EC2 Instance Storage Section

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TOPIC

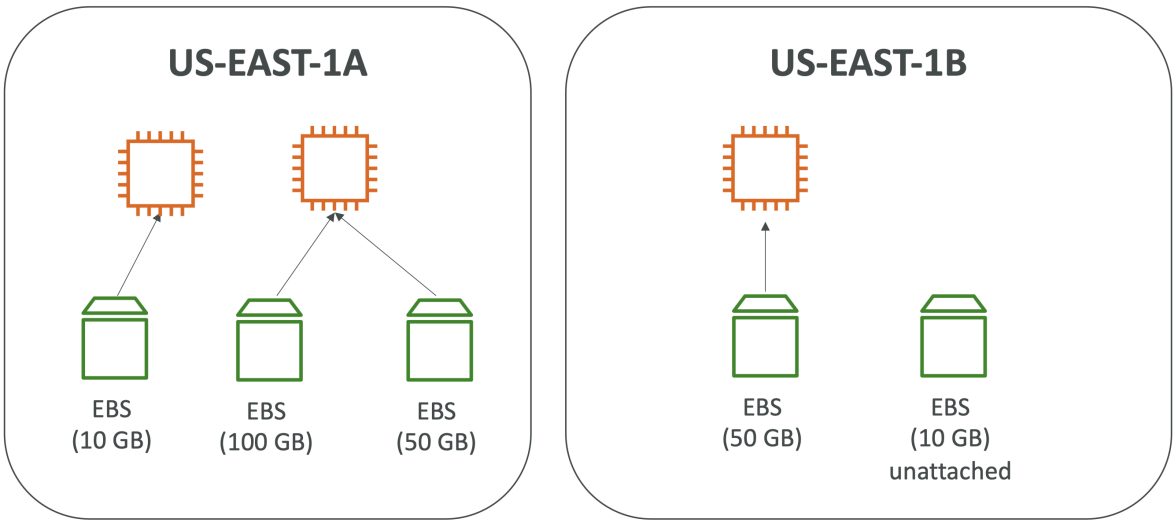
EC2 - Instance Storage Section(PPT. p.91 - p.115)

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
  - 30GB of free EBS storage of type General Purpose (SSD) or Magnetic per month
- 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 instances and attached to another one quickly
- It's locked to an Availability Zone(not to a region)
    - 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 Example



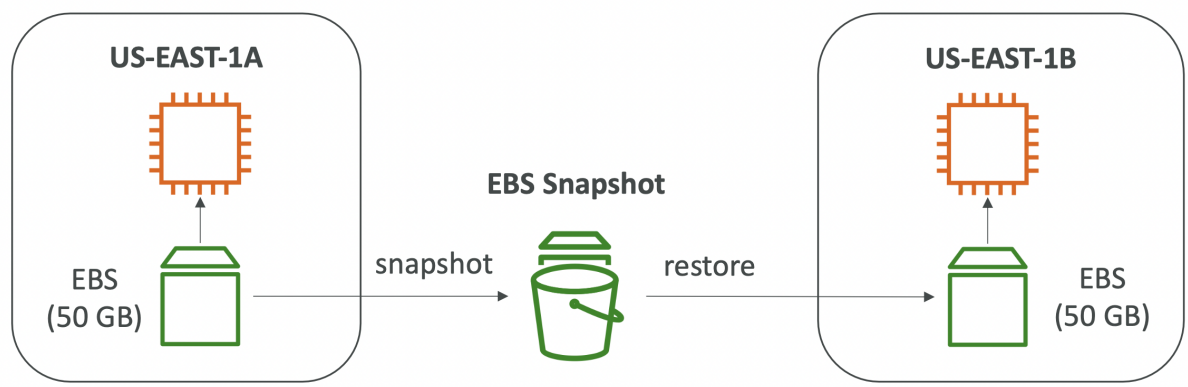
EBS Delete on Termination attribute

- 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 enabled)
- 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



- 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)
  - Fast Snapshot restore (FSR)
    - Force full initialization of snapshot to have no latency on the first use (expensive)
  - Use case:
    - **If you don’t need to restore fast, Just use a snapshot archive**

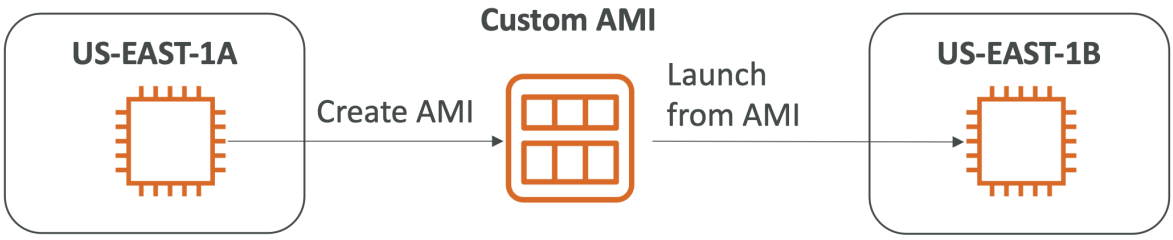
AMI

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 ca 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

- 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

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
  - st1 (HDD): Low cost HDD volume designed for frequently accessed, throughput-intensive workloads
  - sc1 (HDD): Lowest cost HDD volume designed for less frequently accessed workloads
- 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 io1/io2 can be used as boot volumes**

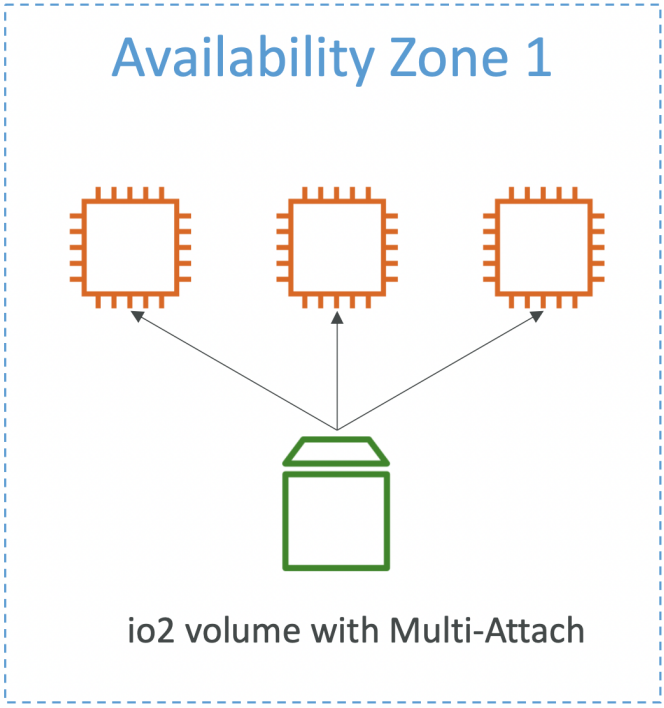
EBS Volume Types - Use cases

- Provisioned IOPS (PIOPS) 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)
  - Max PIOPS: 64,000 for Nitro EC2 instances & 32,000 for other
  - io1/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 io1)
    - 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
- Hard Disk Drives (HDD)
    - Cannot be a boot volume
    - 125 GiB 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 Multi-Attach - io 1 / io 2 family

- Attach the same EBS volume to multiple EC2 instances in the same AZ
- Each instance has full read & write permissions to the high-performance volume
- Use case:
    - Achieve higher application availability in clustered Linux applications (ex:Teradata)
    - Applications must manage concurrent write operations
- **Up to 16 EC2 Instances at a time**
- Must use a file system that’s cluster-aware (not XFS, EX4, etc...)



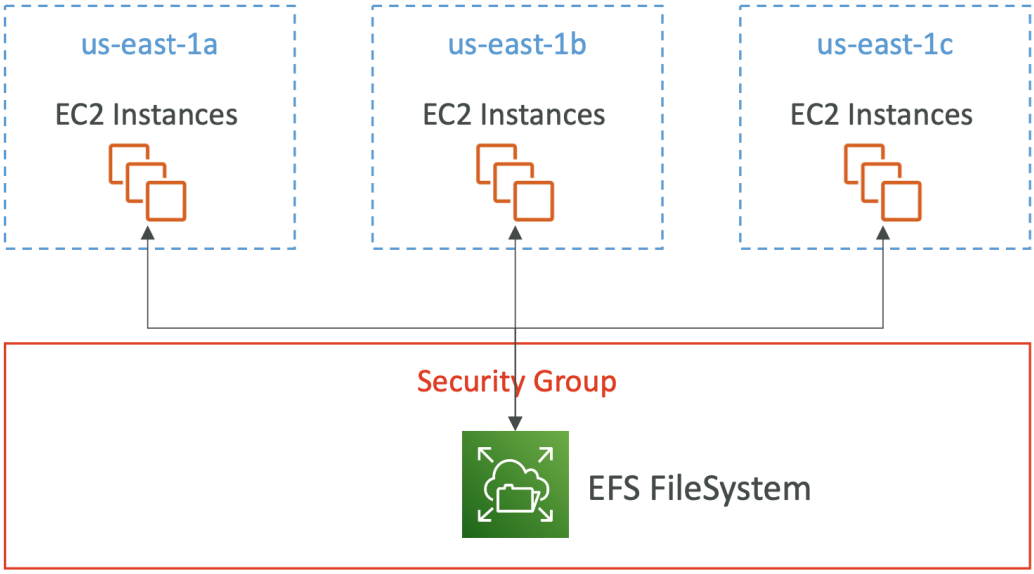
EBS Encryption

- When you create an encrypted EBS volume, you get the following:
  - Data at rest is encrypted inside the volume
  - All the data in flight moving between the instance and the volume is encrypted
  - All snapshots are encrypted
  - All volumes created from the snapshot
- Encryption and decryption are handled transparently (you have nothing to do)
- Encryption has a minimal impact on latency
- EBS Encryption leverages keys from KMS (AES-256)
- Copying an unencrypted snapshot allows encryption
- Snapshots of encrypted volumes are encrypted
- **encrypt an unencrypted EBS volume**
  - Create an EBS snapshot of the volume
  - Encrypt the EBS snapshot (using copy)

- Create new ebs volume from the snapshot (the volume will also be encrypted)
- Now you can attach the encrypted volume to the original instance

Amazon EFS - Elastic File System

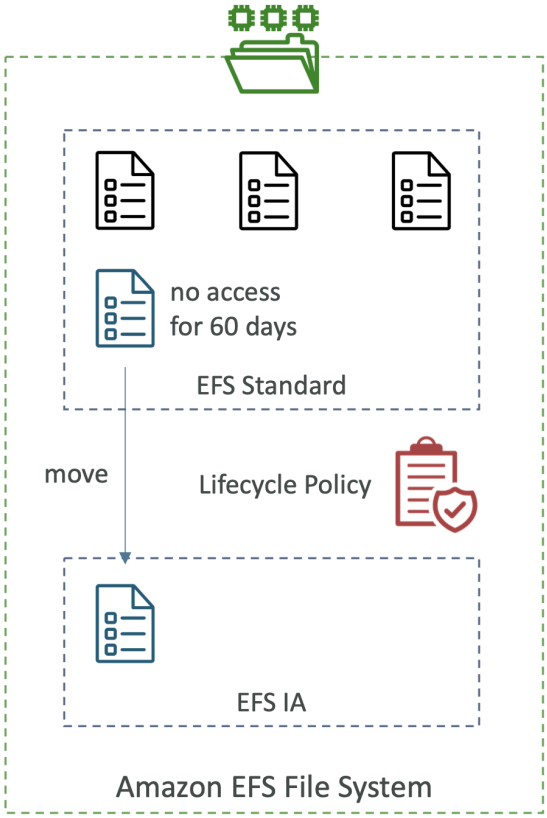
- Managed NFS (network file system) that can be mounted on many EC2
- EFS works with EC2 instances in multi-AZ
- Highly available, scalable, expensive (3x gp2), pay per use



- Use cases:
  - **content management, web serving, data sharing,Wordpress**
- Uses NFSv4.1 protocol
- Uses security group to control access to EFS
- **Compatible with Linux based AMI (not Windows)**
- Encryption at rest using KMS
- POSIX file system (~Linux) that has a standard file API
- File system scales automatically, pay-per-use, no capacity planning!

EFS - Performance & Storage Classes

- EFS Scale
  - 1000s of concurrent NFS clients, 10 GB+ /s throughput
  - Grow to Petabyte-scale network file system, automatically
- Performance mode (set at EFS creation time)
  - Generalpurpose(default):latency-sensitiveusecases(webserver,CMS,etc...)
  - Max I/O – higher latency, throughput, highly parallel (big data, media processing)
- Throughput mode
  - Bursting (1TB = 50MiB/s + burst of up to 100MiB/s)
  - Provisioned : set your throughput regardless of storage size, ex: 1GiB/s for 1TB storage
- Storage Tiers (lifecycle management feature – move file after N days)
  - Standard: for frequently accessed files
  - Infrequent access (EFS-IA): cost to retrieve files, lower price to store. Enable EFS-IA with a Lifecycle Policy
- Availability and durability
  - Standard: Multi-AZ, great for prod
  - One Zone: One AZ, great for dev, backup enabled by default, compatible with IA (EFS One Zone-IA)
- Over 90% in cost savings

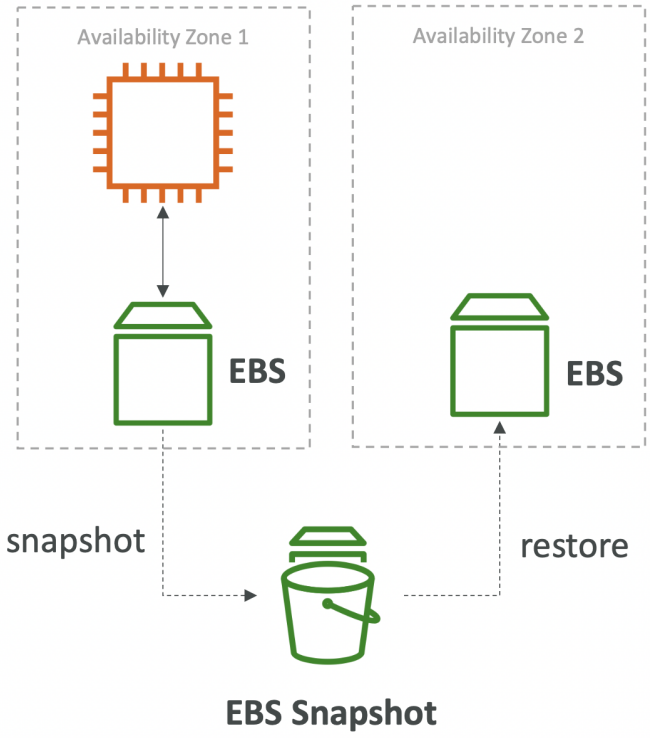


EBS vs EFS

Elastic Block Storage

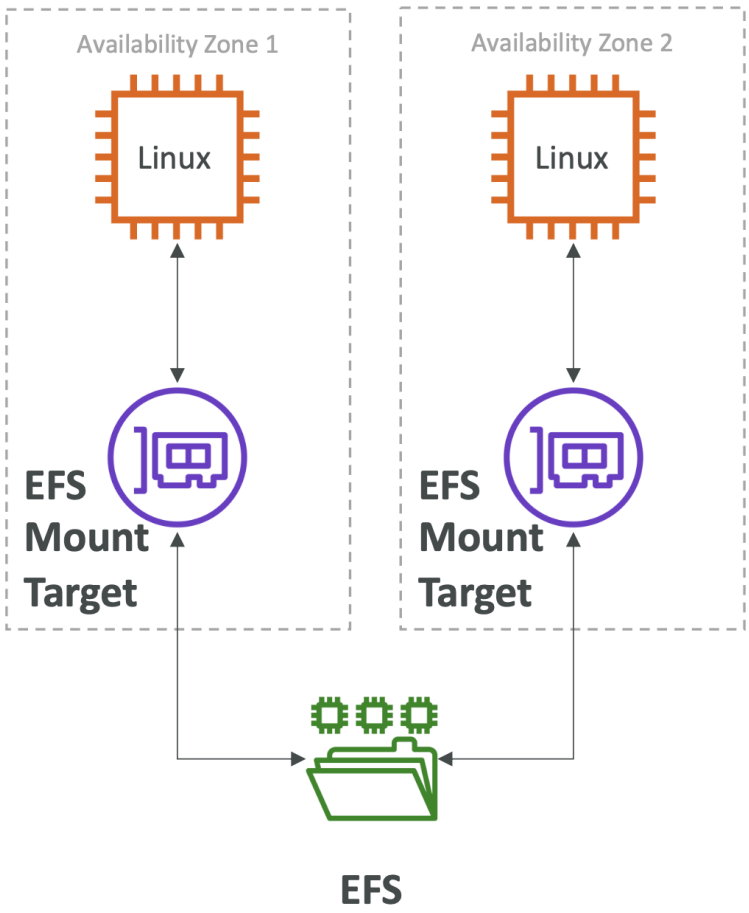
- EBS volumes...
  - can be attached to only one instance at a time
  - are locked at the AZ level
  - gp2 : IO increases if the disk size increases
  - io1 : can increase IO independently
- To migrate an EBS volume across AZ
  - Take a snapshot
  - Restore the snapshot to another AZ
  - EBS backups 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. (you can disable that)



Elastic File System

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


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