AWS Foundation

Introduction to EC2, EBS & EFS

Agenda

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2. REGIONS & AVAILABILITY ZONES
3. PRE-EC2
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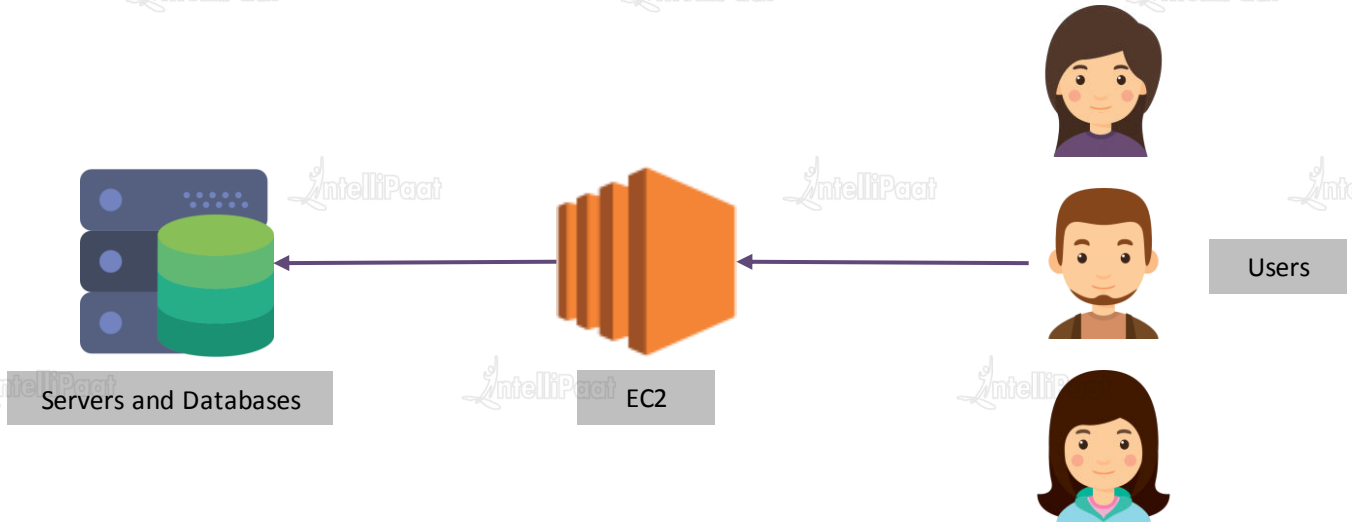
Introduction to EC2

Introduction to EC2

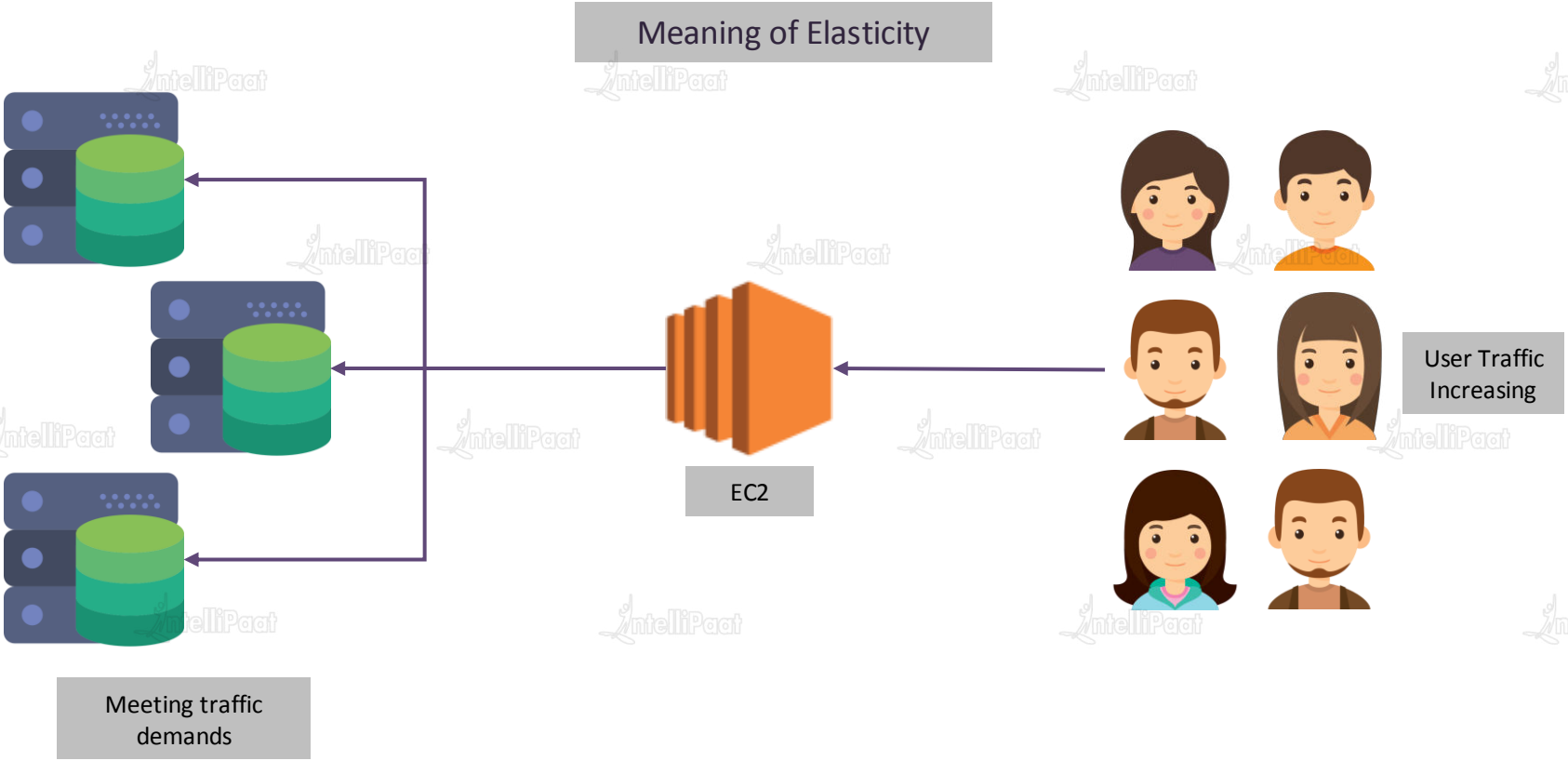
Elastic Compute Cloud

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 current demand as closely as possible

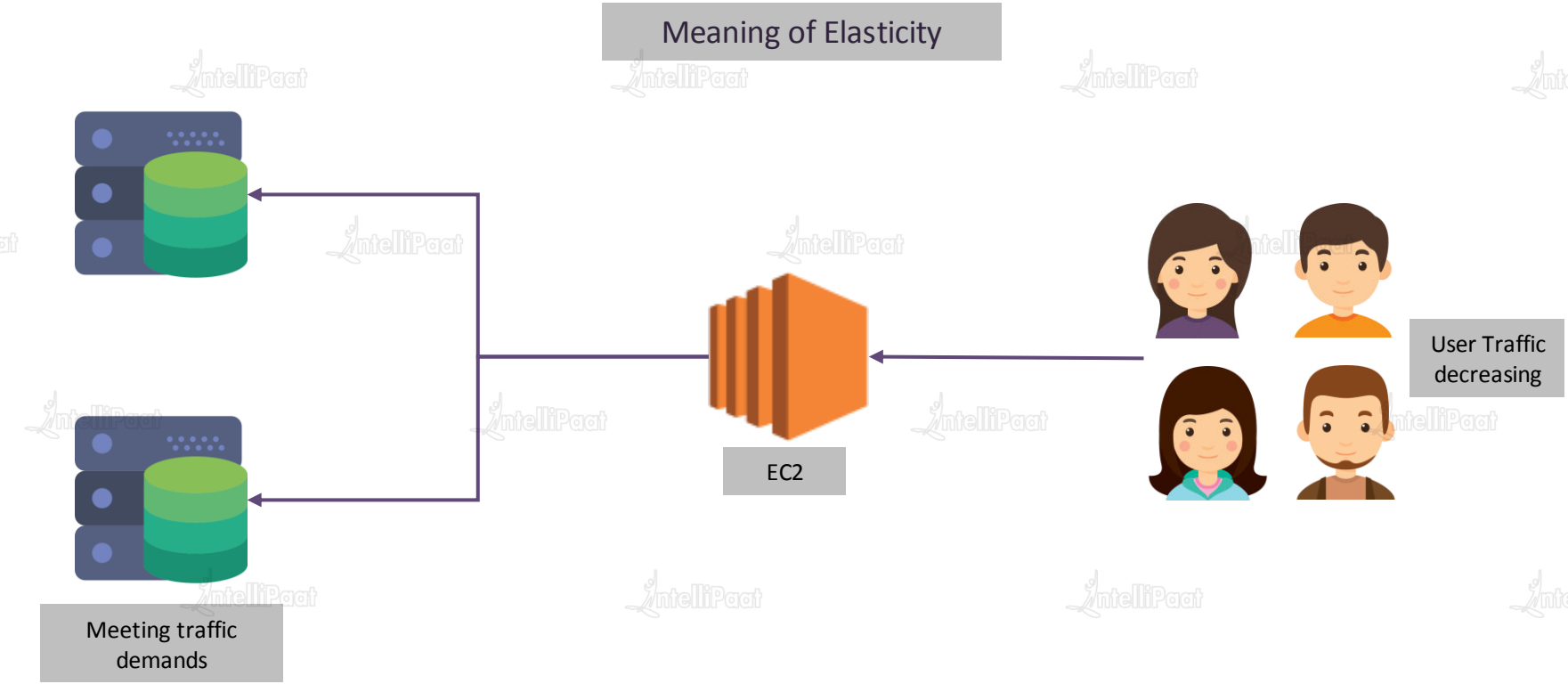
Meaning of Elasticity



Introduction to EC2



Introduction to EC2



Regions and Availability Zones

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 its 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)

"us-east-1" contains 6 data centers or Availability Zones:

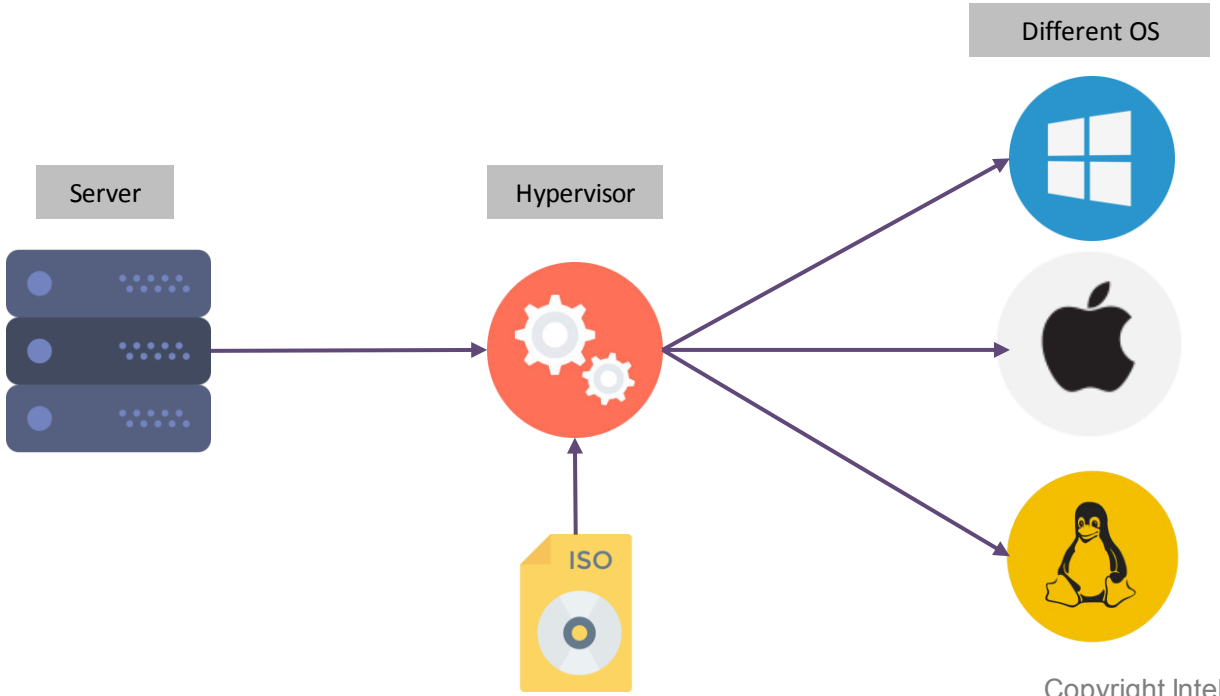
- us-east-1a
- us-east-1b
- us-east-1c
- us-east-1d
- us-east-1e
- us-east-1f

Availability Zone

Pre-EC2

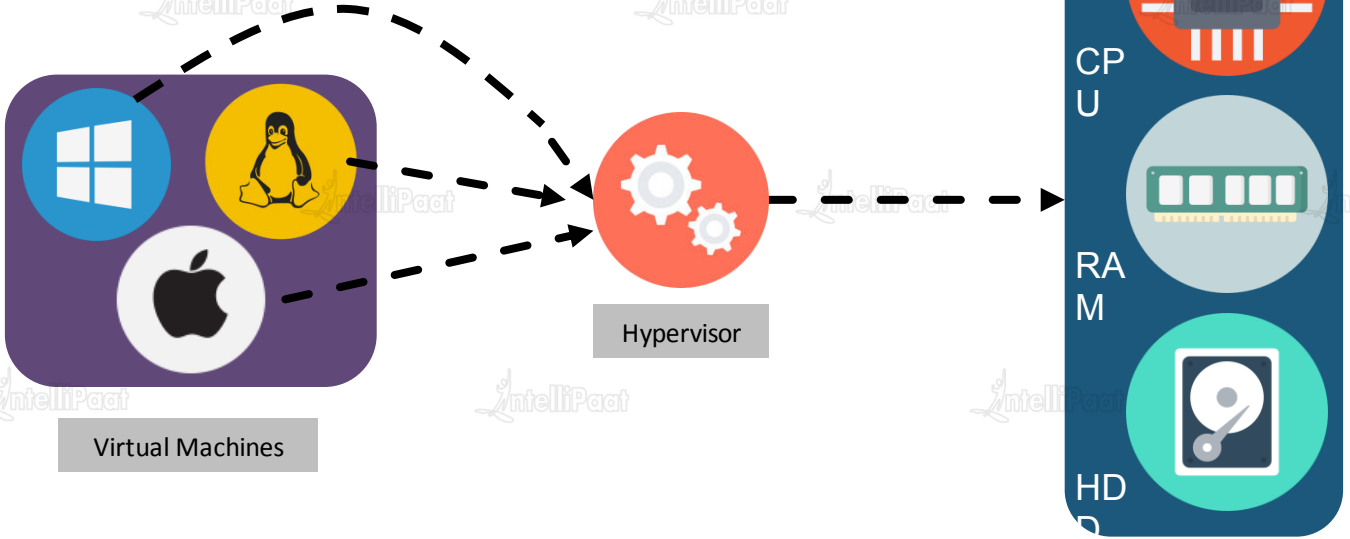
Pre-EC2

Virtual machine is an emulation of a computer system having OS, RAM, CPU or compute capacity.



Pre-EC2

- In the simplest terms, it is running virtual operating system inside of an operating system.
- Suppose, you want to run Ubuntu in your Windows OS you could easily install and use it as an virtual OS



Pre-EC2

Intel Processor Generation

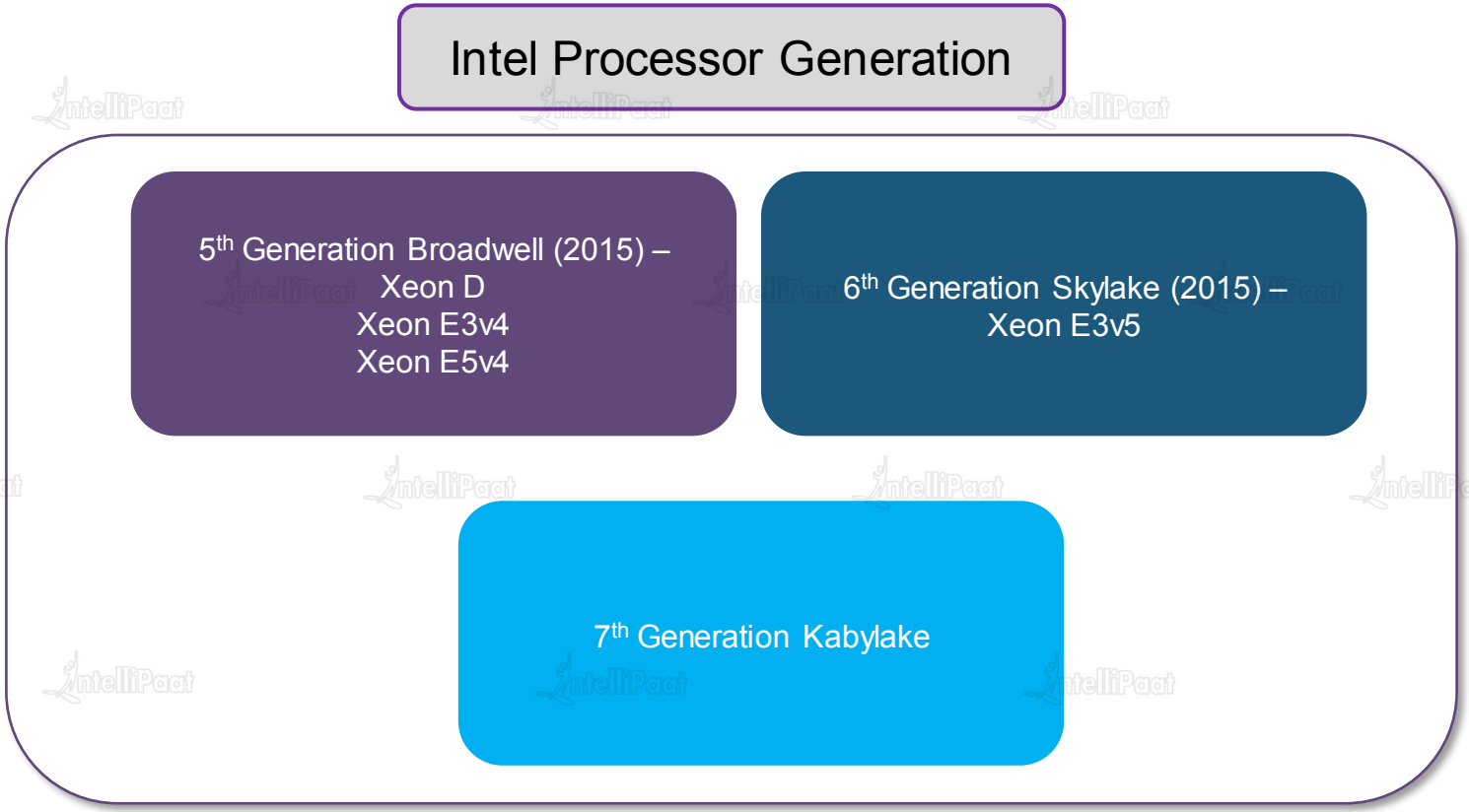
1st Generation Nehalem (2006) – Introduced hyper-threading.

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

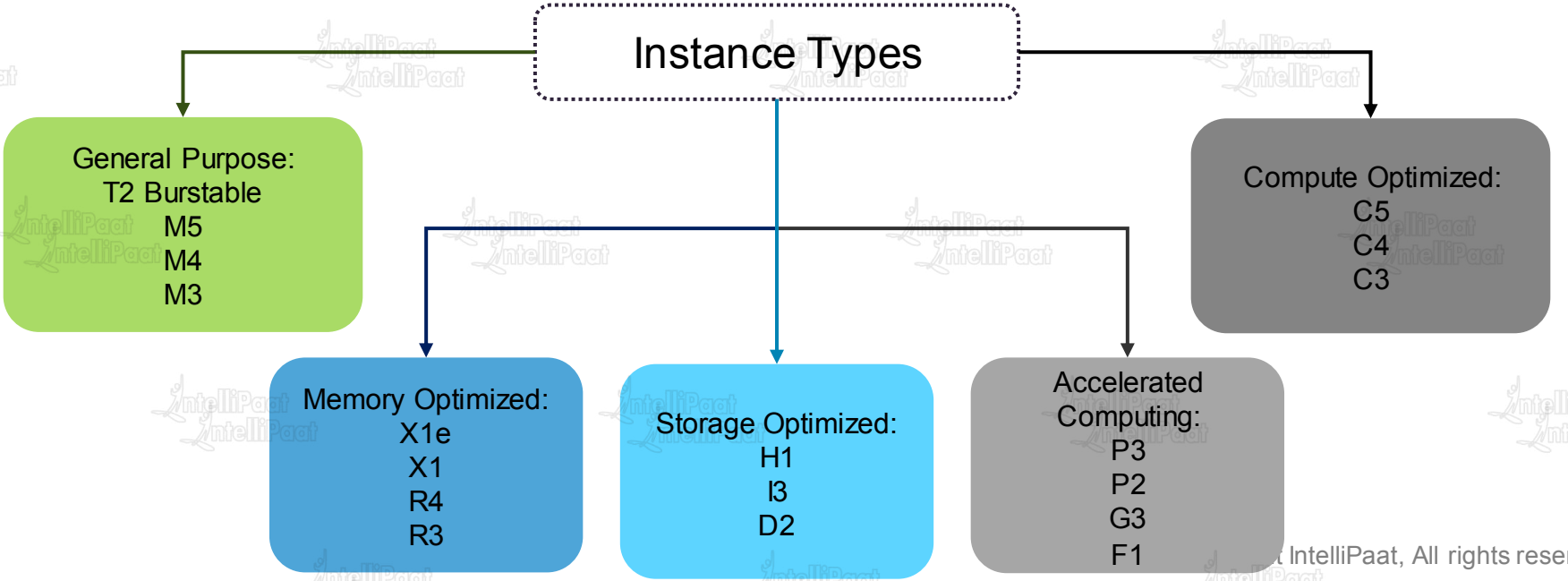
Pre-EC2



EC2 Instance Types

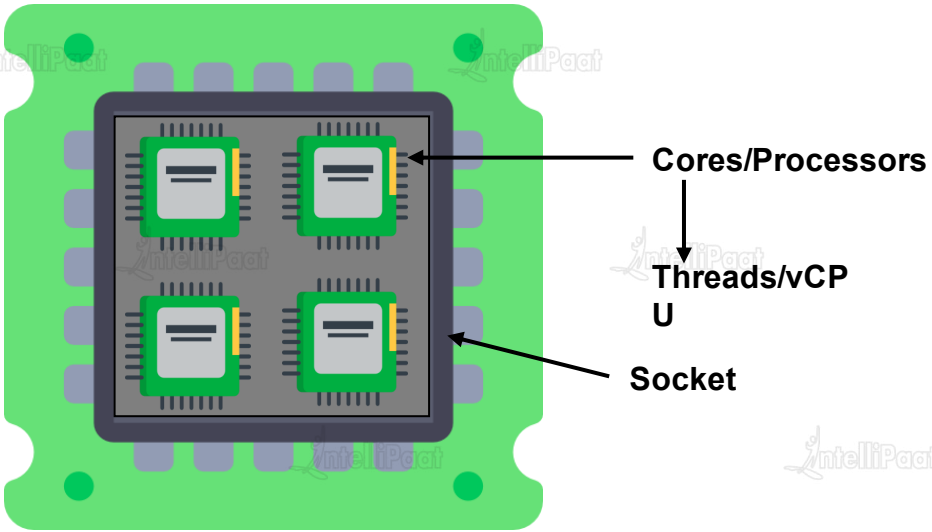
EC2 Instance Types

Instance type determines the hardware of the underlying host computer on which ec2 instances are launched.



vCPU, Root Device Volume

Each vCPU is a hyper-thread of an Intel Xeon core except for t2 and m3.medium instances (AWS Definition).
Root Device Volume: Contains the image using which the instance is booted.



Demo 1: Launching an Instance

Demo 1: Launching an Instance

Steps for launching an EC2 Instance

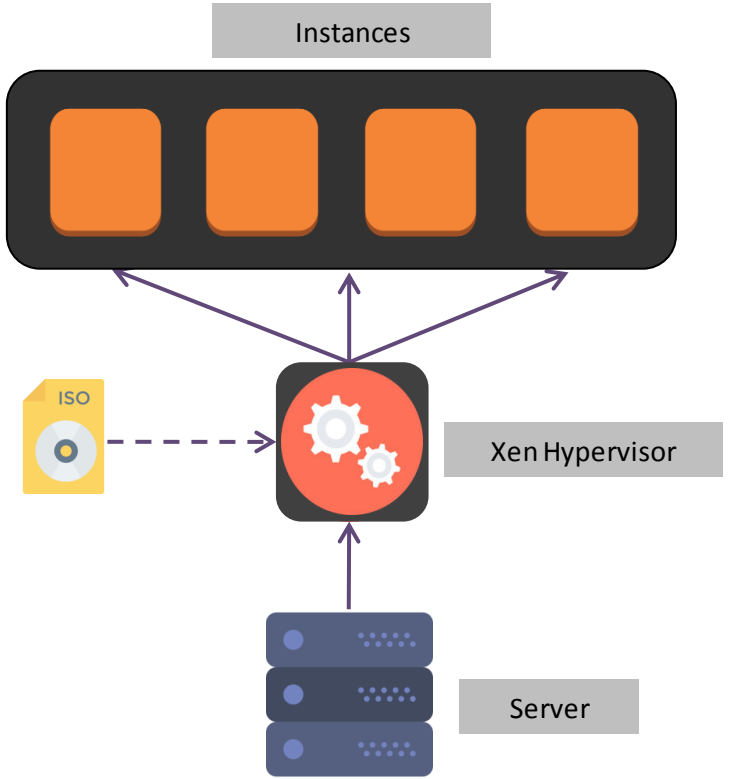
1. Open AWS Management Console, click on the Services drop down box and choose EC2
2. Click “launch Instance” button and choose an AMI (i.e. in our demo Ubuntu 18.04)
3. Choose Instance type (Free tier eligible) and click next
4. Then Configure instances, add storage and unique tags
5. Configure network group (Choose create new group) then review once and launch
6. Next, choose “create a new key pair” and give a name then download
7. Click on launch instances and wait till it initializes. Now you have successfully created a EC2 Instance

What is an AMI?

What is an AMI?

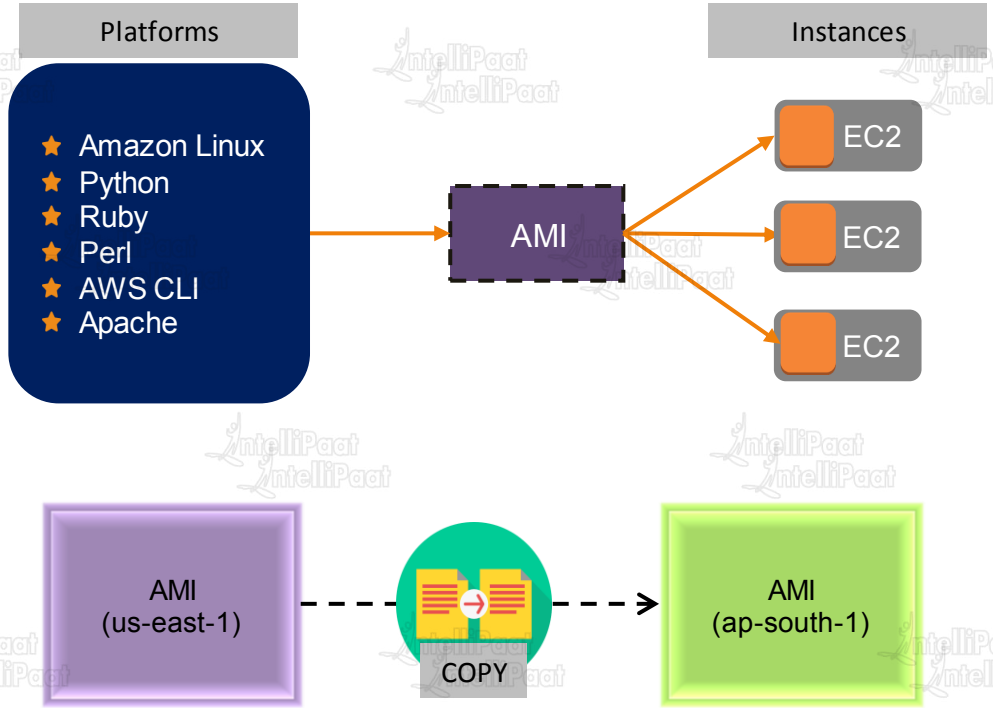
Amazon Machine Image: AMI contains information required to launch an instance.

- Operating System
- Architecture
- Storage for the root device (Instance Store or EBS backed)
- Virtualization Type (HVM or PV)



Creating and Copying an AMI

- Create AMI from an Instance.
- Launch multiple instances from it.
- Copy AMI.
- AMI Permissions.



Demo 2: Creating and Copying an AMI

Demo 2: Creating and Copying an AMI

Creating an AMI

1. Select the instance which we have created in the last demo
2. Now click on the “actions” button and choose (image → create image)
3. Provide a Name and a small description for the image then click on create AMI
4. Now click AMIs option under the Images group in the left side scroll bar
5. 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” button
3. Go back to the AMIs view and wait till it is available
4. You have now successfully created and copied an AMI

Public IP vs Elastic IP

Public IP

- It is not associated with AWS account
- No charges for the public IP, even it is not being used while the instance is running
- When the instance is relaunched the public IP changes every time

Elastic IP

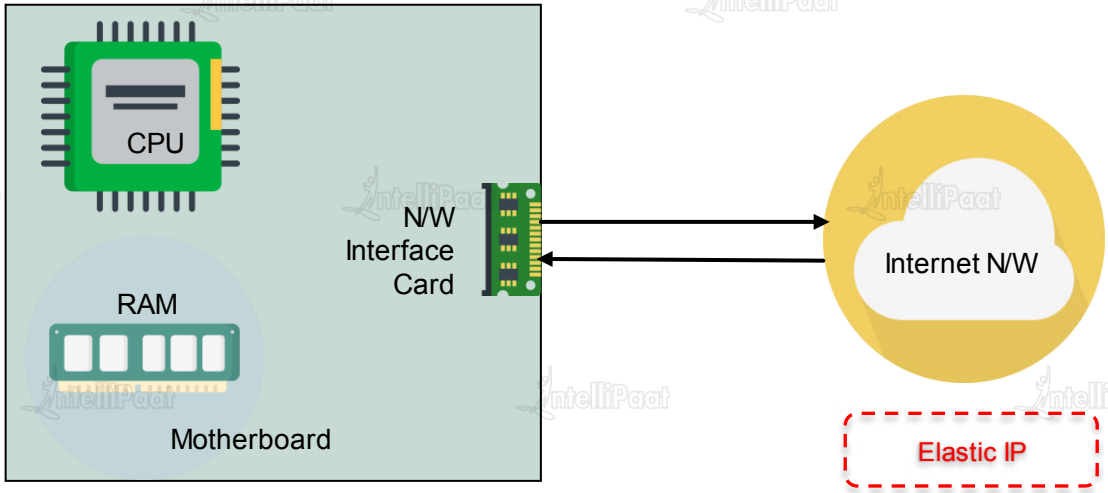
- It is associated with the AWS account
- Charges are applied while the same is done with Elastic IP
- Elastic IP is the same and static for every launch until you manually release it

Elastic Network Interface

Network interface is the interface between a computer and an internet network. Network IO happens through n/w interface cards.

N/W interfaces contain :

- Elastic IP
- Public IP
- Private IP
- Security Groups



Introduction to EBS

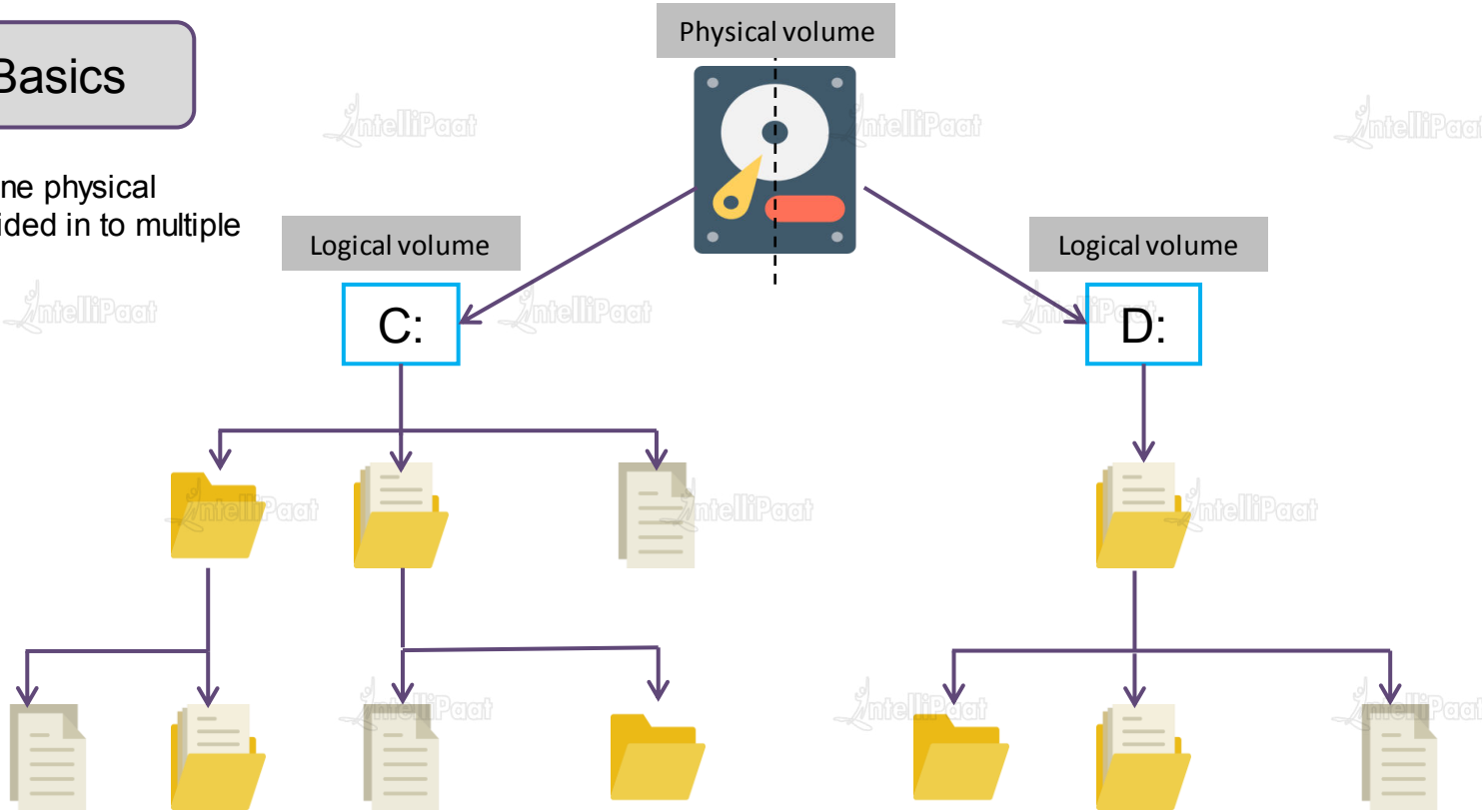
Introduction to EBS

File System Basics

- In simple terms, one physical volume will be divided in to multiple logical volumes

Directory

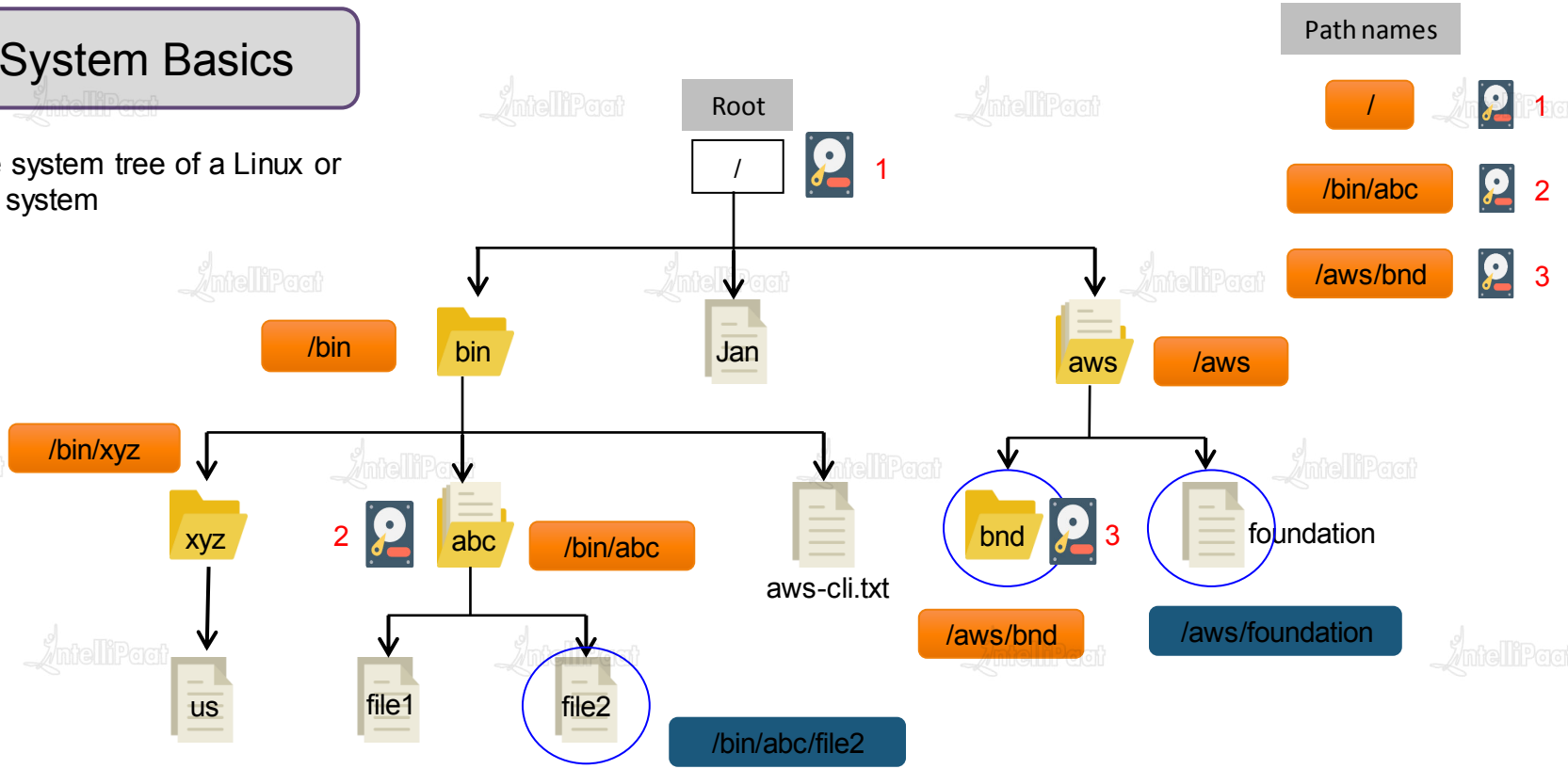
File



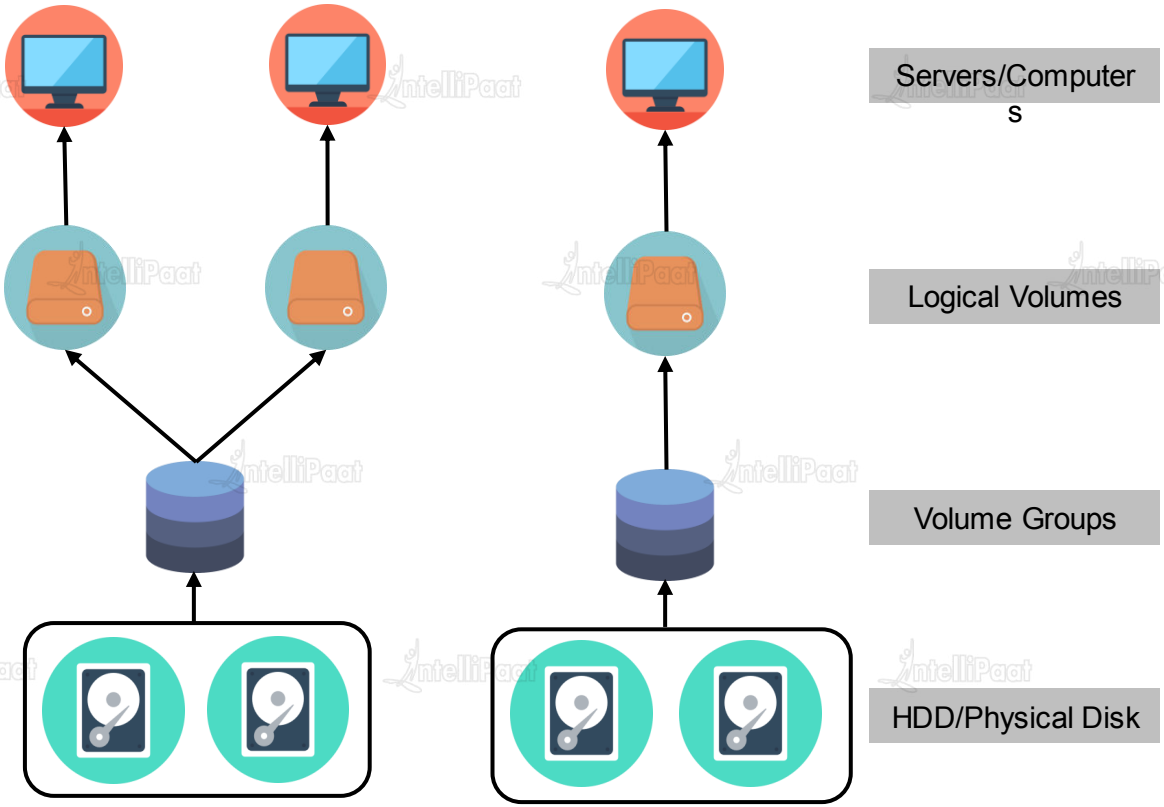
Introduction to EBS

File System Basics

- A file system tree of a Linux or Unix system

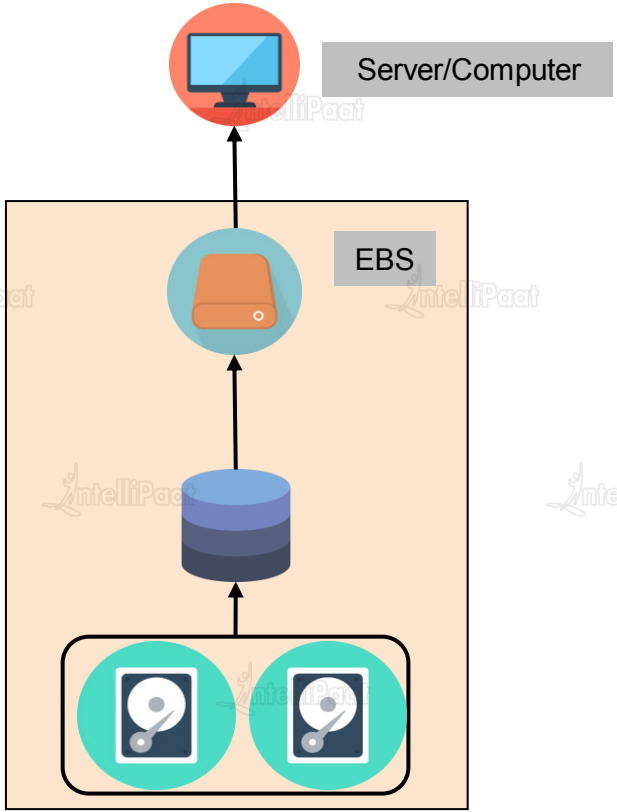


Pre-EBS Storage Layers



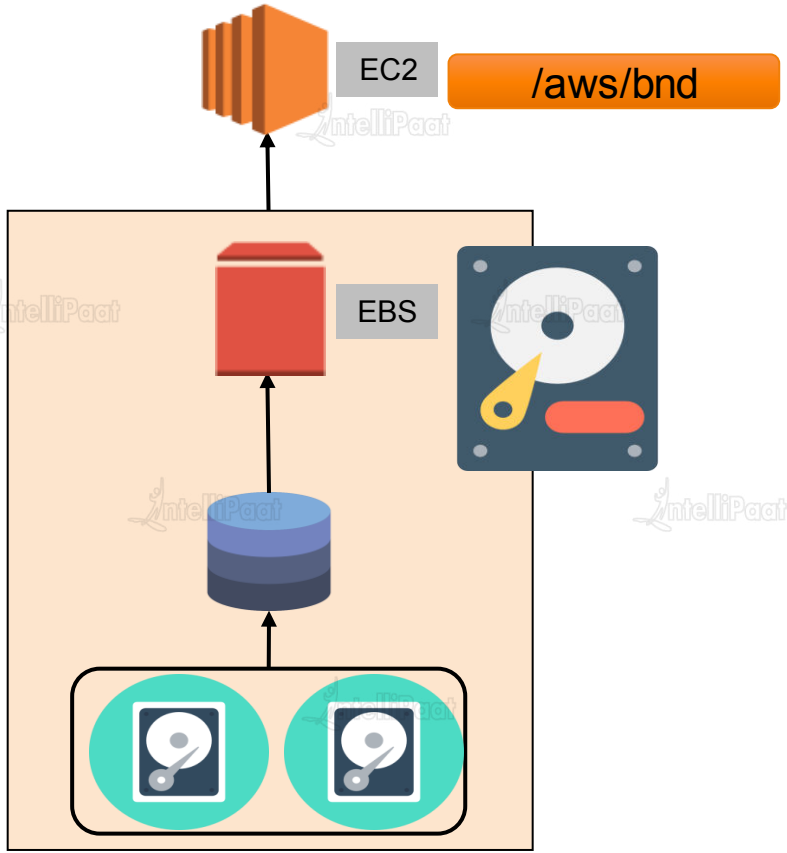
Elastic Block Store

- In a EBS block level storage, the server-base operating system connects with the raw volumes which are created through a fibre channel.
- They are used as individual disks after that and it is very versatile, it could be used as a file storage, database storage and virtual machine volumes.



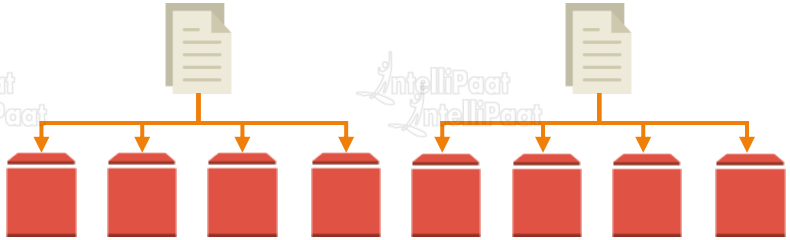
EBS Concepts

- 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, ephemeral memory will be detached

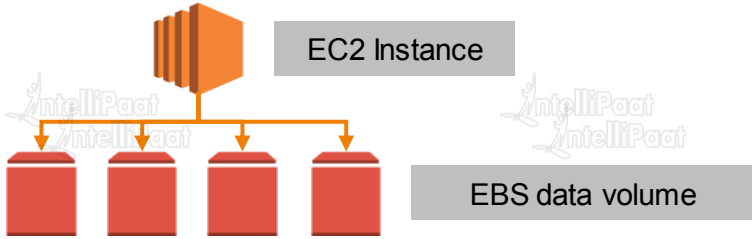


EBS Concepts

- Raw unformatted block level storage. Exposed as raw device to the EC2 instance.
- EBS volumes persists independently from the life of EC2 instance.
- An EBS volume is automatically replicated within an Availability Zone.
- **THROUGHPUT** – It is the sequential transfer rate which an SSD or HDD will maintain continuously.



- **IOPS** – It is the measure of no. of I/O operations a drive, SSD or HDD, will handle per second with each block being read from or written to a RANDOM location of the disk.



EBS Concepts

Volume Types

GP2 – General Purpose SSD.

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

IO1 – Provisioned SSD.

- From 100 to 32000 IOPS can be provisioned.
- Max throughput per volume 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 250 MB/s per TB with a max of 500 MB/s per volume.

SC1 – Cold Storage HDD

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

EBS Concepts

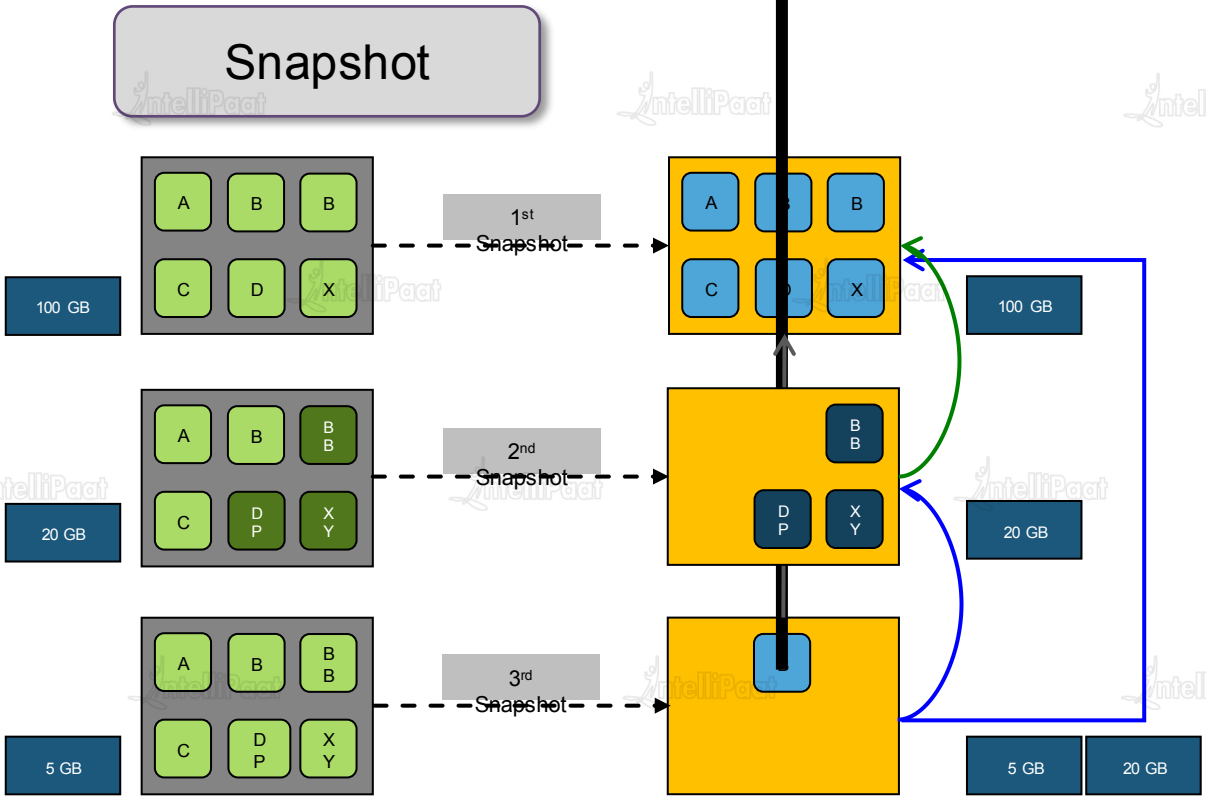
Volume Types

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

EBS Snapshots

EBS Snapshot

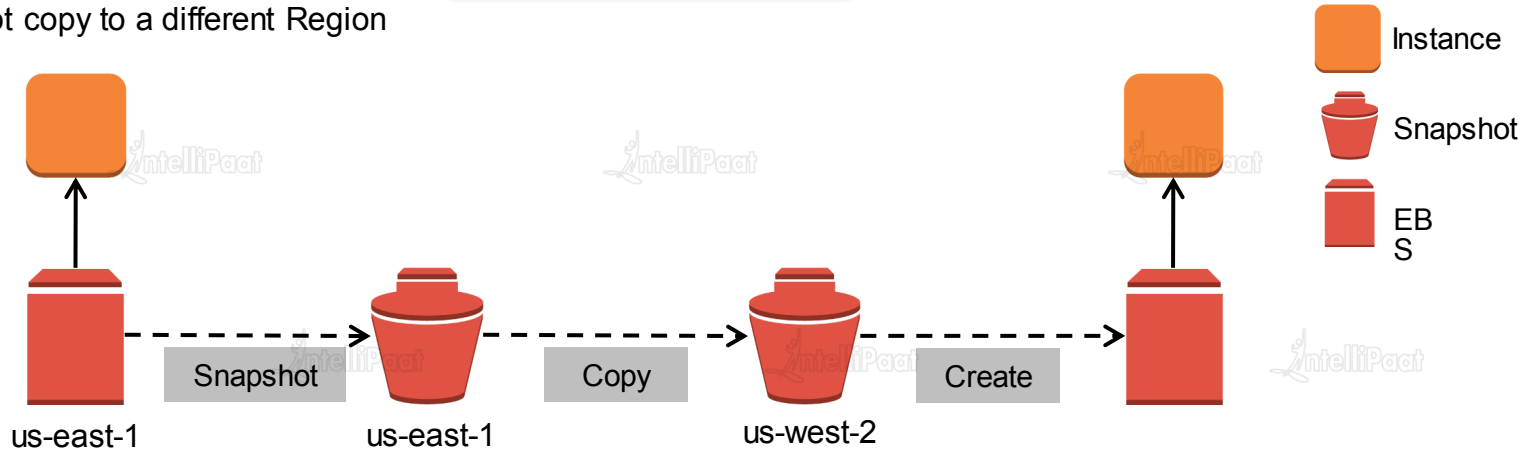
- Snapshots are used to backup data on the EBS volumes.
- All snapshots are incremental backups except for the first one.
- Snapshots are copied to Amazon S3.



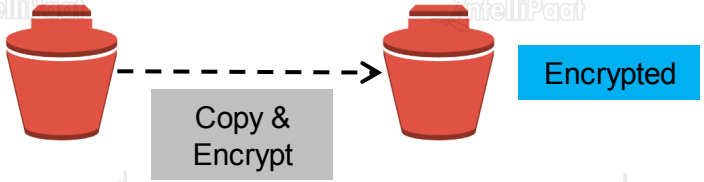
EBS Snapshot

Snapshot Copy

- Snapshot copy to a different Region



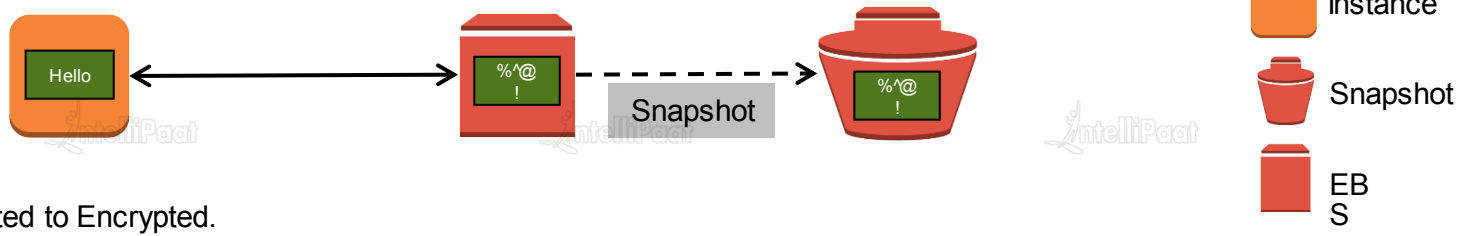
- Encrypt during copying



EBS Snapshot

EBS Encryption

- Supported by all volume types, but not by all Instance types



- Unencrypted to Encrypted.

- Encrypted to Unencrypted

Demo 3: EBS Demo

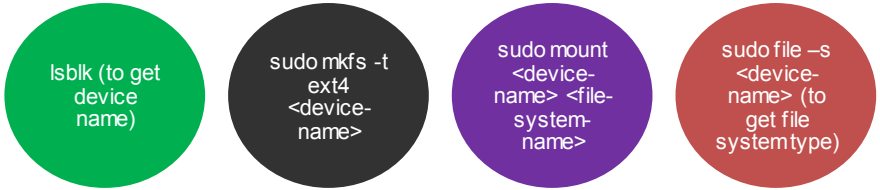
Demo 3: EBS Demo

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 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 and choose the available instance then proceed to create
6. A volume is created and is ready to be mounted

Mounting the EBS volume onto the instance

Reconnect your ubuntu Instance and follow this commands below, one by one to mount the created EBS volume to it



Introduction to EFS

Introduction to EFS

Amazon Elastic File System

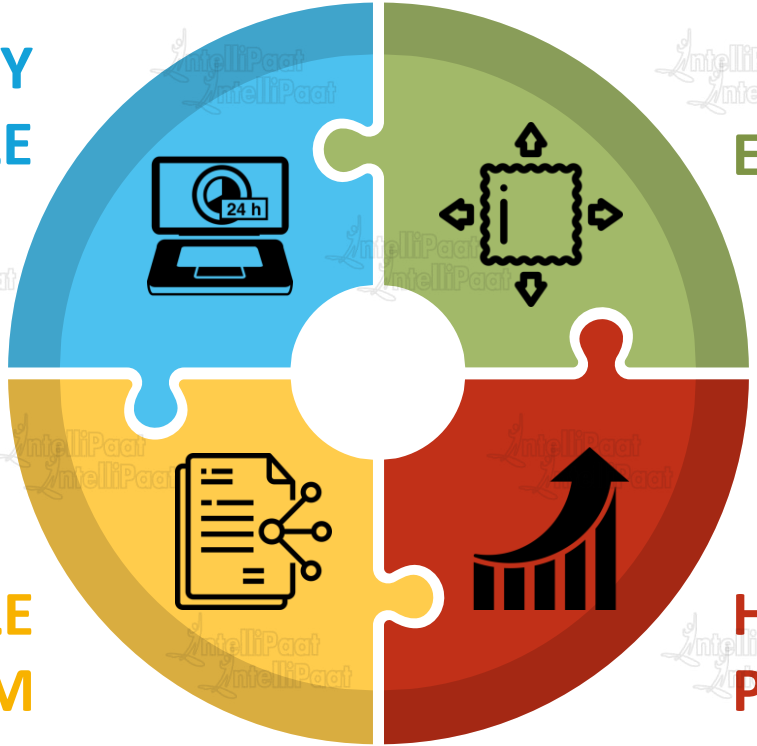
Amazon EFS (**Elastic File System**) is a cloud-based file storage service for applications and workloads that run in the **Amazon Web Services** (**AWS**) public cloud.

Why do we need EFS?

If your application is running on Amazon EC2 and needs a file system or any use case where a file system is needed.

EFS Benefits

HIGHLY AVAILABLE



ELASTICITY

SHARED FILE SYSTEM

HIGH PERFORMANCE

Demo 4: Elastic File System

Creating an Amazon EFS

1. Open AWS Management Console, click on the Services drop down box and choose EFS
2. Choose **Create File System**
3. Choose the **default VPC** from the VPV list
4. Check all the checkboxes for all the Availability Zones and then click on Next
5. Name your File System, add tags if any needed
6. Select **General Purpose** and **Bursting** for high performance
7. Review the file system properties once, then choose **Create File System**.
8. Note down the **File System ID** value for further use.

Mounting the EFS in a EC2 Instance

1. Connect your ubuntu EC2 Instances using PuTTY
2. Install NFS client using the following command

```
sudo apt-get -y install nfs-common
```

3. Now proceed with the commands one by one. I have mentioned them below.

```
sudo mkdir efs
```

```
sudo mount -t efs fs-12345678:/ /mnt/efs
```

```
cd efs
```

```
sudo mkdir getting-started
sudo chown ec2-user getting-started
cd getting-started
```

```
touch test-file.txt
```

```
ls -al
```

Demo 5: Elastic File System

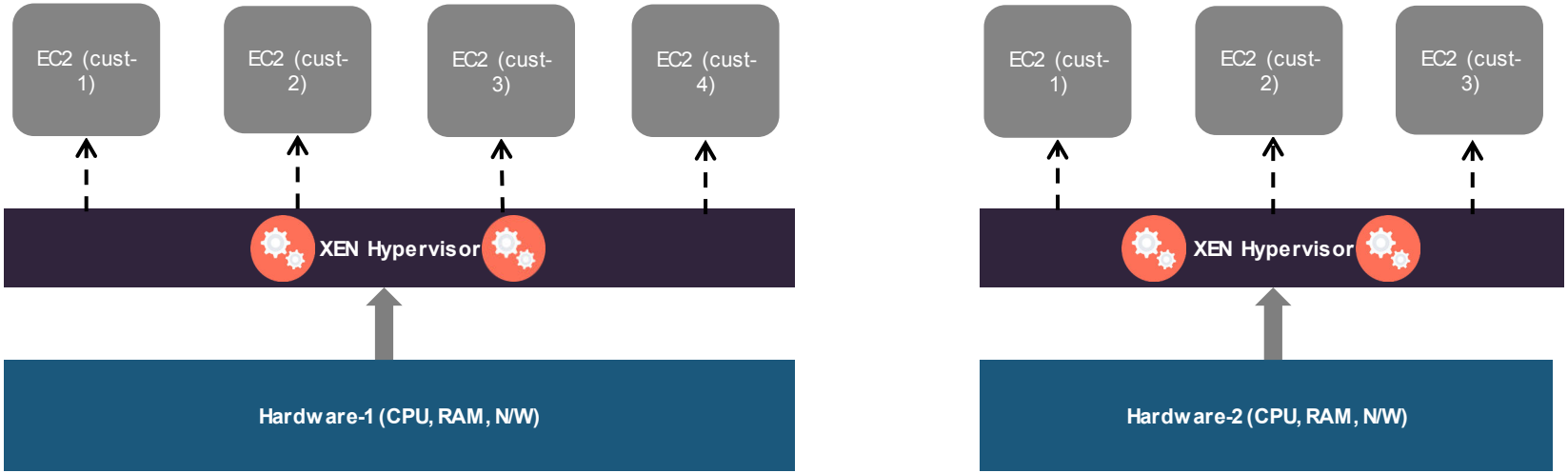
Connecting multiple Instances with a shared EFS

1. Create another EC2 instance (Ubuntu)
2. Mount the Previously created EFS into this Instance
3. Create a file in the EFS directory in the second instance
4. Verify in the first instance whether the file which was created in the second instance available

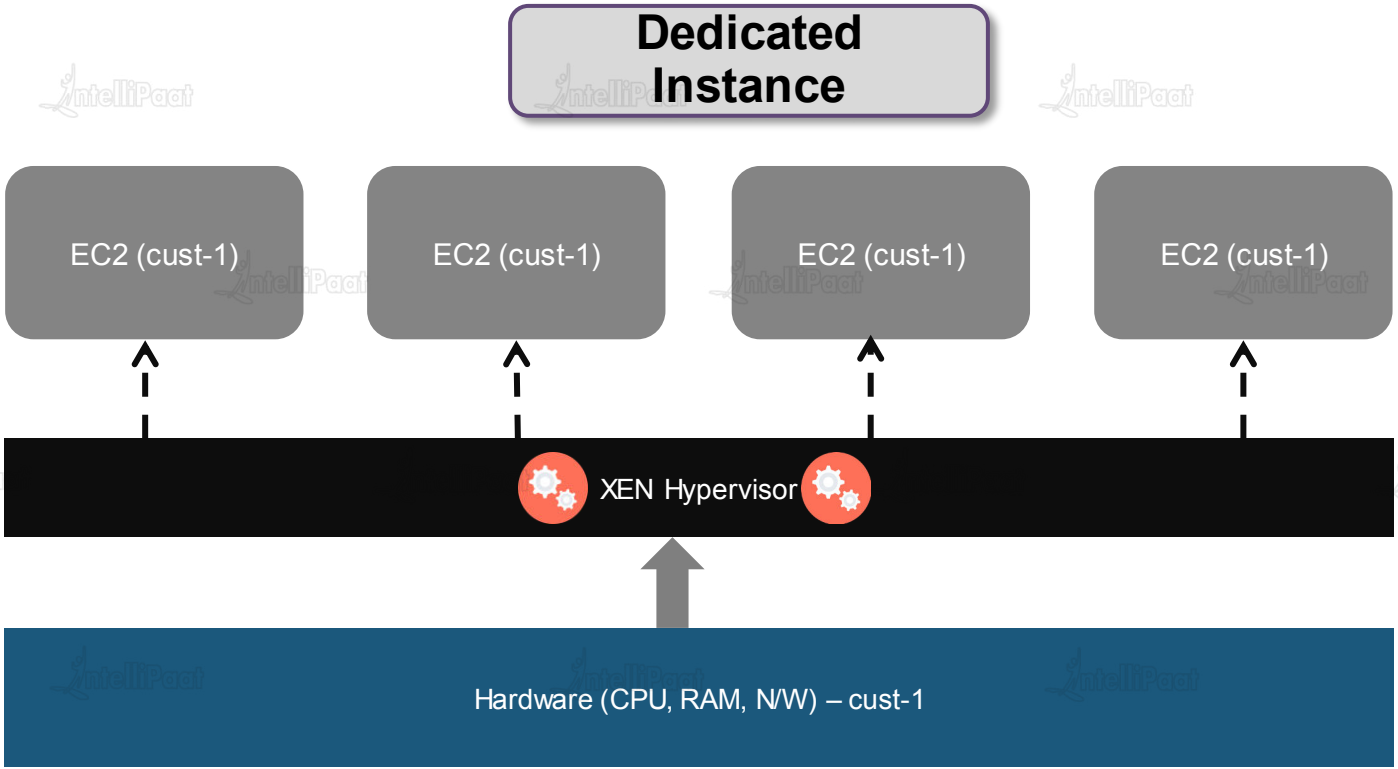
Instance Tenancy, Reserved and Spot Instances

Instance Tenancy

Shared/Default Instance



Instance Tenancy



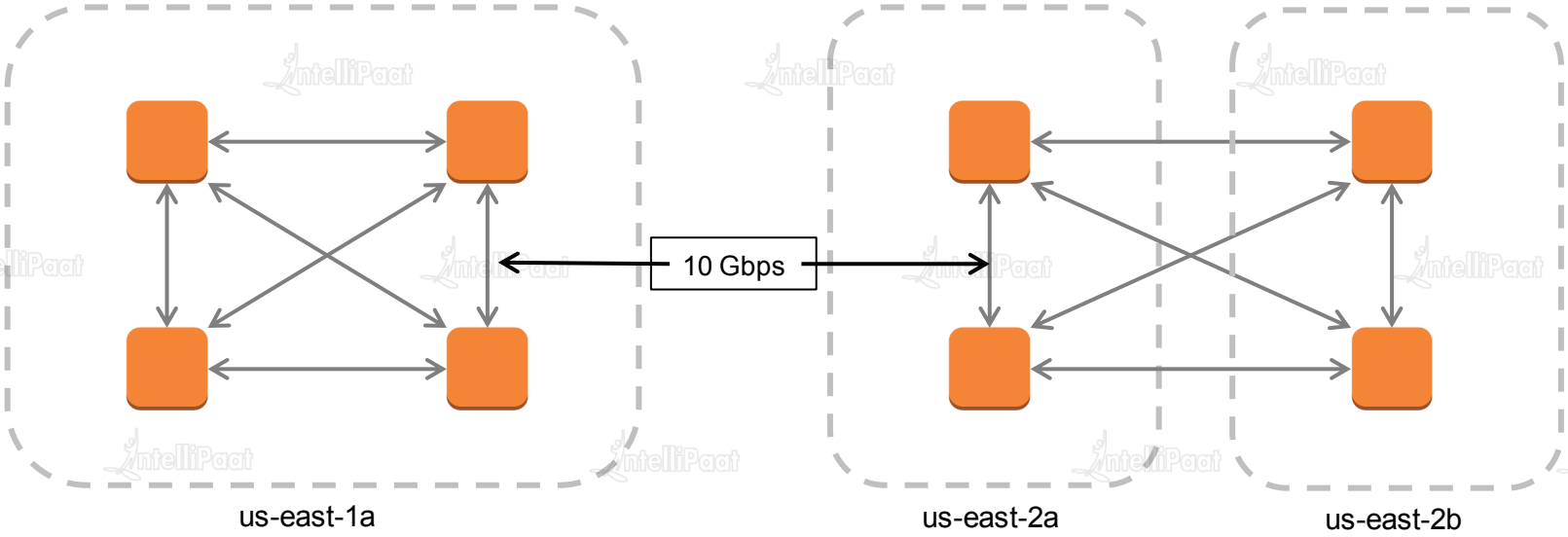
Instance Restart

What happens during a restore?

Placement Group

Cross-platform PG

EC2 instances should support Enhanced N/W



Reserved and Spot Instances

Reserved Instances

- Regional RI – AZ and Instance Size Flexibility (default tenancy only).
- The resources and capacity is reserved until the contract period ends.
- Scheduled RI

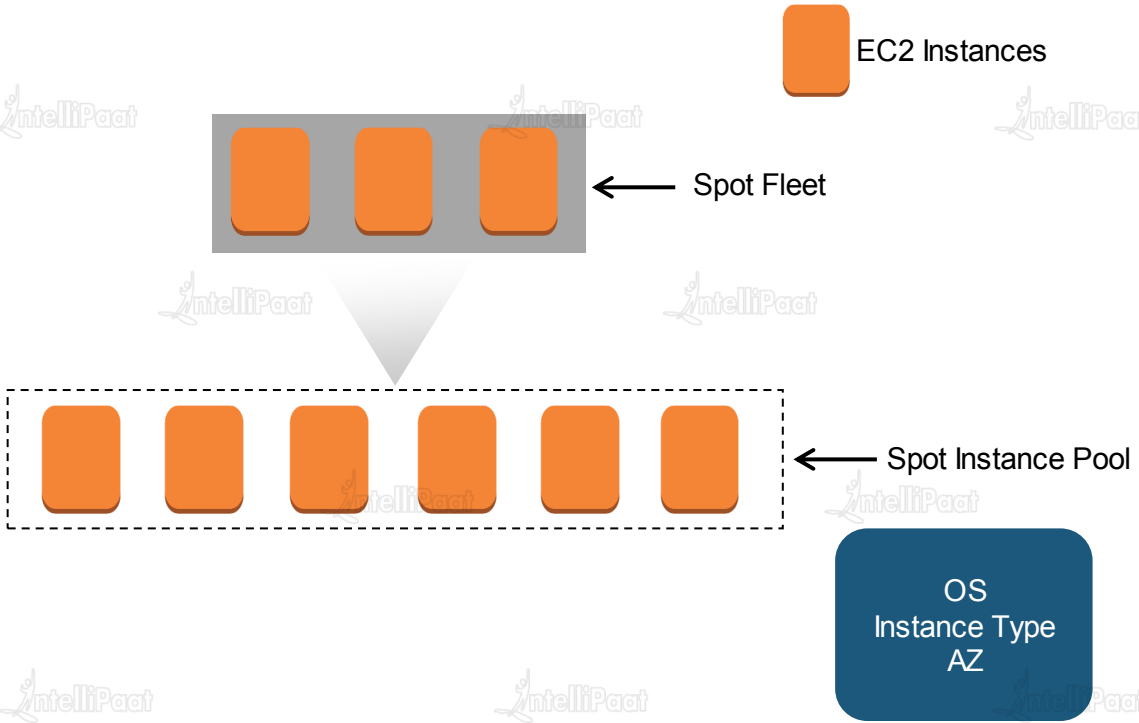
Running Instance	RI bought
4 m3.large Linux, Default tenancy in AZ us-east-1a	4 m3.large, Linux, default tenancy, AZ us-east-1a
2 m4.4xlarge Amazon Linux, Default Tenancy in us-east-1b	4 m4.large, Amazon Linux, default tenancy, region us-east-1
c4.xlarge RHEL Dedicated tenancy in AZ us-east-1c	C4.large, 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 instance available for lesser price than the On-Demand price
- Instance is terminated if Spot Price increases than bid price.
- Significant price reduction.



Pricing

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 = $0.096/Hour
- c5.large = $0.085/Hour
- r4.large = $0.133/Hour

Data Transfer IN:
FREE from anywhere

SLA = 99.99% Uptime

Data Transfer OUT:

From EC2 To

- S3, Glacier, DynamoDB, SES, SQS in same region = FREE
- S3, Glacier, DynamoDB, SES, SQS in different region = $0.020/GB
- EC2, RDS, Redshift, Elasticache, ELB, ENI in same AZ = FREE with private IP. $0.010/GB with public IP.
- EC2, RDS, Redshift, Elasticache, ELB, ENI in different AZ = $0.010/GB.

EC2 Purchasing options (RI)

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

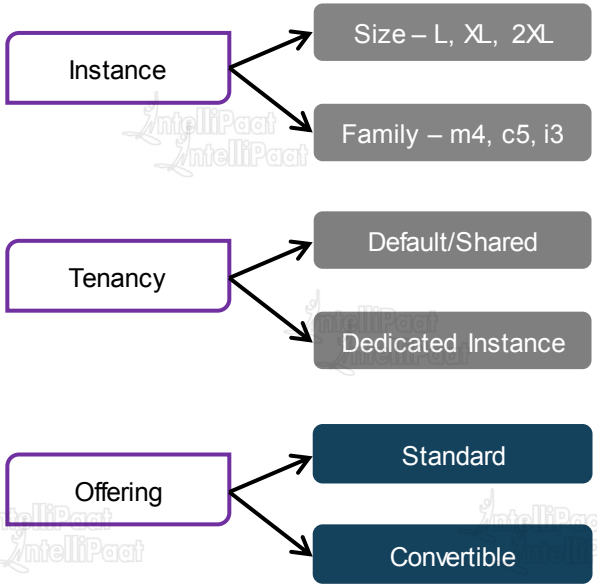
M5.XLARGE = $0.192/hr

Yearly = $1681.92

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

EC2 Purchasing options (RI)

Reserved Instances



EBS Pricing

- gp2 - $0.1 per GB per month.
- io1 - $0.125 per GB per month. $0.065 per provisioned IOPS per month.
- st1 - $0.045 per GB per month.
- sc1 - $0.025 per GB per month.
- EBS snapshot to Amazon S3 - $0.05 per GB per month.
- Free Tier: 30GB/month, combination of gp2 and magnetic. 2,000,000 IO with magnetic. 1GB of snapshot storage.
- Visit https://aws.amazon.com/ebs/pricing/ for details

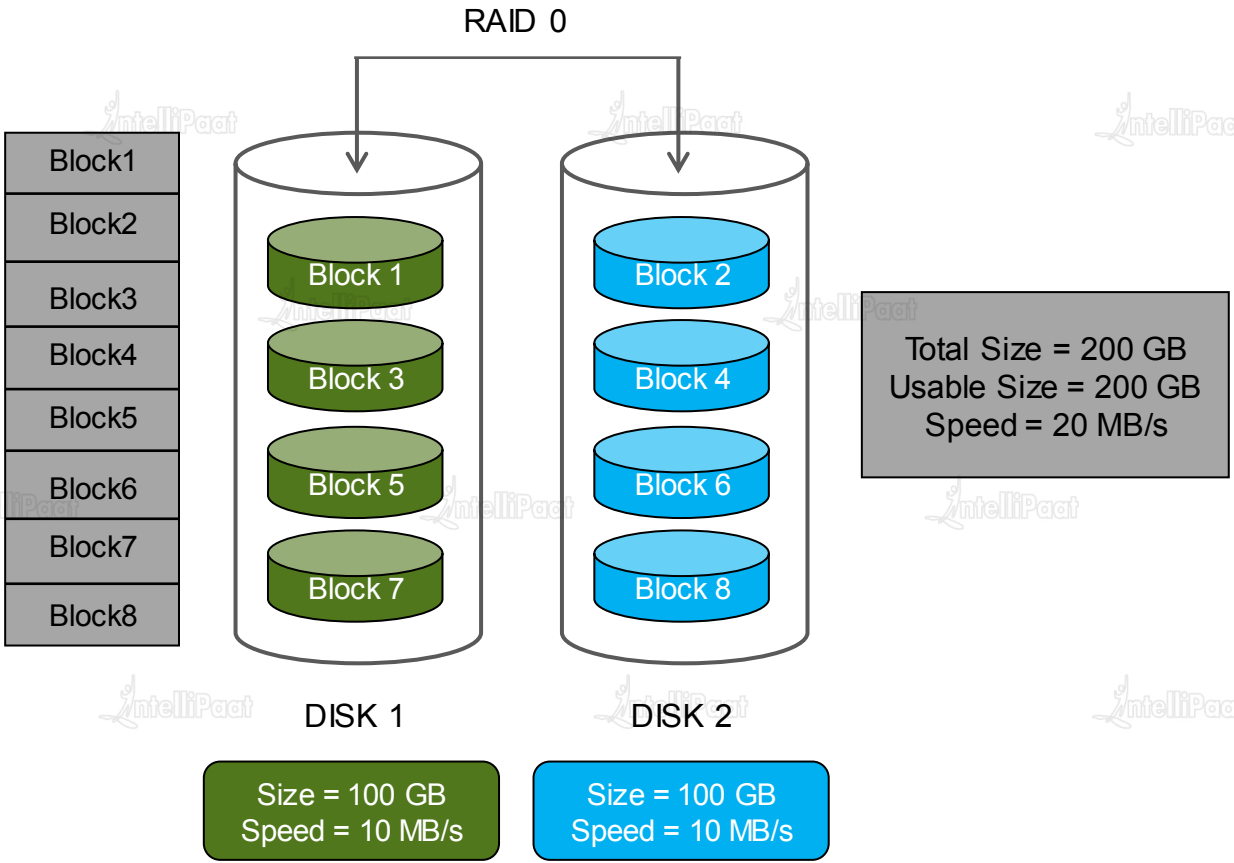
Uptime SLA: 99.99%

Design Patterns

Design Patterns

RAID

RAID 0 (Striping)

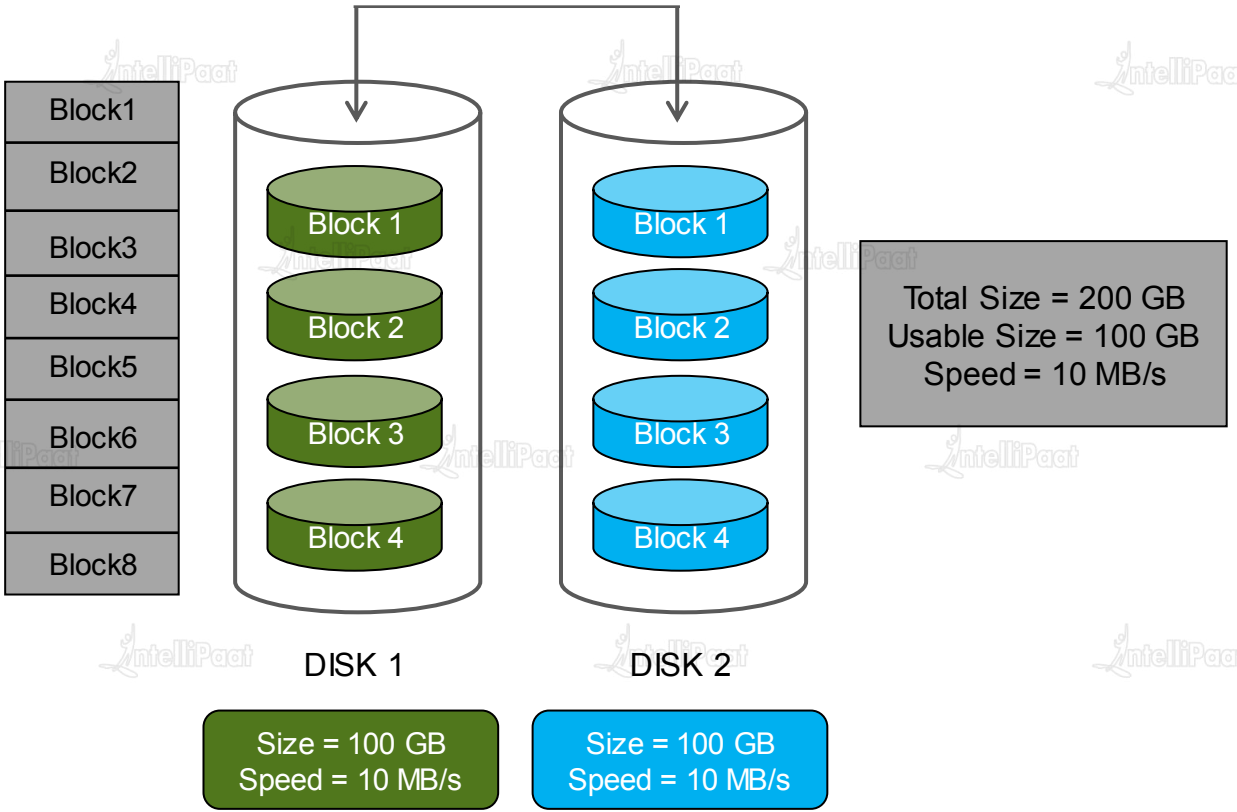


Design Patterns

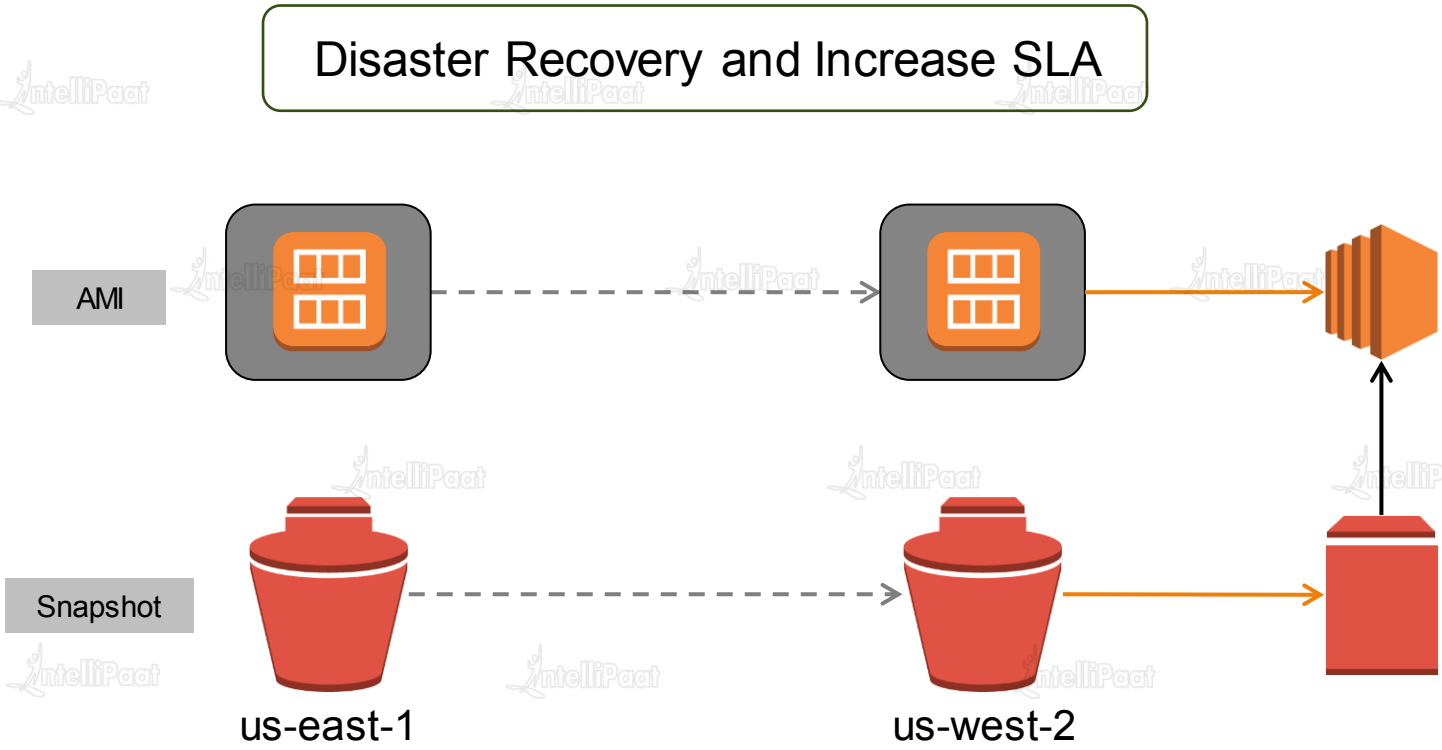
RAID

RAID 0 (Striping)

RAID 1 (Mirroring)



Design Patterns



Summary

Summary

- Regions and Availability Zones (AZs)
- Amazon Machine Images
- Instance Types
- Instance tenancy attributes – Dedicated Host, Dedicated Instance and Default Tenancy
- Elastic Block Store –Volume types
- Snapshots

Quiz

Quiz

1. Whether Spot instance runs whenever your bid exceeds the current market price?

A. Yes

B. No

Quiz

2. Can primary Ethernet(eth0) detach from instance and attach to another instance after instance failure?

A. Yes

B. No

Quiz

3. You have one instance, which you have to stop after 50 mins. and then start the instance again, you are billed for how many hours?

A. 1hrs

B. 1.5hrs

C. 2hrs

D. 3hrs

Quiz

4. How many EIP allowed per region?

A. 20

B. 5

C. 10

D. No limitations

Quiz

5. Security group rules are always permissive; you can't create rules that deny access?

A. Yes

B. No

India : +91-7847955955

US : 1-800-216-8930 (TOLL FREE)

support@intellipaat.com

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