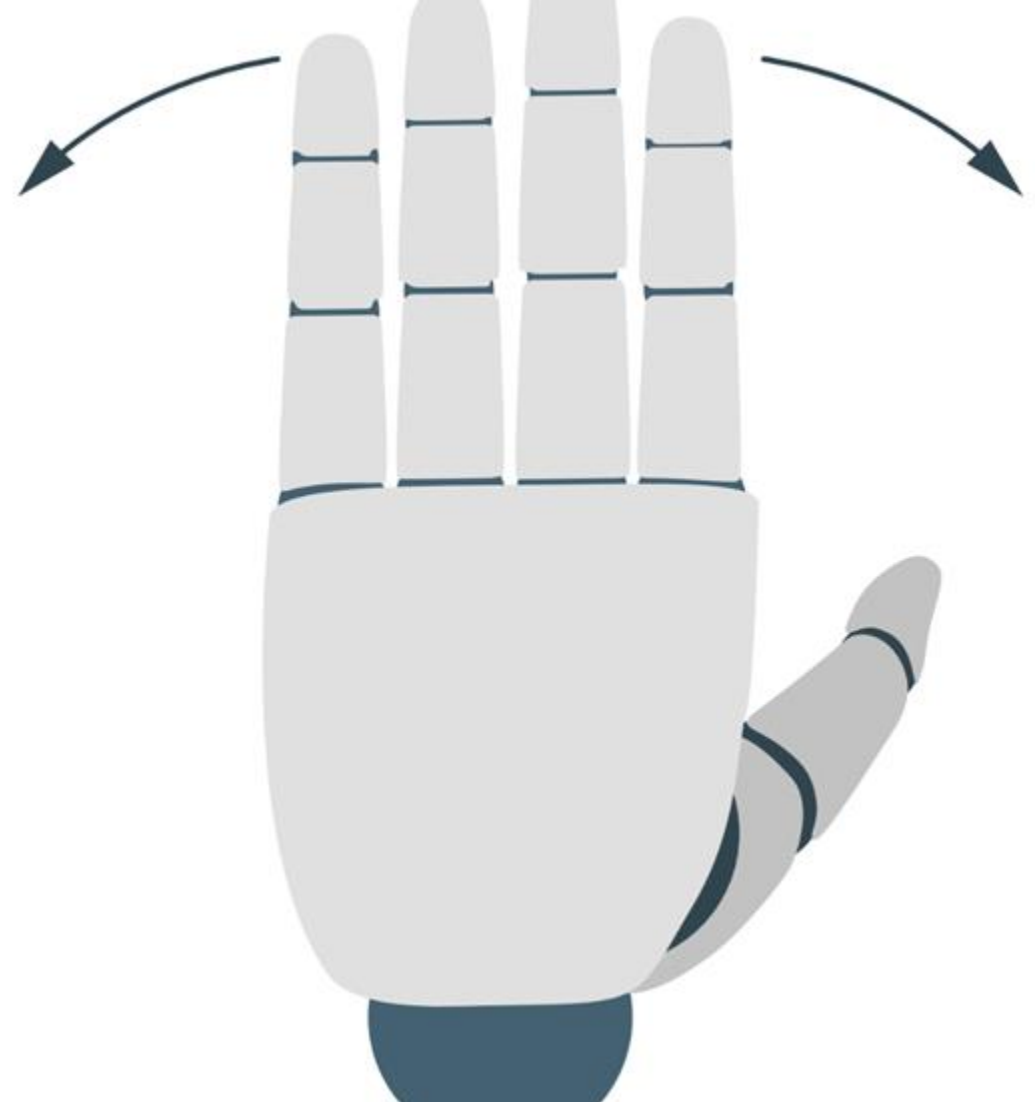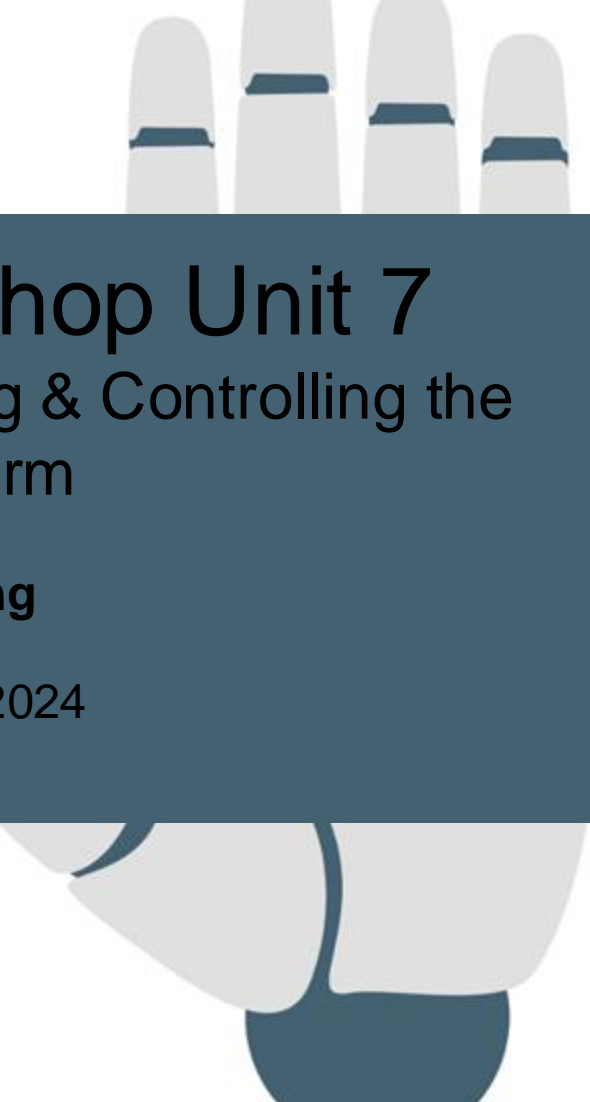# Workshop Unit 7
Interfacing & Controlling the Robotic Arm
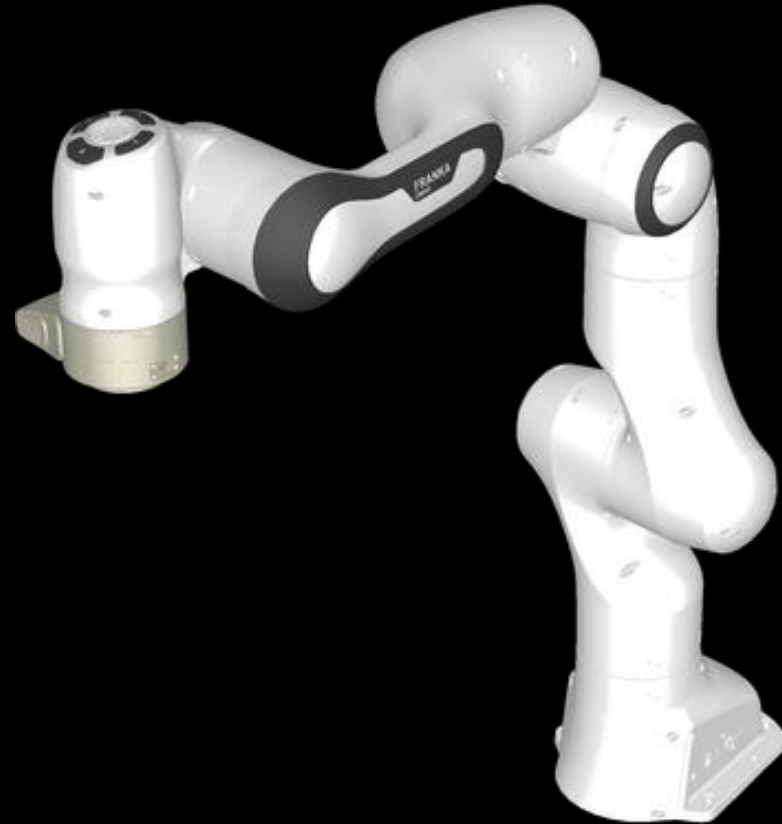
Chenyu Yang

21 October 2024

Overview

1. Hardware

2. Control software structure

3. Interface the robot

4. Testing

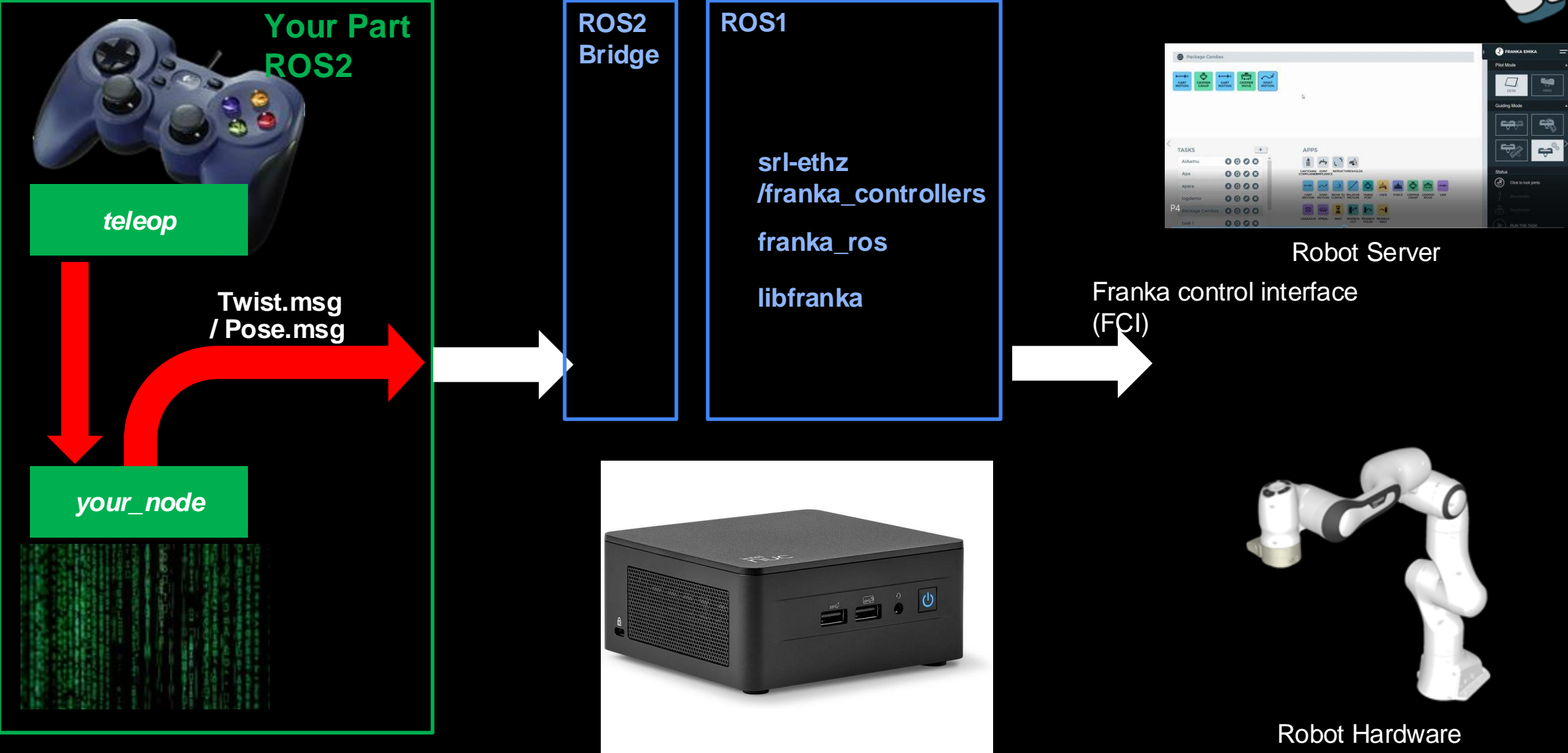# Franka Emika Panda

- 7 DoF robotic arm

- Task Space: 855 mm

- End-effector payload: 3 kg
  - less if far from the end-effector

- Control via ROS (ROS2 w/ bridge)

Control Structure

Your Part ROS2

teleop

Twist.msg / Pose.msg

your_node

ROS2 Bridge

ROS1

srl-ethz /franka_controllers

franka_ros

libfranka

Robot Server

Franka control interface (FCI)

Robot Hardware

ROS: Robotic Operating System

ROS Launch

Your Part

| ROS1 ROS Master | ROS2 Data Distribution Service (DDS) |

Registration   Registration

teleop

franka_controllers

Publish   Subscribe

franka_twist_cmd

Subscribe

*.msg   Message definition
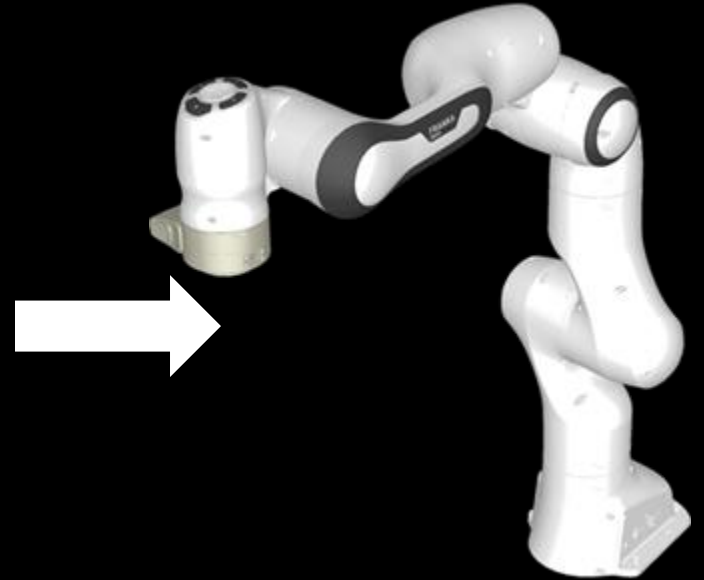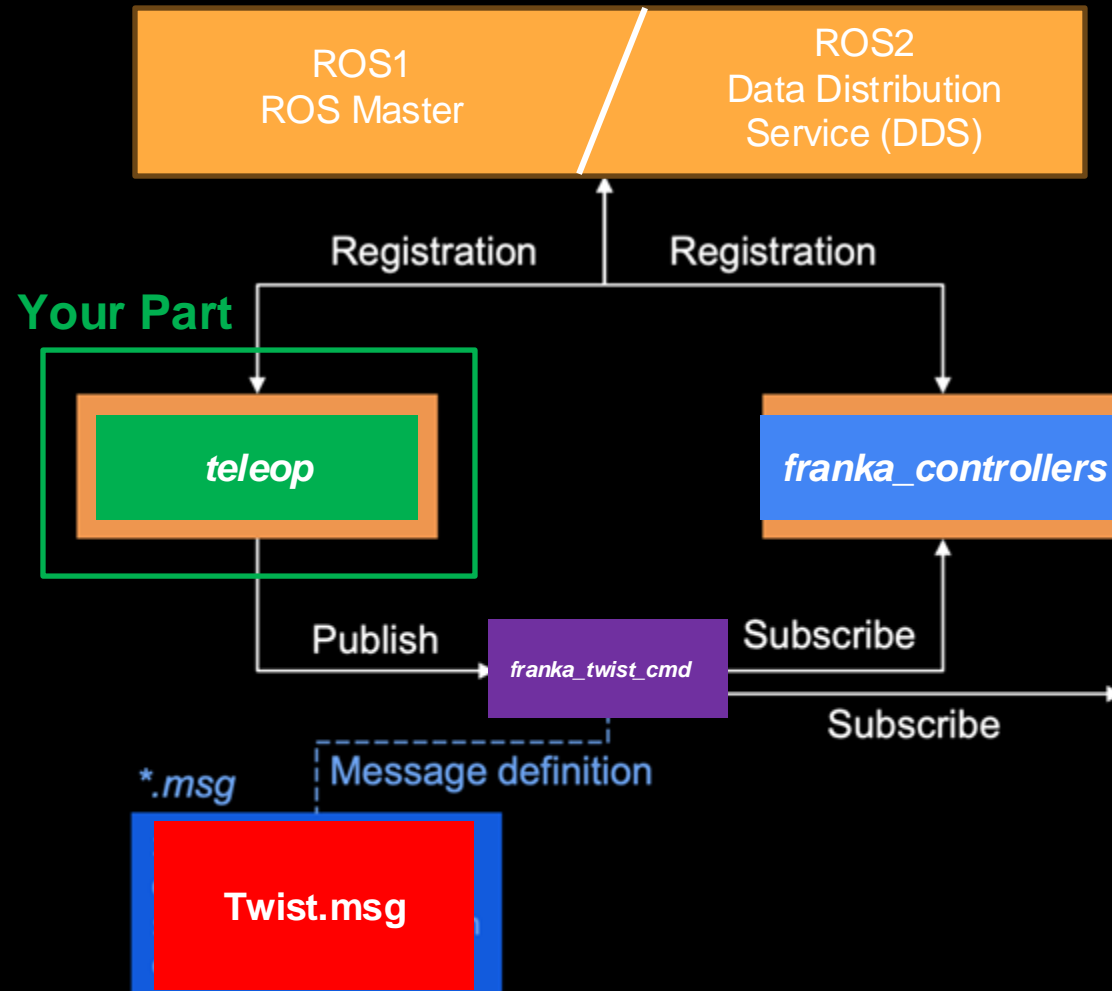
Twist.msg

Twist Message

Velocity in free space broken into its linear and angular parts:

geometry_msgs/Twist.msg
     geometry_msgs/Vector3 linear
          float64 x
          float64 y
          float64 z
     geometry_msgs/Vector3 angular
          float64 x
          float64 y
          float64 z

http://docs.ros.org/en/noetic/api/geometry_msgs/html/msg/Twist.html

PoseStamped Message

geometry_msgs/PoseStamped.msg
    std_msgs/Header header
        uint32 seq
        time stamp
        string frame_id
    geometry_msgs/Pose pose
        geometry_msgs/Point position
            float64 x
            float64 y
            float64 z
        geometry_msgs/Quaternion orientation
            float64 x
            float64 y
            float64 z
            float64 w

https://docs.ros.org/en/noetic/api/geometry_msgs/html/msg/PoseStamped.html

Working with the robot

- Teleoperation

  - Run vel_impedance controller.
    Take the Logitech Joy stick teleoperate the arm.

  - Run pos_impedance controller.
    Send sequence of pose.

Safety Limits

- Collaborative Robot Arm

- Safety stop and emergency stop buttons

  - If you want to stop the robot, use safety stop

  - Emergency stop can harm the robot,
    only in emergencies

- **Be cautious, only operate under supervision of a TA or a staff member**
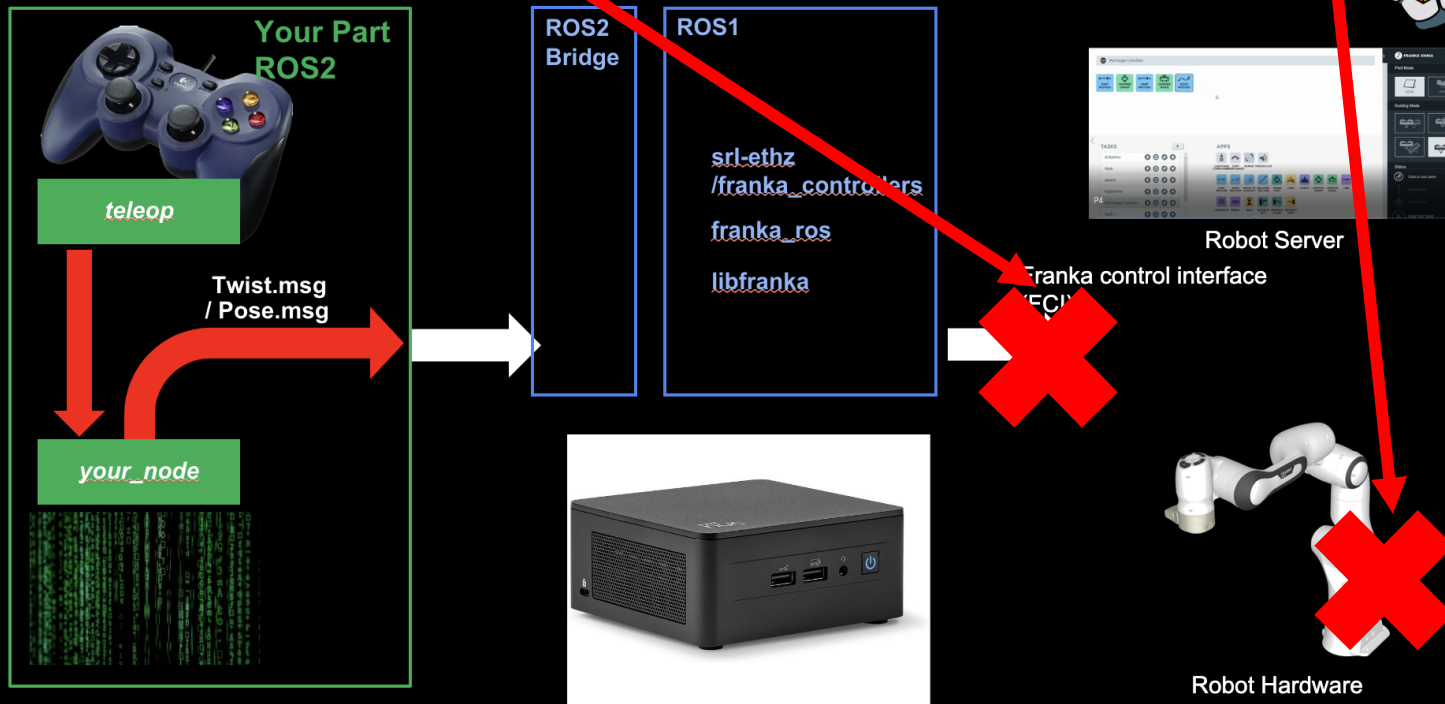

Safety Stop

Emergency Stop

Stop buttons

Safety Stop

Emergency Stop

Your Part ROS2

teleop

Twist.msg / Pose.msg

your_node

ROS2 Bridge

ROS1

srl-ethz /franka_controllers

franka_ros

libfranka

Robot Server

Franka control interface

Robot Hardware

ETHzürich

SoftRobotics Laboratory

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Procedure to interface the arm

- Prerequisites
  - Laptop ROS2
  - Ethernet connection
- Find this presentation on Moodle
- Find instruction and example code in rwr-ros2-examples

Your Turn!

Every group tests out the robot