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Hashu Advani Memorial Complex, Collector Colony, Chembur East, Mumbai - 400074.

Department of Information Technology

A.Y. 2024-25

Advance DevOps Lab
Experiment 12

Aim: To Build Your Application using AWS CodeBuild and Deploy on S3 / SEBS using AWS CodePipeline, deploy Sample Application on EC2 instance using AWS CodeDeploy.

Roll No.	53
Name	Aryan Deepak Saraf
Class	D15B
Subject	Advance DevOps Lab
LO Mapped	LO1: To understand the fundamentals of Cloud Computing and be fully proficient with Cloud based DevOps solution deployment options to meet your business requirements. LO6: To engineer a composition of nano services using AWS Lambda and Step Functions with the Serverless Framework
Grade:	

AIM : To create a Lambda function which will log “An Image has been added” once you add an object to a specific bucket in S3.

THEORY :

AWS Lambda and S3 Integration

Delving into the powerful integration between AWS Lambda and Amazon S3, a popular use case in serverless architecture. AWS Lambda enables automatic execution of code in response to events generated by other AWS services, such as the addition of an object to an S3 bucket.

Event-Driven Architecture

AWS Lambda operates on an event-driven model, where specific events trigger the execution of predefined functions. In this case, when an object like an image is uploaded to a specific S3 bucket, S3 generates an event notification. This event is sent to AWS Lambda, which then triggers the function you have created. The function can be designed to perform various tasks, such as processing the object, extracting metadata, or, as in this experiment, simply logging a message—“An Image has been added.”

Automation and Real-Time Processing

The integration of AWS Lambda with S3 is a prime example of automation in the cloud. It allows you to set up a real-time response system where actions are automatically triggered without manual intervention. This is particularly useful in scenarios where immediate processing or reaction is required, such as in applications that handle large volumes of incoming data or media files.

Scalability and Efficiency

One of the key advantages of using AWS Lambda with S3 is its scalability. Lambda functions can automatically scale to handle multiple events concurrently, ensuring that no matter how many objects are added to the S3 bucket, each will trigger the necessary function without delay. This setup is highly efficient, reducing operational overhead and ensuring that processes remain consistent and reliable, even under heavy workloads.

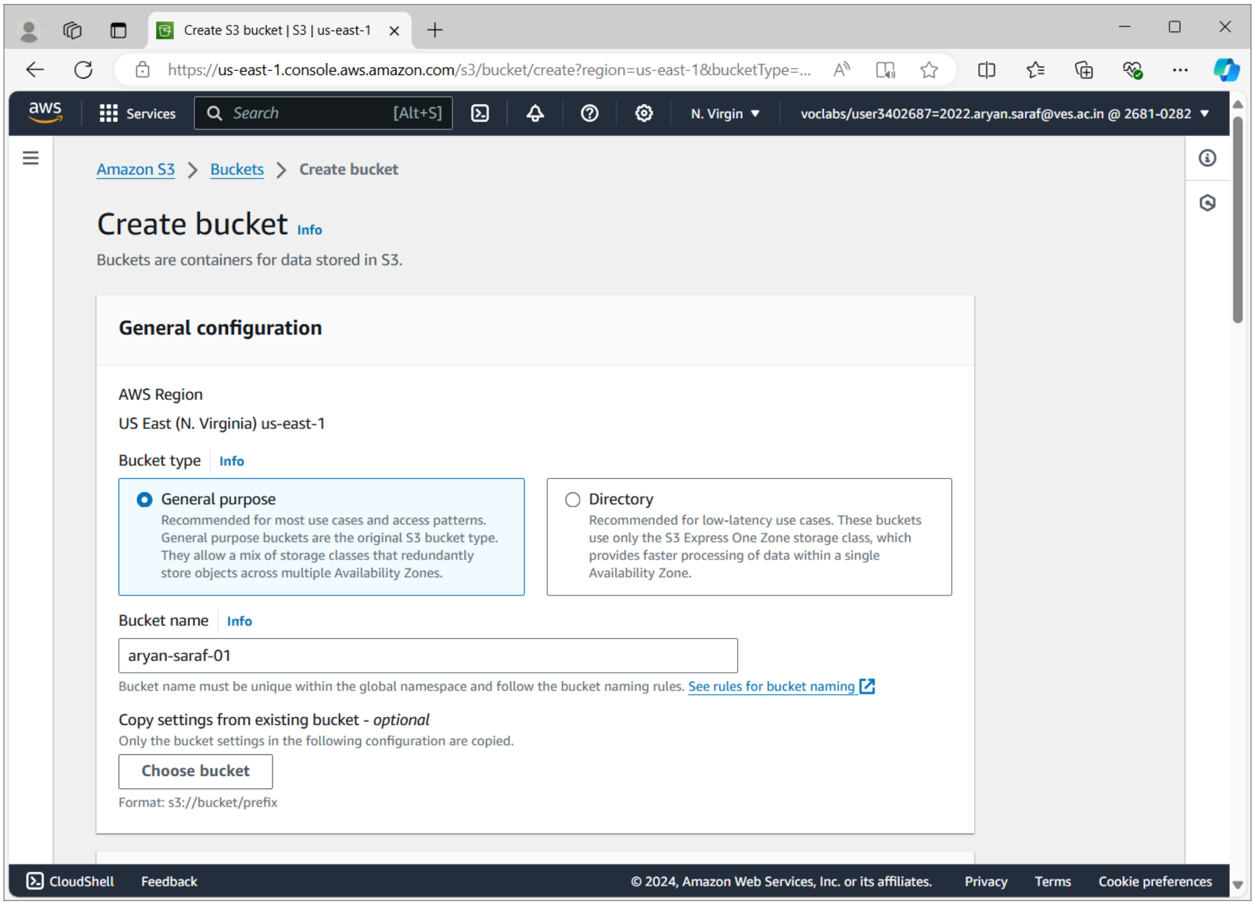
Use Cases and Practical Applications

This type of setup is widely used in various domains, including media processing, where images or videos uploaded to S3 can trigger Lambda functions to generate thumbnails or transcode files. It is also commonly used in data analytics, where data uploaded to S3 triggers processing functions that prepare the data for further analysis or storage. Another application is in backup systems, where new files added to S3 are immediately backed up or replicated in other locations.

Security Considerations

When working with AWS Lambda and S3, security is paramount. Each Lambda function interacts with S3 via permissions defined by AWS IAM roles and policies. These permissions must be carefully configured to ensure that the function has the necessary access rights—such as read and write permissions for the specific S3 bucket—without exposing unnecessary access to other resources. This ensures that the system remains secure while performing the required tasks efficiently.

Create an S3 Bucket. Enter a unique bucket name.


Create S3 bucket | S3 | us-east-1
https://us-east-1.console.aws.amazon.com/s3/bucket/create?region=us-east-1&bucketType=...
aws
Services
Search [Alt+S]
N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282
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
aryan-saraf-01
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.
Choose bucket
Format: s3://bucket/prefix

CloudShell
Feedback
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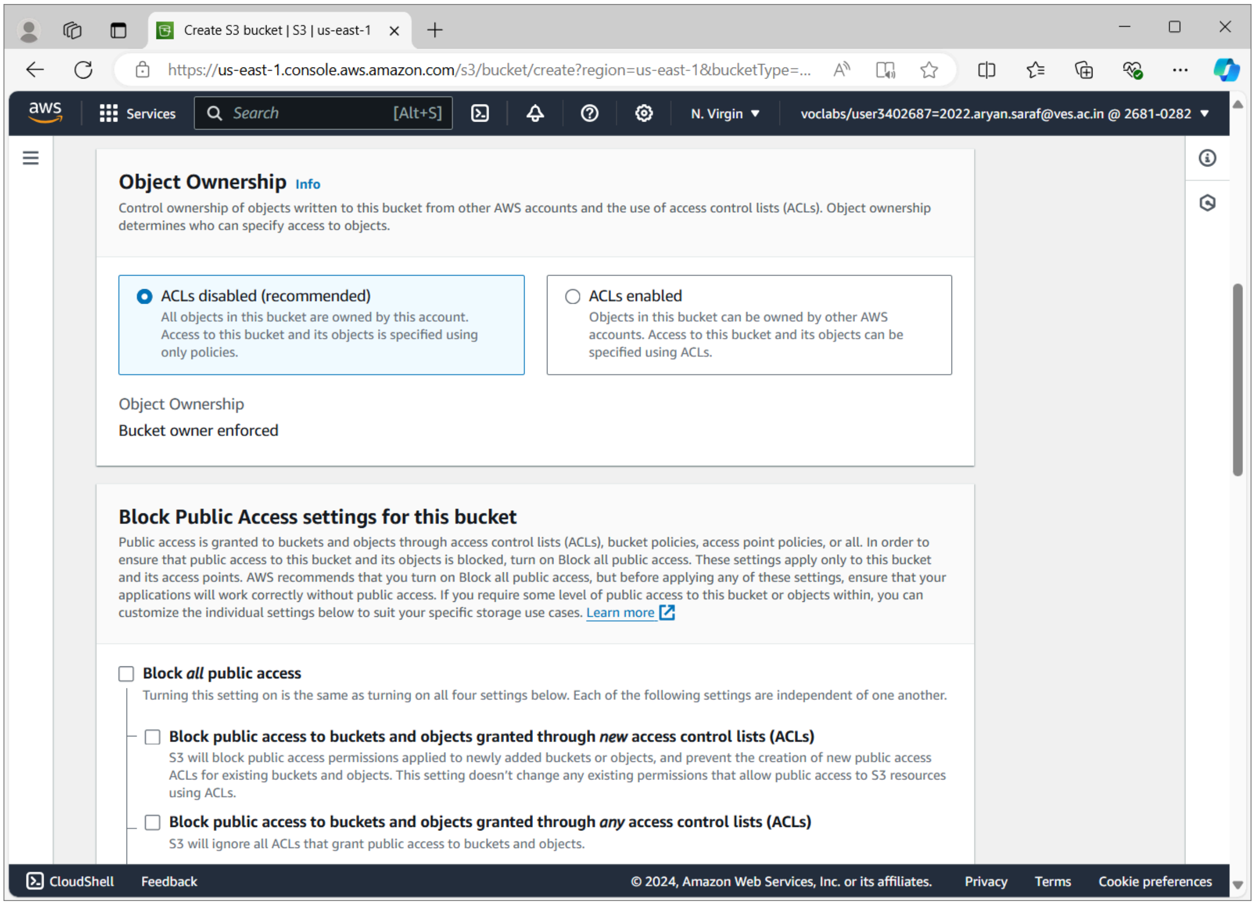

Create S3 bucket | S3 | us-east-1
https://us-east-1.console.aws.amazon.com/s3/bucket/create?region=us-east-1&bucketType=...
aws
Services
Search [Alt+S]
N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282

Object Ownership Info

Control ownership of objects written to this bucket from other AWS accounts and the use of access control lists (ACLs). Object ownership determines who can specify access to objects.

● ACLs disabled (recommended)
All objects in this bucket are owned by this account. Access to this bucket and its objects is specified using only policies.

○ ACLs enabled
Objects in this bucket can be owned by other AWS accounts. Access to this bucket and its objects can be specified using ACLs.

Object Ownership
Bucket owner enforced

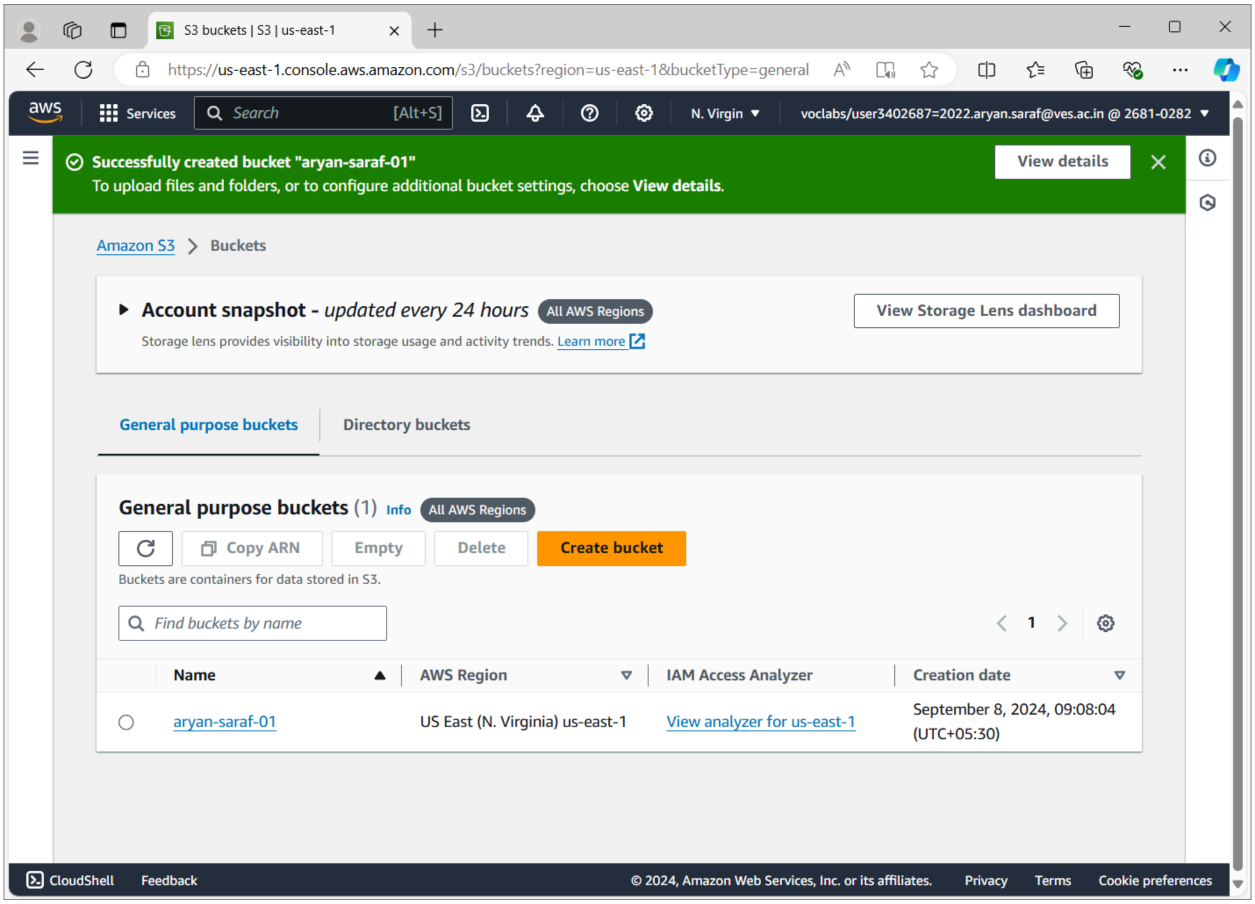
Block Public Access settings for this bucket

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 this bucket and its 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 this bucket 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.


S3 buckets | S3 | us-east-1
https://us-east-1.console.aws.amazon.com/s3/buckets?region=us-east-1&bucketType=general
aws
Services
Search
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N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282
View details
Amazon S3 > Buckets
View Storage Lens dashboard
General purpose buckets
Directory buckets
Copy ARN
Empty
Delete
Create bucket
Find buckets by name
CloudShell
Feedback
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Successfully created bucket "aryan-saraf-01"
To upload files and folders, or to configure additional bucket settings, choose **View details**.

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

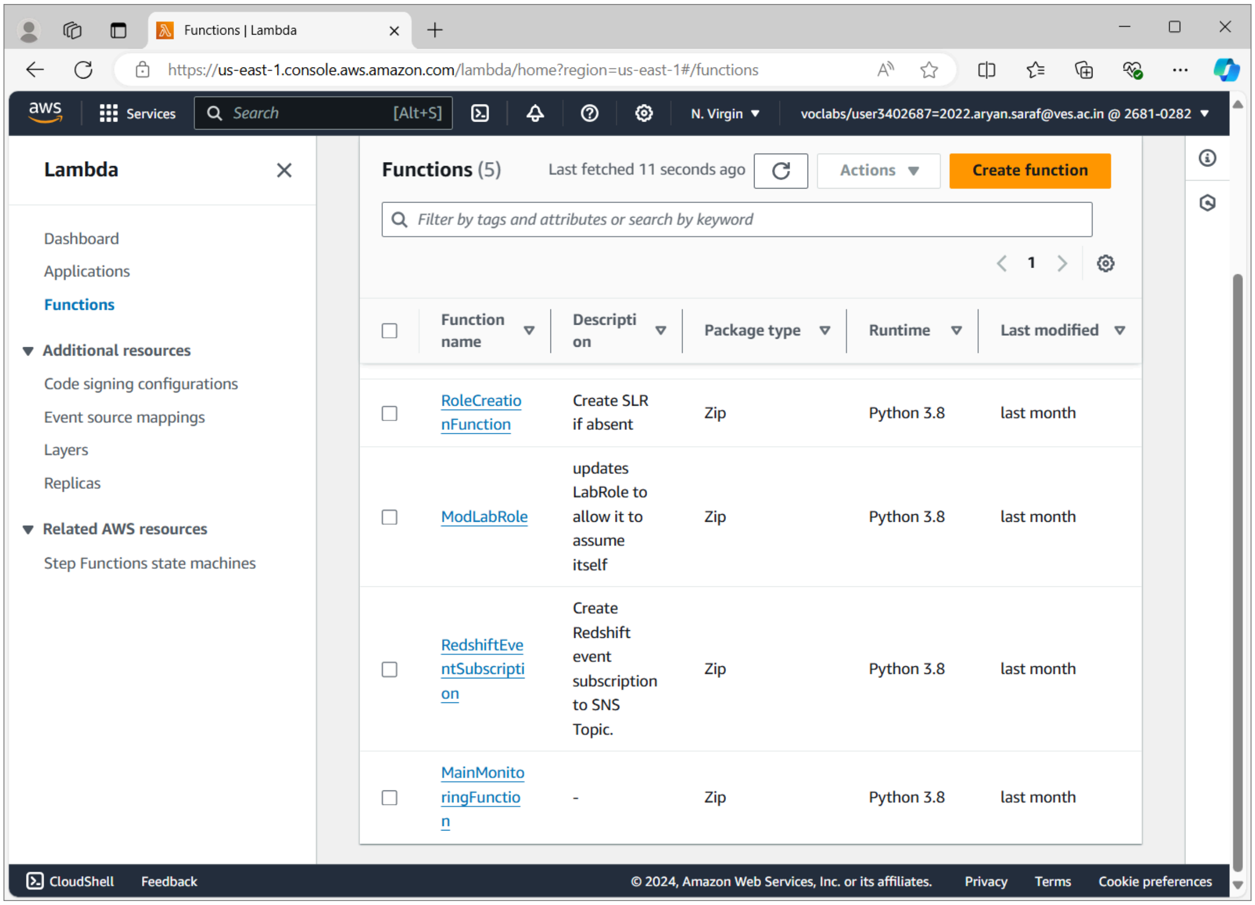
Storage lens provides visibility into storage usage and activity trends. Learn more

General purpose buckets (1) Info All AWS Regions

Buckets are containers for data stored in S3.

	Name	AWS Region	IAM Access Analyzer	Creation date
○	aryan-saraf-01	US East (N. Virginia) us-east-1	View analyzer for us-east-1	September 8, 2024, 09:08:04 (UTC+05:30)

Navigate to the Lambda service. Click on "Create function."


Functions | Lambda
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions
aws
Services
Search
[Alt+S]
N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282
Lambda
Dashboard
Applications
Functions
Additional resources
Code signing configurations
Event source mappings
Layers
Replicas
Related AWS resources
Step Functions state machines
Actions
Create function
Filter by tags and attributes or search by keyword
CloudShell
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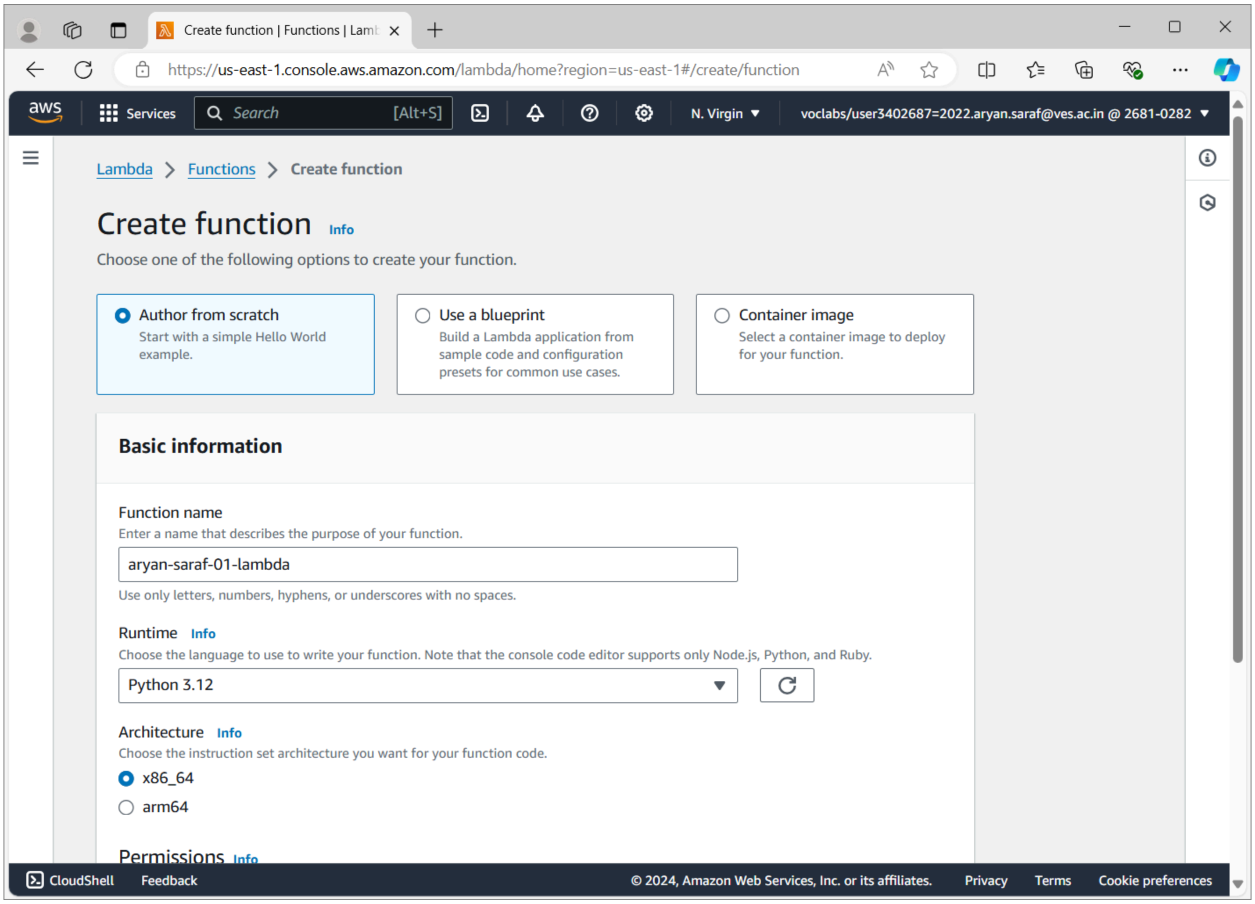
Functions (5) Last fetched 11 seconds ago

□	Function name	Description	Package type	Runtime	Last modified
□	RoleCreationFunction	Create SLR if absent	Zip	Python 3.8	last month
□	ModLabRole	updates LabRole to allow it to assume itself	Zip	Python 3.8	last month
□	RedshiftEventSubscription	Create Redshift event subscription to SNS Topic.	Zip	Python 3.8	last month
□	MainMonitoringFunction	-	Zip	Python 3.8	last month

Choose "Author from scratch." Enter a name for your function. Select a runtime (Python 3.x).



Create function | Functions | Lamb
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/create/function
aws
Services
Search [Alt+S]
N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282

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.
aryan-saraf-01-lambda
Use only letters, numbers, hyphens, or underscores with no spaces.

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

Permissions Info

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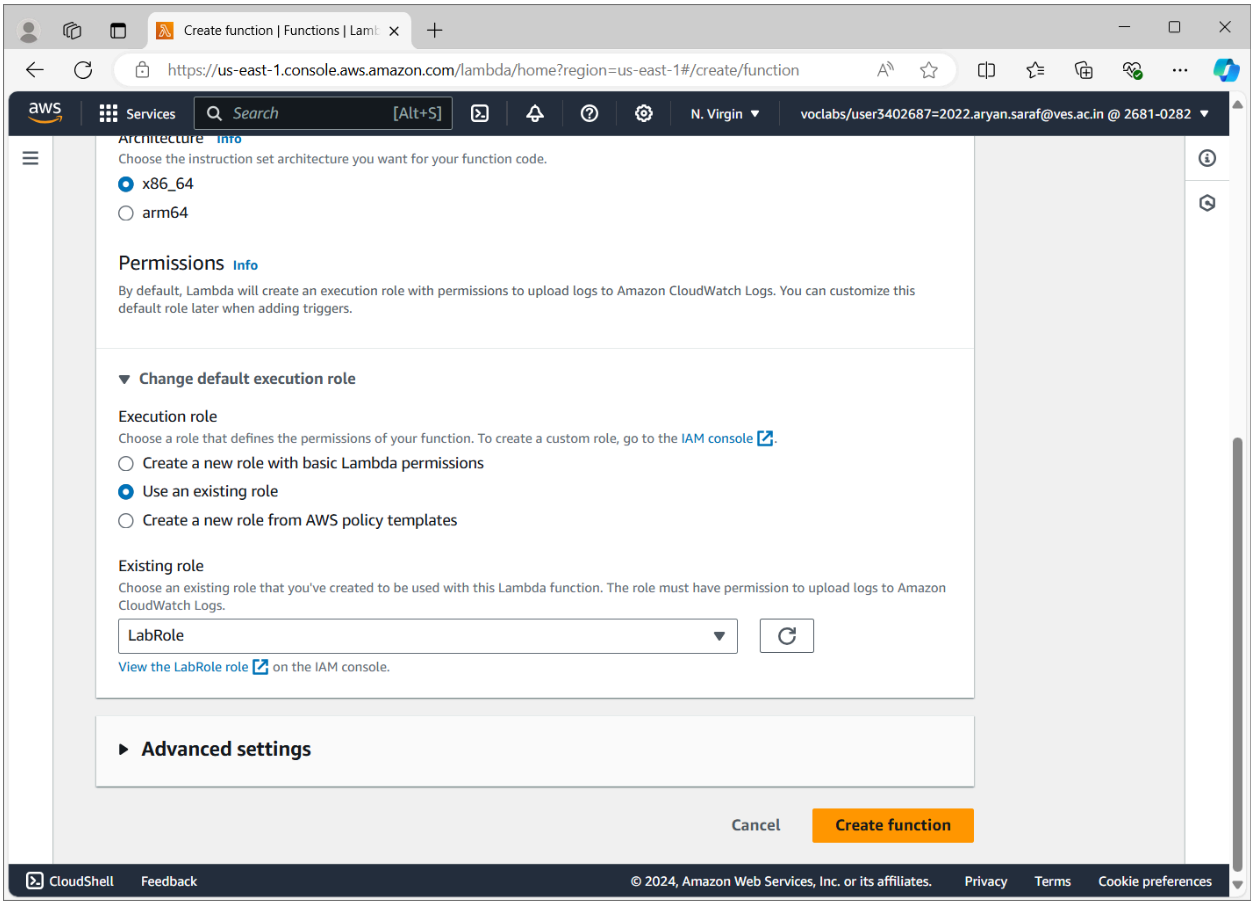


Create function | Functions | Lamb
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/create/function
aws
Services
Search [Alt+S]
N. Virgin
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282

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

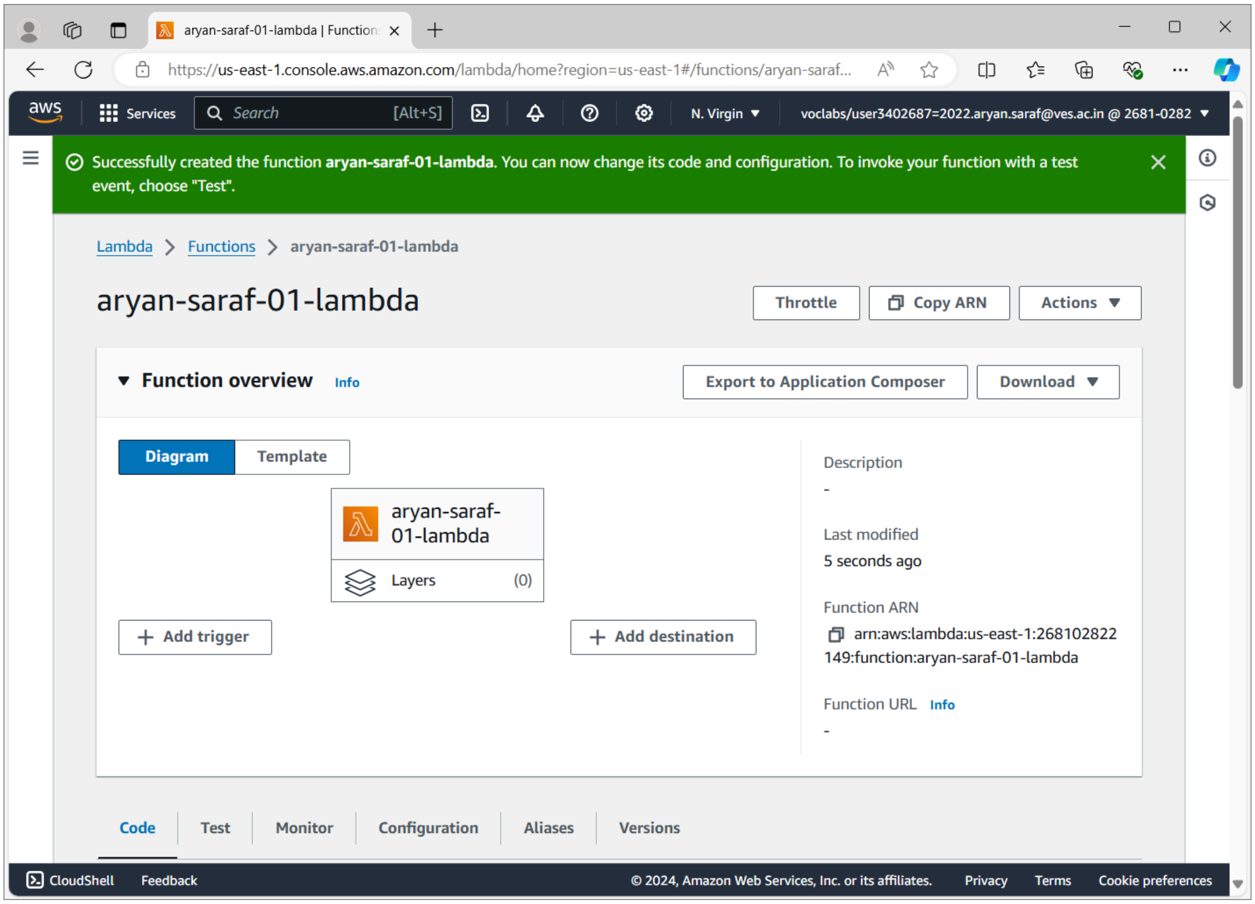
Permissions Info
By default, Lambda will create an execution role with permissions to upload logs to Amazon CloudWatch Logs. You can customize this default role later when adding triggers.

▼ 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.

▶ Advanced settings



Successfully created the function **aryan-saraf-01-lambda**. You can now change its code and configuration. To invoke your function with a test event, choose "Test".

Lambda > Functions > aryan-saraf-01-lambda

aryan-saraf-01-lambda

Function overview

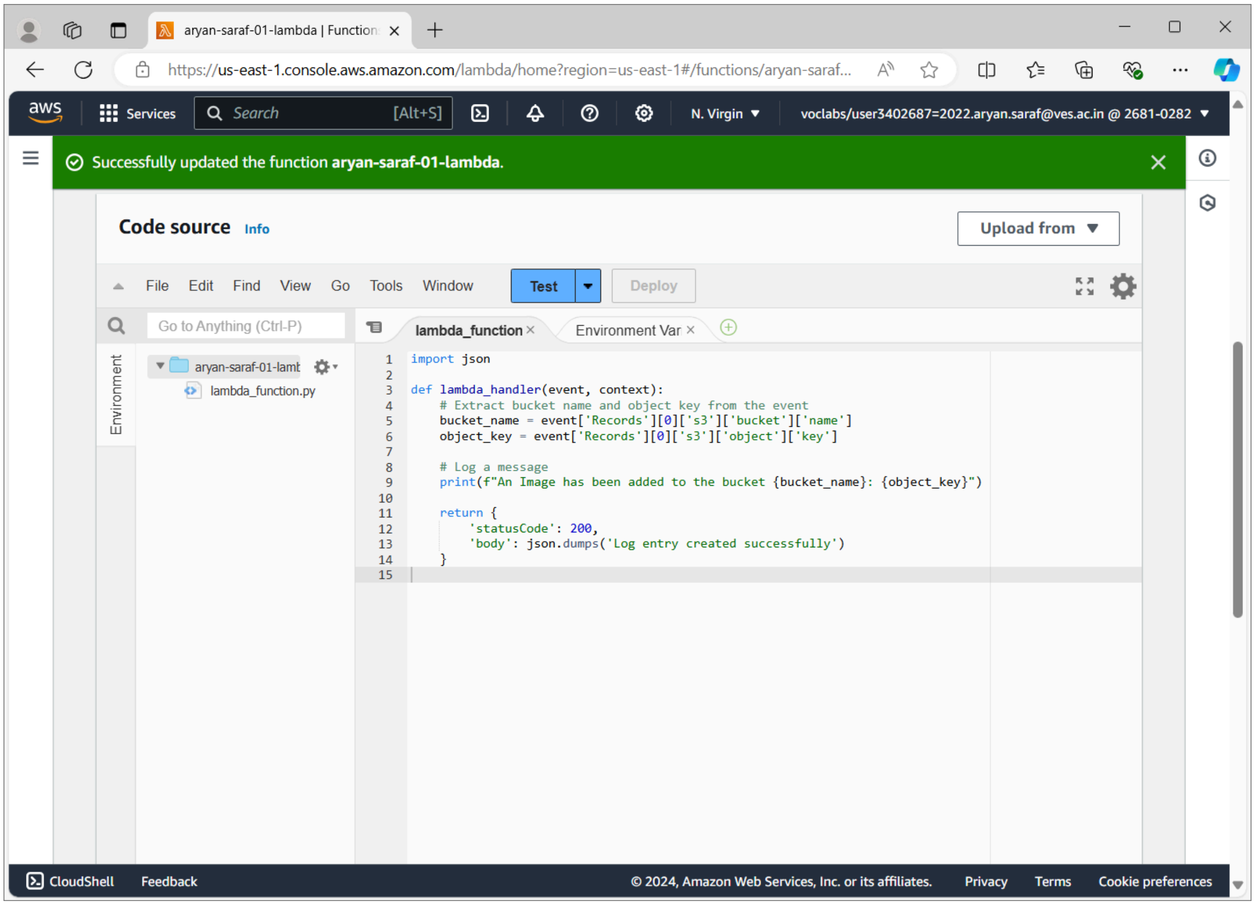
Description
-

Last modified
5 seconds ago

Function ARN
arn:aws:lambda:us-east-1:268102822149:function:aryan-saraf-01-lambda

Function URL
-

Write the Lambda Function Code. Click "Deploy" to save your changes.

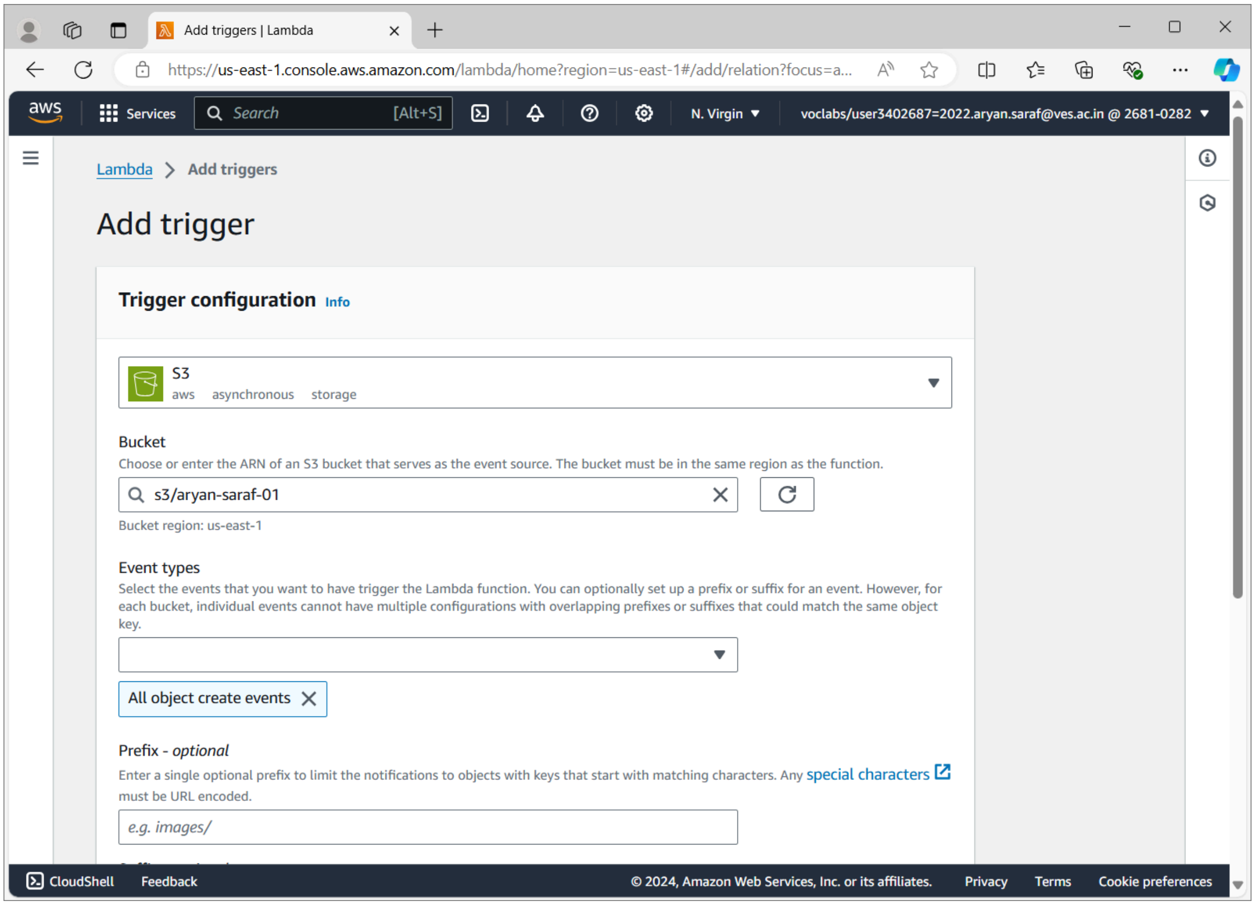


Successfully updated the function **aryan-saraf-01-lambda**.

Code source

```python
import json

def lambda_handler(event, context):
    # Extract bucket name and object key from the event
    bucket_name = event['Records'][0]['s3']['bucket']['name']
    object_key = event['Records'][0]['s3']['object']['key']

    # Log a message
    print(f"An Image has been added to the bucket {bucket_name}: {object_key}")

    return {
        'statusCode': 200,
        'body': json.dumps('Log entry created successfully')
    }

```

Select "S3" from the list of triggers. Choose the S3 bucket you created earlier. In the "Event type" dropdown, select "All object create events." Click "Add."


Add triggers | Lambda
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/add/relation?focus=a...
aws
Services
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voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282
Lambda > Add triggers

Add trigger

Trigger configuration Info

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/aryan-saraf-01
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/

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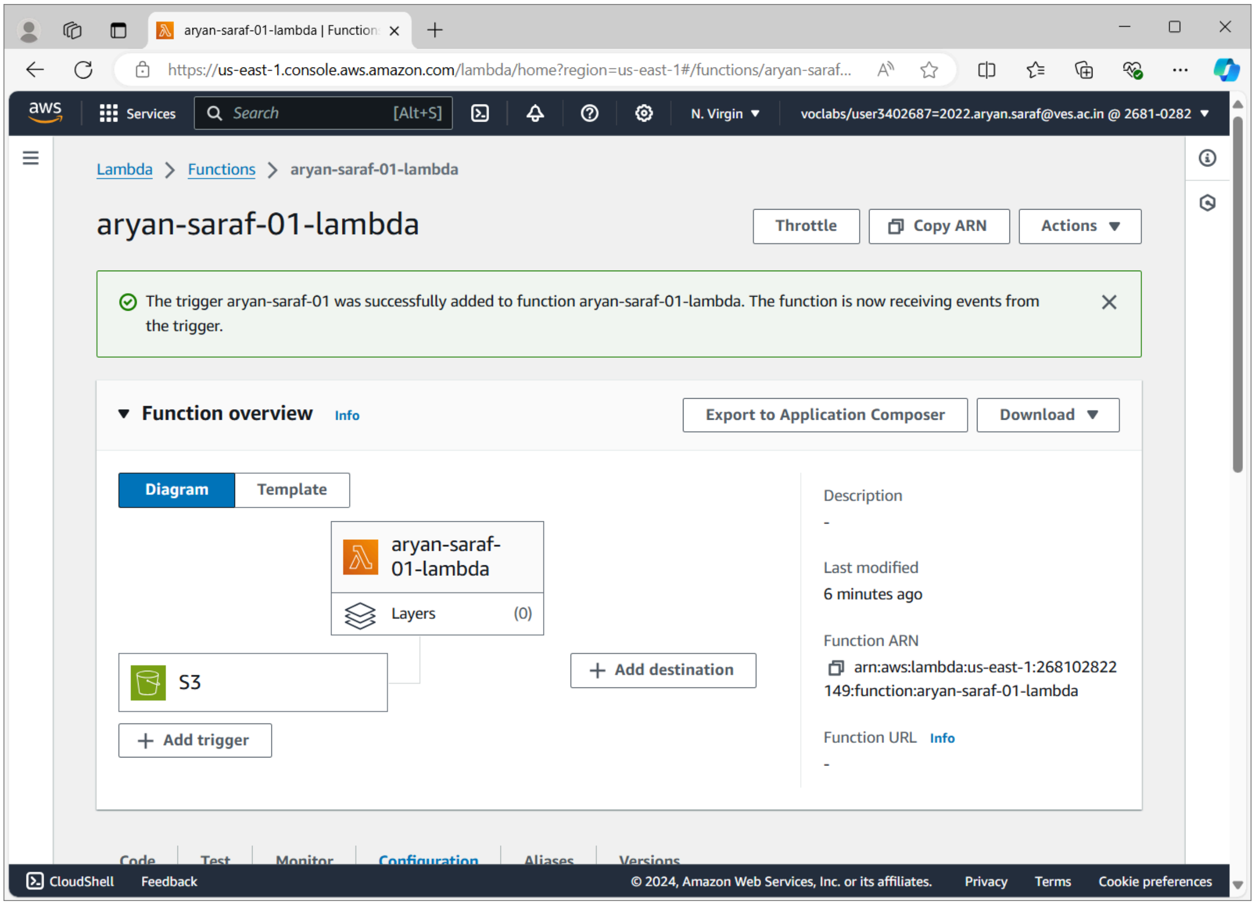
aryan-saraf-01-lambda | Function
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions/aryan-saraf...
aws
Services
Search [Alt+S]
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voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 2681-0282
Lambda > Functions > aryan-saraf-01-lambda
Throttle
Copy ARN
Actions

aryan-saraf-01-lambda

The trigger aryan-saraf-01 was successfully added to function aryan-saraf-01-lambda. The function is now receiving events from the trigger.

Function overview Info

Export to Application Composer
Download
Diagram
Template
aryan-saraf-01-lambda
Layers (0)
S3
+ Add destination
+ Add trigger

Description
-
Last modified
6 minutes ago
Function ARN
arn:aws:lambda:us-east-1:268102822149:function:aryan-saraf-01-lambda
Function URL Info
-

Code
Test
Monitor
Configuration
Aliases
Versions
CloudShell
Feedback
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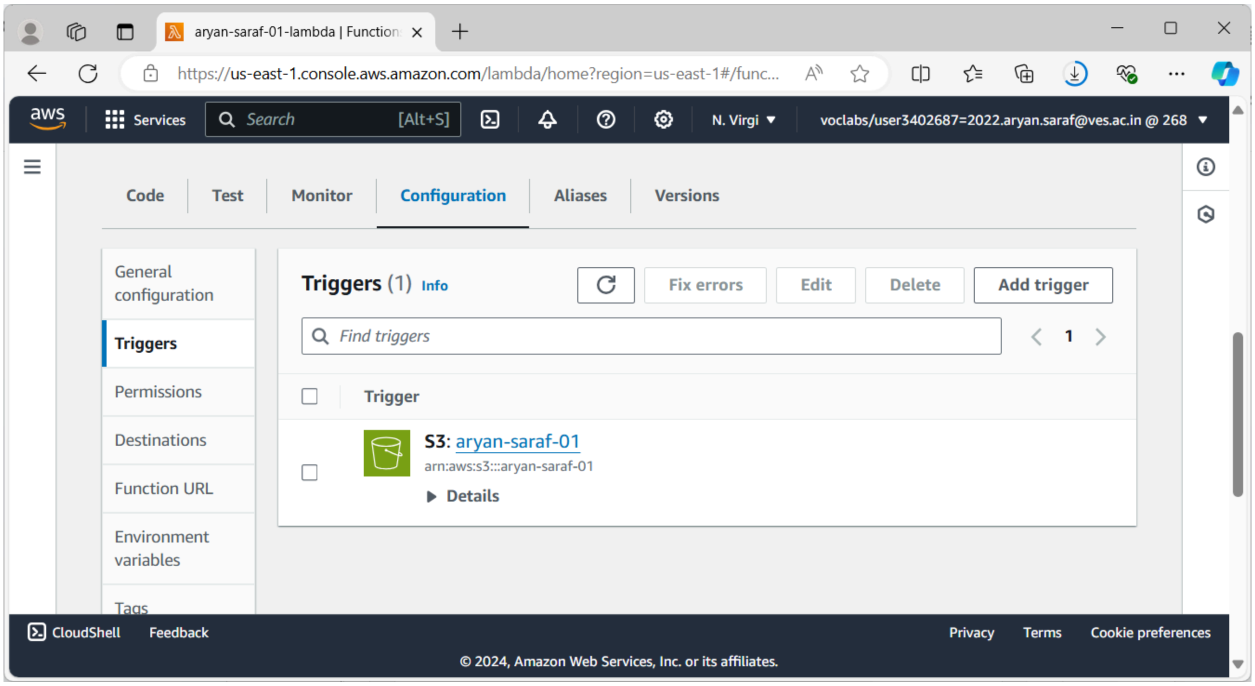
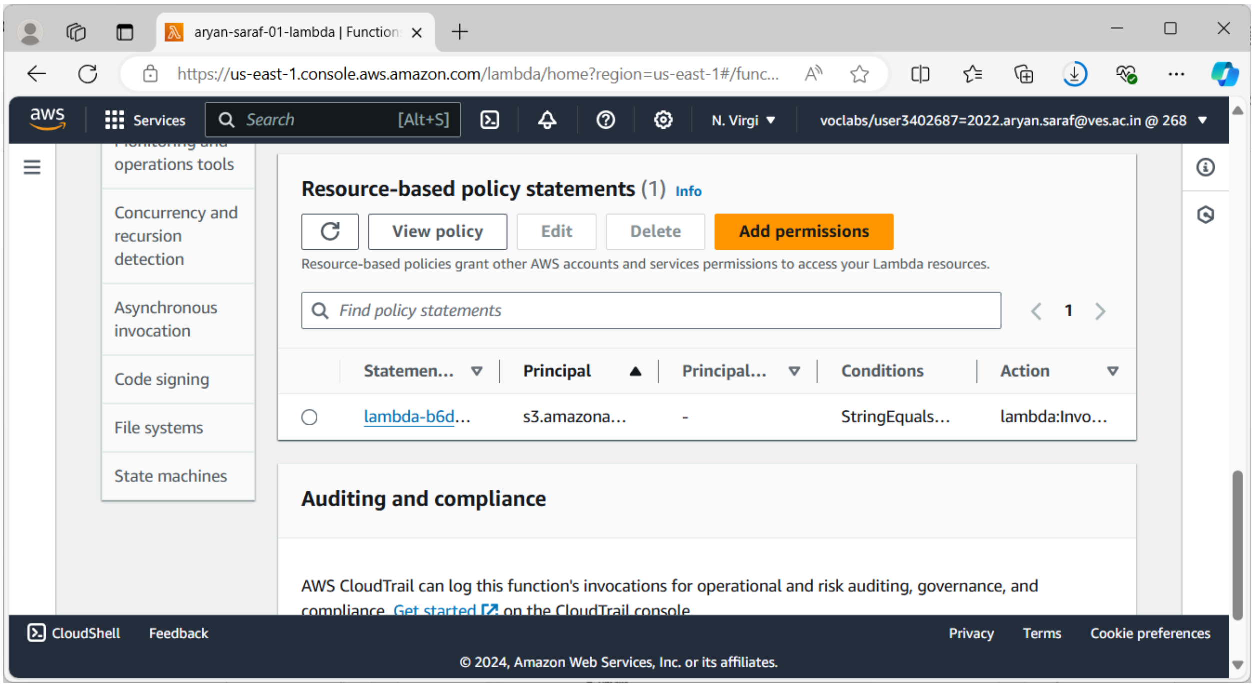


Triggers (1) Info

	Trigger
□	S3: aryan-saraf-01 arn:aws:s3:::aryan-saraf-01 ▶ Details

Navigate to the "Permissions" tab of your Lambda function. Ensure the Lambda function's execution role has the necessary permissions to access the S3 bucket.


aryan-saraf-01-lambda | Function
https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/func...
Services
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voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 268
operations tools
Concurrency and recursion detection
Asynchronous invocation
Code signing
File systems
State machines
View policy
Edit
Delete
Add permissions
Find policy statements
CloudShell
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Resource-based policy statements (1) Info

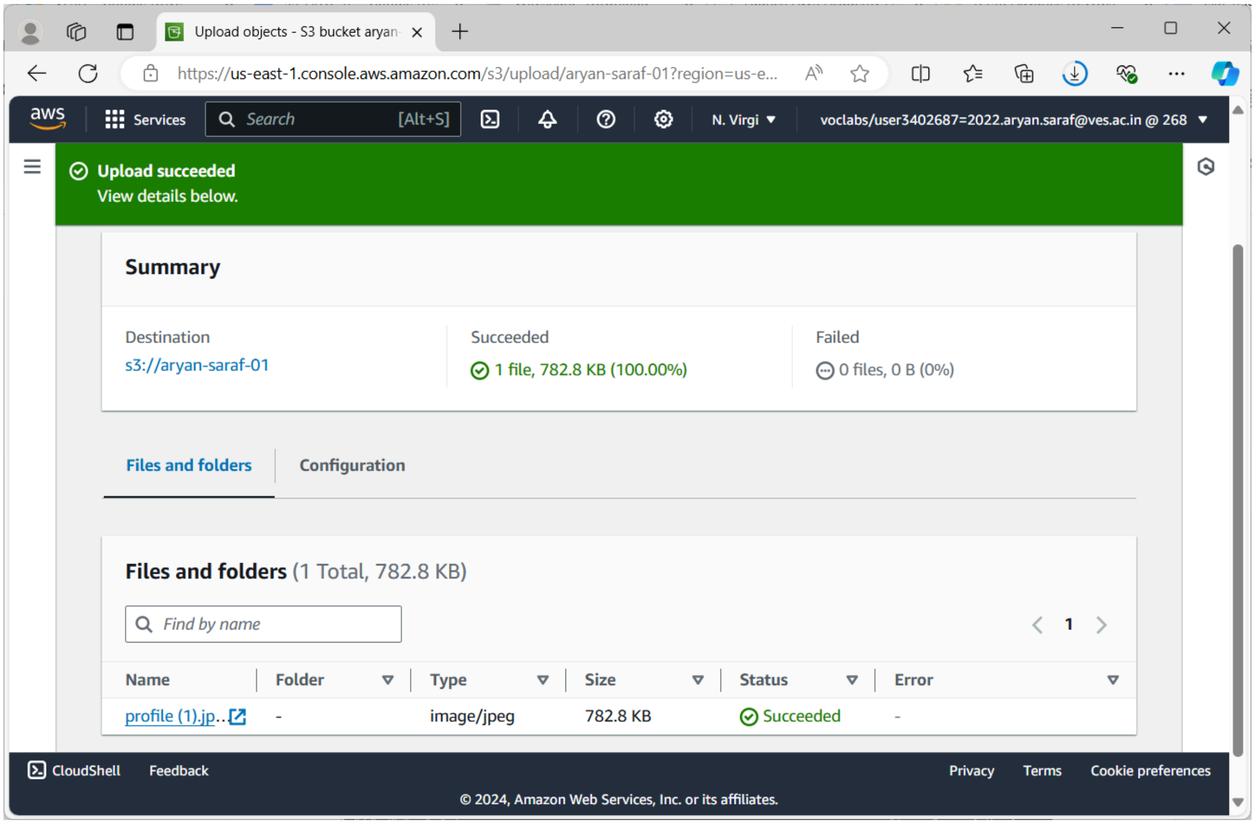
Resource-based policies grant other AWS accounts and services permissions to access your Lambda resources.

	Statemen...	Principal	Principal...	Conditions	Action
○	lambda-b6d...	s3.amazona...	-	StringEquals...	lambda:Invo...

Auditing and compliance

AWS CloudTrail can log this function's invocations for operational and risk auditing, governance, and compliance. Get started on the CloudTrail console.

Upload an image file to your S3 bucket.


Upload objects - S3 bucket aryan
https://us-east-1.console.aws.amazon.com/s3/upload/aryan-saraf-01?region=us-e...
aws
Services
Search [Alt+S]
N. Virgi
voclabs/user3402687=2022.aryan.saraf@ves.ac.in @ 268
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Upload succeeded
View details below.

Summary

Destination	Succeeded	Failed
s3://aryan-saraf-01	✓ 1 file, 782.8 KB (100.00%)	0 files, 0 B (0%)

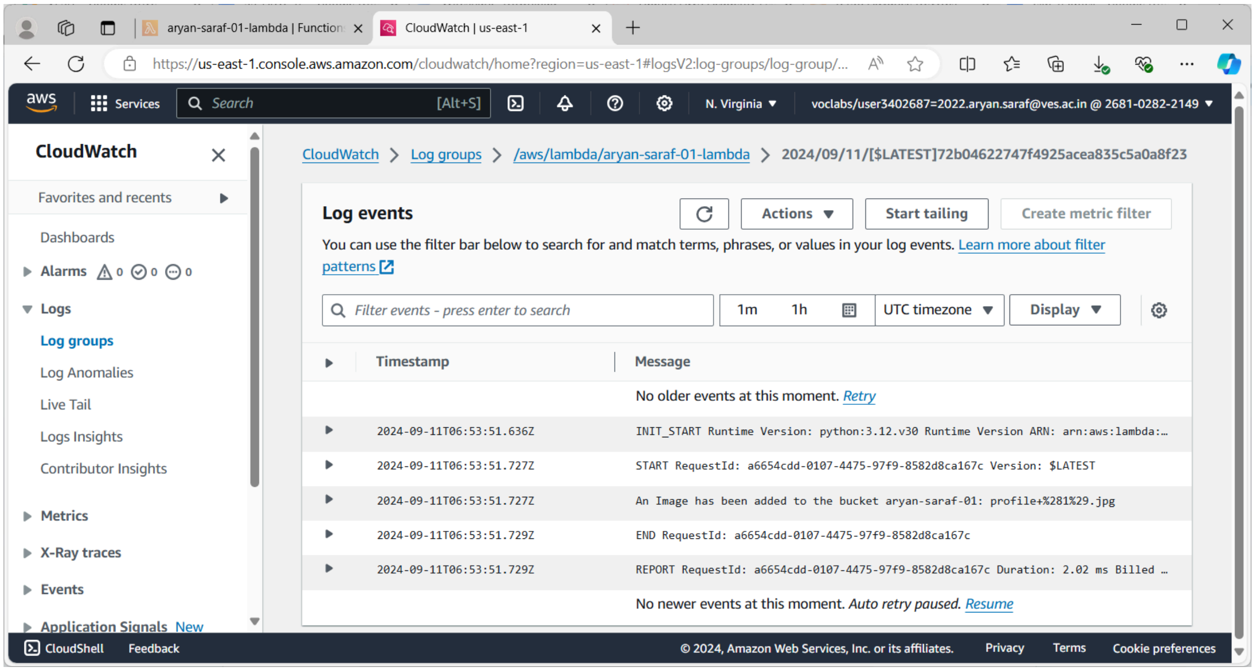
Files and folders | Configuration

Files and folders (1 Total, 782.8 KB)

Find by name

Name	Folder	Type	Size	Status	Error
profile (1).jp..	-	image/jpeg	782.8 KB	✓ Succeeded	-

Go to the "Monitoring" tab in your Lambda function to check the logs. Use CloudWatch Logs to view the output and confirm that the message "An Image has been added" has been logged.



CloudWatch > Log groups > /aws/lambda/aryan-saraf-01-lambda > 2024/09/11/[$LATEST]72b04622747f4925acea835c5a0a8f23

Log events

Actions ▼ | Start tailing | Create metric filter

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

Filter events - press enter to search | 1m | 1h | UTC timezone ▼ | Display ▼

```
Timestamp                  Message
                           No older events at this moment. Retry
2024-09-11T06:53:51.636Z   INIT_START Runtime Version: python:3.12.v30 Runtime Version ARN: arn:aws:lambda:…
2024-09-11T06:53:51.727Z   START RequestId: a6654cdd-0107-4475-97f9-8582d8ca167c Version: $LATEST
2024-09-11T06:53:51.727Z   An Image has been added to the bucket aryan-saraf-01: profile+%281%29.jpg
2024-09-11T06:53:51.729Z   END RequestId: a6654cdd-0107-4475-97f9-8582d8ca167c
2024-09-11T06:53:51.729Z   REPORT RequestId: a6654cdd-0107-4475-97f9-8582d8ca167c Duration: 2.02 ms Billed …
                           No newer events at this moment. Auto retry paused. Resume
```

CONCLUSION :

By integrating AWS Lambda with S3, you can create a seamless, automated process that responds instantly to changes in your S3 bucket. This not only improves efficiency but also allows for greater flexibility in handling data and media in real-time, making it a powerful tool in modern cloud-based applications.