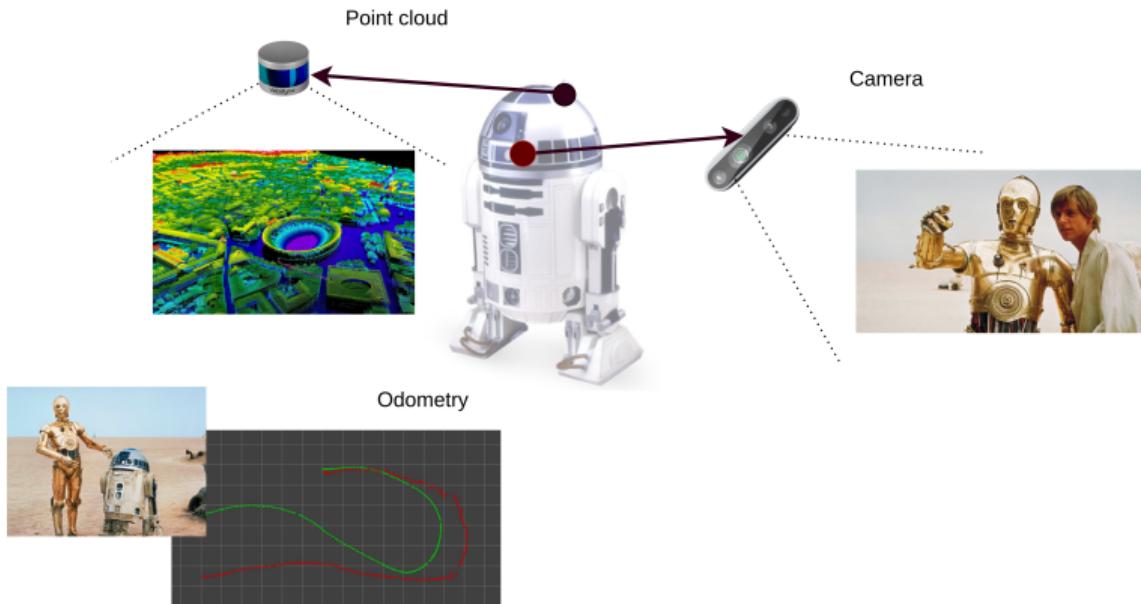


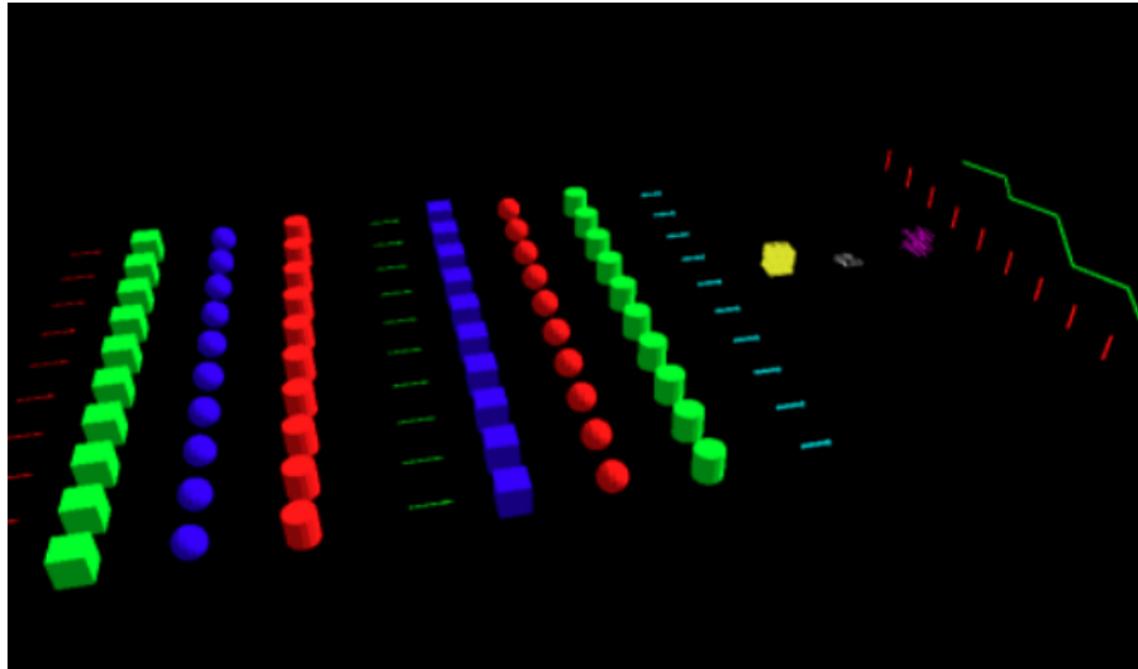
Introduction to ROS: Basics, Motion, and Vision

ROS Visualization

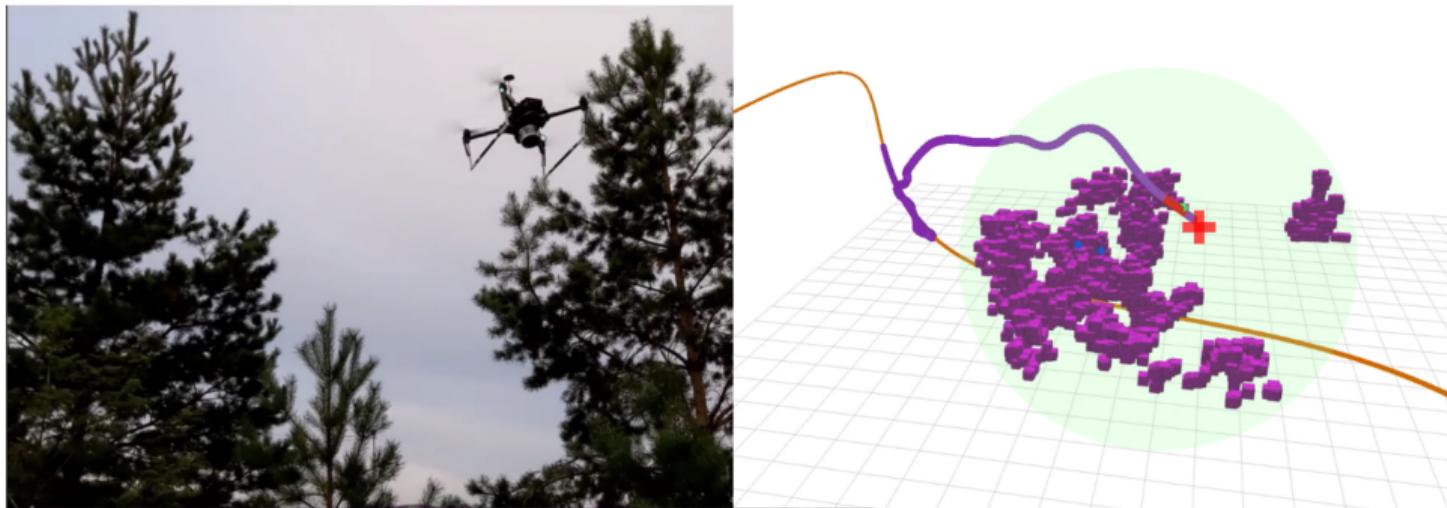


ROS Visualization

1 rviz <http://wiki.ros.org/rviz>



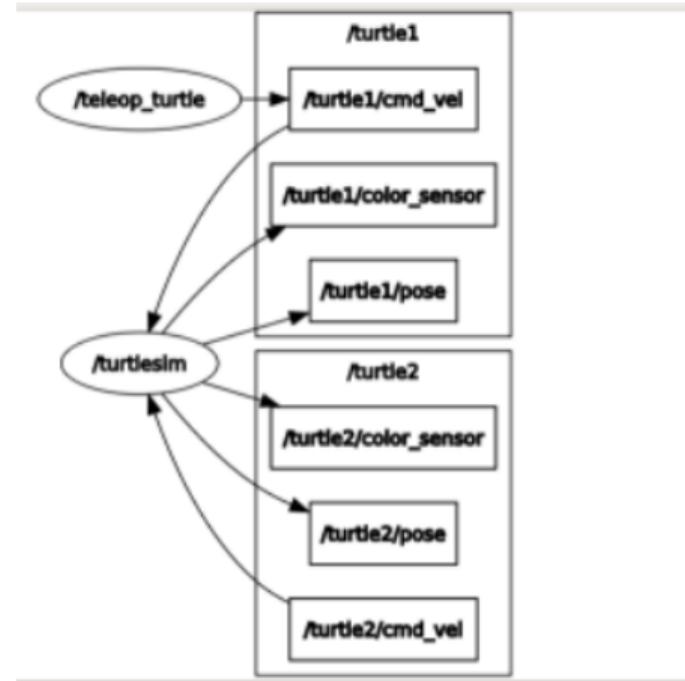
ROS Visualization



- Initial reference trajectory R
- Refined reference trajectory R_{t_n}
- Prediction horizon P_{t_n}
- Map update range (M)
- Current pose

ROS Visualization

1 rqt <http://wiki.ros.org/rqt>



ROS Visualization with rqt

- 1 rqt can be used as a visualization tool as well as debugging tool
- 2 Scalar data can be easily visualized with rqt, however, non-scalar data such as images, pose, can also be visualized up to some extent in default setting
- 3 rqt consists of several sub-tools : rqt,rqt_bag,rqt_console,rqt_dep, rqt_graph,rqt_image_view,rqt_logger_level,rqt_plot and rqt_shell

ROS Visualization with rqt

- 1 Let's try to plot scalar data

to plot scalar data

```
roslaunch ros_visualization joy_hagen_sub.launch  
roslaunch ros_visualization joy_hagen_pub.launch  
rosrun rqt_plot rqt_plot /joy_hagen imu
```

- 2 If the message consists of data that is not a scalar value, have to specify the fields separated by comma,

to plot non-scalar data

```
rosrun rqt_plot rqt_plot /joy_hagen imu/x:z
```

ROS Visualization with rqt

to visualize a single image

```
roslaunch ros_visualization hagen_joy_camera.launch  
rosrun image_view image_view image:=/joy_hagen_camera/camera
```

ROS Visualization with rviz

- 1 3D visualization is not possible with rqt, rviz, which is built with the help of OpenGL, can be used to visualize the 3D sensor data, e.g., stereo images, point clouds from camera
- 2 rviz can be launched in different ways:

to visualize a single image

```
rosrun rqt_rviz rqt_rviz  
rviz
```

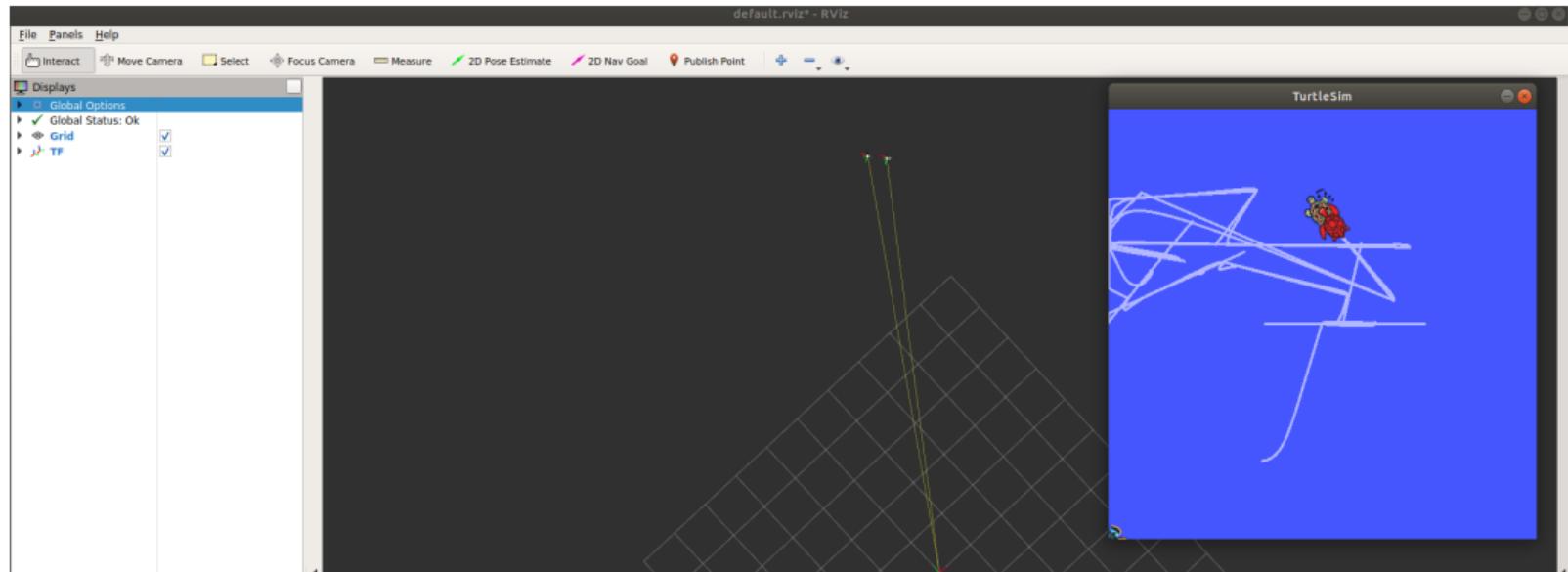
ROS Visualization: topics and frames

- 1 All the topic must have a frame_id, which defines the location of the sensor or device with respect to defined coordinate system
- 2 Usually, when we define the root of robot, it is named as the base_link, which is the common standard that everyone follows

to visualize frame of robots

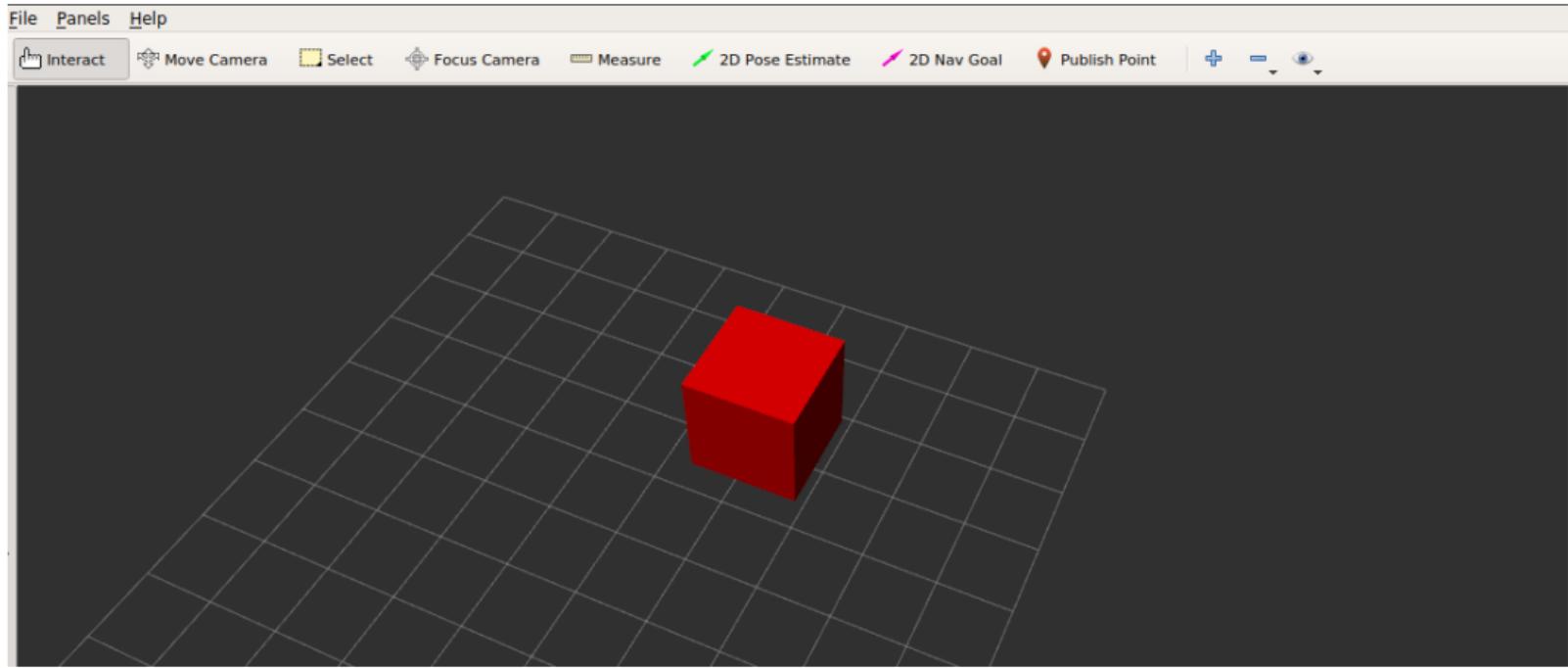
```
roslaunch turtle_tf turtle_tf_demo.launch  
rosrun turtle_tf turtle_tf_listener  
rviz
```

ROS Visualization: topics and frames

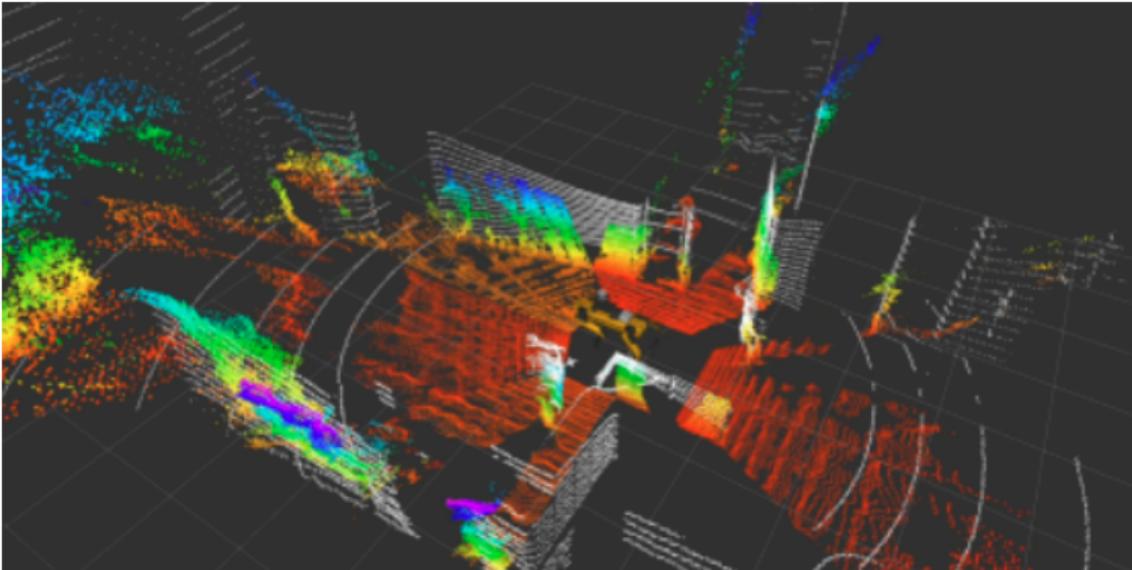


ROS Visualization: cube

Let's try to visualize a cube <http://wiki.ros.org/rviz/DisplayTypes/Marker>



ROS Visualization: point cloud



ROS Visualization: point cloud

Let's try to visualize a point cloud

