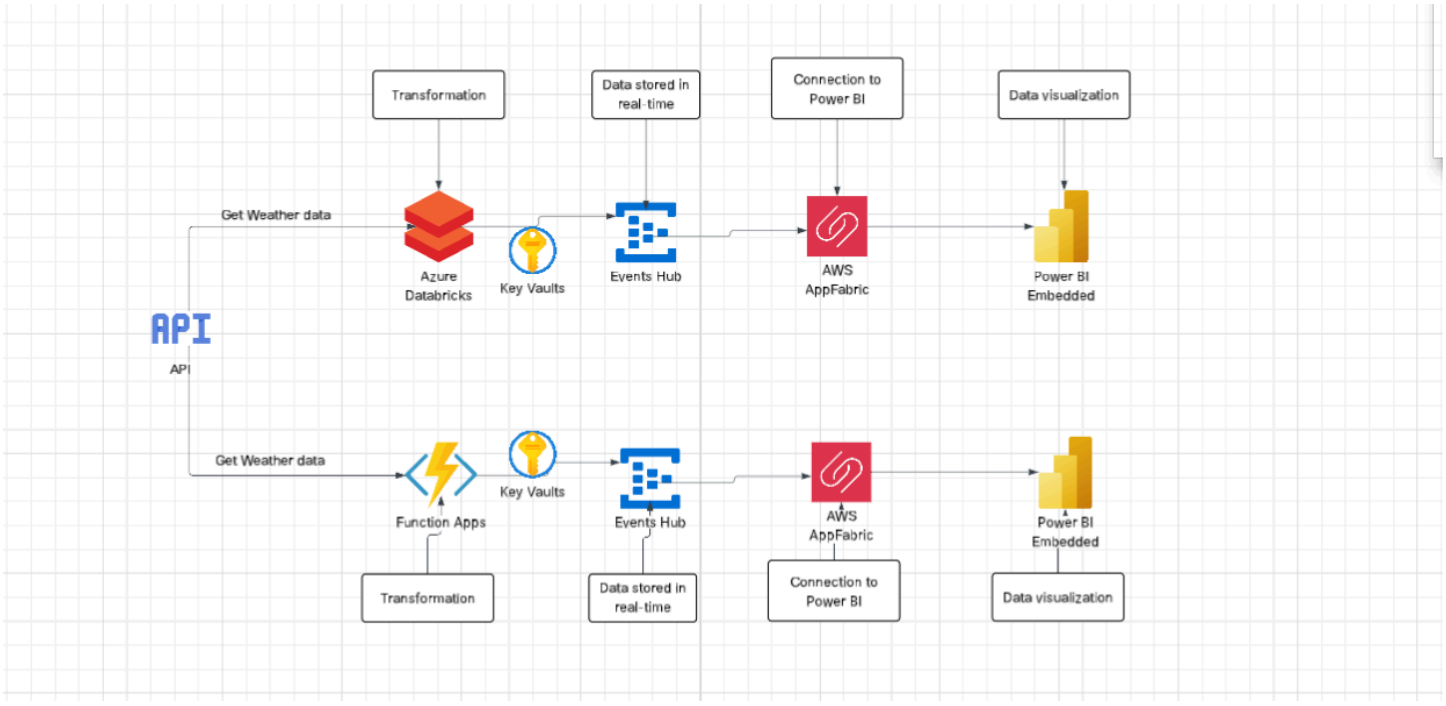
Real-time Weather Streaming Project on Azure by Diljot Singh

Git: diljotrandhawaa/Weather-Streaming-App-Azure

Workflow:



The goal of the Project:
Fetch the Weather Data for a city (Chennai, India) every 30 seconds, Perform transformations and select appropriate data to create a visual report in Power BI.

Tech used:

API (Weather API)
Azure Databricks and Databricks Clusters
Azure Key Vault
Azure Event hubs
Microsoft Fabric
Event house and Event Stream
Power BI

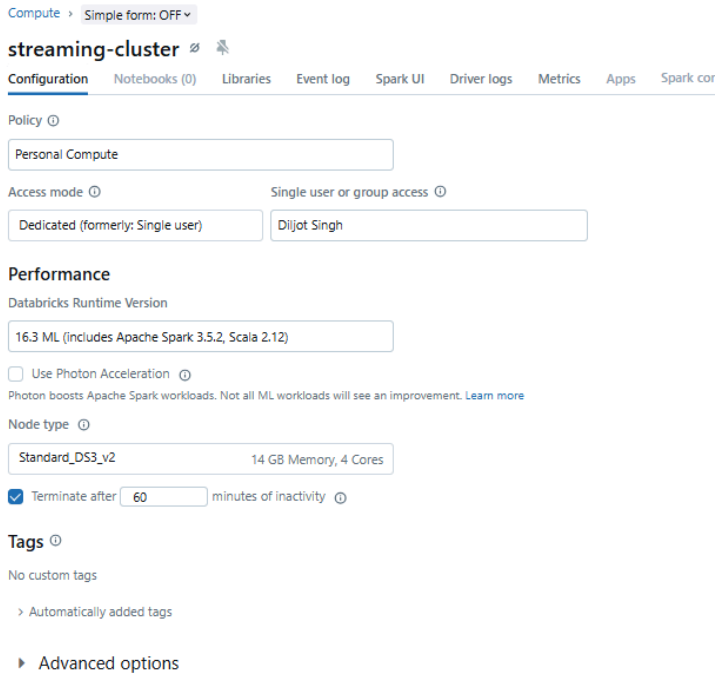
The code for Jupyter notebook and the Function app can be found in the git repository: diljotrandhawaa/Weather-Streaming-App-Azure

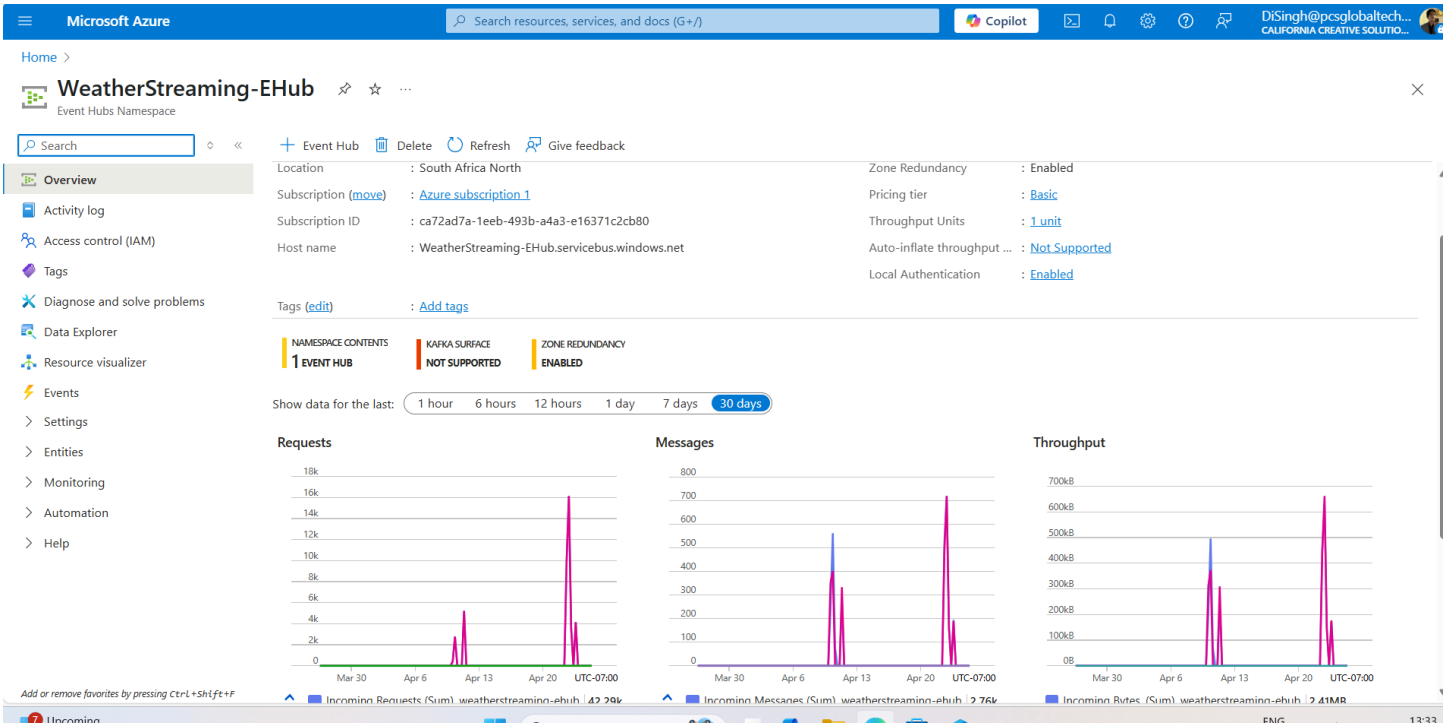
The project can be implemented in two ways:
1. Using Databricks's Jupyter notebook to fetch data from the API, or

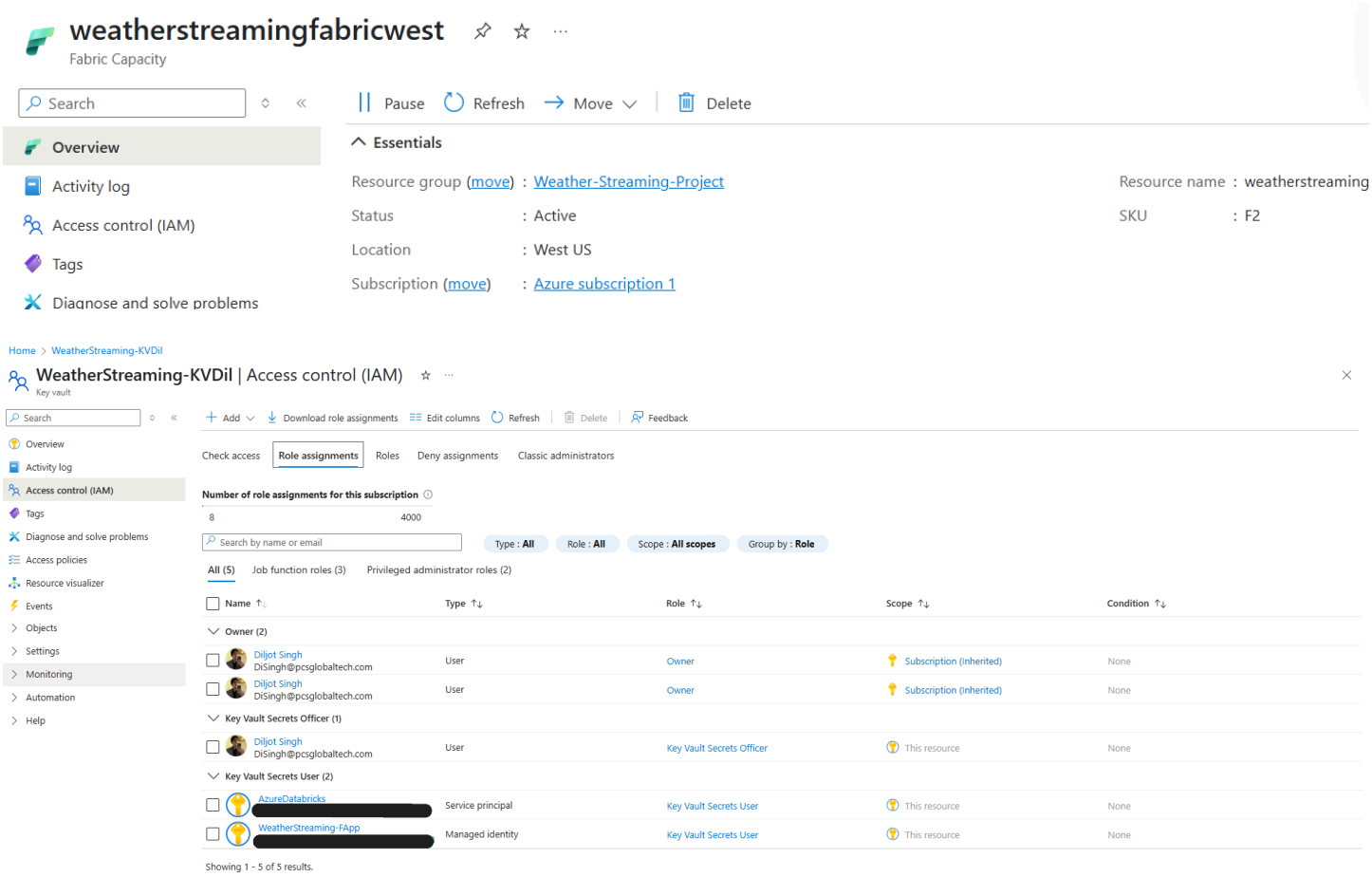
2. Using function app to fetch data from the API

Both ways are demonstrated and implemented in Azure

Before starting with implementation:
1. Create an Azure Databricks workspace and inside Databricks, create a Cluster.
2. Then create a Function App (for alternate implementation).
3. Next, create a Event Hub Namespace like below:
4. Create a Event Hub inside the Namespace.
5. Create a Microsoft Fabric capacity like below:
6. Create a Azure Key Vault and add Databricks and the Function App as Secrets Users.





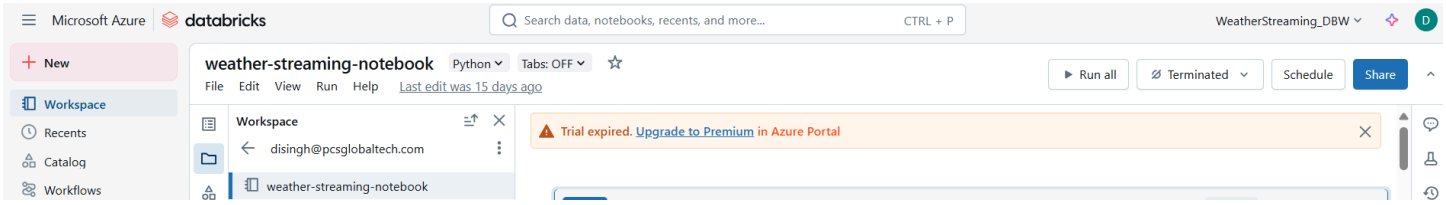


Steps:

Step 1:

Below is data fetch using Databricks:

a. A notebook is created called “weathers-streaming-notebook”



b. The code to fetch weather API data

```python
from azure.eventhub import EventHubProducerClient, EventData
import json
import requests
from datetime import datetime, timedelta

# Event Hub configuration
EVENT_HUB_NAME = "weatherstreamingnamehub"
eventhub_connection_string = dbutils.secrets.get(scope="key-vault-scope", key="eventhub-connectionstring")
weatherapikey = dbutils.secrets.get(scope="key-vault-scope", key="weatherapikey")

# Initialize the Event Hub producer
producer = EventHubProducerClient.from_connection_string(conn_str=eventhub_connection_string, eventhub_name=EVENT_HUB_NAME)

# Function to send events to Event Hub
def send_event(event):
    event_data_batch = producer.create_batch()
    event_data_batch.add(EventData(json.dumps(event)))
    producer.send_batch(event_data_batch)

# Function to handle the API response
def handle_response(response):
    if response.status_code == 200:
        return response.json()
    else:
        return f"Error: {response.status_code}, {response.text}"
```

c. Once the data is fetched, it is flattened to get the aspects we need from the data below is just a snippet of the code:

```python
# Flatten and merge the data
def flatten_data(current_weather, forecast_weather, alerts):
    location_data = current_weather.get("location", {})
    current = current_weather.get("current", {})
    condition = current.get("condition", {})
    air_quality = current.get("air_quality", {})
    forecast = forecast_weather.get("forecast", {}).get("forecast
    alert_list = alerts.get("alerts", {}).get("alert", [])

    flattened_data = {
        'name': location_data.get('name'),
        'region': location_data.get('region'),
        'country': location_data.get('country'),
        'lat': location_data.get('lat'),
        'lon': location_data.get('lon'),
        'localtime': location_data.get('localtime'),
        'temp_c': current.get('temp_c'),
        'is_day': current.get('is_day'),
        'condition_text': condition.get('text'),
        'condition_icon': condition.get('icon'),
        'wind_kph': current.get('wind_kph'),
        'wind_degree': current.get('wind_degree'),
        'wind_dir': current.get('wind_dir'),
        'pressure_in': current.get('pressure_in'),
        'precip_in': current.get('precip_in'),
        'humidity': current.get('humidity'),
        'cloud': current.get('cloud'),
        'feelslike_c': current.get('feelslike_c'),
        'uv': current.get('uv'),
        'air_quality': {
            'co': air_quality.get('co'),
            'no2': air_quality.get('no2'),
            'o3': air_quality.get('o3'),
            'so2': air_quality.get('so2'),
            'pm2_5': air_quality.get('pm2_5'),
            'pm10': air_quality.get('pm10'),
            'us-epa-index': air_quality.get('us-epa-index'),
            'gb-defra-index': air_quality.get('gb-defra-index')
        },
```

d. Once, we have the data we need in a flattened form, a function is created to make sure that the **API data is fetched every 30 seconds** from the source and gets written to the destination, the **destination is Event Hub** (using send_event function described above)

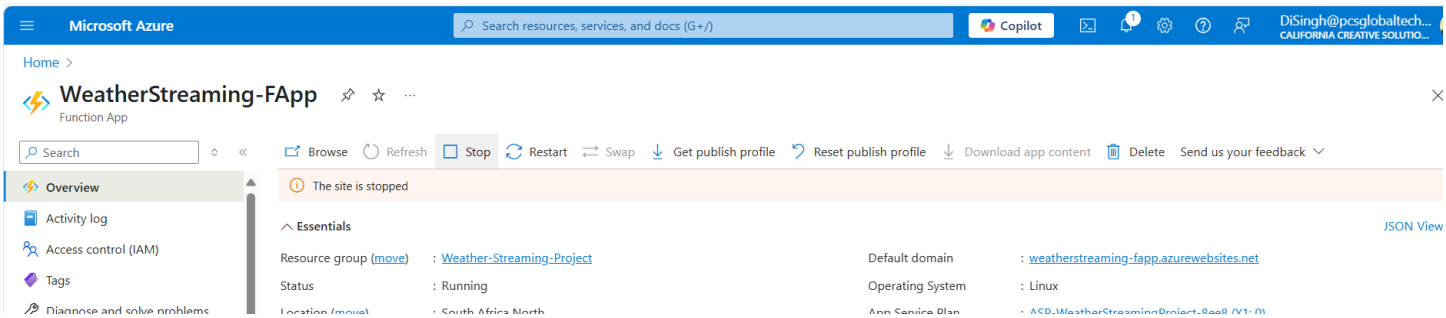
```python
# Main program
def process_batch(batch_df, batch_id):
    global last_sent_time
    try:
        # Get current time
        current_time = datetime.now()

        # Check if 30 seconds have passed since last event was sent
        if (current_time - last_sent_time).total_seconds() >= 30:
            # Fetch weather data
            weather_data = fetch_weather_data()

            # Send the weather data (current weather part)
            send_event(weather_data)

            # Update last sent time
            last_sent_time = current_time
            print(f'Event Sent at {last_sent_time}')
```

This completes the DataBricks section

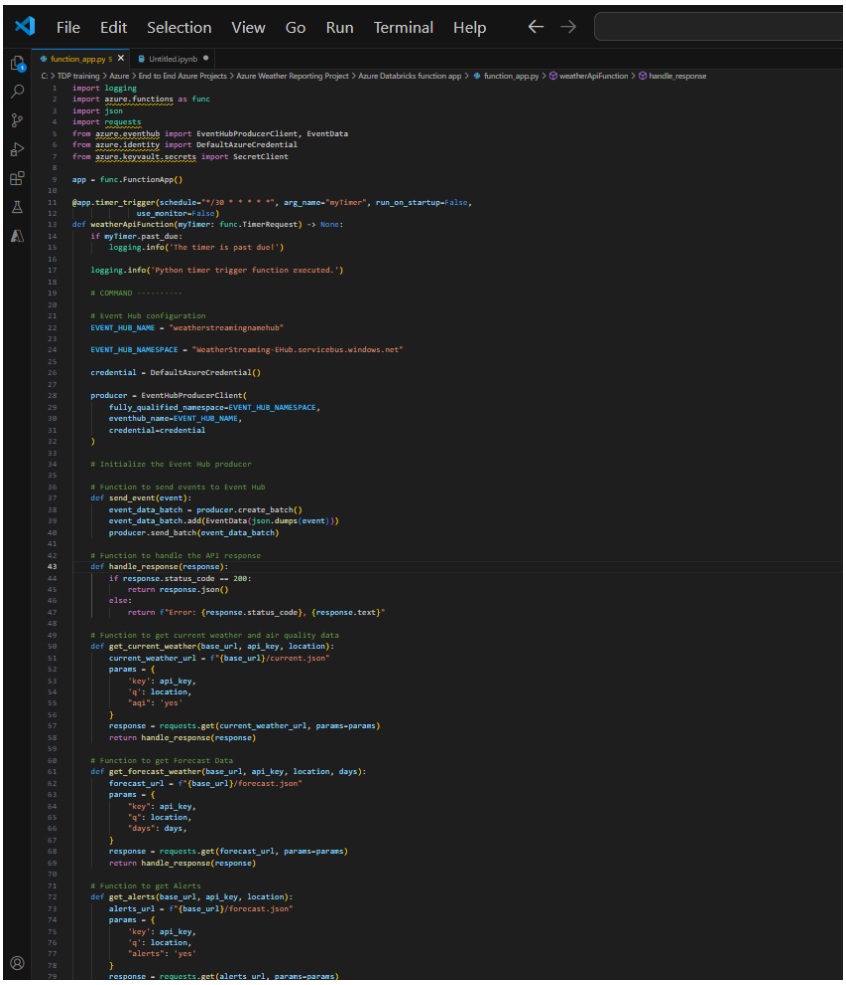
The same is done using Function App, either one can be used.

Below is data fetch using Function App:

a. A function app is created first in Azure



b. Then a Python Source file is written using Visual Studio Code, it has the same code as our Jupyter notebook.
Below is a snippet from the code:



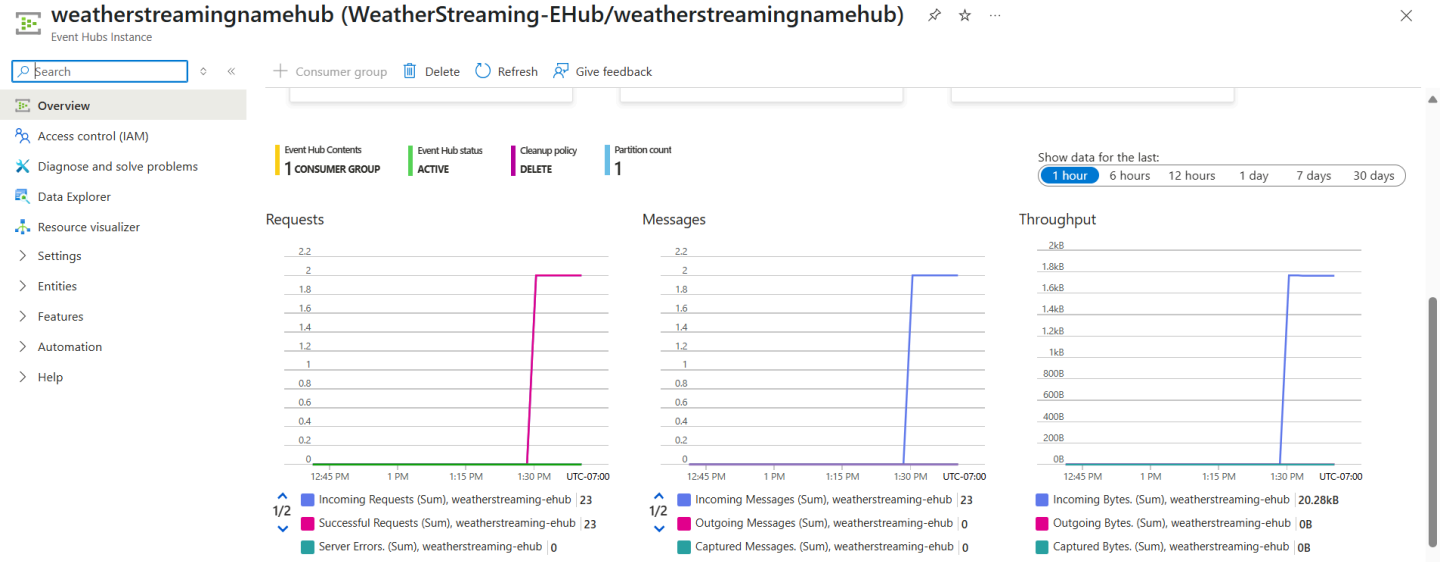
c. This Source code file is connected to the function app using Azure credentials. and The

code sends data to our Event Hub.

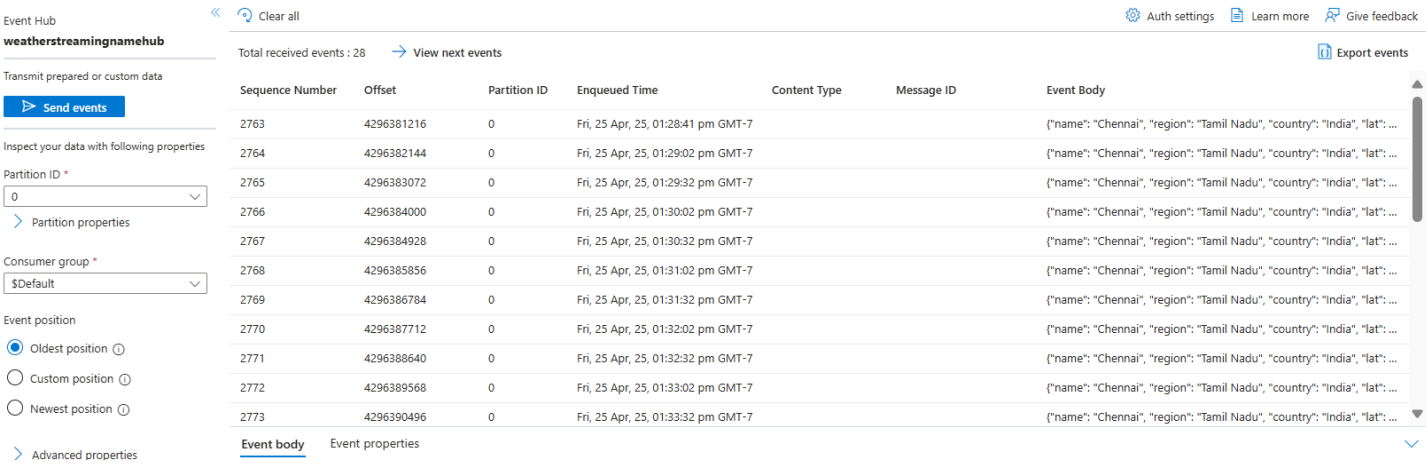
This sums up the Step 1.

Step 2:

Once the data is received in the Event hub



The data can be viewed in Data Explorer

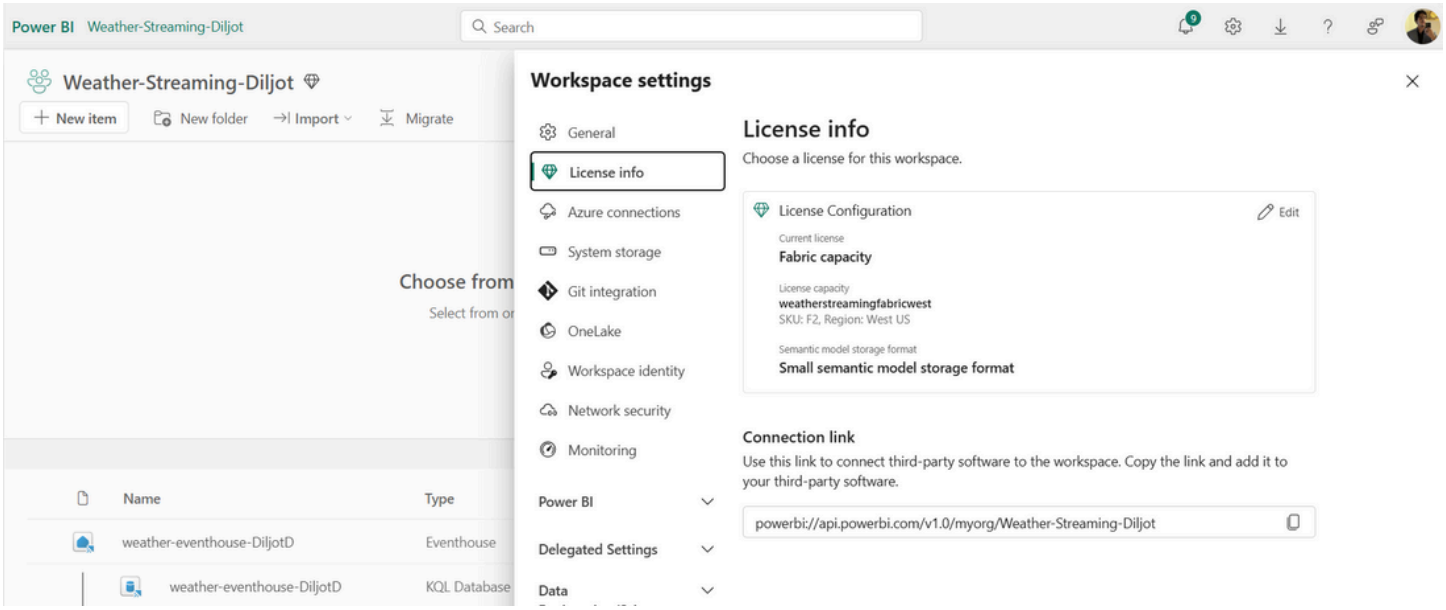


We are fetching data live for Chennai, India every 30 seconds.

Step 3:

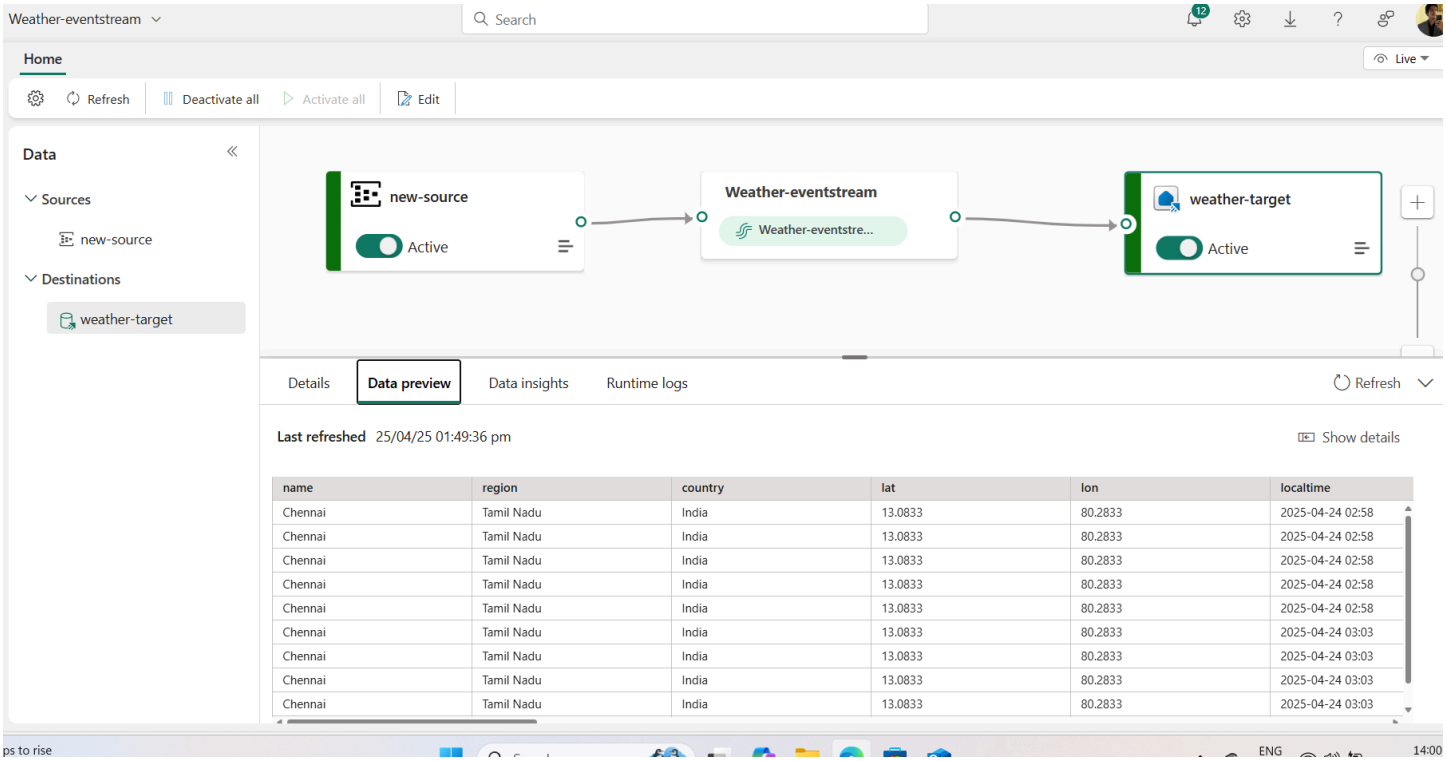
Now we have the data in the flattened form, we will export this data to Power BI using Fabric.

Go to Power BI and connect the Fabric capacity in Power BI
I have created a separate workspace and by editing the License Info, I have connected it to my Fabric capacity.



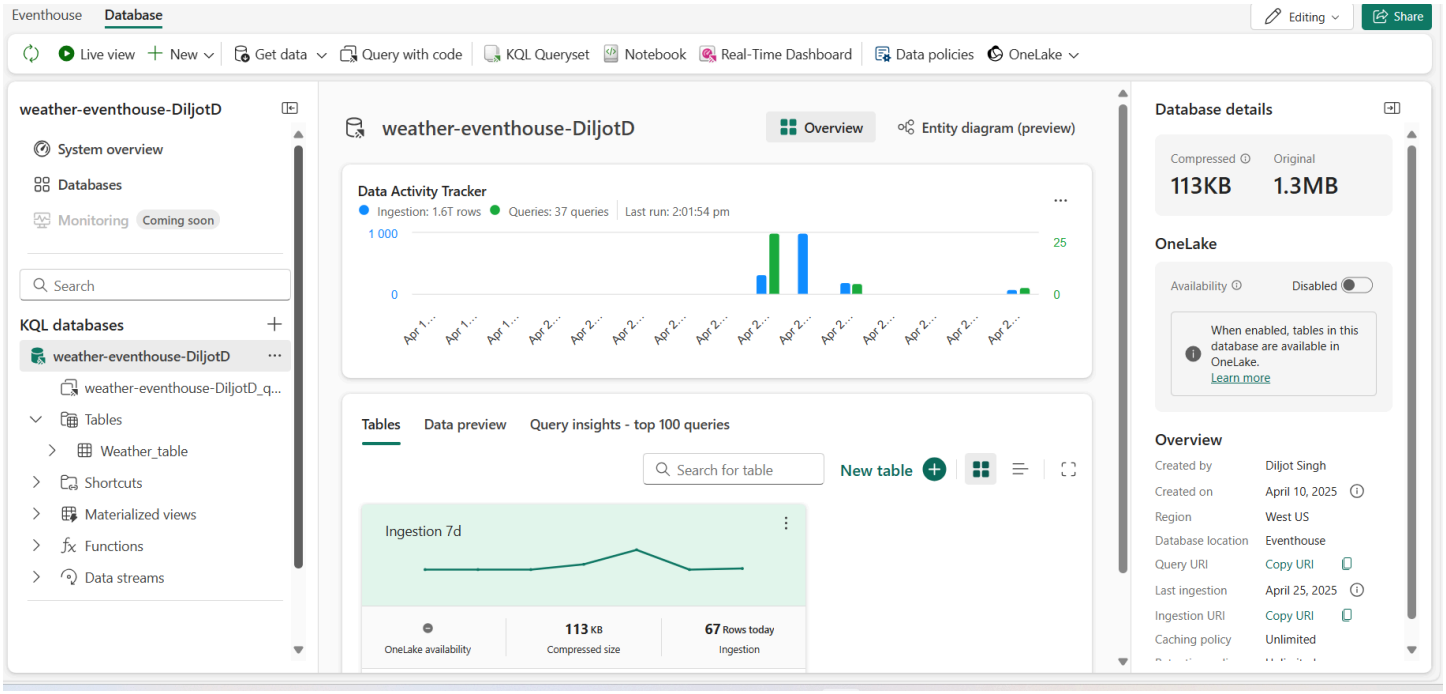
Step 4:

After connecting the fabric capacity to Power BI, we created an Eventhouse and an Eventstream to fetch data from Event Hub.
In the Eventstream, the source is set as Event Hub and the target is Eventhouse



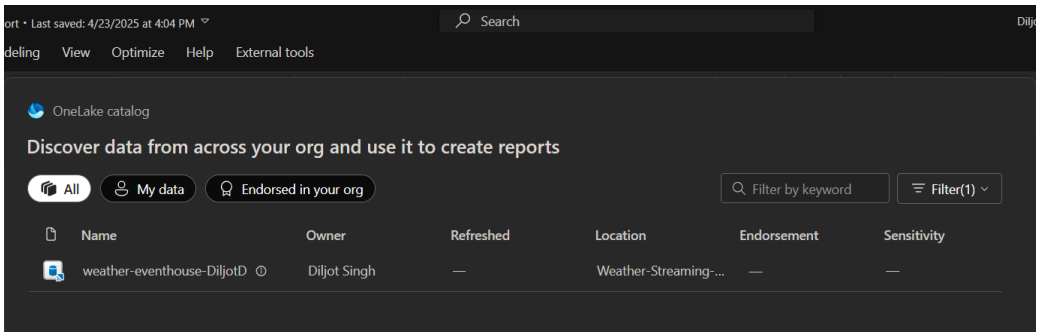
Step 5:

Next, a KQL database is created in Eventhouse to display and query data coming from EventHub



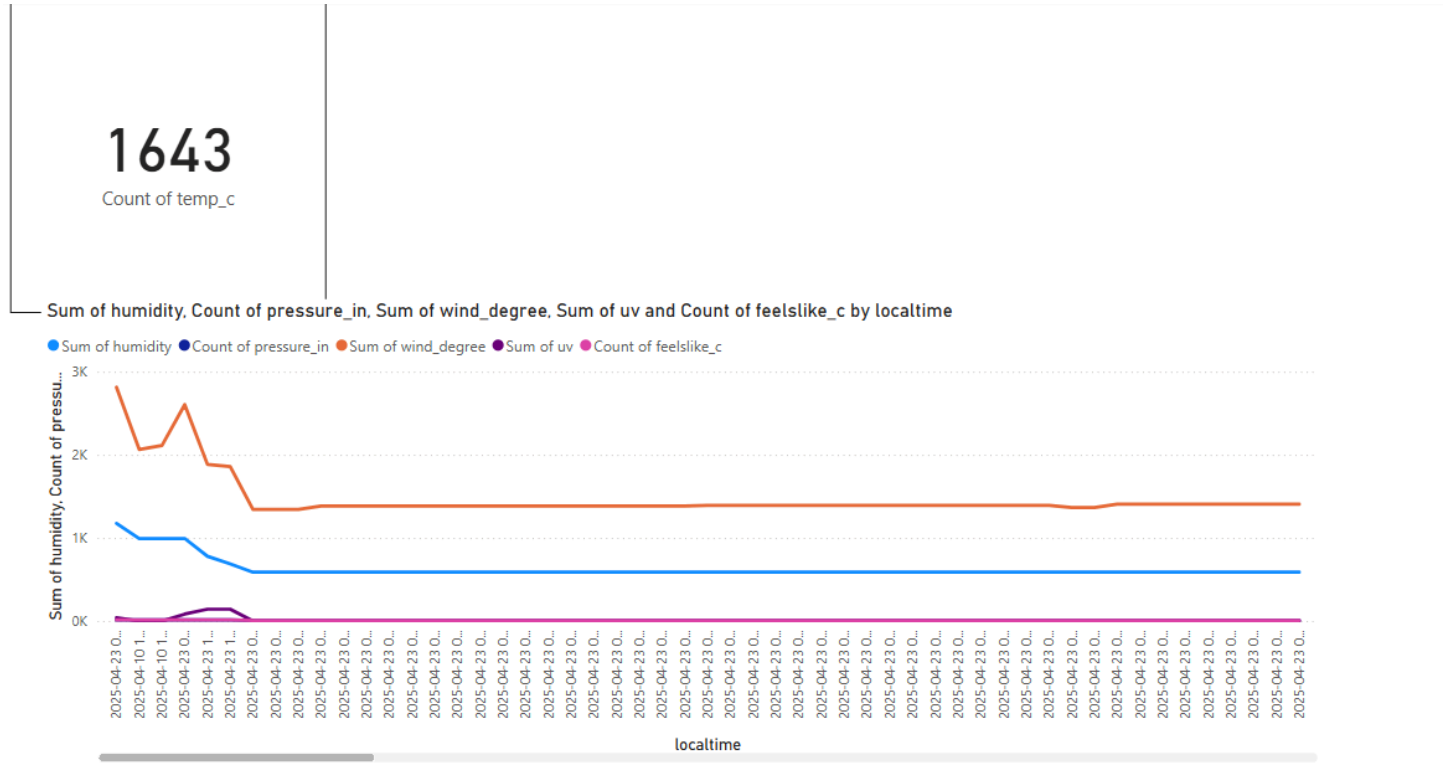
Step 6:

Now, we will create a report using the KQL database in Power BI.
Under “Get data”, we will select KQL database and import the table we created in KQL database.



Step 7:

Create extra Measures and add visualizations to the Report, a simple example is shown below:



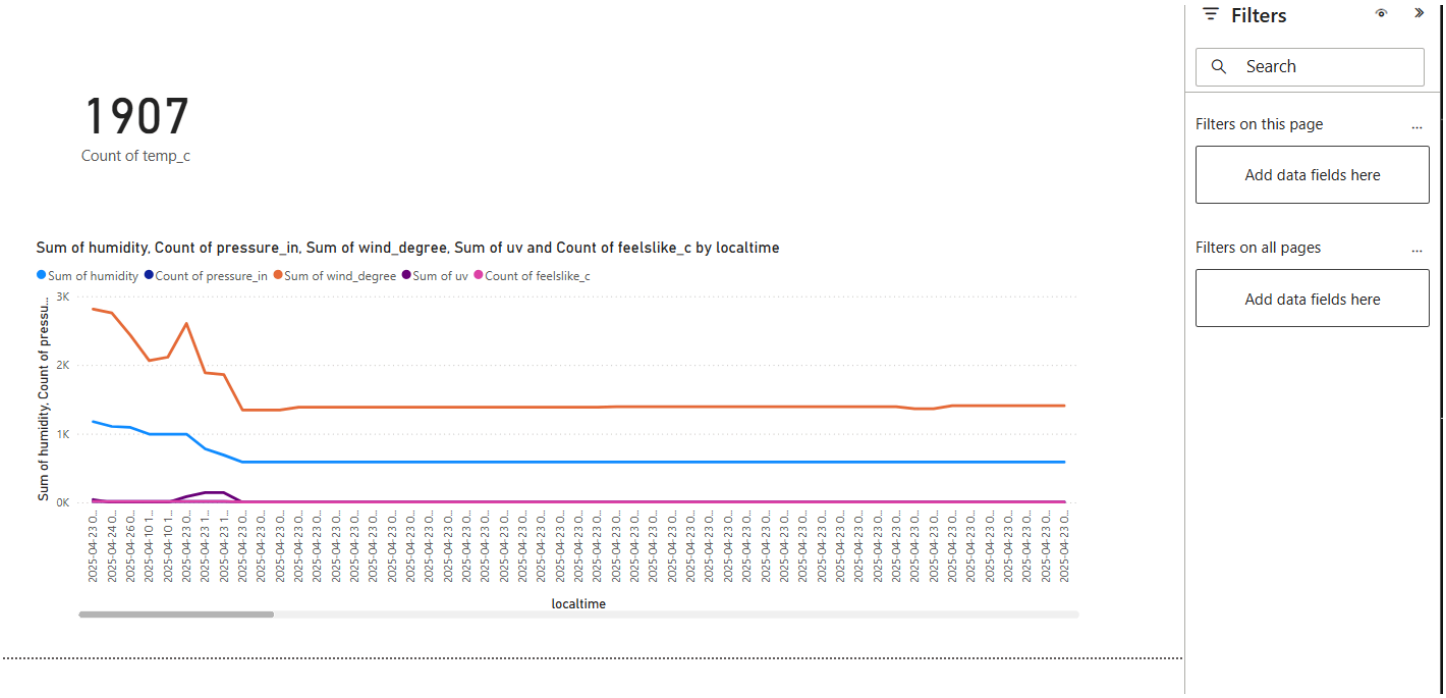
The Implementation is Done.

Example Run:

The project is Real-time, so it fetches the data every 30 seconds, send it to Event Hub, then to KQL database in Eventhouse, which then gets sent to Power BI.

The Power BI report is real-time as well, it updates every 30 seconds.

Below is the report at 14:10, April 25th, 2025 (Pacific time):
Number of records are 1907.



Below is the report at 14:15, 5 minutes later:
Number of records: 1918.