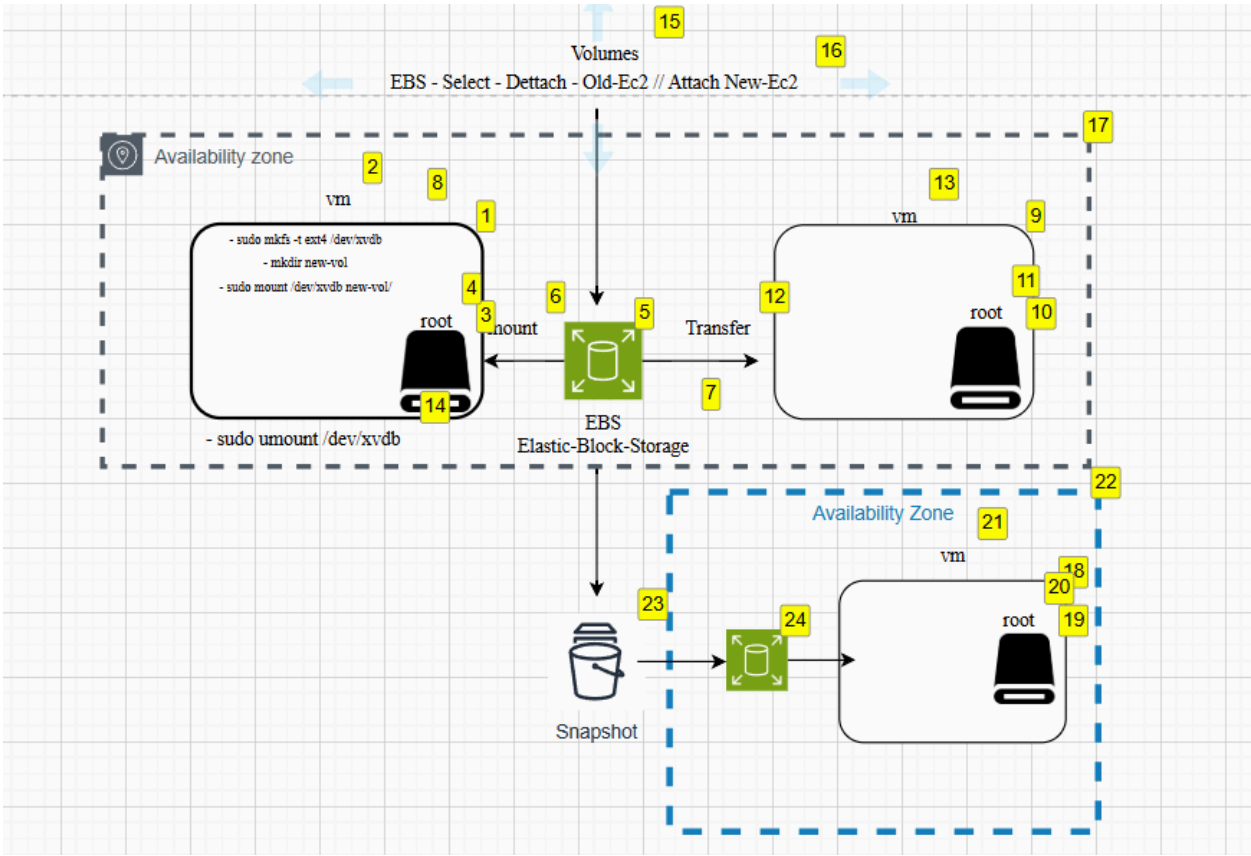

📦 What is AWS EBS (Elastic Block Store)?

Amazon Elastic Block Store (EBS) is a **cloud-based block storage service** provided by AWS. Think of it like a **virtual hard disk** that you can attach to your **Amazon EC2 virtual machine (instance)**. 🖥️

Just like your laptop or PC uses a physical hard drive to store the operating system, files, and applications, EBS provides **durable, high-performance storage** for your cloud-based virtual machines.



🔧 How EBS Works

- You **create an EBS volume** in a specific **Availability Zone** (AZ).
- You **attach it** to an EC2 instance in the same AZ.
- The EC2 instance sees it like a physical disk (e.g., /dev/xvdf).
- You can **format** it, **mount** it, and **use** it like any normal drive.
- Data stored in an EBS volume **persists** even after the instance is stopped or terminated (unless the volume is deleted).

✨ Key Features of AWS EBS

1️⃣ Block-Level Storage

- Unlike object storage (like Amazon S3), EBS gives you **raw block storage**, ideal for:
  - Operating systems 🖥️
  - Databases (MySQL, MongoDB) 🗃️
  - File systems (ext4, XFS) 📁
- Acts like a traditional HDD or SSD.

2️⃣ Persistent Storage 🔄

- Your data remains intact even after you stop or restart your EC2 instance.
- You can detach the volume from one instance and attach it to another.

3️⃣ High Availability and Durability 🛡️

- EBS volumes are **replicated within the same Availability Zone**, ensuring fault tolerance.
- Designed for **99.999% availability** and durability.

4️⃣ Flexible Volume Types 🎛️

Volume Type	Description	Best For
gp3 (General Purpose SSD)	Default choice, low latency, scalable IOPS	Web apps, dev/test
io2 / io2 Block Express	High IOPS, high durability	Databases, critical workloads
st1 (Throughput HDD)	High throughput, low cost	Big data, log processing
sc1 (Cold HDD)	Lowest cost, low throughput	Archiving, rarely accessed data

---

5️⃣ Elastic Volumes 📏

You can **resize** your EBS volumes, change types, and adjust performance **on the fly** — without detaching or restarting your EC2 instance.

6️⃣ Snapshots & Backup 💾

- Create **point-in-time backups** of your volumes.
- Stored in **Amazon S3** (not directly visible there).
- Use snapshots to:

- Restore data
- Clone environments
- Migrate between regions

aws ec2 create-snapshot --volume-id vol-xxxxxx --description "Backup snapshot"

7️⃣ Encryption 🔐

- EBS supports encryption at rest using **AWS Key Management Service (KMS)**.
- All data, snapshots, and backups are encrypted transparently.
- Great for meeting **compliance and security** standards.

8️⃣ Performance Monitoring 📊

- You can monitor your EBS volumes using **CloudWatch metrics**:
  - IOPS (Input/Output per second)
  - Throughput (MB/s)
  - Latency
  - Burst balance

💰 Cost & Pricing (as of 2025)

EBS pricing is **pay-as-you-go**, based on:

Resource	Cost Factor
Storage	GB per month
IOPS	Only for io1/io2 if provisioned
Throughput	For gp3 if you exceed baseline
Snapshots	GB/month of data stored in S3

Example Monthly Pricing (Region dependent):

Volume Type	Cost per GB/month	Notes
gp3	~$0.08	3,000 IOPS baseline free
io2	~$0.125	High IOPS, up to 256,000
st1	~$0.045	Inexpensive for large data
sc1	~$0.025	Cheapest, archival only

> 💡 **Snapshots** typically cost around **$0.05 per GB/month**, stored in S3.

🔧 Real-World Use Cases

Scenario	Why Use EBS?
Host a database	Consistent performance & IOPS
Run a WordPress site	OS and website data on separate volumes
Log processing (e.g. ELK stack)	st1 volumes with high throughput

Disaster recovery	Use snapshots to restore to any region

🧠 Summary

Feature	Description
Type	Block-level storage
Durability	99.999% in a single AZ
Backup	Snapshots to S3
Encryption	Built-in with KMS
Volume Types	gp3, io2, st1, sc1
Mountable To	EC2 instances
Cost	Based on GB, IOPS, snapshots

🏁 Final Thoughts

🎓 AWS EBS is one of the foundational storage services in the cloud.
It's like giving your EC2 instances fast, reliable, and flexible "hard drives" that you can manage easily and securely.

Whether you're building a blog, a data warehouse, or a high-traffic enterprise app — **EBS gives you the power, scalability, and safety** you need in the cloud.
