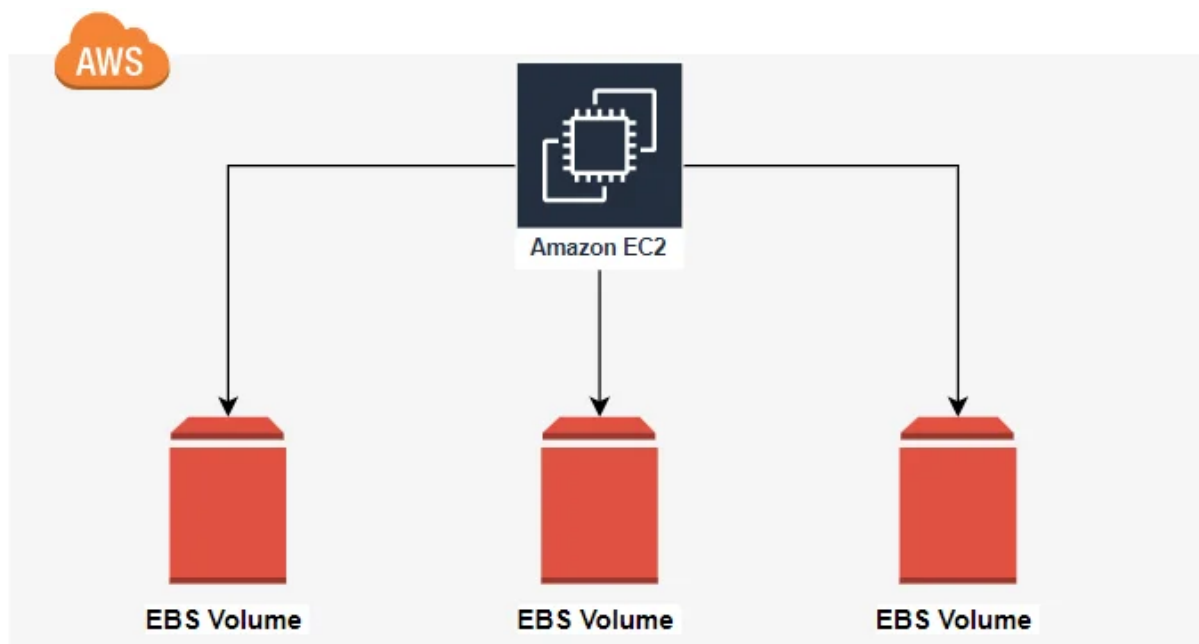# EBS Volume

- `What's an EBS Volume?`

- `Feature`

- `EBS Volume Types`

- `EBS Snapshots Features`

- `What is its purpose?`

- `Hands on lab - how to use EBS`

- To further grasp this notion, you need be familiar with EC2 and have an AWS account.

What's an EBS Volume?

An EBS (Elastic Block Store) volume is a durable, block-level storage device that you can attach to a single EC2 instance. You can use EBS volumes as primary storage for data that requires frequent updates, such as the system drive for an instance or storage for a database application. They are designed to protect against data loss by replicating

within its availability zone and offers several types of volumes that differ in performance characteristics and price.

- EBS stores data as Blocks
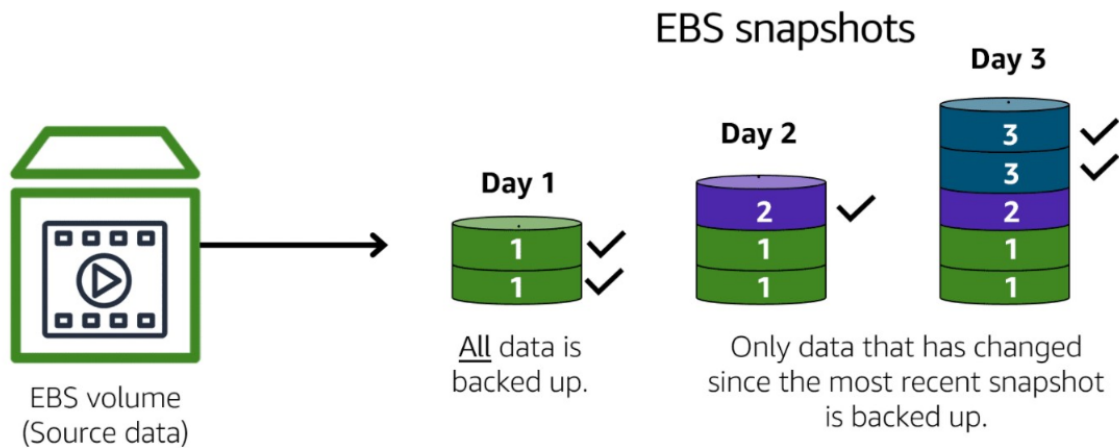
EBS Volume - Example
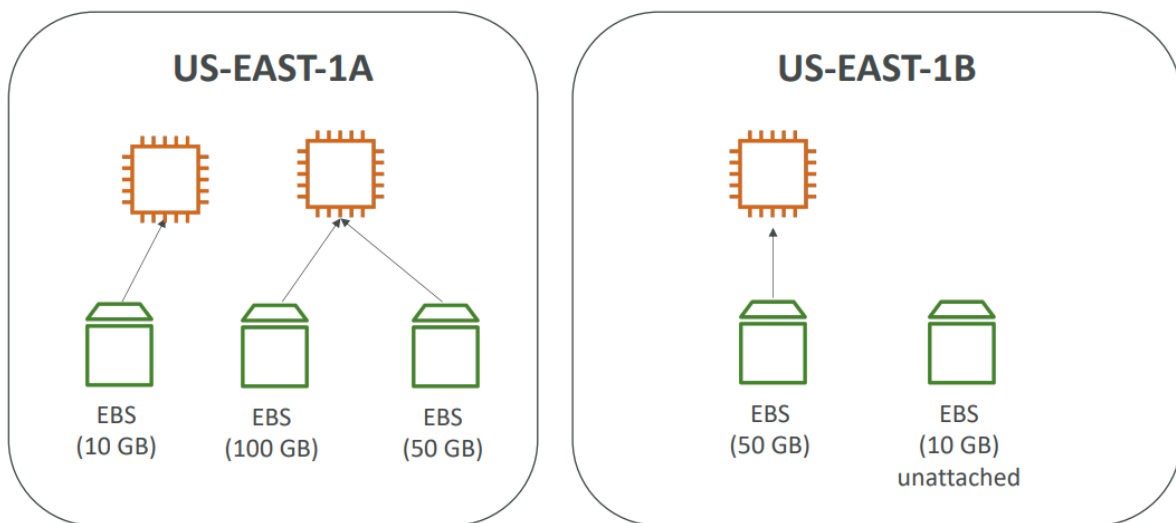
Features of EBS :

- EBS volumes are created in a specific Availability Zone and attached to an instance within that zone. To make a volume accessible outside of the zone, a snapshot can be created and restored to a new volume anywhere in that Region. Snapshots can be copied to other Regions and restored to new volumes, facilitating geographical expansion, data center migration, and disaster recovery.

- Amazon EBS offers various volume types including General Purpose SSD, Provisioned IOPS SSD, Throughput Optimized HDD, and Cold HDD. More details can be found at EBS volume types.

  - *General Purpose SSD volumes* (`gp2` and `gp3`) offer balanced price and performance, ideal for boot volumes, medium-size single instance databases, and development/test environments.

  - *Provisioned IOPS SSD volumes* (`io1` and `io2`) cater to I/O-intensive workloads requiring consistent storage performance. They provide a consistent IOPS rate specified during volume creation, enabling predictable scaling to tens of

thousands of IOPS per instance. Additionally, io2 volumes provide superior volume durability.

- *Throughput Optimized HDD volumes* (`st1`) offer low-cost magnetic storage, defining performance in terms of throughput rather than IOPS, ideal for large, sequential workloads such as Amazon EMR, ETL, data warehouses, and log processing.

- *Cold HDD volumes* (`sc1`) also offer low-cost magnetic storage with performance defined by throughput rather than IOPS. These volumes are suitable for large, sequential, cold-data workloads. If infrequent data access is required and cost-saving is priority, these volumes provide an affordable block storage solution.

- EBS volumes can be created as encrypted volumes to meet various data-at-rest encryption requirements for regulated/audited data and applications. Creating an encrypted EBS volume and attaching it to a supported instance type ensures encryption of data stored at rest on the volume, disk I/O, and snapshots created from the volume. More information can be found at Amazon EBS encryption.

- Point-in-time snapshots of EBS volumes can be created and persisted to Amazon S3, ensuring long-term data protection. These snapshots can serve as the starting point for new EBS volumes and can be replicated across AWS Regions. More information can be found at Amazon EBS snapshots.

- Performance metrics such as bandwidth, throughput, latency, and average queue length are available through the AWS Management Console. Provided by Amazon CloudWatch, these metrics assist in monitoring volume performance ensuring sufficient application performance without overpaying for unneeded resources. More information can be found at Amazon EBS volume performance on Linux instances.

EBS Snapshot:

An EBS snapshot provides an incremental data backup solution. Initially, the snapshot backs up the entire volume of data. Subsequent snapshots only capture the blocks of data that have changed since the last snapshot. This efficient approach helps to optimize storage costs by avoiding data duplication.

EBS snapshots

EBS volume (Source data)

Day 1 — All data is backed up.

Day 2, Day 3 — Only data that has changed since the most recent snapshot is backed up.

EBS Volume Types:

EBS – Volume Type Usage

	Solid State Drives (SSD)		Hard Disk Drives (HDD)		
Volume Type	General Purpose	Provisioned IOPS SSD	Throughput Optimized HDD	Cold HDD	EBS Magnetic
API Names	gp2	io1	st1	sc1	standard
Description	Balances price and performance	Highest SSD performance for Mission-critical low latency or high throughput	Low-cost. Designed for frequently accessed, throughput intensive workloads	Lowest HDD cost. Less frequently used workloads	
Use Cases	Most Workloads	Large Databases IOPS greater than 16,000 or Throughput greater than 250 MiB	Data Warehouses Big Data Log Processing	File Storage	Archival Storage
Volume Size	1GiB - 16TiB	4GB - 16 TiB	500GiB - 15TiB	500GiB - 15TiB	500GiB - 15TiB
Max IOPS	16,000	64,000	500	250	40-200

1. **General Purpose (SSD)** (gp2) for general usage without specific requirements
2. **Provisioned IOPS (SSD)** (io1) when you require really fast input & output
3. **Throughput Optimized HDD** (st1) magnetic drive optimised for quick throughput
4. **Cold HDD** (sc1) Lowest cost HDD volume for infrequently access workloads
5. **EBS Magnetic** (standard) previous generation HDD

SSD:

Ideal for small data with fast I/Ops needs. Can be root volumes for EC2 instances.

- ***General Purpose SSD (GP2)***
  - Delivers single-digit millisecond latency.

- Provides a burst of up to 3000 IOps.

- IOps speed ranges from 3-10000 IOps.

- Throughput is 128MBPS up to 170GB, then increases by 768KBPS per GB, maxing at 160MBPS.

- ***Provisioned IOPS SSD (IO1)***

    - Designed for IO intensive tasks.

    - Users can set IOPS requirements during creation.

    - Size varies between 4TB-16TB.

    - AWS states that these volumes deliver defined IOPS 99.9% of the time when attached to EBS optimized instances.

    - Max IOPS speed is 20000.

HDD:

Best for large data and slower processing. Cannot be root volumes for EC2. AWS states these volumes deliver expected throughput 99.9% of the time.

- ***Cold HDD (SC1)***

    - The most affordable EBS volume type, best for large, seldom accessed data.

    - Max Burst speed is 250 Mbps.

- ***Throughput optimized HDD (ST)***

    - Designed for large, frequently accessed data.

    - Burst speed between 250 MBPS to 500 MBPS.

EFS   **HOST COMPUTER**   **EBS**
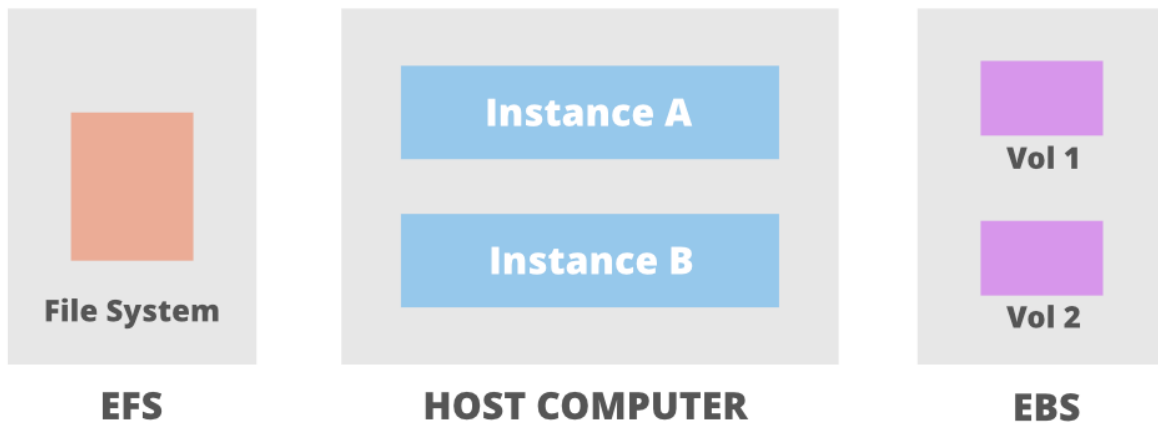
The image above illustrates single EBS volumes linked to respective EC2 instances. Note, EBS cannot be shared between two volumes, but one EFS can connect to multiple EC2 servers. These volumes have numerous applications, such as:

- **Database storage:** EBS' low latency and scalability make it perfect for storing both relational and NoSQL databases.

- **Business-intensive applications:** The scheduled backup feature provided by EBS ensures quick data recovery and efficient system reboot with minimal data loss.

- **Hard Disks for EC2 servers:** EBS volumes can act as hard drives for your EC2 servers. They are independent of your EC2 servers, safeguarding your data even if EC2 servers fail, reboot, or terminate.

- **Hosting Large Applications:** EBS' low latency contributes to the architecture's powerful computing capabilities. It can host large enterprise application software and data.

- **Root Volumes for EC2:** GP2 and IO1 EBS types can be root volumes for your EC2 server.

EBS in Database Applications:

EBS can be used in several ways to store data for database applications, including:

1. As a root volume for a database instance: EBS can serve as the root volume for an Amazon EC2 running database applications like MySQL or PostgreSQL. This allows

the database to store its data on a persistent, highly available storage volume, rather than relying on the EC2 instance's temporary storage.

2. As a storage volume for a managed database service: AWS services like Amazon RDS and Amazon Aurora allow users to set up a database without managing the underlying infrastructure. These services enable users to use EBS volumes for their database storage, providing persistent and scalable storage for their data.

3. As a storage volume for containerized databases: EBS can also be the storage for containerized database applications, such as those deployed using Amazon ECS or Amazon EKS. This means users can store their database data on a persistent and highly available storage volume, while still benefiting from running their database in a containerized environment.

Limitations:

- EBS is not suitable as temporary storage.

- They cannot be shared between instances, limiting their use as multi-instance accessed storage.

- AWS S3 and AWS EFS offer higher durability.

Now EC2 Or EBS ?

```
 Amazon EC2 Instance Store is suited for temporary storage needs where high performance and
low latency are critical. Amazon EBS, on the other hand, is ideal for long-term data storage
with better durability and accessibility features.
```

We've now covered the underlying principles of EBS. So, how can we apply this in the AWS Management Console?

Step 1 : Launch an instance - EC2 instance in the aws management console

Once you have received the 'passed' status check, proceed by clicking on the instance id and then the Storage tab. Here, you'll find the Block devices section which includes details such as the Volume ID and allocated Volume Size.

Next, generate an additional volume and navigate to Action → Attach Volume.

After viewing our EC2 instance in the Storage section, we can observe two Volume IDs.

Note : Please note, if you attempt to create a volume in a different region than your EC2 instance, you will be unable to attach it. This is because EBS operates only within the same, specific region.
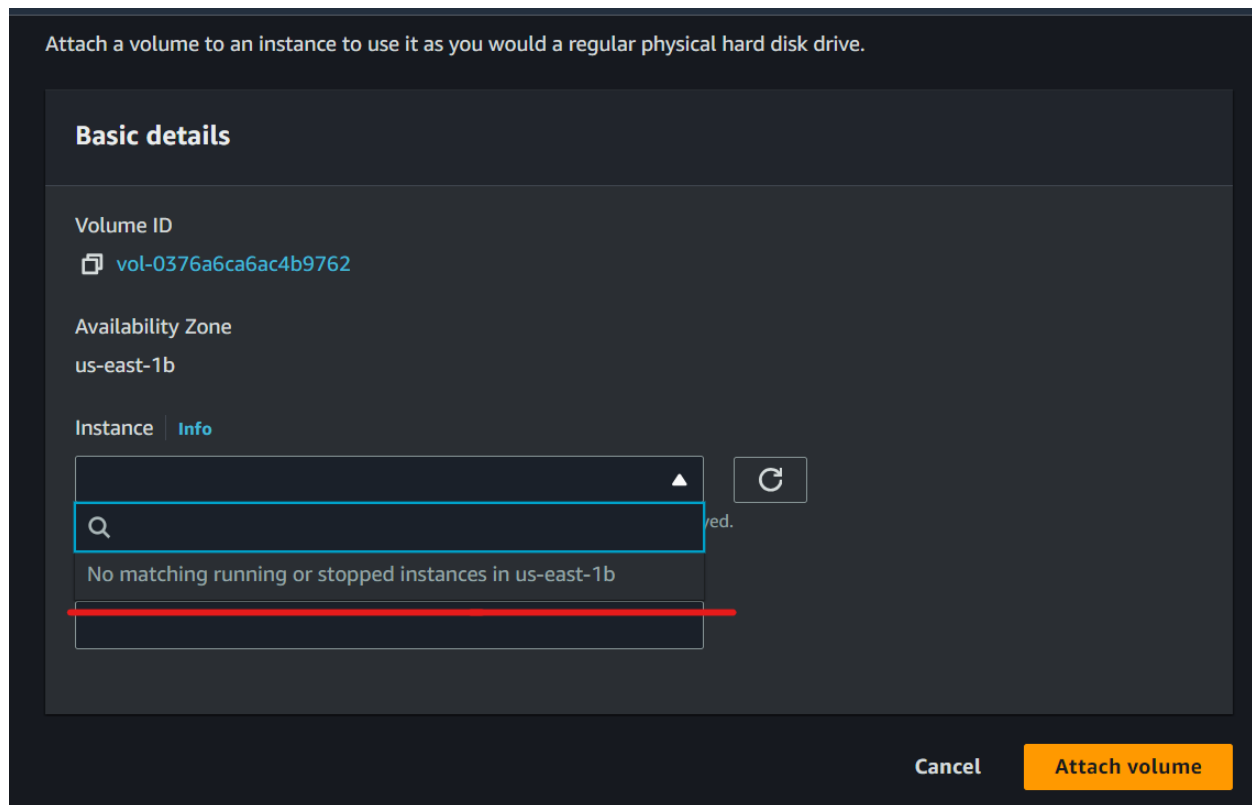
Please return to your EC2 instance and scroll horizontally until you locate the 'Delete on Termination' tab.
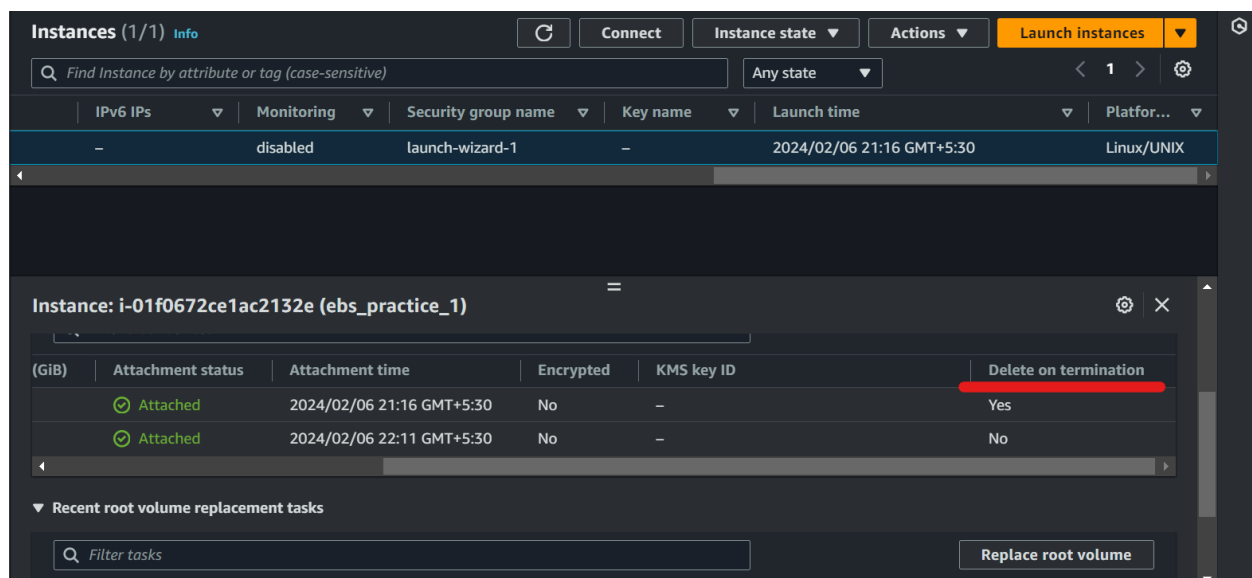
Note : To verify this, initiate another instance, scroll until you encounter the storage details, and select 'Advanced'.

Next, shut down your EC2 instance to verify if the created volume is still accessible. If the "delete on termination" option is set to 'No', the volume will be retained. If it's set to 'Yes', the volume will be deleted along with the instance.

Therefore, if you want your EBS volume to persist after termination, ensure that the "delete on termination" option is set to 'No'.

Following the termination of the EC2 instance, you'll notice a decrease in the number of volumes from two to one. This reduction is a direct result of the 'delete on termination' setting.

As a result, we now know a little bit about the Amazon Management Console's Elastic Block Storage (EBS).

Reference Links :

1 . https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-volumes.html

2 . https://www.w3schools.com/aws/aws_cloudessentials_awsebs.php#:~:text=EBS volumes are used for,the attached EBS volume remains.

3 . Udmey Course **AWS Certified Cloud Practitioner CLF-C02**-
https://www.udemy.com/share/103a093@gG3wB_rQsHoK-1POYwnODHmPfx9PC6yyTnlAo_vkpLvHbs4NS618UM4EPDLuZXcGCw==/