Homework 2 Writeup

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Introduction to code

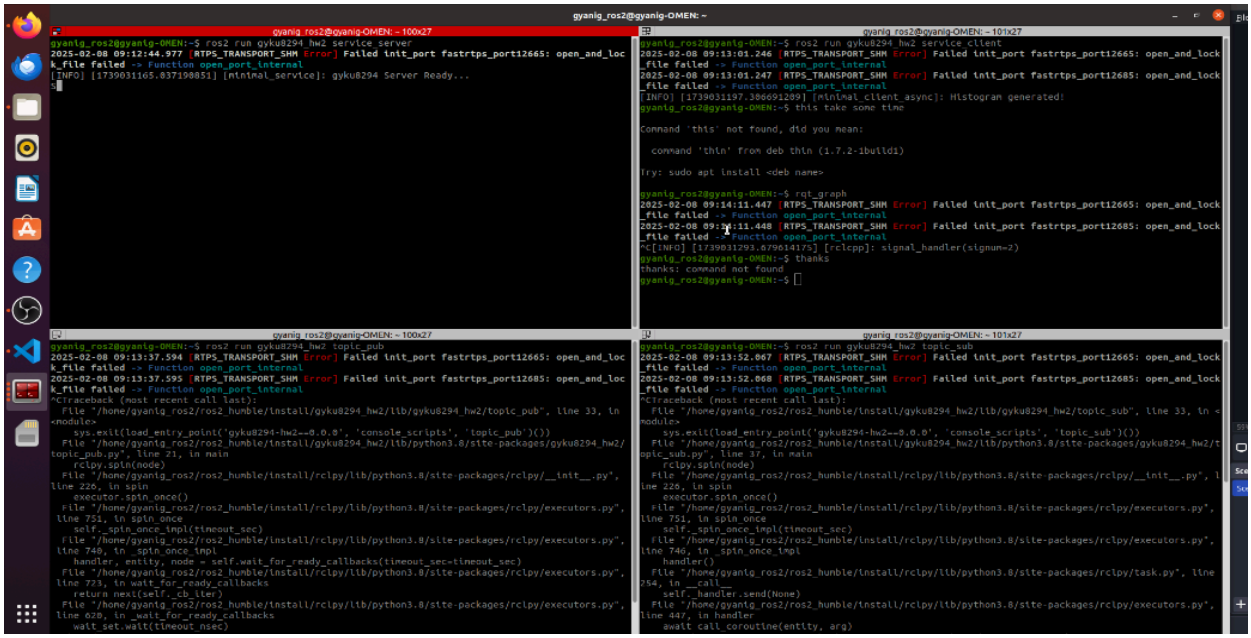
I have created the files as required in the assignment. Used ament python and cmake both compatibility for building the service package for ros2. Used just ament python for building the server/client/sub/publisher packages for ros2.

The file tree looks like this -

```
gyku8924_service
├── CMakeLists.txt
├── include
│   └── gyku8294_service
├── package.xml
├── src
└── srv
        └── Gyku8294Service.srv
```

```
Gyku8294_hw2
├── gyku8294_hw2
│   ├── client_member.py
│   ├── __init__.py
│   ├── server_member.py
│   ├── topic_pub.py
│   └── topic_sub.py
├── package.xml
├── resource
│   └── gyku8294_hw2
├── setup.cfg
├── setup.py
└── test
        ├── test_copyright.py
        ├── test_flake8.py
        └── test_pep257.py
```

3 directories, 12 files



The above is a snapshot of my terminals running the part b,c.

This server node will:

- Reverse the input string.
- Measure execution time.
- Return the reversed string and execution time.

The client will:

- Send a string request.
- Receive the reversed string and execution time.
- Measure round-trip latency for 400 calls.

The publisher will send messages containing the current time in the header.
The subscriber will measure the latency between publishing and reception.

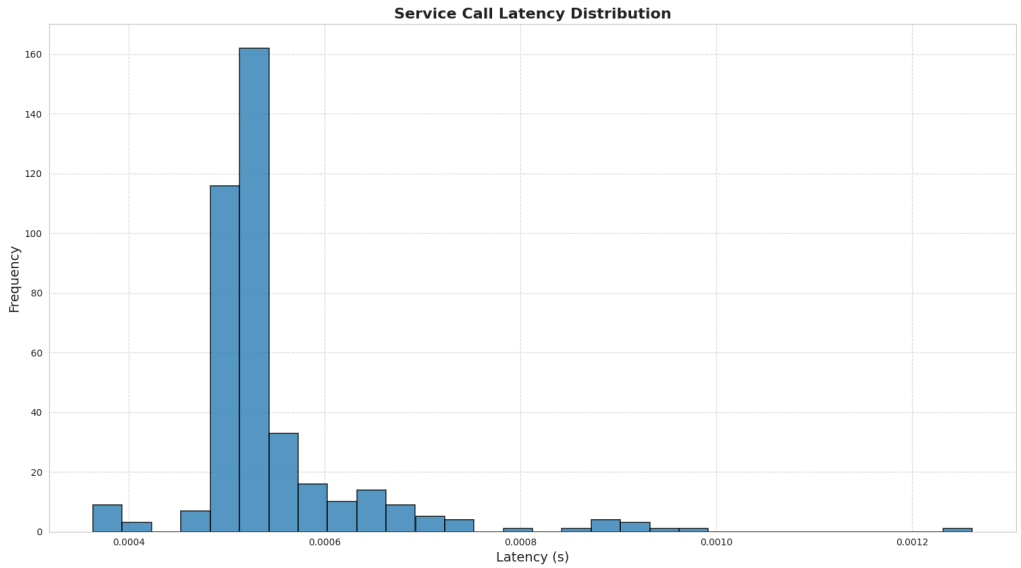
Explanation of Histograms

1. Service Call Latency Histogram

Low Latency, Narrow Histogram with peak at 160 Frequency@0.5ms timestamp

- This histogram shows the distribution of round-trip latencies for 400 service calls, excluding the processing time.

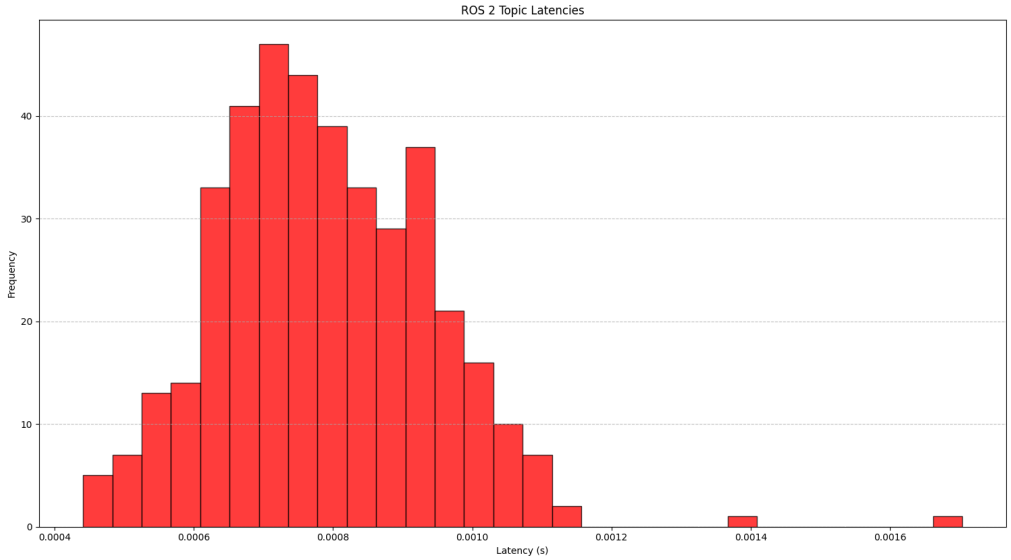
- The x-axis represents the network latency (i.e., the time taken to send a request and receive a response **minus** the service execution time).
- The y-axis represents the frequency of occurrences for each latency range.



2. Topic Communication Latency Histogram

Wide Distribution with a peak at ~45@0.7ms timestamp

- This histogram captures the time difference between when a message was **published** and when it was **received** over a ROS 2 topic.
- The x-axis represents the time delay in seconds (i.e., message transmission latency).
- The y-axis represents how frequently each latency value occurred.
- The histogram is centered around a low latency (e.g., **~0.4-0.8ms**), this indicates a **fast and reliable** ROS 2 communication system.



- A narrow distribution (i.e., all values close together) suggests **consistent** service performance.
- If messages arrive **quickly and consistently**, the histogram will be tightly clustered around a small value (e.g., a peak at **4-11ms**).

Compare Service vs. Topic Latencies

- **Service calls are usually slower** because they require a **request-response** mechanism.
- **Topics can be faster** because they use **asynchronous** communication.
- The **service latency histogram is wider** than the topic latency histogram, it confirms that service-based communication is more variable.

Hope it helped you understand better 🙂

Thank you for reading!