National College of Ireland

Real-Time Inventory Optimization Using AWS Lambda and Amazon Kinesis Configuration Manual

MSc Research
Cloud Computing

Abhishek Yadav
Student ID: 23153423

School of Computing
National College of Ireland

Supervisor:Dr. Shivani Jaswal

National College of Ireland

MSc Project Submission Sheet

School of Computing

Student Name:	Abhishek Yadav
Student ID:	23153423
Programme:	Cloud Computing **Year:** 2024
Module:	MSc Research Project
Lecturer:	Dr. Shivani Jaswal
Submission Due Date:	12/12/2024
Project Title:	Real-Time Inventory Optimization Using AWS Lambda and Amazon Kinesis
Word Count:	..... **Page Count: 11**

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature: Abhishek Yadav.....

Date: 11/12/2024.....

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

Attach a completed copy of this sheet to each project (including multiple copies)	□
Attach a Moodle submission receipt of the online project submission, to each project (including multiple copies).	□
You must ensure that you retain a HARD COPY of the project, both for your own reference and in case a project is lost or mislaid. It is not sufficient to keep a copy on computer.	□

Assignments that are submitted to the Programme Coordinator Office must be placed into the assignment box located outside the office.

Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Configuration Manual

Abhishek Yadav
Student ID: 23153423

1 Introduction

The configuration manual provides a step-by-step instruction to how to setup the cloud services for the inventory management services for the user to perform the application work in local live environment based on the lit review performed by various paper and analysing the methodology of done by different researchers to make the prediction and forecast.

2 Steps for Configure the steup

Certation of account :
Visit AWS Registration to step up the account and provide all relevant information.
Now got to billing preferences to monitor costs chart.

Then setup of data Streaming with Kinesis
In the AWS Management Console search Kinesis and click on Kinesis Data Streams and follow the below mention steps.

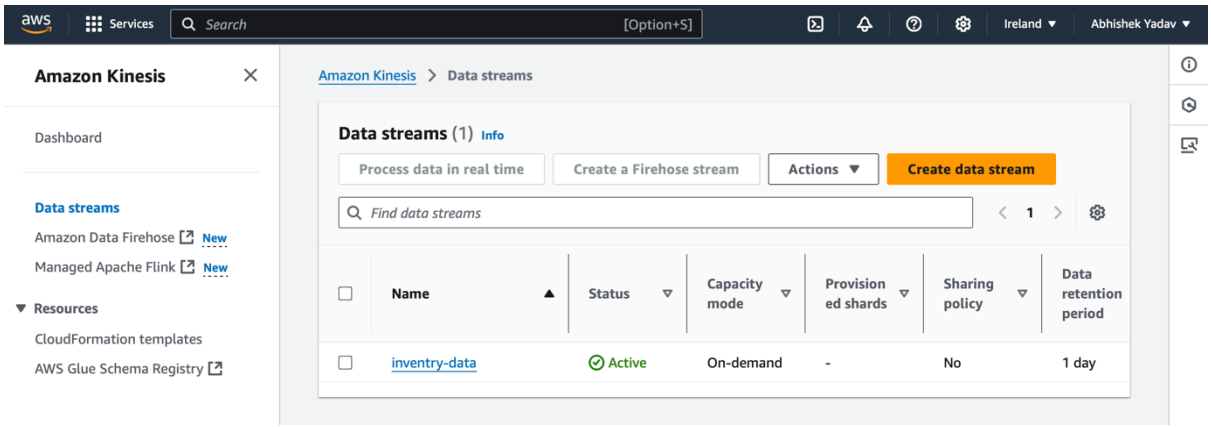

Figure1:Setup for Kinesis.

For creating the data stream:

- Click on create data stream.
- Give the name to your stream (RealTimeInventoryStream).
- In this we have to Specify the number of shards based.

Configure stream retention:

- Set the retention period (default is 24 hours).

Now moving to the intergradation of kinesis producers:

- Use the Kinesis SDK in your application to push inventory data into the stream.

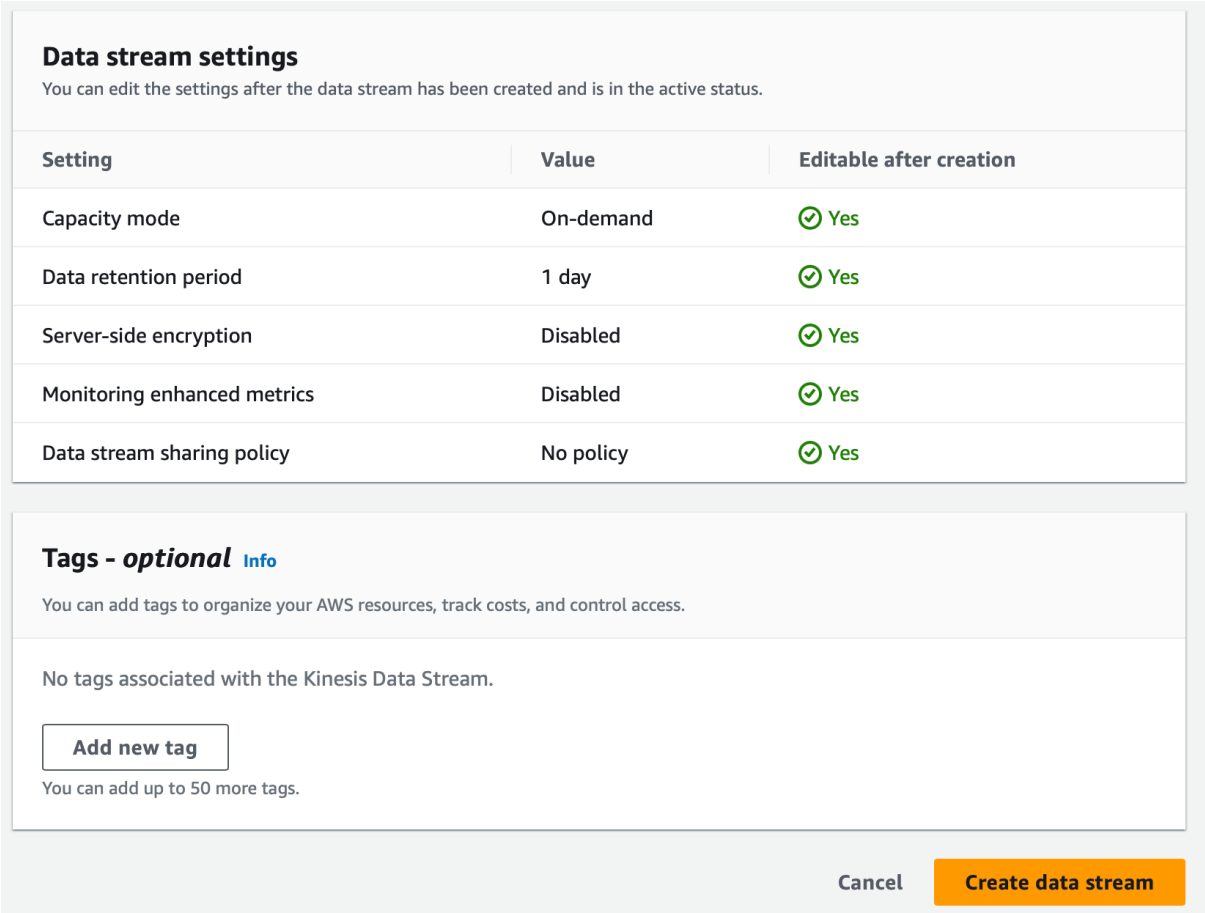

Figure2: Kinesis data configuration.

Setting up AWS Lambda for for function trigger.

First we need to create a lambda function for that go to AWS Lambda and click on create a functions.

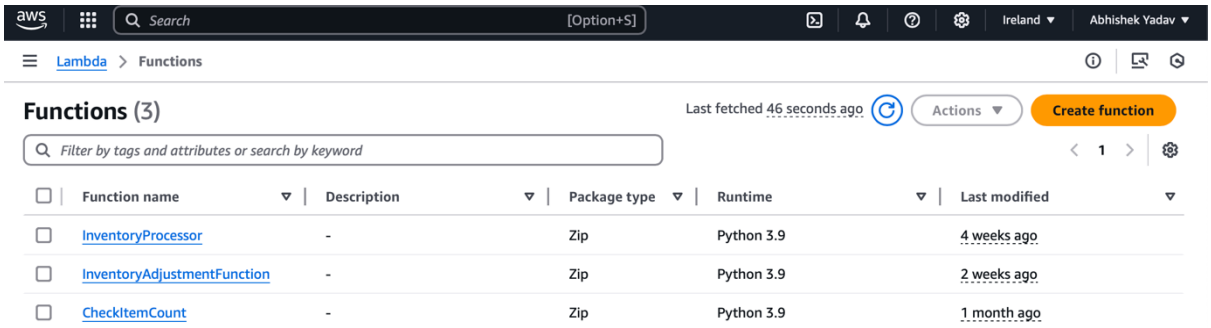

Figure3:Lambda function creation.

- Give the function name (Inventory process data).
- select the programming language as we choose (Python).
- Now we can create kinesis trigger:

- click to add triggers button and select the service as kinesis.

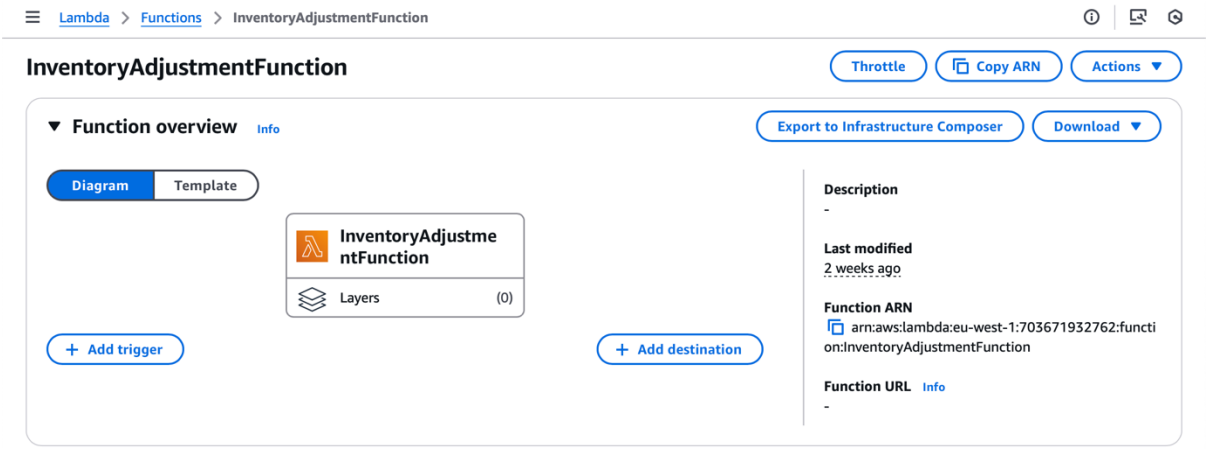

Figure4:Connection with trigger services.

- Here we can link the created which we have already created.

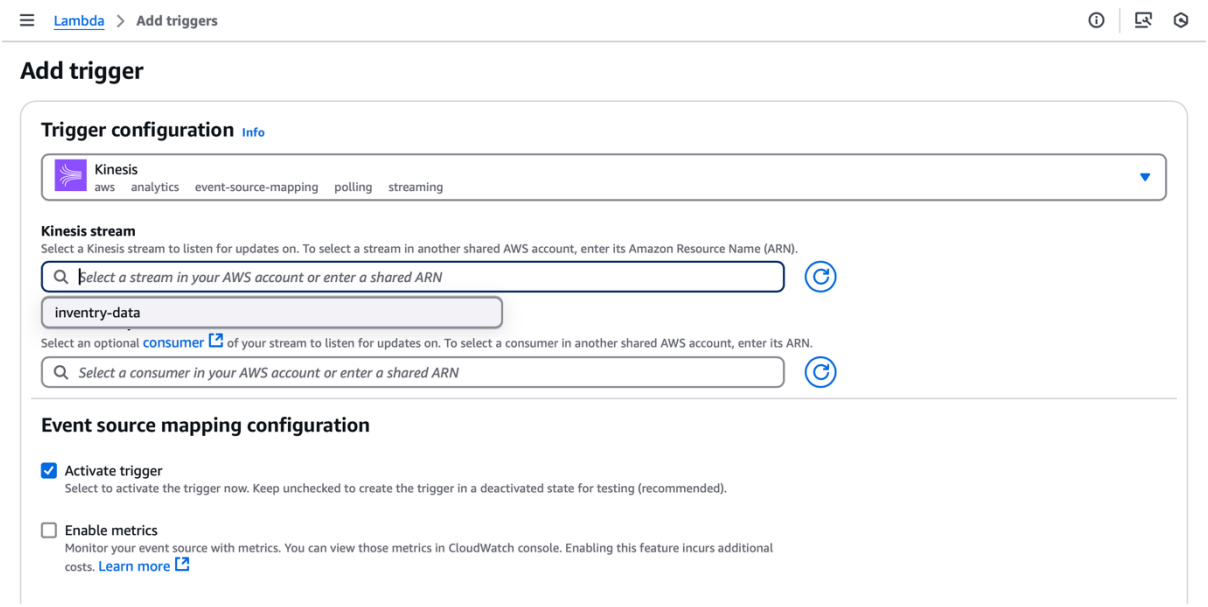

Figure5:Kinesis configuration with lambda function.

Now we have to write a lambda code which is the function to process incoming data and store results in DynamoDB.

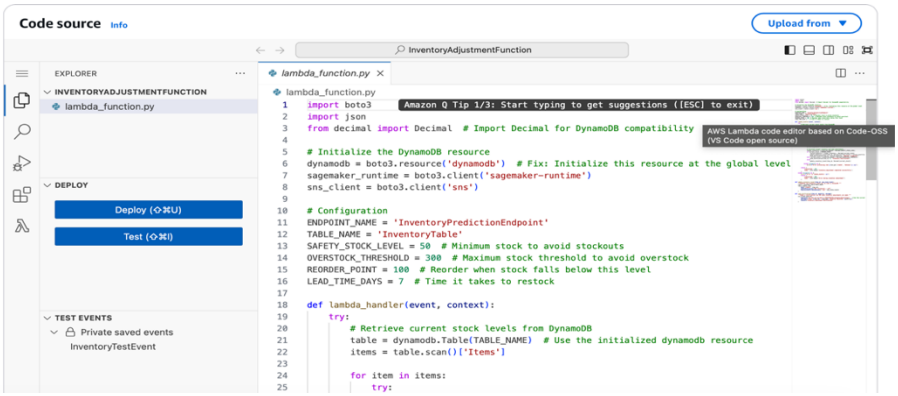

Figure6:Fuction process of code.

Moving Forward Data Storage on DynamoDB and S3.

1. For setting up DynamoDB follow the below mention steps.

- Go to amazon DynamoDB and create the table.
- Give the name to the table (InventoryData).
- Now we have to set a partition key (ItemID).

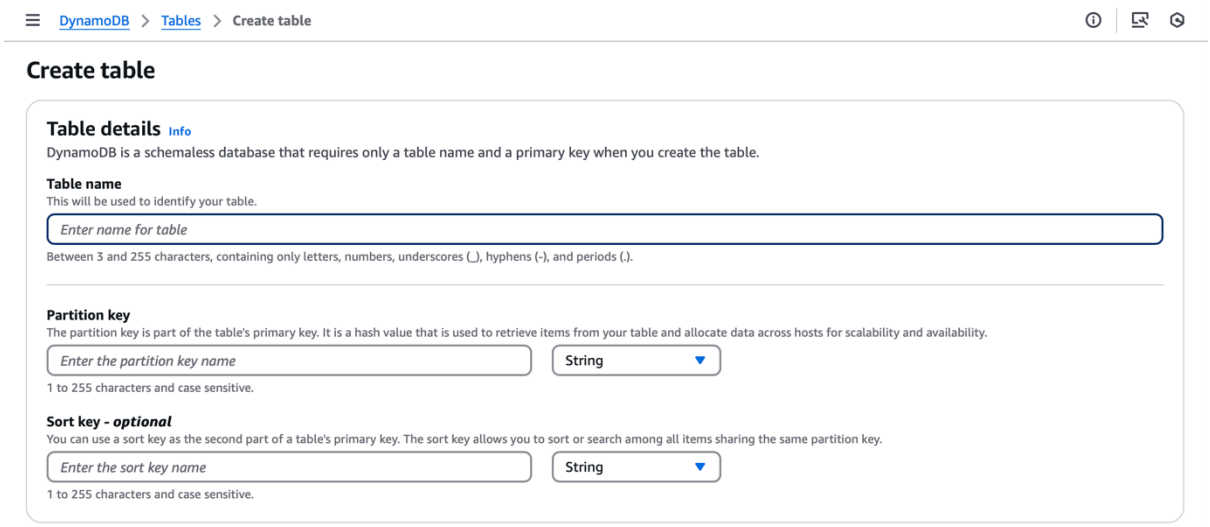

Figure7:Creation of DynamoDB Table

2. For S3 Bucket setup:

- Go to S3 and Create Bucket.
- Give suitable name to the bucket (InventoryDataStorage).
- After that set permissions as public access.

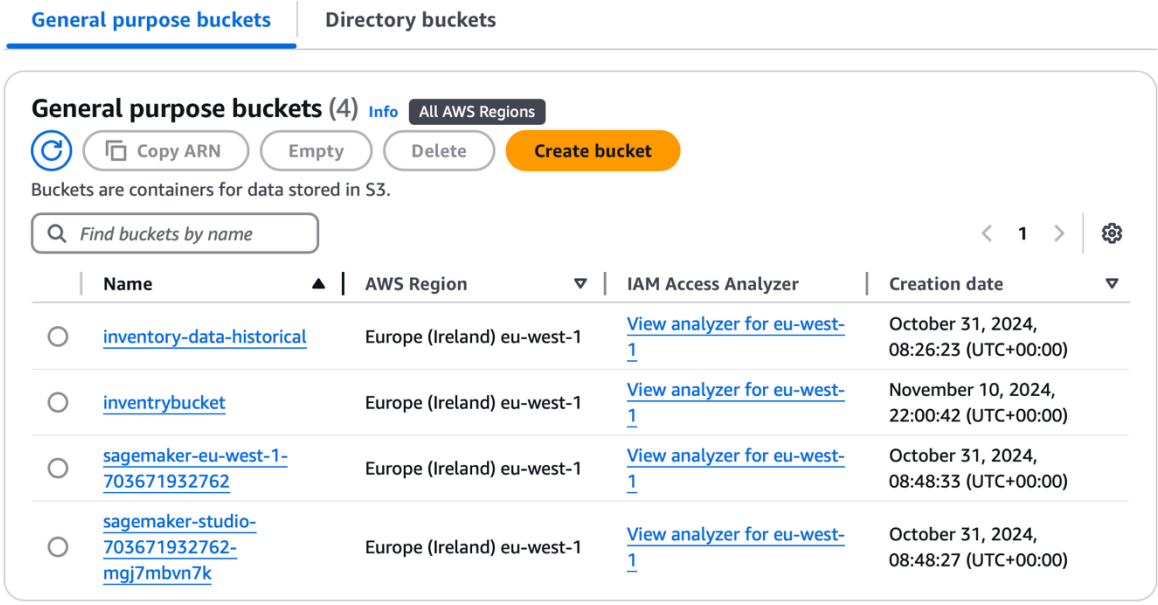

Figure8:Setting and creation of S3 bucket.

3. The Intergradation of S3 with Lambda:

- Make the changes inside the Lambda function to save the processed data of inventory into the S3 bucket.

Machine Learning model integration with amazon SageMaker

- Go to Amazon SageMaker and click on create notebook instance.
- Name the instance "InventoryOptimizationModel".
- Select the instance which show type ml.t3.medium.

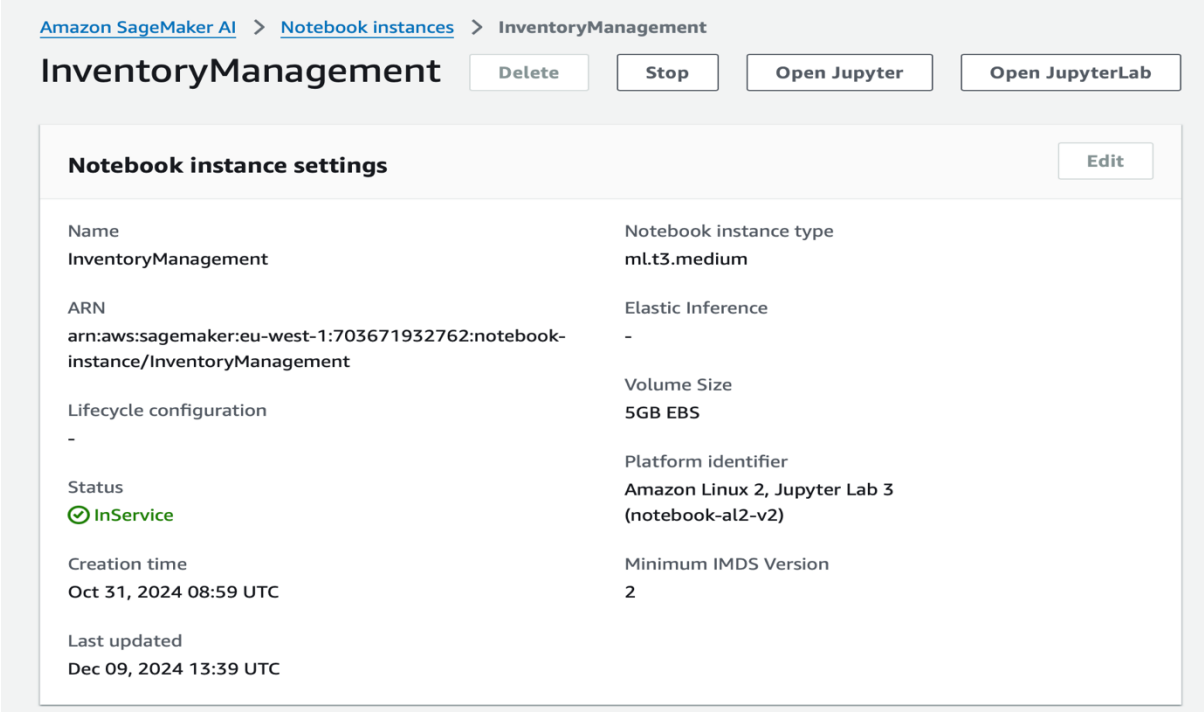

Figure9:Stage Maker juptyper notebook configuration.

1. To Preparing and training dataset for prediction follow the given steps.

- Use SageMaker to preprocess the data inside the notebook.

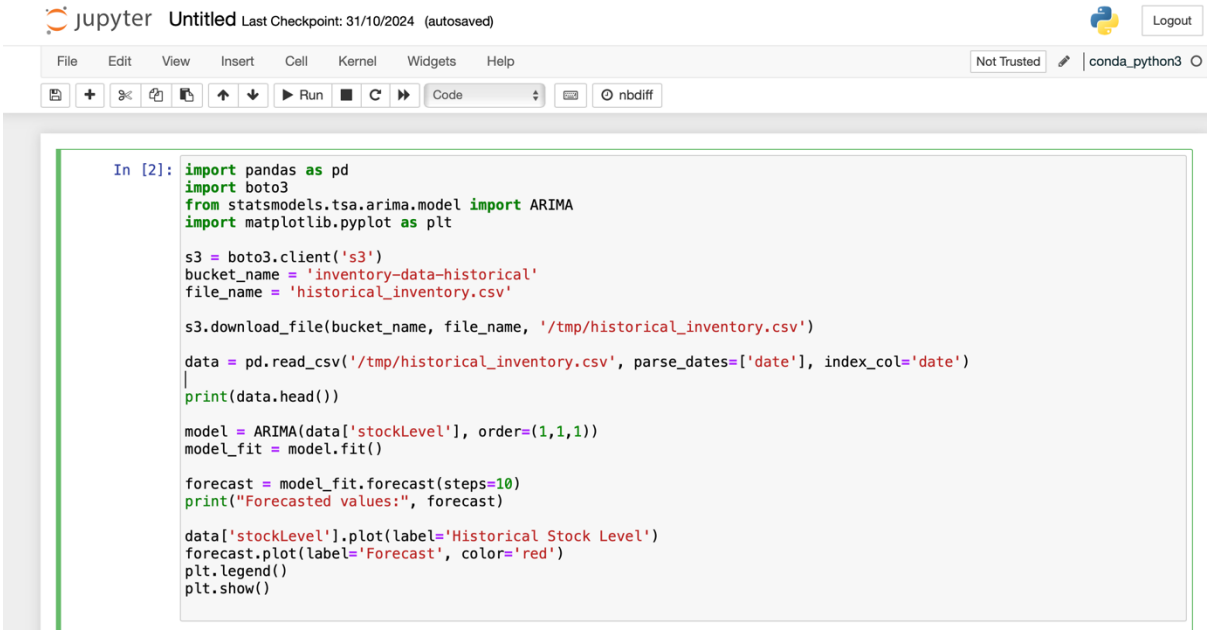

Figure10:Stage Maker jupyter notebook configuration with S3 bucket.

For Model training follow these steps.

- Use built-in algorithms Autoregressive Integrated Moving Average for train the model on inventory trends.

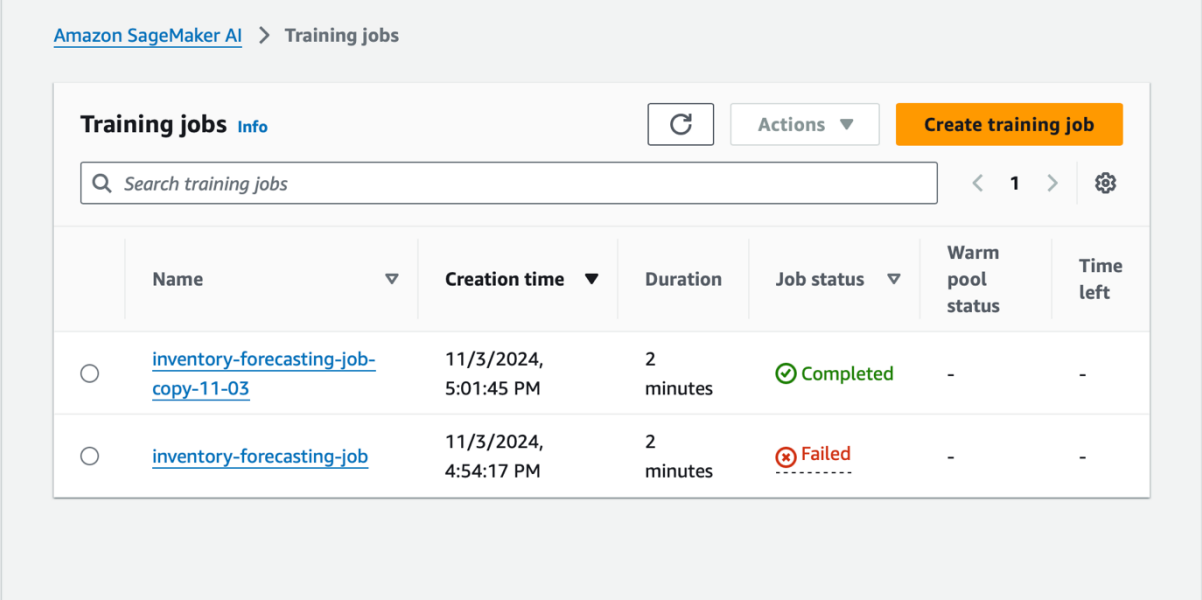

Figure11:Stage Maker model training completion .

- Deploy the model train model as an endpoint for real-time prediction.

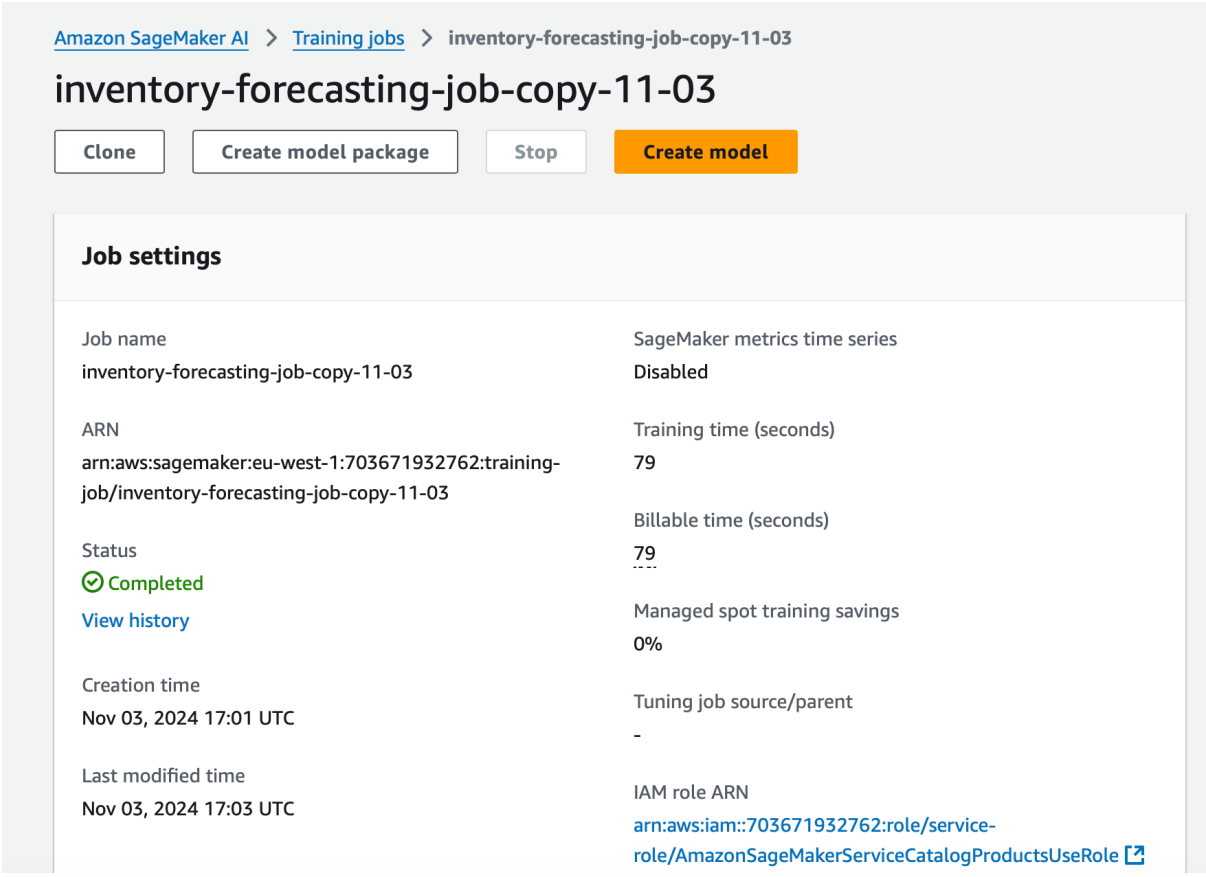

Figure12:Deploying the train model .

- we will use this endpoint to forecast inventory hits coming from the kinesis.

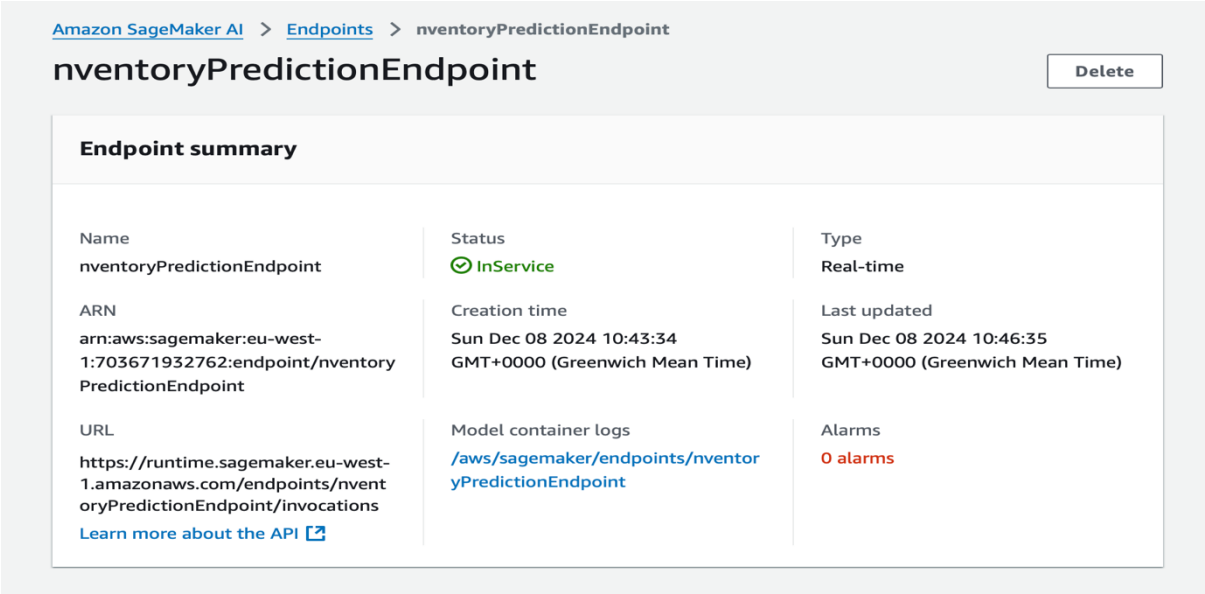

Figure13:Endpoint to demonstration for prediction.

After the machine model integration we have to set up visualizing Data so that user can understand the trend therefore we will step up Amazon QuickSight

- For the QuickSightint setup go to Amazon QuickSight and Sign Up.
- Then choose the standard edition for a single user license.
- Connect to Data Sources and then add the DynamoDB and S3 as data sources.

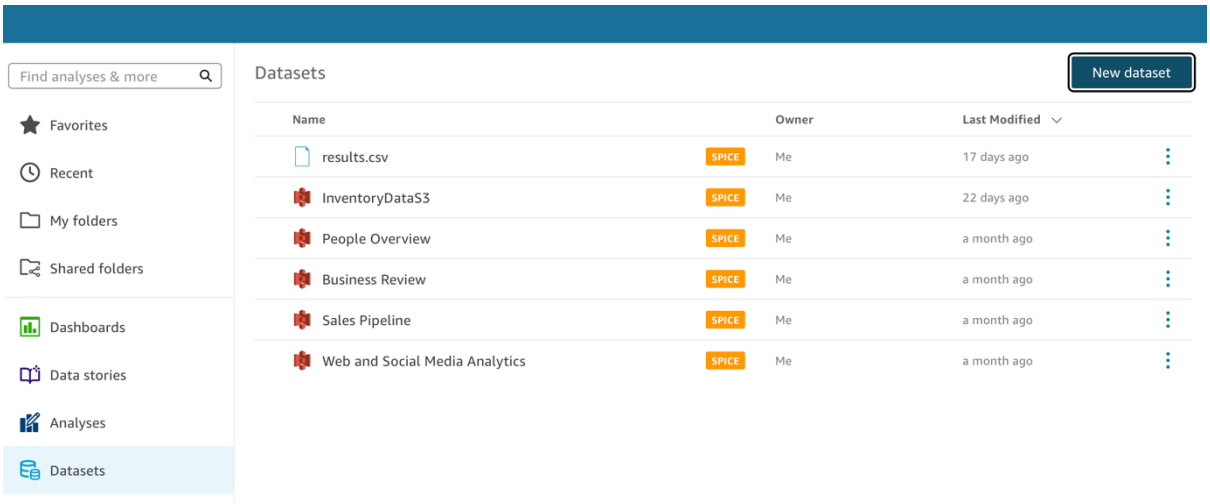

Figure14:QuickSight dataset demonstration setup.

- Now we will create a dashboards to visualize inventory trends and predictions.

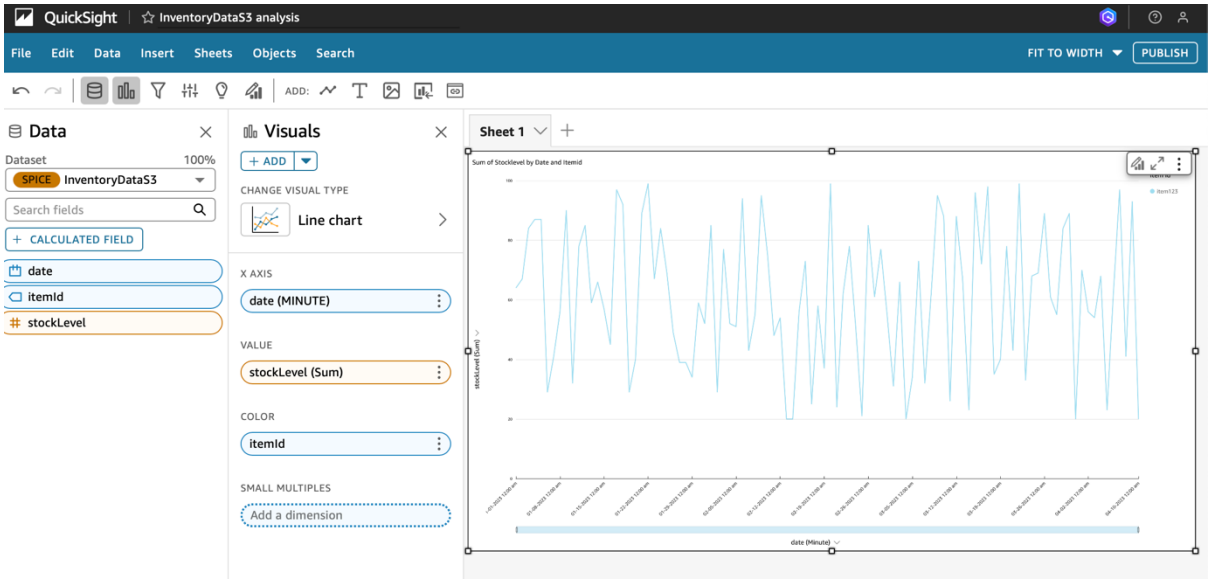

Figure15:QuickSight dashboard creation.

Once's the visual setup is done we move to setting up the Monitoring and Optimization in Amazon CloudWatch For that follow the below mention steps.

- Go to CloudWatch and click on create an alarm and select the custom Metrics .

=

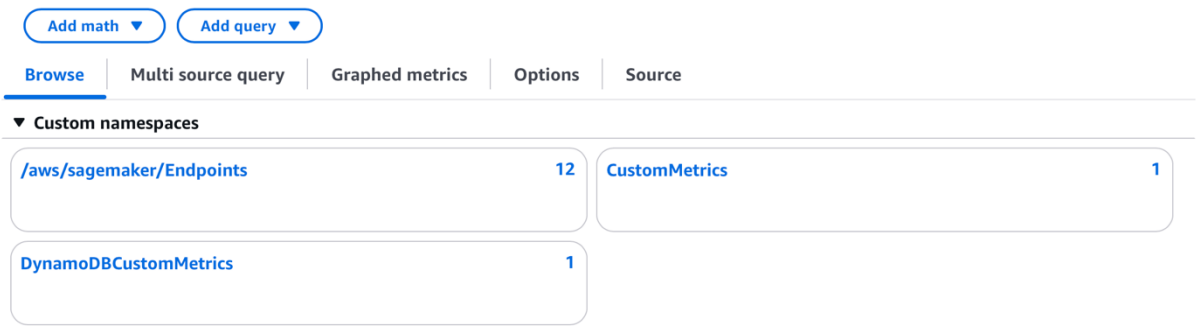

Figure16:Cloud watch alarm custom metrics selection.

- Click on the create alarms button and give name and defined the alarm type.
- Turn on the notifications via Amazon SNS to alert .

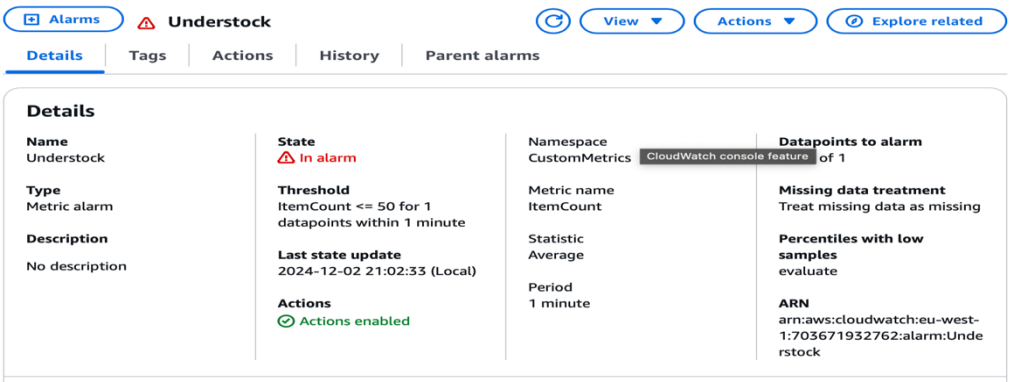

Figure17:Alarm configuration all settings.

1. Simulation Performances Steps

1. For Simulate Inventory first need to connect the EC2 instances with local terminal to perform update on inventory, so go to the connect button and click on it.

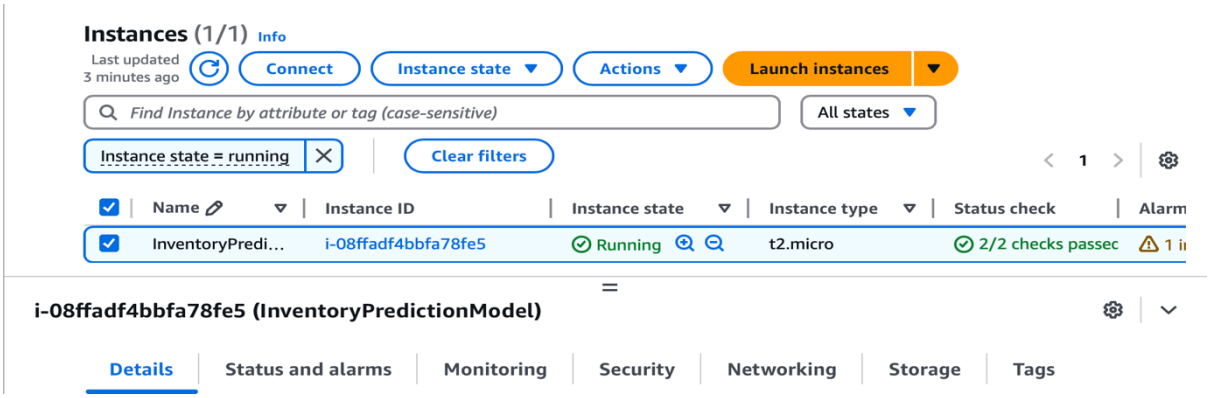

Figure18:EC2 instances connection.

2. After this it will open SSH client in which we have to copy the path of Example

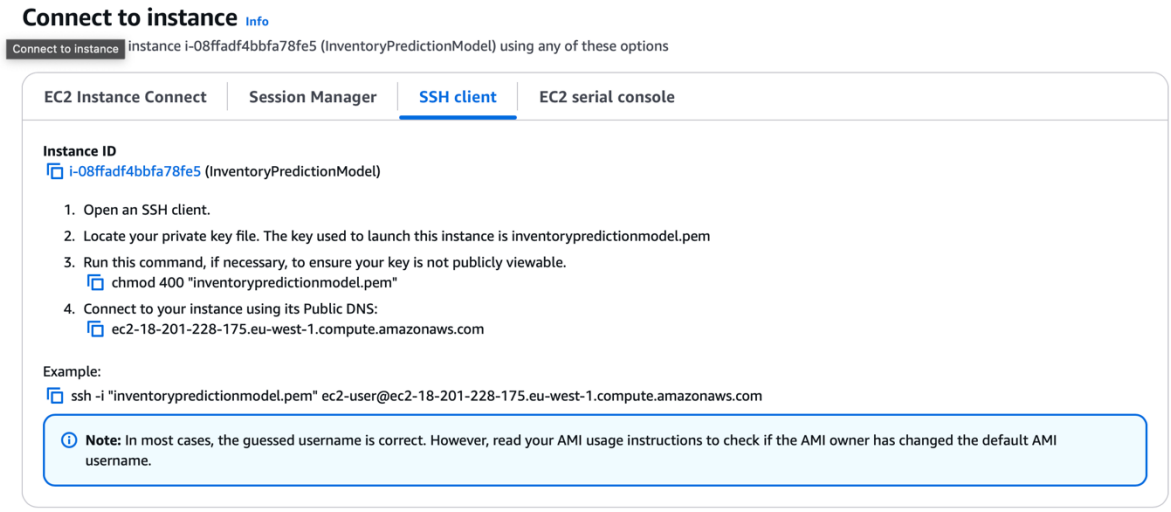

Figure19:SSH key for connection.

3. After this past this path into local terminal.

```
Last login: Mon Dec  9 14:36:05 on ttys000
abhishek@Abhisheks-MacBook-Air ~ % cd Downloads
abhishek@Abhisheks-MacBook-Air Downloads % ec2-18-201-228-175.eu-west-1.compute.amazonaws.com
zsh: command not found: ec2-18-201-228-175.eu-west-1.compute.amazonaws.com
abhishek@Abhisheks-MacBook-Air Downloads % ssh -i "inventorypredictionmodel.pem" ec2-user@ec2-18-201-228-175.
eu-west-1.compute.amazonaws.com
Last login: Mon Dec  9 14:36:19 2024 from 37.228.244.140
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/

3 package(s) needed for security, out of 6 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-27-152 ~]$
```

Figure20:Terminal demonstration of Connection.

4. The connection with the terminal and DynamoDB has been made now run the below mention code to check two parameter of Overstock and Understock situation which is defined to forece fully update the data into loop and check the situation of the inventory
    - Overstock

```
for i in {1..500}; do
  aws dynamodb put-item \
    --table-name InventoryTable \
    --item "{\"itemId\": {\"S\": \"SampleItemId$i\"}, \"attribute1\": {\"S\": \"Value$i\"}}"
done
```

    - Understock

```
for i in {1..500}; do
  aws dynamodb delete-item \
    --table-name InventoryTable \
    --key "{\"itemId\": {\"S\": \"SampleItemId$i\"}}"
done
```

5. After running above mention code user need to go on cloud watch and see the alarms which has been set for give an update on each threshold parameter and demonstrate the uses of CPU, lambda utilization of handling the situation and user get responses on email of each trigger and max and min limits of utilization.