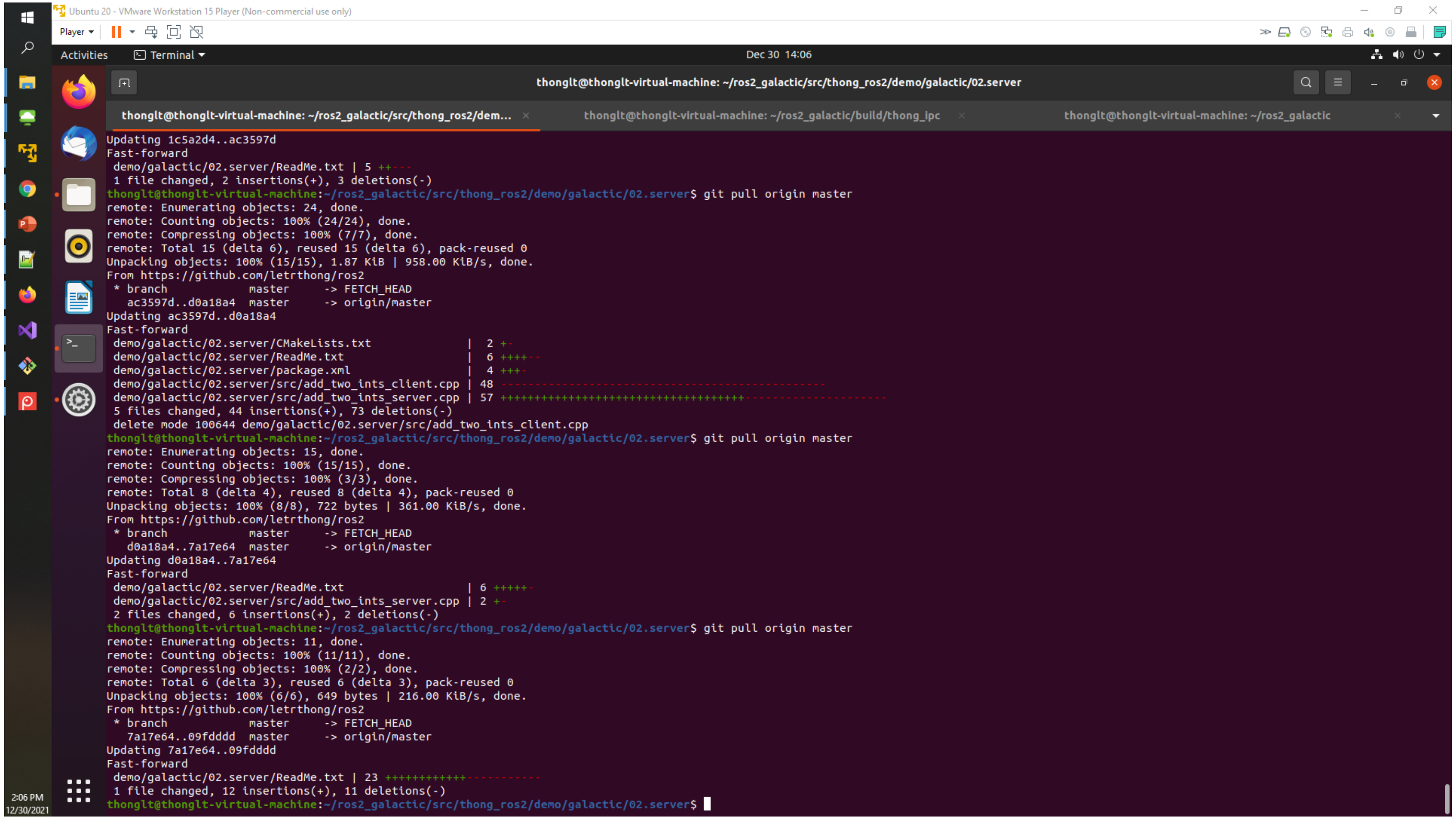
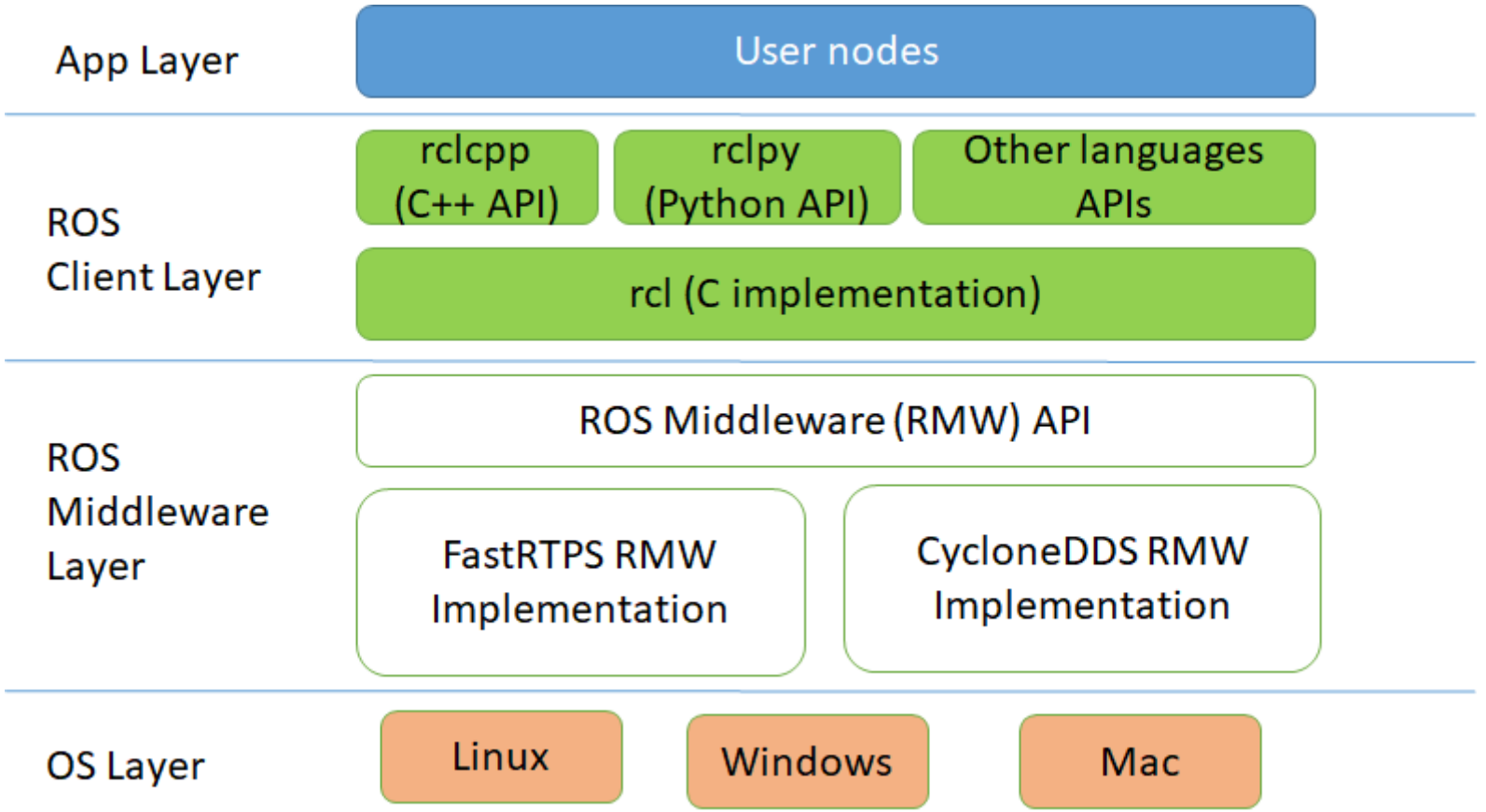
ROS 2

Setup RO2 on Virtual Ubuntu OS

https://docs.ros.org/en/galactic/Installation.html

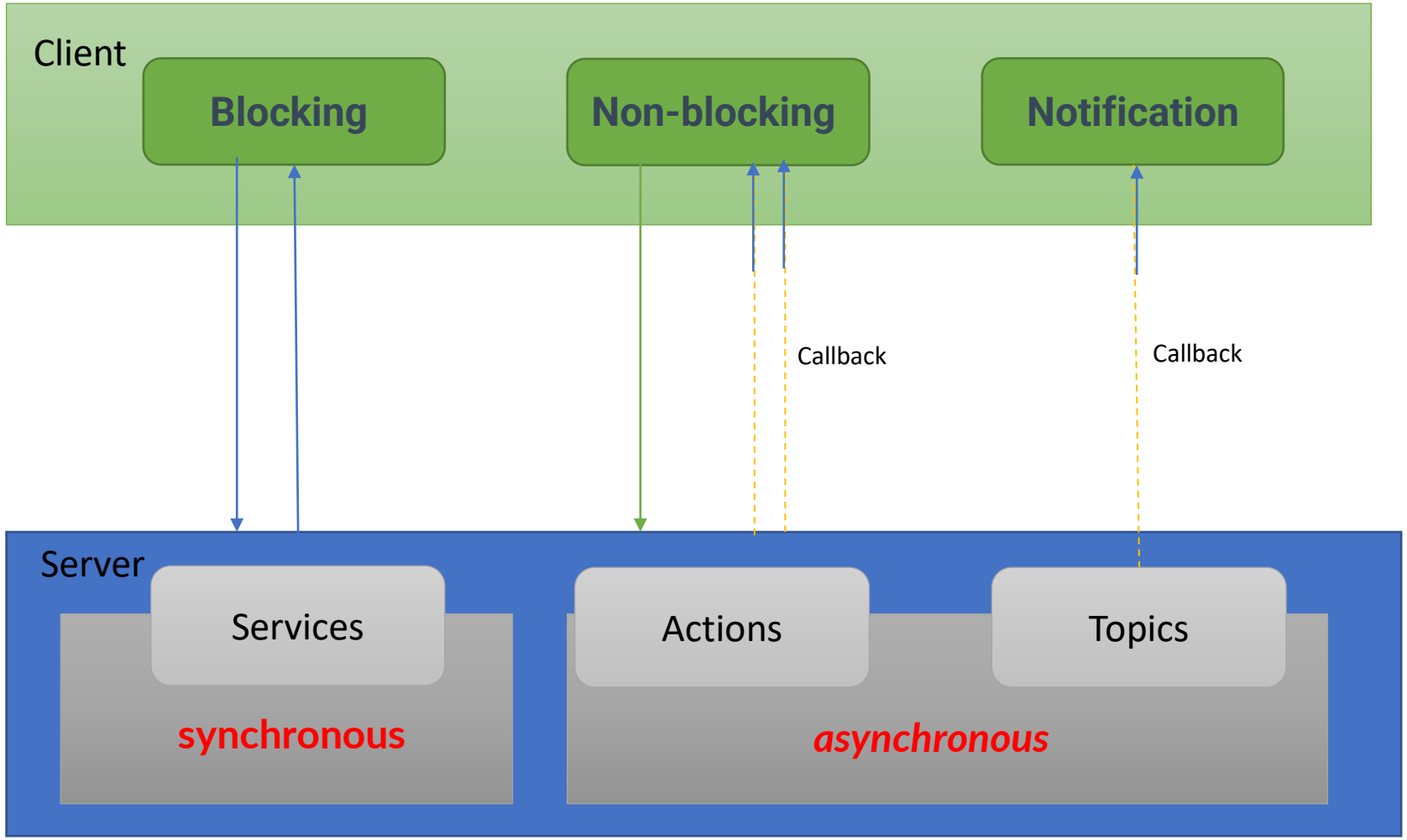


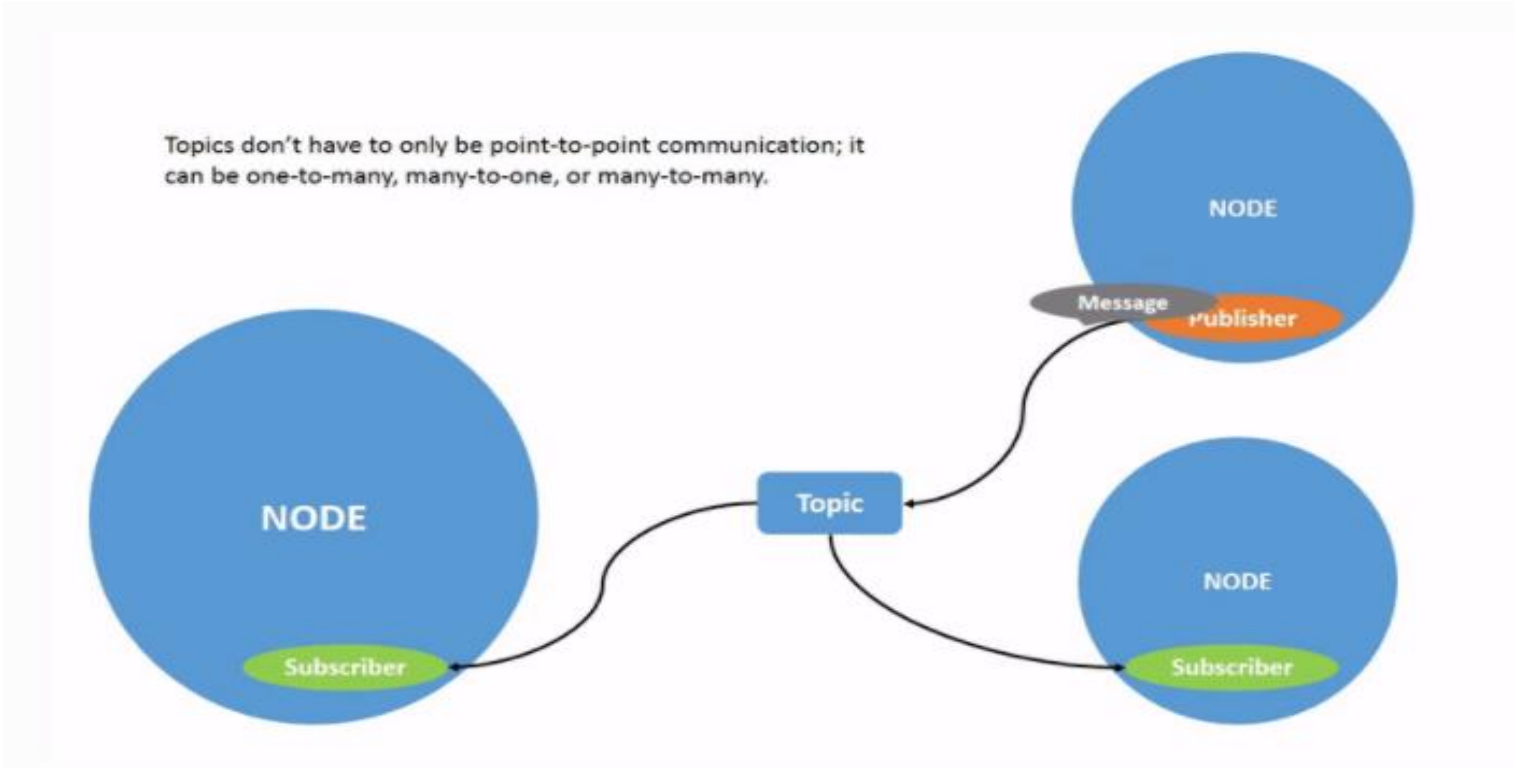
Thong LT



https://aws.amazon.com/blogs/robotics/ros2-foxy-fitzroy-robot-development/

IPC

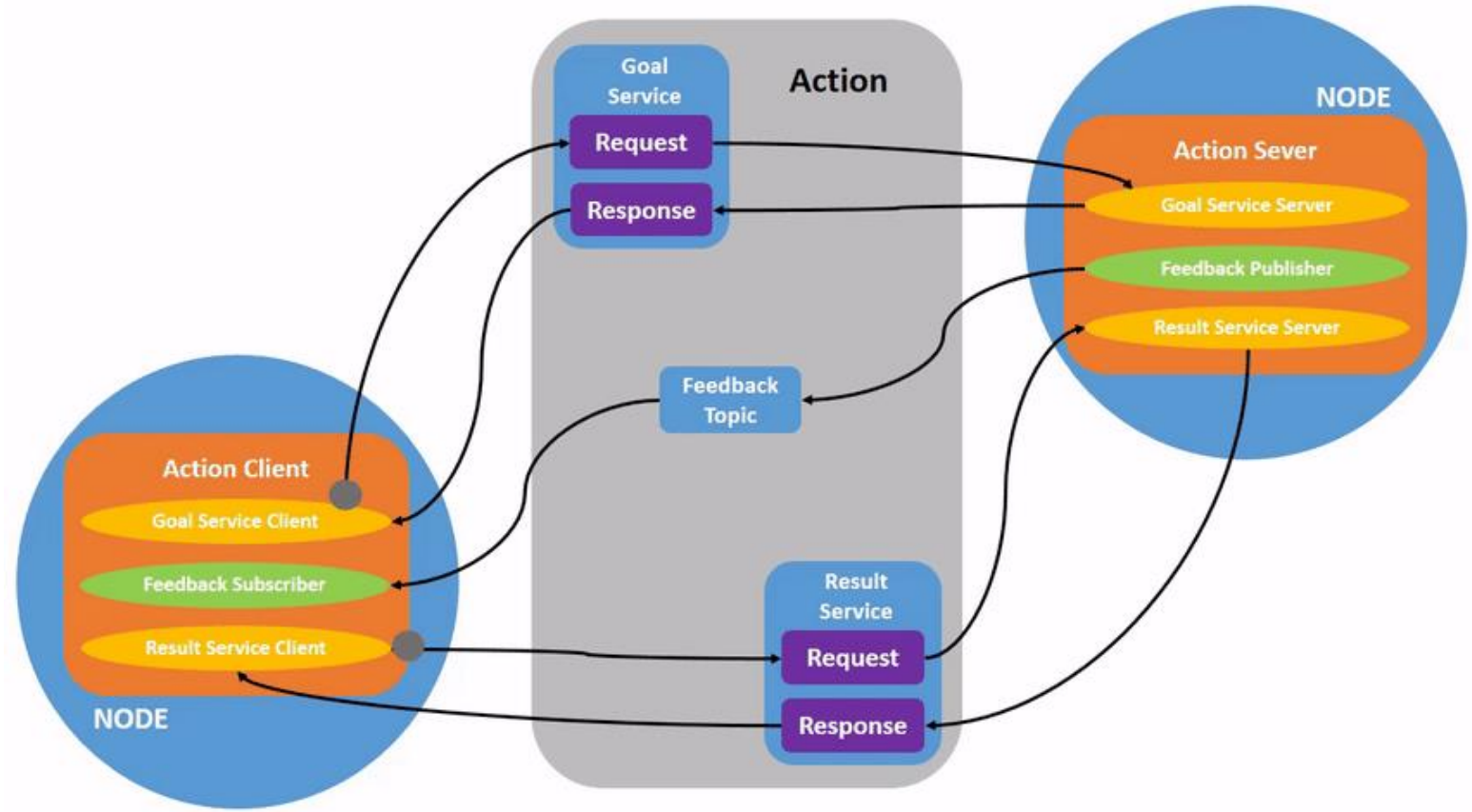

Client
Blocking
Non-blocking
Notification
Callback
Callback
Server
Services
Actions
Topics
synchronous
asynchronous



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

Nodes https://github.com/ros2/examples/tree/master/rclcpp/

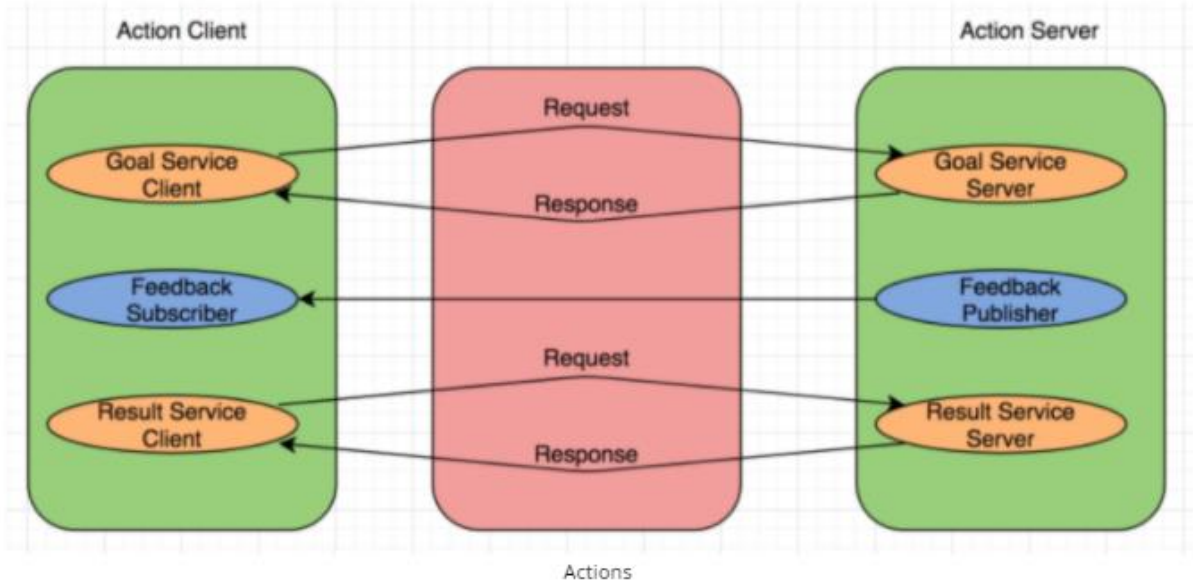
Topics
Services
Parameter server



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

Nodes

Topics
Services
Parameter server



Actions

Exercises you will be doing

Topics

- Control the TurtleBot3 robot based on the laser readings.

Services

- Create a service to control the TurtleBot3 robot using input strings.

Actions

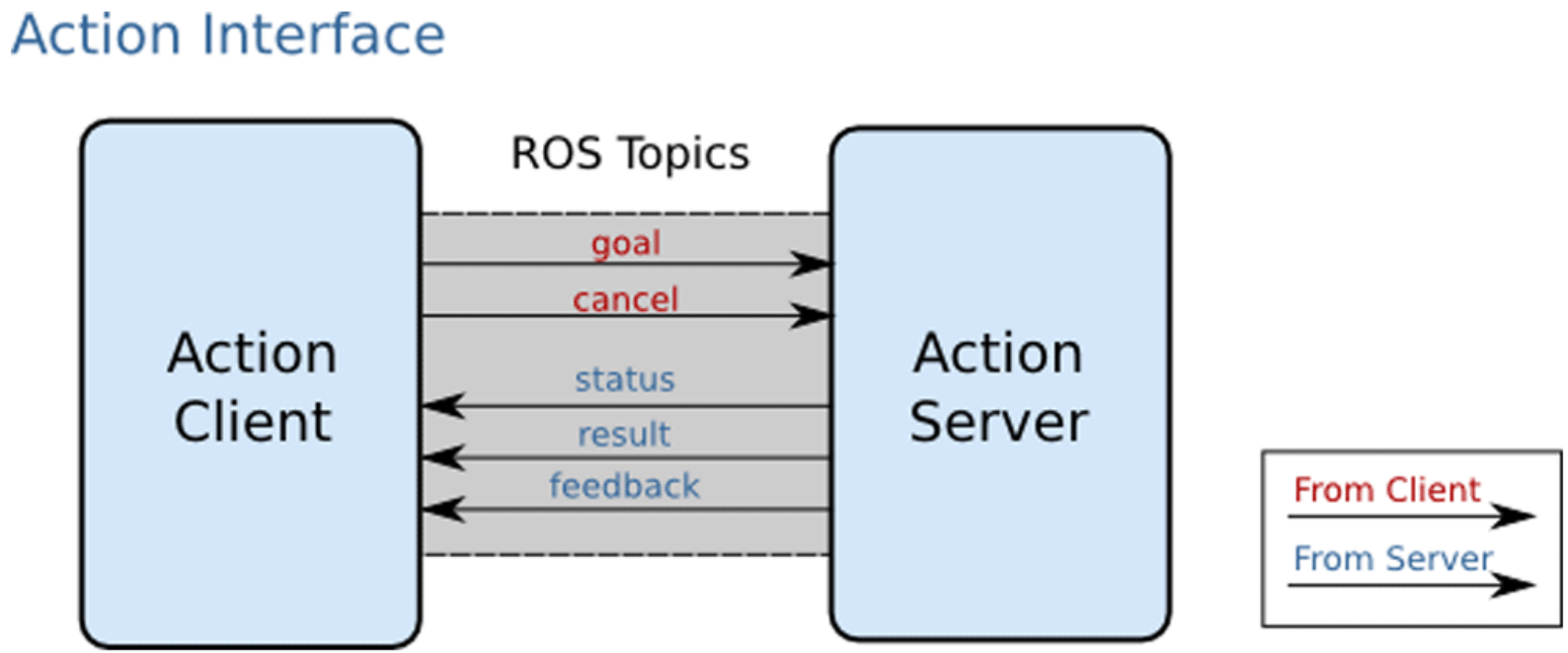
- Create a custom action to control the TurtleBot3 robot while reading the robot's status.

https://www.reddit.com/r/ROS/comments/nrzk9d/ros2_basics_for_python/

2. Order online

   a. Place your order **(request)**.
   b. Order confirmation notice **(feedback)**.
   c. Possibly cancel the order **(cancel)**.
   d. Check up your order status once in a while **(status)**.
   e. *Do other things.*
   f. Pizza is delivered **(response)**.

To wrap up, consider the image below, saying roughly saying the same thing we have been saying, only in a "thousand words":



https://www.theconstructsim.com/ros-5-mins-034-ros-action/

Install packets

1. **Install ros2**

   - Ubuntu Linux - Focal Fossa (20.04) 64-bit

   Step1.

   https://docs.ros.org/en/galactic/Installation/Ubuntu-Development-Setup.html

   Step2.

   https://docs.ros.org/en/galactic/Installation/Ubuntu-Install-Debians.html

   sudo apt install ros-galactic-desktop
   source /opt/ros/galactic/setup.bash

2. **Install packets in C++ (rclcpp)**

3. **Install packets for testing**

   source /opt/ros/galactic/setup.bash
   ros2 run demo_nodes_cpp talker

   source /opt/ros/galactic/setup.bash
   ros2 run demo_nodes_py listener

Cli on ros 2

- ros2 node list
- ros2 node info <node_name>

```
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ros2 node list
/talker
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ros2 node info  talker
Unable to find node 'talker'
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ros2 node info  /talker
/talker
  Subscribers:
    /parameter_events: rcl_interfaces/msg/ParameterEvent
  Publishers:
    /chatter: std_msgs/msg/String
    /parameter_events: rcl_interfaces/msg/ParameterEvent
    /rosout: rcl_interfaces/msg/Log
  Service Servers:
    /talker/describe_parameters: rcl_interfaces/srv/DescribeParameters
    /talker/get_parameter_types: rcl_interfaces/srv/GetParameterTypes
    /talker/get_parameters: rcl_interfaces/srv/GetParameters
    /talker/list_parameters: rcl_interfaces/srv/ListParameters
    /talker/set_parameters: rcl_interfaces/srv/SetParameters
    /talker/set_parameters_atomically: rcl_interfaces/srv/SetParametersAtomically
  Service Clients:

  Action Servers:

  Action Clients:

thonglt@thonglt-virtual-machine:~/ros2_galactic$
```

rclcpp

- ros2 node list
- ros2 node info <node_name>

rclcpp

How to create an example

https://docs.ros.org/en/galactic/Tutorials/Writing-A-Simple-Cpp-Service-And-Client.html

installing system dependencies.

http://wiki.ros.org/rosdep
http://wiki.ros.org/rosdep/Tutorials/How%20to%20add%20a%20system%20dependency

https://colcon.readthedocs.io/en/released/

ROS 2 package and packets in workspaces

https://docs.ros.org/en/foxy/Tutorials/Creating-Your-First-ROS2-Package.html

Example at

https://docs.ros.org/en/galactic/Features.html
https://github.com/ros2/examples/tree/master/rclcpp
https://roboticsbackend.com/create-a-ros2-cpp-package/

rclcpp

interface

https://github.com/ros2/example_interfaces/tree/master/msg

https://docs.ros.org/en/foxy/Tutorials/Custom-ROS2-Interfaces.html

```
thonglt@thonglt-virtual-machine:~/ros2_galactic/src/ros2/example_interfaces$ ls
action  CHANGELOG.rst  CMakeLists.txt  CONTRIBUTING.md  LICENSE  mapping_rules.yaml  msg  package.xml  README.md  srv
thonglt@thonglt-virtual-machine:~/ros2_galactic/src/ros2/example_interfaces$ cat package.xml
<?xml version="1.0"?>
<?xml-model href="http://download.ros.org/schema/package_format3.xsd" schematypens="http://www.w3.org/2001/XMLSchema"?>
<package format="3">
  <name>example_interfaces</name>
  <version>0.9.2</version>
  <description>Contains message and service definitions used by the examples.</description>
  <maintainer email="jacob@openrobotics.org">Jacob Perron</maintainer>
  <license>Apache License 2.0</license>

  <author email="dthomas@openrobotics.org">Dirk Thomas</author>

  <buildtool_depend>ament_cmake</buildtool_depend>

  <buildtool_depend>rosidl_default_generators</buildtool_depend>

  <depend>action_msgs</depend>

  <exec_depend>rosidl_default_runtime</exec_depend>

  <member_of_group>rosidl_interface_packages</member_of_group>

  <export>
    <build_type>ament_cmake</build_type>
    <ros1_bridge mapping_rules="mapping_rules.yaml"/>
  </export>
</package>
thonglt@thonglt-virtual-machine:~/ros2_galactic/src/ros2/example_interfaces$
```

colcon

- https://colcon.readthedocs.io/en/released/user/quick-start.html

```
$ mkdir -p /tmp/workspace/src     # Make a workspace directory with a src subdirectory
$ cd /tmp/workspace               # Change directory to the workspace root
$ <...>                           # Populate the `src` directory with packages
$ colcon list                     # List all packages in the workspace
$ colcon graph                    # List all packages in the workspace in topological order
                                  # and visualize their dependencies
$ colcon build                    # Build all packages in the workspace
$ colcon test                     # Test all packages in the workspace
$ colcon test-result --all        # Enumerate all test results
$ . install/local_setup.bash      # Setup the environment to use the built packages
$ <...>                           # Use the built packages
```

Build an example

```
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ls
build  install  log  ros2.repos  src
thonglt@thonglt-virtual-machine:~/ros2_galactic$
thonglt@thonglt-virtual-machine:~/ros2_galactic$ pwd
/home/thonglt/ros2_galactic
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ls
build  install  log  ros2.repos  src
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ls src/
ament  eclipse-cyclonedds  eclipse-iceoryx  eProsima  osrf  ros  ros2  ros-perception
thonglt@thonglt-virtual-machine:~/ros2_galactic$
```

- https://github.com/ros2/examples

Build an example from ros2

Step1: cd src

Step2: git clone git clone https://github.com/letrthong/ros2 thong_ros2

Step3: cd ..

Step4: colcon list | grep “thong”

Step5: colcon build --packages-select --allow-overriding `thong_ipc`

Step6: . ~/ros2_galactic/install/local_setup.bash

Step7: ros2 run ipc demo.out

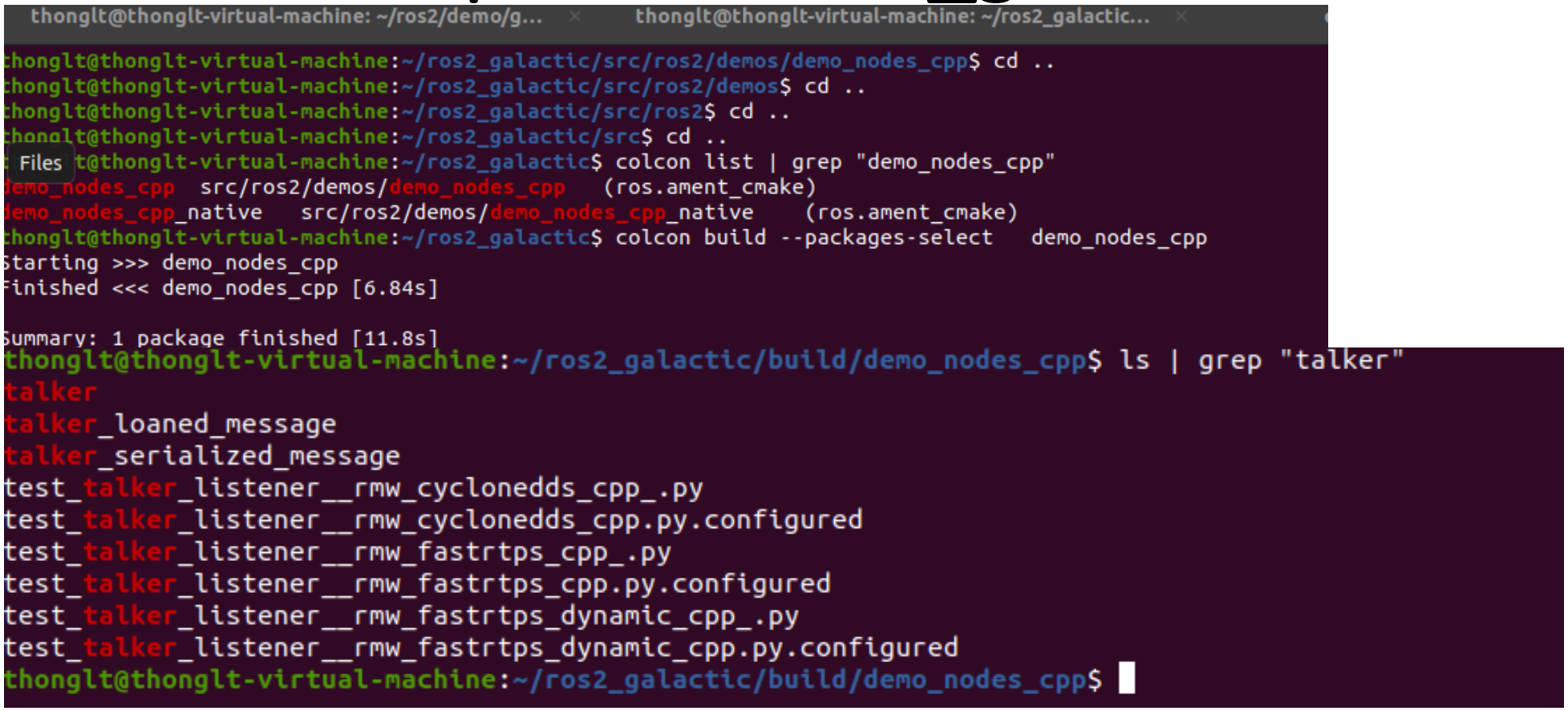
Build source from ros2

```
thonglt@thonglt-virtual-machine:~/ros2_galactic/src$ git clone https://github.com/letrthong/ros2 thong_ros2
Cloning into 'thong_ros2'...
remote: Enumerating objects: 193, done.
remote: Counting objects: 100% (193/193), done.
remote: Compressing objects: 100% (116/116), done.
remote: Total 193 (delta 73), reused 173 (delta 53), pack-reused 0
Receiving objects: 100% (193/193), 1.90 MiB | 1.52 MiB/s, done.
Resolving deltas: 100% (73/73), done.
thonglt@thonglt-virtual-machine:~/ros2_galactic/src$ cd ..
thonglt@thonglt-virtual-machine:~/ros2_galactic$ colcon list | grep "thong"
ipc     src/thong ros2/demo/galactic/02.server  (ros.ament_cmake)
```

```
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ls
build  install  log  ros2.repos  src
thonglt@thonglt-virtual-machine:~/ros2_galactic$ ros2 run  thong_ipc server.out
[INFO] [1640846155.392159783] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 0'
[INFO] [1640846155.890899578] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 1'
[INFO] [1640846156.391771209] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 2'
[INFO] [1640846156.891455485] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 3'
[INFO] [1640846157.391081928] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 4'
[INFO] [1640846157.891389583] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 5'
[INFO] [1640846158.391618777] [minimal_publisher]: Publishing: 'Thong LT Hello, world! 6'
```

https://github.com/letrthong/ros2/tree/master/demo/galactic/02.server#readme
https://github.com/letrthong/ros2/tree/master/demo/galactic/02.server

Build an example from os2_galactic



colcon build --packages-select demo_nodes_cpp

. ~/ros2_galactic/install/local_setup.bash

ros2 run demo_nodes_cpp talker