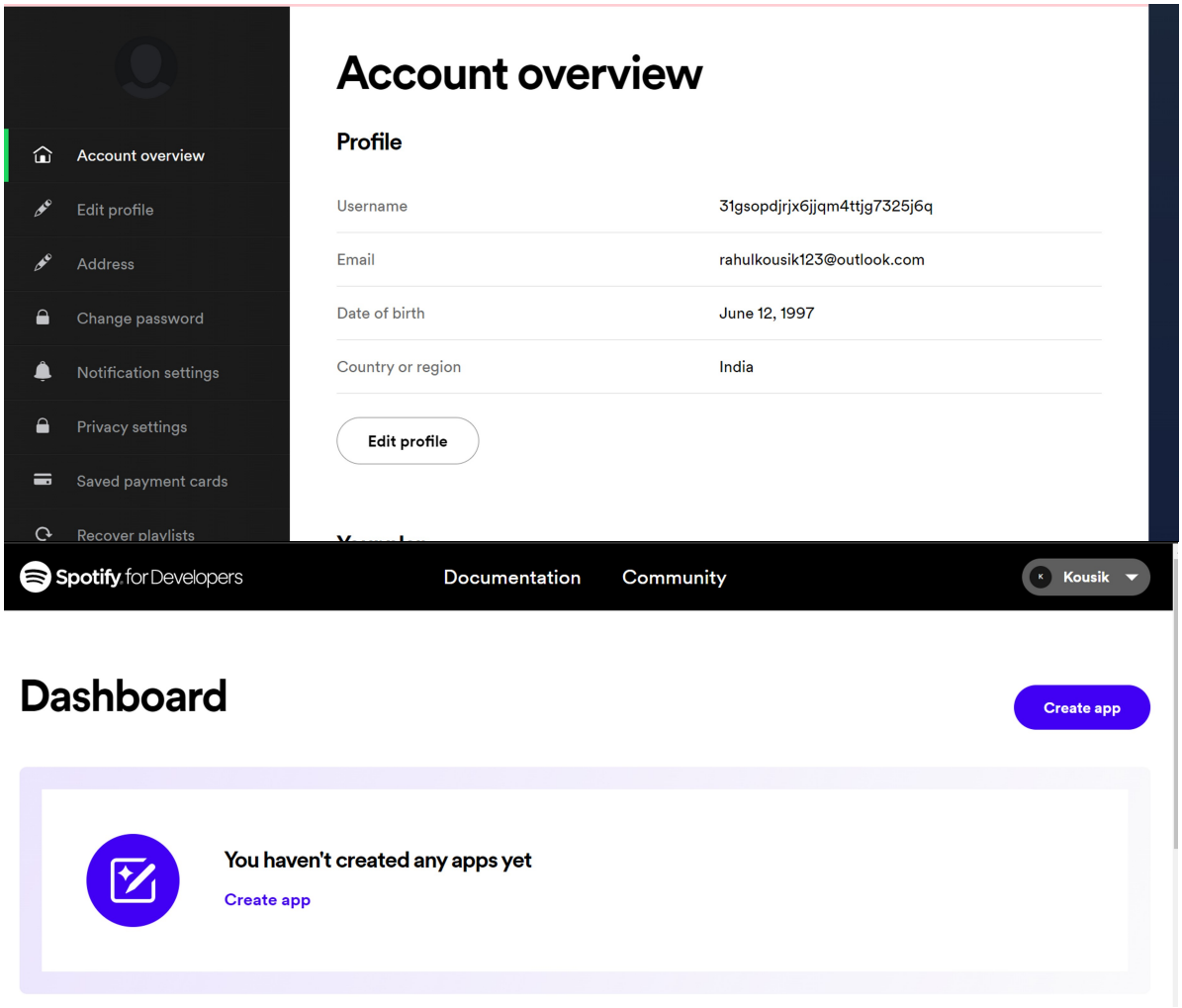
Project: Spotify Data Pipeline Using Airflow

Monday, August 21, 2023 9:30 AM

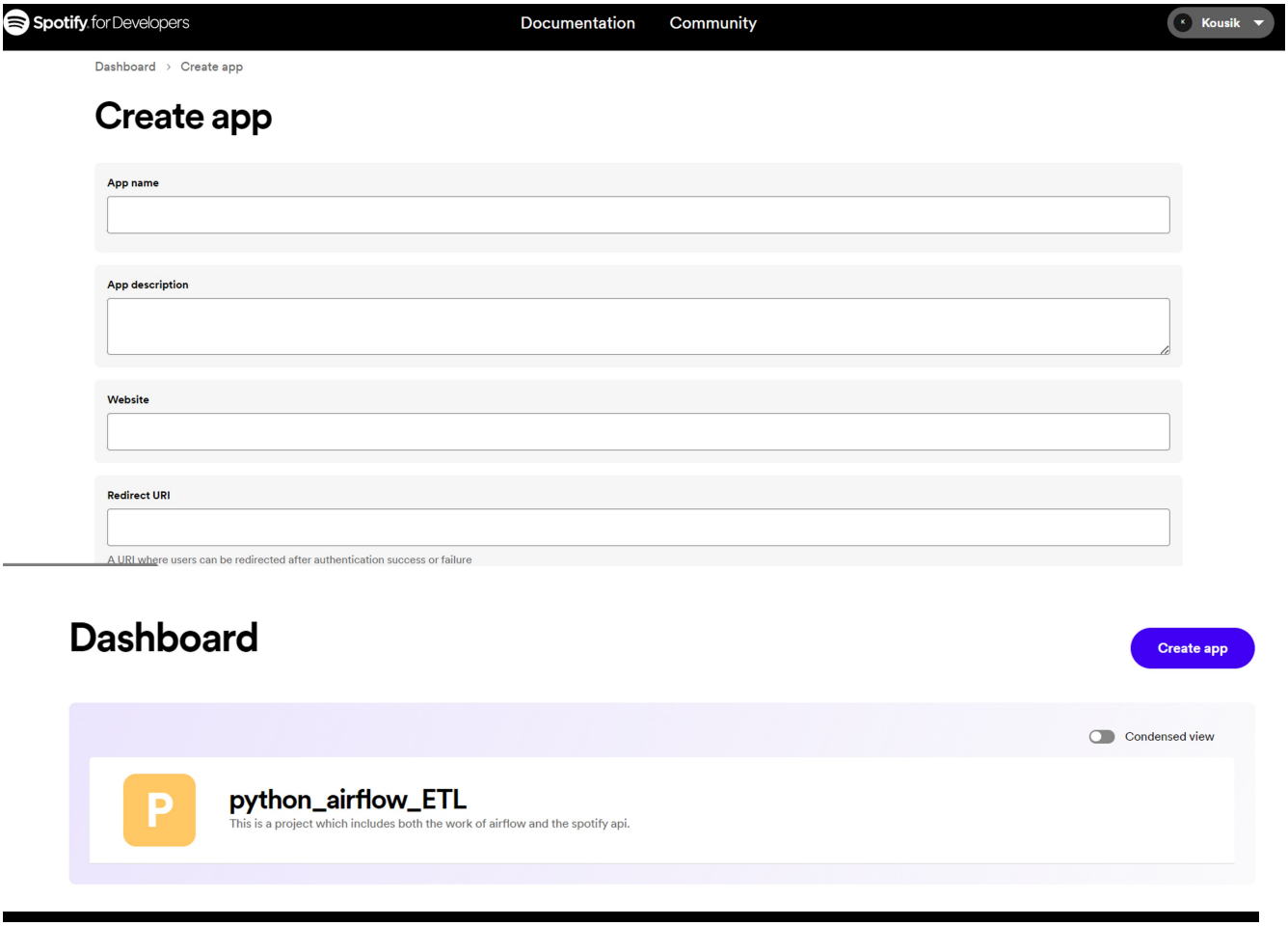
Process to Execute the Project : -

Step 1: First lets login to Website : https://developer.spotify.com/
Note : You must have a spotify account for that.

Step 2: Let's see the account overview -



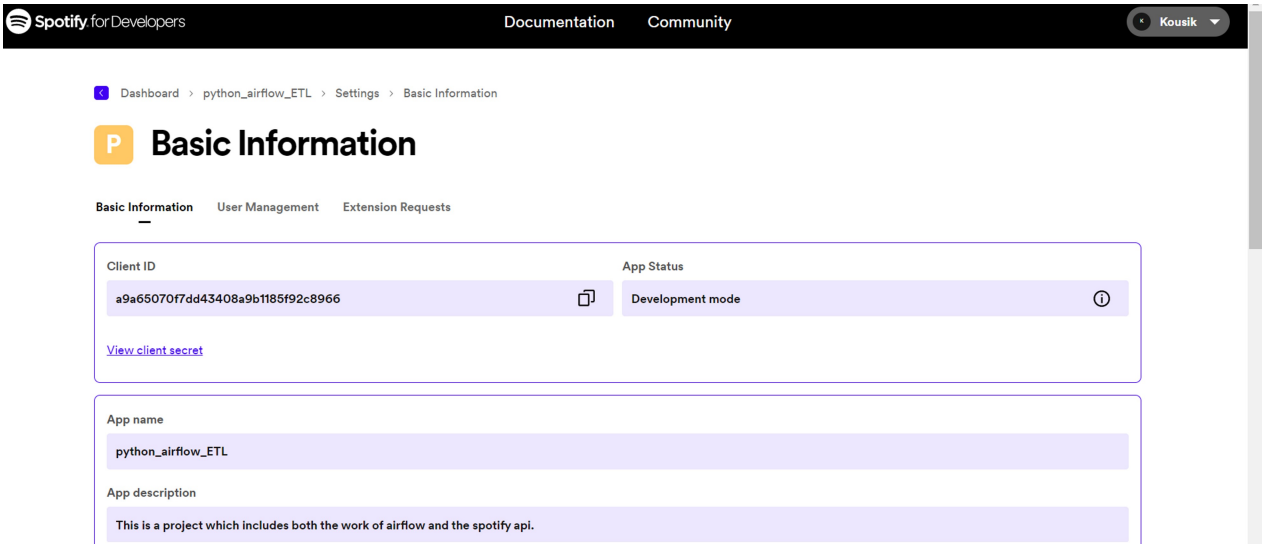
Then lets create an app into that :



So, we have created an app name : **python_airflow_ETL**

In essence, creating an application that fetches data from an API allows you to harness external data sources and services to enhance the functionality, accuracy, and real-time nature of your application. It's a fundamental concept in modern software development that enables dynamic, interconnected, and feature-rich applications.

Now we need client ID and secret :



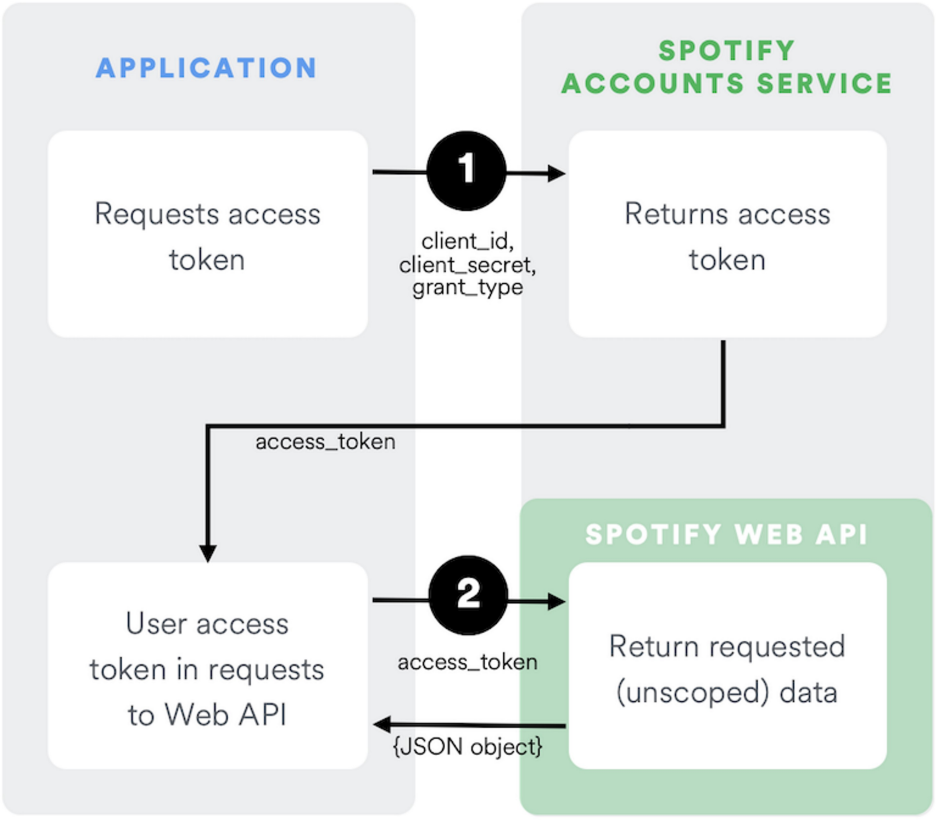
A client ID and client secret are often used as part of the OAuth 2.0 authentication framework for APIs. OAuth 2.0 is a widely used protocol for securing API access and allowing applications to interact with protected resources on behalf of users without exposing their credentials. The client ID and client secret play specific roles in this process:

- **Client ID**: The client ID is a unique identifier assigned to the application (also known as the "client") by the API provider. It helps the API provider recognize and identify the application making requests to the API. Each application that wants to access the API is given a distinct client ID. This allows the API provider to keep track of which applications are using their services.
- **Client Secret:** The client secret is a confidential string that's associated with the client ID. It's a form of authentication to verify the identity of the application making the request. The client secret should be kept secure and not shared publicly or exposed in the application code. It's used to authenticate the application with the API provider and establish trust.

In summary, the client ID and secret are used in OAuth 2.0-based API authentication to ensure secure and controlled access to protected resources while providing the API provider with the means to manage and monitor how applications are interacting with their API.

Follow this documentation : https://developer.spotify.com/documentation/web-api/tutorials/client-credentials-flow

Now the flow how it works is :



So how it works is, we have our access token and we will be requesting an access token from spotify, by providing the **client_id, client_secret** and few other information. Then this service will release a temporary access token, having this access token we can give it to spotify web api and we can get in return json object.

```python
def get_token():
    auth_string = client_id + ":" + client_secret  # this we need to get the access token
    auth_bytes = auth_string.encode("utf-8")  # Next we need to encode the string with utf - 8
    auth_base64 = str(base64.b64encode(auth_bytes),"utf-8") # then we need to encode the auth_string with the base64 encoding

    url = "https://accounts.spotify.com/api/token" # we will be sending a request to this website
    headers = {
        "Authorization" : "Basic " + auth_base64,
        "Content-Type" : "application/x-www-form-urlencoded"
    }
    data = {"grant_type" : "client_credentials"}
    result = post(url, headers = headers, data = data)
    json_result = json.loads(result.content)
    token = json_result["access_token"]
    return token
```

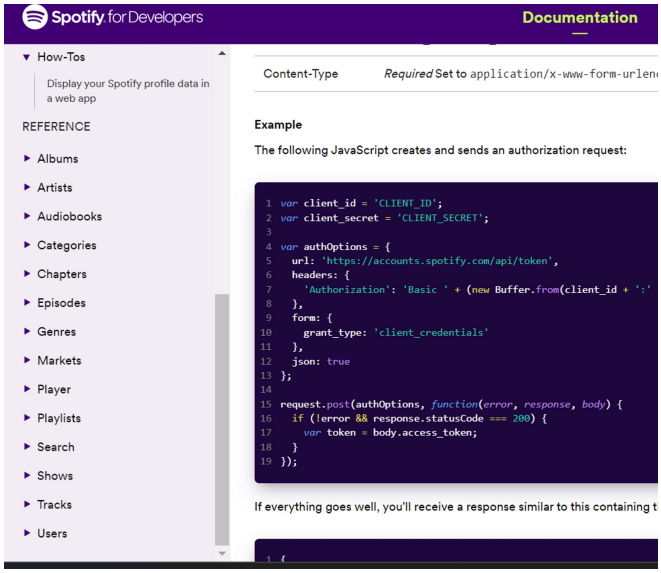
This headers we will be using for further request from Web API.

```python
def get_auth_header(token):
    return {"Authorization": "Bearer " + token}
```

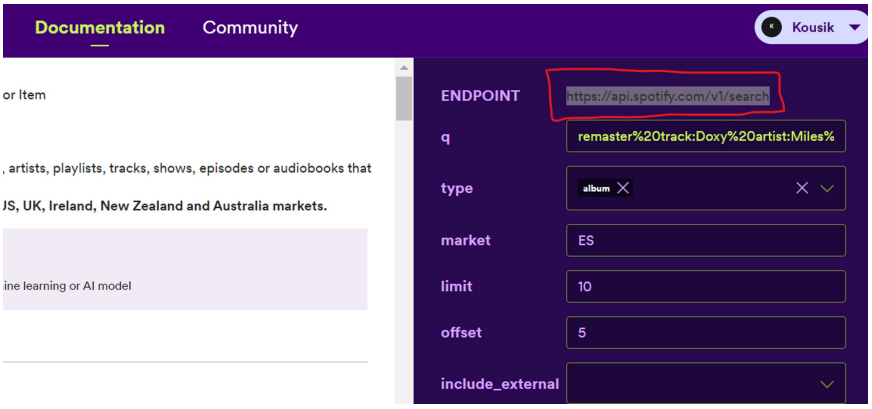
This token we will be using for the further requests.

- Bearer tokens are a much simpler way of making API requests, since they don't require cryptographic signing of each request.

Now this is the website for the documentation , whatever we want with the help of the API we can find it here.
https://developer.spotify.com/documentation/web-api/tutorials/client-credentials-flow



Our endpoint to access the resources :



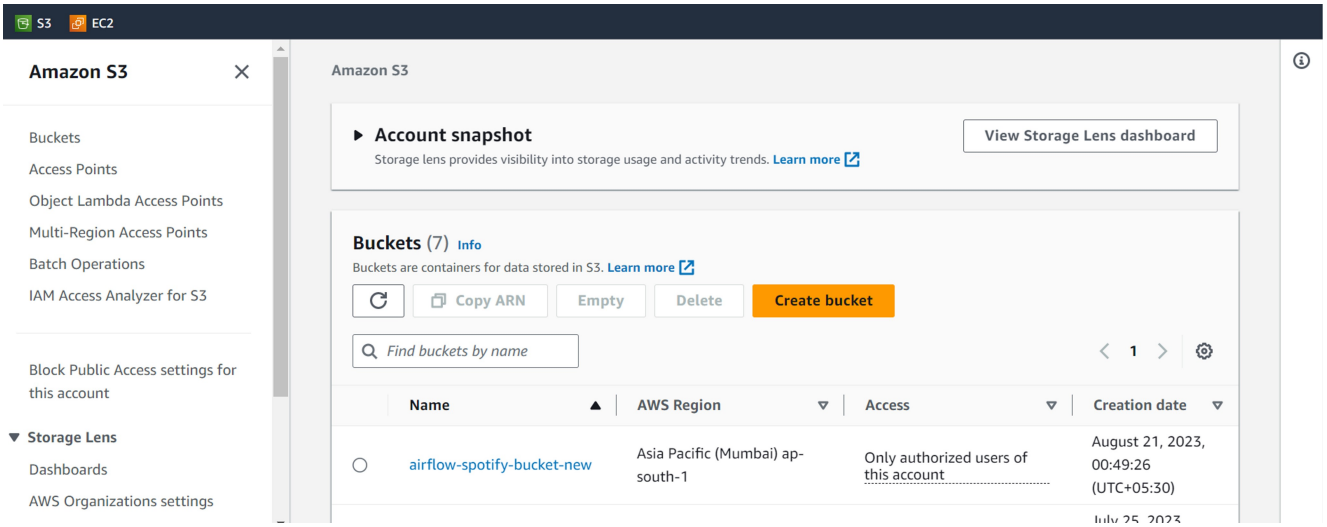

```
def search_for_artist(token, artist_name):
    url = "https://api.spotify.com/v1/search"
    headers = get_auth_header(token)
    query = f"?q={artist_name}&type=artist&limit=1"   # whatever we search in the search bar , the first suggestion we will take
    query_url = url + query
    result = get(query_url,headers = headers)
    json_result = json.loads(result.content)["artists"]["items"]
    if len(json_result) == 0:
        print("no artist with this name exists")
        return None
    return json_result[0]
```

```
def get_song_by_artist(token,artist_id):
    url = f"https://api.spotify.com/v1/artists/{artist_id}/top-tracks?country=IN"
    headers = get_auth_header(token)
    result = get(url, headers = headers)
    json_result = json.loads(result.content)['tracks']
    return json_result


token = get_token()
# input
artist_name = "arijit"
result = search_for_artist(token, artist_name)
#print(result["name"])
artist_id = result['id']
songs = get_song_by_artist(token,artist_id)
ids = []
song_name = []
for idx,song in enumerate(songs):
    ids.append(idx+1)
    song_name.append(song['name'])
# Saving the data in the dataframe : top tracks of a artist

songs_data = pd.DataFrame({'id': ids, 'Top_Tracks' : song_name})
songs_data = songs_data.set_index('id')
songs_data.to_csv(f"result_{artist_name}.csv")
```

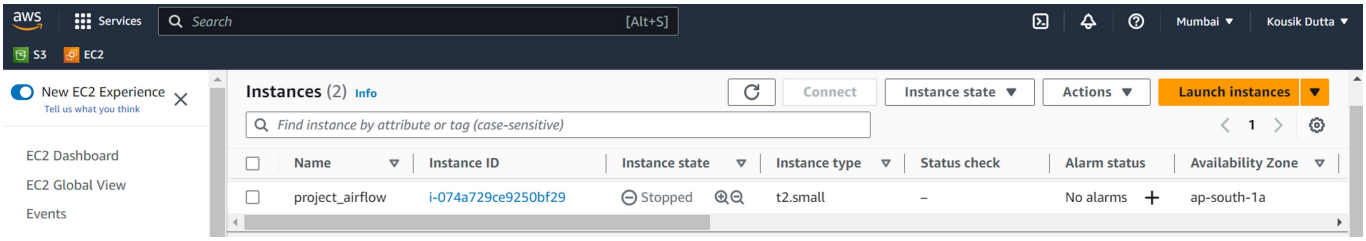
Put everything in a single function :

```python
def spotify_artist_search_and_save():

    # Replace these with your actual client ID, client secret, and artist name
    client_id = "a9a65070f7dd43408a9b1185f92c8966"
    client_secret = "cbf316d2e45f468680e1ca3f759813ec"
    artist_name = "arijit"

    def get_token():
        auth_string = client_id + ":" + client_secret
        auth_bytes = auth_string.encode("utf-8")
        auth_base64 = str(base64.b64encode(auth_bytes), "utf-8")

        url = "https://accounts.spotify.com/api/token"
        headers = {
            "Authorization": "Basic " + auth_base64,
            "Content-Type": "application/x-www-form-urlencoded"
        }
        data = {"grant_type": "client_credentials"}
        result = post(url, headers=headers, data=data)
        json_result = json.loads(result.content)
        token = json_result["access_token"]
        return token

    def get_auth_header(token):
        return {"Authorization": "Bearer " + token}

    def search_for_artist(token, artist_name):
        url = "https://api.spotify.com/v1/search"
        headers = get_auth_header(token)
        query = f"?q={artist_name}&type=artist&limit=1"
        query_url = url + query
        result = get(query_url, headers=headers)
        json_result = json.loads(result.content)["artists"]["items"]

        if len(json_result) == 0:
            print("No artist with this name exists")
            return None
        return json_result[0]

    def get_song_by_artist(token, artist_id):
        url = f"https://api.spotify.com/v1/artists/{artist_id}/top-tracks?country=IN"
        headers = get_auth_header(token)
        result = get(url, headers=headers)
        json_result = json.loads(result.content)['tracks']
        return json_result

    token = get_token()
    result = search_for_artist(token, artist_name)
    artist_id = result['id']
    songs = get_song_by_artist(token, artist_id)

    ids = []
    song_name = []
    for idx, song in enumerate(songs):
        ids.append(idx + 1)
        song_name.append(song['name'])

    songs_data = pd.DataFrame({'id': ids, 'Top_Tracks': song_name})
    songs_data = songs_data.set_index('id')
    songs_data.to_csv(f"s3://airflow-spotify-bucket-new/result_{artist_name}.csv")
```

Step 3 : Next Create S3 bucket to store the data fetched from Spotify :



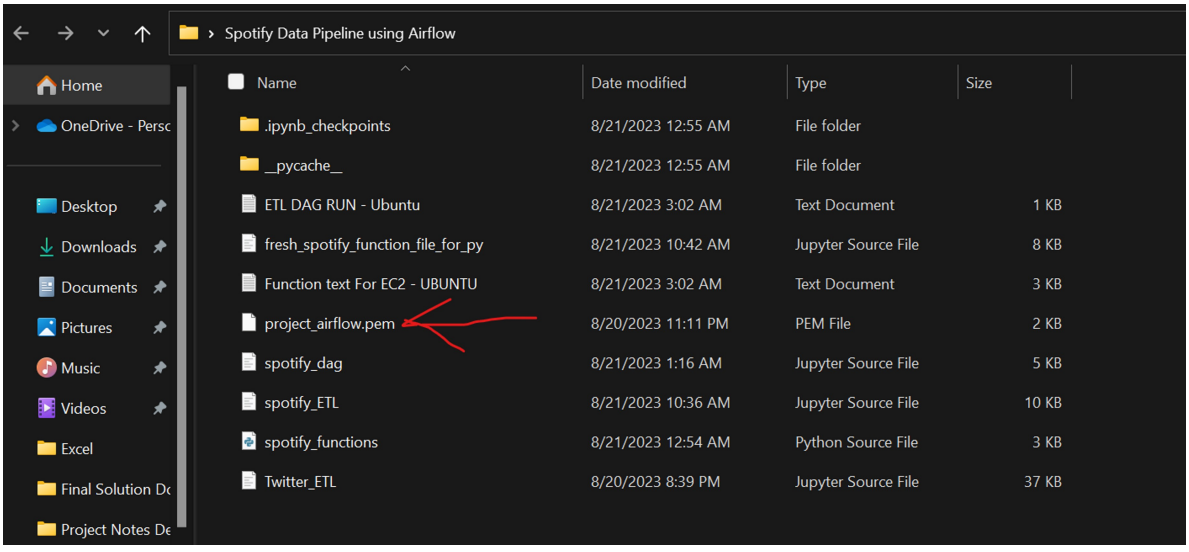
Step 4: Create an EC2 instance for running the Airflow server :



Configuration : 1Vcpu, 2 GB Ram : Virtual machine (Ubuntu - Linux)

In general terms, a CPU with "1 CPU" typically refers to a single physical processing unit, also known as a "core." So, in this context, when you have "1 CPU," it means that the CPU has a single core.

Now, we will be running the EC2 machine (Ubuntu) from our terminal. From same folder where our pem key is available.



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Futurense\Desktop\Spotify Data Pipeline using Airflow> ssh -i "project_airflow.pem" ubuntu@ec2-13-232-166-171.ap-south-1.
compute.amazonaws.com
The authenticity of host 'ec2-13-232-166-171.ap-south-1.compute.amazonaws.com (13.232.166.171)' can't be established.
ED25519 key fingerprint is SHA256:Dw5k1PfMscobtX29pfwePWr7HxutnVsBzHBQjscjyG0.
This host key is known by the following other names/addresses:
    C:\Users\Futurense/.ssh/known_hosts:17: ec2-43-205-236-170.ap-south-1.compute.amazonaws.com
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-13-232-166-171.ap-south-1.compute.amazonaws.com' (ED25519) to the list of known hosts.
Welcome to Ubuntu 22.04.2 LTS (GNU/Linux 5.19.0-1025-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Mon Aug 21 05:22:03 UTC 2023

  System load:  0.10205078125     Processes:             98
  Usage of /:   36.9% of 7.57GB   Users logged in:       0
  Memory usage: 12%               IPv4 address for eth0: 172.31.45.95
  Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.
```

Then complete the following installation :

Sudo apt-get update
Sudo apt install python3-pip
Sudo pip install apache airflow
Sudo pip install pandas
Sudo pip install s3fs

Then write **airflow :** check if its running or not.

Then type **airflow standalone :** check the server is running or not

```
Last login: Sun Aug 20 19:53:34 2023 from 122.171.16.72
ubuntu@ip-172-31-45-95:~$ ls
airflow  snap
ubuntu@ip-172-31-45-95:~$ sudo snap install aws-cli
```

We have to install AWS CLI as well, because without that w will not be able to configure or send the data from API through DAG to the S3 file system.

We have to configure AWS as Well :

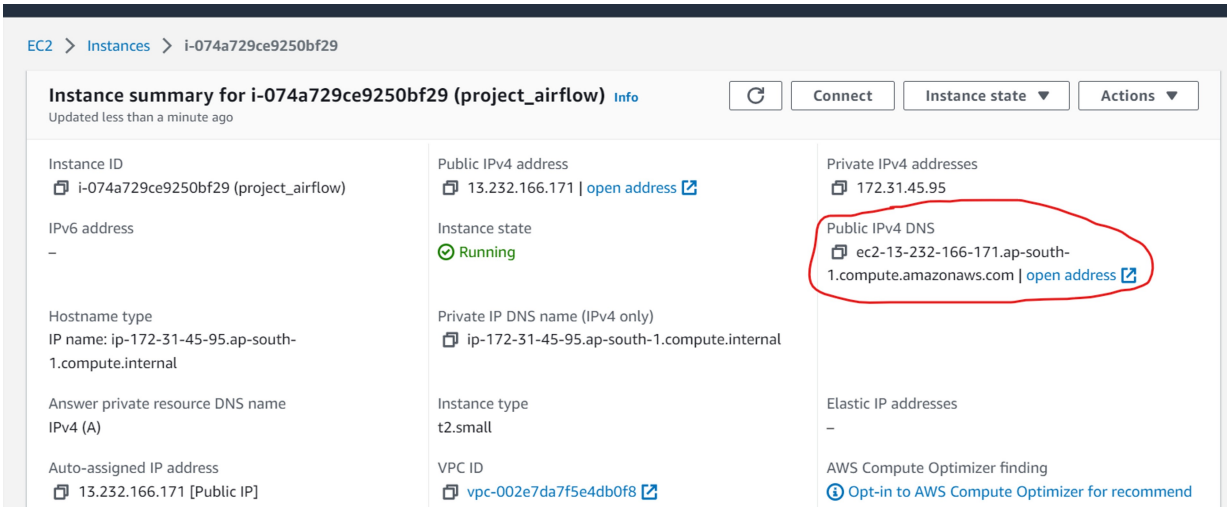
```
ubuntu@ip-172-31-45-95:~$ aws configure
AWS Access Key ID [****************HQWA]: ^C
```

For that we have to create a User and then we have to assign role **{Administrator access}** -- > then we can generate an access key and get the access key for getting the s3 file system access.

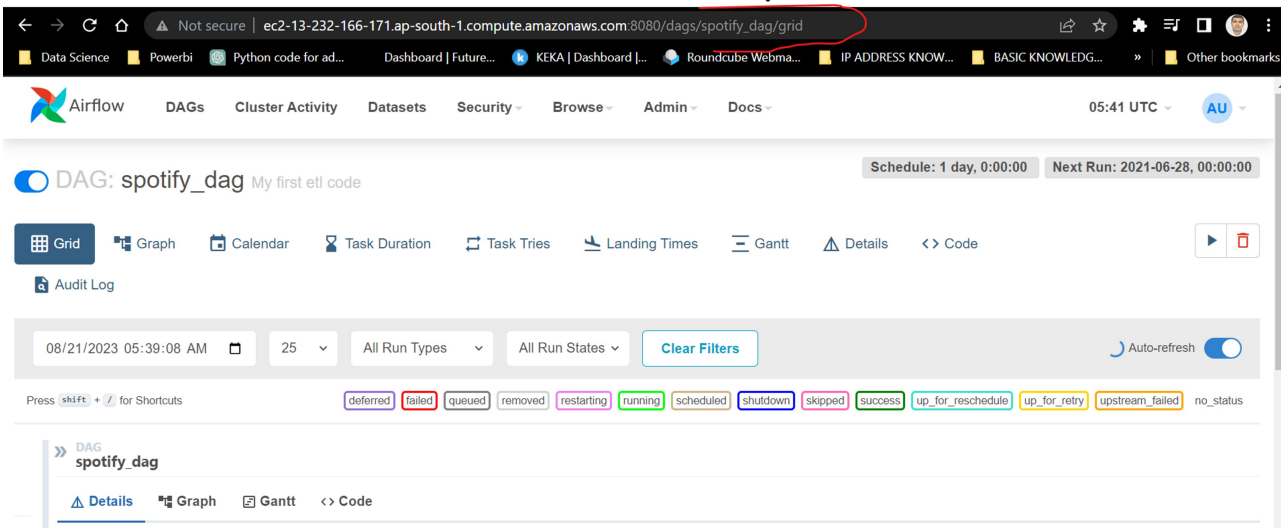
So, now the thing is : we can get the admin and password

```
n_after=2021-06-10T00:00:00+00:00
 scheduler | [2023-08-21T05:37:40.570+0000] {dag.py:3677} INFO - Setting next_dagrun for spotify_dag to 2021-06-10T00:00:00+00:00, ru
n_after=2021-06-11T00:00:00+00:00
 scheduler | [2023-08-21T05:37:40.607+0000] {scheduler_job_runner.py:414} INFO - 1 tasks up for execution:
 scheduler | <TaskInstance: spotify_dag.complete_spotify_etl scheduled__2021-06-09T00:00:00+00:00 [scheduled]>
 scheduler | [2023-08-21T05:37:40.607+0000] {scheduler_job_runner.py:479} INFO - DAG spotify_dag has 0/16 running and queued tasks
 scheduler | [2023-08-21T05:37:40.607+0000] {scheduler_job_runner.py:595} INFO - Setting the following tasks to queued state:
 scheduler | <TaskInstance: spotify_dag.complete_spotify_etl scheduled__2021-06-09T00:00:00+00:00 [scheduled]>
 scheduler | [2023-08-21T05:37:40.609+0000] {taskinstance.py:1441} WARNING - cannot record scheduled_duration for task complete_spoti
fy_etl because previous state change time has not been saved
 scheduler | [2023-08-21T05:37:40.609+0000] {scheduler_job_runner.py:638} INFO - Sending TaskInstanceKey(dag_id='spotify_dag', task_i
d='complete_spotify_etl', run_id='scheduled__2021-06-09T00:00:00+00:00', try_number=1, map_index=-1) to executor with priority 1 and
queue default
 scheduler | [2023-08-21T05:37:40.609+0000] {base_executor.py:144} INFO - Adding to queue: ['airflow', 'tasks', 'run', 'spotify_dag',
 'complete_spotify_etl', 'scheduled__2021-06-09T00:00:00+00:00', '--local', '--subdir', 'DAGS_FOLDER/spotify_dag.py']
 scheduler | [2023-08-21T05:37:40.615+0000] {sequential_executor.py:74} INFO - Executing command: ['airflow', 'tasks', 'run', 'spotif
y_dag', 'complete_spotify_etl', 'scheduled__2021-06-09T00:00:00+00:00', '--local', '--subdir', 'DAGS_FOLDER/spotify_dag.py']
standalone |
standalone | Airflow is ready
standalone | Login with username: admin  password: fHySf4y8uAmUMyHQ
standalone | Airflow Standalone is for development purposes only. Do not use this in production!
standalone |
 scheduler | [2023-08-21T05:37:41.563+0000] {dagbag.py:539} INFO - Filling up the DagBag from /home/ubuntu/airflow/spotify_dag/spotif
y_dag.py
 scheduler | [2023-08-21T05:37:42.424+0000] {example_python_operator.py:89} WARNING - The virtalenv_python example task requires virt
ualenv, please install it.
 scheduler | [2023-08-21T05:37:42.451+0000] {tutorial_taskflow_api_virtualenv.py:29} WARNING - The tutorial_taskflow_api_virtualenv e
xample DAG requires virtualenv, please install it.
 scheduler | [2023-08-21T05:37:42.502+0000] {example_kubernetes_executor.py:38} WARNING - The example_kubernetes_executor example DAG
 requires the kubernetes provider. Please install it with: pip install apache-airflow[cncf.kubernetes]
 scheduler | [2023-08-21T05:37:42.585+0000] {example_local_kubernetes_executor.py:39} WARNING - Could not import DAGs in example_loca
l_kubernetes_executor.py
```

And then we can start the airflow :



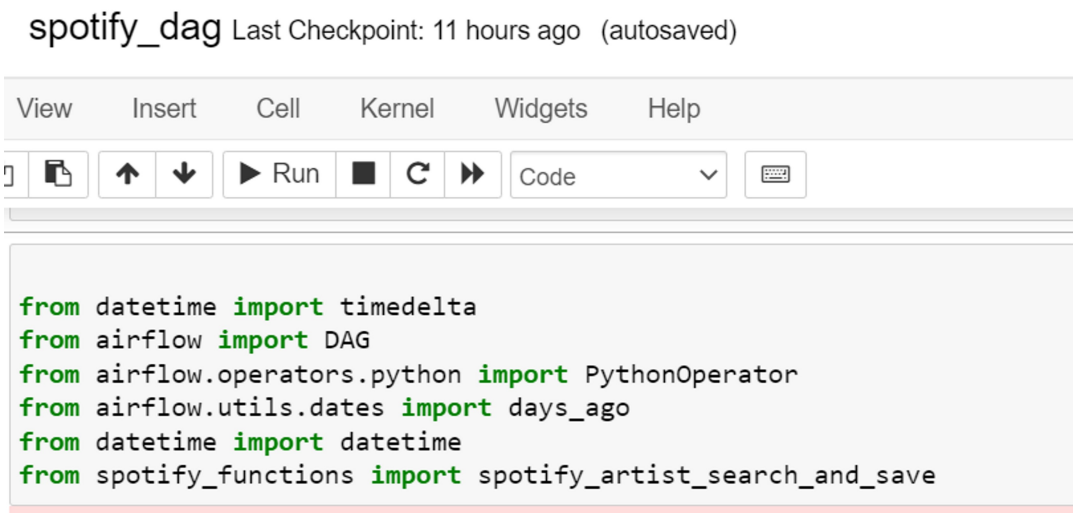
We can start the airflow website with that : **it runs on the 8080 port**



Remember if this website does not run then we can : do the **edit inbound rules.**

With Edit inbound rules we can get the website.

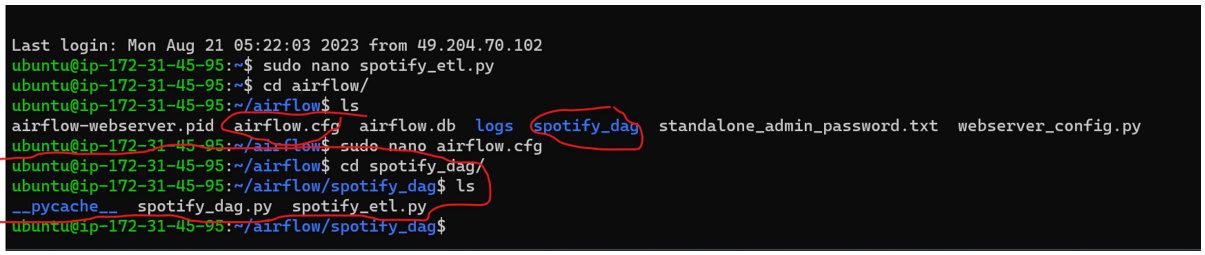
Step 5: In next step we can do is , we have to convert the function file to the **.py** module. Because from this source code we will be importing the data to other jupyter notebook.



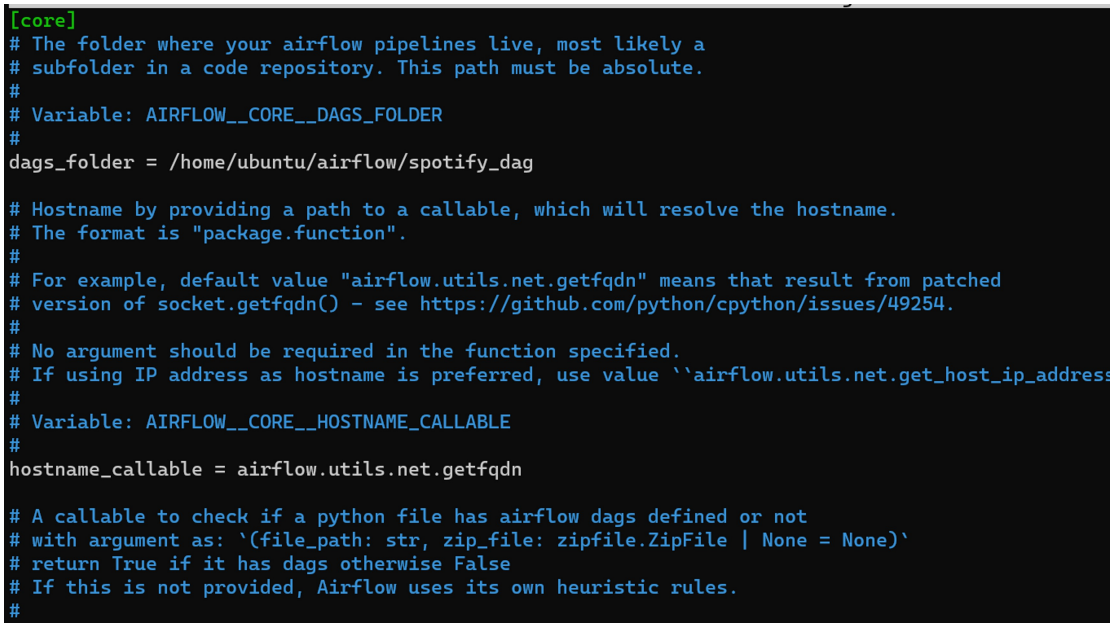

```
from spotify_functions import spotify_artist_search_and_save
```

Let's run the spotify DAG :

```
default_args = {
    'owner':'airflow',
    'depends_on_past' : False,
    'start_date' : datetime(2020,11,8),
    'email': ['airflow@example.com'],
    'email_on_failure':False,
    'email_on_retry':False,
    'retries':1,
    'retry_delay':timedelta(minutes = 1)
}

dag = DAG('spotify_dag',
          default_args=default_args,
          description='My first etl code')

run_etl = PythonOperator(
    task_id='complete_spotify_etl',
    python_callable=spotify_artist_search_and_save,
    dag = dag)

run_etl
```

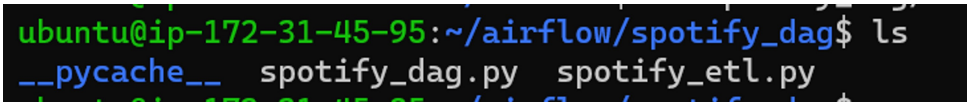


Inside airflow cfg :



So, now as we can see : there is a file name **airflow.cfg** : there the name of the folder should be same as outside folder : which is **spotify_dag** as we can see,

We have created two nano files inside the spotify dag as well :



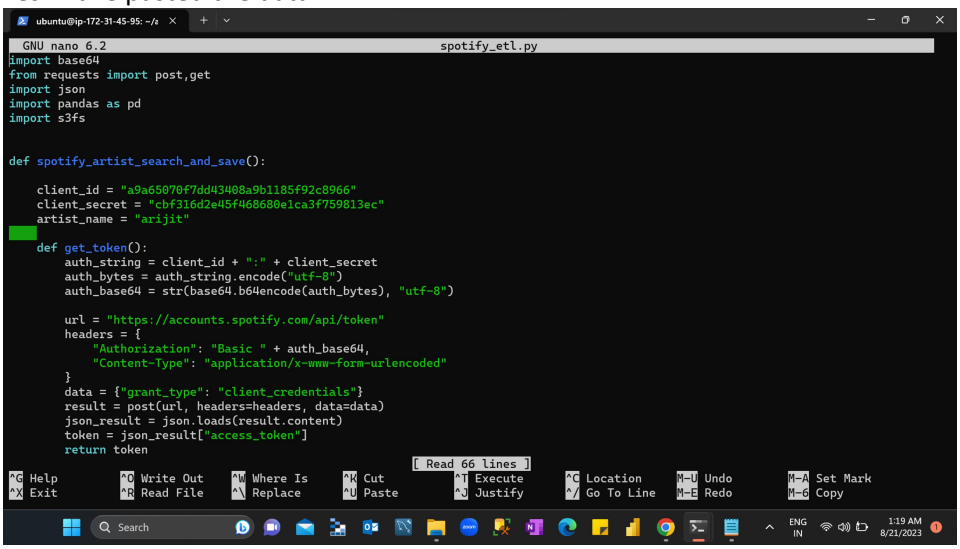
There we have copied both the files which we have created above : both the jupyter files.

Then we can run the DAG and get the data.

```python
default_args = {
    'owner': 'airflow',
    'depends_on_past': False,
    'start_date': datetime.now(),
    'email': ['airflow@example.com'],
    'email_on_failure': False,
    'email_on_retry': False,
    'retries': 1,
    'retry_delay': timedelta(minutes=1)
}

dag = DAG('spotify_dag',
          default_args=default_args,
          description='My first etl code',
          schedule_interval=timedelta(minutes=5))  # Run the DAG every 5 minutes

def spotify_artist_search_and_save():
    # Your ETL code here

run_etl = PythonOperator(
    task_id='complete_spotify_etl',
    python_callable=spotify_artist_search_and_save,
    dag=dag)
```

I have scheduled for every 5 minute , starting from datetime.now()

Like that in nano files I have pasted the data : -- >



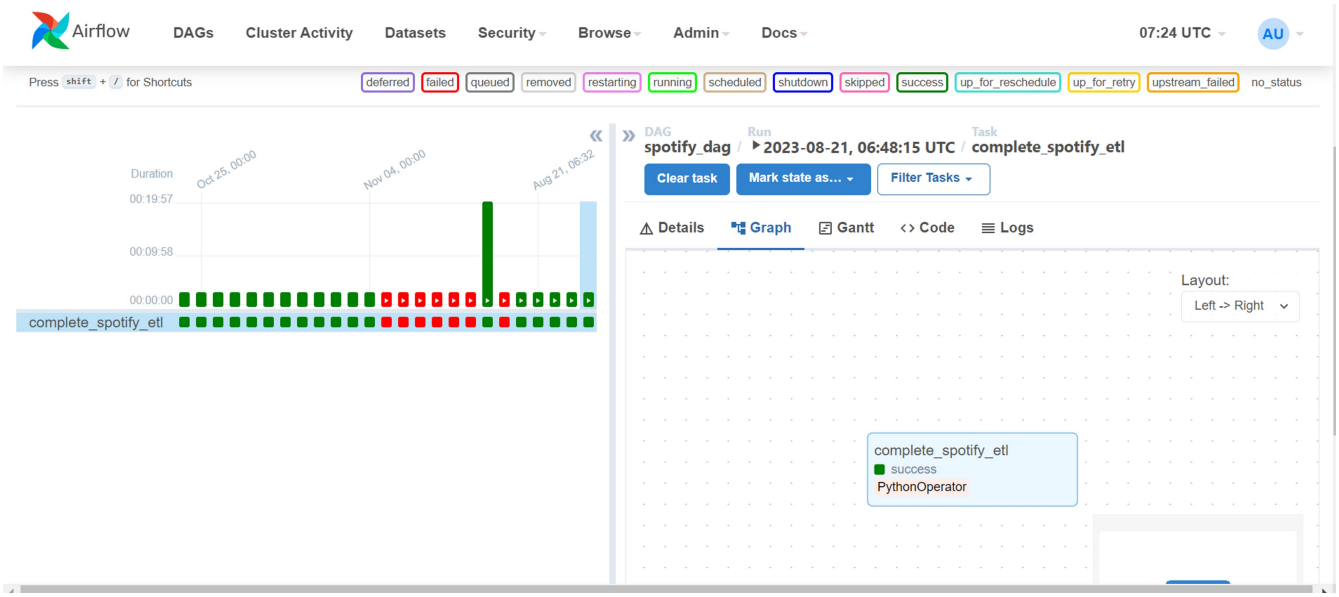
Airflow server running :

```
ubuntu@ip-172-31-45-95:~/airflow$ airflow standalone
standalone | Starting Airflow Standalone
standalone | Checking database is initialized
INFO  [alembic.runtime.migration] Context impl SQLiteImpl.
INFO  [alembic.runtime.migration] Will assume non-transactional DDL.
WARNI [unusual_prefix_de310399792f7c66d0607289cf7f70223c00f7ca_example_python_operator] The virtalenv_python example tas
k requires virtualenv, please install it.
WARNI [unusual_prefix_e1e1e746b8b87627f53519aca03f086299788fc2_tutorial_taskflow_api_virtualenv] The tutorial_taskflow_a
pi_virtualenv example DAG requires virtualenv, please install it.
WARNI [unusual_prefix_13903d1433e73a905598409829be4c61c9cdea5f_example_kubernetes_executor] The example_kubernetes_execu
tor example DAG requires the kubernetes provider. Please install it with: pip install apache-airflow[cncf.kubernetes]
WARNI [unusual_prefix_4c1c0063a36d033a56d4343efc723c3a45c1bd59_example_local_kubernetes_executor] Could not import DAGs
in example_local_kubernetes_executor.py
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-packages/airflow/example_dags/example_local_kubernetes_executor.py", line 37, in
<module>
    from kubernetes.client import models as k8s
ModuleNotFoundError: No module named 'kubernetes'
WARNI [unusual_prefix_4c1c0063a36d033a56d4343efc723c3a45c1bd59_example_local_kubernetes_executor] Install Kubernetes dep
endencies with: pip install apache-airflow[cncf.kubernetes]
WARNI [airflow.models.crypto] empty cryptography key - values will not be stored encrypted.
standalone | Database ready
/usr/local/lib/python3.10/dist-packages/flask_limiter/extension.py:293 UserWarning: Using the in-memory storage for trac
```

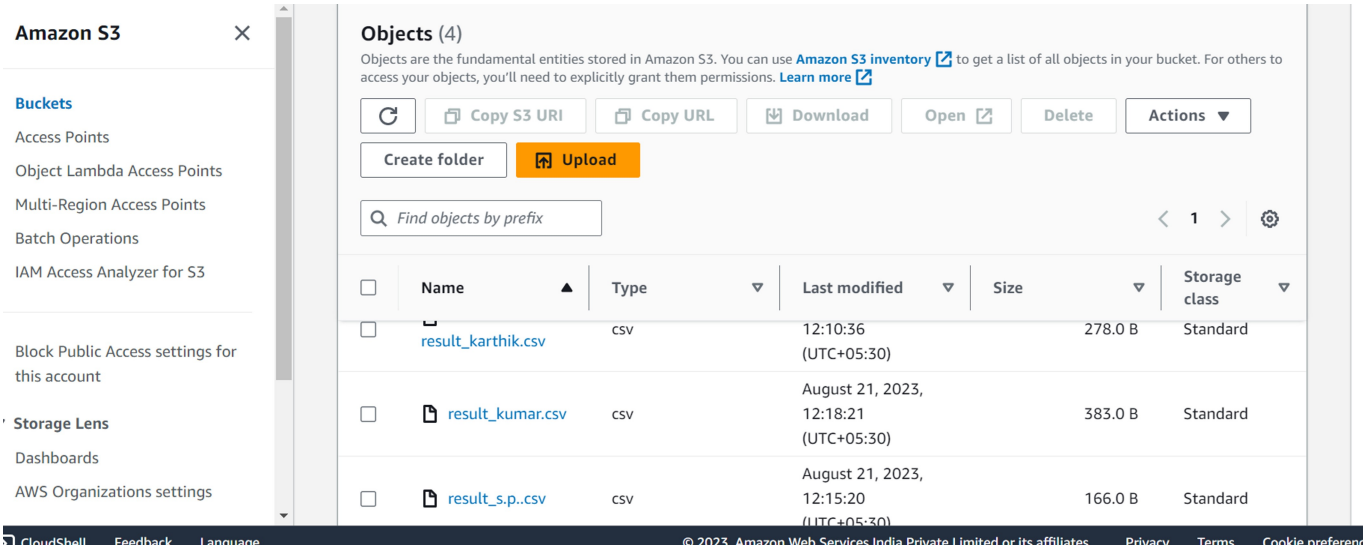
Note :

If I want to save my data for some other singer, then I just need to change the name of the particular person it will fetch the data from the web spotify, and you need to run the AIRFLOW, and you will be able to get the data directly to the S3 Bucket.

DAG status :



Let's check the bucket :



We have successfully received data from Spotify web api and stored it in the S3 bucket.

Reference :

- Twitter Data Pipeline using Airflow for Beginners | Data Engineering Project
- How to Use Spotify's API with Python | Write a Program to Display Artist, Tracks, and More
- https://developer.spotify.com/documentation/web-api/reference/search