2022.prathamesh.shetty@ves.ac.in

Name:Prathamesh Shetty **Class:D15B** **Roll No:57**

Case Study Report: Serverless Data Processing with AWS Lambda, S3 and DynamoDB

---

1. Introduction

This case study demonstrates how to implement a serverless data processing solution using AWS Lambda, S3, and DynamoDB. The solution processes a JSON file uploaded to an S3 bucket, extracts specific fields (such as userID and timestamp), and writes them to a DynamoDB table. This project showcases AWS's serverless capabilities and scalable data processing.

---

2. Objective

The objective is to create an AWS Lambda function that triggers automatically when a JSON file is uploaded to an S3 bucket. The function parses the file to extract specific fields and writes them to a DynamoDB table. The steps cover the entire process from creating the infrastructure to testing the solution.

---

3. Tools Used

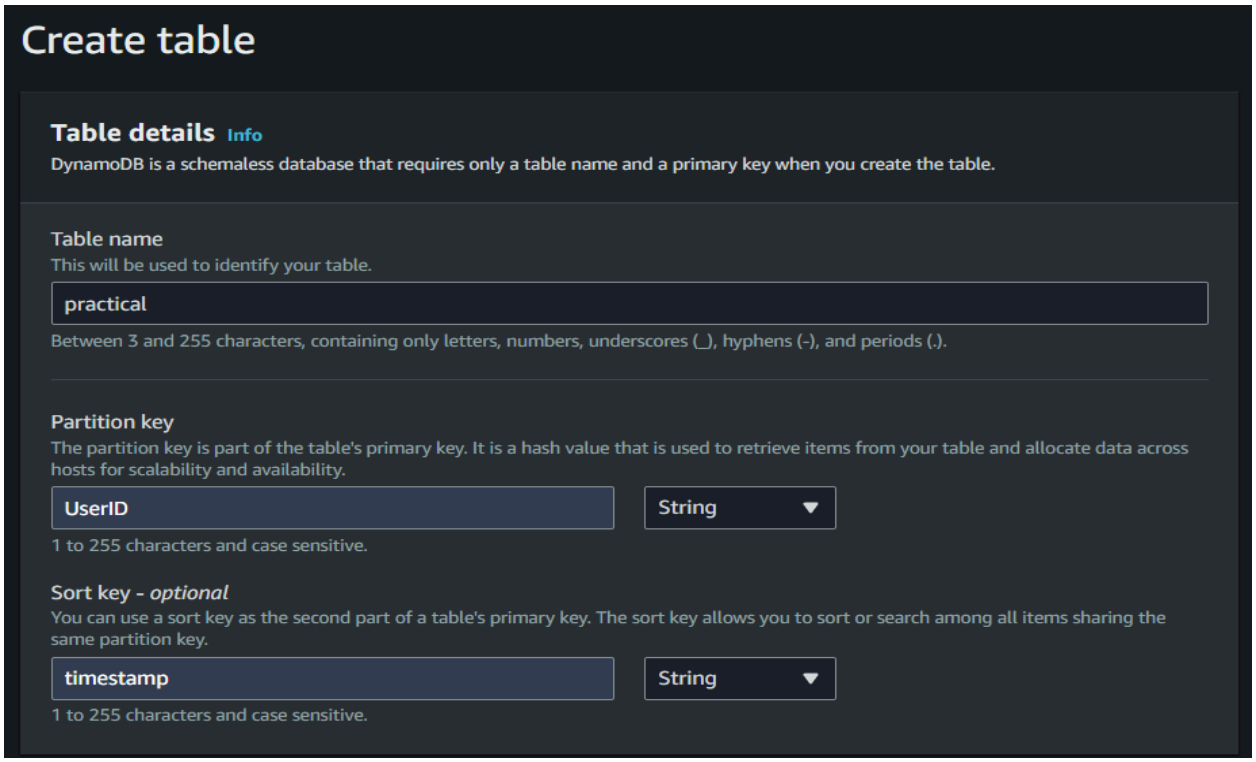
- **AWS Lambda Function:** A serverless compute service that allows running code without provisioning or managing servers.
- **Amazon S3:** An object storage service used to store the JSON files.
- **Amazon DynamoDB:** A fully managed NoSQL database where the extracted fields from the JSON file are stored.
- **Python:** The programming language used in the Lambda function.

---

4. Step-by-Step Implementation

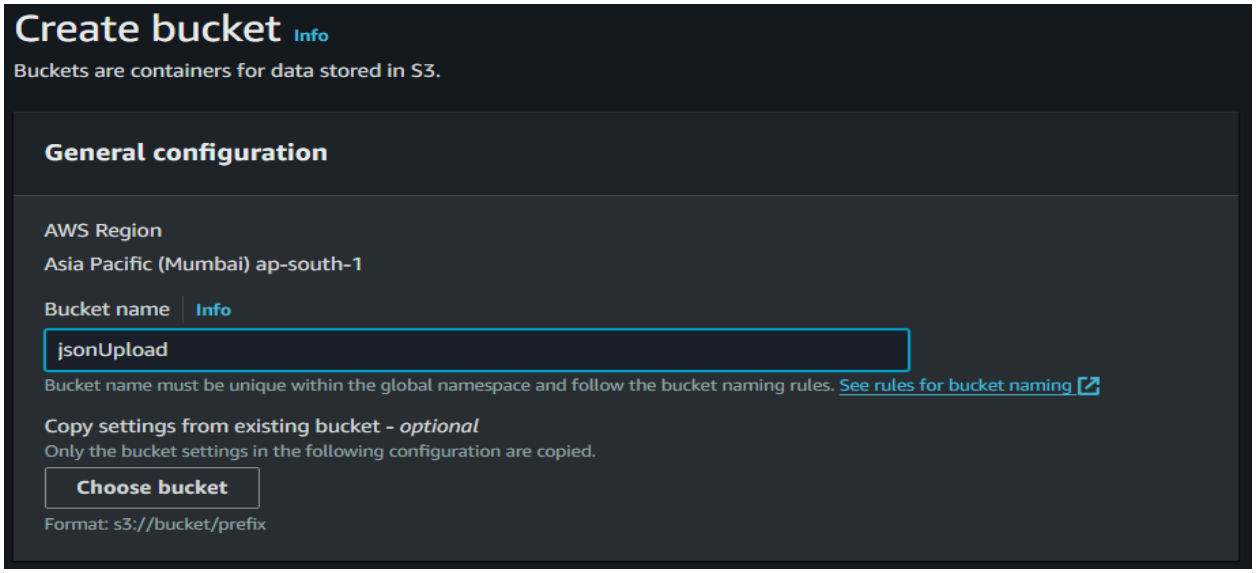
4.1. Creating the DynamoDB Table

1. Go to the **DynamoDB** service in AWS.
2. Create a new table named **practical.**
3. Enter partition key as **UserID** and sort key as **timestamp.**



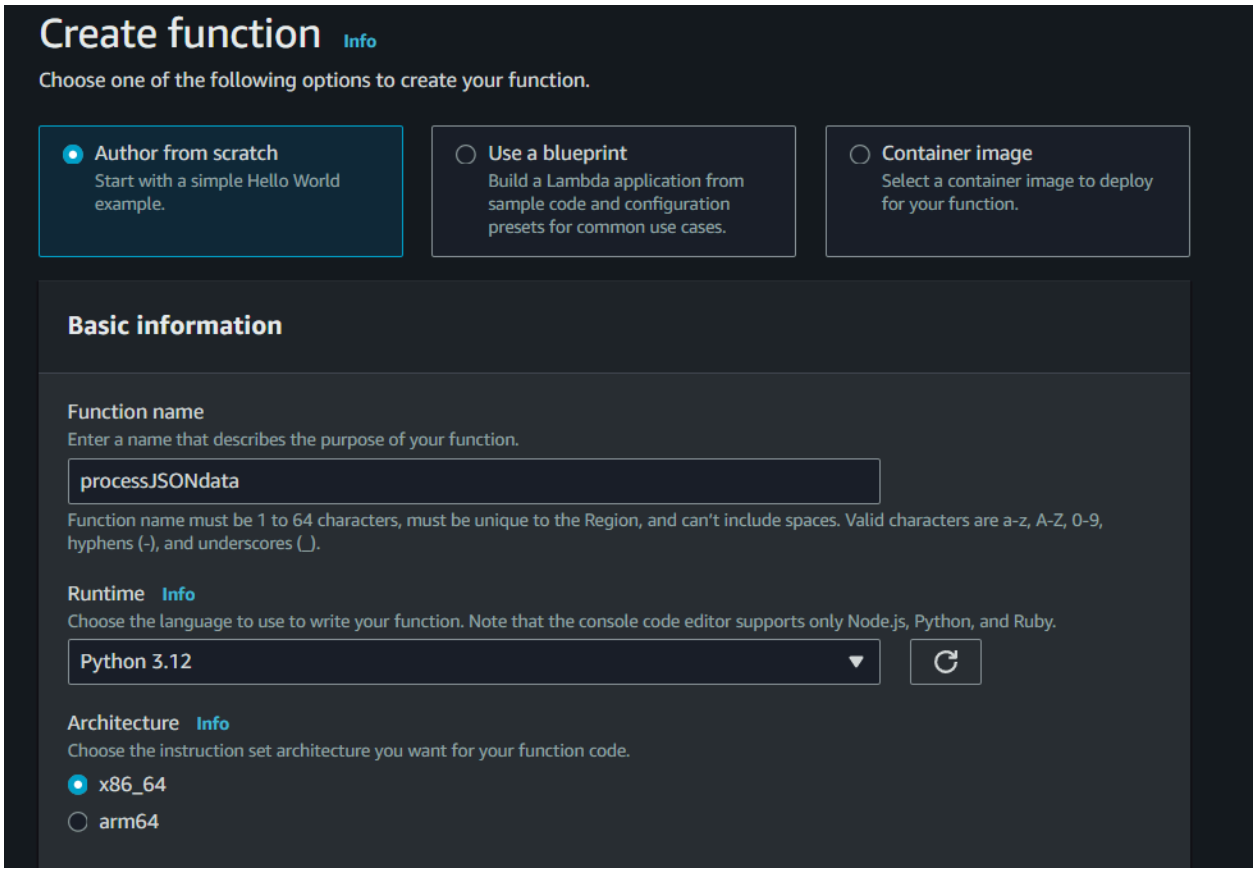
4.2. Creating an S3 Bucket

1. Navigate to the **S3** service in AWS.
2. Create a new S3 bucket named **jsonUpload** to upload JSON files.
3. Keep all other settings default.



4.3. Writing the AWS Lambda Function in Python

1. Go to **AWS Lambda** and create a new Lambda function.
2. Choose Python 3.x as the runtime.
3. Write the Python code that extracts the **UserID** and **timestamp** from the JSON file.



Lambda Function code:

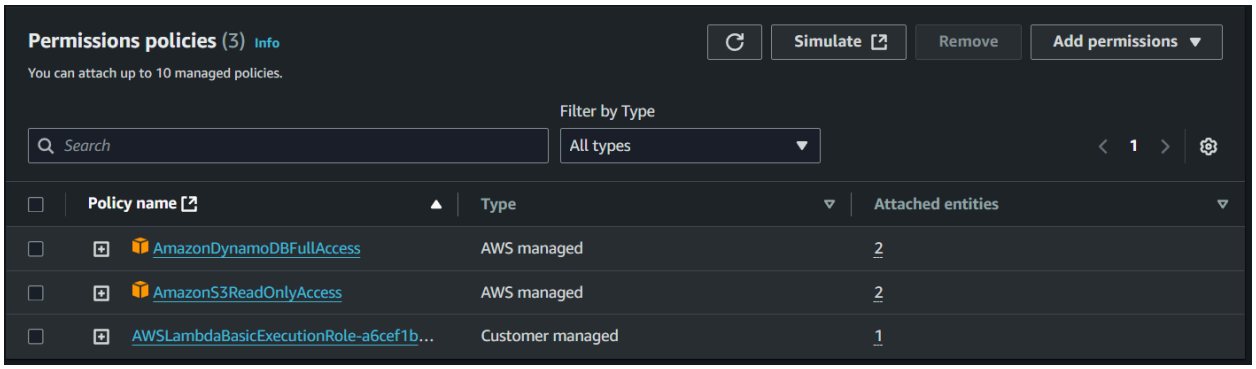
```
import json
import boto3

s3 = boto3.client('s3')
dynamodb = boto3.resource('dynamodb')

def lambda_handler(event, context):

    bucket_name = event['Records'][0]['s3']['bucket']['name']
    object_key = event['Records'][0]['s3']['object']['key']

    try:

        s3_response = s3.get_object(Bucket=bucket_name, Key=object_key)
        file_content = s3_response['Body'].read().decode('utf-8')
```

```
        json_content = json.loads(file_content)

        user_id = json_content.get('UserID')
        timestamp = json_content.get('timestamp')

        table = dynamodb.Table('practical')
        table.put_item(Item={
            'UserID': user_id,
            'timestamp': timestamp
        })

        return {
            'statusCode': 200,
            'body': 'Data successfully written to DynamoDB!'
        }

    except Exception as e:
        print(f"Error processing the S3 file: {e}")
        return {
            'statusCode': 500,
            'body': 'Error processing file'
        }
```

4.3. Assigning IAM Roles and Permissions for Lambda

Before setting up the event trigger, it's essential to ensure that your Lambda function has the correct permissions to access both S3 and DynamoDB. Follow these steps to assign the necessary IAM roles and permissions:

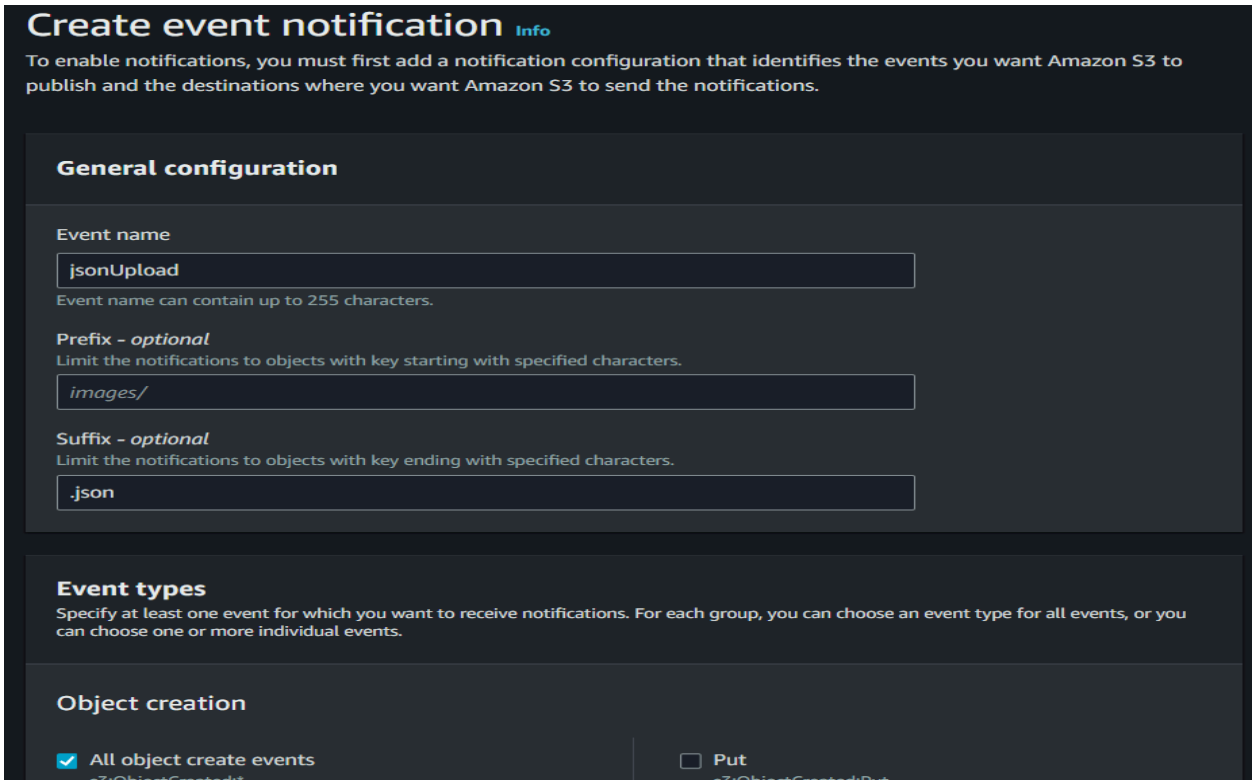
- Go to your lambda function and below click on **Configurations** tab.
- Go to **permissions** and click on Role Name link..
- Scroll down and click of **Add Permissions** drop down and select **Attach Policies.**
- Attach the following policies:
    - **AmazonS3ReadOnlyAccess** (to allow Lambda to read objects from S3).
    - **AmazonDynamoDBFullAccess** (to allow Lambda to write to DynamoDB).
- IAM roles are provided to Lambda function to interact with S3 bucket and DynamoDB table.

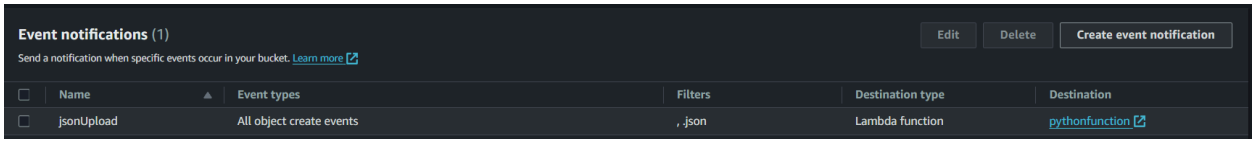


4.4. Setting Up S3 Event Trigger for Lambda

After setting up the correct permissions, you can now configure the S3 bucket to trigger the Lambda function when a JSON file is uploaded:

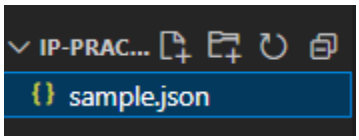
- In the **S3 bucket**, navigate to **Properties** and scroll to **Event Notifications**.
- Create a new event notification and select the **Put** event type to trigger the function when an object is created (uploaded).
- Specify the **prefix** (if applicable) to limit the event to only certain file types (e.g., "*.json").
- In the **Lambda Trigger** section, choose the Lambda function you previously created, and save the configuration.



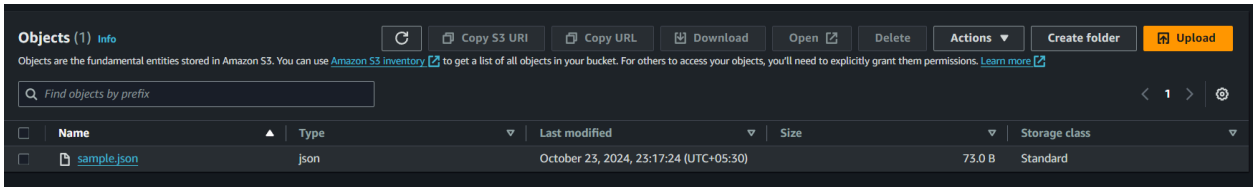


4.5. Uploading a Sample JSON File to S3

1. Create a sample JSON file with UserID and timestamp values.

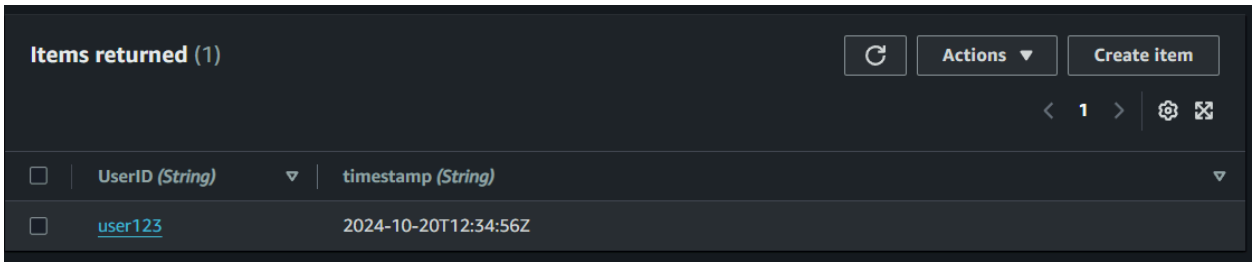


2. Upload this file to the **jsonUpload** S3 bucket.



4.6. Verifying Data in DynamoDB

1. Go to the **DynamoDB** console.
2. View the data in the **practical** table and verify that the UserID and timestamp were written successfully.



5. Key Feature and Application

The unique key feature of this case study is the **serverless, event-driven architecture** provided by AWS Lambda. This enables automatic execution of functions in response to events, such as an S3 file upload, without the need to manage or provision servers.

Application in IoT Data Collection and Processing:

In current time IoT devices use Traditional Server-Based Architecture. IoT devices continuously send data to centralized servers, which can be hosted either on-premise or in the cloud. These servers listen for incoming data, store it, and perform analysis. However, managing this infrastructure presents significant challenges, including provisioning resources, scaling servers to handle varying data loads, and ensuring high availability.

This process can be made very convenient using Lambda Function.In IoT applications, devices generate a continuous stream of data. By using a similar event-driven architecture, data from sensors or devices can be uploaded to S3 and automatically processed by Lambda. This system can analyze or store data in DynamoDB for further use, such as generating alerts, dashboards, or usage reports.

---

6. Conclusion

This case study illustrates the efficiency and scalability of AWS's serverless infrastructure in handling real-time data processing with minimal operational complexity. By utilizing S3 for storage, Lambda for event-triggered processing, and DynamoDB for persistent storage, we create a seamless, highly reliable solution. The architecture scales automatically to handle varying workloads, reducing the need for manual infrastructure management. This setup is particularly powerful for IoT applications, where devices generate continuous streams of data, as it allows for automatic data collection, analysis, and storage without the overhead of maintaining servers or complex scaling solutions.