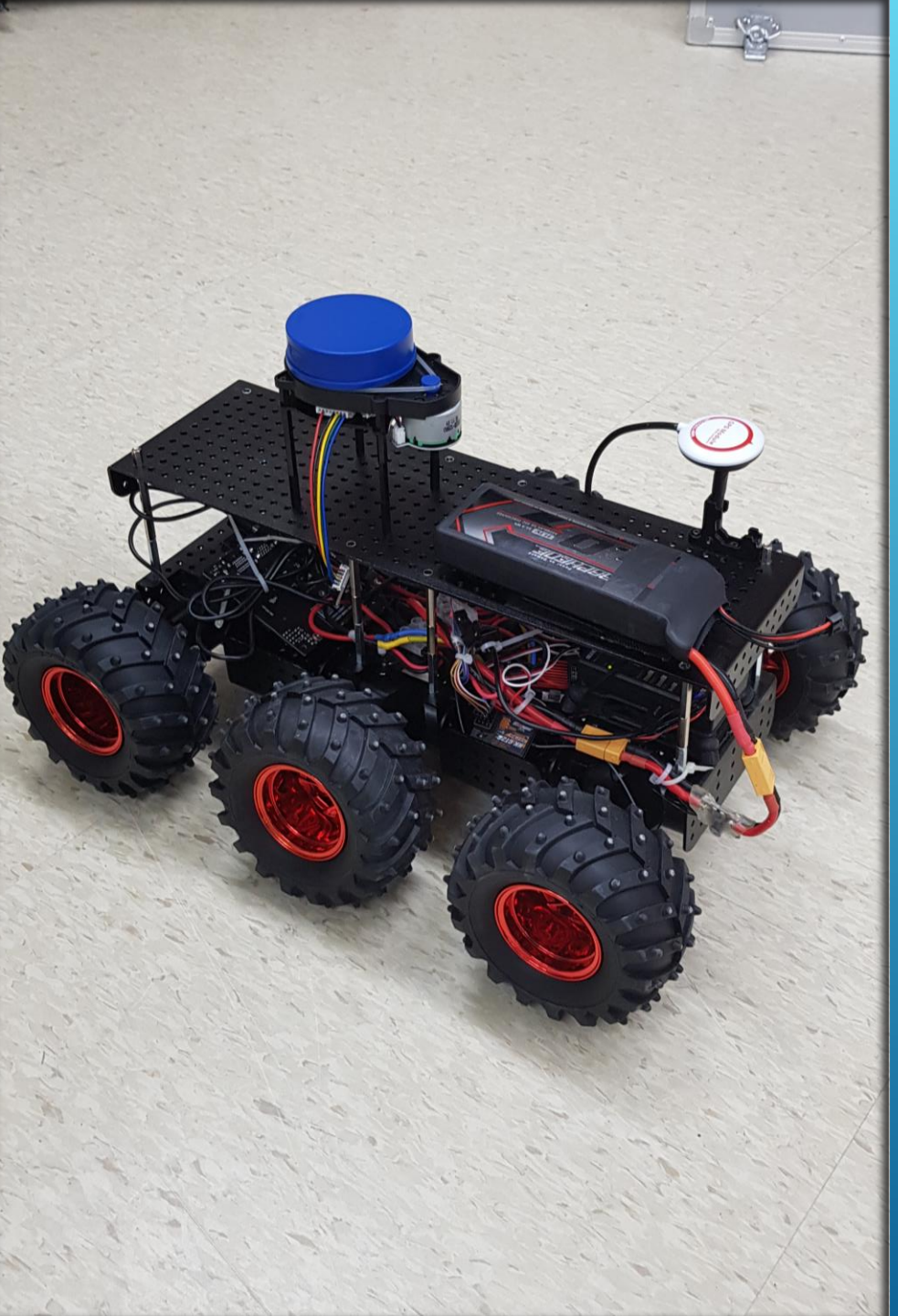
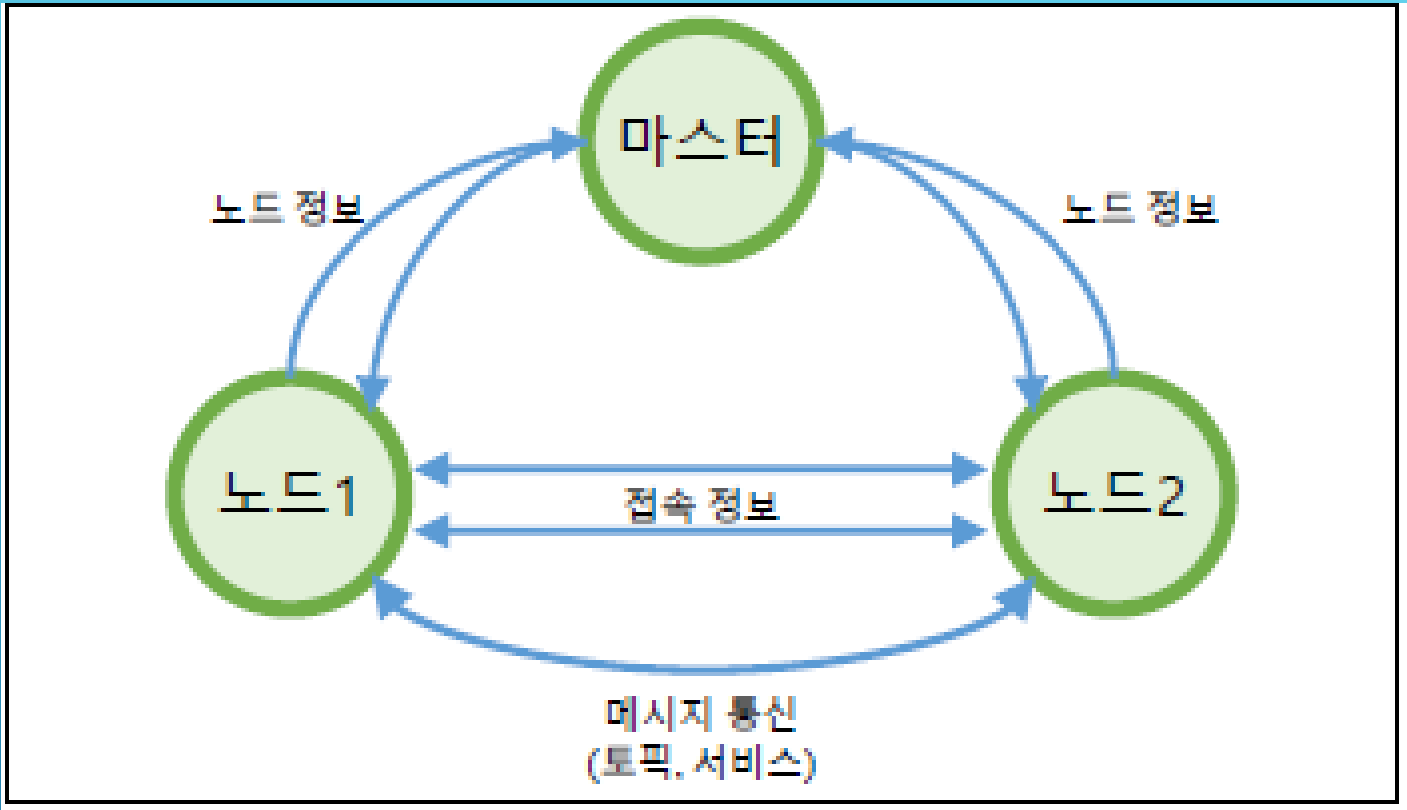


ROS SLAM & NAVIGATION STRUCTURE & INSTRUCTION

송전기술연구실 김보성

ROS 기본구조



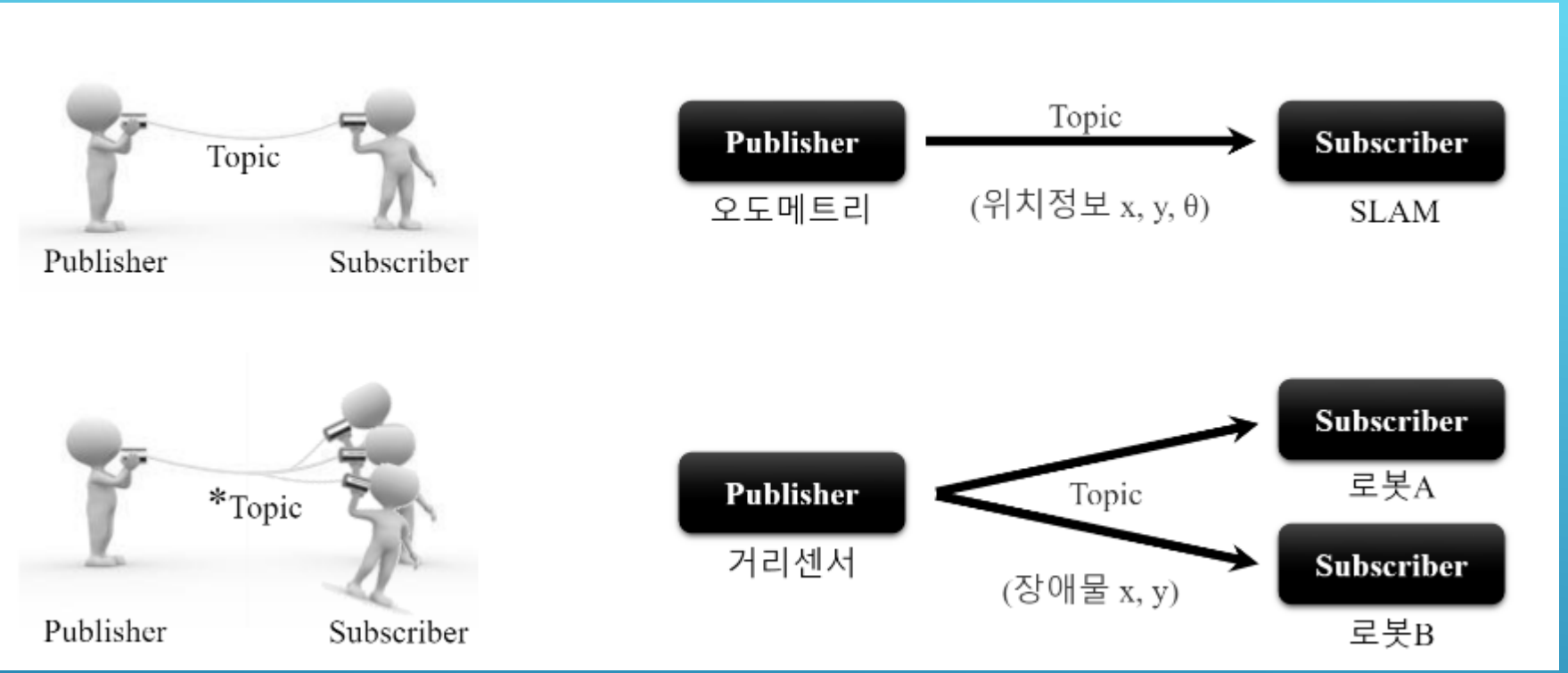
최소단위 프로세스 = 노드

발신자: Publisher
수신자: Subscriber

피드백이 필요한 대부분의
노드는 당연히 퍼블리셔인
동시에 서브스크라이버.

토픽방식은 일단 연결되면
퍼블리시 하는대로 꾸준히 통신.

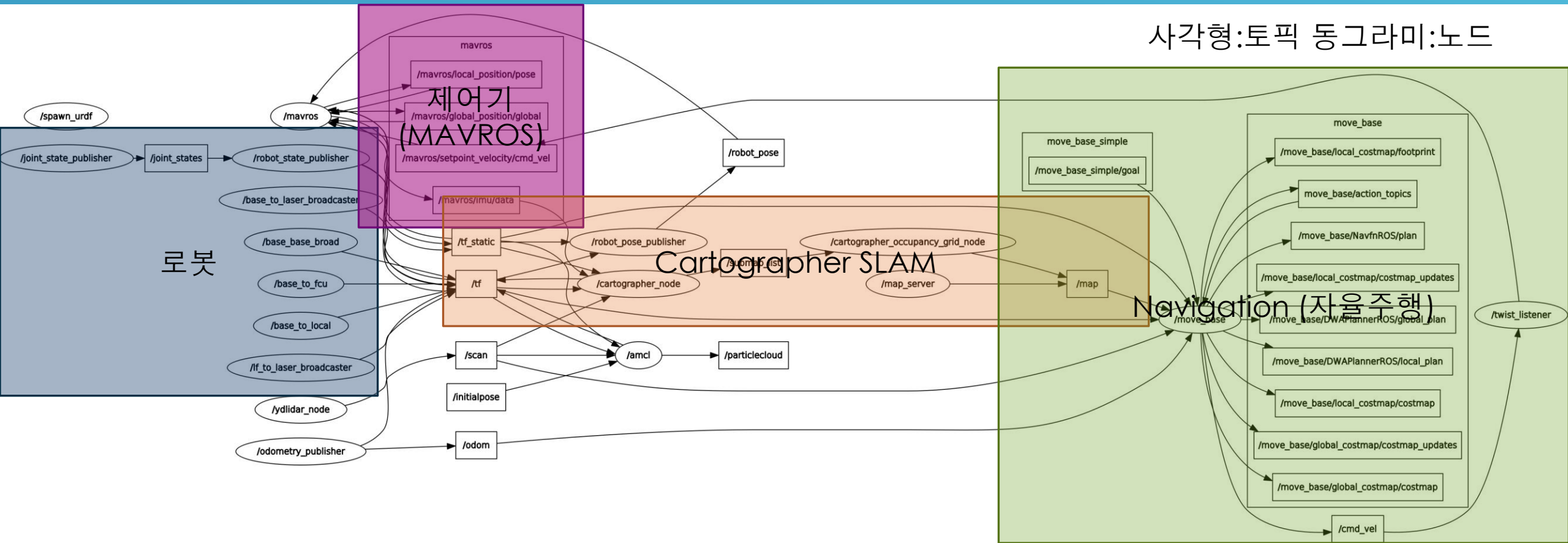
서비스는 1회성으로서 요청하면
정보를 제공하고 연결 해제.

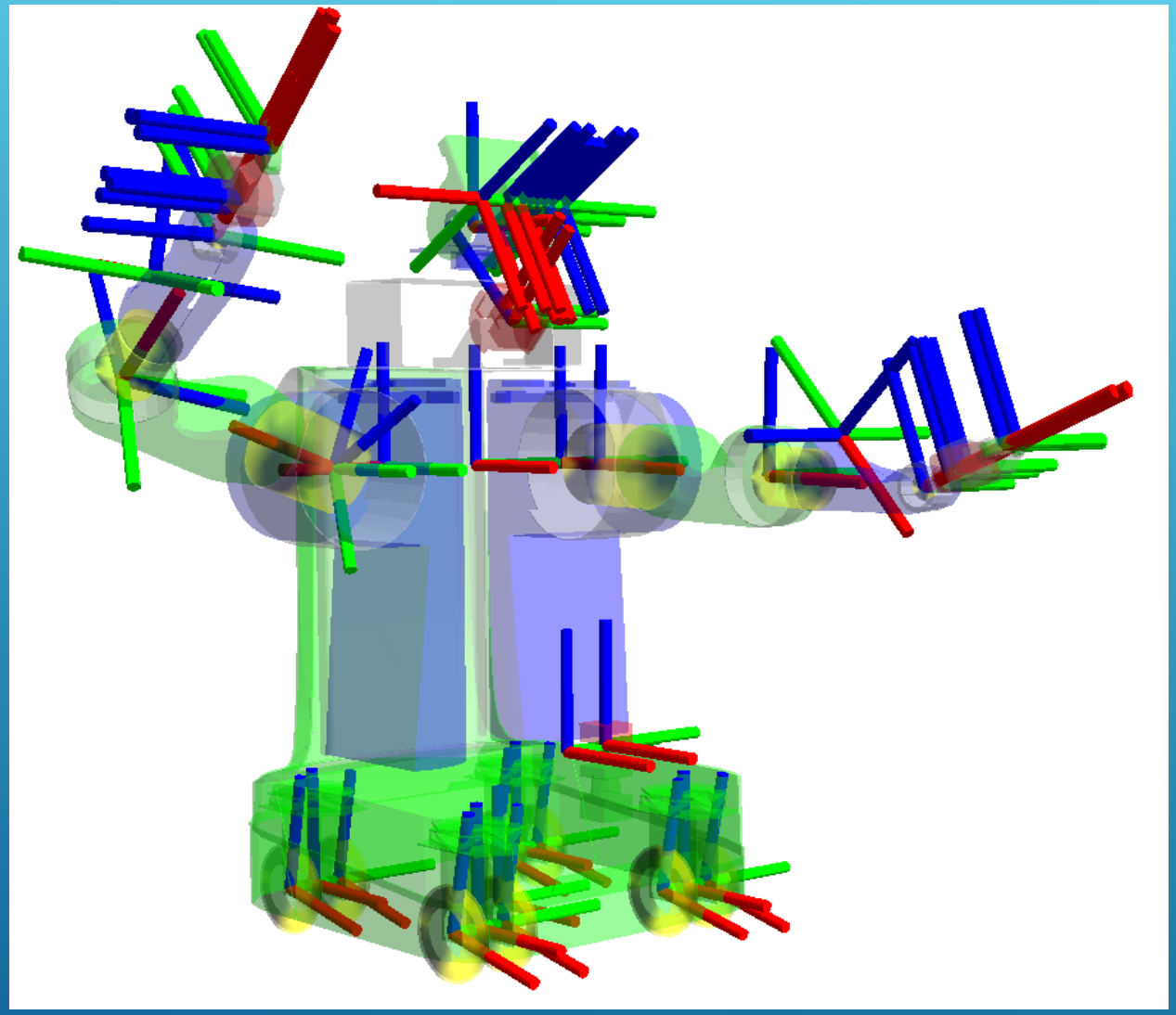


1:1,1:N, N:N 통신 가능

받을 토픽을 노드에서 선언하는 것 만으로 연결되어 Subscribe 된다.

Overall Structure of SLAM-Navigation System





ROBOT FRAME

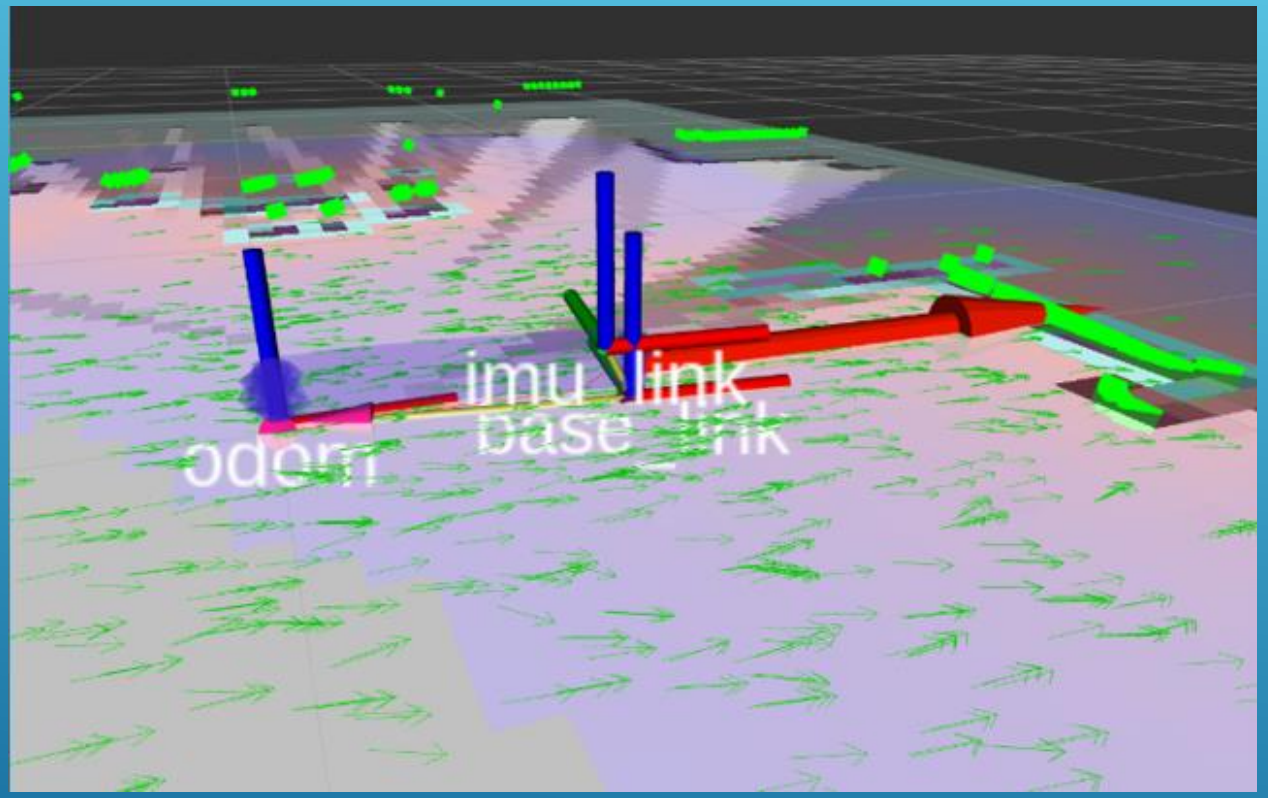
Frame : Coordination 기준 , 정보의 틀

Link : 로봇 각 파츠의 물리적 표현

Joint: 'Link' 간 연결

TF : 'Link' 의 'Frame'들과 다른 Frame 간 상대적 좌표 변환

➔ 로봇의 위치를 바르게 추정하기 위해 올바른 TF 설정은 필수.



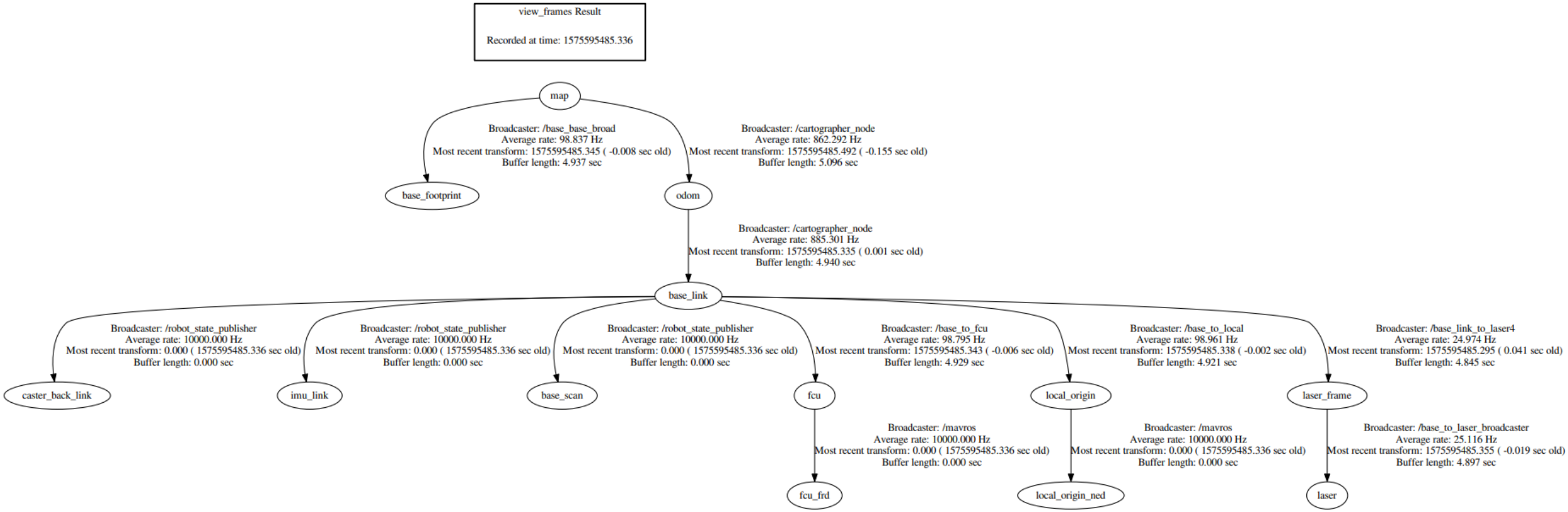
TF

TF? :

프레임 간 상대 좌표 변환!

Question:
늘 나와 한걸음 떨어진 당신.
내가 한걸음 다가가면 당신은?

나의 '위치' 즉 좌표가 절대적으로 중요한 이 시스템에서 TF는 최고의 중요도!!!!



TF 계층도
상위 프레임을 '부모'
하위 프레임을 '자식'
'자식'은 '부모'를 기준으로 표현된다.

MAP: 기준이 되는 '월드', 최상위 프레임.
Odom: 주행의 기록, 현재 자세.
Base_link: 로봇의 본체

```
  fi
fi
source /opt/ros/kinetic/setup.bash
# Load ROS Kinetic Setup
source /opt/ros/kinetic/setup.bash
#source ~/catkin_ws/devel/setup.bash

# Configure ROS Network
export ROS_LOCALIP=xxx.xxx.xxx.xxx
export ROS_MASTER_URI=http://localhost:11311

# Configure ROS alias command
alias cw='cd ~/ydlidar_ws'
alias cs='cd ~/ydlidar_ws/src'
alias cm='cd ~/ydlidar_ws && catkin_make'
alias cb='cd ~/ydlidar_ws && catkin build'
alias sb='source ~/ydlidar_ws/devel/setup.bash'
alias ch='google-chrome'
export PATH=/home/user/bin:/home/user/.local/bin:/opt/ros/kinetic/bin:/home/user/bin:/
home/user/.local/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/
games:/usr/local/games:/snap/bin:/home/user/.local/bin
source ~/ydlidar_ws/devel/setup.bash
source ~/ydlidar_ws/devel/setup.bash




export ROS_MASTER_URI=http://192.168.8.111:11311

export ROS_HOSTNAME=192.168.8.110
```

```
export ROS_IP=192.168.8.111                    #192.168.8.101
export ROS_MASTER_URI=http://localhost:11311
export ROS_HOSTNAME=$ROS_I

# Add an "alert" alias for long running commands.  Use like so:
#   sleep 10; alert
alias alert='notify-send --urgency=low -i "$([ $? = 0 ] && echo
\s*//;s/[;&|]\s*alert$//'\'')"'

# Alias definitions.
# You may want to put all your additions into a separate file li
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enab
# this, if it's already enabled in /etc/bash.bashrc and /etc/prof
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi
export PATH=/usr/local/cuda-10.0/bin:$PATH
export LD_LIBRARY_PATH=/usr/local/cuda-10.0/lib64:$LD_LIBRARY_PA
source /opt/ros/melodic/setup.bash
source ~/catkin_ws/devel/setup.bash
source ~/catkin_ws/devel/setup.bash
source ~/ydlidar_ws/devel/setup.bash
source ~/catkin_ws/devel/setup.bash
source ~/ydlidar_ws/devel/setup.bash
source ~/catkin_ws/devel/setup.bash
source ~/ydlidar_ws/devel/setup.bash
source ~/ydlidar_ws/devel/setup.bash
~
~
```

모바일 플랫폼과의 통신

WIFI 망 아래 연결된 노트북과 모바일 플랫폼.
같은 마스터 서버 아래에서는 ROS의 규칙이 통용.

```
<launch>
        <!-- vim: set ft=xml noet : -->
        <!-- example launch script for ArduPilot based FCU's -->

        <arg name="fcu_url" default="/dev/ttyACM0:57600" />
        <arg name="gcs_url" default="" />
        <arg name="tgt_system" default="1" />
        <arg name="tgt_component" default="1" />
        <arg name="log_output" default="screen" />
        <arg name="fcu_protocol" default="v2.0" />
        <arg name="respawn_mavros" default="false" />
        <include file="/home/nvidia/ydlidar_ws/src/ydlidar_ros/launch/lidar.launch">
        </include>
        <include file="$(find mavros)/launch/node.launch">
                <arg name="pluginlists_yaml" value="$(find mavros)/launch/apm_pluginlists.yaml" />
                <arg name="config_yaml" value="$(find mavros)/launch/apm_config.yaml" />

                <arg name="fcu_url" value="$(arg fcu_url)" />
                <arg name="gcs_url" value="$(arg gcs_url)" />
                <arg name="tgt_system" value="$(arg tgt_system)" />
                <arg name="tgt_component" value="$(arg tgt_component)" />
                <arg name="log_output" value="$(arg log_output)" />
                <arg name="fcu_protocol" value="$(arg fcu_protocol)" />
                <arg name="respawn_mavros" default="$(arg respawn_mavros)" />
        </include>
</launch>
~
```

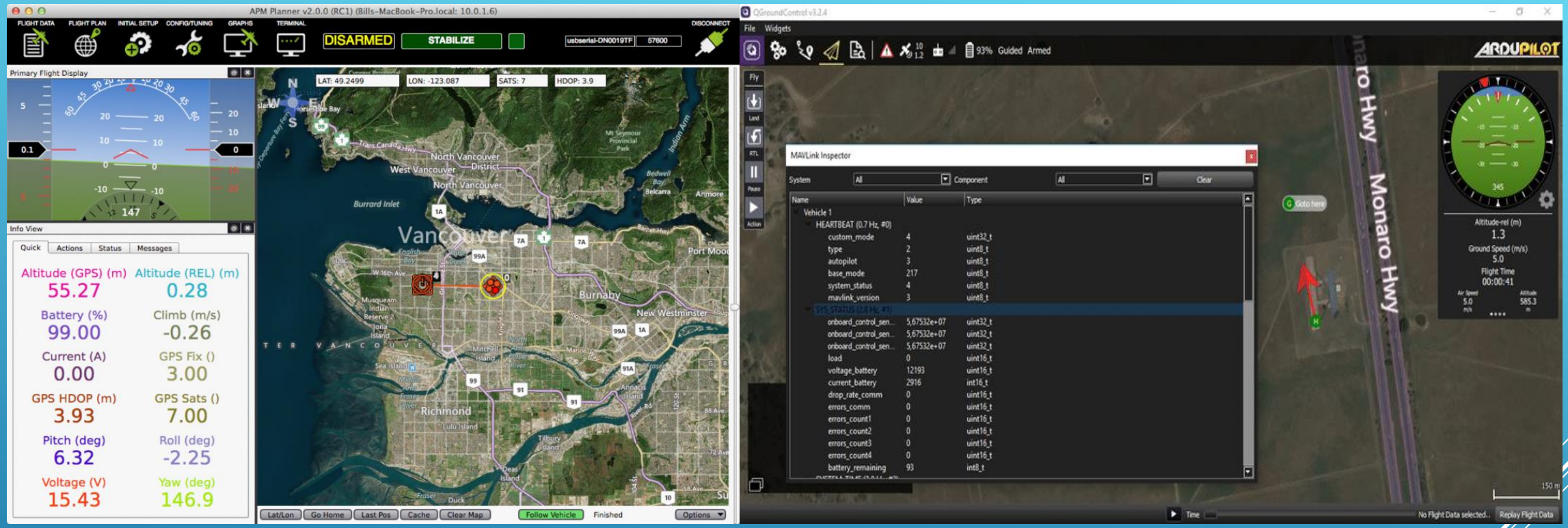
<실행 파일의 조작>

하나의 실행파일로 다수의 다른 실행파일을 동시 실행

->라이다와 제어기 통신(MAVROS)을 동시에 실행 하도록 설정

```
[ INFO] [1578554903.726851747]: Plugin mocap_pose_estimate initialized
[ INFO] [1578554903.727201643]: Plugin mount_control loaded
[ INFO] [1578554903.737188154]: Plugin mount_control initialized
[ INFO] [1578554903.737536539]: Plugin obstacle_distance loaded
[ INFO] [1578554903.745385862]: Plugin obstacle_distance initialized
[ INFO] [1578554903.745703570]: Plugin odom loaded
[ INFO] [1578554903.761868779]: Plugin odom initialized
[ INFO] [1578554903.762261539]: Plugin param loaded
[ INFO] [1578554903.771698935]: Plugin param initialized
[ INFO] [1578554903.771825497]: Plugin px4flow blacklisted
[ INFO] [1578554903.772215602]: Plugin rangefinder loaded
[ INFO] [1578554903.774144872]: Plugin rangefinder initialized
[ INFO] [1578554903.774533935]: Plugin rc_io loaded
[ INFO] [1578554903.785016800]: Plugin rc_io initialized
[ INFO] [1578554903.785221643]: Plugin safety_area blacklisted
[ INFO] [1578554903.785575550]: Plugin setpoint_accel loaded
[ INFO] [1578554903.795723570]: Plugin setpoint_accel initialized
[ INFO] [1578554903.796158779]: Plugin setpoint_attitude loaded
[ INFO] [1578554903.825523206]: Plugin setpoint_attitude initialized
[ INFO] [1578554903.825934299]: Plugin setpoint_position loaded
[ INFO] [1578554903.866210393]: Plugin setpoint_position initialized
[ INFO] [1578554903.866862789]: Plugin setpoint_raw loaded
[ INFO] [1578554903.893233102]: Plugin setpoint_raw initialized
[ INFO] [1578554903.893602060]: Plugin setpoint_velocity loaded
[ INFO] [1578554903.907456643]: Plugin setpoint_velocity initialized
[ INFO] [1578554903.908419039]: Plugin sys_status loaded
[YDLIDAR INFO] Now YDLIDAR is scanning ......
[ INFO] [1578554903.935002581]: Plugin sys_status initialized
[ INFO] [1578554903.935380966]: Plugin sys_time loaded
[ INFO] [1578554903.948913622]: TM: Timesync mode: MAVLINK
[ INFO] [1578554903.952079404]: Plugin sys_time initialized
[ INFO] [1578554903.952376279]: Plugin trajectory loaded
[ INFO] [1578554903.965406435]: Plugin trajectory initialized
[ INFO] [1578554903.966001122]: Plugin vfr_hud loaded
[ INFO] [1578554903.967867268]: Plugin vfr_hud initialized
[ INFO] [1578554903.967990914]: Plugin vibration blacklisted
[ INFO] [1578554903.968219560]: Plugin vision_pose_estimate loaded
[ INFO] [1578554903.985597529]: Plugin vision_pose_estimate initialized
[ INFO] [1578554903.985755029]: Plugin vision_speed_estimate blacklisted
[ INFO] [1578554903.986151174]: Plugin waypoint loaded
[ INFO] [1578554903.996096487]: Plugin waypoint initialized
[ INFO] [1578554903.996234560]: Plugin wheel_odometry blacklisted
[ INFO] [1578554903.996509299]: Plugin wind_estimation loaded
[ INFO] [1578554903.998080185]: Plugin wind_estimation initialized
[ INFO] [1578554903.998208883]: Built-in SIMD instructions: ARM NEON
[ INFO] [1578554903.998340289]: Built-in MAVLink package version: 2019.9.9
[ INFO] [1578554903.998607477]: Known MAVLink dialects: common ardupilotmega ASLUAV autoquad icarous matrixpilot paparazzi slugs standard uAvionix ualberta
[ INFO] [1578554903.998684716]: MAVROS started. MY ID 1.240, TARGET ID 1.1
[ INFO] [1578554904.184828466]: RC_CHANNELS message detected!
[ INFO] [1578554904.185568258]: IMU: Raw IMU message used.
[ WARN] [1578554904.185905445]: IMU: linear acceleration on RAW_IMU known on APM only.
[ WARN] [1578554904.186330029]: IMU: ~imu/data_raw stores unscaled raw acceleration report.
[ WARN] [1578554904.197322476]: TM: Wrong FCU time.
[ INFO] [1578554904.496537633]: CON: Got HEARTBEAT, connected. FCU: ArduPilot
[ INFO] [1578554904.685528414]: RC_CHANNELS message detected!
[ WARN] [1578554904.697337632]: GP: No GPS fix
[ INFO] [1578554905.519359038]: VER: 1.1: Capabilities         0x00000000000031cf
[ INFO] [1578554905.520123570]: VER: 1.1: Flight software:     030502ff ( 16a1b5f)
[ INFO] [1578554905.520718309]: VER: 1.1: Middleware software: 00000000 (       )
[ INFO] [1578554905.521291799]: VER: 1.1: OS software:         00000000 ( 1ba712a)
[ INFO] [1578554905.521808049]: VER: 1.1: Board hardware:      00000000
[ INFO] [1578554905.522358674]: VER: 1.1: VID/PID:             0000:0000
[ INFO] [1578554905.522903518]: VER: 1.1: UID:                 0000000000000000
[ WARN] [1578554905.523651122]: CMD: Unexpected command 520, result 0
```

모바일 플랫폼 제어기와의 원격 통신!



<일반적인 GCS의 예, APMPLANNER,QGROUNDCONTROL>

MAVROS? CLI기반 GCS!

SLAM?

- Simultaneous Localization And Mapping!
- 동시적 위치 추정 및 지도 작성!

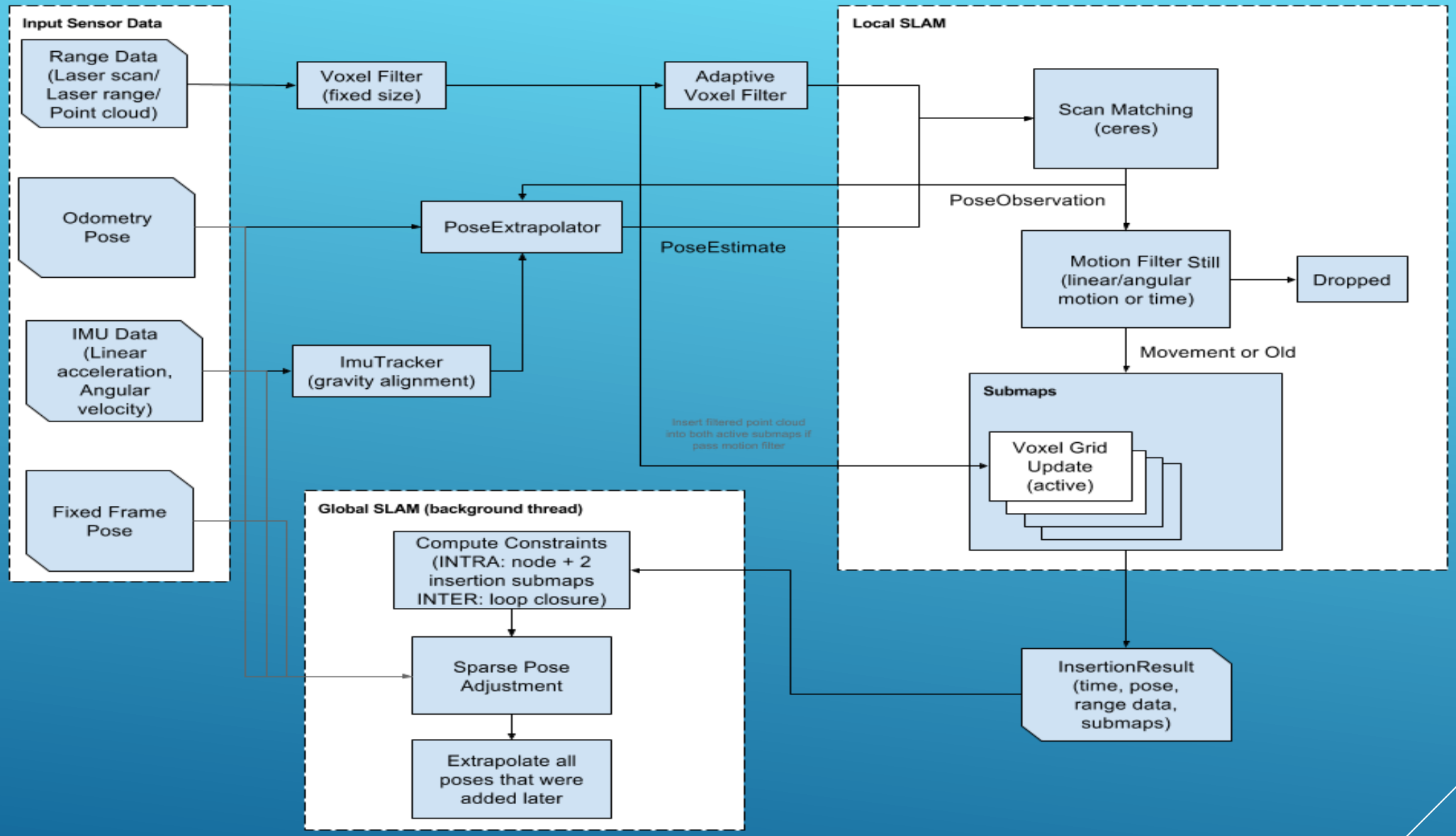
쉽지 않은 문제. 왜?

닭과 계란 문제

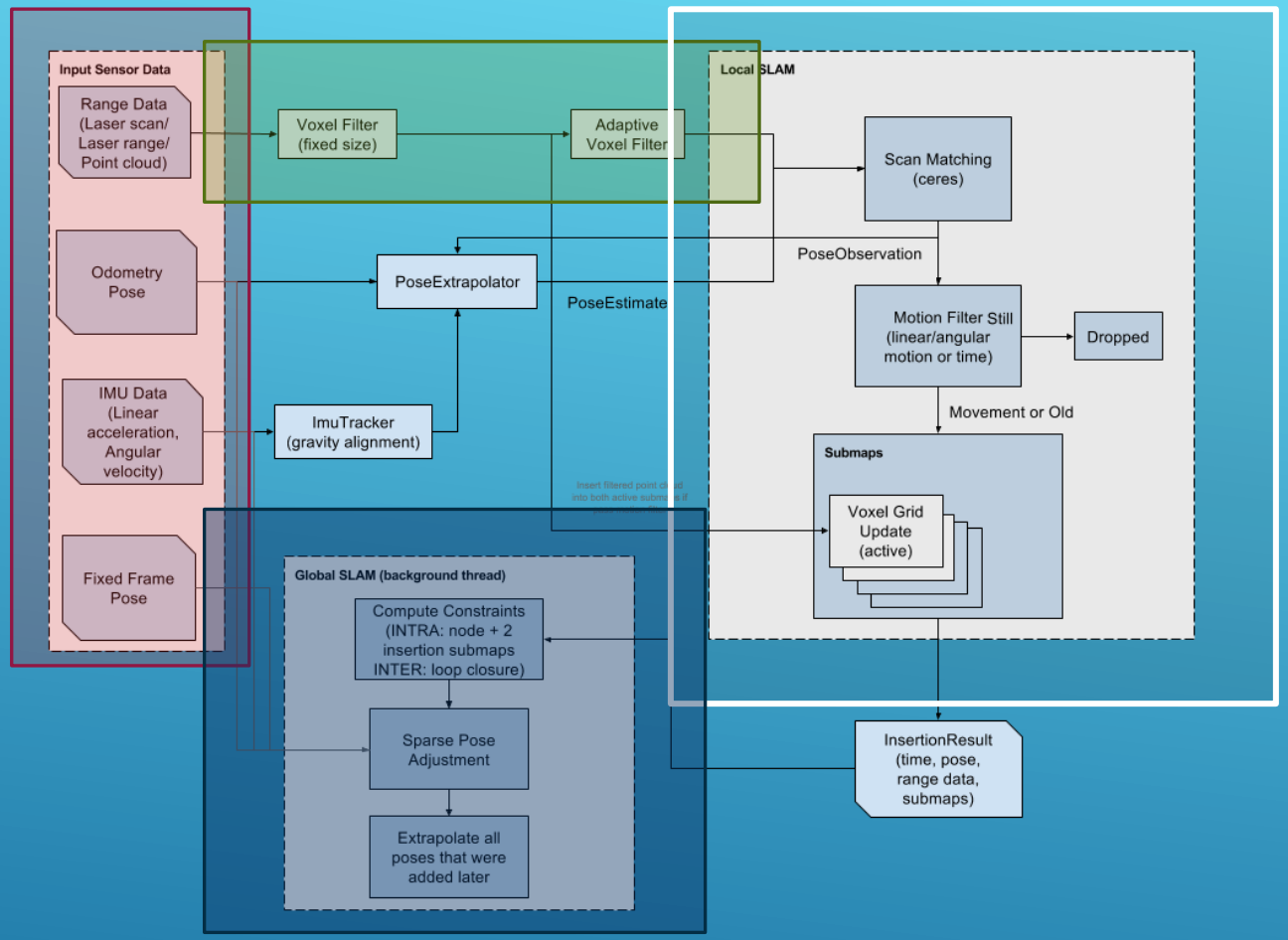
위치 : 나는 여기 있다. 그런데 여기가 뭐지?

지도 : 뭘 기준으로 그리는데? 내가 어디 있길래?

상호 의존적인 두 문제는 동시에 해결해야 한다



GOOGLE CARTOGRAPHER SLAM



4. Global SLAM

Local SLAM의 위치 정보 통합 -> 더 정확한 위치!

Local SLAM의 Submap 통합 -> 더 넓고 확실한 지도!

1. 센서 데이터의 입력.
센서값 획득! From MAVROS & Lidar!

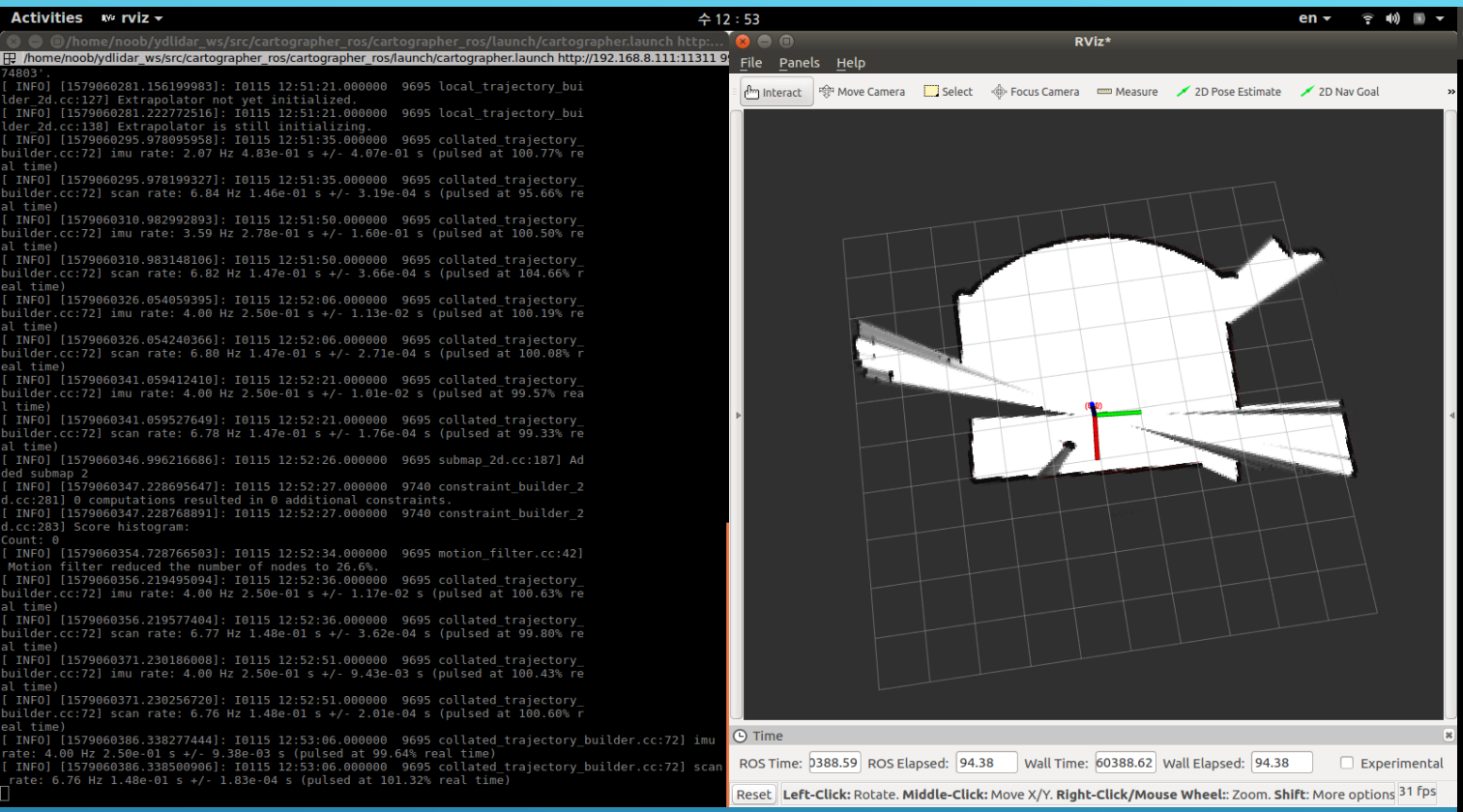
2. 라이다 센서 값:
너무 많다! 1차 고정형 복셀필터!(Downsampling)
그래도 가까운 건 정확하게! 2차 적응형 복셀필터!

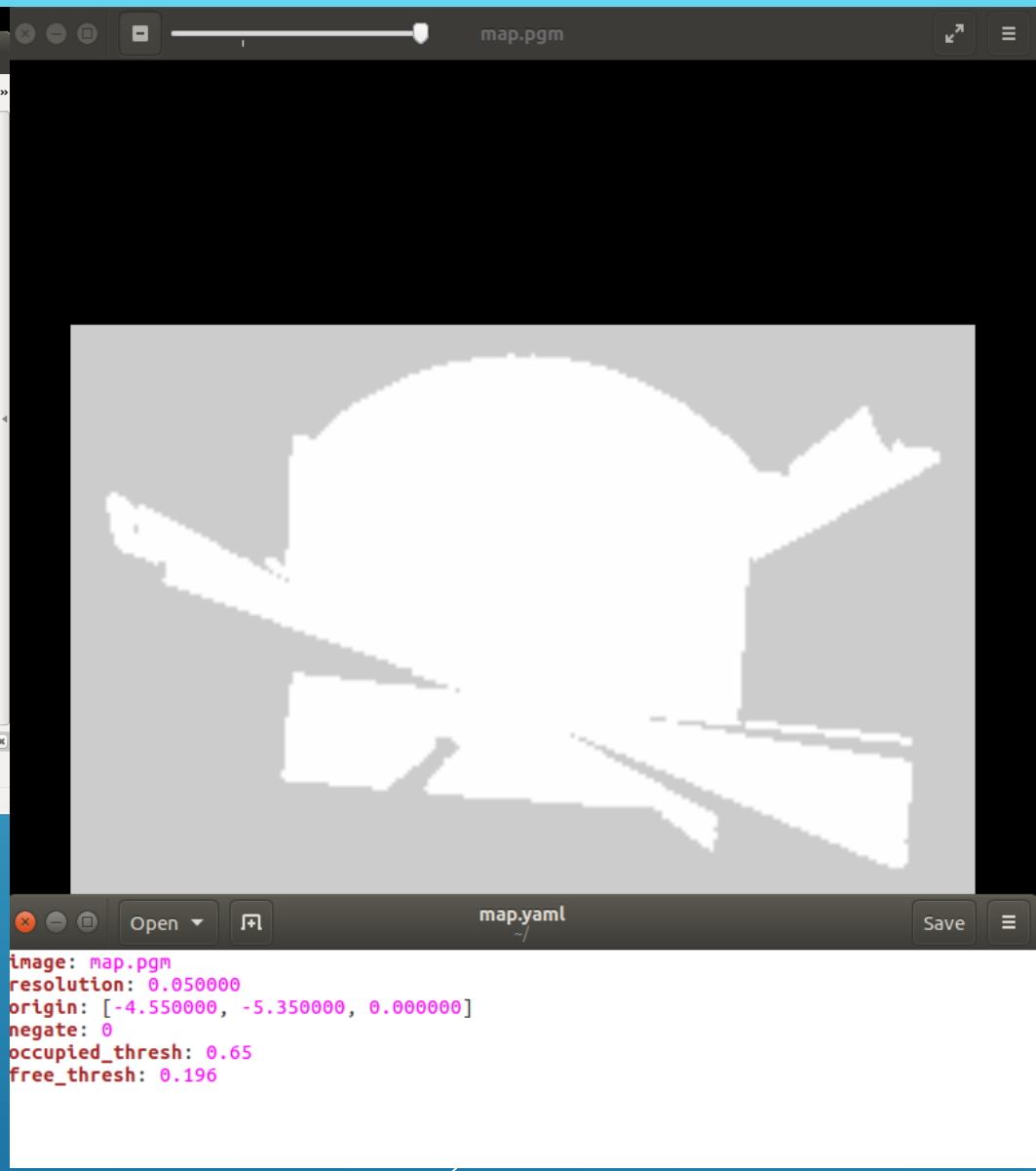
3. Local SLAM.
라이다 데이터: 예측 불가 노이즈 가득! Ceres-Solver로!

최적화된 거리 값 -> PoseExtrapolator로,
동시에 PE 값 기준으로 점유 격자 Submap 작성!

최적화된 거리 값-> PE를 업데이트! ->
위치 추정 업데이트!

위치에 맞게 적응형 복셀 필터 조정!

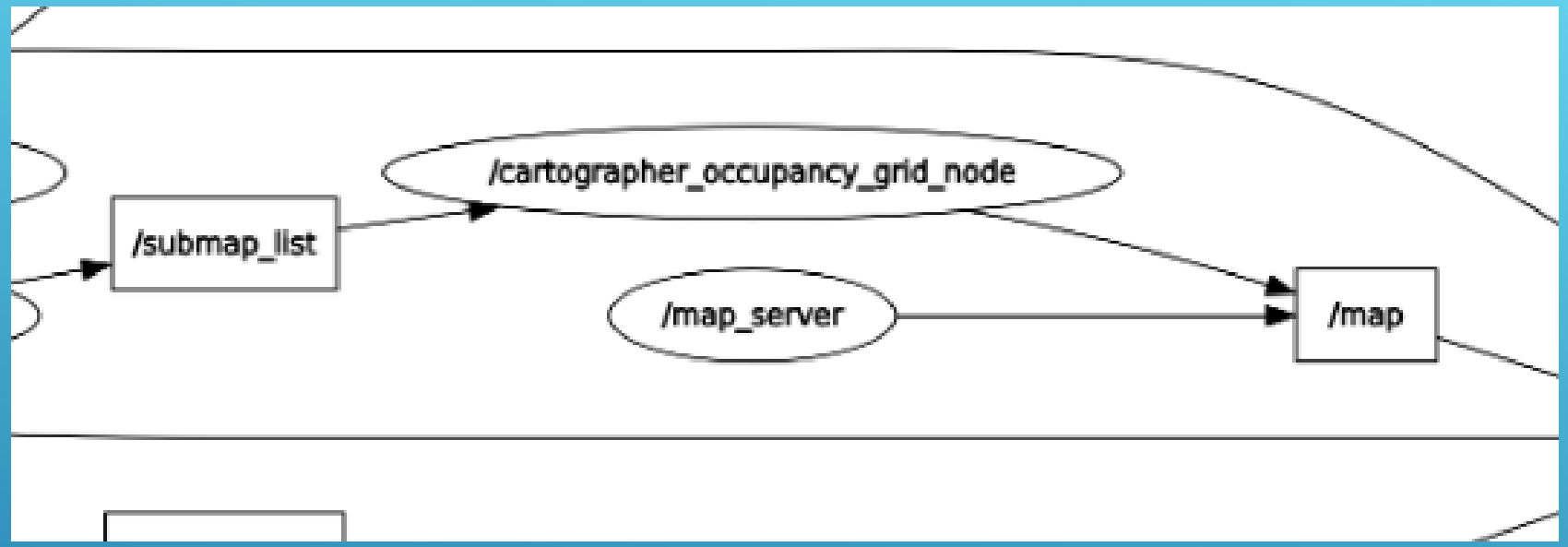




Cartographer 구동.
지금 이 곳의 지도 획득.
8만원짜리 센서로 이토록 높은 정확도의 지도를!

작성 완료 -> 지도 파일로 저장 가능!

★이후 더 낮은 사양에서 더 높은 정확도로 구동 가능★

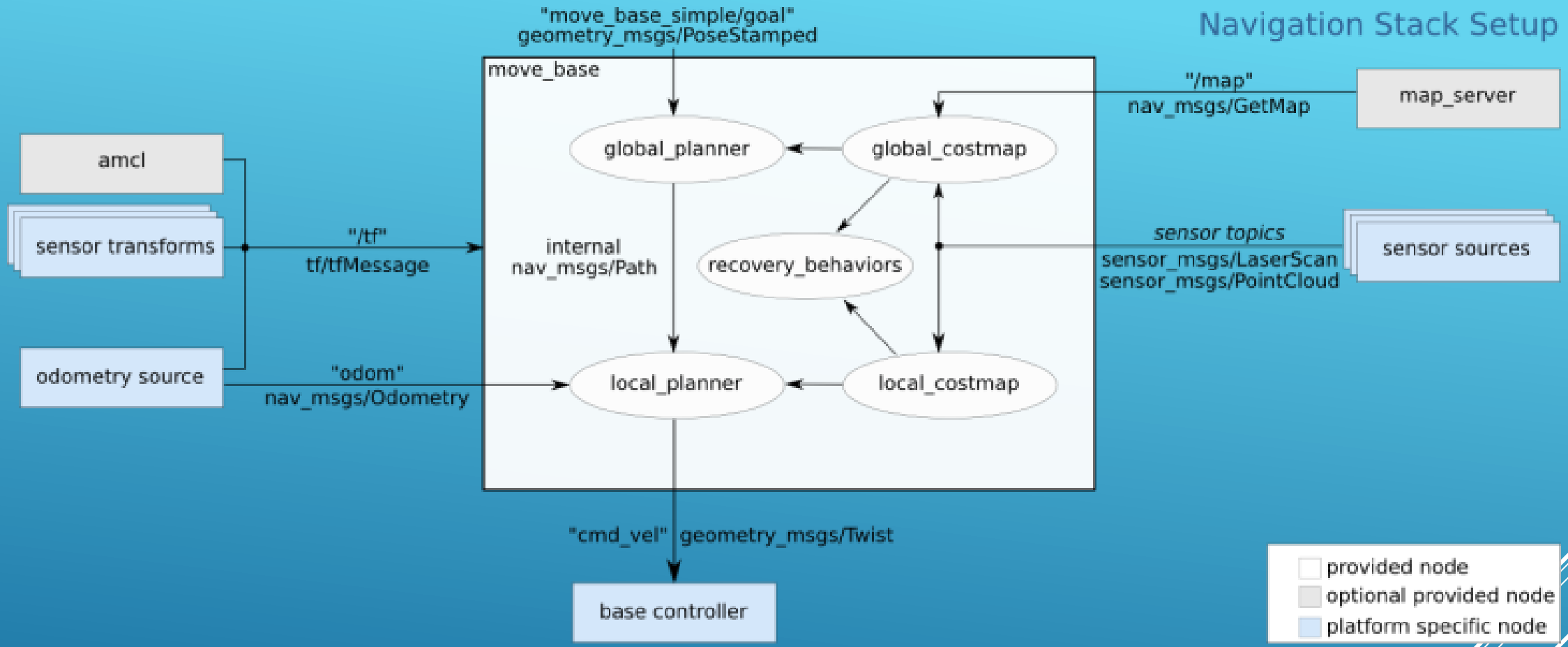


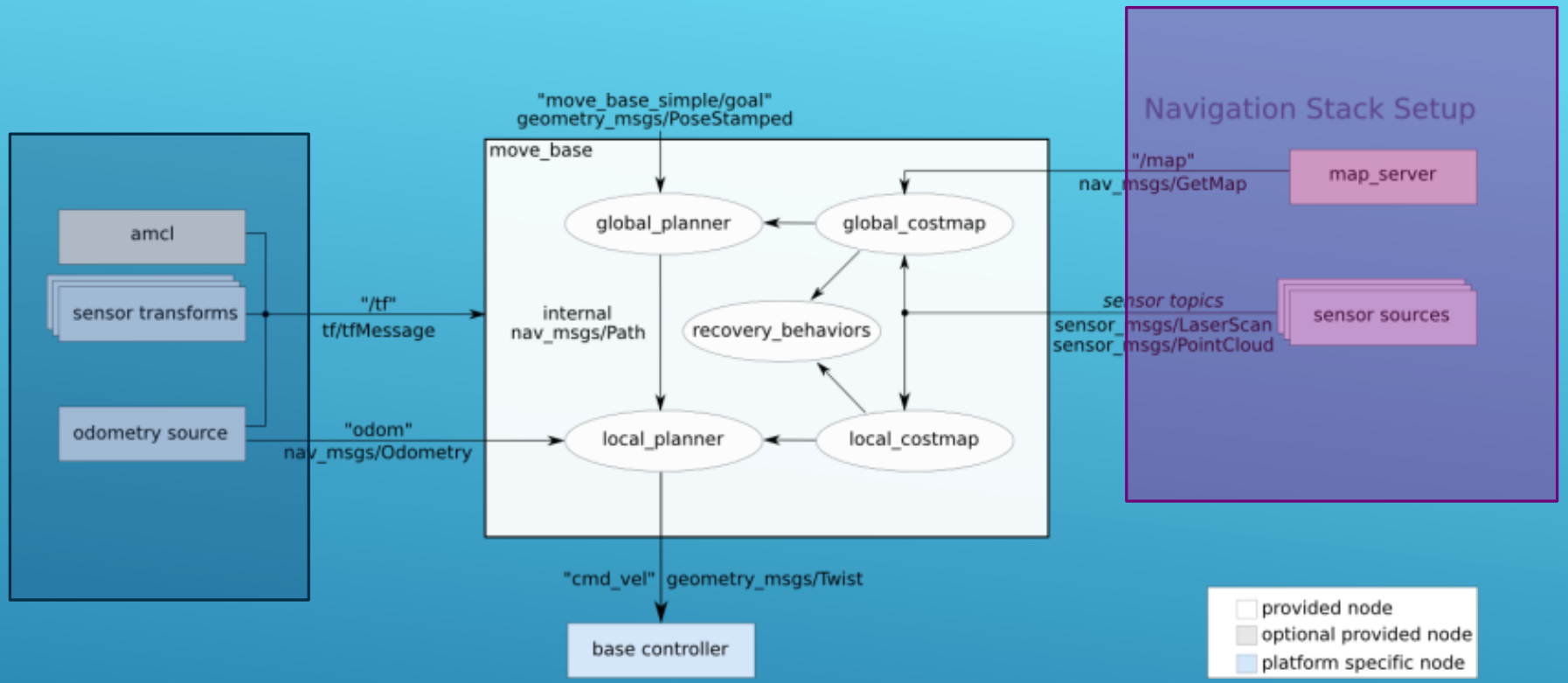
Cartographer의 Map --> 실시간으로 /map 을 찾는 이에게…

그게 누구..?

Navigation (Move_base)…!

Navigation

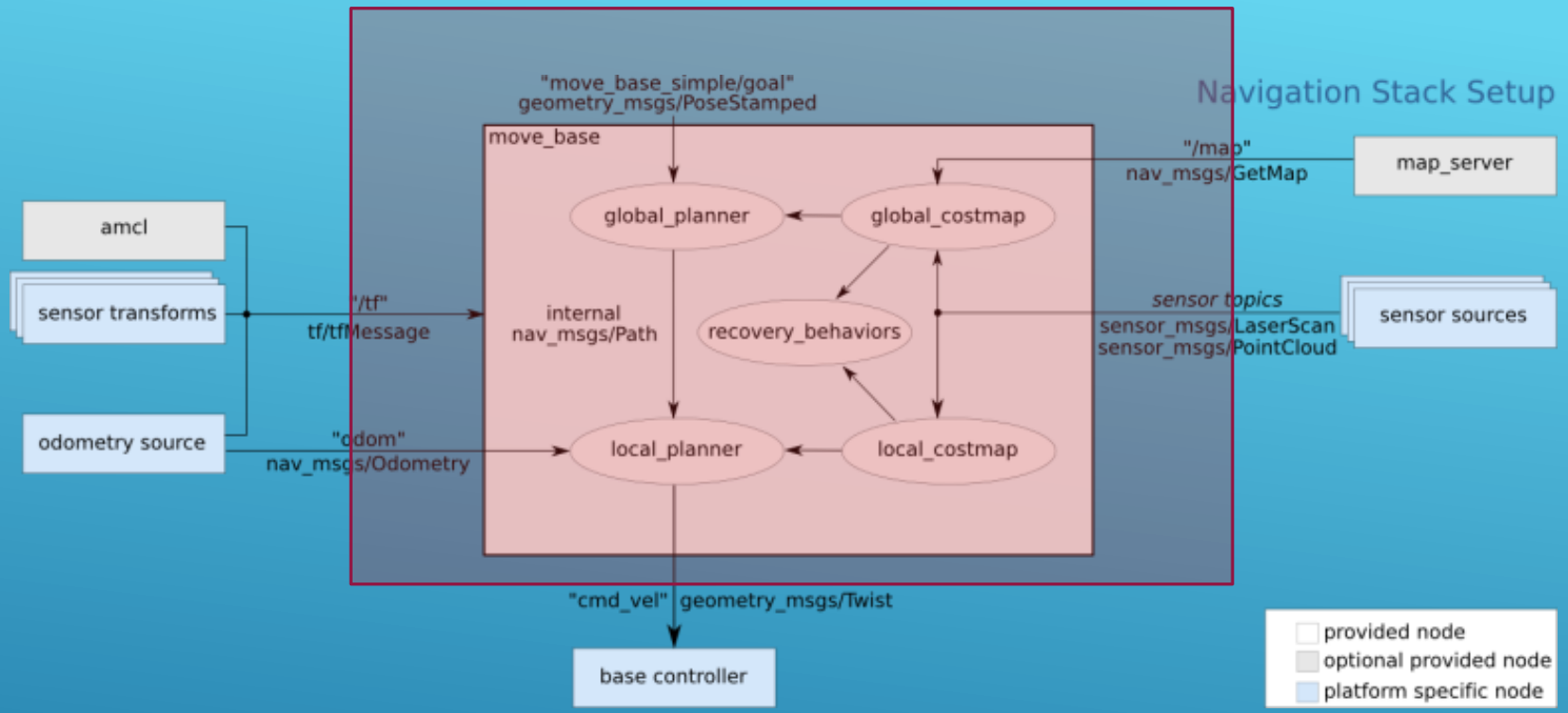

Navigation Stack Setup
"move_base_simple/goal"
geometry_msgs/PoseStamped
move_base
global_planner
global_costmap
"/map"
nav_msgs/GetMap
map_server
amcl
sensor transforms
"/tf"
tf/tfMessage
internal
nav_msgs/Path
recovery_behaviors
sensor topics
sensor_msgs/LaserScan
sensor_msgs/PointCloud
sensor sources
odometry source
"odom"
nav_msgs/Odometry
local_planner
local_costmap
"cmd_vel" geometry_msgs/Twist
base controller
provided node
optional provided node
platform specific node



메인 노드 Move_base의 외부.

1. Pose data 획득 From TF (Cartographer 영향) / 주행기록계 /AMCL 구동

2. /map 토픽을 받아 move_base에 작성된 /작성중인 map을 공급하며
실시간 센서 데이터 또한 move_base의 costmap 작성용으로 퍼블리시.



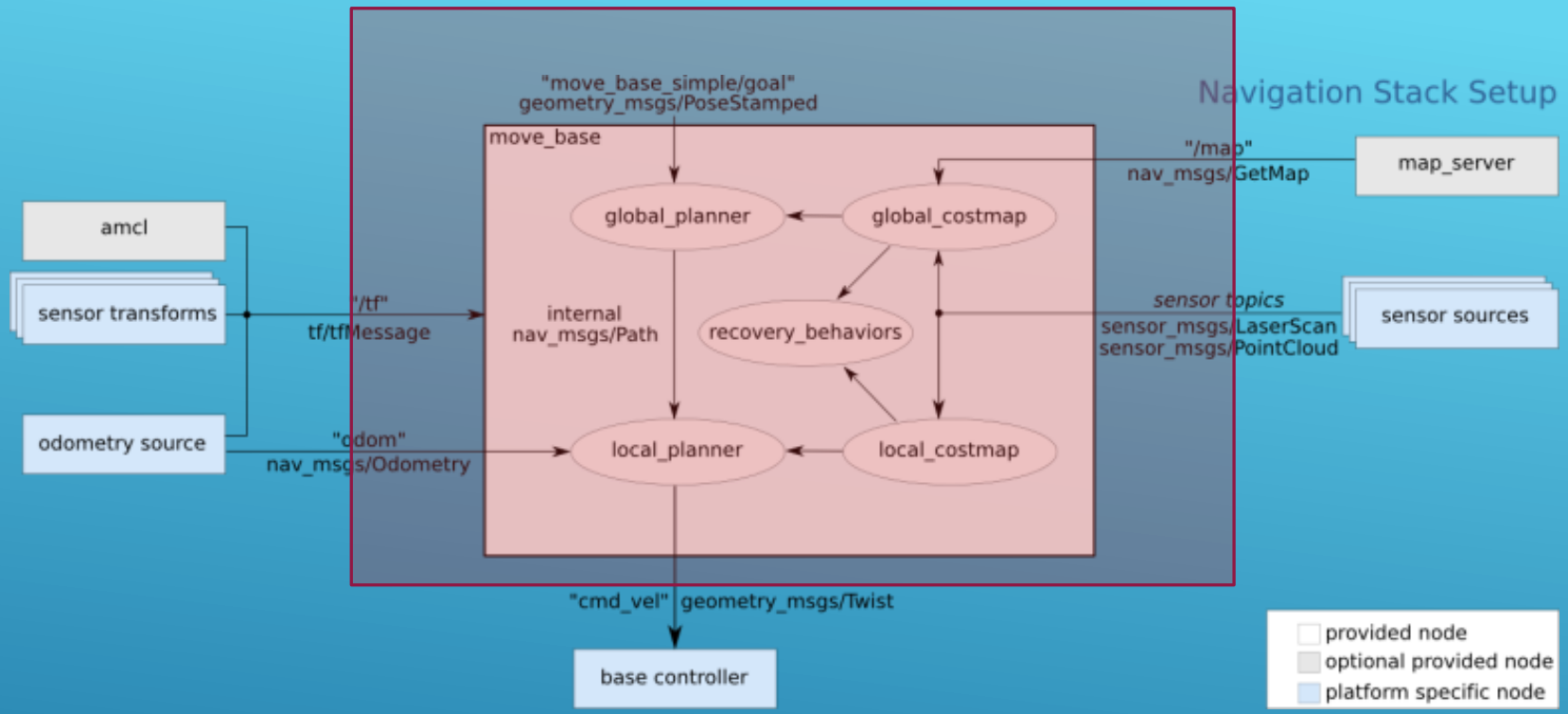
메인 노드 Move_base의 내부.

1. 받은 map 기반, 레이저 스캔 데이터와 덧씌워 costmap을 작성.

2. Grid map의 각 grid 점유 확률에 차등하여 점유 grid 주변 cost를 계산 및 시각화.

3. 목표지점까지의 지도 기반(/map에서 받은)으로 장기적 경로를 만드는 global planner에 global costmap.

4. 실시간 업데이트가 빠르고 속응성 있는 경로를 만드는 local planner에 local costmap이 공급됨.



5. Local planner는 일정 단위의 속도 제어 명령으로 제어할 수 있는 이동 경로 로서 매우 짧음.

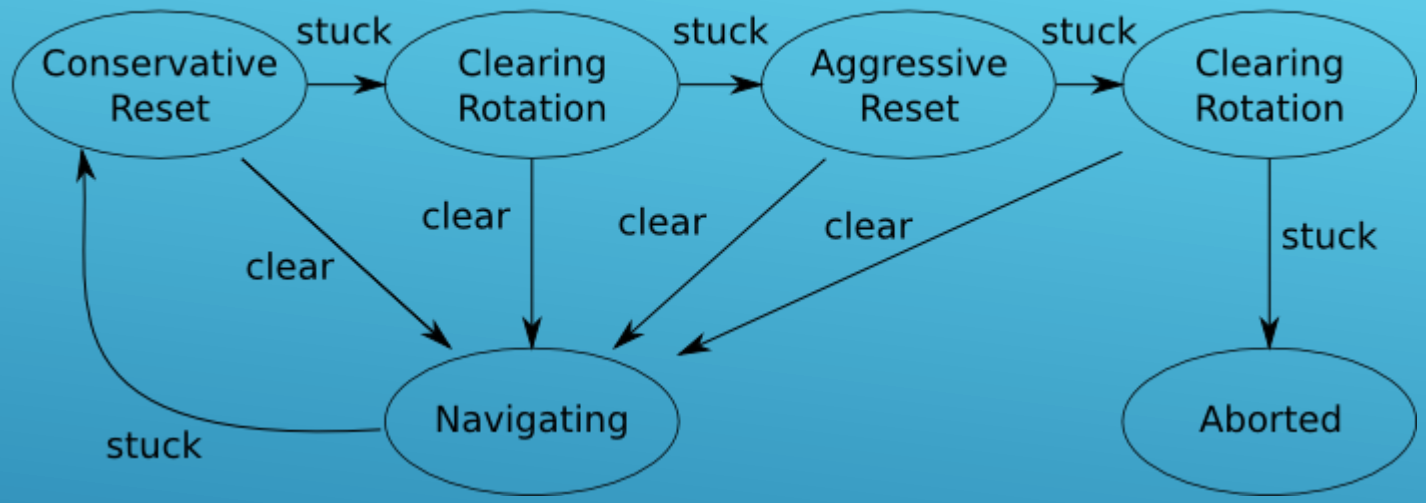
6. Local planner는 최대한 Global planner의 경로를 추종하도록 되어있음.

7. Global planner 또한 최초의 계획과 다르게 장애물이 나타날 경우 수정될 수 있으며, Local planner는 수정된 경로를 따라 주행.

8. 주행 중 문제가 생겼을 시 recovery behavior 시작.

Recovery behavior 알고리즘

move_base Default Recovery Behaviors

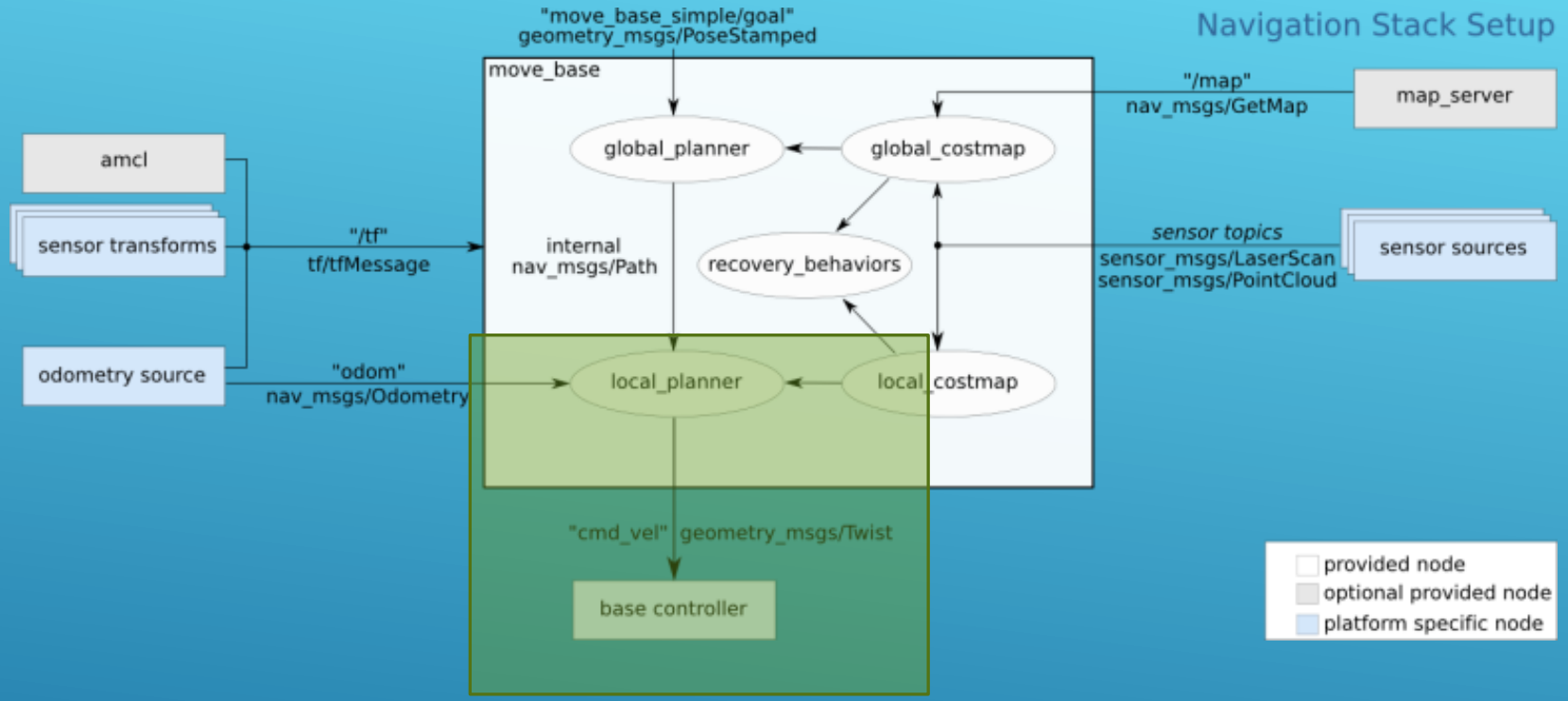


1. Costmap은 점유되지 않은 Grid(격자)일수록 높은 Cost를 지님.

2. Planner는 기본적으로 Cost의 총 합이 가장 높은 Grid를 지나도록 경로를 생성.

3. 오차와 사고로 Cost가 낮은 Grid 지역 진입 -> Recovery Behavior 시작!

4. a.) 제자리 회전, 장애물 탈출 시도
   b.) 탈출 확인
   c.) 고속 제자리 회전, 장애물 탈출 시도
   d.) 탈출 확인 , 실패 시 주행 중지



Move_base output

1. Local Planner는 직접적인 속도 제어 토픽인 /cmd_vel 을 Geometry_msgs/Twist 형식으로 퍼블리시.

2. 해당 메시지가 /mavros/setpoint_velocity/cmd_vel로 들어가게 되면, Guided 모드 하 모터 제어.

문제점.

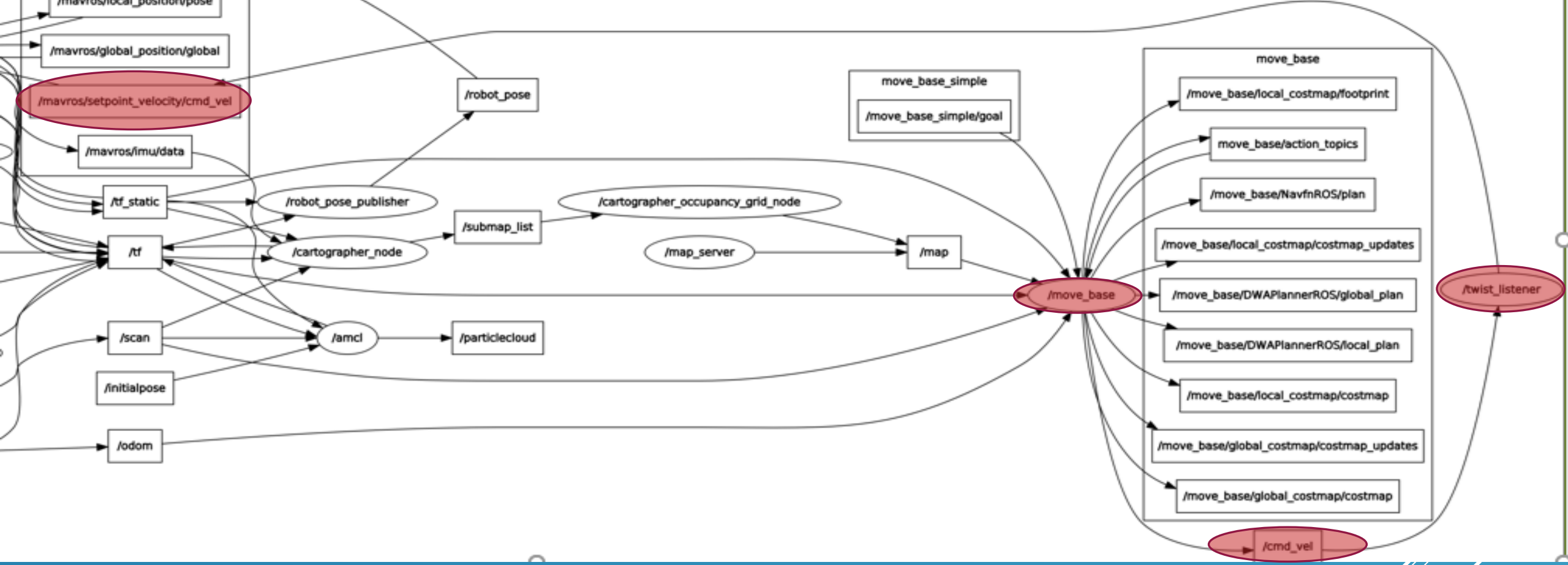
/mavros/setpoint_velocity/cmd_vel -> Geometry_msgs/Twist 아님.

Geometry_msgs/TwistStamped 필요 !!!

같은 토픽, 다른 메시지 형식.

시간 헤더, 프레임 지정 필요.

중간자 필요, 형식 번역 노드 도입.



/cmd_vel : Move_base(자율주행 프로세스) -> Twist_listener(번역기)-> /Mavros(제어기)

Navigation 사용 순서

1. GUIDED 모드 진입 필요

외부 명령 제어 -> GUIDED 모드!

외부 명령 모터 제어 -> 초기 위치 확정 필요! (안전장치) -> SLAM 구동 필요

```
[ INFO] [1579067580.781376141]: VER: 1.1: UID:                    0000000000000000
[ WARN] [1579067580.782827756]: CMD: Unexpected command 520, result 0
[ INFO] [1579067584.974609317]: FCU: EKF2 IMU0 is using external nav data
[ INFO] [1579067584.977583535]: FCU: EKF2 IMU0 initial pos NED = 0.0,0.0,-0.0 (m
)
[ INFO] [1579067584.978570202]: FCU: EKF2 IMU0 ext nav yaw alignment complete
[ INFO] [1579067584.979940410]: FCU: EKF2 IMU1 is using external nav data
[ INFO] [1579067584.981293483]: FCU: EKF2 IMU1 initial pos NED = 0.0,0.0,-0.0 (m
)
[ INFO] [1579067584.982725723]: FCU: EKF2 IMU1 ext nav yaw alignment complete
[ INFO] [1579067589.737668065]: HP: requesting home position
```

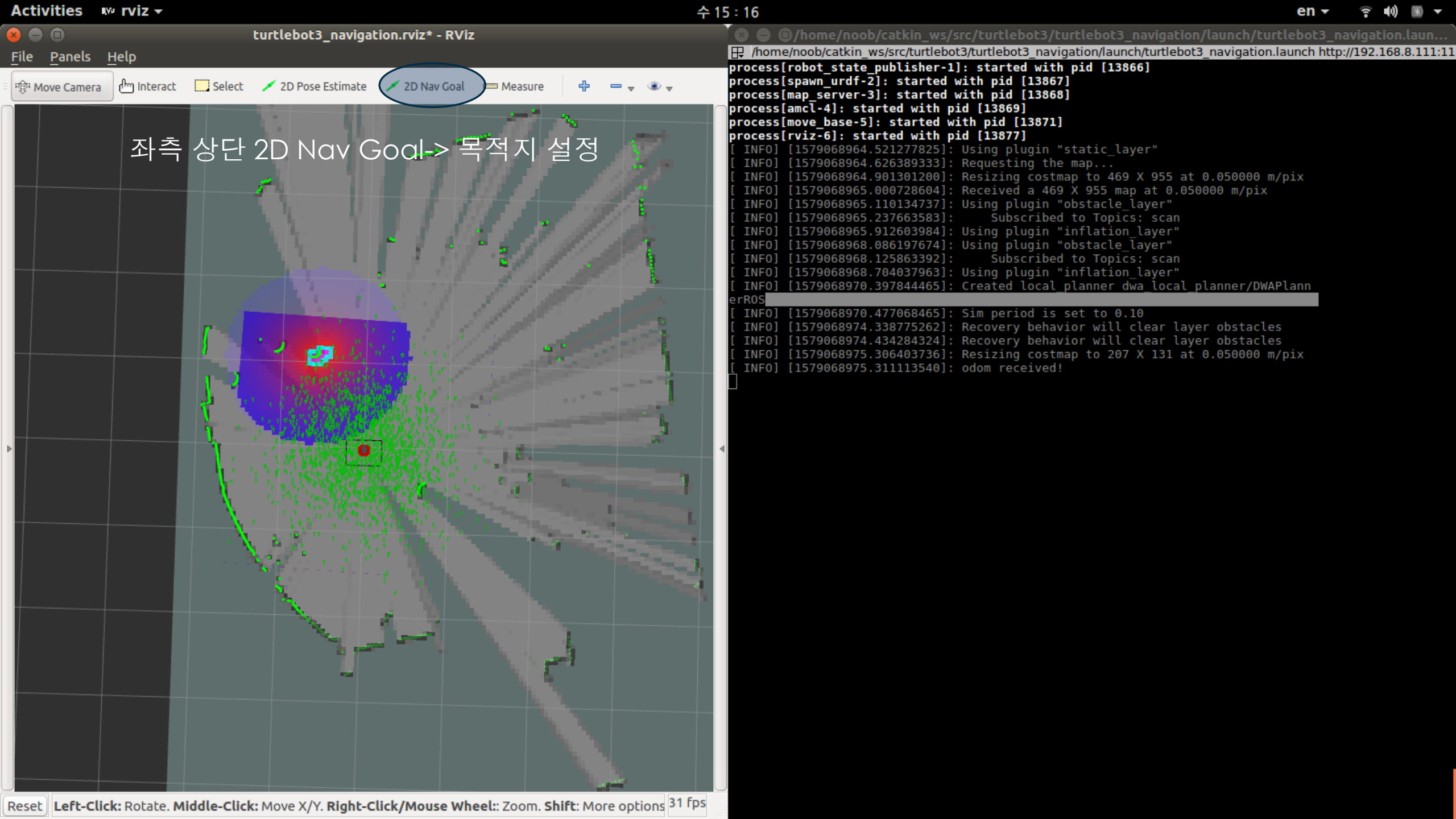
* Google Cartographer 실행-> MAVROS 상태창 확인 (initial pos NED….)

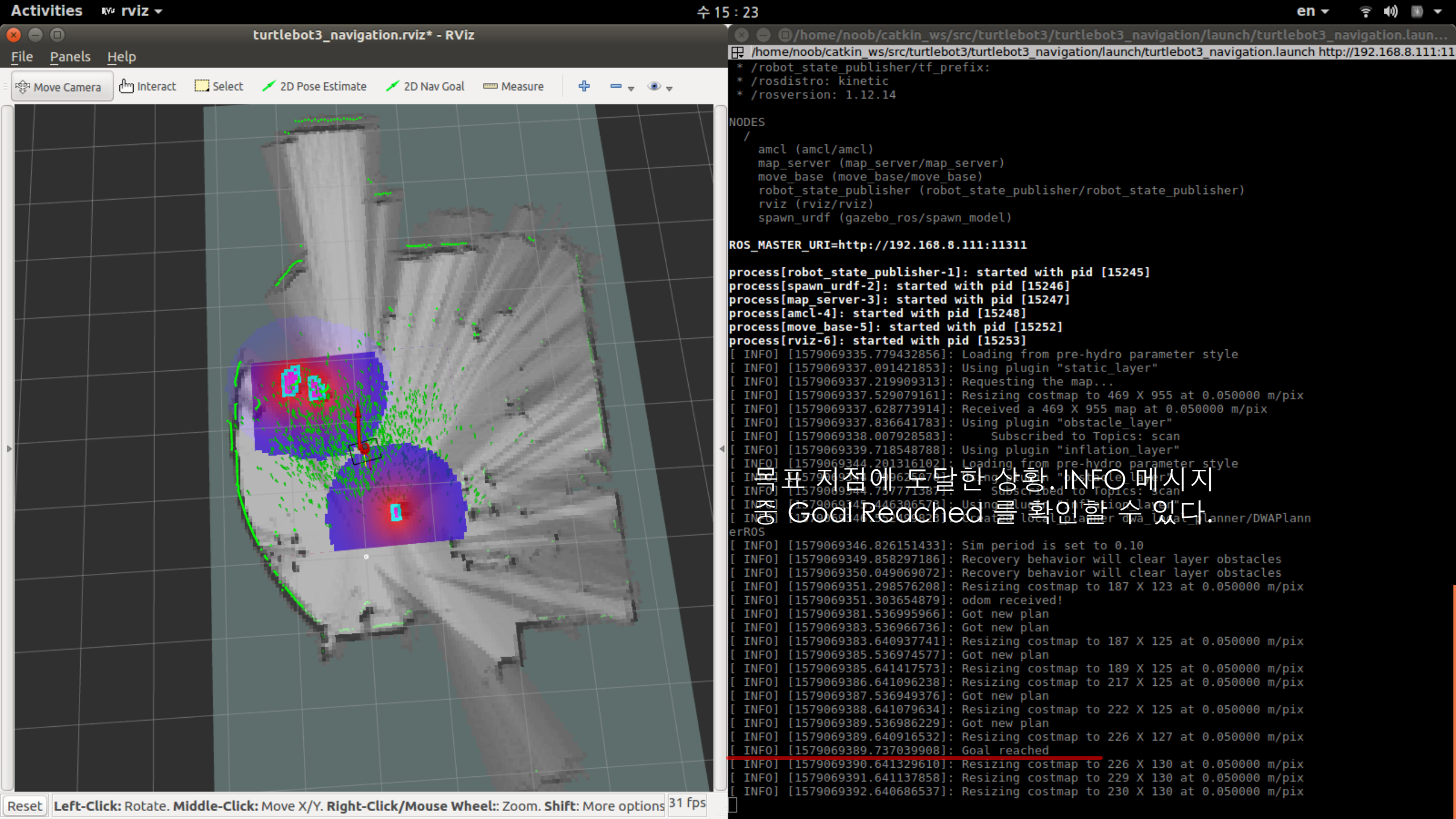
```
74803'.
[ INFO] [1579060281.156199983]: I0115 12:51:21.000000  9695 local_trajectory_bui
lder_2d.cc:127] Extrapolator not yet initialized.
[ INFO] [1579060281.222772516]: I0115 12:51:21.000000  9695 local_trajectory_bui
lder_2d.cc:138] Extrapolator is still initializing.
[ INFO] [1579060295.978095958]: I0115 12:51:35.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 2.07 Hz 4.83e-01 s +/- 4.07e-01 s (pulsed at 100.77% re
al time)
[ INFO] [1579060295.978199327]: I0115 12:51:35.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.84 Hz 1.46e-01 s +/- 3.19e-04 s (pulsed at 95.66% re
al time)
[ INFO] [1579060310.982992893]: I0115 12:51:50.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 3.59 Hz 2.78e-01 s +/- 1.60e-01 s (pulsed at 100.50% re
al time)
[ INFO] [1579060310.983148106]: I0115 12:51:50.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.82 Hz 1.47e-01 s +/- 3.66e-04 s (pulsed at 104.66% r
eal time)
[ INFO] [1579060326.054059395]: I0115 12:52:06.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 4.00 Hz 2.50e-01 s +/- 1.13e-02 s (pulsed at 100.19% re
al time)
[ INFO] [1579060326.054240366]: I0115 12:52:06.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.80 Hz 1.47e-01 s +/- 2.71e-04 s (pulsed at 100.08% r
eal time)
[ INFO] [1579060341.059412410]: I0115 12:52:21.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 4.00 Hz 2.50e-01 s +/- 1.01e-02 s (pulsed at 99.57% rea
l time)
[ INFO] [1579060341.059527649]: I0115 12:52:21.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.78 Hz 1.47e-01 s +/- 1.76e-04 s (pulsed at 99.33% re
al time)
[ INFO] [1579060346.996216686]: I0115 12:52:26.000000  9695 submap_2d.cc:187] Ad
ded submap 2
[ INFO] [1579060347.228695647]: I0115 12:52:27.000000  9740 constraint_builder_2
d.cc:281] 0 computations resulted in 0 additional constraints.
[ INFO] [1579060347.228768891]: I0115 12:52:27.000000  9740 constraint_builder_2
d.cc:283] Score histogram:
Count: 0
[ INFO] [1579060354.728766503]: I0115 12:52:34.000000  9695 motion_filter.cc:42]
 Motion filter reduced the number of nodes to 26.6%.
[ INFO] [1579060356.219495094]: I0115 12:52:36.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 4.00 Hz 2.50e-01 s +/- 1.17e-02 s (pulsed at 100.63% re
al time)
[ INFO] [1579060356.219577404]: I0115 12:52:36.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.77 Hz 1.48e-01 s +/- 3.62e-04 s (pulsed at 99.80% re
al time)
[ INFO] [1579060371.230186008]: I0115 12:52:51.000000  9695 collated_trajectory_
builder.cc:72] imu rate: 4.00 Hz 2.50e-01 s +/- 9.43e-03 s (pulsed at 100.43% re
al time)
[ INFO] [1579060371.230256720]: I0115 12:52:51.000000  9695 collated_trajectory_
builder.cc:72] scan rate: 6.76 Hz 1.48e-01 s +/- 2.01e-04 s (pulsed at 100.60% r
eal time)
[ INFO] [1579060386.338277444]: I0115 12:53:06.000000  9695 collated_trajectory_builder.cc:72] imu
rate: 4.00 Hz 2.50e-01 s +/- 9.38e-03 s (pulsed at 99.64% real time)
[ INFO] [1579060386.338500906]: I0115 12:53:06.000000  9695 collated_trajectory_builder.cc:72] scan
 rate: 6.76 Hz 1.48e-01 s +/- 1.83e-04 s (pulsed at 101.32% real time)
```

Cartographer

-> 실시간 MAP 공급

-> 실시간 위치 정보 제공


Activities
rviz
수 15 : 16
en
turtlebot3_navigation.rviz* - RViz
File
Panels
Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
좌측 상단 2D Nav Goal-> 목적지 설정
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options
31 fps
/home/noob/catkin_ws/src/turtlebot3/turtlebot3_navigation/launch/turtlebot3_navigation.laun...
/home/noob/catkin_ws/src/turtlebot3/turtlebot3_navigation/launch/turtlebot3_navigation.launch http://192.168.8.111:11
process[robot_state_publisher-1]: started with pid [13866]
process[spawn_urdf-2]: started with pid [13867]
process[map_server-3]: started with pid [13868]
process[amcl-4]: started with pid [13869]
process[move_base-5]: started with pid [13871]
process[rviz-6]: started with pid [13877]
[INFO] [1579068964.521277825]: Using plugin "static_layer"
[INFO] [1579068964.626389333]: Requesting the map...
[INFO] [1579068964.901301200]: Resizing costmap to 469 X 955 at 0.050000 m/pix
[INFO] [1579068965.000728604]: Received a 469 X 955 map at 0.050000 m/pix
[INFO] [1579068965.110134737]: Using plugin "obstacle_layer"
[INFO] [1579068965.237663583]: Subscribed to Topics: scan
[INFO] [1579068965.912603984]: Using plugin "inflation_layer"
[INFO] [1579068968.086197674]: Using plugin "obstacle_layer"
[INFO] [1579068968.125863392]: Subscribed to Topics: scan
[INFO] [1579068968.704037963]: Using plugin "inflation_layer"
[INFO] [1579068970.397844465]: Created local_planner dwa_local_planner/DWAPlann
erROS
[INFO] [1579068970.477068465]: Sim period is set to 0.10
[INFO] [1579068974.338775262]: Recovery behavior will clear layer obstacles
[INFO] [1579068974.434284324]: Recovery behavior will clear layer obstacles
[INFO] [1579068975.306403736]: Resizing costmap to 207 X 131 at 0.050000 m/pix
[INFO] [1579068975.311113540]: odom received!


Activities
rviz
수 15 : 23
en
turtlebot3_navigation.rviz* - RViz
File
Panels
Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
/home/noob/catkin_ws/src/turtlebot3/turtlebot3_navigation/launch/turtlebot3_navigation.launch http://192.168.8.111:11
* /robot_state_publisher/tf_prefix:
* /rosdistro: kinetic
* /rosversion: 1.12.14
NODES
/
amcl (amcl/amcl)
map_server (map_server/map_server)
move_base (move_base/move_base)
robot_state_publisher (robot_state_publisher/robot_state_publisher)
rviz (rviz/rviz)
spawn_urdf (gazebo_ros/spawn_model)
ROS_MASTER_URI=http://192.168.8.111:11311
process[robot_state_publisher-1]: started with pid [15245]
process[spawn_urdf-2]: started with pid [15246]
process[map_server-3]: started with pid [15247]
process[amcl-4]: started with pid [15248]
process[move_base-5]: started with pid [15252]
process[rviz-6]: started with pid [15253]
[INFO] [1579069335.779432856]: Loading from pre-hydro parameter style
[INFO] [1579069337.091421853]: Using plugin "static_layer"
[INFO] [1579069337.219909313]: Requesting the map...
[INFO] [1579069337.529079161]: Resizing costmap to 469 X 955 at 0.050000 m/pix
[INFO] [1579069337.628773914]: Received a 469 X 955 map at 0.050000 m/pix
[INFO] [1579069337.836641783]: Using plugin "obstacle_layer"
[INFO] [1579069338.007928583]: Subscribed to Topics: scan
[INFO] [1579069339.718548788]: Using plugin "inflation_layer"
[INFO] [1579069344.201316102]: Loading from pre-hydro parameter style
[INFO] [1579069346.826151433]: Sim period is set to 0.10
[INFO] [1579069349.858297186]: Recovery behavior will clear layer obstacles
[INFO] [1579069350.049069072]: Recovery behavior will clear layer obstacles
[INFO] [1579069351.298576208]: Resizing costmap to 187 X 123 at 0.050000 m/pix
[INFO] [1579069351.303654879]: odom received!
[INFO] [1579069381.536995966]: Got new plan
[INFO] [1579069383.536966736]: Got new plan
[INFO] [1579069383.640937741]: Resizing costmap to 187 X 125 at 0.050000 m/pix
[INFO] [1579069385.536974577]: Got new plan
[INFO] [1579069385.641417573]: Resizing costmap to 189 X 125 at 0.050000 m/pix
[INFO] [1579069386.641096238]: Resizing costmap to 217 X 125 at 0.050000 m/pix
[INFO] [1579069387.536949376]: Got new plan
[INFO] [1579069388.641079634]: Resizing costmap to 222 X 125 at 0.050000 m/pix
[INFO] [1579069389.536986229]: Got new plan
[INFO] [1579069389.640916532]: Resizing costmap to 226 X 127 at 0.050000 m/pix
[INFO] [1579069389.737039908]: Goal reached
[INFO] [1579069390.641329610]: Resizing costmap to 226 X 130 at 0.050000 m/pix
[INFO] [1579069391.641137858]: Resizing costmap to 229 X 130 at 0.050000 m/pix
[INFO] [1579069392.640686537]: Resizing costmap to 230 X 130 at 0.050000 m/pix
목표 지점에 도달한 상황. INFO 메시지 중 Goal Reached 를 확인할 수 있다.
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options
31 fps

Demo Video