S3

05:05 PM

Section introduction

- Amazon S3 is one of the main building blocks of AWS
- It's advertised as "infinitely scaling" storage
- It's widely popular and deserves its own section
- Many websites use Amazon S3 as a backbone
- Many AWS services uses Amazon S3 as an integration as well
- We'll have a step-by-step approach to S3

Amazon S3 Overview - Buckets

- Amazon S3 allows people to store objects (files) in "buckets" (directories)
- Buckets must have a **globally unique name**
- Buckets are defined at the region level
- Naming convention
  - No uppercase
  - No underscore
  - 3-63 characters long
  - Not an IP
  - Must start with lowercase letter or number

Amazon S3 Overview - Objects

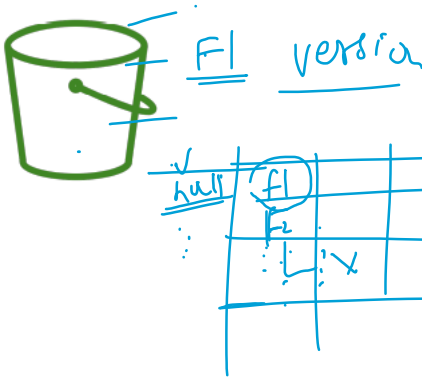
- Objects (files) have a Key
- The key is the FULL path:
  - s3://my-bucket/my_file.txt
  - s3://my-bucket/my_folder1/another_folder/my_file.txt
- The key is composed of prefix + object name
  - s3://my-bucket/my_folder1/another_folder/my_file.txt
- There's no concept of "directories" within buckets (although the UI will trick you to think otherwise)
- Just keys with very long names that contain slashes ("/")

Amazon S3 Overview – Objects (continued)

- Object values are the content of the body:
  - Max Object Size is 5TB (5000GB)
  - If uploading more than 5GB, must use "multi-part upload"

- Metadata (list of text key / value pairs – system or user metadata)
- Tags (Unicode key / value pair – up to 10) – useful for security / lifecycle
- Version ID (if versioning is enabled)

Amazon S3 - Versioning



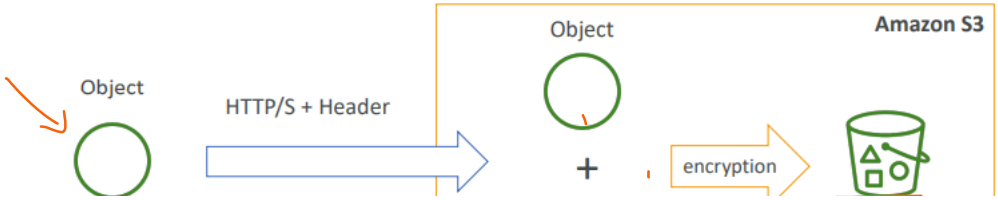
- You can version your files in Amazon S3
- It is enabled at the **bucket level**
- Same key overwrite will increment the "version": 1, 2, 3….
- It is best practice to version your buckets
  - Protect against unintended deletes (ability to restore a version)
  - Easy roll back to previous version
- Notes:
  - Any file that is not versioned prior to enabling versioning will have version "null"
  - Suspending versioning does not delete the previous versions

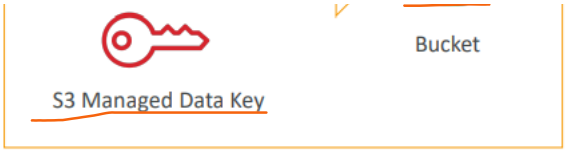
S3 Encryption for Objects

- There are 4 methods of encrypting objects in S3
  - SSE-S3: encrypts S3 objects using keys handled & managed by AWS
  - SSE-KMS: leverage AWS Key Management Service to manage encryption keys
  - SSE-C: when you want to manage your own encryption keys
  - Client Side Encryption
- It's important to understand which ones are adapted to which situation for the exam

SSE-S3

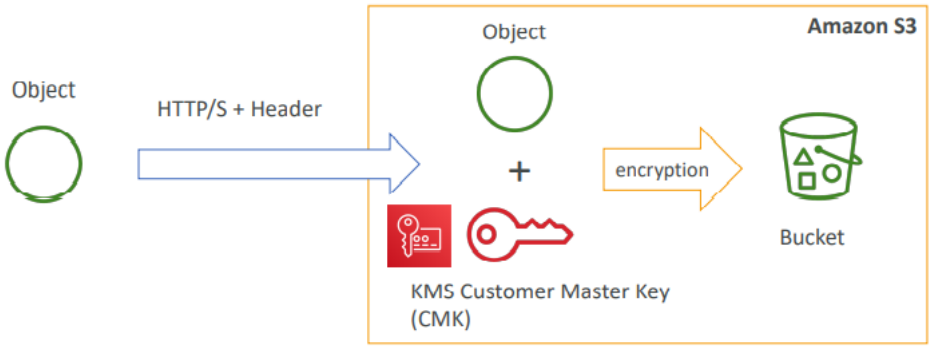
- SSE-S3: encryption using keys handled & managed by Amazon S3
- Object is encrypted server side
- AES-256 encryption type
- Must set header: "x-amz-server-side-encryption": "AES256"





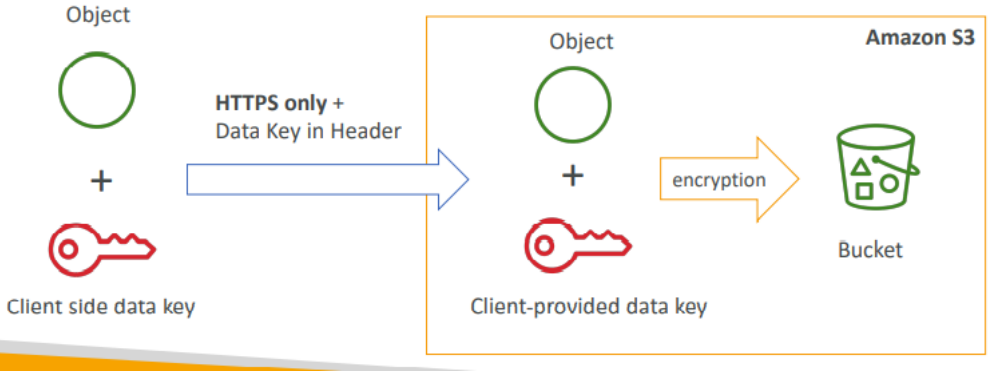
SSE-KMS

- SSE-KMS: encryption using keys handled & managed by KMS
- KMS Advantages: user control + audit trail
- Object is encrypted server side
- Must set header: **"x-amz-server-side-encryption": "aws:kms"**



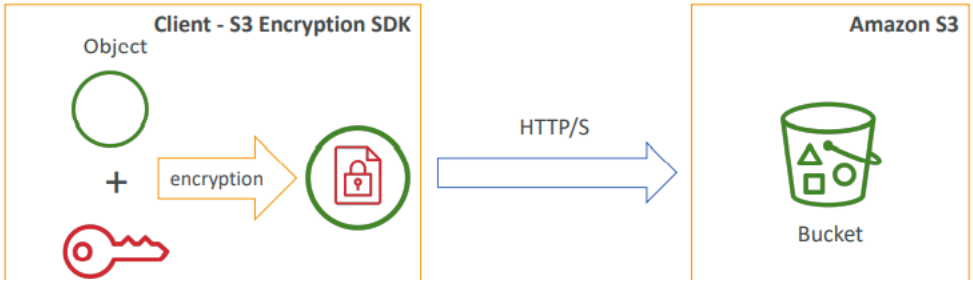
SSE-C

- SSE-C: server-side encryption using data keys fully managed by the customer outside of AWS
- Amazon S3 does not store the encryption key you provide
- **HTTPS must be used**
- Encryption key must provided in HTTP headers, for every HTTP request made



Client Side Encryption

- Client library such as the Amazon S3 Encryption Client
- Clients must encrypt data themselves before sending to S3
- Clients must decrypt data themselves when retrieving from S3
- Customer fully manages the keys and encryption cycle



Client side data key

Encryption in transit (SSL/TLS)

- Amazon S3 exposes:
  - HTTP endpoint: non encrypted
  - HTTPS endpoint: encryption in flight
- You're free to use the endpoint you want, but HTTPS is recommended
- Most clients would use the HTTPS endpoint by default
- HTTPS is mandatory for SSE-C
- Encryption in flight is also called SSL/TLS

S3 Security

- User based
  - IAM policies - which API calls should be allowed for a specific user from IAM console
- Resource Based
  - Bucket Policies - bucket wide rules from the S3 console - allows cross account
  - Object Access Control List (ACL) – finer grain
  - Bucket Access Control List (ACL) – less common
- Note: an IAM principal can access an S3 object if
  - the user IAM permissions allow it OR the resource policy ALLOWS it
  - AND there's no explicit DENY

S3 Bucket Policies

- JSON based policies
  - Resources: buckets and objects
  - Actions: Set of API to Allow or Deny
  - Effect: Allow / Deny
  - Principal: The account or user to apply the policy to
- Use S3 bucket for policy to:
  - Grant public access to the bucket
  - Force objects to be encrypted at upload
  - Grant access to another account (Cross Account)

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "PublicRead",
            "Effect": "Allow",
            "Principal": "*",
            "Action": [
                "s3:GetObject"
            ],
            "Resource": [
                "arn:aws:s3:::examplebucket/*"
            ]
        }
    ]
}
```

Bucket settings for Block Public Access

- Block public access to buckets and objects granted through
  - *new* access control lists (ACLs)
  - *any* access control lists (ACLs)
  - *new* public bucket or access point policies
- Block public and cross-account access to buckets and objects through *any* public bucket or access point policies

- **These settings were created to prevent company data leaks**
- If you know your bucket should never be public, leave these on
- Can be set at the account level

S3 Security - Other

- Networking:
  - Supports VPC Endpoints (for instances in VPC without www internet)
- Logging and Audit:
  - S3 Access Logs can be stored in other S3 bucket
  - API calls can be logged in AWS CloudTrail
- User Security:
  - MFA Delete: MFA (multi factor authentication) can be required in versioned buckets to delete objects
  - Pre-Signed URLs: URLs that are valid only for a limited time (ex: premium video service for logged in users)

S3 Websites

- S3 can host static websites and have them accessible on the www
- The website URL will be:
  - <bucket-name>.s3-website-<AWS-region>.amazonaws.com

  OR
  - <bucket-name>.s3-website.<AWS-region>.amazonaws.com

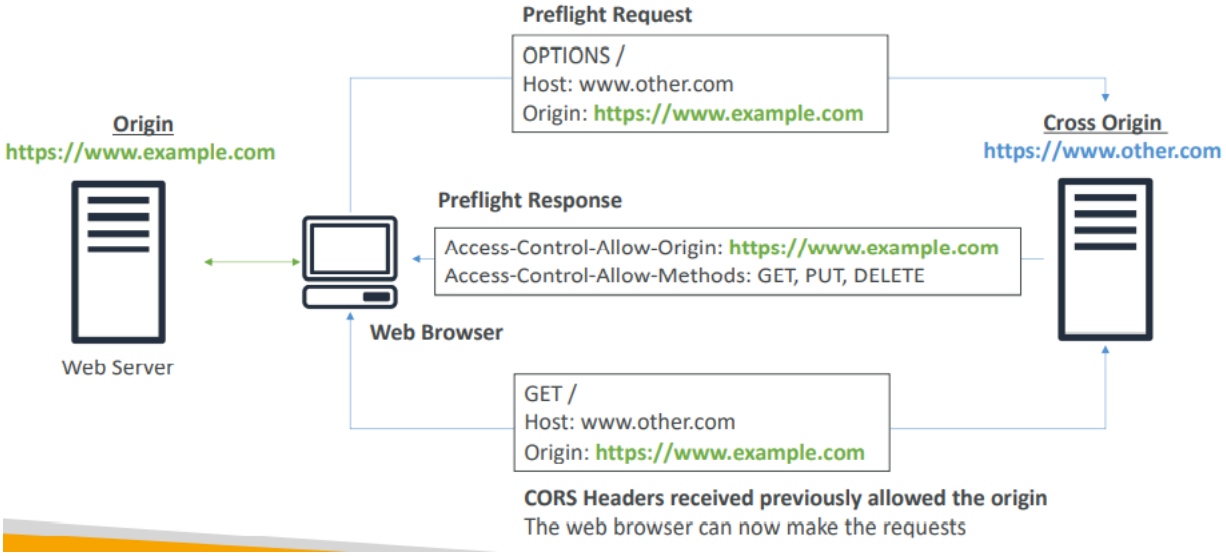
- If you get a 403 (Forbidden) error, make sure the bucket policy allows public reads!

CORS - Explained

- An **origin** is a scheme (protocol), host (domain) and port
  - E.g.: https://www.example.com (implied port is 443 for HTTPS, 80 for HTTP)
- CORS means Cross-Origin Resource Sharing
- **Web Browser** based mechanism to allow requests to other origins while visiting the main origin

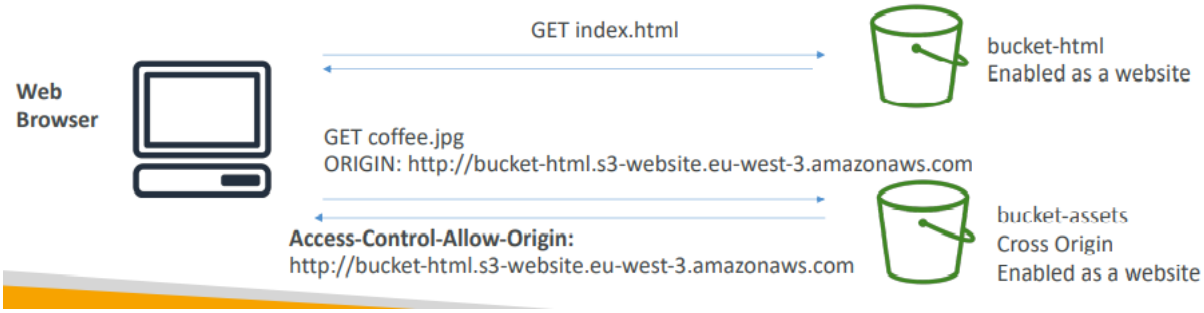
- Same origin: http://example.com/app1 & http://example.com/app2
- Different origins: http://www.example.com & http://other.example.com
- The requests won't be fulfilled unless the other origin allows for the requests, using **CORS Headers (ex: Access-Control-Allow-Origin)**

CORS – Diagram



S3 CORS

- If a client does a cross-origin request on our S3 bucket, we need to enable the correct CORS headers
- It's a popular exam question
- You can allow for a specific origin or for * (all origins)



Amazon S3 - Consistency Model

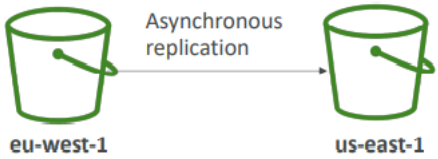
- **Strong consistency as of Dec 2020:**
- After a:
  - successful write of a new object (new PUT)
  - or an overwrite or delete of an existing object (overwrite PUT or DELETE)
- …any:

- subsequent read request immediately receives the latest version of the object (read after write consistency)
- subsequent list request immediately reflects changes (list consistency)

- Available at no additional cost, without any performance impact

S3 Replication (CRR & SRR)

- **Must enable versioning** in source and destination
- Cross Region Replication (CRR)
- Same Region Replication (SRR)
- Buckets can be in different accounts
- Copying is asynchronous
- Must give proper IAM permissions to S3



- CRR - Use cases: compliance, lower latency access, replication across accounts
- SRR – Use cases: log aggregation, live replication between production and test accounts

S3 Replication – Notes

- After activating, only new objects are replicated (not retroactive)

- For DELETE operations:
  - Can replicate delete markers from source to target (optional setting)
  - Deletions with a version ID are not replicated (to avoid malicious deletes)

- There is no "chaining" of replication
  - If bucket 1 has replication into bucket 2, which has replication into bucket 3
  - Then objects created in bucket 1 are not replicated to bucket 3