



**Cloud Computing
(SOFE 4630U)**

**Project Milestone 1: Data Ingestion Software (Cloud
Pub/Sub)**

Name	Student ID
Rohan Radadiya	100704614

Due Date: January 27, 2025

GitHub Link:

<https://github.com/rohanradadiya/Cloud-Computing-Project-MS-1/tree/main>

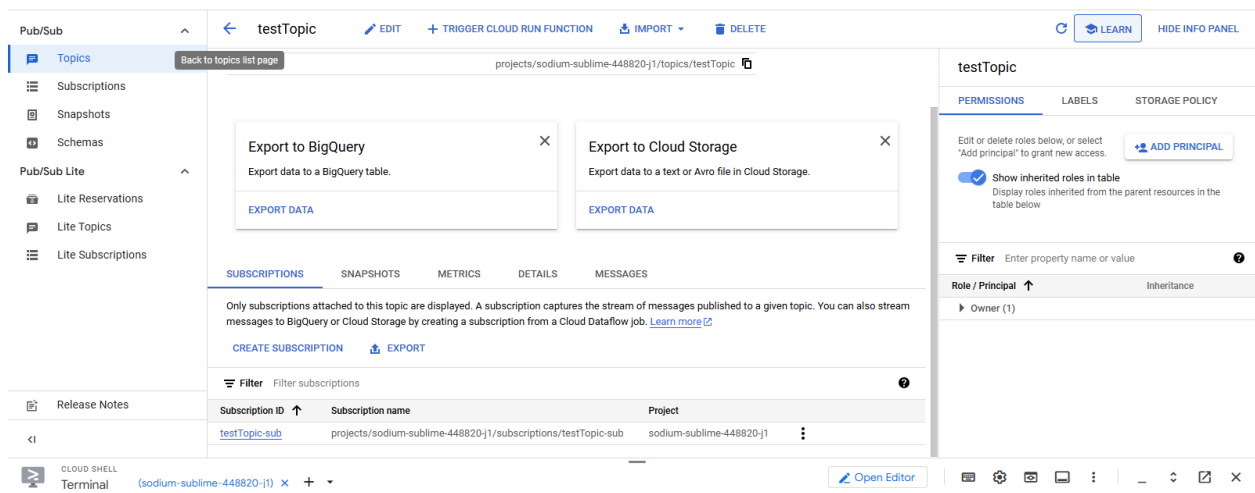
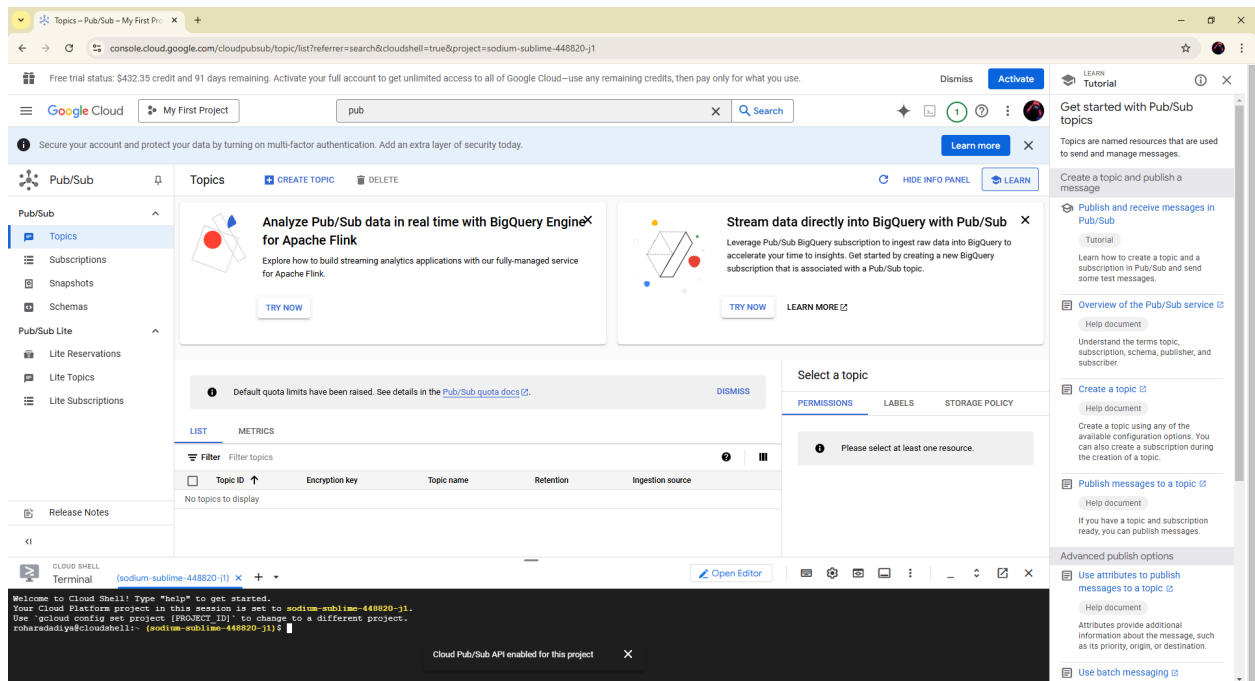
Video Link 1:

<https://youtu.be/HpQnY2xQqJs>

Video Link 2:

<https://youtu.be/dngTpA5jiko>

Screenshots:



testTopic was created:

accounts / Create service account

← Create service account

✓ Service account details

2 Grant this service account access to project (optional)

Grant this service account access to My First Project so that it has permission to complete specific actions on the resources in your project. [Learn more](#)

Role
Pub/Sub Publisher
Publish messages to a topic.

IAM condition (optional) ?
+ ADD IAM CONDITION

Role
Pub/Sub Subscriber
Consume messages from a subscription, attach subscriptions to a topic, and seek to a snapshot.

IAM condition (optional) ?
+ ADD IAM CONDITION

+ ADD ANOTHER ROLE

CONTINUE

Creating service accounts with the two roles:

Service accounts

+ CREATE SERVICE ACCOUNT DELETE MANAGE ACCESS REFRESH LEARN

Service accounts for project "My First Project"

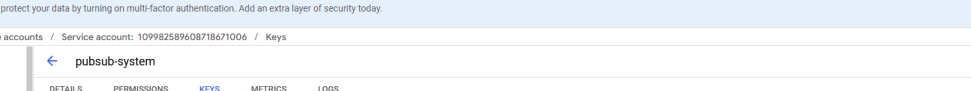
A service account represents a Google Cloud service identity, such as code running on Compute Engine VMs, App Engine apps, or systems running outside Google. [Learn more about service accounts.](#)

Organization policies can be used to secure service accounts and block risky service account features, such as automatic IAM Grants, key creation/upload, or the creation of service accounts entirely. [Learn more about service account organization policies.](#)

Filter Enter property name or value

<input type="checkbox"/>	Email	Status	Name ↑	Description	Key ID	Key creation date	OAuth 2 Client ID ?	Actions
<input type="checkbox"/>	pubsub-system@sodium-sublime-448820-11.iam.gserviceaccount.com	Enabled	pubsub-system		No keys		109982589608718671006	

Service account was created:



The screenshot shows the Google Cloud IAM & Admin console. The left sidebar lists navigation options: IAM, IAM, Principal Access Bound..., Organizations, Identity & Organization, Policy Troubleshooter, Policy Analyzer, Organization Policies, Service Accounts (selected), Workload Identity Federation, Workforce Identity Federation, Labels, Manage Resources, and Release Notes. The main content area is titled 'pubsub-system' and has tabs for DETAILS, PERMISSIONS, KEYS (selected), METRICS, and LOGS. A warning message states: 'Service account keys could pose a security risk if compromised. We recommend you avoid downloading service account keys and instead use the Workload Identity Federation. Learn more about the best way to authenticate service accounts on Google Cloud.' Below this, a message indicates that Google automatically disables service account keys detected in public repositories. A section titled 'Add a new key pair or upload a public key certificate from an existing key pair.' includes links for 'Block service account key creation using organization policies' and 'Learn more about setting organization policies for service accounts'. An 'ADD KEY' button is present. A table lists the existing keys:

Type	Status	Key	Creation date	Expiration date
Google-managed	Active	d34ff04d1e801c3309c15f693439a847bac14fa0	Jan 24, 2025	Dec 31, 9999

Key was created:

[illegible]

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Downloading urllib3-2.3.0-py3-none-any.whl (128 kB)
Downloading wrapt-1.17.2-cp312-cp312-win_amd64.whl (38 kB)
Downloading zipp-3.21.0-py3-none-any.whl (9.6 kB)
Installing collected packages: zipp, wrapt, urllib3, typing-extensions, pyyaml, protobuf, idna, grpcio, charset-normalizer, certifi, cachetools, rsa, requests, pyasn1-modules, proto-plus, importlib-metadata, googleapis-common-protos, deprecated, opentelemetry-api, grpcio-status, google-auth, opentelemetry-semantic-conventions, grpc-google-iam-v1, google-api-core, opentelemetry-sdk, google-cloud-pubsub
WARNING: The script normalizer.exe is installed in 'C:\Users\vrohan\AppData\Local\Programs\Python\Python312\Scripts\' which is not on PATH.
Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.
WARNING: The scripts pyasn1.exe, pyrsa-keygen.exe, pyrsa-pkcs8.exe, pyrsa-pubkey.exe, pyrsa-sign.exe and pyrsa-verify.exe are installed in 'C:\Users\vrohan\AppData\Local\Programs\Python\Python312\Scripts\' which is not on PATH.
Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.
Successfully installed cachetools-5.5.1 certifi-2024.12.14 charset-normalizer-3.4.1 deprecated-1.2.17 google-api-core-2.24.0 google-auth-2.38.0 google-cloud-pubsub-2.27.3 googleapis-common-protos-1.66.0 grpc-google-iam-v1-0.14.0 grpcio-1.70.0 grpcio-status-1.70.0 idna-3.10 importlib-metadata-8.5.0 opentelemetry-api-1.29.0 opentelemetry-sdk-1.29.0 opentelemetry-semantic-conventions-0.50b0 proto-plus-1.25.0 protobuf-5.29.3 pyasn1-0.6.1 pyasn1-modules-0.4.1 requests-2.32.3 rsa-4.9.0 typing-extensions-4.12.2 urllib3-2.3.0 or wrapt-1.17.2 zipp-3.21.0

[notice] A new release of pip is available: 24.2 -> 24.3.1
[notice] To update, run: python.exe -m pip install --upgrade pip
PS C:\Users\vrohan>

```

```

PS C:\Users\vrohano> pip install google-cloud-pubsub
Defaulting to user installation because normal site-packages is not writable
Collecting google-cloud-pubsub
  Downloading google_cloud_pubsub-2.27.3-py2.py3-none-any.whl.metadata (9.7 kB)
Collecting grpcio<2.0dev,>=1.51.3 (from google-cloud-pubsub)
  Downloading grpcio-1.78.0-py32-grpcio-win_amd64.whl.metadata (4.0 kB)
Collecting google-auth<3.0.0dev,>=2.14.1 (from google-cloud-pubsub)
  Downloading google_auth-2.38.0-py2.py3-none-any.whl.metadata (4.8 kB)
Collecting google-api-core<2.0,*>=2.1,*>=2.10,*>=2.2,*>=2.3,*>=2.4,*>=2.5,*>=2.6,*>=2.7,*>=2.8,*>=2.9,*>=3.0.0dev,>=1.34.0 (from google-api-core[grpc]>=2.0,*>=2.1,*>=2.10,*>=2.2,*>=2.3,*>=2.4,*>=2.5,*>=2.6,*>=2.7,*>=2.8,*>=2.9,*>=3.0.0dev,>=1.34.0)
  Downloading google_api_core-2.24.0-py3-none-any.whl.metadata (3.0 kB)
Collecting proto-plus<2.0dev,>=1.22.0 (from google-cloud-pubsub)
  Downloading proto-plus-1.22.0 (from google-cloud-pubsub)

```

```
>>
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> Get-Childitem
>>

Directory: C:\Users\rohan\Documents\Cloud Computing Milestone One

Mode                LastWriteTime         Length Name
----                -
-a----            2025-01-24   8:20 PM           1697 consumer.py
-a----            2025-01-24   8:30 PM           1328 producer.py
-a----            2025-01-24   8:18 PM           2392 sodium-sublime-448820-j1-d34ff34die80.json
```

```
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> pip install google-cloud-pubsub
>>
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: google-cloud-pubsub in c:\users\rohan\appdata\roaming\python\python312\site-packages (2.27.3)
Requirement already satisfied: grpcio<2.0.dev,>=1.51.3 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (1.70.0)
Requirement already satisfied: google-auth<3.0.dev,>=2.14.1 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (2.38.0)
Requirement already satisfied: google-api-core<2.0.*,>=2.1.*[!<2.0.0,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-api-core[grpc]<2.0.*,>=2.1.*,>=2.10.*,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] (google-cloud-pubsub) (2.34.0)
Requirement already satisfied: proto-plus<2.0.dev,>=1.22.0 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (1.25.0)
Requirement already satisfied: protobuf<4.21.0,>=4.21.1,<4.21.2,>=4.21.3,<4.21.4,>=4.21.5,<6.0.dev,>=3.20.2 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (5.29.3)
Requirement already satisfied: grpc-google-iam-v1<1.0.dev,>=0.12.4 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (0.14.0)
Requirement already satisfied: grpcio-status<1.33.2 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (1.70.0)
Requirement already satisfied: opentelemetry-api<1.27.0 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (1.29.0)
Requirement already satisfied: opentelemetry-sdk<1.27.0 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-cloud-pubsub) (1.29.0)
Requirement already satisfied: google-api-core[grpc]<2.0.*,>=2.1.*[!<2.0.0,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] (google-cloud-pubsub) (1.66.0)
google-api-core[grpc]<2.0.*,>=2.1.*[!<2.0.0,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] (google-cloud-pubsub) (2.32.3)
Requirement already satisfied: google-auth<3.0.dev,>=2.14.1 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from google-auth<3.0.dev,>=2.14.1] (google-cloud-pubsub) (6.5.4)
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ev,>=1.34.0] (google-api-core[grpc]<2.0.*,>=2.1.*[!<2.0.0,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] (google-cloud-pubsub) (2.3.0)
Requirement already satisfied: certifi<2017.4.17 in c:\users\rohan\appdata\roaming\python\python312\site-packages (from requests<3.0.0.dev0,>=2.18.0] (google-api-core<2.0.*,>=2.1.*[!<2.0.0,>=2.2.*,>=2.3.*,>=2.4.*,>=2.5.*,>=2.6.*,>=2.7.*,>=2.8.*,>=2.9.*,<3.0.dev,>=1.34.0] (google-cloud-pubsub) (2024.12.14)

[notice] A new release of pip is available: 24.2 -> 24.3.1
[notice] To update, run: python.exe -m pip install --upgrade pip
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> $env:GOOGLE_APPLICATION_CREDENTIALS="C:\Users\rohan\Documents\Cloud Computing Milestone One\sodium-sublime-448820-j1-d34ff34die80.json"
>>
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> python producer.py
>>
Published messages with ordering keys to projects/sodium-sublime-448820-j1/topics/testTopic.
Enter a value (String):Hello World!
Producing a record: b'Hello World!'
Enter a value (String):[]
```

The screenshot displays the Google Cloud console interface for a Pub/Sub subscription named 'testTopic-sub'. The 'MESSAGES' tab is active, showing a list of messages. A single message is visible, published at 'Jan 24, 2025, 8:42:48 PM' with the body 'Hello World!'. The message has an 'Ack' button next to it. The console also shows the subscription details, including the subscription name 'projects/sodium-sublime-448820-j1/subscriptions/testTopic-sub' and its state 'active'. The 'PERMISSIONS' tab is also visible, showing the roles assigned to the subscription.

Message was pulled (“Hello World!”):

```

19 topic_path = 'projects/{}/topics/{}'.format(project_id,topic_name);
20
21 print("Listening for messages on {subscription_path}..\n")
22
23 # A callback function for handling received messages
24 def callback(message: pubsub_v1.subscriber.message.Message) -> None:
25     # convert from bytes to string (deserialization)
26     message_data = str(message.data);
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PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

PS C:\Users\rohan> cd "C:\Users\rohan\Documents\Cloud Computing Milestone One"
>>
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> python producer.py
>>
Published messages with ordering keys to projects/sodium-sublime-448820-ji/topics/testTopic.
Enter a value (String):Hello Consumer
Producing a record: b'Hello Consumer'
Enter a value (String):

```

Ln 17, Col 42 Spaces: 4 UTF-8 LF Python 3.12.6 64-bit

```

15
16 # create a subscriber to the subscriber for the project using the subscription_id
17 subscriber = pubsub_v1.SubscriberClient()
18 subscription_path = subscriber.subscription_path(project_id, subscription_id)
19 topic_path = 'projects/{}/topics/{}'.format(project_id,topic_name);
20
21 print("Listening for messages on {subscription_path}..\n")
22
23 # A callback function for handling received messages
24 def callback(message: pubsub_v1.subscriber.message.Message) -> None:
25     # convert from bytes to string (deserialization)
26     message_data = str(message.data);
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PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

PS C:\Users\rohan> cd "C:\Users\rohan\Documents\Cloud Computing Milestone One"
>>
PS C:\Users\rohan\Documents\Cloud Computing Milestone One> python consumer.py
>>
Listening for messages on projects/sodium-sublime-448820-ji/subscriptions/testTopic-sub...
Consumed record with value: b'Hello World!'
Consumed record with value: b'Hello Consumer'
[]

```

Ln 17, Col 42 Spaces: 4 UTF-8 LF Python 3.12.6 64-bit

Producer/Consumer interaction.

```

File Edit Selection View Go Run Terminal Help
< -> Search
producer.py x consumer.py C:\...Cloud Computing Milestone One consumer.py C:\...CC Milestone1v2 x
C:\Users\rohan\Documents\Cloud Computing Milestone One> consumer.py
1 from google.cloud import pubsub_v1 # pip install google-cloud-pubsub #to install
2 import glob # for searching for json file
3 import json
4 import os
5
6 # Search the current directory for the JSON file (including the service account key)
7 # to set the GOOGLE_APPLICATION_CREDENTIALS environment variable.
8 files=glob.glob("*.json")
9 os.environ["GOOGLE_APPLICATION_CREDENTIALS"]=files[0];
10
11 # Set the project_id with your project ID
12 project_id="sodium-sublime-448820-ji";
13 topic_name = "smartMeter"; # change it for your topic name if needed
14 subscription_id = "smartMeter-sub"; # change it for your topic name if needed
15
16 # create a subscriber to the subscriber for the project using the subscription_id
17 subscriber = pubsub_v1.SubscriberClient()
18 subscription_path = subscriber.subscription_path(project_id, subscription_id)
19 topic_path = 'projects/{}/topics/{}'.format(project_id,topic_name);
20
21 print(f"Listening for messages on {subscription_path}..\n")
22
23 # A callback function for handling received messages
24 def callback(message: pubsub_v1.subscriber.message.Message) -> None:
25     # convert from bytes to dictionary (deserialization)
26     message_data = json.loads(message.data.decode('utf-8'));
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V2 files and edits.

```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

File "C:\Users\rohan\AppData\Roaming\Python\Python312\site-packages\google\auth\_default.py", line 719, in default
    raise exceptions.DefaultCredentialsError(CLOUD_SDK_MISSING_CREDENTIALS)
google.auth.exceptions.DefaultCredentialsError: Your default credentials were not found. To set up Application Default Credentials, see https://cloud.google.com/docs/authentication/external/set-up-adc for more information.
PS C:\Users\rohan\Documents\CC MilestoneV2> echo $env:GOOGLE_APPLICATION_CREDENTIALS
>>
PS C:\Users\rohan\Documents\CC MilestoneV2> $env:GOOGLE_APPLICATION_CREDENTIALS="C:\Users\rohan\Documents\CC MilestoneV2\sodium-sublime-448820-ji-d34ff34d1e80.json"
>>
PS C:\Users\rohan\Documents\CC MilestoneV2> python smartMeter.py
>>
Published message: {'device_id': 'device_34', 'measurement': 164, 'timestamp': 1737776838.8338573}
Published message: {'device_id': 'device_52', 'measurement': 176, 'timestamp': 1737776839.8402834}
Published message: {'device_id': 'device_29', 'measurement': 96, 'timestamp': 1737776840.84217}
Published message: {'device_id': 'device_46', 'measurement': 123, 'timestamp': 1737776841.8535373}
Published message: {'device_id': 'device_30', 'measurement': 92, 'timestamp': 1737776842.856663}
Published message: {'device_id': 'device_17', 'measurement': 66, 'timestamp': 1737776843.8585274}
Published message: {'device_id': 'device_53', 'measurement': 147, 'timestamp': 1737776844.8620982}
Published message: {'device_id': 'device_65', 'measurement': 115, 'timestamp': 1737776845.8641915}
Published message: {'device_id': 'device_33', 'measurement': 188, 'timestamp': 1737776846.8663294}
Published message: {'device_id': 'device_47', 'measurement': 121, 'timestamp': 1737776847.8679762}
PS C:\Users\rohan\Documents\CC MilestoneV2>

```

```

26 # Serialize message to JSON
27 message_json = json.dumps(measurement)

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

IndexError: list index out of range
PS C:\Users\rohan\Documents\CC MilestoneV2> python consumer.py
Traceback (most recent call last):
  File "C:\Users\rohan\Documents\CC MilestoneV2\consumer.py", line 12, in <module>
    raise FileNotFoundError("No JSON file found for the service account key in the current directory.")
FileNotFoundError: No JSON file found for the service account key in the current directory.
PS C:\Users\rohan\Documents\CC MilestoneV2> python consumer.py
Listening for messages on projects/sodium-sublime-448820-ji/subscriptions/smartMeter-sub..

Consumed record with value : {'device_id': 'device_34', 'measurement': 164, 'timestamp': 1737776838.8338573}
Consumed record with value : {'device_id': 'device_52', 'measurement': 176, 'timestamp': 1737776839.8402834}
Consumed record with value : {'device_id': 'device_29', 'measurement': 96, 'timestamp': 1737776840.84217}
Consumed record with value : {'device_id': 'device_46', 'measurement': 123, 'timestamp': 1737776841.8535373}
Consumed record with value : {'device_id': 'device_30', 'measurement': 92, 'timestamp': 1737776842.856663}
Consumed record with value : {'device_id': 'device_17', 'measurement': 66, 'timestamp': 1737776843.8585274}
Consumed record with value : {'device_id': 'device_53', 'measurement': 147, 'timestamp': 1737776844.8620982}
Consumed record with value : {'device_id': 'device_65', 'measurement': 115, 'timestamp': 1737776845.8641915}
Consumed record with value : {'device_id': 'device_33', 'measurement': 188, 'timestamp': 1737776846.8663294}
Consumed record with value : {'device_id': 'device_47', 'measurement': 121, 'timestamp': 1737776847.8679762}

```

V2 files, and the smartMeter.py and consumer.py files communicating as required.

Discussion:

1. What is EDA? What are its advantages and disadvantages?

EDA stands for “Exploratory Data Analysis”. It represents an approach in data analysis that has to do with summarizing and visualizing data to identify patterns and relationships. Statistics and graphs are also utilized to better understand the data’s structure and further analyze it. Some advantages of EDA are that it greatly helps with better understanding the data and identifying outliers or missing data as well. EDA also helps to make certain predictions of the data and the visualization tools make it easier to understand the data better and this also helps to communicate the data better to stakeholders. One disadvantage of EDA is that it can be very time-consuming. It can also be very difficult when dealing with large datasets, and there is usually a need for a deep understanding of the technology and tools to do this.

2. Cloud Pub/Sub has two types of subscriptions: push and pull. Describe them, showing the strengths and weaknesses of each based on potential applications.

A pull subscription has to do with subscribers requesting messages from the Pub/Sub server, and the subscriber is also able to control when and how often to pull the messages. Some scenarios when a pull subscription might be useful is when the messages need to be processed in batches rather than in real-time, and when subscribers need to pull the messages when they require, depending on the workloads. Some weaknesses may be that there may be high latency and more delays, and also an increased level of complexity.

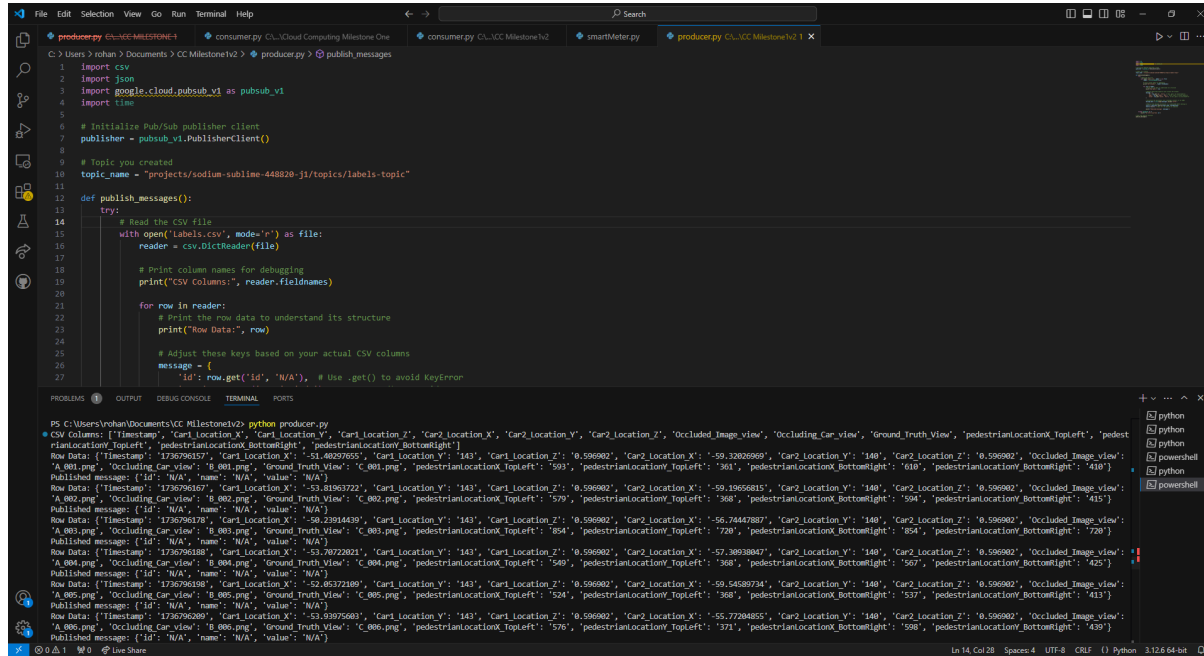
On the other hand, a push subscription has to do with the process that Pub/Sub pushes the messages automatically when the messages arrive, to an HTTP/HTTPS endpoint. Some strengths are that there is low latency, and the implementation is simpler, but some disadvantages are that there has to be an available endpoint to be able to receive the messages. The complexity can also be increased, and there may be scalability issues due to being able to handle an unexpected amount of messages at certain times. Some applications of this can be for real-time processing scenarios and also when there is communication between microservices in distributed systems.

3. When publishing a message into a topic, an ordering key can be specified. Using examples, describe the role and benefits of ordering keys.

To start, ordering keys in Pub/Sub is useful when applications require the messages to be processed in a specific order. With the use of ordering keys, companies, businesses, and other organizations are able to ensure consistency, simplify logic, etc. The way it works is that the publisher specifies an ordering key when sending a message to the topic. With the ordering key, the Pub/Sub makes sure that the messages with the same ordering key are delivered in the correct order that they were sent. If there is a scenario where there is a delivery fail, the Pub/Sub holds

certain messages with the same key until the previous messages are acknowledged/confirmed. An example of when ordering keys may be used is during financial transactions, delivery companies, and even IoT-related systems.

Design:



```

1 import csv
2 import json
3 import google.cloud.pubsub_v1 as pubsub_v1
4 import time
5
6 # Initialize Pub/Sub publisher client
7 publisher = pubsub_v1.PublisherClient()
8
9 # Topic you created
10 topic_name = "projects/codium-subline-448820-1/topics/labels-topic"
11
12 def publish_messages():
13     try:
14         # Read the CSV file
15         with open('labels.csv', mode='r') as file:
16             reader = csv.DictReader(file)
17
18             # Print column names for debugging
19             print("CSV Columns:", reader.fieldnames)
20
21             for row in reader:
22                 # Print the row data to understand its structure
23                 print("Row Data:", row)
24
25                 # Adjust these keys based on your actual CSV columns
26                 message = {
27                     'id': row.get('id', 'N/A'), # Use .get() to avoid KeyError

```

PROBLEMS | OUTPUT | DEBUG CONSOLE | TERMINAL | PORTS

```

PS C:\Users\rohan\Documents\CC MilestoneV2> python producer.py
CSV Columns: ['timestamp', 'Car1_location_X', 'Car1_location_Y', 'Car1_location_Z', 'Car2_location_X', 'Car2_location_Y', 'Car2_location_Z', 'Occluded_Image_view', 'Occluding_Car_view', 'Ground_Truth_View', 'pedestrianlocation_TopLeft', 'pedestrianlocation_TopRight', 'pedestrianlocation_BottomLeft', 'pedestrianlocation_BottomRight']
Row Data: {'timestamp': '1767996157', 'Car1_location_X': '-51.40297655', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-59.32026969', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 001.png', 'Occluding_Car_view': '0 001.png', 'Ground_Truth_View': 'C 001.png', 'pedestrianlocation_TopLeft': '593', 'pedestrianlocation_TopRight': '361', 'pedestrianlocation_BottomLeft': '610', 'pedestrianlocation_BottomRight': '410'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}
Row Data: {'timestamp': '1767996167', 'Car1_location_X': '-53.81963722', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-59.19656815', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 002.png', 'Occluding_Car_view': '0 002.png', 'Ground_Truth_View': 'C 002.png', 'pedestrianlocation_TopLeft': '579', 'pedestrianlocation_TopRight': '368', 'pedestrianlocation_BottomLeft': '594', 'pedestrianlocation_BottomRight': '415'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}
Row Data: {'timestamp': '1767996178', 'Car1_location_X': '-50.23934439', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-56.74447807', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 003.png', 'Occluding_Car_view': '0 003.png', 'Ground_Truth_View': 'C 003.png', 'pedestrianlocation_TopLeft': '854', 'pedestrianlocation_TopRight': '720', 'pedestrianlocation_BottomLeft': '854', 'pedestrianlocation_BottomRight': '720'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}
Row Data: {'timestamp': '1767996188', 'Car1_location_X': '-53.70722021', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-57.38938847', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 004.png', 'Occluding_Car_view': '0 004.png', 'Ground_Truth_View': 'C 004.png', 'pedestrianlocation_TopLeft': '549', 'pedestrianlocation_TopRight': '368', 'pedestrianlocation_BottomLeft': '567', 'pedestrianlocation_BottomRight': '425'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}
Row Data: {'timestamp': '1767996198', 'Car1_location_X': '-52.85372189', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-59.54589734', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 005.png', 'Occluding_Car_view': '0 005.png', 'Ground_Truth_View': 'C 005.png', 'pedestrianlocation_TopLeft': '524', 'pedestrianlocation_TopRight': '368', 'pedestrianlocation_BottomLeft': '537', 'pedestrianlocation_BottomRight': '413'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}
Row Data: {'timestamp': '1767996209', 'Car1_location_X': '-53.93975683', 'Car1_location_Y': '143', 'Car1_location_Z': '0.596902', 'Car2_location_X': '-55.77284855', 'Car2_location_Y': '140', 'Car2_location_Z': '0.596902', 'Occluded_Image_view': 'A 006.png', 'Occluding_Car_view': '0 006.png', 'Ground_Truth_View': 'C 006.png', 'pedestrianlocation_TopLeft': '570', 'pedestrianlocation_TopRight': '371', 'pedestrianlocation_BottomLeft': '598', 'pedestrianlocation_BottomRight': '439'}
Published message: {'id': 'N/A', 'name': 'N/A', 'value': 'N/A'}

```

Producer view:

[illegible]

Consumer view: There are many null fields in the consumed messages, but this may be due to the connectivity and functionality between the .csv file and the other corresponding project files.