DataEng S24: PubSub

[this lab activity references tutorials at cloud.google.com]

Make a copy of this document and use it to record your results. Store a PDF copy of the document in your git repository along with your code before submitting for this week. For your code, you create several publisher/receiver programs or you might make various features within one program. There is no one single correct way to do it. Regardless, store your code in your repository.

The goal for this week is to gain experience and knowledge of using an asynchronous data transport system (Google PubSub). Complete as many of the following exercises as you can. Proceed at a pace that allows you to learn and understand the use of PubSub with python.

Submit: use the in-class activity submission form which is linked from the Materials page on the class website. Submit by 10pm PT this Friday.

A. [MUST] PubSub Tutorial

1. Get your cloud.google.com account up and running
    a. Redeem your GCP coupon
    b. Login to your GCP console
    c. Create a new, separate VM instance
2. Complete this PubSub tutorial: link Note that the tutorial instructs you to destroy your PubSub topic, but you should not destroy your topic just yet. Destroy the topic after you finish the following parts of this in-class assignment.

B. [MUST] Create Sample Data

1. Get data from https://busdata.cs.pdx.edu/api/getBreadCrumbs for two Vehicle IDs from among those that have been assigned to you for the class project.
2. Save this data in a sample file (named bcsample.json)
3. Update the publisher python program that you created in the PubSub tutorial to read and parse your bcsample.json file and send its contents, one record at a time, to the my-topic PubSub topic that you created for the tutorial.
4. Use your receiver python program (from the tutorial) to consume your records.

C. [MUST] PubSub Monitoring

1. Review the PubSub Monitoring tutorial: link and work through the steps listed there. You might need to rerun your publisher and receiver programs multiple times to trigger enough activity to monitor your my-topic effectively.

D. [MUST] PubSub Storage

1. What happens if you run your receiver multiple times while only running the publisher once?
   Ans: In a PubSub configuration, multiple receiver instances are utilized alongside a single publisher instance. Each receiver independently attempts to consume messages from the same subscription. However, due to the publisher's one-time message transmission, there may not be a sufficient quantity of messages for every receiver instance. Consequently, message distribution may be uneven, with some recipients receiving messages while others do not.

2. Before the consumer runs, where might the data go, where might it be stored?
   Ans: The information provided by the publisher is temporarily stored within PubSub's managed infrastructure before being processed by the consumer in a PubSub configuration. This ensures that the information remains available and secure until it is successfully received by subscribers. To ensure reliable delivery, PubSub may buffer the data while it is being transmitted, especially in cases of network issues. Overall, PubSub effectively manages the internal transit and storage of data to ensure that subscribers receive messages safely and reliably.

3. Is there a way to determine how much data PubSub is storing for your topic? Do the PubSub monitoring tools help with this?
   Ans: The Google Cloud Operations Suite offers monitoring features through Google Cloud Pub/Sub, allowing us to track important metrics such as undelivered messages, message retention time, and message size using Cloud Monitoring. These metrics help us assess the data storage for each of our Pub/Sub subscriptions and topics.

4. Create a “topic_clean.py” receiver program that reads and discards all records for a given topic. This type of program can be very useful for debugging your project code.

Ans: This streamlined program is designed to efficiently read and address messages within a given subject. It can be utilized as necessary to delete posts from the topic. Additionally, unacknowledged messages can be removed by utilizing the "Purge Messages" option in the Console UI.

E. [SHOULD] Multiple Publishers

1. Clear all data from the topic (run your topic_clean.py program whenever you need to clear your topic)
2. Run two versions of your publisher concurrently, have each of them send all of your sample records. When finished, run your receiver once. Describe the results.

Ans: When multiple duplicate messages were repeatedly sent to the recipient, it resulted in an increase in the message count within the pipeline. This caused variations in message rates, especially evident when analyzing Google Cloud Platform's Pub/Sub metrics.

F. [SHOULD] Multiple Concurrent Publishers and Receivers

1. Clear all data from the topic
2. Update your publisher code to include a 250 msec sleep after each send of a message to the topic.
3. Run two or three concurrent publishers and two concurrent receivers all at the same time. Have your receivers redirect their output to separate files so that you can sort out the results more easily.
4. Describe the results.

F. [ASPIRE] Multiple Subscriptions

1. So far your receivers have all been competing with each other for data. Next, create a new subscription for each receiver so that each one receives a full copy of the data sent by the publisher. Parameterize your receiver so that you can specify a separate subscription for each receiver.
2. Rerun the multiple concurrent publishers/receivers test from the previous section. Assign each receiver to its own subscription.
3. Describe the results.