AWS Storage   Ankit Mohari

Amazon Simple Storage Service (S3)

Amazon S3 is object storage built to store and retrieve any amount of data from anywhere – web sites and mobile apps, corporate applications, and data from IoT sensors or devices.We can store any type of file in S3.

S3 is designed to deliver 99.999999999% durability, and stores data for millions of applications used by market leaders in every industry.

S3 provides comprehensive security and compliance capabilities that meet even the most stringent regulatory requirements.

S3 gives customers flexibility in the way they manage data for cost optimization, access control, and compliance.

Typical use cases include:

- **Backup and Storage** – Provide data backup and storage services for others.

- **Application Hosting** – Provide services that deploy, install, and manage web applications.

- **Media Hosting** – Build a redundant, scalable, and highly available infrastructure that hosts video, photo, or music uploads and downloads.

- **Software Delivery** – Host your software applications that customers can download.

- **Static Website** – we can configure a static website to run from an S3 bucket.

S3 provides query-in-place functionality, allowing us to run powerful analytics directly on our data at rest in S3. And Amazon S3 is the most supported cloud storage service available, with integration from the largest community of third-party solutions, systems integrator partners, and other AWS services.

Files can be anywhere from 0 bytes to 5 TB.There is unlimited storage available.

Files are stored in buckets. Buckets are root level folders.Any subfolder within a bucket is known as a "folder".

S3 is a universal namespace so bucket names must be unique globally.

There are six S3 storage classes.

- S3 Standard (durable, immediately available, frequently accessed).

- S3 Intelligent-Tiering (automatically moves data to the most cost-effective tier).

- S3 Standard-IA (durable, immediately available, infrequently accessed).

- S3 One Zone-IA (lower cost for infrequently accessed data with less resilience).

- S3 Glacier (archived data, retrieval times in minutes or hours).

- S3 Glacier Deep Archive (lowest cost storage class for long term retention).

The table below provides the details of each Amazon S3 storage class:

	S3 Standard	S3 Intelligent-Tiering*	S3 Standard-IA	S3 One Zone-IA†	S3 Glacier	S3 Glacier Deep Archive
Designed for durability	99.999999999% (11 9's)	99.999999999% (11 9's)	99.999999999% (11 9's)	99.999999999% (11 9's)	99.999999999% (11 9's)	99.999999999% (11 9's)
Designed for availability	99.99%	99.9%	99.9%	99.5%	99.99%	99.99%
Availability SLA	99.9%	99%	99%	99%	99.9%	99.9%
Availability Zones	≥3	≥3	≥3	1	≥3	≥3
Minimum capacity charge per object	N/A	N/A	128KB	128KB	40KB	40KB
Minimum storage duration charge	N/A	30 days	30 days	30 days	90 days	180 days
Retrieval fee	N/A	N/A	per GB retrieved	per GB retrieved	per GB retrieved	per GB retrieved
First byte latency	milliseconds	millseconds	milliseconds	milliseconds	select minutes or hours	select hours
Storage type	Object	Object	Object	Object	Object	Object
Lifecycle transitions	Yes	Yes	Yes	Yes	Yes	Yes

When we successfully upload a file to S3 we receive a HTTP 200 code.

S3 is a persistent, highly durable data store.

Persistent data stores are non-volatile storage systems that retain data when powered off.

This is in contrast to transient data stores and ephemeral data stores which lose the data when powered off.

The following table provides a description of persistent, transient and ephemeral data stores and which AWS service to use:

Storage Type	Description	Examples
Persistent Data Store	Data is durable and sticks around after reboots, restarts, or power cycles	S3, Glacier, EBS, EFS
Transient Data Store	Data is just temporarily stored and passed along to another process or persistent store	SQS, SNS
Ephemeral Data Store	Data is lost when the system is stopped	EC2 Instance Store, Memcached

Bucket names must follow a set of rules:

- Names must be unique across all of AWS.
- Names must be 3 to 63 characters in length.
- Names can only contain lowercase letters, numbers and hyphens.
- Names cannot be formatted as an IP address.

Data consistency:

- Read after write consistency for PUTS of new objects.

- Eventual consistency for overwrite PUTS and DELETES (takes time to propagate).

Objects consist of:

- Key (name of the object).

- Value (data made up of a sequence of bytes).

- Version ID (used for versioning).

- Metadata (data about the data that is stored).

Subresources:

- Access control lists.

- Torrent.

Built for 99.99 availability.

SLA is 99.9% availability.

Amazon guarantee 99.99999999% durability.

Object sharing – the ability to make any object publicly available via a URL.

Lifecycle management – set rules to transfer objects between storage classes at defined time intervals.

Versioning – automatically keep multiple versions of an object (when enabled).

Encryption.

Data secured using ACLs (Amazon S3 **access control lists** (**ACLs**) enable you to manage access to buckets and objects. Each bucket and object has an **ACL** attached to it as a subresource. It defines which **AWS** accounts or groups are granted access and the type of access) and bucket policies.

Tiers:

- S3 standard.

- S3-IA.

- S3 One Zone – IA.

- Glacier.

Charges:

- Storage.

- Requests.

- Storage management pricing.

- Data transfer pricing.

- Transfer acceleration.

When we create a bucket you need to select the region where it will be created.

It is a best practice to create buckets in regions that are physically closest to our users to reduce latency.

Additional capabilities offered by Amazon S3 include:

Additional S3 Capability	How it Works
Transfer Acceleration	Speed up data uploads using CloudFront in reverse
Requester Pays	The requester rather than the bucket owner pays for requests and data transfer
Tags	Assign tags to objects to use in costing, billing, security etc.
Events	Trigger notifications to SNS, SQS, or Lambda when certain events happen in your bucket
Static Web Hosting	Simple and massively scalable static website hosting
BitTorrent	Use the BitTorrent protocol to retrieve any publicly available object by automatically generating a .torrent file

AWS Snowball

With AWS Snowball (Snowball), we can transfer hundreds of terabytes or petabytes of data between our on-premises data centers and Amazon Simple Storage Service (Amazon S3).

Uses a secure storage device for physical transportation.

AWS Snowball Client is software that is installed on a local computer and is used to identify, compress, encrypt, and transfer data.

Uses 256-bit encryption (managed with the AWS KMS) and tamper-resistant enclosures with TPM.

Snowball (80TB) (50TB model available only in the USA).

Snowball Edge (100TB) comes with onboard storage and compute capabilities.

Snowmobile – exabyte scale with up to 100PB per Snowmobile.

Snowball can import to S3 or export from S3.

Import/export is when we send our own disks into AWS – this is being deprecated in favour of Snowball.

Snowball must be ordered from and returned to the same region.

To speed up data transfer it is recommended to run simultaneous instances of the AWS Snowball Client in multiple terminals and transfer small files as batches.

Amazon Elastic Block Store (EBS)

Amazon Elastic Block Store (Amazon EBS) provides persistent block storage volumes for use with Amazon EC2 instances in the AWS Cloud.

Each Amazon EBS volume is automatically replicated within its Availability Zone to protect us from component failure, offering high availability and durability.

Amazon EBS volumes offer the consistent and low-latency performance needed to run our workloads. With Amazon EBS, we can scale our usage up or down within minutes – all while paying a low price for only what we provision.

The following table shows a comparison of a few EBS volume types:

	Solid State Drives (SSD)		Hard Disk Drives (HDD)	
Volume Type	EBS Provisioned IOPS SSD (io1)	EBS General Purpose SSD (gp2)*	Throughput Optimized HDD (st1)	Cold HDD (sc1)
Short Description	Highest performance SSD volume designed for latency-sensitive transactional workloads	General Purpose SSD volume that balances price performance for a wide variety of transactional workloads	Low cost HDD volume designed for frequently accessed, throughput intensive workloads	Lowest cost HDD volume designed for less frequently accessed workloads
Use Cases	I/O-intensive NoSQL and relational databases	Boot volumes, low-latency interactive apps, dev & test	Big data, data warehouses, log processing	Colder data requiring fewer scans per day
API Name	io1	gp2	st1	sc1
Volume Size	4 GB - 16 TB	1 GB - 16 TB	500 GB - 16 TB	500 GB - 16 TB
Max IOPS**/Volume	64,000	16,000	500	250
Max Throughput***/Volume	1,000 MB/s	250 MB/s	500 MB/s	250 MB/s
Max IOPS/Instance	80,000	80,000	80,000	80,000
Max Throughput/Instance	1,750 MB/s	1,750 MB/s	1,750 MB/s	1,750 MB/s

EBS volume data persists independently of the life of the instance.

EBS volumes do not need to be attached to an instance.

We can attach multiple EBS volumes to an instance.

We cannot attach an EBS volume to multiple instances (use Elastic File Store instead).

EBS volumes must be in the same AZ as the instances they are attached to.

Termination protection is turned off by default and must be manually enabled (keeps the volume/data when the instance is terminated).

Root EBS volumes are deleted on termination by default.

Extra non-boot volumes are not deleted on termination by default.

The behaviour can be changed by altering the "DeleteOnTermination" attribute.

EBS Snapshots:

- Snapshots capture a point-in-time state of an instance.

- Snapshots are stored on S3.

- Does not provide granular backup (not a replacement for backup software).

- If we make periodic snapshots of a volume, the snapshots are incremental, which means that only the blocks on the device that have changed after our last snapshot are saved in the new snapshot.

- Even though snapshots are saved incrementally, the snapshot deletion process is designed so that you need to retain only the most recent snapshot in order to restore the volume.

- Snapshots can only be accessed through the EC2 APIs.

- EBS volumes are AZ specific but snapshots are region specific.

INSTANCE STORES

Instance store volumes are high performance local disks that are physically attached to the host computer on which an EC2 instance runs.

Instance stores are ephemeral which means the data is lost when powered off (non-persistent).

Instances stores are ideal for temporary storage of information that changes frequently, such as buffers, caches, or scratch data.

Instance store volume root devices are created from AMI templates stored on S3.

Instance store volumes cannot be detached/reattached.

Amazon Elastic File System (EFS)

EFS is a fully-managed service that makes it easy to set up and scale file storage in the Amazon Cloud.

Good for big data and analytics, media processing workflows, content management, web serving, home directories etc.

EFS uses the NFSv4.1 protocol.

Pay for what we use (no pre-provisioning required).

Can scale up to petabytes.

EFS is elastic and grows and shrinks as you add and remove data.

Can concurrently connect 1 to 1000s of EC2 instances, from multiple AZs.

A file system can be accessed concurrently from all AZs in the region where it is located.

By default you can create up to 10 file systems per account.

On-premises access can be enabled via Direct Connect or AWS VPN.

Can choose General Purpose or Max I/O (both SSD).

The VPC of the connecting instance must have DNS hostnames enabled.

EFS provides a file system interface, file system access semantics (such as strong consistency and file locking).

Data is stored across multiple AZ's within a region.

Read after write consistency.

Need to create mount targets and choose AZ's to include (recommended to include all AZ's).

Instances can be behind an ELB.

There are two performance modes:

- "General Purpose" performance mode is appropriate for most file systems.

- "Max I/O" performance mode is optimized for applications where tens, hundreds, or thousands of EC2 instances are accessing the file system.

Amazon EFS is designed to burst to allow high throughput levels for periods of time.