AWS S3

Simple Storage Service

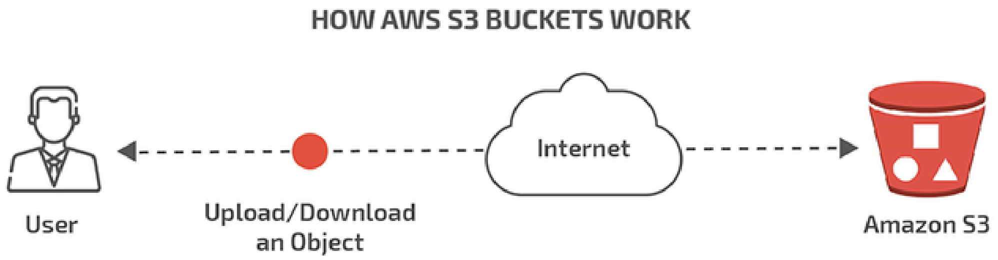
Concept Overview:

About S3:

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance.

Customers of all sizes and industries can use Amazon S3 to store and protect any amount of data for a range of use cases, such as data lakes, websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices, and big data analytics.

Amazon S3 provides management features so that you can optimize, organize, and configure access to your data to meet your specific business, organizational, and compliance requirements.



Features of S3:

1. Storage Classes

- S3 Standard / S3 Express One Zone: Frequent access, high performance, lowest latency.
- S3 Standard-IA / One Zone-IA: Infrequent access, lower cost.
- S3 Glacier (Instant, Flexible, Deep Archive): Archival, lowest-cost storage.
- S3 Intelligent-Tiering: Automatically moves data between frequent/infrequent/archive tiers based on usage.

2. Storage Management

- Lifecycle: Move or expire objects over time.
- Object Lock: Prevent deletion/overwrite (WORM).
- Replication: Copy objects across regions/buckets.
- Batch Operations: Manage billions of objects at scale.

3. Access & Security

- Block Public Access: Prevent unwanted exposure.
- IAM & Bucket Policies → Fine-grained access control.
- Access Points & ACLs: Manage shared dataset access (ACLs less recommended).
- Object Ownership: Bucket owner controls all objects.
- IAM Access Analyzer: Monitor bucket access policies.

Features of S3:

4. Data Processing

- S3 Object Lambda: Modify data on retrieval (filter, resize, redact).
- Event Notifications: Trigger Lambda, SQS, or SNS on bucket events.

5. Monitoring & Logging

- CloudWatch Metrics: Track health & billing alerts.
- CloudTrail: API activity logs.
- Server Access Logging: Detailed request logs.
- Trusted Advisor: Security, cost, and performance recommendations.

6. Analytics & Insights

- S3 Storage Lens: Org-wide usage & activity dashboards.
- Storage Class Analysis: Decide on cheaper storage options.
- Inventory Reports: Object metadata, replication, encryption audits.

7. Consistency

- Strong Read-After-Write Consistency: Immediate consistency for PUT/DELETE across all regions.

Use case of S3:

- **Backup & Restore:** Store application, database, or server backups securely and cost-effectively.
- **Disaster Recovery:** Replicate data across regions for business continuity.
- **Data Archiving:** Use Glacier tiers for compliance or long-term storage at very low cost.
- **Big Data Analytics:** Store raw data for analytics (such as Athena, Redshift, EMR).
- **Content Storage & Distribution:** Host static websites, images, and videos (often with CloudFront CDN).
- **Application Data Storage:** Store logs, documents, user uploads, or app-generated content.
- **Media Hosting & Streaming:** Store and stream videos, audio, and large media files.
- **Machine Learning:** Keep large datasets for ML training and model storage.
- **Hybrid Cloud Storage:** Extend on-prem storage to cloud with S3 + Storage Gateway.
- **Compliance & Security:** WORM storage with Object Lock for financial, healthcare, or government data.

What is bucket & Types of bucket:

An S3 bucket is a container for storing objects (files, data, and their metadata) in Amazon Simple Storage Service (S3). Buckets organize and manage data, control access, and define where and how the data is stored.

- Each bucket has a unique name across all AWS.
- Objects (data) are stored inside buckets.
- Buckets define permissions, storage class, region, and management settings for the objects they contain.

Types of S3 Buckets

- General Purpose Buckets: All-purpose storage.
- Directory Buckets: Low-latency / residency workloads.
- Table Buckets: Analytics & ML tabular data.
- Vector Buckets: AI/ML vector embeddings & similarity search.

What is object:

Objects are the fundamental entities stored in Amazon S3. Objects consist of object data and metadata. The metadata is a set of name-value pairs that describe the object.

These pairs include some default metadata, such as the date last modified, and standard HTTP metadata, such as Content-Type.

You can also specify custom metadata at the time that the object is stored.Every object is contained in a bucket.

For example, if the object named photos/puppy.jpg is stored in the amzn-s3-demo-bucket general purpose bucket in the US West (Oregon) Region, then it is addressable by using the URL https://amzn-s3-demo-bucket.s3.us-west2.amazonaws.com/photos/puppy.jpg.

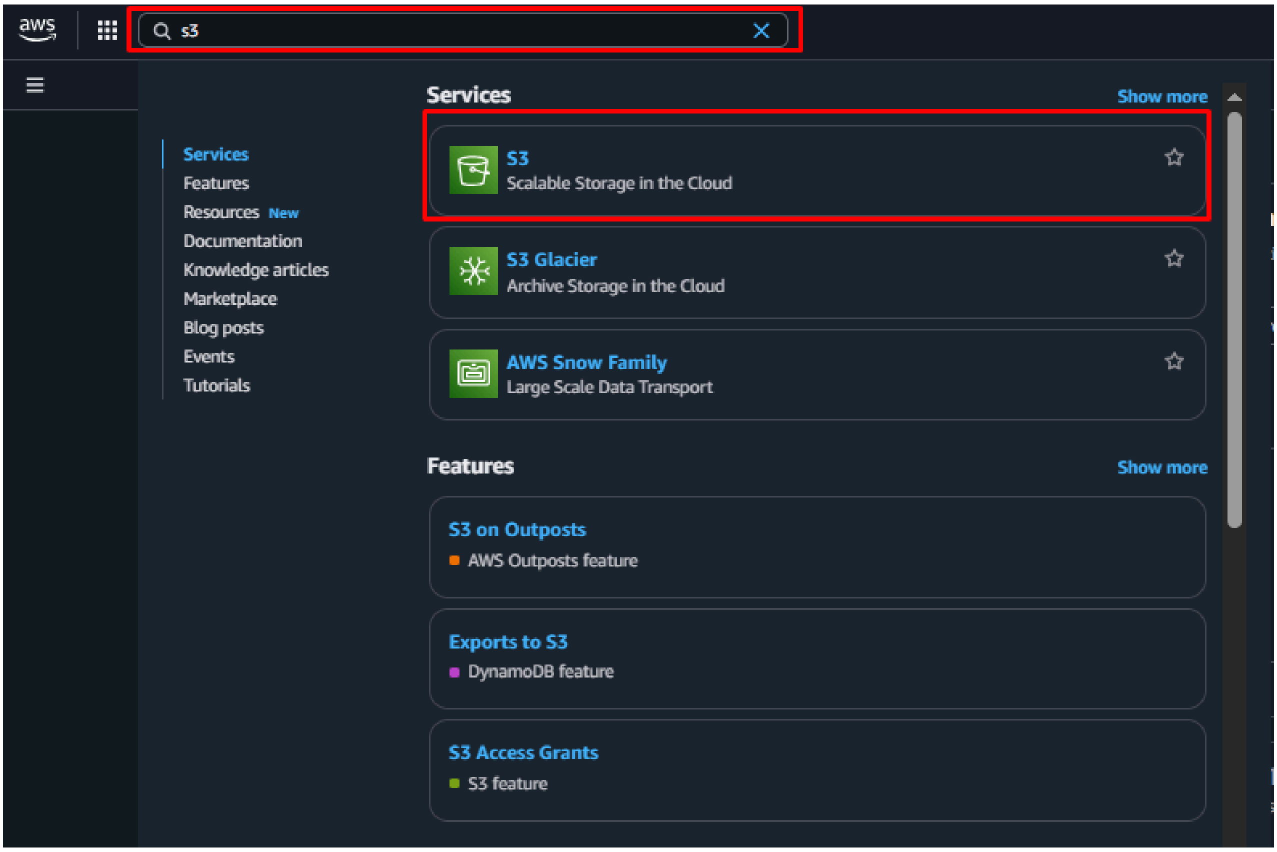
Understanding Keys:

An object key (or key name) is the unique identifier for an object within a bucket. Every object in a bucket has exactly one key. The combination of a bucket, object key, and optionally, version ID (if S3 Versioning is enabled for the bucket) uniquely identify each object. So you can think of Amazon S3 as a basic data map between "bucket + key + version" and the object itself.

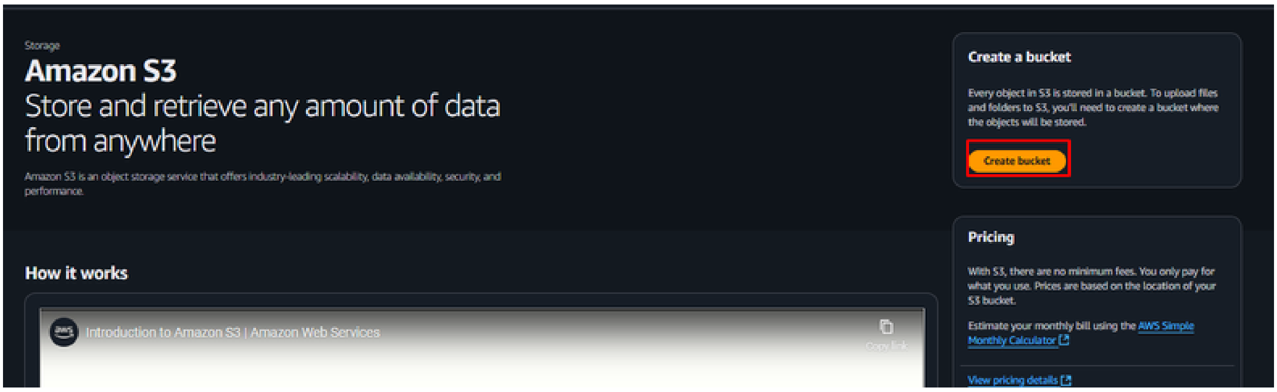
Every object in Amazon S3 can be uniquely addressed through the combination of the web service endpoint, bucket name, key, and optionally, a version. For example, in the URL https://amzn-s3-demo-bucket.s3.us-west2.amazonaws.com/photos/puppy.jpg, amzn-s3-demo-bucket is the name of the bucket and photos/puppy.jpg is the key.

Configure an S3 bucket:

To configure an S3 bucket, first log in to your AWS console and then search for S3.



Click on S3 to open this page, then click the Create Bucket button to create a new bucket.



Store and retrieve any amount of data from anywhere

Amazon S3 is an object storage service that offers industry-leading scalability, data availability, security, and performance.

Every object in S3 is stored in a bucket. To upload files and folders to S3, you'll need to create a bucket where the objects will be stored.

With S3, there are no minimum fees. You only pay for what you use. Prices are based on the location of your S3 bucket.

Estimate your monthly bill using the AWS Simple Monthly Calculator

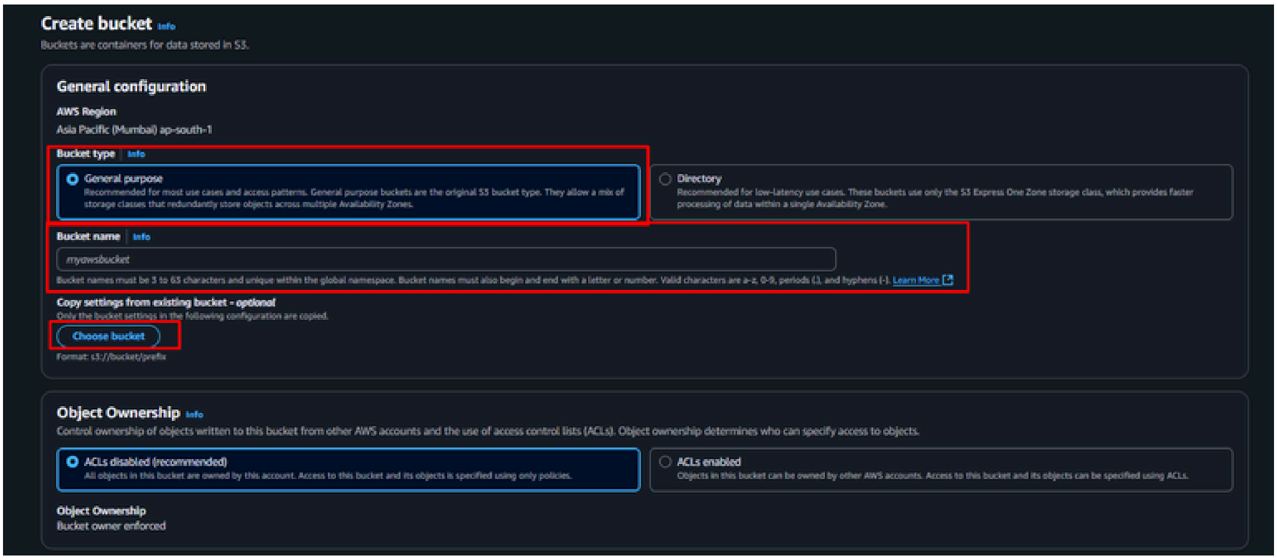
Configure an S3 bucket:

Select the bucket type and give it a name. If you want to copy from another bucket, click on Choose Bucket and select an existing bucket. Then, select the project ownership.

S3 Bucket Naming Rule:

- Your bucket name must be globally unique — not just unique in your AWS account.

- If someone anywhere in the world has already used that name, you can't use it.



Create bucket Info

Buckets are containers for data stored in S3.

General configuration

AWS Region
Asia Pacific (Mumbai) ap-south-1

Bucket type | Info

● General purpose
Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.

○ Directory
Recommended for low-latency use cases. These buckets use only the S3 Express One Zone storage class, which provides faster processing of data within a single Availability Zone.

Bucket name | Info
myawsbucket
Bucket names must be 3 to 63 characters and unique within the global namespace. Bucket names must also begin and end with a letter or number. Valid characters are a-z, 0-9, periods (.), and hyphens (-). Learn More

Copy settings from existing bucket - *optional*
Only the bucket settings in the following configuration are copied.

Format: s3://bucket/prefix

Object Ownership Info

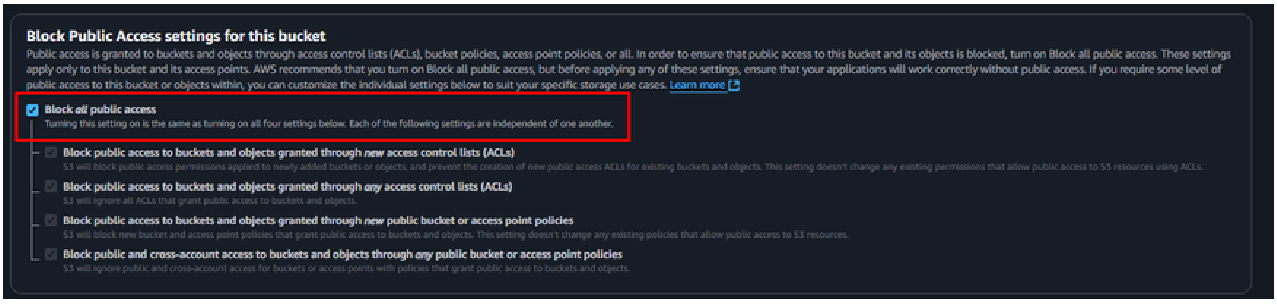
Control ownership of objects written to this bucket from other AWS accounts and the use of access control lists (ACLs). Object ownership determines who can specify access to objects.

● ACLs disabled (recommended)
All objects in this bucket are owned by this account. Access to this bucket and its objects is specified using only policies.

○ ACLs enabled
Objects in this bucket can be owned by other AWS accounts. Access to this bucket and its objects can be specified using ACLs.

Object Ownership
Bucket owner enforced

If you want to block public access to your bucket, check this option; otherwise, leave it unchecked.



Block Public Access settings for this bucket

Public access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to ensure that public access to this bucket and its objects is blocked, turn on Block all public access. These settings apply only to this bucket and its access points. AWS recommends that you turn on Block all public access, but before applying any of these settings, ensure that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings below to suit your specific storage use cases. Learn more

☑ Block *all* public access
Turning this setting on is the same as turning on all four settings below. Each of the following settings are independent of one another.

☑ Block public access to buckets and objects granted through *new* access control lists (ACLs)
S3 will block public access permissions applied to newly added buckets or objects, and prevent the creation of new public access ACLs for existing buckets and objects. This setting doesn't change any existing permissions that allow public access to S3 resources using ACLs.

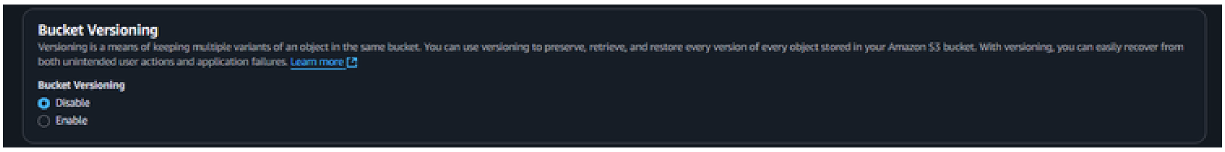
☑ Block public access to buckets and objects granted through *any* access control lists (ACLs)
S3 will ignore all ACLs that grant public access to buckets and objects.

☑ Block public access to buckets and objects granted through *new* public bucket or access point policies
S3 will block new bucket and access point policies that grant public access to buckets and objects. This setting doesn't change any existing policies that allow public access to S3 resources.

☑ Block public and cross-account access to buckets and objects through *any* public bucket or access point policies
S3 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and objects.

Configure an S3 bucket:

Bucket Versioning: If you want to enable versioning for your bucket, turn it on; otherwise, keep it disabled.



Bucket Versioning

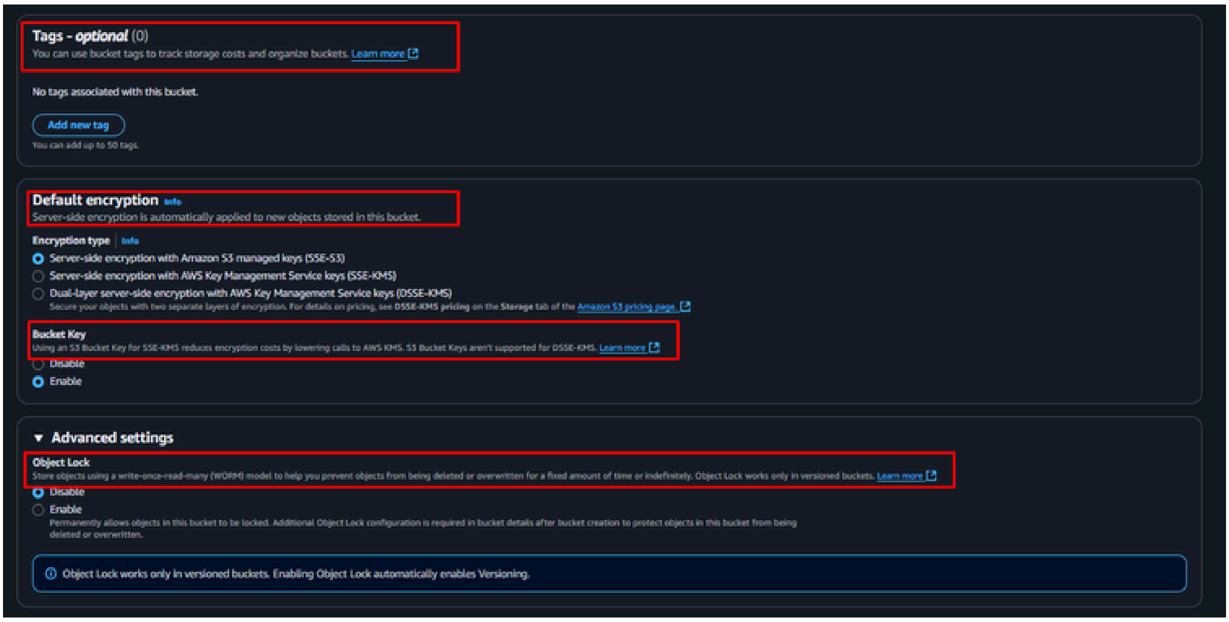
Versioning is a means of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. Learn more

Bucket Versioning

● Disable

○ Enable

Set up all these options based on your needs. I kept it as it is.



Tags - *optional* (0)

You can use bucket tags to track storage costs and organize buckets. Learn more

No tags associated with this bucket.

You can add up to 50 tags.

Default encryption Info

Server-side encryption is automatically applied to new objects stored in this bucket.

Encryption type | Info

● Server-side encryption with Amazon S3 managed keys (SSE-S3)

○ Server-side encryption with AWS Key Management Service keys (SSE-KMS)

○ Dual-layer server-side encryption with AWS Key Management Service keys (DSSE-KMS)

Secure your objects with two separate layers of encryption. For details on pricing, see DSSE-KMS pricing on the Storage tab of the Amazon S3 pricing page.

Bucket Key

Using an S3 Bucket Key for SSE-KMS reduces encryption costs by lowering calls to AWS KMS. S3 Bucket Keys aren't supported for DSSE-KMS. Learn more

○ Disable

● Enable

Advanced settings

Object Lock

Store objects using a write-once-read-many (WORM) model to help you prevent objects from being deleted or overwritten for a fixed amount of time or indefinitely. Object Lock works only in versioned buckets. Learn more

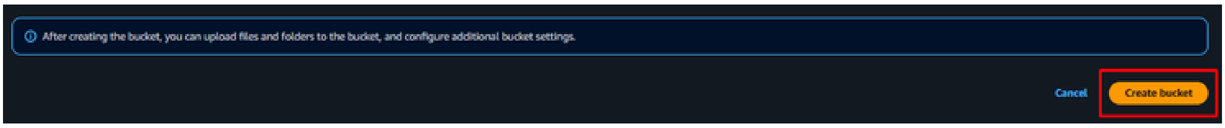
● Disable

○ Enable

Permanently allows objects in this bucket to be locked. Additional Object Lock configuration is required in bucket details after bucket creation to protect objects in this bucket from being deleted or overwritten.

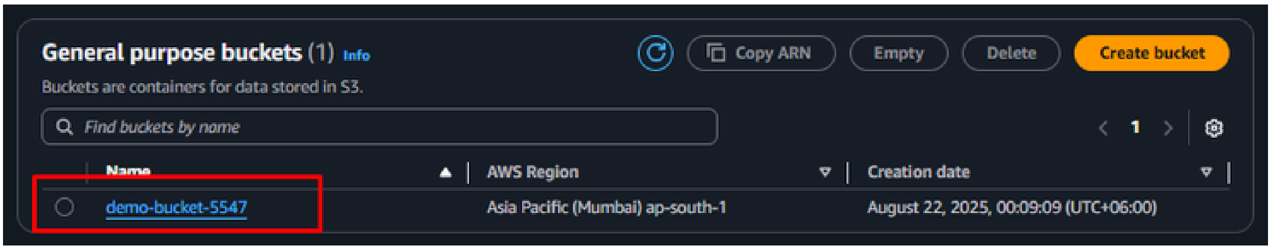
ⓘ Object Lock works only in versioned buckets. Enabling Object Lock automatically enables Versioning.

Now click on create button and it’s created.



ⓘ After creating the bucket, you can upload files and folders to the bucket, and configure additional bucket settings.

Here is my bucket:



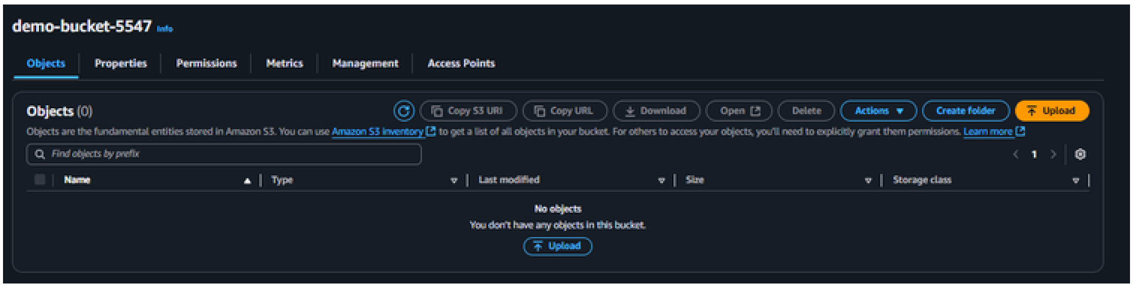
General purpose buckets (1) Info

Buckets are containers for data stored in S3.

	Name	AWS Region	Creation date
○	demo-bucket-5547	Asia Pacific (Mumbai) ap-south-1	August 22, 2025, 00:09:09 (UTC+06:00)

Upload file to the S3 bucket & folder creation:

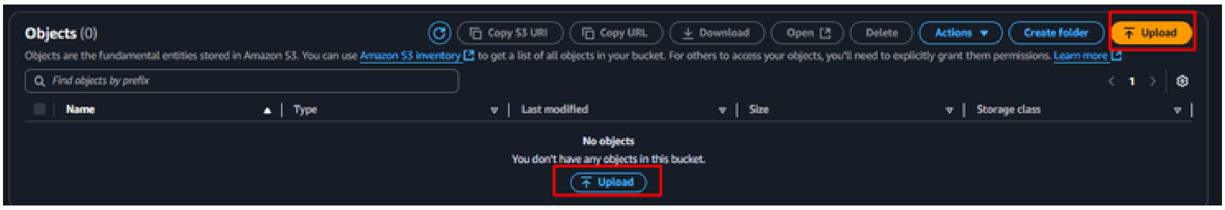
To upload a file, click on your bucket and go to the details page. Here is the details page:



Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

No objects
You don't have any objects in this bucket.

Click on the Upload button to open the file upload page.



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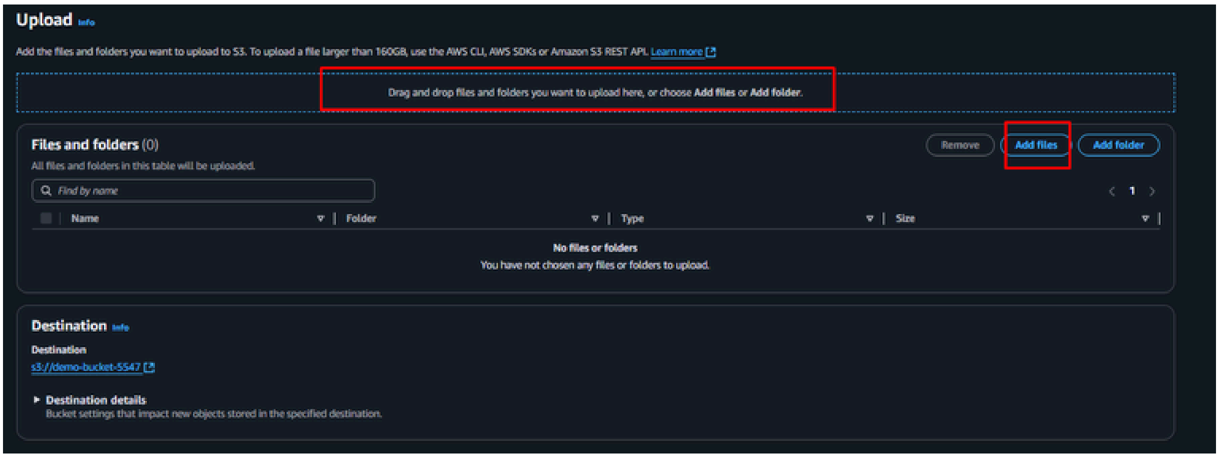


Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDKs or Amazon S3 REST API. Learn more

Drag and drop files and folders you want to upload here, or choose **Add files** or **Add folder**.

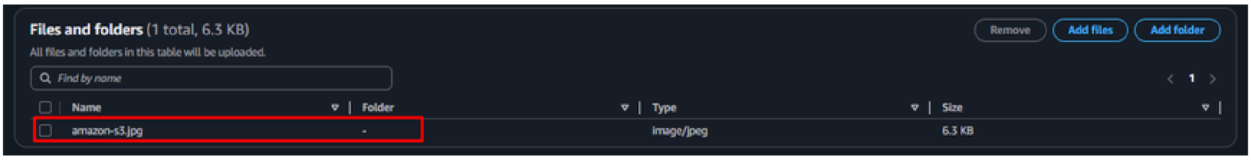
All files and folders in this table will be uploaded.

No files or folders
You have not chosen any files or folders to upload.

Destination
s3://demo-bucket-5547

Bucket settings that impact new objects stored in the specified destination.

You can upload files by using the drag & drop feature or by clicking the Add Files button.



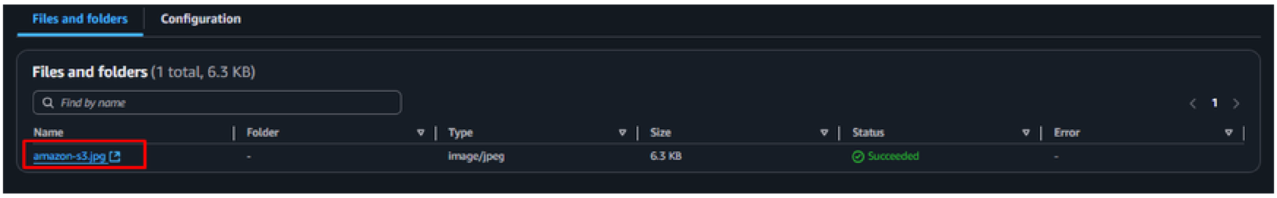
All files and folders in this table will be uploaded.

Name	Folder	Type	Size
amazon-s3.jpg	-	image/jpeg	6.3 KB

in/in/alamgirweb11

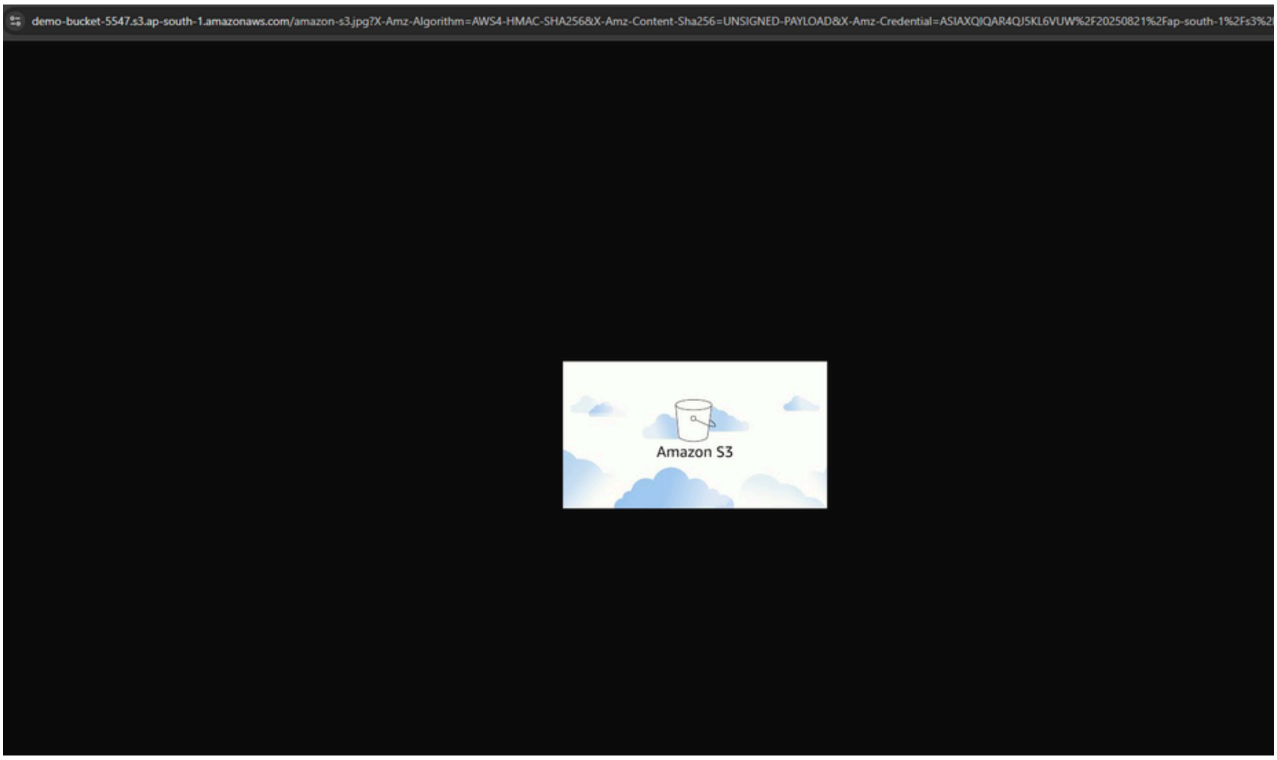
Upload file to the S3 bucket & folder creation:

Here is the image I uploaded.

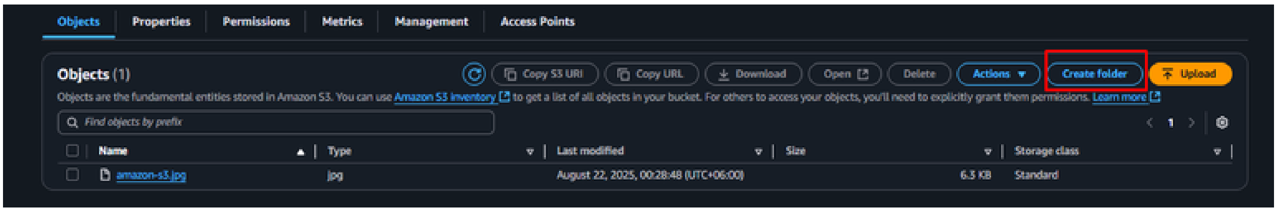


Files and folders (1 total, 6.3 KB)

Name	Folder	Type	Size	Status	Error
amazon-s3.jpg	-	image/jpeg	6.3 KB	Succeeded	-


demo-bucket-5547.s3.ap-south-1.amazonaws.com/amazon-s3.jpg?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Content-Sha256=UNSIGNED-PAYLOAD&X-Amz-Credential=ASIAXQIQAR4QJ5KL6VUW%2F20250821%2Fap-south-1%2Fs3%2

Now create a folder and upload another file and browse it again.



Objects (1)

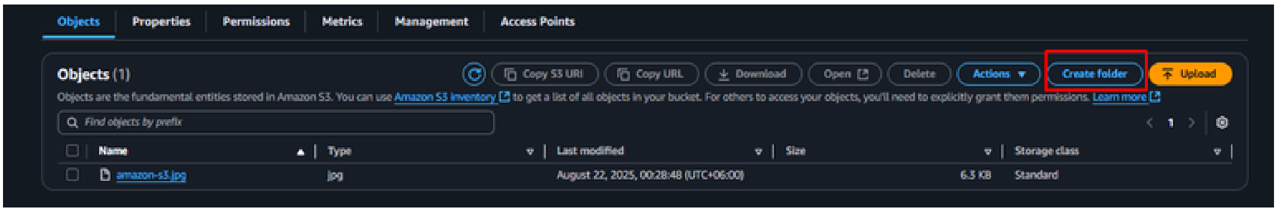
Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

□	Name	Type	Last modified	Size	Storage class
□	amazon-s3.jpg	jpg	August 22, 2025, 00:28:48 (UTC+06:00)	6.3 KB	Standard

Click on the Create Folder button to open the folder creation page.

Upload file to the S3 bucket & folder creation:

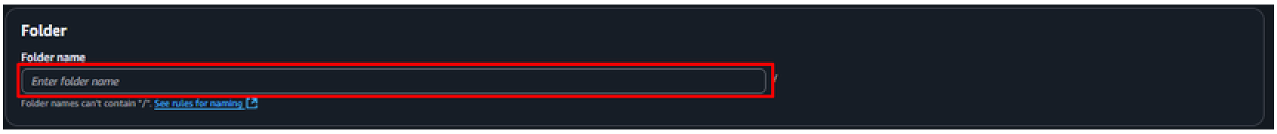
Now create a folder and upload another file and browse it again.



Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

Name	Type	Last modified	Size	Storage class
amazon-s3.jpg	jpg	August 22, 2025, 00:28:48 (UTC+06:00)	6.3 KB	Standard



Folder

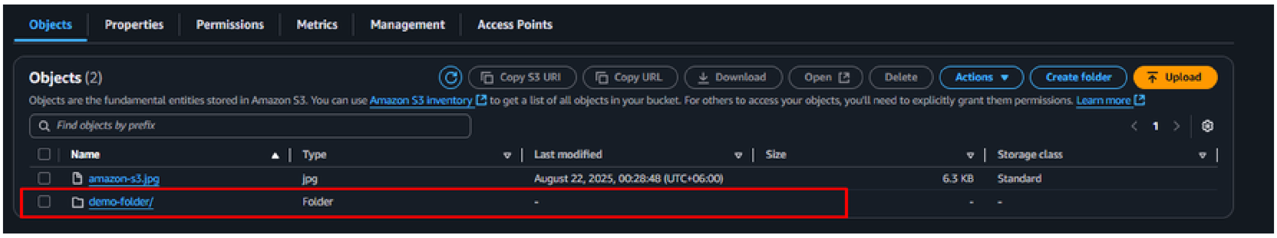
Folder name

Enter folder name

Folder names can't contain "/". See rules for naming

Type your folder name. Unlike bucket names, there are no restrictions, you can choose any folder name you want.

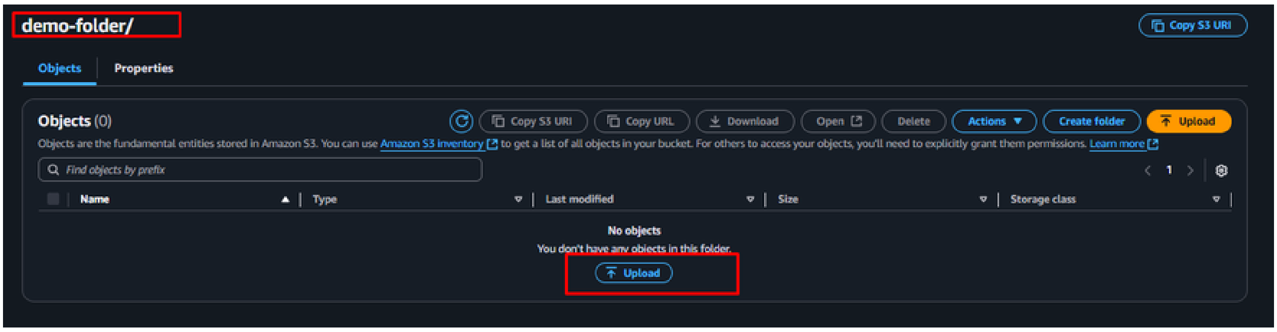
Here is my folder. Now, upload a file inside the folder and browse it.



Objects (2)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

Name	Type	Last modified	Size	Storage class
amazon-s3.jpg	jpg	August 22, 2025, 00:28:48 (UTC+06:00)	6.3 KB	Standard
demo-folder/	Folder	-	-	-



demo-folder/

Objects (0)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

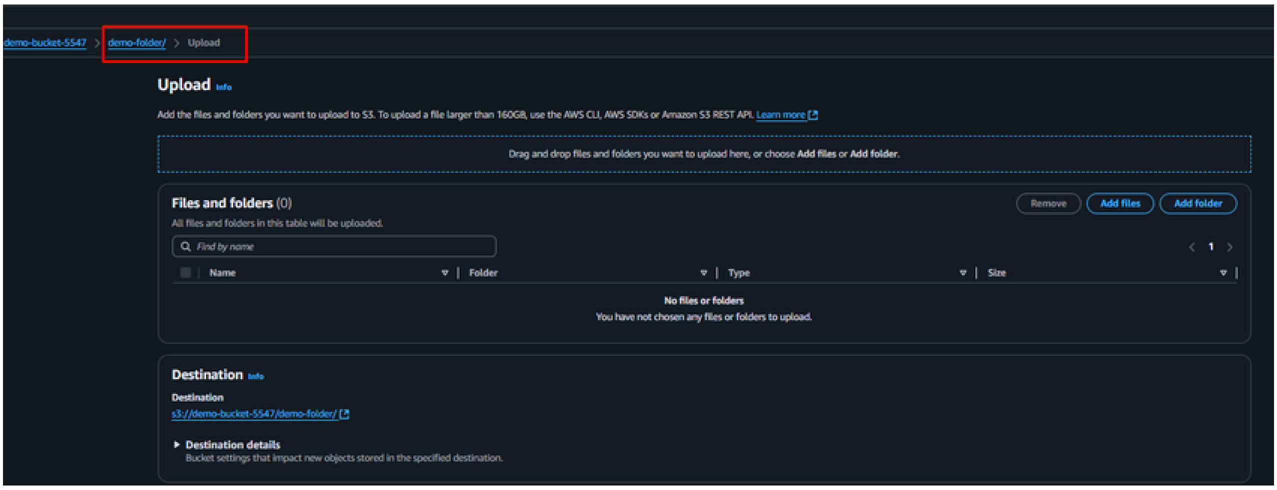
Name	Type	Last modified	Size	Storage class

No objects

You don't have any objects in this folder.

Upload file to the S3 bucket & folder creation:

Choose file and upload.



demo-bucket-5547 > demo-folder/ > Upload

Upload Info

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDKs or Amazon S3 REST API. Learn more

Drag and drop files and folders you want to upload here, or choose **Add files** or **Add folder**.

Files and folders (0)

All files and folders in this table will be uploaded.

Name	Folder	Type	Size

No files or folders

You have not chosen any files or folders to upload.

Destination Info

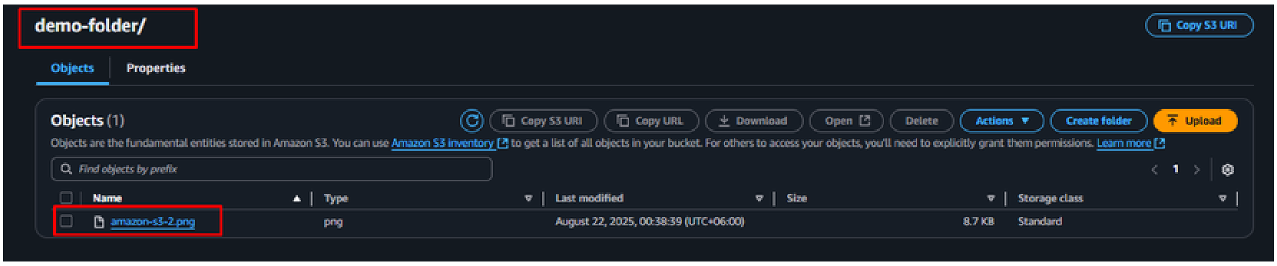
Destination

s3://demo-bucket-5547/demo-folder/

Destination details

Bucket settings that impact new objects stored in the specified destination.

Here is the file I uploaded in the folder.

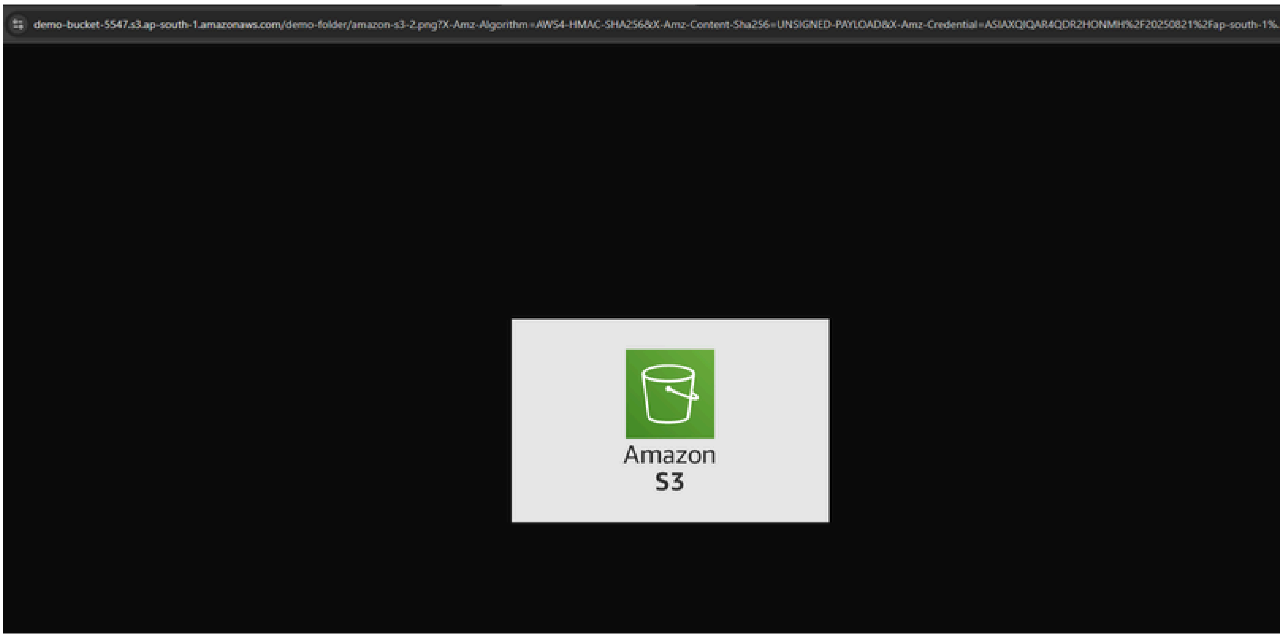


demo-folder/

Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

Name	Type	Last modified	Size	Storage class
amazon-s3-2.png	png	August 22, 2025, 00:38:39 (UTC+06:00)	8.7 KB	Standard



demo-bucket-5547.s3.ap-south-1.amazonaws.com/demo-folder/amazon-s3-2.png?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Content-Sha256=UNSIGNED-PAYLOAD&X-Amz-Credential=ASIAXQIQAR4QDR2HONMH%2F20250821%2Fap-south-1%

Bucket Security:

- **Block Public Access:** Prevent accidental public exposure of data.
- **IAM Policies:** Control who can access S3 (identity-based access).
- **Bucket Policies:** Set resource-based permissions at bucket level.
- **Access Points:** Simplify and secure access for shared datasets.
- **Object Ownership:** Ensure bucket owner controls all objects (disable ACLs).
- **Encryption:** Protect data at rest (S3-managed keys, KMS) and in transit (HTTPS).
- **Replication with Encryption:** Securely replicate data across regions/buckets.
- **IAM Access Analyzer:** Detect overly permissive access policies.
- **Logging & Monitoring:** Use CloudTrail & CloudWatch for activity tracking.

Versioning & replication:

Versioning: keep a history of objects.
Replication: copy objects across buckets/regions.

S3 Versioning

- Keeps multiple versions of an object in a bucket.
- Protects against accidental deletion or overwrite.
- You can restore an older version anytime.
- Must be enabled on the bucket (not default).

S3 Replication

- Automatically copies objects across buckets (same or different Regions).
- Ensures compliance, backup, disaster recovery, and low-latency access.
- Works with versioning enabled buckets.

Replication Types:

1. Cross-Region Replication (CRR): Copy to a bucket in another Region.
2. Same-Region Replication (SRR): Copy within the same Region.

S3 Performance:

Performance: S3 scales automatically, delivers millisecond latency, supports massive parallel requests, and ensures strong consistency.

- **High Throughput:** Scales automatically to support any request rate (thousands of requests per second).
- **Low Latency:** Millisecond access, S3 Express One Zone gives single-digit ms latency (10x faster than S3 Standard).
- **Parallelization:** Multipart upload & byte-range fetch improve performance for large objects.
- **Strong Consistency:** Immediate read-after-write consistency for PUT/DELETE operations.
- **Scalable Prefixes:** No performance limits on prefixes (unlimited parallelism).
- **Data Locality:** Place data in specific AZ/Local Zone (with directory buckets) for lowest latency.

S3 Event Notifications:

Notifications: automate workflows or alerts when bucket objects change.

- **Purpose:** Automatically trigger actions when objects in a bucket change.
- **Supported events:** Object created, deleted, restored, or replicated.
- **Targets:** Amazon SNS, SQS, or Lambda functions.
- **Configuration:** Set at bucket level; can filter by prefix or object suffix.

Use cases

- Trigger workflows when new files are uploaded.
- Process or transform data automatically.
- Send alerts or notifications on object changes.

S3 presigned URL:

You can use presigned URLs to grant time-limited access to objects in Amazon S3 without updating your bucket policy. A presigned URL can be entered in a browser or used by a program to download an object. The credentials used by the presigned URL are those of the AWS Identity and Access Management (IAM) principal who generated the URL.

You can also use presigned URLs to allow someone to upload a specific object to your Amazon S3 bucket. This allows an upload without requiring another party to have AWS security credentials or permissions. If an object with the same key already exists in the bucket as specified in the presigned URL, Amazon S3 replaces the existing object with the uploaded object.

You can use the presigned URL multiple times, up to the expiration date and time.

When you create a presigned URL, you must provide your security credentials, and then specify the following:

- An Amazon S3 bucket
- An object key (if downloading this object will be in your Amazon S3 bucket, if uploading this is the file name to be uploaded)
- An HTTP method (GET for downloading objects, PUT for uploading, HEAD for reading object metadata, etc)
- An expiration time interval

S3 Access Logs:

S3 Access Logs: A detailed record of all bucket requests for monitoring and auditing.

- **Purpose:** Track requests made to your S3 bucket for auditing, security, or analytics.
- **What's logged:** Request type (GET, PUT, DELETE), requester, bucket name, object key, timestamp, response, and more.
- **Configuration:** Enable at bucket level; logs are delivered to a target S3 bucket.

Use cases

- Security auditing and compliance.
- Understand usage patterns.
- Troubleshoot access or permission issues.

Thank You

Stay Connect:

in/in/alamgirweb11

/alamgirweb11