

Training Course

Amazon Web Service



Course Schedule

Day	Presentations	Lab
Day 1	System Operations on AWS	
Day 2	Computing on AWS	X
Day 3	Networking on AWS	X
Day 4	Storage and Archiving in the Cloud	X
Day 5	Monitoring in the Cloud	X
Day 6	Managing Resource Consumption in the Cloud	X

Module 4: Storage and archiving in the Cloud (AWS)



- **Goal:** Understanding the format repository at Amazon. Store how, operate, share data. Distinguishing features and uses of format storage
 - ✓ EBS
 - ✓ AMI
 - ✓ EC2 Instance Store
 - ✓ EBS Volume Types
 - ✓ Encryption
 - ✓ EFS

Lab 3: Create and configuring Storage

EBS

What's an EBS Volume?

- An EBS (Elastic Block Store) Volume is a network drive you can attach to your instances while they run
- It allows your instance to persist data, even after their termination
- They can only be mounted to one instance at a time
- They are bound to a specific availability zone

What's an EBS Volume?

- Analogy: Thinks of them as a “network USB stick”
- Free tier: 30GB of free EBS storage of type General Purpose (SSD) or Magnetic per month

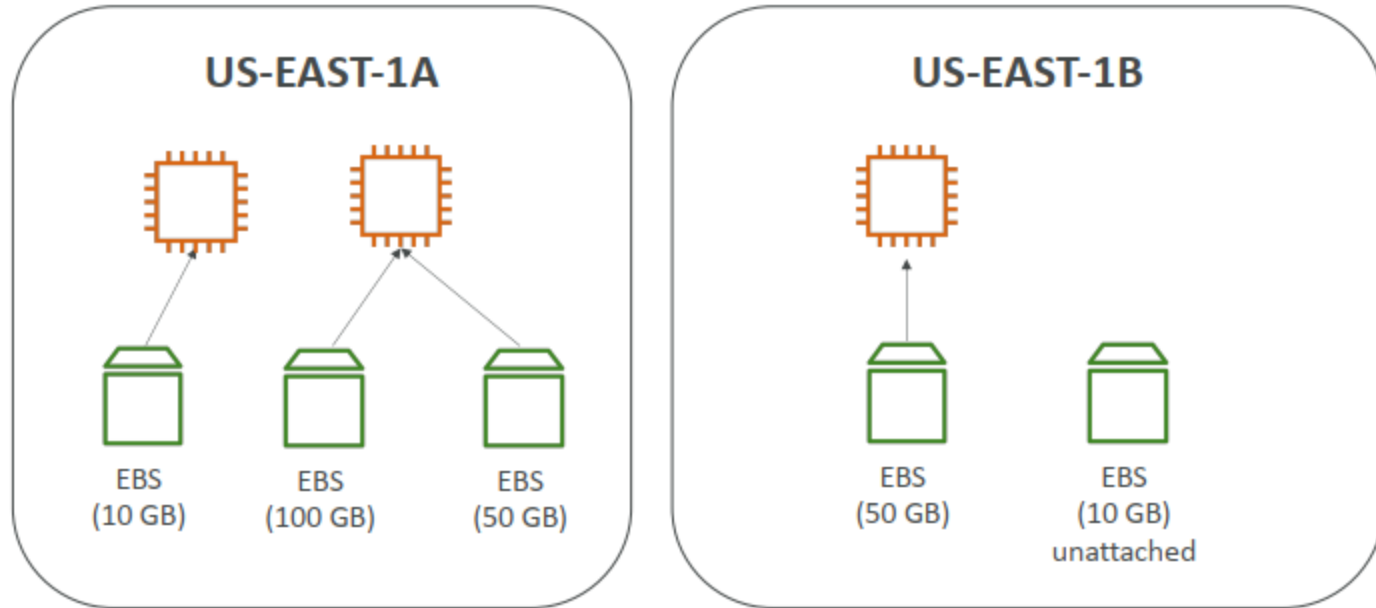
EBS Volume

- It's a network drive (not a physical drive)
 - It uses the network to communicate the instance, which means there might be a bit of latency
 - It can be detached from an EC2 instance and attached to another one quickly
- It's locked to an Availability Zone (AZ)
 - An EBS Volume in us-east-1a cannot be attached to us-east-1b
 - To move a volume across, you first need to snapshot it

EBS Volume

- Have a provisioned capacity (size in GBs, and IOPS)
 - You get billed for all the provisioned capacity
 - You can increase the capacity of the drive over time

EBS Volume



EBS – Delete on Termination attribute

- Controls the EBS behavior when an EC2 instance terminates
 - By default, the root EBS volume is deleted (attribute enabled)
 - By default, any other attached EBS volume is not deleted (attribute disabled)
- This can be controlled by the AWS console / AWS CLI
- **Use case:** preserve root volume when instance is terminated

EBS – Delete on Termination attribute

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 4: Add Storage

Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. [Learn more](#) about storage options in Amazon EC2.

Volume Type ⓘ	Device ⓘ	Snapshot ⓘ	Size (GiB) ⓘ	Volume Type ⓘ	IOPS ⓘ	Throughput (MB/s) ⓘ	Delete on Termination ⓘ
Root	/dev/xvda	snap-053c42bdb1128764a	<input type="text" value="8"/>	General Purpose SSD (gp2) ▼	100 / 3000	N/A	<input checked="" type="checkbox"/>
<input type="text" value="EBS"/> ▼	<input type="text" value="/dev/sdb"/> ▼	<input type="text" value="Search (case-insensit"/>	<input type="text" value="8"/>	General Purpose SSD (gp2) ▼	100 / 3000	N/A	<input type="checkbox"/>
<input type="button" value="Add New Volume"/>							

EBS Snapshots

- Make a backup (snapshot) of your EBS volume at a point in time
- Not necessary to detach volume to do snapshot (but recommened)
- Can copy snapshots across AZ or Region

EBS Snapshots



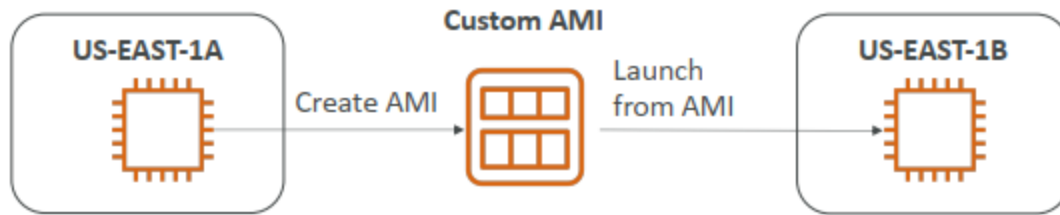
AMI Overview

AMI Overview

- AMI = Amazon Machine Image (**!= IAM**)
- AMI are a customization of an EC2 instance
 - Can add software, configuration, operation system, monitoring...
 - Faster boot / configuration time because all software is pre-packaged
- AMI are built for a specific region (and can be copied across regions)
- You can launch EC2 instances from
 - A public AMI: AWS provided
 - Your own AMI: you make and maintain them yourself
 - An AWS Marketplace AMI: an AMI someone else made (and potentially sells)

AMI Process (from an EC2 instance)

- Start an EC2 instance and customize it
- Stop the instance (for data integrity)
- Build an AMI – this will also create EBS snapshots
- Launch instances from other AMIs



EC2 Instance Store

EC2 Instance Store

- EBS volumes are networking drives with good but “limited” performance
- **If need a high-performance hardware disk, use EC2 Instance Store**
- Better I/O performance
- EC2 Instance Store lose data if stopped (ephemeral)
- Good for buffer/cache/scratch data/temporary content
- Risk of data loss if hardware fails
- Backups and Replicaton are your responsibility

Local EC2 Instance Store

Instance Size	100% Random Read IOPS	Write IOPS
i3.large *	100,125	35,000
i3.xlarge *	206,250	70,000
i3.2xlarge	412,500	180,000
i3.4xlarge	825,000	360,000
i3.8xlarge	1.65 million	720,000
i3.16xlarge	3.3 million	1.4 million
i3.metal	3.3 million	1.4 million
i3en.large *	42,500	32,500
i3en.xlarge *	85,000	65,000
i3en.2xlarge *	170,000	130,000
i3en.3xlarge	250,000	200,000
i3en.6xlarge	500,000	400,000
i3en.12xlarge	1 million	800,000
i3en.24xlarge	2 million	1.6 million
i3en.metal	2 million	1.6 million

EBS Volume Types

EBS Volume Types

- EBS Volumes come in 6 types
 - **gp2 / gp3 (SSD)**: General purpose SSD volume that balances price and performance for a wide variety of workloads
 - **io1 / io2 (SSD)**: Highest-performance SSD volume for mission-critical low-latency or high-throughput workloads
 - **st 1 (HDD)**: Low cost HDD volume designed for frequently accessed, throughput-intensive workloads
 - **sc 1 (HDD)**: Lowest cost HDD volume designed for less frequently accessed workloads

EBS Volume Types Use cases

- EBS Volumes are characterized in Size | Throughput | IOPS (I/O Ops Per Sec)
- When in doubt always consult the AWS documentation – it's good
- **Only gp2/gp3 and io 1/io 2 can be used as boot volumes**

EBS Volume Types Use cases

General Purpose SSD

- Cost effective storage, low-latency
- System boots volumes, Virtual desktops, Development and test environments
- 1 Gib – 16 TiB

EBS Volume Types Use cases

General Purpose SSD

- Gp3:
 - Baseline of 3,000 IOPS and throughput of 125 MiB/s
 - Can increase IOPS up to 16,000 and throughput up to 1000 MiB/s independently
- Gp2:
 - Small gp2 volumes can burst IOPS to 3000
 - Size of the volume and IOPS are linked, max IOPS is 16000
 - 3 IOPS per GB, means at 5,334 GB we are at the max IOPS

EBS Volume Types Use cases

Provisioned IOPS SSD

- Critical business applications with sustained IOPS performance
- Or applications that need more than 16,000 IOPS
- Great for **databases workloads** (sensitive to storage perf and consistency)

EBS Volume Types Use cases

Provisioned IOPS SSD

- io 1 /io2 (4 GiB – 16 TiB)
 - Max PIOPS: 64,000 for Nitro EC2 instances & 32,000 for other
 - Can increase PIOPS independently from storage size
 - io2 have more durability and more IOPS per GiB (at the same price as io 1)
- io2 Block Express (4 Gib – 64 TiB)
 - Sub-millisecond latency
 - Max PIOPS: 256,000 with an IOPS:Gib ratio of 1,000:1
- Supports EBS Multi-attach

EBS Volume Types Use cases

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EBS Volume Types Use cases

Hard Disk Drives (HDD)

- Cannot be a boot volume
- 125 Mib to 16 Tib
- Throughput Optimized HDD (st 1)
 - Big Data, Data Warehouses, Log Processing
 - **Max throughput** 500 MiB/s – max IOPS 500
- Cold HDD (sc 1)
 - For data that is infrequently accessed
 - Scenarios where lowest cost is important
 - **Max throughput** 250 MiB/s – max IOPS 250

EBS Volume Types Summary

EBS Volume Types (Cheat Sheet)

	<u>General Purpose (SSD)</u>	<u>Provisioned IOPS (SSD)</u>	<u>Magnetic</u>
Recommend Use Cases	Boot Volumes Low to Med Perf DBs Dev and test	I/O intensive High Perf DBs	Cold Storage
Storage Media	SSD-backed	SSD-backed	Magnetic-backed
Volume Size	1GB-1TB	1GB-1TB	1GB-1TB
Max IOPS per volume	3 IOPS/GB Burst up to 3000 IOPS	4,000 IOPS	~100 IOPS
Read and Write Peak Throughput	128 MB/s	128 MB/s	~50-90 MB/s
Max I/O per node	48,000	48,000	~1000-5000
Peak Throughput Node	800 MB/s	800 MB/s	~800 MB/s
Latency (random read)	1-2ms	1-2 ms	20-40 ms
API Name	gp2	io1	standard
Price*	\$.10/GB-Month	\$.125/GB-Month \$.065/provisioned IOPS	\$.05/GB-Month \$.05/ 1M I/O



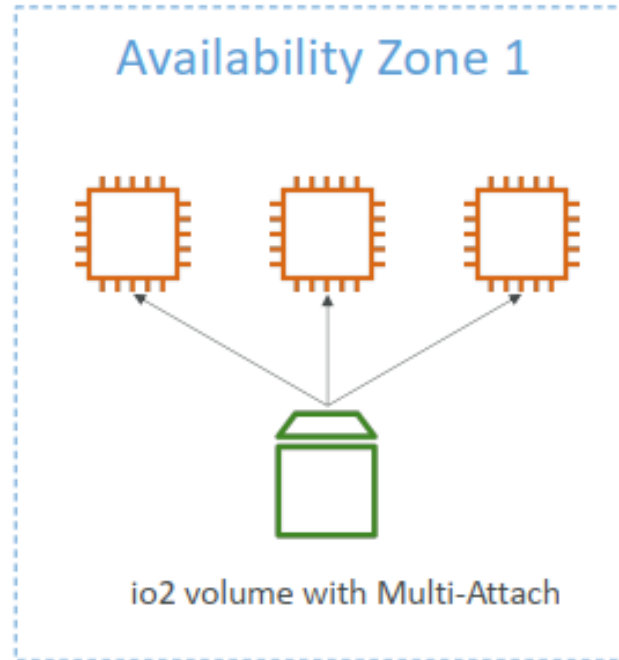
EBS Multi-Attach – io1/io2 family

- Attach the same EBS volume to multiple EC2 instances in the same AZ
- Each instance has full read & write permissions to the volume

EBS Multi-Attach – io1/io2 family

- Use case:
 - Achieve higher application availability in clustered Linux applications (ex: Teradata)
 - Applications must manage concurrent write operations

EBS Multi-Attach – io1/io2 family

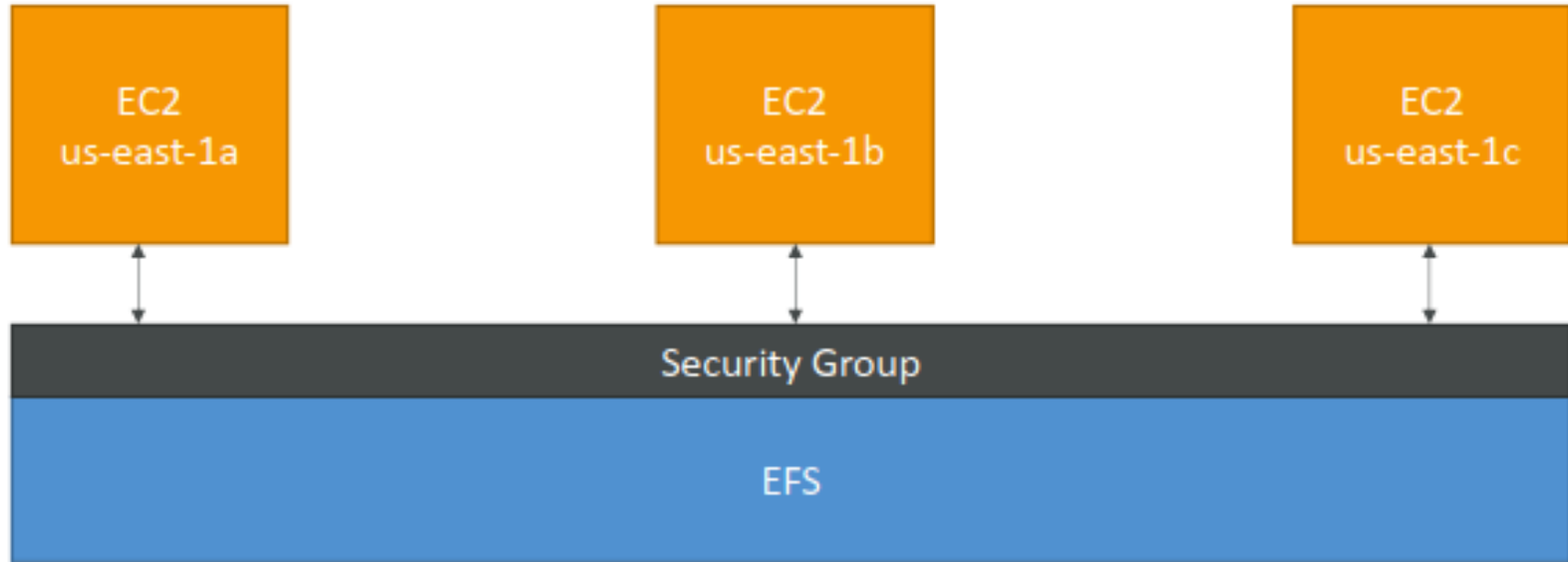


EFS

EFS – Elastic File System

- Managed NFS (network file system) that can be mounted on many EC2
- EFS works with EC2 instances in multi-AZ
- Highly available, scalable, expensive (3x gp2), pay per use

EFS – Elastic File System



EFS – Performance

- EFS Scale
 - 10 GB+ /S throughput
 - Grow to Petabyte-scale network file system, automatically
- Performance mode (set at EFS creation time)
 - General purpose (default): latency-sensitive use cases (web server, CMS, etc...)
 - Max I/O – higher latency, throughput, highly parallel (big data, media processing)

EBS vs EFS – Elastic Block Storage

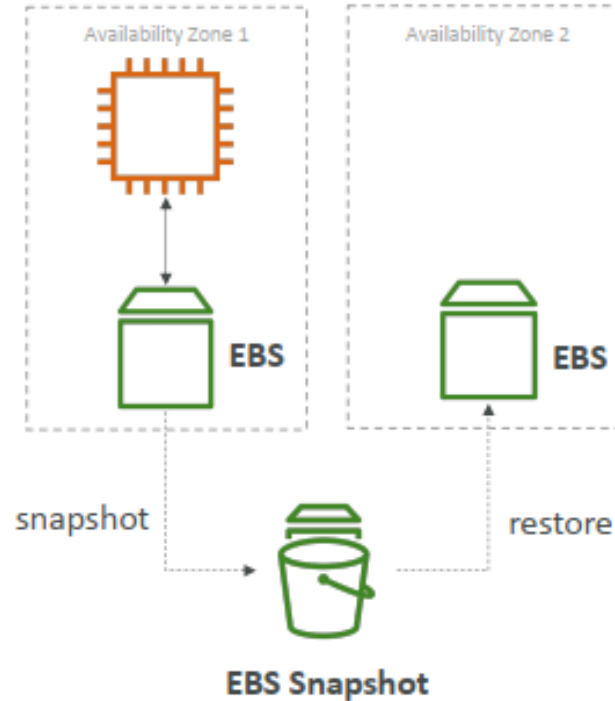
- EBS volumes...
 - Can be attached to only one instance at a time
 - Are locked at the Availability Zone (AZ) level
 - Gp2: IO increases if the disk size increases
 - Io 1: can increase IO independently

EBS vs EFS – Elastic Block Storage

- To migrate EBS volumes across AZ...
 - Take a snapshot
 - Restore the snapshot to another AZ
 - EBS backups use IO and you shouldn't run them while your application is handling a lot of traffic
- Root EBS Volumes of instances get terminated by default if the EC2 instance gets terminated (can disable that)

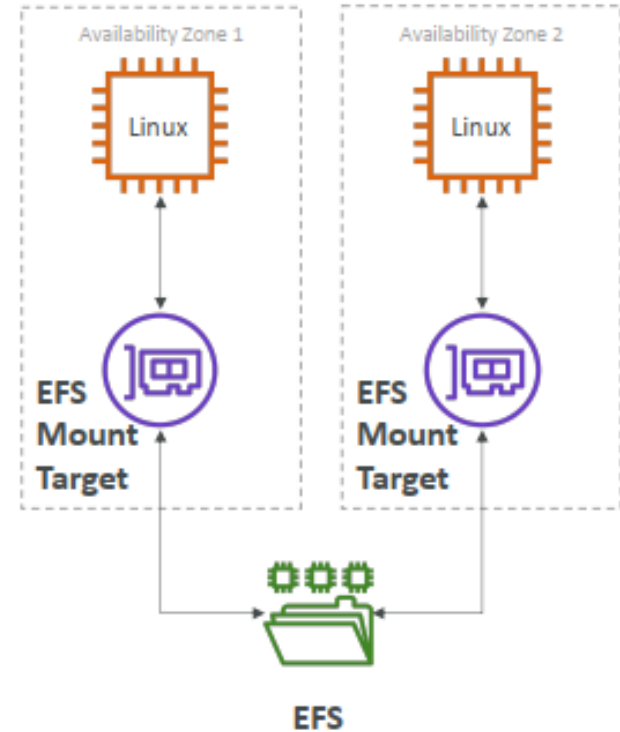
EBS vs EFS – Elastic Block Storage

- EBS volumes



EBS vs EFS – Elastic File System

- Mounting 100s of instances across AZ
- EFS share websites files (WordPress)
- Only for Linux Instance (POSIX)
- EFS has a higher price point than EBS
- Can leverage EFS-IA for cost savings



Remember: EFS vs EBS vs Instance Store!!

Thank you!!!