CMPE 281Enterprise software platform
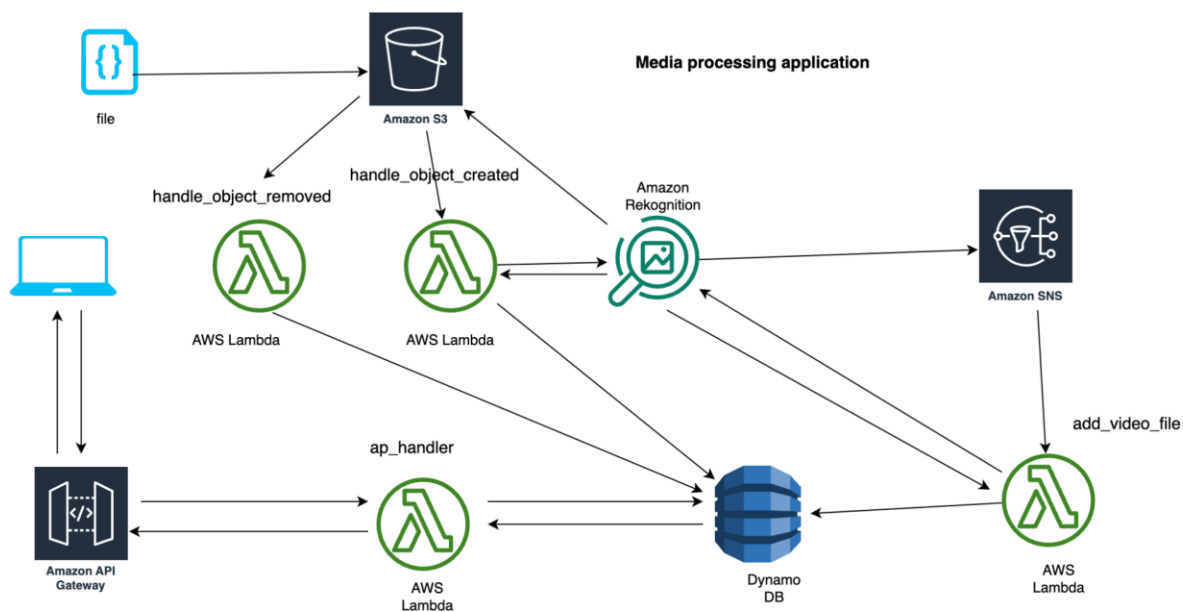Serverless Framework
The Invincibles

Media processing serverless Application

Media processing application that allows us to analyze images and videos to detect real world objects in media files. The results of the analysis can then be queried through the REST API.

Architecture Diagram:

When a picture is uploaded to an S3 bucket, a lambda function is called to process it using Amazon Rekognition. Once complete, the lambda function adds the processed image and stores the labels and date in a Dynamo DB.

A lambda function is called for video processing when a video file is uploaded into an S3 bucket. After the video is analyzed using Amazon Rekognition, one message notification is triggered in SNS. After it is finished, the video lambda function will then save the labels from Amazon Rekognition into Dynamo DB.

Through an API gateway, the app handler lambda function accesses data from Dynamo DB and provides users with information about labels produced by media processing.

- First we need to clone the application I have developed.
  https://github.com/saisankethravva/CPME-281_Serverless

- **Downloaded and installed all dependencies, chalice libraries and setup virtual environment**

```
PS C:\tmp\demo\media-query> python3
PS C:\tmp\demo\media-query> python3 -m venv /tmp/venv37 $ . /tmp/venv37/bin/activate
PS C:\tmp\demo\media-query>
PS C:\tmp\demo\media-query>
PS C:\tmp\demo\media-query> pip install -r requirements.txt
Collecting boto3<1.15.0
  Downloading boto3-1.14.63-py2.py3-none-any.whl (129 kB)
     ---------------------------------------- 129.1/129.1 kB 7.4 MB/s eta 0:00:00
Collecting jmespath<1.0.0,>=0.7.1
  Downloading jmespath-0.10.0-py2.py3-none-any.whl (24 kB)
Collecting s3transfer<0.4.0,>=0.3.0
  Downloading s3transfer-0.3.7-py2.py3-none-any.whl (73 kB)
     ---------------------------------------- 73.4/73.4 kB ? eta 0:00:00
Collecting botocore<1.18.0,>=1.17.63
  Downloading botocore-1.17.63-py2.py3-none-any.whl (6.6 MB)
     ---------------------------------------- 6.6/6.6 MB 6.2 MB/s eta 0:00:00
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from botocore<1.18.0,>=1.17.63->boto3<1.15.0->-r requirements.tx
t (line 1)) (2.8.2)
Collecting urllib3<1.26,>=1.20
  Downloading urllib3-1.25.11-py2.py3-none-any.whl (127 kB)
     ---------------------------------------- 128.0/128.0 kB ? eta 0:00:00
Collecting docutils<0.16,>=0.10
  Downloading docutils-0.15.2-py3-none-any.whl (547 kB)
     ---------------------------------------- 547.6/547.6 kB 17.3 MB/s eta 0:00:00
Requirement already satisfied: six>=1.5 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.18.0,>=1.17.63->boto3<1.15.0->-r requi
rements.txt (line 1)) (1.16.0)
Installing collected packages: urllib3, jmespath, docutils, botocore, s3transfer, boto3
  Attempting uninstall: urllib3
    Found existing installation: urllib3 1.26.12
    Uninstalling urllib3-1.26.12:
      Successfully uninstalled urllib3-1.26.12
Successfully installed boto3-1.14.63 botocore-1.17.63 docutils-0.15.2 jmespath-0.10.0 s3transfer-0.3.7 urllib3-1.25.11
PS C:\tmp\demo\media-query> pip install chalice
Collecting chalice
  Downloading chalice-1.27.3-py3-none-any.whl (263 kB)
     ---------------------------------------- 264.0/264.0 kB 1.3 MB/s eta 0:00:00
Requirement already satisfied: six<2.0.0,>=1.10.0 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from chalice) (1.16.0)
Requirement already satisfied: jmespath<2.0.0,>=0.9.3 in c:\python\python310\lib\site-packages (from chalice) (0.10.0)
Collecting pip<22.3,>=9
  Using cached pip-22.2.2-py3-none-any.whl (2.0 MB)
Collecting typing-extensions<5.0.0,>=4.0.0
  Downloading typing_extensions-4.4.0-py3-none-any.whl (26 kB)
Collecting click<9.0,>=7
  Downloading click-8.1.3-py3-none-any.whl (96 kB)
     ---------------------------------------- 96.6/96.6 kB ? eta 0:00:00
Collecting inquirer<3.0.0,>=2.7.0
  Downloading inquirer-2.10.0-py3-none-any.whl (17 kB)
Requirement already satisfied: setuptools in c:\python\python310\lib\site-packages (from chalice) (65.5.0)
Collecting pyyaml<7.0.0,>=5.3.1
```

```
PS C:\tmp\demo\media-query> C:\Python\Python310\python.exe -m pip install chalice
Collecting chalice
  Using cached chalice-1.27.3-py3-none-any.whl (263 kB)
Requirement already satisfied: setuptools in c:\python\python310\lib\site-packages (from chalice) (65.5.0)
Collecting pyyaml<7.0.0,>=5.3.1
  Using cached PyYAML-6.0-cp310-cp310-win_amd64.whl (151 kB)
Requirement already satisfied: botocore<2.0.0,>=1.14.0 in c:\python\python310\lib\site-packages (from chalice) (1.17.63)
Collecting attrs<21.5.0,>=19.3.0
  Using cached attrs-21.4.0-py2.py3-none-any.whl (60 kB)
Requirement already satisfied: six<2.0.0,>=1.10.0 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from chalice) (1.16.0)
Collecting inquirer<3.0.0,>=2.7.0
  Using cached inquirer-2.10.0-py3-none-any.whl (17 kB)
Collecting wheel
  Using cached wheel-0.37.1-py2.py3-none-any.whl (35 kB)
Collecting click<9.0,>=7
  Using cached click-8.1.3-py3-none-any.whl (96 kB)
Collecting typing-extensions<5.0.0,>=4.0.0
  Using cached typing_extensions-4.4.0-py3-none-any.whl (26 kB)
Collecting pip<22.3,>=9
  Using cached pip-22.2.2-py3-none-any.whl (2.0 MB)
Requirement already satisfied: jmespath<2.0.0,>=0.9.3 in c:\python\python310\lib\site-packages (from chalice) (0.10.0)
Requirement already satisfied: docutils<0.16,>=0.10 in c:\python\python310\lib\site-packages (from botocore<2.0.0,>=1.14.0->chalice) (0.15.2)
Requirement already satisfied: urllib3<1.26,>=1.20 in c:\python\python310\lib\site-packages (from botocore<2.0.0,>=1.14.0->chalice) (1.25.11)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from botocore<2.0.0,>=1.14.0->chalice) (2.8.2)
Requirement already satisfied: colorama in c:\users\checkout\appdata\roaming\python\python310\site-packages (from click<9.0,>=7->chalice) (0.4.5)
Collecting readchar>=3.0.6
  Using cached readchar-4.0.3-py3-none-any.whl (8.4 kB)
Collecting python-editor>=1.0.4
  Using cached python_editor-1.0.4-py3-none-any.whl (4.9 kB)
Collecting blessed>=1.19.0
  Using cached blessed-1.19.1-py2.py3-none-any.whl (58 kB)
Requirement already satisfied: wcwidth>=0.1.4 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from blessed>=1.19.0->inquirer<3.0.0,>=2.7.0->chalice) (0.2.5)
Collecting jinxed>=1.1.0
  Using cached jinxed-1.2.0-py2.py3-none-any.whl (33 kB)
Collecting ansicon
  Using cached ansicon-1.89.0-py2.py3-none-any.whl (63 kB)
Installing collected packages: python-editor, ansicon, wheel, typing-extensions, readchar, pyyaml, pip, jinxed, click, attrs, blessed, inquirer, chalice
  Attempting uninstall: pip
    Found existing installation: pip 22.3
    Uninstalling pip-22.3:
      Successfully uninstalled pip-22.3
  Attempting uninstall: attrs
    Found existing installation: attrs 22.1.0
    Uninstalling attrs-22.1.0:
      Successfully uninstalled attrs-22.1.0
Successfully installed ansicon-1.89.0 attrs-21.4.0 blessed-1.19.1 chalice-1.27.3 click-8.1.3 inquirer-2.10.0 jinxed-1.2.0 pip-22.2.2 python-editor-1.0.4 pyyaml-6.0 readchar-4.0.3 typing-extens
ions-4.4.0 wheel-0.37.1
```

- AWS CLI to deploy a CloudFormation stack containing the S3 bucket, DynamoDB table, and SNS topic needed to run this application.

```
Mode                LastWriteTime      Length Name
----                -------------      ------ ----
d-----        10/23/2022    5:16 PM           $
d-----        10/23/2022    5:02 PM           .chalice
d-----        10/23/2022    5:02 PM           chalicelib
d-----        10/23/2022    5:16 PM           Include
d-----        10/23/2022    5:16 PM           Lib
d-----        10/23/2022    5:17 PM           Scripts
-a----        10/23/2022    5:02 PM      3165 app.py
-a----        10/23/2022    5:16 PM       169 pyvenv.cfg
-a----        10/23/2022    5:02 PM      1258 recordresources.py
-a----        10/23/2022    5:02 PM        14 requirements.txt
-a----        10/23/2022    5:02 PM      2194 resources.json

PS C:\tmp\demo\media-query> aws --version
aws-cli/2.7.29 Python/3.9.11 Windows/10 exe/AMD64 prompt/off
PS C:\tmp\demo\media-query> aws cloudformation deploy --template-file resources.json --stack-name media-query --capabilities CAPABILITY_IAM

Waiting for changeset to be created..
Waiting for stack create/update to complete
Successfully created/updated stack - media-query
PS C:\tmp\demo\media-query> python recordresources.py --stack-name media-query
PS C:\tmp\demo\media-query> cat .chalice/config.json
{
  "version": "2.0",
  "app_name": "media-query",
  "stages": {
    "dev": {
      "api_gateway_stage": "api",
      "autogen_policy": false,
      "environment_variables": {
        "MEDIA_TABLE_NAME": "media-query-MediaTable-A2E2036O1AVO",
        "MEDIA_BUCKET_NAME": "media-query-mediabucket-ulprndai2b81",
        "VIDEO_TOPIC_NAME": "media-query-VideoTopic-L1ShIRbJ165E",
        "VIDEO_ROLE_ARN": "arn:aws:iam::039185736668:role/media-query-VideoRole-LN55P5RULAI0",
        "VIDEO_TOPIC_ARN": "arn:aws:sns:us-east-1:039185736668:media-query-VideoTopic-L1ShIRbJ165E"
      }
    }
  }
}
PS C:\tmp\demo\media-query> chalice deploy
C:\Python\Python310\lib\site-packages\_distutils_hack\__init__.py:33: UserWarning: Setuptools is replacing distutils.
  warnings.warn("Setuptools is replacing distutils.")
C:\Python\Python310\lib\site-packages\chalice\deploy\validate.py:46: UserWarning: You are currently running python3.10, but the closest supported version on AWS Lambda is python3.9
Please use python3.9, otherwise you may run into deployment issues.
  validate_python_version(config)
Creating deployment package.
Creating IAM role: media-query-dev-handle_object_created
```

- Deploying Lambda Functions

```
PS C:\tmp\demo\media-query> chalice deploy
C:\Python\Python310\lib\site-packages\_distutils_hack\__init__.py:33: UserWarning: Setuptools is replacing distutils.
  warnings.warn("Setuptools is replacing distutils.")
C:\Python\Python310\lib\site-packages\chalice\deploy\validate.py:46: UserWarning: You are currently running python3.10, but the closest supported version on AWS Lambda is python3.9
Please use python3.9, otherwise you may run into deployment issues.
  validate_python_version(config)
Creating deployment package.
Creating IAM role: media-query-dev-handle_object_created
Creating lambda function: media-query-dev-handle_object_created
Configuring S3 events in bucket media-query-mediabucket-ulprndai2b81 to function media-query-dev-handle_object_created
Creating IAM role: media-query-dev-handle_object_removed
Creating lambda function: media-query-dev-handle_object_removed
Configuring S3 events in bucket media-query-mediabucket-ulprndai2b81 to function media-query-dev-handle_object_removed
Creating IAM role: media-query-dev-add_video_file
Creating lambda function: media-query-dev-add_video_file
Subscribing media-query-dev-add_video_file to SNS topic media-query-VideoTopic-L1ShIRbJ165E
Creating IAM role: media-query-dev-api_handler
Creating lambda function: media-query-dev
Creating Rest API
Resources deployed:
  - Lambda ARN: arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-handle_object_created
  - Lambda ARN: arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-handle_object_removed
  - Lambda ARN: arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-add_video_file
  - Lambda ARN: arn:aws:lambda:us-east-1:039185736668:function:media-query-dev
  - Rest API URL: https://1t2j91w48l.execute-api.us-east-1.amazonaws.com/api/
```

- Execute recordresource.py to create config.json file which can be used to deploy the lambda functions. And uploading images and videos into S3 bucket

```
PS C:\tmp\demo\media-query> cat .chalice/config.json
{
  "version": "2.0",
  "app_name": "media-query",
  "stages": {
    "dev": {
      "api_gateway_stage": "api",
      "autogen_policy": false,
      "environment_variables": {
        "MEDIA_TABLE_NAME": "media-query-MediaTable-A2E203601AVO",
        "MEDIA_BUCKET_NAME": "media-query-mediabucket-ulprndai2b81",
        "VIDEO_TOPIC_NAME": "media-query-VideoTopic-L1ShIRbJ165E",
        "VIDEO_ROLE_ARN": "arn:aws:iam::039185736668:role/media-query-VideoRole-LN55P5RULAI0",
        "VIDEO_TOPIC_ARN": "arn:aws:sns:us-east-1:039185736668:media-query-VideoTopic-L1ShIRbJ165E"
      }
    }
  }
}
PS C:\tmp\demo\media-query> aws s3 copy /tmp/demo/assets/sample.js s3://media-query-mediabucket-ulprndai2b81

usage: aws [options] <command> <subcommand> [<subcommand> ...] [parameters]
To see help text, you can run:

  aws help
  aws <command> help
  aws <command> <subcommand> help

aws.exe: error: argument subcommand: Invalid choice, valid choices are:

ls                                       | website
cp                                       | mv
rm                                       | sync
mb                                       | rb
presign
PS C:\tmp\demo\media-query> aws s3 cp /tmp/demo/assets/sample.js s3://media-query-mediabucket-ulprndai2b81

The user-provided path /tmp/demo/assets/sample.js does not exist.
PS C:\tmp\demo\media-query> aws s3 cp C:\Users\Checkout\Desktop s3://media-query-mediabucket-ulprndai2b81
upload failed: ..\..\..\Users\Checkout\Desktop\ to s3://media-query-mediabucket-ulprndai2b81/ Parameter validation failed:
Invalid length for parameter Key, value: 0, valid min length: 1
PS C:\tmp\demo\media-query> aws s3 cp C:\Users\Checkout\Desktop\sjsu.jpg s3://media-query-mediabucket-ulprndai2b81
upload: ..\..\..\Users\Checkout\Desktop\sjsu.jpg to s3://media-query-mediabucket-ulprndai2b81/sjsu.jpg
PS C:\tmp\demo\media-query> aws s3 cp C:\Users\Checkout\Desktop\sample.mp4 s3://media-query-mediabucket-ulprndai2b81
upload: ..\..\..\Users\Checkout\Desktop\sample.mp4 to s3://media-query-mediabucket-ulprndai2b81/sample.mp4
PS C:\tmp\demo\media-query> chalice url
https://1t2j91w481.execute-api.us-east-1.amazonaws.com/api/
PS C:\tmp\demo\media-query> pip install httpie
```

- Installing httpie using pip and getting chalice

```
PS C:\tmp\demo\media-query> pip install httpie
Collecting httpie
  Downloading httpie-3.2.1-py3-none-any.whl (124 kB)
     ---------------------------------------- 125.0/125.0 kB 2.4 MB/s eta 0:00:00
Requirement already satisfied: charset-normalizer>=2.0.0 in c:\python\python310\lib\site-packages (from httpie) (2.1.1)
Requirement already satisfied: colorama>=0.2.4 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from httpie) (0.4.5)
Requirement already satisfied: requests[socks]>=2.22.0 in c:\python\python310\lib\site-packages (from httpie) (2.28.1)
Collecting requests-toolbelt>=0.9.1
  Downloading requests_toolbelt-0.10.0-py2.py3-none-any.whl (54 kB)
     ---------------------------------------- 54.4/54.4 kB 2.8 MB/s eta 0:00:00
Collecting multidict>=4.7.0
  Downloading multidict-6.0.2-cp310-cp310-win_amd64.whl (27 kB)
Requirement already satisfied: pip in c:\python\python310\lib\site-packages (from httpie) (22.2.2)
Requirement already satisfied: Pygments>=2.5.2 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from httpie) (2.13.0)
Requirement already satisfied: setuptools in c:\python\python310\lib\site-packages (from httpie) (65.5.0)
Collecting rich>=9.10.0
  Downloading rich-12.6.0-py3-none-any.whl (237 kB)
     ---------------------------------------- 237.5/237.5 kB 7.1 MB/s eta 0:00:00
Requirement already satisfied: defusedxml>=0.6.0 in c:\users\checkout\appdata\roaming\python\python310\site-packages (from httpie) (0.7.1)
Requirement already satisfied: certifi>=2017.4.17 in c:\python\python310\lib\site-packages (from requests[socks]>=2.22.0->httpie) (2022.6.15)
Requirement already satisfied: idna<4,>=2.5 in c:\python\python310\lib\site-packages (from requests[socks]>=2.22.0->httpie) (3.3)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\python\python310\lib\site-packages (from requests[socks]>=2.22.0->httpie) (1.25.11)
Collecting PySocks!=1.5.7,>=1.5.6
  Downloading PySocks-1.7.1-py3-none-any.whl (16 kB)
Collecting commonmark<0.10.0,>=0.9.0
  Downloading commonmark-0.9.1-py2.py3-none-any.whl (51 kB)
     ---------------------------------------- 51.1/51.1 kB ? eta 0:00:00
Installing collected packages: commonmark, rich, PySocks, multidict, requests-toolbelt, httpie
Successfully installed PySocks-1.7.1 commonmark-0.9.1 httpie-3.2.1 multidict-6.0.2 requests-toolbelt-0.10.0 rich-12.6.0

[notice] A new release of pip available: 22.2.2 -> 22.3
[notice] To update, run: python.exe -m pip install --upgrade pip
PS C:\tmp\demo\media-query> chalice url
https://1t2j91w481.execute-api.us-east-1.amazonaws.com/api/
PS C:\tmp\demo\media-query> http https://1t2j91w481.execute-api.us-east-1.amazonaws.com/api/
HTTP/1.1 200 OK
Connection: keep-alive
Content-Length: 756
Content-Type: application/json
Date: Mon, 24 Oct 2022 01:04:13 GMT
Via: 1.1 6354bde44a975facce9c0ed03828827e.cloudfront.net (CloudFront)
X-Amz-Cf-Id: AcQoGOi8Ojw3yUAWu7h8WqCIJmJFzUwp4jApjNDDzPJLj8e9H7Pmuw==
X-Amz-Cf-Pop: SFO53-P1
X-Amzn-Trace-Id: Root=1-6355e48a-234c7282753fa0e02fe57b1b;Sampled=0
X-Cache: Miss from cloudfront
x-amz-apigw-id: afClrF6pIAMF_HQ=
x-amzn-RequestId: 36140509-0f33-42c3-9e01-204ab731ddff

[
```

- Getting the AWS rekognition information about media files using chalice http

X-Amzn-Trace-Id: Root=1-6355e48a-234c7282753fa0e02fe57b1b;Sampled=0
X-Cache: Miss from cloudfront
x-amz-apigw-id: afClrF6pIAMF_HQ=
x-amzn-RequestId: 36140509-0f33-42c3-9e01-204ab731ddff

[
    {
        "labels": [
            "Soup Bowl",
            "Outdoors",
            "Vegetable",
            "Field",
            "Bud",
            "Person",
            "Vegetation",
            "Agavaceae",
            "Bamboo",
            "Dessert",
            "Plant",
            "Housing",
            "Nature",
            "Food",
            "Flower",
            "Grass",
            "Cactus",
            "Anther",
            "Aloe",
            "Stew",
            "Produce",
            "Petal",
            "House",
            "Building",
            "Meal",
            "Villa",
            "Daisies",
            "Blossom",
            "Dish",
            "Bowl",
            "Seasoning",
            "Bucket",
            "Scenery",
            "Human",
            "Daisy",
            "Fence",
            "Sprout",
            "Bean"
        ],
        "name": "sample.mp4",
        "type": "video"
    },

        "type": "video"
    },
    {
        "labels": [
            "Person",
            "Human",
            "Pedestrian",
            "Road",
            "Building",
            "City",
            "Town",
            "Urban",
            "Office Building",
            "Tarmac",
            "Asphalt",
            "Architecture",
            "Street",
            "Downtown",
            "Vehicle",
            "Transportation",
            "Condo",
            "Housing",
            "Postal Office",
            "High Rise",
            "Intersection",
            "Neighborhood",
            "Apartment Building",
            "Zebra Crossing",
            "Car",
            "Automobile",
            "Bicycle",
            "Bike"
        ],
        "name": "sjsu.jpg",
        "type": "image"
    }
]

[
    {
        "labels": [
            "Golden Retriever",
            "Canine",
            "Pet",
            "Dog",
            "Mammal",
            "Animal",
            "Puppy",
            "Grass",
            "Plant",
            "Outdoors"
        ],
        "name": "sam.jpg",
        "type": "image"
    },
    {

- Images of AWS S3 bucket, Lambda Functions in AWS Console

Lambda > Functions > media-query-dev-handle_object_removed

media-query-dev-handle_object_removed

Throttle | Copy ARN | Actions ▼

▼ **Function overview** Info

media-query-dev-handle_object_removed

Layers (0)

S3

+ Add trigger

+ Add destination

Description
-

Last modified
2 hours ago

Function ARN
arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-handle_object_removed

Function URL Info
-

Lambda > Functions > media-query-dev-handle_object_created

media-query-dev-handle_object_created

Throttle | Copy ARN | Actions ▼

▼ **Function overview** Info

media-query-dev-handle_object_created

Layers (0)

S3

+ Add trigger

+ Add destination

Description
-

Last modified
2 hours ago

Function ARN
arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-handle_object_created

Function URL Info
-

Lambda > Functions > media-query-dev-add_video_file

media-query-dev-add_video_file

Throttle | Copy ARN | Actions ▼

▼ **Function overview** Info

media-query-dev-add_video_file

Layers (0)

SNS

+ Add trigger

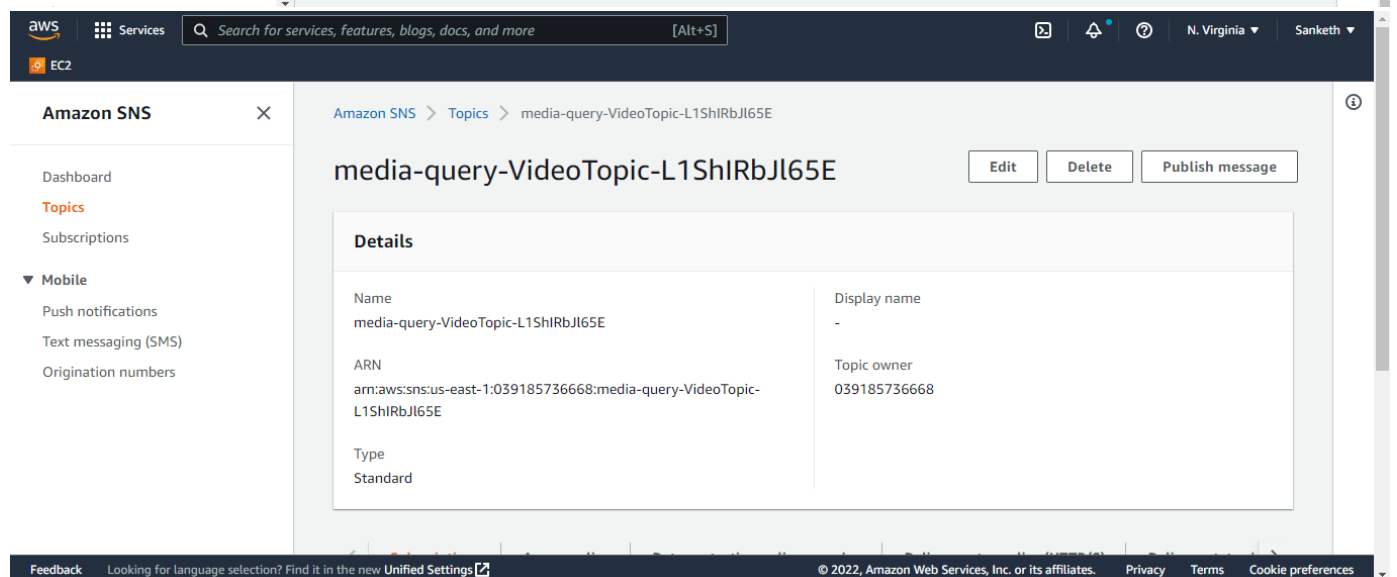+ Add destination
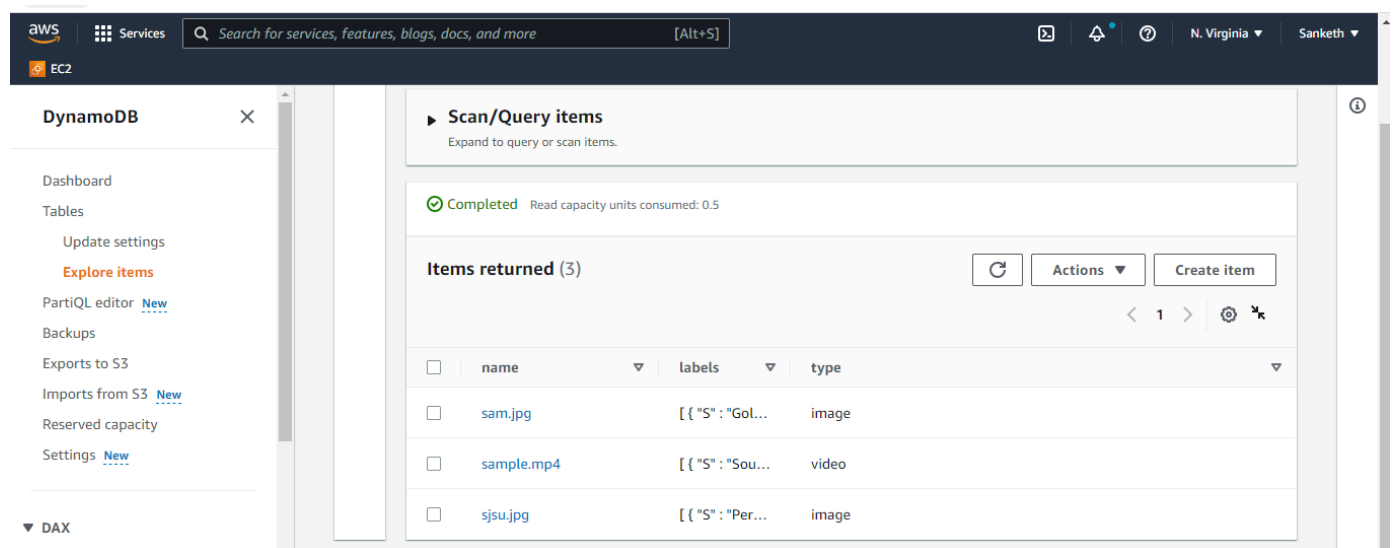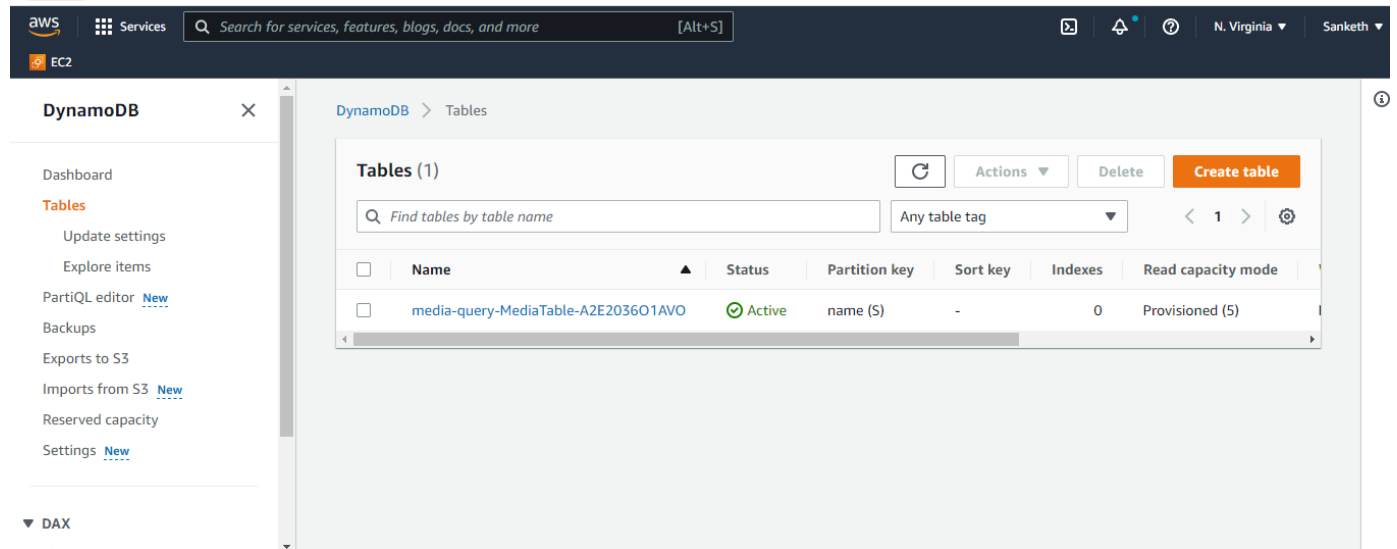
Description
-

Last modified
2 hours ago

Function ARN
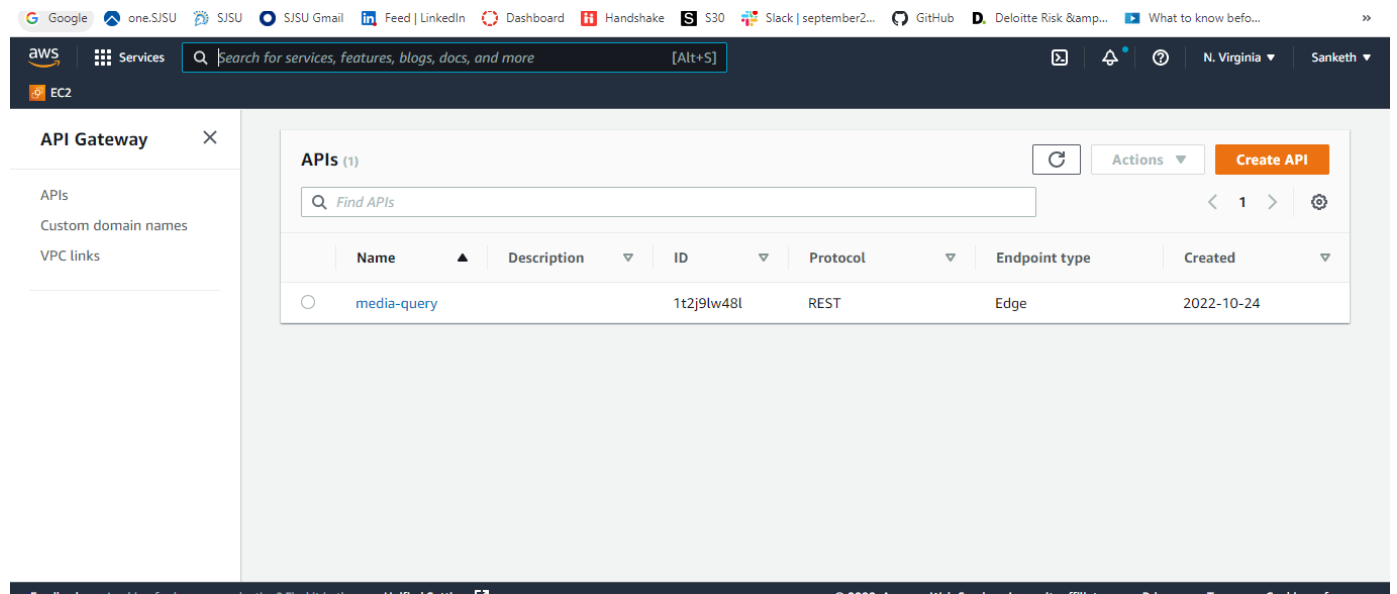arn:aws:lambda:us-east-1:039185736668:function:media-query-dev-add_video_file

Function URL Info
-

- Images of AWS DynamoDB, AWS SNS, AWS API Gateway console

The Chalice url of rekognition data for media files.

- https://1t2j9lw48l.execute-api.us-east-1.amazonaws.com/api/ startswith==sjsu.jpg
- https://1t2j9lw48l.execute-api.us-east-1.amazonaws.com/api/ startswith==sam.jpg
- https://1t2j9lw48l.execute-api.us-east-1.amazonaws.com/api/ startswith==sample.mp4

Google Drive link for media files
https://photos.app.goo.gl/4mdsWrWytfg9En6U6