spot Instances

Dedicated Instance

| EC2 (cust-1) | EC2 (cust-1) | EC2 (cust-1) | EC2 (cust-1) |

XEN
Hypervisor

Hardware (CPU, RAM, N/W)
– cust-1
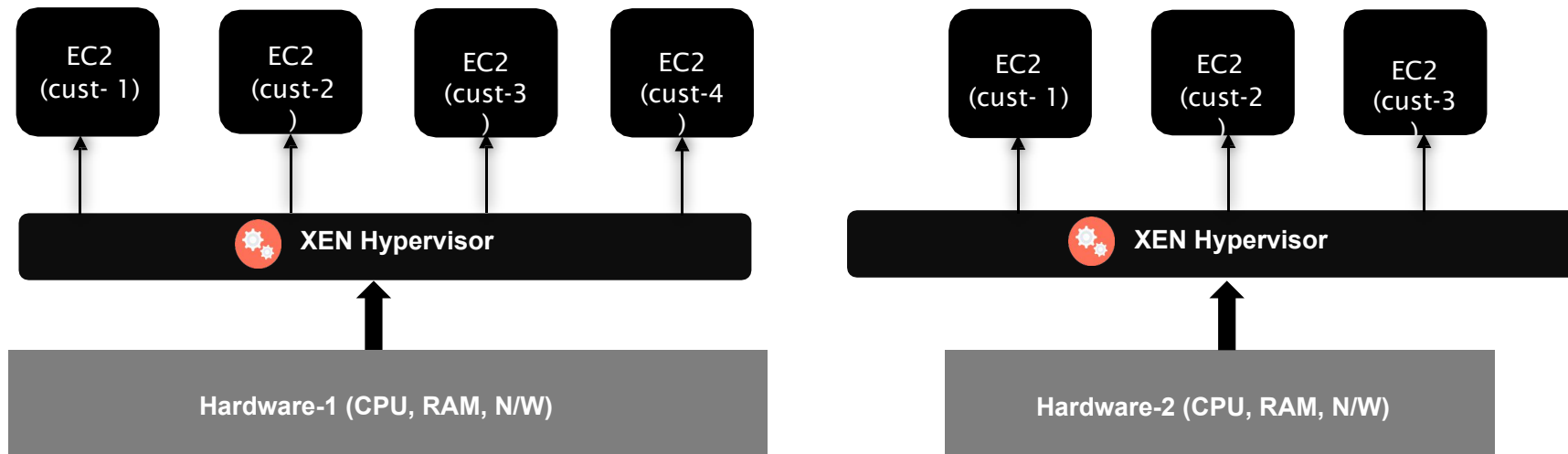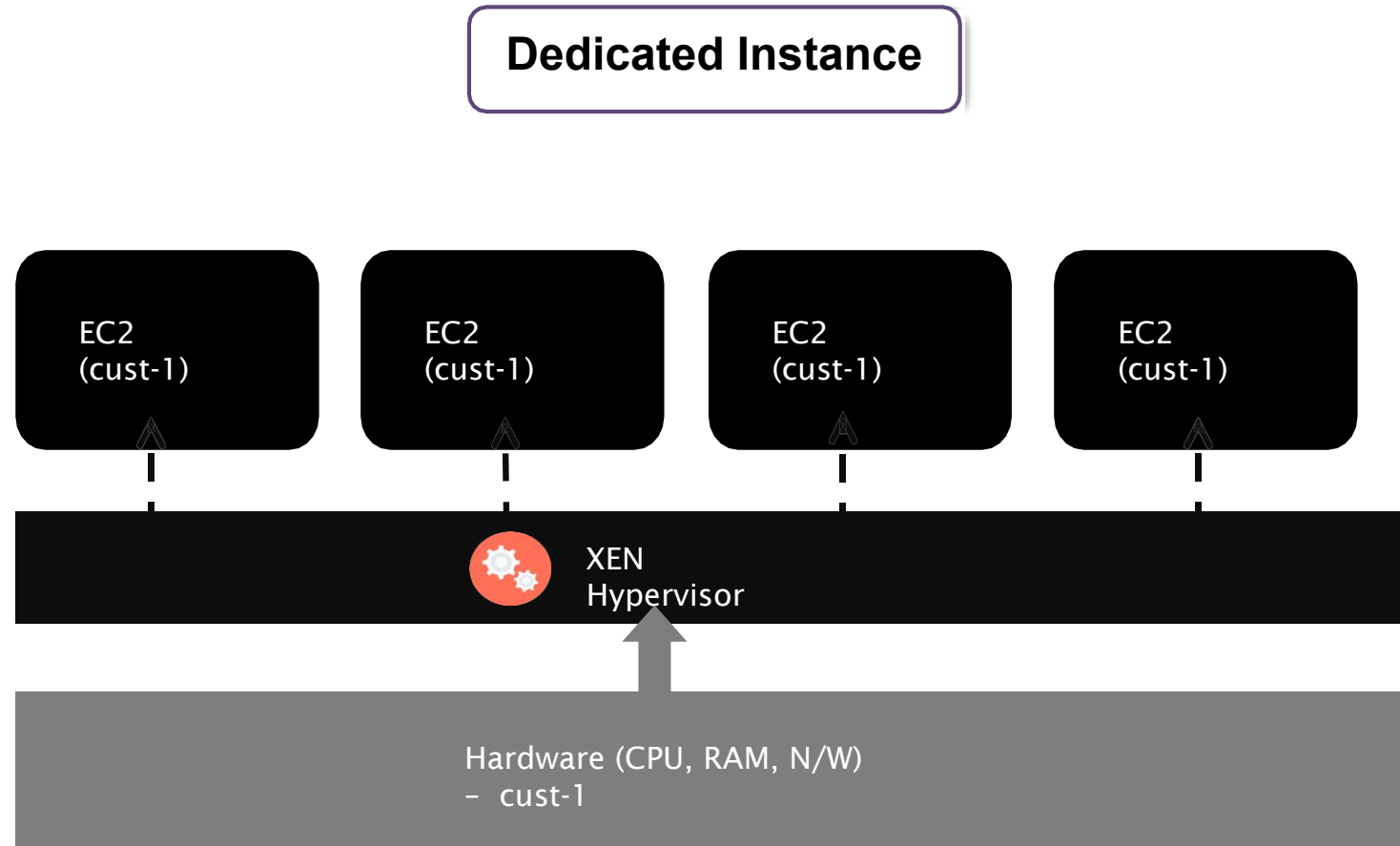
Placement Group

Cross-platform PG

EC2 instances should support enhanced N/W

us-east-1
a

10
Gbps

us-east-2
a

us-east-2
b
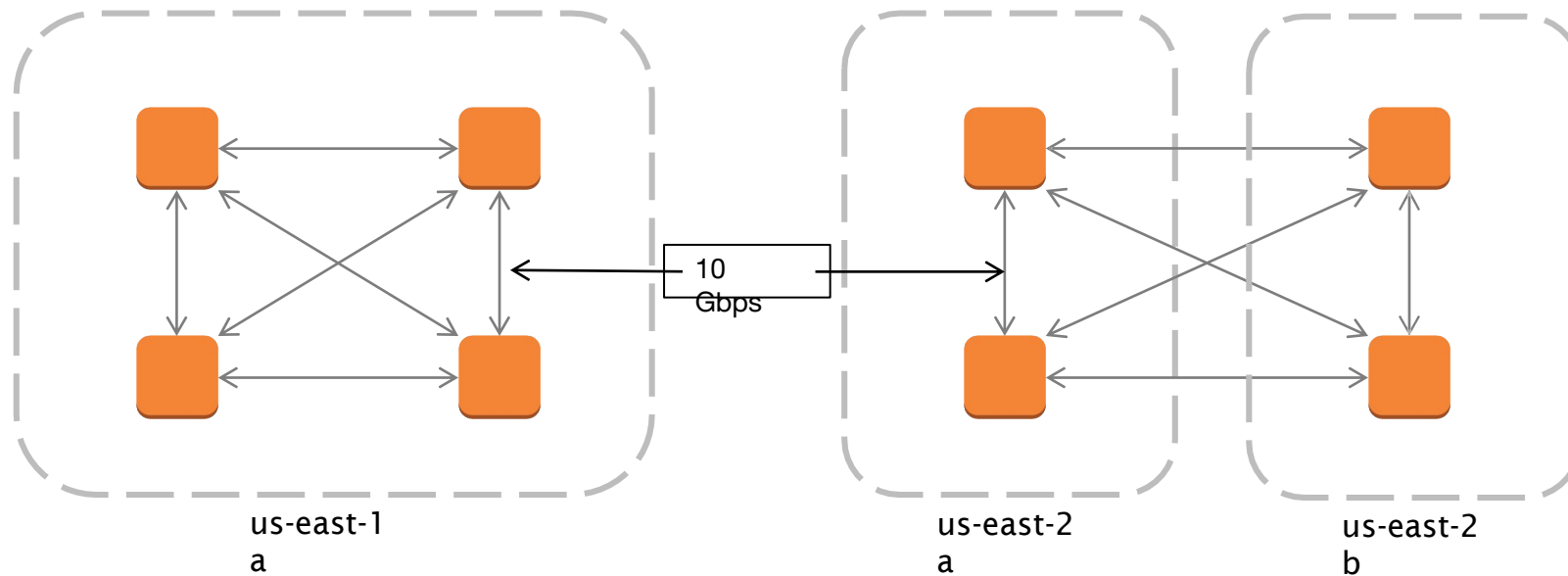
Reserved and Spot Instances

Reserved Instances

Regional RI – AZ and Instance Size Flexibility (Both default and dedicated tenancy)

Resources and capacity is reserved until the contract

period ends Scheduled RI

Running Instance	RI bought
4 m3.large Linux, default tenancy in AZ us-east-1a	4 m3.large, Linux, default tenancy, AZ us-east-1a
2 m4.4xlarge Amazon Linux, default tenancy in us-east-1b	4 m4.large, Amazon Linux, default tenancy, region us-east-1
c4.xlarge RHEL dedicated tenancy in AZ us-east-1c	C4.large, RHEL, default tenancy, region us-east-1

Instance size	Normalization factor
nano	0.25
micro	0.5
small	1
medium	2
large	4
xlarge	8
2xlarge	16
4xlarge	32
8xlarge	64
9xlarge	72
10xlarge	80
12xlarge	96
16xlarge	128
18xlarge	144
24xlarge	192
32xlarge	256

Reserved and Spot Instances

Spot Instances

- Unused EC2 instances available for lesser price than the on-demand price

-Instances are terminated if the spot price increases than the bid price

-Significant price reduction

Spot Fleet

Spot Instance Pool

OS Instance Type AZ
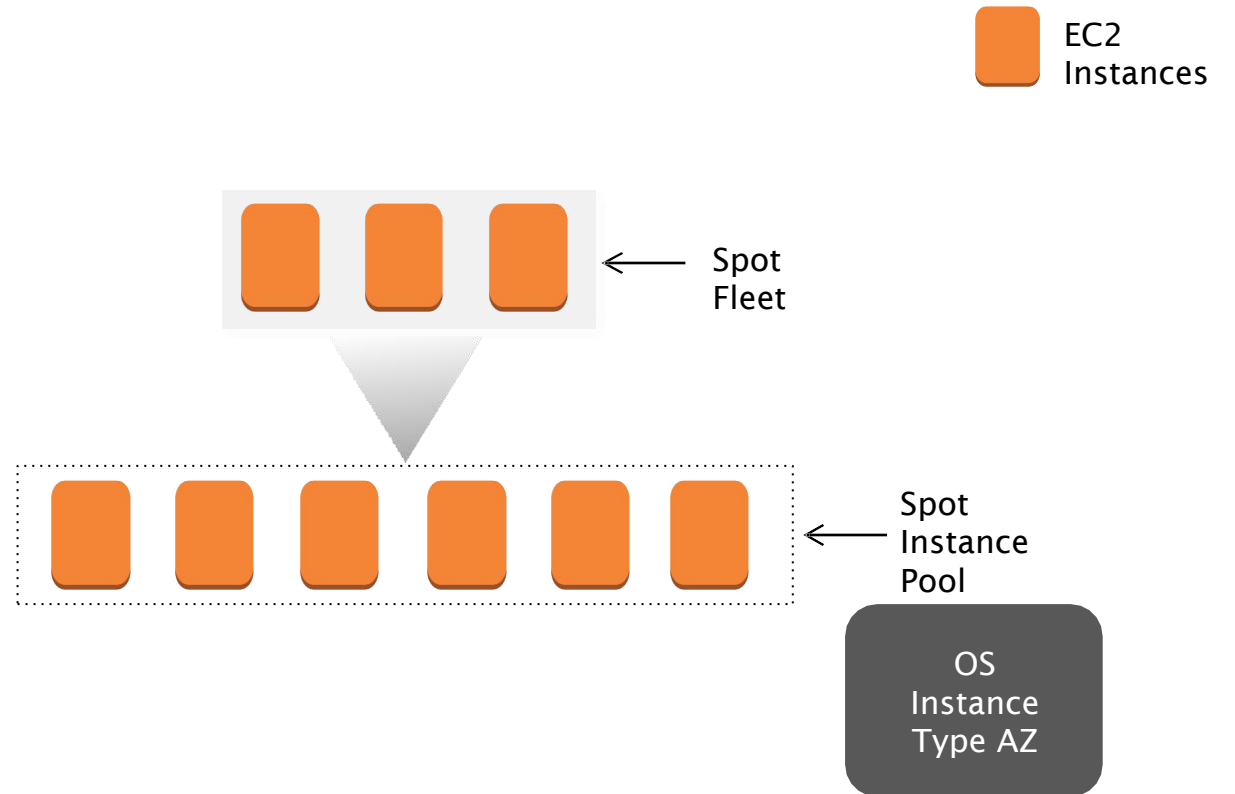
Pricing

EC2 Pricing
(us-east-1)
Pay as you use
Free Tier: 750 hours per month of Amazon

Linux, RHEL, SLES, Windows t2.micro single

instance usage

On-demand price:
✓ m5.large =
✓ US$0.096/hour c5.large
✓ = US$0.085/hour
r4.large =
US$0.133/hour

✓ Data Transfer IN:
FREE from anywhere

SLA = 99.99% Uptime

Data Transfer OUT:

From EC2 to

-S3, Glacier, DynamoDB, SES,

and SQS in same region = FREE

- S3, Glacier, DynamoDB, SES, and
  SQS in different region

  = US$0.020/GB

- EC2, RDS, Redshift, Elasticache,
  ELB, and ENI in same AZ =

  FREE with private IP and

  US$0.010/GB with

  public IP

- EC2, RDS, Redshift, Elasticache, ELB, and ENI

  in different AZ =

  US$0.010/GB

Pricing

Reserved Instance: 1 to 3-year terms
Pricing (on-demand us-east-1 region)

M5.XLARGE = US$0.192/hr

Yearly = US$1681.92

Payment Type	One Time Payment	Total Yearly Cost	Savings
No Upfront	US$0	US$89.79*12 = US$1077.48	36%
Partial Upfront	US$512	US512 + (42.34*12) = US$1020.08	39%
Full Upfront	US$1003	US$1003	40%

EC2 Purchasing Options (RI)

Reserved Instances

Instance
- Size: L, XL, & 2XL
- Family: m4, c5, & i3

Tenancy
- Default/Shared
- Dedicated Instance

Offering
- Standard
- Convertible

Scope
- Region
- AZ (Zonal)

Platform
- Windows
- Linu
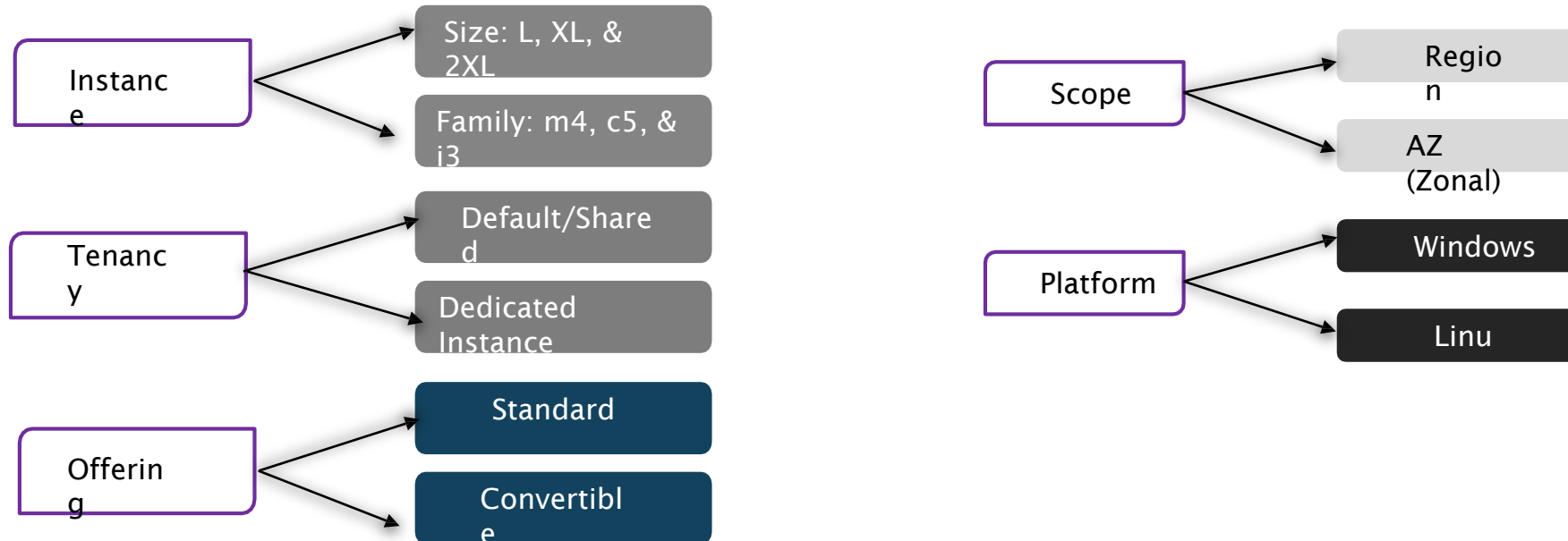
EBS Pricing

- gp2: US$0.1 per GB per month

- io1: US$0.125 per GB per month and US$0.065 per provisioned IOPS per month st1: US$0.045 per GB per month

- sc1: US$0.025 per GB per month

- EBS snapshot to Amazon S3: US$0.05 per GB per month

- Free Tier: 30 GB/month, a combination of gp2 and magnetic. 2,000,000 IO with magnetic, 1 GB of snapshot storage

Uptime SLA: 99.99%

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