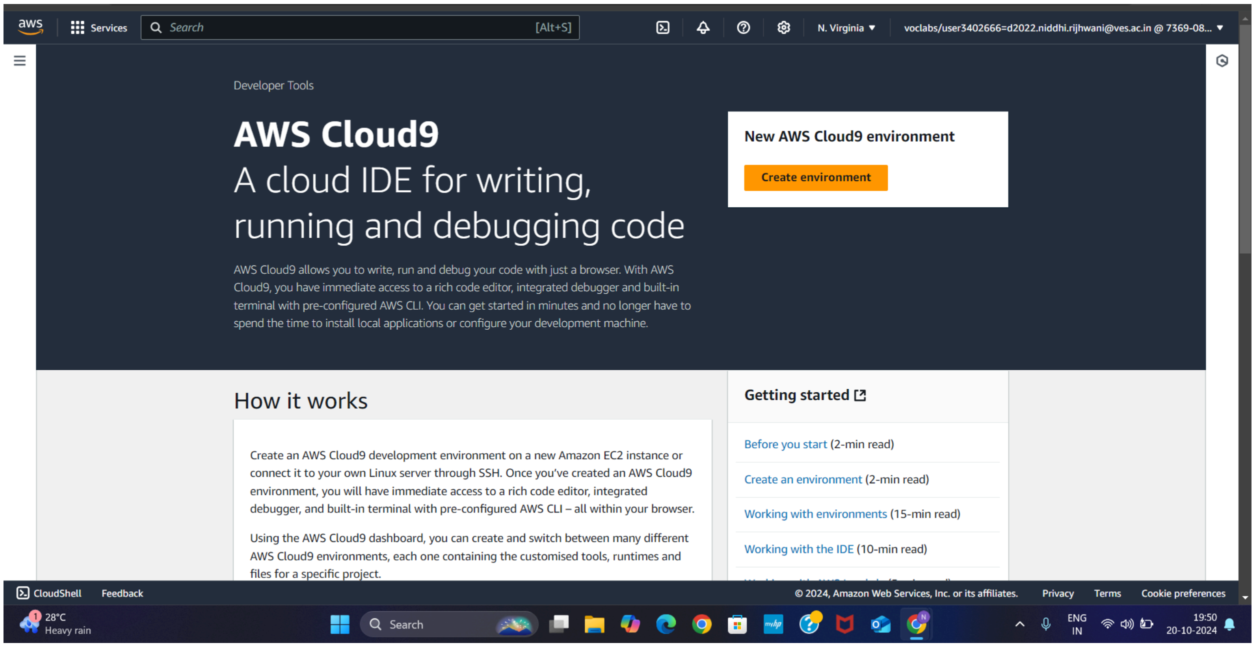
12. Serverless Logging with S3 and Lambda

- **Concepts Used**: AWS Lambda, S3, and AWS Cloud9.
- **Problem Statement**: "Set up a Lambda function using AWS Cloud9 that triggers when a text file is uploaded to an S3 bucket. The Lambda function should read the file's content and log it."
- **Tasks**:
  - Create a Lambda function in Python using AWS Cloud9.
  - Configure an S3 bucket as the trigger for the Lambda function.
  - Upload a text file to the S3 bucket and verify that the Lambda function logs the content.

Step 1: Set Up Your AWS Cloud9 Environment

1. **Login to AWS Management Console:**
   - **Go to [AWS Management Console](#).**
2. **Navigate to AWS Cloud9:**
   - **Search for and select Cloud9.**



AWS Cloud9

A cloud IDE for writing, running and debugging code

AWS Cloud9 allows you to write, run and debug your code with just a browser. With AWS Cloud9, you have immediate access to a rich code editor, integrated debugger and built-in terminal with pre-configured AWS CLI. You can get started in minutes and no longer have to spend the time to install local applications or configure your development machine.

How it works

Create an AWS Cloud9 development environment on a new Amazon EC2 instance or connect it to your own Linux server through SSH. Once you've created an AWS Cloud9 environment, you will have immediate access to a rich code editor, integrated debugger, and built-in terminal with pre-configured AWS CLI – all within your browser.

Using the AWS Cloud9 dashboard, you can create and switch between many different AWS Cloud9 environments, each one containing the customised tools, runtimes and files for a specific project.

Before you start (2-min read)

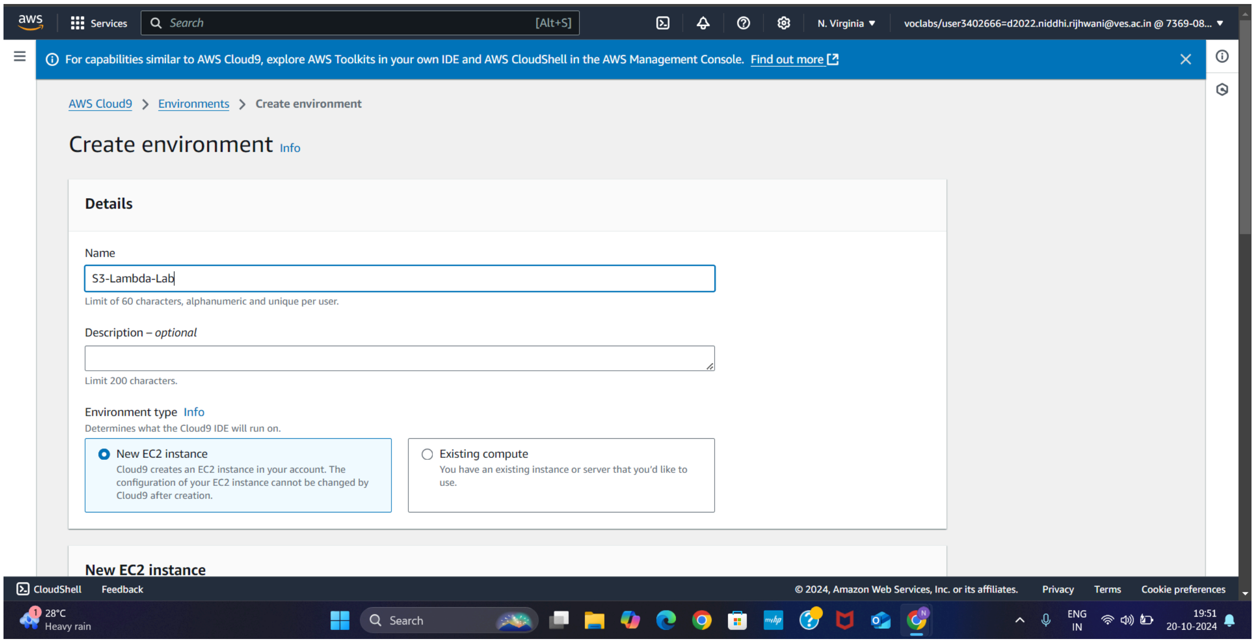
Create an environment (2-min read)

Working with environments (15-min read)

Working with the IDE (10-min read)

3. **Create a New Cloud9 Environment:**
   - **Click Create environment.**
   - **Name your environment (e.g., `S3-Lambda-Lab`).**
   - **Optionally, provide a description.**
   - **Choose an instance type (default is usually fine).**

- **Click Next step, then Create environment.**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voclabs/user3402666=d2022.niddhi.rijhwani@ves.ac.in @ 7369-08... ▾

For capabilities similar to AWS Cloud9, explore AWS Toolkits in your own IDE and AWS CloudShell in the AWS Management Console. Find out more

AWS Cloud9 > Environments > Create environment

Create environment Info

Details

Name

S3-Lambda-Lab

Limit of 60 characters, alphanumeric and unique per user.

Description – *optional*

Limit 200 characters.

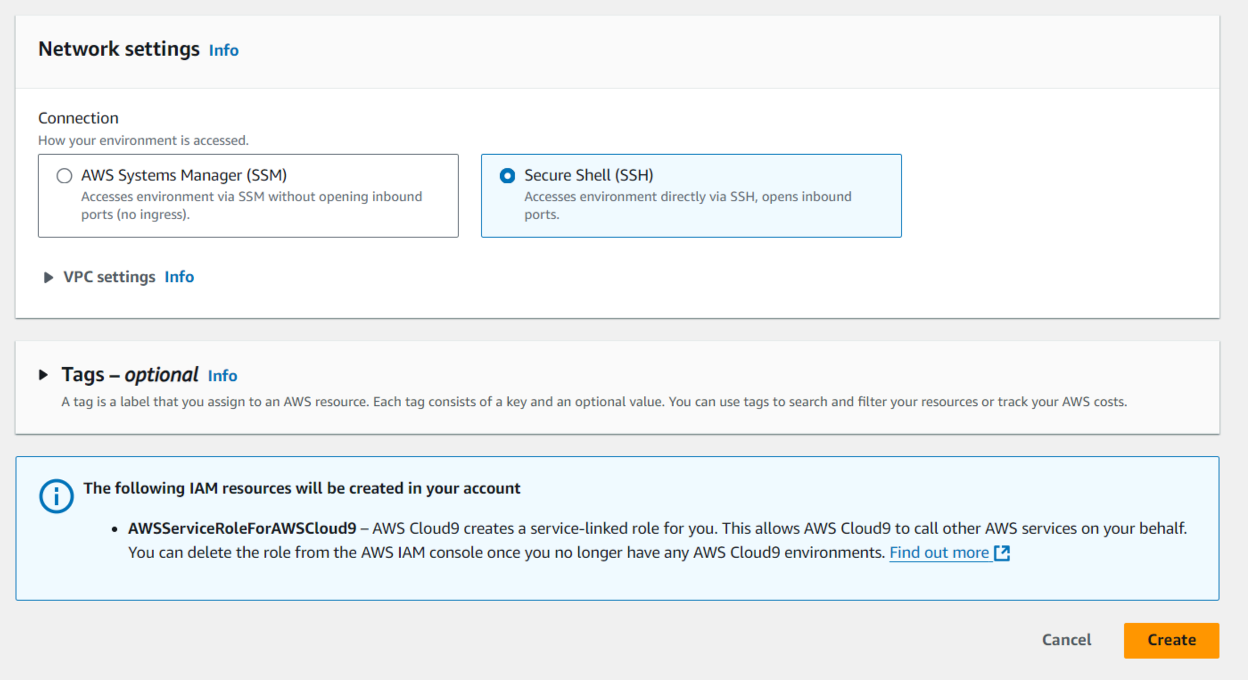
Environment type Info

Determines what the Cloud9 IDE will run on.

● New EC2 instance
Cloud9 creates an EC2 instance in your account. The configuration of your EC2 instance cannot be changed by Cloud9 after creation.

○ Existing compute
You have an existing instance or server that you'd like to use.

New EC2 instance


Network settings Info

Connection

How your environment is accessed.

○ AWS Systems Manager (SSM)
Accesses environment via SSM without opening inbound ports (no ingress).

● Secure Shell (SSH)
Accesses environment directly via SSH, opens inbound ports.

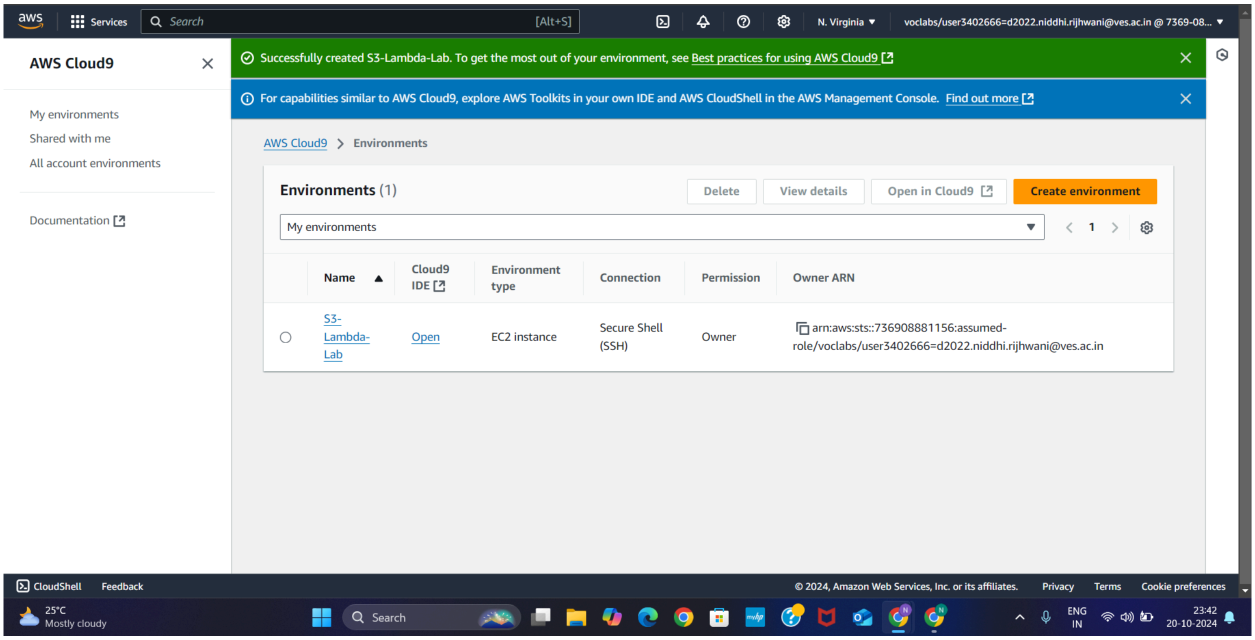
▶ VPC settings Info

▶ Tags – *optional* Info

A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

The following IAM resources will be created in your account

- **AWSServiceRoleForAWSCloud9** – AWS Cloud9 creates a service-linked role for you. This allows AWS Cloud9 to call other AWS services on your behalf. You can delete the role from the AWS IAM console once you no longer have any AWS Cloud9 environments. Find out more



Successfully created S3-Lambda-Lab. To get the most out of your environment, see Best practices for using AWS Cloud9

For capabilities similar to AWS Cloud9, explore AWS Toolkits in your own IDE and AWS CloudShell in the AWS Management Console. Find out more

AWS Cloud9 > Environments

Environments (1) Delete View details Open in Cloud9 Create environment

My environments

Name	Cloud9 IDE	Environment type	Connection	Permission	Owner ARN
○ S3-Lambda-Lab	Open	EC2 instance	Secure Shell (SSH)	Owner	arn:aws:sts::736908881156:assumed-role/voclabs/user3402666=d2022.niddhi.rijhwani@ves.ac.in

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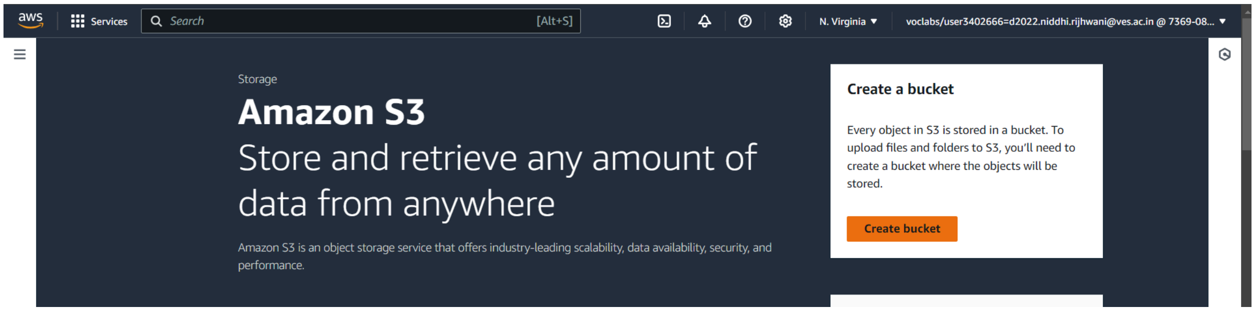
Step 2: Create an S3 Bucket

1. **Navigate to S3:**
   - **In the AWS Management Console, search for S3 and select it.**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Storage

Amazon S3

Store and retrieve any amount of data from anywhere

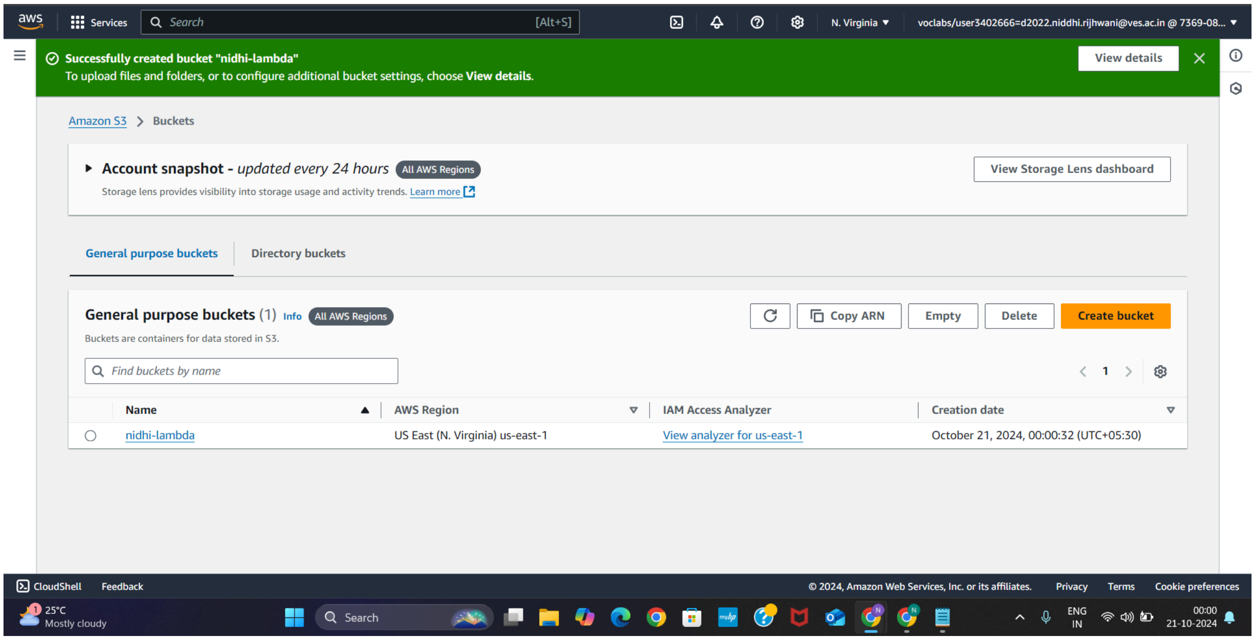
Amazon S3 is an object storage service that offers industry-leading scalability, data availability, security, and performance.

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

2. **Create a New Bucket:**
   - **Click Create bucket.**
   - **Enter a unique bucket name (e.g., `nidhi-lambda`).**
   - **Click Create bucket at the bottom of the page.**



Successfully created bucket "nidhi-lambda"
To upload files and folders, or to configure additional bucket settings, choose **View details**.

Amazon S3 > Buckets

Account snapshot - *updated every 24 hours* All AWS Regions

Storage lens provides visibility into storage usage and activity trends. Learn more

General purpose buckets (1) Info All AWS Regions

Buckets are containers for data stored in S3.

Name	AWS Region	IAM Access Analyzer	Creation date
nidhi-lambda	US East (N. Virginia) us-east-1	View analyzer for us-east-1	October 21, 2024, 00:00:32 (UTC+05:30)

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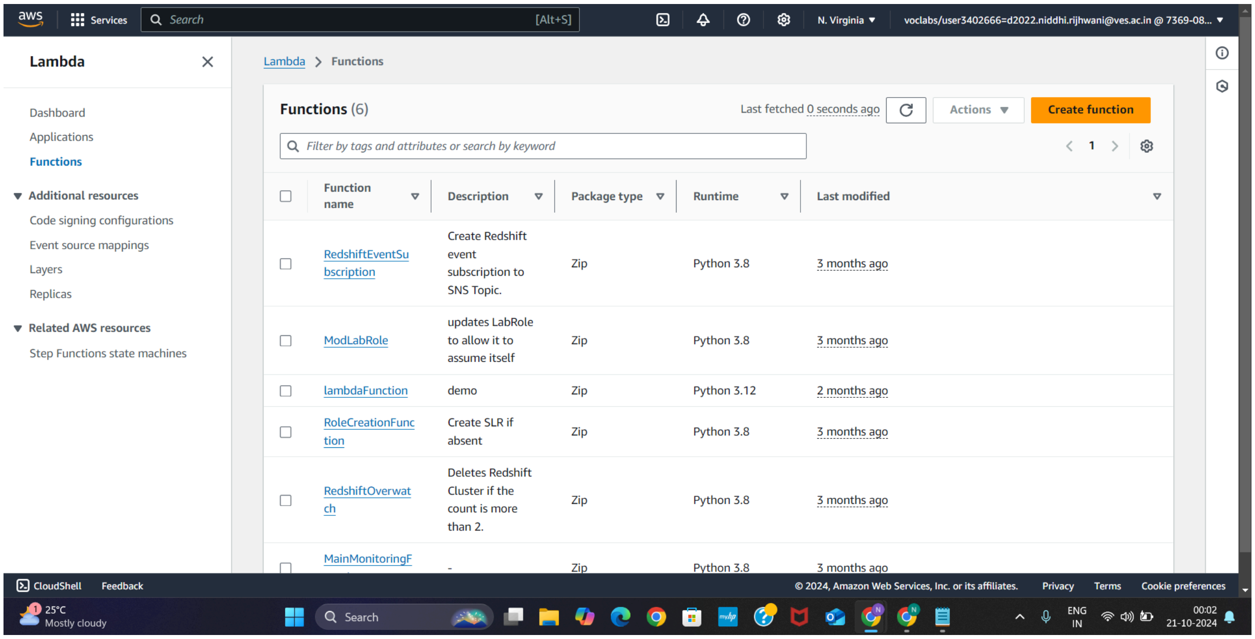
Step 3: Create the Lambda Function

1. **Navigate to AWS Lambda:**
   - **In the AWS Management Console, search for Lambda and select it.**



Lambda > Functions

Functions (6)

Last fetched 0 seconds ago

Function name	Description	Package type	Runtime	Last modified
RedshiftEventSubscription	Create Redshift event subscription to SNS Topic.	Zip	Python 3.8	3 months ago
ModLabRole	updates LabRole to allow it to assume itself	Zip	Python 3.8	3 months ago
lambdaFunction	demo	Zip	Python 3.12	2 months ago
RoleCreationFunction	Create SLR if absent	Zip	Python 3.8	3 months ago
RedshiftOverwatch	Deletes Redshift Cluster if the count is more than 2.	Zip	Python 3.8	3 months ago
MainMonitoringF	-	Zip	Python 3.8	3 months ago

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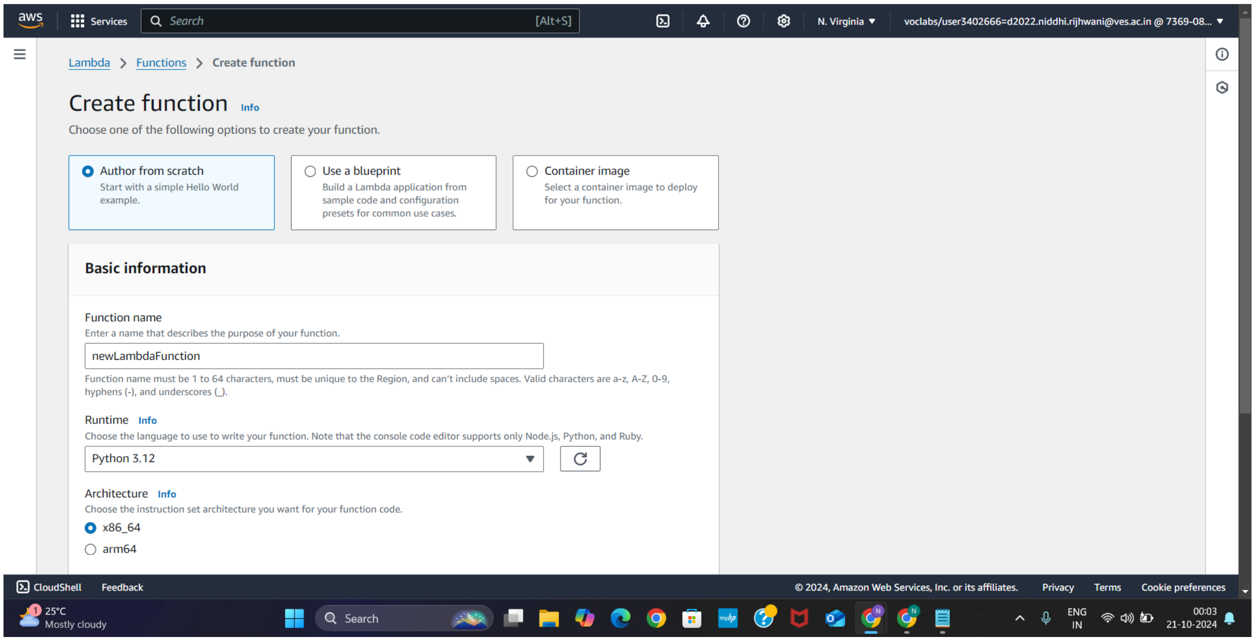
2. **Create a New Function:**
   - **Click Create function.**
   - **Select Author from scratch.**
   - **Set the function name (e.g., `newLambdaFunction`).**

- **Choose Python 3.x as the runtime.**
- **Click Create function.**



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Lambda > Functions > Create function

Create function Info

Choose one of the following options to create your function.

● Author from scratch
Start with a simple Hello World example.

○ Use a blueprint
Build a Lambda application from sample code and configuration presets for common use cases.

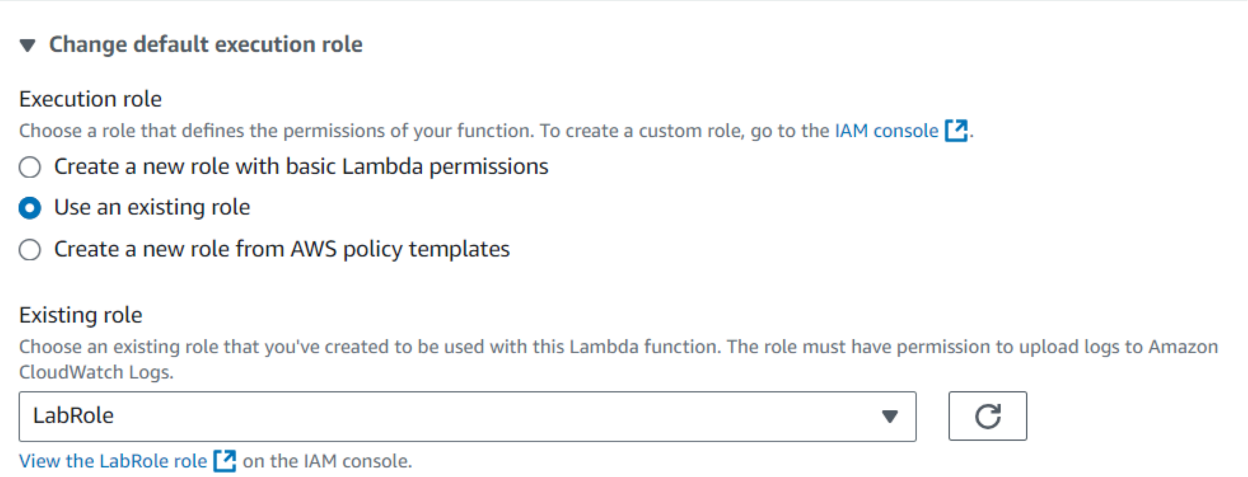
○ Container image
Select a container image to deploy for your function.

Basic information

Function name
Enter a name that describes the purpose of your function.
newLambdaFunction
Function name must be 1 to 64 characters, must be unique to the Region, and can't include spaces. Valid characters are a-z, A-Z, 0-9, hyphens (-), and underscores (_).

Runtime Info
Choose the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby.
Python 3.12 ▾

Architecture Info
Choose the instruction set architecture you want for your function code.
● x86_64
○ arm64



▼ Change default execution role

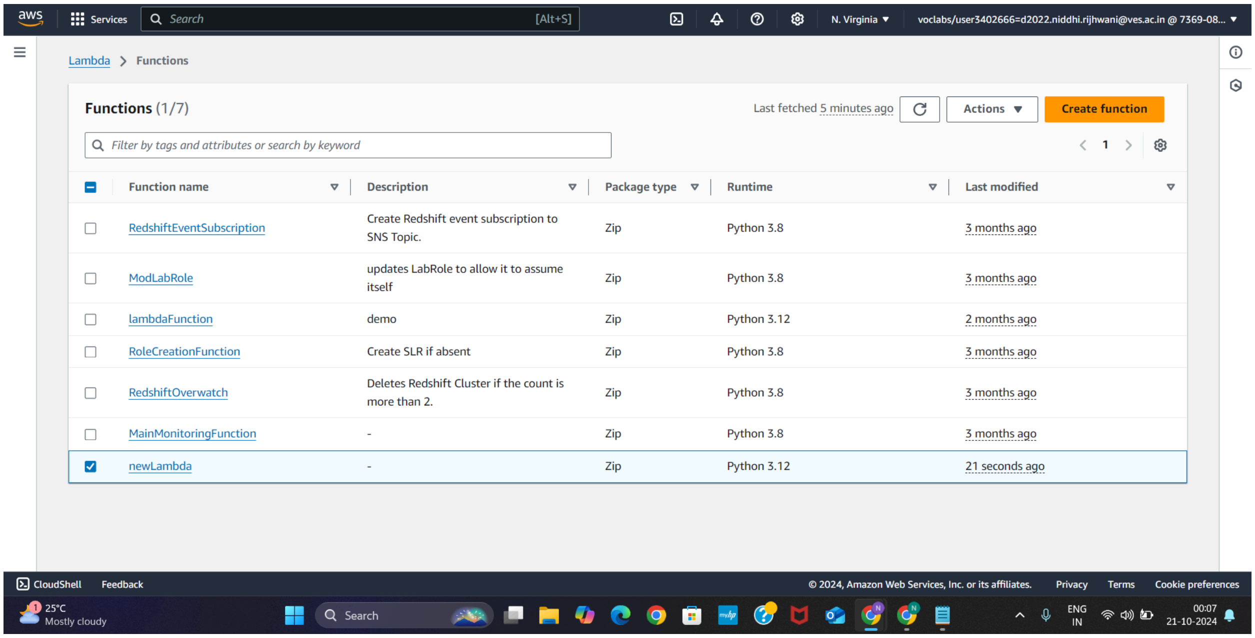
Execution role
Choose a role that defines the permissions of your function. To create a custom role, go to the IAM console.

○ Create a new role with basic Lambda permissions
● Use an existing role
○ Create a new role from AWS policy templates

Existing role
Choose an existing role that you've created to be used with this Lambda function. The role must have permission to upload logs to Amazon CloudWatch Logs.

LabRole ▾

View the LabRole role on the IAM console.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Lambda > Functions
Last fetched 5 minutes ago
Actions ▾
Create function
Filter by tags and attributes or search by keyword
CloudShell
Feedback
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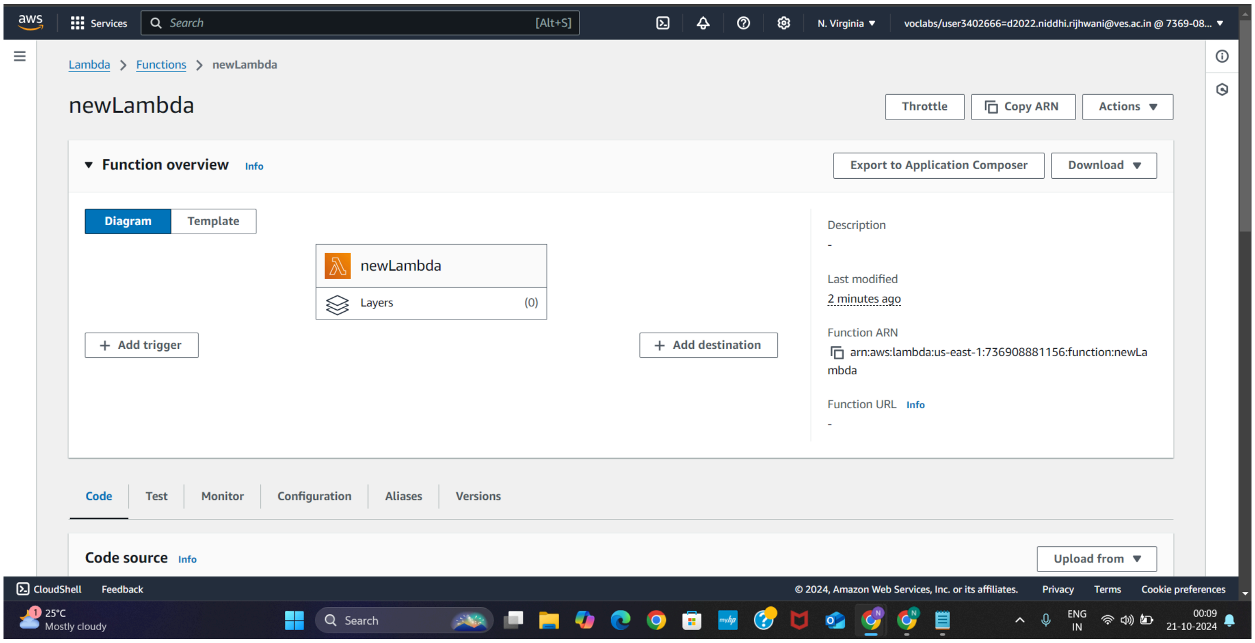
Functions (1/7)

	Function name	Description	Package type	Runtime	Last modified
□	RedshiftEventSubscription	Create Redshift event subscription to SNS Topic.	Zip	Python 3.8	3 months ago
□	ModLabRole	updates LabRole to allow it to assume itself	Zip	Python 3.8	3 months ago
□	lambdaFunction	demo	Zip	Python 3.12	2 months ago
□	RoleCreationFunction	Create SLR if absent	Zip	Python 3.8	3 months ago
□	RedshiftOverwatch	Deletes Redshift Cluster if the count is more than 2.	Zip	Python 3.8	3 months ago
□	MainMonitoringFunction	-	Zip	Python 3.8	3 months ago
☑	newLambda	-	Zip	Python 3.12	21 seconds ago



newLambda

▾ Function overview Info

Description
-

Last modified
2 minutes ago

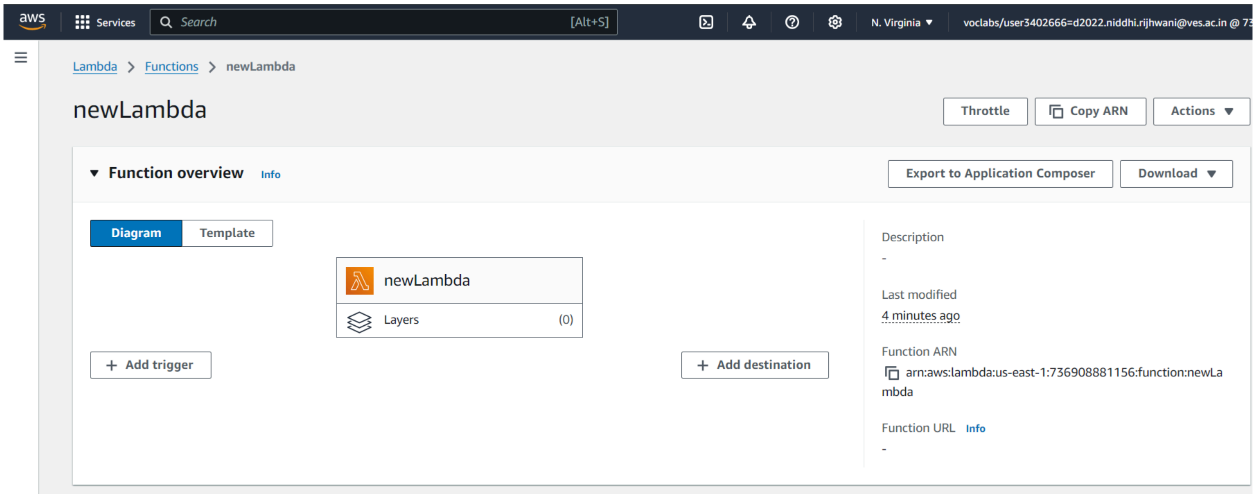
Function ARN
arn:aws:lambda:us-east-1:736908881156:function:newLambda

Function URL Info
-

Code source Info

Step 4: Configure S3 Trigger

1. **Add Trigger:**
   - **Scroll down to the Function overview section and click Add trigger.**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Lambda > Functions > newLambda
Throttle
Copy ARN
Actions
Info
Export to Application Composer
Download
Diagram
Template
+ Add trigger
+ Add destination

newLambda

Function overview

newLambda

Layers (0)

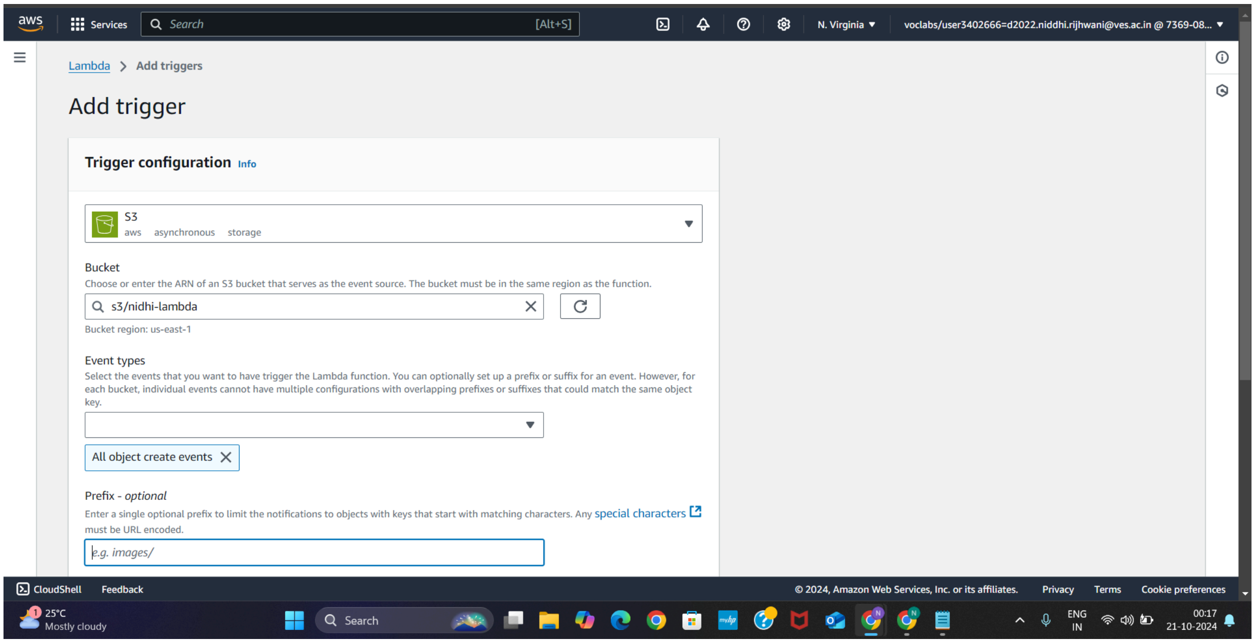
Description
-

Last modified
4 minutes ago

Function ARN
arn:aws:lambda:us-east-1:736908881156:function:newLambda

Function URL Info
-

- Select S3 from the trigger list.
- Choose the bucket you created earlier.
- For Event type, select All object create events.
- Click Add.



Add trigger

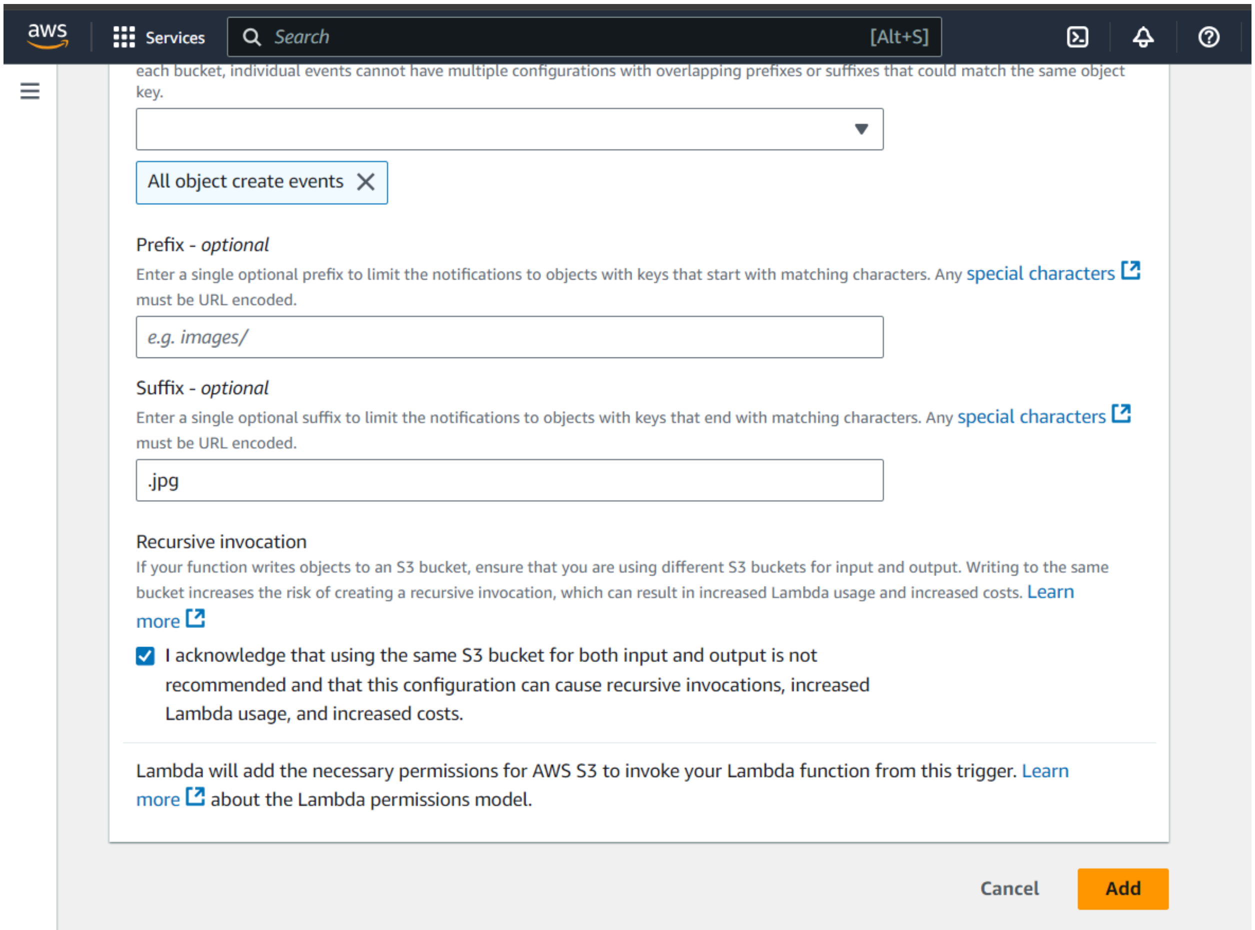
Trigger configuration

S3
aws asynchronous storage

Bucket
Choose or enter the ARN of an S3 bucket that serves as the event source. The bucket must be in the same region as the function.
s3/nidhi-lambda
Bucket region: us-east-1

Event types
Select the events that you want to have trigger the Lambda function. You can optionally set up a prefix or suffix for an event. However, for each bucket, individual events cannot have multiple configurations with overlapping prefixes or suffixes that could match the same object key.
All object create events

Prefix - *optional*
Enter a single optional prefix to limit the notifications to objects with keys that start with matching characters. Any special characters must be URL encoded.
e.g. images/



each bucket, individual events cannot have multiple configurations with overlapping prefixes or suffixes that could match the same object key.

All object create events ✕

Prefix - *optional*

Enter a single optional prefix to limit the notifications to objects with keys that start with matching characters. Any special characters must be URL encoded.

e.g. images/

Suffix - *optional*

Enter a single optional suffix to limit the notifications to objects with keys that end with matching characters. Any special characters must be URL encoded.

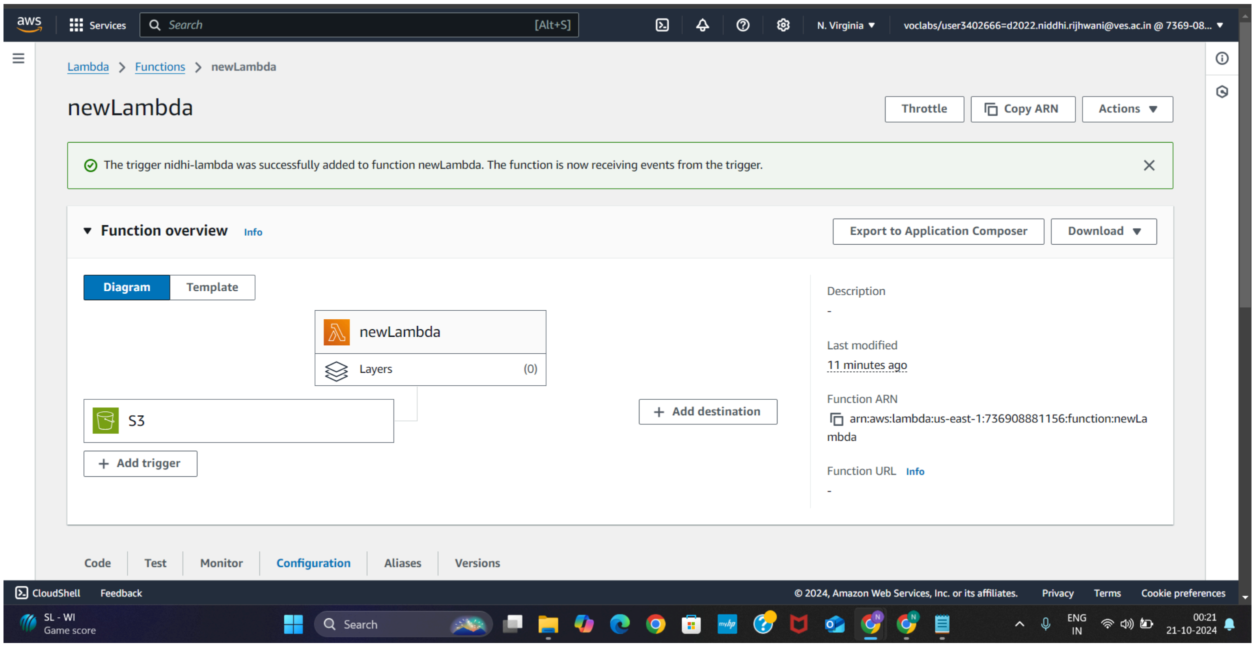
.jpg

Recursive invocation

If your function writes objects to an S3 bucket, ensure that you are using different S3 buckets for input and output. Writing to the same bucket increases the risk of creating a recursive invocation, which can result in increased Lambda usage and increased costs. Learn more

☑ I acknowledge that using the same S3 bucket for both input and output is not recommended and that this configuration can cause recursive invocations, increased Lambda usage, and increased costs.

Lambda will add the necessary permissions for AWS S3 to invoke your Lambda function from this trigger. Learn more about the Lambda permissions model.



voclabs/user3402666=d2022.niddhi.rijhwani@ves.ac.in @ 7369-08... ▼

Lambda > Functions > newLambda

newLambda

The trigger nidhi-lambda was successfully added to function newLambda. The function is now receiving events from the trigger.

▼ Function overview Info

Description
-

Last modified
11 minutes ago

Function ARN
arn:aws:lambda:us-east-1:736908881156:function:newLambda

Function URL Info
-

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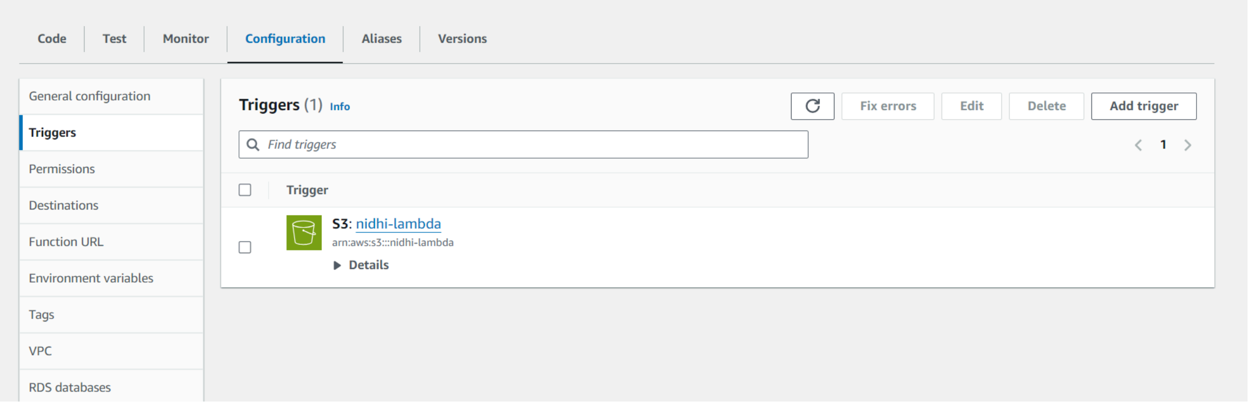


S3: nidhi-lambda
arn:aws:s3:::nidhi-lambda

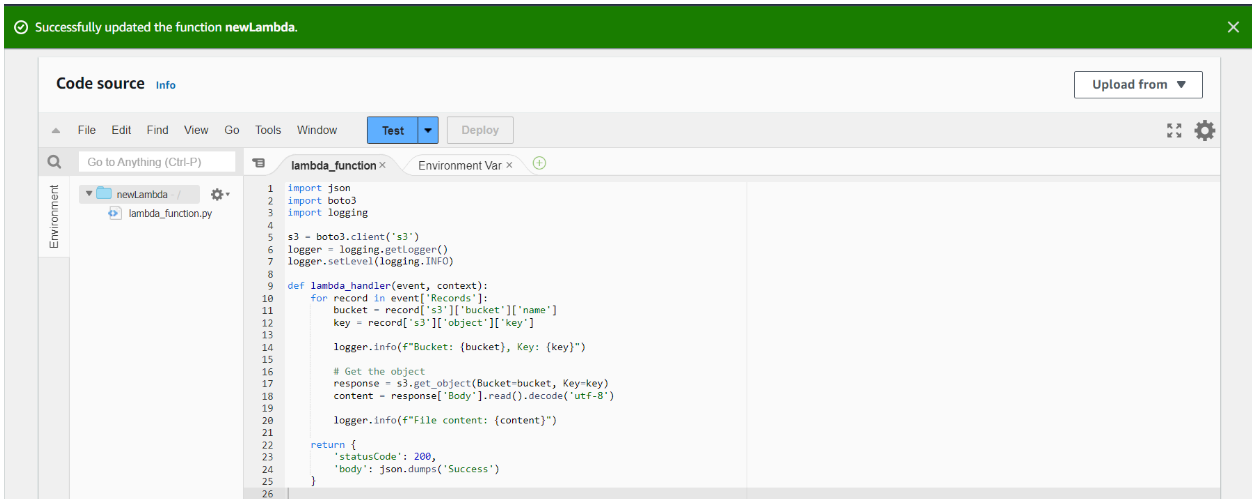
Step 5: Write the Lambda Function Code

1. **Open the Code Editor:**
   - **In the Lambda function editor, find the code area.**
2. **Enter the Code:**
   - **Replace the default code with the following Python code:**

python
Copy code

```python
import json
import boto3
import logging

s3 = boto3.client('s3')
logger = logging.getLogger()
logger.setLevel(logging.INFO)

def lambda_handler(event, context):
    for record in event['Records']:
        bucket = record['s3']['bucket']['name']
        key = record['s3']['object']['key']

        logger.info(f"Bucket: {bucket}, Key: {key}")

        # Get the object
        response = s3.get_object(Bucket=bucket, Key=key)
        content = response['Body'].read().decode('utf-8')

        logger.info(f"File content: {content}")
    return {
        'statusCode': 200,
        'body': json.dumps('Success')
    }
```

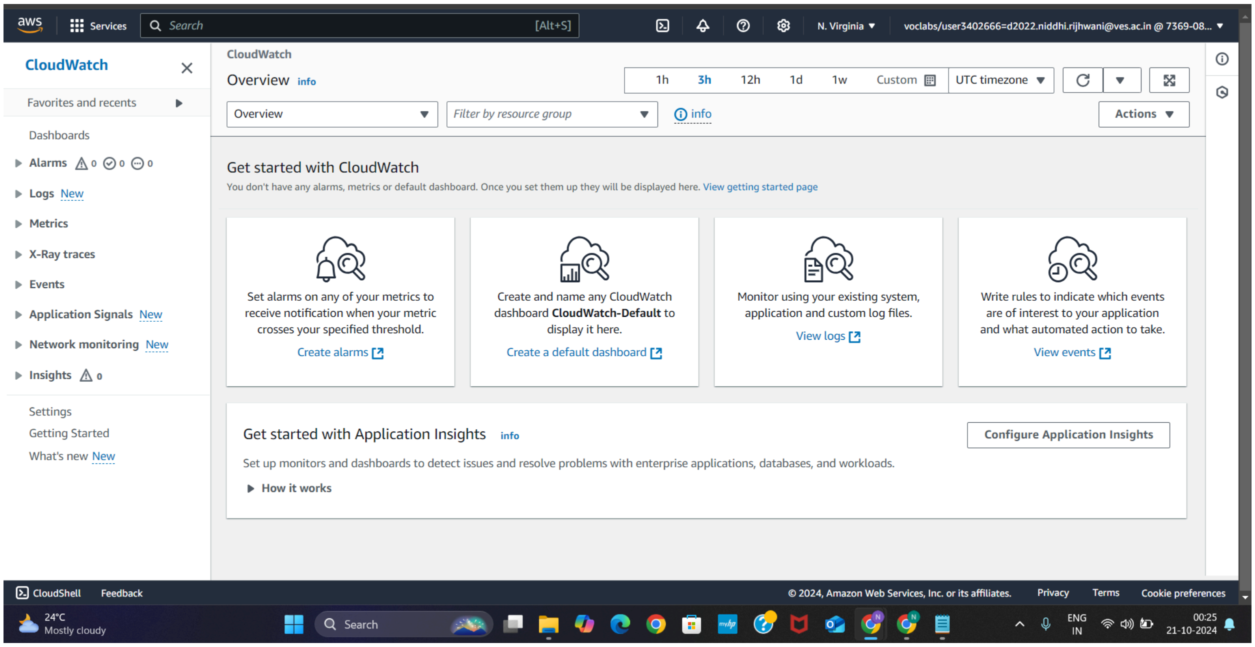
3. **Deploy Changes:**
   - ○ **Click Deploy to save your changes.**



Successfully updated the function **newLambda**.

Code source Info

```python
import json
import boto3
import logging

s3 = boto3.client('s3')
logger = logging.getLogger()
logger.setLevel(logging.INFO)

def lambda_handler(event, context):
    for record in event['Records']:
        bucket = record['s3']['bucket']['name']
        key = record['s3']['object']['key']

        logger.info(f"Bucket: {bucket}, Key: {key}")

        # Get the object
        response = s3.get_object(Bucket=bucket, Key=key)
        content = response['Body'].read().decode('utf-8')

        logger.info(f"File content: {content}")

    return {
        'statusCode': 200,
        'body': json.dumps('Success')
    }

```



Get started with CloudWatch

You don't have any alarms, metrics or default dashboard. Once you set them up they will be displayed here. View getting started page

Set alarms on any of your metrics to receive notification when your metric crosses your specified threshold.
Create alarms

Create and name any CloudWatch dashboard **CloudWatch-Default** to display it here.
Create a default dashboard

Monitor using your existing system, application and custom log files.
View logs

Write rules to indicate which events are of interest to your application and what automated action to take.
View events

Get started with Application Insights info

Configure Application Insights

Set up monitors and dashboards to detect issues and resolve problems with enterprise applications, databases, and workloads.

▸ How it works

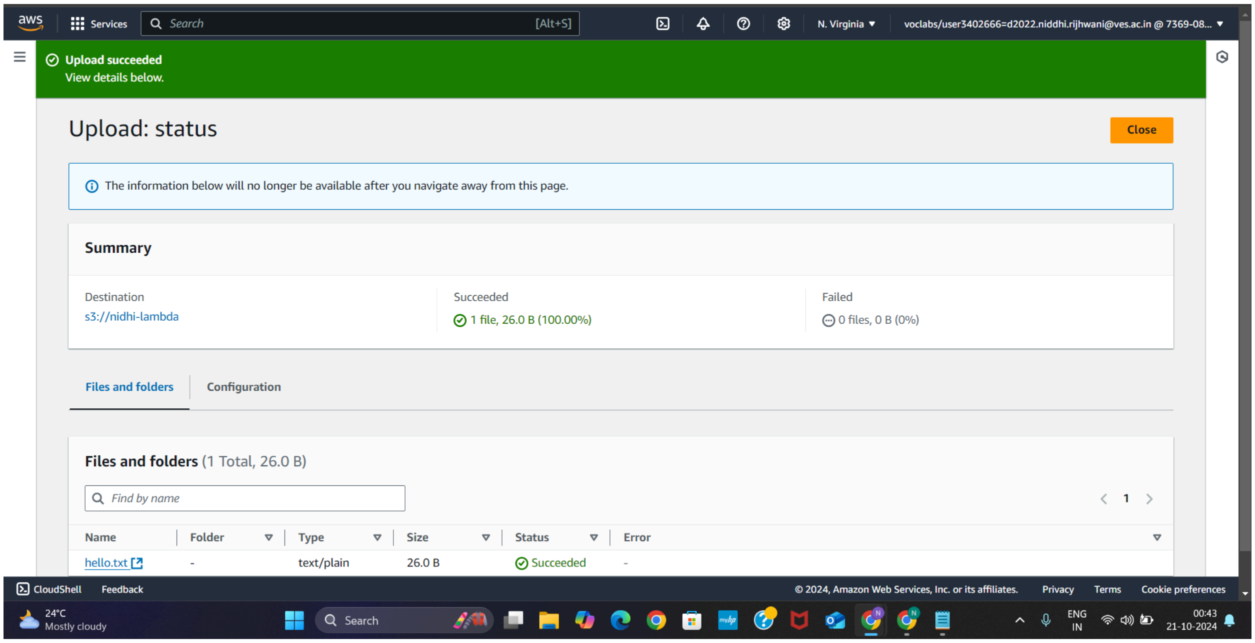
Step 6: Set Permissions

1. **Navigate to IAM:**
   - ○ **Search for and select IAM in the AWS Management Console.**

2. **Find the Lambda Role:**
   - **Click on Roles in the left sidebar.**
   - **Search for the role that corresponds to your Lambda function (it will be named something like `LogS3FileContent-role-xxxx`).**
3. **Attach Policies:**
   - **Click on Attach policies.**
   - **Search for AWSLambdaBasicExecutionRole and AmazonS3ReadOnlyAccess.**
   - **Check the boxes next to both policies and click Attach policy.**

Step 7: Test Your Setup

1. **Upload a Text File:**
   - **Go back to your S3 bucket.**
   - **Click Upload, choose a text file, and upload it.**



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Upload succeeded
View details below.

Upload: status

The information below will no longer be available after you navigate away from this page.

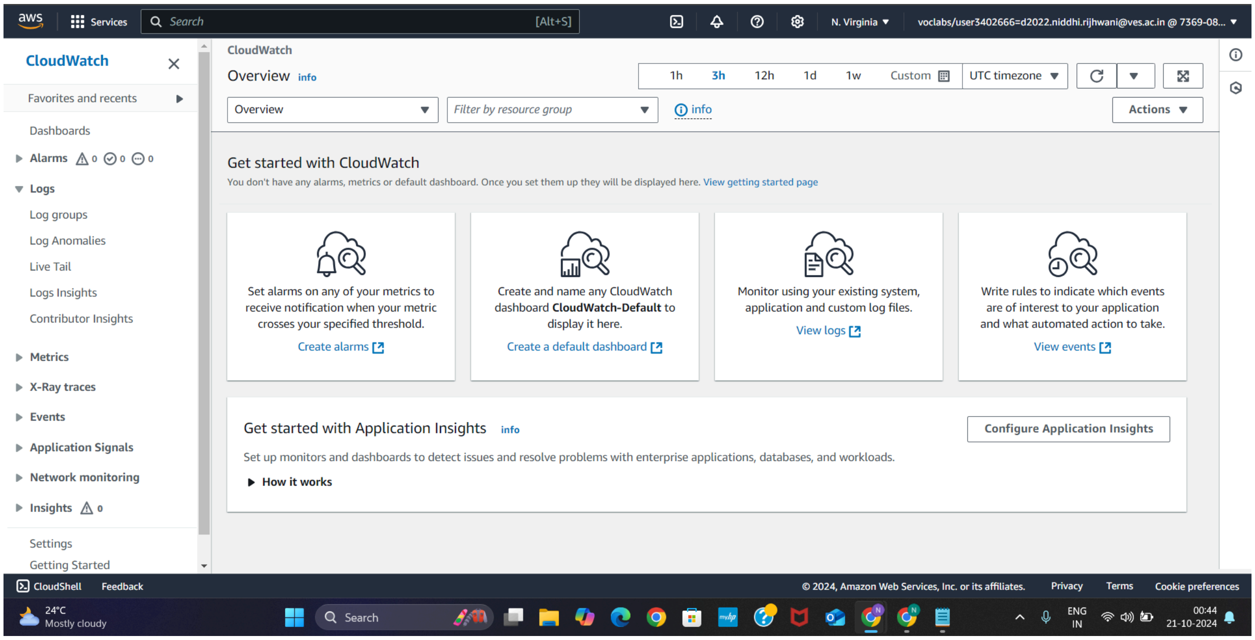
Summary

Destination	Succeeded	Failed
s3://nidhi-lambda	1 file, 26.0 B (100.00%)	0 files, 0 B (0%)

Files and folders (1 Total, 26.0 B)

Name	Folder	Type	Size	Status	Error
hello.txt	-	text/plain	26.0 B	Succeeded	-

2. **Check CloudWatch Logs:**
   - **In the AWS Management Console, search for CloudWatch and select it.**



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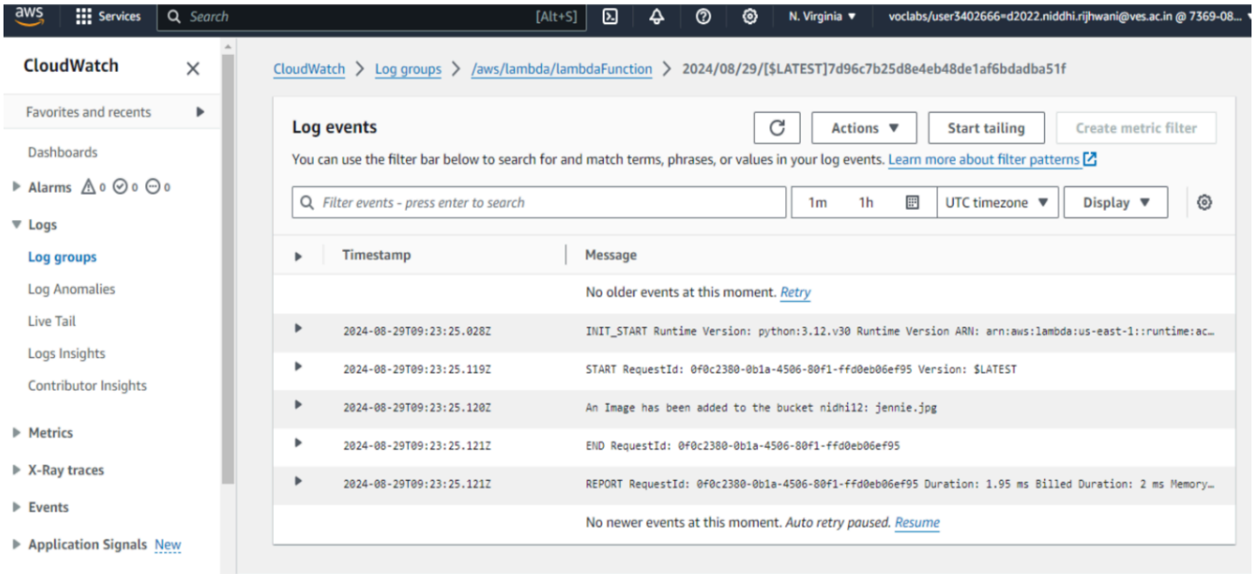
Get started with Application Insights info

Configure Application Insights

Set up monitors and dashboards to detect issues and resolve problems with enterprise applications, databases, and workloads.

How it works



CloudWatch > Log groups > /aws/lambda/lambdaFunction > 2024/08/29/[$LATEST]7d96c7b25d8e4eb48de1af6bdadba51f

Log events

You can use the filter bar below to search for and match terms, phrases, or values in your log events. Learn more about filter patterns

```
Timestamp                  Message
                           No older events at this moment. Retry
2024-08-29T09:23:25.028Z   INIT_START Runtime Version: python:3.12.v30 Runtime Version ARN: arn:aws:lambda:us-east-1::runtime:ac…
2024-08-29T09:23:25.119Z   START RequestId: 0f0c2380-0b1a-4506-80f1-ffd0eb06ef95 Version: $LATEST
2024-08-29T09:23:25.120Z   An Image has been added to the bucket nidhi12: jennie.jpg
2024-08-29T09:23:25.121Z   END RequestId: 0f0c2380-0b1a-4506-80f1-ffd0eb06ef95
2024-08-29T09:23:25.121Z   REPORT RequestId: 0f0c2380-0b1a-4506-80f1-ffd0eb06ef95 Duration: 1.95 ms Billed Duration: 2 ms Memory…
                           No newer events at this moment. Auto retry paused. Resume
```

- **Click on Logs in the left sidebar.**
- **Find the log group named `/aws/lambda/LogS3FileContent`.**
- **Click on the latest log stream to view the output, which should include the file content logged.**

Step 8: Clean Up Resources

- **Once you've confirmed everything works, remember to delete the Lambda function, S3 bucket, and Cloud9 environment to avoid incurring costs.**

CLEARED!!!

Conclusion

You’ve successfully created a Lambda function that logs the content of text files uploaded to an S3 bucket! If you have any questions or need further assistance, feel free to ask.