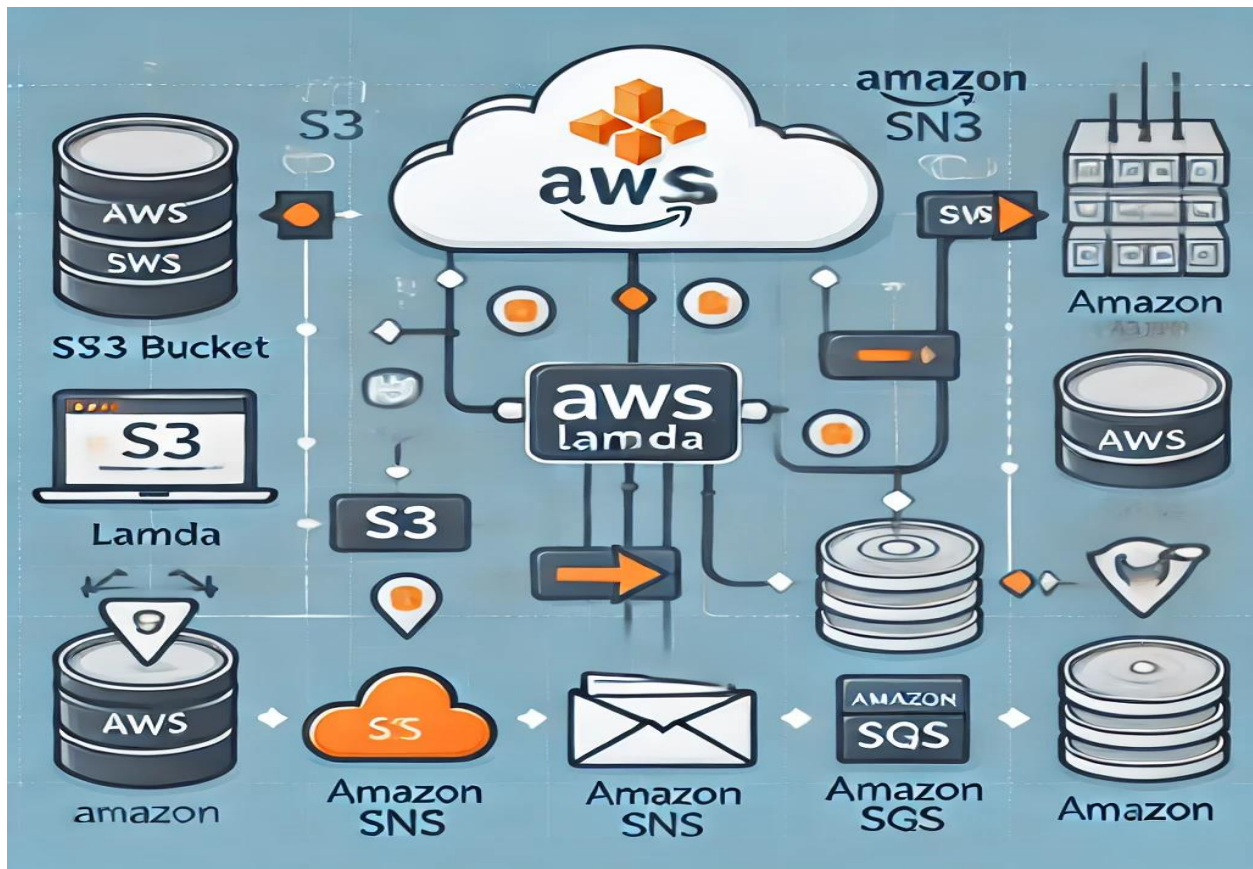


# cprime

## Serverless Event-Driven Workflow with AWS S3, Lambda, SNS, and SQS



Name : T MANOJ

EMPID : LYAKE2KHS

## Objective

The objective of this project is to build a serverless event-driven architecture using AWS S3, SNS, SQS, and Lambda. The solution ensures that when a file is uploaded to an S3 bucket, a Lambda function is triggered to process the event, send notifications via SNS, and forward messages to an SQS queue for further processing.

## Advantages

### 1. Scalability:

AWS services like S3, Lambda, SNS, and SQS automatically scale with the workload.

### 2. Cost-Effective:

Pay-as-you-go pricing for Lambda and S3 ensures minimal cost, with no server management overhead.

### 3. Serverless Architecture:

No need to manage underlying servers, ensuring reduced operational complexity.

### 4. Real-Time Processing:

Immediate notification and processing of files as they are uploaded.

## Proecess :

### 1. Create an S3 Bucket

- **Navigate to S3 Service:** Go to the S3 service from the AWS Management Console.
- **Create a Bucket:**
  - Click Create bucket.
  - Enter a unique bucket name (e.g., manojconnects-s3-bucket).
  - Choose the AWS region where you want the bucket.
- **Disable Bucket Encryption:**
  - Scroll to Default encryption and select Disable.
- **Finish Creation:** Click Create bucket.

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Storage

# Amazon S3

## Store and retrieve any amount of data from anywhere

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

### Create a bucket

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

Create bucket

### Pricing

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

Estimate your monthly bill using the [AWS Simple Monthly Calculator](#)

### How it works

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Introduction to Amazon S3

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Amazon S3

Buckets

Create bucket

## Create bucket [Info](#)

Buckets are containers for data stored in S3.

### General configuration

#### AWS Region

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

#### Bucket type [Info](#)

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

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

#### Bucket name [Info](#)

LambdaBuckte

Bucket name must be unique within the global namespace and follow the bucket naming rules. [See rules for bucket naming](#)

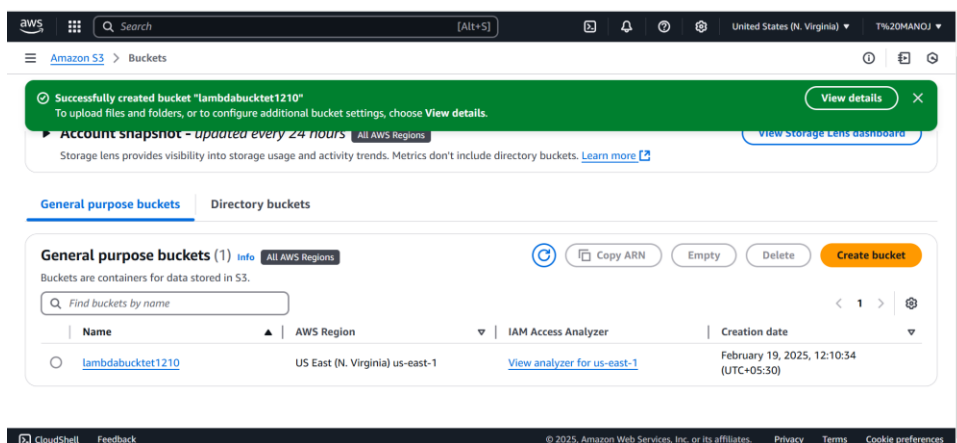
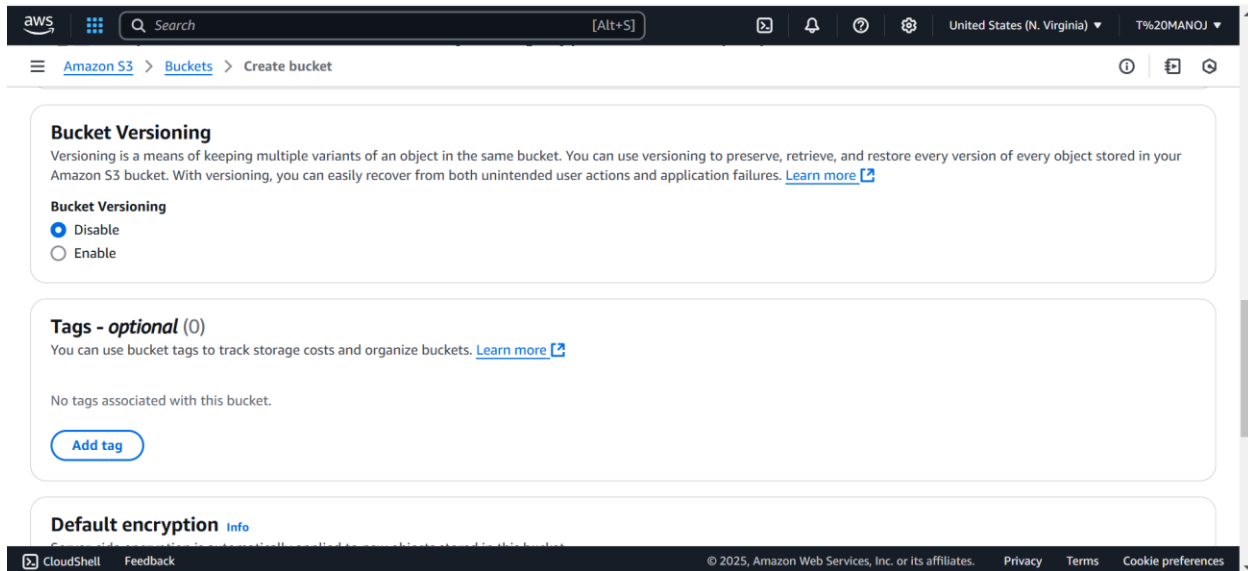
#### Copy settings from existing bucket - optional

Only the bucket settings in the following configuration are copied.

CloudShell

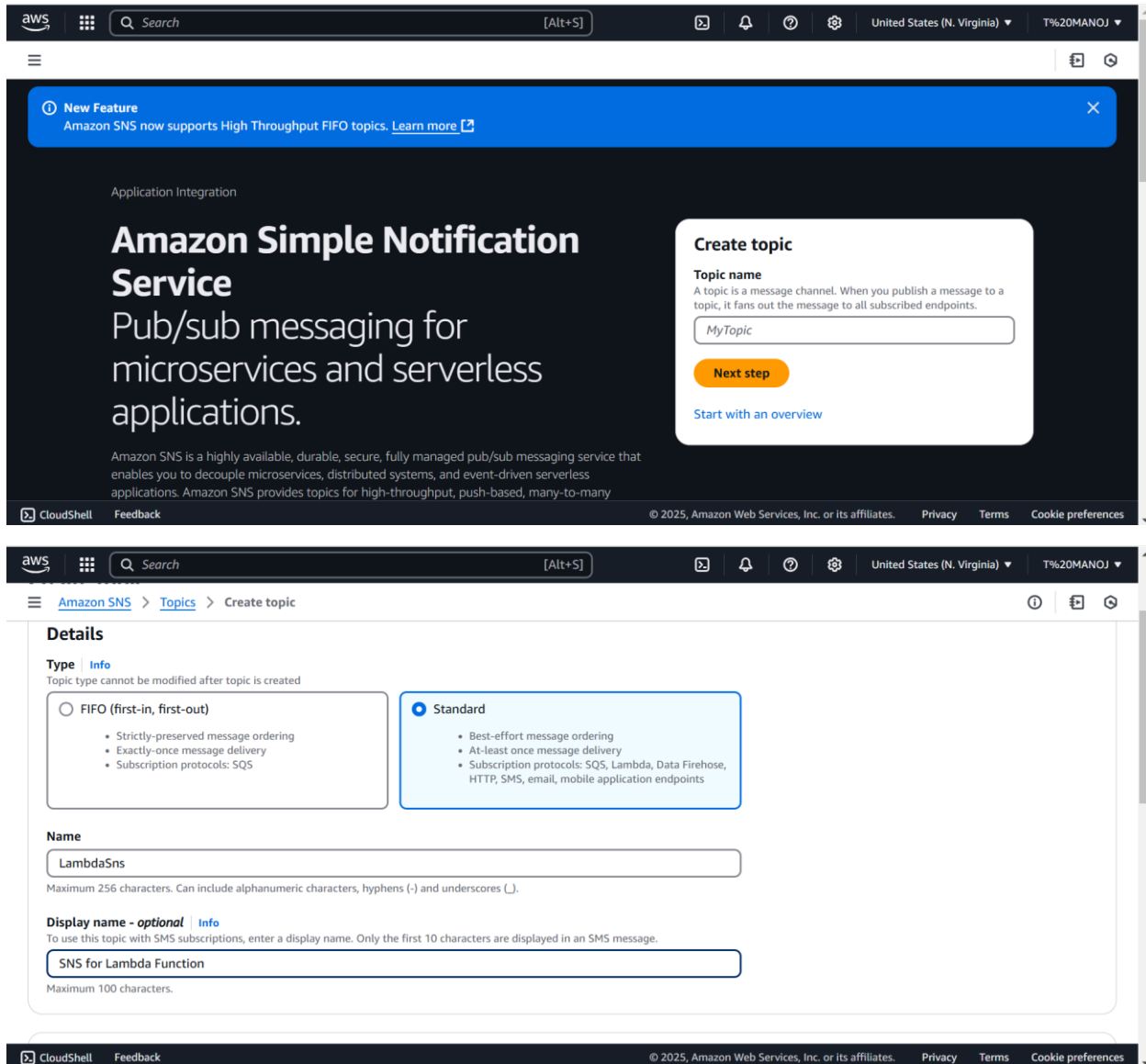
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## 2. Create an SNS Topic

- Go to SNS Service: Open Amazon SNS from the AWS Console.
- Create a Topic:
  - Choose Topics → Create topic.
  - Select Standard type.
  - Provide a Topic name .
  - Click Create topic.



### 3. Create Subscriptions for Email and SQS

- Create Email Subscription:
  - On the SNS topic page, click Create subscription.
  - Protocol: Select Email.

- Endpoint: Enter your email address.
- Click Create subscription.
- Check your email and confirm the subscription.

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Amazon SNS > Subscriptions > Create subscription

### Create subscription

**Details**

**Topic ARN**

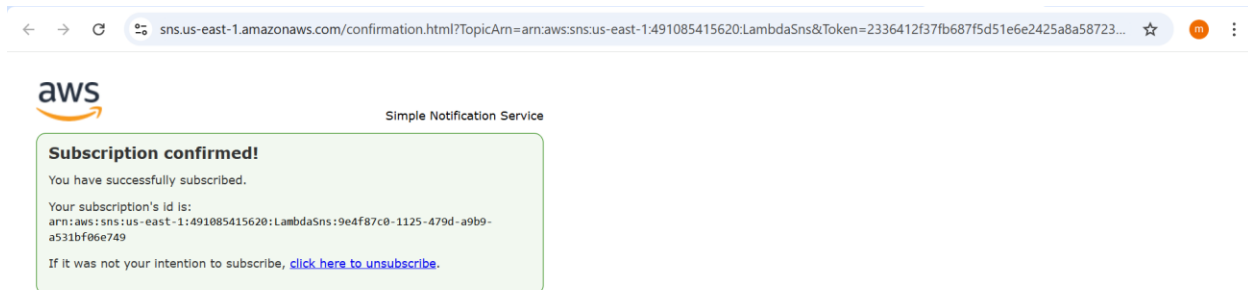
**Protocol**  
 The type of endpoint to subscribe

**Endpoint**  
 An email address that can receive notifications from Amazon SNS.

After your subscription is created, you must confirm it. [Info](#)

► **Subscription filter policy - optional** [Info](#)

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- Create SQS Subscription:
  - Ensure you have an SQS queue created. If not, go to SQS and create one.
  - On the SNS topic page, click Create subscription again.

- Create the Role that has the permission for Communication.
- Protocol: Select Amazon SQS.
- Endpoint: Choose the SQS queue ARN.
- Click Create subscription.

Application Integration

# Amazon SQS

## A message queuing service

Amazon SQS provides queues for high-throughput, system-to-system messaging. You can use queues to decouple heavyweight processes and to buffer and batch work. Amazon SQS stores messages until microservices and serverless applications process them.

**Get started**

Learn how to use Amazon SQS by creating a queue, sending a message to the queue, and receiving and processing the message.

[Create queue](#)

**Pricing (US)**

You can get started with Amazon SQS for free. All customers can make 1 million Amazon SQS requests for free each month. Some applications might be able to operate within this Free Tier limit.

### How it works

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Amazon SQS > Queues > Create queue

## Create queue

### Details

**Type**  
Choose the queue type for your application or cloud infrastructure.

☒ **Standard Info**  
At-least-once delivery, message ordering isn't preserved

- At-least once delivery
- Best-effort ordering

☐ **FIFO Info**  
First-in-first-out delivery, message ordering is preserved

- First-in-first-out delivery
- Exactly-once processing

**You can't change the queue type after you create a queue.**

**Name**

LambdaQueue

A queue name is case-sensitive and can have up to 80 characters. You can use alphanumeric characters, hyphens (-), and underscores (\_).

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IAM

Roles

Create role

Step 1

Select trusted entity

Step 2

Add permissions

Step 3

Name, review, and create

Select trusted entity

Info

Trusted entity type

☒ AWS service

Allow AWS services like EC2, Lambda, or others to perform actions in this account.

☐ AWS account

Allow entities in other AWS accounts belonging to you or a 3rd party to perform actions in this account.

☐ Web identity

Allows users federated by the specified external web identity provider to assume this role to perform actions in this account.

☐ SAML 2.0 federation

Allow users federated with SAML 2.0 from a corporate directory to perform actions in this account.

☐ Custom trust policy

Create a custom trust policy to enable others to perform actions in this account.

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IAM

Roles

Create role

Step 1

Select trusted entity

Step 2

Add permissions

Step 3

Name, review, and create

Name, review, and create

Role details

Role name

Enter a meaningful name to identify this role.

LambdaSqs

Maximum 64 characters. Use alphanumeric and '+', '@', '-' characters.

Description

Add a short explanation for this role.

Allows SNS to call CloudWatch Logs on your behalf.

Maximum 1000 characters. Use letters (A-Z and a-z), numbers (0-9), tabs, new lines, or any of the following characters: '\_', '=', '@', '-', '/', '[', ']', '!', '#', '\$', '%', '^', '\*', '~', '``'.

Step 1: Select trusted entities

Edit

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Amazon SQS > Queues > Create queue

Define who can access your queue.

Choose method

☒ Basic

Use simple criteria to define a basic access policy.

☐ Advanced

Use a JSON object to define an advanced access policy.

Define who can send messages to the queue

☐ Only the queue owner

Only the owner of the queue can send messages to the queue.

☒ Only the specified AWS accounts, IAM users and roles

Only the specified AWS account IDs, IAM users and roles can send messages to the queue.

arn:aws:iam::491085415620:role/LambdaSqs

Define who can receive messages from the queue

☒ Only the queue owner

Only the owner of the queue can receive messages from the queue.

☐ Only the specified AWS accounts, IAM users and roles

Only the specified AWS account IDs, IAM users and roles can receive messages from the queue.

JSON (read-only)

```
{  "Version": "2012-10-17",  "Id": "__default_policy_ID",  "Statement": [    {      "Sid": "__owner_statement",      "Effect": "Allow",      "Principal": {        "AWS": "491085415620"      },      "Action": [        "SQS:*"      ],      "Resource": "arn:aws:sqs:us-east-1:491085415620:LambdaQueue"    }  ]}
```

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Queue LambdaQueue created successfully

You can now send and receive messages.

LambdaQueue

Edit Delete Purge Send and receive messages Start DLQ redrive

Details info

Name	Type	ARN
LambdaQueue	Standard	arn:aws:sqs:us-east-1:491085415620:LambdaQueue
Encryption	URL	Dead-letter queue
Disabled	https://sqs.us-east-1.amazonaws.com/491085415620/LambdaQueue	-

More

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Amazon SNS > Subscriptions > Create subscription

Amazon SNS now supports High Throughput FIFO topics. [Learn more](#)

## Create subscription

### Details

**Topic ARN**

arn:aws:sns:us-east-1:491085415620:LambdaSns

**Protocol**

The type of endpoint to subscribe

Amazon SQS

**Endpoint**

Only Amazon SQS standard queues will be listed and can receive notifications from an Amazon SNS standard topic.

arn:aws:sqs:us-east-1:491085415620:LambdaQueue

☐ Enable raw message delivery

After your subscription is created, you must confirm it. [Info](#)

us-east-1.console.aws.amazon.com/sns/v3/home?region=us-east-1#/topic/arn:aws:sns:us-east-1:491085415620:LambdaSns

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Amazon SNS > Topics > LambdaSns

Dashboard

Topics

Subscriptions

▼ Mobile

Push notifications

Text messaging (SMS)

ARN

arn:aws:sns:us-east-1:491085415620:LambdaSns

Topic owner

491085415620

Type

Standard

< Subscriptions Access policy Data protection policy Delivery policy (HTTP/S) Delivery status >

Subscriptions (2) Edit Delete Request confirmation Confirm subscription Create subscription

Search

< 1 >

ID	Endpoint	Status	Protocol
<input type="radio"/> <a href="#">254cb8f2-5544-477f-afc...</a>	arn:aws:sqs:us-east-1:49...	Confirmed	SQS
<input type="radio"/> <a href="#">9e4f87c0-1125-479d-a9...</a>	dreamers2k22@gmail.com	Confirmed	EMAIL

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Amazon SNS > Queues > LambdaQueue

More

< SNS subscriptions Lambda triggers EventBridge Pipes Dead-letter queue Monitoring Tagging Queue policies Encrypt >

Subscription region

us-east-1

SNS subscriptions (1) Info View in SNS Delete Subscribe to Amazon SNS topic

Search subscriptions

< 1 >

Subscription ARN	Topic ARN
<input type="radio"/> arn:aws:sns:us-east-1:491085415620:LambdaSns:254cb8f2-5544-477f-afc7-e22172710904	arn:aws:sns:us-east-1:491085415620:LambdaSns

aws [Search] [Alt+S] United States (N. Virginia) T%20MANOJ

Amazon SQS > Queues > LambdaQueue > Subscribe to Amazon SNS topic

### Subscribe to Amazon SNS topic [Info](#)

**Amazon SNS topic**  
To allow your queue to receive messages from an Amazon SNS topic, subscribe it to an Amazon SNS topic.  
Specify an Amazon SNS topic available for this queue.

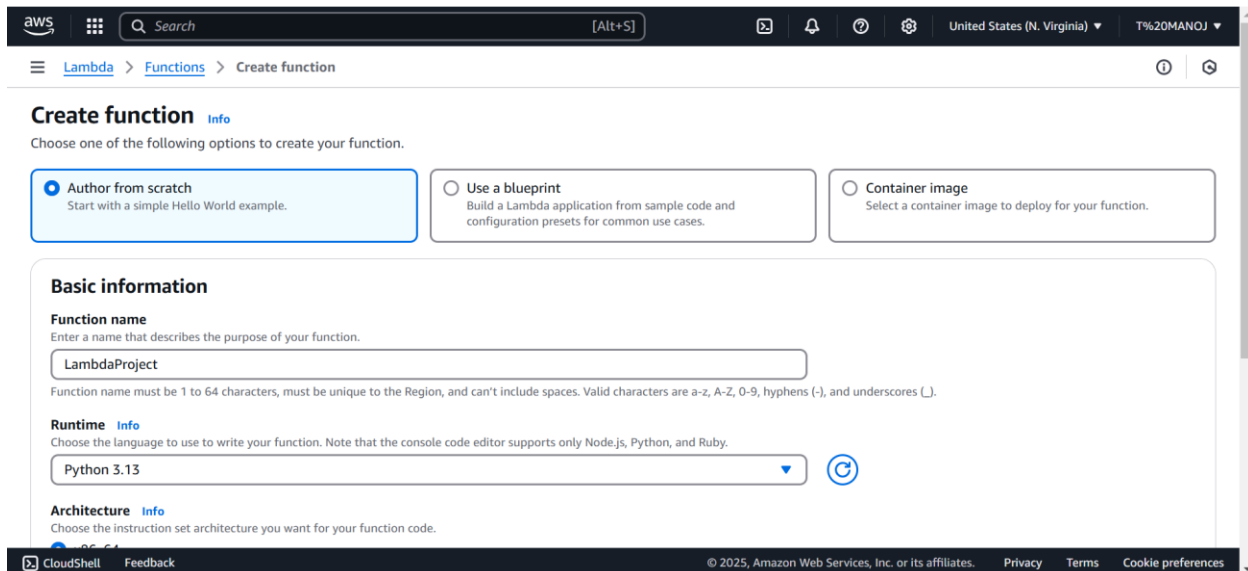
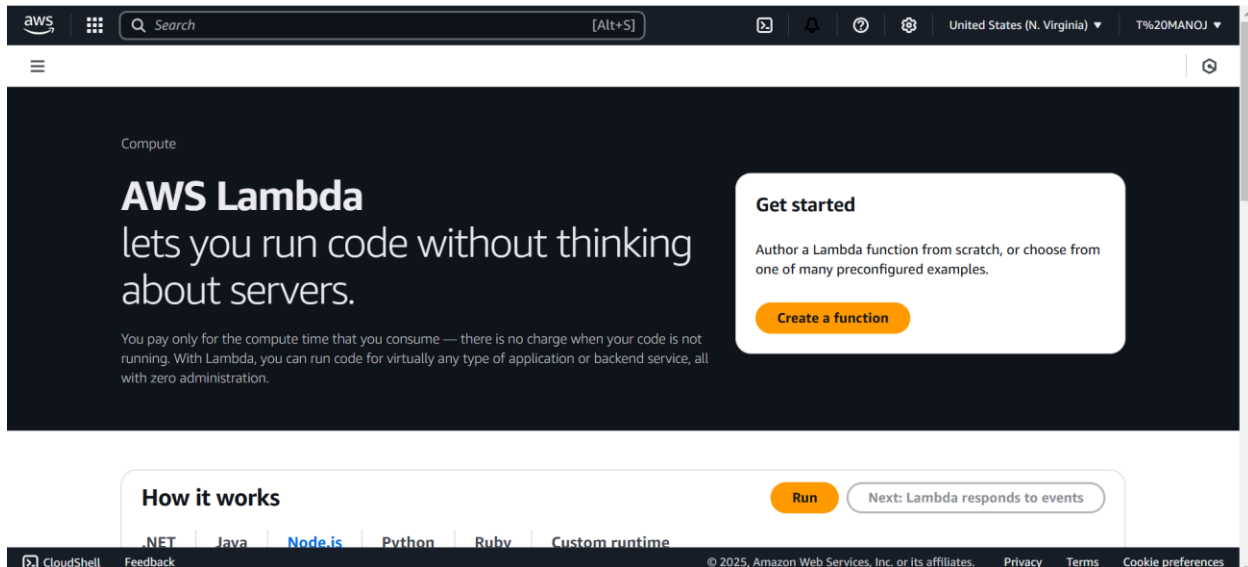
arn:aws:sns:us-east-1:491085415620:LambdaSns

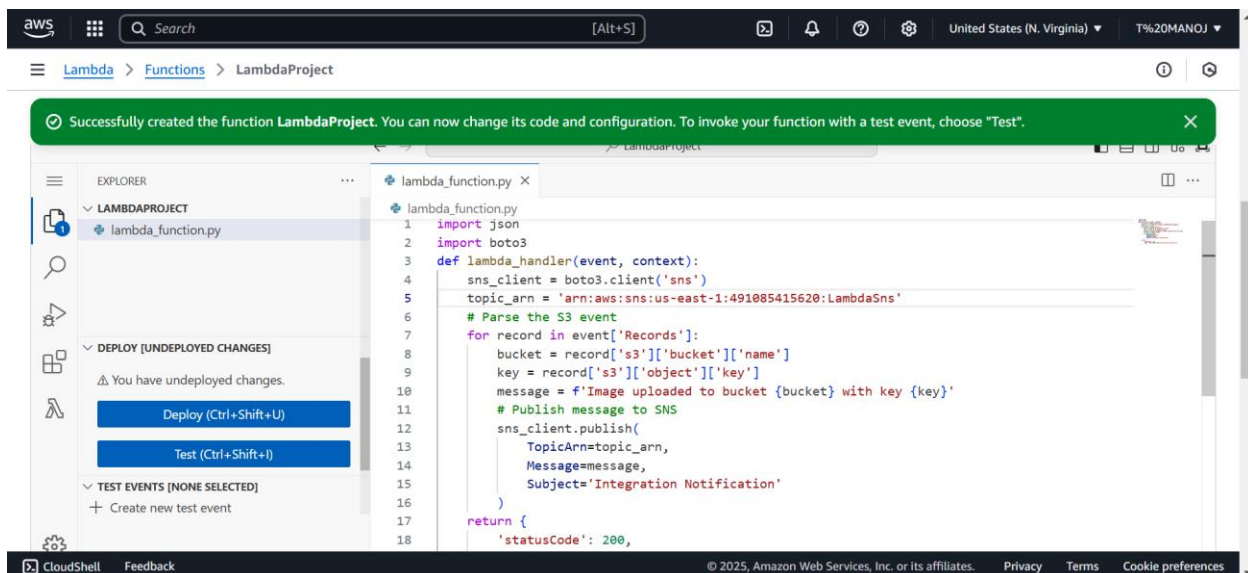
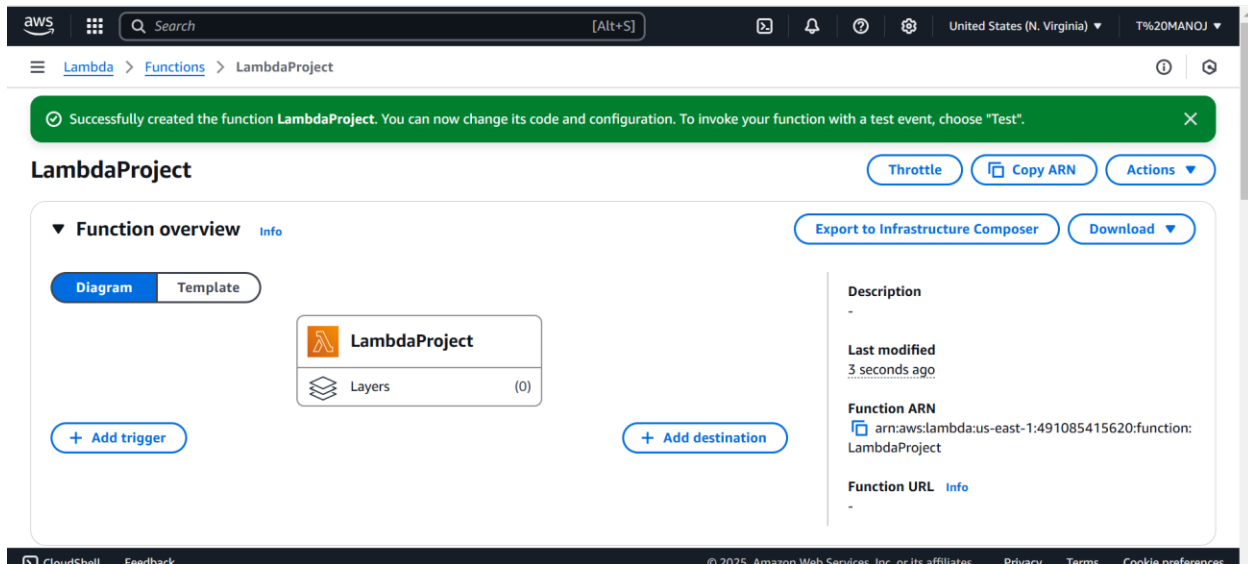
[Cancel](#) [Save](#)

## 4. Create and Configure the Lambda Function

- **Navigate to Lambda Service:** In the AWS console, select Lambda.
- **Create Lambda Function:**
  - Click Create function.
  - Author from scratch:
    - Function name.
    - Runtime: Select Python (latest version).
    - Click Create function.
- **Create and Save a Test Event:**
  - Go to the Test tab in the Lambda console.
  - Click Configure test event.
  - Provide an event name and paste sample S3 event data.
  - Click Save.
- **Add Lambda Code:**
  - In the Code source section, paste your Python code.
  - Ensure the SNS topic ARN is included in the code to publish messages.
- **Deploy the Code:**

- Click Deploy after adding the code.
- Test the Code:
  - Use the Test button to trigger the Lambda function and ensure it works as expected.





Code :

import json

import boto3def lambda\_handler(event, context):

sns\_client = boto3.client('sns')

topic\_arn = 'arn<sup>aws</sup>sns:us-east-2:975050243542:myeventopic' # Parse the S3 event

for record in event['Records']:

bucket = record['s3']['bucket']['name']

key = record['s3']['object']['key']

```
message = f'Image uploaded to bucket {bucket} with key {key}'    # Publish message to SNS
sns_client.publish(
    TopicArn=topic_arn,
    Message=message,
    Subject='Integration Notification'
) return {
    'statusCode': 200,
    'body': json.dumps('Notification sent successfully!')
}
```

## 5. Integrate Lambda with S3 Bucket

- Add Permissions to Lambda Role:
  - Go to the Configuration tab of the Lambda function → Permissions.
  - Attach a policy with S3 read and SNS publish permissions to the Lambda execution role.
- Configure S3 Event Notification:
  - Navigate to S3 → select your bucket → Properties tab.
  - Scroll to Event notifications → click Create event notification.
  - Event name.
  - Event types: Select PUT.
  - Destination: Choose Lambda function and select your created Lambda function.
  - Click Save changes.

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Lambda > Functions > LambdaProject

Test event Info

CloudWatch Logs Live Tail Save Test

To invoke your function without saving an event, configure the JSON event, then choose Test.

Test event action

Create new event Edit saved event

Event name

LambdaEvent

Maximum of 25 characters consisting of letters, numbers, dots, hyphens and underscores.

Event sharing settings

Private

This event is only available in the Lambda console and to the event creator. You can configure a total of 10. [Learn more](#)

Shareable

This event is available to IAM users within the same account who have permissions to access and use shareable events. [Learn more](#)

Template - optional

hello world

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Amazon S3 > Buckets > lambdabucket1210

Configure in CloudTrail

Event notifications (0)

Edit Delete Create event notification

Send a notification when specific events occur in your bucket. [Learn more](#)

Name	Event types	Filters	Destination type	Destination
No event notifications				
Choose <a href="#">Create event notification</a> to be notified when a specific event occurs.				

Create event notification

Amazon EventBridge

For additional capabilities, use Amazon EventBridge to build event-driven applications at scale using S3 event notifications. [Learn more](#) or [see EventBridge pricing](#)

Send notifications to Amazon EventBridge for all events in this bucket

Off

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Amazon S3

Buckets

lambdabucket1210

Create event notification

1

## Create event notification [Info](#)

To enable notifications, you must first add a notification configuration that identifies the events you want Amazon S3 to publish and the destinations where you want Amazon S3 to send the notifications.

### General configuration

**Event name**

LambdaEvent

Event name can contain up to 255 characters.

**Prefix - optional**

Limit the notifications to objects with key starting with specified characters.

images/

**Suffix - optional**

Limit the notifications to objects with key ending with specified characters.

.jpg

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Amazon S3

Buckets

lambdabucket1210

Create event notification

1

## Event types

Specify at least one event for which you want to receive notifications. For each group, you can choose an event type for all events, or you can choose one or more individual events.

### Object creation

☐ All object create events  
s3:ObjectCreated:\*

☒ Put  
s3:ObjectCreated:Put

☐ Post  
s3:ObjectCreated:Post

☐ Copy  
s3:ObjectCreated:Copy

☐ Multipart upload completed  
s3:ObjectCreated:CompleteMultipartUpload

### Object removal

☐ All object removal events

☐ Permanently deleted

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Buckets

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Create event notification

Event types

Specify at least one event for which you want to receive notifications. For each group, you can choose an event type for all events, or you can choose one or more individual events.

Object creation

☐ All object create events  
s3:ObjectCreated:\*

☒ Put  
s3:ObjectCreated:Put

☐ Post  
s3:ObjectCreated:Post

☐ Copy  
s3:ObjectCreated:Copy

☐ Multipart upload completed  
s3:ObjectCreated:CompleteMultipartUpload

Object removal

☐ All object removal events

☐ Permanently deleted

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Amazon S3

Buckets

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Create event notification

Destination

Choose a destination to publish the event. [Learn more](#)

☒ Lambda function  
Run a Lambda function script based on S3 events.

☐ SNS topic  
Fanout messages to systems for parallel processing or directly to people.

☐ SQS queue  
Send notifications to an SQS queue to be read by a server.

Specify Lambda function

☒ Choose from your Lambda functions

☐ Enter Lambda function ARN

Lambda function

LambdaProject

Cancel

Save changes

CloudShell

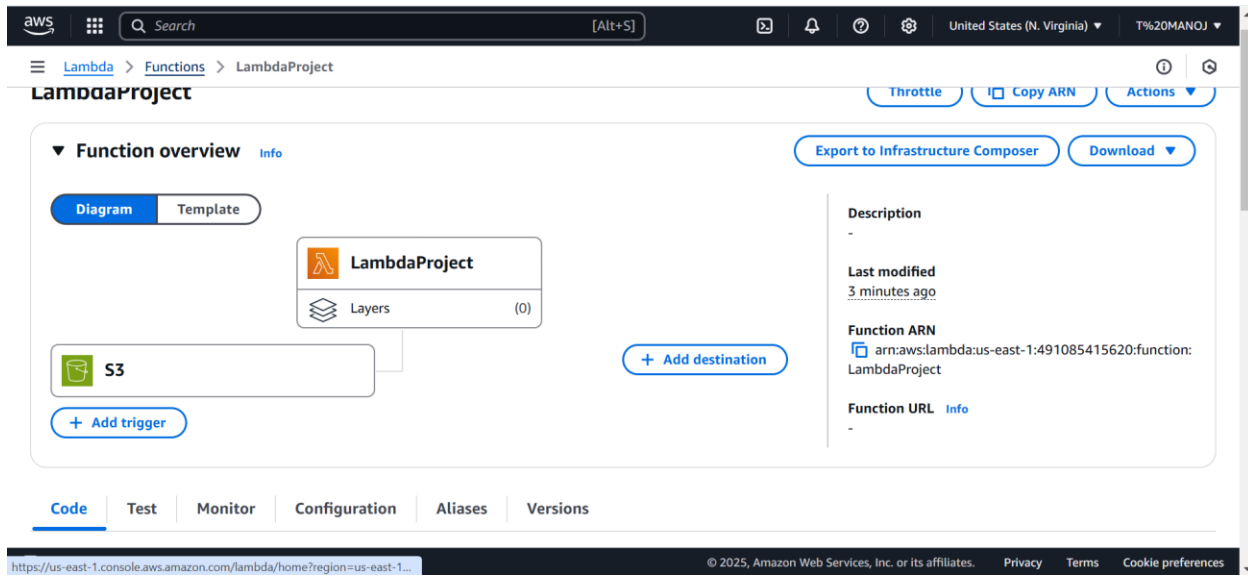
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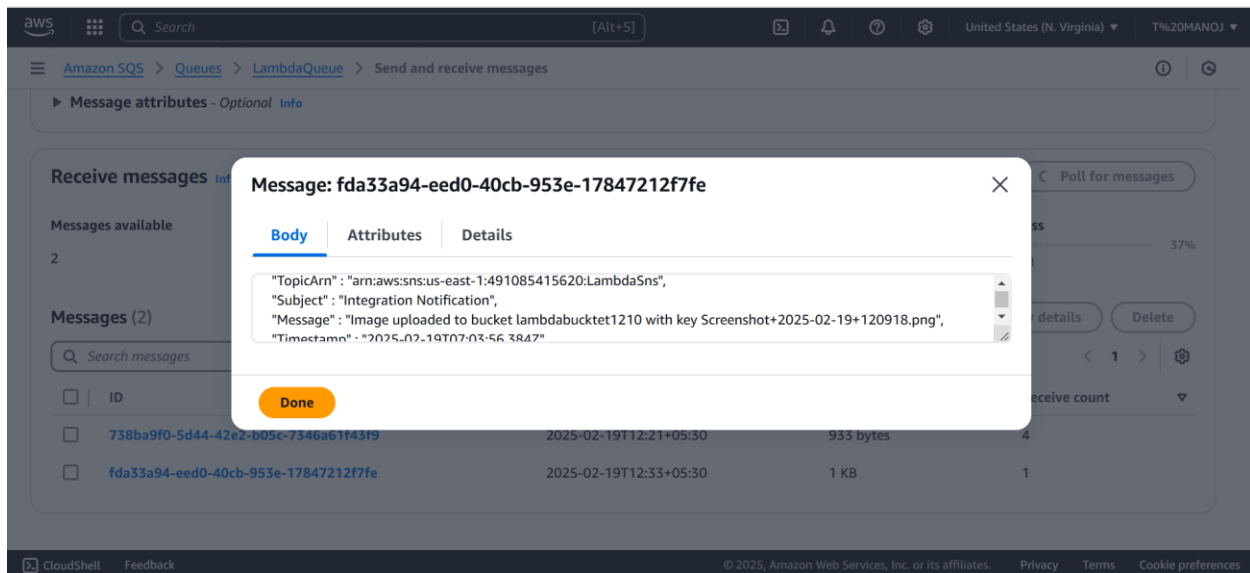
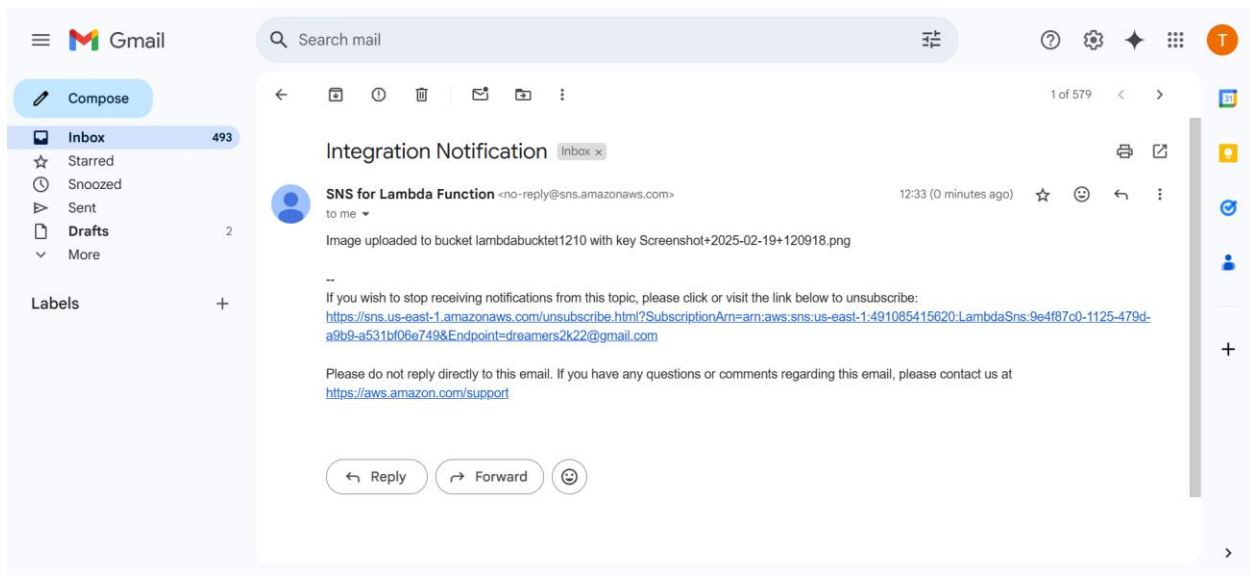
Terms

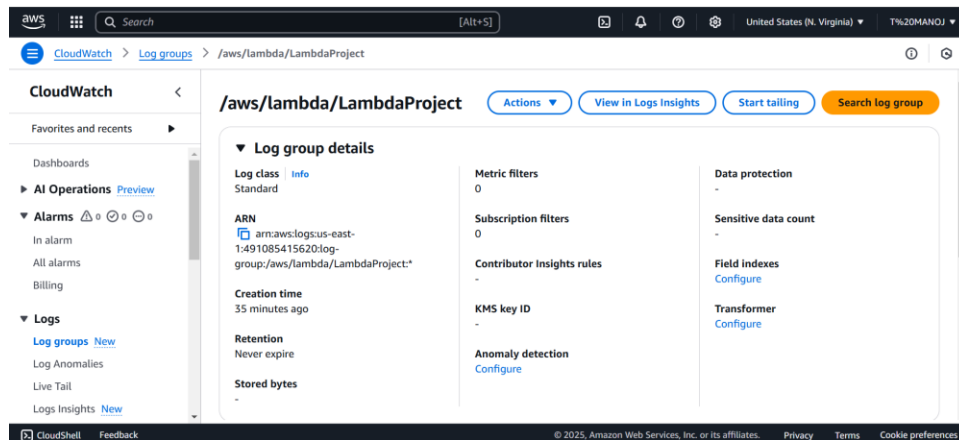
Cookie preferences



## 6. Verify the Entire Setup

- Upload a File to S3:
  - Upload any file to the S3 bucket.
- Check Outputs:
  - The Lambda function should trigger.
  - Check the SNS email for a notification.
  - Check the SQS queue for the message.





## Conclusion

This project demonstrates a robust, scalable, and cost-effective serverless architecture using AWS services. By integrating S3, Lambda, SNS, and SQS, the system ensures real-time processing, decoupled component interaction, and reliable notifications. The architecture is suitable for a wide range of applications, from media processing to IoT data handling, while maintaining high availability and minimal operational overhead.