Simple Storage Service

10. Simple Storage Service (S3)

- Object storage is a computer data storage architecture that manages data as objects, as opposed to other storage architectures like file systems which manages data as a file hierarchy, and block storage which manages data as blocks

What is S3 in AWS?

- Amazon S3 or Amazon Simple Storage Service is a service offered by AWS that provides object storage through a web service interface.
- This is similar to google drive but more advanced for technical people.
- This is not like block storage we cannot mount anywhere.
- It's a only drive we do not need to create any file system.
- It is designed to make web-scale computing easier for IT people.
- Basically, s3 is storage for the internet which has a simple webservices interface for simple storing and retrieving data anytime or from anywhere on the internet.
- S3 has a distributed data-size architecture where objects are redundantly stored in multiple locations (min 3 zones).

Advantages-

- Reliable Security
- All-time Availability
- Very Low cost
- Ease of Migration
- The Simplicity of Management

Distributed architecture-

- An AWS Availability Zone is a physically isolated location within an AWS Region. Within each AWS Region, S3 operates in a minimum of three AZs, each separated by miles to protect against local events like fires, power down, etc.

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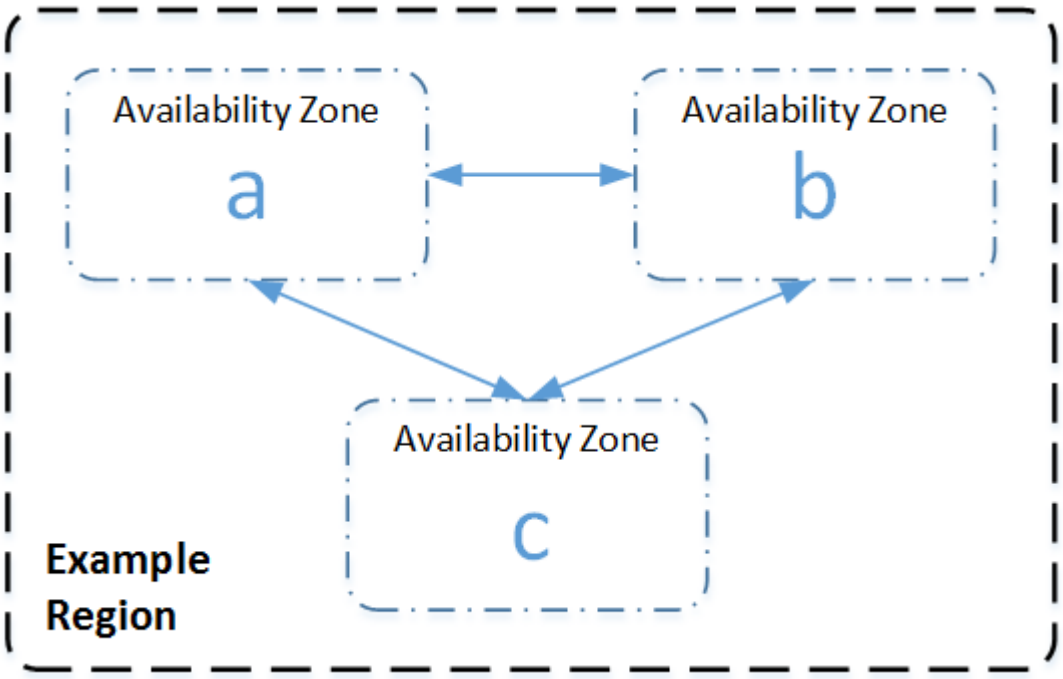


S3 concepts –

- Buckets
- Keys
- Objects
- S3 bucket resources
- S3 storage classes

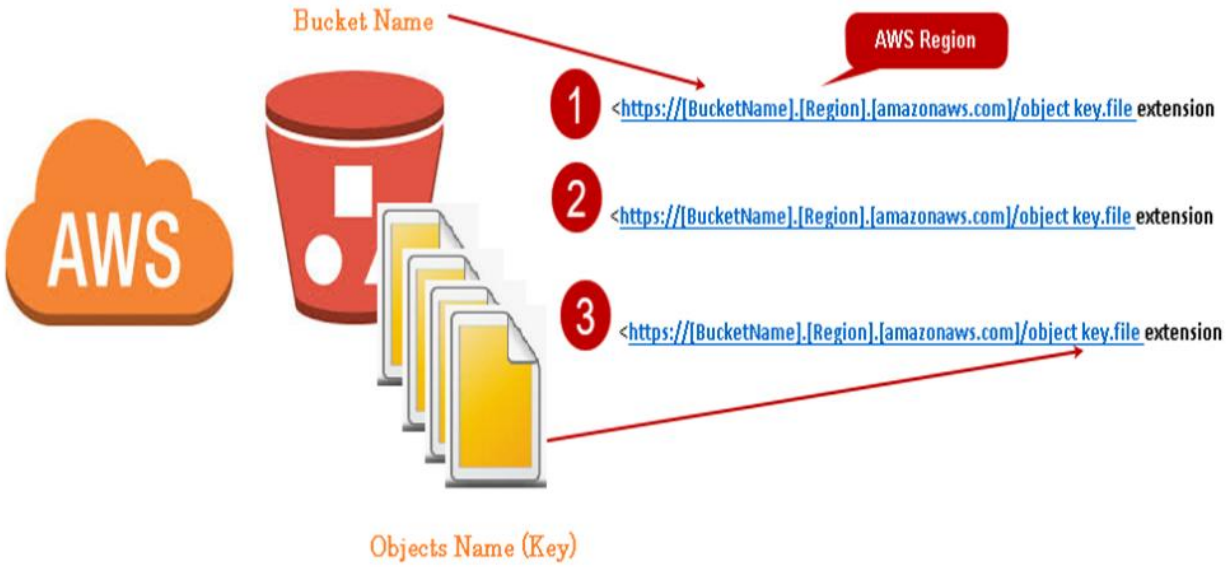
Buckets/Keys/Objects –

- An Amazon S3 bucket is a public cloud storage resource available in Amazon Web Services' (AWS) Simple Storage Service (S3), an object storage offering.
- Amazon S3 buckets, which are similar to file folders, store objects, which consist of data.
- Data is stored inside a bucket.
- Bucket is nothing but a flat container of objects
- Individual Amazon **S3** objects can range in **size** from 1 byte to 5 terabytes.
- The largest object that can be uploaded in a single PUT is 5 gigabytes. For objects larger than 100 megabytes, customers should consider using the Multipart Upload capability.
- There is no limit on objects per **bucket**.
- You can create or upload multiple folders in one bucket but you cannot create a bucket inside a bucket (Nested bucket not possible)
- S3 bucket is region specific.
- You can have 100 buckets per account, this number can be increased.
- By default buckets and its objects are private, thus by default only the owner can access the buckets.
- There are some naming rules while creating a s3 bucket.
- A S3 bucket name should be globally unique across all the regions and accounts.
- Bucket names must be between 3 and 63 characters long.
- Bucket names can consist only of lowercase letters, numbers, dots (.), and hyphens (-).

- Bucket names must begin and end with a letter or number.
- Bucket names must not be formatted as an IP address (for example, 192.168.5.4).

url –

https://docs.aws.amazon.com/AmazonS3/latest/userguide/bucketnamingrules.html



S3 sub resources-

- Lifecycle
- Website
- Versioning
- Access control lists

S3 object lifecycle-

- A lifecycle configuration is a set of rules that are applied to the objects in specific S3 buckets.

- Each rule specifies which objects are affected and when those objects will expire (on a specific date or after some number of days).

Website-

- You can use Amazon S3 to host a static website. On a static website, individual webpages include static content.
- When you configure a bucket as a static website, you must enable static website hosting, configure an index document, and set permissions.
- You can enable static website hosting using the Amazon S3 console, REST API, the AWS SDKs, the AWS CLI, or AWS CloudFormation.

- Configuring a static website using a custom domain registered with Route 53

Versioning-

- Versioning in Amazon S3 is a means of keeping multiple variants of an object in the same bucket.
- You can use the S3 Versioning feature to preserve, retrieve, and restore every version of every object stored in your buckets.
- With versioning you can recover more easily from both unintended user actions and application failures.
- Versioning-enabled buckets can help you recover objects from accidental deletion or overwrite
- For example, if you delete an object, Amazon S3 inserts a delete marker instead of removing the object permanently.
- The delete marker becomes the current object version.
- You can still recover the object by deleting the delete marker.
- This versioning is incremental versioning.
- You can use versioning with S3 lifecycle policy to delete older versions to move them to cheaper s3 versions.
- Versioning can be applied to all objects in a bucket, not partially applied

Access Control Lists-

- 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.
- When a request is received against a resource, Amazon S3 checks the corresponding ACL to verify that the requester has the necessary access permissions.
- https://docs.aws.amazon.com/AmazonS3/latest/userguide/acl-overview.html

MFA delete in S3 bucket-

- Multifactor authentication delete is a versioning capacity that adds another level of security in case your account is compromised.
- This adds another layer of security for the following
- Changing your bucket versioning state or permanently deleting an object version

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AWS S3 Storage Classes

S3 offers a variety of storage class designs to cater to different usecases.You can choose the appropriate storage class & also move objects from one storage class to other.

- Amazon s3 standard
- Amazon glacier deep archive
- Amazon glacier
- Amazon s3 infrequent access (standard IA)
- Amazon s3 one-zone IA
- Amazon S3 intelligent tiering
- Theory Link:- https://aws.amazon.com/s3/storage-classes/
- Pricing link:- https://aws.amazon.com/s3/pricing/

Storage Classes

1. **S3 Standard:**

- This is default storage classes.
- It offers HA (high availability), durability and performance
- In this storage class, you pay more for storage and less for accessing
- When we use S3 the files in S3 standard are synchronously copied across three facilities and designed to sustain the loss of data in two facilities
- Durability is 99.999999999%
- Designed for 99.99% availability over a given year.
- Largest object that can be uploaded in a single PUT is 5TB.

1. **S3 Standard Infrequent access:**

- Designed for the objects that are accessed less frequently i.e. paying more for access and less for storage
- Resilient against events that impact an entire AZ.
- Availability is 99.9% in year.
- Support SSL for data in transit and encryption of data at rest.
- Data that is deleted from S3 IA within 30 days will be charged for a full 30 days.

1. **S3 One Zone infrequent access:**

- In this data is stored only in one AZ when compared to S3 Standard/S3 standard infrequent access where the data is copied in 3 AZ's
- Storage cost is less and access cost is high.
- Ideal for those who want lower cost option of IA data.
- It is good choice for storing secondary backup copies of one premise data or easily re-creatable data.
- You can use S3 lifecycle policies.
- Availability is 99.5%
- Durability is 99.999999999%
- Because S3 zone-IA stores data in a single is it data stored in this storage class will be lost in the event of AZ destructions.

1. **S3 Intelligent-Tiering:**

- Designed to optimize costs by automatically moving the data from one storage class to another based on access patterns.
- It works by storing object into access tiers.
- If an object in the infrequent access tire is it automatically moved back to frequent access tier.
- There are no retrieval fees when using S3 intelligent tiering storage class and no additional tiering fee when objects are moved between access tiers.
- Same low latency and high performance of S3 standard.
- Object less than 128 KB cannot move to IA.
- Durability is 99.999999999%
- Availability is 99.9%

1. **S3 Glacier:**

- S3 Glacier is secure durable low cost storage class for data archiving.
- To keep cost low yet suitable for wearing needs S3 Glacier provides 3 retrieval options that range from a few minute to hours.
- You can upload object directly to Glacier or use lifecycle policies.
- Durability is 99.999999999%
- Data is resilient in the event of one entire AZ destructions.
- Support SSL for data in transit and encryption data at rest.

1. **S3 Glacier Deep Archive:**

- This is used for long-term archival storage (compliance reasons)
- You may be accessing this data hardly once or twice a year.
- Glacier Deep archive is the ideal solution for replacement of tape storage
- With S3 Glacier Deep Archive, Data can be restore within 12 hours
- Design to retain data for long period eg..10 years.
- All object store in S3 Glacier deep achieve are replicated and told across at least at three geographically depressed AZ.
- Durability is 99.999999999%
- Storage cost is up to 75% less than for the existing S3 Glacier storage class.
- Availability is 99.9%

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Characteristic	S3 Standard	S3 Intelligent Tiering	S3 IA	S3 One-Zone IA	S3 Glacier	S3 Glacier Deep Archive
Designed for Durability	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Designed for Availability	99.99%	99.90%	99.90%	99.50%	99.99%	99.99%
Availability SLA	99.90%	99%	99%	99%	99.90%	99.90%
AZs	>= 3	>=3	>=3	1	>=3	>=3
Min charge/object	N/A	N/A	128 KB	128 KB	40 KB	40 KB
Min storage duration cache	N/A	30 days	30 days	30 days	90 days	90 days
Retrieval fee	N/A	N/A	per GB retreived	per GB retreived	per GB retreived	per GB retreived
First byte latency	milli seconds	milli seconds	milli seconds	milli seconds	minutes or Hours	hours

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Versioning:

- By default aws will try to show the latest object, if we need to maintain multiple versions of the object then we need to enable versioning
- After enabling the versioning, each object gets the version id and default url will point to latest version

S3 supports enable versioning and suspend versioning.

Bucket Deletion

- S3 bucket deletion requires the bucket to be empty before deleting.

Policies and Permissions in Amazon S3:

In its most basic sense, a policy contains the following elements:

- Resources– Buckets, objects, access points, and jobs are the Amazon S3 resources for which you can allow or deny permissions. In a policy, you use the Amazon Resource Name (ARN) to identify the resource. For more information, see Amazon S3 resources.
- Actions– For each resource, Amazon S3 supports a set of operations. You identify resource operations that you will allow (or deny) by using action keywords.
  For example, the s3:ListBucket permission allows the user to use the Amazon S3 GET Bucket (List Objects)operation. For more information about using Amazon S3 actions, see Amazon S3 actions. For a complete list of Amazon S3 actions, see Actions.
- Effect– What the effect will be when the user requests the specific action—this can be either allow or deny. If you do not explicitly grant access to (allow) a resource, access is implicitly denied. You can also explicitly deny access to a resource. You might do this to make sure that a user can't access the resource, even if a different policy grants access. For more information, see IAM JSON Policy Elements: Effect.
- Principal– The account or user who is allowed access to the actions and resources in the statement. In a bucket policy, the principal is the user, account, service, or other entity that is the recipient of this permission. For more information, see Principals.
- Condition– Conditions for when a policy is in effect. You can use AWS-wide keys and Amazon S3-specific keys to specify conditions in an Amazon S3 access policy. For more information, see Amazon S3 condition key examples.

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S3 Naming –

The following example bucket names are valid and follow the recommended naming guidelines:

- `docexamplebucket1`
- `log-delivery-march-2020`
- `my-hosted-content`

The following example bucket names are valid but not recommended for uses other than static website hosting:

- `docexamplewebsite.com`
- `www.docexamplewebsite.com`
- `my.example.s3.bucket`

The following example bucket names are *not* valid:

- `doc_example_bucket` (contains underscores)
- `DocExampleBucket` (contains uppercase letters)
- `doc-example-bucket-` (ends with a hyphen)