S3: Simple storage service

- S3 is an object storage service offering industry-leading scalability, data availability, security, and performance.
- S3 bucket name must be unique globally.

An object consist of:

- Key(name of object)
- Version Id
- value(actual data)
- Meta data
- Subresources
- Access control list

File storage vs Object storage:

In filestorage , we are storing data in files and creating a hierarchy of directories..
We can put a folder inside another folder to organise.
File systems are mounted to an OS.
Function like local storage.
Network connection is maintained once you mount. Ex. Aws EFS.

In S3,
Data stored in buckets
Flat names(no hierarchy)
Accessed by REST API can can not be mounted
Network completed is completed after each request.

Storage class:

Durability:

- Durability is protection is against Data loss and Data corruption
- S3 offers 11 9s durability.
- If you store 10 million objects,then you expect to lose one object every 10,000 years.

Availability:

- The amount of time the data is available to you
- Expressed as percent of time per year . e.g 99.99%

Storage classes	Use Case	Durability	Availability	Retrieval Time	Use Case
Standard	Frequent Access General purpose Low latency & High Throughput	99.99999 9999% 11 nines	99.99%	Instant	BigData,Mob & gaming app,Content distributions
Intelligent tiering	Unpredictable Access/ Changing access patterns		99.90%	Instant	
Standard-IA	Infrequent Access, but FAST retrieval		99.90%	Instant	DR,backups
OneZone -IA	Lower Cost infrequent access(Single Az). Recreatble-data		99.50%	Instant	Secondary bkp of on-premises data,or data that can be recreated
Glacier **instant** Retrieval	Archival in millisecs.		99.99%	Millisecs Min. Storage-90 Days	
Glacier **flexible** Retrieval	Long term storage Archival in minutes to hours		99.99%	**Expedited** (1-5 min), **Standard** (3-5 hrs), **Bulk** is	

				free(5-12 hrs) Min. Storage-90 Days	
Glacier **deep** Archive	Lowest-cost long term archival		99.99%	Standard (12 hrs), Bulk (48 hrs) Min. Storage-180 Days	

S3 intelligent tiering:

- S3 Intelligent-Tiering continuously monitors how frequently objects are accessed. This monitoring incurs a small monthly fee per object.
- Moves objects automatically between Access Tiers based on usage
- There are no retrieval charges in S3 Intelligent-Tiering

Access Tier Types:

1. Frequent Access Tier: Optimized for frequently accessed data, offering low latency and high throughput similar to S3 Standard.
2. Infrequent Access Tier: A lower-cost tier for data not accessed for 30 consecutive days.40% cost saving
3. Archive Instant Access Tier: For data not accessed for 90 days, providing significant cost savings.68% cost saving compared to Freq. Access Tier
4. Deep Archive Access Tier: An optional tier for rarely accessed data, offering up to 95% cost savings after 180 days of inactivity.

S3 Express oneZone and S3 onZone-IA is single AZ , others are >= 3AZ

S3 Policy:

Resource-based policies:

Access control Lists -ACL

Bucket Policies- bucket wide rule from s3 console- allow cross account

User Policies:
IAM policies- which API calls should be allowed for a specific IAM user

AWS recommends using bucket policy or IAM policy for s3 bucket

S3 Bucket Policy for static website.Example:

```
{
   "Version": "2012-10-17",
   "Id": "Policy1741612009855",
   "Statement": [
      {
         "Sid": "Stmt1741611996343",
         "Effect": "Allow",
         "Principal": "*",
         "Action": "s3:GetObject",
         "Resource": "arn:aws:s3:::cj-photo-gallery/*"
      }
   ]
}
```

S3 Lifecycle policy:
Helps to manage objects storage , automate the transition to diff. Storage class and expiration of objects from S3 bucket.

```
{
  "Rules": [
    {
      "ID": "Move to Glacier",
      "Status": "Enabled",
      "Prefix": "",
      "Transitions": [
        {
          "Days": 90,
          "StorageClass": "GLACIER"
        },
        {
          "Days": 180,
          "StorageClass": "DEEP_ARCHIVE"
```

```
      }
     ],
     "Expiration": {
      "Days": 365
     }
    }
  ]
}
```

S3 cross-region replication(CRR):

Cross-Region Replication (CRR) is a feature of Amazon S3 that automatically replicates objects from a source bucket in one AWS region to a destination bucket in another AWS region. CRR helps with compliance, data redundancy, disaster recovery, and content delivery

S3 same region replication(SRR):

Replicate objects between two S3 buckets **within the same AWS region**. This is useful for creating copies of objects for **data protection, compliance, backup, or content distribution** within the same region.

S3 object Lock:

- This feature prevents objects from being deleted or overwritten for a fixed amount of time or indefinitely. This is particularly useful for **compliance, regulatory requirements, and data retention** needs. With Object Lock enabled, you can apply **Retention** or **Legal Hold** to objects to prevent accidental or malicious deletion.
- provides data immutability for compliance, backup, and data protection needs.

Two main modes for **S3 Object Lock**:

1. **Governance Mode**: In this mode, users with appropriate permissions can override the lock and delete or overwrite objects.

2. **Compliance Mode**: In this mode, even users with full permissions (including the root user) cannot delete or overwrite the objects until the retention period expires.

S3 inventory:

S3 versioning:

S3 Gateway Endpoint: