



# Agenda

- ❖ Storage Services
  - What is Storage Services
- ❖ Elastic Block Storage
  - What is EBS
  - EBS Features
  - EBS Benefits
  - EBS Types
  - EBS General Purposed SSD
  - EBS Provisioned IOPS SSD
  - EBS Throughput Optimized HDD
  - EBS Cold HDD
  - EBS Comparison
  - EBS Previous Generation Volumes
  - EBS Pricing
  - EBS Life Cycle
  - EBS Snapshot
  - EBS How Incremental Snapshots Work
  - EBS Deleting an Amazon EBS Snapshot
  - EBS Summary
  - Hands-On Lab

# Storage Services

# What is Storage Services

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- ❑ Amazon provides you with flexible, cost effective, and easy-to-use data storage options.
- ❑ Each option has a unique combination of performance and durability.
- ❑ These storage options can be used independently or in combination to suit your requirements.

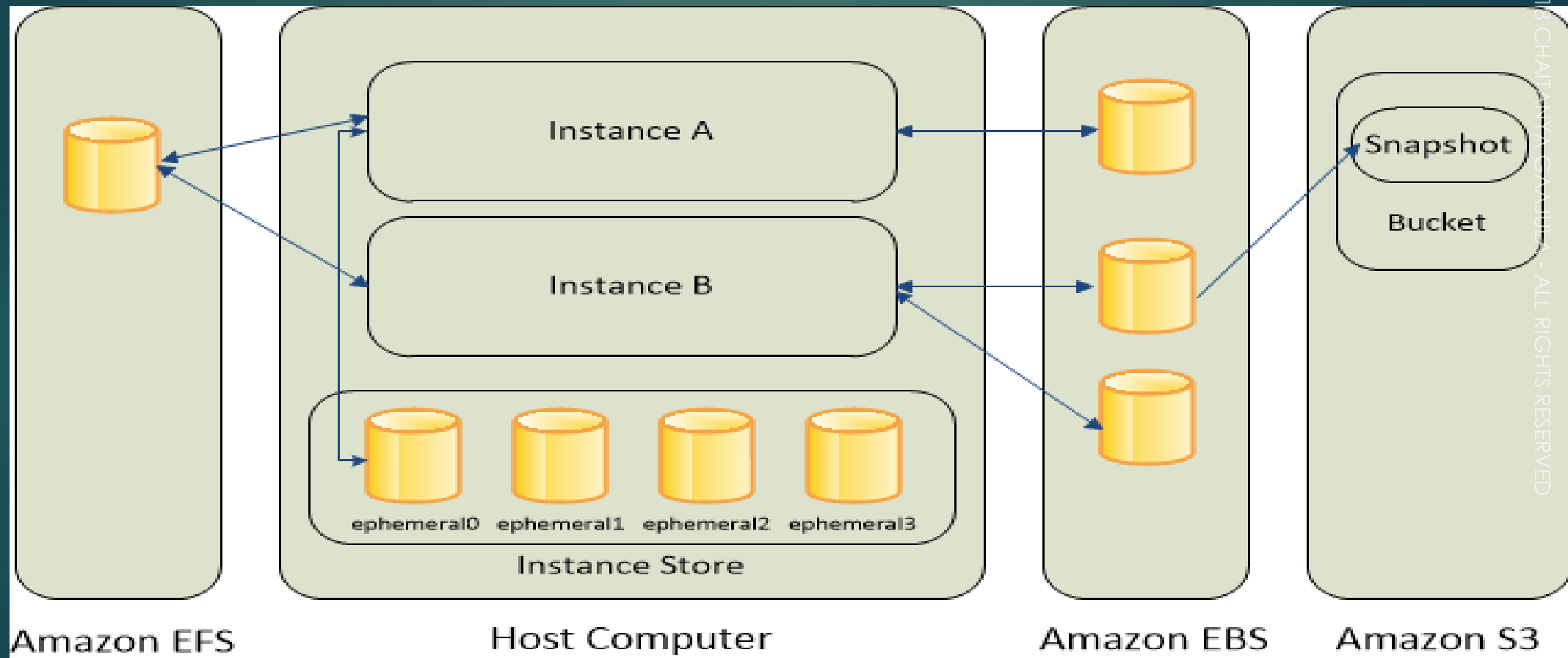
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# What is Storage Services

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- The following figure shows the relationship between these types of storage.



# Elastic Block Storage (EBS)

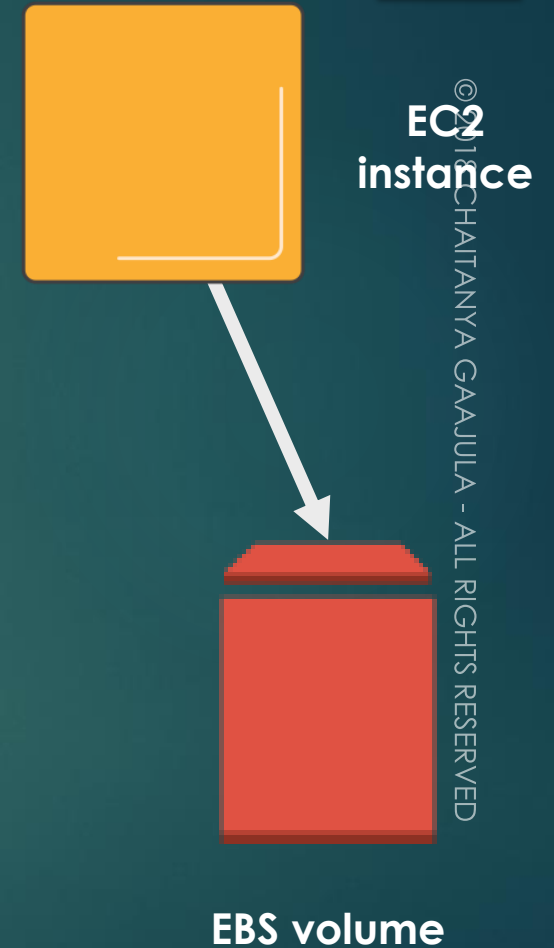
# What is EBS

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- ❑ Amazon Elastic Block Store (EBS) provides block level storage volumes for use with EC2 instances.
- ❑ EBS volumes are highly available and reliable storage volumes that can be attached to any running instance that is in the same Availability Zone.
- ❑ With Amazon EBS, you pay only for what you use.
- ❑ You can create EBS provisioned and throughput optimized volumes up to 16 TiB.
- ❑ You can mount these volumes as devices on your Amazon EC2 instances.

# AWS EBS

- ❑ Amazon Elastic Block Store provides block level storage volumes for use with EC2 instances.
- ❑ EBS can be attached to any running instance that is in the same Availability Zone.
- ❑ EBS volumes that are attached to an EC2 instance are exposed as storage volumes that persist independently from the life of the instance.
- ❑ With Amazon EBS, you pay only for what you use.

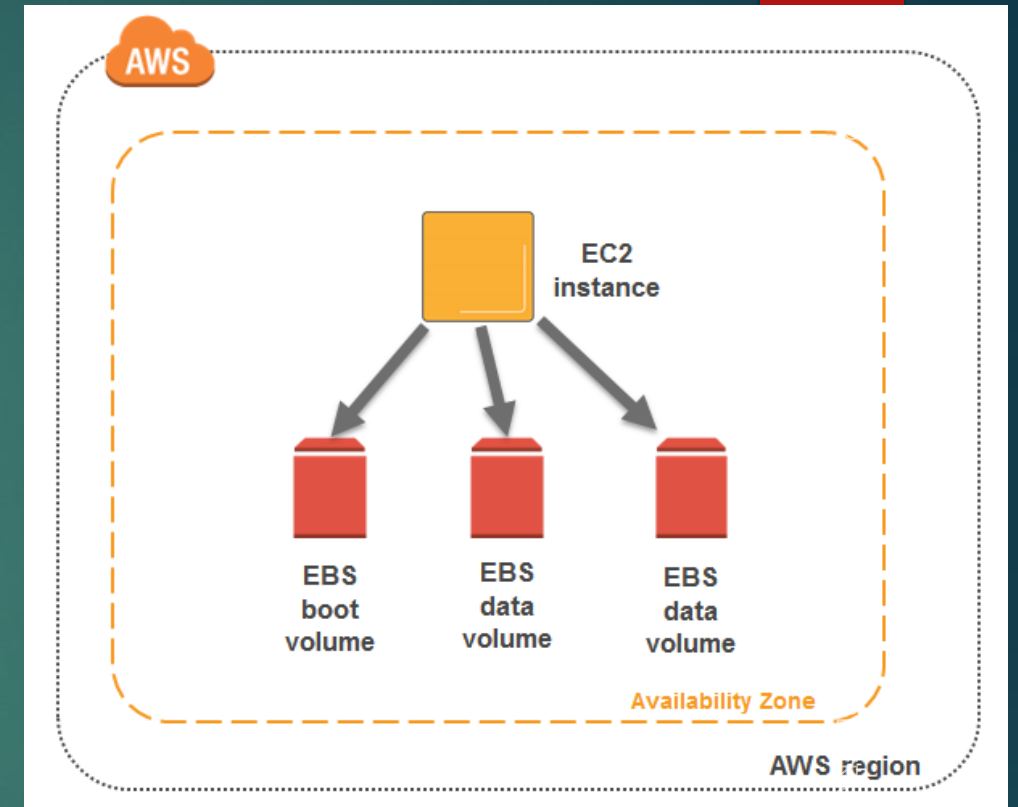




# AWS EBS

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- ❑ You can mount multiple volumes on the same instance, but each volume can be attached to only one instance at a time.
- ❑ You can dynamically change the configuration of a volume attached to an instance.
- ❑ EBS volumes behave like raw, unformatted block devices. We can create a file system on top of these volumes.



# AWS EBS: Features

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Magnetic & SSD

Pre-Warming  
not required

0.1% to 0.2%  
Annual Failure Rate  
(AFR)

99.999%  
Service Availability

# AWS EBS: Benefits

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Data  
Availability

Data  
Persistence

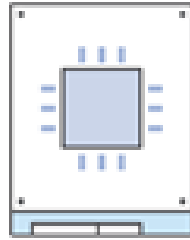
Data  
Encryption

Flexibility

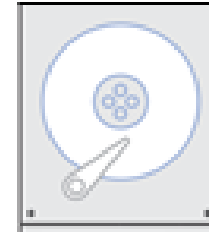
Snapshot

# AWS EBS: Types

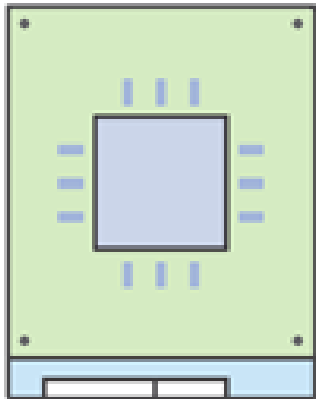
12



**SSD**

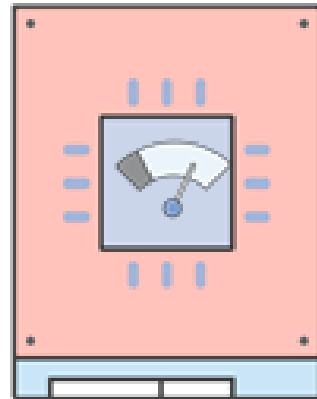


**HDD**



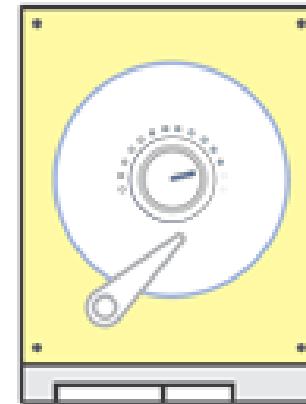
**gp2**

General Purpose  
SSD



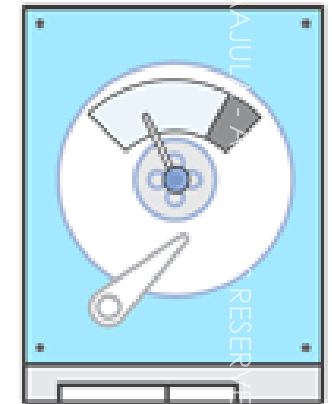
**io1**

Provisioned IOPS  
SSD



**st1**

Throughput Optimized  
HDD



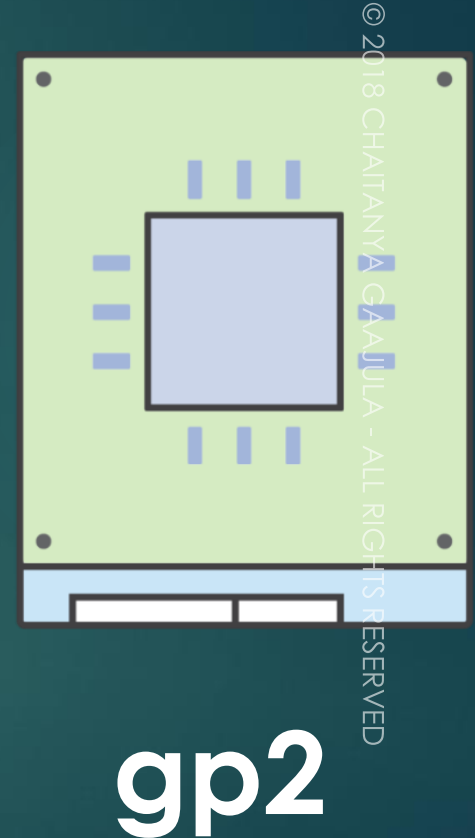
**sc1**

Cold  
HDD

# AWS EBS: General Purposed SSD (gp2)

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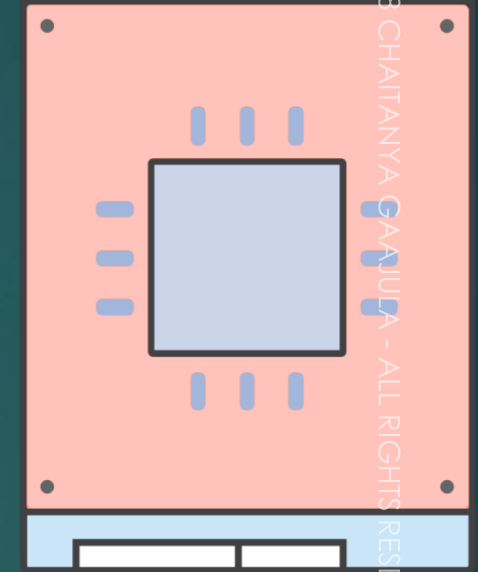
- ❑ Expect base performance of **3 IOPS/ GiB**, with the ability to burst to **3,000 IOPS**.
- ❑ Gp2 volumes support up to **10,000 IOPS** and **160 MB/s** of throughput.
- ❑ Gp2 volume can range in size from 1 GiB to **16 TiB**.
- ❑ Gp2 volume give **single-digit ms** latency.
- ❑ Gp2 volumes are ideal for a broad range of use cases such as boot volumes, small and medium-size databases, and development and test environments.



# AWS EBS: Provisioned IOPS SSD (io1)

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- ❑ Provisioned IOPS SSD (io1) volumes are designed to meet the needs of I/O-intensive workloads, particularly database workloads.
- ❑ io1 volumes support up to **20,000 IOPS** and **320 MB/s** of throughput.
- ❑ io1 volume give **single-digit ms** latency.
- ❑ io1 volume can range in size from 4 GiB to **16 TiB**.



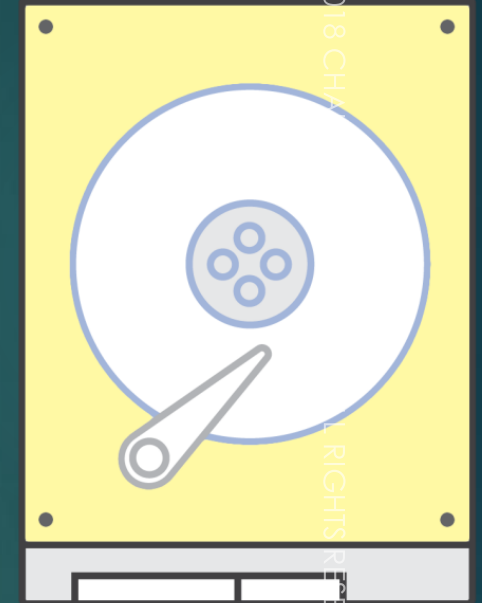
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io1

# AWS EBS: Throughput Optimized HDD (st1)

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- ❑ sc1 volumes provide low-cost magnetic storage that defines performance in terms of throughput rather than IOPS.
- ❑ sc1 burst throughput from 40 MiB/s to **250 MiB/s**, this volume type is a good fit for large, sequential, cold-data workloads.
- ❑ sc1 volume can range in size from 500 GiB to **16 TiB**.
- ❑ Bootable sc1 volumes are not supported.



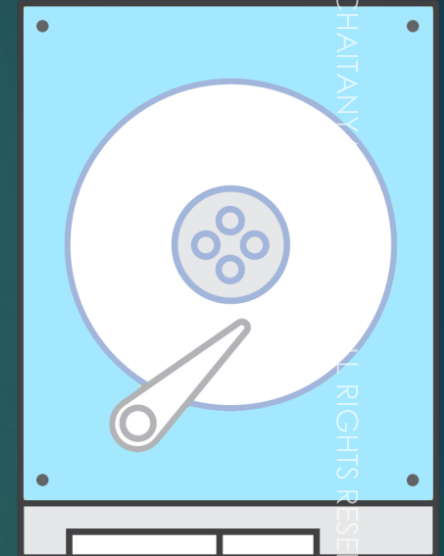
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st1

# AWS EBS: Cold HDD (sc1)

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- ❑ sc1 volumes provide low-cost magnetic storage that defines performance in terms of throughput rather than IOPS.
- ❑ sc1 burst throughput from 40 MiB/s to **250 MiB/s**, this volume type is a good fit for large, sequential, cold-data workloads.
- ❑ sc1 volume can range in size from 500 GiB to **16 TiB**.
- ❑ Bootable sc1 volumes are not supported.



sc1



# AWS EBS: Comparison

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Description	Solid-State Drives (SSD)		Hard disk Drives (HDD)	
	General Purpose SSD (gp2)	Provisioned IOPS SSD (io1)	Throughput Optimized HDD (st1)	Cold HDD (sc1)
Volume Type	General Purpose SSD (gp2)	Provisioned IOPS SSD (io1)	Throughput Optimized HDD (st1)	Cold HDD (sc1)
Purpose	For transactional workloads	for mission-critical applications	for frequently accessed, throughput-intensive workloads	for less frequently accessed workloads
Use Cases	<ul style="list-style-type: none"><li>✓ System boot volumes</li><li>✓ Virtual desktops</li><li>✓ Low-latency interactive apps</li><li>✓ Development and test environments</li></ul>	<ul style="list-style-type: none"><li>✓ Critical business applications</li><li>✓ Large database:<ul style="list-style-type: none"><li>▪ MongoDB</li><li>▪ Cassandra</li><li>▪ MS SQL</li><li>▪ MySQL</li><li>▪ PostgreSQL</li><li>▪ Oracle</li></ul></li></ul>	<ul style="list-style-type: none"><li>✓ Streaming workloads requiring consistent, fast throughput</li><li>✓ Big data</li><li>✓ Data warehouses</li><li>✓ Log processing</li><li>✓ Cannot be a boot volume</li></ul>	<ul style="list-style-type: none"><li>✓ Throughput-oriented storage for large volumes of data that is infrequently accessed</li><li>✓ Scenarios where the lowest storage cost is important</li><li>✓ Cannot be a boot volume</li></ul>

# AWS EBS: Comparison

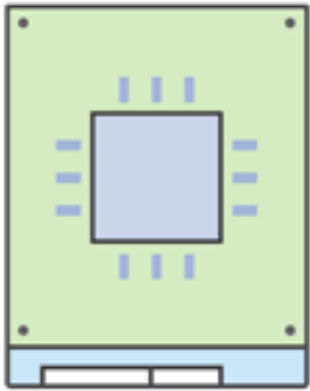
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Description	Solid-State Drives (SSD)		Hard disk Drives (HDD)	
Name	gp2	io1	st1	Sc1
Volume Size	1 GiB - 16 TiB	4 GiB - 16 TiB	500 GiB - 16 TiB	500 GiB - 16 TiB
Max. IOPS/Volume	10,000	20,000	500	250
Max. Throughput/Volume	160 MiB/s	320 MiB/s	500 MiB/s	250 MiB/s
Max. IOPS/Instance	75,000	75,000	75,000	75,000
Max. Throughput/Instance	1,750 MB/s	1,750 MB/s	1,750 MB/s	1,750 MB/s
Dominant Performance Attribute	IOPS	IOPS	MiB/s	MiB/s

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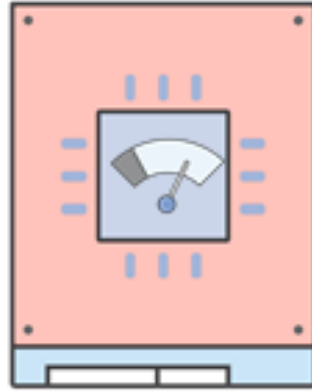
# AWS EBS: Pricing

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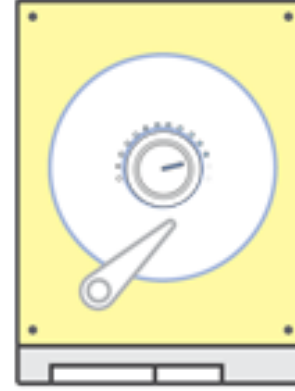
**gp2**

\$0.10 per GB



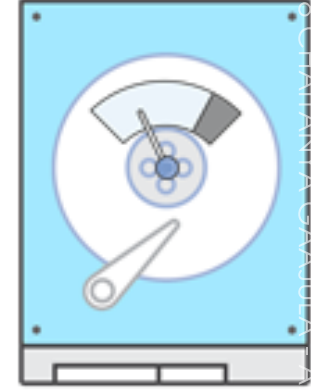
**io1**

\$0.125 per GB  
\$0.065 per PIOPS



**st1**

\$0.045 per GB



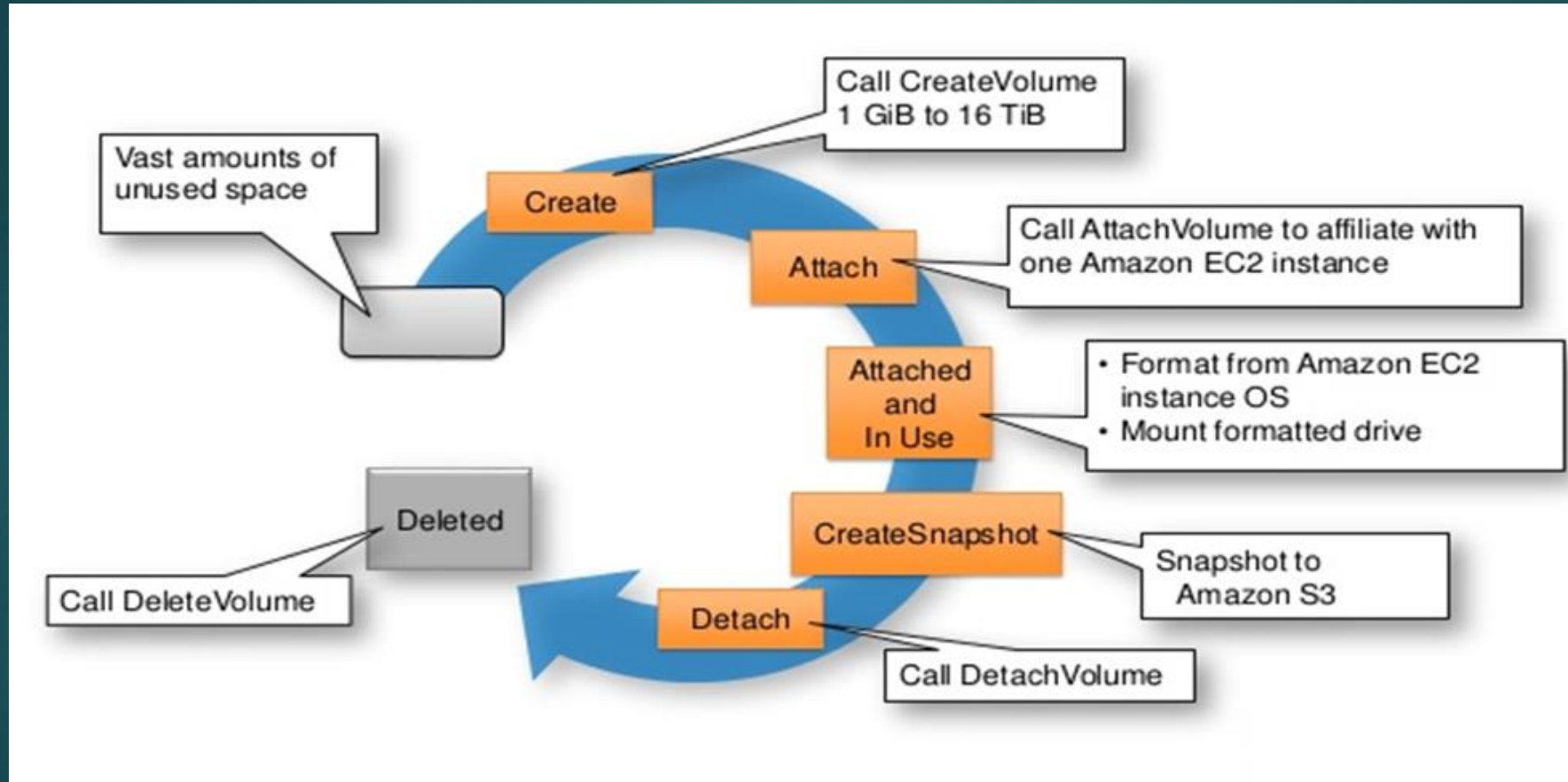
**sc1**

\$0.025 per GB

# AWS EBS Lifecycle

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# AWS EBS: Snapshot

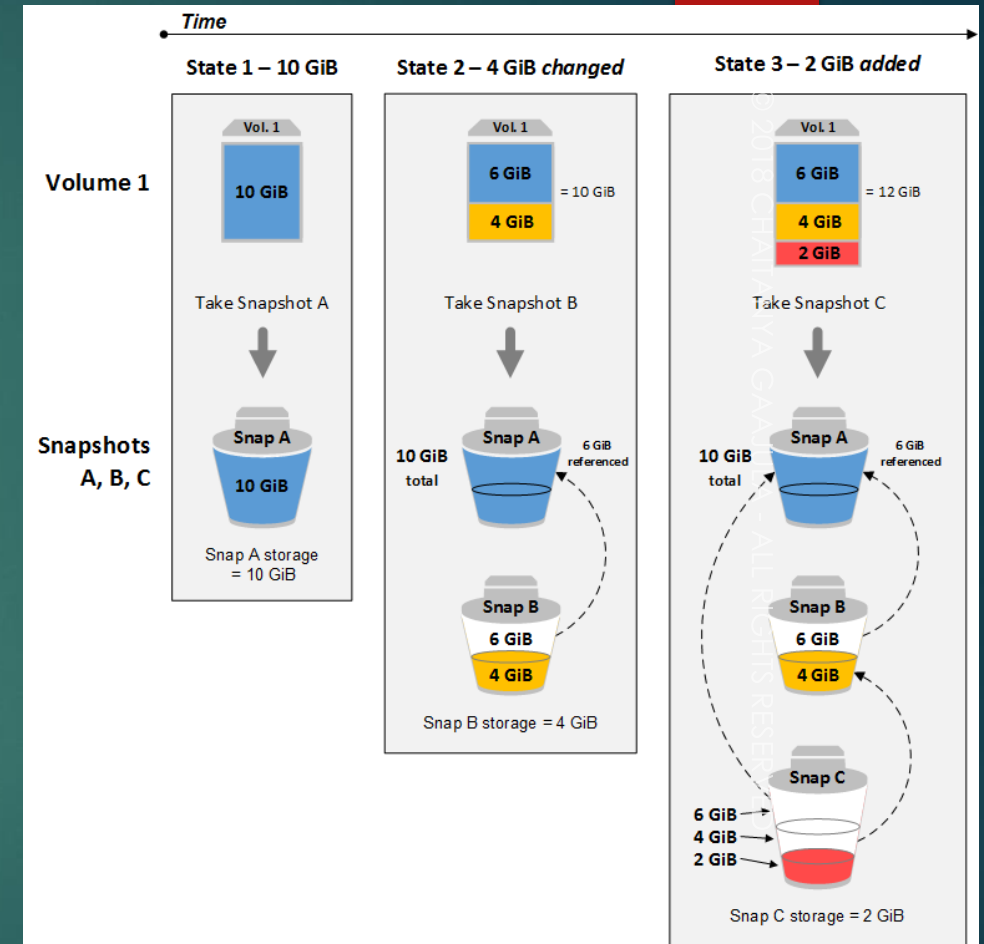
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- ❑ You can back up the data on your Amazon EBS volumes to Amazon S3 by taking point-in-time snapshots.
- ❑ Snapshots are incremental backups, which means that only the blocks on the device that have changed after your most recent snapshot are saved.
- ❑ This minimizes the time required to create the snapshot and saves on storage costs by not duplicating data.
- ❑ When you delete a snapshot, only the data unique to that snapshot is removed.
- ❑ Each snapshot contains all of the information needed to restore your data (from the moment when the snapshot was taken) to a new EBS volume.

# AWS EBS: How Incremental Snapshots Work

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- ❑ In State 1
  - The volume has 10 GiB of data.
  - Snap A is the first snapshot, the entire 10 GiB of data must be copied.
- ❑ In State 2
  - 4 GiB have changed (out of 10 GiB).
  - Snap B needs to copy and store only the 4 GiB that changed after Snap A was taken.
  - The other 6 GiB of unchanged data, which are already copied and stored in Snap A, are referenced by Snap B rather than copied.
- ❑ In State 3
  - 2 GiB of data have been added, total is 12 GiB.
  - Snap C needs to copy the 2 GiB that were added after Snap B was taken.
  - Snap C also references the 4 GiB of data stored in Snap B, and the 6 GiB of data stored in Snap A. The total storage required for the three snapshots is 16 GiB.

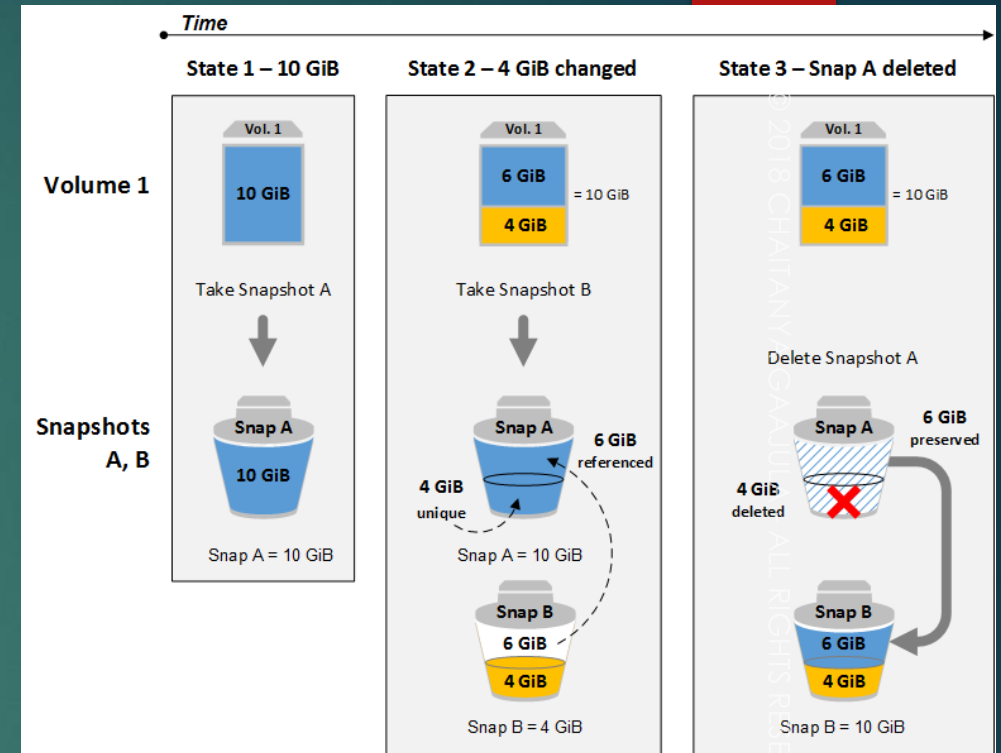




# AWS EBS: Deleting an Amazon EBS Snapshot

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- ❑ In State 1
  - The volume has 10 GiB of data.
  - Snap A is the first snapshot, the entire 10 GiB of data must be copied.
- ❑ In State 2
  - 4 GiB have changed (out of 10 GiB).
  - Snap B needs to copy and store only the 4 GiB that changed after Snap A was taken.
  - The other 6 GiB of unchanged data, which are already copied and stored in Snap A, are referenced by Snap B rather than copied.
- ❑ In State 3
  - Snapshot A has been deleted.
  - The 6 GiB of data stored in Snapshot A that were referenced by Snapshot B have now been moved to Snapshot B
  - Still it storing 10 GiB of data, 6 GiB of unchanged data from Snap A, and 4 GiB of changed data from Snap B.



# Hands-On Lab



# Hands-on Lab

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- ❑ Create the size, IOPS, or type of an EBS volume
- ❑ Attach a volumes
- ❑ Modifying the size, IOPS, or type of an EBS volume
- ❑ Create snapshot
- ❑ Restore snapshot
- ❑ Copy snapshot across the region
- ❑ Detach a volumes

# Thank You