DAY– 4

AWS EBS

AWS Architecture and Design

1. Day 1 Overview of Cloud Computing
2. Day 2 Overview of AWS
3. Day 3 Amazon EC2*
4. **Day 4 Amazon EBS ***
5. Day 5 Amazon CloudWatch *
6. Day 6 Amazon S3*
7. Day 7 Amazon Elastic Load Balancer *
8. Day 8 Amazon Auto Scaling *
9. Day 9 Amazon VPC *
10. Day 10 Amazon IAM *
11. Day 11 Amazon RDS
12. Day 12 Amazon Route 53 *
13. Day 13 Amazon DynamoDB* & Glacier
14. Day 14 Amazon Cloudfront* & Import Export & Amazon SES *
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16. Day 16 AWS Economics & AWS Account Overview *
17. Day 17 AWS Architecture
18. Day 18 AWS Certification Preparation

[With Hands on Demo]

Amazon Elastic Block Storage

AWS EBS

→ What is EBS?

→ EBS Key Terminology

→ Types of EBS

→ EBS Performance Optimization

→ Demo

Storage System

Block Level Storage

SAN
Each block a row volume
Each block is like independent Hard Drive
Blocks controlled by OS
Hard disk over remote network

File Level Storage

NAS
Regular File storage system
Easy to use and manage
Supports NFS or SMB/CIFS protocols

→ For File-level storage individual files and folders can be accessed and managed by the storage system and unlike Block level storage they are unable to directly control the smaller storage blocks that make up the files and folders.

→ In the block-level storage, you have to create a volume, deploy an OS, and then attach this created volume; in the file level world, the storage device handles the files and folders on the device

Amazon EBS

→ Amazon Elastic Block Store (EBS) provides block level storage volumes for use with Amazon EC2 instances. Its idle for file system / persistent database storage.

Persistent Block level Storage	HA & Reliability	Snapshots for Backup
Snapshots are incremental	Size from 1 GB to 16 TB	Data security with encryption

EBS in Details

EBS Key Terms

→ What is EBS:

>> EBS is a distributed, replicated block data store that is optimized for consistency and low latency read and write access from EC2 instances

>> Ideally suited to be uses as the primary storage for a file system, database, or for any applications that requires fine granular updates

>> Does give you SSD (Solid State Drive) based storage options for high performance

→ What is EBS Volume:

>> A volume can be attached to one instance only in same AZ, but many volumes can be attached to a single instance.

→ EBS Snapshot:

>> Point in time backup of volume. Used to instantiate multiple new volumes, expand the size of a volume or move volumes across Availability Zones. Snapshots can be shared with other accounts.
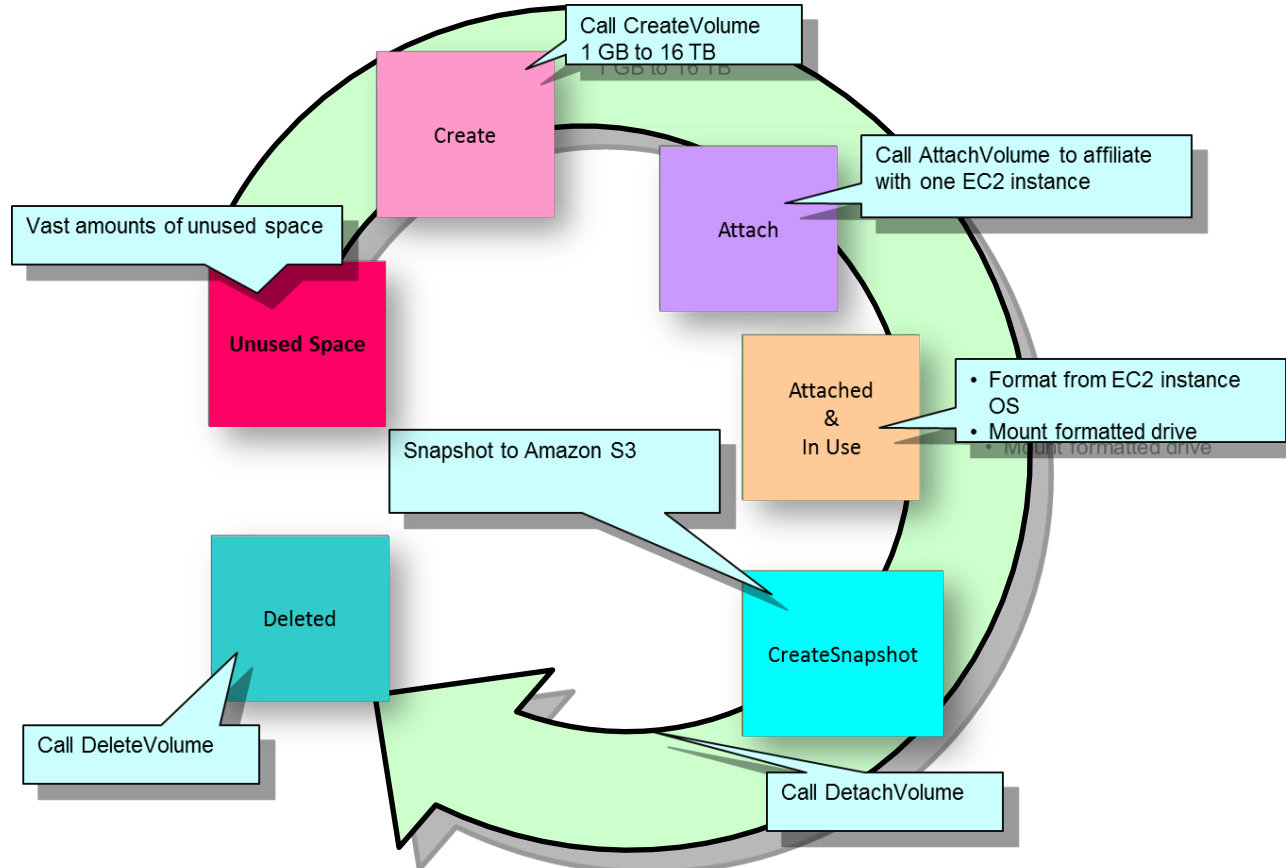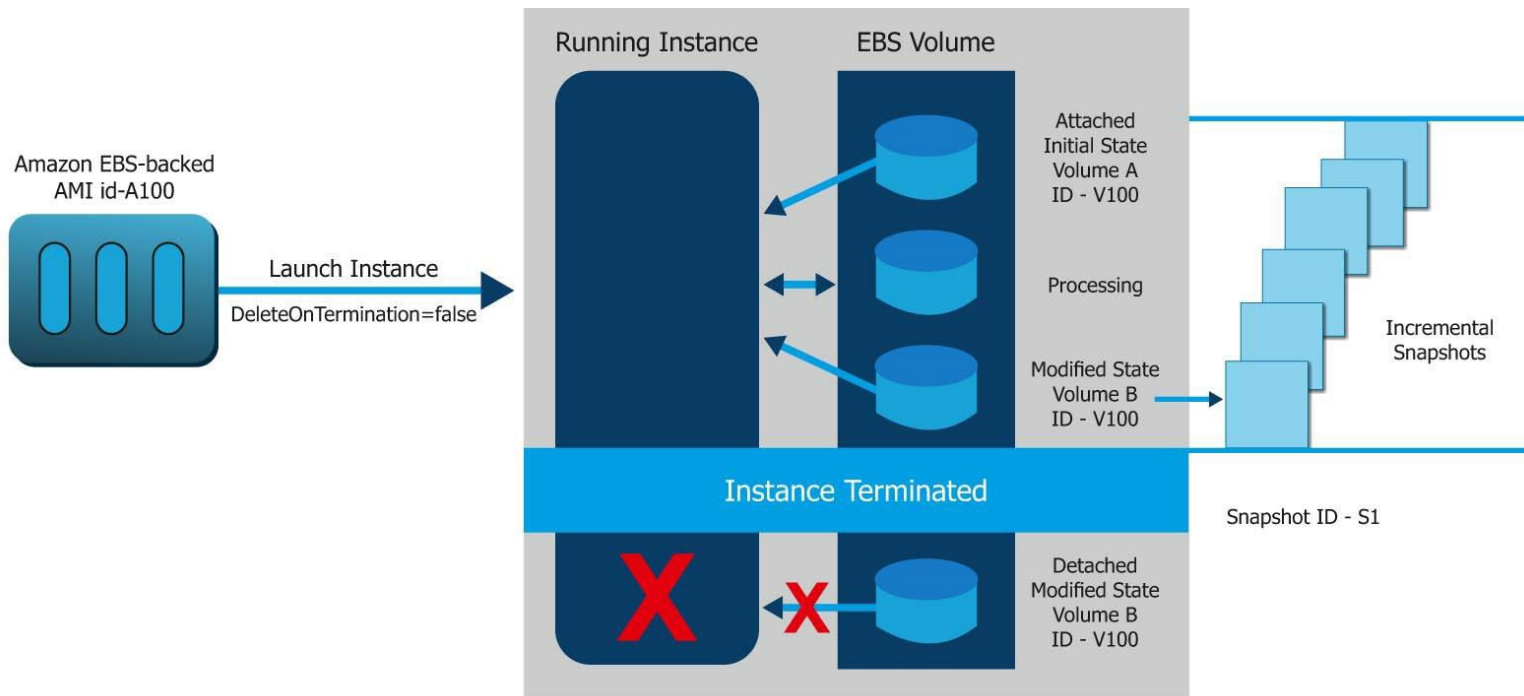
EBS Volumes & Zones

EBS Volumes can be attached in instance in same Availability Zone.

Availability Zone - 1

Availability Zone - 2
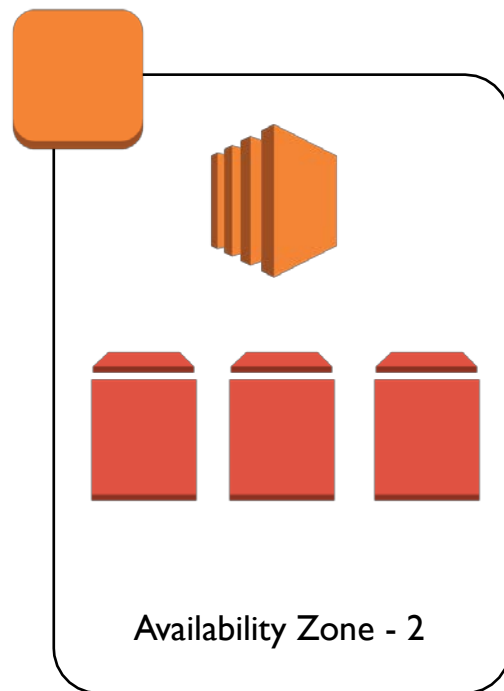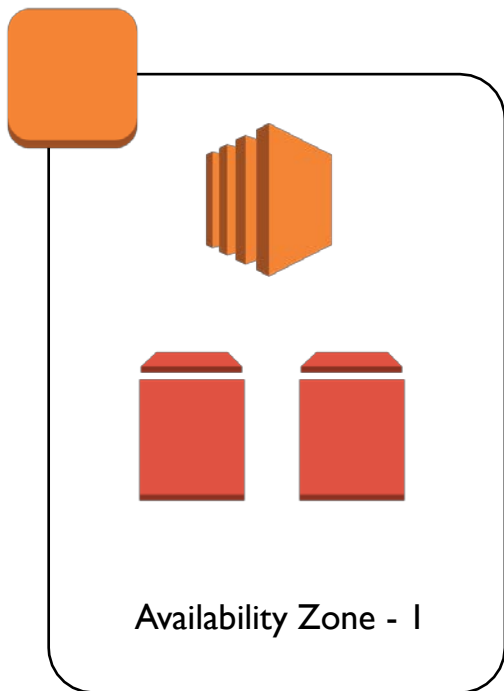
EBS Volume Life Cycle

Amazon EBS

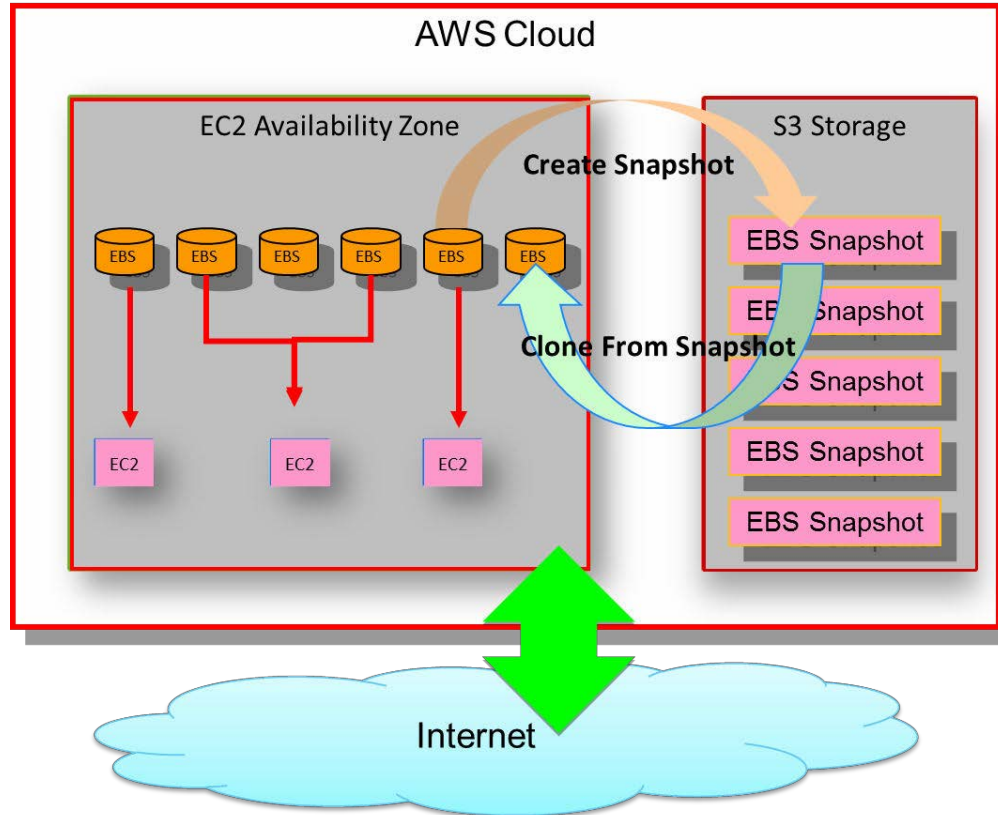# Demo & EBS Vocabulary

→ Snapshots

→ Standard and Provisioned IOPS Volumes

→ Block Size

→ Queue Depth

EBS with EC2 & S3

EBS Snapshots

Create snapshots (backups) of any Amazon EBS volume:

→ Point in time Backup

→ Always stored in AWS S3

→ Charged at $0.095/GB of storage

→ Take snapshot whether volume may or may not be attached to instance.

→ Advantages
  → Create new EBS Volume
  → Expand Size of EBS Volume
  → Create volume in separate AZ
  → Copy to separate Regions
  → Share with other AWS accounts

→ Overall it helps for DR.

Incremental Snapshot
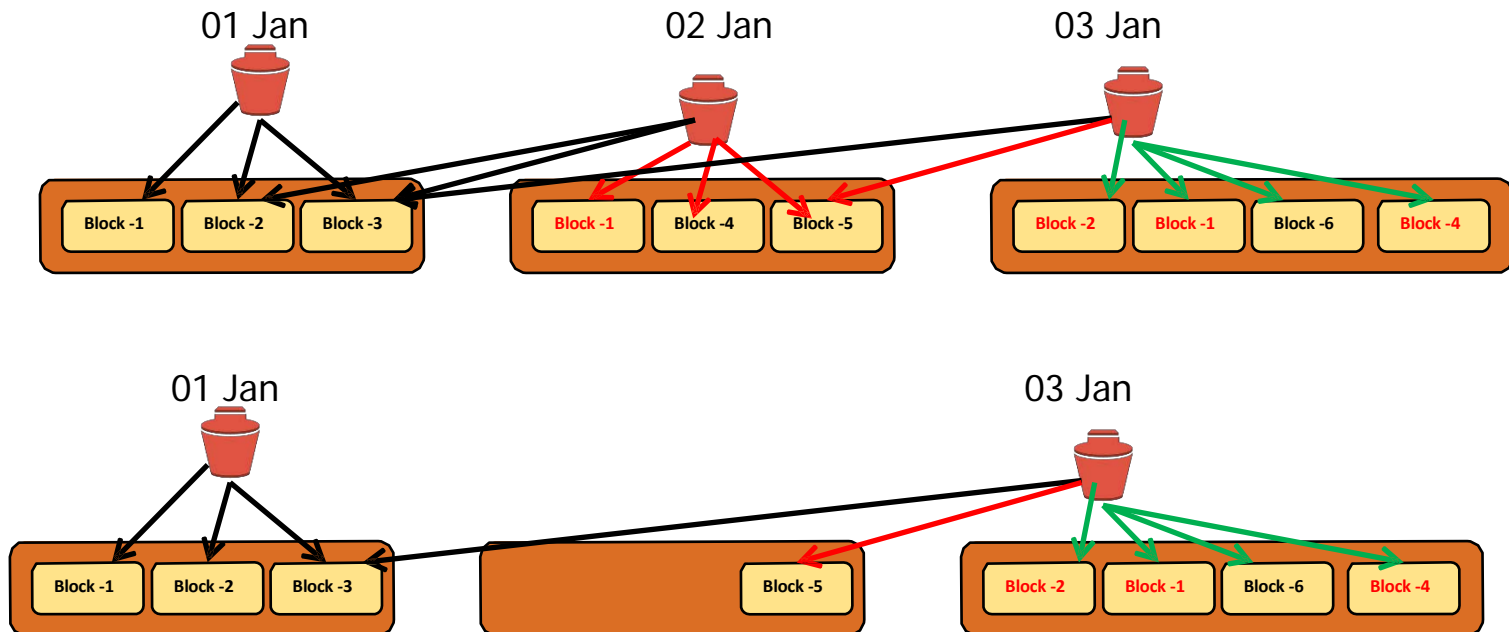
Volume Types

Amazon EBS provides three types of storage service.

→ General Purpose (SSD)

→ PIOPS (SSD)

→ Magnetic (Standard)

General Purpose

→ SSD Based Storage

→ For Balanced Price & Performance

→ 99.999% Availability

→ 10x more IOPS and 1/10the latency comparing magnetic volume

→ Costs double than Magentic Volumes [$0.10 / GB / Month]

→ They can burst up to 3,000 IOPS during boot

→ Provides 3 IOPS for every GB of configured storage max 10000 IOPS

→ Best fit for booting an instance faster

→ Size from 1 GiB to 16 TiB

Provisioned IOPS Volume Types

If you want very high IOs for performance then you can provision a specific level of I/O using Provisioned IOPS volume.

→ To maximize the performance of your I/O-intensive applications

→ Designed to meet the needs of I/O-intensive workloads, particularly database workloads, that are sensitive to storage performance and consistency in random access I/O throughput

→ Amazon EBS provisions IOPS rate for the lifetime of the volume

→ This allows you to predictably scale to thousands of IOPS per Amazon EC2 instance

→ Amazon EBS currently supports up to 20000 IOPS per volume

→ Stripe multiple volumes together to deliver thousands of IOPS per instance to your application

→ Amazon EBS delivers within 10 percent of the provisioned IOPS performance 99.9 percent of the time over a given year

→ Size from 4 GiB to 16 TiB

Magnetic Volume Types

The original Standard Volume available with EBS

→ Lowest cost per GiB

→ Backed by Magnetic Drives and ideal for performing sequential reads where data is infrequently
    accessed

→ For lower storage cost

→ Size from 1 GiB to 1 TiB

→ Gives 100 IOPS on average

Standard and Provisioned IOPS Volume Types

Volume Type	General Purpose (SSD)	Provisioned IOPS (SSD)	Magnetic
Use cases	→System boot volumes →Virtual desktops →Small to medium sized databases →Development and test environments	→Critical business applications that require sustained IOPS performance above 3,000 IOPS →Large database workloads, such as: No SQL (e.g. Mongo) or RDBMS (e.g. MySQL, PostgreSQL, MSSQL, Oracle)	→Cold workloads where data is infrequently accessed →Scenarios where the lowest storage cost is important
Volume size	1 GB - 16 TB	10 GB - 16 TB	1 GB - 1 TB
IOPS performance	The ability to burst to 3,000 IOPS maximum, with a base performance of 3 IOPS/GiB	Consistently performs at provisioned level, 20,000 IOPS maximum	100 IOPS on average with the ability to burst to hundreds of IOPS
API and CLI volume name	gp2	io1	Standard
Pricing	$0.10 / GB / Month	$0.125 / GB / month 0.065 / Month / PIOPS	$0.05 / GB / Month $0.05/ 1 Mn IO

http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EBSVolumeTypes.html

Comparing EBS Volumes

General Purpose EBS:
→ For boot volume
→ Good for applications with low or moderate IO
→ Bursty workloads may be a good fit

Magnetic EBS
→ For cost saving or for R&D, Dev/Test

Provisioned IOPS EBS:
→ Great for steady IO patterns that need consistency
→ Good for transactional app that has high and consistent IO
need e.g. DB
→ Not always more expensive than standard
→ Be sure to use the IOPS you provision

EBS Pricing

→ **For example**, a medium sized database with storage of around 100 GB in size and one experiencing average 100 I/Os per second over the course of a month. This would translate to

» Magnetic: $5 per month in storage costs (100 GB x $0.05/month), and approximately $13 per month in request
  costs (~260 million seconds/month [100*3600*24*30] * $0.05 per million I/O). total $18

» General Purpose : $10 per month storage cost and no IO cost

» PIOPS : $12.5 per month for storage cost and $6.5 for IOPS so total $19

EBS Price Comparison

→ Requirement
  » For 500 IOPS & 100 GB storage

Volume Type	General Purpose (SSD)	Provisioned IOPS (SSD)	Magnetic (RAID)
Storage Cost	170 * 0.10 = $17 / Month	100*$.125 = $12.5	100*$0.05 = $5
IOPS	$0 [Can achieve 510 IOPS with 170 GB sizze]	500 * 0.065 = $32.5	Striping 5 Volumes of 20 GB each so 5 * [100 IOPS*(60*60*24*30) * 0.05) / 1000000] = $64
Total	$17	$45	$69

EBS Encryption

EBS Supports Server Side Encryption

→ Useful for encrypting data at Rest

→ No need for additional software to encrypt the data

→ Performed and manage by amazon using Amazon secure AES -256 keys

→ Does not work for boot volume as of now

→ A blank volume can be encrypted but if created from unencrypted snapshot it will not support encryption

→ Free of Cost

EBS Performance

→ **Architecting for Performance**

 » Avoid throughput saturation (By maintaining Queue Depth as per throughput)
 » Striping (Raiding)
 » EBS Optimized Instance

→ **Achieving Consistent Performance**

 » Pre-warm Provisioned IOPS volumes
 » Plan for snapshot (From Read-Replica)

→ **Snapshot Performance**

Architecting for Performance

→ **Use EBS Optimized Instances:**

» EBS-Optimized EC2 Instances allocate dedicated bandwidth to its attached EBS Standard and Provisioned IOPS volumes. As a best practice, we recommend using EBS-Optimized EC2 instances when attaching a Provisioned IOPS volume

→ **Avoid Throughput Saturation:**

» Network throughput can be saturated by disk IOs. Choose the instance type that best supports the needed network throughput, and calculate the max number of EBS volumes before saturating the network throughput

Achieving Consistent Performance

Achieving Consistent Performance: Plan for Snapshot

To minimize the impact of snapshots on performance of a master node you need to follow the two things:

→ Create snapshots from a read replica of your data
→ Plan snapshots during off-peak usage

Thank You

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