Week_4

- 오타가 없도록 ssh 환경에서 복사-붙혀넣기로 다운로드

```
ubuntu@ubuntu:~$ wget https://github.com/ROBOTIS-GIT/OpenCR-Binaries/raw/master/turtlebot3/ROS2/lates
t/opencr_update.tar.bz2
--2023-07-25 05:40:08--  https://github.com/ROBOTIS-GIT/OpenCR-Binaries/raw/master/turtlebot3/ROS2/la
test/opencr_update.tar.bz2
Resolving github.com (github.com)... 20.200.245.247
Connecting to github.com (github.com)|20.200.245.247|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://raw.githubusercontent.com/ROBOTIS-GIT/OpenCR-Binaries/master/turtlebot3/ROS2/latest
/opencr_update.tar.bz2 [following]
--2023-07-25 05:40:08--  https://raw.githubusercontent.com/ROBOTIS-GIT/OpenCR-Binaries/master/turtleb
ot3/ROS2/latest/opencr_update.tar.bz2
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.199.108.133, 185.199.110.133,
185.199.109.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.199.108.133|:443... connected
.
HTTP request sent, awaiting response... 200 OK
Length: 359119 (351K) [application/octet-stream]
Saving to: ‘opencr_update.tar.bz2’

opencr_update.tar.b 100%[===================>] 350.70K  --.-KB/s    in 0.06s

2023-07-25 05:40:08 (6.20 MB/s) - ‘opencr_update.tar.bz2’ saved [359119/359119]
```

- 펌웨어 업데이트

```
ubuntu@ubuntu:~/opencr_update$ ./update.sh $OPENCR_PORT $OPENCR_MODEL.opencr
aarch64
arm
OpenCR Update Start..
opencr_ld_shell ver 1.0.0
opencr_ld_main
[  ] file name          : burger.opencr
[  ] file size          : 136 KB
[  ] fw_name            : burger
[  ] fw_ver             : V230127R1
[OK] Open port          : /dev/ttyACM0
[  ]
[  ] Board Name         : OpenCR R1.0
[  ] Board Ver          : 0x17020800
[  ] Board Rev          : 0x00000000
[OK] flash_erase        : 0.97s
[OK] flash_write        : 1.35s
[OK] CRC Check          : D92222 D92222 , 0.004000 sec
[OK] Download
[OK] jump_to_fw
```

- 이후 브링업 정상 작동

```
ubuntu@ubuntu:~/opencr_update$ export TURTLEBOT3_MODEL=burger
ubuntu@ubuntu:~/opencr_update$ ros2 launch turtlebot3_bringup robot.launch.py
[INFO] [launch]: All log files can be found below /home/ubuntu/.ros/log/2023-07-25-05-41-20-120509-ubuntu-3368
[INFO] [launch]: Default logging verbosity is set to INFO
urdf_file_name : turtlebot3_burger.urdf
[INFO] [robot_state_publisher-1]: process started with pid [3369]
[INFO] [hlds_laser_publisher-2]: process started with pid [3371]
[INFO] [turtlebot3_ros-3]: process started with pid [3373]
[turtlebot3_ros-3] [INFO] [1690263682.483371660] [turtlebot3_node]: Init TurtleBot3 Node Main
[hlds_laser_publisher-2] [INFO] [1690263682.484934531] [hlds_laser_publisher]: Init hlds_laser_publisher Node Main
[hlds_laser_publisher-2] [INFO] [1690263682.485662252] [hlds_laser_publisher]: port : /dev/ttyUSB0 frame_id : base_scan
[turtlebot3_ros-3] [INFO] [1690263682.511470475] [turtlebot3_node]: Init DynamixelSDKWrapper
[turtlebot3_ros-3] [INFO] [1690263682.522918228] [DynamixelSDKWrapper]: Succeeded to open the port(/dev/ttyACM0)!
[turtlebot3_ros-3] [INFO] [1690263682.536795409] [DynamixelSDKWrapper]: Succeeded to change the baudrate!
[turtlebot3_ros-3] [INFO] [1690263682.581538452] [turtlebot3_node]: Start Calibration of Gyro
[robot_state_publisher-1] [INFO] [1690263682.591836770] [robot_state_publisher]: got segment base_footprint
[robot_state_publisher-1] [INFO] [1690263682.592489027] [robot_state_publisher]: got segment base_link
[robot_state_publisher-1] [INFO] [1690263682.592612178] [robot_state_publisher]: got segment base_scan
[robot_state_publisher-1] [INFO] [1690263682.592703476] [robot_state_publisher]: got segment caster_back_link
[robot_state_publisher-1] [INFO] [1690263682.592784608] [robot_state_publisher]: got segment imu_link
[robot_state_publisher-1] [INFO] [1690263682.592859943] [robot_state_publisher]: got segment wheel_left_link
[robot_state_publisher-1] [INFO] [1690263682.592934148] [robot_state_publisher]: got segment wheel_right_link
[turtlebot3_ros-3] [INFO] [1690263687.581987974] [turtlebot3_node]: Calibration End
[turtlebot3_ros-3] [INFO] [1690263687.582227905] [turtlebot3_node]: Add Motors
[turtlebot3_ros-3] [INFO] [1690263687.583268522] [turtlebot3_node]: Add Wheels
[turtlebot3_ros-3] [INFO] [1690263687.584195655] [turtlebot3_node]: Add Sensors
[turtlebot3_ros-3] [INFO] [1690263687.609211869] [turtlebot3_node]: Succeeded to create battery state publisher
[turtlebot3_ros-3] [INFO] [1690263687.616165179] [turtlebot3_node]: Succeeded to create imu publisher
[turtlebot3_ros-3] [INFO] [1690263687.634303381] [turtlebot3_node]: Succeeded to create sensor state publisher
[turtlebot3_ros-3] [INFO] [1690263687.638264936] [turtlebot3_node]: Succeeded to create joint state publisher
[turtlebot3_ros-3] [INFO] [1690263687.638498849] [turtlebot3_node]: Add Devices
[turtlebot3_ros-3] [INFO] [1690263687.638694872] [turtlebot3_node]: Succeeded to create motor power server
[turtlebot3_ros-3] [INFO] [1690263687.645254433] [turtlebot3_node]: Succeeded to create reset server
[turtlebot3_ros-3] [INFO] [1690263687.649525366] [turtlebot3_node]: Succeeded to create sound server
[turtlebot3_ros-3] [INFO] [1690263687.653026873] [turtlebot3_node]: Run!
[turtlebot3_ros-3] [INFO] [1690263687.725301394] [diff_drive_controller]: Init Odometry
[turtlebot3_ros-3] [INFO] [1690263687.756215005] [diff_drive_controller]: Run!
```

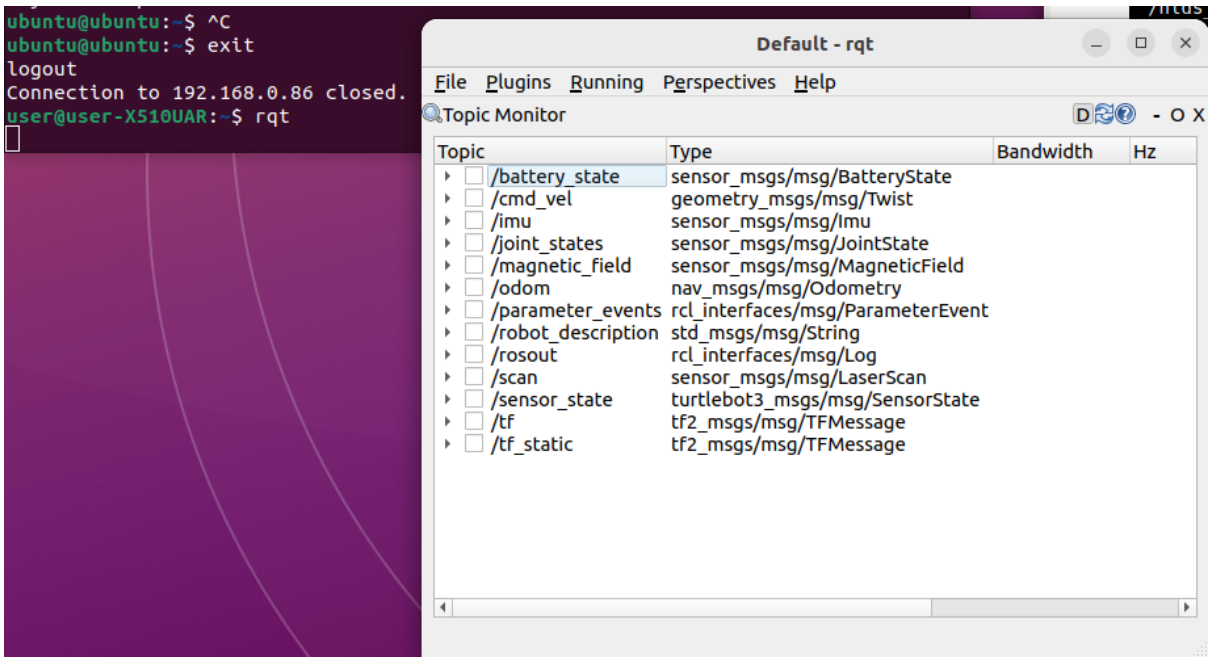
- 다른 터미널을 ssh로 열어서
  - ros2 topic list

```
ubuntu@ubuntu:~$ ros2 topic list
/battery_state
/cmd_vel
/imu
/joint_states
/magnetic_field
/odom
/parameter_events
/robot_description
/rosout
/scan
/sensor_state
/tf
/tf_static
```

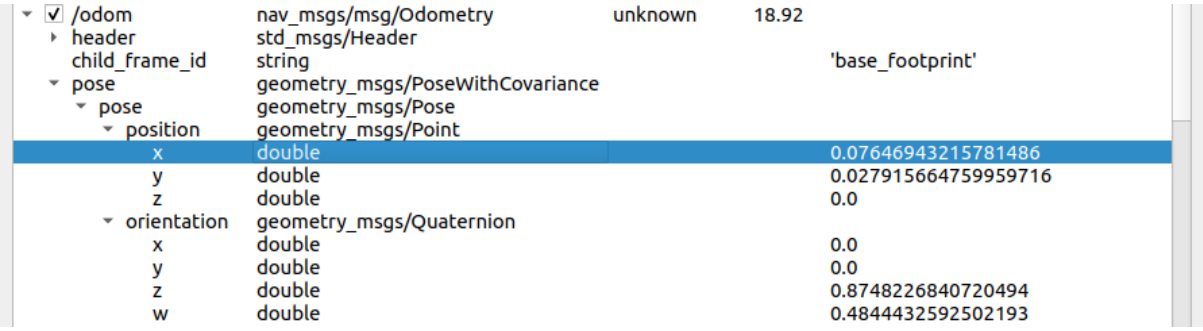
- ros2 service list 실행

```
ubuntu@ubuntu:~$ ros2 service list
/diff_drive_controller/describe_parameters
/diff_drive_controller/get_parameter_types
/diff_drive_controller/get_parameters
/diff_drive_controller/list_parameters
/diff_drive_controller/set_parameters
/diff_drive_controller/set_parameters_atomically
/hlds_laser_publisher/describe_parameters
/hlds_laser_publisher/get_parameter_types
/hlds_laser_publisher/get_parameters
/hlds_laser_publisher/list_parameters
/hlds_laser_publisher/set_parameters
/hlds_laser_publisher/set_parameters_atomically
/motor_power
/reset
/robot_state_publisher/describe_parameters
/robot_state_publisher/get_parameter_types
/robot_state_publisher/get_parameters
/robot_state_publisher/list_parameters
/robot_state_publisher/set_parameters
/robot_state_publisher/set_parameters_atomically
/sound
/turtlebot3_node/describe_parameters
/turtlebot3_node/get_parameter_types
/turtlebot3_node/get_parameters
/turtlebot3_node/list_parameters
/turtlebot3_node/set_parameters
/turtlebot3_node/set_parameters_atomically
```

- ssh 모드 종료 후 rqt를 실행해서 Topic확인
  - 같은 도메인이라면, 같은 ip 주소 내에 토픽이 공유되기 때문에
  - 해당 도메인고 해당 ip 주소에 접근한다면 토픽을 제어할 수 있다.

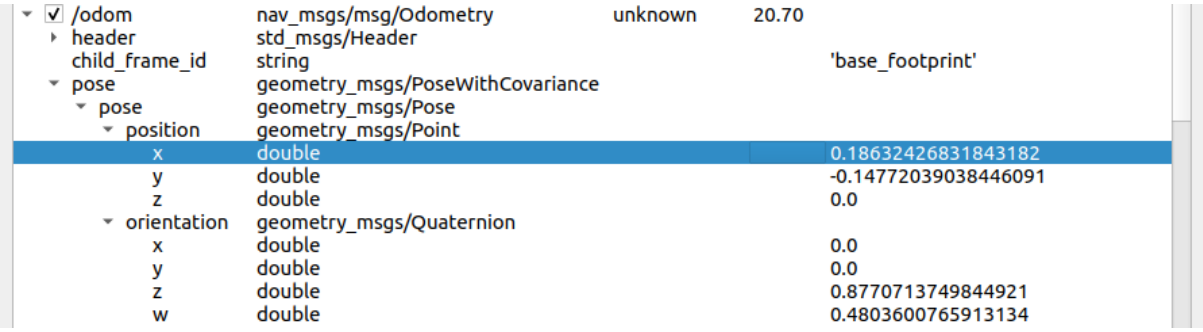


- teleop로 이동 시 x 위치 좌표가 변하는 것을 확인한다.



/odom	nav_msgs/msg/Odometry	unknown	18.92	
header	std_msgs/Header			
child_frame_id	string			'base_footprint'
pose	geometry_msgs/PoseWithCovariance			
pose	geometry_msgs/Pose			
position	geometry_msgs/Point			
x	double			0.07646943215781486
y	double			0.027915664759959716
z	double			0.0
orientation	geometry_msgs/Quaternion			
x	double			0.0
y	double			0.0
z	double			0.8748226840720494
w	double			0.4844432592502193

이동 후



/odom	nav_msgs/msg/Odometry	unknown	20.70	
header	std_msgs/Header			
child_frame_id	string			'base_footprint'
pose	geometry_msgs/PoseWithCovariance			
pose	geometry_msgs/Pose			
position	geometry_msgs/Point			
x	double			0.18632426831843182
y	double			-0.14772039038446091
z	double			0.0
orientation	geometry_msgs/Quaternion			
x	double			0.0
y	double			0.0
z	double			0.8770713749844921
w	double			0.4803600765913134