UDACITY

Designing Your First Workflow

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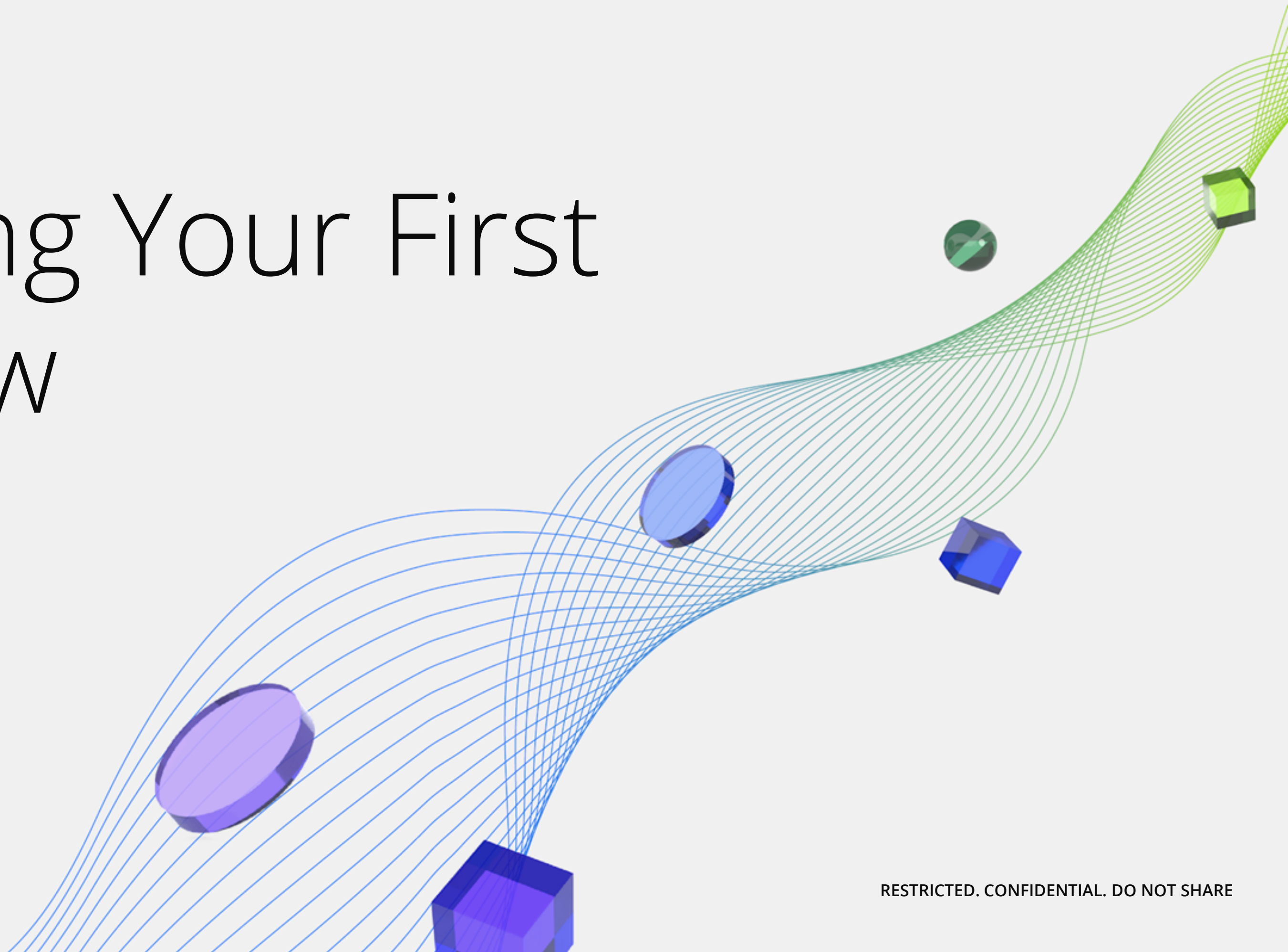
LinkedIn

August, 02, 2024



Connect Sessions | Purpose

A Connect Session **IS**:

- Focused on learning, encouragement & graduation for a group of students coached by a Udacity Session Lead
- Setting weekly study goals
- Helping each other with progress (including peer to peer)
- Keeping everyone accountable for their responsibilities
- A way to meet individuals in tech field & learn about the industry
- **Mandatory**

A Connect Session **IS NOT**:

- A social meetup
- A study group
- A substitute for online learning
- **Optional**

UDACITY

Let’s check your progress

You are encouraged to spend at lest 10 hours/week to graduate.

Presentation date

RESTRICTED. CONFIDENTIAL. DO NOT SHARE

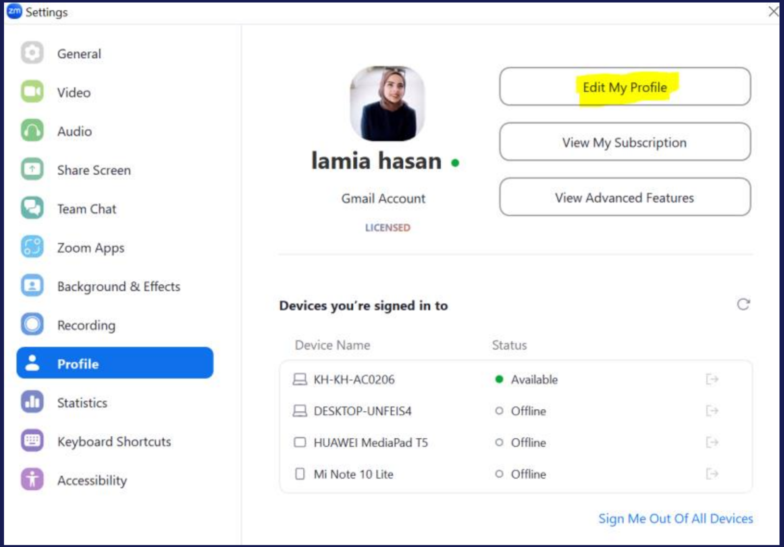
UDACITY

Attendance is taken automatically

Please change your name to be First Name and Last name on Zoom
Like : Lamia Zain

UDACITY

Change your Name on Zoom



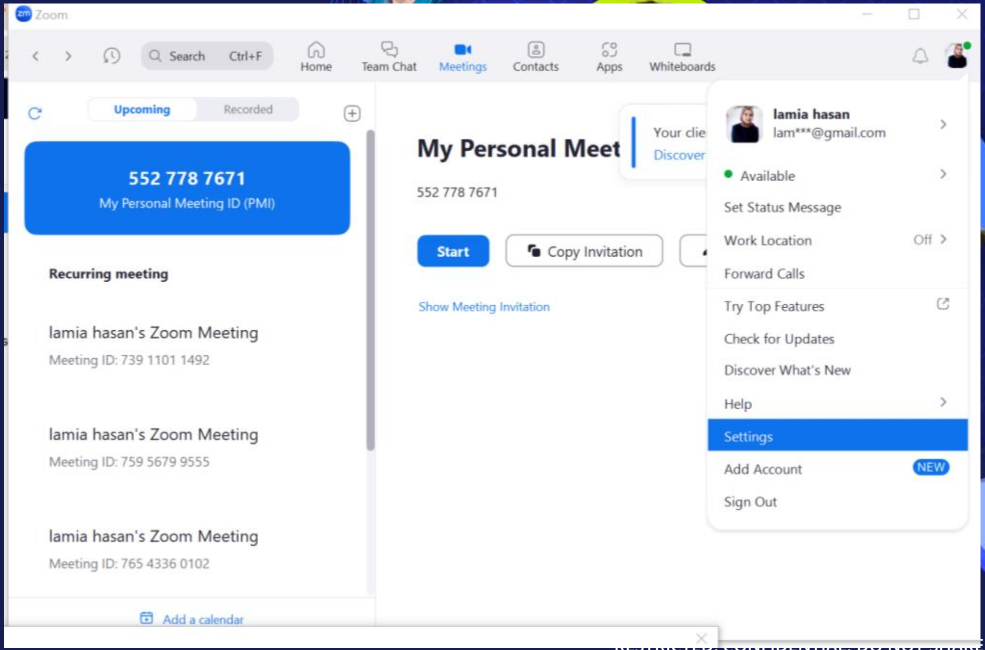
lamia hasan ●

Gmail Account

LICENSED

Devices you're signed in to

Device Name	Status
KH-KH-AC0206	● Available
DESKTOP-UNFEIS4	○ Offline
HUAWEI MediaPad T5	○ Offline
Mi Note 10 Lite	○ Offline



552 778 7671
My Personal Meeting ID (PMI)

Recurring meeting

lamia hasan's Zoom Meeting
Meeting ID: 739 1101 1492

lamia hasan's Zoom Meeting
Meeting ID: 759 5679 9555

lamia hasan's Zoom Meeting
Meeting ID: 765 4336 0102

My Personal Meet

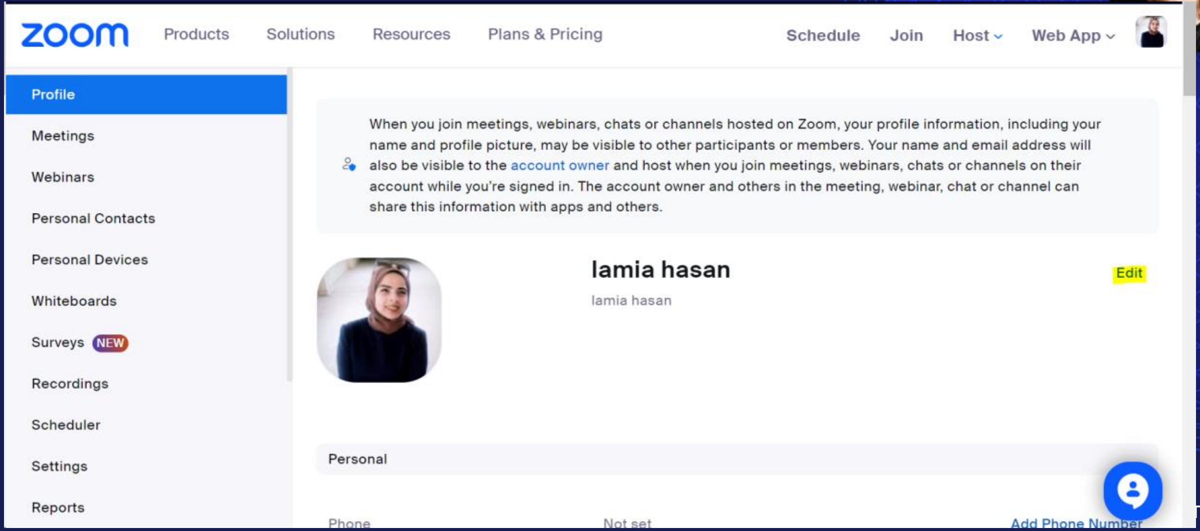
552 778 7671

Your clie
Discover

lamia hasan
lam***@gmail.com

UDACITY

Change your Name on Zoom



When you join meetings, webinars, chats or channels hosted on Zoom, your profile information, including your name and profile picture, may be visible to other participants or members. Your name and email address will also be visible to the account owner and host when you join meetings, webinars, chats or channels on their account while you're signed in. The account owner and others in the meeting, webinar, chat or channel can share this information with apps and others.

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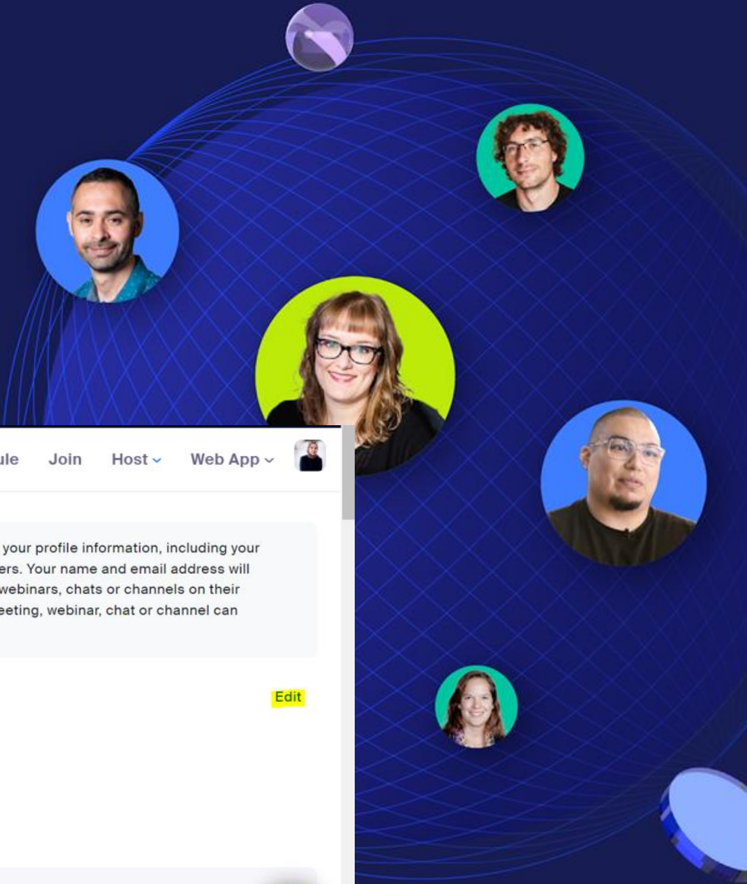
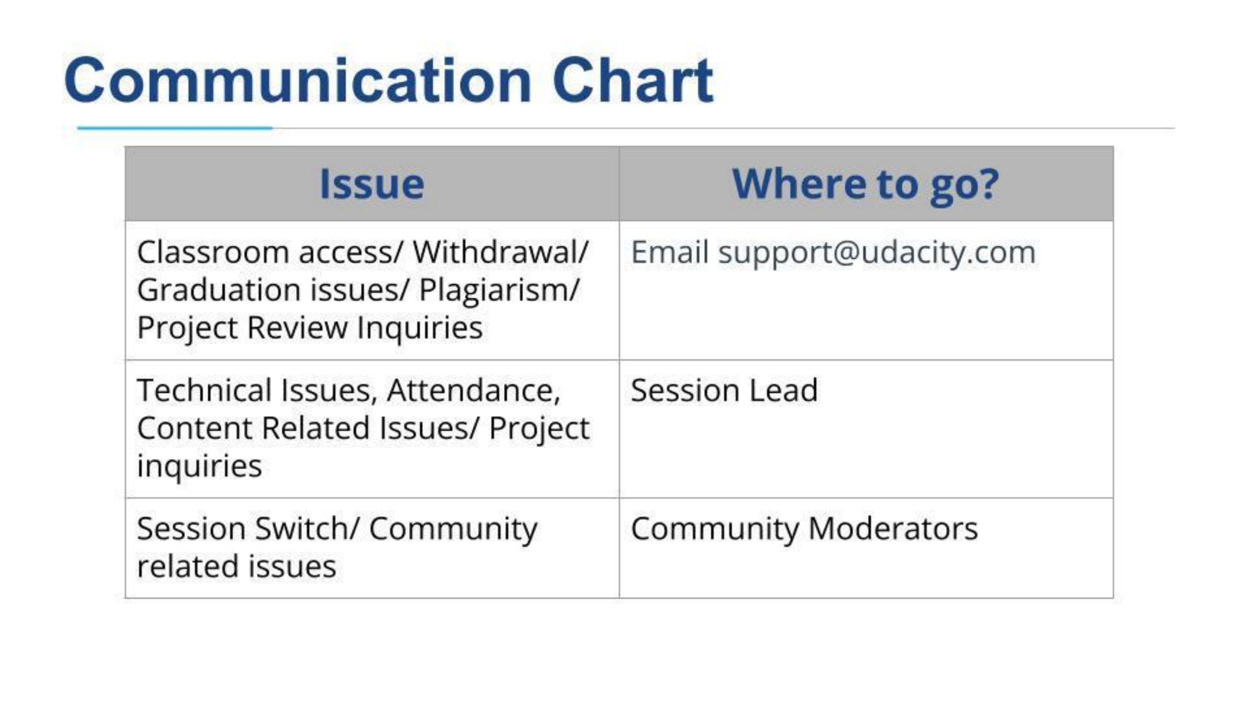
Edit

Personal

Phone Not set Add Phone Number



Session Lead role:

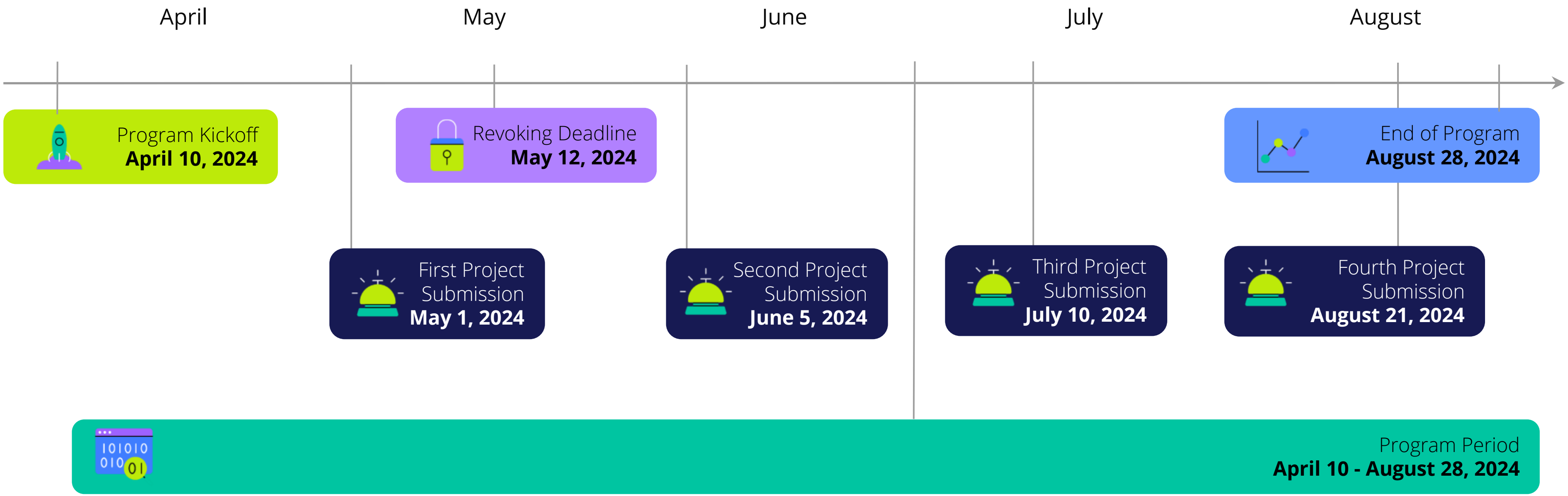


Communication Chart

Issue	Where to go?
Classroom access/ Withdrawal/ Graduation issues/ Plagiarism/ Project Review Inquiries	Email support@udacity.com
Technical Issues, Attendance, Content Related Issues/ Project inquiries	Session Lead
Session Switch/ Community related issues	Community Moderators

Program Timeline & Learning Journey

2024



Program Kickoff
April 10, 2024

Revoking Deadline
May 12, 2024

End of Program
August 28, 2024

First Project Submission
May 1, 2024

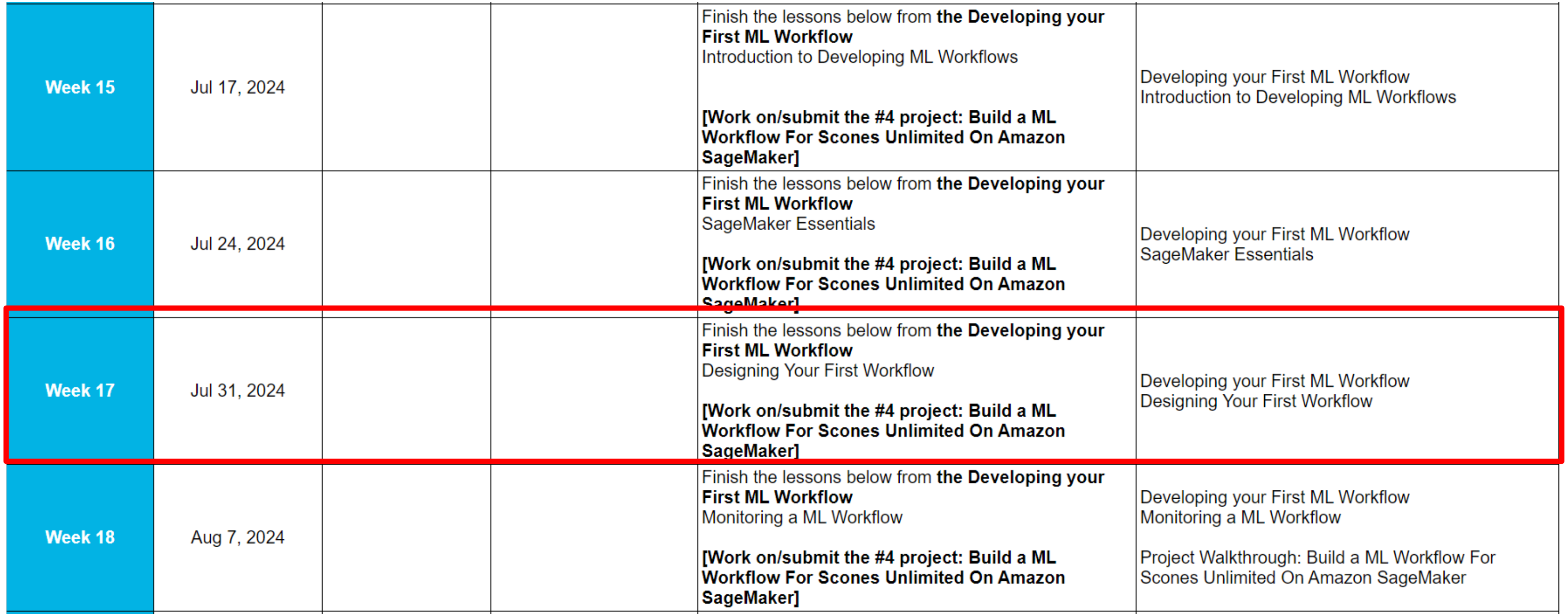
Second Project Submission
June 5, 2024

Third Project Submission
July 10, 2024

Fourth Project Submission
August 21, 2024

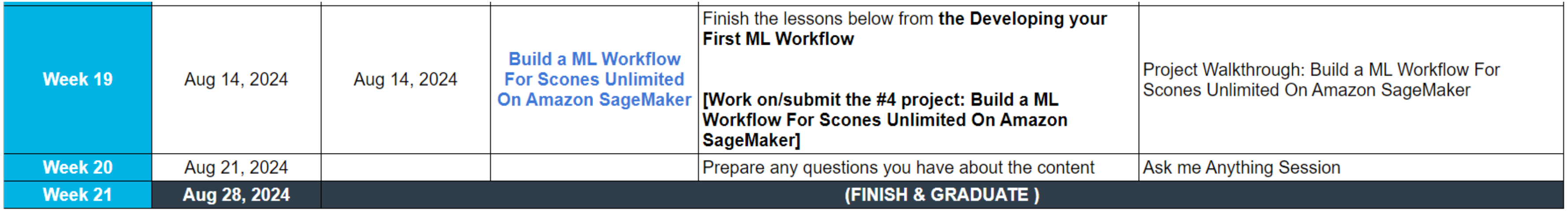
Program Period
April 10 - August 28, 2024

Four-weeks Agenda, Weekly schedule



Week 15	Jul 17, 2024			Finish the lessons below from **the Developing your First ML Workflow** Introduction to Developing ML Workflows **[Work on/submit the #4 project: Build a ML Workflow For Scones Unlimited On Amazon SageMaker]**	Developing your First ML Workflow Introduction to Developing ML Workflows
Week 16	Jul 24, 2024			Finish the lessons below from **the Developing your First ML Workflow** SageMaker Essentials **[Work on/submit the #4 project: Build a ML Workflow For Scones Unlimited On Amazon SageMaker]**	Developing your First ML Workflow SageMaker Essentials
Week 17	Jul 31, 2024			Finish the lessons below from **the Developing your First ML Workflow** Designing Your First Workflow **[Work on/submit the #4 project: Build a ML Workflow For Scones Unlimited On Amazon SageMaker]**	Developing your First ML Workflow Designing Your First Workflow
Week 18	Aug 7, 2024			Finish the lessons below from **the Developing your First ML Workflow** Monitoring a ML Workflow **[Work on/submit the #4 project: Build a ML Workflow For Scones Unlimited On Amazon SageMaker]**	Developing your First ML Workflow Monitoring a ML Workflow Project Walkthrough: Build a ML Workflow For Scones Unlimited On Amazon SageMaker

Four-weeks Agenda, Weekly schedule



Week 19	Aug 14, 2024	Aug 14, 2024	**Build a ML Workflow For Scones Unlimited On Amazon SageMaker**	Finish the lessons below from **the Developing your First ML Workflow** **[Work on/submit the #4 project: Build a ML Workflow For Scones Unlimited On Amazon SageMaker]**	Project Walkthrough: Build a ML Workflow For Scones Unlimited On Amazon SageMaker
Week 20	Aug 21, 2024			Prepare any questions you have about the content	Ask me Anything Session
Week 21	**Aug 28, 2024**	**(FINISH & GRADUATE)**			

Student Milestone | Revoking

REVOKING

Revoking is the process by which Udacity removes a student from a Nanodegree program.

AWS reserves the right to revoke you from the program if you do not comply with program requirements.

CRITERIA

Students can be revoked if they fail to:

- Submit Project 1
- Complete the required concepts

The date of **Revoking** for the scholarship is **May 12, 2024**

Code of Conduct | Plagiarism

BASIC RULES

- Project submissions must consist of original work
- Submitted projects will be scanned for plagiarism
- Students who are found to have plagiarised will risk their Nanodegree being revoked
- Read the honor code and the rubric carefully for all projects

Objectives:

1- Processing Jobs using Python SDK.
2- Create Lambda Functions SageMaker Python SDK.
3- Create Lambda Functions SageMaker Console.
4- Invoke lambda functions through a test event
5- Invoke lambda functions from a jupyter notebook.
6- Invoke lambda functions with CloudWatch event rules (Readings).

Processing Job

Processing Jobs

Processing Jobs are SageMaker service for data preprocessing.
Session Exercise: Create a SklearnProcessor object to drop one column of the Breast Cancer dataset Before training the model.
Documentation:
1- SageMaker SDK
2- Example here

Lambda Functions

Why?

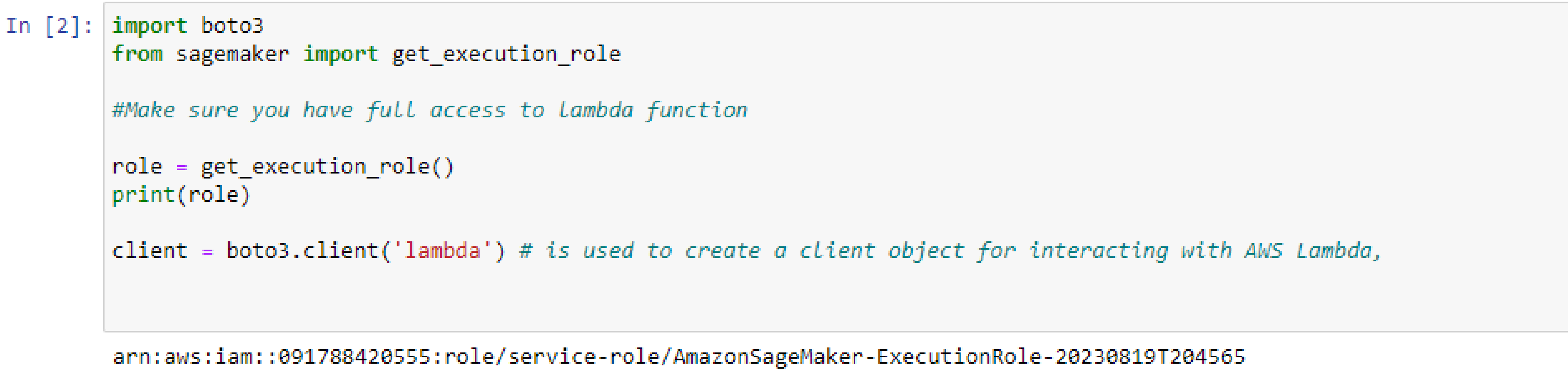
2- No Resources Selection needed (Instance type and count)
1- Small tasks done repeatedly.

You Can:
1- Specify the execution time for lamda function
2- Specify the size of the lambda function
3- Specify Lambda Function policies attached to its IAM role.

Creating a Lambda Function BOTO3 SDK

Lambda function, SDK

Add Lambda Full access permission to the current notebook

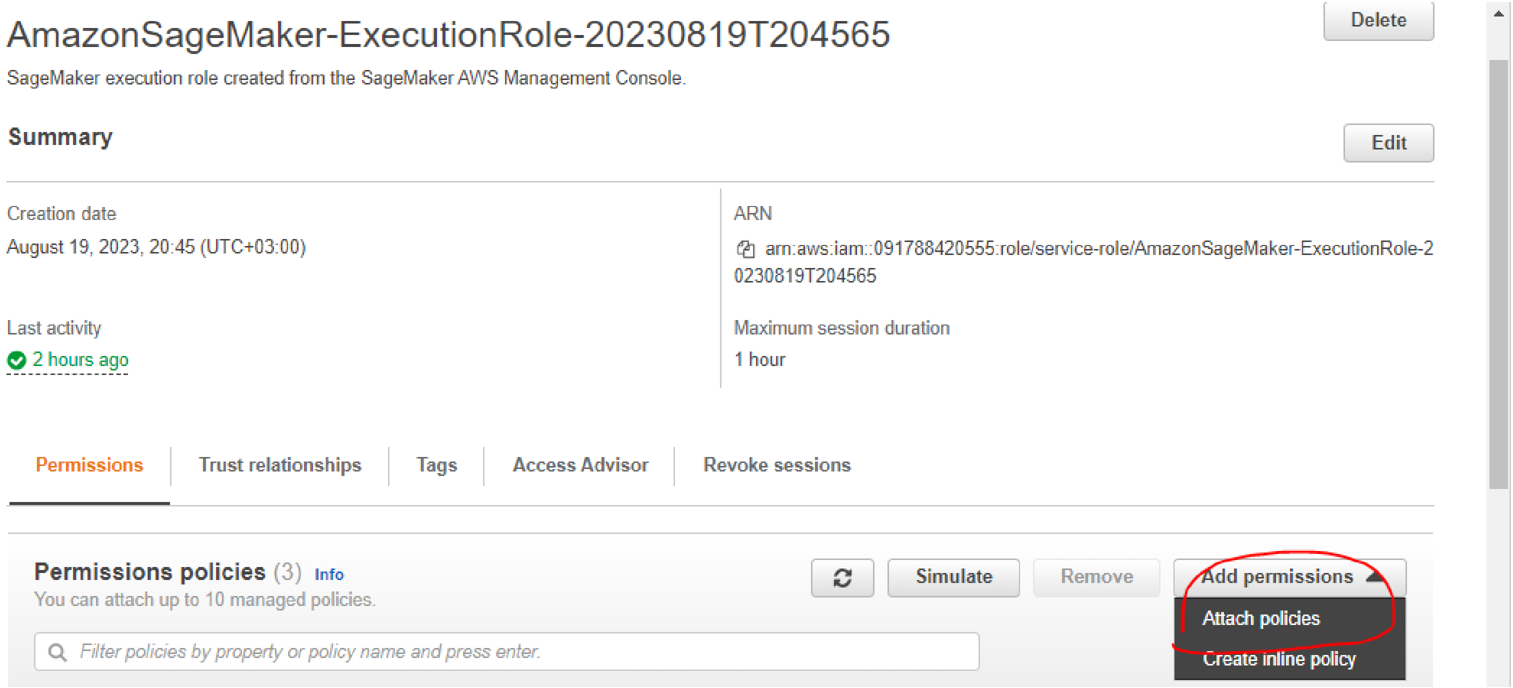


In [2]:

```
import boto3
from sagemaker import get_execution_role

#Make sure you have full access to lambda function

role = get_execution_role()
print(role)

client = boto3.client('lambda') # is used to create a client object for interacting with AWS Lambda,
```

```
arn:aws:iam::091788420555:role/service-role/AmazonSageMaker-ExecutionRole-20230819T204565
```

Go to role in IAM role



AmazonSageMaker-ExecutionRole-20230819T204565

SageMaker execution role created from the SageMaker AWS Management Console.

Summary

Creation date
August 19, 2023, 20:45 (UTC+03:00)

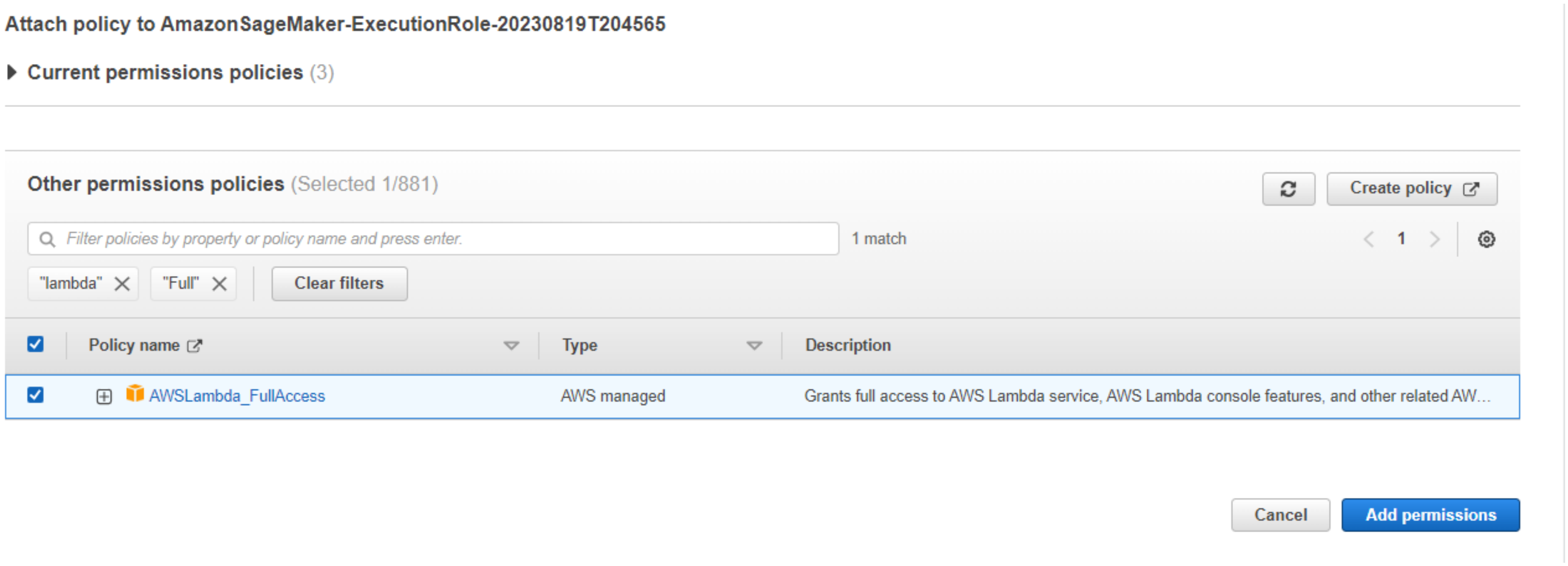
ARN
arn:aws:iam::091788420555:role/service-role/AmazonSageMaker-ExecutionRole-20230819T204565

Last activity
2 hours ago

Maximum session duration
1 hour

Permissions policies (3) Info
You can attach up to 10 managed policies.

Search for **AWSLambdaFullAceess** Permission and add it



Attach policy to AmazonSageMaker-ExecutionRole-20230819T204565

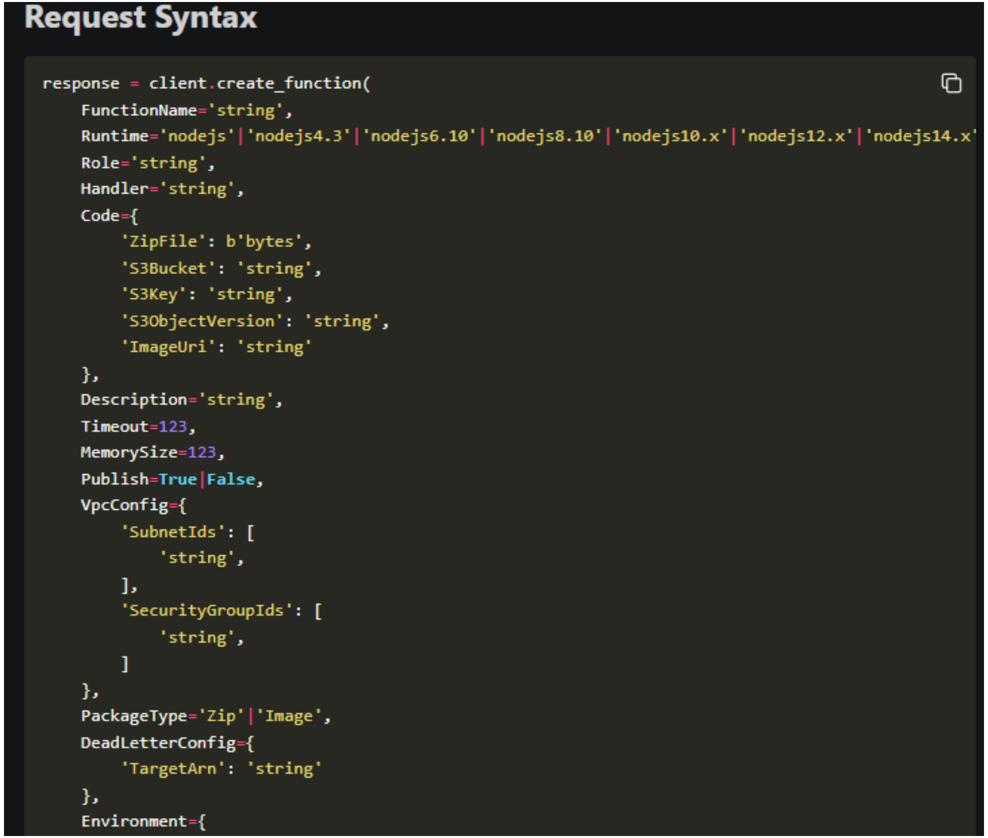
▸ Current permissions policies (3)

Other permissions policies (Selected 1/881)

☑	Policy name	Type	Description
☑	⊞ AWSLambda_FullAccess	AWS managed	Grants full access to AWS Lambda service, AWS Lambda console features, and other related AW...

Lambda function, SDK

boto3.client(‘lambda’).create_function()

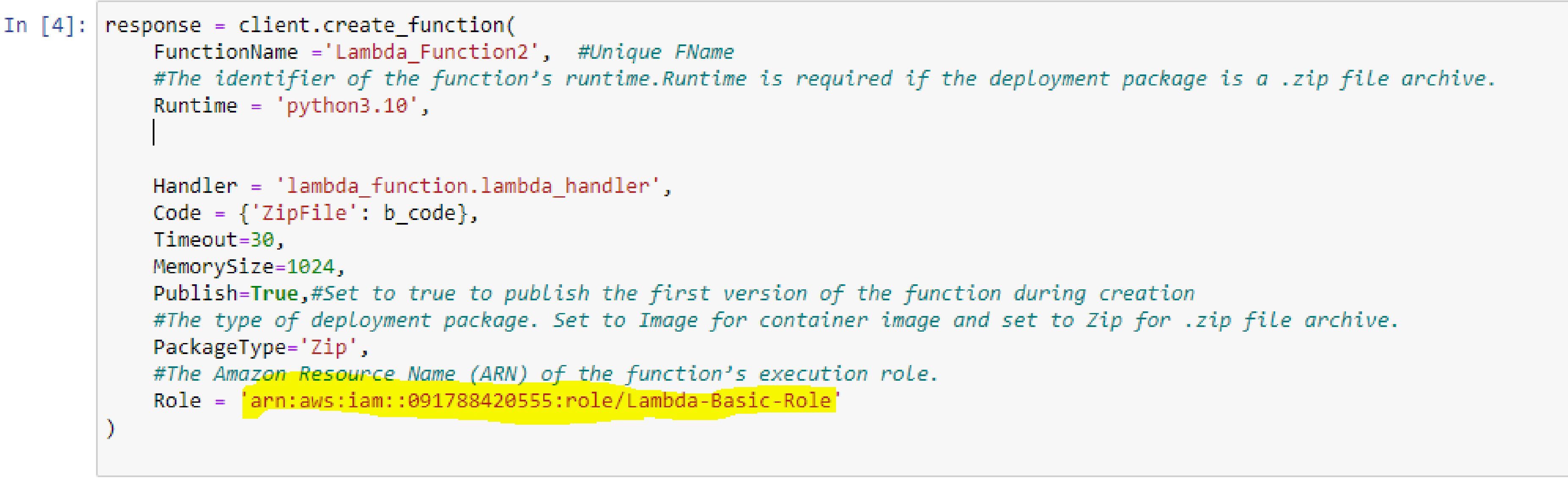


Request Syntax

```
response = client.create_function(
    FunctionName='string',
    Runtime='nodejs'|'nodejs4.3'|'nodejs6.10'|'nodejs8.10'|'nodejs10.x'|'nodejs12.x'|'nodejs14.x'
    Role='string',
    Handler='string',
    Code={
        'ZipFile': b'bytes',
        'S3Bucket': 'string',
        'S3Key': 'string',
        'S3ObjectVersion': 'string',
        'ImageUri': 'string'
    },
    Description='string',
    Timeout=123,
    MemorySize=123,
    Publish=True|False,
    VpcConfig={
        'SubnetIds': [
            'string',
        ],
        'SecurityGroupIds': [
            'string',
        ]
    },
    PackageType='Zip'|'Image',
    DeadLetterConfig={
        'TargetArn': 'string'
    },
    Environment={
```

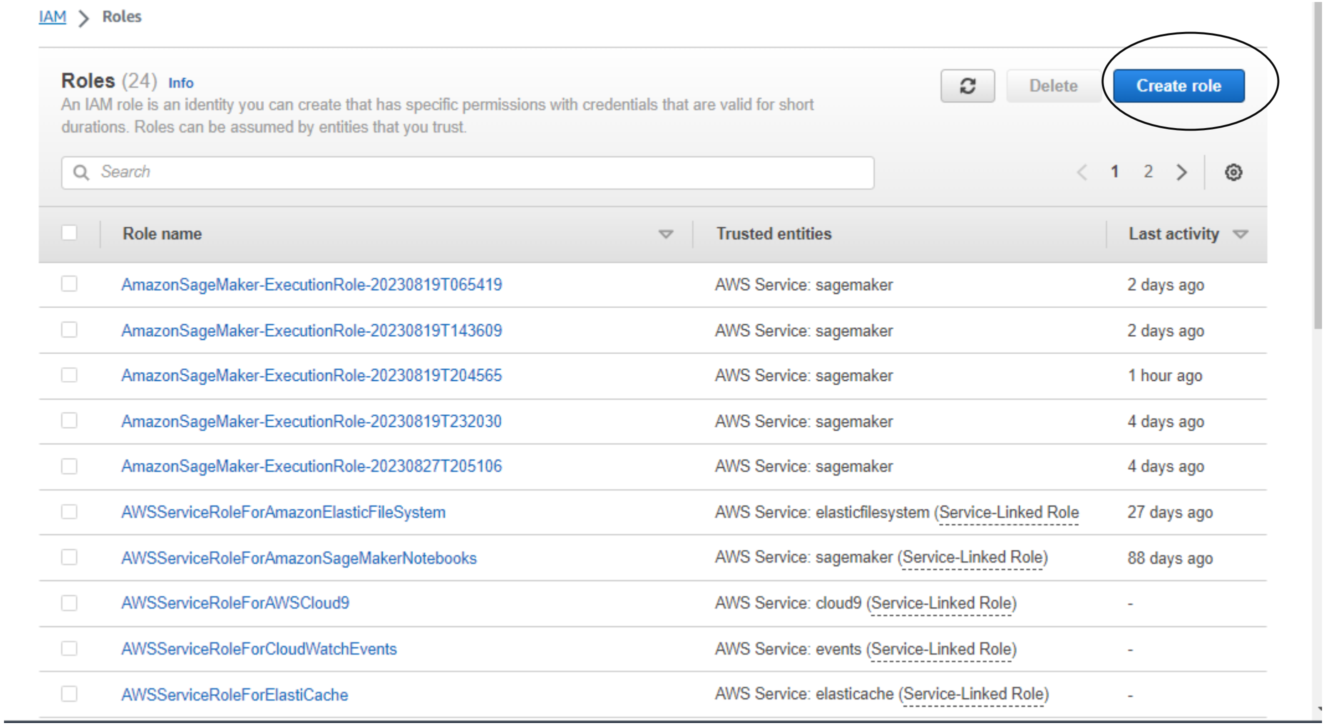
Lambda function, SDK

Create a role that access lambda function.



```
In [4]: response = client.create_function(
            FunctionName ='Lambda_Function2',  #Unique FName
            #The identifier of the function's runtime.Runtime is required if the deployment package is a .zip file archive.
            Runtime = 'python3.10',


            Handler = 'lambda_function.lambda_handler',
            Code = {'ZipFile': b_code},
            Timeout=30,
            MemorySize=1024,
            Publish=True,#Set to true to publish the first version of the function during creation
            #The type of deployment package. Set to Image for container image and set to Zip for .zip file archive.
            PackageType='Zip',
            #The Amazon Resource Name (ARN) of the function's execution role.
            Role = 'arn:aws:iam::091788420555:role/Lambda-Basic-Role'
        )
```

Create a role that access lambda function.

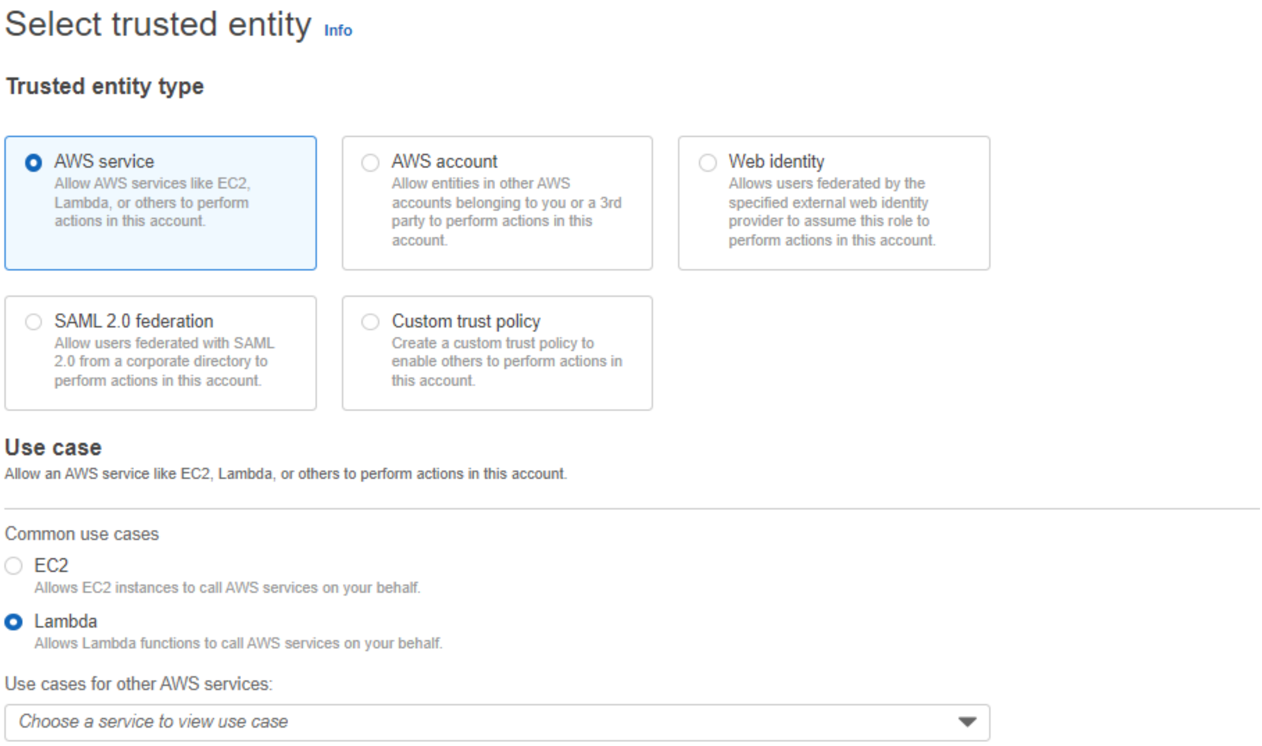


Roles (24) Info

An IAM role is an identity you can create that has specific permissions with credentials that are valid for short durations. Roles can be assumed by entities that you trust.

Role name	Trusted entities	Last activity
AmazonSageMaker-ExecutionRole-20230819T065419	AWS Service: sagemaker	2 days ago
AmazonSageMaker-ExecutionRole-20230819T143609	AWS Service: sagemaker	2 days ago
AmazonSageMaker-ExecutionRole-20230819T204565	AWS Service: sagemaker	1 hour ago
AmazonSageMaker-ExecutionRole-20230819T232030	AWS Service: sagemaker	4 days ago
AmazonSageMaker-ExecutionRole-20230827T205106	AWS Service: sagemaker	4 days ago
AWSServiceRoleForAmazonElasticFileSystem	AWS Service: elasticfilesystem (Service-Linked Role	27 days ago
AWSServiceRoleForAmazonSageMakerNotebooks	AWS Service: sagemaker (Service-Linked Role)	88 days ago
AWSServiceRoleForAWSCloud9	AWS Service: cloud9 (Service-Linked Role)	-
AWSServiceRoleForCloudWatchEvents	AWS Service: events (Service-Linked Role)	-
AWSServiceRoleForElastiCache	AWS Service: elasticache (Service-Linked Role)	-

Create a role that access lambda function.



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.

Use case

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

Common use cases

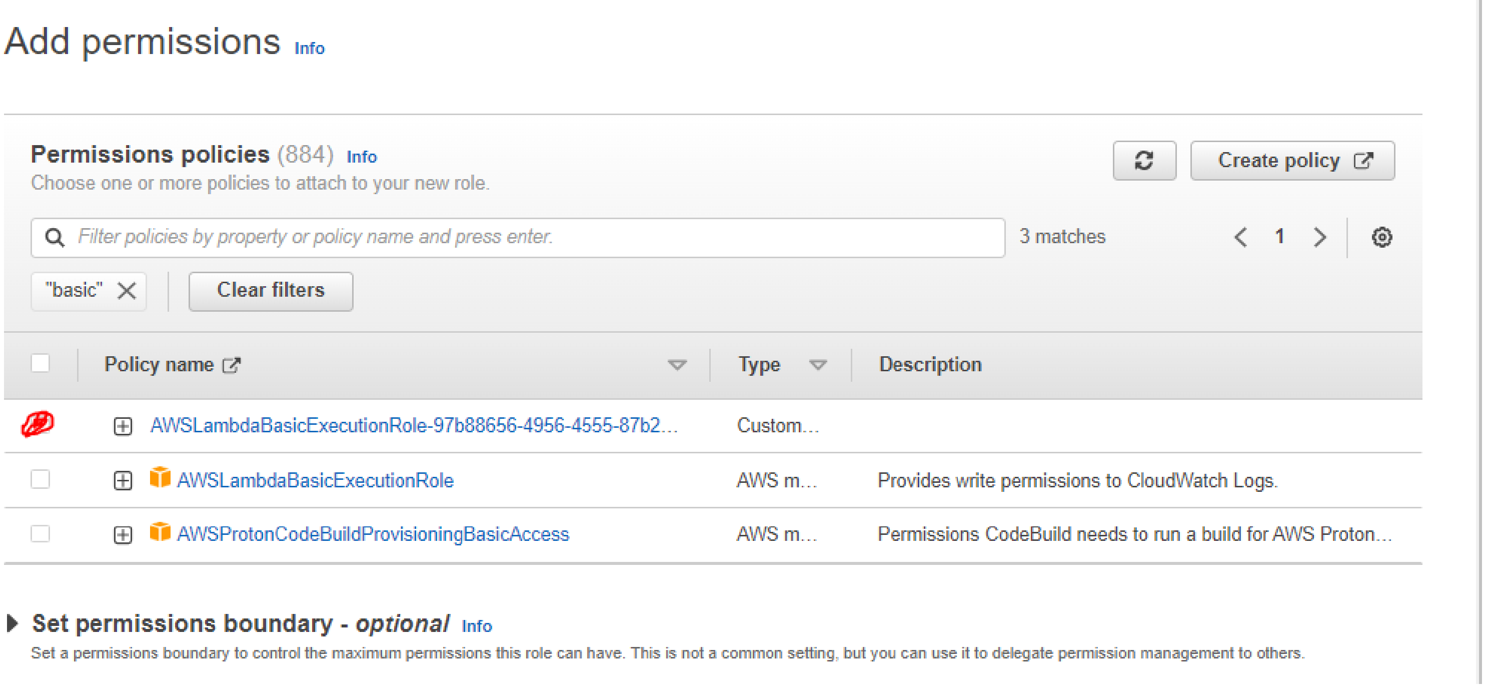
○ EC2
Allows EC2 instances to call AWS services on your behalf.

● Lambda
Allows Lambda functions to call AWS services on your behalf.

Use cases for other AWS services:

Choose a service to view use case ▾

Add lambda basic execution role to policies



Add permissions Info

Permissions policies (884) Info

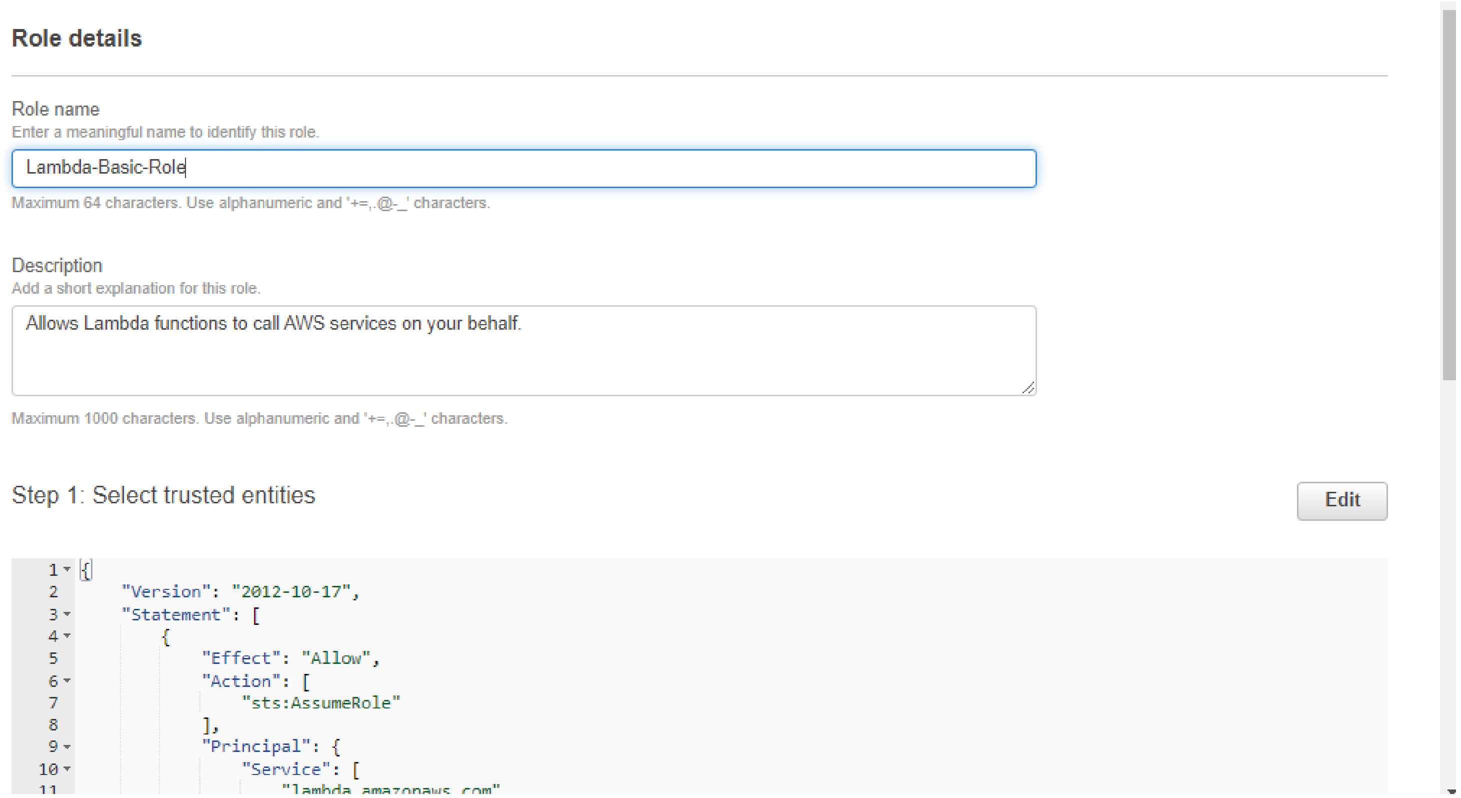
Choose one or more policies to attach to your new role.

□	Policy name	Type	Description
☑	AWSLambdaBasicExecutionRole-97b88656-4956-4555-87b2...	Custom...	
□	AWSLambdaBasicExecutionRole	AWS m...	Provides write permissions to CloudWatch Logs.
□	AWSProtonCodeBuildProvisioningBasicAccess	AWS m...	Permissions CodeBuild needs to run a build for AWS Proton...

Set permissions boundary - *optional* Info

Set a permissions boundary to control the maximum permissions this role can have. This is not a common setting, but you can use it to delegate permission management to others.

Provide Role Name



Role details

Role name

Enter a meaningful name to identify this role.

Lambda-Basic-Role

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

Description

Add a short explanation for this role.

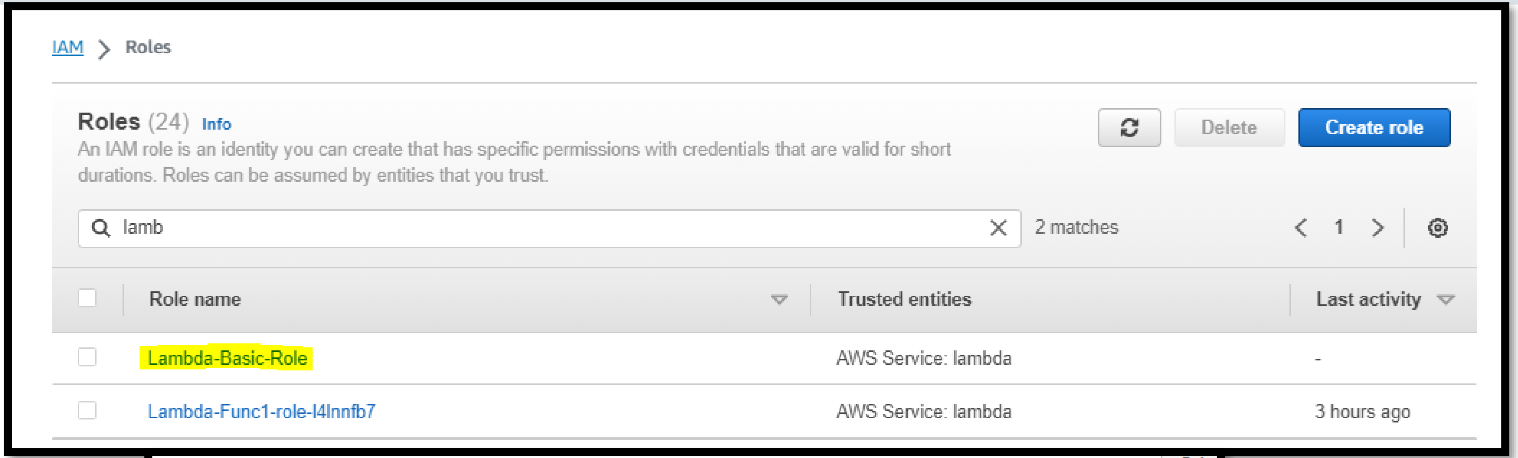
Allows Lambda functions to call AWS services on your behalf.

Maximum 1000 characters. Use alphanumeric and '+=,.@-_' characters.

Step 1: Select trusted entities

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "sts:AssumeRole"
            ],
            "Principal": {
                "Service": [
                    "lambda.amazonaws.com"
```

Search for the role, copy its ARN



IAM > Roles

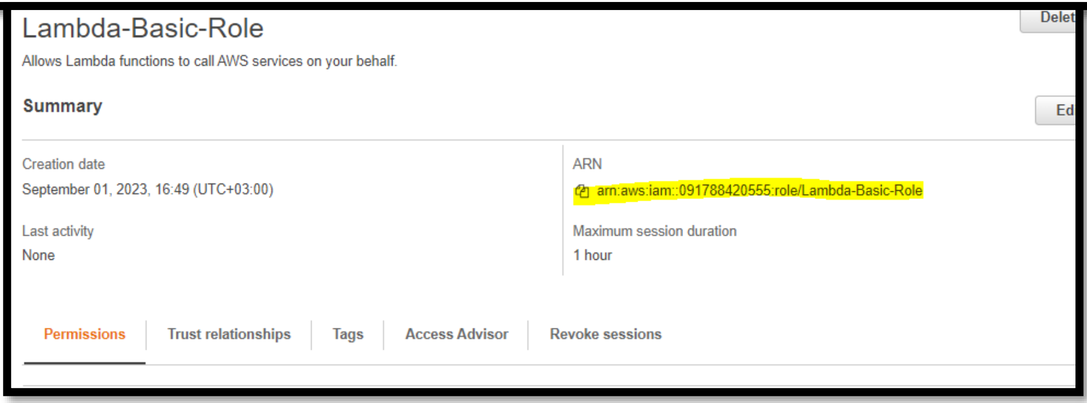
Roles (24) Info

An IAM role is an identity you can create that has specific permissions with credentials that are valid for short durations. Roles can be assumed by entities that you trust.

lamb

2 matches

□	Role name	Trusted entities	Last activity
□	Lambda-Basic-Role	AWS Service: lambda	-
□	Lambda-Func1-role-l4lnnfb7	AWS Service: lambda	3 hours ago



Lambda-Basic-Role

Allows Lambda functions to call AWS services on your behalf.

Summary

Creation date
September 01, 2023, 16:49 (UTC+03:00)

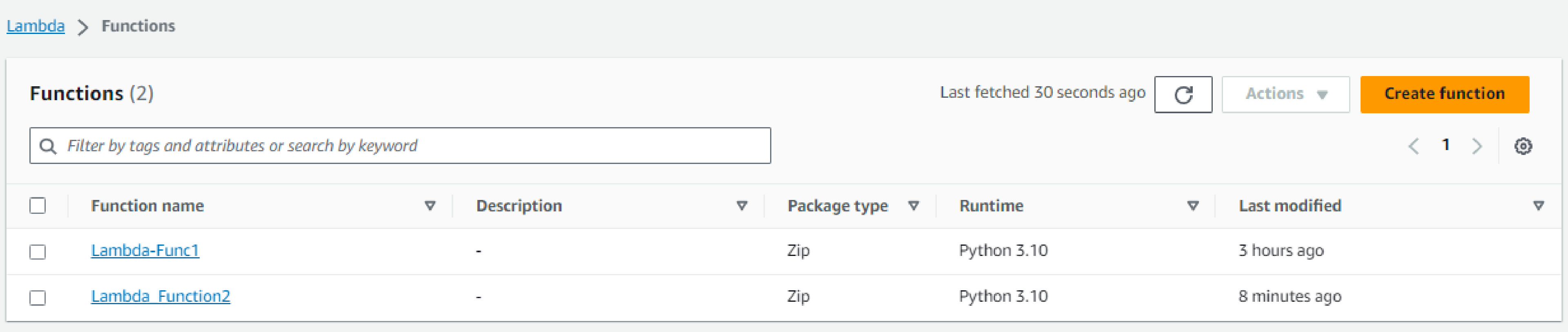
ARN
arn:aws:iam::091788420555:role/Lambda-Basic-Role

Last activity
None

Maximum session duration
1 hour

Lambda function, SDK

Lambda function is created



Lambda > Functions
Last fetched 30 seconds ago
Actions
Create function
Filter by tags and attributes or search by keyword
1

Functions (2)

□	Function name	Description	Package type	Runtime	Last modified
□	Lambda-Func1	-	Zip	Python 3.10	3 hours ago
□	Lambda_Function2	-	Zip	Python 3.10	8 minutes ago

Creating a Lambda Function SageMaker Console

Break (10 minutes)

Satisfaction Survey

Exercise#1 Invoking Lambda function Preprocessing Toys' review dartaset

Preprocess Toys' review DS using Lambda Function

Lesson 3 Exercise

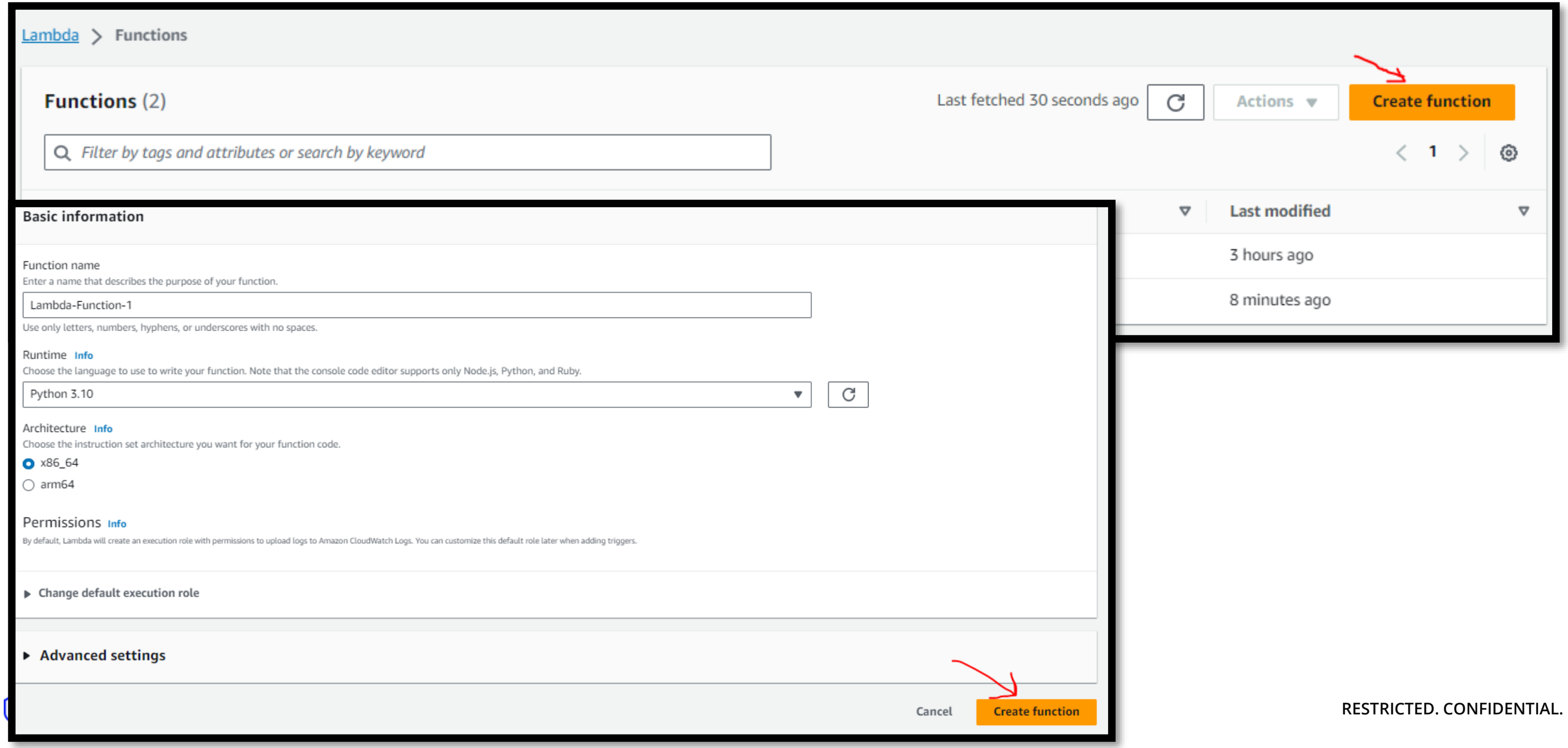
In this exercise, Our goal is:
Use Lambda function to extract Toys' reviews data from a .zip file stored in S3 Bucket, preprocess data to be in this format, split files to training and testing files, and upload to S3 again.

```
__label__1  linux ready for prime time , intel says , despite all the linux hype , the open-source movement has yet to make a huge splash in the desktop market . that may be about to change , thanks to chipmaking giant intel corp .

__label__2  bowled by the slower one again , kolkata , november 14 the past caught up with sourav ganguly as the indian skippers return to international cricket was short lived .
```

Preprocess Toys' review DS using Lambda Function

Steps:

- Create Lambda function:



Lambda > Functions

Functions (2)

Last fetched 30 seconds ago

Last modified
3 hours ago
8 minutes ago

Basic information

Function name
Enter a name that describes the purpose of your function.
Lambda-Function-1
Use only letters, numbers, hyphens, or underscores with no spaces.

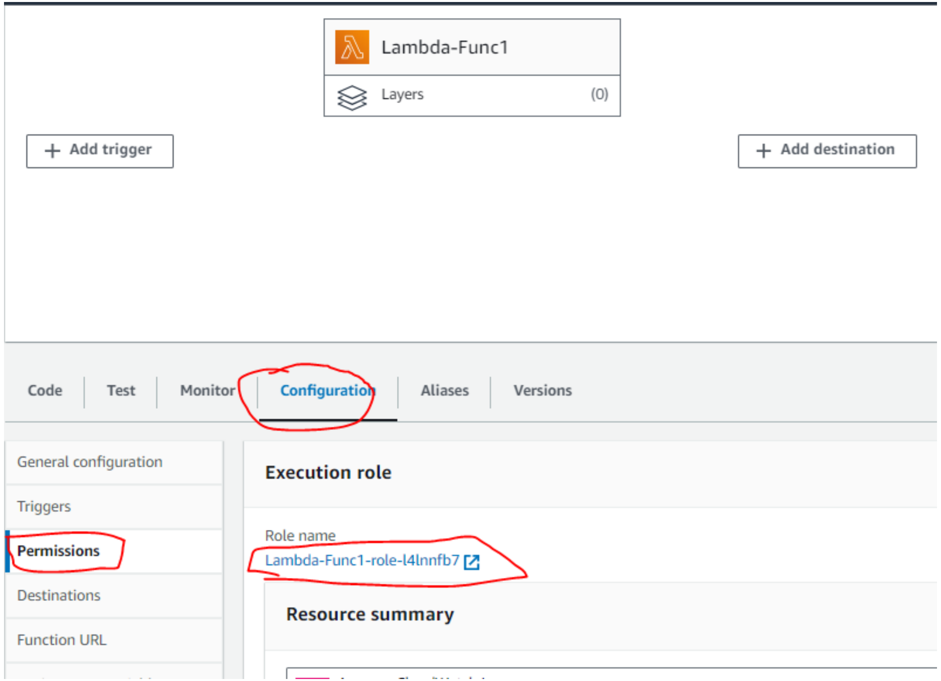
Runtime Info
Choose the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby.
Python 3.10

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.

Steps:

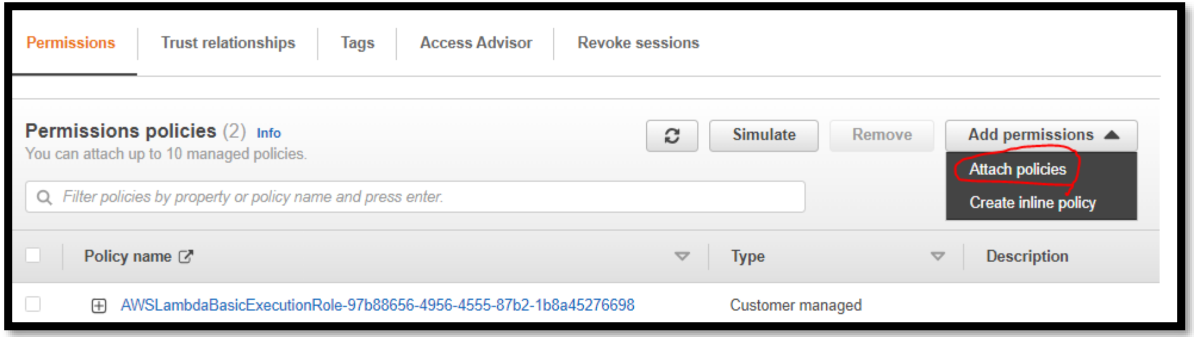
- Go to the corresponding role



Preprocess Toys' review DS using Lambda Function

Steps:

- Add permission to the lambda function to Fully access s3 Bucket.

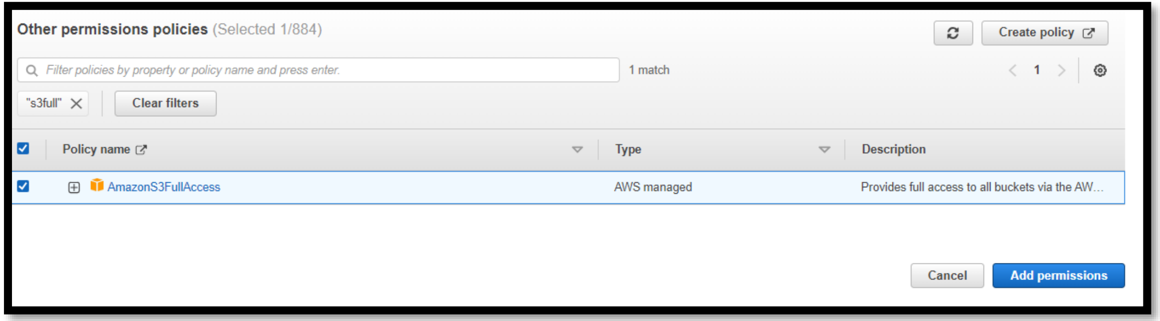


Permissions policies (2) Info

You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter.

☐	Policy name	Type	Description
☐	⊞ AWSLambdaBasicExecutionRole-97b88656-4956-4555-87b2-1b8a45276698	Customer managed	



Other permissions policies (Selected 1/884)

Filter policies by property or policy name and press enter.

1 match

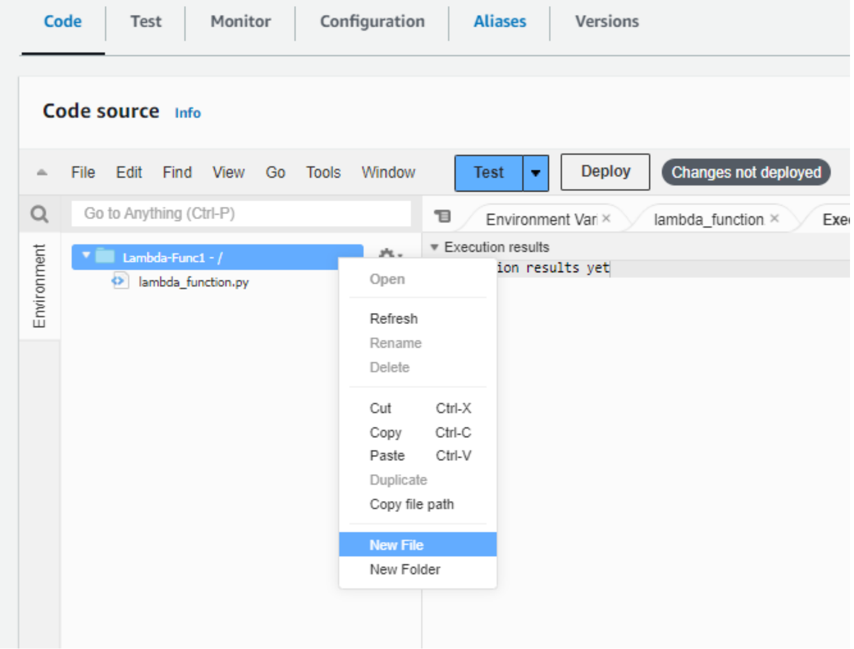
"s3full" ✕

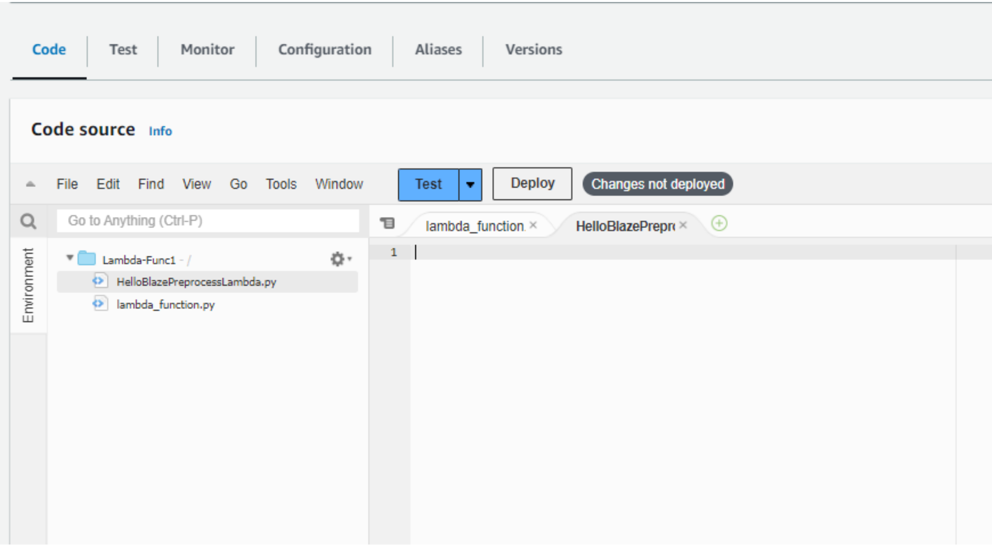
☑	Policy name	Type	Description
☑	⊞ AmazonS3FullAccess	AWS managed	Provides full access to all buckets via the AW...

Preprocess Toys' review DS using Lambda Function

Steps:

- Create a new python file and name it **HelloBlazePreprocessLambda.py**

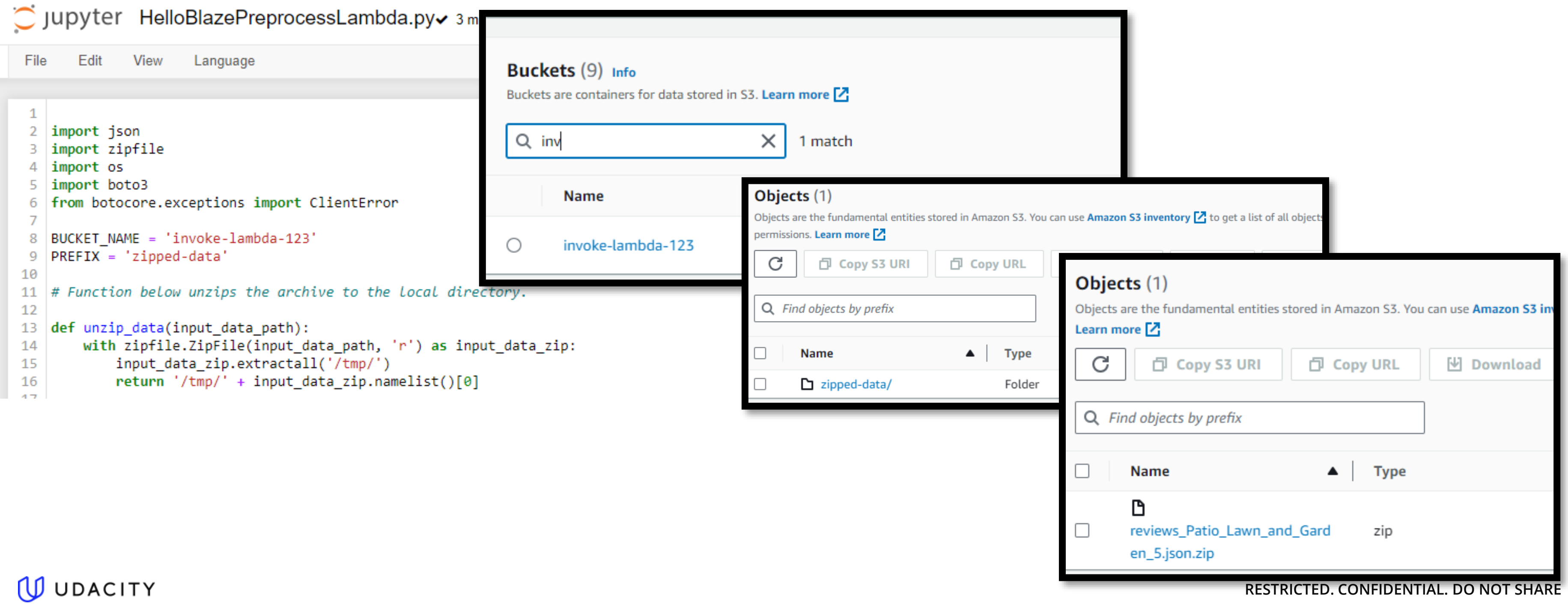




Preprocess Toys' review DS using Lambda Function

Steps:

- Edit the provided **HelloBlazePreprocessLambda.py** to contain valid Bucket and prefix



```python

import json
import zipfile
import os
import boto3
from botocore.exceptions import ClientError

BUCKET_NAME = 'invoke-lambda-123'
PREFIX = 'zipped-data'

# Function below unzips the archive to the local directory.

def unzip_data(input_data_path):
    with zipfile.ZipFile(input_data_path, 'r') as input_data_zip:
        input_data_zip.extractall('/tmp/')
        return '/tmp/' + input_data_zip.namelist()[0]
```

Buckets (9) Info

Buckets are containers for data stored in S3. Learn more

inv

1 match

	Name
○	invoke-lambda-123

Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all object permissions. Learn more

□	Name ▲	Type
□	zipped-data/	Folder

Objects (1)

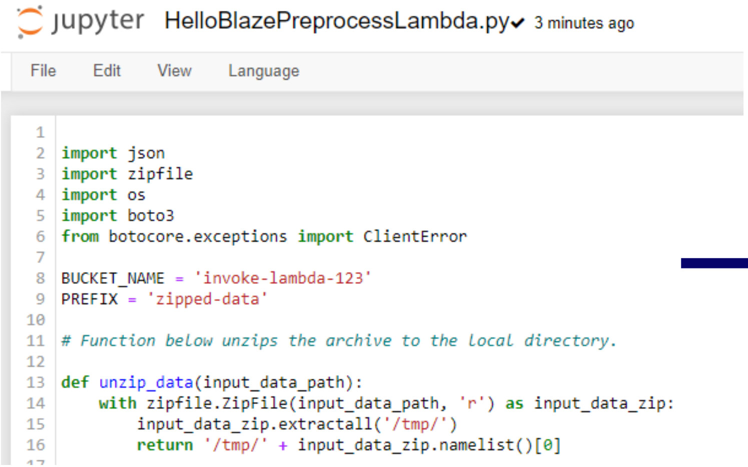
Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 in
Learn more

□	Name ▲	Type
□	reviews_Patio_Lawn_and_Garden_5.json.zip	zip

Preprocess Toys’ review DS using Lambda Function

Steps:

- Copy file content to lambda **HelloBlazePreprocessLambda.py** file



```python

import json
import zipfile
import os
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BUCKET_NAME = 'invoke-lambda-123'
PREFIX = 'zipped-data'

# Function below unzips the archive to the local directory.

def unzip_data(input_data_path):
    with zipfile.ZipFile(input_data_path, 'r') as input_data_zip:
        input_data_zip.extractall('/tmp/')
        return '/tmp/' + input_data_zip.namelist()[0]
```
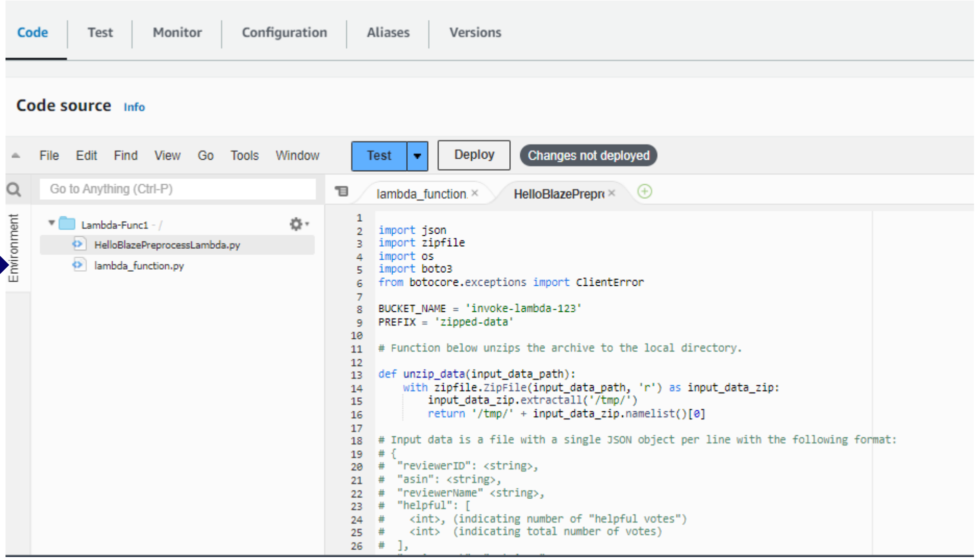
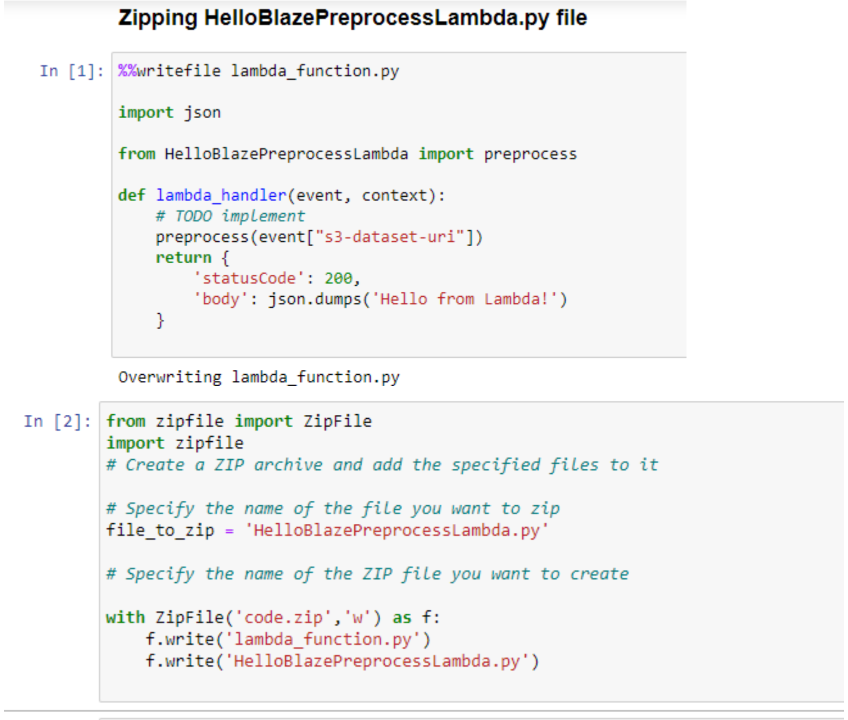



```python

import json
import zipfile
import os
import boto3
from botocore.exceptions import ClientError

BUCKET_NAME = 'invoke-lambda-123'
PREFIX = 'zipped-data'

# Function below unzips the archive to the local directory.

def unzip_data(input_data_path):
    with zipfile.ZipFile(input_data_path, 'r') as input_data_zip:
        input_data_zip.extractall('/tmp/')
        return '/tmp/' + input_data_zip.namelist()[0]

# Input data is a file with a single JSON object per line with the following format:
# {
#  "reviewerID": <string>,
#  "asin": <string>,
#  "reviewerName" <string>,
#  "helpful": [
#    <int>, (indicating number of "helpful votes")
#    <int>  (indicating total number of votes)
#  ],
```

Preprocess Toys' review DS using Lambda Function

Steps:

- You can also Zip the two files.py and upload them to lambda at once



Zipping HelloBlazePreprocessLambda.py file

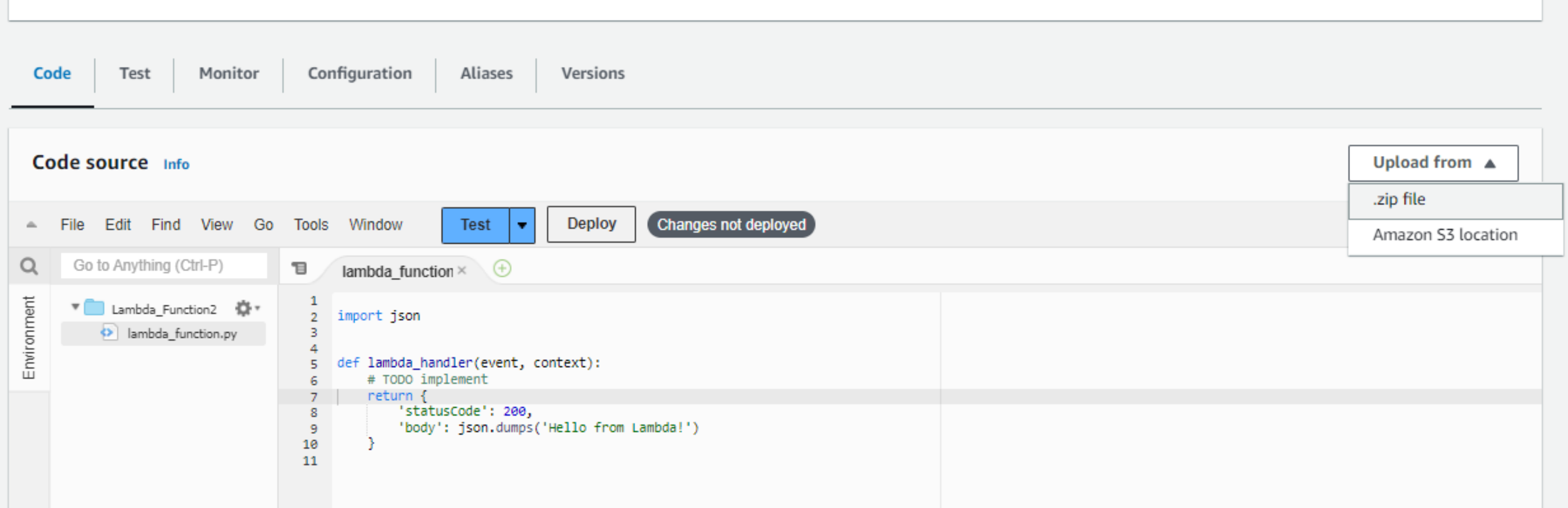
In [1]:
```
%%writefile lambda_function.py

import json

from HelloBlazePreprocessLambda import preprocess

def lambda_handler(event, context):
    # TODO implement
    preprocess(event["s3-dataset-uri"])
    return {
        'statusCode': 200,
        'body': json.dumps('Hello from Lambda!')
    }
```

```
Overwriting lambda_function.py
```

In [2]:
```
from zipfile import ZipFile
import zipfile
# Create a ZIP archive and add the specified files to it

# Specify the name of the file you want to zip
file_to_zip = 'HelloBlazePreprocessLambda.py'

# Specify the name of the ZIP file you want to create

with ZipFile('code.zip','w') as f:
    f.write('lambda_function.py')
    f.write('HelloBlazePreprocessLambda.py')
```

Steps:

- You can also Zip the two files.py and upload them to lambda at once



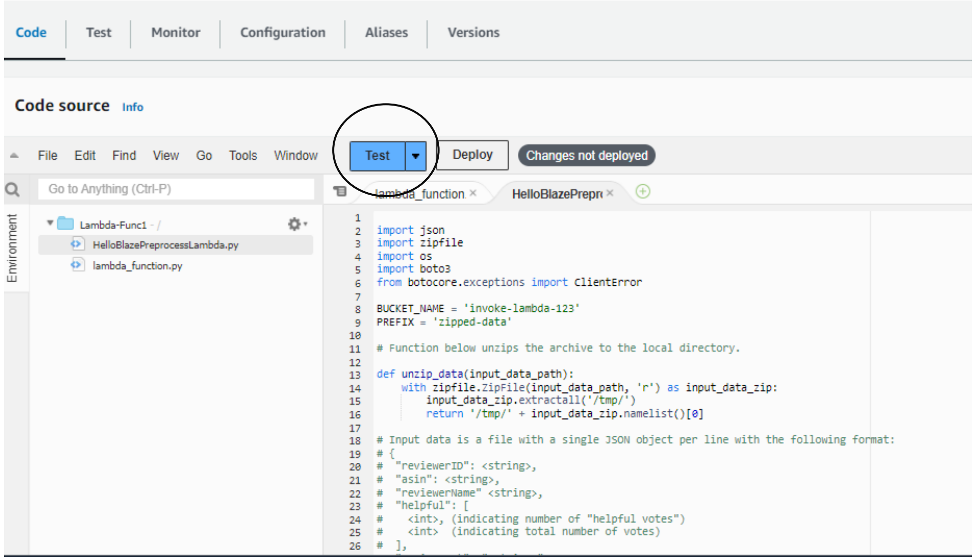
```

import json


def lambda_handler(event, context):
    # TODO implement
    return {
        'statusCode': 200,
        'body': json.dumps('Hello from Lambda!')
    }

```

Preprocess Toys' review DS using Lambda Function

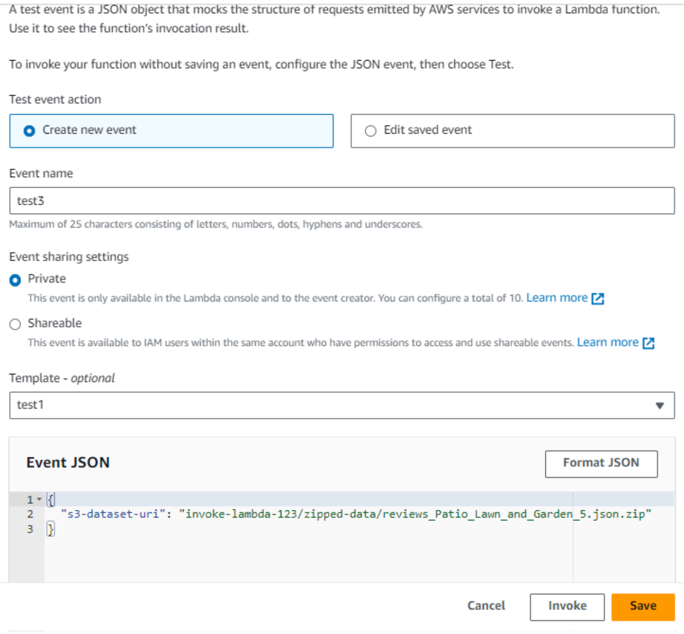
Steps:

- Configure a test event.
- Json Object will be like:

{ "s3-dataset-uri": "invoke-lambda-123/zipped-data/reviews_Patio_Lawn_and_Garden_5.json.zip"}



```python

import json
import zipfile
import os
import boto3
from botocore.exceptions import ClientError

BUCKET_NAME = 'invoke-lambda-123'
PREFIX = 'zipped-data'

# Function below unzips the archive to the local directory.

def unzip_data(input_data_path):
    with zipfile.ZipFile(input_data_path, 'r') as input_data_zip:
        input_data_zip.extractall('/tmp/')
        return '/tmp/' + input_data_zip.namelist()[0]

# Input data is a file with a single JSON object per line with the following format:
# {
#  "reviewerID": <string>,
#  "asin": <string>,
#  "reviewerName" <string>,
#  "helpful": [
#    <int>, (indicating number of "helpful votes")
#    <int>  (indicating total number of votes)
#  ],
```



A test event is a JSON object that mocks the structure of requests emitted by AWS services to invoke a Lambda function. Use it to see the function's invocation result.

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

test3

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*

test1

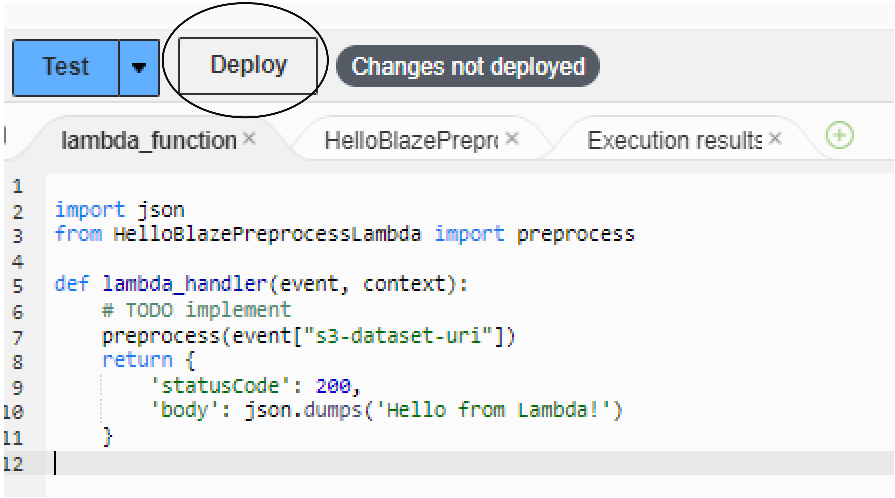
Event JSON

```json
{
  "s3-dataset-uri": "invoke-lambda-123/zipped-data/reviews_Patio_Lawn_and_Garden_5.json.zip"
}
```

Invoking Lambda function Through a test event (Synchronous Invocation)

Steps:

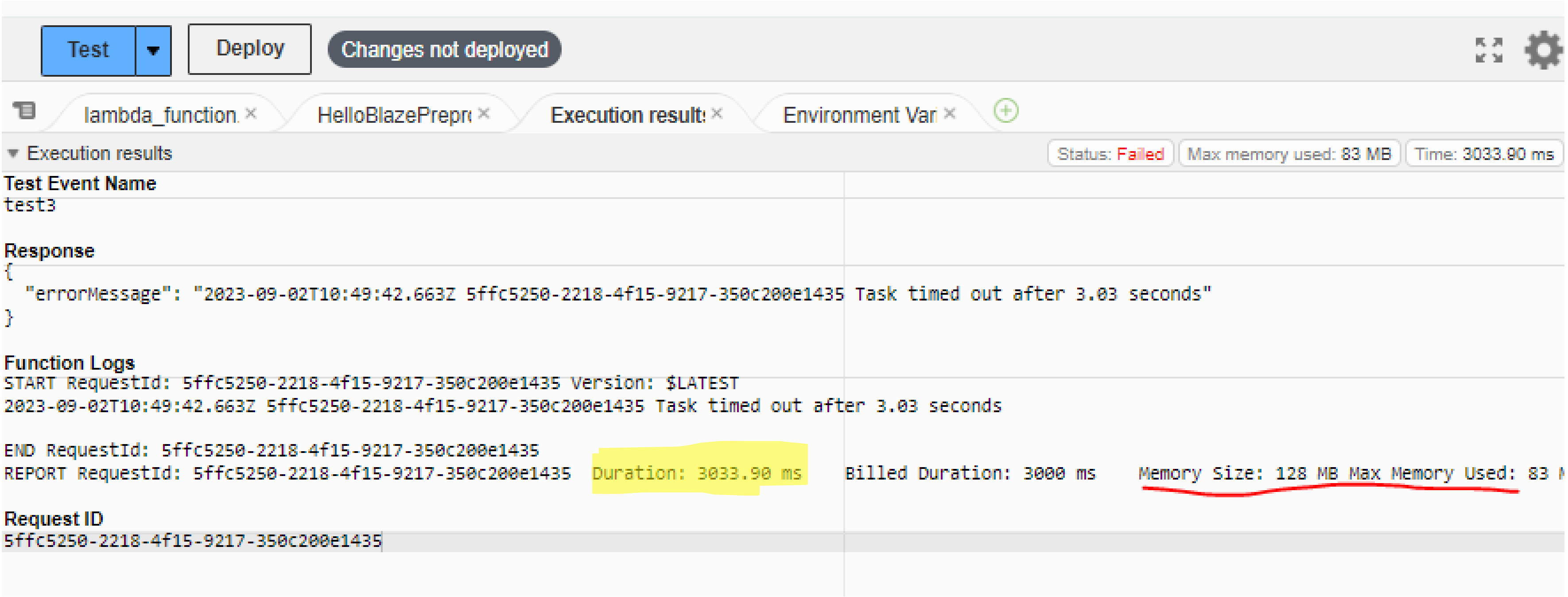
- Invoke the test event from lamba_handler function.



```

import json
from HelloBlazePreprocessLambda import preprocess

def lambda_handler(event, context):
    # TODO implement
    preprocess(event["s3-dataset-uri"])
    return {
        'statusCode': 200,
        'body': json.dumps('Hello from Lambda!')
    }

```

Steps:

- A problem might appear → Lambda function low execution time



Test Event Name

test3

Response

```
{
  "errorMessage": "2023-09-02T10:49:42.663Z 5ffc5250-2218-4f15-9217-350c200e1435 Task timed out after 3.03 seconds"
}
```

Function Logs

```
START RequestId: 5ffc5250-2218-4f15-9217-350c200e1435 Version: $LATEST
2023-09-02T10:49:42.663Z 5ffc5250-2218-4f15-9217-350c200e1435 Task timed out after 3.03 seconds

END RequestId: 5ffc5250-2218-4f15-9217-350c200e1435
REPORT RequestId: 5ffc5250-2218-4f15-9217-350c200e1435  Duration: 3033.90 ms   Billed Duration: 3000 ms   Memory Size: 128 MB Max Memory Used: 83 M
```

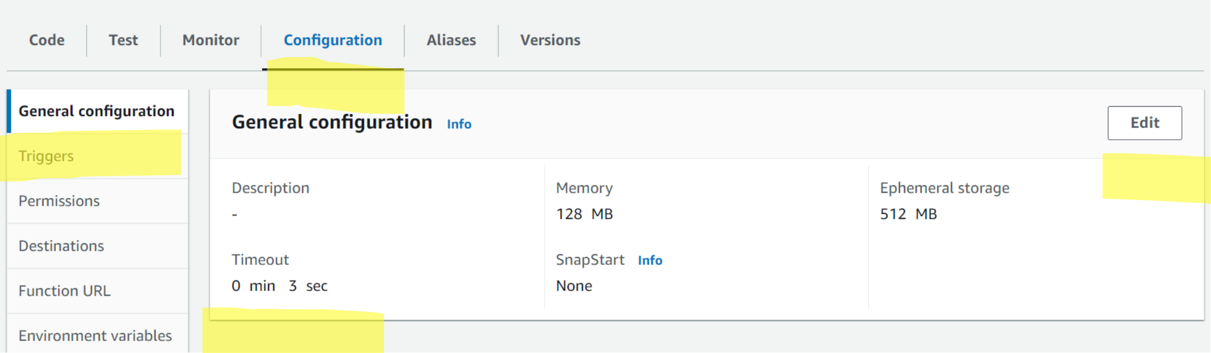
Request ID

5ffc5250-2218-4f15-9217-350c200e1435

Preprocess Toys' review DS using Lambda Function

Steps:

- A solution would be increasing the reserved memory for this lambda function.



General configuration Info

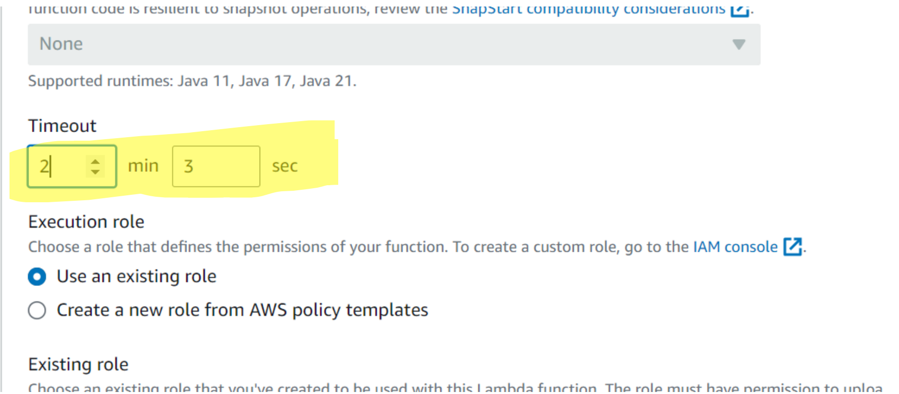
Description
-

Memory
128 MB

Ephemeral storage
512 MB

Timeout
0 min 3 sec

SnapStart Info
None



function code is resilient to snapshot operations, review the SnapStart compatibility considerations .

None

Supported runtimes: Java 11, Java 17, Java 21.

Timeout
2 min 3 sec

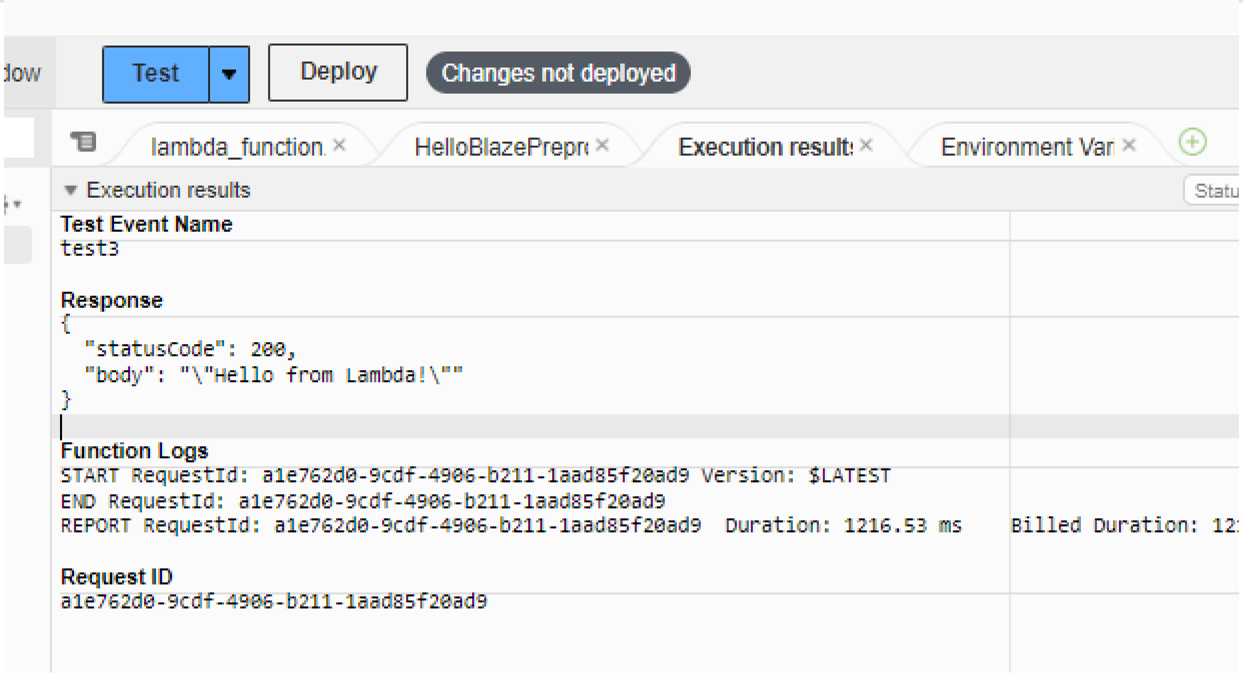
Execution role
Choose a role that defines the permissions of your function. To create a custom role, go to the IAM console .

● 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 uploa

Steps:

- Re-Run test event



Test Event Name
test3

Response
```
{
  "statusCode": 200,
  "body": "\"Hello from Lambda!\""
}
```

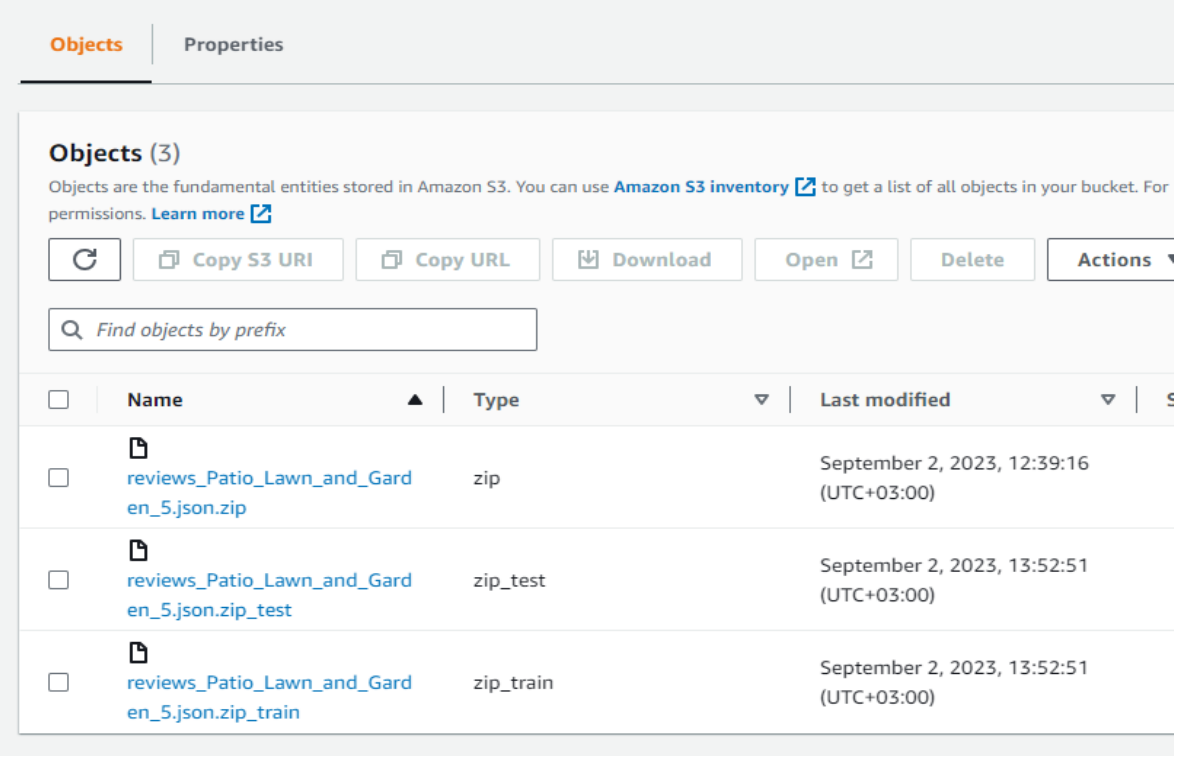
Function Logs
```
START RequestId: a1e762d0-9cdf-4906-b211-1aad85f20ad9 Version: $LATEST
END RequestId: a1e762d0-9cdf-4906-b211-1aad85f20ad9
REPORT RequestId: a1e762d0-9cdf-4906-b211-1aad85f20ad9  Duration: 1216.53 ms    Billed Duration: 12
```

Request ID
a1e762d0-9cdf-4906-b211-1aad85f20ad9

Preprocess Toys' review DS using Lambda Function

Steps:

- Make sure Output is generated



Objects (3)

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 permissions. **Learn more**

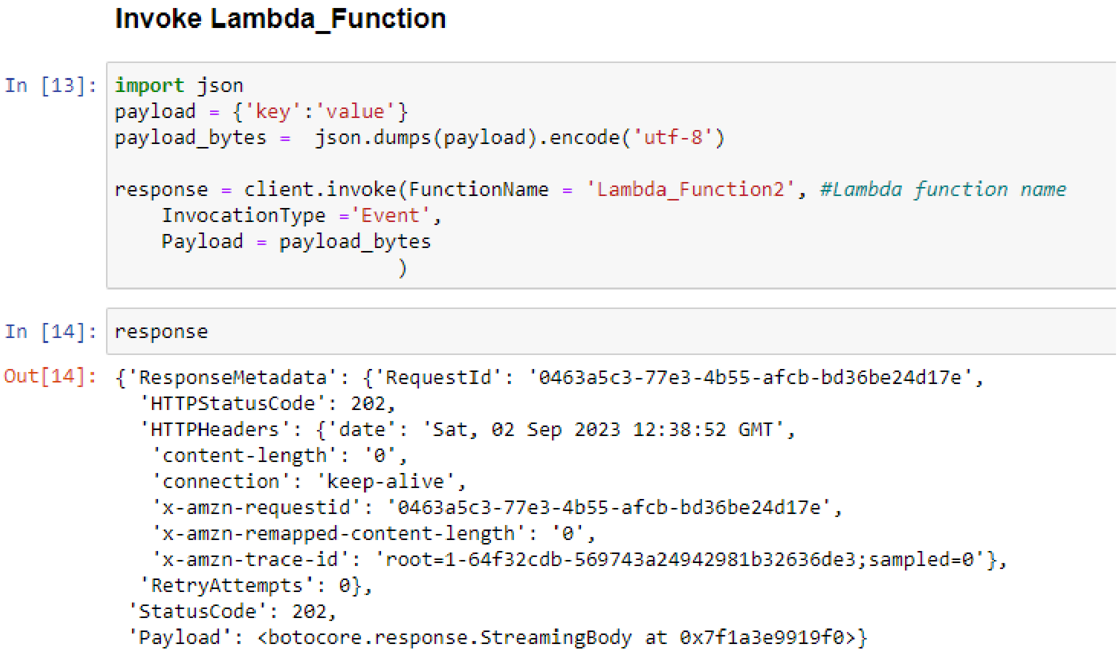
□	Name	Type	Last modified
□	reviews_Patio_Lawn_and_Garden_5.json.zip	zip	September 2, 2023, 12:39:16 (UTC+03:00)
□	reviews_Patio_Lawn_and_Garden_5.json.zip_test	zip_test	September 2, 2023, 13:52:51 (UTC+03:00)
□	reviews_Patio_Lawn_and_Garden_5.json.zip_train	zip_train	September 2, 2023, 13:52:51 (UTC+03:00)

Invoking Lambda function From a Jupyter Notebook (Event invocation) (Synchronous Invocation)

Event Invocation From a Jupyter Notebook

Steps:

- Event Invocation using boto3 SDK



Invoke Lambda_Function

```
In [13]: import json
         payload = {'key':'value'}
         payload_bytes =  json.dumps(payload).encode('utf-8')

         response = client.invoke(FunctionName = 'Lambda_Function2', #Lambda function name
             InvocationType ='Event',
             Payload = payload_bytes
                                 )
```

```
In [14]: response
```

```
Out[14]: {'ResponseMetadata': {'RequestId': '0463a5c3-77e3-4b55-afcb-bd36be24d17e',
           'HTTPStatusCode': 202,
           'HTTPHeaders': {'date': 'Sat, 02 Sep 2023 12:38:52 GMT',
            'content-length': '0',
            'connection': 'keep-alive',
            'x-amzn-requestid': '0463a5c3-77e3-4b55-afcb-bd36be24d17e',
            'x-amzn-remapped-content-length': '0',
            'x-amzn-trace-id': 'root=1-64f32cdb-569743a24942981b32636de3;sampled=0'},
           'RetryAttempts': 0},
          'StatusCode': 202,
          'Payload': <botocore.response.StreamingBody at 0x7f1a3e9919f0>}
```

Invoking Lambda function Through a CloudWatch Event Rules (Synchronous Invocation)

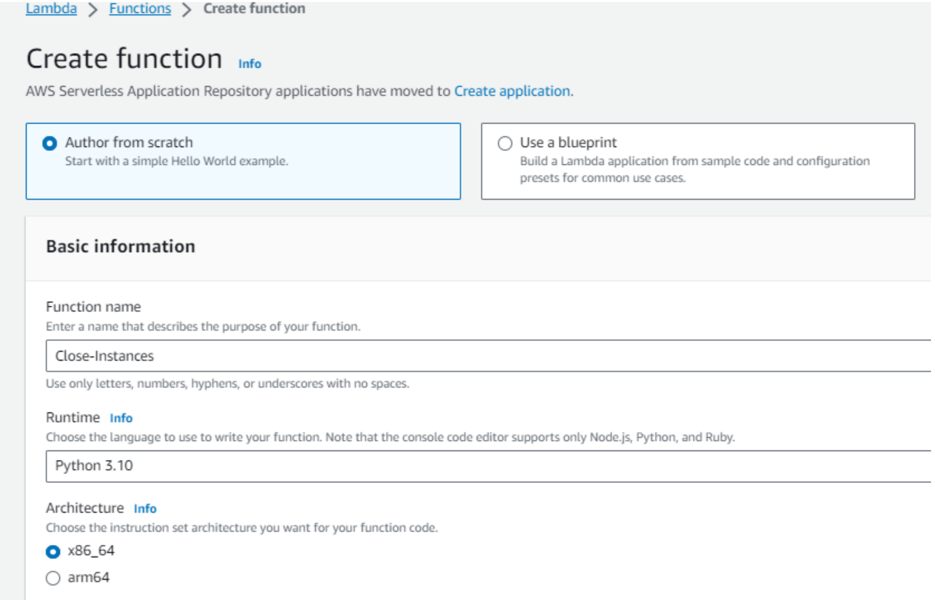
Cloudwatch event to invoke lambda funcion

Example:

Create a cloud watch event that closes Notebook instances that are open each 10 minutes.

Steps:

Create a Lambda function that closes Notebooks



Create function Info

AWS Serverless Application Repository applications have moved to Create application.

● 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.

Basic information

Function name
Enter a name that describes the purpose of your function.
Close-Instances
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 3.10

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

Cloudwatch event to invoke lambda funcion

Steps:

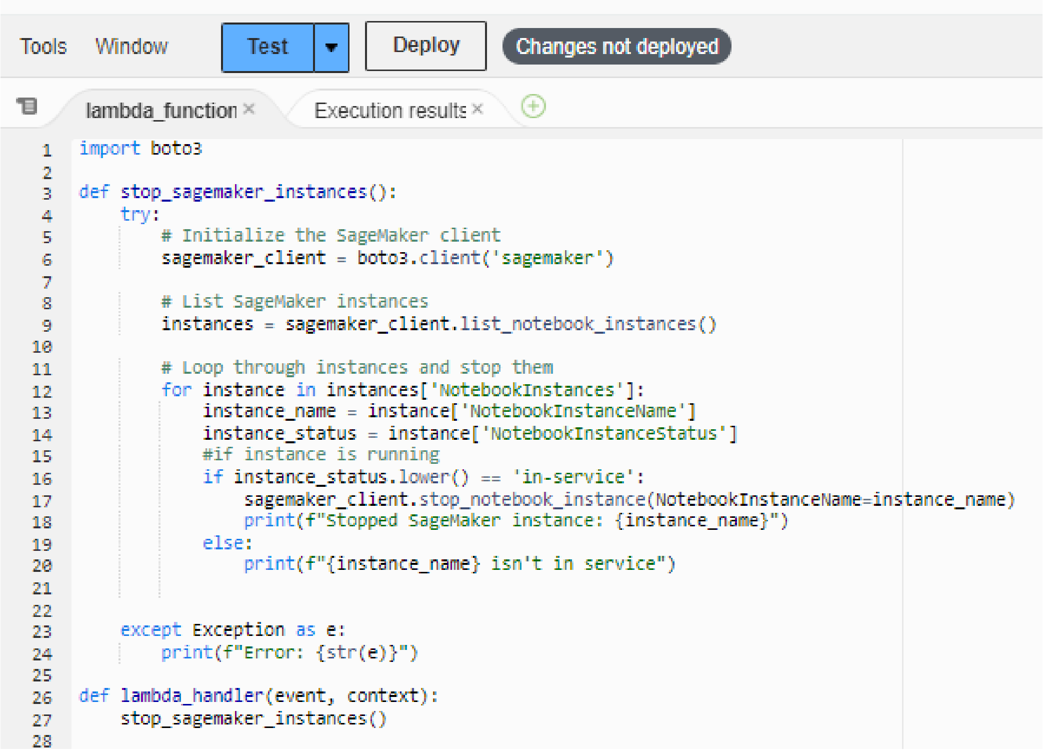
Add the following code to lambda_function.py

```
import boto3
def stop_sagemaker_instances():
    try:
        # Initialize the SageMaker client
        sagemaker_client = boto3.client(‘sagemaker’)

        #Replace 'your-region' with your AWS region # List SageMaker instances
        instances = sagemaker_client.list_notebook_instances()

        # Loop through instances and stop them
        for instance in instances['NotebookInstances’]:
            instance_name = instance['NotebookInstanceName’]
            instance_status = instance['NotebookInstanceStatus’]

            if instance_status.lower() == 'in-service’:
                sagemaker_client.stop_notebook_instance(
                    NotebookInstanceName=instance_name)
                print(f"Stopped SageMaker instance: {instance_name}")
            else:
                print(f" {instance_name} isn't in service")
    except Exception as e:
        print(f"Error: {str(e)}")
def lambda_handler(event, context):
    stop_sagemaker_instances()
```

Cloudwatch event to invoke lambda funcion

Steps:

Add the following code to lambda_function.py



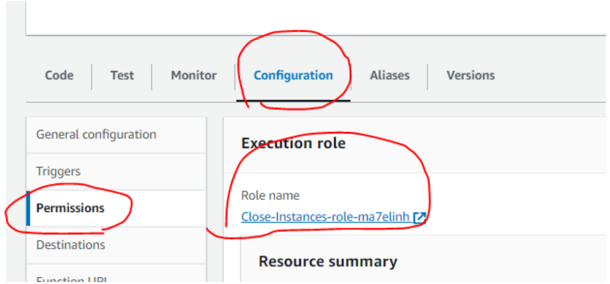
```python
import boto3

def stop_sagemaker_instances():
    try:
        # Initialize the SageMaker client
        sagemaker_client = boto3.client('sagemaker')

        # List SageMaker instances
        instances = sagemaker_client.list_notebook_instances()

        # Loop through instances and stop them
        for instance in instances['NotebookInstances']:
            instance_name = instance['NotebookInstanceName']
            instance_status = instance['NotebookInstanceStatus']
            #if instance is running
            if instance_status.lower() == 'in-service':
                sagemaker_client.stop_notebook_instance(NotebookInstanceName=instance_name)
                print(f"Stopped SageMaker instance: {instance_name}")
            else:
                print(f"{instance_name} isn't in service")


    except Exception as e:
        print(f"Error: {str(e)}")

def lambda_handler(event, context):
    stop_sagemaker_instances()

```

Cloudwatch event to invoke lambda funcion

Steps:

Give the right permissions to the lambda function corresponding role.

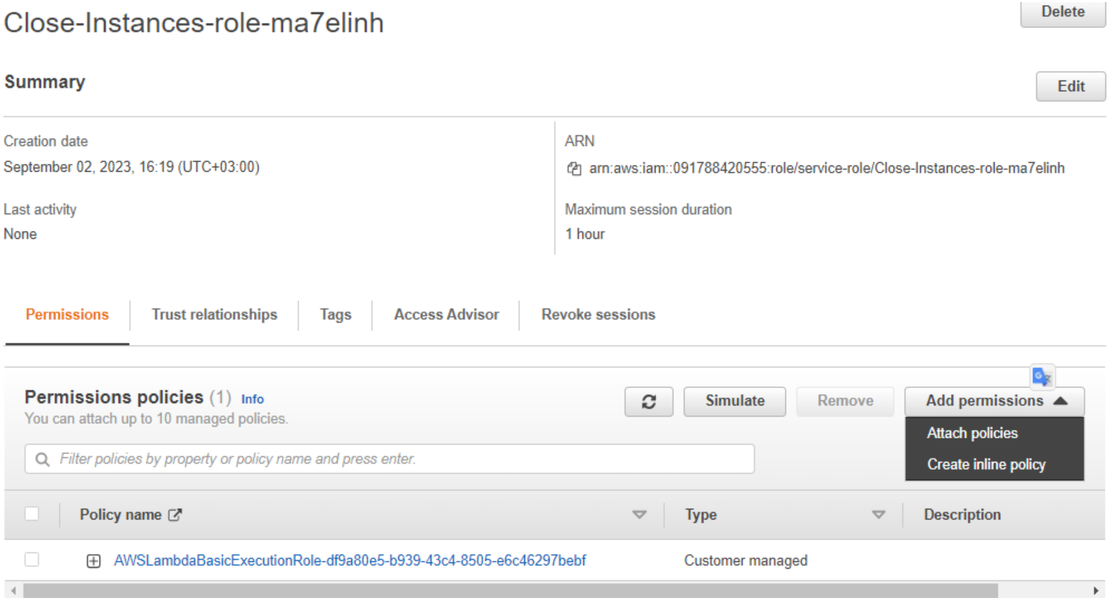
- **AmazonSageMakerFullAccess** gives permission to notebooks and deleting them



Execution role

Role name
Close-Instances-role-ma7elinh

Resource summary



Close-Instances-role-ma7elinh

Summary

Creation date
September 02, 2023, 16:19 (UTC+03:00)

ARN
arn:aws:iam::091788420555:role/service-role/Close-Instances-role-ma7elinh

Last activity
None

Maximum session duration
1 hour

Permissions policies (1) Info
You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter.

□	Policy name	Type	Description
□	AWSLambdaBasicExecutionRole-df9a80e5-b939-43c4-8505-e6c46297bebf	Customer managed	

UDACITY

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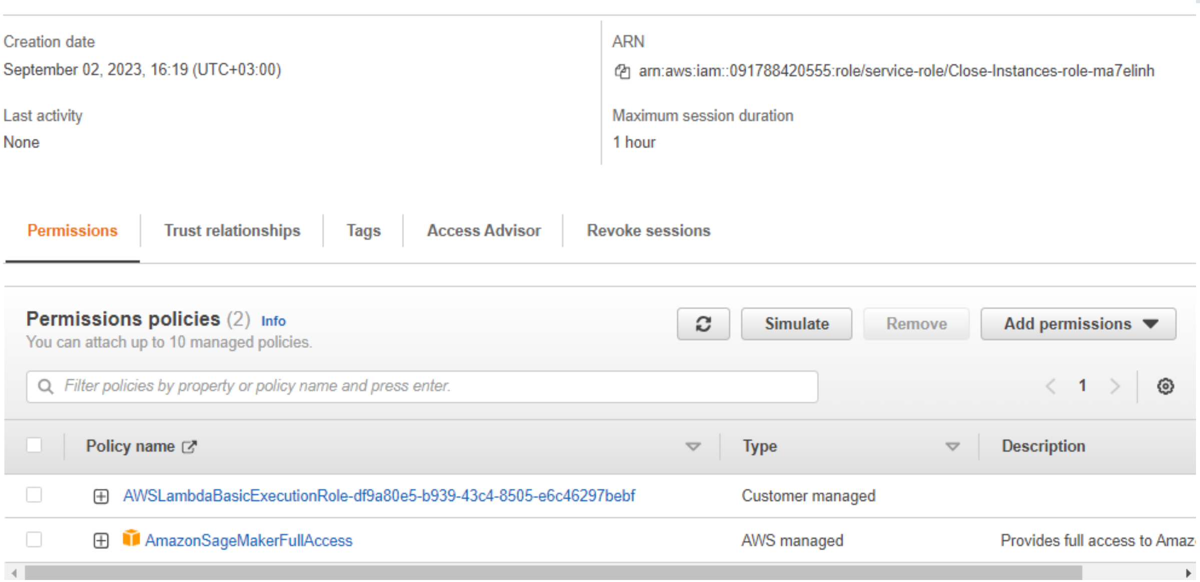
Cloudwatch event to invoke lambda funcion

Steps:

Give the right permissions to the lambda function corresponding role.

- **AmazonSageMakerFullAccess** gives permission to notebooks and deleting them



Creation date
September 02, 2023, 16:19 (UTC+03:00)

ARN
arn:aws:iam::091788420555:role/service-role/Close-Instances-role-ma7elinh

Last activity
None

Maximum session duration
1 hour

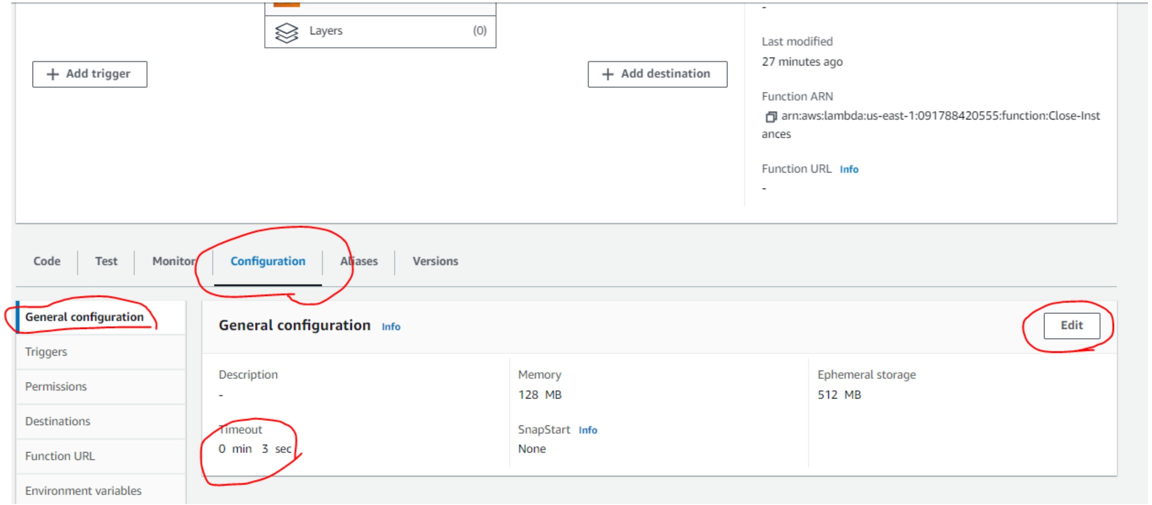
Permissions policies (2) Info
You can attach up to 10 managed policies.

□	Policy name	Type	Description
□	⊞ AWSLambdaBasicExecutionRole-df9a80e5-b939-43c4-8505-e6c46297bebf	Customer managed	
□	⊞ AmazonSageMakerFullAccess	AWS managed	Provides full access to Amaz

Cloudwatch event to invoke lambda funcion

Steps:

Give lambda more time to execute maybe 2 mins is enough.



-

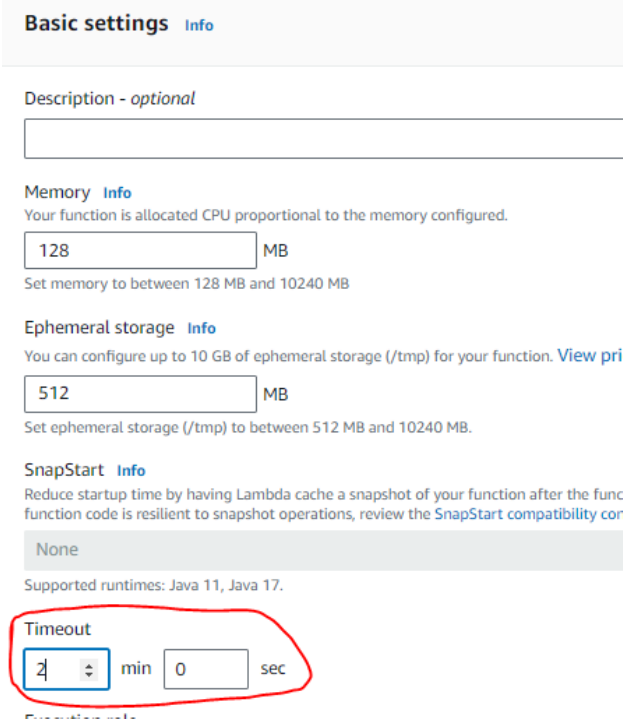
Last modified
27 minutes ago

Function ARN
arn:aws:lambda:us-east-1:091788420555:function:Close-Instances

Function URL Info
-

General configuration Info

Description	Memory	Ephemeral storage
-	128 MB	512 MB
Timeout 0 min 3 sec	SnapStart Info None	



Basic settings Info

Description - *optional*

Memory Info
Your function is allocated CPU proportional to the memory configured.
128 MB
Set memory to between 128 MB and 10240 MB

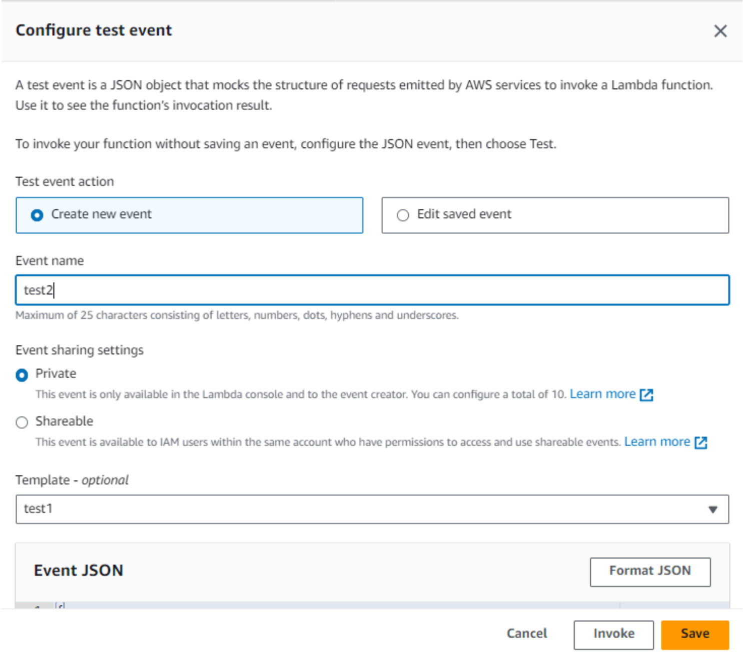
Ephemeral storage Info
You can configure up to 10 GB of ephemeral storage (/tmp) for your function. View pri
512 MB
Set ephemeral storage (/tmp) to between 512 MB and 10240 MB.

SnapStart Info
Reduce startup time by having Lambda cache a snapshot of your function after the func
function code is resilient to snapshot operations, review the SnapStart compatibility cor
None
Supported runtimes: Java 11, Java 17.

Timeout
2 min 0 sec

Cloudwatch event to invoke lambda funcion

You can test the event now with the test event as shown. It will close all instances without scheduling. So **be careful**



Configure test event

A test event is a JSON object that mocks the structure of requests emitted by AWS services to invoke a Lambda function. Use it to see the function's invocation result.

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

test2

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

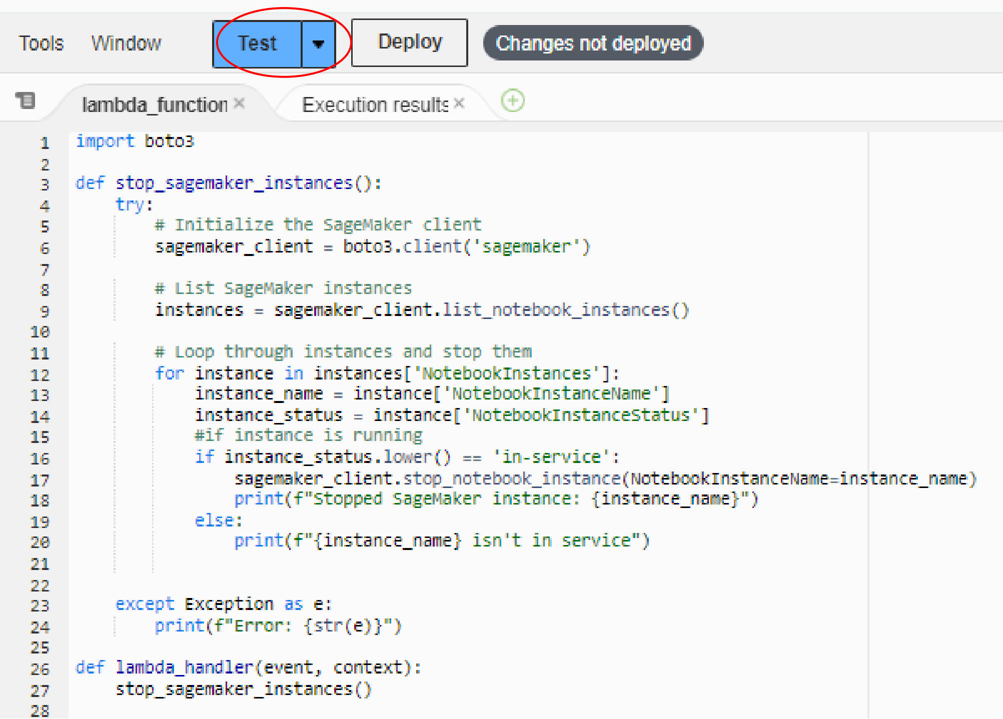
○ Shareable

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

Template - *optional*

test1

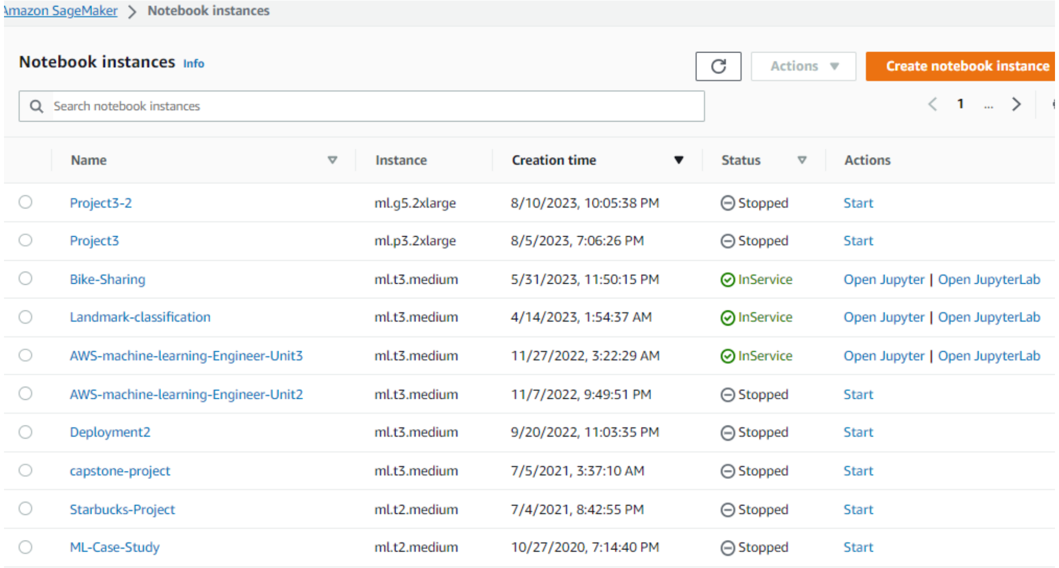
Event JSON



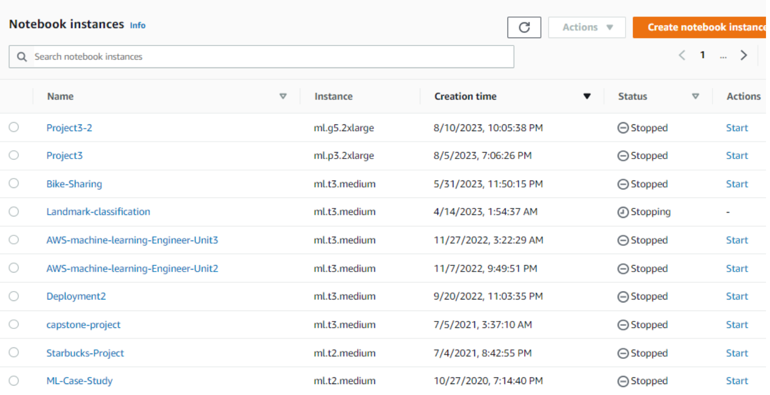
```python
import boto3

def stop_sagemaker_instances():
    try:
        # Initialize the SageMaker client
        sagemaker_client = boto3.client('sagemaker')

        # List SageMaker instances
        instances = sagemaker_client.list_notebook_instances()

        # Loop through instances and stop them
        for instance in instances['NotebookInstances']:
            instance_name = instance['NotebookInstanceName']
            instance_status = instance['NotebookInstanceStatus']
            #if instance is running
            if instance_status.lower() == 'in-service':
                sagemaker_client.stop_notebook_instance(NotebookInstanceName=instance_name)
                print(f"Stopped SageMaker instance: {instance_name}")
            else:
                print(f"{instance_name} isn't in service")


    except Exception as e:
        print(f"Error: {str(e)}")

def lambda_handler(event, context):
    stop_sagemaker_instances()

```

Cloudwatch event to invoke lambda funcion

Before & After

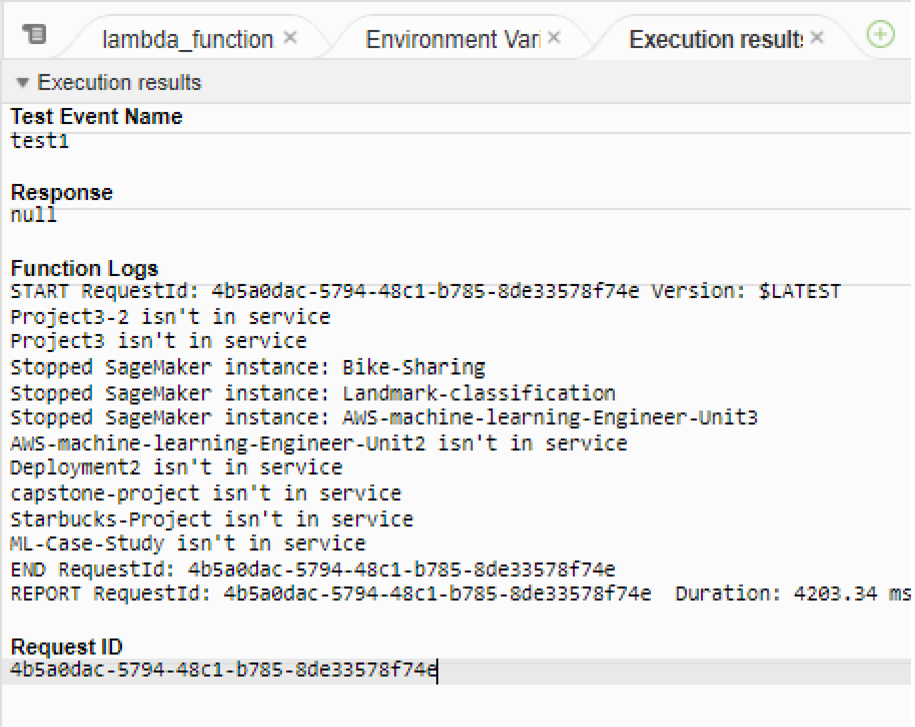

Amazon SageMaker > Notebook instances
Notebook instances Info
Actions
Create notebook instance
Search notebook instances
1 ...

	Name	Instance	Creation time	Status	Actions
○	Project3-2	ml.g5.2xlarge	8/10/2023, 10:05:38 PM	⊖ Stopped	Start
○	Project3	ml.p3.2xlarge	8/5/2023, 7:06:26 PM	⊖ Stopped	Start
○	Bike-Sharing	ml.t3.medium	5/31/2023, 11:50:15 PM	✓ InService	Open Jupyter | Open JupyterLab
○	Landmark-classification	ml.t3.medium	4/14/2023, 1:54:37 AM	✓ InService	Open Jupyter | Open JupyterLab
○	AWS-machine-learning-Engineer-Unit3	ml.t3.medium	11/27/2022, 3:22:29 AM	✓ InService	Open Jupyter | Open JupyterLab
○	AWS-machine-learning-Engineer-Unit2	ml.t3.medium	11/7/2022, 9:49:51 PM	⊖ Stopped	Start
○	Deployment2	ml.t3.medium	9/20/2022, 11:03:35 PM	⊖ Stopped	Start
○	capstone-project	ml.t3.medium	7/5/2021, 3:37:10 AM	⊖ Stopped	Start
○	Starbucks-Project	ml.t2.medium	7/4/2021, 8:42:55 PM	⊖ Stopped	Start
○	ML-Case-Study	ml.t2.medium	10/27/2020, 7:14:40 PM	⊖ Stopped	Start



	Name	Instance	Creation time	Status	Actions
○	Project3-2	ml.g5.2xlarge	8/10/2023, 10:05:38 PM	⊖ Stopped	Start
○	Project3	ml.p3.2xlarge	8/5/2023, 7:06:26 PM	⊖ Stopped	Start
○	Bike-Sharing	ml.t3.medium	5/31/2023, 11:50:15 PM	⊖ Stopped	Start
○	Landmark-classification	ml.t3.medium	4/14/2023, 1:54:37 AM	◷ Stopping	-
○	AWS-machine-learning-Engineer-Unit3	ml.t3.medium	11/27/2022, 3:22:29 AM	⊖ Stopped	Start
○	AWS-machine-learning-Engineer-Unit2	ml.t3.medium	11/7/2022, 9:49:51 PM	⊖ Stopped	Start
○	Deployment2	ml.t3.medium	9/20/2022, 11:03:35 PM	⊖ Stopped	Start
○	capstone-project	ml.t3.medium	7/5/2021, 3:37:10 AM	⊖ Stopped	Start
○	Starbucks-Project	ml.t2.medium	7/4/2021, 8:42:55 PM	⊖ Stopped	Start
○	ML-Case-Study	ml.t2.medium	10/27/2020, 7:14:40 PM	⊖ Stopped	Start

Code output of lambda function



Test Event Name

```
test1
```

Response

```
null
```

Function Logs

```
START RequestId: 4b5a0dac-5794-48c1-b785-8de33578f74e Version: $LATEST
Project3-2 isn't in service
Project3 isn't in service
Stopped SageMaker instance: Bike-Sharing
Stopped SageMaker instance: Landmark-classification
Stopped SageMaker instance: AWS-machine-learning-Engineer-Unit3
AWS-machine-learning-Engineer-Unit2 isn't in service
Deployment2 isn't in service
capstone-project isn't in service
Starbucks-Project isn't in service
ML-Case-Study isn't in service
END RequestId: 4b5a0dac-5794-48c1-b785-8de33578f74e
REPORT RequestId: 4b5a0dac-5794-48c1-b785-8de33578f74e  Duration: 4203.34 ms
```

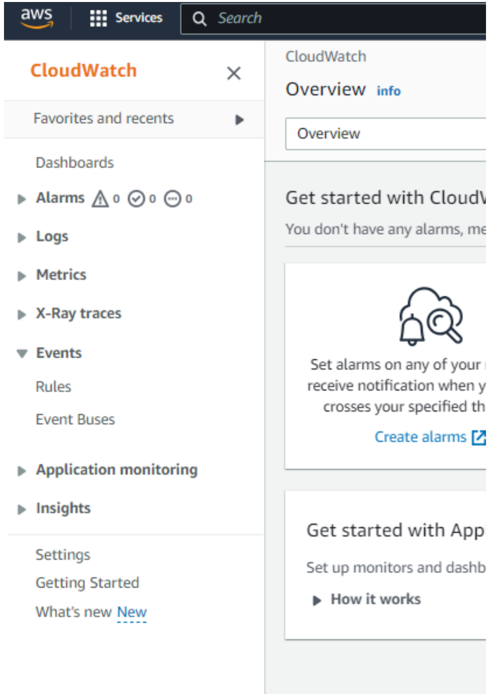
Request ID

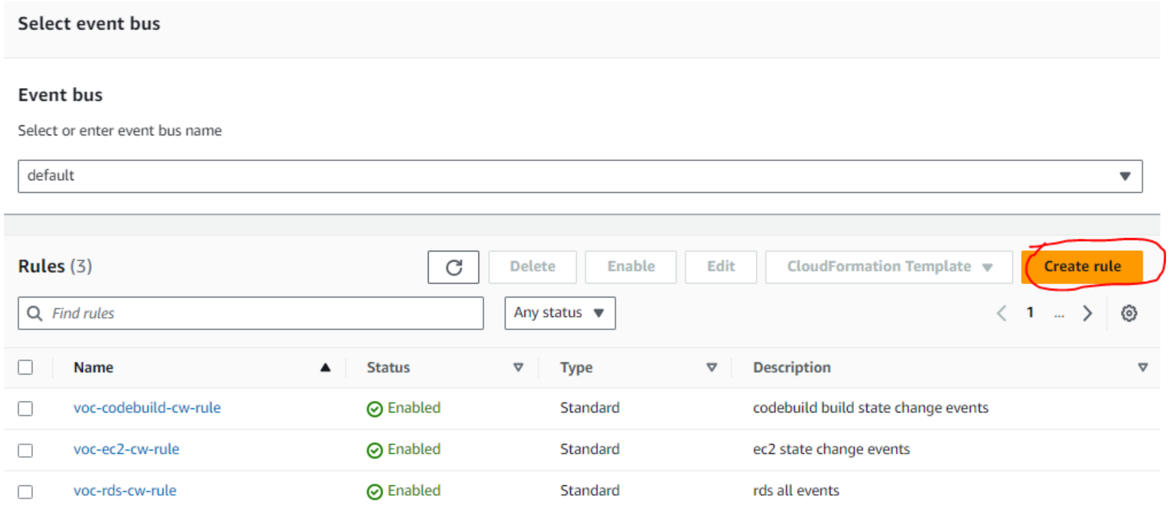
```
4b5a0dac-5794-48c1-b785-8de33578f74e
```

Cloudwatch event to invoke lambda funcion

Steps:

Create a Cloudwatch scheduled event to trigger/invoke the LambdaFunction





Select event bus

Event bus

Select or enter event bus name

default

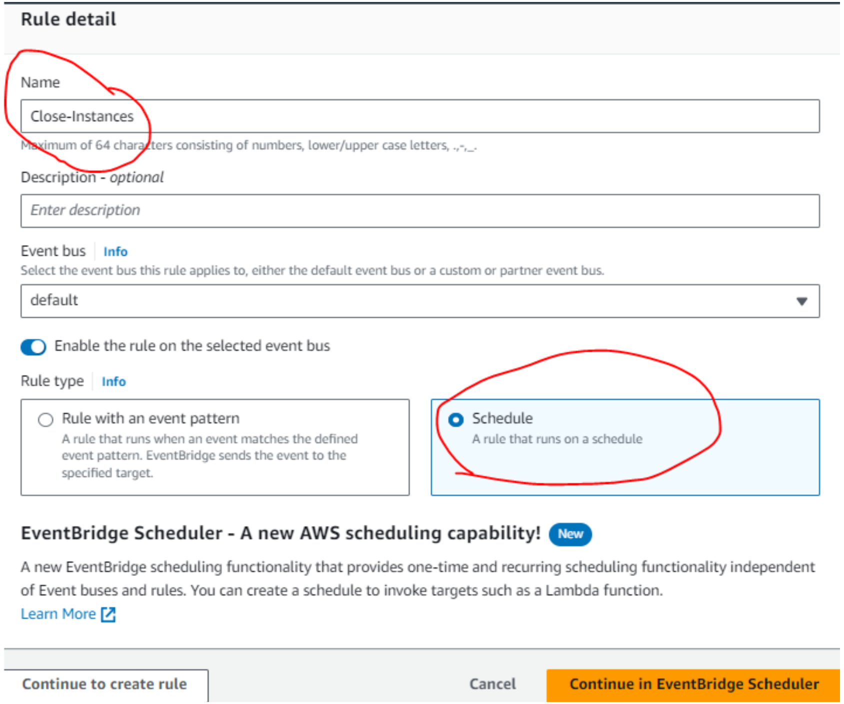
Rules (3)

□	Name	Status	Type	Description
□	voc-codebuild-cw-rule	✓ Enabled	Standard	codebuild build state change events
□	voc-ec2-cw-rule	✓ Enabled	Standard	ec2 state change events
□	voc-rds-cw-rule	✓ Enabled	Standard	rds all events

Cloudwatch event to invoke lambda funcion

Steps:

Create a Cloudwatch scheduled event to trigger/invoke the LambdaFunction



Rule detail

Name

Close-Instances

Maximum of 64 characters consisting of numbers, lower/upper case letters, .,-,_.

Description - *optional*

Enter description

Event bus | Info

Select the event bus this rule applies to, either the default event bus or a custom or partner event bus.

default ▼

Enable the rule on the selected event bus

Rule type | Info

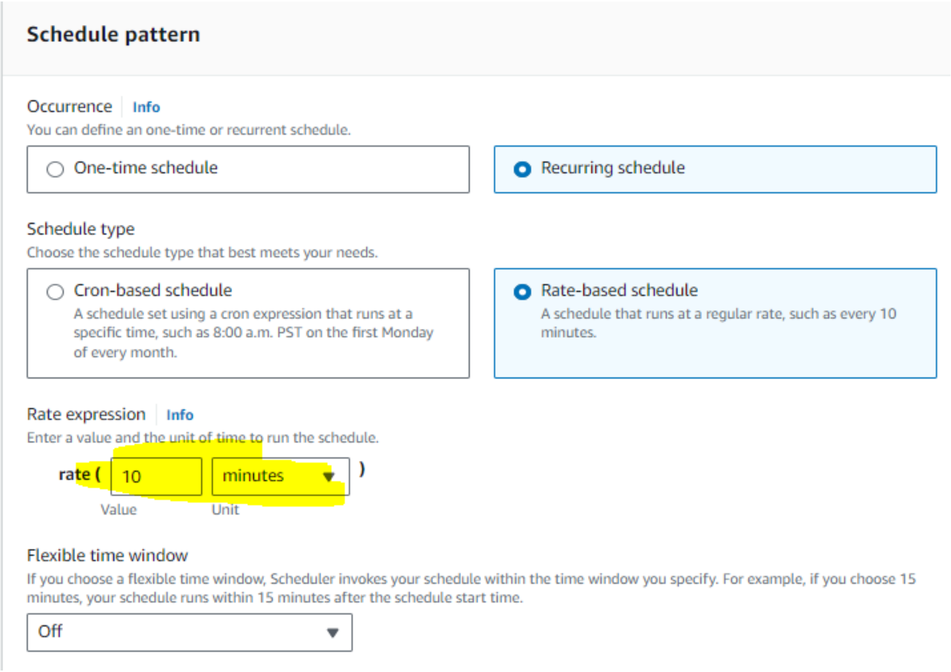
○ Rule with an event pattern
A rule that runs when an event matches the defined event pattern. EventBridge sends the event to the specified target.

● Schedule
A rule that runs on a schedule

EventBridge Scheduler - A new AWS scheduling capability! New

A new EventBridge scheduling functionality that provides one-time and recurring scheduling functionality independent of Event buses and rules. You can create a schedule to invoke targets such as a Lambda function.

Learn More



Schedule pattern

Occurrence | Info

You can define an one-time or recurrent schedule.

○ One-time schedule

● Recurring schedule

Schedule type

Choose the schedule type that best meets your needs.

○ Cron-based schedule
A schedule set using a cron expression that runs at a specific time, such as 8:00 a.m. PST on the first Monday of every month.

● Rate-based schedule
A schedule that runs at a regular rate, such as every 10 minutes.

Rate expression | Info

Enter a value and the unit of time to run the schedule.

rate (10 minutes ▼)

Value Unit

Flexible time window

If you choose a flexible time window, Scheduler invokes your schedule within the time window you specify. For example, if you choose 15 minutes, your schedule runs within 15 minutes after the schedule start time.

Off ▼

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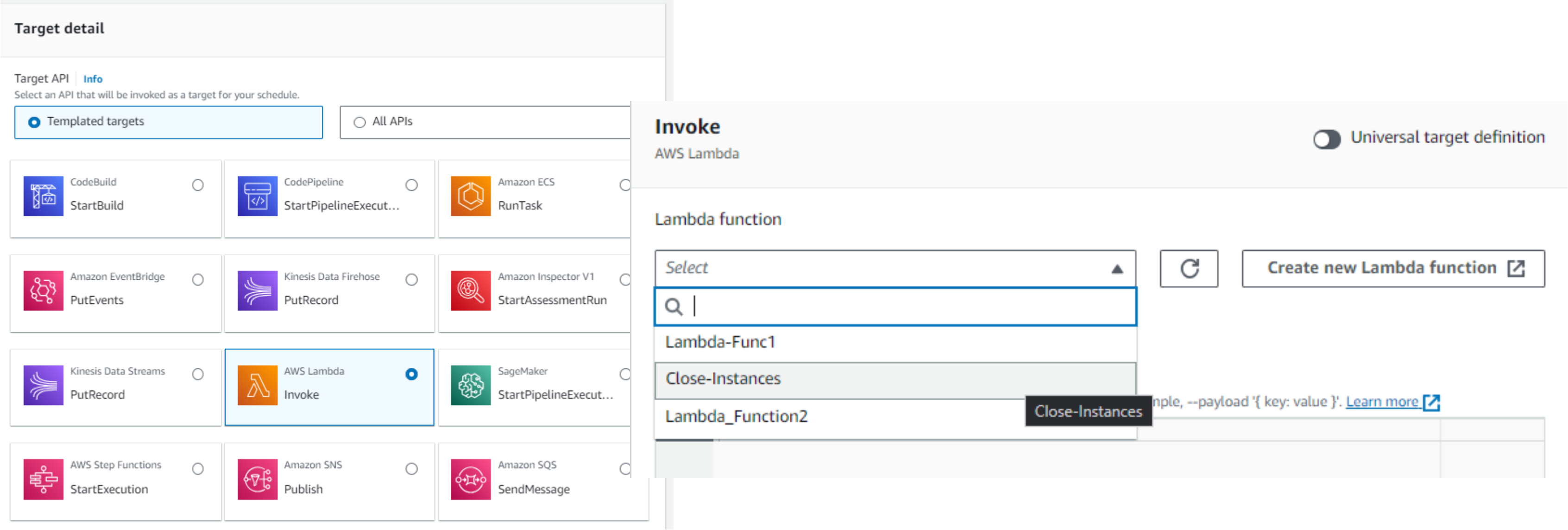
Cloudwatch event to invoke lambda funcion

Steps:

Create a Cloudwatch scheduled event to trigger/invoke the LambdaFunction



Target detail

Target API | Info

Select an API that will be invoked as a target for your schedule.

● Templated targets ○ All APIs

CodeBuild StartBuild ○	CodePipeline StartPipelineExecut... ○	Amazon ECS RunTask ○
Amazon EventBridge PutEvents ○	Kinesis Data Firehose PutRecord ○	Amazon Inspector V1 StartAssessmentRun ○
Kinesis Data Streams PutRecord ○	AWS Lambda Invoke ●	SageMaker StartPipelineExecut... ○
AWS Step Functions StartExecution ○	Amazon SNS Publish ○	Amazon SQS SendMessage ○

Invoke

AWS Lambda

Universal target definition

Lambda function

Select

Lambda-Func1

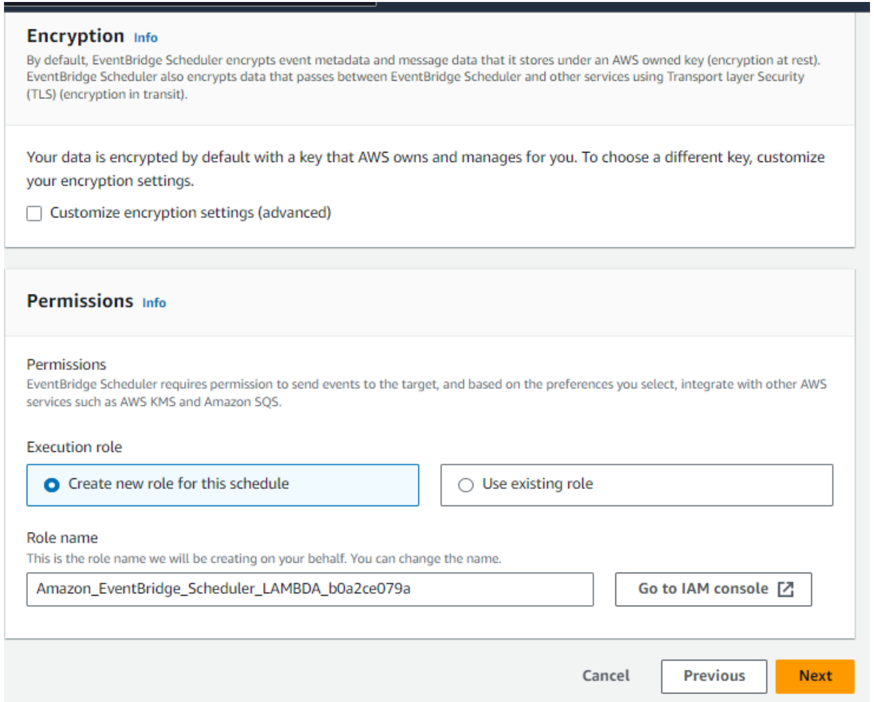
Close-Instances

Lambda_Function2

Create new Lambda function
Close-Instances
nple, --payload '{ key: value }'. Learn more

Note:

This task won't be implemented using the given AWS accounts. Use a personal account to have the authority to create a cloud watch event



Encryption Info

By default, EventBridge Scheduler encrypts event metadata and message data that it stores under an AWS owned key (encryption at rest). EventBridge Scheduler also encrypts data that passes between EventBridge Scheduler and other services using Transport layer Security (TLS) (encryption in transit).

Your data is encrypted by default with a key that AWS owns and manages for you. To choose a different key, customize your encryption settings.

□ Customize encryption settings (advanced)

Permissions Info

Permissions

EventBridge Scheduler requires permission to send events to the target, and based on the preferences you select, integrate with other AWS services such as AWS KMS and Amazon SQS.

Execution role

● Create new role for this schedule ○ Use existing role

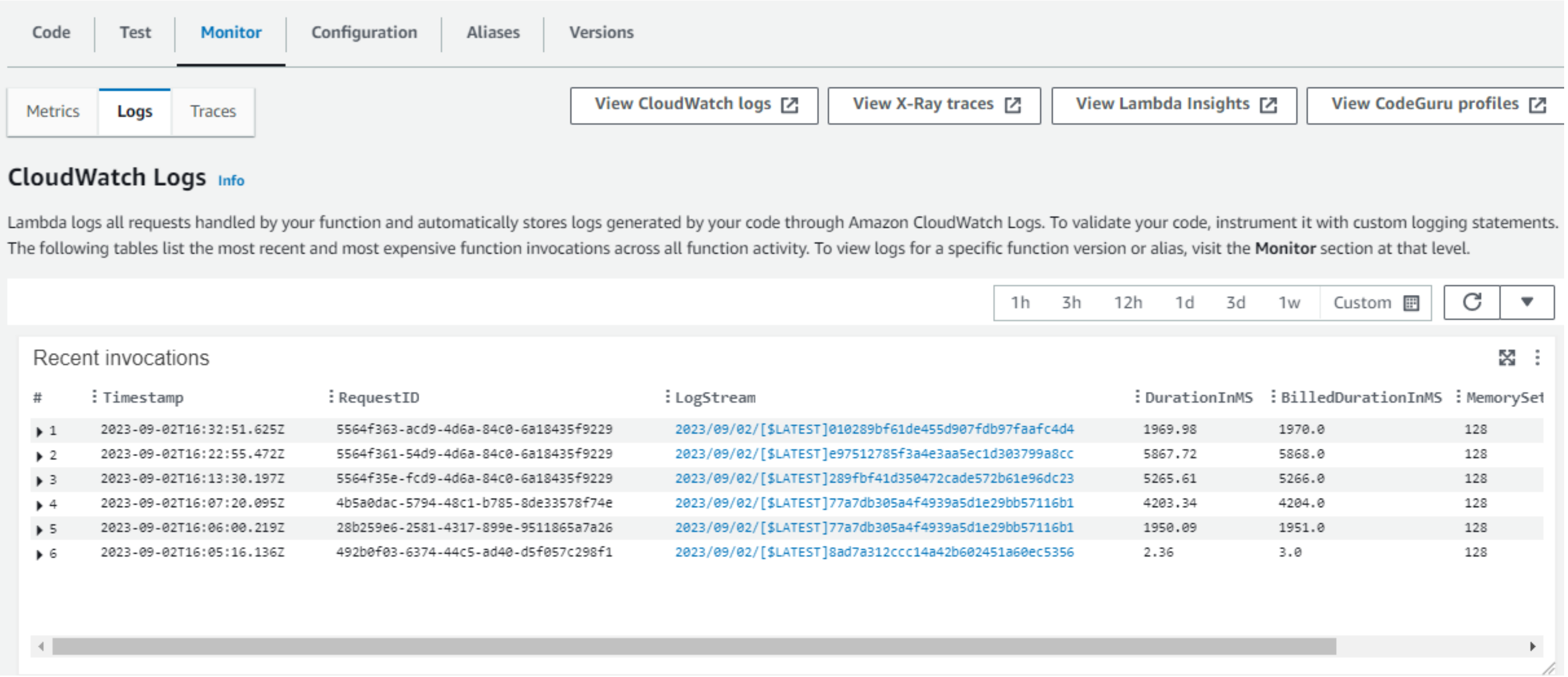
Role name

This is the role name we will be creating on your behalf. You can change the name.

Amazon_EventBridge_Scheduler_LAMBDA_b0a2ce079a

Steps:

Monitor your lambda function after a CloudWatch Event is created



CloudWatch Logs Info

Lambda logs all requests handled by your function and automatically stores logs generated by your code through Amazon CloudWatch Logs. To validate your code, instrument it with custom logging statements. The following tables list the most recent and most expensive function invocations across all function activity. To view logs for a specific function version or alias, visit the **Monitor** section at that level.

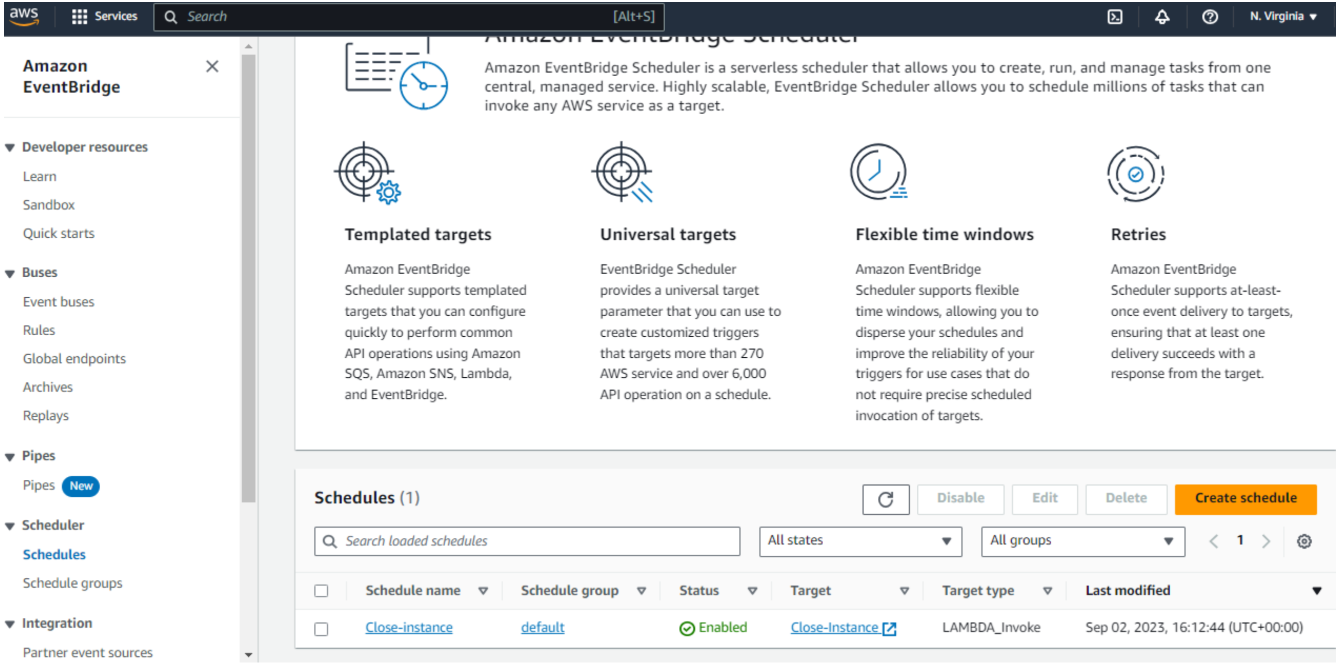
Recent invocations

#	Timestamp	RequestID	LogStream	DurationInMS	BilledDurationInMS	MemorySet
1	2023-09-02T16:32:51.625Z	5564f363-acd9-4d6a-84c0-6a18435f9229	2023/09/02/[$LATEST]010289bf61de455d907fdb97faafc4d4	1969.98	1970.0	128
2	2023-09-02T16:22:55.472Z	5564f361-54d9-4d6a-84c0-6a18435f9229	2023/09/02/[$LATEST]e97512785f3a4e3aa5ec1d303799a8cc	5867.72	5868.0	128
3	2023-09-02T16:13:30.197Z	5564f35e-fcd9-4d6a-84c0-6a18435f9229	2023/09/02/[$LATEST]289fbf41d350472cade572b61e96dc23	5265.61	5266.0	128
4	2023-09-02T16:07:20.095Z	4b5a0dac-5794-48c1-b785-8de33578f74e	2023/09/02/[$LATEST]77a7db305a4f4939a5d1e29bb57116b1	4203.34	4204.0	128
5	2023-09-02T16:06:00.219Z	28b259e6-2581-4317-899e-9511865a7a26	2023/09/02/[$LATEST]77a7db305a4f4939a5d1e29bb57116b1	1950.09	1951.0	128
6	2023-09-02T16:05:16.136Z	492b0f03-6374-44c5-ad40-d5f057c298f1	2023/09/02/[$LATEST]8ad7a312ccc14a42b602451a60ec5356	2.36	3.0	128

Cloudwatch event to invoke lambda funcion

Steps:

Don’t forget to terminate your scheduler



Amazon EventBridge Scheduler

Amazon EventBridge Scheduler is a serverless scheduler that allows you to create, run, and manage tasks from one central, managed service. Highly scalable, EventBridge Scheduler allows you to schedule millions of tasks that can invoke any AWS service as a target.

Templated targets

Amazon EventBridge Scheduler supports templated targets that you can configure quickly to perform common API operations using Amazon SQS, Amazon SNS, Lambda, and EventBridge.

Universal targets

EventBridge Scheduler provides a universal target parameter that you can use to create customized triggers that targets more than 270 AWS service and over 6,000 API operation on a schedule.

Flexible time windows

Amazon EventBridge Scheduler supports flexible time windows, allowing you to disperse your schedules and improve the reliability of your triggers for use cases that do not require precise scheduled invocation of targets.

Retries

Amazon EventBridge Scheduler supports at-least-once event delivery to targets, ensuring that at least one delivery succeeds with a response from the target.

Schedules (1)

□	Schedule name	Schedule group	Status	Target	Target type	Last modified
□	Close-instance	default	✓ Enabled	Close-Instance	LAMBDA_Invoke	Sep 02, 2023, 16:12:44 (UTC+00:00)

Break (10 minutes)

Satisfaction Survey

Step Functions

Definitions

State Machine:

Workflow/ Repeated pattern of activity (Ex: Pattern Of activation Functions)

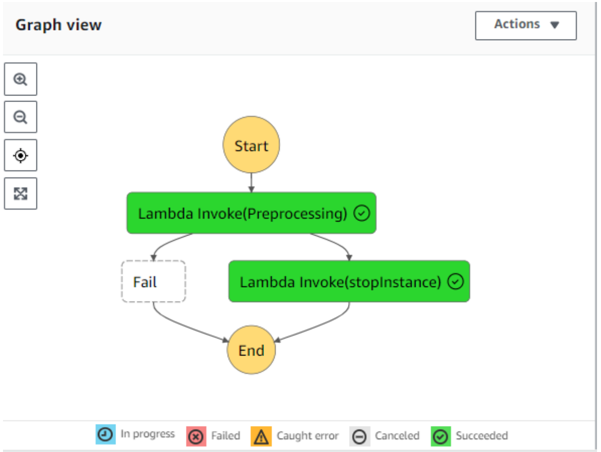
Task:

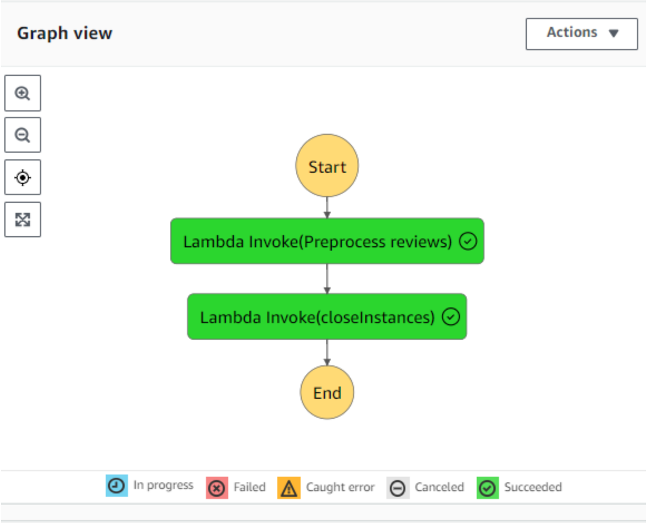
Single unit / activity in the workflow.

Step Function achieves:

1- Orchestration: Ordered execution of activities

2- Branching: Determination of which path to take based on the prior task's state





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Problems With Step Functions

Needs Knowledge of Amazon state Language

Expensive when executed

Not Compatible with other similar orchestration tools

When to consider?

Complex processes to be implemented less frequently

When to consider other tools?

Simple processes to be implemented more frequently

Task: Create a step function that preprocess Toys’ Reviews and after that closes all SageMaker Instances (Console & SDK)

ML workflow

Exercise: Create a workflow to preprocess the Breast Cancer dataset and to run an estimator for training an XGBOOST model

Any Question?

Thank you

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