Elastic Block Store - EBS

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Elastic Block Store

Amazon Elastic Block Store (EBS) is an easy to use, high-performance, block-storage service designed for use with Amazon Elastic Compute Cloud (EC2) for both throughput and transaction intensive workloads at any scale.

An Amazon EBS volume is a durable, Block-level storage device that you can attach to your EC2 instances. You can use EBS volumes as primary storage for data that requires frequent updates, such as system drive for an instance or storage for a database application.

Features:

- Performance for any workload
- Highly available and durable
- Cost-effective
- Easy to use
- Virtually unlimited scale
- Secure

EBS Volumes are designed for mission-critical systems, EBS volumes are replicated with in availability zone (AZ) and can easily scale to petabytes of data. Also, you can use EBS Snapshots with automated lifecycle policies to backup your volumes in amazon S3, while ensuring geographic protection of your data and business continuity.

Benefits of using EBS Volumes:

- **Data Availability:** When you create an EBS Volume, it is automatically replicated within its availability zone to prevent data loss due to failure of any single hardware component.
- **Data persistence:** EBS Volumes that are attached to a running instance can automatically detach from the instance with their data intact when the instance is terminated if you uncheck the delete on termination check box when you configure EBS Volumes.

  By default, the root EBS Volume that is created and attached to an instance at launch is deleted when that instance is terminated.

- **Data Encryption:** You can create encrypted EBS volumes with the amazon EBS Encryption feature. All EBS Volume types support encryption. You can use encrypted EBS Volumes to meet wide range of data-at-rest encryption requirements for regulated/audited data and applications.

  Amazon EBS Encryption uses 25-bit Advanced Encryption Standard algorithm (AES-256) and an amazon-managed key infrastructure (KMS).

- **Snapshots:** Amazon EBS provides the ability to create napshots(backups) of any EBS volume and write a copy of the data in the volume to amazon S3, where it is stored redundantly in multiple availability zones. These snapshots can be used to create multiple new EBS Volumes or more volumes across availability zones. Snapshots of encrypted EBS Volumes are automatically encrypted.

The snapshot can be shared with specific AWS accounts or made public. When you create snapshots, you incur charges in Amazon S3 based on the volume's total size. Snapshots are incremental backups, meaning that only the blocks on the volume that have changed after you most recent snapshot are saved.

- **Flexibility:** EBS volumes support live configuration changes while in production. You can modify volume type, volume size, and IOPS capacity without service interruptions.

Amazon EBS Volume types:

Amazon EBS Provides the following volume types, which differ in performance characteristics and price, so that you can tailor your storage performance and cost to the needs of your applications.

The volume types fall into these categories:

Solid State Drives (SSD): Optimized for transactional workloads involving frequent read/write operations with small I/O size, where the dominant performance attribute is IOPS.

Hard disk drives (HDD): Optimized for large streaming workloads where the dominant performance attribute is throughput (MBPS)

Previous Generation: Hard disk drives that can be used for workloads with small datasets where data is accessed infrequently, and performance is not of primary importance. Amazon recommends that you consider a current generation volume type instead.

Solid State Drives (SSD):

The SSD-backed volumes provided by Amazon EBS fall into these categories:

- General Purpose SSD
    - gp2
    - gp3
- Provisioned IOPS SSD
    - io1
    - io2

Hard Disk Drives (HDD):

- Throughput optimized HDD (st1)
- Cold HDD (sc1)

Previous Generation Volume types:

- Magnetic

General Purpose SSD – gp2:

Durability	:	99.8% - 99.9%
Volume Size	:	1GiB – 16 TiB
IOPS	:	100 – 16000, No option to select the desired IOPS manually
IOPS Ratio	:	3:1 [IOPS:GiB] with minimum 100 IOPS
Throughput	:	Not applicable (128 MB/s – 250 MB/s)
Multi-attach	:	Not supported
Boot Volume	:	Supported
Usecase	:	Low latency interactive apps

General Purpose SSD – gp3:

Durability	:	99.8% - 99.9%
Volume Size	:	1GiB – 16 TiB
IOPS	:	3000 – 16000
IOPS Ratio	:	500:1 [IOPS:GiB] with minimum 3000 IOPS
Throughput	:	125 MB/s – 1000 MB/s , 0.25:1 Ratio [MB/s:IOPS]
Multi-attach	:	Not supported
Boot Volume	:	Supported
Use case	:	Low Latency Interactive Apps

Provisioned IOPS – io1:

Durability	:	99.8% - 99.9%
Volume Size	:	4GiB – 16 TiB
IOPS	:	100 – 64000, You will get an option to choose desired IOPS
IOPS Ratio	:	50:1 [IOPS:GiB] with minimum 100 IOPS
Throughput	:	Not applicable [Upto 1000 MB/s]
Multi-attach	:	Available
Boot Volume	:	Supported
Use Case	:	Workloads that require sustained IOPS or more than 16000 IOPS, I/O-intensive database workloads

Provisioned IOPS – io2:

Durability	:	99.999%
Volume Size	:	4GiB – 16 TiB
IOPS	:	100 – 64000, You will get an option to choose desired IOPS
IOPS Ratio	:	500:1 [IOPS:GiB] with minimum 100 IOPS
Throughput	:	Not applicable [Upto 4000 MB/s]
Multi-attach	:	Available
Boot Volume	:	Supported
Use Case	:	Workloads that require sub-millisecond latency & Sustained IOPS Performance

Note: Volumes with greater than 32000 IOPS must be attached to a Nitro based instance to achieve provisioned performance.

Throughput Optimized HDD – st1:

Durability	:	99.8% - 99.9%
Volume Size	:	125GiB – 16 TiB
IOPS	:	Not Applicable [upto 500 IOPS]
IOPS Ratio	:	Not Applicable
Throughput	:	Upto 500 MB/s, 40 MB/s per TB
Multi-attach	:	Not Supported
Boot Volume	:	Not Supported
Use Case	:	Big Data, Data Warehouses, Log Processing

Cold HDD – sc1:

Durability	:	99.8% - 99.9%
Volume Size	:	125GiB – 16 TiB
IOPS	:	Not Applicable [upto 250 IOPS]
IOPS Ratio	:	Not Applicable
Throughput	:	250MB/s, 12MB/s per TB
Multi-attach	:	Not Supported
Boot Volume	:	Not Supported
Use Case	:	Throughput-oriented storage for data that is infrequently accessed
		Scenarios where the lowest storage cost is important

Magnetic or Standard:

Volume Size	:	1GiB – 1TiB
IOPS	:	Not Applicable [40 – 200]
Throughput	:	Not Applicable [40 – 90 MiB/s]
Boot Volume	:	Supported

KeyPoints:

- EBS Volumes are Block Based storage volumes
- EBS Volumes are locked to Availability Zones (AZ)
- We can create snapshots of EBS volumes which can store your data as a backup
- We can create the volumes from the snapshots in any availability zone in the same region
- We can copy the snapshots across all regions
- Snapshots will be stored in Amazon S3 buckets in the backend
- Snapshots are a kind of incremental backups.

Elastic Block Store (EBS) Lab:

Prerequisite:

- Amazon Account Access

ToDo List 1:

1. Create a gp2 volume of 1GB in us-east-1a Availability Zone
2. Create a gp3 volume of 2Gib in us-east-1b Availability Zone
3. Create a io1 volume of 4Gib in us-east-1a availability Zone
4. Create a io2 volume of 5GiB in us-east-1b availability zone
5. Create sc1 volume of 125 GiB in us-east-1c availability zone
6. Create st1 volume of 130GiB in us-east-1b availability zone
7. Create a magnetic volume of 3GiB in us-east-1a availability zone

ToDo List 2:

1. Create a windows EC2 instance (1A) in us-east-1a Availability Zone (N.Virginia Region)
2. Create a windows EC2 instance(1B) in us-east-1b Availability Zone (N.Virginia Region)

ToDo List 3:

1. Attach 1GiB gp2 Volume to an EC2 instance 1B and note down the observations
2. Attach 2GiB gp3 volume to an EC2 instance 1A and note down the observations
3. Attach 1GiB gp2 volume to an EC2 instance 1A
    a. Make the 1GiB volume Online and create a file system through diskmanagement by logging into windows EC2 instance.
    b. Create some files
4. Attach 2GiB gp3 Volume to an EC2 instance 1B
    a. Make the 2GiB volume Online and create a file system through diskmanagement by logging into windows EC2 instance.
    b. Create some files
5. Create manual snapshots of gp2 and gp3 EBS volumes
6. Create new volume from the snapshot of gp2 in us-east-1b Availability zone & verify the file available or not
7. Create new volume from the snapshot of gp3 in us-east-1a Availability zone & verify the file available or not
8. Copy the snapshot of gp2 volume from N.Virginia Region to Mumbai region
9. Create a new EBS volume of your choice in Mumbai Region using the snapshot copied from N.virginia to Mumbai
10. Create a new EC2 instance in Mumbai region and attach newly create volume from the snapshot in Mumbai region

ToDo List 4:

EBS Volume Management:

1. Increase the gp2 volume size from 1Gib to 11Gib
2. Login to the 1A EC2 instance and increase the Size of the volume from 1GiB to 11GiB
3. Modify the volume type of gp3 volume to provisioned IOPS by changing the respective values accordingly (GiB, IOPS, etc)
4. Modify the Volume sc1 to gp2 volume by increasing the size to 150GiB

ToDo List 5:

1. Create any EBS volume by enabling encryption
2. Create a snapshot of that EBS volume
3. Create a new EBS volume from the snapshot which we created and observe whether it is being encrypted by default or not

ToDo List 6:

Data Life Cycle Manager

1. Create a life cycle policy to capture an automated snapshot of all EBS volumes which are having a tag ***Backup:True*** (you need to create the tags on few EBS Volumes)
2. Create a life cycle policy to capture an automated snapshot of all EC2 instances which are having a tag ***Prod:Yes*** (you need to create the tags on EC2 instances)