1. Install ROS Melodic according the steps in http://wiki.ros.org/melodic/Installation/Ubuntu

2. Make a ROS workspace and build it

$ mkdir -p ~/ros_ws/src
$ cd ~/ros_ws
$ source /opt/ros/melodic/setup.bash

```
$ mkdir -p ~/ros_ws/src
$ cd ~/ros_ws
$ source /opt/ros/melodic/setup.bash
$
```

3. Create the B5L package and build it

$ cd src
$ catkin_create_pkg omron_b5l_a roscpp std_msgs pcl_conversions sensor_msgs
$ cd ~/ros_ws/
$ catkin_make

```
$ mkdir -p ~/ros_ws/src
$ cd ~/ros_ws
$ source /opt/ros/melodic/setup.bash
$ cd src
$ catkin_create_pkg omron_b5l_a roscpp std_msgs pcl_conversions sensor_msgs
Created file omron_b5l_a/package.xml
Created file omron_b5l_a/CMakeLists.txt
Created folder omron_b5l_a/include/omron_b5l_a
Created folder omron_b5l_a/src
Successfully created files in /home/kakiuchi/ros_ws/src/omron_b5l_a. Please adju
st the values in package.xml.
$ cd ~/ros_ws/
$ catkin_make
Base path: /home/kakiuchi/ros_ws
Source space: /home/kakiuchi/ros_ws/src
Build space: /home/kakiuchi/ros_ws/build
Devel space: /home/kakiuchi/ros_ws/devel
Install space: /home/kakiuchi/ros_ws/install
Creating symlink "/home/kakiuchi/ros_ws/src/CMakeLists.txt" pointing to "/opt/ro
s/melodic/share/catkin/cmake/toplevel.cmake"
####
#### Running command: "cmake /home/kakiuchi/ros_ws/src -DCATKIN_DEVEL_PREFIX=/ho
me/kakiuchi/ros_ws/devel -DCMAKE_INSTALL_PREFIX=/home/kakiuchi/ros_ws/install -G
 Unix Makefiles" in "/home/kakiuchi/ros_ws/build"
####
-- The C compiler identification is GNU 7.5.0
-- The CXX compiler identification is GNU 7.5.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Using CATKIN_DEVEL_PREFIX: /home/kakiuchi/ros_ws/devel
-- Using CMAKE_PREFIX_PATH: /opt/ros/melodic
-- This workspace overlays: /opt/ros/melodic
-- Found PythonInterp: /usr/bin/python2 (found suitable version "2.7.17", minimu
m required is "2")
-- Using PYTHON_EXECUTABLE: /usr/bin/python2
-- Using Debian Python package layout
-- Using empy: /usr/bin/empy
-- Using CATKIN_ENABLE_TESTING: ON
-- Call enable_testing()
-- Using CATKIN_TEST_RESULTS_DIR: /home/kakiuchi/ros_ws/build/test_results
-- Found gtest sources under '/usr/src/googletest': gtests will be built
-- Found gmock sources under '/usr/src/googletest': gmock will be built
-- Found PythonInterp: /usr/bin/python2 (found version "2.7.17")
-- Looking for pthread.h
-- Looking for pthread.h - found
-- Looking for pthread_create
-- Looking for pthread_create - not found
-- Looking for pthread_create in pthreads
-- Looking for pthread_create in pthreads - not found
-- Looking for pthread_create in pthread
-- Looking for pthread_create in pthread - found
-- Found Threads: TRUE
-- Using Python nosetests: /usr/bin/nosetests-2.7
-- catkin 0.7.29
-- BUILD_SHARED_LIBS is on
-- BUILD_SHARED_LIBS is on
-- ~~  traversing 1 packages in topological order:
-- ~~  - omron_b5l_a
-- +++ processing catkin package: 'omron_b5l_a'
-- ==> add_subdirectory(omron_b5l_a)
-- Configuring done
-- Generating done
-- Build files have been written to: /home/kakiuchi/ros_ws/build
####
#### Running command: "make -j8 -l8" in "/home/kakiuchi/ros_ws/build"
####
$
```

4. Unzip the ROS1 Sample Code package into ~/ros_ws/src/

* The folder structure will be;

~/ros_ws/src
+omron_b5l_a
+include
+omron_b5l_a
+src
+config

```
$ unzip omron_b5l_a_ROS1.zip -d ~/ros_ws/src/
Archive:  omron_b5l_a_ROS1.zip
replace /home/kakiuchi/ros_ws/src/omron_b5l_a/CMakeLists.txt? [y]es, [n]o, [A]ll
, [N]one, [r]ename: A
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/CMakeLists.txt
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/include/omron_b5l_a/TOFApiZ.h
pp
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/include/omron_b5l_a/ToF_Sampl
e.hpp
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/include/omron_b5l_a/uart.h
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/include/omron_b5l_a/publisher
_member_function.hpp
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/TOFApiZ.cpp
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/ToF_Sample.cpp
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/uart_linux.c
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/publisher_member_function
.cpp
   creating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/config/
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/src/config/ToF_Sample.prm
  inflating: /home/kakiuchi/ros_ws/src/omron_b5l_a/package.xml
```

```
$ tree -d ~/ros_ws/src/
/home/kakiuchi/ros_ws/src/
└── omron_b5l_a
    ├── include
    │   └── omron_b5l_a
    └── src
        └── config

5 directories
$
```

5. Build the omron_b5l_a

If it doesn't compile、add the --force-cmake option

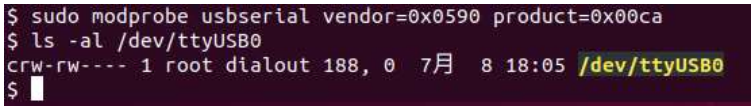
> catkin_make or > catkin_make --force-cmake

```
$ pwd
/home/kakiuchi/ros_ws
$ catkin_make
Base path: /home/kakiuchi/ros_ws
Source space: /home/kakiuchi/ros_ws/src
Build space: /home/kakiuchi/ros_ws/build
Devel space: /home/kakiuchi/ros_ws/devel
Install space: /home/kakiuchi/ros_ws/install
####
#### Running command: "make cmake_check_build_system" in "/home/kakiuchi/ros_ws/
build"
####
-- Using CATKIN_DEVEL_PREFIX: /home/kakiuchi/ros_ws/devel
-- Using CMAKE_PREFIX_PATH: /home/kakiuchi/ros_ws/devel;/opt/ros/melodic
-- This workspace overlays: /home/kakiuchi/ros_ws/devel;/opt/ros/melodic
-- Found PythonInterp: /usr/bin/python2 (found suitable version "2.7.17", minimu
m required is "2")
-- Using PYTHON_EXECUTABLE: /usr/bin/python2
-- Using Debian Python package layout
-- Using empy: /usr/bin/empy
-- Using CATKIN_ENABLE_TESTING: ON
-- Call enable_testing()
-- Using CATKIN_TEST_RESULTS_DIR: /home/kakiuchi/ros_ws/build/test_results
-- Found gtest sources under '/usr/src/googletest': gtests will be built
-- Found gmock sources under '/usr/src/googletest': gmock will be built
```

```
VolumeAMR;vtkRenderingVolumeOpenGL;vtkTestingGen...;vtkTe
stingRendering;vtkViewsContext2D;vtkViewsGeovis;vtkWrappingJava (Required is at
least version "1.8")
-- Configuring done
-- Generating done
-- Build files have been written to: /home/kakiuchi/ros_ws/build
####
#### Running command: "make -j8 -l8" in "/home/kakiuchi/ros_ws/build"
####
Scanning dependencies of target omron_b5l_a
[ 60%] Building C object omron_b5l_a/CMakeFiles/omron_b5l_a.dir/src/uart_linux.c
.o
[ 60%] Building CXX object omron_b5l_a/CMakeFiles/omron_b5l_a.dir/src/TOFApiZ.cp
p.o
[ 60%] Building CXX object omron_b5l_a/CMakeFiles/omron_b5l_a.dir/src/publisher_
member_function.cpp.o
[ 80%] Building CXX object omron_b5l_a/CMakeFiles/omron_b5l_a.dir/src/ToF_Sample
.cpp.o
cc1: warning: command line option '-std=c++11' is valid for C++/ObjC++ but not f
or C
/home/kakiuchi/ros_ws/src/omron_b5l_a/src/publisher_member_function.cpp: In func
tion 'void timer_callback(const ros::WallTimerEvent&)':
/home/kakiuchi/ros_ws/src/omron_b5l_a/src/publisher_member_function.cpp:68:48: w
arning: unused parameter 'event' [-Wunused-parameter]
 void timer_callback(const ros::WallTimerEvent& event)
                                                ^~~~~
[100%] Linking CXX executable /home/kakiuchi/ros_ws/devel/lib/omron_b5l_a/omron_
b5l_a
[100%] Built target omron_b5l_a
$
```

6. Connect the B5L and check the permit of /dev/ttyUSB0

> sudo modprobe usbserial vendor=0x0590 product=0x00ca
> ls -al /dev/ttyUSB0



* If the permission is not enough,

> sudo chgrp dialout /dev/ttyUSB0
> sudo chmod 660 /dev/ttyUSB0
> sudo adduser $USER dialout

*You can also use connect_tof.sh

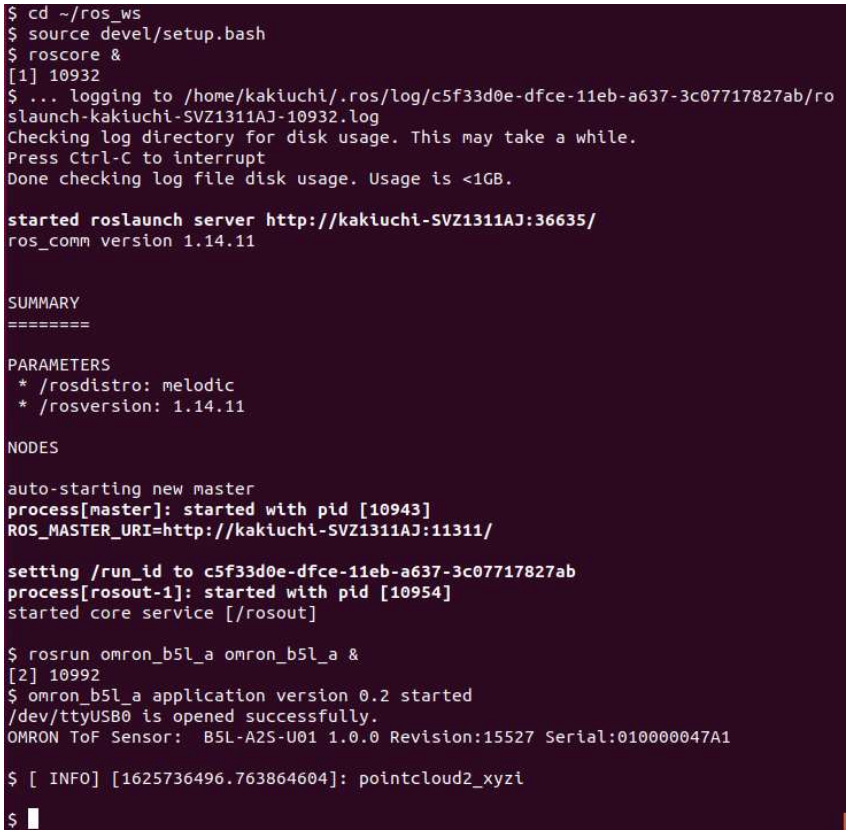
7. B5L configuration file is stored in ~/ros_ws/src/omron_b5l_a/src/config/ToF_Sample.prm

8. Run the roscore

> cd ~/ros_ws
> source devel/setup.bash
> roscore &

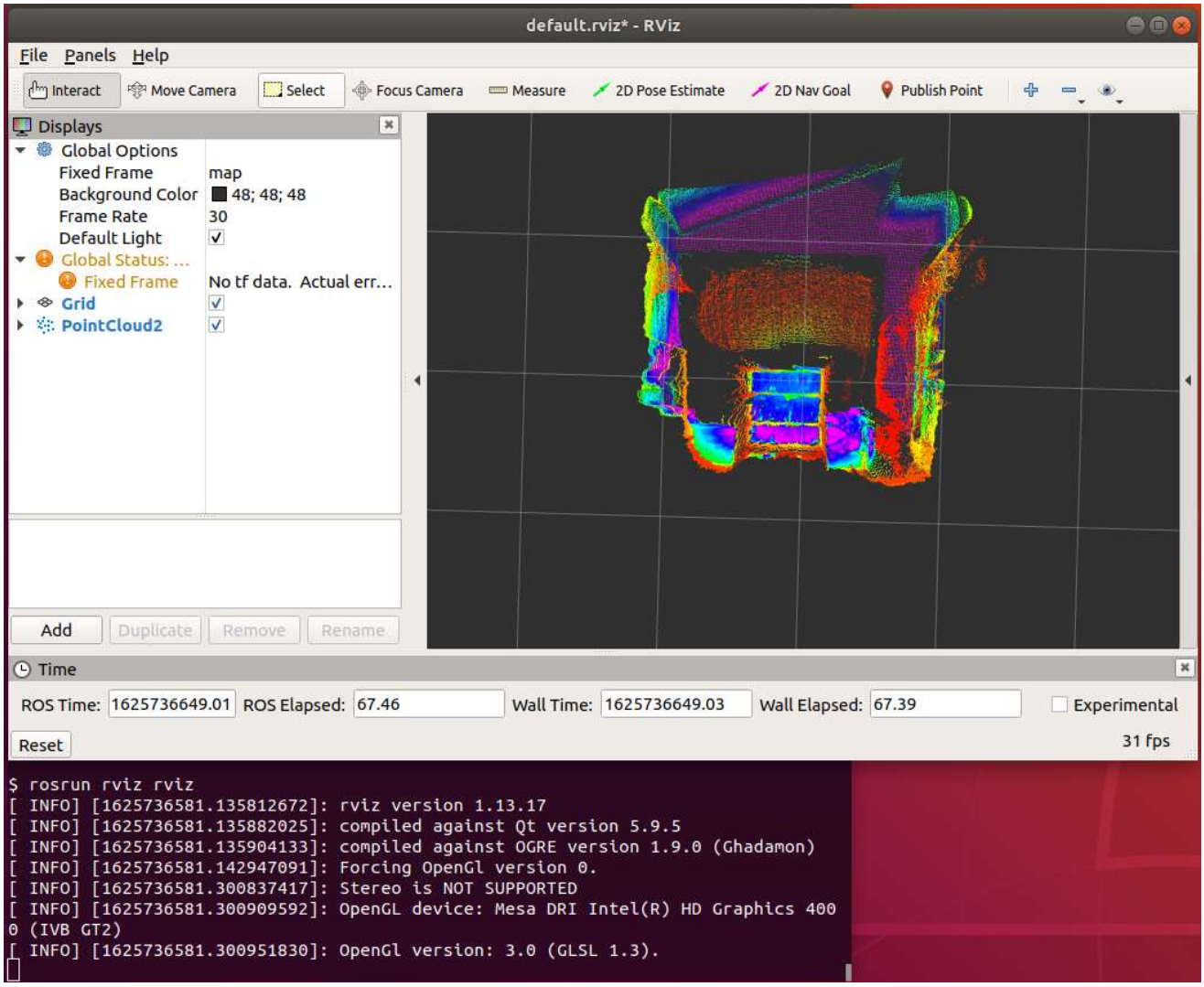
9. Run the omron_b5l_a node

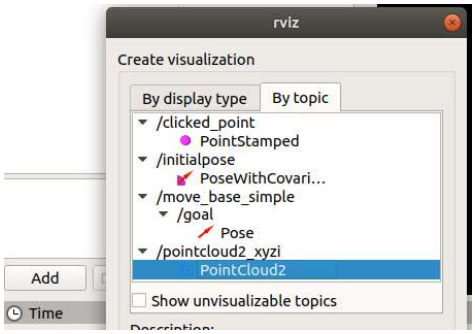
> cd ~/ros_ws
> source devel/setup.bash
> rosrun omron_b5l_a omron_b5l_a &



10. If you need, run the Rviz tool and add the /pointcloud_xyzi (or /pointcloud_xyz) topic

> cd ~/ros_ws
> source devel/setup.bash
> rosrun rviz rviz


default.rviz* - RViz
File Panels Help
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: ...
Fixed Frame
No tf data. Actual err...
Grid
PointCloud2
Add
Duplicate
Remove
Rename
Time
ROS Time: 1625736649.01
ROS Elapsed: 67.46
Wall Time: 1625736649.03
Wall Elapsed: 67.39
Experimental
Reset
31 fps
$ rosrun rviz rviz
[INFO] [1625736581.135812672]: rviz version 1.13.17
[INFO] [1625736581.135882025]: compiled against Qt version 5.9.5
[INFO] [1625736581.135904133]: compiled against OGRE version 1.9.0 (Ghadamon)
[INFO] [1625736581.142947091]: Forcing OpenGl version 0.
[INFO] [1625736581.300837417]: Stereo is NOT SUPPORTED
[INFO] [1625736581.300909592]: OpenGL device: Mesa DRI Intel(R) HD Graphics 400
0 (IVB GT2)
[INFO] [1625736581.300951830]: OpenGl version: 3.0 (GLSL 1.3).


rviz
Create visualization
By display type
By topic
/clicked_point
PointStamped
/initialpose
PoseWithCovari...
/move_base_simple
/goal
Pose
/pointcloud2_xyzi
PointCloud2
Show unvisualizable topics
Add
Time