EC2 Instance Storage Section

What's an EBS Volume?

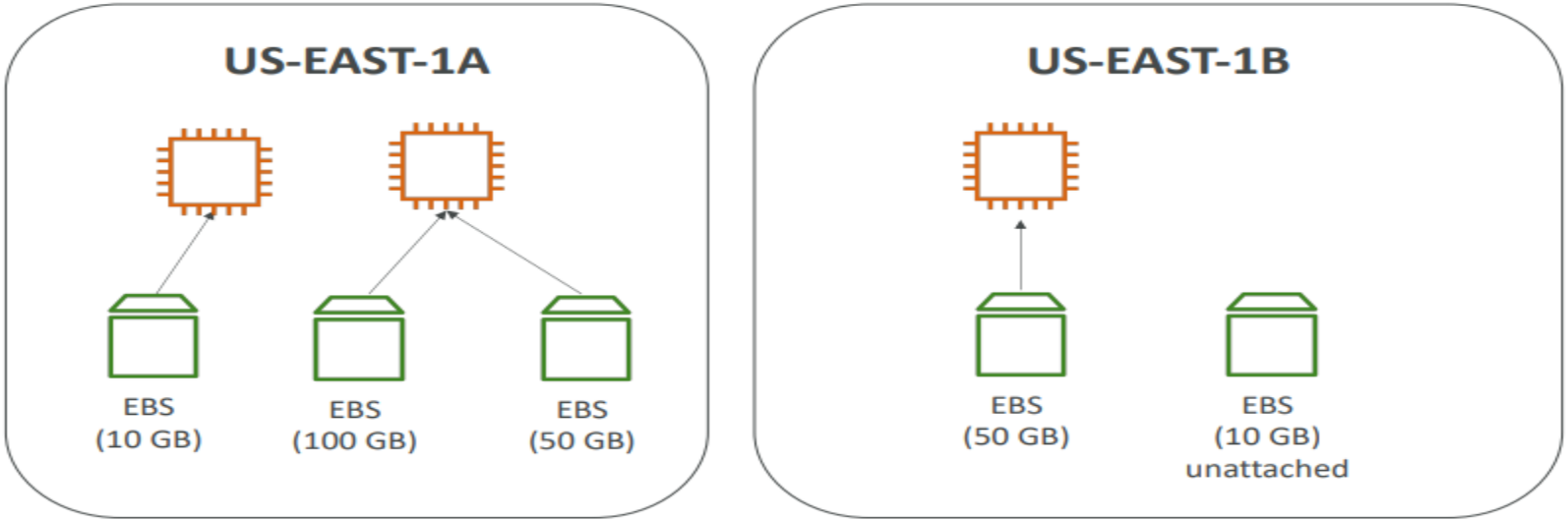
- An EBS (Elastic Block Store) Volume is a network drive you can attach to your instances while they run
- It allows your instances to persist data, even after their termination
- **They can only be mounted to one instance at a time** (at the CCP level)
- They are bound to **a specific availability zone**

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

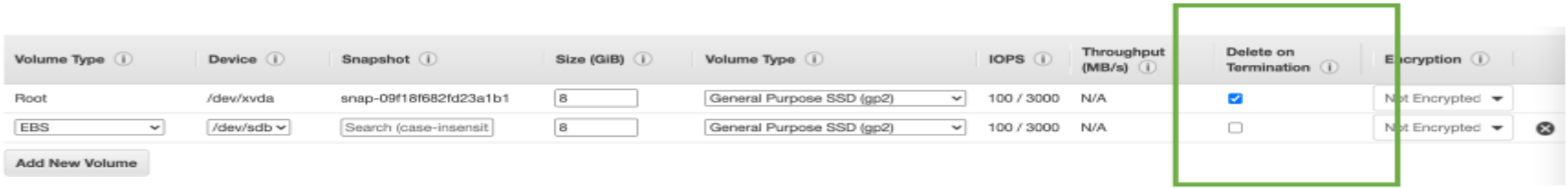
EBS Volume

- It's a network drive (i.e. 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
- 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 - Example



EBS – Delete on Termination attribute



- Controls the EBS behaviour 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 Snapshots

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

EBS Snapshots Features

- **EBS Snapshot Archive**
  - Move a Snapshot to an "archive tier" that is 75% cheaper
  - Takes within 24 to 72 hours for restoring the archive

- **Recycle Bin for EBS Snapshots**
  - Setup rules to retain deleted snapshots so you can recover them after an accidental deletion
  - Specify retention (from 1 day to 1 year)

AMI Overview

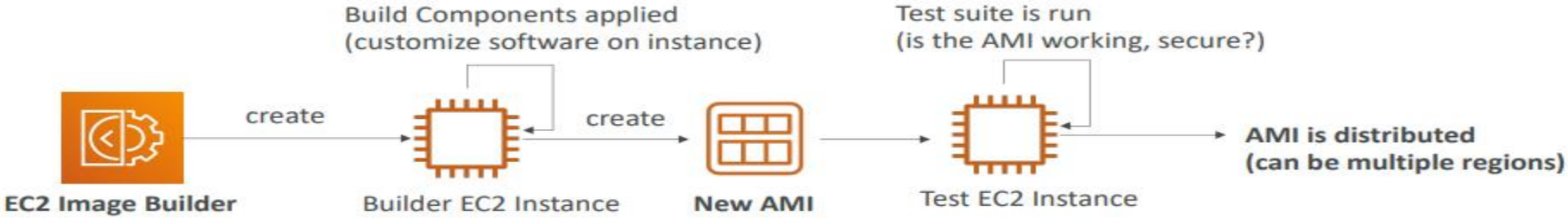
- AMI = Amazon Machine Image
- AMI are a **customization** of an EC2 instance
  - You add your own software, configuration, operating system, monitoring…
  - Faster boot / configuration time because all your software is pre-packaged
- AMI are built for a **specific region** (and can be copied across 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)

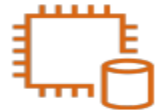
- Start an EC2 instance and customize it
- Stop the instance (for data integrity)
- Build an AMI – this will also create EBS snapshots
- Launch instances from other AMIs

EC2 Image Builder

- Used to automate the creation of Virtual Machines or container images
- => Automate the creation, maintain, validate and test **EC2 AMIs**
- Can be run on a schedule (weekly, whenever packages are updated, etc…)
- Free service (only pay for the underlying resources)



EC2 Instance Store



- EBS volumes are **network drives** with good but "limited" performance
- If you need a high-performance hardware disk, use EC2 Instance Store

- Better I/O performance
- EC2 Instance Store lose their storage if they're stopped (ephemeral)
- Good for buffer / cache / scratch data / temporary content
- Risk of data loss if hardware fails
- Backups and Replication are your responsibility

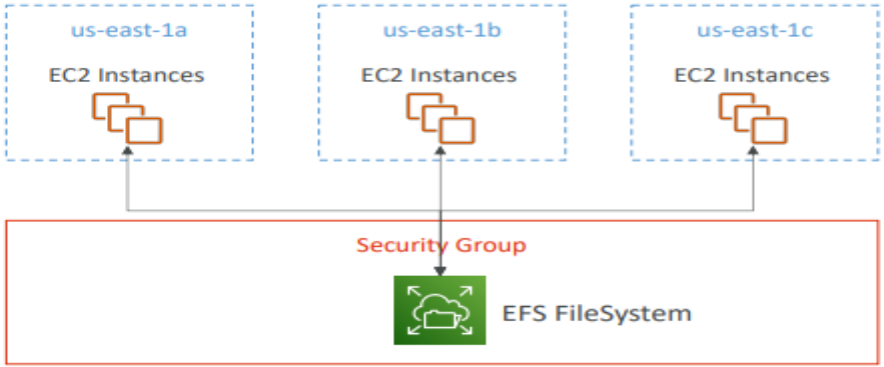
Local EC2 Instance Store

Very high IOPS

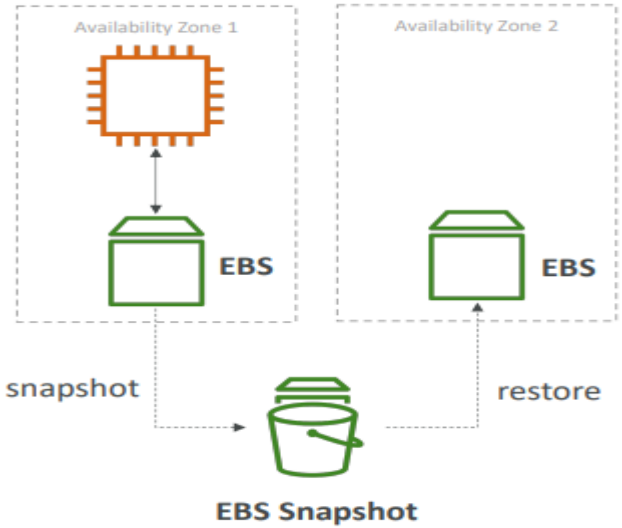
Instance Size	100% Random Read IOPS	Write IOPS
i3.large *	100,125	35,000
i3.xlarge *	206,250	70,000
i3.2xlarge	412,500	180,000
i3.4xlarge	825,000	360,000
i3.8xlarge	1.65 million	720,000
i3.16xlarge	3.3 million	1.4 million
i3.metal	3.3 million	1.4 million
i3en.large *	42,500	32,500
i3en.xlarge *	85,000	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

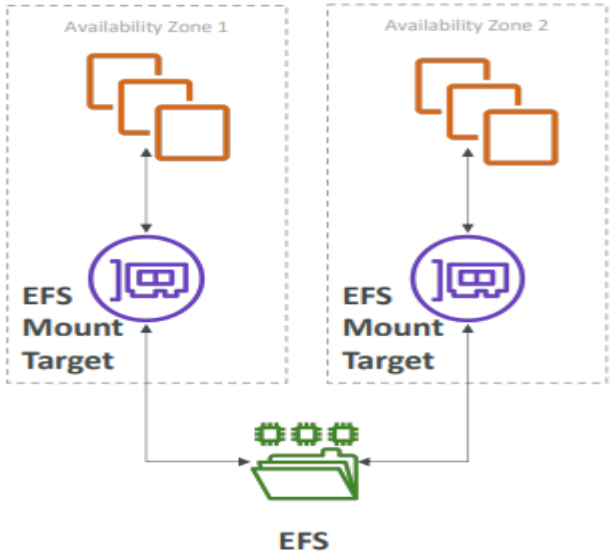
EFS – Elastic File System

- Managed NFS (network file system) that **can be mounted on 100s of EC2**
- EFS works with **Linux** EC2 instances in **multi-AZ**
- Highly available, scalable, expensive (3x gp2), pay per use, no capacity planning



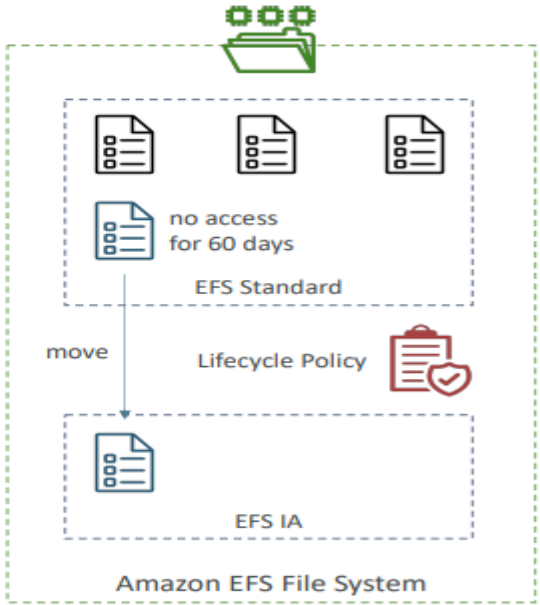
EBS vs EFS


Availability Zone 1
Availability Zone 2
EBS
EBS
snapshot
restore
EBS Snapshot


Availability Zone 1
Availability Zone 2
EFS
Mount
Target
EFS
Mount
Target
EFS

EFS Infrequent Access (EFS-IA)

- **Storage class** that is cost-optimized for files not accessed every day
- Up to 92% lower cost compared to EFS Standard
- EFS will automatically move your files to EFS-IA based on the last time they were accessed
- Enable EFS-IA with a Lifecycle Policy
- Example: move files that are not accessed for 60 days to EFS-IA
- Transparent to the applications accessing EFS



Shared Responsibility Model for EC2 Storage

- Infrastructure
- Replication for data for EBS volumes & EFS drives
- Replacing faulty hardware
- Ensuring their employees cannot access your data

- Setting up backup / snapshot procedures
- Setting up data encryption
- Responsibility of any data on the drives
- Understanding the risk of using EC2 Instance Store

Amazon FSx – Overview

- Launch 3rd party high-performance file systems on AWS
- Fully managed service

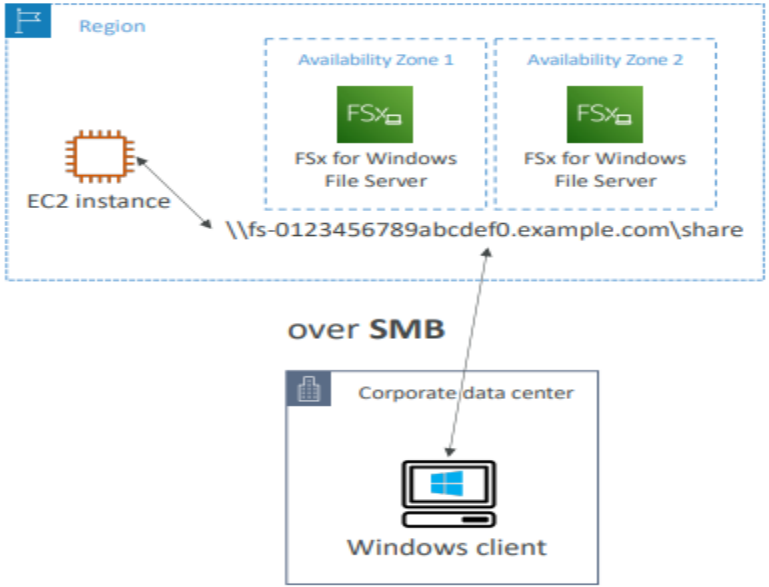
FSx for Lustre

FSx for Windows File Server

FSx for NetApp ONTAP

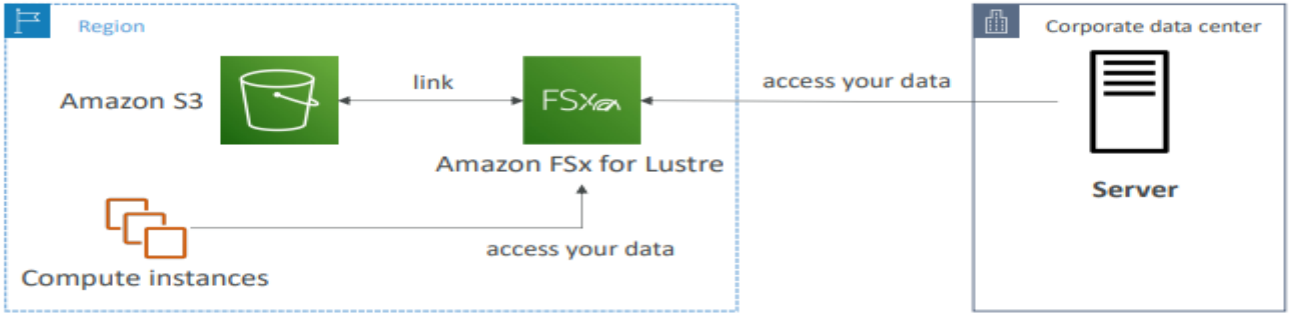
Amazon FSx for Windows File Server

- A fully managed, highly reliable, and scalable **Windows native** shared file system
- Built on **Windows File Server**
- Supports **SMB protocol** & Windows NTFS
- Integrated with Microsoft Active Directory
- Can be accessed from AWS or your on-premise infrastructure



Amazon FSx for Lustre

- A fully managed, high-performance, scalable file storage for **High Performance Computing (HPC)**
- The name Lustre is derived from "Linux" and "cluster"
- Machine Learning, Analytics, Video Processing, Financial Modeling, ...
- Scales up to 100s GB/s, millions of IOPS, sub-ms latencies



EC2 Instance Storage - Summary

- **EBS volumes:**
  - network drives attached to one EC2 instance at a time
  - Mapped to an Availability Zones
  - Can use EBS Snapshots for backups / transferring EBS volumes across AZ
- **AMI:** create ready-to-use EC2 instances with our customizations
- **EC2 Image Builder:** automatically build, test and distribute AMIs
- **EC2 Instance Store:**
  - High performance hardware disk attached to our EC2 instance
  - Lost if our instance is stopped / terminated
- **EFS:** network file system, can be attached to 100s of instances in a region
- **EFS-IA:** cost-optimized storage class for infrequent accessed files
- **FSx for Windows:** Network File System for Windows servers
- **FSx for Lustre:** High Performance Computing Linux file system