ROS2 exercise

ROS2 is a useful middleware for robotics systems. Please read the ros2 official documentation to fulfill the assignments, especially, the tutorials about publisher/subscriber and server/client.

Please use ROS2 foxy or later version for the assignments.

1. Communication between two robots

(*Hint: you can use two nodes to represent two robots*)

1.1 Message model

Now, you have two robots in your system. These two robots want to talk to each other with some predefined message formats. Please help them with following requirements:

- Every message should include
    - a unique ID of the message sender
    - a unique ID of the message receiver
    - a sending timestamp
- Every message should be classified as `request` or `response` type
    - for a `response` message, please also indicate the time slot between receive and sending.
- Every message should include a field called `value`. The data format of `value` should be `float`

1.2 Interaction

Based on your message model, the two robots (let's say A and B) finally know what they should talk to each other! Cheers! Now, let's implement the interaction follows the requirements:

- Robot A:

- sends a `request` type message to robot B every two seconds
- after sending, it waits for one second to get response from robot B
- Robot B:
    - once it receives a `request` type message from robot A, it calculates the square of the `value` in the message.
    - after the calculation, it sends a `response` type message to Robot A.
    - **Note**: Robot B is lazy, and its calculation time consumption varies in `(0, 1.5 seconds]`. Please implement it as well.

Please run your code to allow the two robots to communicate as shown above!

2. Action server and client mode

Now, please rethink about the above scenario and make it as a server/client mode with the reference example.

3. Real-time programming

A big update for ROS2 from ROS1 is that ROS finally supports real-time performance. Please read the document Understanding real-time programming and answer the questions:

- What is the difference between hard real-time and soft real-time? Please explain with some application examples.
- Please briefly describe that how to configure real-time settings in ROS2