Computing and Storage Service on Cloud

Torry Harris 26/11/2021
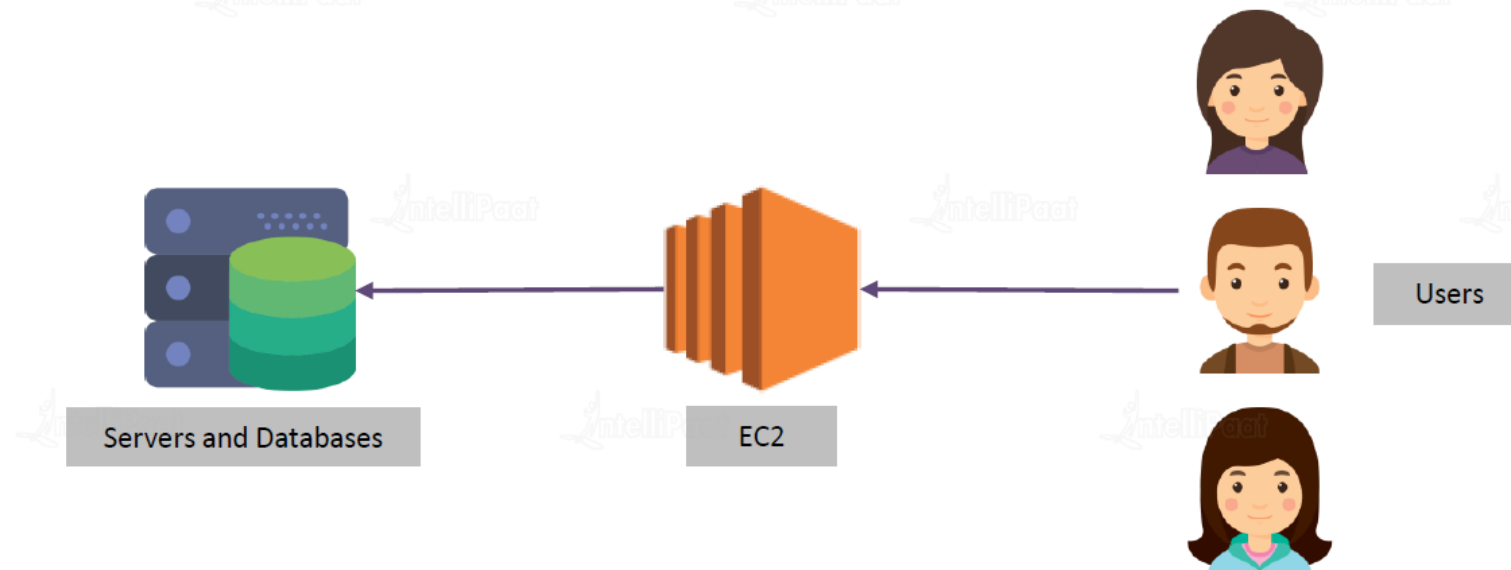
Agenda

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Introduction to EC2 → Regions and Availability Zone → Pre-EC2 → EC2 Instance Type → Demo1-Launching an Instance → What is an AMI ? → Demo2-Creating and Copying an AMI. → Introduction to EBS → EBS Snapshots → Demo3-EBS → EFS
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- Introduction to EC2
- Regions and Availability Zone
- Pre-EC2
- EC2 Instance Type
- Demo1-Launching an Instance
- What is an AMI ?
- Demo2-Creating and Copying an AMI.
- Introduction to EBS
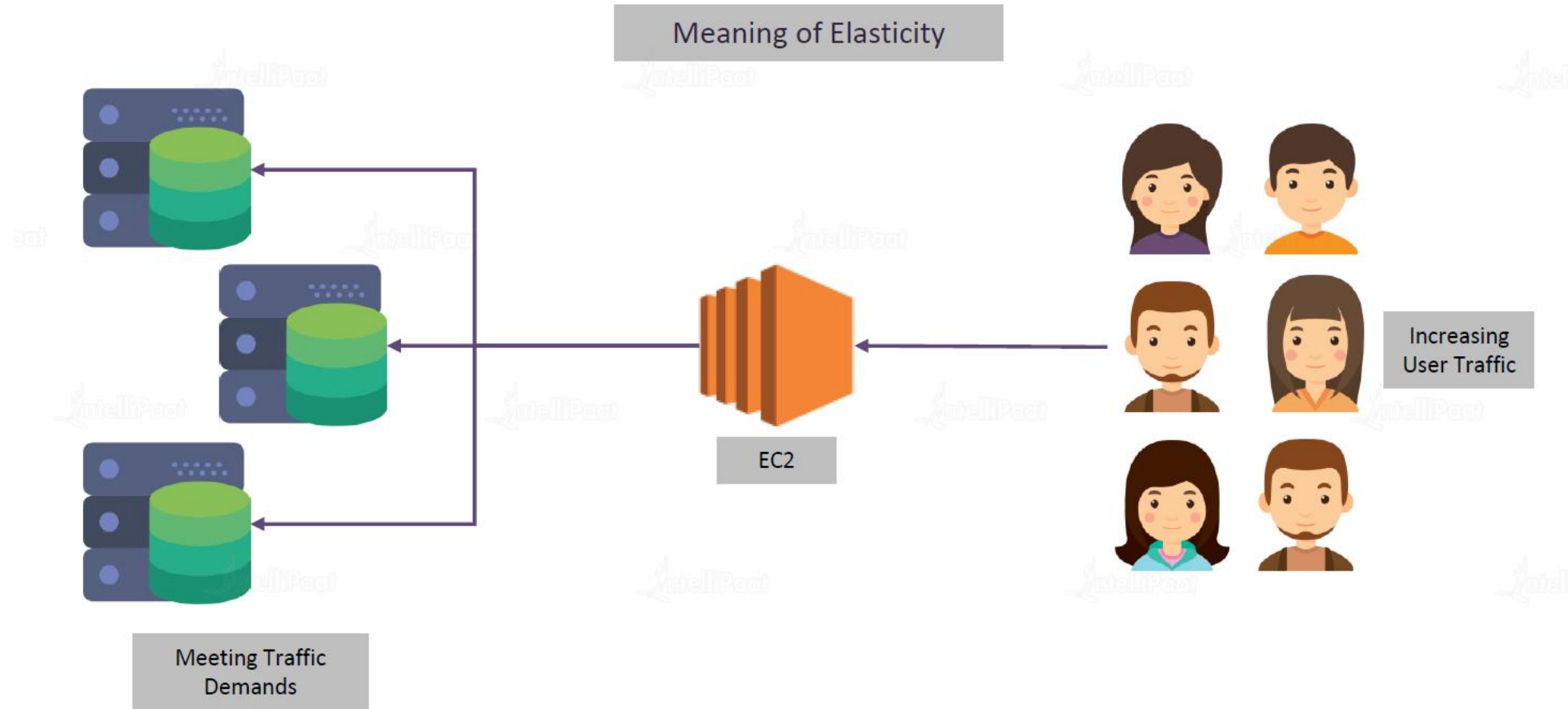- EBS Snapshots
- Demo3-EBS
- EFS

Introduction to EC2

Elastic Compute Cloud

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
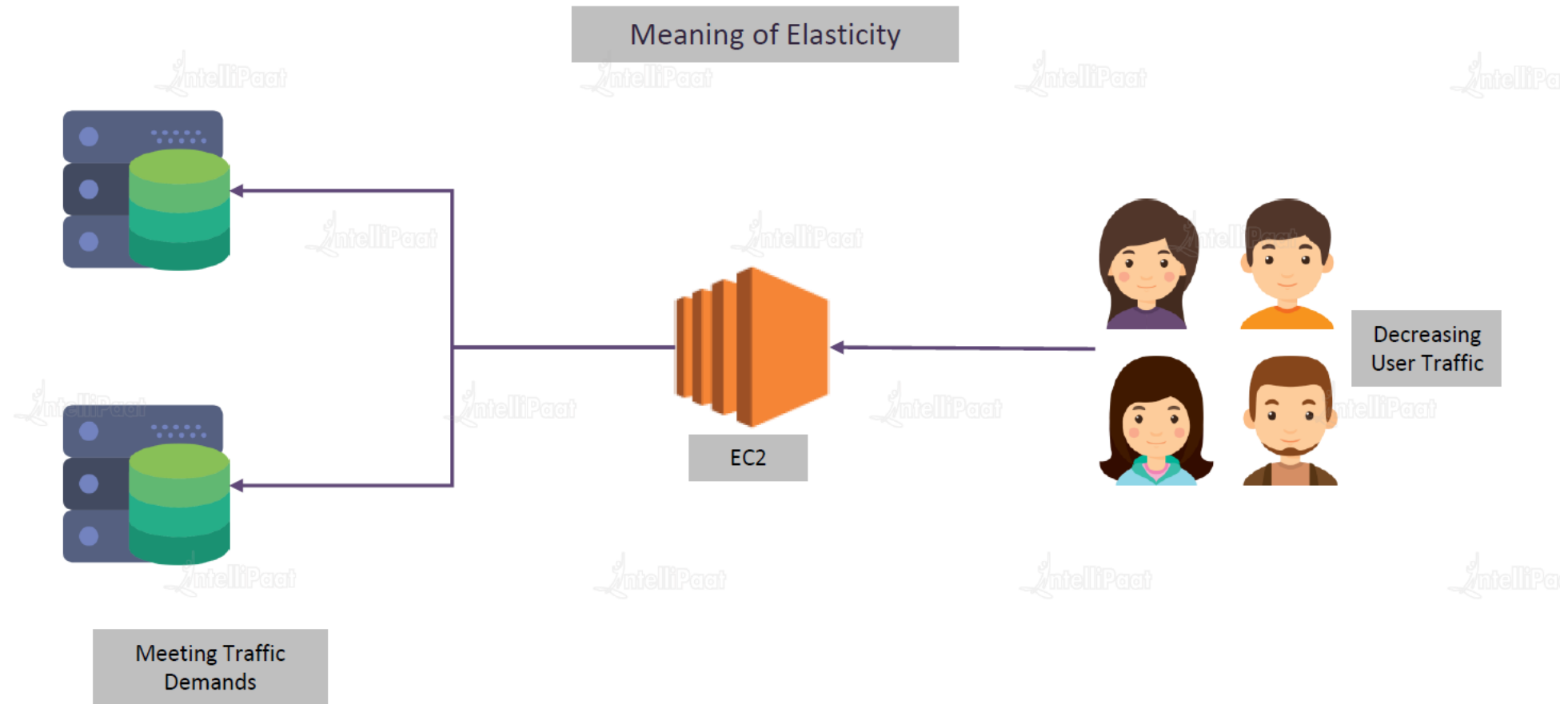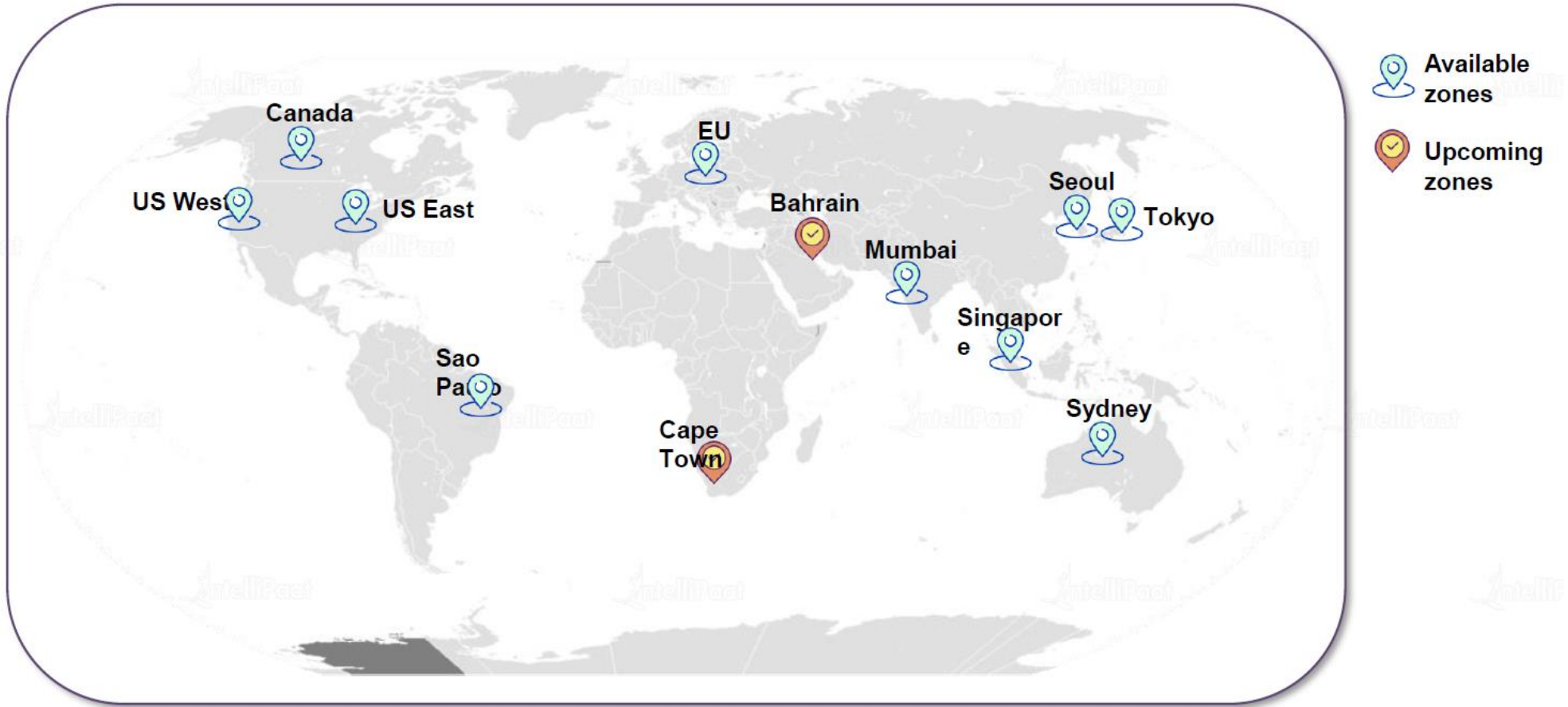
Meaning of Elasticity

Servers and Databases

EC2

Users

Meaning of Elasticity

EC2

Increasing User Traffic

Meeting Traffic Demands

Introduction to EC2

Meaning of Elasticity

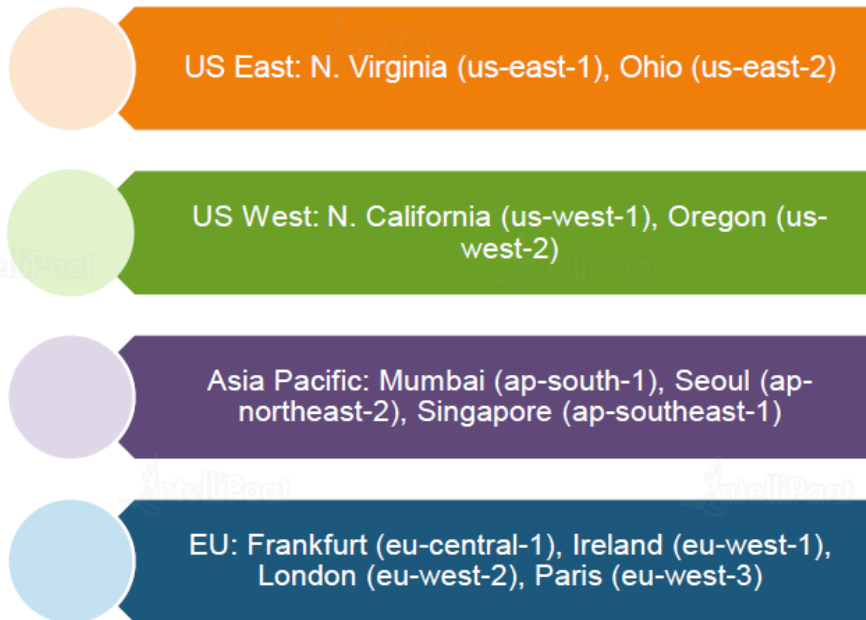Meeting Traffic Demands

EC2

Decreasing User Traffic
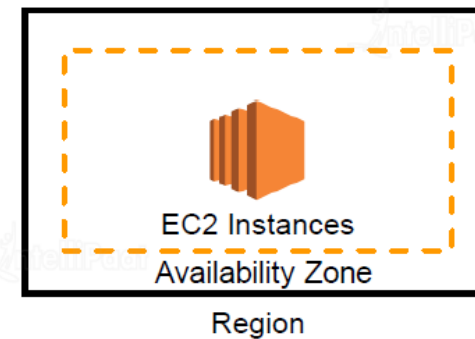
EC2 Regions and Availability Zones

EC2 Regions and Availability Zones

Regions are geographical locations where AWS data centers reside. Following are AWS region names and their subdivisions:
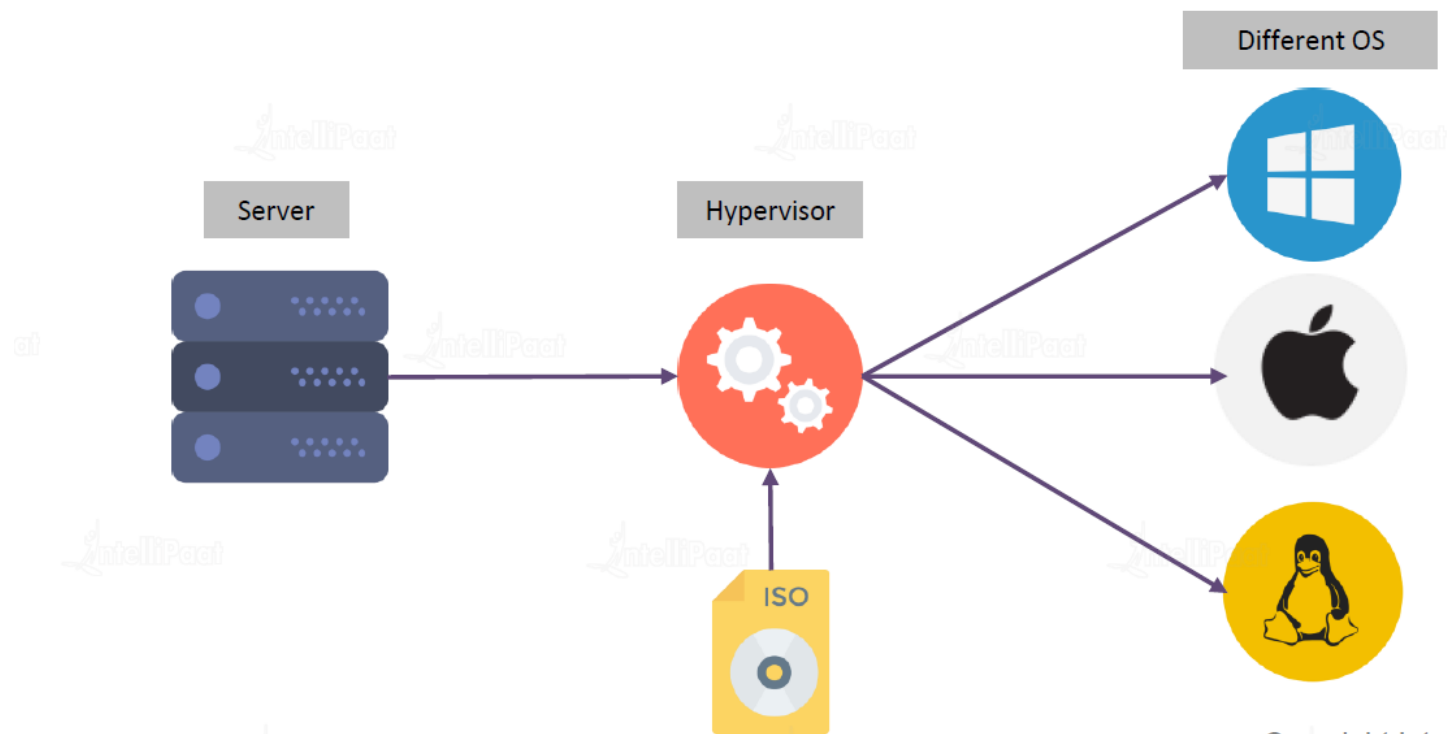
US East: N. Virginia (us-east-1), Ohio (us-east-2)

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

Asia Pacific: Mumbai (ap-south-1), Seoul (ap-northeast-2), Singapore (ap-southeast-1)

EU: Frankfurt (eu-central-1), Ireland (eu-west-1), London (eu-west-2), Paris (eu-west-3)

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

- ☆ us-east-1a
- ☆ us-east-1b
- ☆ us-east-1c
- ☆ us-east-1d
- ☆ us-east-1e
- ☆ us-east-1f

EC2 Instances
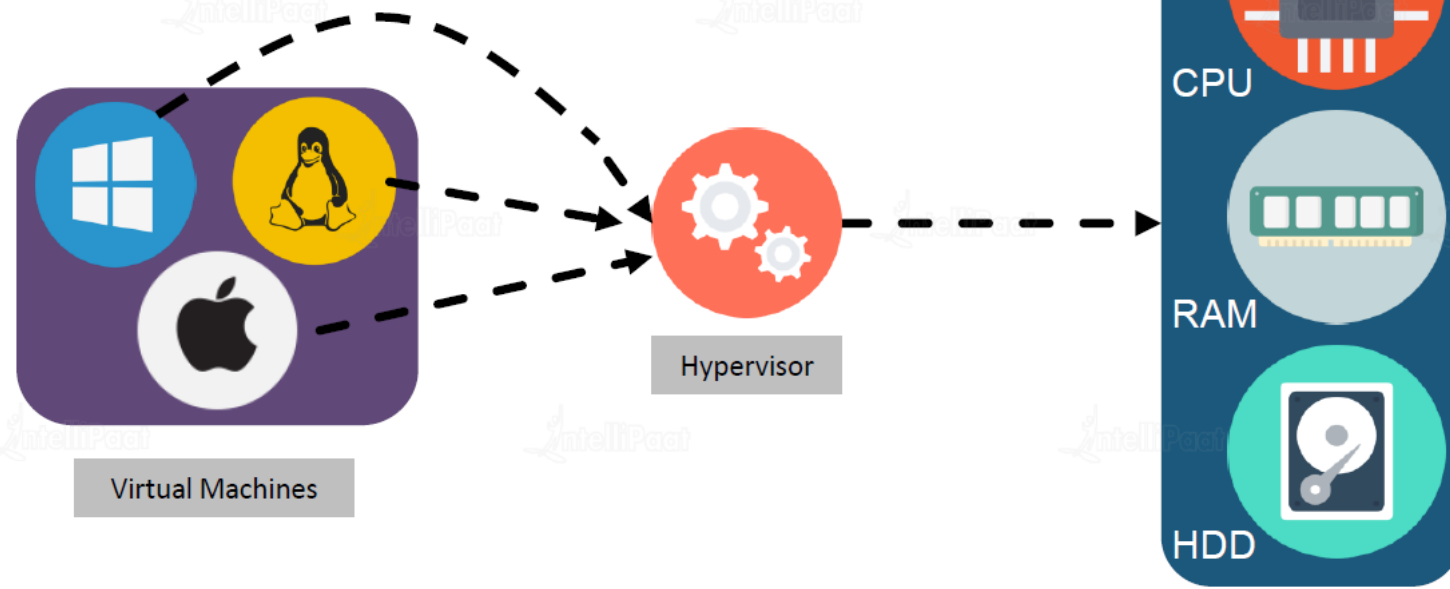
Availability Zone

Region

Pre-EC2

- In simple terms, it is running a virtual operating system inside an operating system

- Suppose, we want to run Ubuntu in our Windows OS, we could easily install and use it as a virtual OS

Resources/Hardware

Virtual Machines

Hypervisor

CPU

RAM

HDD

Pre-EC2

Intel Processor Generation

1st Generation Nehalem (2006):
Introduced hyper-threading

2nd Generation Sandy Bridge (2011):
Pentium
Xeon E3
Xeon E5

3rd Generation Ivy Bridge (2012):
Pentium
Xeon E3v2
Xeon E5v2
Xeon E7v2

4th Generation Haswell (2013):
Xeon E3v3
Xeon E5v3
Xeon E7v3

Pre-EC2

Intel Processor Generation

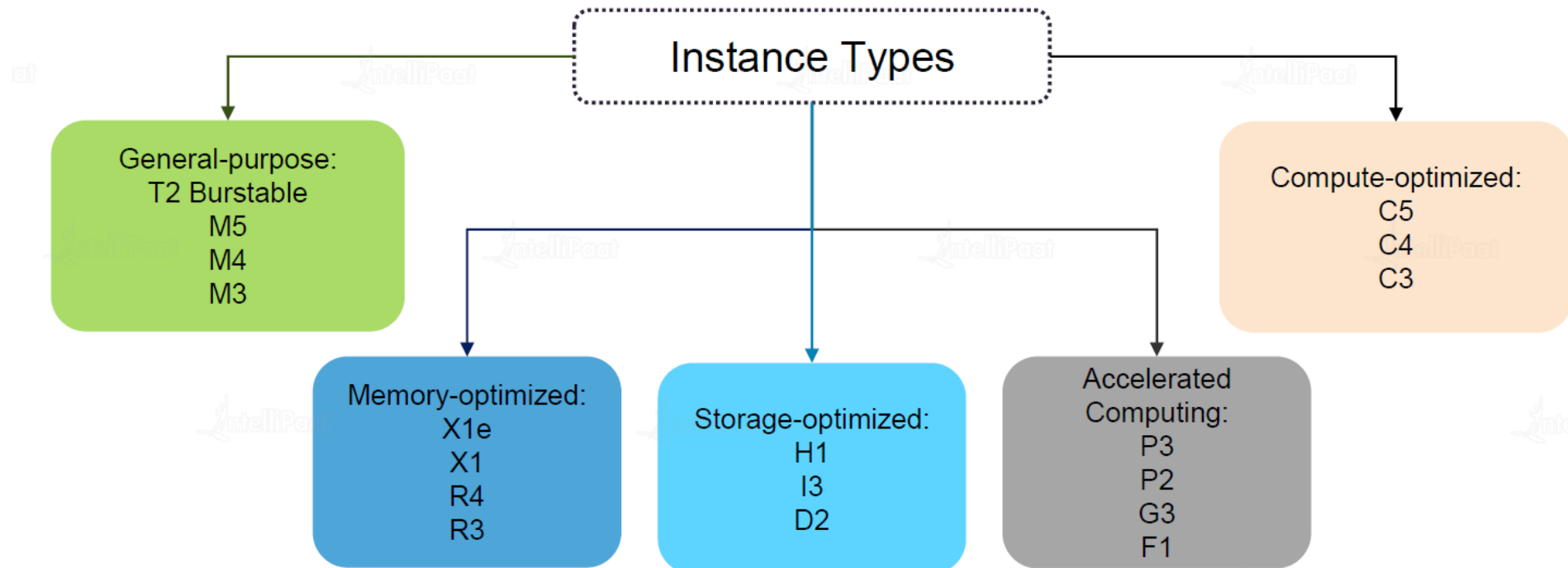5th Generation Broadwell (2015):
Xeon D
Xeon E3v4
Xeon E5v4

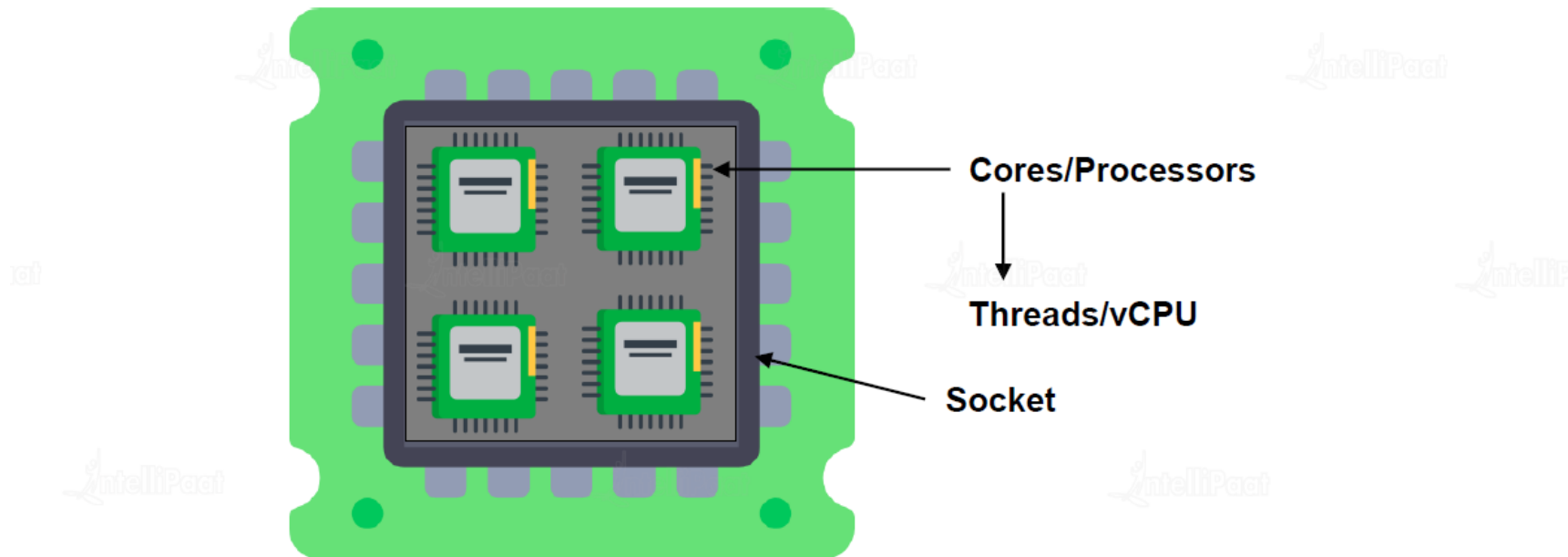6th Generation Skylake (2015):
Xeon E3v5

7th Generation Kaby Lake

EC2-Instance Type

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

Instance Types

General-purpose:
T2 Burstable
M5
M4
M3

Memory-optimized:
X1e
X1
R4
R3

Storage-optimized:
H1
I3
D2

Accelerated Computing:
P3
P2
G3
F1

Compute-optimized:
C5
C4
C3

The Vcpu & Root Device Volume

Each vCPU is a hyper-thread of an Intel Xeon core except for t2 and m3.medium instances (AWS Definition)

The Root Device Volume contains the image using which the instance is booted
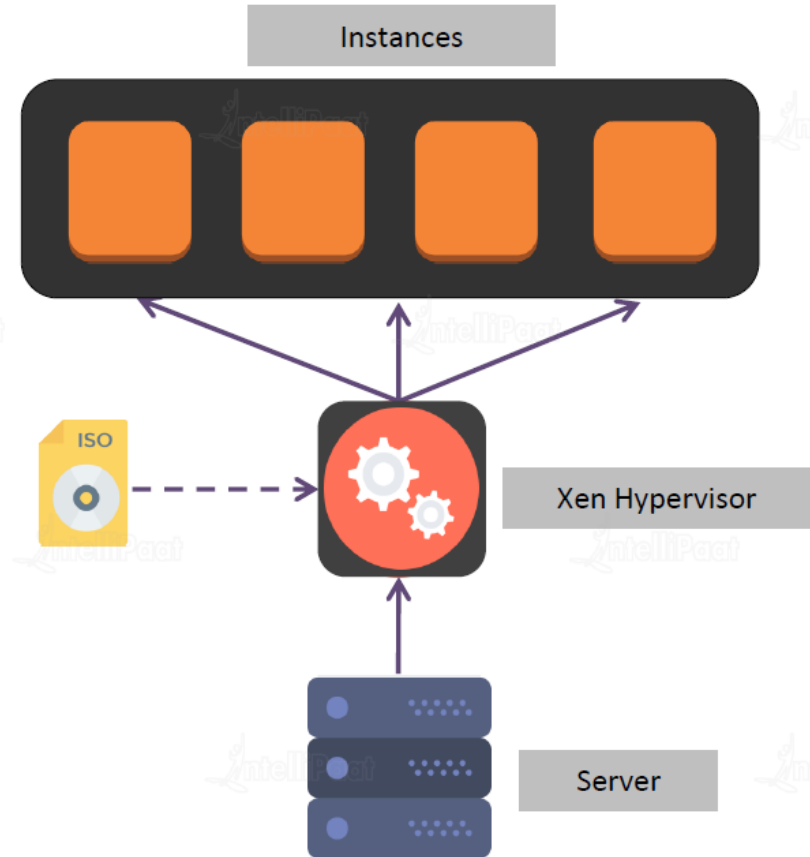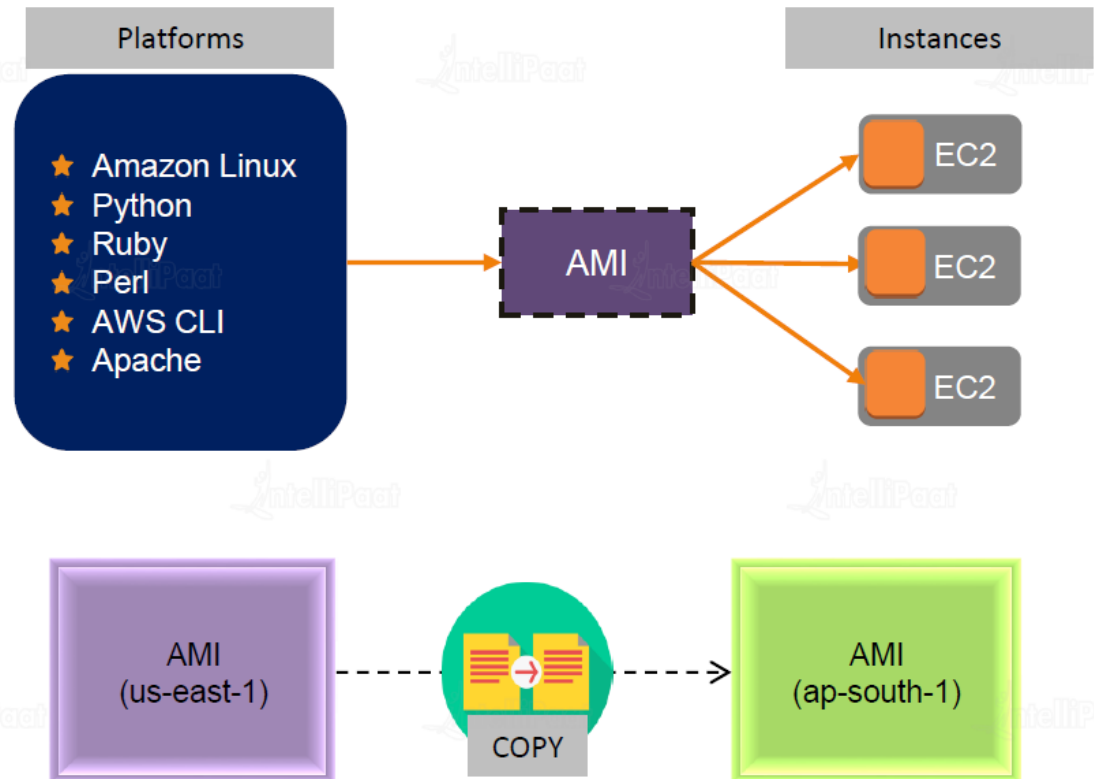
Demo1- Launching and Instace

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)
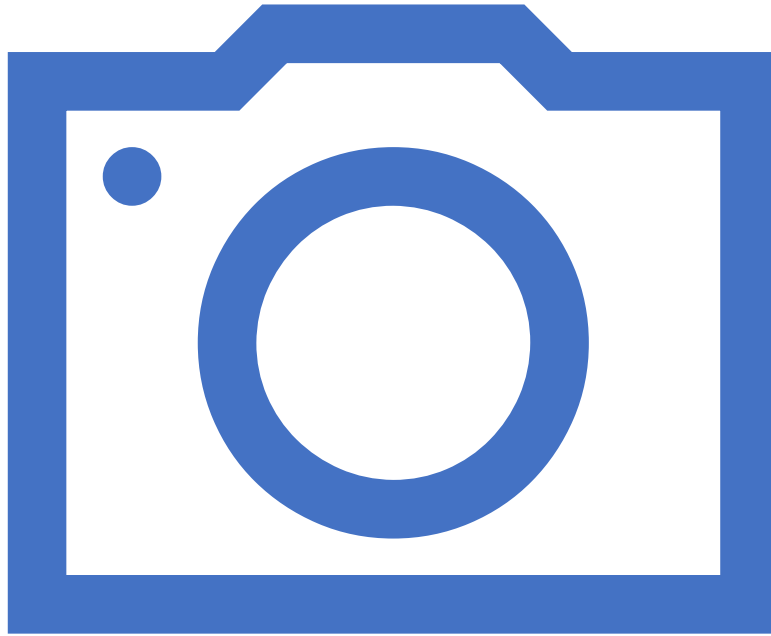
★ Virtualization type (HVM or PV)

Instances

ISO

Xen Hypervisor

Server

Creating and Copying an AMI

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

Platforms

- ★ Amazon Linux
- ★ Python
- ★ Ruby
- ★ Perl
- ★ AWS CLI
- ★ Apache

AMI

Instances

EC2

EC2

EC2

AMI (us-east-1) → COPY → AMI (ap-south-1)

Demo 2: Creating and Copying an AMI

Creating and Copying an AMI

Creating an AMI

1. Select the instance we created in the last demo
2. Click on the **Actions** button, and choose: Image → Create image
3. Provide a name and a small description for the image, and then click on **Create AMI**
4. Now, click on **AMIs** under the Images group in the left-side scroll bar

We will see that the AMI has been created!

Copying an AMI to Another Region

1. Select the created AMI, and click on the Actions button (Actions → Copy AMI)
2. Choose the destination region, and click on **Copy AMI**
3. Go back to the AMIs view, and wait until it is available

We have now successfully created and copied an AMI!

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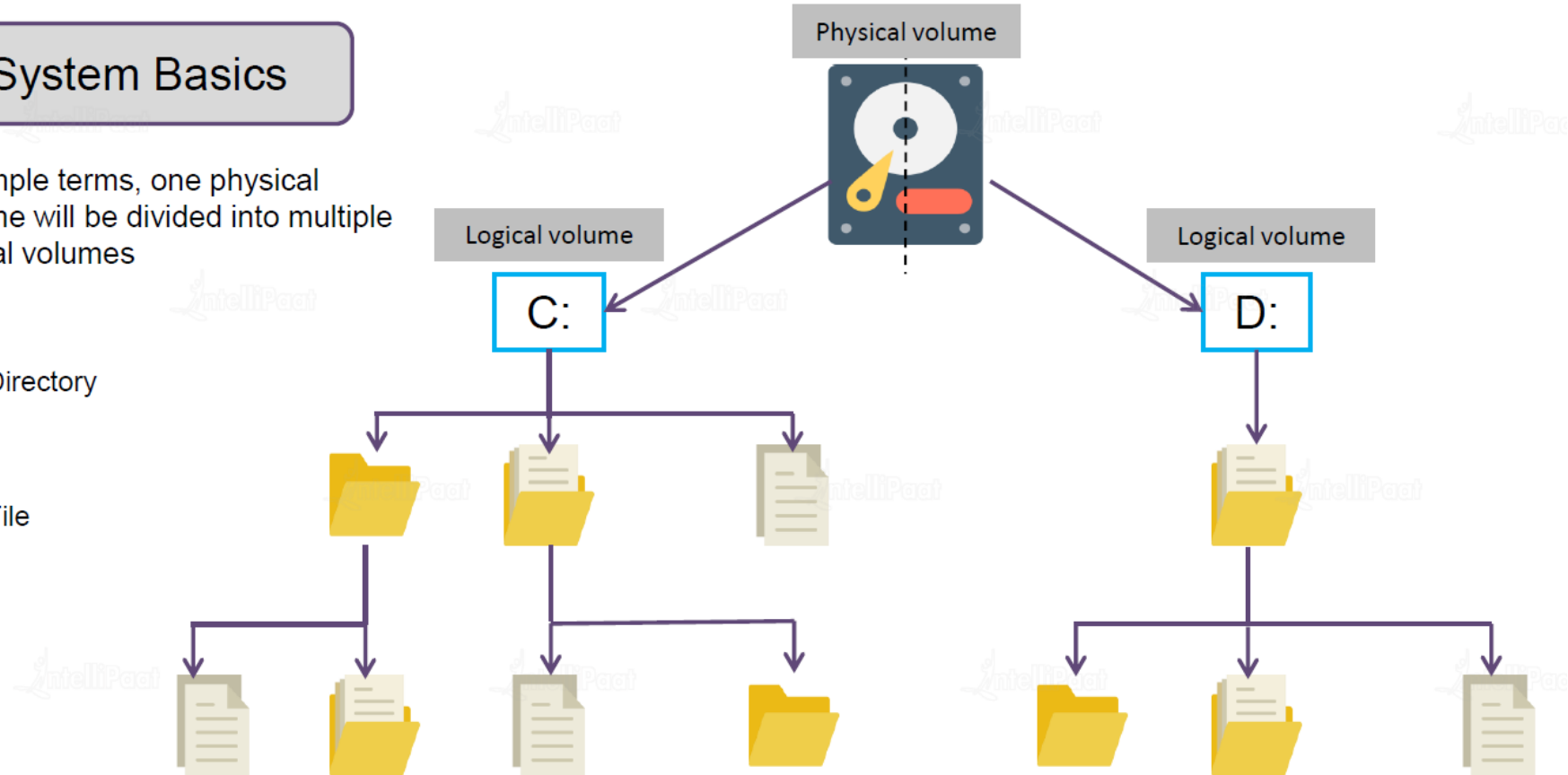- Whenever the instance is re-launched, the public IP changes

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
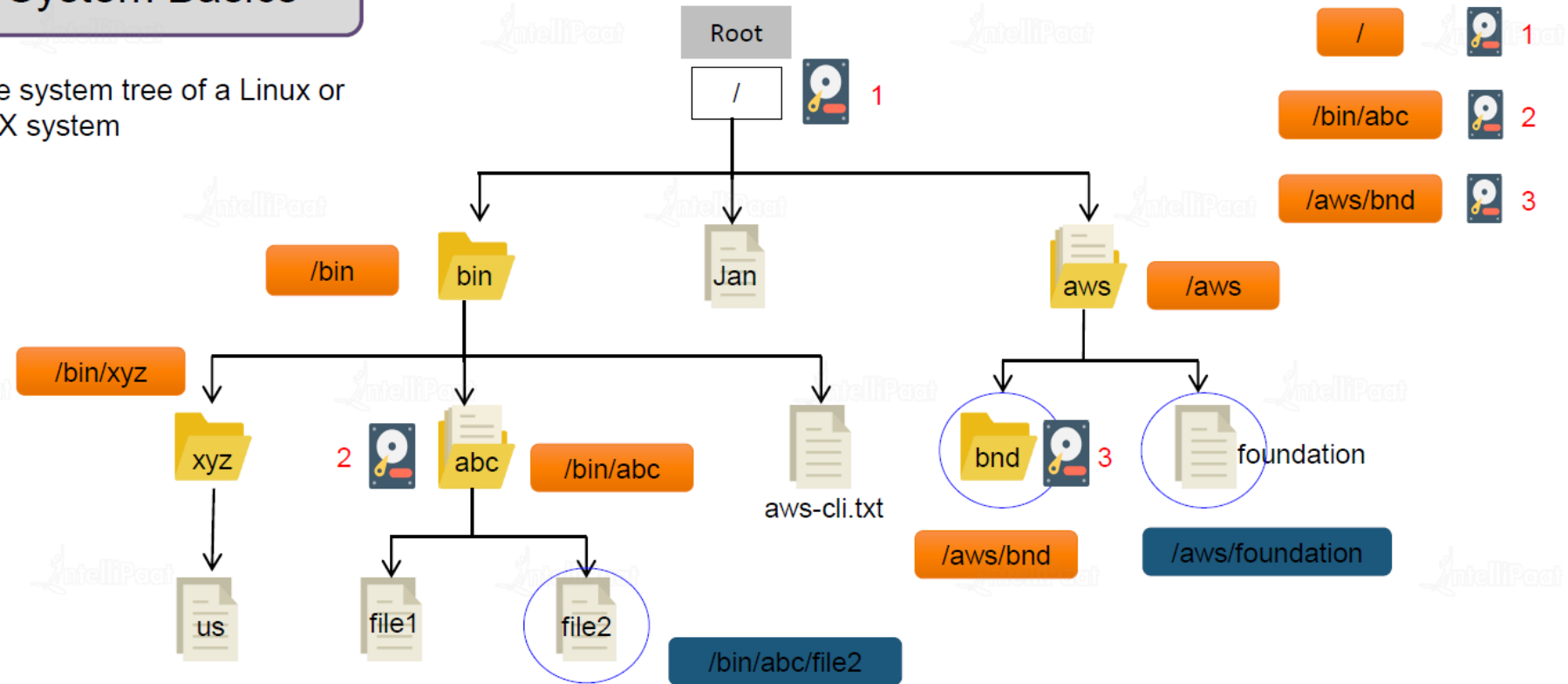
Introduction to EBS

File System Basics

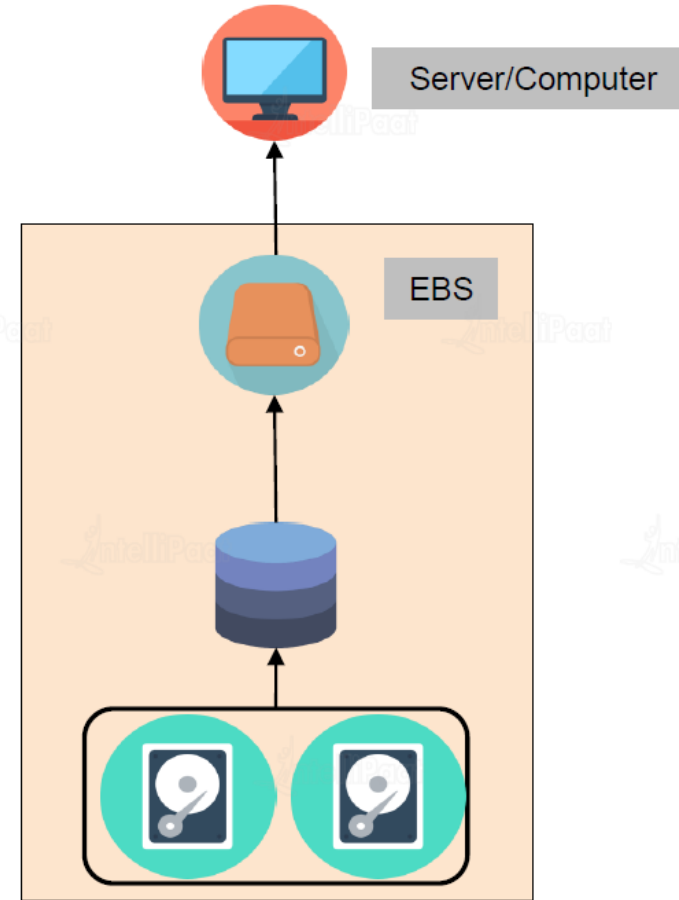★ In simple terms, one physical volume will be divided into multiple logical volumes

Directory

File

Physical volume

Logical volume

C:

Logical volume

D:

File System Basics

★ A file system tree of a Linux or UNIX system

Root
/

Path names

/   1
/bin/abc   2
/aws/bnd   3

/bin — bin

Jan

aws — /aws

/bin/xyz

xyz

abc — /bin/abc

aws-cli.txt

bnd — /aws/bnd

foundation — /aws/foundation
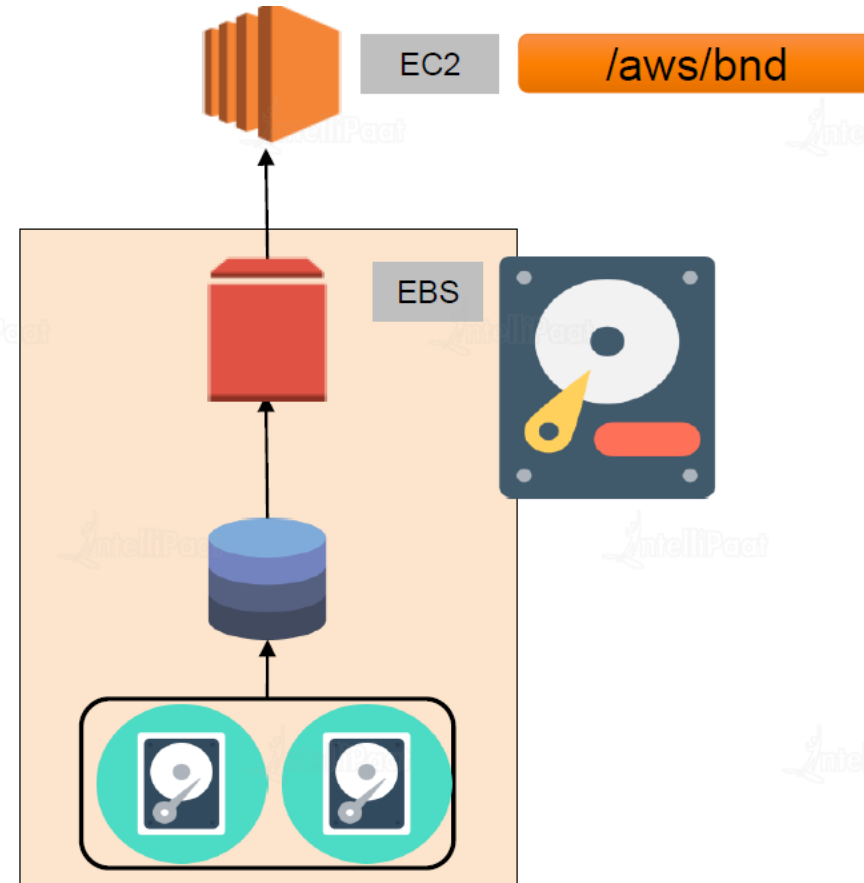
us

file1

file2 — /bin/abc/file2

Elastic Block Store

- In an EBS block-level storage, the server-base operating system connects with the raw volumes that are created through a fiber channel
- Then, they are used as individual disks, and if it is very versatile, it can be used as file storage, database storage, and virtual machine volumes
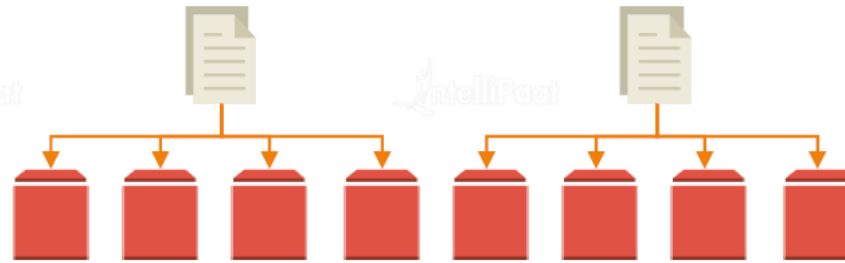
Server/Computer

EBS

Elastic Block Store

★ An EC2 instance is directly connected to EBS

★ While the instance is running, a volatile memory called ephemeral storage will be attached to the instance

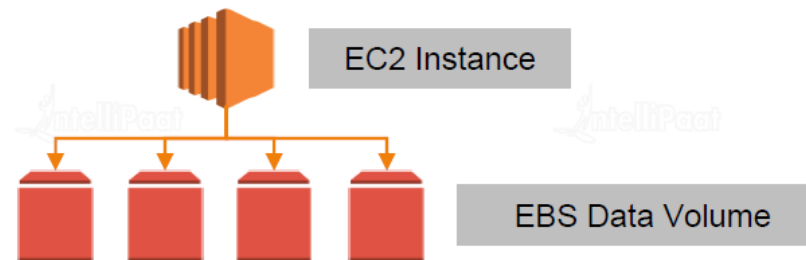★ If the instance is stopped, the ephemeral memory will be detached

EC2

/aws/bnd

EBS

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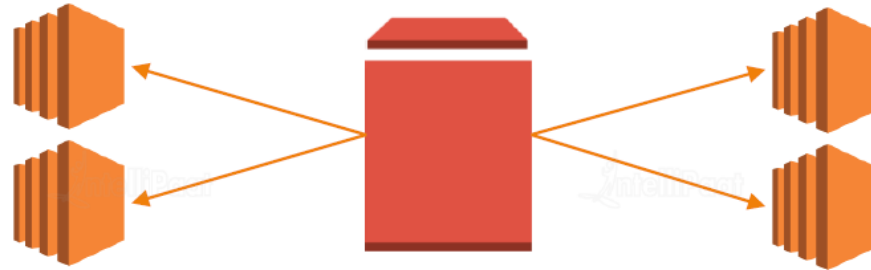- Burst performance is 80 MB/s per TB with a max. of 250 MB/s per volume

EBS Concepts

Volume Types

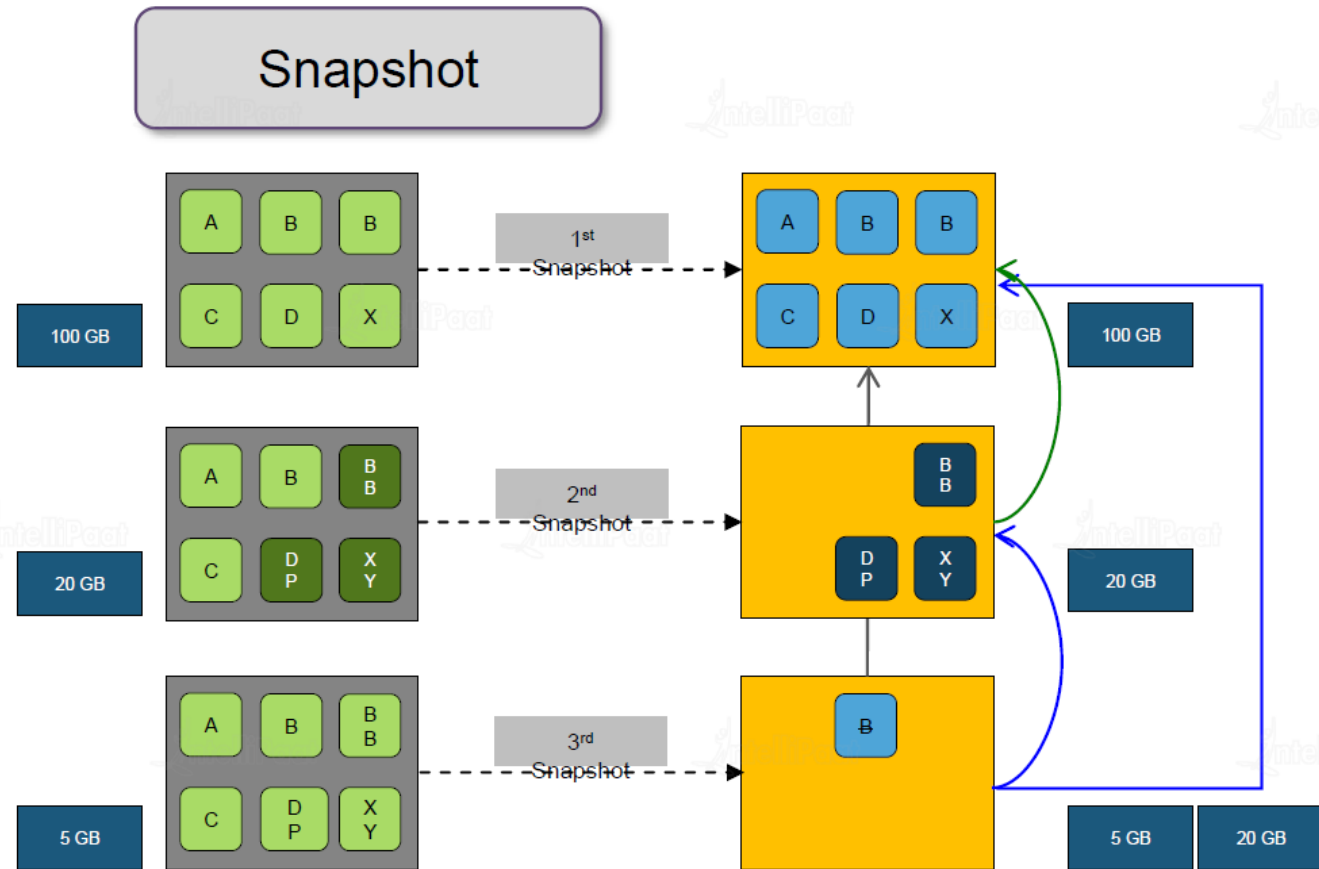| Volume Type	Size Limit	Maximum IOPS	Maximum Throughput	Maximum Burst
GP2	1 GB – 16 TB	10000	160 MB/s	3000
IO1	4 GB – 16 TB	32000	500 MB/s	NA
ST1	500 GB – 16 TB	500	500 MB/s	500 MB/s
SC1	500 GB – 16 TB	250	192 MB/s	250 MB/s

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
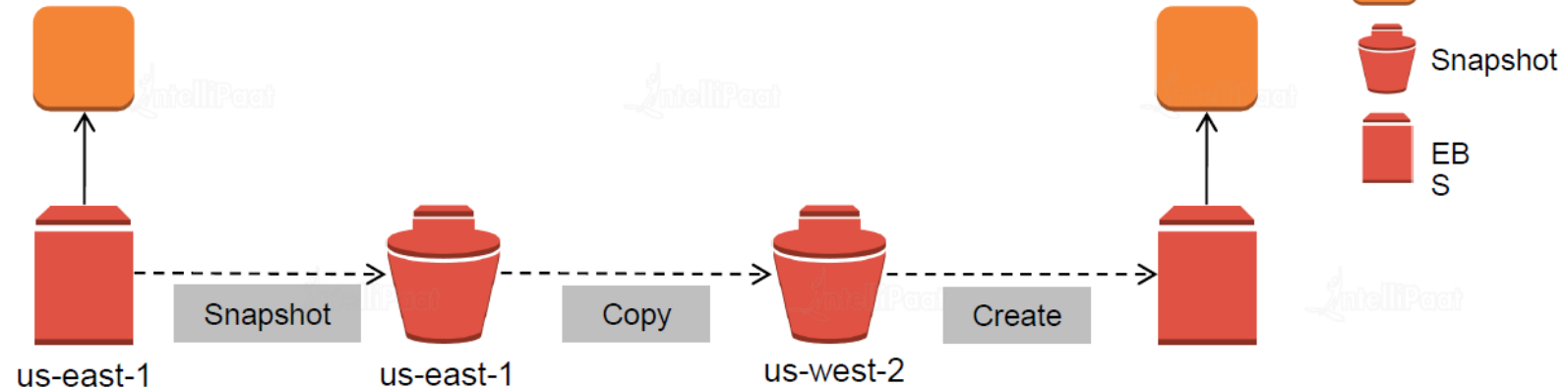
EBS Snapshots

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

EBS Snapshots

Demo3: Creating and Mounting an EBS Volume

Demo3

Creating an EBS volume

1. Choose EBS under Volumes from the EC2 dashboard
2. Click on Create volume
3. Reduce the size to 8 GB, and choose the availability zone the same as the zone of the created Ubuntu EC2 instance
4. Create the volume, and click on Actions → Attach Volume
5. Click on the instance field; choose the available instance, and proceed to create

A volume is created and is ready to be mounted!

Mounting the EBS volume onto the instance

Reconnect our Ubuntu instance and follow the commands below one by one to mount the created EBS volume to it

- lsblk (to get the device name)
- sudo mkfs -t ext4 <device-name>
- sudo mount <device-name> <file-system-name>
- sudo file –s <device-name> (to get file system type)

Creating an volume which can be attached with multiple EC2 instances with the Multi-attach feature.