Lab2

Introduction to ROS - Summer 2022 - Innopolis University
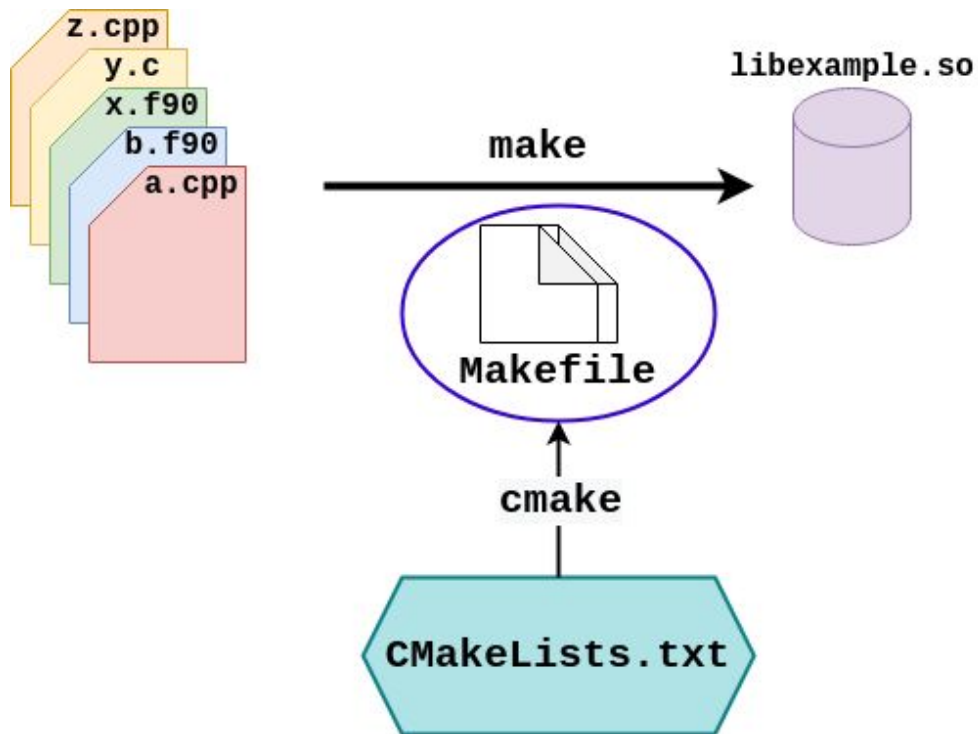
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CMake exercise ?

Recap on CMake list

- What is CMake?

CMake list

- Let's go inside the CMakeLists.txt in ROS

Source: http://wiki.ros.org/catkin/CMakeLists.txt
https://github.com/ros/catkin_tutorials/blob/master/create_package_pubsub/catkin_ws/src/beginner_tutorials/CMakeLists.txt

Package.xml

- What is package.xml file?

  - Just metadata
    - "This file defines properties about the package such as the package name, version numbers, authors, maintainers, and dependencies on other catkin packages"
  - Let's go inside the package.xml

Let us see ROS msg & srv Documentation

- https://docs.ros.org/en/api/std_msgs/html/index-msg.html
- http://docs.ros.org/en/api/std_srvs/html/index-msg.html
- http://docs.ros.org/en/api/geometry_msgs/html/index-msg.html

What is ROS launch?

- "is a tool for easily launching multiple ROS nodes"

Do you remember? Let us create a launch file! （Exercise 1）


```
# terminal 1:
$ roscore

# terminal 2
$ rosrun turtlesim turtlesim_node
```
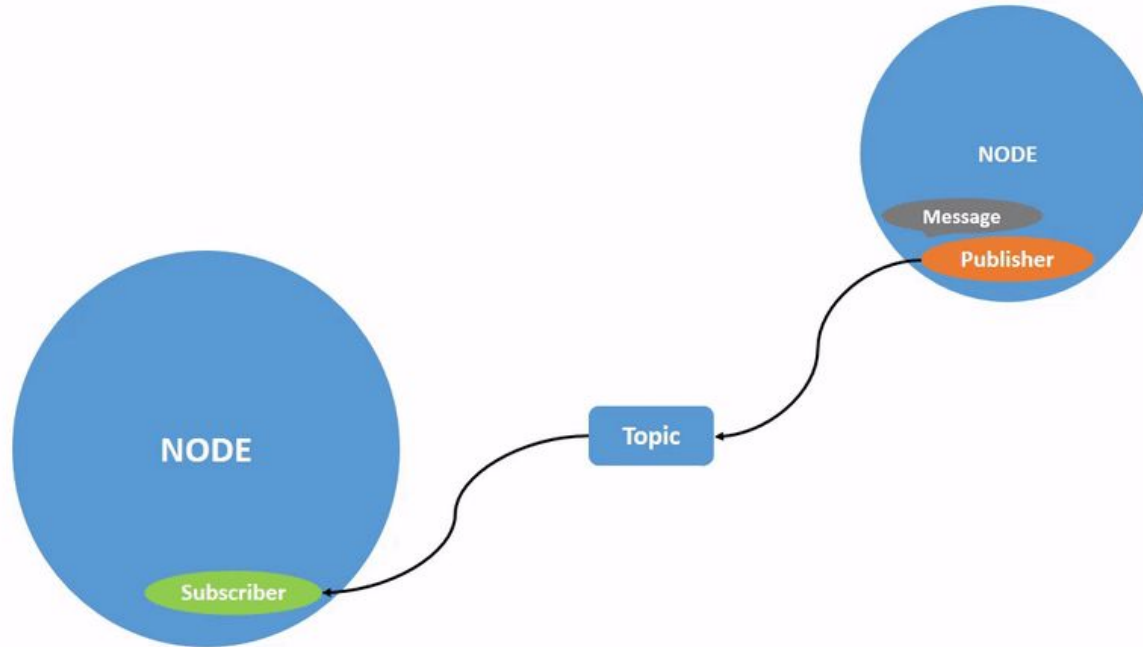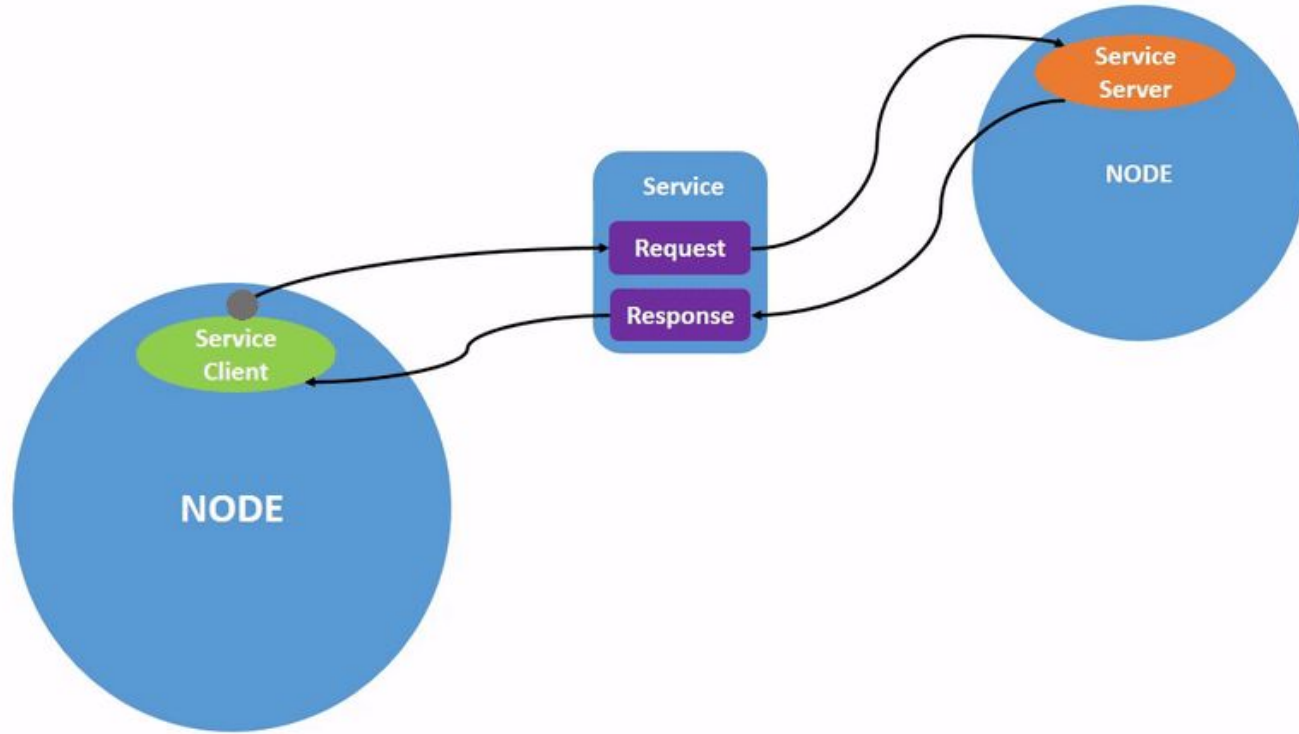


```
# terminal 5
$ rosrun teleop_twist_keyboard teleop_twist_keyboard.py
cmd_vel:=turtle1/cmd_vel
```

ROS architecture: Publisher & Subscriber

Source: https://docs.ros.org/en/foxy/Tutorials/Topics/Understanding-ROS2-Topics.html

ROS architecture: Service-client

What is the difference between them?

- Subscribe, process and publish at fixed rate
- Multiple subscriber to the same topic
- Request and response (Kinda private)

Source:
https://answers.ros.org/question/298612/what-is-the-difference-between-publisher-subscriber-vs-server-client/

ROS Publisher & Subscriber (Exercise 2)

- Create a publisher that publish a random point (x,y) (geometry_msgs/Pose2D)
- Create a subscriber that subscribe to that publisher
  - Use it as a client to teleport the turtle (turtle1/teleport_absolute) when listen to the publisher

ROS Publisher & Subscriber（Exercise 3）

- Let us create 3 publisher nodes to one topic (int32) with different rates (1,2,3)
- Each publisher generate random number
- Publisher and subscriber together
  - Subscribe to that topic and accumulate the numbers published in that topic
  - Then publish it to a final topic
- Let us use a custom message, that stores the result and the number of times the callbacks invoked

  - -> use argc and argv (atof from stdlib)
  - https://www.cplusplus.com/reference/cstdlib/atof/
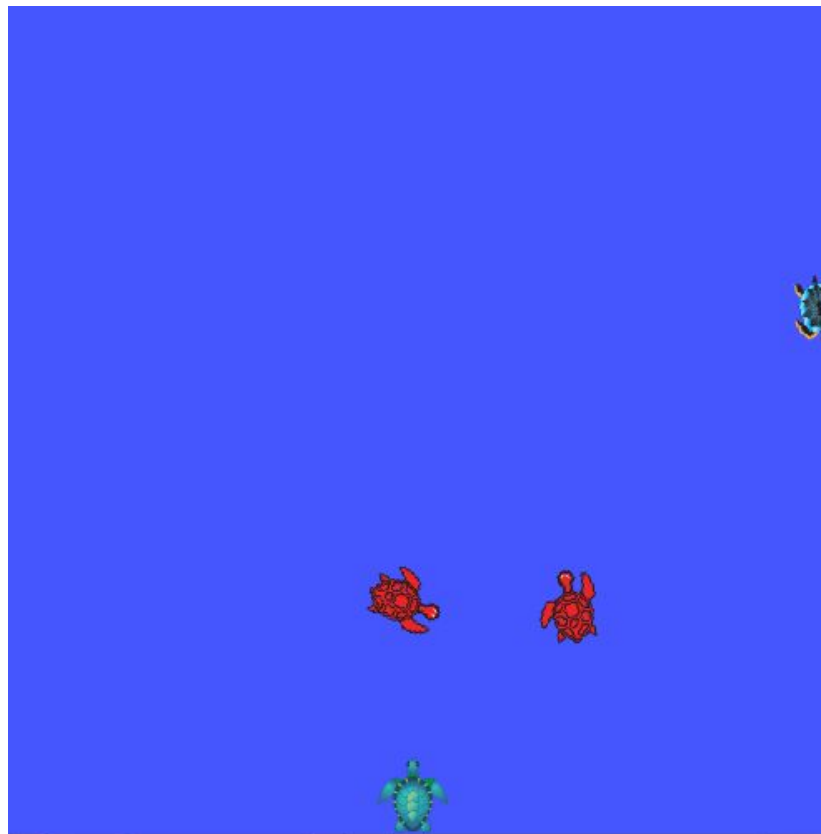
Break (5 minutes)

ROS Service & Client (Exercise 4)

- Let us create our own service and client (Start and stop -> Factory)
  - Just print!

ROS Service & Client (Exercise 5)

- Let us create our client to spawn a turtle!

Homework 1 (Check README.md)

Extra exercise 1

- Write ROS nodes as publisher and subscriber to perform service-like behavior for doubling a number.
- https://answers.ros.org/question/298612/what-is-the-difference-between-publisher-subscriber-vs-server-client/

Source: https://github.com/hany606/ROS2-GSoD-OSRF-Task-2021 (Entry task for OSRF)

Extra exercise 2

- Create a simple FSM
  - Create a custom message (4 numbers (float32): n1, n2, n3, res)
  - Input node (1st) take input (3 numbers) from the command line and publish them to one topic with the custom message (3 numbers and res=0)
  - Second node subscribes to that topic, then with each update, it needs to wait 1 second. Then adds these numbers together and publish the result to another topic.
  - Third node subscribes to that topic from the second node. It adds the result to the first number then multiply by the second number then divide by the third number.

Continue Extra exercise 2
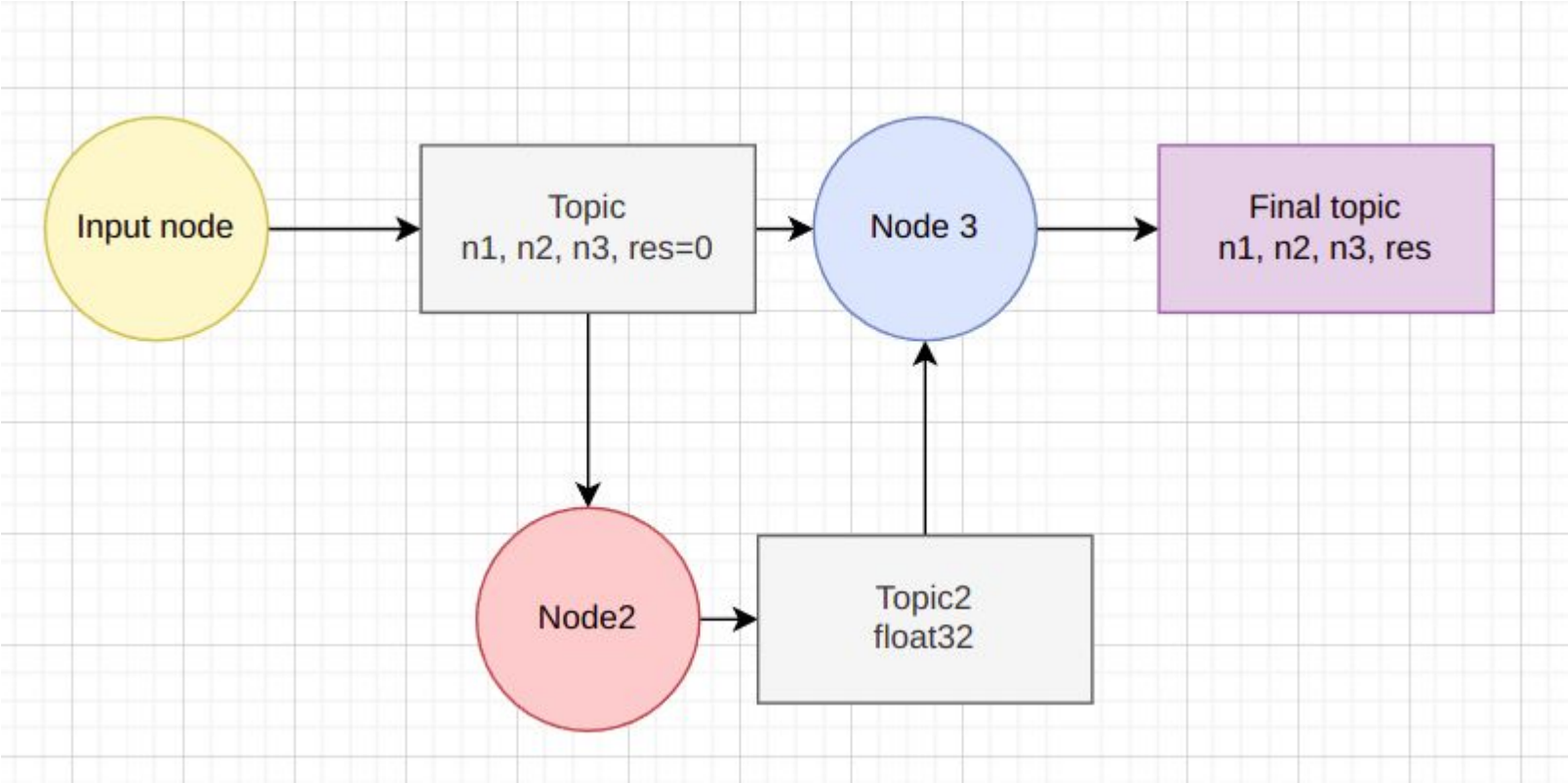
Extra exercise 3 (Extra 1 points)

- Create a publisher and a subscriber using classes
- https://roboticsbackend.com/oop-with-ros-in-cpp/

Extra exercise 4

- Google Summer of Code Challenge:
  https://github.com/hany606/JDE_Challenge-GSoC_2020/blob/master/C%2B%2B_Challenge/gsoc2020-c%2B%2B_test.pdf

Templates and sources

- Template C++: link
- C++ ROS: link
- ROS tutorials: link
- Example for CMakeLists.txt: link

Any Questions?