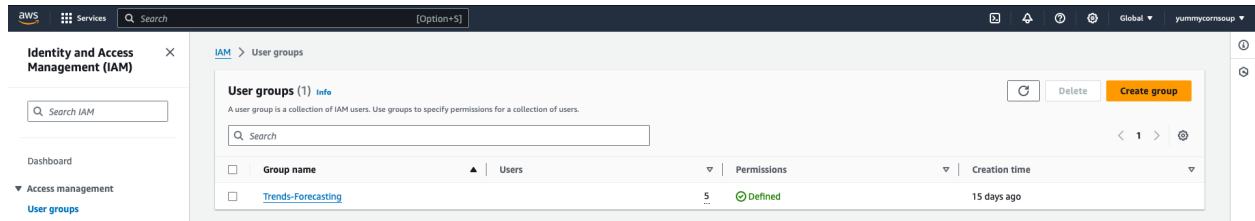


STEP 1- AWS Services and Our Conducting Process

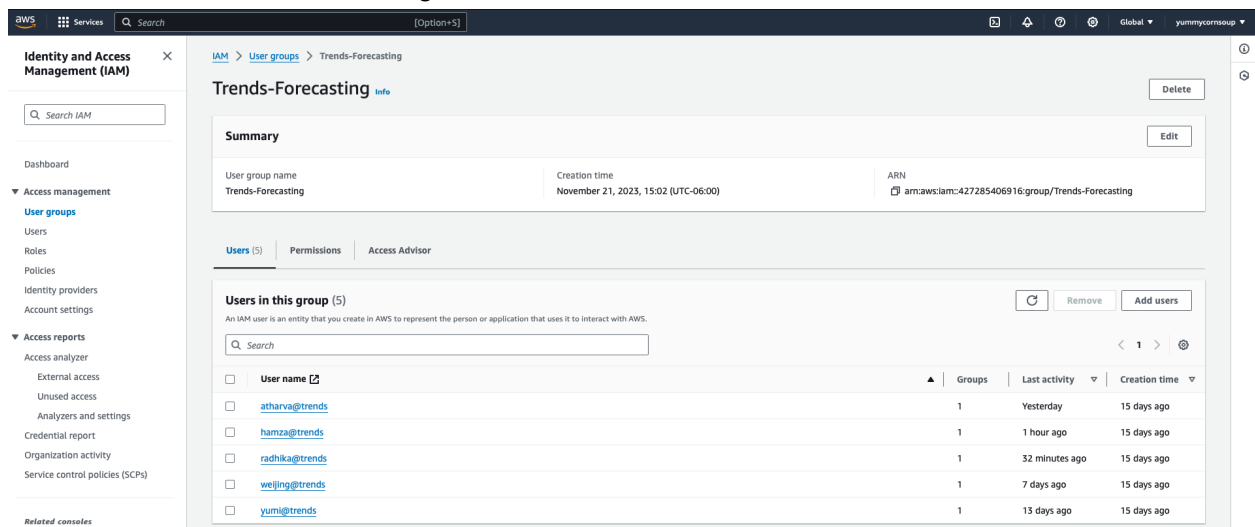
AWS IAM Services

AWS IAM is used to grant access to each user. It acts as a security guard to make sure users only can reach the data and resources based on their jobs.

1. Create user group for our project



2. Add team members using their email



3. Set up permissions policies for each member based on the services they need

The screenshot shows the AWS IAM console for the user 'yumi@trends'. The left sidebar contains navigation links for Identity and Access Management (IAM), including Dashboard, Access management, User groups, Users, Roles, Policies, Identity providers, Account settings, Access reports, Access analyzer, External access, Unused access, Analyzers and settings, Credential report, Organization activity, and Service control policies (SCPs). The main content area shows the user's summary, including their ARN, console access status, and last sign-in. Below this, the 'Permissions policies' section lists 17 policies attached to the user, including AmazonEC2ContainerRegistryFullAccess, AmazonS3FullAccess, AmazonSESFullAccess, AthenaGetWorkGroup, AwsGlueDataBrewFullAccessPolicy, AWSGlueServiceRole, and AWSLambda_FullAccess.

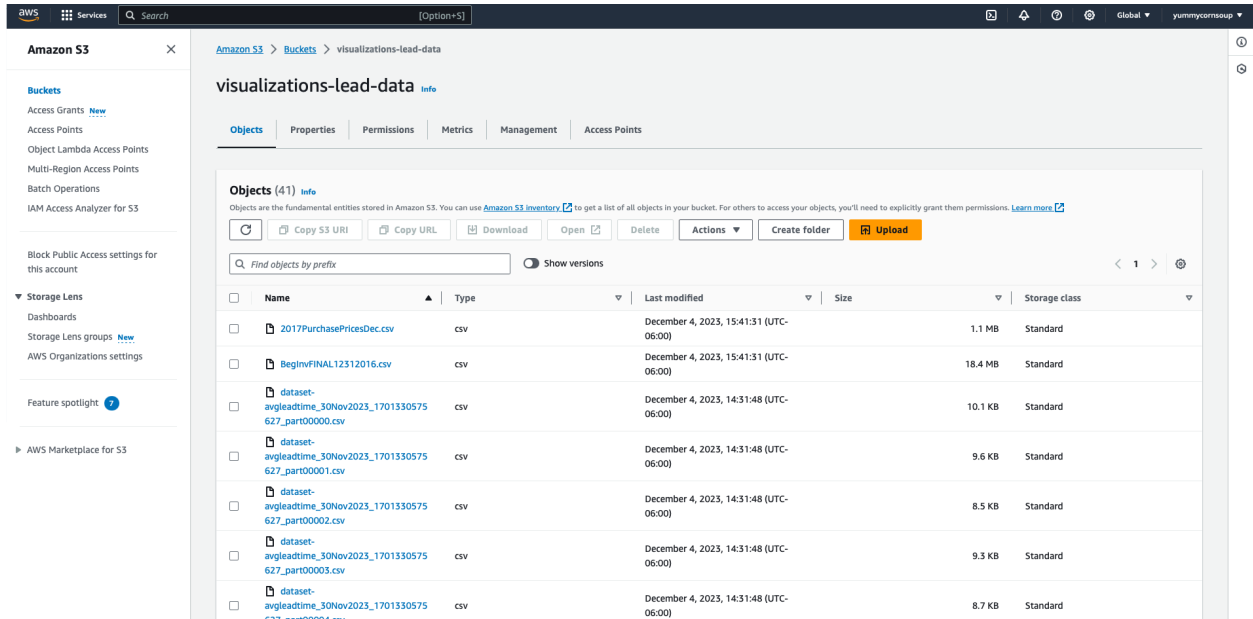
STEP 2- AWS S3

AWS S3 allows users to store and retrieve any amount of data from anywhere on the web. It is ideal for backing up and archiving data, including storing processed or cleaned data after computation or analysis using other AWS services.

1. Create a bucket to store all the data we need to process

The screenshot shows the Amazon S3 console. The left sidebar contains navigation links for Buckets, Access Grants, Access Points, Object Lambda Access Points, Multi-Region Access Points, Batch Operations, IAM Access Analyzer for S3, Block Public Access settings, Storage Lens, Dashboards, Storage Lens groups, and AWS Organizations settings. The main content area shows the 'visualizations-lead-data' bucket, including its name, AWS Region (US East (N. Virginia) us-east-1), Access (Bucket and objects not public), and Creation date (December 4, 2023, 14:30:01 (UTC-06:00)).

2. Upload the data file to the bucket



- After cleaning or processing the data, we can use below code to store the data back to S3. (using boto3 in python)

```
import boto3

# Initialize a session using AWS credentials
s3 = boto3.client('s3')

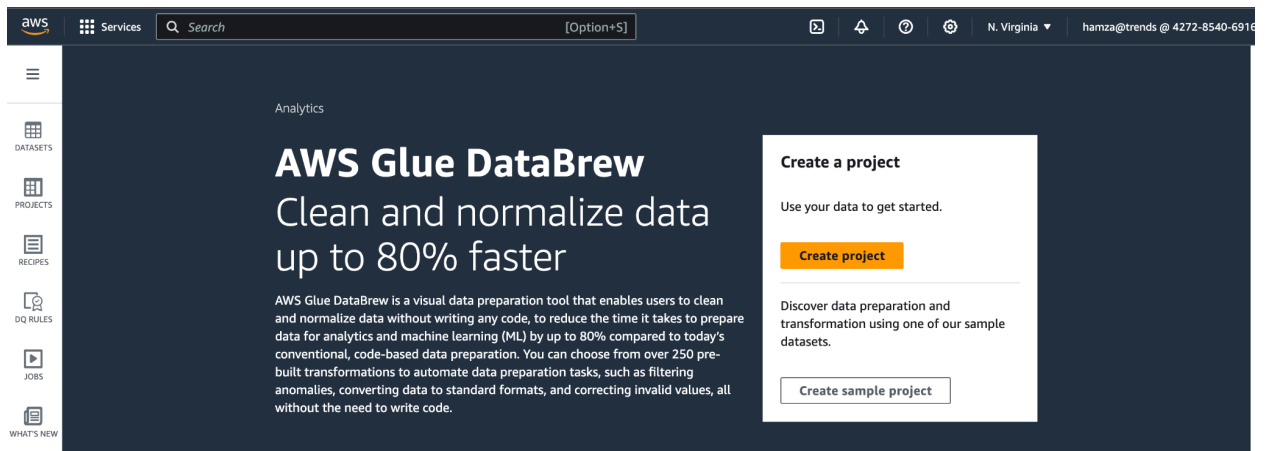
# Specify the file path and S3 bucket and key
file_path = 'path/to/cleaned_data.csv'
bucket_name = 's3-bucket'
object_name = 'path/in/bucket/cleaned_data.csv'

# Upload the file
s3.upload_file(file_path, bucket_name, object_name)
```

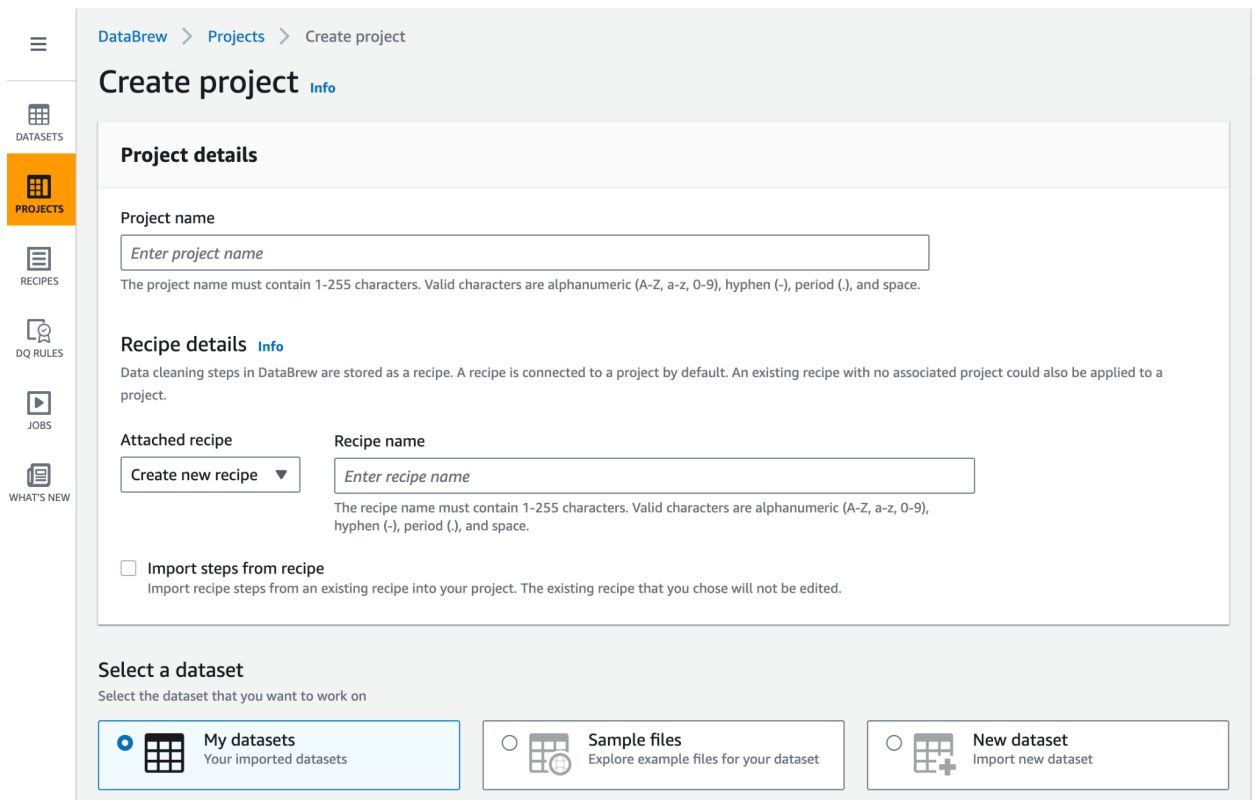
STEP 3- AWS Glue Databrew

AWS Glue DataBrew is a visual data preparation tool provided by Amazon Web Services (AWS). It simplifies the process of cleaning, enriching, and transforming data for analytics and machine learning. Here's an overview of how to use this tool for our solution:

1. Press 'Create Project' to get started



2. Give your project a name and press on 'My datasets' to choose file you want to work on from AWS S3



3. Select your role that was created in the first step and create project

Permissions Info
 DataBrew needs permission to connect to data on your behalf. Use an IAM role with the [required policy](#) attached.

Role name
 Choose the role that has access to your data. Refresh to see the latest updates.

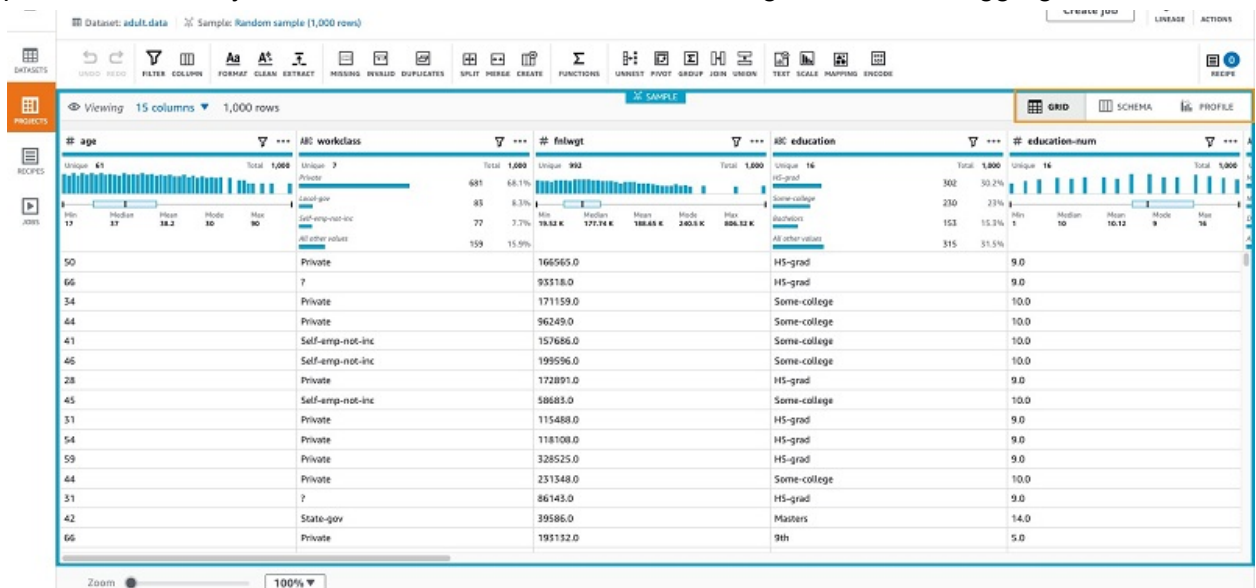
AWSGlueDataBrewServiceRole-trends

By clicking "Create project" you are authorizing DataBrew to add required permissions to access all the datasets in this project to the selected service role.

As soon as you create a DataBrew project, the project opens and costs begin to accrue to your AWS account. [Pricing details](#)

Cancel Create project

4. Identify and correct inconsistencies, missing values, and anomalies in the data and perform necessary transformations like normalization, categorization, and aggregation.



5. Save the cleaned and processed data back to AWS S3 for further analysis

STEP 4- AWS Forecast

Amazon Forecast is a machine learning service provided by Amazon Web Services (AWS) that helps users generate accurate forecasts for various business use cases.

1. Start by creating a dataset group

Dataset groups (1)
[Info](#)

[View details](#)
[Delete](#)
[Create dataset group](#)

Dataset groups are containers for your datasets, predictors, and forecasts.

< 1 >

	Dataset group name	Dataset group ARN	Date created	Modified
<input type="radio"/>	newdata	arn:aws:forecast:us-east-1:427285406916:dataset-group/newdata	Tue, 05 Dec 2023 19:59:32 GMT	Tue, 05 Dec 2023 21:01:18 GMT

2. Give a name to your forecast and select forecast domain based on the industry you are operating in

Create dataset group
[Info](#)

Dataset group details

Dataset group name

The name can help you distinguish this dataset group from other dataset groups on the dataset groups dashboard.

The dataset group name must have 1 to 63 characters. Valid characters: a-z, A-Z, 0-9, and _

Forecasting domain

[Info](#)

A forecasting domain defines a forecasting use case. You can choose a predefined domain, or you can create your own domain.

Tags - optional
[Info](#)

A tag is an administrative label that you assign to AWS resources to make it easier to manage them. Each tag consists of a key and an optional value. Use tags to search and filter your resources or track your AWS costs.

[Cancel](#)
[Next](#)

3. Make sure that the dataset you import has these three columns with the right data type as mentioned here

Data schema
[Info](#)

Use the data schema section to specify the attribute types for each column in your dataset. You can specify the schema in two ways:

☒ **Schema builder**

Specify your Attribute Name, Attribute Type, and attribute order in the text boxes provided.

☐ **JSON schema**

Specify AttributeName and AttributeType in the JSON format.

Schema builder
[Info](#)

The attributes below are required for your chosen domain. You may add additional attributes. All attributes displayed must exist in your CSV file and must be ordered in the same order that they appear in your CSV file. To reorder the attributes, simply drag and drop each attribute to the correct position.

Column

1

Attribute Name

Attribute Type

string

2

Attribute Name

Attribute Type

timestamp

Timestamp Format

[Info](#)

yyyy-MM-dd HH:mm:ss

3

Attribute Name

Attribute Type

float

[Add attribute](#)

You can add up to 10 more attributes

4. Add the s3 path where you have saved the sales file after cleaning and preprocessing

Dataset import details

Dataset import name
The name can help you distinguish this dataset import from other imports on your dataset detail page.

The dataset import name must have 1 to 63 characters. Valid characters: a-z, A-Z, 0-9, and _

Select time zone | [Info](#)
Select a time zone for your dataset.

Do not use time zone ▼

Import file type- optional
Files will be considered as CSV by default. If you wish to import Parquet files, choose Parquet below.

☒ CSV
☐ PARQUET

Data location | [Info](#)
The location is the path to the file in your S3 bucket that contains your data.

[View](#) [Browse S3](#)

Your files must be in CSV format.


IAM role | [Info](#)
Dataset groups require permissions from IAM to read your dataset files in S3. Choose or create a role using this control.

Enter a custom IAM role ARN ▼

Custom IAM role ARN

5. Add the other datasets in item metadata and related time series sections which might be useful for forecasting like price, promotion, brand, category, discounts.

Overview


Import your data
Datasets are required to train predictors, which are then used to generate forecasts.

Target time series data


Active View Edit

Item metadata data

Import


Related time series data

Import


Train a predictor
Train a predictor, a custom model with underlying infrastructure that Amazon Forecast trains on your datasets.


View predictors

Train predictor


Generate forecasts
Generate forecasts using your trained predictors.

Create a forecast

Query forecast


Explore insights
Identify the attributes impacting your forecasts with explainability and explore different scenarios in a what-if analysis.

Explore explainability

Explore what-if analysis

6. Press 'Train Predictor' to start running the forecasting model by adding the relevant details

Predictor settings

Predictor name
The name can help you distinguish this predictor from your other predictors.

The predictor name must have 1 to 63 characters. Valid characters: a-z, A-Z, 0-9, and _

Forecast configuration

Forecast frequency
This is the frequency at which your forecasts are generated.
Your forecast frequency is

Time alignment boundary - optional
The time boundary along which data is aligned and forecasts are generated.

Forecast horizon [Info](#)
This number tells Amazon Forecast how far into the future to predict your data at the specified forecast frequency.

Forecast dimensions - optional
Item id is used in training by default. Select additional keys you would like to use to generate a forecast. These keys are fields in your dataset.

Forecast quantiles - optional [Info](#)
Specify the quantiles used to create forecasts and evaluate predictors. Choose up to 5 quantiles between 0.01 and 0.99 (by increments of 0.01). You can also include the mean forecast with 'mean'.

Forecast quantile	Value	
<input type="text" value="Forecast quantile 1"/>	<input type="text" value="0.10"/>	<input type="button" value="Remove"/>
<input type="text" value="Forecast quantile 2"/>	<input type="text" value="0.50"/>	<input type="button" value="Remove"/>
<input type="text" value="Forecast quantile 3"/>	<input type="text" value="0.90"/>	<input type="button" value="Remove"/>

- Once the forecast is ready, press 'generate forecasts' and export the results to s3 bucket

STEP 5- AWS QuickSight

- For analysis, we need to first connect to datasets in S3. Go to Datasets and click on New Dataset

QuickSight

Find analyses & more

★ Favorites

🕒 Recent

📁 My folders

📁 Shared folders

📊 Dashboards

📖 Data stories Beta

📊 Analyses

📊 **Datasets**

🔍 Topics

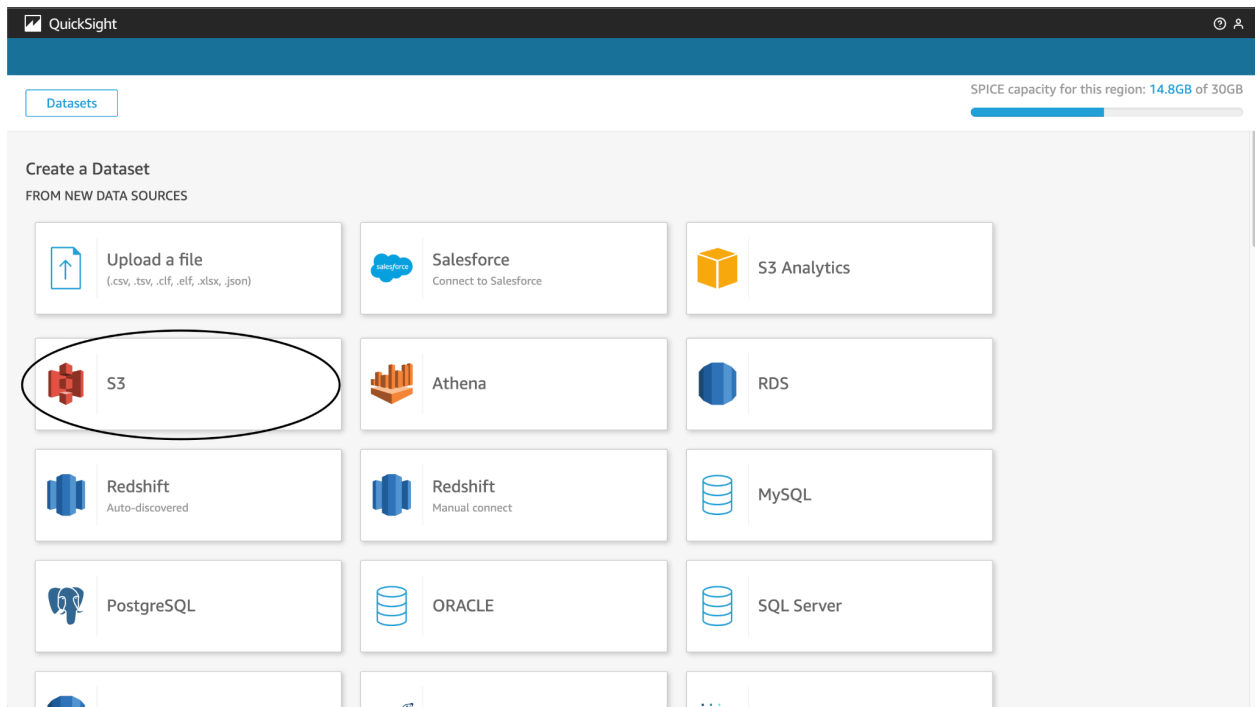
👤 Community

Datasets

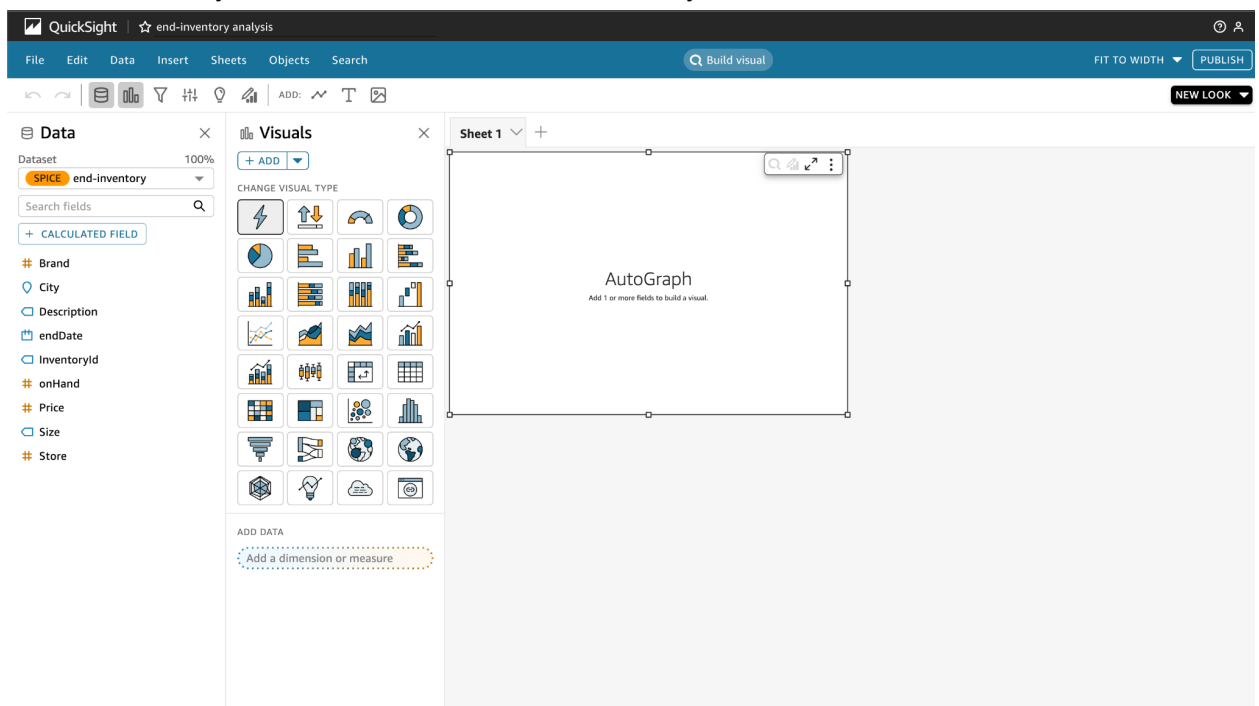
New dataset

Name		Owner	Last Modified	
forecast1		Me	a day ago	⋮
forecast-data		Me	a day ago	⋮
historical-product-demand		Me	a day ago	⋮
purchase-final		Me	2 days ago	⋮
invoice-purchase		Me	2 days ago	⋮
end-inventory		Me	2 days ago	⋮
purchase-prices		Me	2 days ago	⋮
beg-inventory		Me	2 days ago	⋮
sales-final		Me	2 days ago	⋮
visualizations-data-2		Me	2 days ago	⋮
visualizations-data		Me	2 days ago	⋮
Web and Social Media Analytics		Me	4 days ago	⋮
People Overview		Me	4 days ago	⋮
Sales Pipeline		Me	4 days ago	⋮
Business Review		Me	4 days ago	⋮

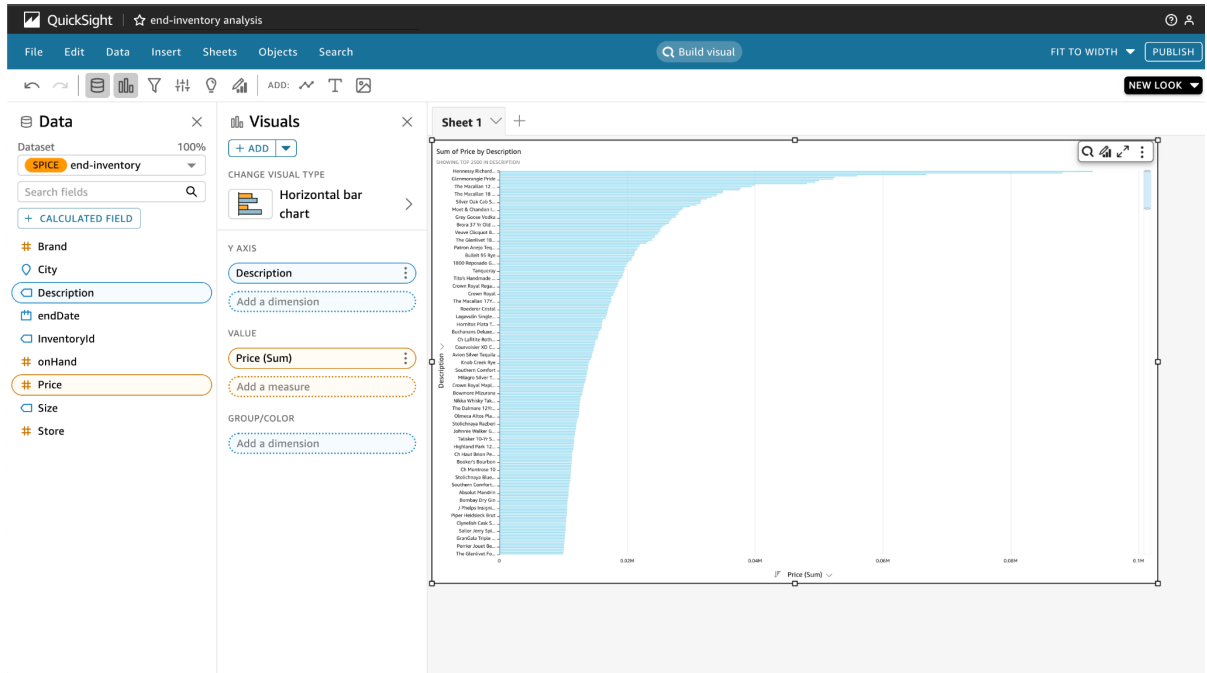
2. Click on S3, give the data source a name and upload your manifest file



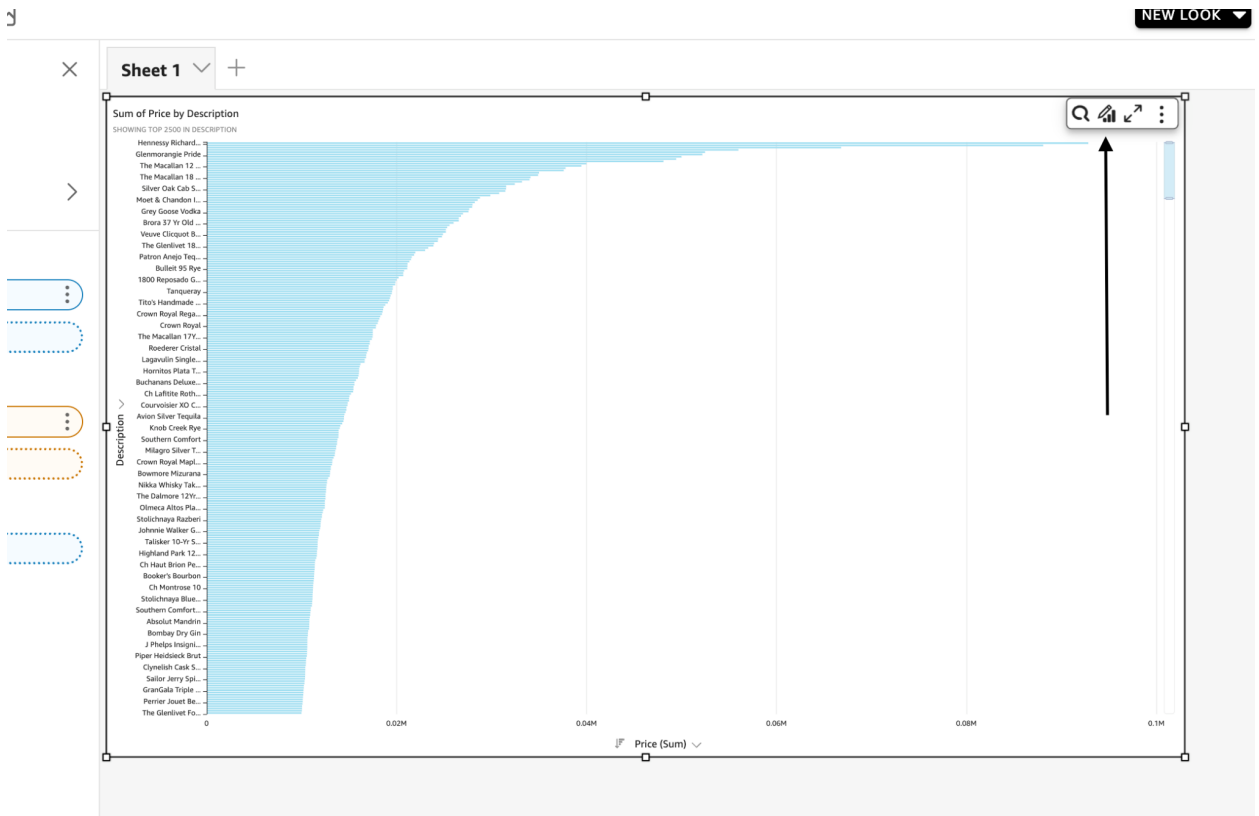
3. After the file is successfully uploaded, you can start your analysis. Go to the Analyses tab and click on your data source name. This is how your dashboard will look:



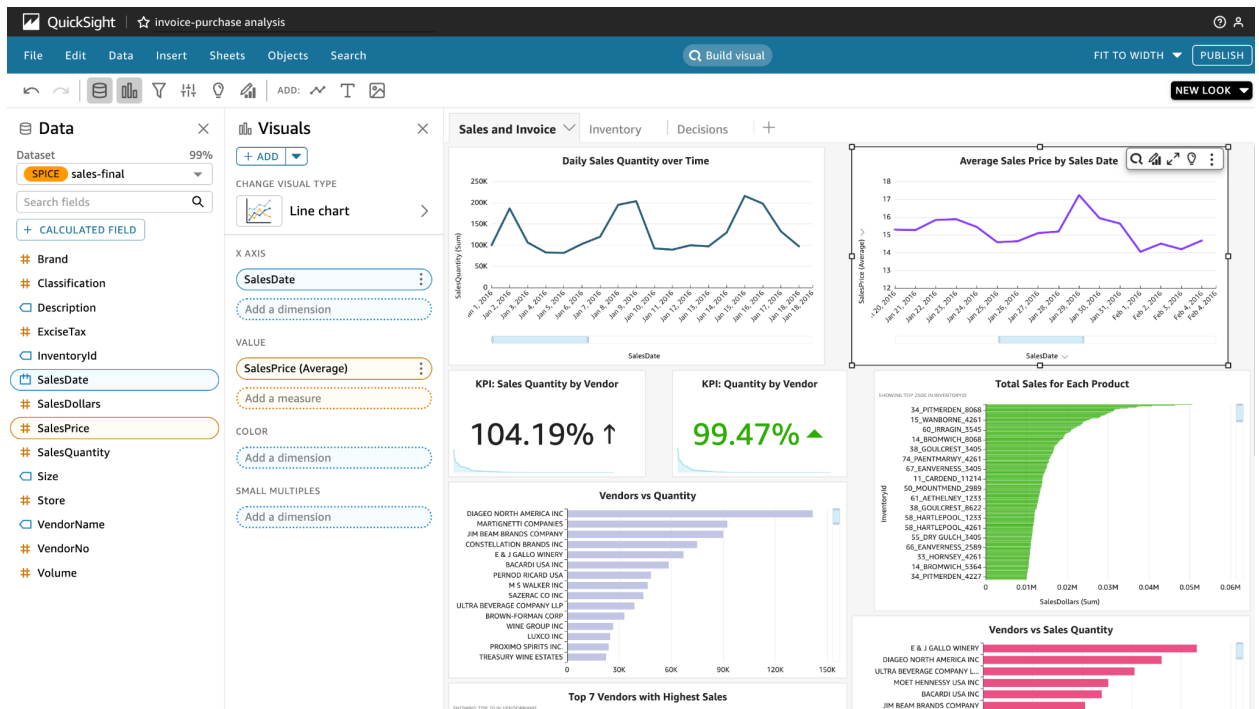
4. On the left, you can click on the data variables and select your visual. Here, for example, I have selected variables 'Description' and 'Price' to be on Horizontal bar chart



5. You can format your graph by clicking on the format visual icon on the right upper-corner of the chart. In this, you can also give your chart interaction capabilities so that it can interact with other charts in the sheet



6. Similarly, by adding multiple graphs, you can create a dashboard



STEP 6- AWS Lambda

Lambda job is triggered whenever a new forecast file is posted in the s3 bucket by AWS Forecast. This job is responsible for checking the products which are going to go below the set threshold and trigger an email to the concerned stakeholders reminding them to take necessary actions to restock those products.

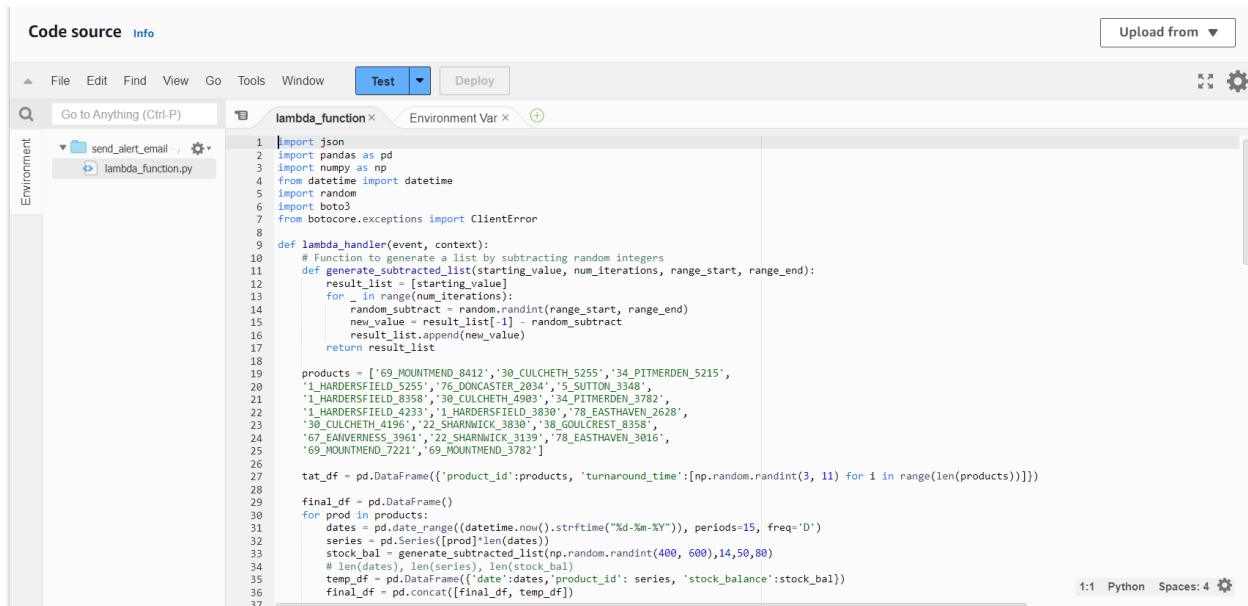
1: Go to AWS Lambda Dashboard and click on functions.

Resources for US East (N. Virginia)				Create function
Lambda function(s)	Code storage	Full account concurrency	Unreserved account concurrency	
1	2.1 kB (0% of 75.0 GB)	10	10	

2: Click on “Create Function”

Functions (1)						Last fetched 1 minute ago	Actions	Create function
Filter by tags and attributes or search by keyword								
<input type="checkbox"/>	Function name	Description	Package type	Runtime	Last modified			
<input type="checkbox"/>	send_alert_email	-	Zip	Python 3.11	yesterday			

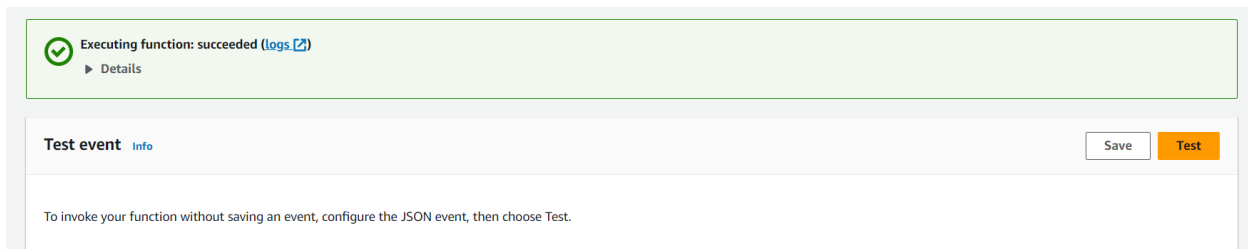
3: Name the Lambda function and paste the code you want to run via the lambda function in the Code Section:



The screenshot shows the AWS Lambda console interface. At the top, there's a 'Code source' tab with an 'Info' link and an 'Upload from' dropdown. Below this is a menu bar with 'File', 'Edit', 'Find', 'View', 'Go', 'Tools', 'Window', 'Test', and 'Deploy'. The 'Test' button is highlighted. On the left, there's an 'Environment' sidebar with a search bar and a list of files: 'send_alert_email' and 'lambda_function.py'. The main area displays the Python code for the 'lambda_function'. The code includes imports for json, pandas, numpy, datetime, random, and boto3. It defines a 'lambda_handler' function that generates a list of products, creates a DataFrame for product turnaround times, and another DataFrame for stock balances. The code is 37 lines long. At the bottom right, it shows '1:1 Python Spaces: 4'.

```
1 import json
2 import pandas as pd
3 import numpy as np
4 from datetime import datetime
5 import random
6 import boto3
7 from botocore.exceptions import ClientError
8
9 def lambda_handler(event, context):
10     # Function to generate a list by subtracting random integers
11     def generate_subtracted_list(starting_value, num_iterations, range_start, range_end):
12         result_list = [starting_value]
13         for _ in range(num_iterations):
14             random_subtract = random.randint(range_start, range_end)
15             new_value = result_list[-1] - random_subtract
16             result_list.append(new_value)
17         return result_list
18
19     products = ['69_MOUNTMEND_8412','30_CULCHETH_5255','34_PITMERDEN_5215',
20               '1_HARDERSFIELD_5255','76_DONCASTER_2834','5_SUTTON_3348',
21               '1_HARDERSFIELD_8358','30_CULCHETH_4983','34_PITMERDEN_3782',
22               '1_HARDERSFIELD_4233','1_HARDERSFIELD_3830','78_EASTHAVEN_2628',
23               '30_CULCHETH_4196','22_SHARNWICK_3830','38_GOULCREST_8358',
24               '67_EANVERNESS_3961','22_SHARNWICK_3139','78_EASTHAVEN_3016',
25               '69_MOUNTMEND_7221','69_MOUNTMEND_3782']
26
27     tat_df = pd.DataFrame({'product_id':products, 'turnaround_time':[np.random.randint(3, 11) for i in range(len(products))])})
28
29     final_df = pd.DataFrame()
30     for prod in products:
31         dates = pd.date_range((datetime.now().strftime("%d-%m-%Y")), periods=15, freq='D')
32         series = pd.Series([prod]*len(dates))
33         stock_bal = generate_subtracted_list(np.random.randint(400, 600),14,50,80)
34         # len(dates), len(series), len(stock_bal)
35         temp_df = pd.DataFrame({'date':dates,'product_id': series, 'stock_balance':stock_bal})
36         final_df = pd.concat([final_df, temp_df])
37
```

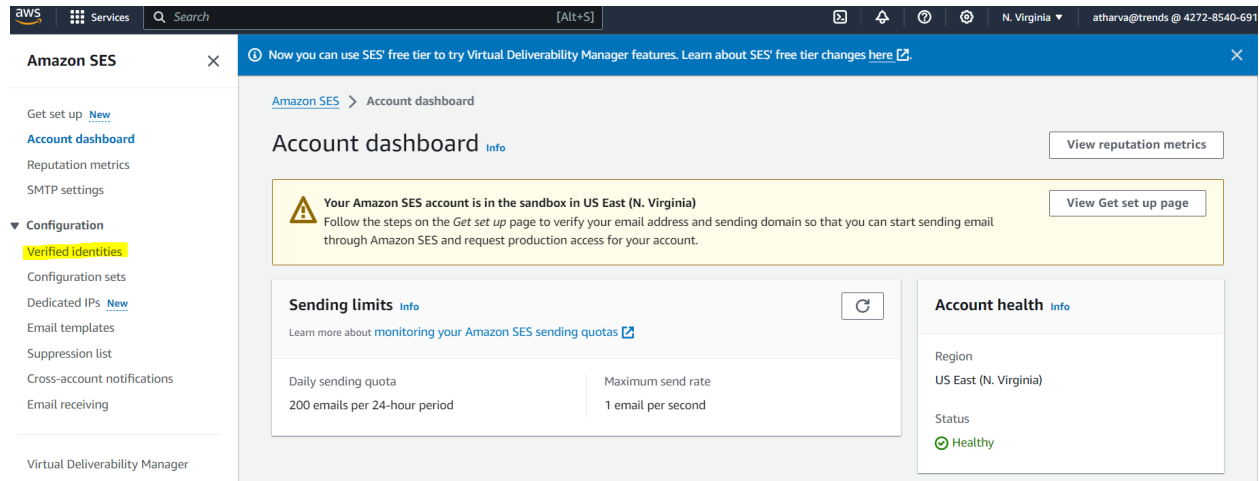
4: Go to Test section and click the Test button to test the code if it runs correctly.



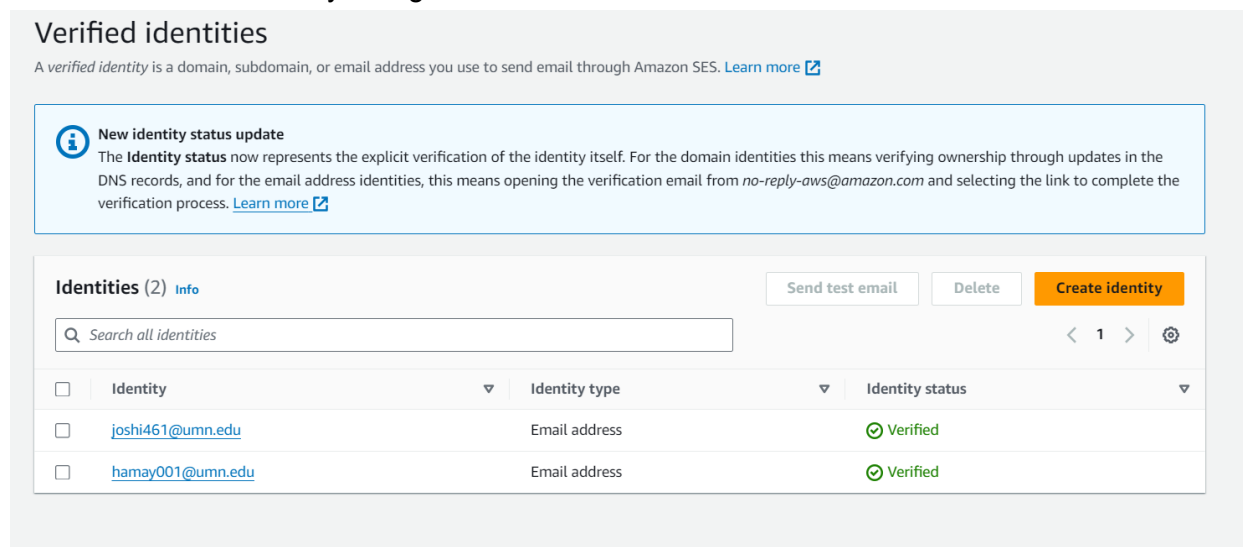
STEP 7- SES

This service is used to send emails from a registered email to other recipient emails that were registered to receive updates regarding out of stock / low-products.

1: Go to AWS SES Dashboard and click on verified identities.



2: Click on Create Identity to register new sender/receiver email ids.



3: Click on Email Address and specify an email ID to register. Click on Create Identity. Once you click it, a confirmation email will be sent by AWS. Go to the link sent in the email to register this

email address.

Identity details [Info](#)

Identity type

☐ Domain
To verify ownership of a domain, you must have access to its DNS settings to add the necessary records.

☒ Email address
To verify ownership of an email address, you must have access to its inbox to open the verification email.

Email address

Email address can contain up to 320 characters, including plus signs (+), equals signs (=) and underscores (_).

☐ Assign a default configuration set

Enabling this option ensures that the assigned configuration set is applied to messages sent from this identity by default whenever a configuration set isn't specified at the time of sending.

Tags - optional [Info](#)

You can add one or more tags to help manage and organize your resources, including identities.

No tags associated with the resource.

Add new tag

You can add 50 more tags.

Cancel

Create identity

4: Your email is registered.