Simple Storage Service -S3

S3 use cases

- Backup and storage
- Disaster Recovery
- Archive
- Hybrid Cloud storage
- Application hosting
- Media hosting
- Data lakes & big data analytics
- Software delivery
- Static website

S3 -Buckets

- Amazon S3 allows people to store objects (files) in "buckets" (directories)
- Buckets must have a **globally unique name (across all regions all accounts)**
- Buckets are defined at the region level
- S3 looks like a global service but buckets are created in a region
- Naming convention
  - No uppercase, No underscore
  - 3-63 characters long
  - Not an IP
  - Must start with lowercase letter or number
  - Must NOT start with the prefix xn--
  - Must NOT end with the suffix -s3alias

S3 Bucket

Availability: up time 90% means in 10 days it will be down 1 day. 100% availability means it will never down.

Durability: data persistent 90% durability means if we upload 10 files 9 files will be keep safe 1 file will be damage by any reason.

S3 -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 ("/")

Object

S3 Bucket with Objects

S3 – Objects (cont.)

- 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)

S3- Security

- User-Based
  - IAM Policies – which API calls should be allowed for a specific user from IAM
- Resource-Based
  - Bucket Policies – bucket wide rules from the S3 console - allows cross account
  - Object Access Control List (ACL) – finer grain (can be disabled)
  - Bucket Access Control List (ACL) – less common (can be disabled)
- 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
- Encryption: encrypt objects in Amazon S3 using encryption keys

S3 Bucket Policies

- JSON based policies
  - Resources: buckets and objects
  - Effect: Allow / Deny
  - Actions: Set of API to Allow or 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

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

Example: Public Access – Use Bucket Policy

Example: User Access to S3 – IAM permission

Example: Ec2 instance access – Use IAM role

Cross Account Access – Use bucket policy

Cross Account access Using bucket policy

Bucket setting for Block public Access

Block *all* public access
On

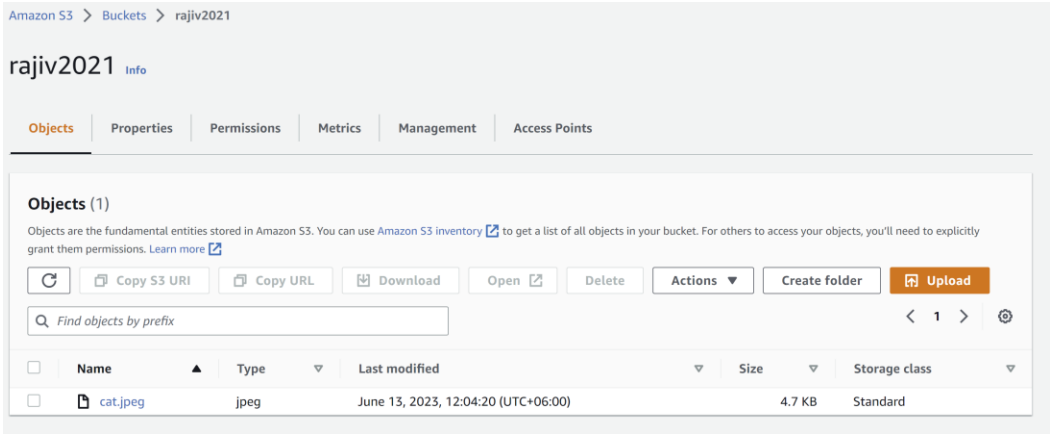
- **Block public access to buckets and objects granted through *new* access control lists (ACLs)**
  On
- **Block public access to buckets and objects granted through *any* access control lists (ACLs)**
  On
- **Block public access to buckets and objects granted through *new* public bucket or access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

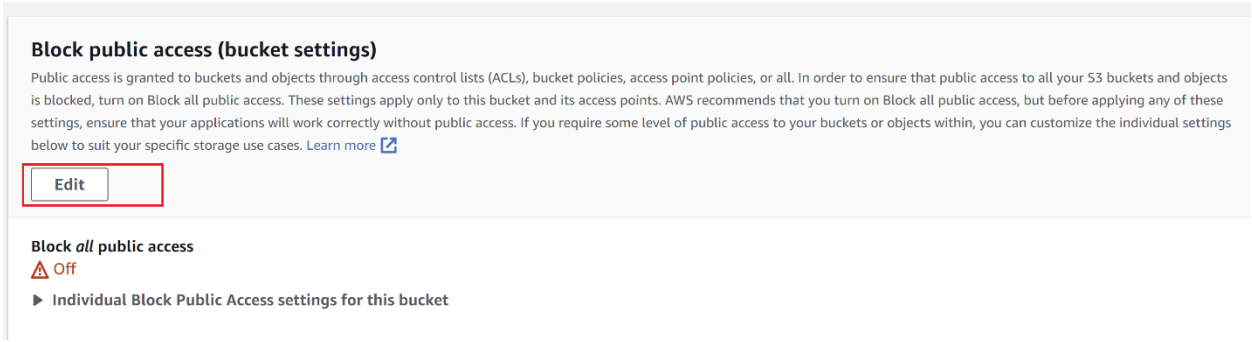
- These settings were created to prevent company data leaks
- If you know your bucket should never be public, leave these on
- Can be set at the account level

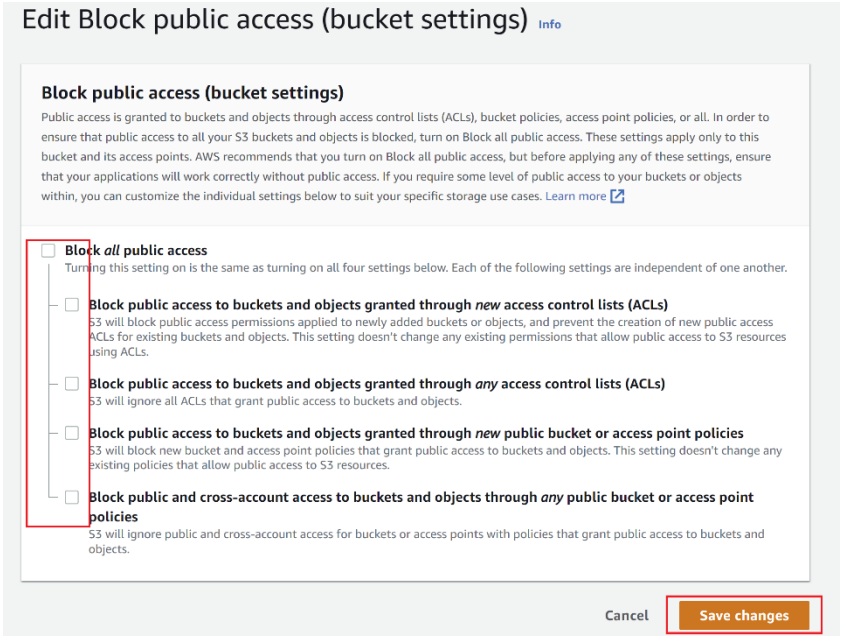
Lab:1

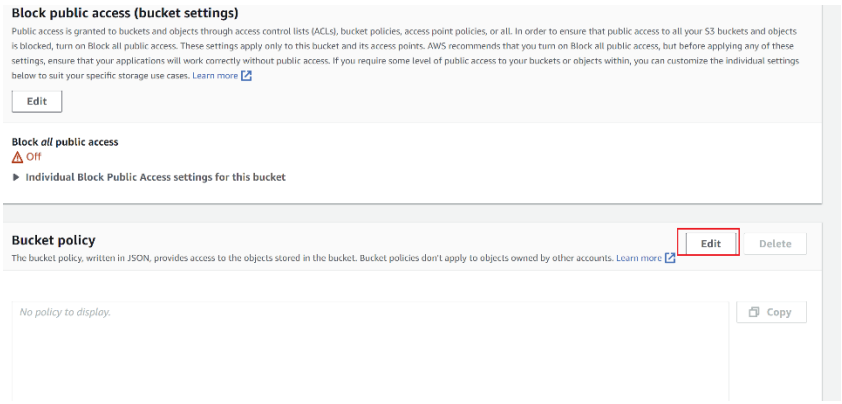
Create a bucket
upload a image to the bucket
check

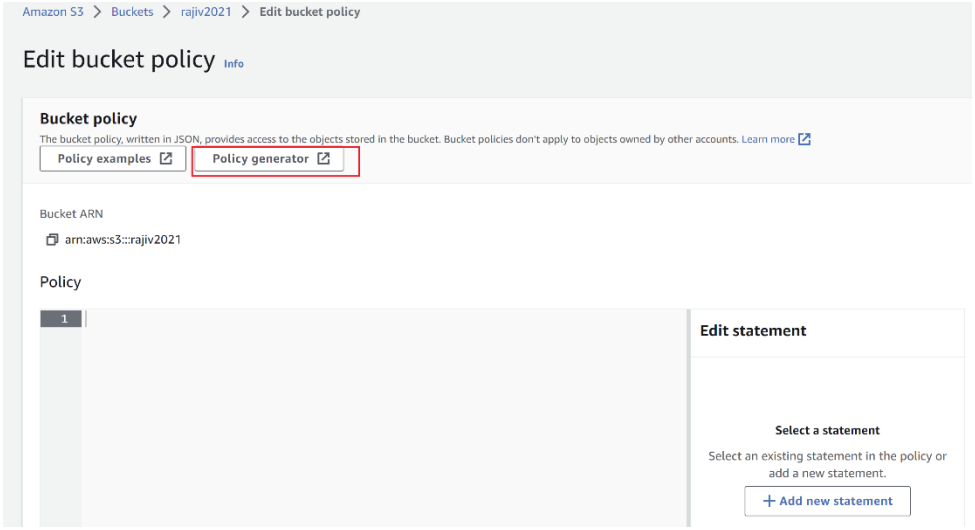
Create a bucket
Upload a image to the bucket
Change the permissions


Amazon S3 > Buckets > rajiv2021
rajiv2021 Info
Objects
Properties
Permissions
Metrics
Management
Access Points
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
Copy S3 URI
Copy URL
Download
Open
Delete
Actions
Create folder
Upload
Find objects by prefix
1
Name
Type
Last modified
Size
Storage class
cat.jpeg
jpeg
June 13, 2023, 12:04:20 (UTC+06:00)
4.7 KB
Standard


Block public access (bucket settings)
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 all your S3 buckets and 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 your buckets or objects within, you can customize the individual settings below to suit your specific storage use cases. Learn more
Edit
Block all public access
Off
Individual Block Public Access settings for this bucket


Edit Block public access (bucket settings) Info
Block public access (bucket settings)
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 all your S3 buckets and 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 your buckets 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.
Cancel
Save changes


Block public access (bucket settings)
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 all your S3 buckets and 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 your buckets or objects within, you can customize the individual settings below to suit your specific storage use cases. Learn more
Edit
Block all public access
Off
Individual Block Public Access settings for this bucket
Bucket policy
The bucket policy, written in JSON, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. Learn more
Edit
Delete
No policy to display.
Copy


Amazon S3 > Buckets > rajiv2021 > Edit bucket policy
Edit bucket policy Info
Bucket policy
The bucket policy, written in JSON, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. Learn more
Policy examples
Policy generator
Bucket ARN
arn:aws:s3:::rajiv2021
Policy
1
Edit statement
Select a statement
Select an existing statement in the policy or add a new statement.
+ Add new statement

AWS Policy Generator

The AWS Policy Generator is a tool that enables you to create policies that control access to Amazon Web Services (AWS) products information about creating policies, see key concepts in Using AWS Identity and Access Management. Here are sample policies.

Step 1: Select Policy Type

A Policy is a container for permissions. The different types of policies you can create are an IAM Policy, an S3 Bucket Policy, an SNS Policy, and an SQS Queue Policy.

Select Type of Policy S3 Bucket Policy

Step 2: Add Statement(s)

A statement is the formal description of a single permission. See a description of elements that you can use in statements.

Effect Allow Deny

Principal *

Use a comma to separate multiple values.

AWS Service Amazon S3 All Services ('*')

Use multiple statements to add permissions for more than one service.

Actions 1 Action(s) Selected All Actions ('*')

- GetObject
- GetObjectAcl
- GetObjectAttributes
- GetObjectLegalHold
- GetObjectRetention
- GetObjectTagging
- GetObjectTorrent
- GetObjectVersion

Amazon Resource Name (ARN)

BucketName}/${KeyName}.

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Effect Allow Deny

Principal *

Use a comma to separate multiple values.

AWS Service Amazon S3 All Services ('*')

Use multiple statements to add permissions for more than one service.

Actions 1 Action(s) Selected All Actions ('*')

Amazon Resource Name (ARN) arn:aws:s3:::rajiv2021/*

ARN should follow the following format: arn:aws:s3:::${BucketName}/${KeyName}.
Use a comma to separate multiple values.

Add Conditions (Optional)

Add Statement

Effect Allow Deny

Principal *

Use a comma to separate multiple values.

AWS Service Amazon S3 All Services ('*')

Use multiple statements to add permissions for more than one service.

Actions 1 Action(s) Selected All Actions ('*')

Amazon Resource Name (ARN) arn:aws:s3:::rajiv2021/*

ARN should follow the following format: arn:aws:s3:::${BucketName}/${KeyName}.
Use a comma to separate multiple values.

Add Conditions (Optional)

Add Statement

1

You added the following statements. Click the button below to Generate a policy.

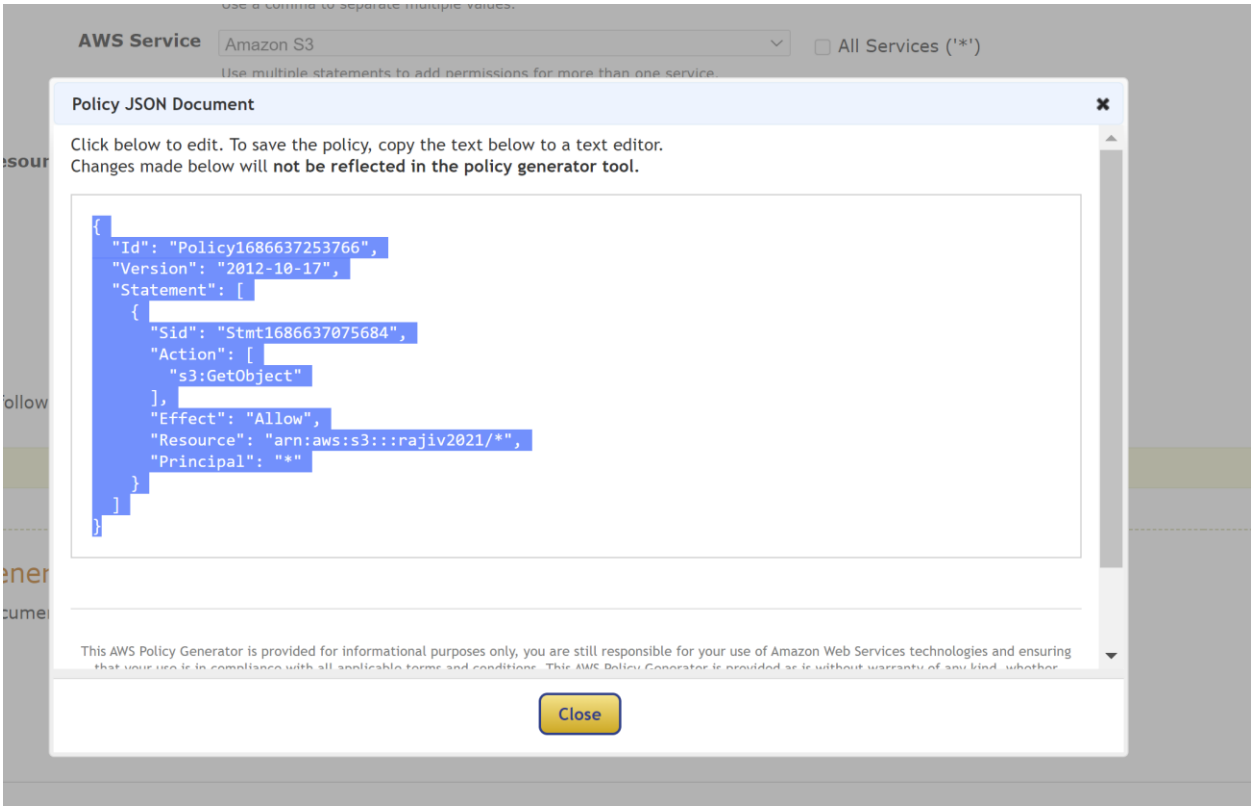
Principal(s)	Effect	Action	Resource	Conditions
• *	Allow	• s3:GetObject	arn:aws:s3:::rajiv2021/*	*None*

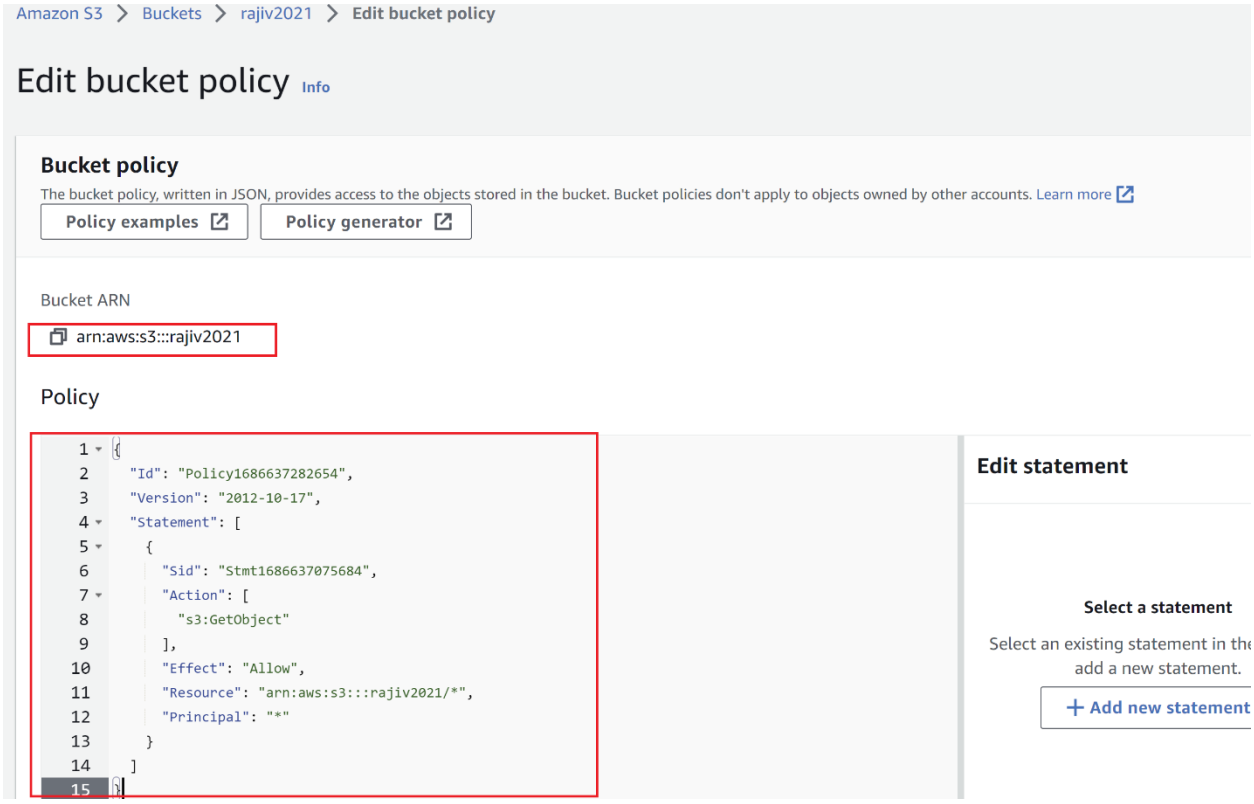
Step 3: Generate Policy

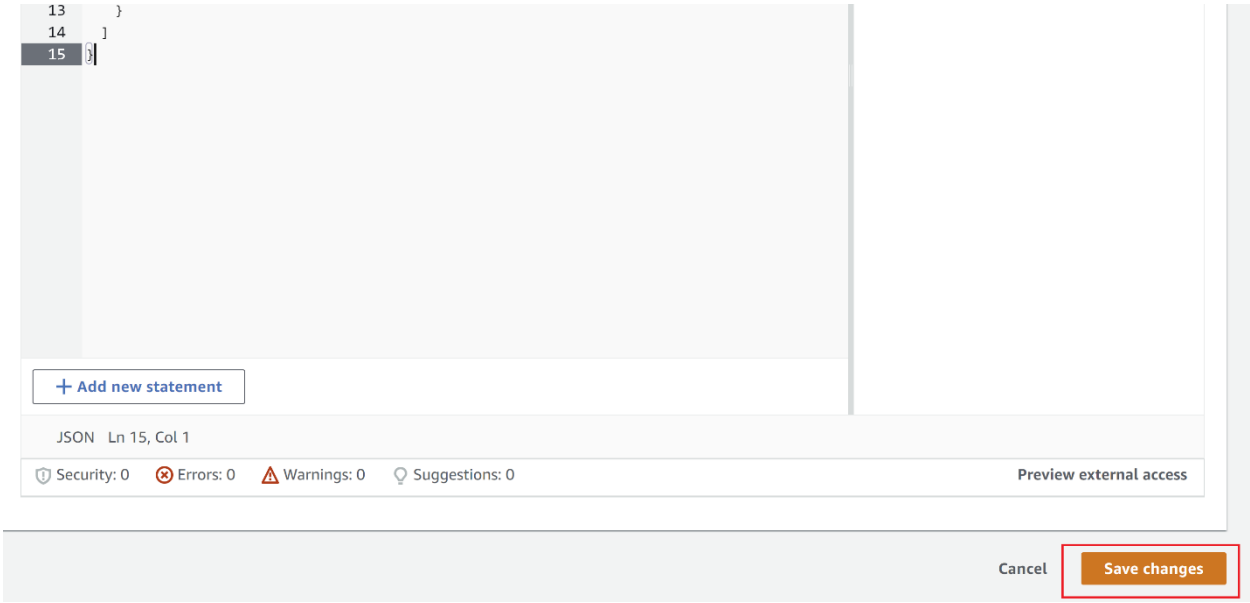
A *policy* is a document (written in the Access Policy Language) that acts as a container for one or more statements.

Generate Policy Start Over

2


AWS Service
Amazon S3
All Services ('*')
Policy JSON Document
Click below to edit. To save the policy, copy the text below to a text editor.
Changes made below will not be reflected in the policy generator tool.
{
"Id": "Policy1686637253766",
"Version": "2012-10-17",
"Statement": [
{
"Sid": "Stmt1686637075684",
"Action": [
"s3:GetObject"
],
"Effect": "Allow",
"Resource": "arn:aws:s3:::rajiv2021/*",
"Principal": "*"
}
]
}
This AWS Policy Generator is provided for informational purposes only, you are still responsible for your use of Amazon Web Services technologies and ensuring
Close

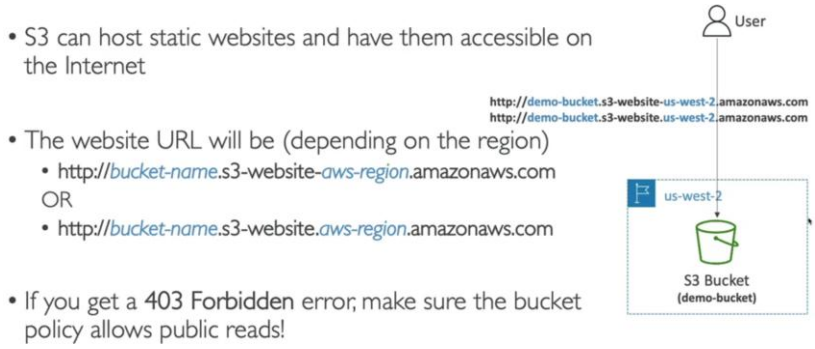

Amazon S3 > Buckets > rajiv2021 > Edit bucket policy
Edit bucket policy Info
Bucket policy
The bucket policy, written in JSON, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. Learn more
Policy examples
Policy generator
Bucket ARN
arn:aws:s3:::rajiv2021
Policy
1 {
2 "Id": "Policy1686637282654",
3 "Version": "2012-10-17",
4 "Statement": [
5 {
6 "Sid": "Stmt1686637075684",
7 "Action": [
8 "s3:GetObject"
9],
10 "Effect": "Allow",
11 "Resource": "arn:aws:s3:::rajiv2021/*",
12 "Principal": "*"
13 }
14]
15 }
Edit statement
Select a statement
Select an existing statement in the
add a new statement.
+ Add new statement



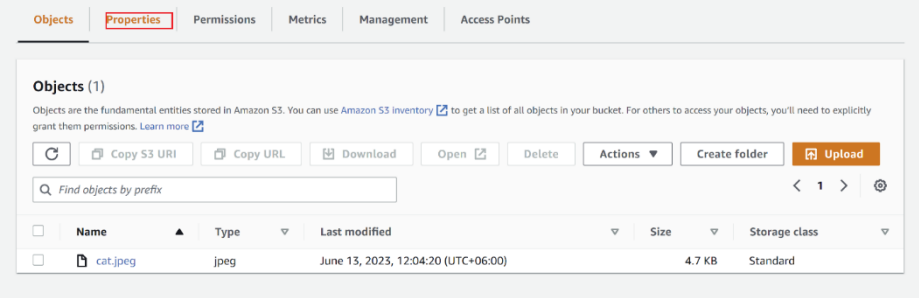
Now we can browse the object as a public from the following URL

https://rajiv2021.s3.amazonaws.com/cat.jpeg

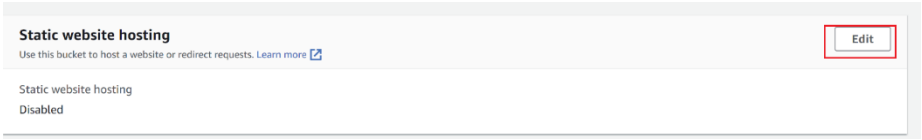
Amazon S3 – Static Website Hosting

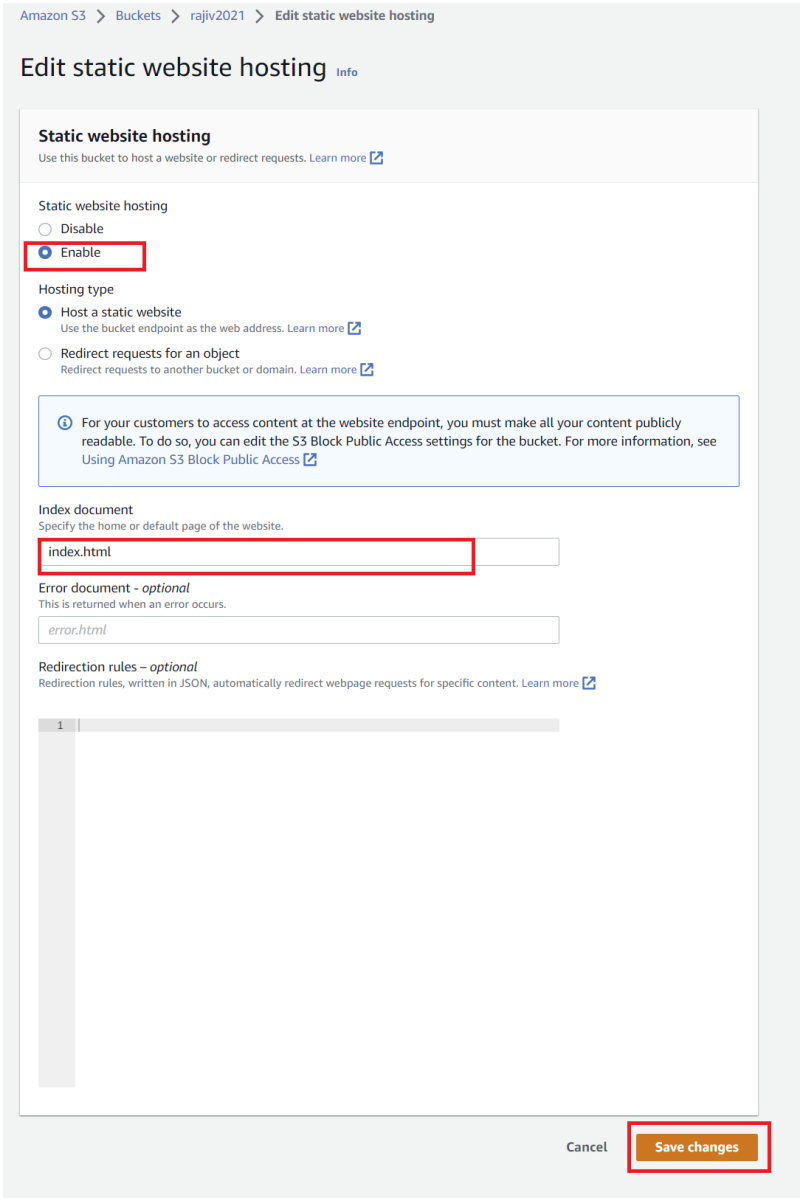


Lab: Create a static website

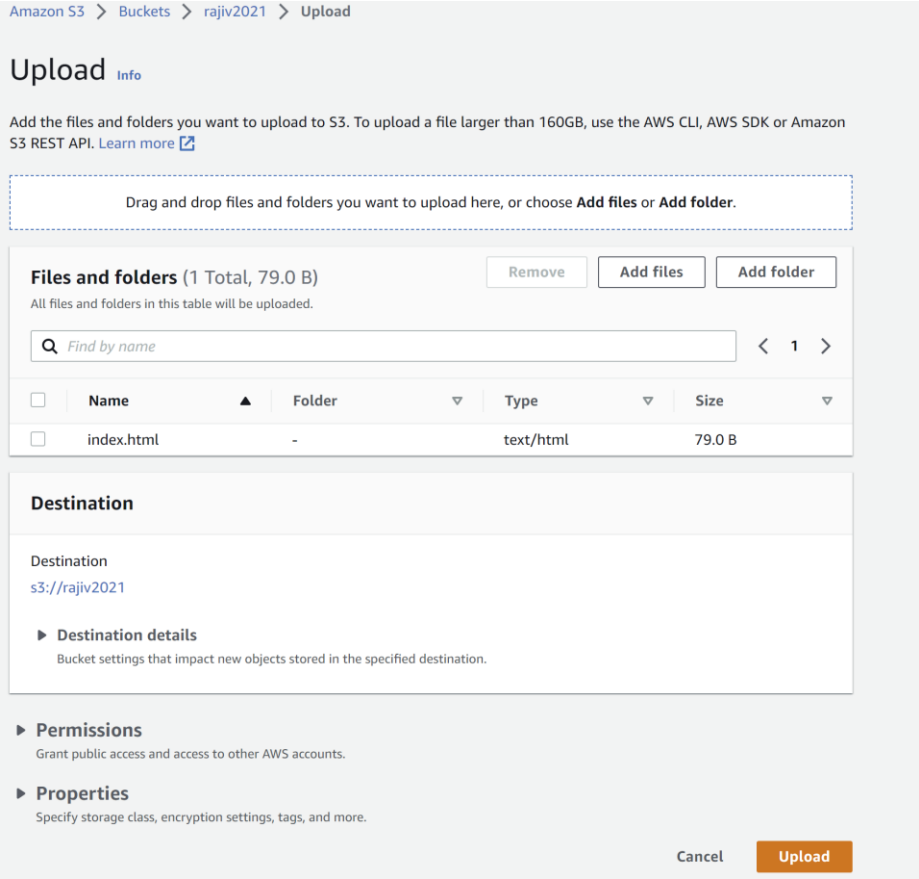


Now scroll down the page and you get the option

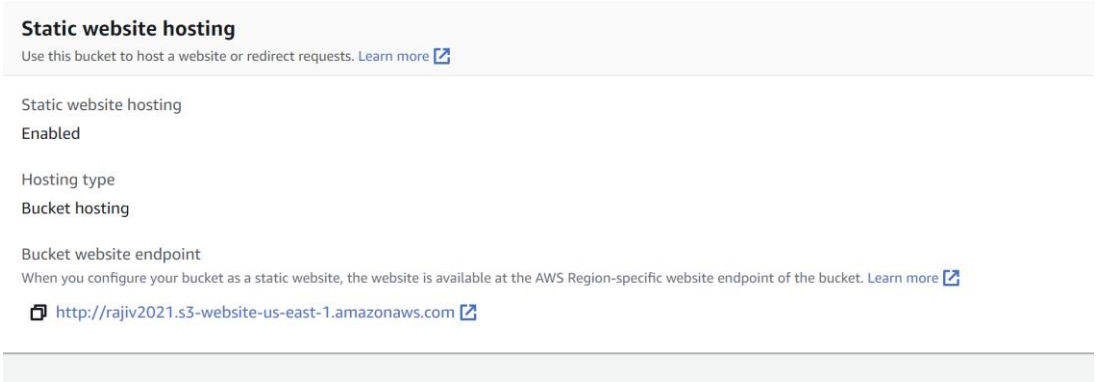




Now go to the object and upload the index.html file



now go to the properties and scroll down and you will get the s3 website url



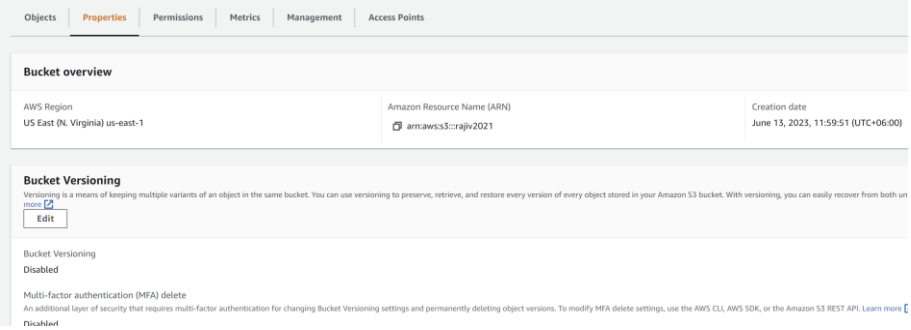
now go to the browser and pest the URL and you will get the website.

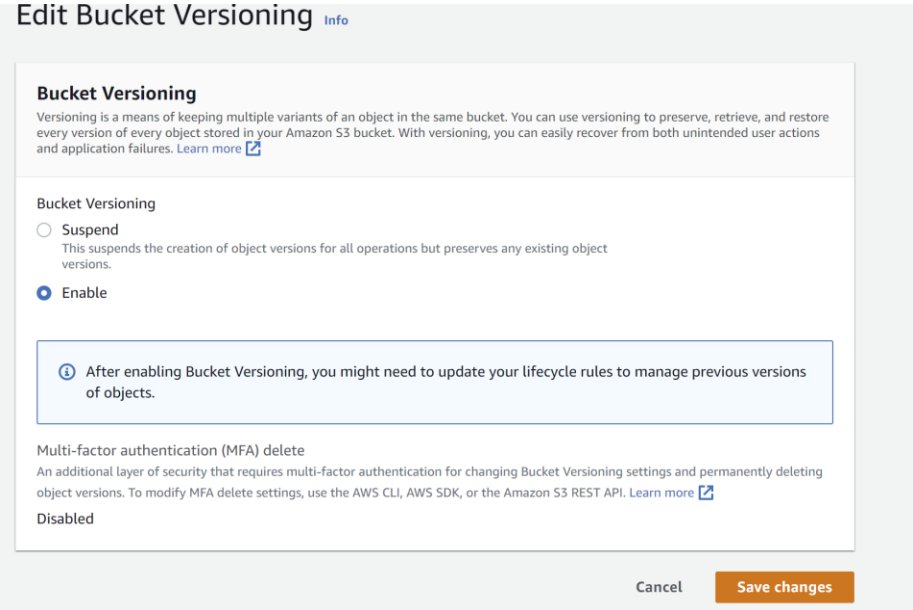
Amazon S3 - Versioning

- You can version your files in Amazon S3
- It is enabled at the **bucket level**
- Same key overwrite will change 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

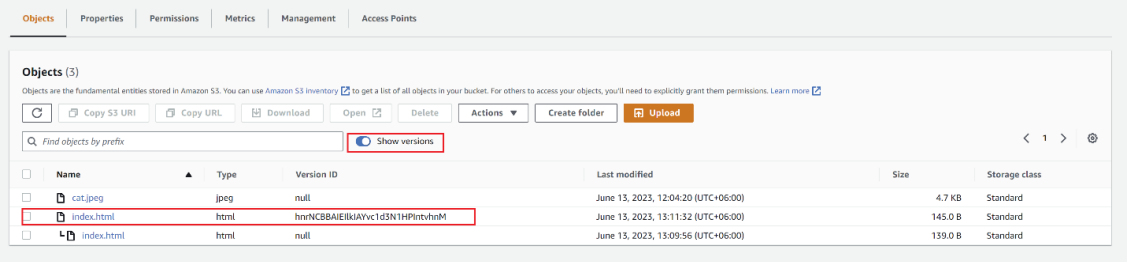
Lab: how to enable versioning

First enable the versioning



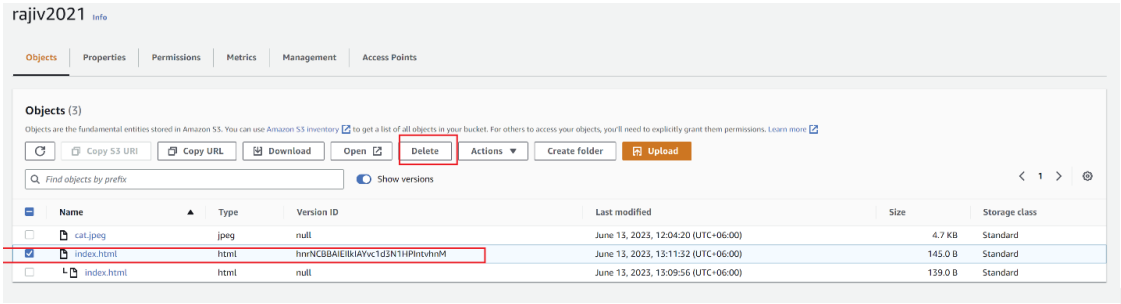


Now edit the index file and upload it and then check.



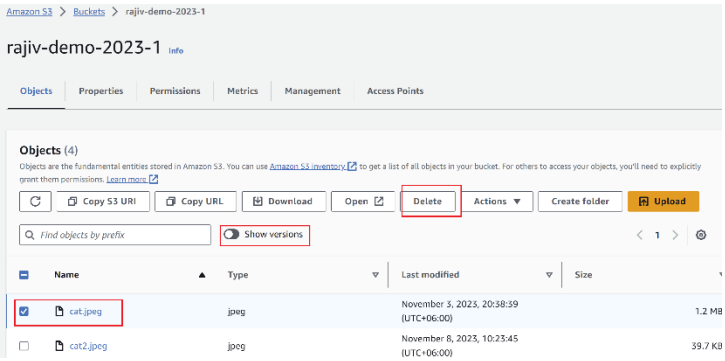
NB: Version ID null means its uploaded before enable versioning.

Now we see the current updated page now it we want back to previous one page then delete the current one version and then brows it



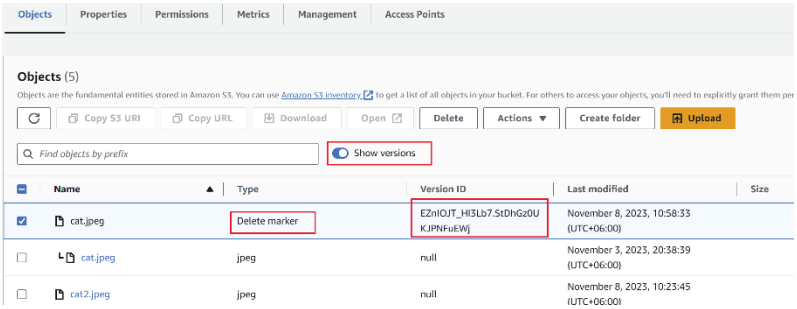
Now if we browse then we get the previous version file

Now we delete any image example cat.jpeg



after delete the cat.jpeg image then we can see the page is not showing.

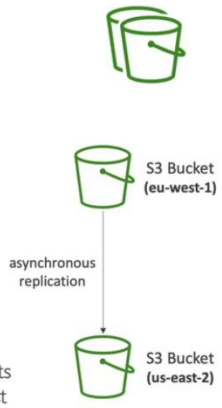
now back to image again we need to delete the delete marker then we can see the image is showing again



NB: Force refresh sfift+R+reload or refresh the page

Amazon S3 - Replication (CRR and SRR)

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



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

Amazon S3 – Replication (Notes)

- After you enable Replication, only new objects are replicated
- Optionally, you can replicate existing objects using S3 Batch Replication
  - Replicates existing objects and objects that failed replication
- 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

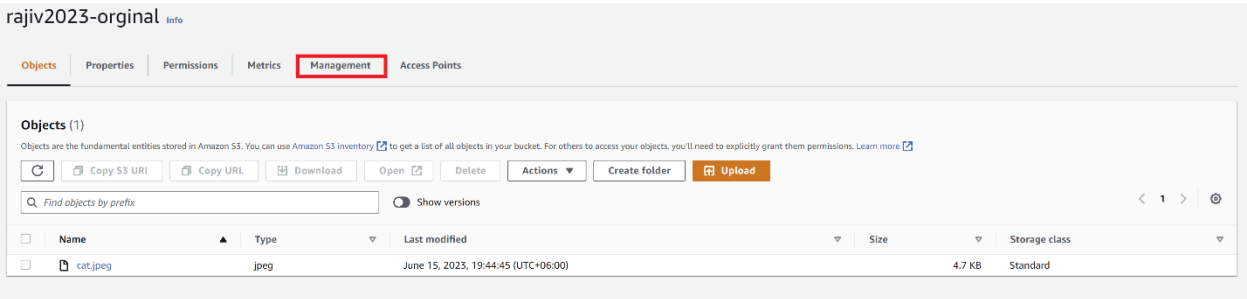
Lab- Replication

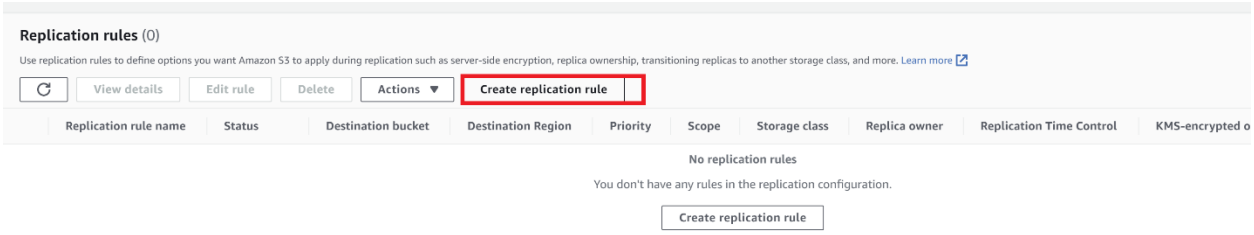
Create 2 buckets with versioning.

1.rajiv2023-original
2.rajiv-2023-replica

Now upload a image to rajiv-2023-orinal

Now enable the replication in rajiv2023-original bucket





Replication rule name

rajiv-2023-original-rule-1

Up to 255 characters. In order to be able to use CloudWatch metrics to monitor the progress of your replication rule, the replication rule name must only contain English characters.

Status

Choose whether the rule will be enabled or disabled when created.

- (●) Enabled
- ( ) Disabled

Priority

The priority value resolves conflicts that occur when an object is eligible for replication under multiple rules to the same destination. The rule is added to the configuration at the highest priority and the priority can be changed on the replication rules table.

0

Source bucket

Source bucket name

rajiv2023-orginal

Source Region

US East (N. Virginia) us-east-1

Choose a rule scope

- ( ) Limit the scope of this rule using one or more filters
- (●) Apply to all objects in the bucket

Destination

Destination

You can replicate objects across buckets in different AWS Regions (Cross-Region Replication) or you can replicate objects across buckets in the same AWS Region (Same-Region Replication). You can also specify a different bucket for each rule in the configuration. Learn more or see Amazon S3 pricing

- (●) Choose a bucket in this account
- ( ) Specify a bucket in another account

Bucket name

Choose the bucket that will receive replicated objects.

rajiv2023-replica [Browse S3]

Destination Region

US East (N. Virginia) us-east-1

IAM role

- (•) Choose from existing IAM roles
- ( ) Enter IAM role ARN

IAM role

Create new role ▼ | ↻ | View

Encryption

Server-side encryption protects data at rest.

- [ ] Replicate objects encrypted with AWS KMS
  You can replicate objects that are encrypted with AWS Key Management Service (AWS KMS) keys.

Destination storage class

Amazon S3 offers a range of storage classes designed for different use cases. Learn more or see Amazon S3 pricing

- [ ] Change the storage class for the replicated objects

Additional replication options

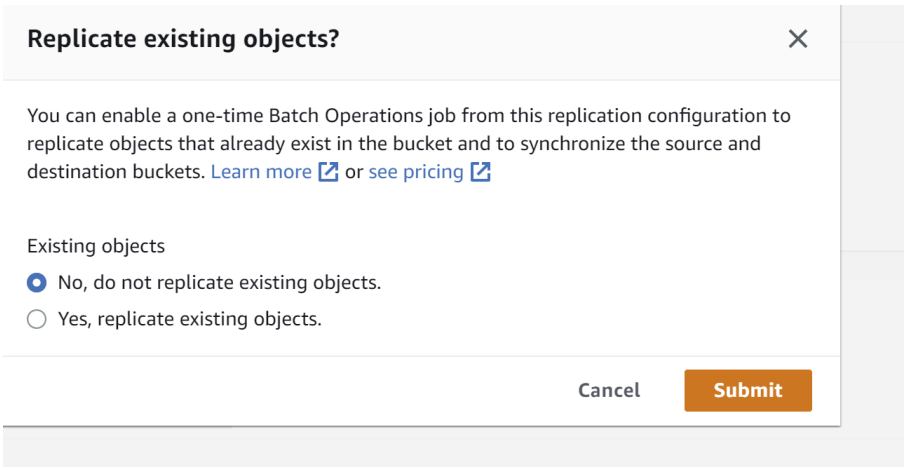
- [ ] Replication Time Control (RTC)
  Replication Time Control replicates 99.99% of new objects within 15 minutes and includes replication metrics. Additional fees will apply. Learn more

- [ ] Replication metrics
  With replication metrics, you can monitor the total number and size of objects that are pending replication, and the maximum replication time to the destination Region. You can also view and diagnose replication failures. CloudWatch metrics fees apply. Learn more or see Amazon CloudWatch pricing

- [ ] Delete marker replication
  Delete markers created by S3 delete operations will be replicated. Delete markers created by lifecycle rules are not replicated. Learn more

- [ ] Replica modification sync
  Replicate metadata changes made to replicas in this bucket to the destination bucket. Learn more

Cancel | Save



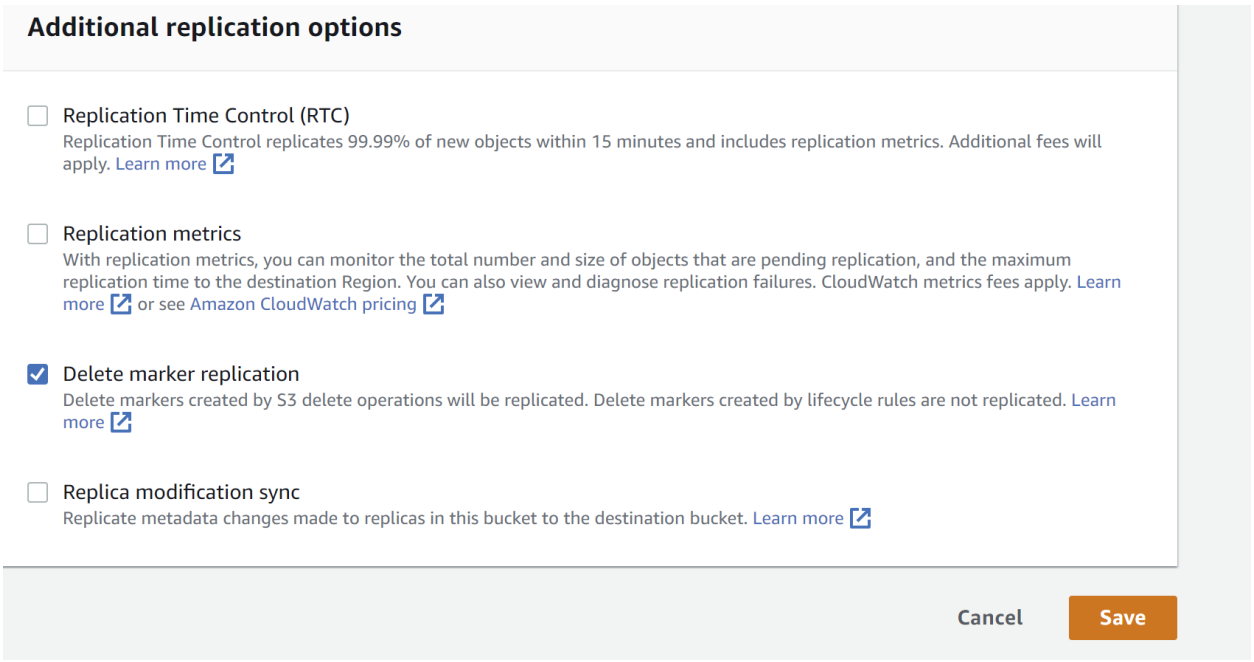
Now upload a picture in rajiv-2023-original

And now go to the rajiv-2023-replica bucket and wait for few seconds and refresh the page and we can see the image is now sowing here.

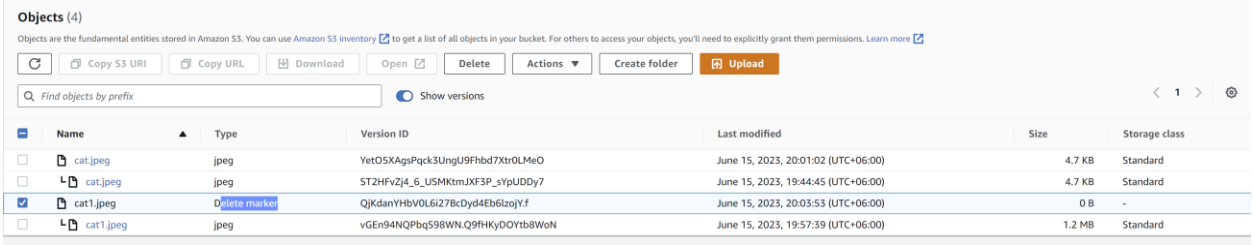
Enable the delete market

select the bucket >Management>select the rule>click edit rule>scroll down >and select the Delete marker replication and save it

Now it we delete any image from the original file the delete maker will replica to the replica bucket



NB: When we delete any image, it will not copy to the replica bucket it only copy delete marker.
if we delete the image from original file permanently it will not delete the file from replica



S3 Storage Class

- Amazon S3 Standard - General Purpose
- Amazon S3 Standard-Infrequent Access (IA)
- Amazon S3 One Zone-Infrequent Access
- Amazon S3 Glacier Instant Retrieval
- Amazon S3 Glacier Flexible Retrieval
- Amazon S3 Glacier Deep Archive
- Amazon S3 Intelligent Tiering

- Can move between classes manually or using S3 Lifecycle configurations

S3 Durability Ad Availability

- Durability:
  - High durability (99.999999999%, 11 9's) of objects across multiple AZ
  - If you store 10,000,000 objects with Amazon S3, you can on average expect to incur a loss of a single object once every 10,000 years
  - Same for all storage classes

- Availability:
  - Measures how readily available a service is
  - Varies depending on storage class
  - Example: S3 standard has 99.99% availability = not available 53 minutes a year

S3 Standard – General

- 99.99% Availability
- Used for frequently accessed data
- Low latency and high throughput
- Sustain 2 concurrent facility failures

- Use Cases: Big Data analytics, mobile & gaming applications, content distribution…

S3 Storage Classes – Infrequent Access

- For data that is less frequently accessed, but requires rapid access when needed
- Lower cost than S3 Standard

- Amazon S3 Standard-Infrequent Access (S3 Standard-IA)
  - 99.9% Availability
  - Use cases: Disaster Recovery, backups

- Amazon S3 One Zone-Infrequent Access (S3 One Zone-IA)
  - High durability (99.999999999%) in a single AZ; data lost when AZ is destroyed
  - 99.5% Availability
  - Use Cases: Storing secondary backup copies of on-premise data, or data you can recreate

S3 Glacier Storage Classes

- Low-cost object storage meant for archiving / backup
- Pricing: price for storage + object retrieval cost

- Amazon S3 Glacier Instant Retrieval
  - Millisecond retrieval, great for data accessed once a quarter
  - Minimum storage duration of 90 days
- Amazon S3 Glacier Flexible Retrieval (formerly Amazon S3 Glacier):
  - Expedited (1 to 5 minutes), Standard (3 to 5 hours), Bulk (5 to 12 hours) – free
  - Minimum storage duration of 90 days
- Amazon S3 Glacier Deep Archive – for long term storage:
  - Standard (12 hours), Bulk (48 hours)
  - Minimum storage duration of 180 days

S3 Intelligent – Tiering

- Small monthly monitoring and auto-tiering fee
- Moves objects automatically between Access Tiers based on usage
- There are no retrieval charges in S3 Intelligent-Tiering

- *Frequent Access tier (automatic):* default tier
- *Infrequent Access tier (automatic)*: objects not accessed for 30 days
- *Archive Instant Access tier (automatic):* objects not accessed for 90 days
- *Archive Access tier (optional):* configurable from 90 days to 700+ days
- *Deep Archive Access tier (optional):* config. from 180 days to 700+ days

S3 Storage Classes Comparison

	Standard	Intelligent-Tiering	Standard-IA	One Zone-IA	Glacier Instant Retrieval	Glacier Flexible Retrieval	Glacier Deep Archive
Durability	99.999999999% == (11 9's)						
Availability	99.99%	99.9%	99.9%	99.5%	99.9%	99.99%	99.99%
Availability SLA	99.9%	99%	99%	99%	99%	99.9%	99.9%
Availability Zones	>= 3	>= 3	>= 3	1	>= 3	>= 3	>= 3
Min. Storage Duration Charge	None	None	30 Days	30 Days	90 Days	90 Days	180 Days
Min. Billable Object Size	None	None	128 KB	128 KB	128 KB	40 KB	40 KB
Retrieval Fee	None	None	Per GB retrieved	Per GB retrieved	Per GB retrieved	Per GB retrieved	Per GB retrieved

S3 Storage Classes – Price Comparison Example: us-east-1

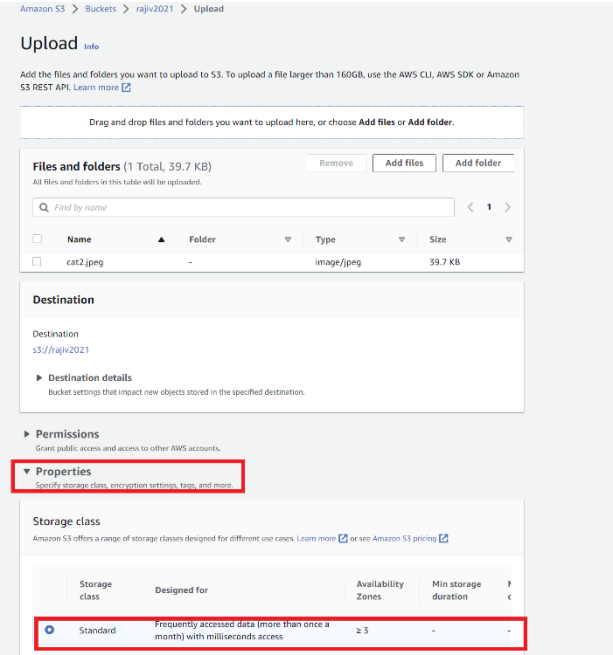
	Standard	Intelligent-Tiering	Standard-IA	One Zone-IA	Glacier Instant Retrieval	Glacier Flexible Retrieval	Glacier Deep Archive
Storage Cost (per GB per month)	$0.023	$0.0025 - $0.023	%0.0125	$0.01	$0.004	$0.0036	$0.00099
Retrieval Cost (per 1000 request)	**GET:** $0.0004 **POST:** $0.005	**GET:** $0.0004 **POST:** $0.005	**GET:** $0.001 **POST:** $0.01	**GET:** $0.001 **POST:** $0.01	**GET:** $0.01 **POST:** $0.02	**GET:** $0.0004 **POST:** $0.03 **Expedited:** $10 **Standard:** $0.05 **Bulk:** free	**GET:** $0.0004 **POST:** $0.05 **Standard:** $0.10 **Bulk:** $0.025
Retrieval Time	Instantaneous					**Expedited** (1 – 5 mins) **Standard** (3 – 5 hours) Bulk (5 – 12 hours)	**Standard** (12 hours) **Bulk** (48 hours)
Monitoring Cost (pet 1000 objects)		$0.0025					

Pricing URL:
https://aws.amazon.com/s3/pricing/

Storage class details
https://aws.amazon.com/s3/storage-classes/

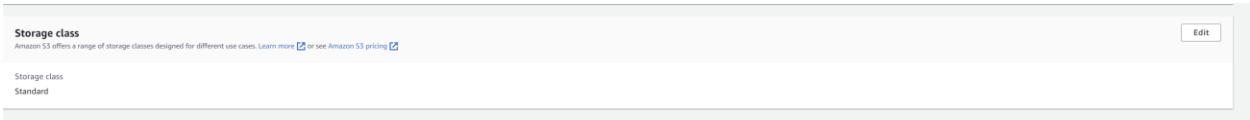
Lab: storage class

Create a bucket and then upload image
or
Choose storage class when upload an image

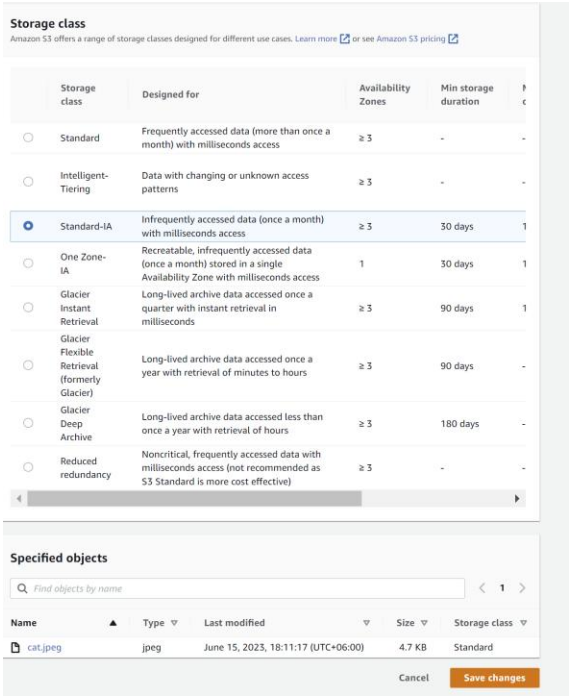


Edit the storage class

click the image>scroll down>click Edit button of Storage class

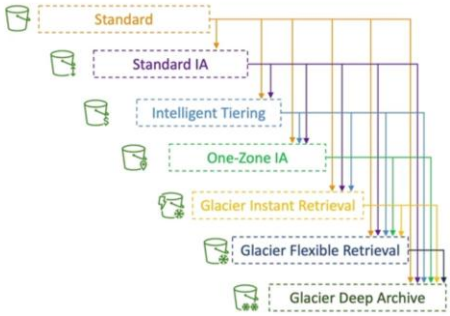


Now select any class and click save changes.



Amazon S3 – Moving between Storage Classes

- You can transition objects between storage classes
- For infrequently accessed object, move them to **Standard IA**
- For archive objects that you don't need fast access to, move them to **Glacier or Glacier Deep Archive**
- Moving objects can be automated using a **Lifecycle Rules**

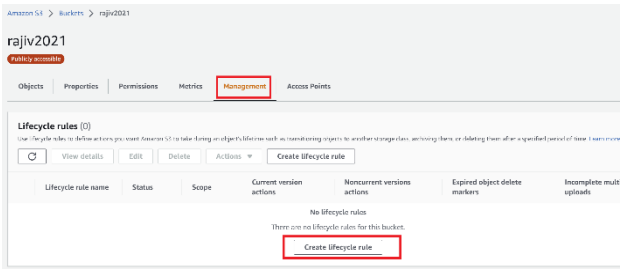


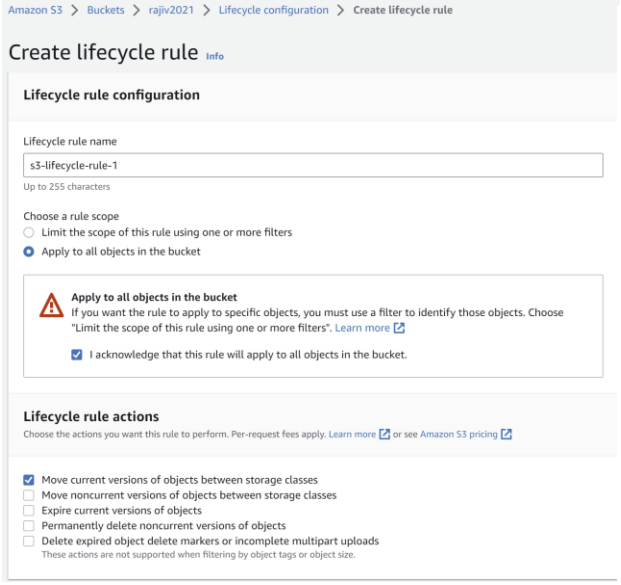
Amazon S3 – Life cycle rule

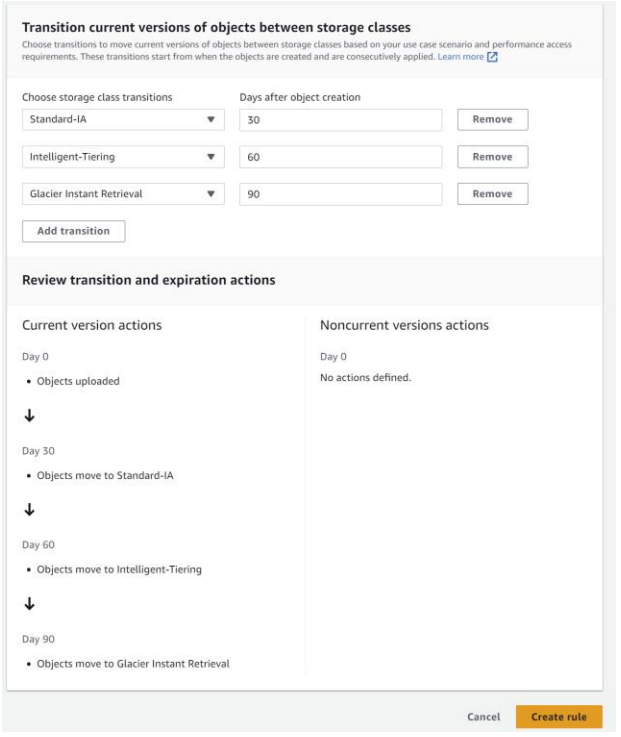
- **Transition Actions** – configure objects to transition to another storage class
  - Move objects to Standard IA class 60 days after creation
  - Move to Glacier for archiving after 6 months
- **Expiration actions** – configure objects to expire (delete) after some time
  - Access log files can be set to delete after a 365 days
  - Can be used to delete old versions of files (if versioning is enabled)
  - Can be used to delete incomplete Multi-Part uploads
- Rules can be created for a certain prefix (example: *s3://mybucket/mp3/**)
- Rules can be created for certain objects Tags (example: *Department: Finance*)

LAB: Create life cycle rule:

Select or get in the bucket > Management>crate lifecycle rule:


rajiv2021
Publicly accessible
Objects
Properties
Permissions
Metrics
Management
Access Points
Lifecycle rules (0)
View details
Edit
Delete
Actions
Create lifecycle rule
Lifecycle rule name
Status
Scope
Current version actions
Noncurrent versions actions
Expired object delete markers
No lifecycle rules
There are no lifecycle rules for this bucket.
Create lifecycle rule


Amazon S3 > Buckets > rajiv2021 > Lifecycle configuration > Create lifecycle rule
Create lifecycle rule Info
Lifecycle rule configuration
Lifecycle rule name
s3-lifecycle-rule-1
Up to 255 characters
Choose a rule scope
Limit the scope of this rule using one or more filters
Apply to all objects in the bucket
Apply to all objects in the bucket
If you want the rule to apply to specific objects, you must use a filter to identify those objects. Choose "Limit the scope of this rule using one or more filters". Learn more
I acknowledge that this rule will apply to all objects in the bucket.
Lifecycle rule actions
Choose the actions you want this rule to perform. Per-request fees apply. Learn more or see Amazon S3 pricing
Move current versions of objects between storage classes
Move noncurrent versions of objects between storage classes
Expire current versions of objects
Permanently delete noncurrent versions of objects
Delete expired object delete markers or incomplete multipart uploads
These actions are not supported when filtering by object tags or object size.


Transition current versions of objects between storage classes
Choose transitions to move current versions of objects between storage classes based on your use case scenario and performance access requirements. These transitions start from when the objects are created and are consecutively applied. Learn more
Choose storage class transitions
Days after object creation
Standard-IA
30
Remove
Intelligent-Tiering
60
Remove
Glacier Instant Retrieval
90
Remove
Add transition
Review transition and expiration actions
Current version actions
Day 0
Objects uploaded
Day 30
Objects move to Standard-IA
Day 60
Objects move to Intelligent-Tiering
Day 90
Objects move to Glacier Instant Retrieval
Noncurrent versions actions
Day 0
No actions defined.
Cancel
Create rule

Amazon S3 – Life cycle rules (Scenario-1)

- Your application on EC2 creates images thumbnails after profile photos are uploaded to Amazon S3. These thumbnails can be easily recreated, and only need to be kept for 60 days. The source images should be able to be immediately retrieved for these 60 days, and afterwards, the user can wait up to 6 hours. How would you design this?

- S3 source images can be on **Standard**, with a lifecycle configuration to transition them to **Glacier** after 60 days
- S3 thumbnails can be on **One-Zone IA**, with a lifecycle configuration to expire them (delete them) after 60 days

Amazon S3 – Life cycle rules (Scenario-2)

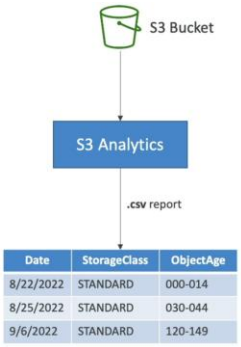
- A rule in your company states that you should be able to recover your deleted S3 objects immediately for 30 days, although this may happen rarely. After this time, and for up to 365 days, deleted objects should be recoverable within 48 hours.

- Enable **S3 Versioning** in order to have object versions, so that "deleted objects" are in fact hidden by a "delete marker" and can be recovered
- Transition the "noncurrent versions" of the object to **Standard IA**
- Transition afterwards the "noncurrent versions" to **Glacier Deep Archive**

NB: non-current version means when we delete any object that object is save with a delete marker this deleted objects are non-current version.

Amazon S3 Analytics – Storage Class Analysis

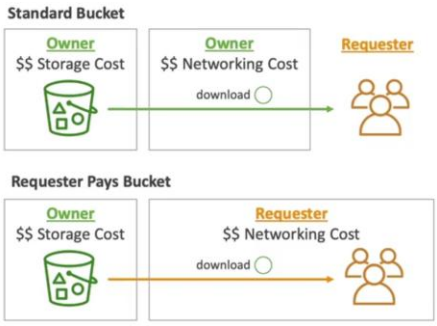
- Help you decide when to transition objects to the right storage class
- Recommendations for **Standard** and **Standard IA**
  - Does NOT work for One-Zone IA or Glacier
- Report is updated daily
- 24 to 48 hours to start seeing data analysis



Date	StorageClass	ObjectAge
8/22/2022	STANDARD	000-014
8/25/2022	STANDARD	030-044
9/6/2022	STANDARD	120-149

S3 Requester pay.

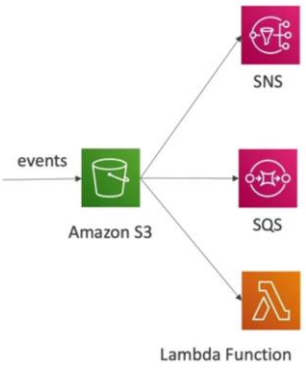
- In general, bucket owners pay for all Amazon S3 storage and data transfer costs associated with their bucket
- With **Requester Pays buckets**, the requester instead of the bucket owner pays the cost of the request and the data download from the bucket
- Helpful when you want to share large datasets with other accounts
- The requester must be authenticated in AWS (cannot be anonymous)



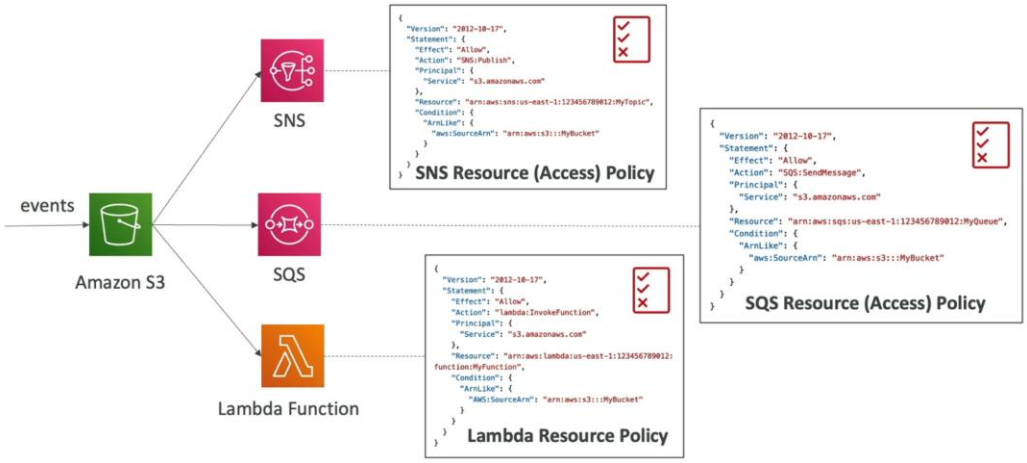
S3 Event Notifications

- S3:ObjectCreated, S3:ObjectRemoved, S3:ObjectRestore, S3:Replication…
- Object name filtering possible (*.jpg)
- Use case: generate thumbnails of images uploaded to S3
- Can create as many "S3 events" as desired

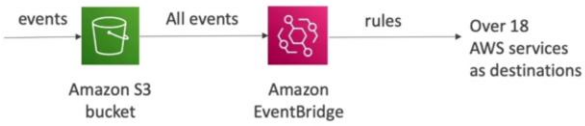
- S3 event notifications typically deliver events in seconds but can sometimes take a minute or longer



S3 Event Notifications – IAM Permissions



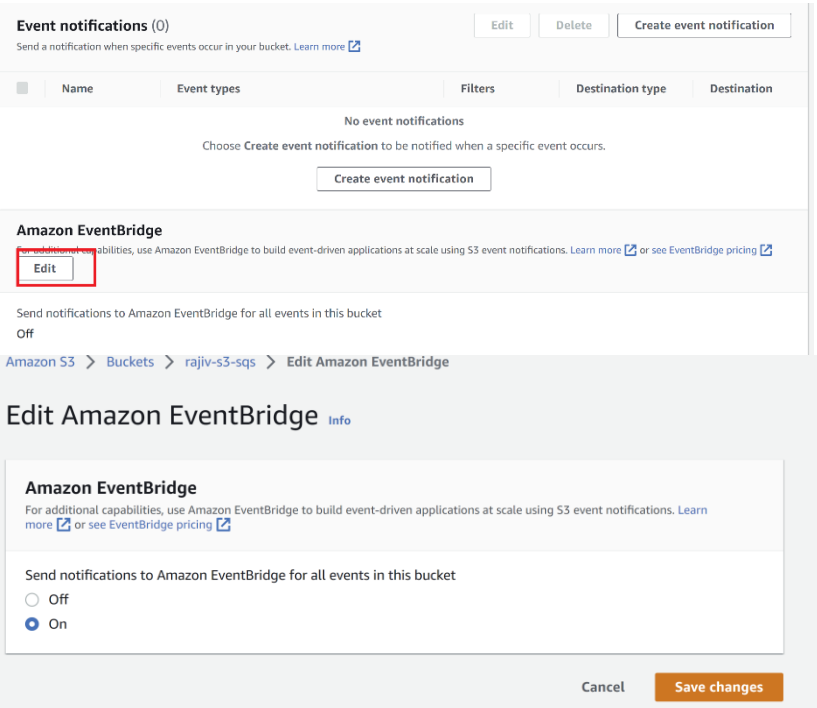
S3 Event Notifications with Amazon EventBridge



- Advanced filtering options with JSON rules (metadata, object size, name...)
- Multiple Destinations – ex Step Functions, Kinesis Streams / Firehose…
- EventBridge Capabilities – Archive, Replay Events, Reliable delivery

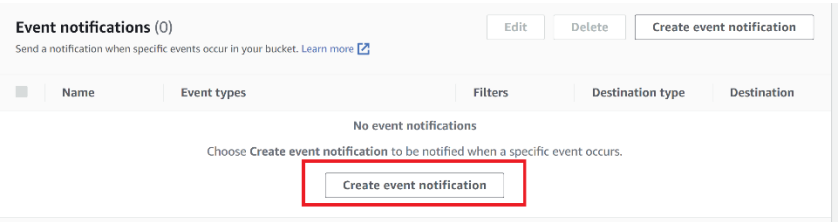
Lab: s3 event notification

Create a bucket
select the bucket>properties>scroll down>edit amazon event bridge>select ON>click save changes.



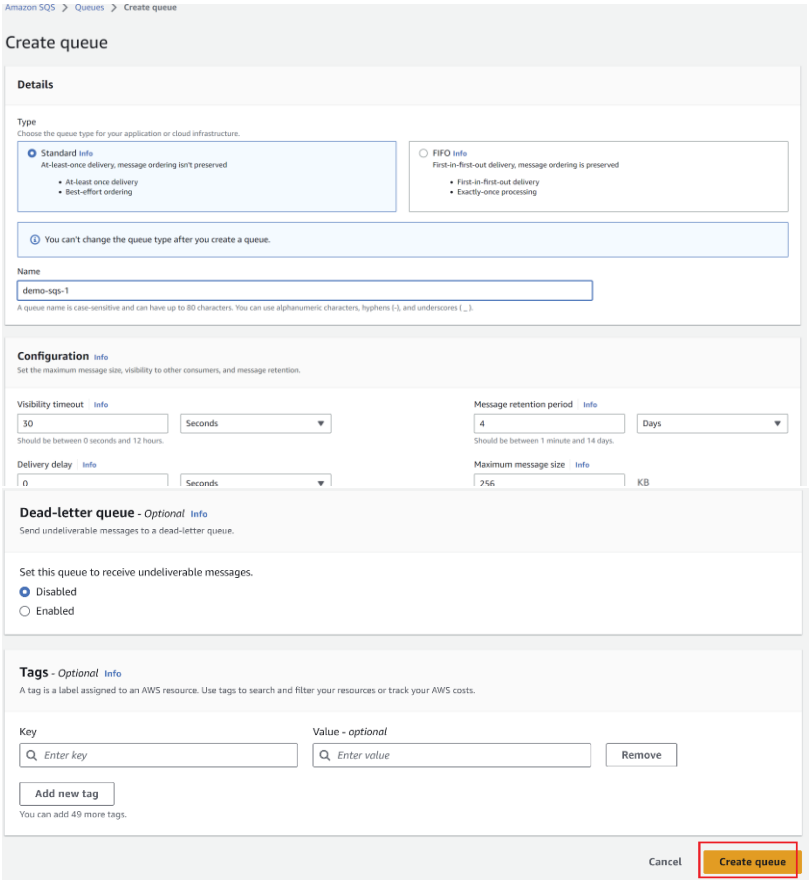
Event bridge is complicated so we will only see event notifications.

select the bucket>properties>scroll down>click event notification

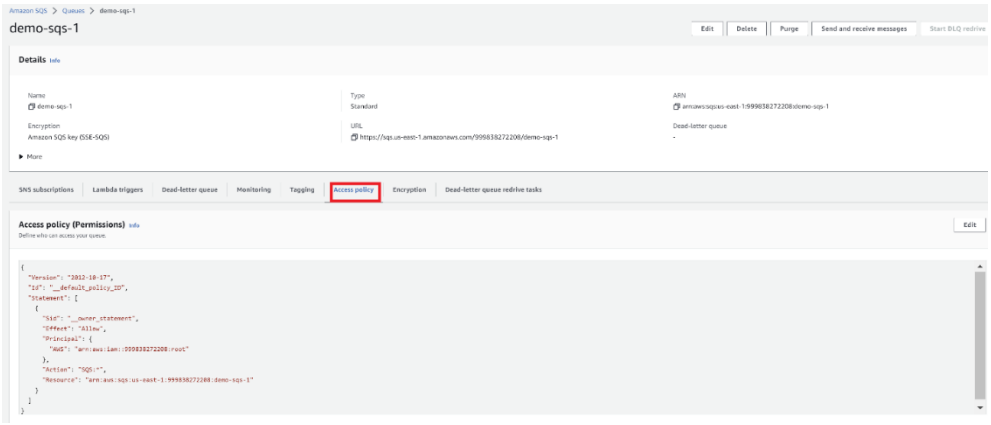


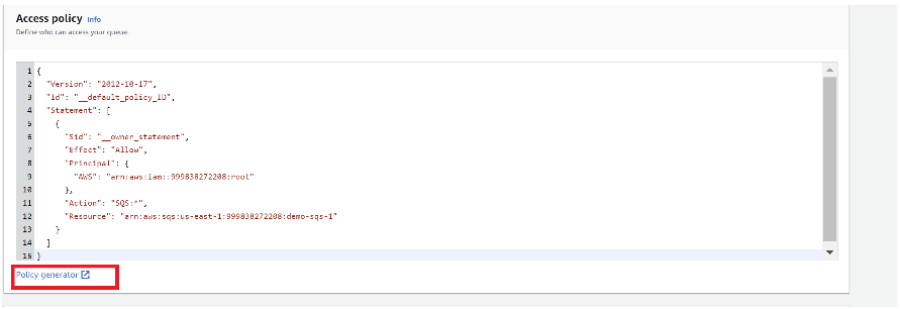
keep on the create notification page

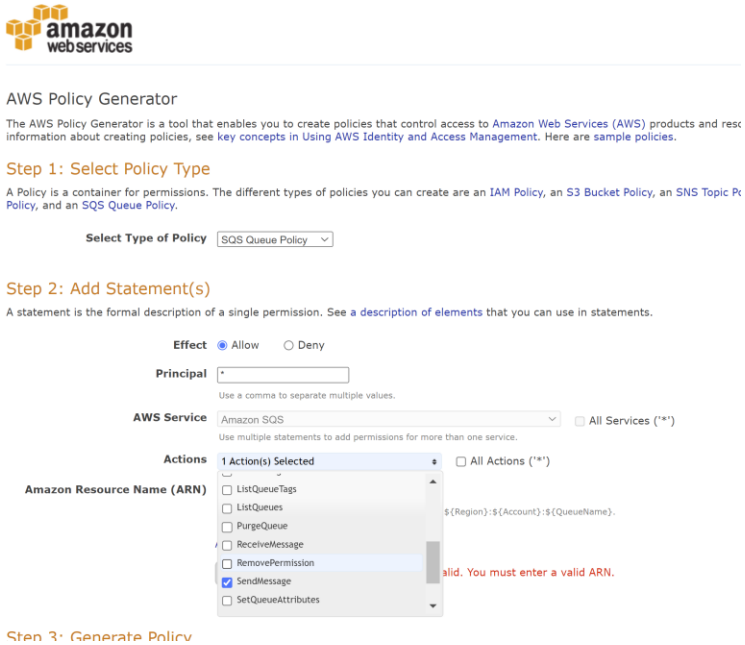
now create a SQS

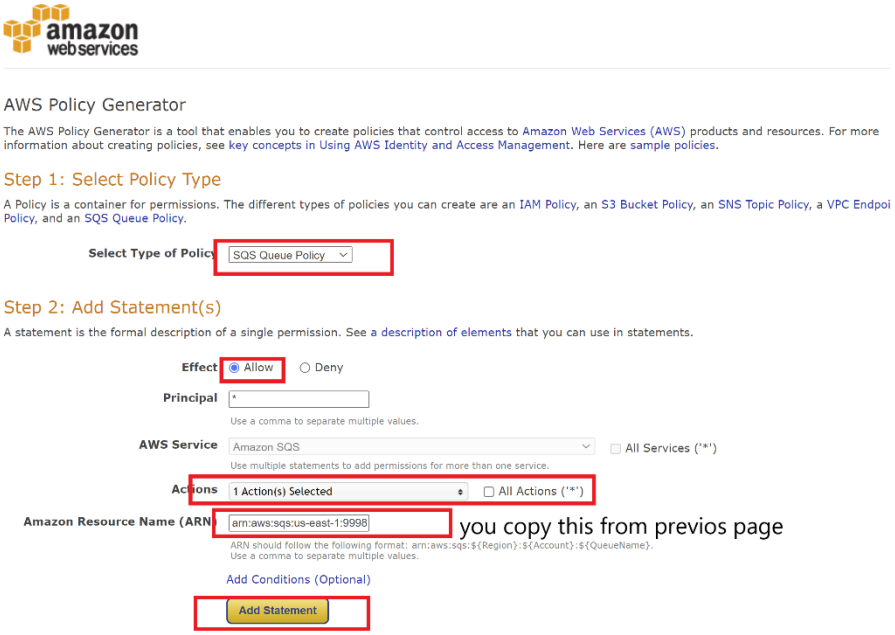


After clicking the create queue then click the access policy

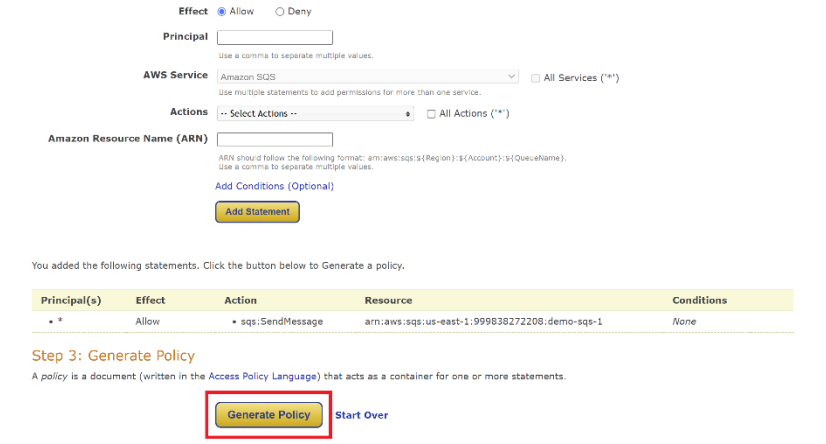


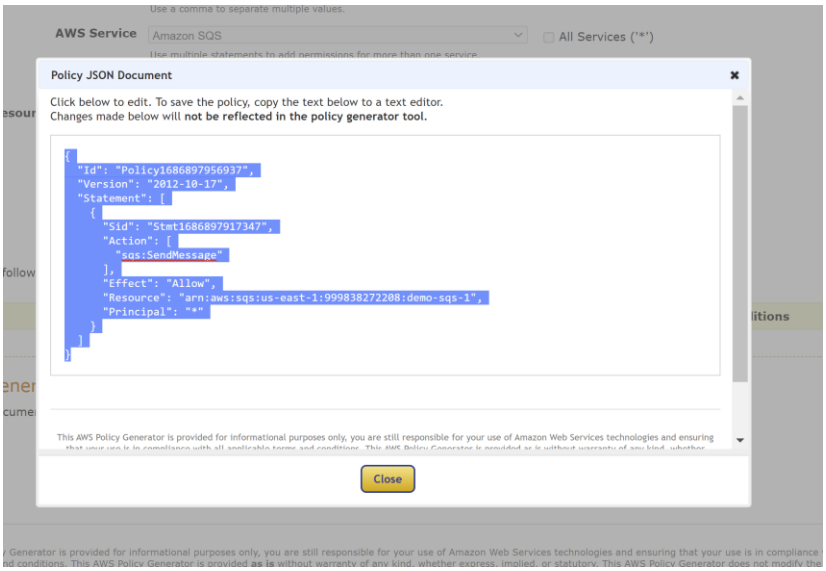

Access policy Info
Define who can access your queue.
{
"Version": "2012-10-17",
"Id": "__default_policy_ID",
"Statement": [
{
"Sid": "__owner_statement",
"Effect": "Allow",
"Principal": {
"AWS": "arn:aws:iam::999838272208:root"
},
"Action": "SQS:*",
"Resource": "arn:aws:sqs:us-east-1:999838272208:demo-sqs-1"
}
]
}
Policy generator


amazon web services
AWS Policy Generator
The AWS Policy Generator is a tool that enables you to create policies that control access to Amazon Web Services (AWS) products and resc
information about creating policies, see key concepts in Using AWS Identity and Access Management. Here are sample policies.
Step 1: Select Policy Type
A Policy is a container for permissions. The different types of policies you can create are an IAM Policy, an S3 Bucket Policy, an SNS Topic Pc
Policy, and an SQS Queue Policy.
Select Type of Policy
SQS Queue Policy
Step 2: Add Statement(s)
A statement is the formal description of a single permission. See a description of elements that you can use in statements.
Effect
Allow
Deny
Principal
*
Use a comma to separate multiple values.
AWS Service
Amazon SQS
All Services ('*')
Use multiple statements to add permissions for more than one service.
Actions
1 Action(s) Selected
All Actions ('*')
Amazon Resource Name (ARN)
ListQueueTags
ListQueues
PurgeQueue
ReceiveMessage
RemovePermission
SendMessage
SetQueueAttributes
${Region}:${Account}:${QueueName}.
alid. You must enter a valid ARN.
Step 3: Generate Policy

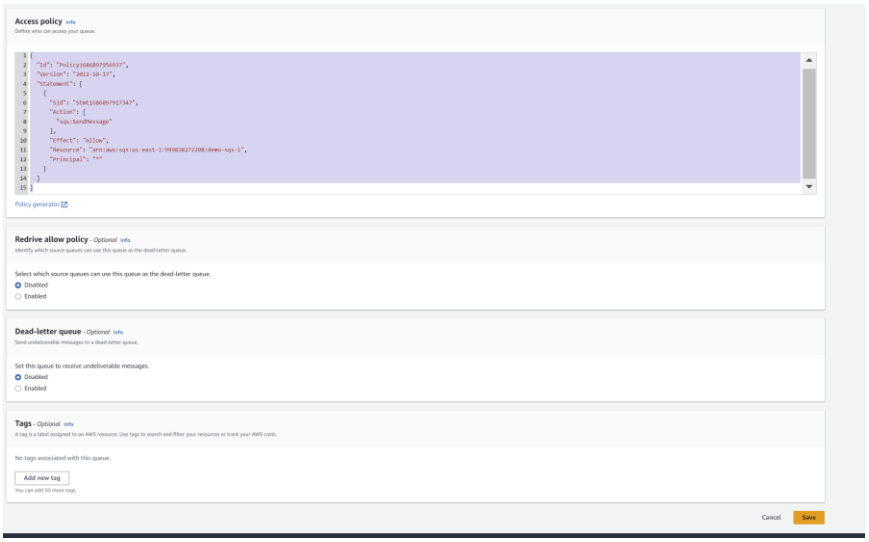

amazon web services
AWS Policy Generator
The AWS Policy Generator is a tool that enables you to create policies that control access to Amazon Web Services (AWS) products and resources. For more
information about creating policies, see key concepts in Using AWS Identity and Access Management. Here are sample policies.
Step 1: Select Policy Type
A Policy is a container for permissions. The different types of policies you can create are an IAM Policy, an S3 Bucket Policy, an SNS Topic Policy, a VPC Endpoi
Policy, and an SQS Queue Policy.
Select Type of Policy
SQS Queue Policy
Step 2: Add Statement(s)
A statement is the formal description of a single permission. See a description of elements that you can use in statements.
Effect
Allow
Deny
Principal
*
Use a comma to separate multiple values.
AWS Service
Amazon SQS
All Services ('*')
Use multiple statements to add permissions for more than one service.
Actions
1 Action(s) Selected
All Actions ('*')
Amazon Resource Name (ARN)
arn:aws:sqs:us-east-1:9998
you copy this from previos page
ARN should follow the following format: arn:aws:sqs:${Region}:${Account}:${QueueName}.
Use a comma to separate multiple values.
Add Conditions (Optional)
Add Statement

After clicking Add Statement

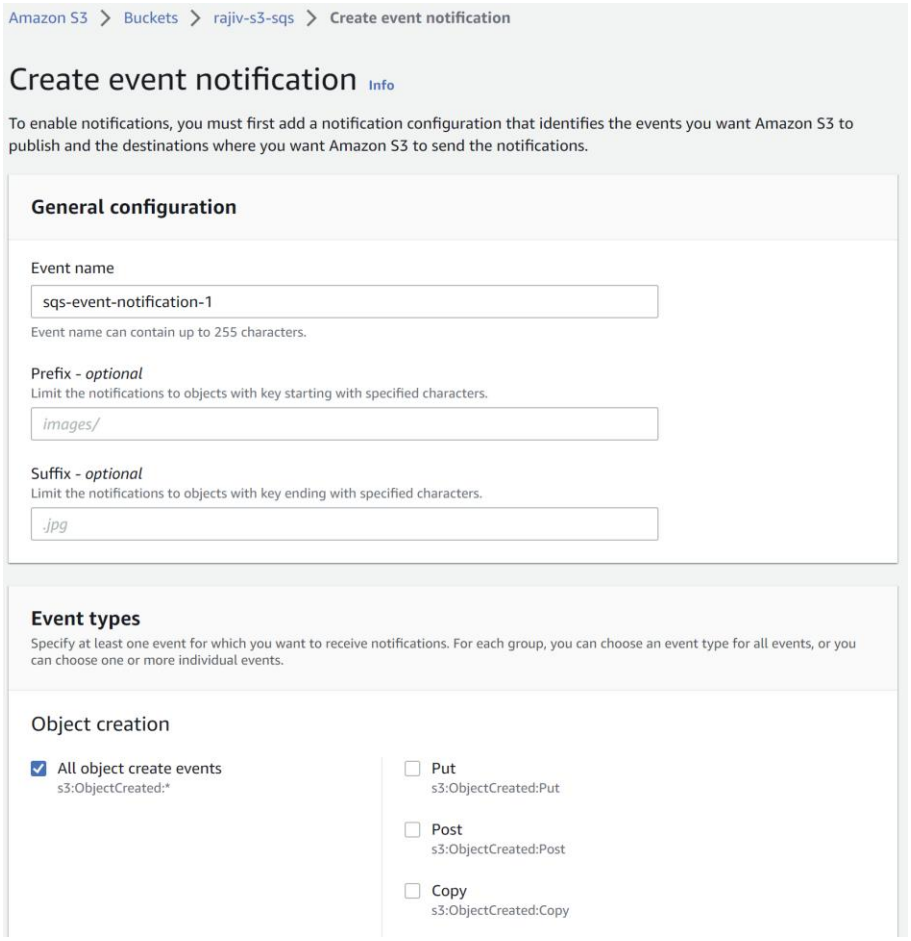




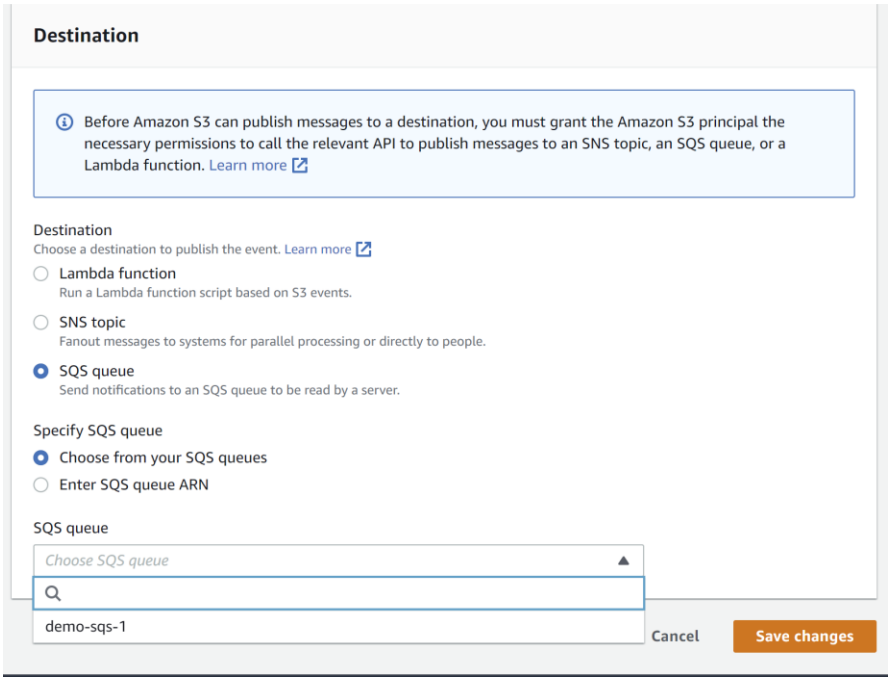
Now copy this and pest it in access policy which is in previous page and save it



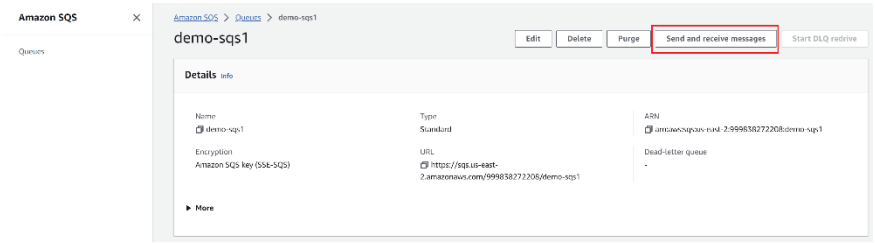
Now go back to event notification page and a event notification



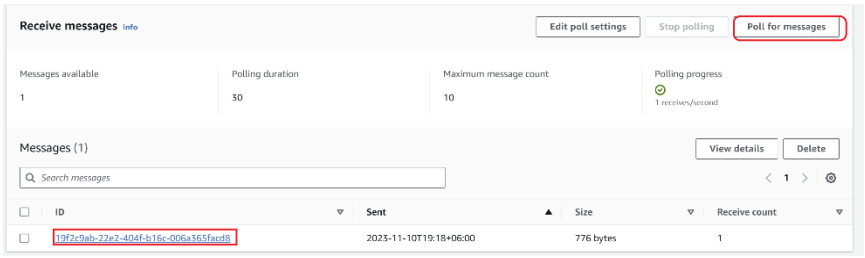
Scroll down



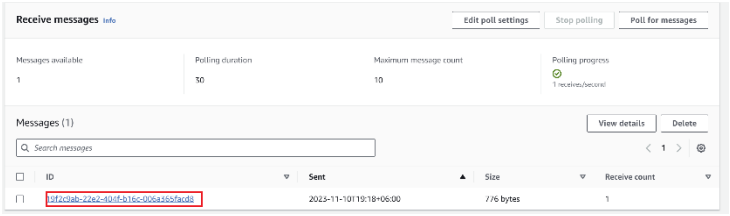
After create event notification go to SQS page click send and receive message button



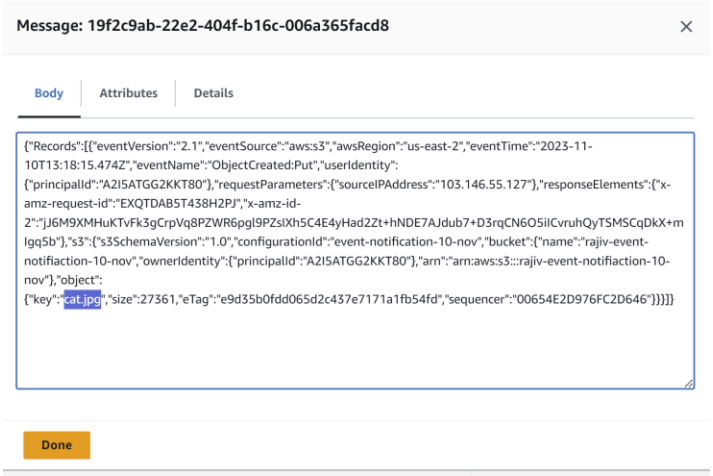
Scroll down and pull the message as shown below



Now select the message and delete it
Now upload an image to that bucket where we create the event notification
now go to the SQS page and click pull for message
Now click the message id



After clicking the id we get the message where is show the upload image details.



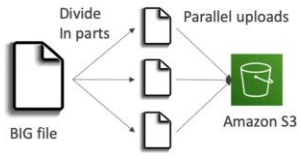
After reading the message delete it

S3- Baseline performance

- Amazon S3 automatically scales to high request rates, latency 100-200 ms
- Your application can achieve at least 3,500 PUT/COPY/POST/DELETE or 5,500 GET/HEAD requests per second per prefix in a bucket.
- There are no limits to the number of prefixes in a bucket.
- Example (object path => prefix):
  - bucket/folder1/sub1/file => /folder1/sub1/
  - bucket/folder1/sub2/file => /folder1/sub2/
  - bucket/1/file => /1/
  - bucket/2/file => /2/
- If you spread reads across all four prefixes evenly, you can achieve 22,000 requests per second for GET and HEAD

S3 performance

- Multi-Part upload:
  - recommended for files > 100MB, must use for files > 5GB
  - Can help parallelize uploads (speed up transfers)

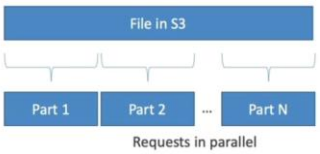


- S3 Transfer Acceleration
  - Increase transfer speed by transferring file to an AWS edge location which will forward the data to the S3 bucket in the target region
  - Compatible with multi-part upload

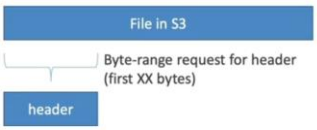
S3 performance – S3 Byte-Range Fetches

- Parallelize GETs by requesting specific byte ranges
- Better resilience in case of failures

Can be used to speed up downloads

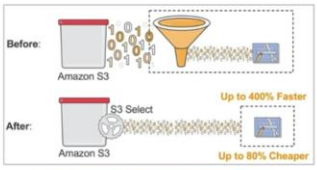


Can be used to retrieve only partial data (for example the head of a file)



S3 Select and Glacier Select

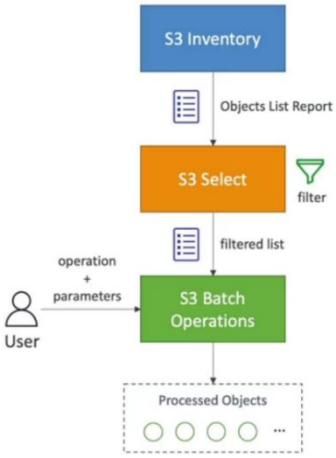
- Retrieve less data using SQL by performing server-side filtering
- Can filter by rows & columns (simple SQL statements)
- Less network transfer, less CPU cost client-side



https://aws.amazon.com/blogs/aws/s3-glacier-select/

S3 Batch Operations

- Perform bulk operations on existing S3 objects with a single request, example:
  - Modify object metadata & properties
  - Copy objects between S3 buckets
  - Encrypt un-encrypted objects
  - Modify ACLs, tags
  - Restore objects from S3 Glacier
  - Invoke Lambda function to perform custom action on each object
- A job consists of a list of objects, the action to perform, and optional parameters
- S3 Batch Operations manages retries, tracks progress, sends completion notifications, generate reports …
- You can use S3 Inventory to get object list and use S3 Select to filter your objects



S3 – Object Encryption

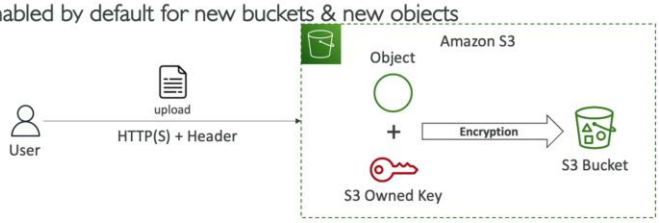
- You can encrypt objects in S3 buckets using one of 4 methods

- Server-Side Encryption (SSE)
  - Server-Side Encryption with Amazon S3-Managed Keys (SSE-S3) – Enabled by Default
    - Encrypts S3 objects using keys handled, managed, and owned by AWS
  - Server-Side Encryption with KMS Keys stored in AWS KMS (SSE-KMS)
    - Leverage AWS Key Management Service (AWS KMS) to manage encryption keys
  - Server-Side Encryption with Customer-Provided Keys (SSE-C)
    - When you want to manage your own encryption keys
- Client-Side Encryption

- It's important to understand which ones are for which situation for the exam

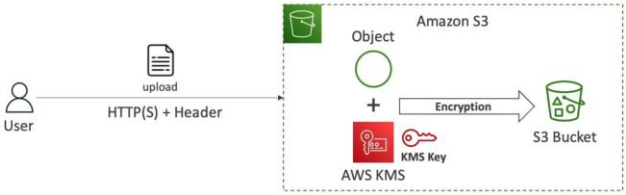
S3 Encryption – SSE-S3

- Encryption using keys handled, managed, and owned by AWS
- Object is encrypted server-side
- Encryption type is AES-256
- Must set header "x-amz-server-side-encryption": "AES256"
- Enabled by default for new buckets & new objects



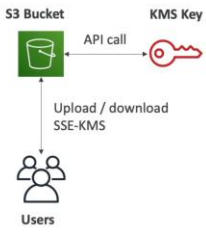
S3 Encryption – SSE-KMS

- Encryption using keys handled and managed by AWS KMS (Key Management Service)
- KMS advantages: user control + audit key usage using CloudTrail
- Object is encrypted server side
- Must set header "x-amz-server-side-encryption": "aws:kms"



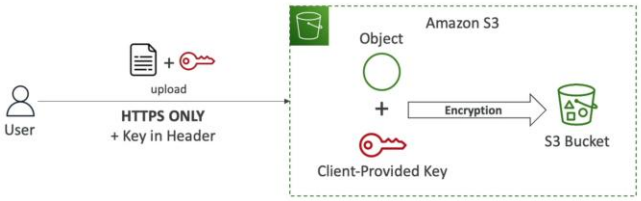
SSE-KMS Limitation

- If you use SSE-KMS, you may be impacted by the KMS limits
- When you upload, it calls the GenerateDataKey KMS API
- When you download, it calls the Decrypt KMS API
- Count towards the KMS quota per second (5500, 10000, 30000 req/s based on region)
- You can request a quota increase using the Service Quotas Console



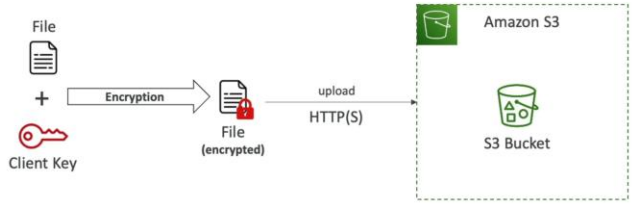
S3 Encryption – SSE-C

- Server-Side Encryption using 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



Amazon S3 Encryption – Client- Side Encryption

- Use client libraries such as **Amazon S3 Client-Side Encryption Library**
- Clients must encrypt data themselves before sending to Amazon S3
- Clients must decrypt data themselves when retrieving from Amazon S3
- Customer fully manages the keys and encryption cycle



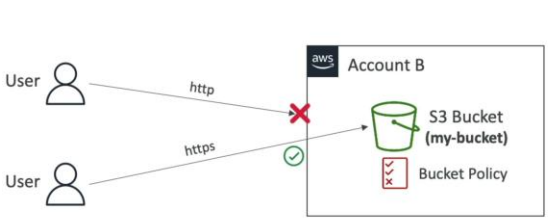
Amazon S3 Encryption in transit (SSL/TSL)

- Encryption in flight is also called SSL/TLS

- Amazon S3 exposes two endpoints:
  - HTTP Endpoint – non encrypted
  - HTTPS Endpoint – encryption in flight

- HTTPS is recommended
- HTTPS is mandatory for SSE-C
- Most clients would use the HTTPS endpoint by default

Amazon S3 – Force Encryption in Transit aws: Secure Transport




```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Deny",
            "Principal": "*",
            "Action": "s3:GetObject",
            "Resource": "arn:aws:s3:::my-bucket/*",
            "Condition": {
                "Bool": {
                    "aws:SecureTransport": "false"
                }
            }
        }
    ]
}
```

Amazon S3 – Default Encryption vs Bucket Policies

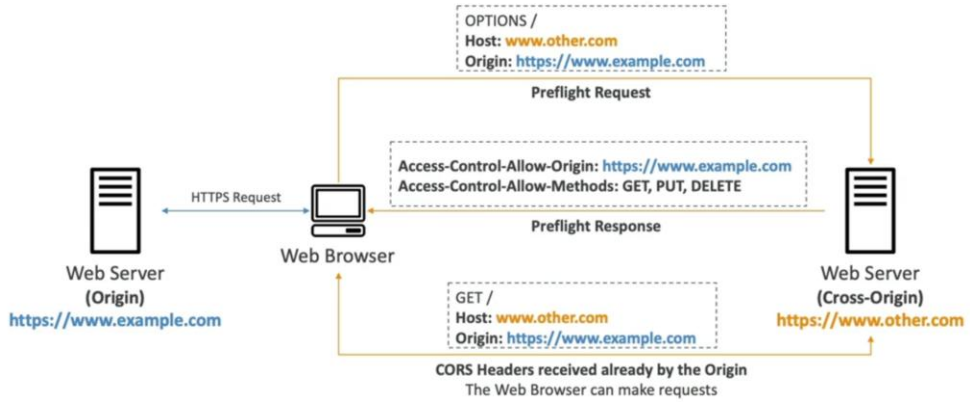
- SSE-S3 encryption is automatically applied to new objects stored in S3 bucket
- Optionally, you can "force encryption" using a bucket policy and refuse any API call to PUT an S3 object without encryption headers (SSE-KMS or SSE-C)

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Deny",
            "Action": "s3:PutObject",
            "Principal": "*",
            "Resource": "arn:aws:s3:::my-bucket/*",
            "Condition": {
                "StringNotEquals": {
                    "s3:x-amz-server-side-encryption": "aws:kms"
                }
            }
        }
    ]
}
```

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Deny",
            "Action": "s3:PutObject",
            "Principal": "*",
            "Resource": "arn:aws:s3:::my-bucket/*",
            "Condition": {
                "Null": {
                    "s3:x-amz-server-side-encryption-customer-algorithm": "true"
                }
            }
        }
    ]
}
```

CORS (Cross Origin Resource Sharing)

- Cross-Origin Resource Sharing (CORS)
- Origin = scheme (protocol) + host (domain) + port
  - example: https://www.example.com (implied port is 443 for HTTPS, 80 for HTTP)
- 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 (example: Access-Control-Allow-Origin)



CORS use in S3

- If a client makes 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)

Lab: CORS

step: 1

first create a bucket with public enable then enable static web hosting and also add the Json script to access the bucket publicly

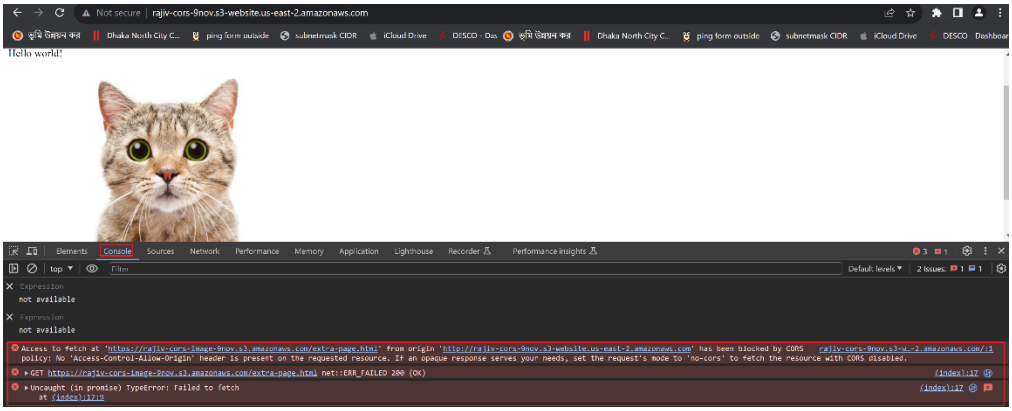
upload 3 filles index.html,extra-page.html,cat.jpg

now brows the static web page- extra-page bottom portion is coming

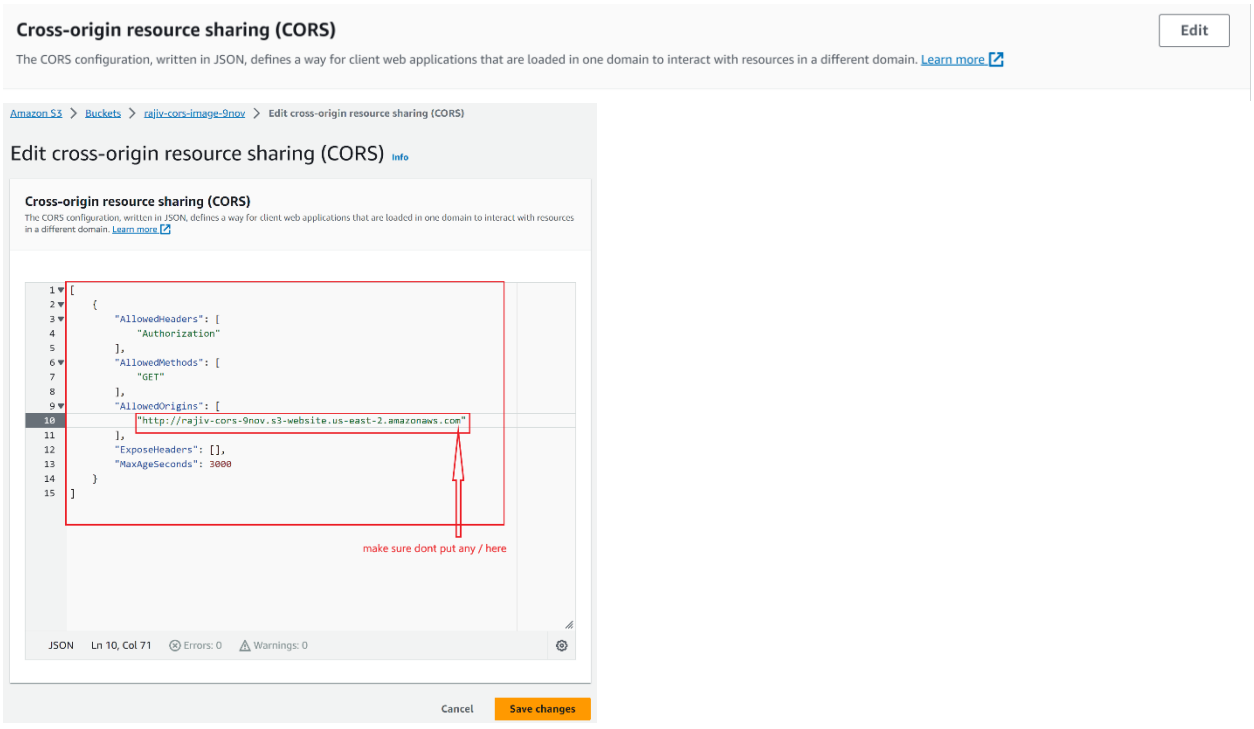
Step:2

Now, create another bucket with public enable then enable static web hosting and json script for access publicly upload the extra-page.html and check the URL that this page is showing the page

Step:3
now go to the previous bucket and delete the extra-page.html
now brose the bucket one URL and we can see the bottom extra page option is not coming
edit the index page add the extra page URL (https://rajiv-cors-image-9nov.s3.amazonaws.com/extra-page.html) to the index file which we get from image bucket. Now upload the index file
now brows the first bucket webpage with developer toll and we can see there is error come



Step:4
now in the 2nd bucket add the cross Json script and save
select the image bucket >permission >scroll down > click the edit and then pest the script and save changes as shown below



now browse the page and we can see page is showing properly and don't get any error in the console.

Amazon S3 MFA Delete

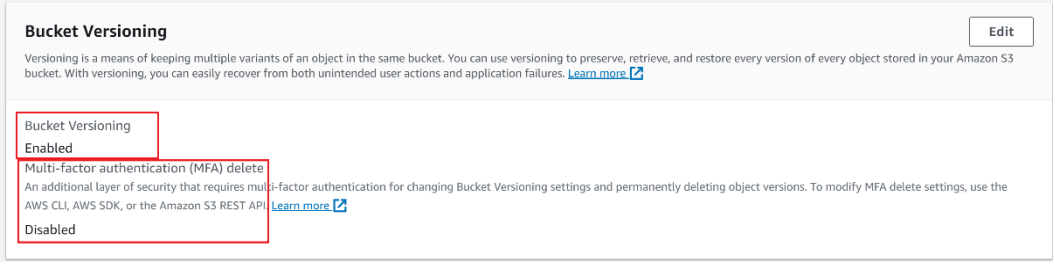
- MFA (Multi-Factor Authentication) – force users to generate a code on a device (usually a mobile phone or hardware) before doing important operations on S3
- MFA will be required to:
  - Permanently delete an object version
  - Suspend Versioning on the bucket
- MFA won't be required to:
  - Enable Versioning
  - List deleted versions
- To use MFA Delete, Versioning must be enabled on the bucket
- Only the bucket owner (root account) can enable/disable MFA Delete

Google Authenticator

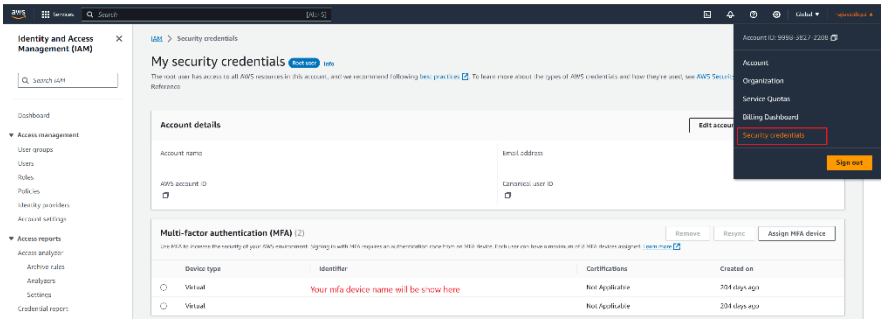
MFA Hardware Device

Lab: MFA enable and disable on a bucket

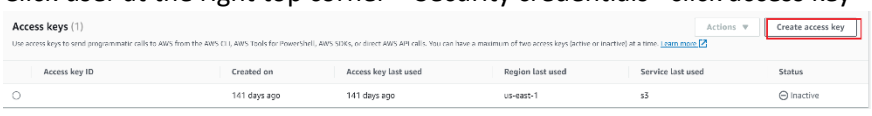
First create a bucket with enable versioning.
Select bucket >properties >click edit bucket versioning > then you can see MFA is disable.



Click user at the right top corner > Security credentials> and you can see your device name.



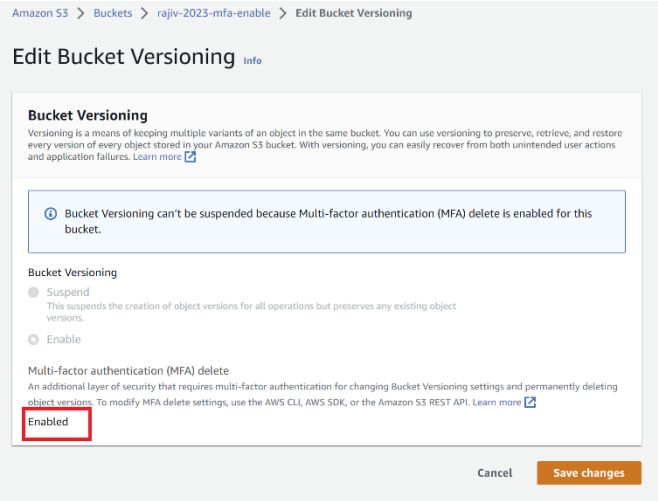
Click user at the right top corner > Security credentials> click access key



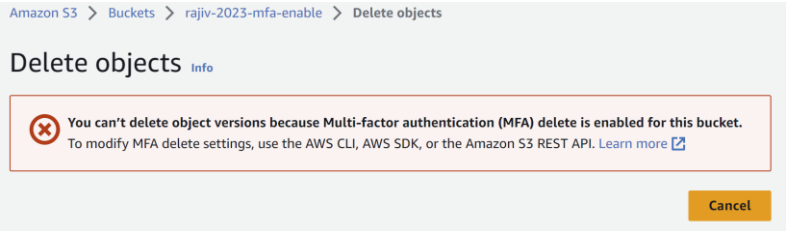
now go to the aws cli and run the following command
aws configure --profile root-mfa-delete-demo
#put the access key
#put the secret access key
#us-east-1
enter

Now we are login as a root by access key and try the following command
#aws s3 ls
#aws s3 --profile root-mfa-delete-demo
#aws s3api put-bucket-versioning --bucket you_bucket_name --versioning-configuration Status=Enabled,MFADelete=Enabled --mfa "arn-of-mfa-device mfa-code " --profile root-mfa-delete-demo

Now go to the aws console and you can see the MFA is enable now



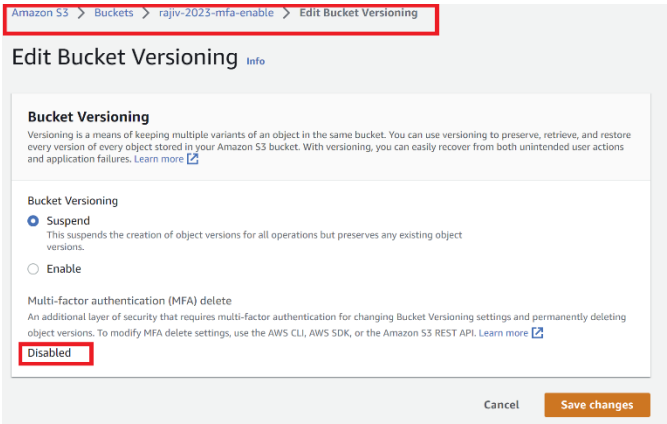
Upload a picture in this bucket
delete the image
now enable the version
now delete the image again and you will get an error message and not able to delete it



Disable the MFA

Go to the aws cli
aws s3api put-bucket-versioning --bucket you_bucket_name --versioning-configuration Status=Enabled,MFADelete=Disabled --mfa "arn-of-mfa-device mfa-code " --profile root-mfa-delete-demo

Now go to aws console and try to delete the image and you able to delete the image now and go to the versioning and you can see the MFA is disable now

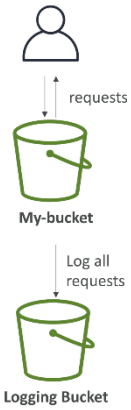


NB: after done the test delete the root accesses key

When you do the test make sure your root account already have enable MFA otherwise you don't get the arn and MFA code.

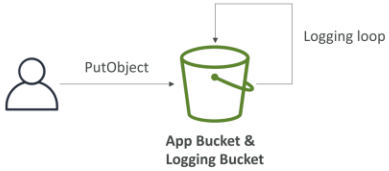
S3 – Access Log

- For audit purpose, you may want to log all access to S3 buckets
- Any request made to S3, from any account, authorized or denied, will be logged into another S3 bucket
- That data can be analyzed using data analysis tools…
- The target logging bucket must be in the same AWS region



S3 – Access Log – important issue

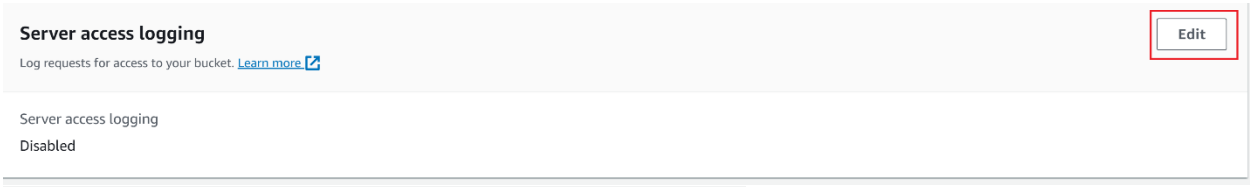
- Do not set your logging bucket to be the monitored bucket
- It will create a logging loop, and your bucket will grow exponentially

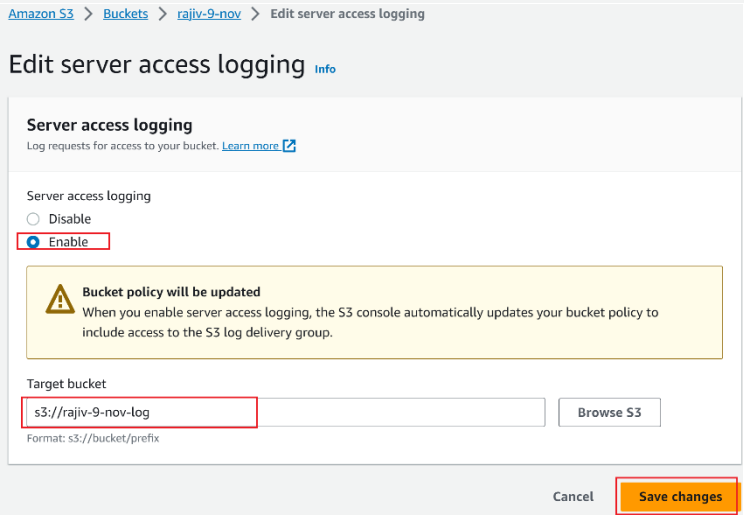


Access log format URL
https://docs.aws.amazon.com/AmazonS3/latest/userguide/LogFormat.html

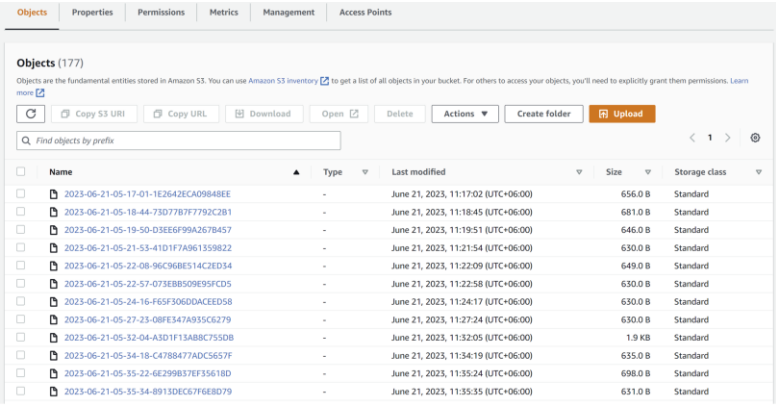
Lab: S3 – Access Log

create 1 bucket for example: arina-2023
create another bucket for examble: arina-2023-log
now go to the arina-2023 >properties>scroll down and edit server access log> enable and select which bucket the log will be store
Now do some activity like upload a image to arina-2023 and that activity will be logged in arina-2023-log





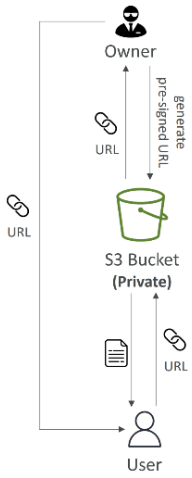
Now so some activity in your main bucket for example see your object or upload any file then go to your go to the log bucket and you can see your log and it will take some time around 1 hour to copy the log of that bucket. We will get the log as below image.



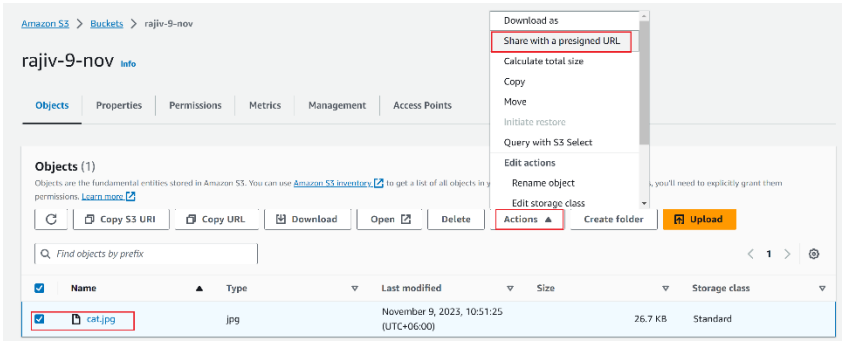
S3 – Preassigned URL

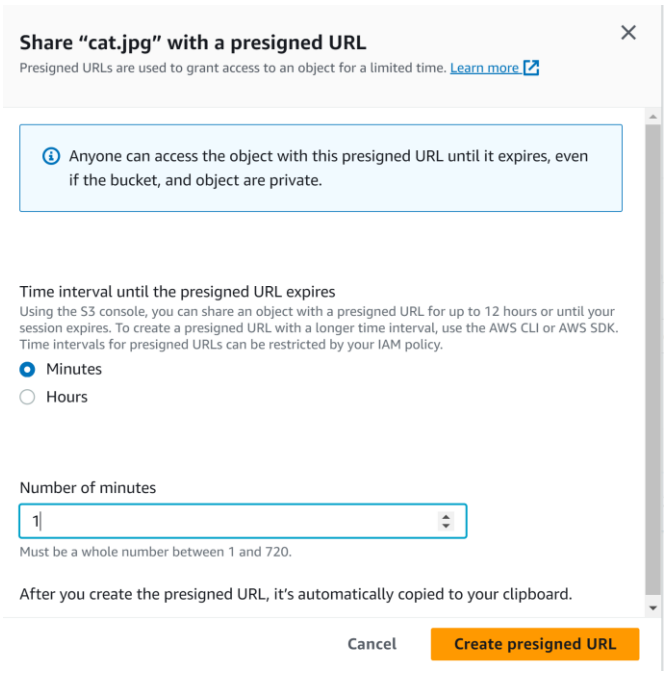
- Generate pre-signed URLs using the S3 Console, AWS CLI or SDK
- URL Expiration
  - S3 Console – 1 min up to 720 mins (12 hours)
  - AWS CLI – configure expiration with *–expires-in* parameter in seconds (default 3600 secs, max. 604800 secs ~ 168 hours)
- Users given a pre-signed URL inherit the permissions of the user that generated the URL for GET / PUT

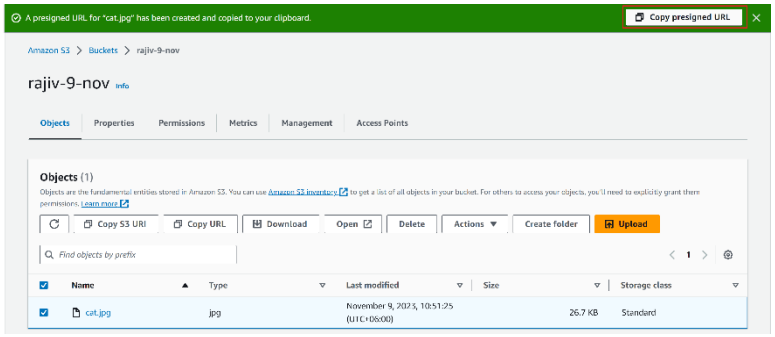
- Examples:
  - Allow only logged-in users to download a premium video from your S3 bucket
  - Allow an ever-changing list of users to download files by generating URLs dynamically
  - Allow temporarily a user to upload a file to a precise location in your S3 bucket



LAB: S3 – Preassigned URL



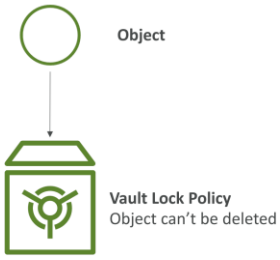




NB: we create the preassigned URL for 1 min so after 1 min the user will not be able to access the file

S3 – Glacier Vault Lock

- Adopt a WORM (Write Once Read Many) model
- Create a Vault Lock Policy
- Lock the policy for future edits (can no longer be changed or deleted)
- Helpful for compliance and data retention

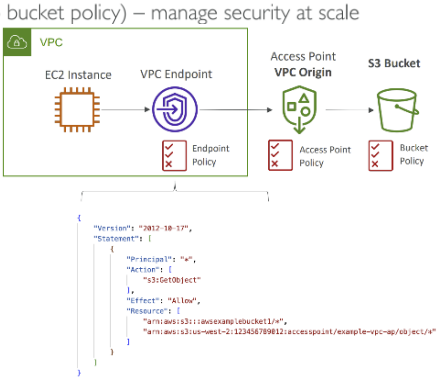


S3 – Object Lock (Versioning must be enabled)

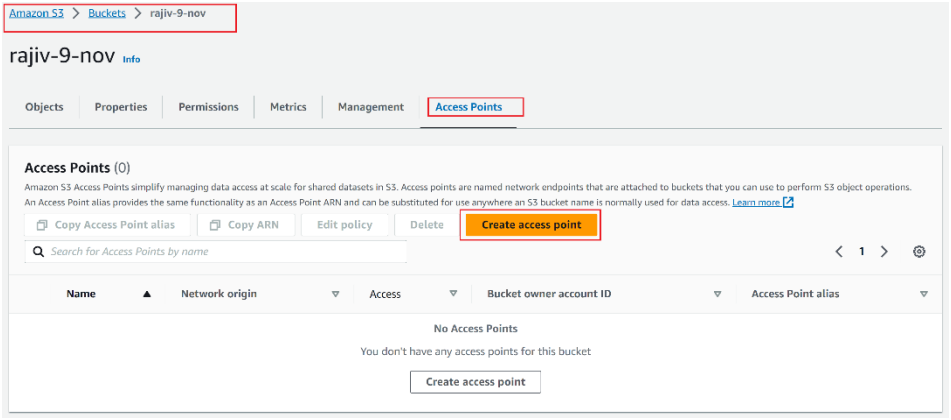
- Adopt a WORM (Write Once Read Many) model
- Block an object version deletion for a specified amount of time
- Retention mode - Compliance:
  - Object versions can't be overwritten or deleted by any user, including the root user
  - Objects retention modes can't be changed, and retention periods can't be shortened
- Retention mode - Governance:
  - Most users can't overwrite or delete an object version or alter its lock settings
  - Some users have special permissions to change the retention or delete the object
- Retention Period: protect the object for a fixed period, it can be extended
- Legal Hold:
  - protect the object indefinitely, independent from retention period
  - can be freely placed and removed using the *s3:PutObjectLegalHold* IAM permission

S3 - Access point

- Access Points simplify security management for S3 Buckets
- Each Access Point has:
  - its own DNS name (Internet Origin or VPC Origin)
  - an access point policy (similar to bucket policy) – manage security at scale
- We can define the access point to be accessible only from within the VPC
- You must create a VPC Endpoint to access the Access Point (Gateway or Interface Endpoint)
- The VPC Endpoint Policy must allow access to the target bucket and Access Point

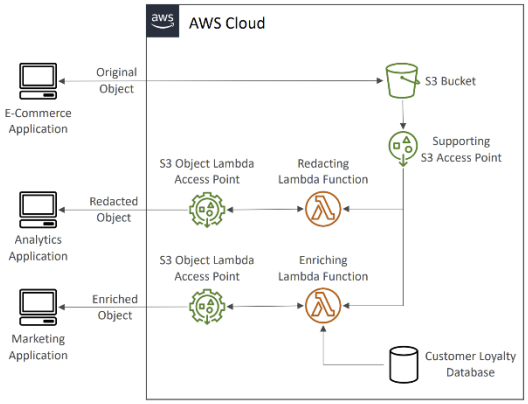


From Web conole



S3 – Object Access Lambda

- Use AWS Lambda Functions to change the object before it is retrieved by the caller application
- Only one S3 bucket is needed, on top of which we create **S3 Access Point** and **S3 Object Lambda Access Points.**
- Use Cases:
  - Redacting personally identifiable information for analytics or non-production environments.
  - Converting across data formats, such as converting XML to JSON.
  - Resizing and watermarking images on the fly using caller-specific details, such as the user who requested the object.



Lab: create, delete, copy and move data from local file to s3 bucket by using aws cli

show aws user list
#aws iam list-users

create bucket
#aws s3 mb s3://rajiv2011

See object from any specific bucket
aws s3 ls s3://rajiv-11-nov

Delete/remove bucket
#aws s3 rb s3://bucket-name

Delete/remove bucket by forcing
#aws s3 rb s3://bucket-name --force

remove object from bucket
#aws s3 rm s3://bucket-name/example/filename.txt

remove all object from bucket
#aws s3 rm s3://bucket-name/example --recursive

move object from bucket to bucket
#aws s3 mv <source> <target> [--options]
example: aws s3 mv s3://bucket-name/example s3://my-bucket/

move file from your local pc to bucket
#aws s3 mv filename.txt s3://bucket-name

move file from bucket to your local pc
#aws s3 mv s3://bucket-name/filename.txt ./

copy from bucket to bucket
#aws s3 cp <source> <target> [--options]
example: aws s3 cp s3://bucket-name/example s3://my-bucket/

Ec2 instance describe
aws ec2 describe-instances --instance-ids i-0cee6d42c5748941c | more

NB: When we create a bucket from web it will be private
When we create a bucket from command line it will be public