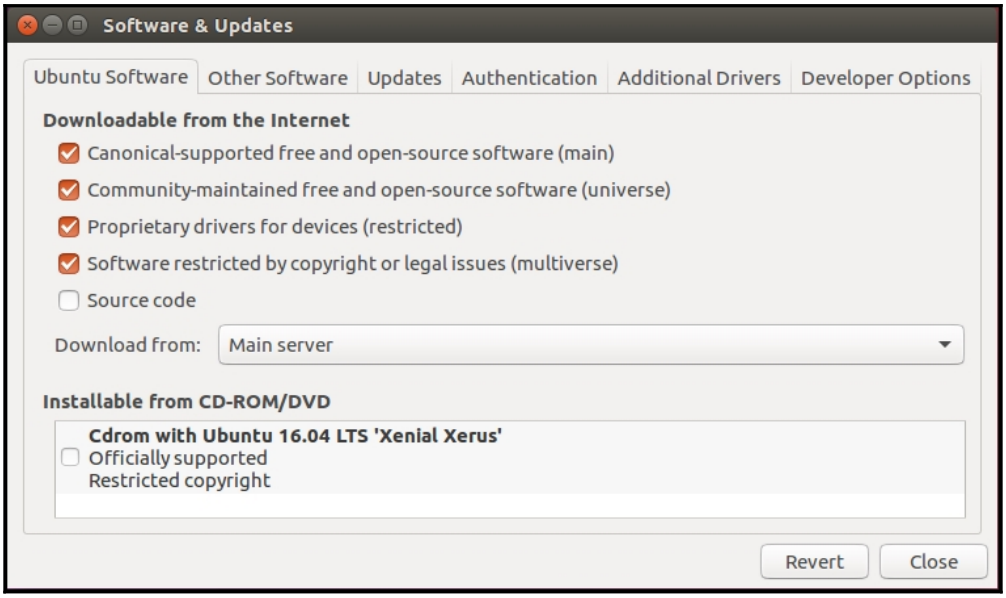
Table of Contents

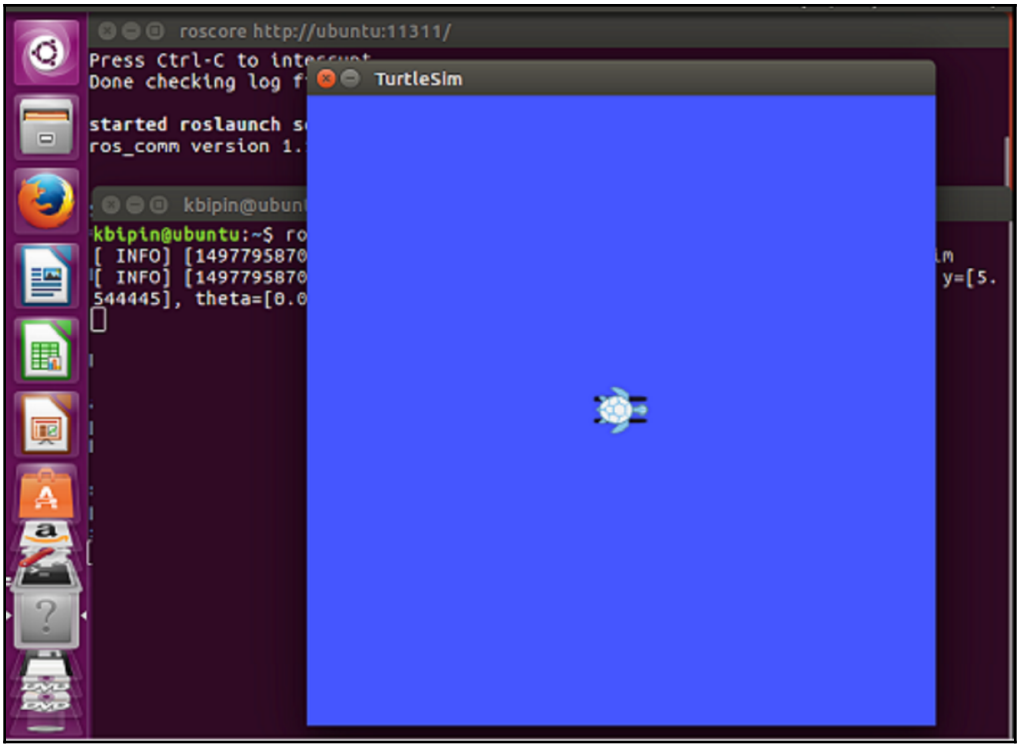
Chapter 1: Getting Started with ROS

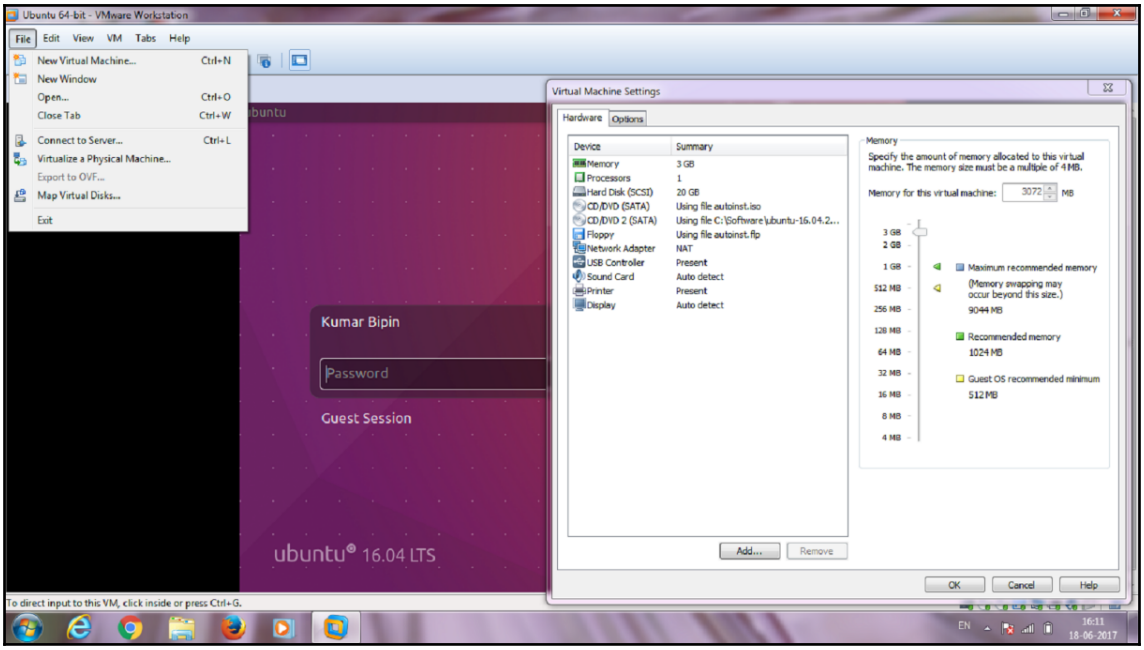
Distro	Release date	Poster	*Tuturtle*, turtle in tutorial	EOL date
ROS Melodic Morenia	May 23rd, 2018			May, 2023 (Bionic EOL)
ROS Lunar Loggerhead	May 23rd, 2017			May, 2019
ROS Kinetic Kame (**Recommended**)	May 23rd, 2016			April, 2021 (Xenial EOL)

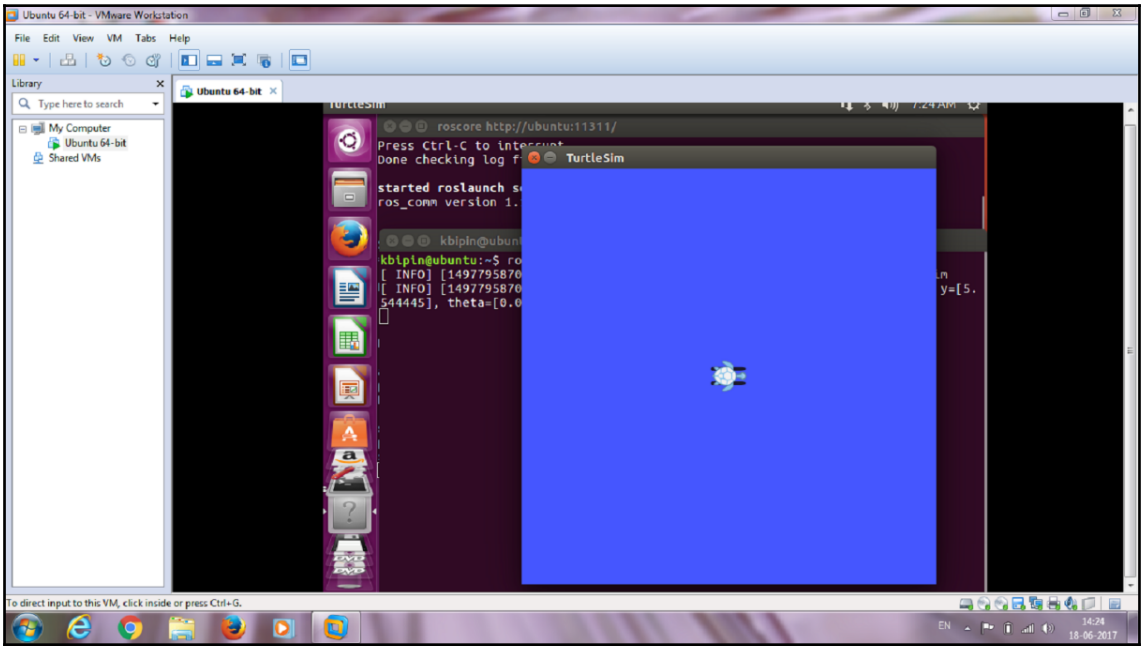
ROS Kinetic Kame
Released May, 2016
LTS, supported until April, 2021

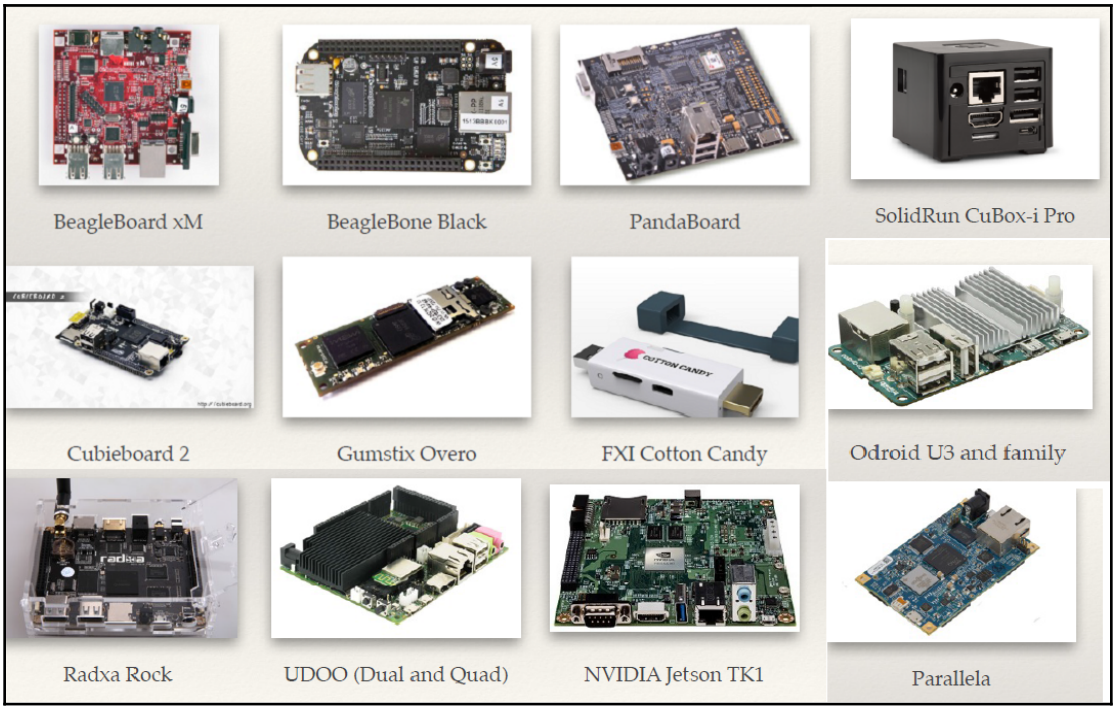
ROS Melodic Morenia
Released May, 2018
Latest LTS, supported until May, 2023

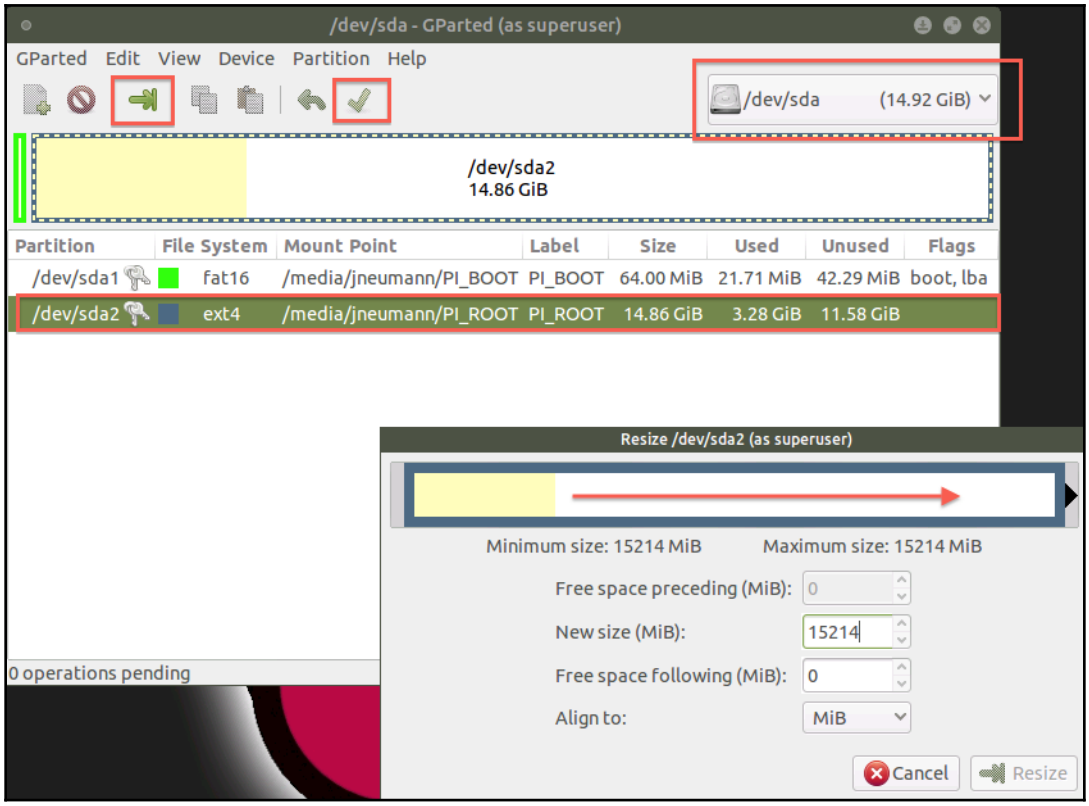

Software & Updates
Ubuntu Software
Other Software
Updates
Authentication
Additional Drivers
Developer Options
Downloadable from the Internet
Canonical-supported free and open-source software (main)
Community-maintained free and open-source software (universe)
Proprietary drivers for devices (restricted)
Software restricted by copyright or legal issues (multiverse)
Source code
Download from:
Main server
Installable from CD-ROM/DVD
Cdrom with Ubuntu 16.04 LTS 'Xenial Xerus'
Officially supported
Restricted copyright
Revert
Close


roscore http://ubuntu:11311/
Press Ctrl-C to
Done checking log
started roslaunch
ros_comm version
kbipin@ubuntu:~$
[INFO] [1497795870
[INFO] [1497795870
544445], theta=[0.0
TurtleSim

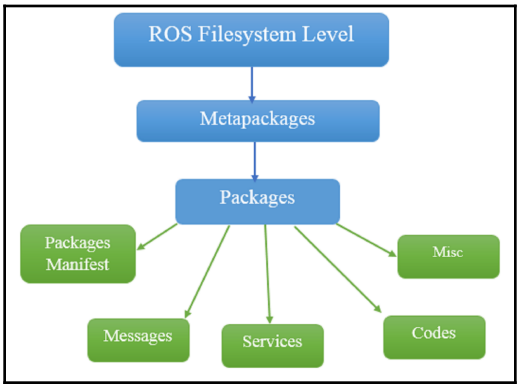

Ubuntu 64-bit - VMware Workstation
File Edit View VM Tabs Help
New Virtual Machine... Ctrl+N
New Window
Open... Ctrl+O
Close Tab Ctrl+W
Connect to Server... Ctrl+L
Virtualize a Physical Machine...
Export to OVF...
Map Virtual Disks...
Exit
Virtual Machine Settings
Hardware Options
Device Summary
Memory 3 GB
Processors 1
Hard Disk (SCSI) 20 GB
CD/DVD (SATA) Using file autoinst.iso
CD/DVD 2 (SATA) Using file C:\Software\ubuntu-16.04.2...
Floppy Using file autoinst.flp
Network Adapter NAT
USB Controller Present
Sound Card Auto detect
Printer Present
Display Auto detect
Add... Remove
Memory
Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.
Memory for this virtual machine: 3072 MB
Maximum recommended memory
(Memory swapping may occur beyond this size.)
9044 MB
Recommended memory
1024 MB
Guest OS recommended minimum
512 MB
OK Cancel Help
Kumar Bipin
Password
Guest Session
ubuntu® 16.04 LTS
To direct input to this VM, click inside or press Ctrl+G.


Ubuntu 64-bit - VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
Ubuntu 64-bit
Shared VMs
Ubuntu 64-bit
roscore http://ubuntu:11311/
Press Ctrl-C to interrupt
Done checking log f
started roslaunch s
ros_comm version 1.
kblpin@ubuntu:~$ ro
[INFO] [1497795870
[INFO] [1497795870
544445], theta=[0.0
TurtleSim
To direct input to this VM, click inside or press Ctrl+G.


BeagleBoard xM
BeagleBone Black
PandaBoard
SolidRun CuBox-i Pro
Cubieboard 2
Gumstix Overo
FXI Cotton Candy
Odroid U3 and family
Radxa Rock
UDOO (Dual and Quad)
NVIDIA Jetson TK1
Parallela

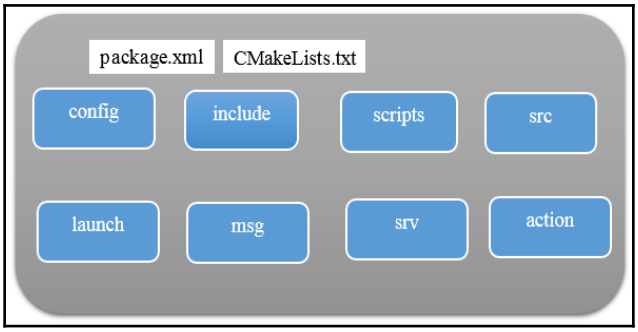

/dev/sda - GParted (as superuser)
GParted Edit View Device Partition Help
/dev/sda (14.92 GiB)
/dev/sda2
14.86 GiB
Partition File System Mount Point Label Size Used Unused Flags
/dev/sda1 fat16 /media/jneumann/PI_BOOT PI_BOOT 64.00 MiB 21.71 MiB 42.29 MiB boot, lba
/dev/sda2 ext4 /media/jneumann/PI_ROOT PI_ROOT 14.86 GiB 3.28 GiB 11.58 GiB
0 operations pending
Resize /dev/sda2 (as superuser)
Minimum size: 15214 MiB
Maximum size: 15214 MiB
Free space preceding (MiB): 0
New size (MiB): 15214
Free space following (MiB): 0
Align to: MiB
Cancel
Resize

Chapter 2: ROS Architecture and Concepts I

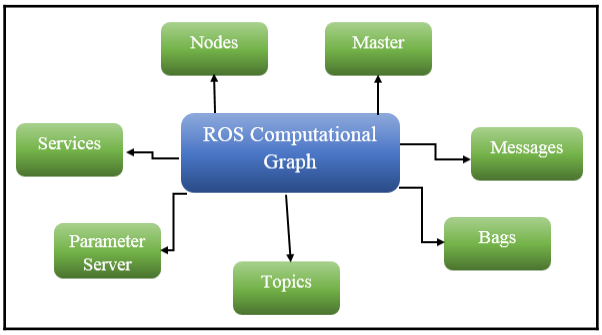


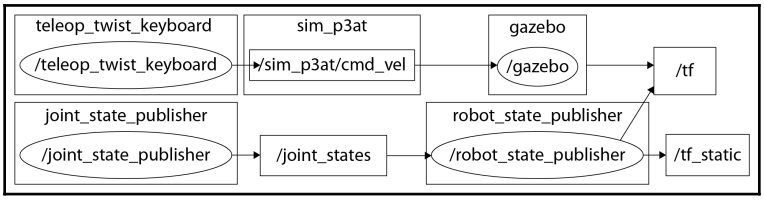

```
└── turtlesim
    ├── CHANGELOG.rst
    ├── CMakeLists.txt
    ├── images
    │   └── kinetic.png
    ├── include
    │   └── turtlesim
    ├── launch
    │   └── multisim.launch
    ├── msg
    │   ├── Color.msg
    │   └── Pose.msg
```

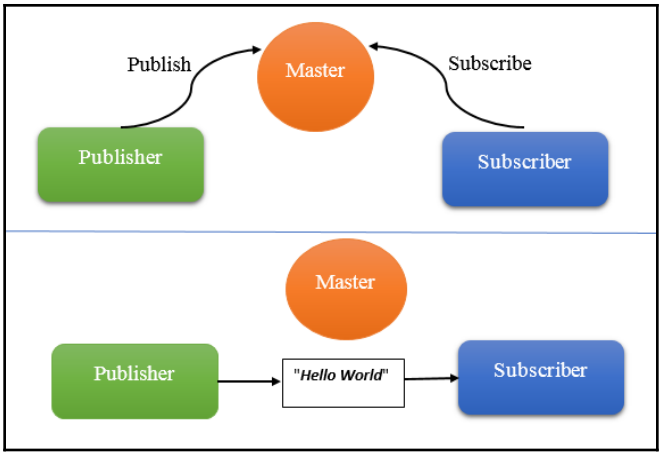
```
└── catkin_ws
    ├── build
    │   ├── catkin
    │   ├── catkin_generated
    │   ├── Makefile
    │   └── ...
    ├── devel
    │   ├── setup.zsh
    │   └── ...
    └── src
        ├── CMakeLists.txt -> /opt/ros/kinetic/share/catkin/cmake/toplevel.cmake
        └── ...
```




```
<package>
    <name>navigation</name>
    <version>1.14.2</version>
    <description>
        A 2D navigation stack that takes in information from odometry, sensor
    </description>
    <maintainer email="linux.kbp@gmail.com">Kumar Bipin</maintainer>
    <author>linux.kbp@gmail.com</author>
    <license>BSD,LGPL,LGPL (amcl)</license>
    <url>http://wwww.kumar-bipin/navigation</url>

    <buildtool_depend>catkin</buildtool_depend>

    <run_depend>amcl</run_depend>
    <run_depend>carrot_planner</run_depend>
    .
    .
    .
    <run_depend>move_slow_and_clear</run_depend>
    <run_depend>voxel_grid</run_depend>

    <export>
        <metapackage/>
    </export>
</package>
```

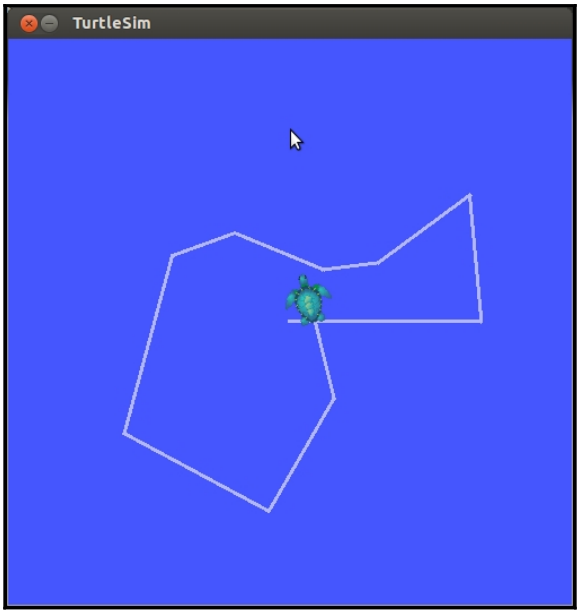




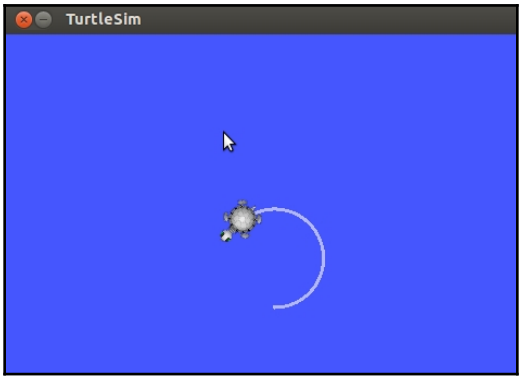


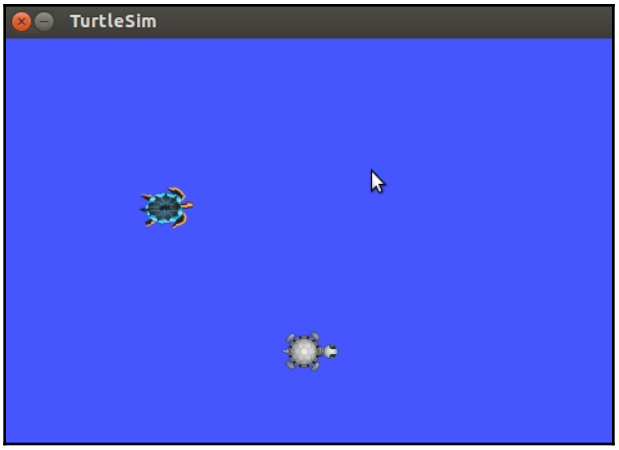

```
kbipin@ubuntu:~/catkin_ws/devel$ roscore
... logging to /home/kbipin/.ros/log/00cf43da-6acd-11e7-a3fd-000c29ba2ae0/roslaunch-ubuntu-2313.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://ubuntu:36055/
ros_comm version 1.12.7


SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.7

NODES

auto-starting new master
process[master]: started with pid [2324]
ROS_MASTER_URI=http://ubuntu:11311/

setting /run_id to 00cf43da-6acd-11e7-a3fd-000c29ba2ae0
process[rosout-1]: started with pid [2337]
started core service [/rosout]
```


```
Node [/turtlesim]
Publications:
 * /turtle1/color_sensor [turtlesim/Color]
 * /rosout [rosgraph_msgs/Log]
 * /turtle1/pose [turtlesim/Pose]

Subscriptions:
 * /turtle1/cmd_vel [unknown type]

Services:
 * /turtle1/teleport_absolute
 * /turtlesim/get_loggers
 * /turtlesim/set_logger_level
 * /reset
 * /spawn
 * /clear
 * /turtle1/set_pen
 * /turtle1/teleport_relative
 * /kill


contacting node http://ubuntu:37703/ ...
Pid: 2422
Connections:
 * topic: /rosout
    * to: /rosout
    * direction: outbound
    * transport: TCPROS
```




```
Node [/teleop_turtle]
Publications:
 * /turtle1/cmd_vel [geometry_msgs/Twist]
 * /rosout [rosgraph_msgs/Log]

Subscriptions: None

Services:
 * /teleop_turtle/get_loggers
 * /teleop_turtle/set_logger_level


contacting node http://ubuntu:34093/ ...
Pid: 3255
Connections:
 * topic: /rosout
    * to: /rosout
    * direction: outbound
    * transport: TCPROS
 * topic: /turtle1/cmd_vel
    * to: /turtlesim
    * direction: outbound
    * transport: TCPROS

kbipin@ubuntu:~$
```



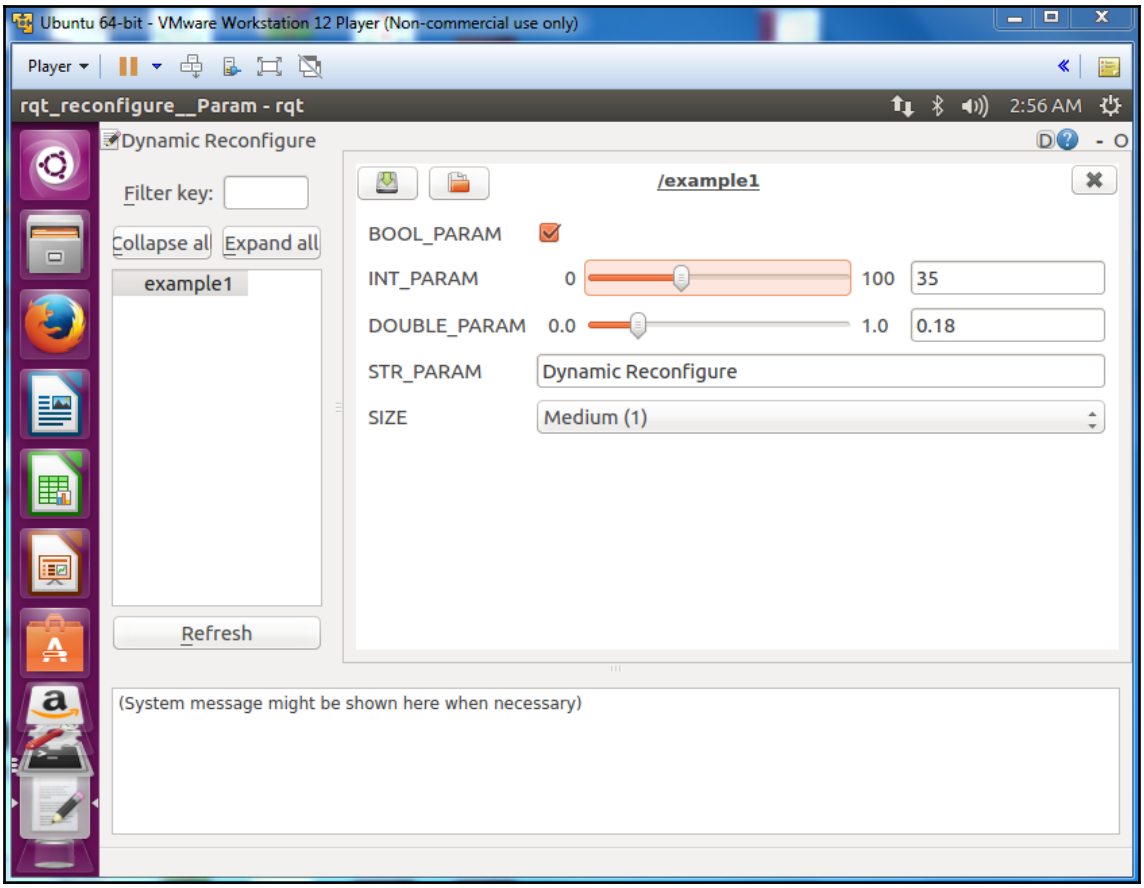



```
[ INFO] [1500790574.666914565]: Thanks: [Hello World!]
[ INFO] [1500790574.766539180]: Thanks: [Hello World!]
[ INFO] [1500790574.866526181]: Thanks: [Hello World!]
[ INFO] [1500790574.966687205]: Thanks: [Hello World!]
[ INFO] [1500790575.066693285]: Thanks: [Hello World!]
[ INFO] [1500790575.166692071]: Thanks: [Hello World!]
[ INFO] [1500790575.266700561]: Thanks: [Hello World!]
```

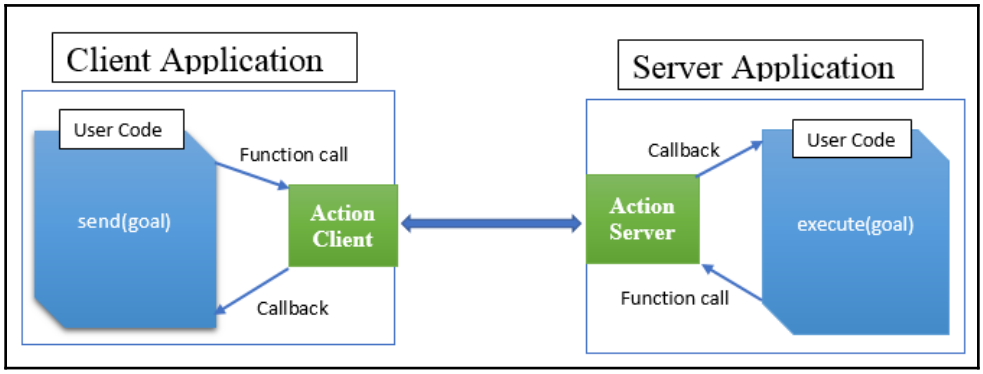
```
kbipin@ubuntu:~$ rosrun chapter2_tutorials example3a
[ INFO] [1500802889.035937665]: adder_server has started
[ INFO] [1500802898.176382487]: Request: A=2, B=3
[ INFO] [1500802898.176455696]: Response: [5]


bipin@ubuntu:~$ rosrun chapter2_tutorials example3b 2 3
[NFO] [1500802898.177676886]: Sum: 5
```

```
kumar@kumar-Inspiron-5437:~/catkin_work$ roslaunch chapter2_tutorials chapter2.launch
... logging to /home/kumar/.ros/log/2733c99e-75b5-11e8-98bc-70188bc28b47/roslaunch-kumar-Inspiron-5437-6338.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://kumar-Inspiron-5437:38817/

SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.13

NODES
  /
    example1a (chapter2_tutorials/example1a)
    example1b (chapter2_tutorials/example1b)

auto-starting new master
process[master]: started with pid [6348]
ROS_MASTER_URI=http://localhost:11311

setting /run_id to 2733c99e-75b5-11e8-98bc-70188bc28b47
process[rosout-1]: started with pid [6361]
started core service [/rosout]
process[example1a-2]: started with pid [6365]
process[example1b-3]: started with pid [6376]
[ INFO] [1529628155.010028040]: Thanks: [Hello World!]
[ INFO] [1529628155.109673794]: Thanks: [Hello World!]
[ INFO] [1529628155.209820197]: Thanks: [Hello World!]
[ INFO] [1529628155.309788735]: Thanks: [Hello World!]
[ INFO] [1529628155.409793729]: Thanks: [Hello World!]
[ INFO] [1529628155.509814054]: Thanks: [Hello World!]
[ INFO] [1529628155.609710445]: Thanks: [Hello World!]
[ INFO] [1529628155.709828066]: Thanks: [Hello World!]
[ INFO] [1529628155.809721661]: Thanks: [Hello World!]
[ INFO] [1529628155.909801384]: Thanks: [Hello World!]
[ INFO] [1529628156.009815417]: Thanks: [Hello World!]
```

Chapter 3: ROS Architecture and Concepts – II



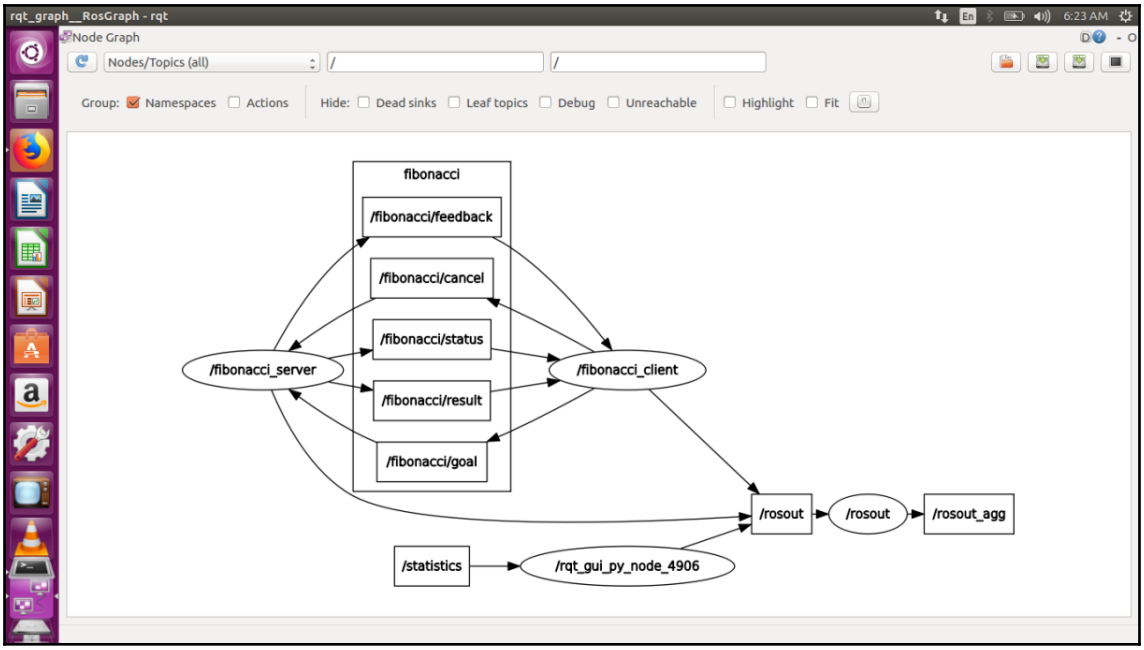

```
^Ckbipin@ubuntu:~$ rosrun chapter3_tutorials example1
[ INFO] [1502444374.797267810]: Reconfigure Request: True 1 0.010000 Dynamic Reconfigure 1
[ INFO] [1502444374.812956575]: Spinning
[ INFO] [1502444437.136884221]: Reconfigure Request: True 3 0.010000 Dynamic Reconfigure 1
[ INFO] [1502444438.914553379]: Reconfigure Request: False 3 0.010000 Dynamic Reconfigure 1
[ INFO] [1502444444.149008958]: Reconfigure Request: False 3 0.010000 Dynamic Reconfigure 2
[ INFO] [1502444445.592562578]: Reconfigure Request: False 3 0.020000 Dynamic Reconfigure 2
[ INFO] [1502444448.205849872]: Reconfigure Request: False 3 0.070000 Dynamic Reconfigure 2
```




```
kumar@kumar-Inspiron-5437:~/catkin_ws/devel/share/actionlib_tutorials/msg$ ls
FibonacciActionFeedback.msg  FibonacciAction.msg        FibonacciFeedback.msg  FibonacciResult.msg
FibonacciActionGoal.msg      FibonacciActionResult.msg  FibonacciGoal.msg
kumar@kumar-Inspiron-5437:~/catkin_ws/devel/share/actionlib_tutorials/msg$
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rosrun actionlib_tutorials fibonacci_server
[ INFO] [1513212615.978484662]: fibonacci: Executing, creating fibonacci sequence of order 20 with seeds 0, 1
[ INFO] [1513212635.978530016]: fibonacci: Succeeded
[ INFO] [1513212816.158578136]: fibonacci: Executing, creating fibonacci sequence of order 20 with seeds 0, 1
[ INFO] [1513212836.158731923]: fibonacci: Succeeded
[ INFO] [1513212851.543786403]: fibonacci: Executing, creating fibonacci sequence of order 20 with seeds 0, 1
[ INFO] [1513212871.543938601]: fibonacci: Succeeded
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rosrun actionlib_tutorials fibonacci_client
[ INFO] [1513212851.266730823]: Waiting for action server to start.
[ INFO] [1513212851.542999285]: Action server started, sending goal.
[ INFO] [1513212871.544769838]: Action finished: SUCCEEDED
kumar@kumar-Inspiron-5437:~/catkin_ws$
```




```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic echo /fibonacci/feedback
header:
  seq: 44
  stamp:
    secs: 1513212855
    nsecs: 543885567
  frame_id: ''
status:
  goal_id:
    stamp:
      secs: 1513212851
      nsecs: 543089279
    id: /fibonacci_client-1-1513212851.543089279
  status: 1
  text: This goal has been accepted by the simple action server
feedback:
  sequence: [0, 1, 1, 2, 3, 5, 8]
---
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic echo /fibonacci/result
header:
  seq: 3
  stamp:
    secs: 1513213621
    nsecs: 978107629
  frame_id: ''
status:
  goal_id:
    stamp:
      secs: 1513213601
      nsecs: 977271538
    id: /fibonacci_client-1-1513213601.977271538
  status: 3
  text: ''
result:
  sequence: [0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946]
---
```

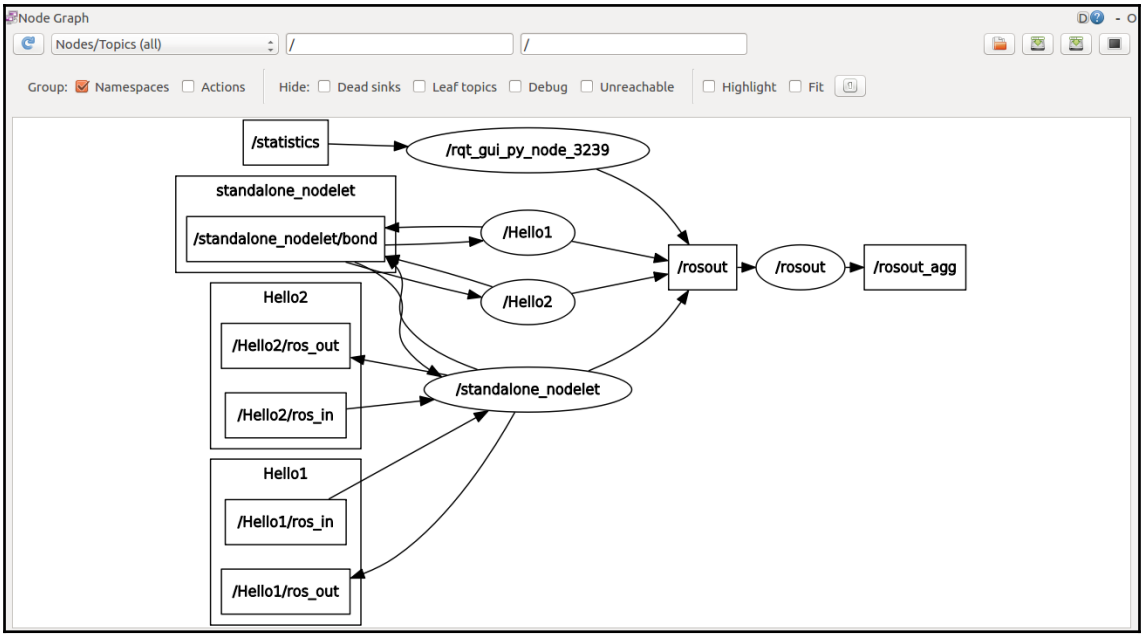
```
^Ckumar@kumar-Inspiron-5437:~/catkin_ws$ rosrun nodelet nodelet manager __name:=nodelet_manager
[ INFO] [1513429439.559984285]: Initializing nodelet with 4 worker threads.
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rosrun nodelet nodelet load nodelet_hello_ros/Hello nodelet_manager __name:=Hello1
[ INFO] [1513436103.522021253]: Loading nodelet /Hello1 of type nodelet_hello_ros/Hello to manager nodelet_manager with the following remapping
s:
```

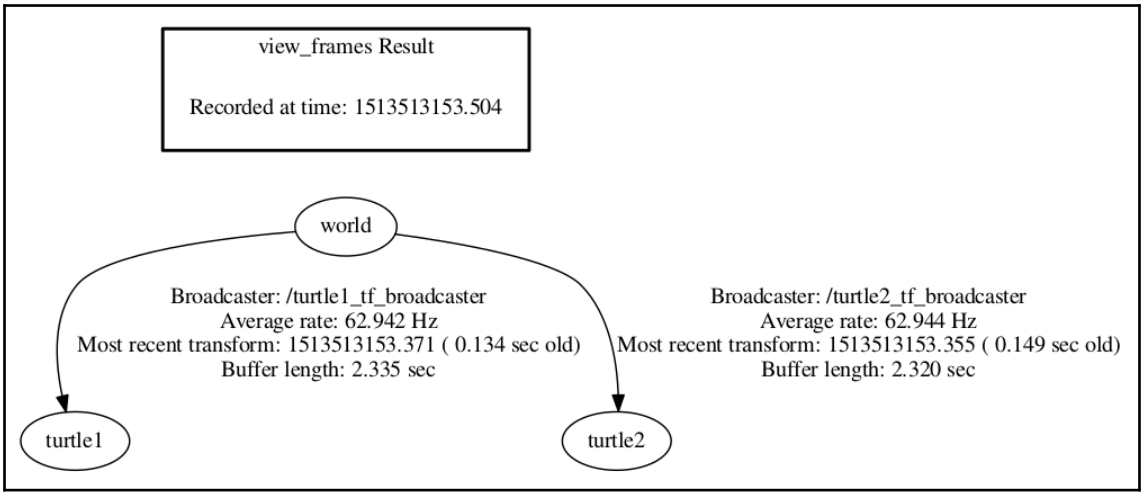
roscore http://kumar-I... × | kumar@kumar-Inspiro... × | kumar@kumar-Inspiro... × | kumar@kumar-

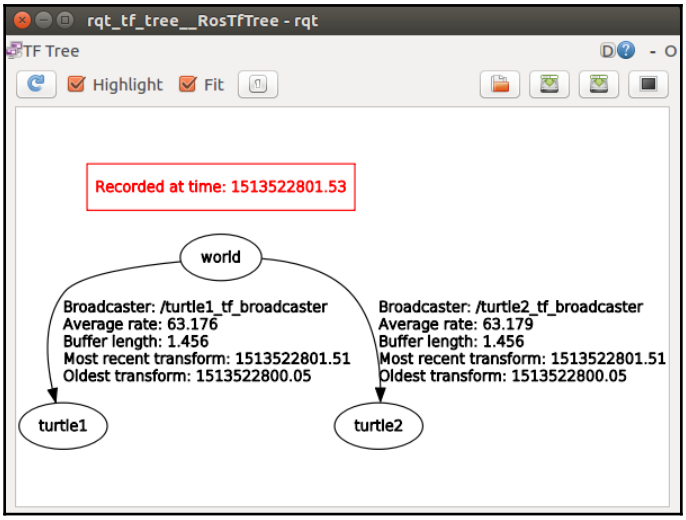
```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic list
/Hello1/msg_in
/Hello1/ros_in
/Hello1/ros_out
/nodelet_manager/bond
/rosout
/rosout_agg
kumar@kumar-Inspiron-5437:~/catkin_ws$
```

```
^Ckumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic pub /Hello1/msg_in std_msgs/String "Hello"
publishing and latching message. Press ctrl-C to terminate

kumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic echo /Hello1/ros_out
data: Hello
---
```

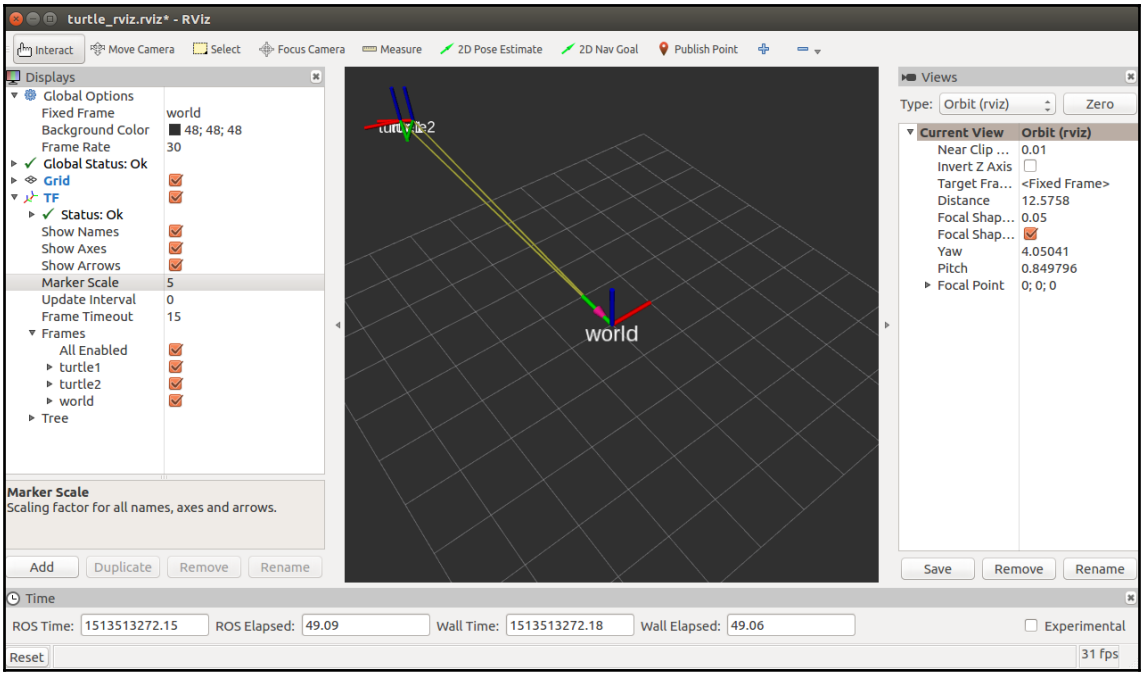


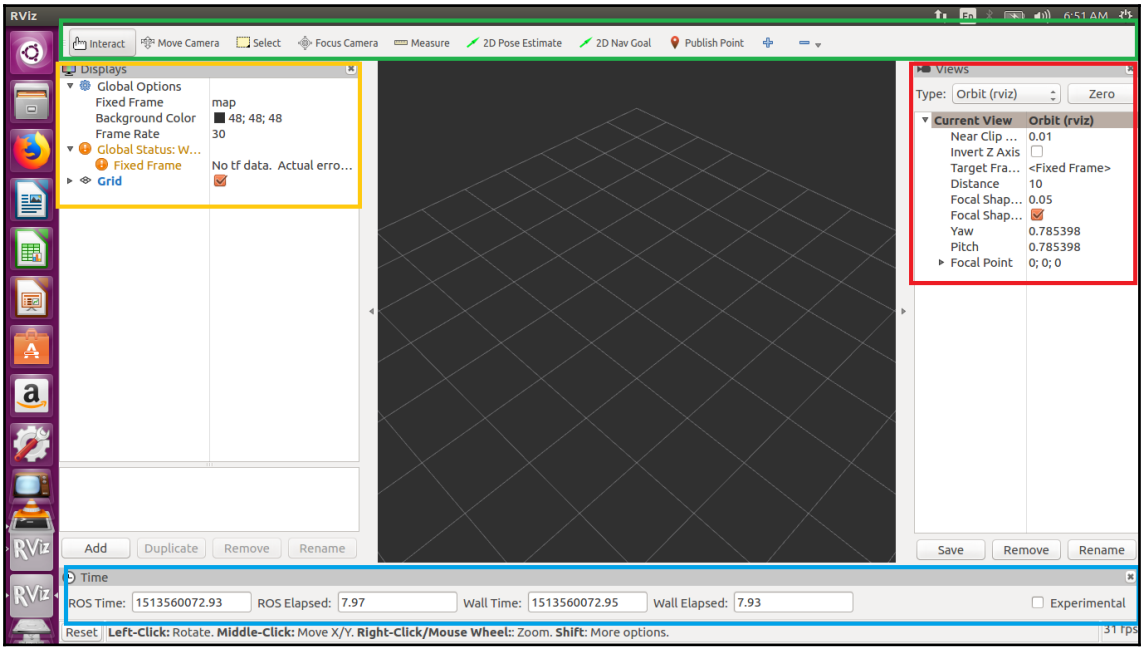

```
kumar@kumar-Inspiron-5437:~/gazebo_plugin_tutorial$ export GAZEBO_PLUGIN_PATH=${GAZEBO_PLUGIN_PATH}:~/gazebo_plugin_tutorial/build
kumar@kumar-Inspiron-5437:~/gazebo_plugin_tutorial$ gzserver ~/gazebo_plugin_tutorial/hello.world --verbose
Gazebo multi-robot simulator, version 8.1.1
Copyright (C) 2012 Open Source Robotics Foundation.
Released under the Apache 2 License.
http://gazebosim.org

[Msg] Waiting for master.
[Msg] Connected to gazebo master @ http://127.0.0.1:11345
[Msg] Publicized address: 192.168.1.2
Hello World!
```

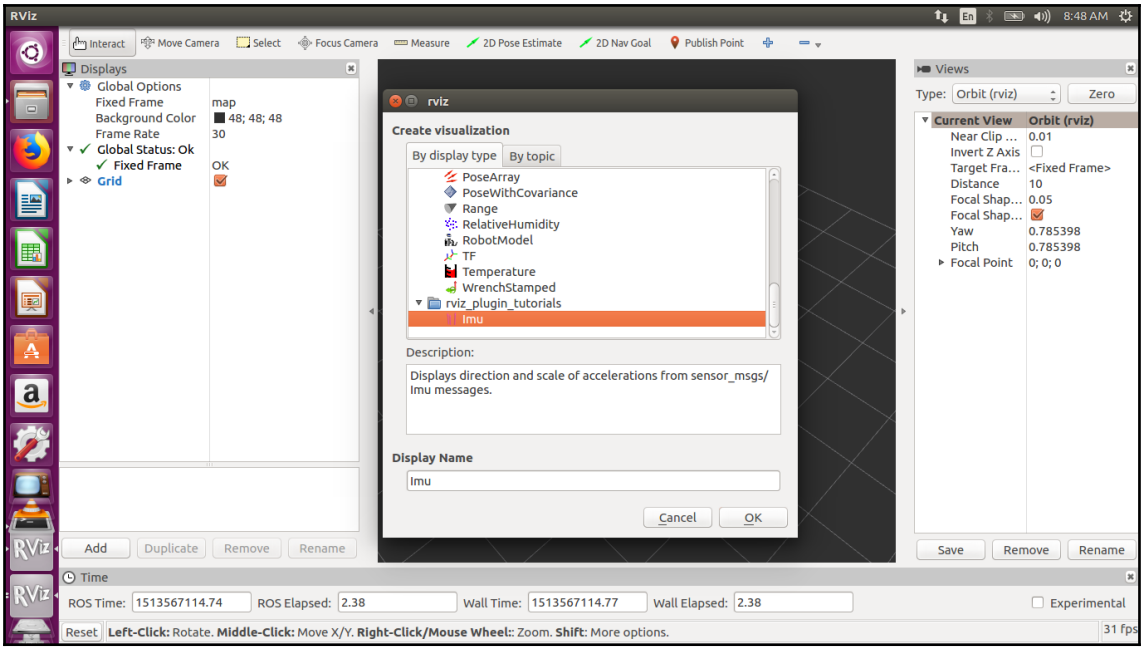


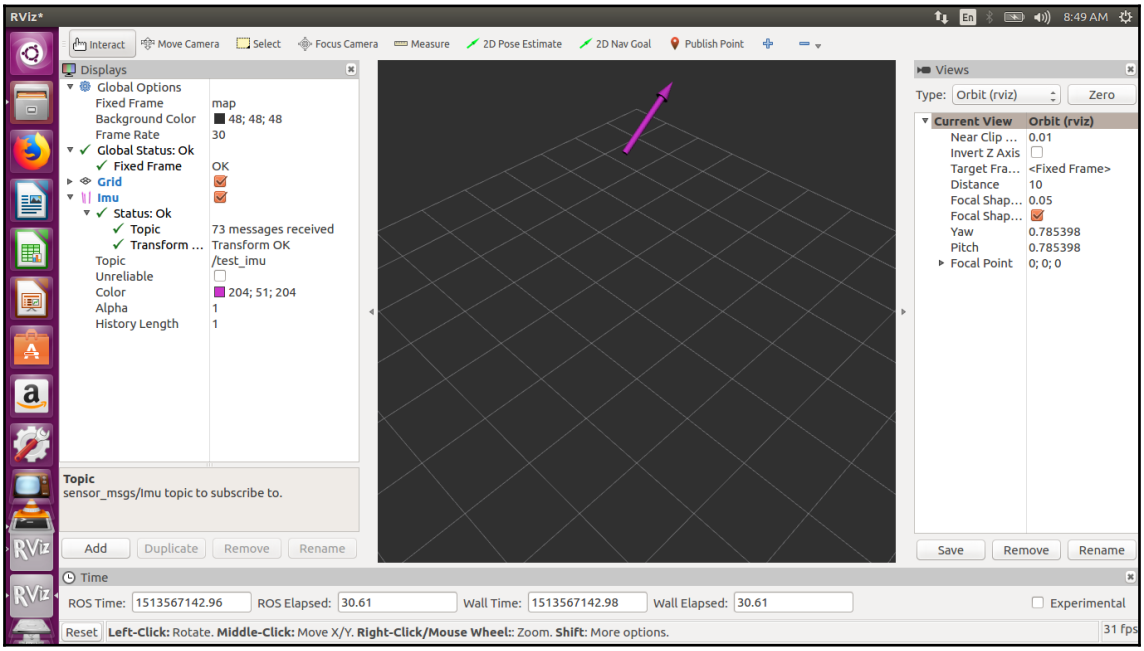



```
kumar@kumar-Inspiron-5437:~$ rosrun tf tf_echo turtle1 turtle2
At time 1513513192.139
- Translation: [0.000, 0.000, 0.000]
- Rotation: in Quaternion [-0.000, -0.000, 0.135, 0.991]
            in RPY (radian) [-0.000, -0.000, 0.271]
            in RPY (degree) [-0.000, -0.000, 15.540]
At time 1513513192.876
- Translation: [0.000, 0.000, 0.000]
- Rotation: in Quaternion [-0.000, -0.000, 0.135, 0.991]
            in RPY (radian) [-0.000, -0.000, 0.271]
            in RPY (degree) [-0.000, -0.000, 15.540]
```

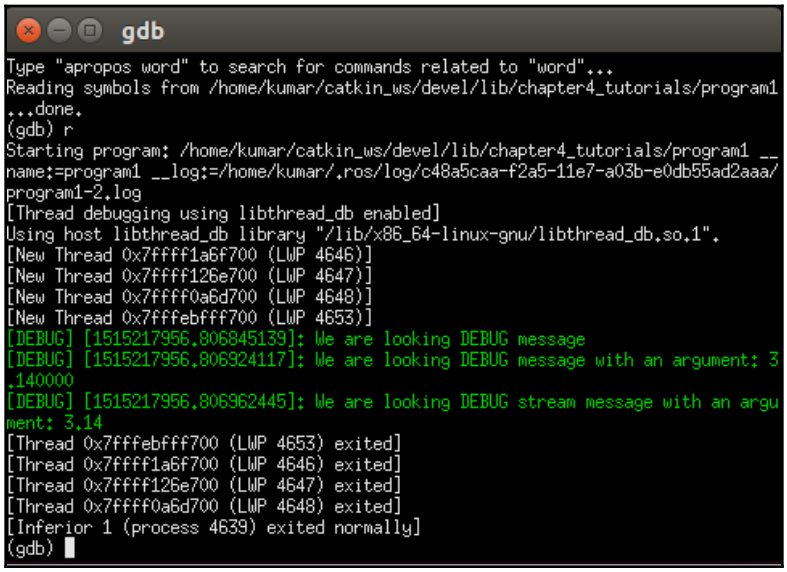

turtle_rviz.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
world
Background Color
48; 48; 48
Frame Rate
30
Global Status: Ok
Grid
TF
Status: Ok
Show Names
Show Axes
Show Arrows
Marker Scale
5
Update Interval
0
Frame Timeout
15
Frames
All Enabled
turtle1
turtle2
world
Tree
Marker Scale
Scaling factor for all names, axes and arrows.
Add
Duplicate
Remove
Rename
world
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
12.5758
Focal Shap...
0.05
Yaw
4.05041
Pitch
0.849796
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
1513513272.15
ROS Elapsed:
49.09
Wall Time:
1513513272.18
Wall Elapsed:
49.06
Experimental
Reset
31 fps

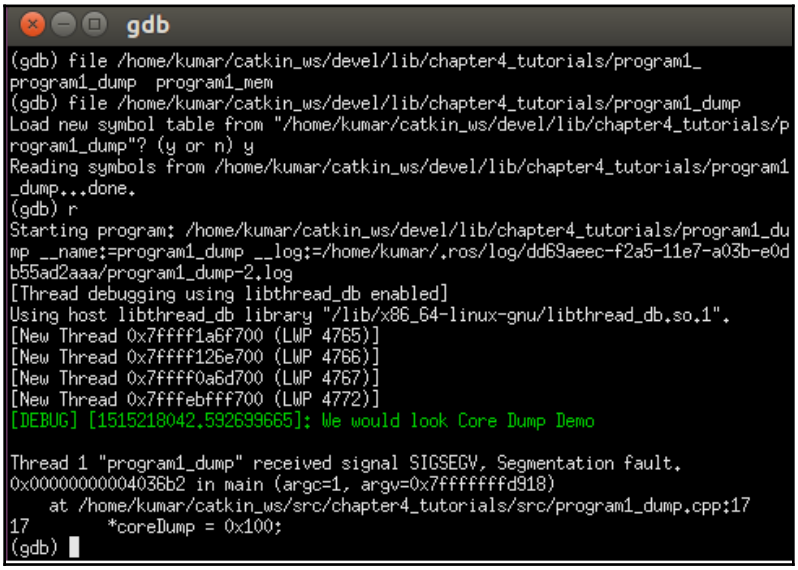

RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Global Status: W...
Fixed Frame
No tf data. Actual erro...
Grid
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
10
Focal Shap...
0.05
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
1513560072.93
ROS Elapsed:
7.97
Wall Time:
1513560072.95
Wall Elapsed:
7.93
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.


RViz
8:48 AM
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
Global Status: Ok
Fixed Frame
OK
Grid
rviz
Create visualization
By display type
By topic
PoseArray
PoseWithCovariance
Range
RelativeHumidity
RobotModel
TF
Temperature
WrenchStamped
rviz_plugin_tutorials
Imu
Description:
Displays direction and scale of accelerations from sensor_msgs/Imu messages.
Display Name
Imu
Cancel
OK
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
10
Focal Shap...
0.05
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Add
Duplicate
Remove
Rename
Save
Time
ROS Time:
1513567114.74
ROS Elapsed:
2.38
Wall Time:
1513567114.77
Wall Elapsed:
2.38
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

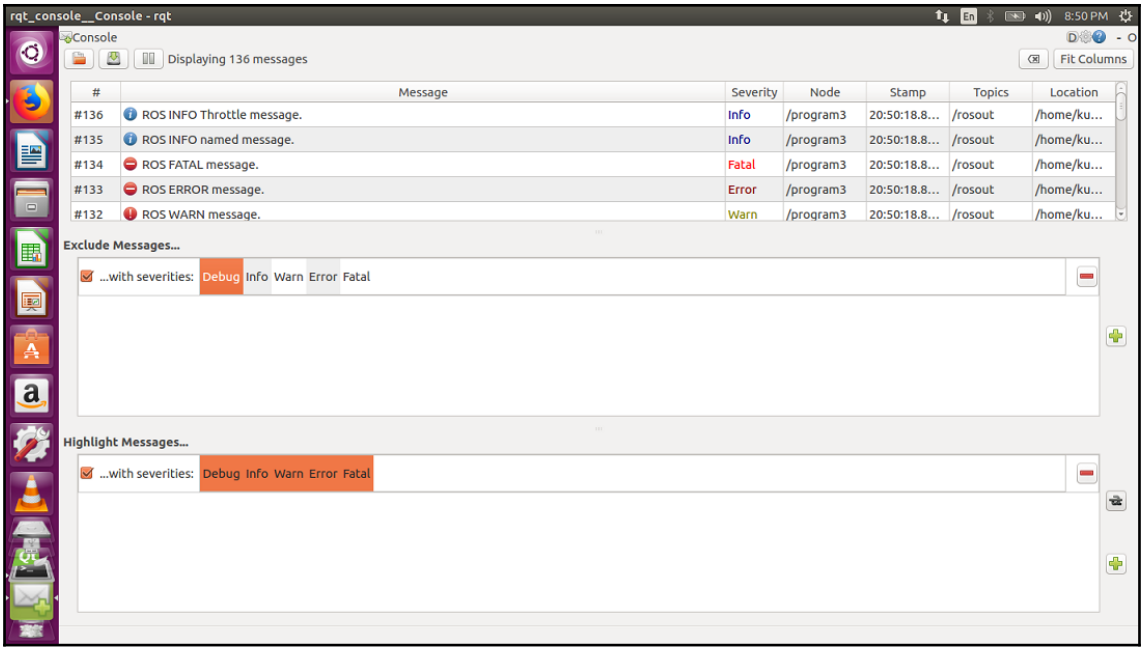

RViz*
8:49 AM
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Global Status: Ok
Fixed Frame
OK
Grid
Imu
Status: Ok
Topic
73 messages received
Transform ...
Transform OK
Topic
/test_imu
Unreliable
Color
204; 51; 204
Alpha
1
History Length
1
Topic
sensor_msgs/Imu topic to subscribe to.
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
10
Focal Shap...
0.05
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Add
Duplicate
Remove
Rename
Save
Time
ROS Time:
1513567142.96
ROS Elapsed:
30.61
Wall Time:
1513567142.98
Wall Elapsed:
30.61
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

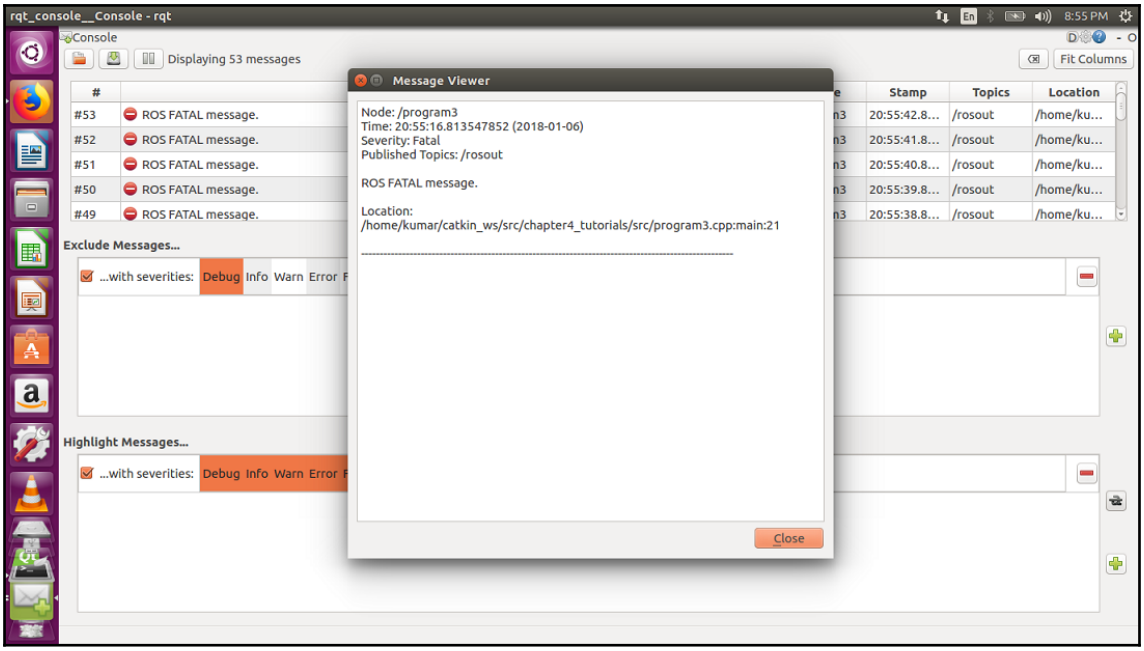
Chapter 4: ROS Visualization and Debugging Tools

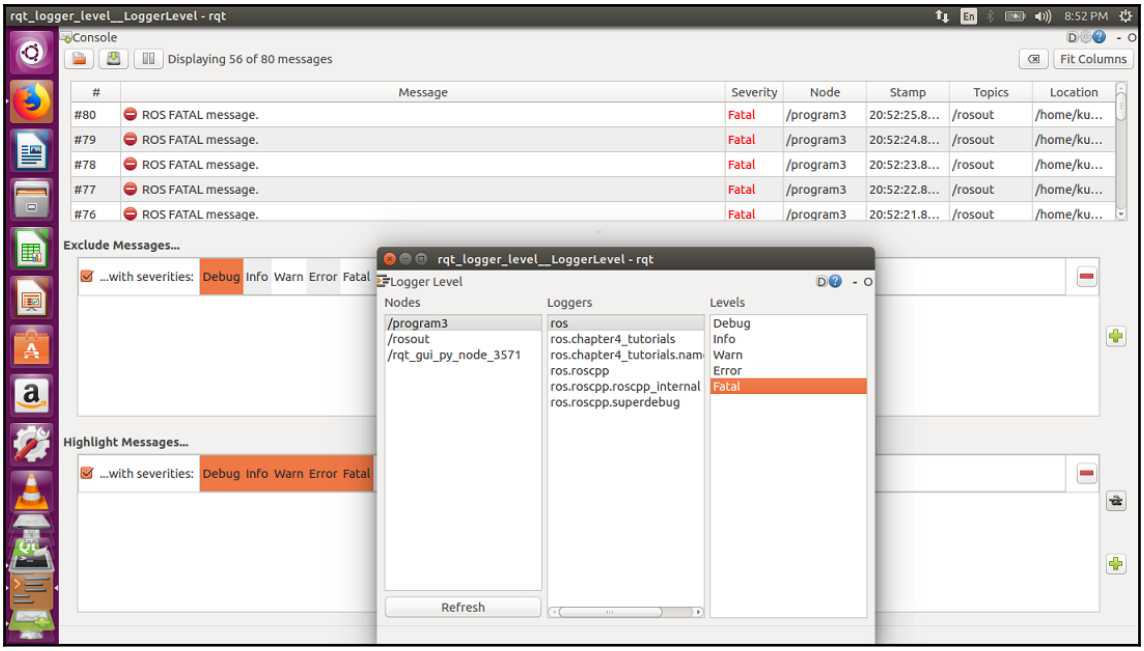


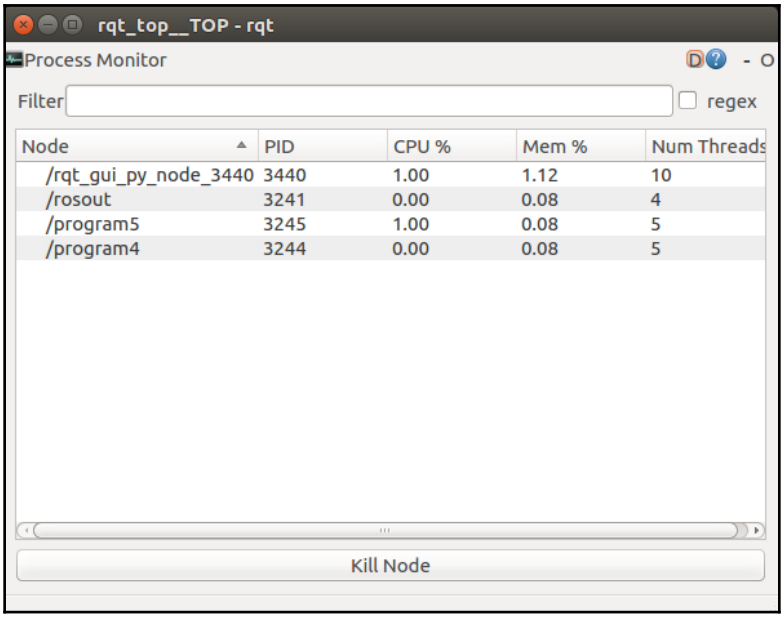


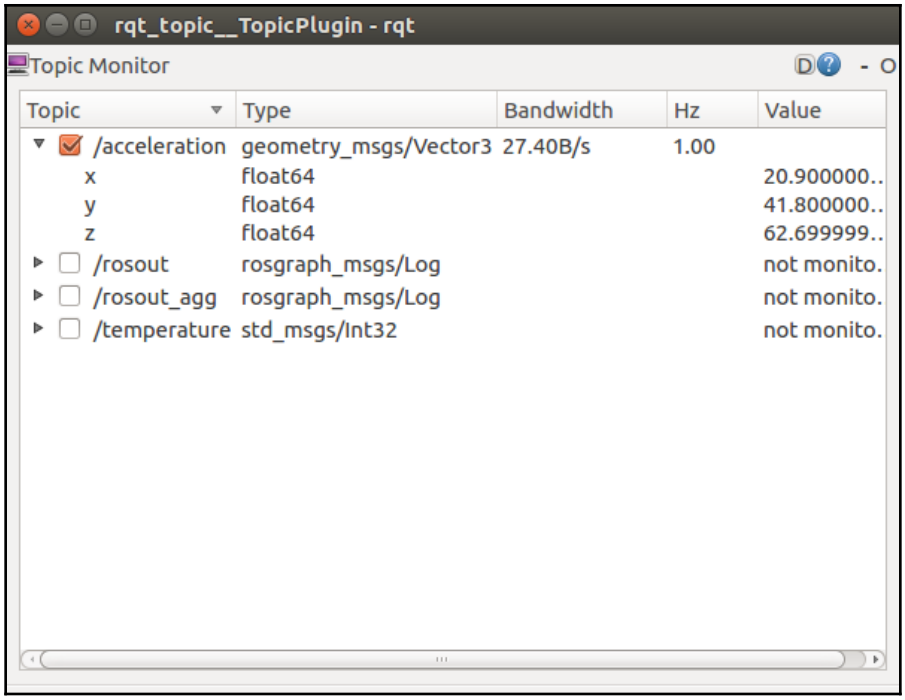
```
process[program1_mem-2]: started with pid [5092]
==5092== Memcheck, a memory error detector
==5092== Copyright (C) 2002-2015, and GNU GPL'd, by Julian Seward et al.
==5092== Using Valgrind-3.11.0 and LibVEX; rerun with -h for copyright info
==5092== Command: /home/kumar/catkin_ws/devel/lib/chapter4_tutorials/program1_mem __name:=p
6-11e7-a03b-e0db55ad2aaa/program1_mem-2.log
==5092==
[DEBUG] [1515218092.923885628]: We would look memory leak Demo
[DEBUG] [1515218092.966403243]: We are lookig DEBUG message with an argument: 3.140000
[DEBUG] [1515218093.014503762]: We are looking DEBUG stream message with an argument: 3.14
==5092==
==5092== HEAP SUMMARY:
==5092==     in use at exit: 77,851 bytes in 53 blocks
==5092==   total heap usage: 1,564 allocs, 1,511 frees, 274,889 bytes allocated
==5092==
==5092== LEAK SUMMARY:
==5092==    definitely lost: 400 bytes in 1 blocks
==5092==    indirectly lost: 0 bytes in 0 blocks
==5092==      possibly lost: 304 bytes in 1 blocks
==5092==    still reachable: 77,147 bytes in 51 blocks
==5092==         suppressed: 0 bytes in 0 blocks
==5092== Rerun with --leak-check=full to see details of leaked memory
==5092==
==5092== For counts of detected and suppressed errors, rerun with: -v
==5092== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
[program1_mem-2] process has finished cleanly
log file: /home/kumar/.ros/log/1b7b3c5a-f2a6-11e7-a03b-e0db55ad2aaa/program1_mem-2*.log
```

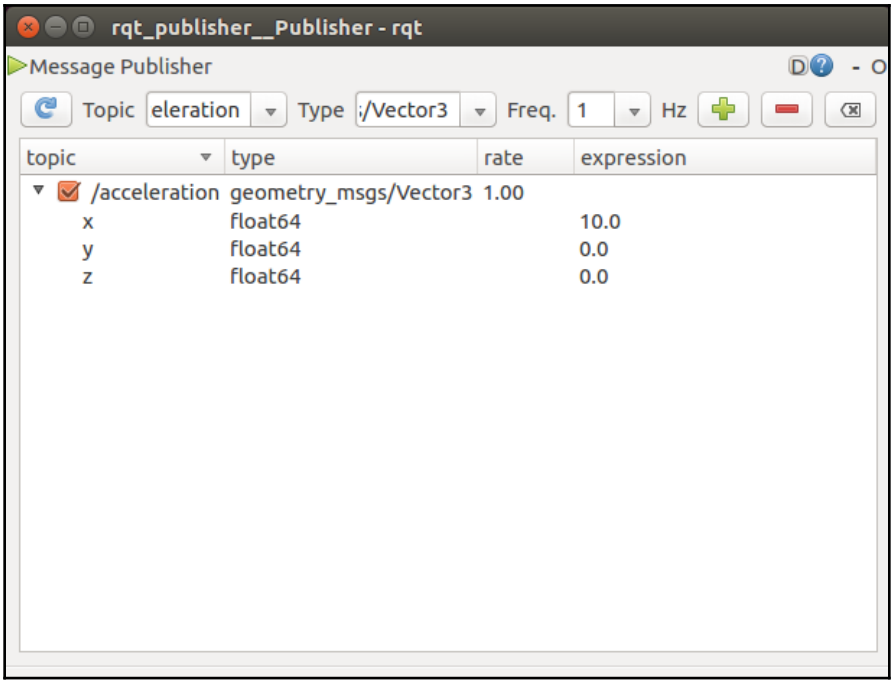


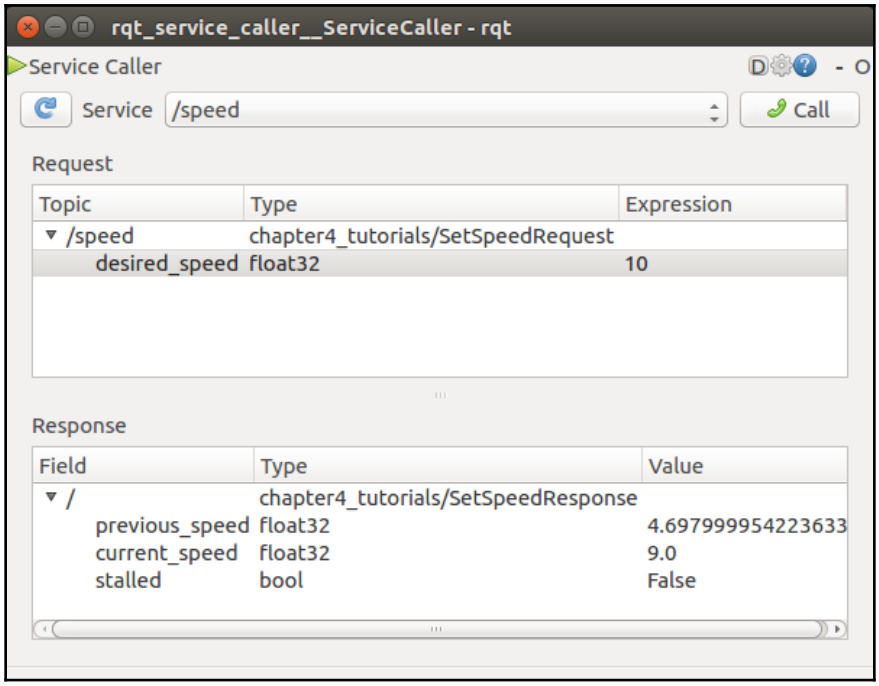

rqt_console__Console - rqt
8:55 PM
Console
Displaying 53 messages
Fit Columns
Message Viewer
Node: /program3
Time: 20:55:16.813547852 (2018-01-06)
Severity: Fatal
Published Topics: /rosout
ROS FATAL message.
Location:
/home/kumar/catkin_ws/src/chapter4_tutorials/src/program3.cpp:main:21
Close
Stamp Topics Location
#53 ROS FATAL message. 20:55:42.8... /rosout /home/ku...
#52 ROS FATAL message. 20:55:41.8... /rosout /home/ku...
#51 ROS FATAL message. 20:55:40.8... /rosout /home/ku...
#50 ROS FATAL message. 20:55:39.8... /rosout /home/ku...
#49 ROS FATAL message. 20:55:38.8... /rosout /home/ku...
Exclude Messages...
...with severities: Debug Info Warn Error
Highlight Messages...
...with severities: Debug Info Warn Error

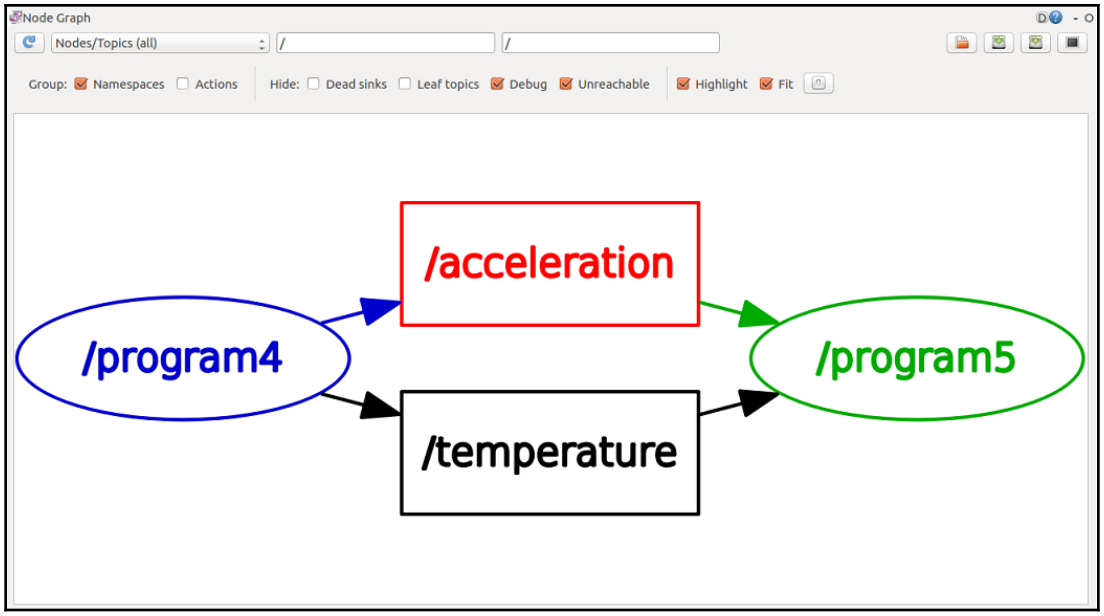

rqt_logger_level__LoggerLevel - rqt
8:52 PM
Console
Displaying 56 of 80 messages
Fit Columns
Message Severity Node Stamp Topics Location
#80 ROS FATAL message. Fatal /program3 20:52:25.8... /rosout /home/ku...
#79 ROS FATAL message. Fatal /program3 20:52:24.8... /rosout /home/ku...
#78 ROS FATAL message. Fatal /program3 20:52:23.8... /rosout /home/ku...
#77 ROS FATAL message. Fatal /program3 20:52:22.8... /rosout /home/ku...
#76 ROS FATAL message. Fatal /program3 20:52:21.8... /rosout /home/ku...
Exclude Messages...
...with severities: Debug Info Warn Error Fatal
Highlight Messages...
...with severities: Debug Info Warn Error Fatal
rqt_logger_level__LoggerLevel - rqt
Logger Level
Nodes
/program3
/rosout
/rqt_gui_py_node_3571
Refresh
Loggers
ros
ros.chapter4_tutorials
ros.chapter4_tutorials.nam
ros.roscpp
ros.roscpp.roscpp_internal
ros.roscpp.superdebug
Levels
Debug
Info
Warn
Error
Fatal

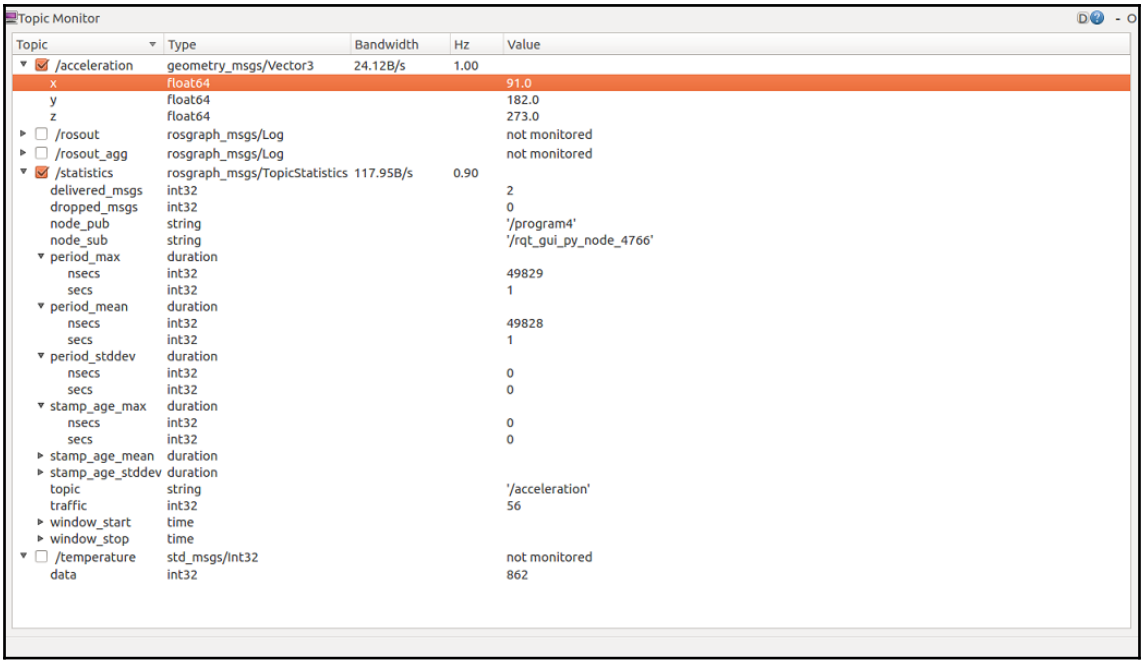

rqt_top__TOP - rqt
Process Monitor
Filter
regex
Node
PID
CPU %
Mem %
Num Threads
/rqt_gui_py_node_3440 3440 1.00 1.12 10
/rosout 3241 0.00 0.08 4
/program5 3245 1.00 0.08 5
/program4 3244 0.00 0.08 5
Kill Node


rqt_topic__TopicPlugin - rqt
Topic Monitor
Topic
Type
Bandwidth
Hz
Value
/acceleration geometry_msgs/Vector3 27.40B/s 1.00
x float64 20.900000..
y float64 41.800000..
z float64 62.699999..
/rosout rosgraph_msgs/Log not monito.
/rosout_agg rosgraph_msgs/Log not monito.
/temperature std_msgs/Int32 not monito.


rqt_publisher__Publisher - rqt
Message Publisher
Topic
eleration
Type
;/Vector3
Freq.
1
Hz
topic
type
rate
expression
/acceleration
geometry_msgs/Vector3
1.00
x
float64
10.0
y
float64
0.0
z
float64
0.0

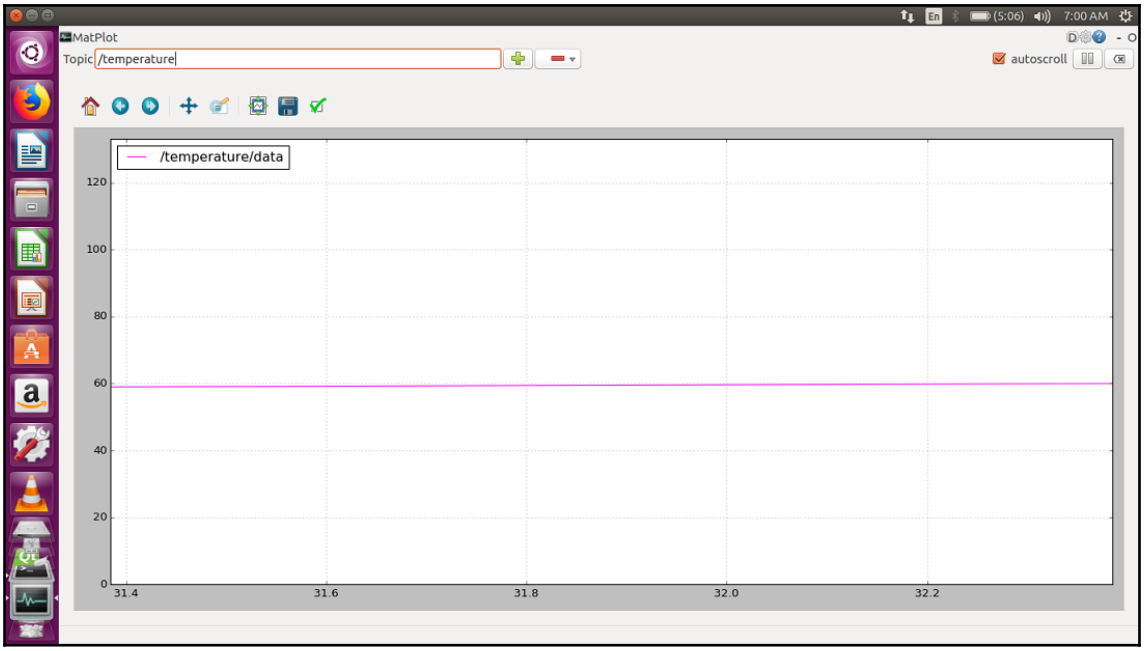

rqt_service_caller__ServiceCaller - rqt
Service Caller
Service
/speed
Call
Request
Topic
Type
Expression
/speed
chapter4_tutorials/SetSpeedRequest
desired_speed
float32
10
Response
Field
Type
Value
/
chapter4_tutorials/SetSpeedResponse
previous_speed
float32
4.697999954223633
current_speed
float32
9.0
stalled
bool
False

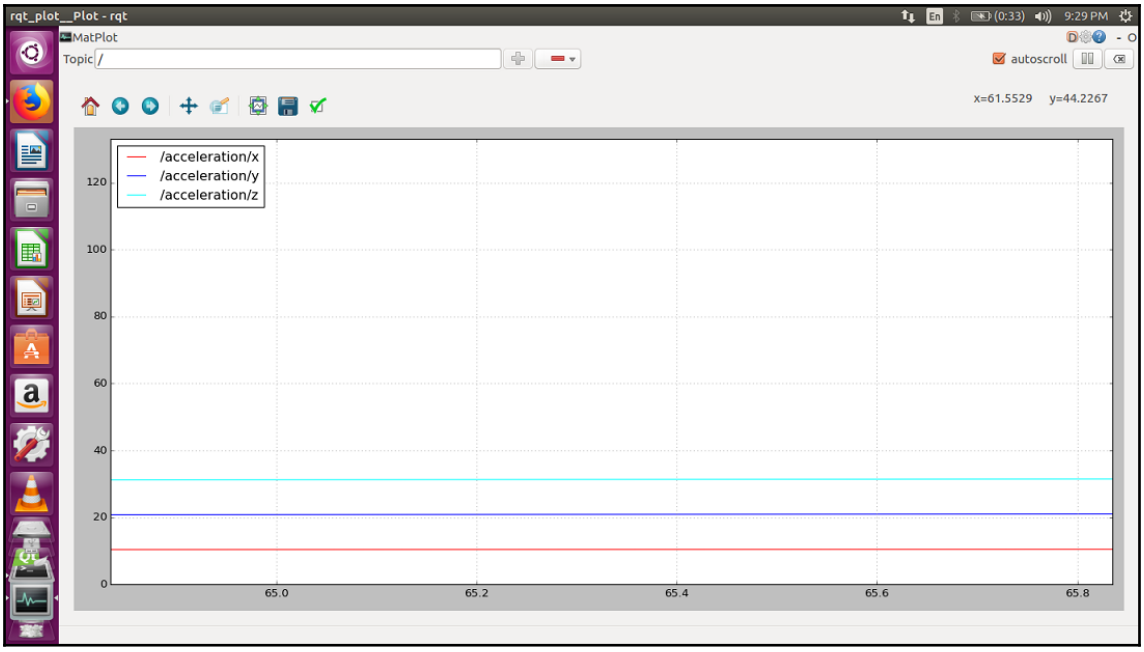

Node Graph
Nodes/Topics (all)
Group:
Namespaces
Actions
Hide:
Dead sinks
Leaf topics
Debug
Unreachable
Highlight
Fit
/acceleration
/program4
/program5
/temperature

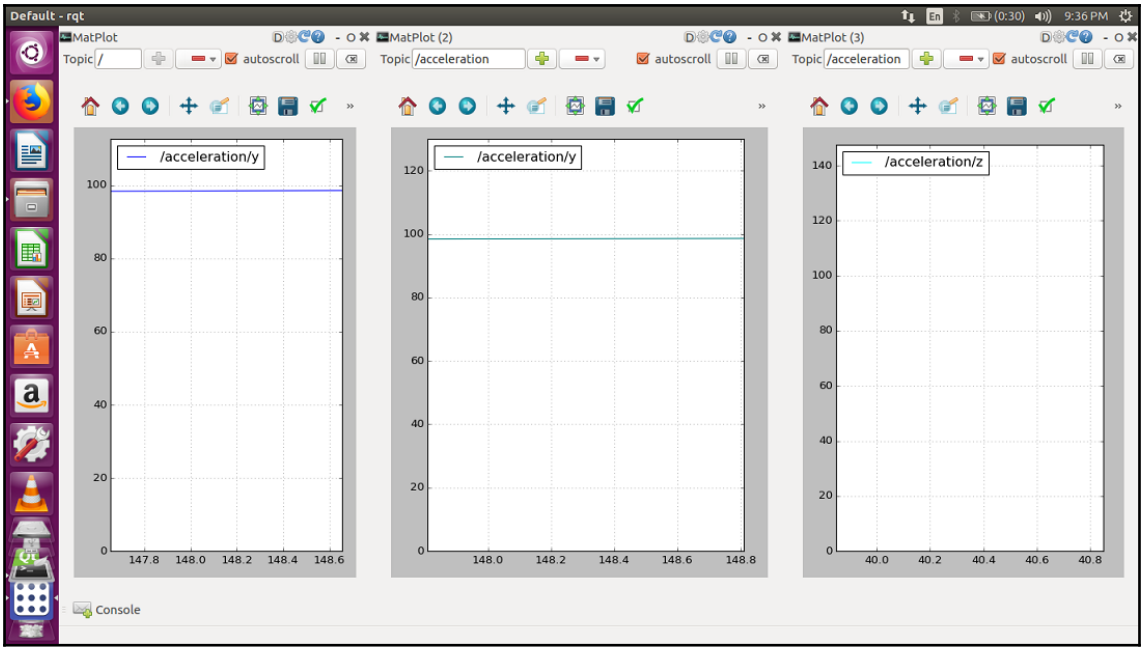


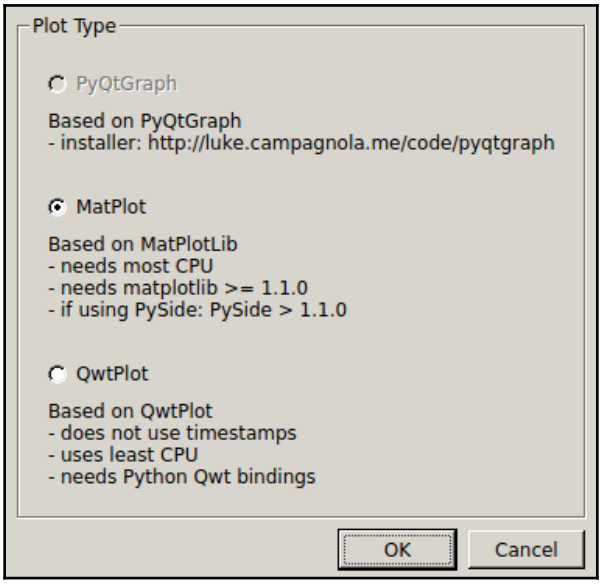

```
kumar@kumar-Inspiron-5437:~/catkin_ws/src/chapter4_tutorials$ roswtf
Loaded plugin tf.tfwtf
Package: chapter4_tutorials
================================================================================
Static checks summary:

No errors or warnings
================================================================================
Beginning tests of your ROS graph. These may take awhile...
analyzing graph...
... done analyzing graph
running graph rules...
... done running graph rules

Online checks summary:

No errors or warnings
kumar@kumar-Inspiron-5437:~/catkin_ws/src/chapter4_tutorials$
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws/src/chapter4_tutorials$ catkin_lint -W2 --pkg chapter4_tutorials
catkin_lint: not a directory: -W2
chapter4_tutorials: warning: executable file 'CMakeLists.txt' is not installed
chapter4_tutorials: warning: executable file 'package.xml' is not installed
chapter4_tutorials: warning: executable file 'config/chapter4_tutorials.config' is not installed
chapter4_tutorials: warning: executable file 'config/program9.rviz' is not installed
chapter4_tutorials: warning: executable file 'config/diagnostic_aggregator.yaml' is not installed
chapter4_tutorials: warning: executable file 'config/bag_plot.perspective' is not installed
chapter4_tutorials: warning: executable file 'config/program_tf.rviz' is not installed
chapter4_tutorials: warning: executable file 'config/program10.rviz' is not installed
chapter4_tutorials: warning: executable file 'src/program1.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program3.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program9.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program4.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program6.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program2.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program8.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program1_mem.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program5.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program10.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program7.cpp' is not installed
chapter4_tutorials: warning: executable file 'src/program1_dump.cpp' is not installed
chapter4_tutorials: warning: executable file 'srv/SetSpeed.srv' is not installed
chapter4_tutorials: warning: executable file 'output/gdb_run_node_example1.txt' is not installed
chapter4_tutorials: warning: executable file 'launch/program4_5.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program1_dump.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program3.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program1_gdb.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program10.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program9.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program1.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program4_record.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program6.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program7.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program8.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program2.launch' is not installed
chapter4_tutorials: warning: executable file 'launch/program1_valgrind.launch' is not installed
chapter4_tutorials: warning: executable file 'bag/2014-07-01-22-54-34.bag' is not installed
catkin_lint: checked 1 packages and found 36 problems
catkin_lint: 16 notices have been ignored. Use -W2 to see them
```


MatPlot
Topic /temperature
autoscroll
/temperature/data
120
100
80
60
40
20
0
31.4
31.6
31.8
32.0
32.2


rqt_plot__Plot - rqt
MatPlot
Topic /
autoscroll
x=61.5529 y=44.2267
/acceleration/x
/acceleration/y
/acceleration/z
120
100
80
60
40
20
0
65.0
65.2
65.4
65.6
65.8


Default - rqt
MatPlot
Topic /
autoscroll
MatPlot (2)
Topic /acceleration
autoscroll
MatPlot (3)
Topic /acceleration
autoscroll
/acceleration/y
/acceleration/y
/acceleration/z
Console


Plot Type
PyQtGraph
Based on PyQtGraph
- installer: http://luke.campagnola.me/code/pyqtgraph
MatPlot
Based on MatPlotLib
- needs most CPU
- needs matplotlib >= 1.1.0
- if using PySide: PySide > 1.1.0
QwtPlot
Based on QwtPlot
- does not use timestamps
- uses least CPU
- needs Python Qwt bindings
OK
Cancel

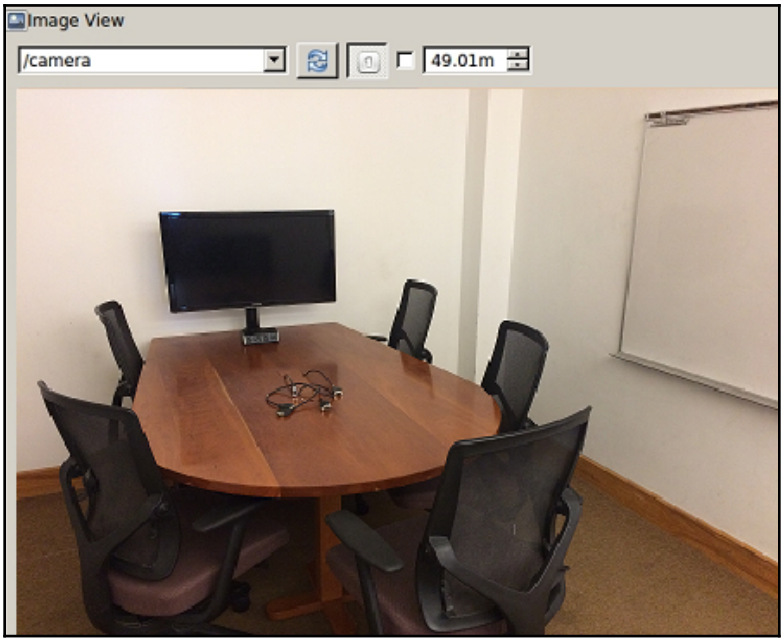
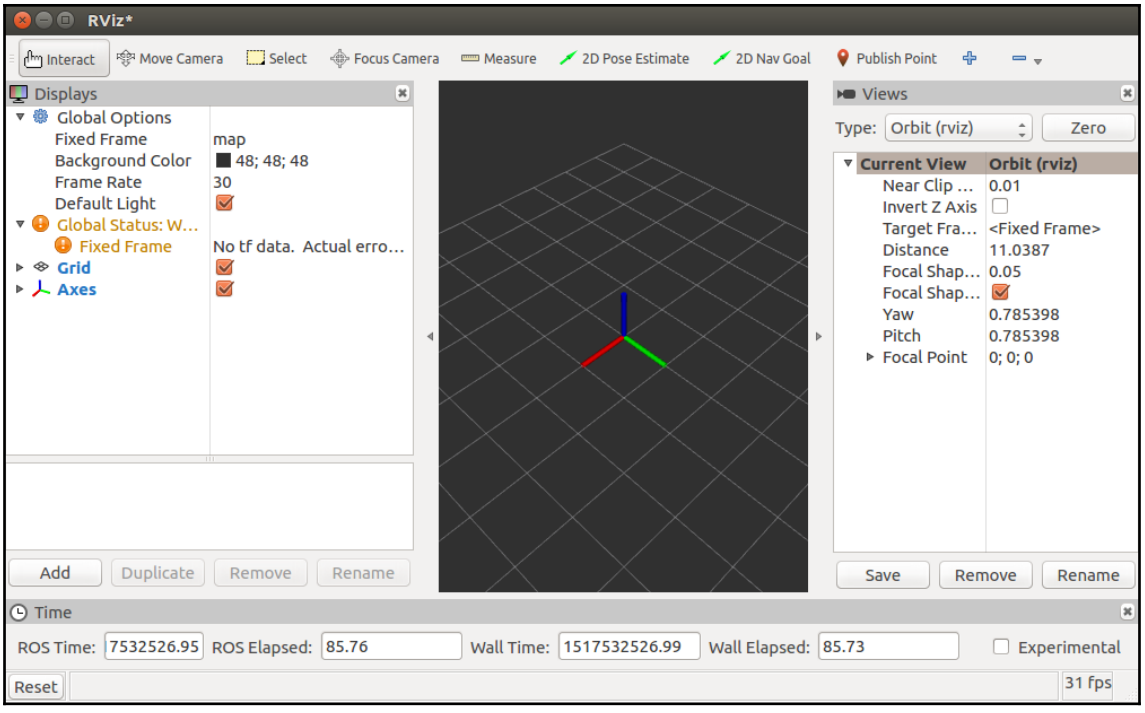
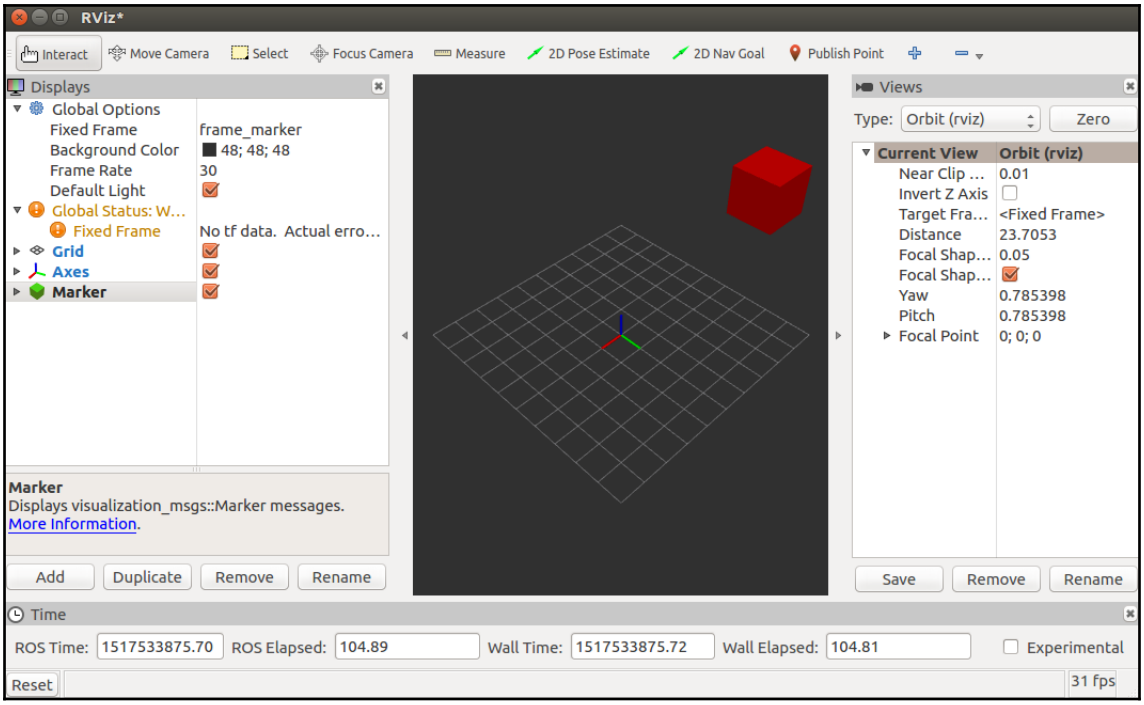
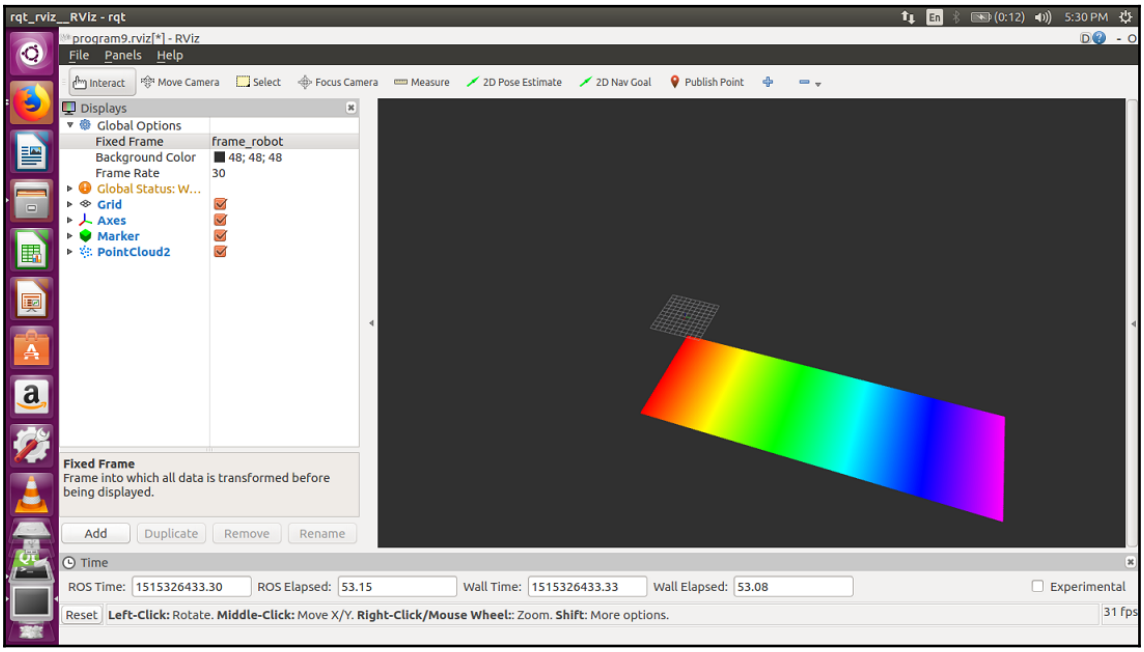
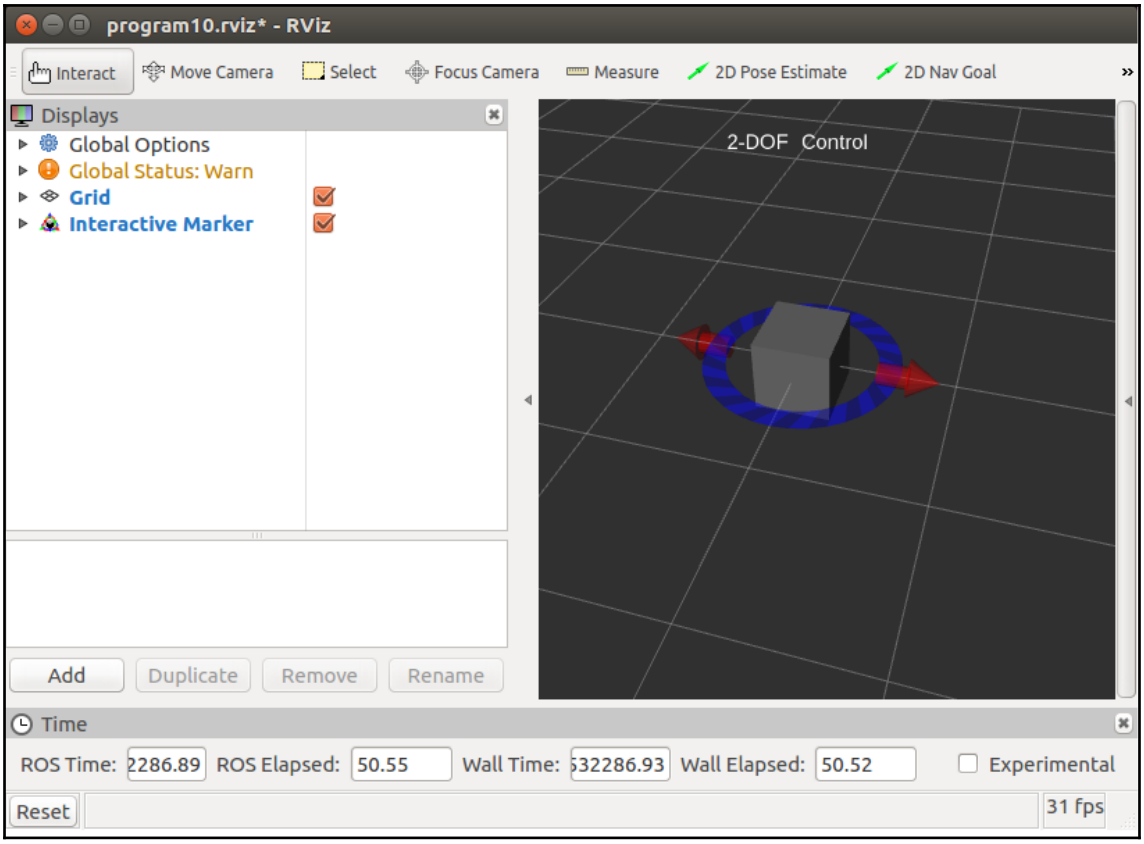


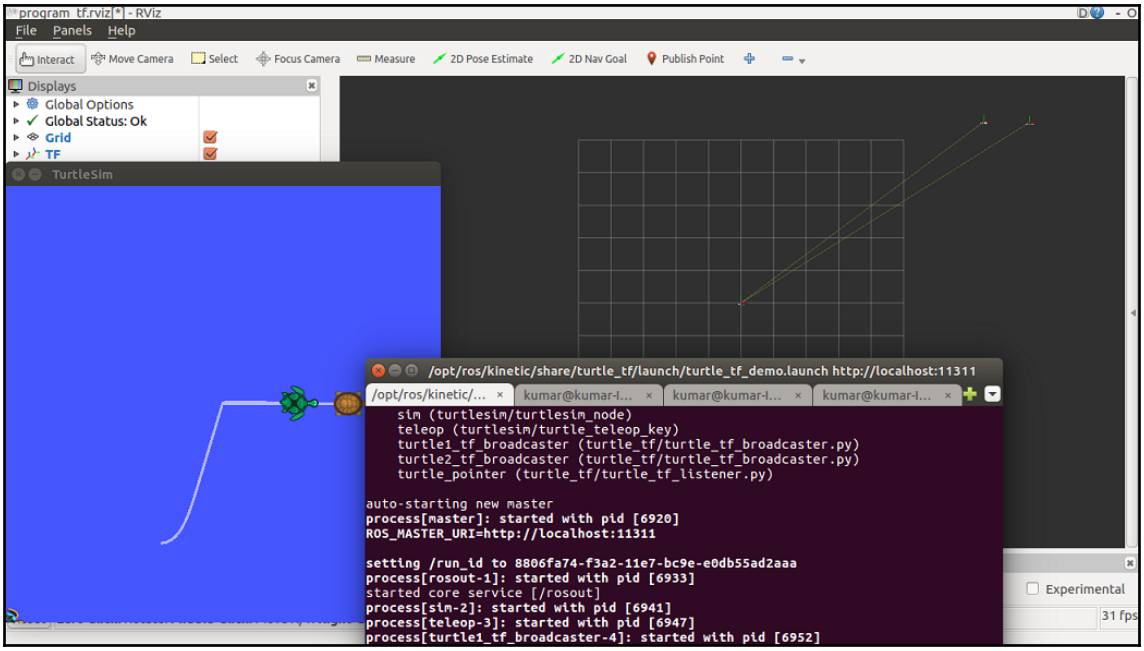
Image View
/camera
49.01m


RViz*
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: W…
Fixed Frame
No tf data. Actual erro…
Grid
Axes
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip …
0.01
Invert Z Axis
Target Fra…
<Fixed Frame>
Distance
11.0387
Focal Shap…
0.05
Focal Shap…
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
7532526.95
ROS Elapsed:
85.76
Wall Time:
1517532526.99
Wall Elapsed:
85.73
Experimental
Reset
31 fps


RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
frame_marker
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: W...
Fixed Frame
No tf data. Actual erro...
Grid
Axes
Marker
Marker
Displays visualization_msgs::Marker messages.
More Information.
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
23.7053
Focal Shap...
0.05
Focal Shap...
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
1517533875.70
ROS Elapsed:
104.89
Wall Time:
1517533875.72
Wall Elapsed:
104.81
Experimental
Reset
31 fps


rqt_rviz__RViz - rqt
program9.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
frame_robot
Background Color
48; 48; 48
Frame Rate
30
Global Status: W...
Grid
Axes
Marker
PointCloud2
Fixed Frame
Frame into which all data is transformed before being displayed.
Add
Duplicate
Remove
Rename
Time
ROS Time:
1515326433.30
ROS Elapsed:
53.15
Wall Time:
1515326433.33
Wall Elapsed:
53.08
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

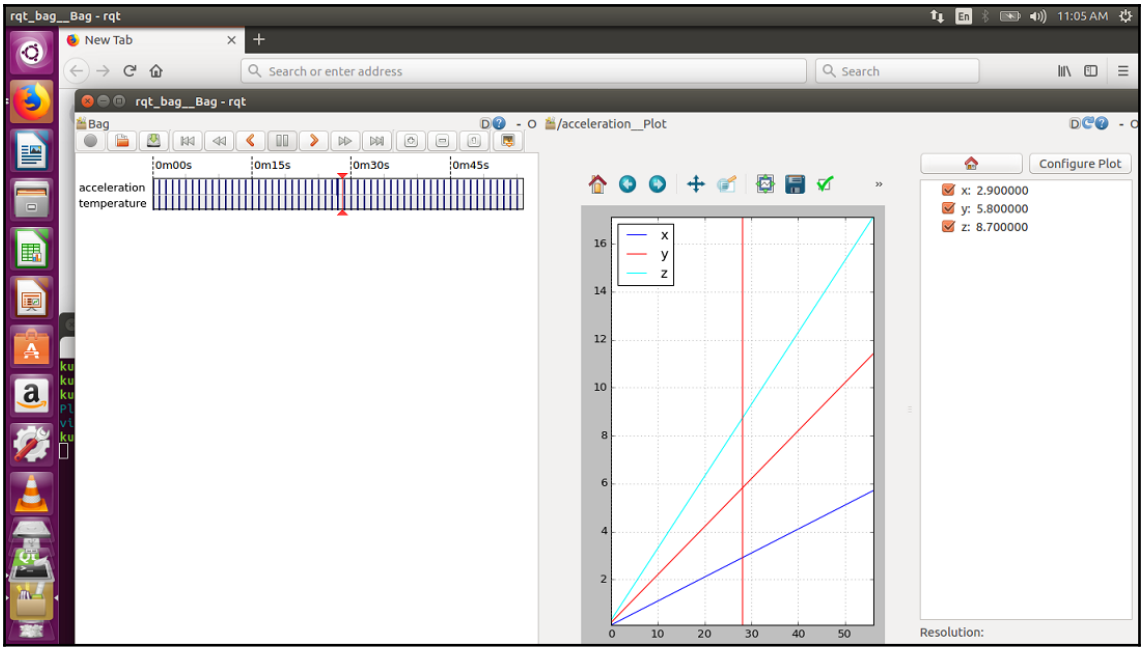

program10.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Displays
Global Options
Global Status: Warn
Grid
Interactive Marker
2-DOF Control
Add
Duplicate
Remove
Rename
Time
ROS Time: 2286.89
ROS Elapsed: 50.55
Wall Time: 32286.93
Wall Elapsed: 50.52
Experimental
Reset
31 fps



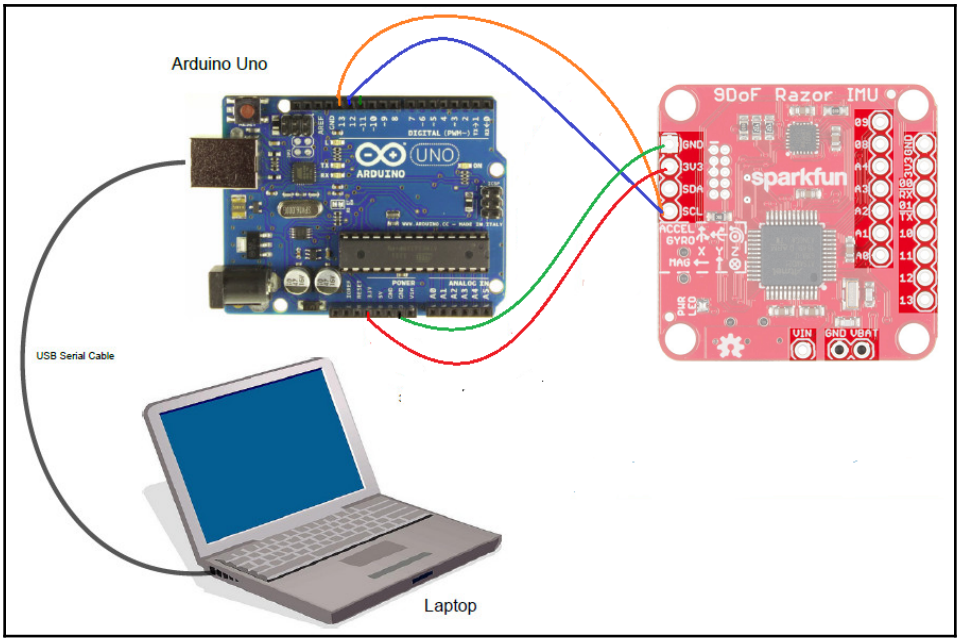

```
kumar@kumar-Inspiron-5437:~/.ros$ rosbag play -r 100 2018-01-07-10-35-00.bag
[ INFO] [1515301638.127694416]: Opening 2018-01-07-10-35-00.bag

Waiting 0.2 seconds after advertising topics... done.

Hit space to toggle paused, or 's' to step.
 [RUNNING]  Bag Time: 1515301515.839165   Duration: 14.021838 / 16.000160
Done.
```

```
kumar@kumar-Inspiron-5437:~/catkin_ws$ rostopic list
/acceleration
/clock
/rosout
/rosout_agg
/temperature
kumar@kumar-Inspiron-5437:~/catkin_ws$
```

```
kumar@kumar-Inspiron-5437:~/.ros$ rosbag info 2018-01-07-10-38-37.bag
path:        2018-01-07-10-38-37.bag
version:     2.0
duration:    56.0s
start:       Jan 07 2018 10:38:38.15 (1515301718.15)
end:         Jan 07 2018 10:39:34.15 (1515301774.15)
size:        13.9 KB
messages:    114
compression: none [1/1 chunks]
types:       geometry_msgs/Vector3 [4a842b65f413084dc2b10fb484ea7f17]
             std_msgs/Int32        [da5909fbe378aeaf85e547e830cc1bb7]
topics:      /acceleration    57 msgs    : geometry_msgs/Vector3
             /temperature     57 msgs    : std_msgs/Int32
```

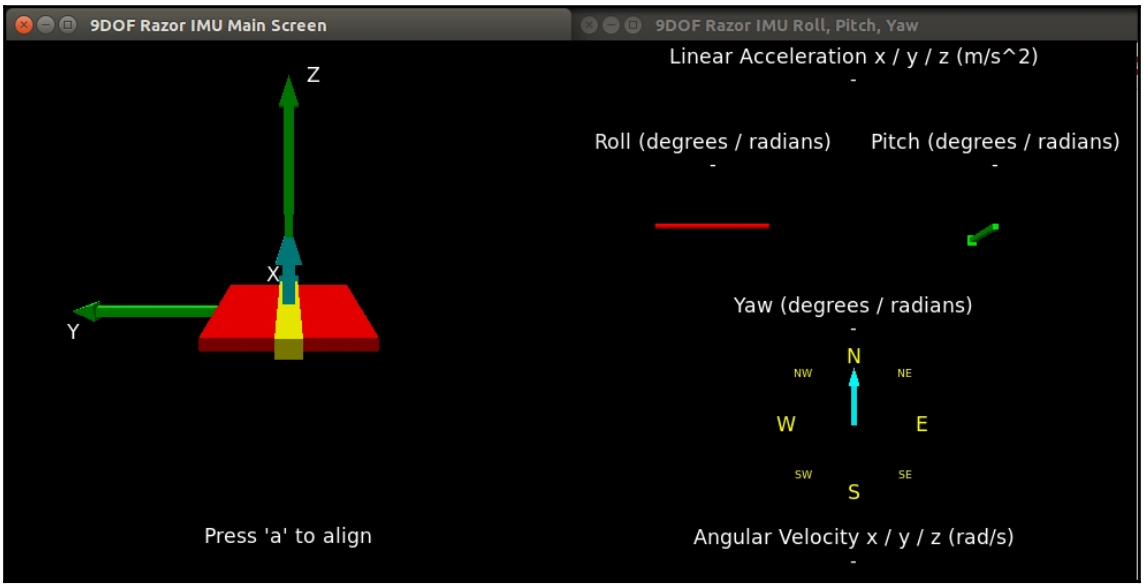

rqt_bag__Bag - rqt
11:05 AM
New Tab
Search or enter address
Search
rqt_bag__Bag - rqt
Bag
/acceleration__Plot
0m00s
0m15s
0m30s
0m45s
acceleration
temperature
Configure Plot
x: 2.900000
y: 5.800000
z: 8.700000
x
y
z
16
14
12
10
8
6
4
2
0
10
20
30
40
50
Resolution:

Chapter 5: Accessing Sensors and Actuators through ROS

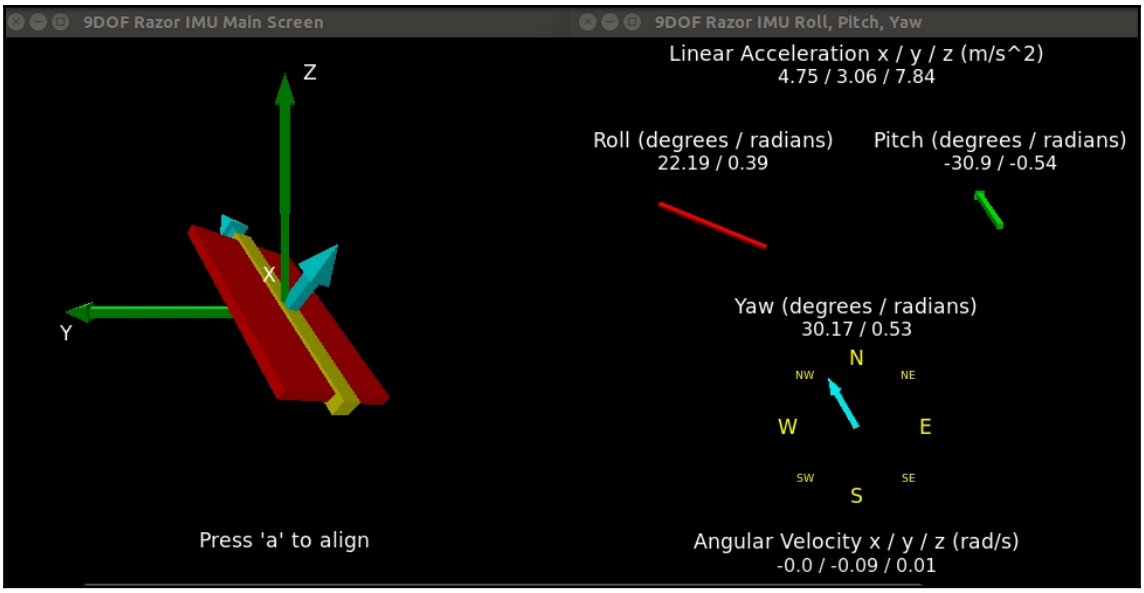


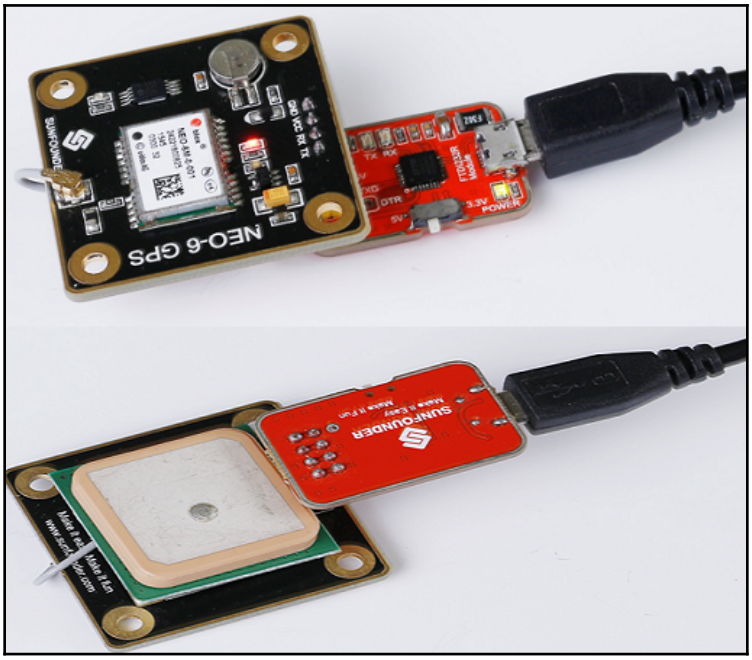

```
206  // HARDWARE OPTIONS
207  /*****************************************************************/
208  // Select your hardware here by uncommenting one line!
209  //#define HW__VERSION_CODE 10125 // SparkFun "9DOF Razor IMU" version "SEN-10125" (HMC5843 magnetometer)
210  //#define HW__VERSION_CODE 10736 // SparkFun "9DOF Razor IMU" version "SEN-10736" (HMC5883L magnetometer)
211    #define HW__VERSION_CODE 14001 // SparkFun "9DoF Razor IMU M0" version "SEN-14001"
212  //#define HW__VERSION_CODE 10183 // SparkFun "9DOF Sensor Stick" version "SEN-10183" (HMC5843 magnetometer)
213  //#define HW__VERSION_CODE 10321 // SparkFun "9DOF Sensor Stick" version "SEN-10321" (HMC5843 magnetometer)
214  //#define HW__VERSION_CODE 10724 // SparkFun "9DOF Sensor Stick" version "SEN-10724" (HMC5883L magnetometer)
```

```
## USB port
port: /dev/ttyUSB0


##### Calibration ####
### accelerometer
accel_x_min: -250.0
accel_x_max: 250.0
accel_y_min: -250.0
accel_y_max: 250.0
accel_z_min: -250.0
accel_z_max: 250.0

### magnetometer
# standard calibration
magn_x_min: -600.0
magn_x_max: 600.0
magn_y_min: -600.0
magn_y_max: 600.0
magn_z_min: -600.0
magn_z_max: 600.0


# extended calibration
calibration_magn_use_extended: false
magn_ellipsoid_center: [0, 0, 0]
magn_ellipsoid_transform: [[0, 0, 0], [0, 0, 0], [0, 0, 0]]

# AHRS to robot calibration
imu_yaw_calibration: 0.0

### gyroscope
gyro_average_offset_x: 0.0
gyro_average_offset_y: 0.0
gyro_average_offset_z: 0.0
```

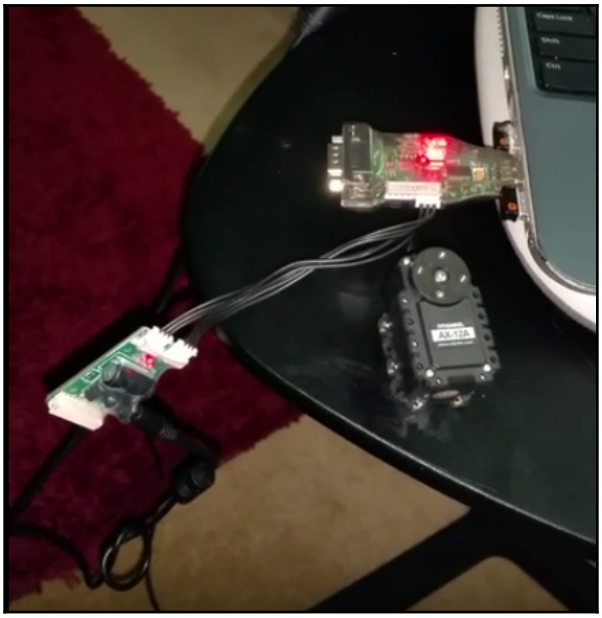


```
Header header

geometry_msgs/Quaternion orientation
float64[9] orientation_covariance # Row major about x, y, z axes

geometry_msgs/Vector3 angular_velocity
float64[9] angular_velocity_covariance # Row major about x, y, z axes

geometry_msgs/Vector3 linear_acceleration
float64[9] linear_acceleration_covariance # Row major x, y z
```



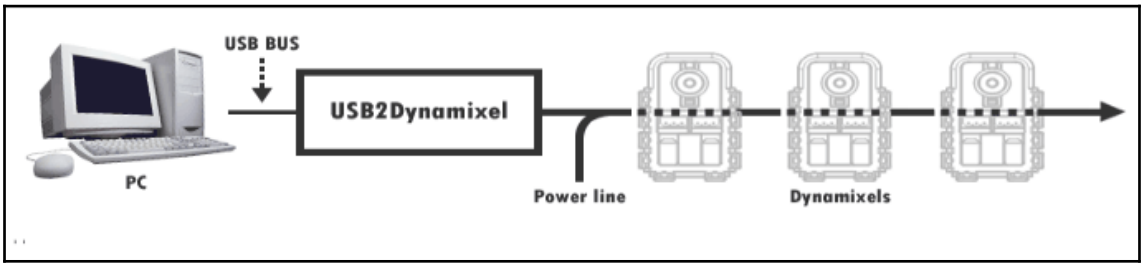



```
header:
  seq: 161
  stamp:
    secs: 40
    nsecs: 500000000
  frame_id: sensor
status:
  status: 0
  service: 0
latitude: -30.0602249716
longitude: -51.17391374
altitude: 9.960587315
position_covariance: [0.0025010000000000006, 0.0, 0.0, 0.0, 0.002501000000
6, 0.0, 0.0, 0.0, 0.0025010000000000006]
position_covariance_type: 2
---
```

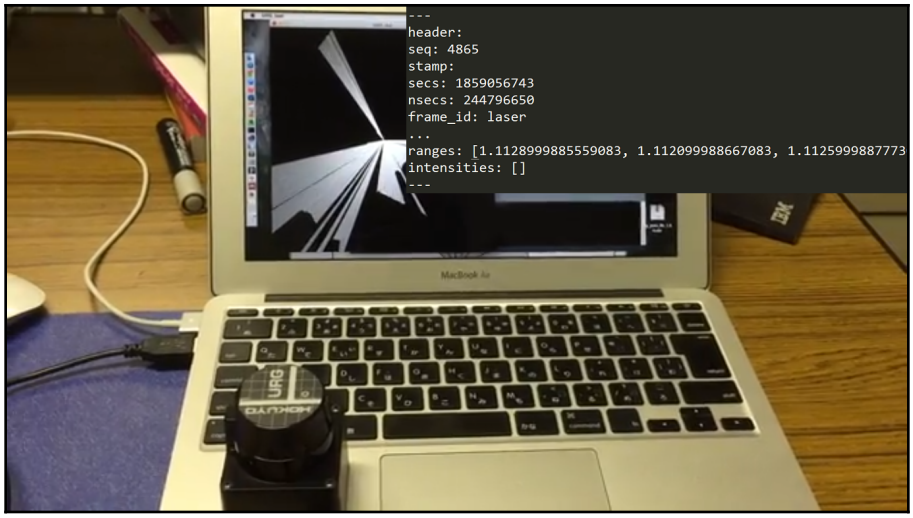



```
process[dynamixel_manager-1]: started with pid [4968]
[INFO] [WallTime: 1259367072.683441] pan_tilt_port: Pinging motor IDs 1 through
25...
[INFO] [WallTime: 1259367074.846670] pan_tilt_port: Found 1 motors - 1 AX-12 [4]
, initialization complete.
```

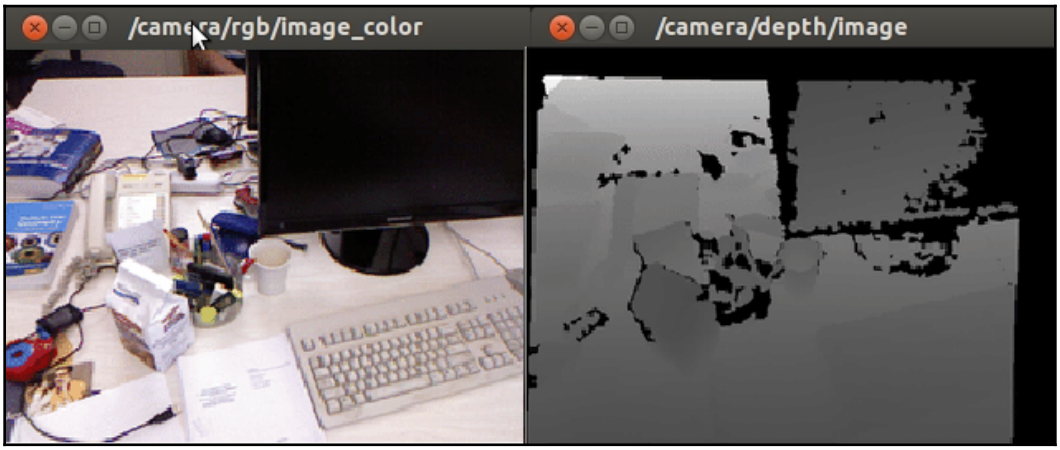
```
$ rostopic list
/diagnostics
/motor_states/pan_tilt_port
/rosout
/rosout_agg
```

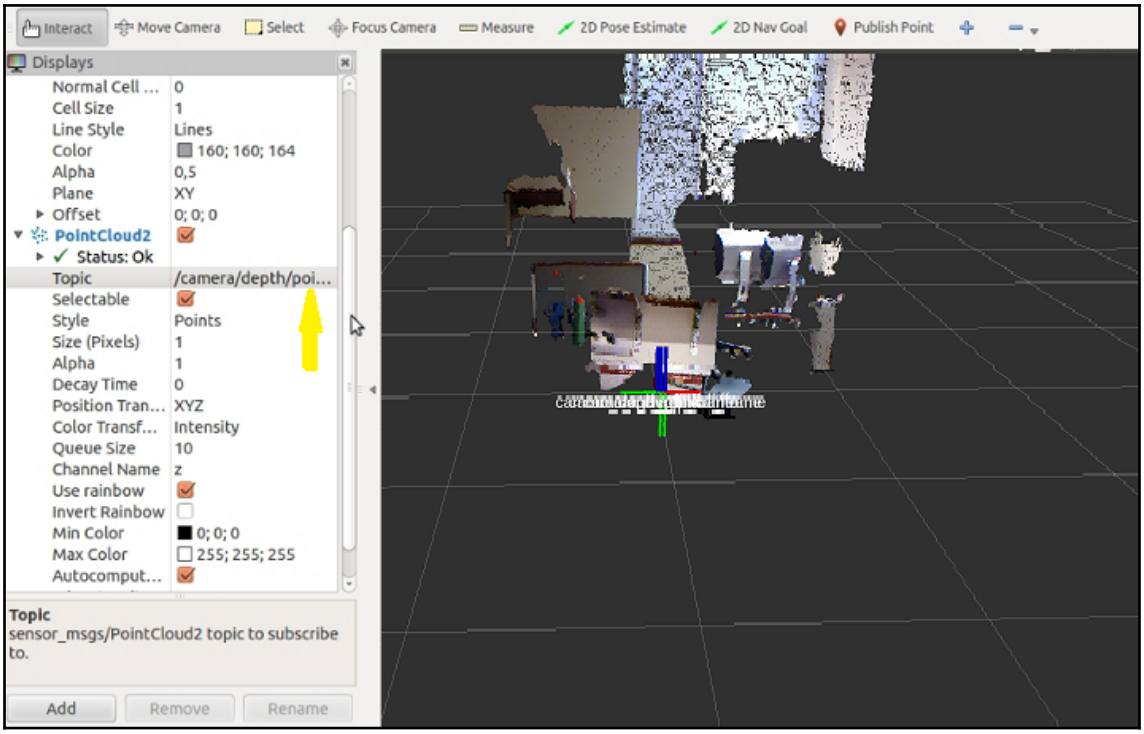


```
/diagnostics
/hokuyo_node/parameter_descriptions
/hokuyo_node/parameter_updates
/rosout
/rosout_agg
/scan
```




```
...
/camera/rgb/image_color
/camera/rgb/image_mono
/camera/rgb/image_raw
/camera/rgb/image_rect
/camera/rgb/image_rect_color
...
```






```
by-id event0 event2 event4 event6 event8 js0 mouse0
by-path event1 event3 event5 event7 event9 mice
```

```
Axes: 0: 0 1: 0 2: 0 Buttons: 0:off 1:off 2:off 3:off 4:off 5:off 6:off 7:off
8:off 9:off 10:off
```

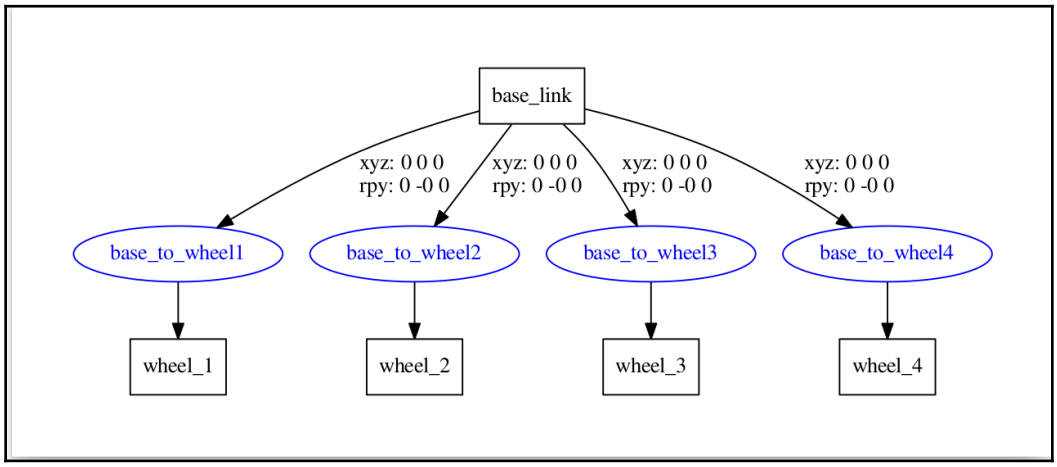
```
[ INFO] [1357571588.441808789]: Opened joystick: /dev/input/js0. deadzone_: 0.
050000.
```

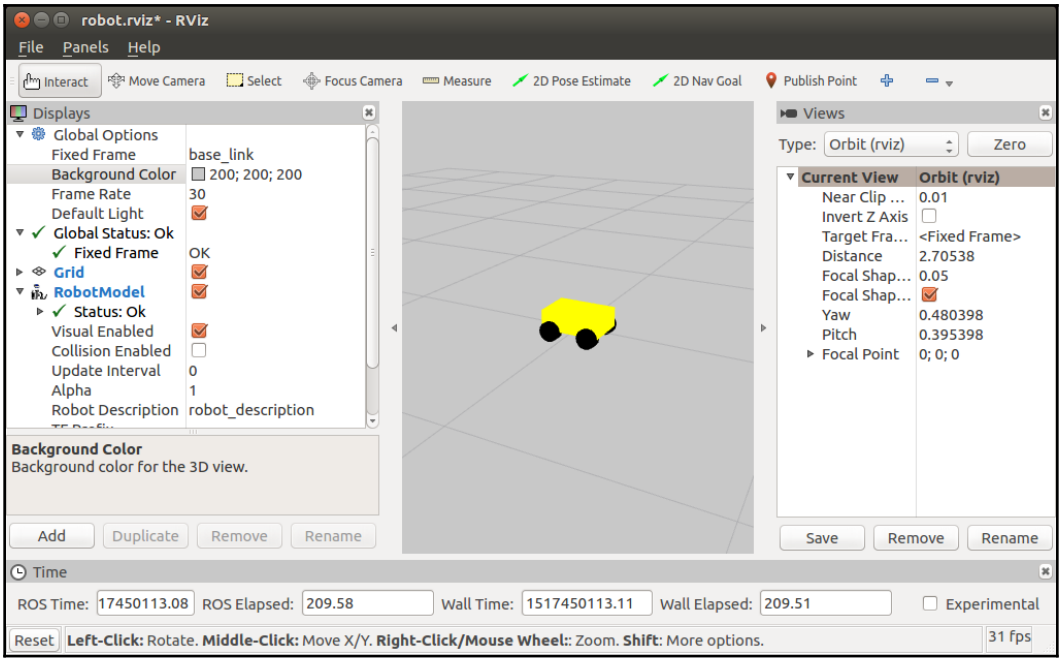
joy topic output

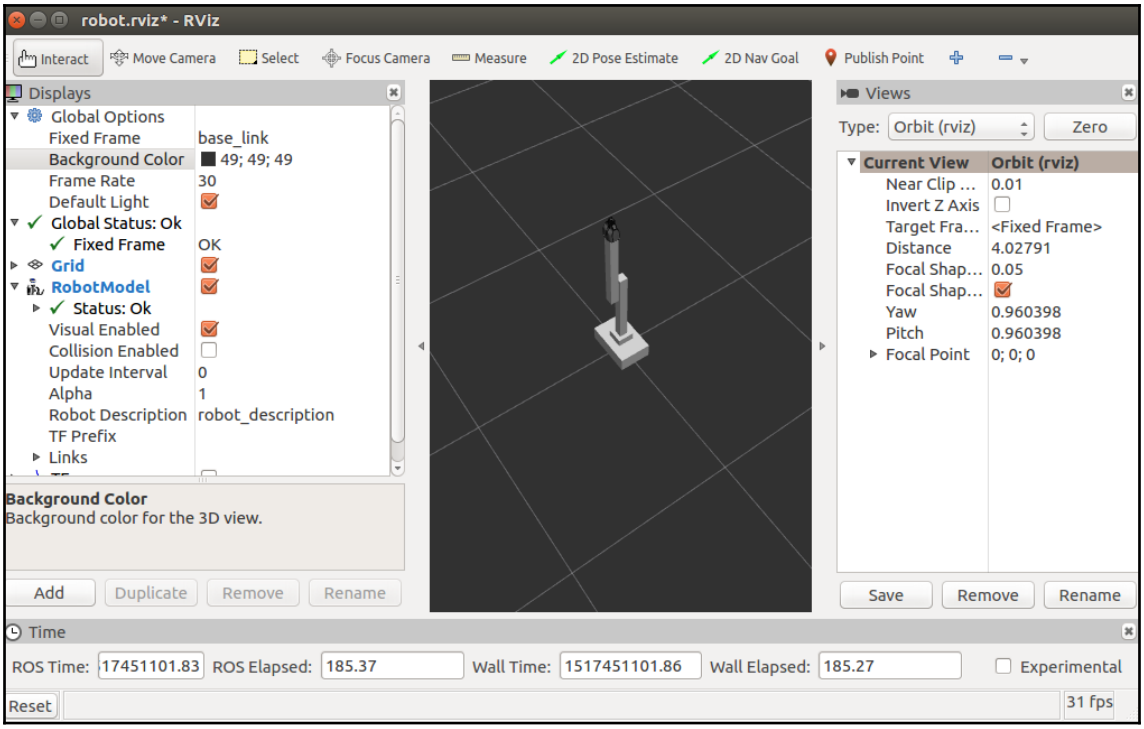
```
---
header:
  seq: 429
  stamp:
    secs: 1415227355
    nsecs: 833352850
  frame_id: ''
axes: [0.19235174357891083, -0.0, 1.0, -0.04268254339694977, -0.048208002001047134, 1.0
buttons: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
---
```

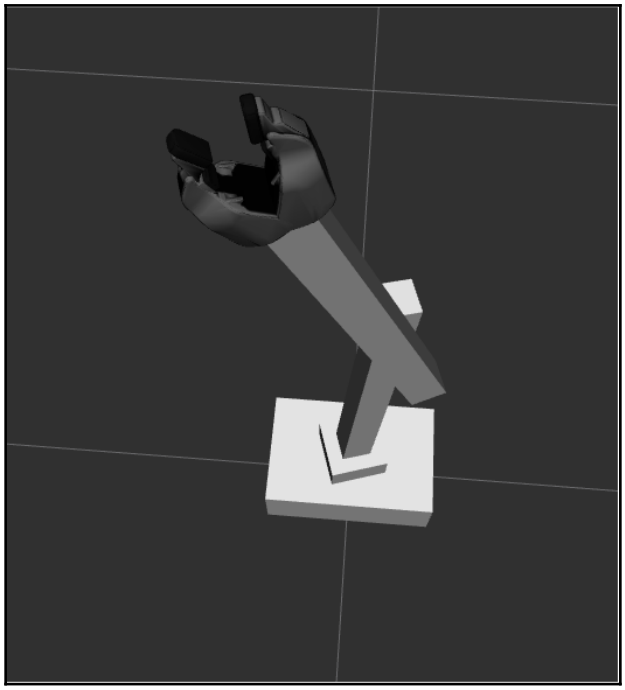
Chapter 6: ROS Modeling and Simulation

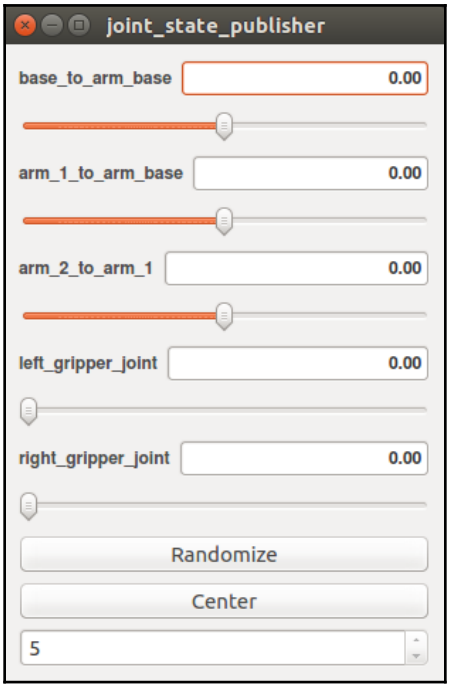
```
kumar@kumar-Inspiron-5437:~/catkin_ws-01/src/chapter6_tutorials/robot_description/urdf$ check_urdf mobile_robot.urdf
robot name is: mobile robot
---------- Successfully Parsed XML ---------------
root Link: base_link has 4 child(ren)
    child(1):  wheel_1
    child(2):  wheel_2
    child(3):  wheel_3
    child(4):  wheel_4
```

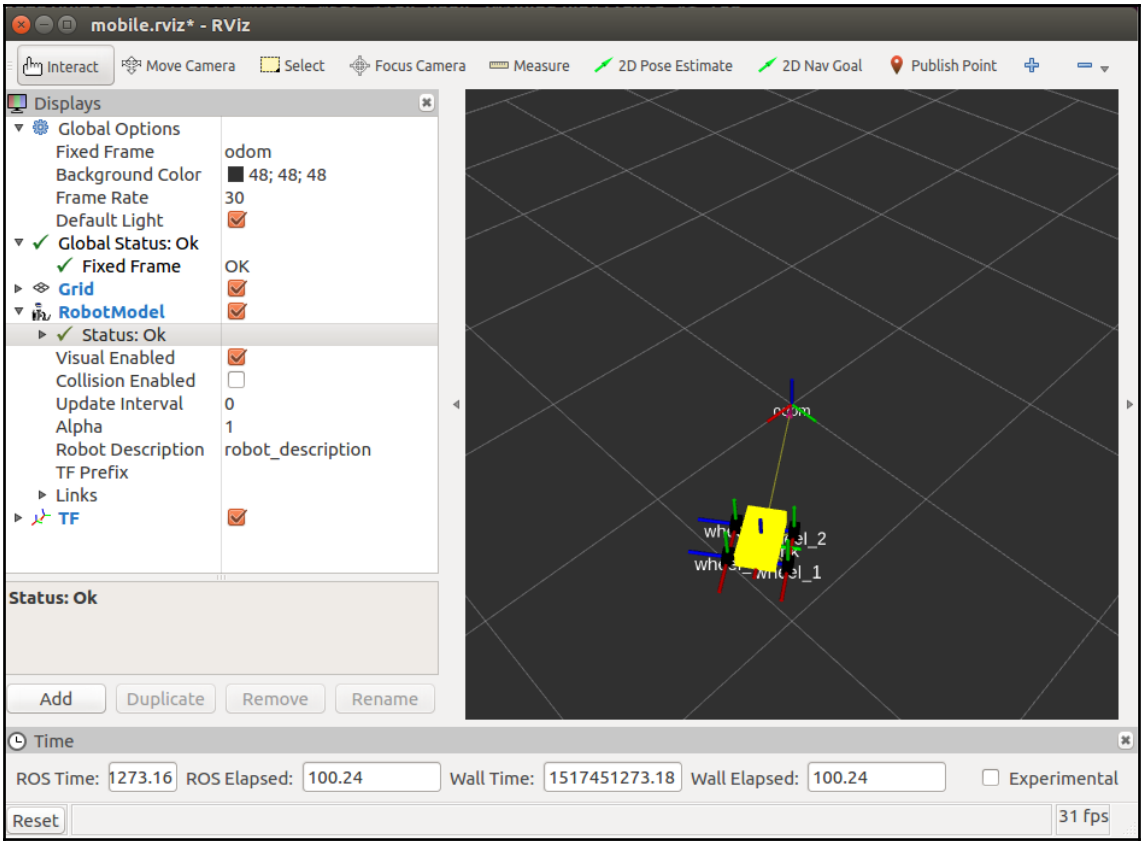


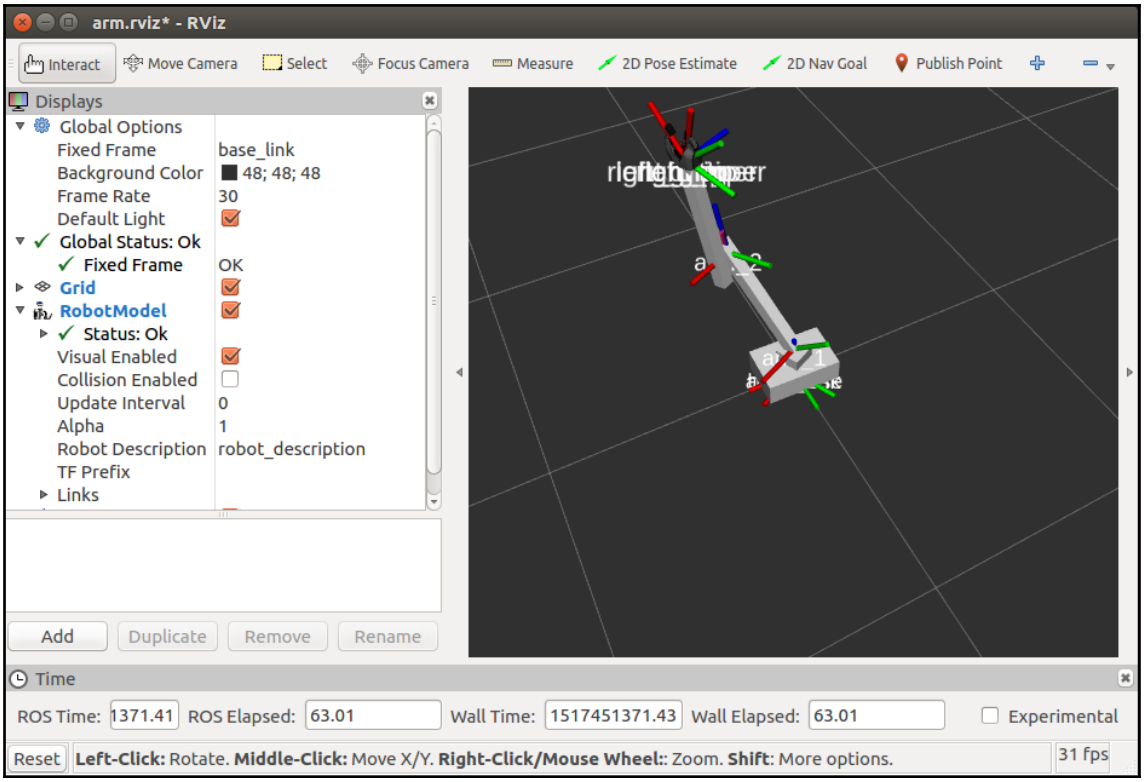

robot.rviz* - RViz
File Panels Help
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame base_link
Background Color 200; 200; 200
Frame Rate 30
Default Light
Global Status: Ok
Fixed Frame OK
Grid
RobotModel
Status: Ok
Visual Enabled
Collision Enabled
Update Interval 0
Alpha 1
Robot Description robot_description
Background Color
Background color for the 3D view.
Add Duplicate Remove Rename
Views
Type: Orbit (rviz)
Zero
Current View Orbit (rviz)
Near Clip ... 0.01
Invert Z Axis
Target Fra... <Fixed Frame>
Distance 2.70538
Focal Shap... 0.05
Focal Shap...
Yaw 0.480398
Pitch 0.395398
Focal Point 0; 0; 0
Save Remove Rename
Time
ROS Time: 17450113.08 ROS Elapsed: 209.58 Wall Time: 1517450113.11 Wall Elapsed: 209.51
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

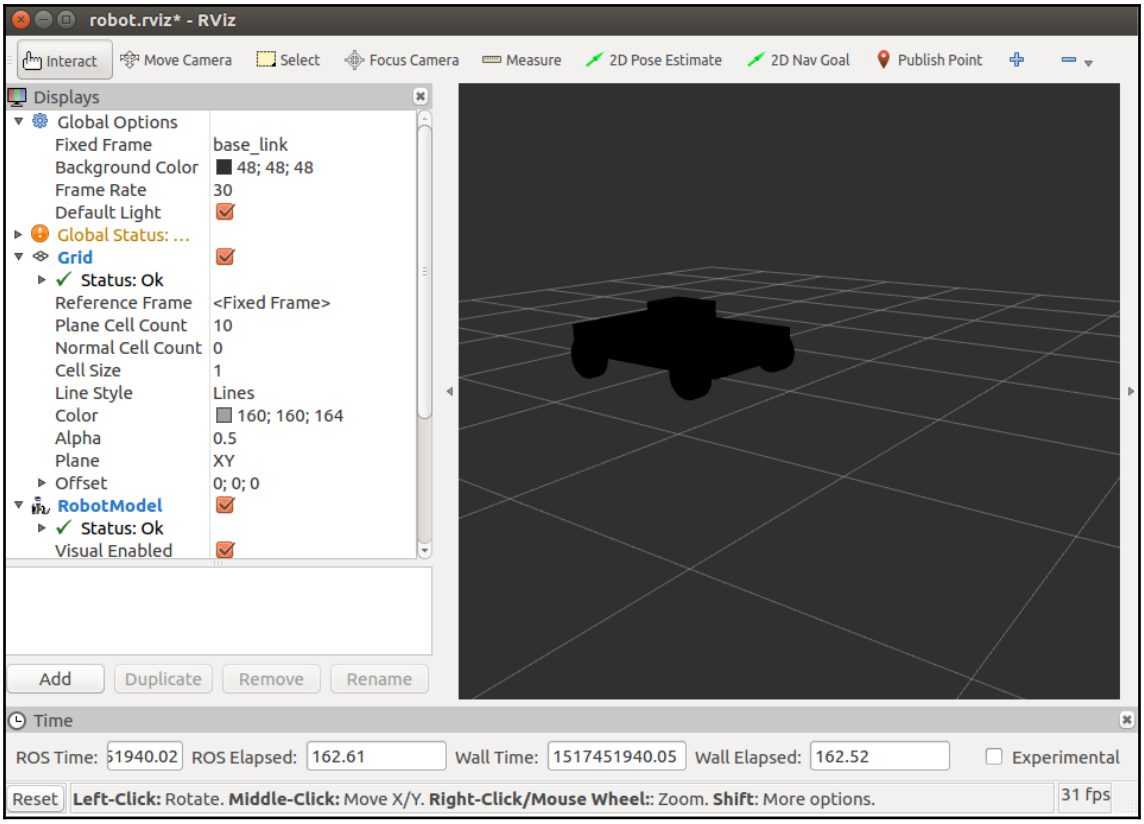

robot.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
base_link
Background Color
49; 49; 49
Frame Rate
30
Default Light
Global Status: Ok
Fixed Frame
OK
Grid
RobotModel
Status: Ok
Visual Enabled
Collision Enabled
Update Interval
0
Alpha
1
Robot Description
robot_description
TF Prefix
Links
Background Color
Background color for the 3D view.
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip ...
0.01
Invert Z Axis
Target Fra...
<Fixed Frame>
Distance
4.02791
Focal Shap...
0.05
Focal Shap...
Yaw
0.960398
Pitch
0.960398
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
17451101.83
ROS Elapsed:
185.37
Wall Time:
1517451101.86
Wall Elapsed:
185.27
Experimental
Reset
31 fps

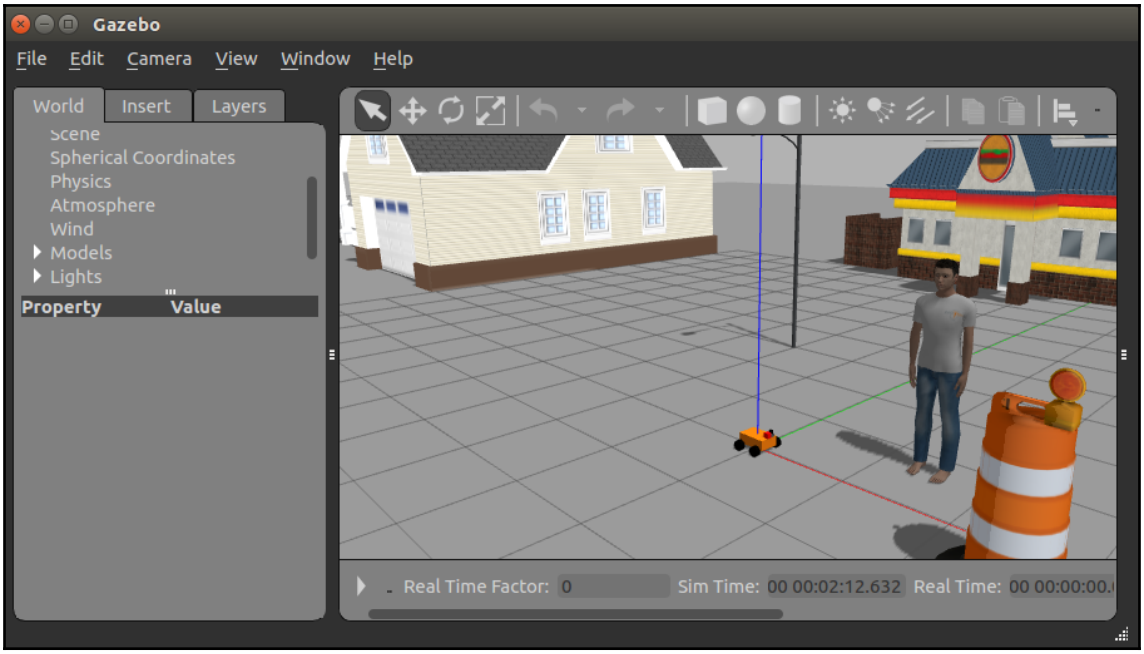


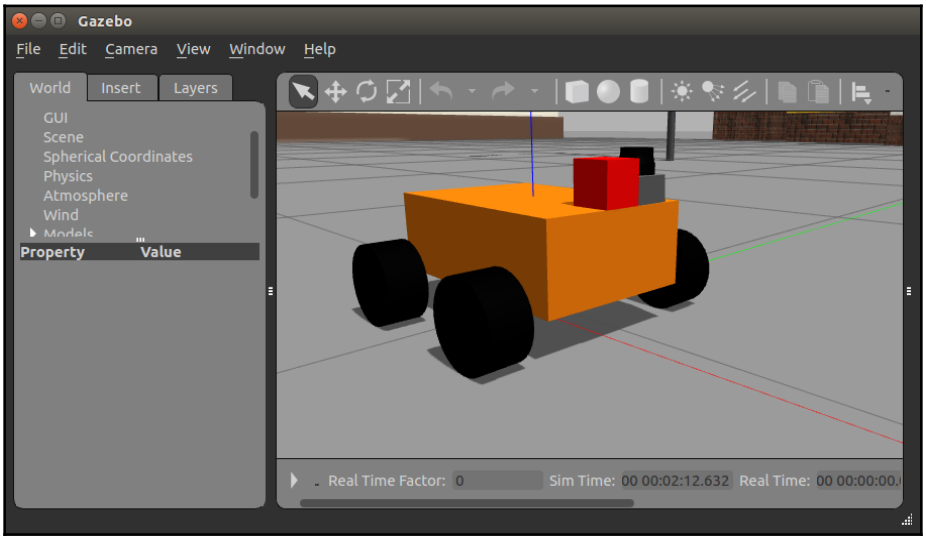

joint_state_publisher
base_to_arm_base
0.00
arm_1_to_arm_base
0.00
arm_2_to_arm_1
0.00
left_gripper_joint
0.00
right_gripper_joint
0.00
Randomize
Center
5

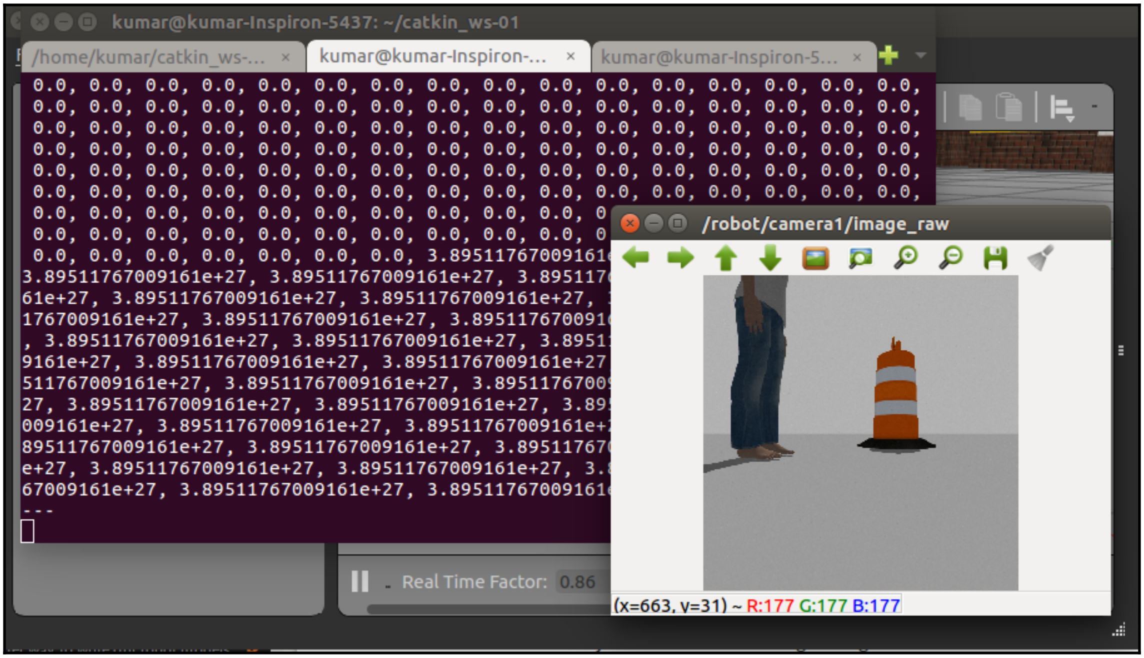

mobile.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
odom
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: Ok
Fixed Frame
OK
Grid
RobotModel
Status: Ok
Visual Enabled
Collision Enabled
Update Interval
0
Alpha
1
Robot Description
robot_description
TF Prefix
Links
TF
Status: Ok
Add
Duplicate
Remove
Rename
Time
ROS Time:
1273.16
ROS Elapsed:
100.24
Wall Time:
1517451273.18
Wall Elapsed:
100.24
Experimental
Reset
31 fps

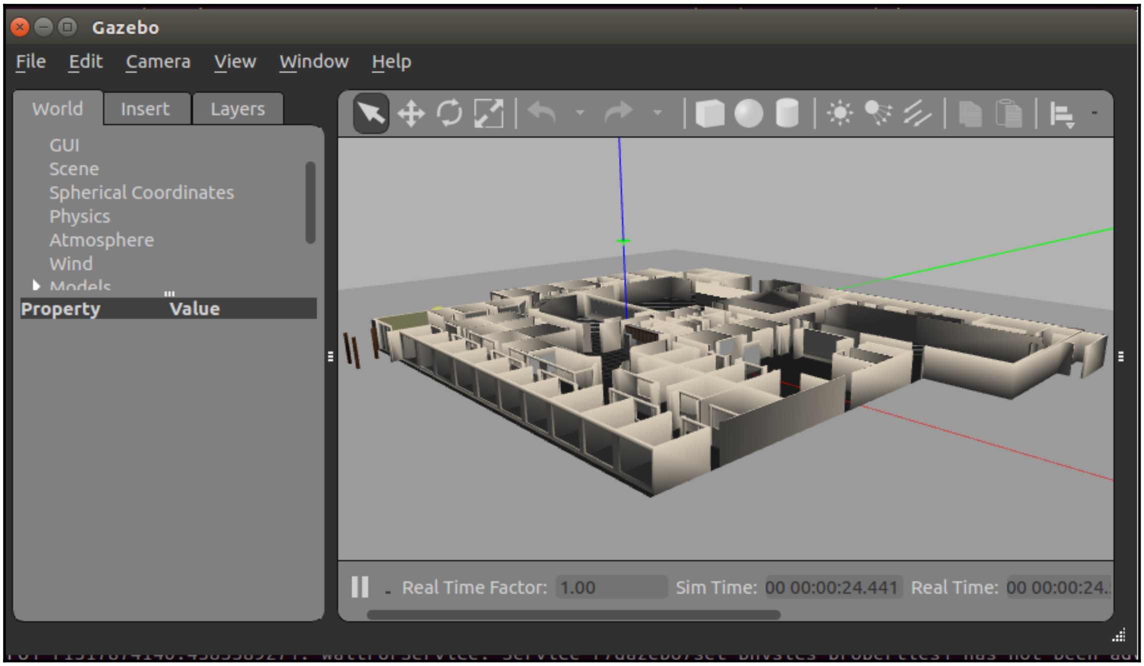

arm.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
base_link
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: Ok
Fixed Frame
OK
Grid
RobotModel
Status: Ok
Visual Enabled
Collision Enabled
Update Interval
0
Alpha
1
Robot Description
robot_description
TF Prefix
Links
Add
Duplicate
Remove
Rename
Time
ROS Time:
1371.41
ROS Elapsed:
63.01
Wall Time:
1517451371.43
Wall Elapsed:
63.01
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

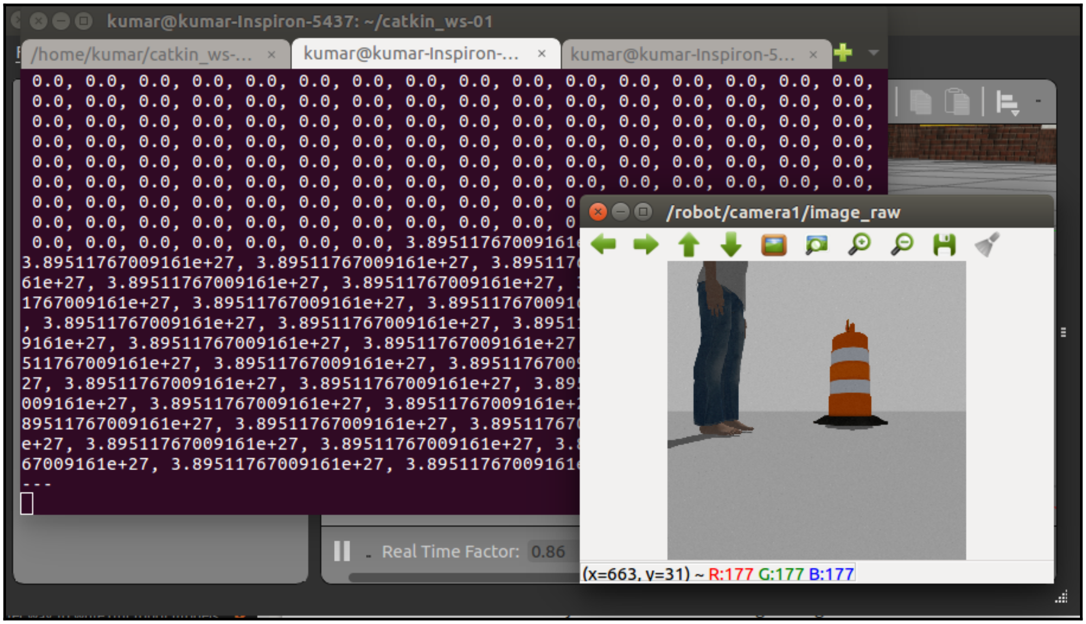

robot.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
base_link
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: ...
Grid
Status: Ok
Reference Frame
<Fixed Frame>
Plane Cell Count
10
Normal Cell Count
0
Cell Size
1
Line Style
Lines
Color
160; 160; 164
Alpha
0.5
Plane
XY
Offset
0; 0; 0
RobotModel
Status: Ok
Visual Enabled
Add
Duplicate
Remove
Rename
Time
ROS Time:
51940.02
ROS Elapsed:
162.61
Wall Time:
1517451940.05
Wall Elapsed:
162.52
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps


Gazebo
File Edit Camera View Window Help
World Insert Layers
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0
Sim Time: 00 00:02:12.632
Real Time: 00 00:00:00.

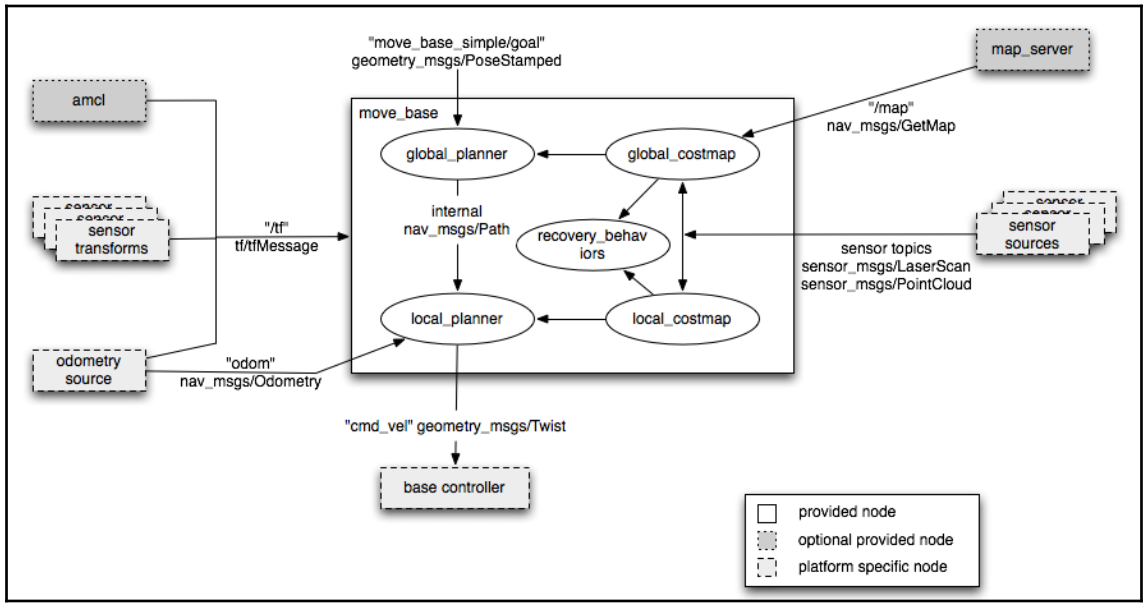

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Property Value
Real Time Factor: 0
Sim Time: 00 00:02:12.632
Real Time: 00 00:00:00.

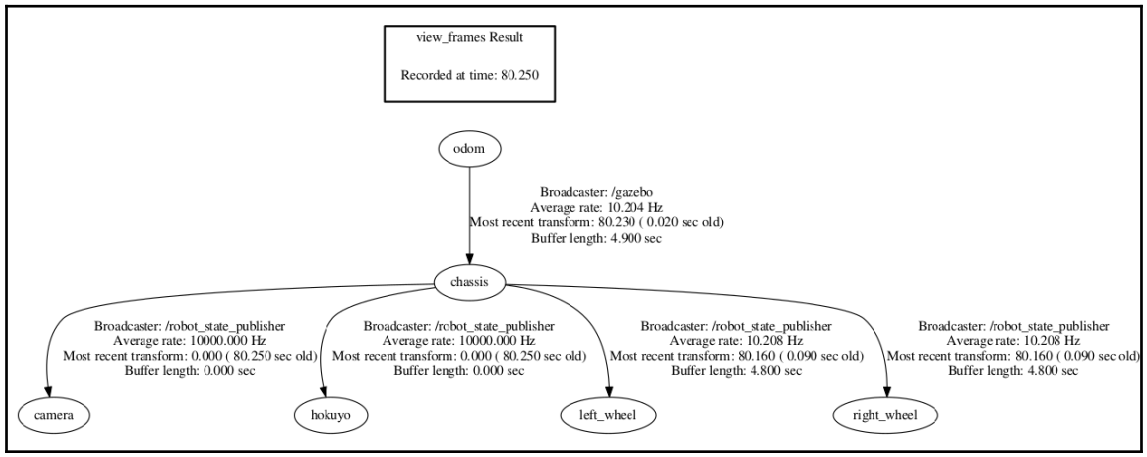

kumar@kumar-Inspiron-5437: ~/catkin_ws-01
/robot/camera1/image_raw
(x=663, y=31) ~ R:177 G:177 B:177
Real Time Factor: 0.86

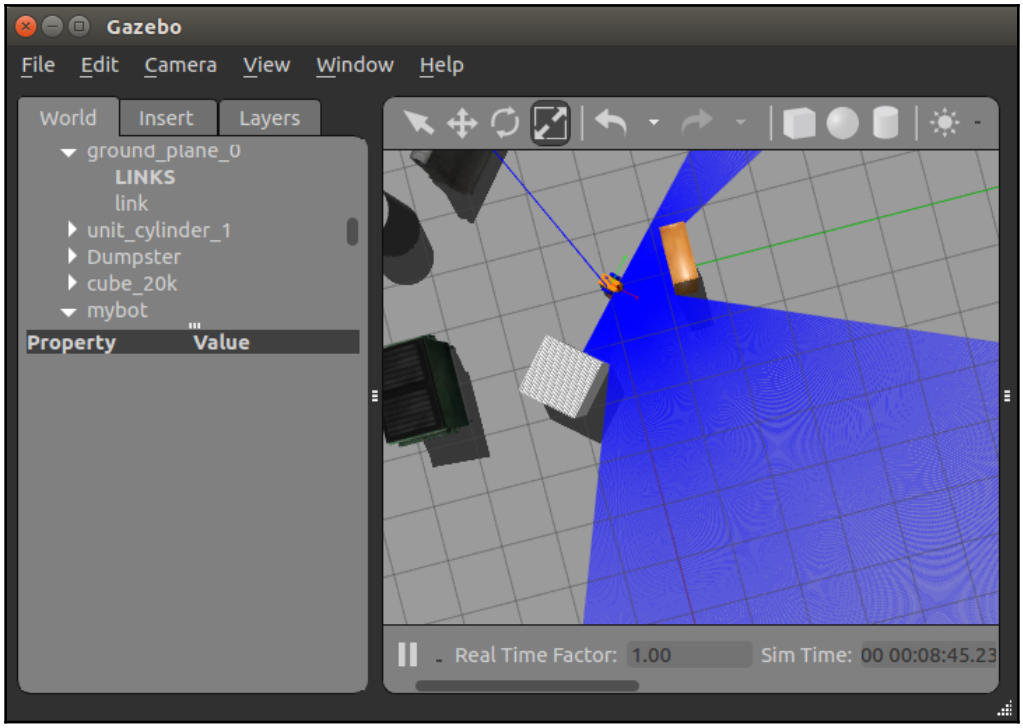

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Property Value
Real Time Factor: 1.00
Sim Time: 00 00:00:24.441
Real Time: 00 00:00:24.

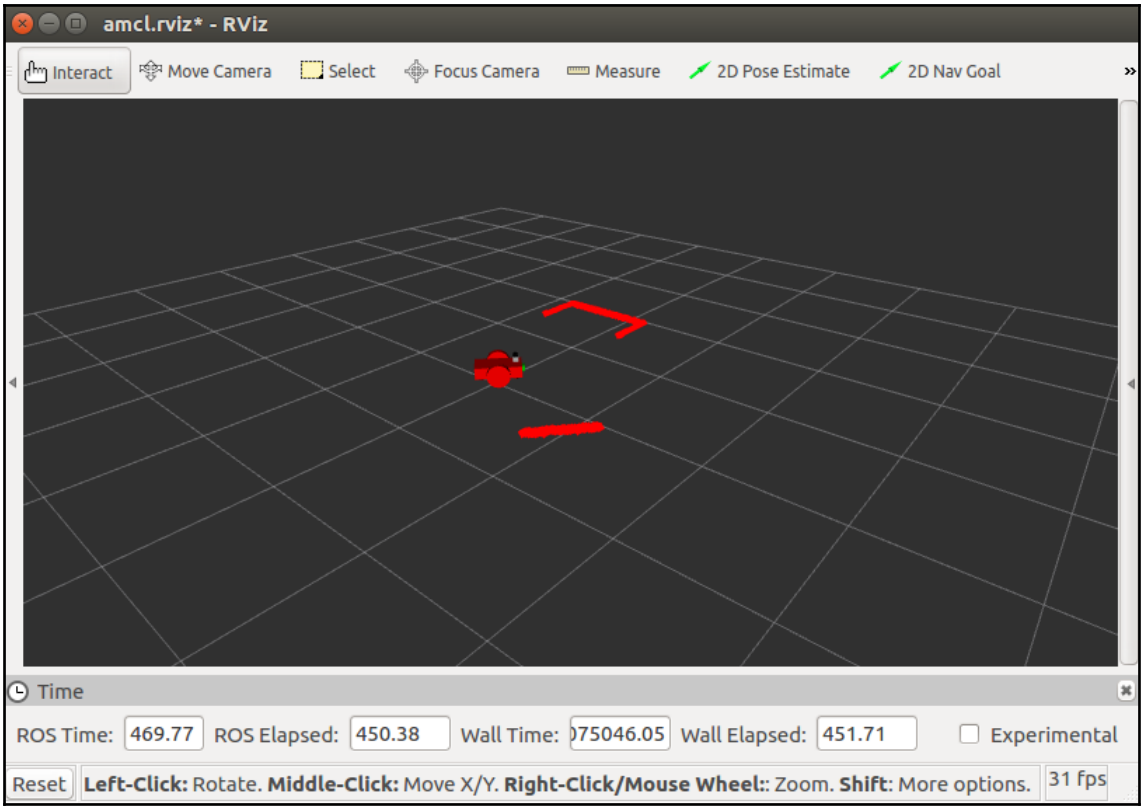

kumar@kumar-Inspiron-5437: ~/catkin_ws-01
/home/kumar/catkin_ws-...
kumar@kumar-Inspiron-...
kumar@kumar-Inspiron-5...
/robot/camera1/image_raw
Real Time Factor: 0.86
(x=663, y=31) ~ R:177 G:177 B:177

Chapter 7: Mobile Robot in ROS

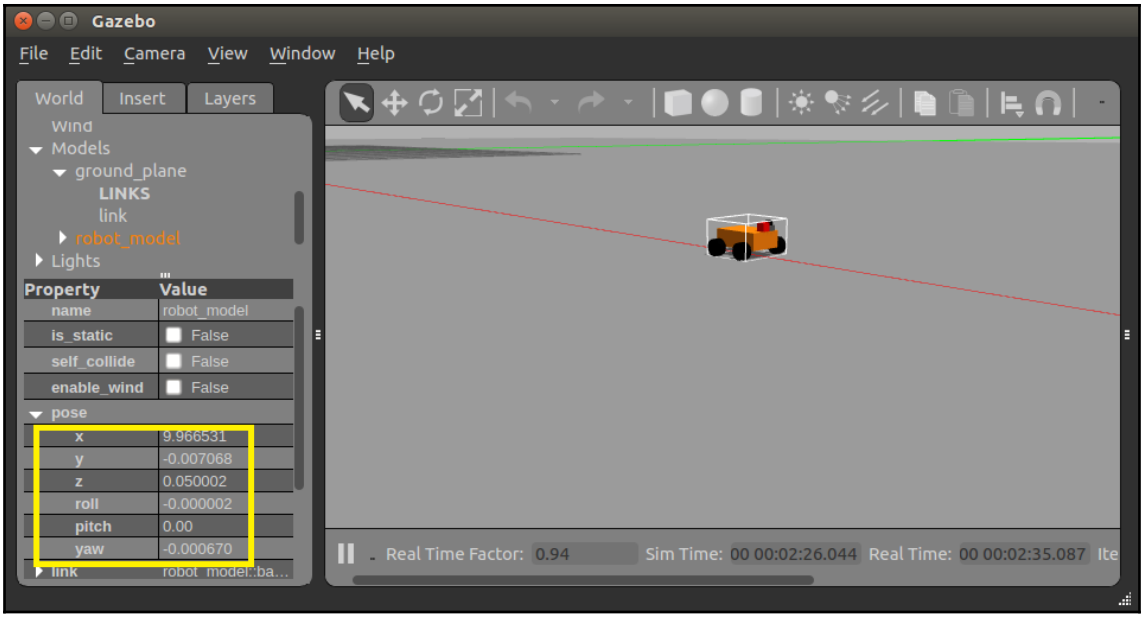





Gazebo
File
Edit
Camera
View
Window
Help
World
Insert
Layers
ground_plane_0
LINKS
link
unit_cylinder_1
Dumpster
cube_20k
mybot
Property
Value
Real Time Factor:
1.00
Sim Time:
00 00:08:45.23

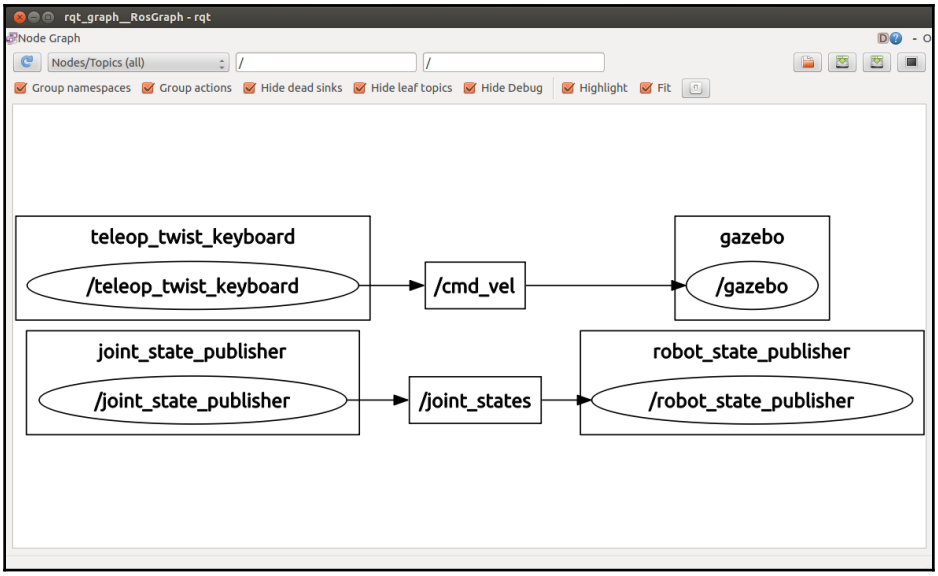

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Time
ROS Time: 469.77
ROS Elapsed: 450.38
Wall Time: 075046.05
Wall Elapsed: 451.71
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

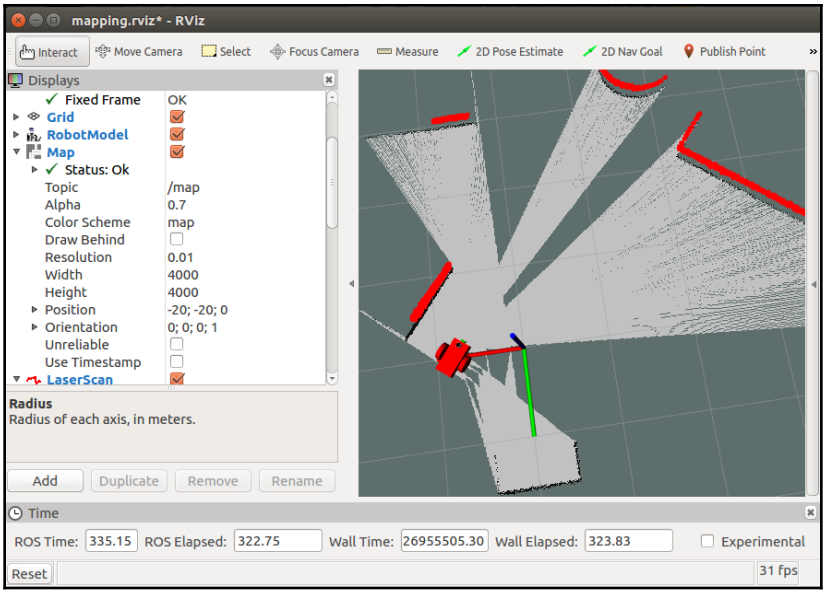
```
std_msgs/Header header
  uint32 seq
  time stamp
  string frame_id
string child_frame_id
geometry_msgs/PoseWithCovariance pose
  geometry_msgs/Pose pose
    geometry_msgs/Point position
      float64 x
      float64 y
      float64 z
    geometry_msgs/Quaternion orientation
      float64 x
      float64 y
      float64 z
      float64 w
  float64[36] covariance
geometry_msgs/TwistWithCovariance twist
  geometry_msgs/Twist twist
    geometry_msgs/Vector3 linear
      float64 x
      float64 y
      float64 z
    geometry_msgs/Vector3 angular
      float64 x
      float64 y
      float64 z
  float64[36] covariance
```



```
position:
  x: 8.48172093136
  y: -0.0100300547219
  z: 0.0
orientation:
  x: -6.76648258058e-07
  y: -2.21915350959e-06
  z: -0.000596712629633
  w: 0.999999821964
---
position:
  x: 8.48672095069
  y: -0.0100359458754
  z: 0.0
orientation:
  x: -2.0040114215e-06
  y: 3.17518798786e-06
  z: -0.00059677150774
  w: 0.999999821925
---
```

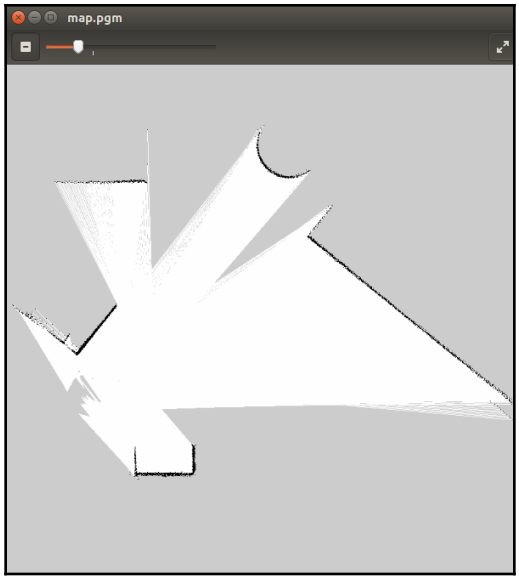
```
geometry_msgs/Vector3 linear
  float64 x
  float64 y
  float64 z
geometry_msgs/Vector3 angular
  float64 x
  float64 y
  float64 z
```

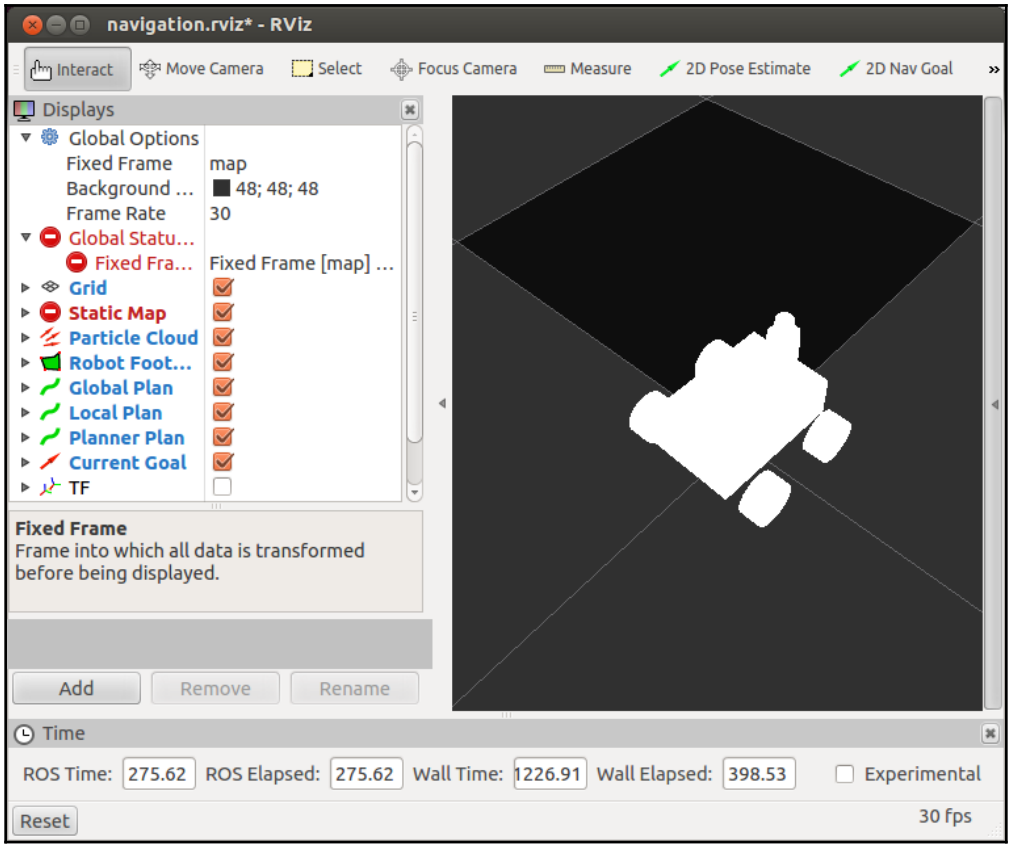

rqt_graph__RosGraph - rqt
Node Graph
Nodes/Topics (all)
/
/
Group namespaces
Group actions
Hide dead sinks
Hide leaf topics
Hide Debug
Highlight
Fit
teleop_twist_keyboard
/teleop_twist_keyboard
/cmd_vel
gazebo
/gazebo
joint_state_publisher
/joint_state_publisher
/joint_states
robot_state_publisher
/robot_state_publisher

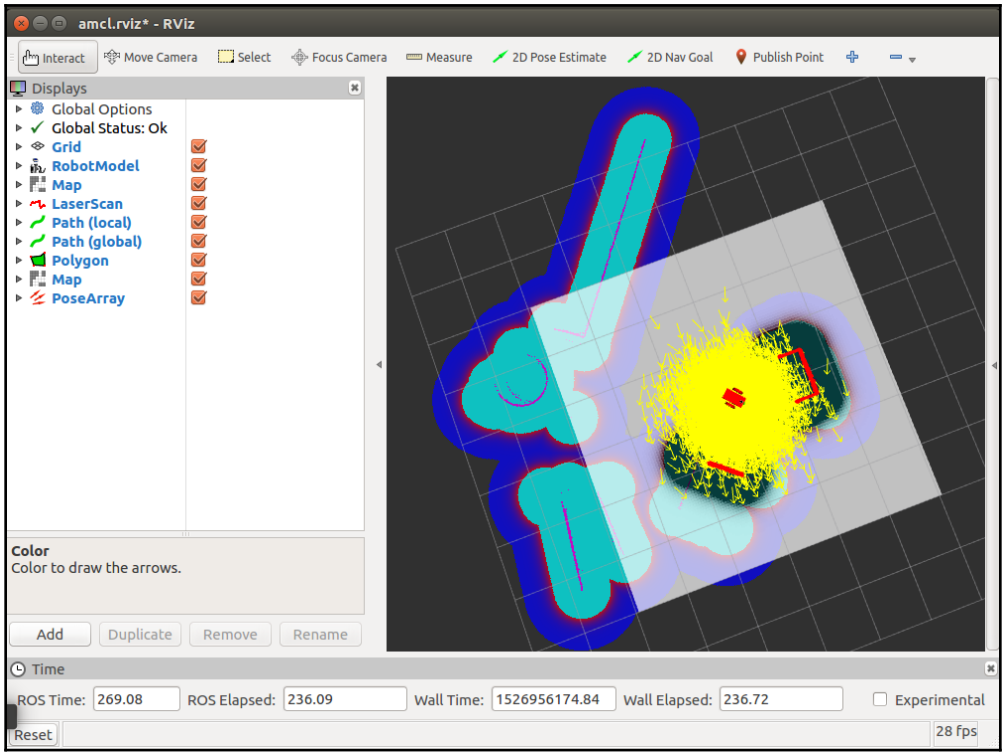

mapping.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Fixed Frame
OK
Grid
RobotModel
Map
Status: Ok
Topic
/map
Alpha
0.7
Color Scheme
map
Draw Behind
Resolution
0.01
Width
4000
Height
4000
Position
-20; -20; 0
Orientation
0; 0; 0; 1
Unreliable
Use Timestamp
LaserScan
Radius
Radius of each axis, in meters.
Add
Duplicate
Remove
Rename
Time
ROS Time:
335.15
ROS Elapsed:
322.75
Wall Time:
26955505.30
Wall Elapsed:
323.83
Experimental
Reset
31 fps

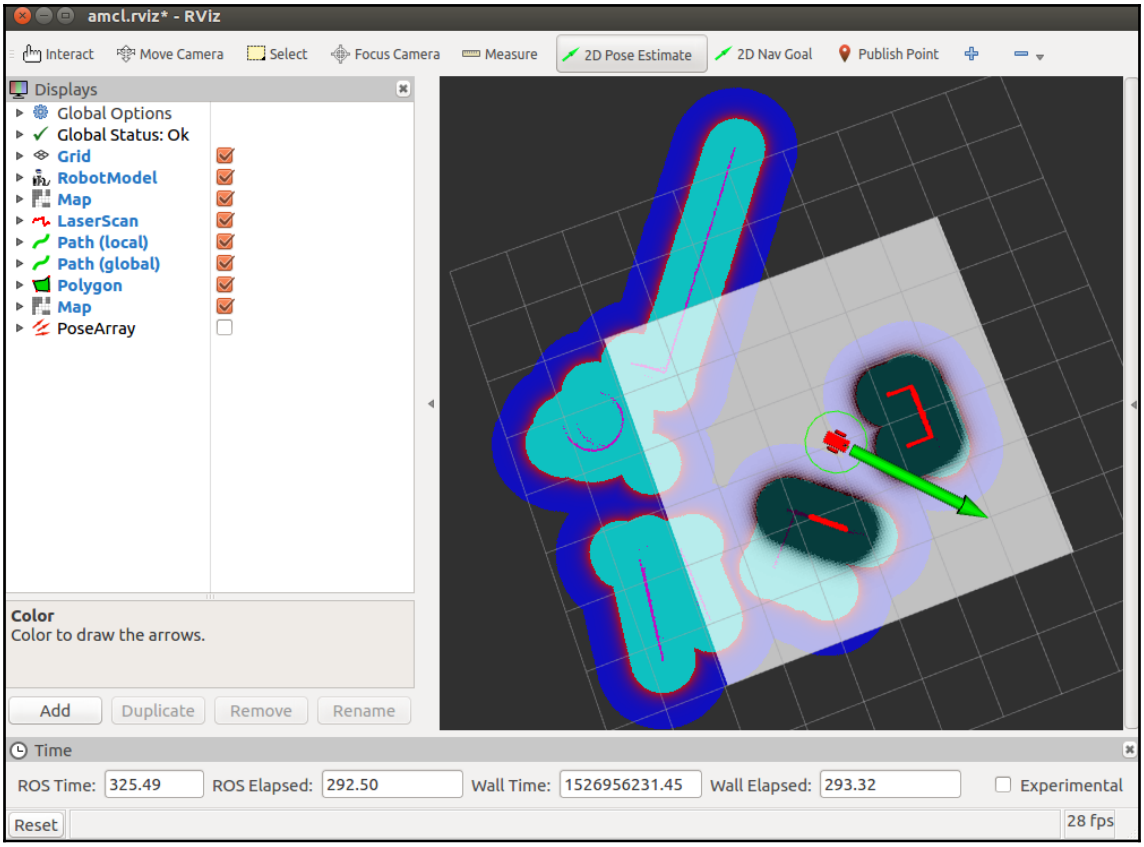
Open

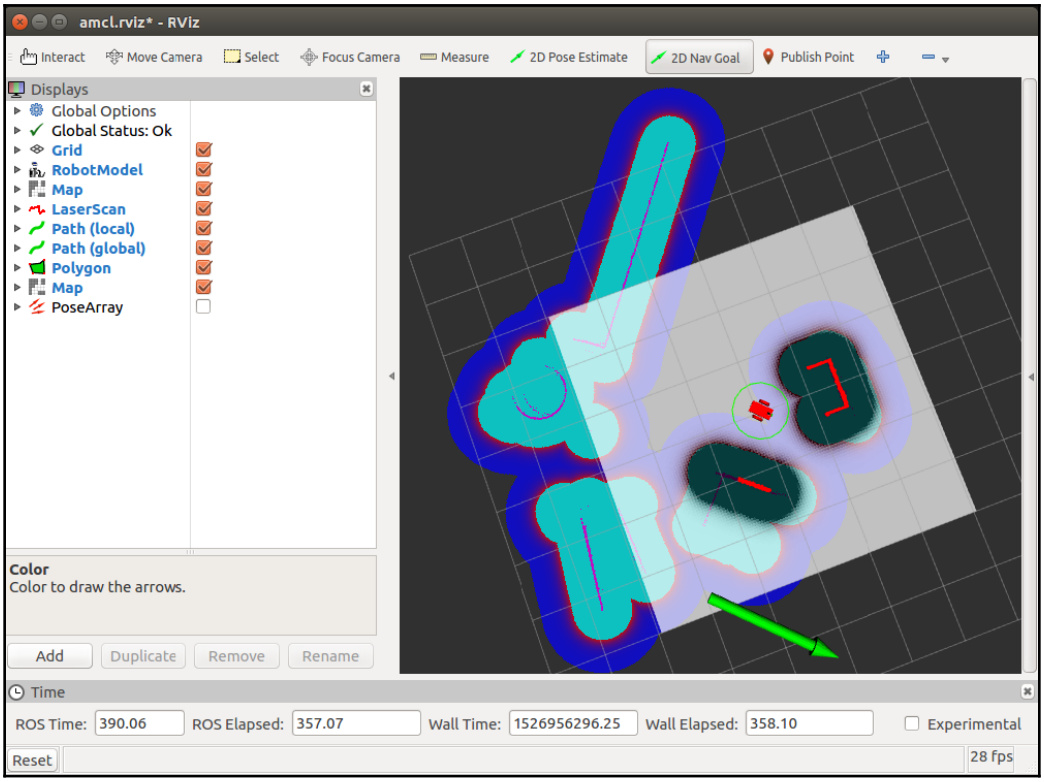
```
image: map.pgm
resolution: 0.050000
origin: [-100.000000, -100.000000, 0.000000]
negate: 0
occupied_thresh: 0.65
free_thresh: 0.196

```

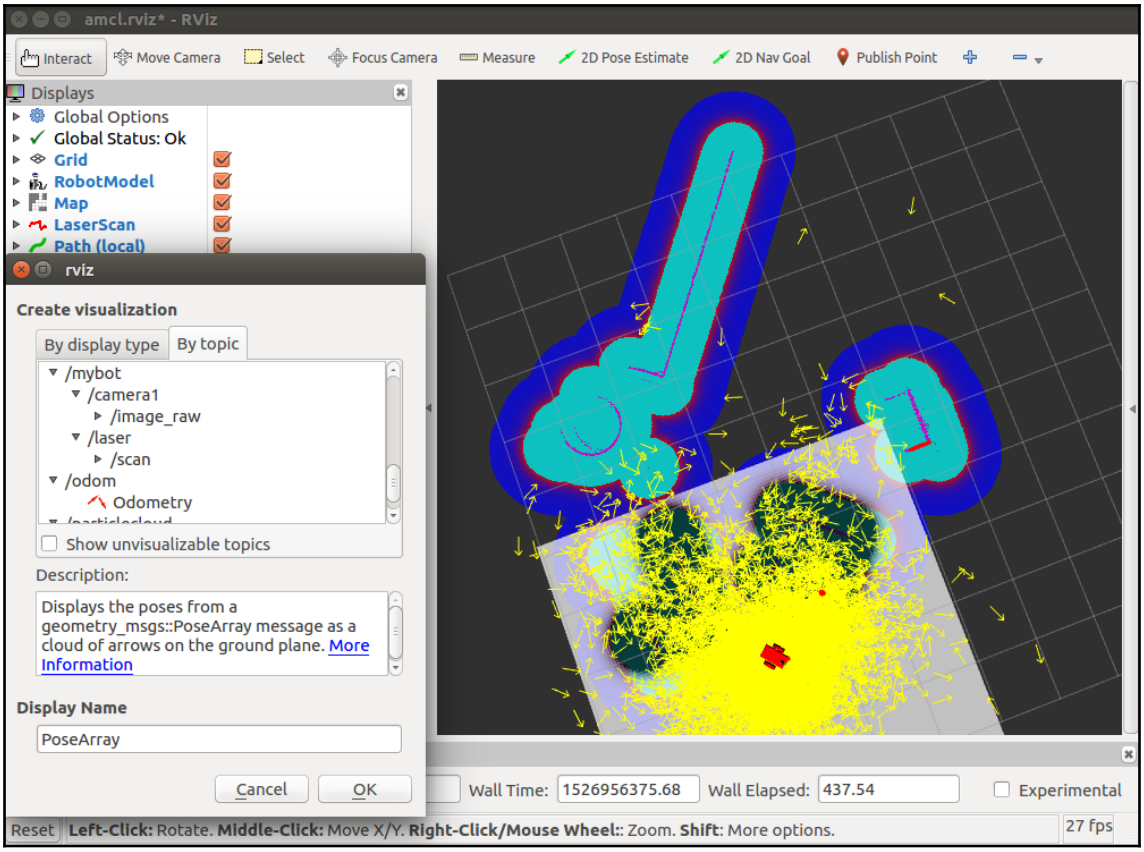


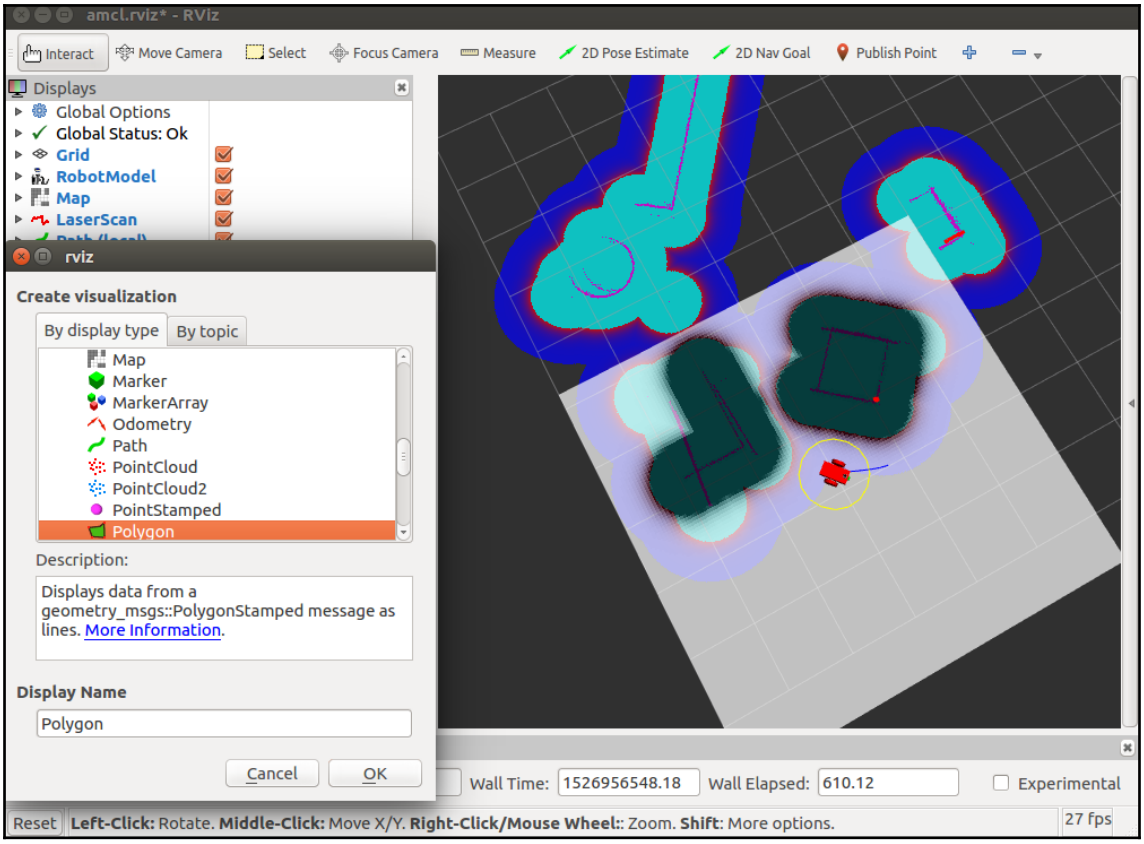

navigation.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Displays
Global Options
Fixed Frame
map
Background ...
48; 48; 48
Frame Rate
30
Global Statu...
Fixed Fra...
Fixed Frame [map] ...
Grid
Static Map
Particle Cloud
Robot Foot...
Global Plan
Local Plan
Planner Plan
Current Goal
TF
Fixed Frame
Frame into which all data is transformed before being displayed.
Add
Remove
Rename
Time
ROS Time:
275.62
ROS Elapsed:
275.62
Wall Time:
1226.91
Wall Elapsed:
398.53
Experimental
Reset
30 fps

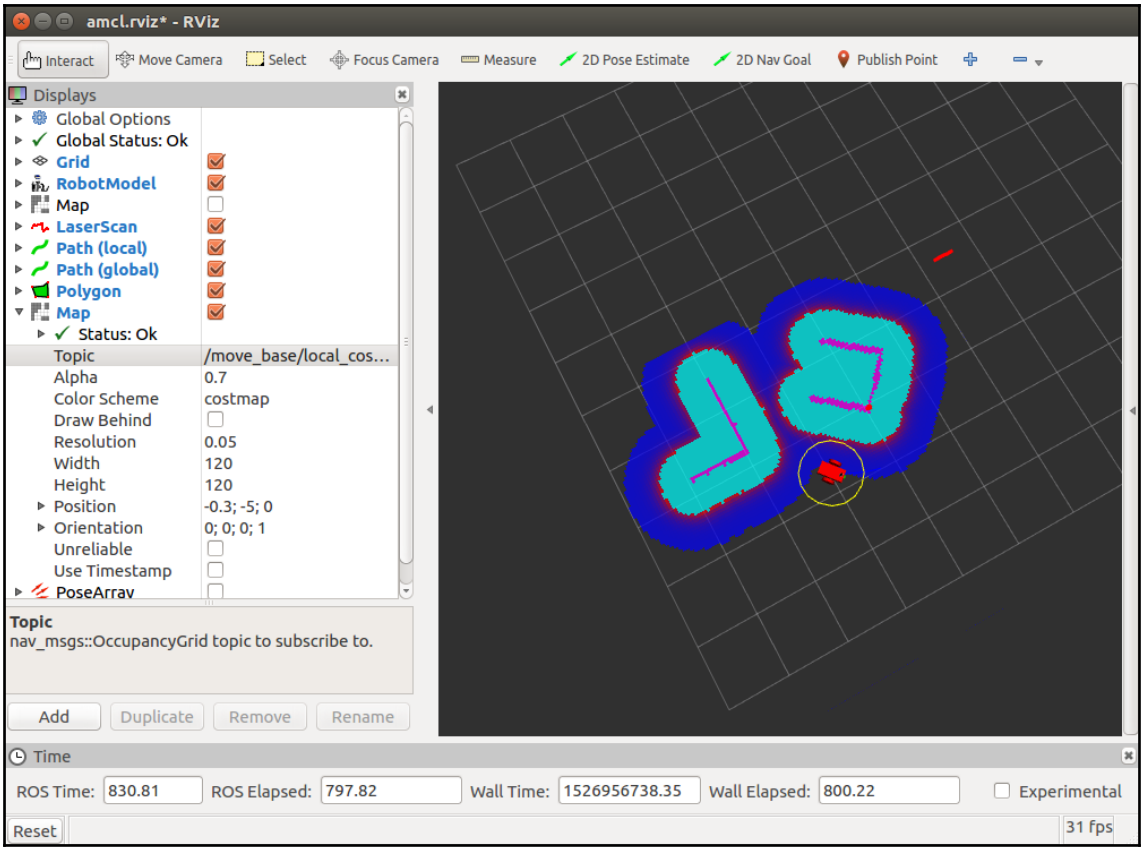

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Color
Color to draw the arrows.
Add
Duplicate
Remove
Rename
Time
ROS Time: 269.08
ROS Elapsed: 236.09
Wall Time: 1526956174.84
Wall Elapsed: 236.72
Experimental
Reset
28 fps

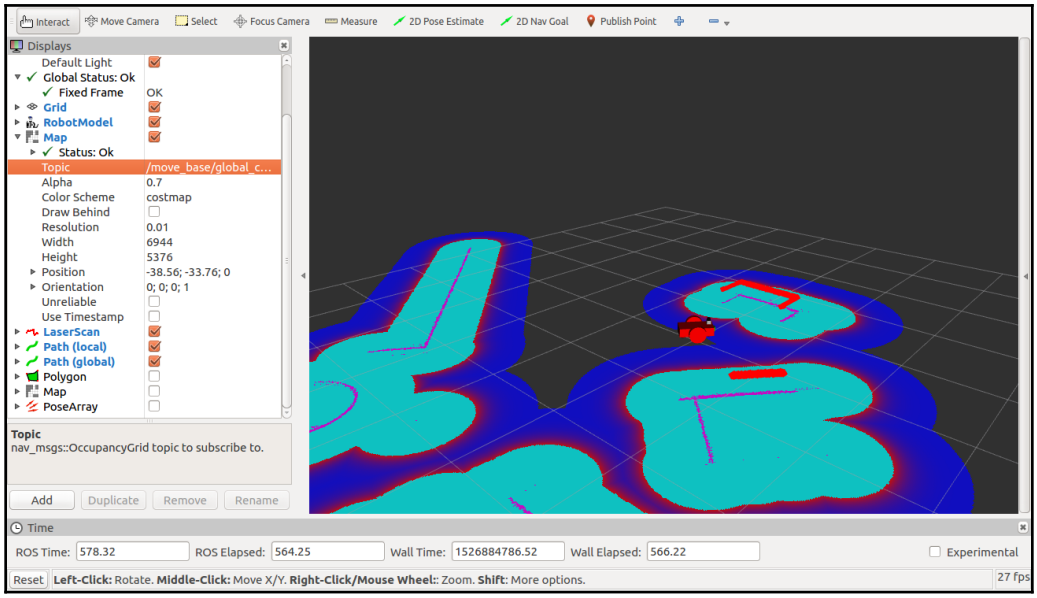

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Color
Color to draw the arrows.
Add
Duplicate
Remove
Rename
Time
ROS Time: 325.49
ROS Elapsed: 292.50
Wall Time: 1526956231.45
Wall Elapsed: 293.32
Experimental
Reset
28 fps

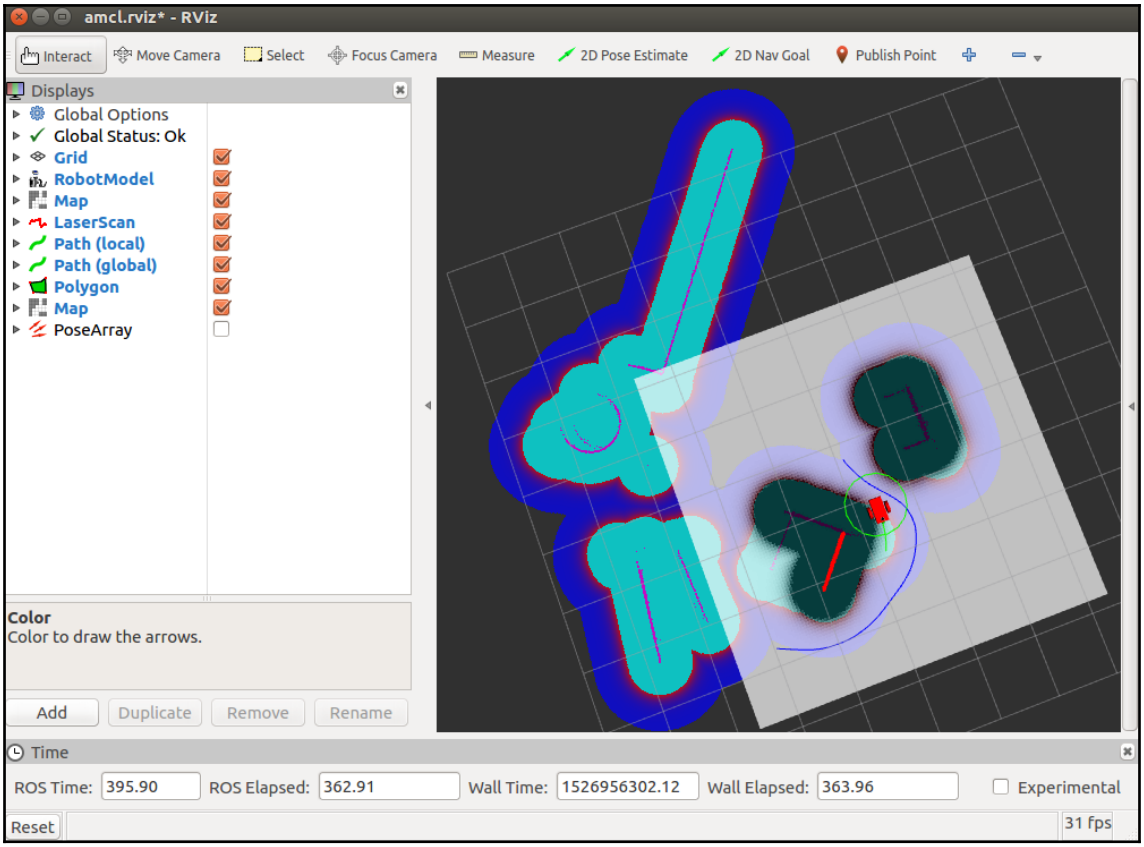

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Color
Color to draw the arrows.
Add
Duplicate
Remove
Rename
Time
ROS Time: 390.06
ROS Elapsed: 357.07
Wall Time: 1526956296.25
Wall Elapsed: 358.10
Experimental
Reset
28 fps

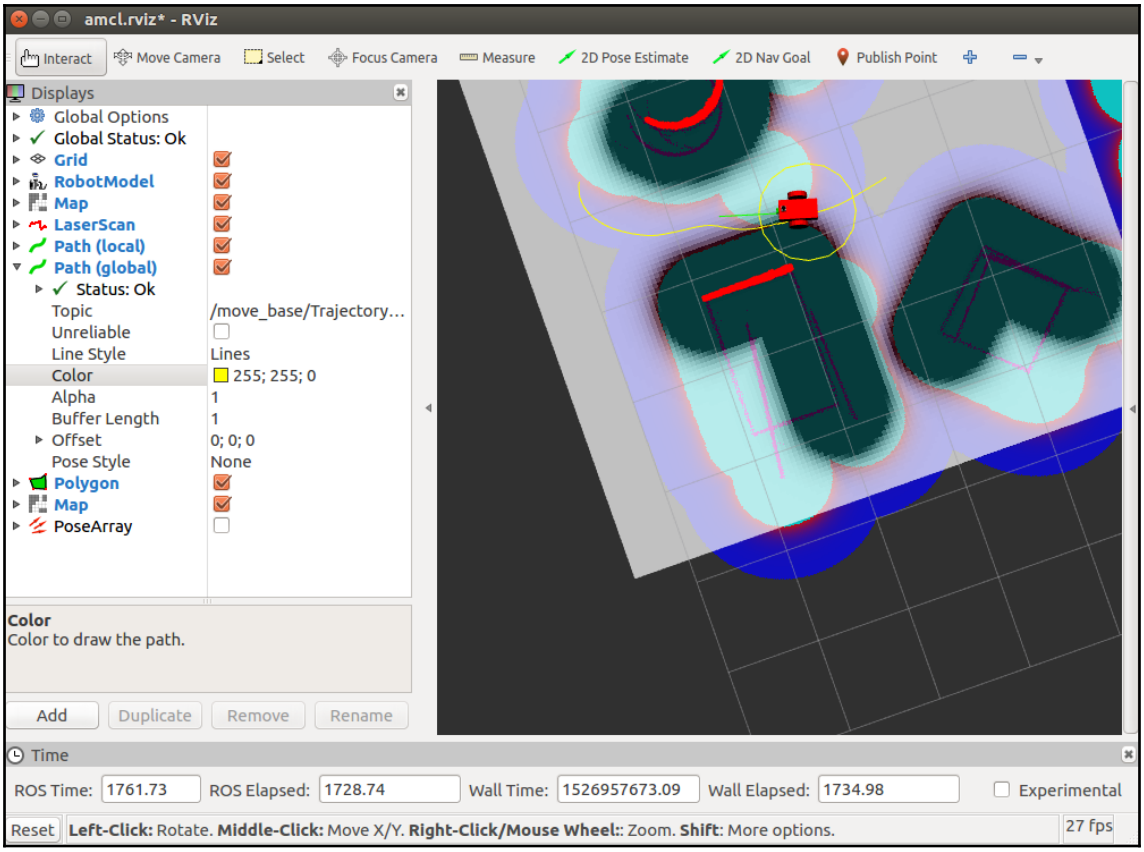

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
rviz
Create visualization
By display type
By topic
/mybot
/camera1
/image_raw
/laser
/scan
/odom
Odometry
Show unvisualizable topics
Description:
Displays the poses from a geometry_msgs::PoseArray message as a cloud of arrows on the ground plane. More Information
Display Name
PoseArray
Cancel
OK
Wall Time: 1526956375.68
Wall Elapsed: 437.54
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
27 fps

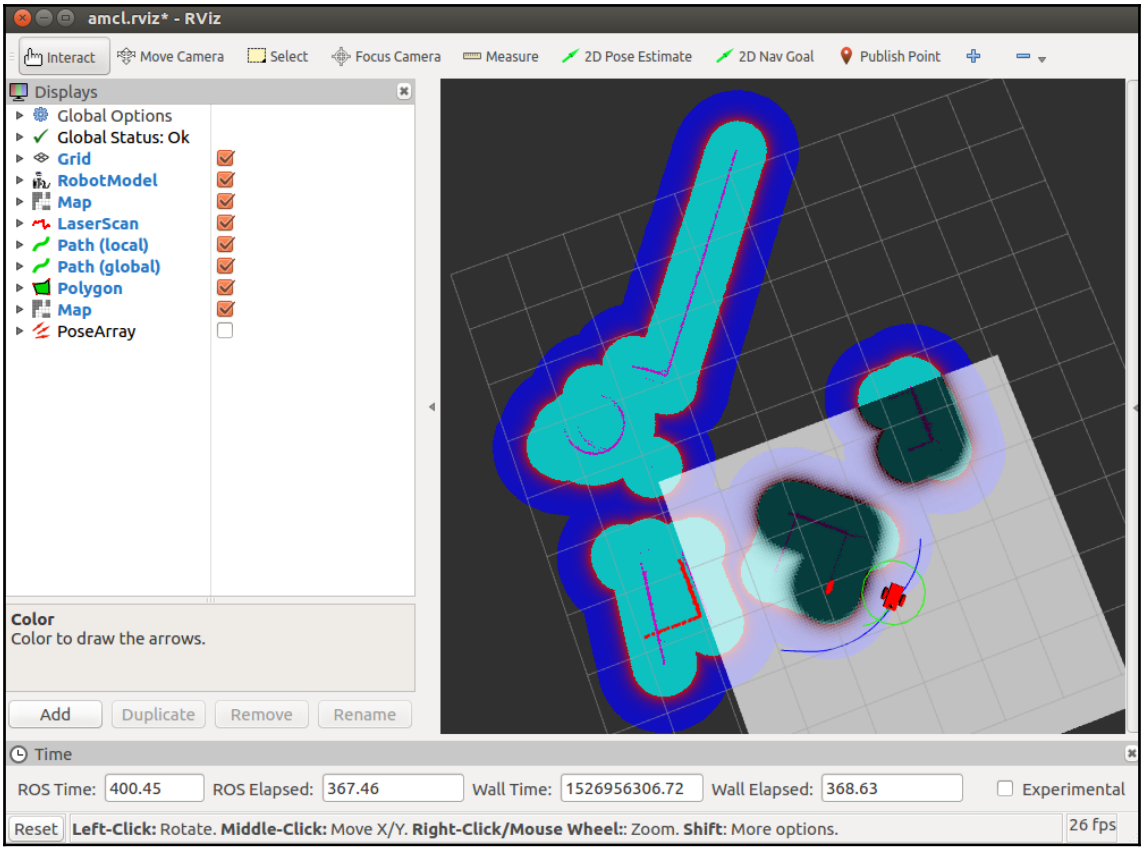

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
rviz
Create visualization
By display type
By topic
Map
Marker
MarkerArray
Odometry
Path
PointCloud
PointCloud2
PointStamped
Polygon
Description:
Displays data from a geometry_msgs::PolygonStamped message as lines. More information.
Display Name
Polygon
Cancel
OK
Wall Time: 1526956548.18
Wall Elapsed: 610.12
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
27 fps

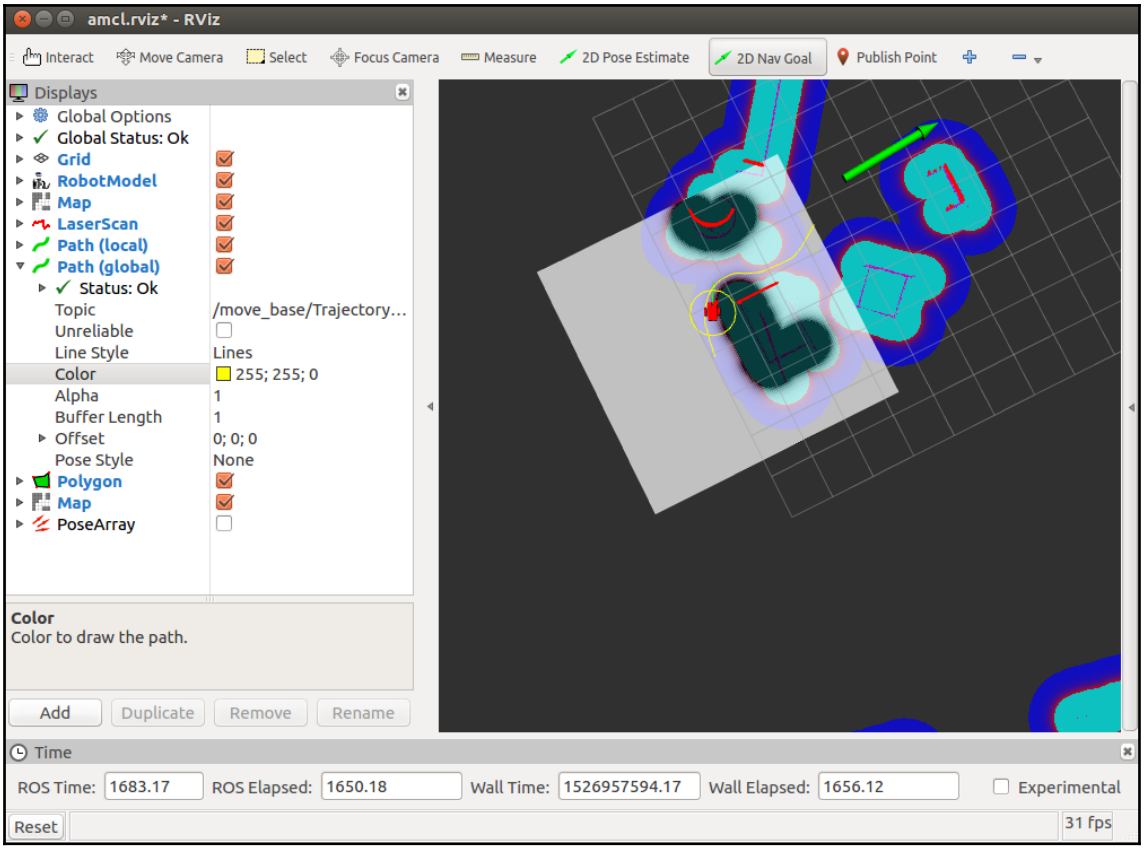

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
Status: Ok
Topic
/move_base/local_cos...
Alpha
0.7
Color Scheme
costmap
Draw Behind
Resolution
0.05
Width
120
Height
120
Position
-0.3; -5; 0
Orientation
0; 0; 0; 1
Unreliable
Use Timestamp
PoseArray
Topic
nav_msgs::OccupancyGrid topic to subscribe to.
Add
Duplicate
Remove
Rename
Time
ROS Time:
830.81
ROS Elapsed:
797.82
Wall Time:
1526956738.35
Wall Elapsed:
800.22
Experimental
Reset
31 fps

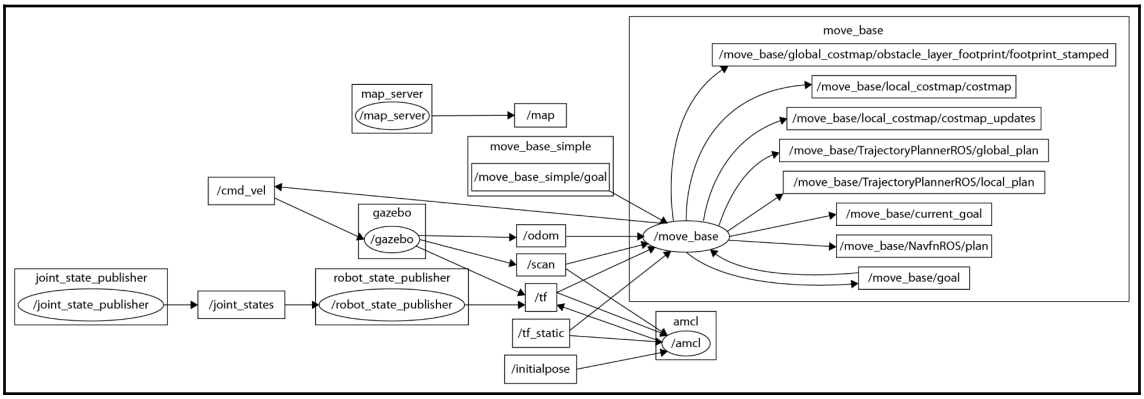

Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Default Light
Global Status: Ok
Fixed Frame
OK
Grid
RobotModel
Map
Status: Ok
Topic
/move_base/global_c...
Alpha
0.7
Color Scheme
costmap
Draw Behind
Resolution
0.01
Width
6944
Height
5376
Position
-38.56; -33.76; 0
Orientation
0; 0; 0; 1
Unreliable
Use Timestamp
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Topic
nav_msgs::OccupancyGrid topic to subscribe to.
Add
Duplicate
Remove
Rename
Time
ROS Time:
578.32
ROS Elapsed:
564.25
Wall Time:
1526884786.52
Wall Elapsed:
566.22
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
27 fps

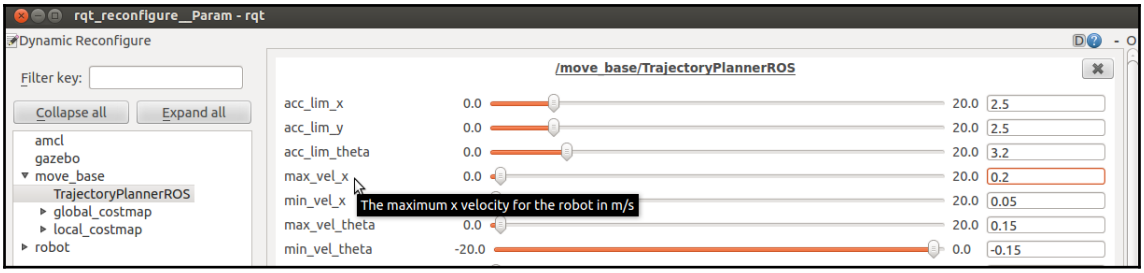

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Color
Color to draw the arrows.
Add
Duplicate
Remove
Rename
Time
ROS Time: 395.90
ROS Elapsed: 362.91
Wall Time: 1526956302.12
Wall Elapsed: 363.96
Experimental
Reset
31 fps

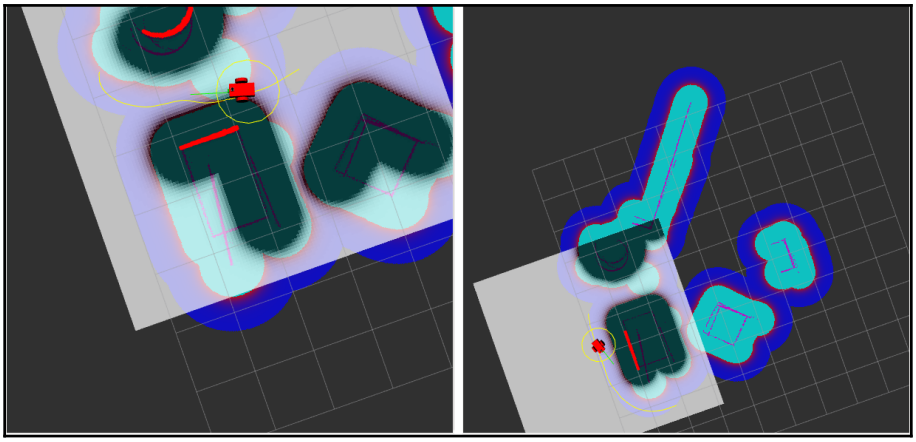

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Status: Ok
Topic
/move_base/Trajectory…
Unreliable
Line Style
Lines
Color
255; 255; 0
Alpha
1
Buffer Length
1
Offset
0; 0; 0
Pose Style
None
Polygon
Map
PoseArray
Color
Color to draw the path.
Add
Duplicate
Remove
Rename
Time
ROS Time:
1761.73
ROS Elapsed:
1728.74
Wall Time:
1526957673.09
Wall Elapsed:
1734.98
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
27 fps

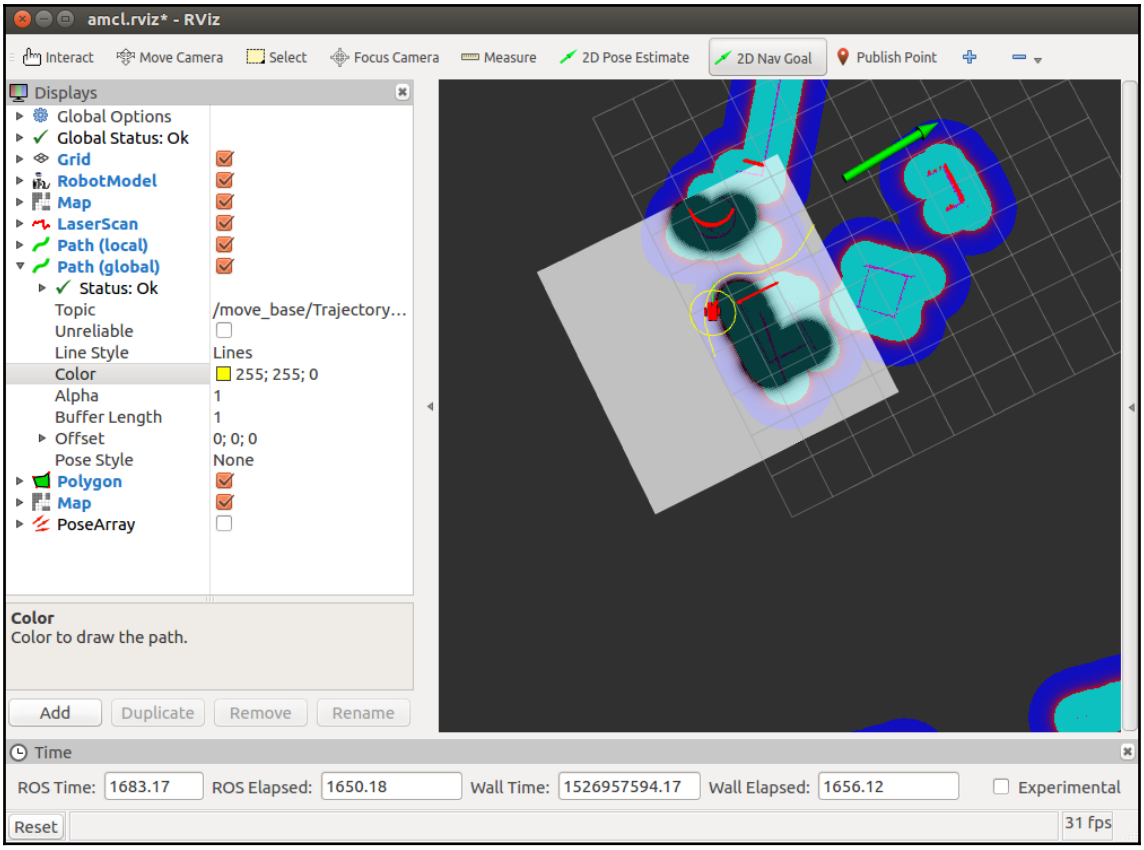

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Polygon
Map
PoseArray
Color
Color to draw the arrows.
Add
Duplicate
Remove
Rename
Time
ROS Time: 400.45
ROS Elapsed: 367.46
Wall Time: 1526956306.72
Wall Elapsed: 368.63
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
26 fps


amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Status: Ok
Topic
/move_base/Trajectory...
Unreliable
Line Style
Lines
Color
255; 255; 0
Alpha
1
Buffer Length
1
Offset
0; 0; 0
Pose Style
None
Polygon
Map
PoseArray
Color
Color to draw the path.
Add
Duplicate
Remove
Rename
Time
ROS Time:
1683.17
ROS Elapsed:
1650.18
Wall Time:
1526957594.17
Wall Elapsed:
1656.12
Experimental
Reset
31 fps

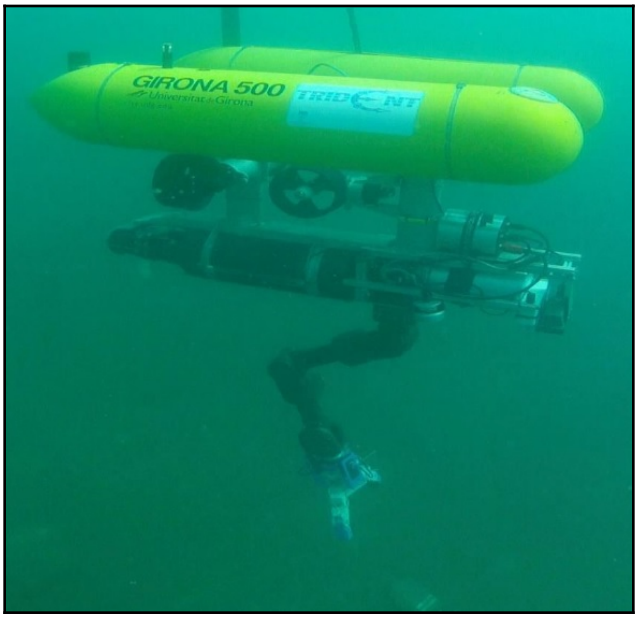

move_base
/move_base/global_costmap/obstacle_layer_footprint/footprint_stamped
/move_base/local_costmap/costmap
/move_base/local_costmap/costmap_updates
/move_base/TrajectoryPlannerROS/global_plan
/move_base/TrajectoryPlannerROS/local_plan
/move_base/current_goal
/move_base/NavfnROS/plan
/move_base/goal
map_server
/map_server
/map
move_base_simple
/move_base_simple/goal
/cmd_vel
gazebo
/gazebo
/odom
/scan
/move_base
joint_state_publisher
/joint_state_publisher
/joint_states
robot_state_publisher
/robot_state_publisher
/tf
/tf_static
amcl
/amcl
/initialpose

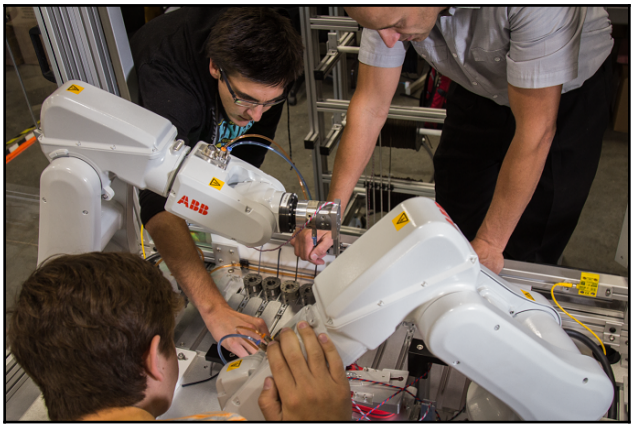

rqt_reconfigure__Param - rqt
Dynamic Reconfigure
Filter key:
Collapse all
Expand all
amcl
gazebo
move_base
TrajectoryPlannerROS
global_costmap
local_costmap
robot
/move_base/TrajectoryPlannerROS
acc_lim_x 0.0 20.0 2.5
acc_lim_y 0.0 20.0 2.5
acc_lim_theta 0.0 20.0 3.2
max_vel_x 0.0 20.0 0.2
min_vel_x 0.0 20.0 0.05
max_vel_theta 0.0 20.0 0.15
min_vel_theta -20.0 0.0 -0.15
The maximum x velocity for the robot in m/s



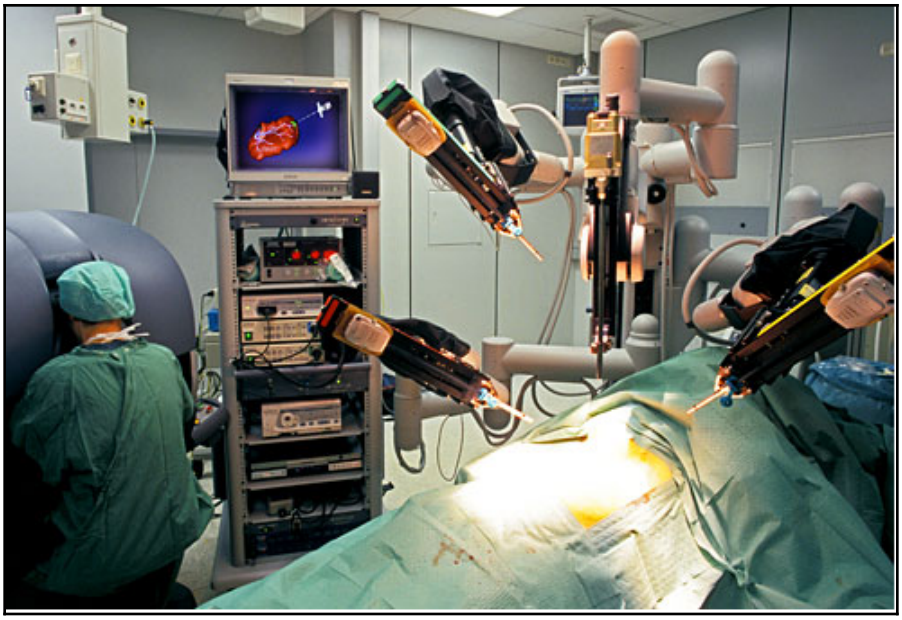

amcl.rviz* - RViz
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Global Status: Ok
Grid
RobotModel
Map
LaserScan
Path (local)
Path (global)
Status: Ok
Topic
/move_base/Trajectory...
Unreliable
Line Style
Lines
Color
255; 255; 0
Alpha
1
Buffer Length
1
Offset
0; 0; 0
Pose Style
None
Polygon
Map
PoseArray
Color
Color to draw the path.
Add
Duplicate
Remove
Rename
Time
ROS Time:
1683.17
ROS Elapsed:
1650.18
Wall Time:
1526957594.17
Wall Elapsed:
1656.12
Experimental
Reset
31 fps

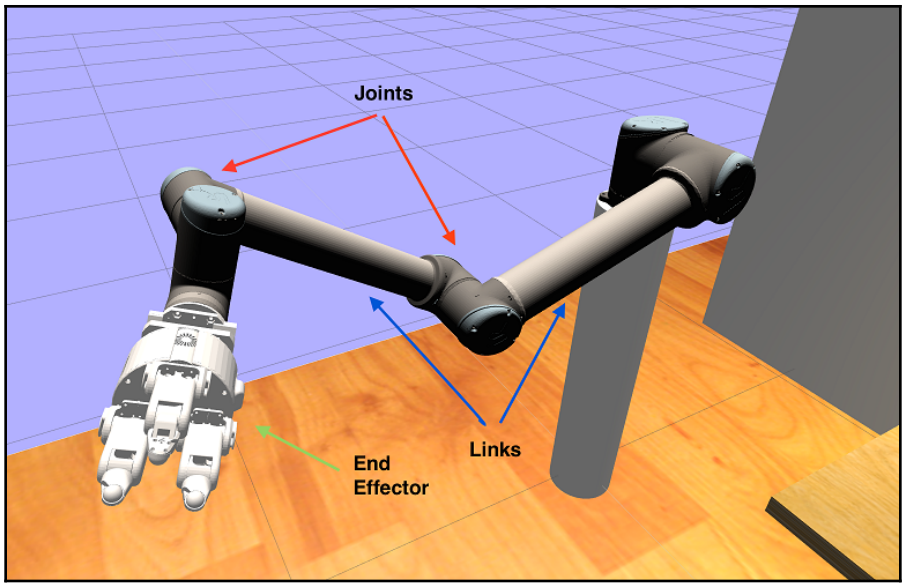
Chapter 8: The Robotic Arm in ROS

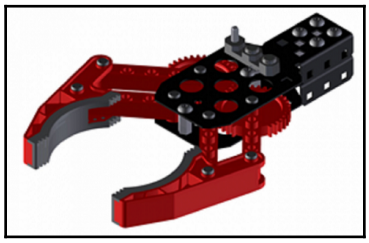


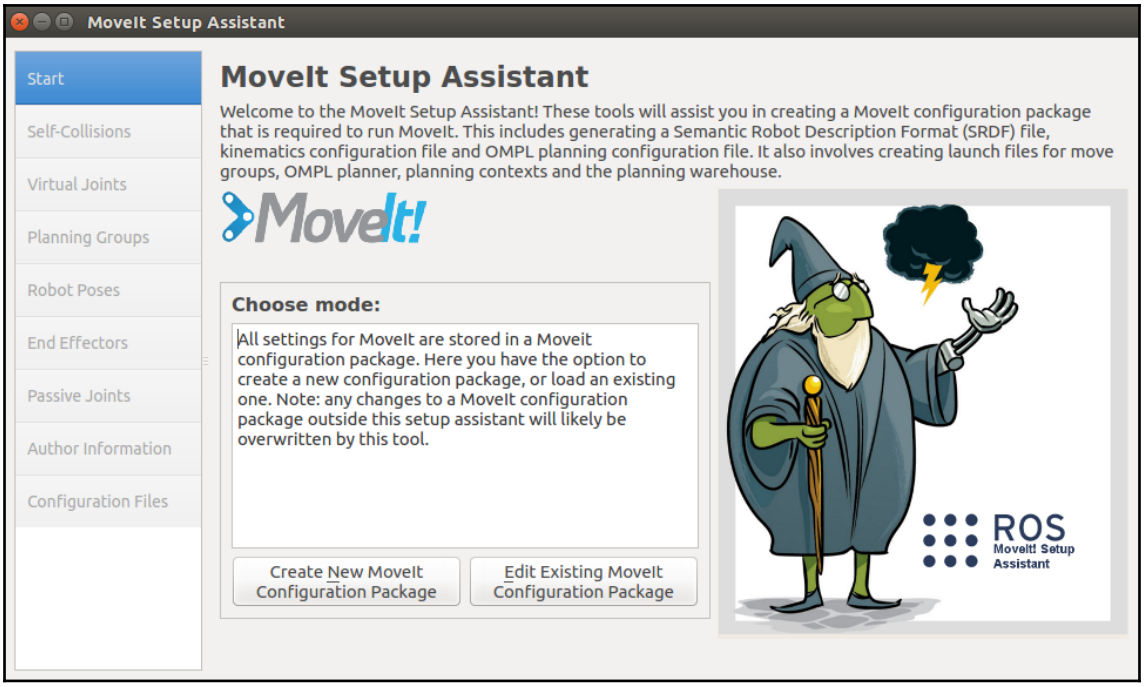


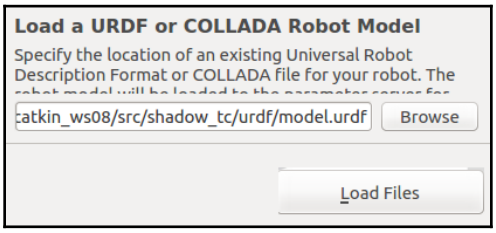
ABB

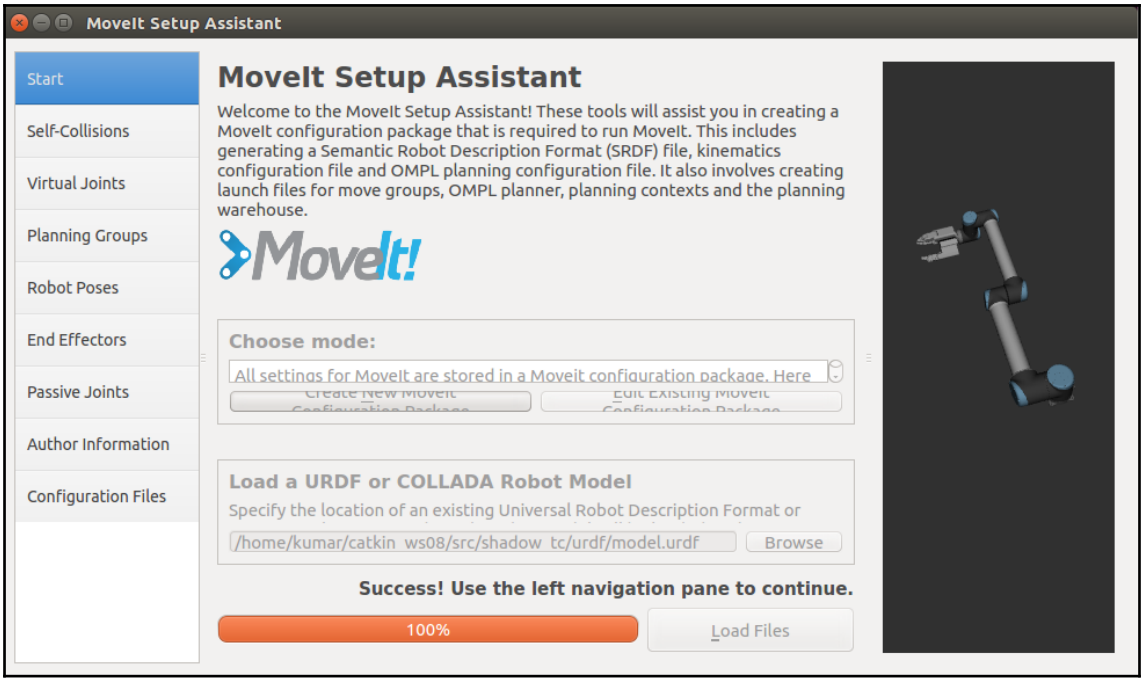



Joints
Links
End
Effector




MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
MoveIt Setup Assistant
Welcome to the MoveIt Setup Assistant! These tools will assist you in creating a MoveIt configuration package that is required to run MoveIt. This includes generating a Semantic Robot Description Format (SRDF) file, kinematics configuration file and OMPL planning configuration file. It also involves creating launch files for move groups, OMPL planner, planning contexts and the planning warehouse.
MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here you have the option to create a new configuration package, or load an existing one. Note: any changes to a MoveIt configuration package outside this setup assistant will likely be overwritten by this tool.
Create New MoveIt Configuration Package
Edit Existing MoveIt Configuration Package
ROS
MoveIt! Setup Assistant


Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or COLLADA file for your robot. The
catkin_ws08/src/shadow_tc/urdf/model.urdf
Browse
Load Files


MoveIt Setup Assistant
Start
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End Effectors
Passive Joints
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Configuration Files
MoveIt Setup Assistant
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MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here
Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or
/home/kumar/catkin_ws08/src/shadow_tc/urdf/model.urdf
Browse
Success! Use the left navigation pane to continue.
100%
Load Files

MoveIt Setup Assistant

- Start
- Self-Collisions
- Virtual Joints
- Planning Groups
- Robot Poses
- End Effectors
- Passive Joints
- Author Information
- Configuration Files

Optimize Self-Collision Checking

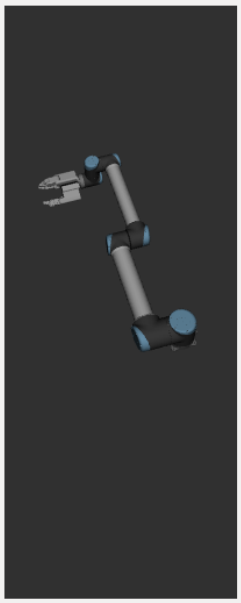
The Default Self-Collision Matrix Generator will search for pairs of links on the robot that can safely be disabled from collision checking, decreasing motion planning processing time. These pairs of links are disabled when they are always in collision, never in collision, in collision in the robot's default position or when the links are adjacent to each other on the kinematic chain. Sampling density specifies how many random robot positions to check for self collision. Higher densities require more computation time.

Sampling Density: Low — High 10000

Min. collisions for "always"-colliding p 95% Generate Collision Matrix

	Link A	Link B	Disabled	ason to Disab
1	base_link	shoulder_link	☑	Adjacent Li…
2	base_link	upper_arm…	☑	Never in Co…
3	base_link	wrist_1_link	☑	Never in Co…
4	ee_link	H1_base_link	☑	Adjacent Li…
5	ee_link	H1_F1_bas…	☑	Never in Co…
6	ee_link	H1_F1_link_1	☑	Never in Co…

link n… ☐ show enabled pairs ◉ linear view ○ matrix view Revert



MoveIt Setup Assistant

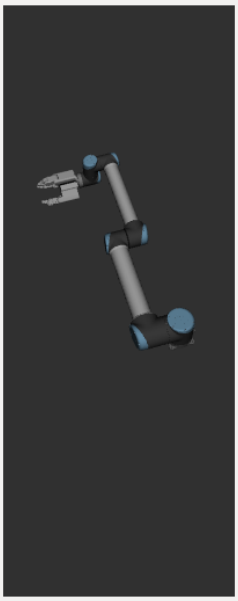
- Start
- Self-Collisions
- Virtual Joints
- Planning Groups
- Robot Poses
- End Effectors
- Passive Joints
- Author Information
- Configuration Files

Virtual Joints

Define a virtual joint between a robot link and an external frame of reference (considered fixed with respect to the robot).

	Virtual Joint Name	Child Link	Parent Frame	Type
1	FixedBase	world	world	fixed

Edit Selected Delete Selected Add Virtual Joint

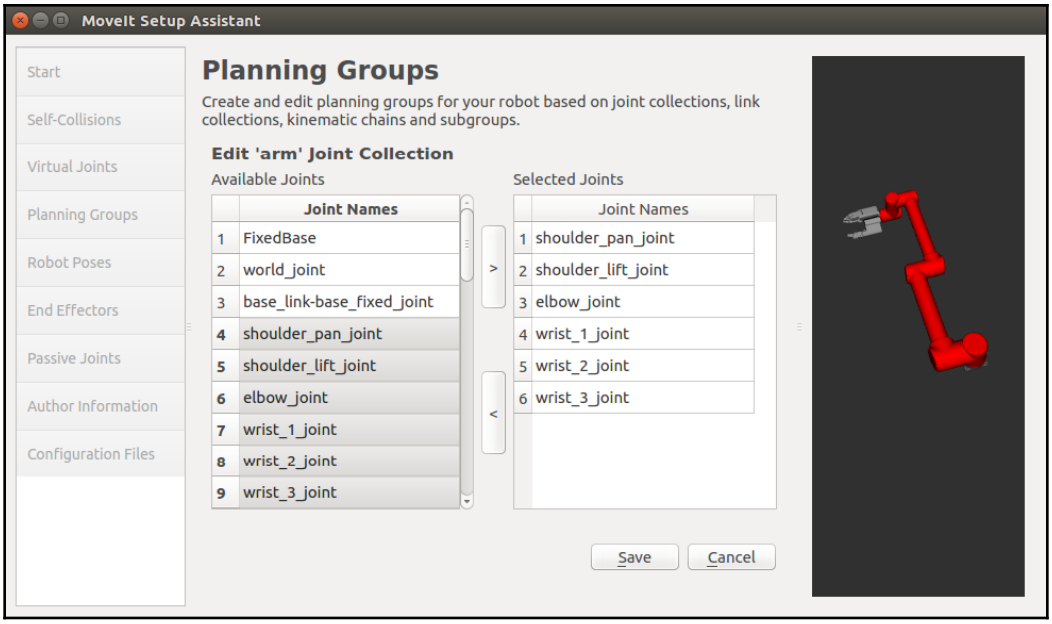


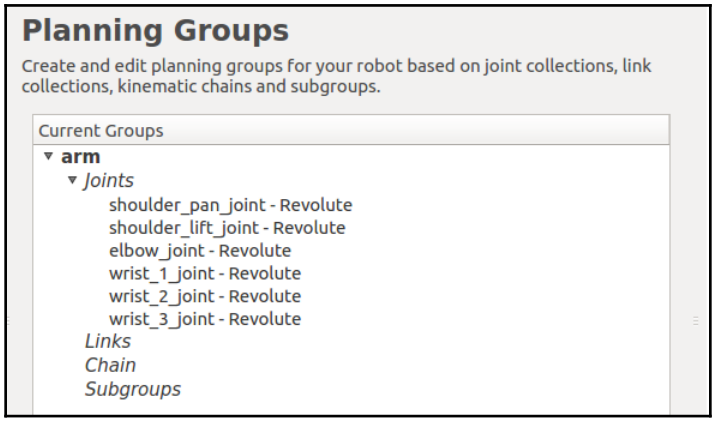
Planning Groups

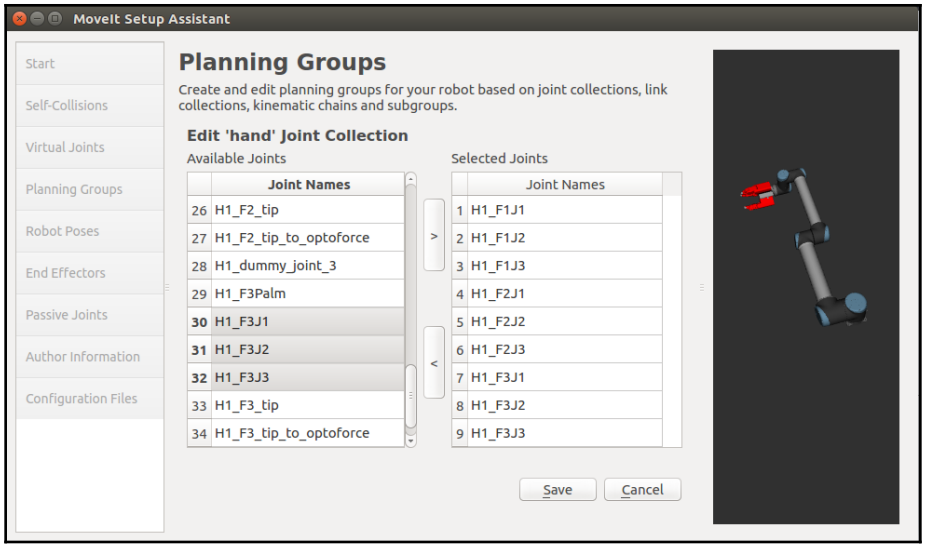
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.

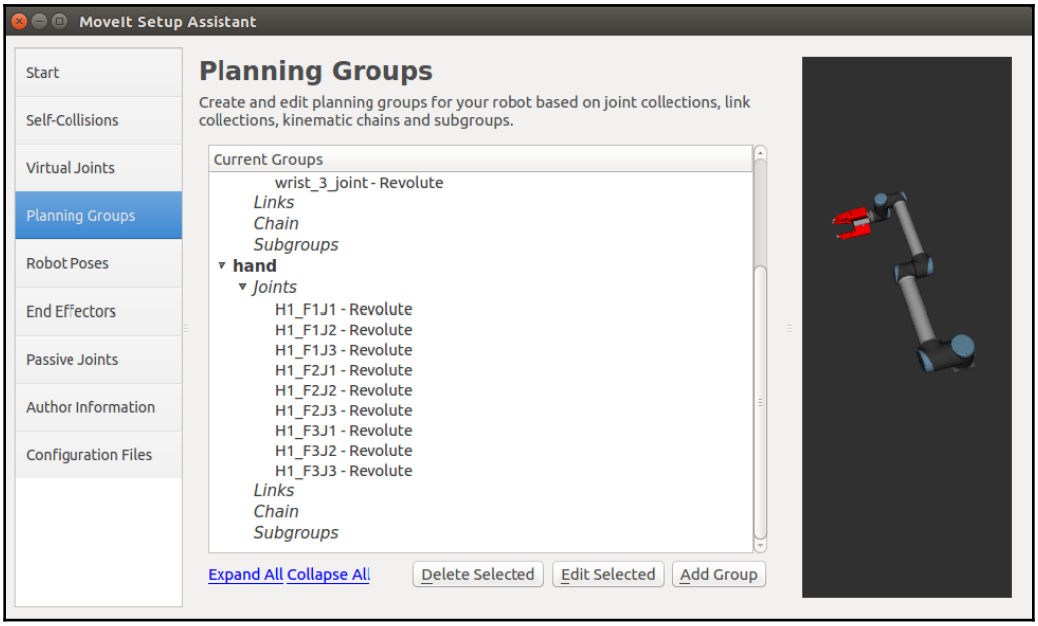
Create New Planning Group

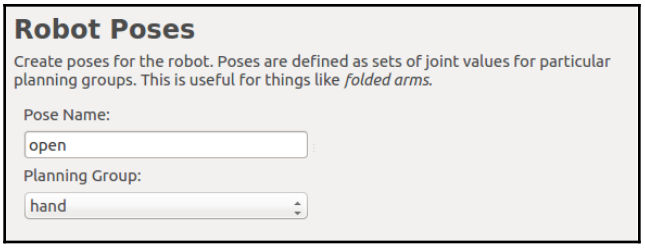
Group Name:	arm
Kinematic Solver:	kdl_kinematics_plugin/KDLKinematicsPlugin
Kin. Search Resolution:	0.005
Kin. Search Timeout (sec):	0.005
Kin. Solver Attempts:	3

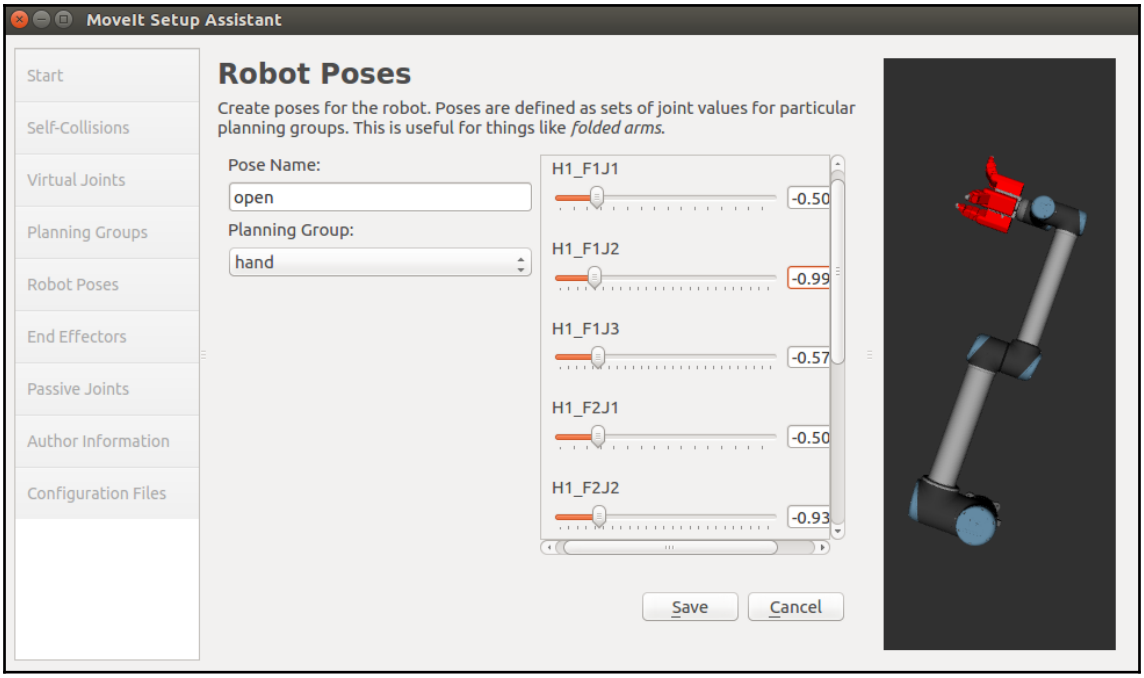


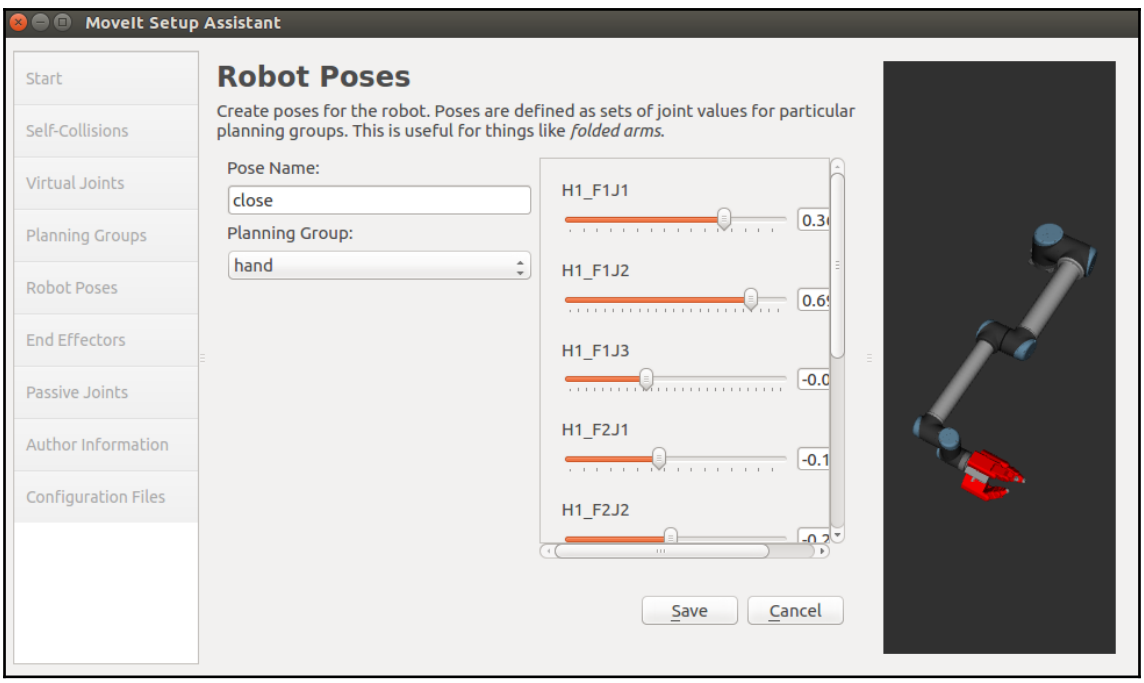

Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Current Groups
arm
Joints
shoulder_pan_joint - Revolute
shoulder_lift_joint - Revolute
elbow_joint - Revolute
wrist_1_joint - Revolute
wrist_2_joint - Revolute
wrist_3_joint - Revolute
Links
Chain
Subgroups


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Edit 'hand' Joint Collection
Available Joints
Joint Names
26 H1_F2_tip
27 H1_F2_tip_to_optoforce
28 H1_dummy_joint_3
29 H1_F3Palm
30 H1_F3J1
31 H1_F3J2
32 H1_F3J3
33 H1_F3_tip
34 H1_F3_tip_to_optoforce
>
<
Selected Joints
Joint Names
1 H1_F1J1
2 H1_F1J2
3 H1_F1J3
4 H1_F2J1
5 H1_F2J2
6 H1_F2J3
7 H1_F3J1
8 H1_F3J2
9 H1_F3J3
Save
Cancel


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Current Groups
wrist_3_joint - Revolute
Links
Chain
Subgroups
hand
Joints
H1_F1J1 - Revolute
H1_F1J2 - Revolute
H1_F1J3 - Revolute
H1_F2J1 - Revolute
H1_F2J2 - Revolute
H1_F2J3 - Revolute
H1_F3J1 - Revolute
H1_F3J2 - Revolute
H1_F3J3 - Revolute
Links
Chain
Subgroups
Expand All Collapse All
Delete Selected
Edit Selected
Add Group


Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
open
Planning Group:
hand


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
open
Planning Group:
hand
H1_F1J1
-0.50
H1_F1J2
-0.99
H1_F1J3
-0.57
H1_F2J1
-0.50
H1_F2J2
-0.93
Save
Cancel


MoveIt Setup Assistant
Start
Self-Collisions
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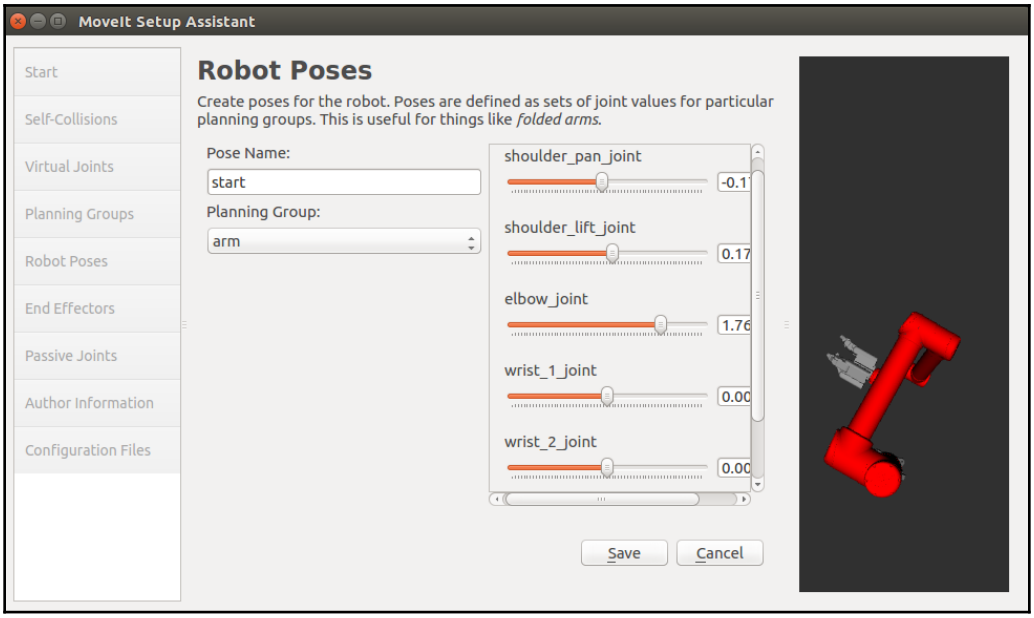
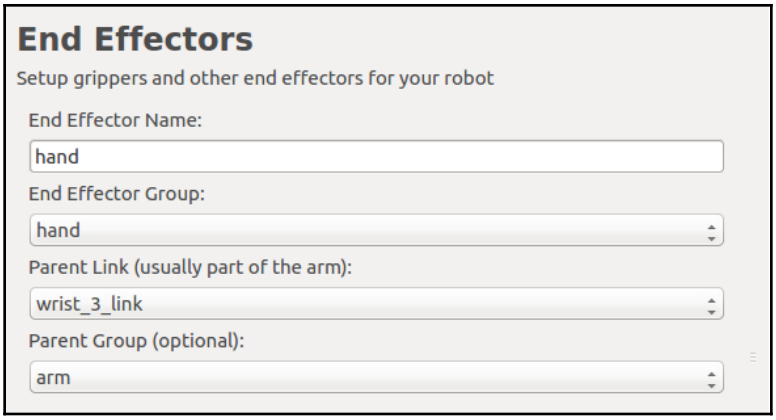
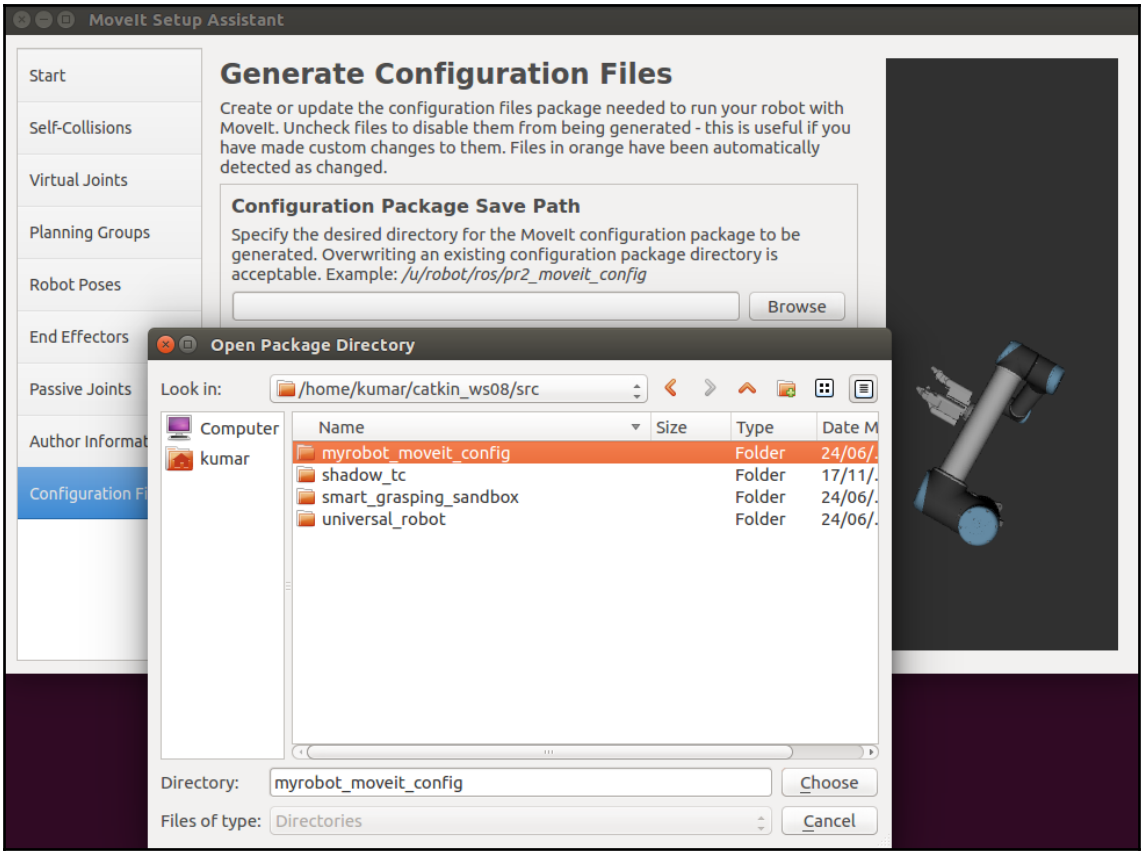
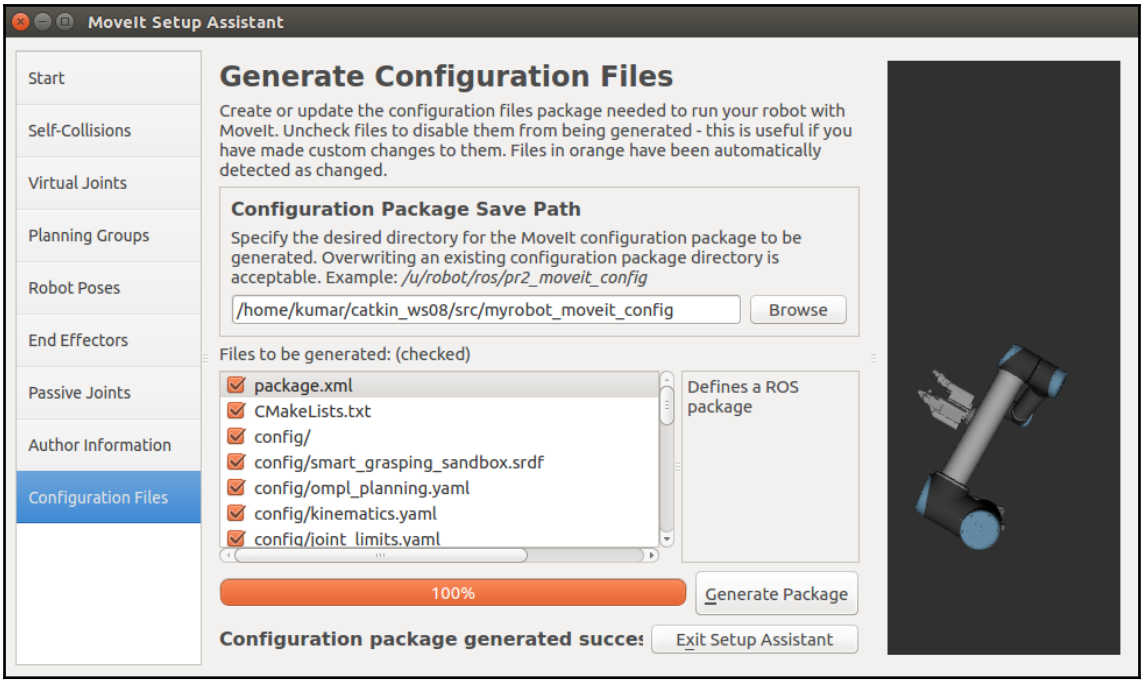
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
close
Planning Group:
hand
H1_F1J1
H1_F1J2
H1_F1J3
H1_F2J1
H1_F2J2
Save
Cancel


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
start
Planning Group:
arm
shoulder_pan_joint
-0.1
shoulder_lift_joint
0.17
elbow_joint
1.76
wrist_1_joint
0.00
wrist_2_joint
0.00
Save
Cancel


End Effectors
Setup grippers and other end effectors for your robot
End Effector Name:
hand
End Effector Group:
hand
Parent Link (usually part of the arm):
wrist_3_link
Parent Group (optional):
arm


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Informat
Configuration Fi
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. Uncheck files to disable them from being generated - this is useful if you have made custom changes to them. Files in orange have been automatically detected as changed.
Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
Browse
Open Package Directory
Look in:
/home/kumar/catkin_ws08/src
Computer
kumar
Name
Size
Type
Date M
myrobot_moveit_config
Folder
24/06/
shadow_tc
Folder
17/11/
smart_grasping_sandbox
Folder
24/06/
universal_robot
Folder
24/06/
Directory:
myrobot_moveit_config
Choose
Files of type:
Directories
Cancel


MoveIt Setup Assistant
Start
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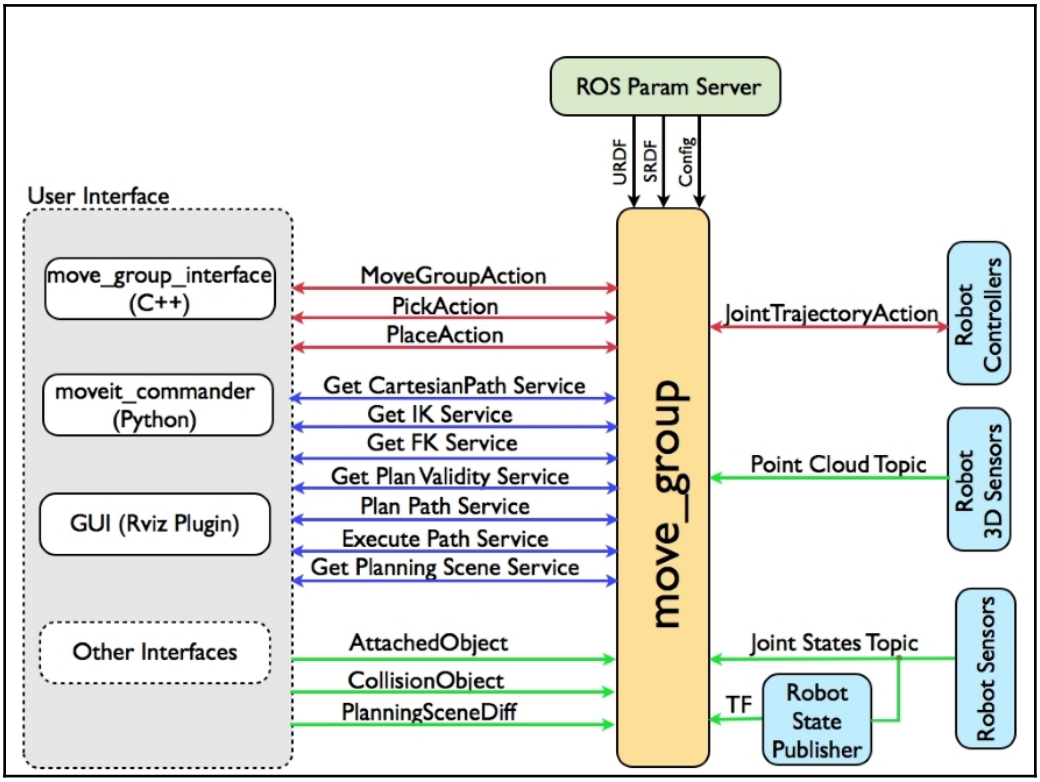
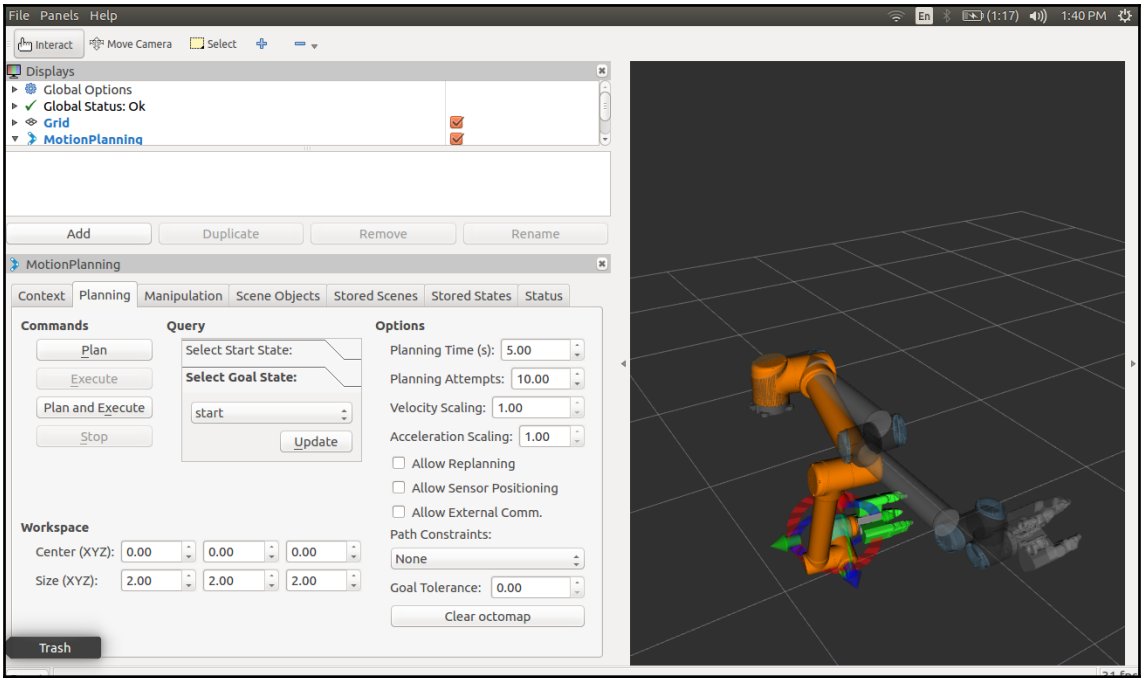
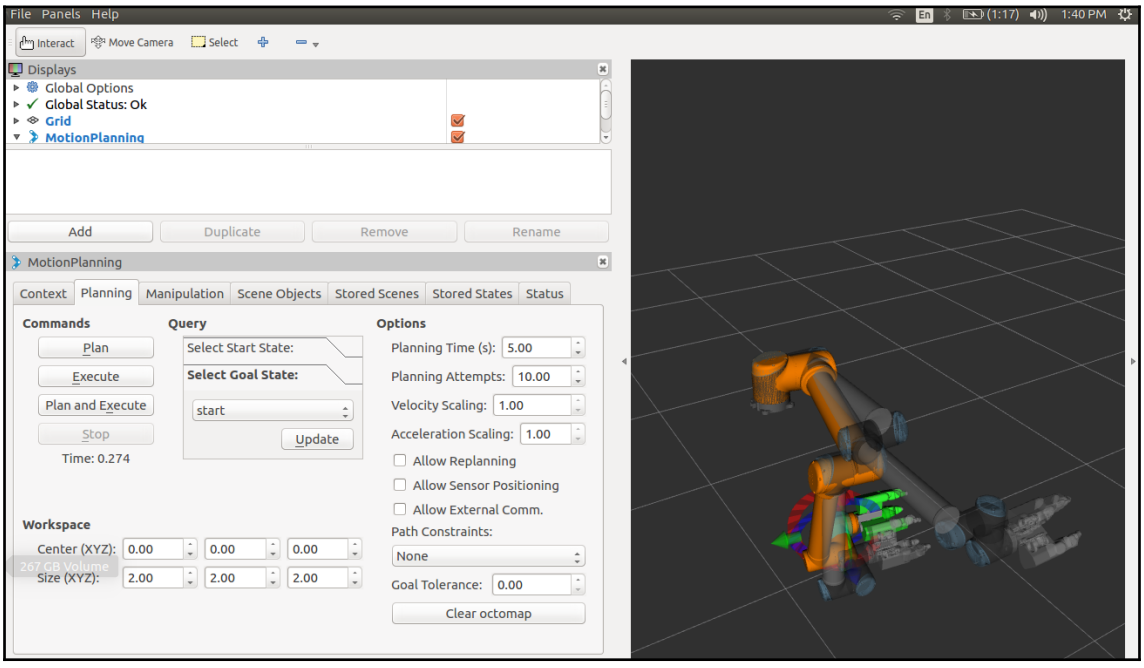
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. Uncheck files to disable them from being generated - this is useful if you have made custom changes to them. Files in orange have been automatically detected as changed.
Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
/home/kumar/catkin_ws08/src/myrobot_moveit_config
Browse
Files to be generated: (checked)
package.xml
CMakeLists.txt
config/
config/smart_grasping_sandbox.srdf
config/ompl_planning.yaml
config/kinematics.yaml
config/joint_limits.yaml
Defines a ROS package
100%
Generate Package
Configuration package generated succes
Exit Setup Assistant

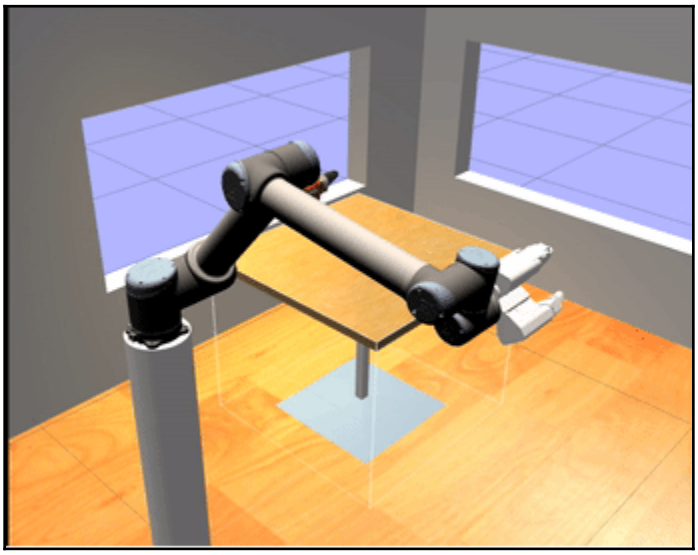

ROS Param Server
URDF
SRDF
Config
User Interface
move_group_interface (C++)
moveit_commander (Python)
GUI (Rviz Plugin)
Other Interfaces
MoveGroupAction
PickAction
PlaceAction
Get CartesianPath Service
Get IK Service
Get FK Service
Get Plan Validity Service
Plan Path Service
Execute Path Service
Get Planning Scene Service
AttachedObject
CollisionObject
PlanningSceneDiff
move_group
JointTrajectoryAction
Point Cloud Topic
Joint States Topic
TF
Robot State Publisher
Robot Controllers
Robot 3D Sensors
Robot Sensors

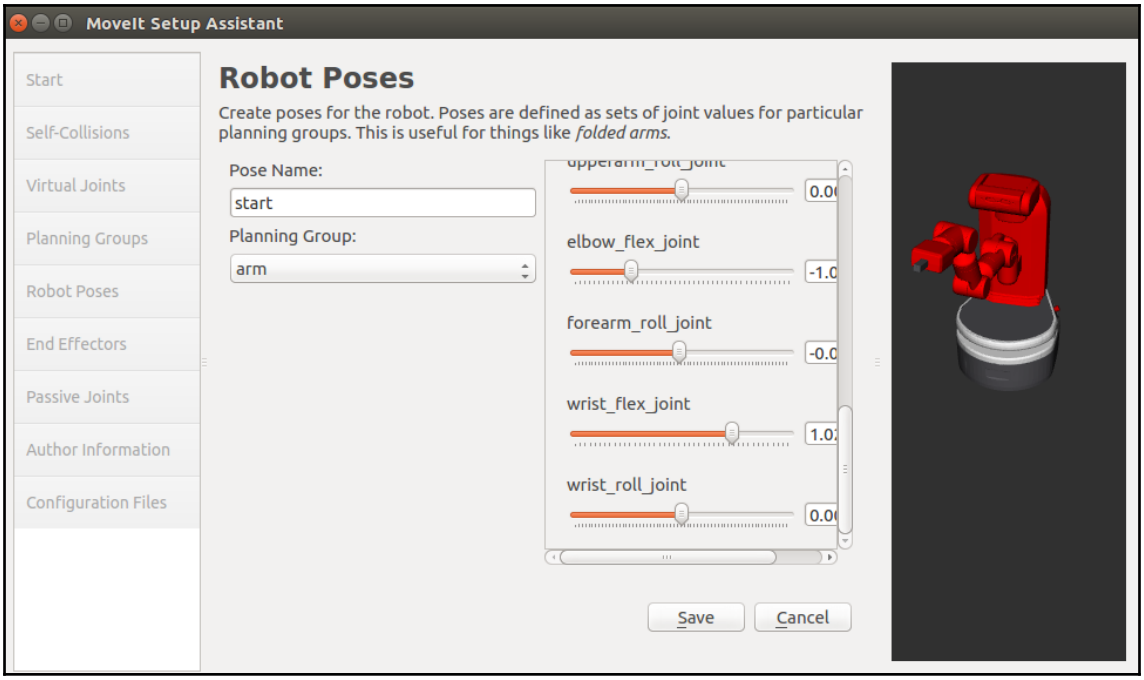

File Panels Help
1:40 PM
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Query
Select Start State:
Select Goal State:
start
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00
Trash

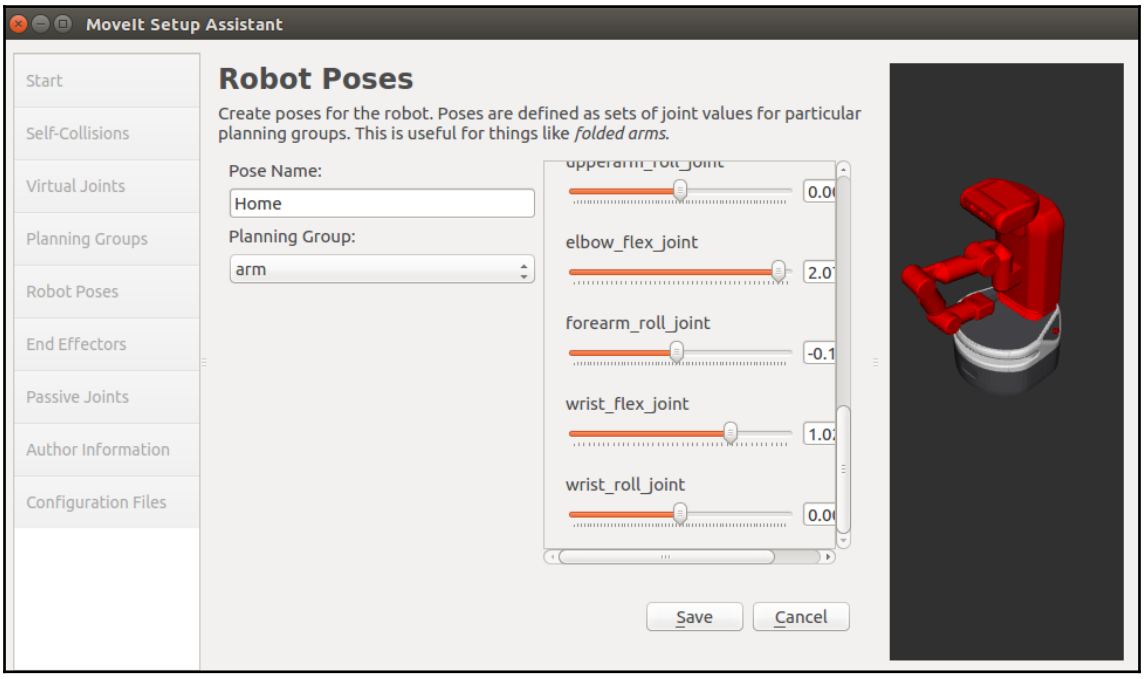

File Panels Help
1:40 PM
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Time: 0.274
Query
Select Start State:
Select Goal State:
start
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00

```
user ~ $ rostopic list
/arm_controller/command
/arm_controller/follow_joint_trajectory/cancel
/arm_controller/follow_joint_trajectory/feedback
/arm_controller/follow_joint_trajectory/goal
/arm_controller/follow_joint_trajectory/result
/arm_controller/follow_joint_trajectory/status
/arm_controller/state
```

```
/hand_controller/command
/hand_controller/follow_joint_trajectory/cancel
/hand_controller/follow_joint_trajectory/feedback
/hand_controller/follow_joint_trajectory/goal
/hand_controller/follow_joint_trajectory/result
/hand_controller/follow_joint_trajectory/status
```




MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
start
Planning Group:
arm
elbow_flex_joint
forearm_roll_joint
wrist_flex_joint
wrist_roll_joint
Save
Cancel


MoveIt Setup Assistant
Start
Self-Collisions
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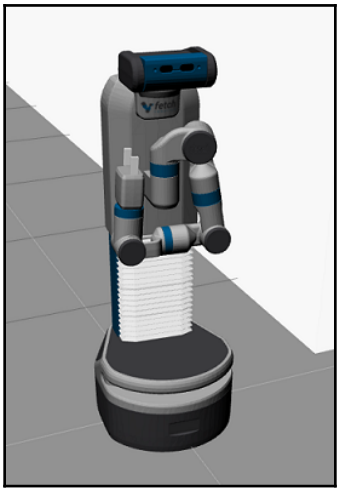
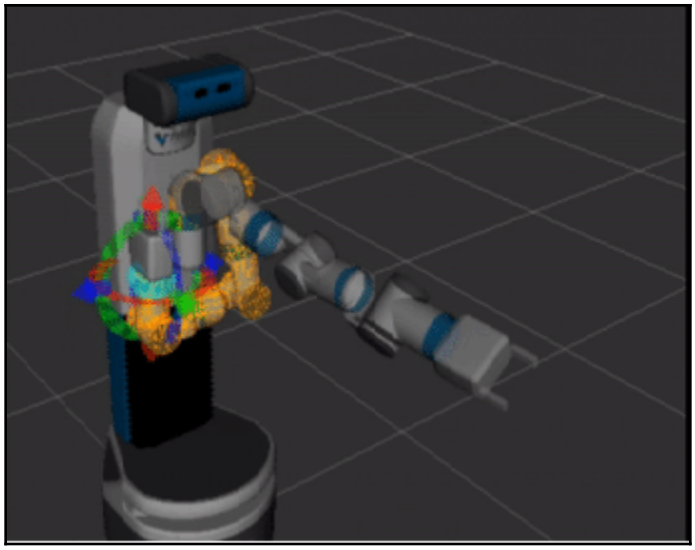
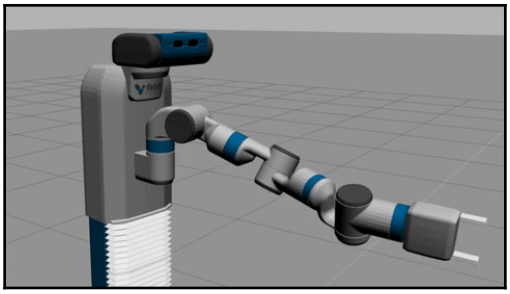
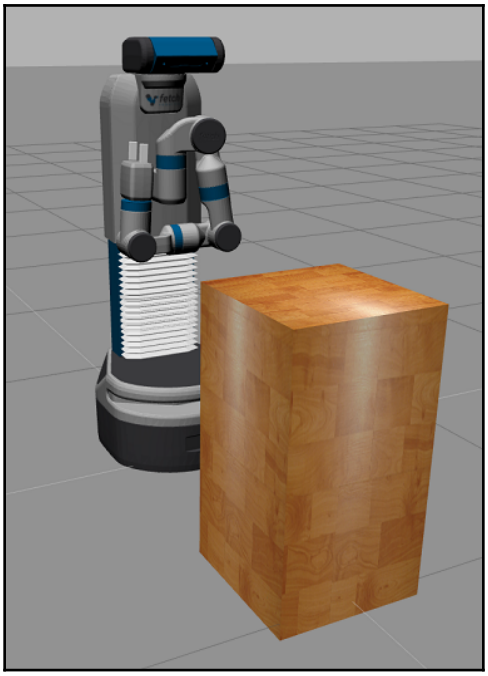
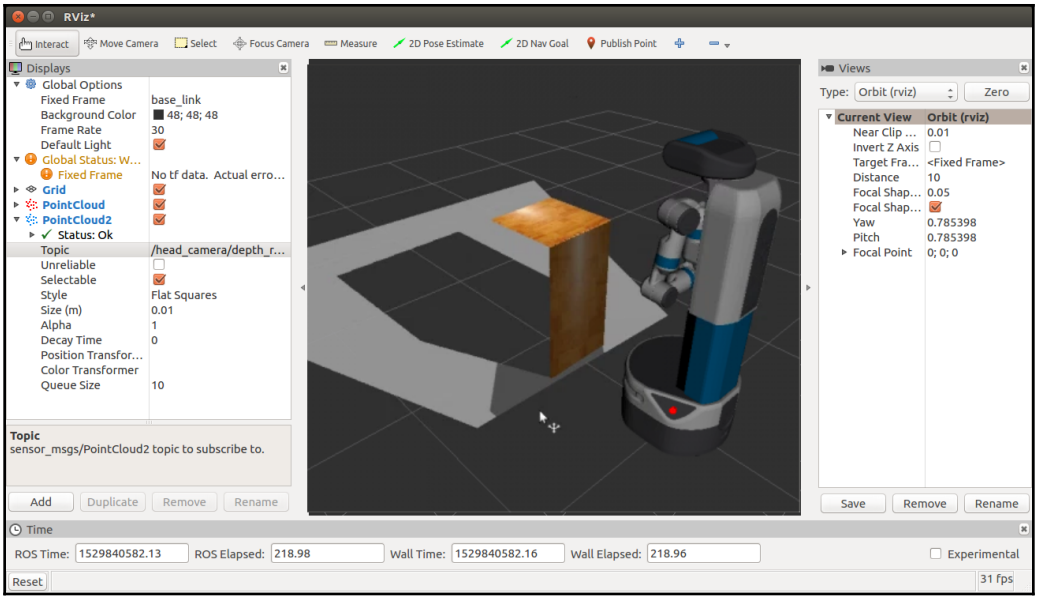
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
Home
Planning Group:
arm
elbow_flex_joint
forearm_roll_joint
wrist_flex_joint
wrist_roll_joint
Save
Cancel

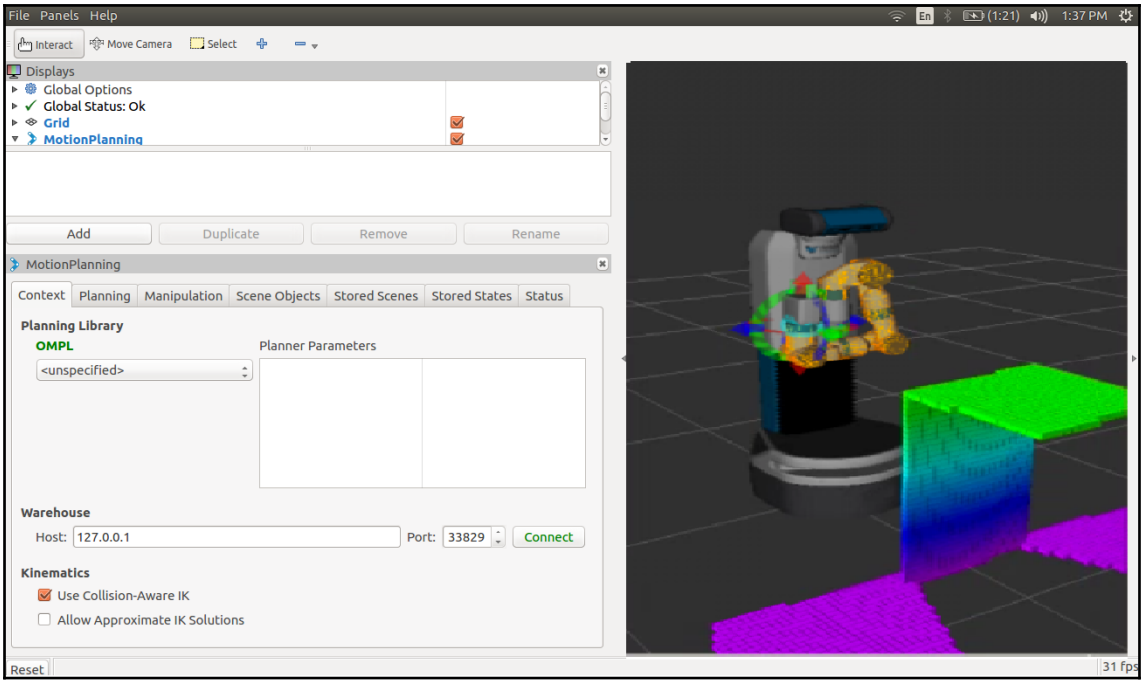


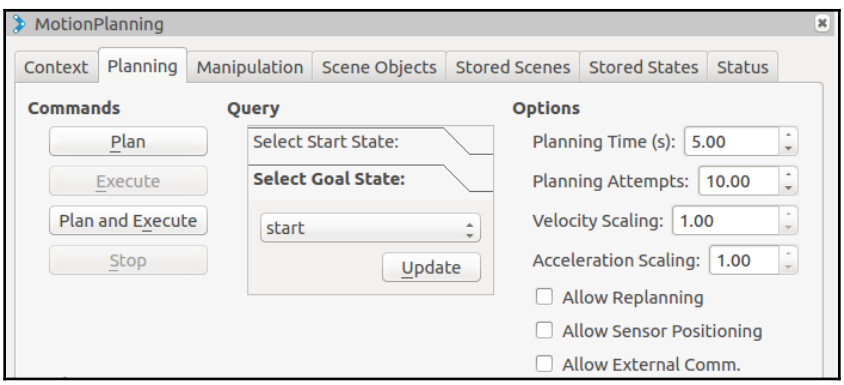


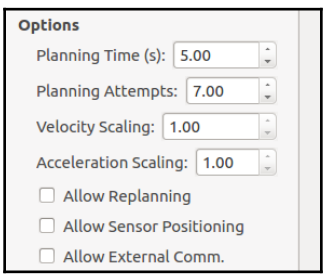


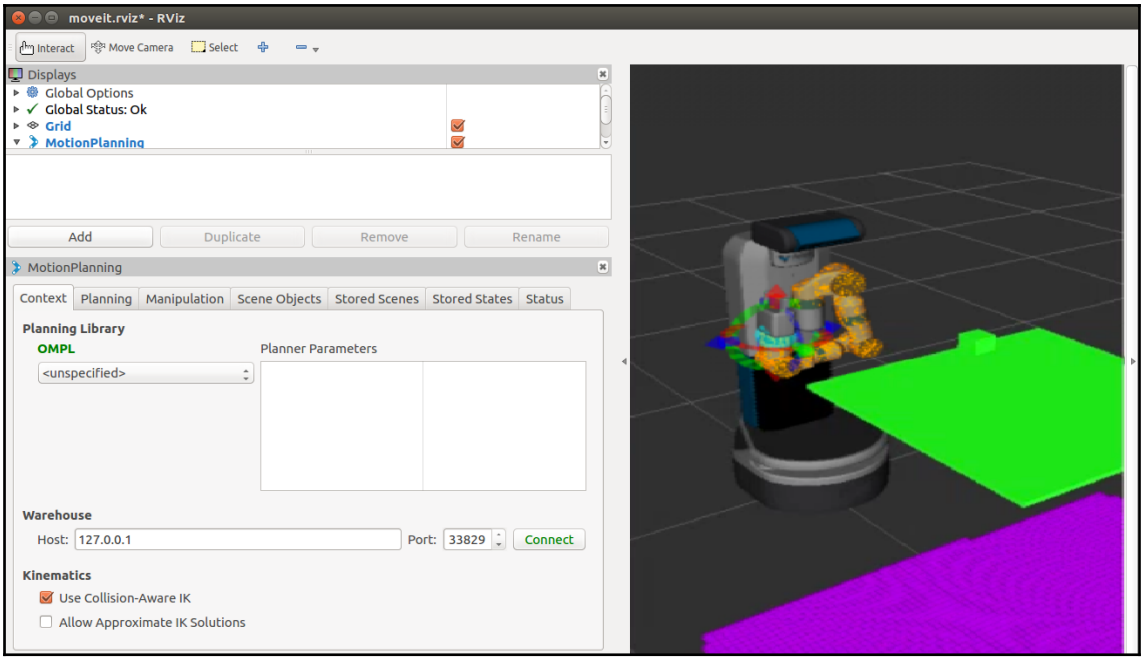


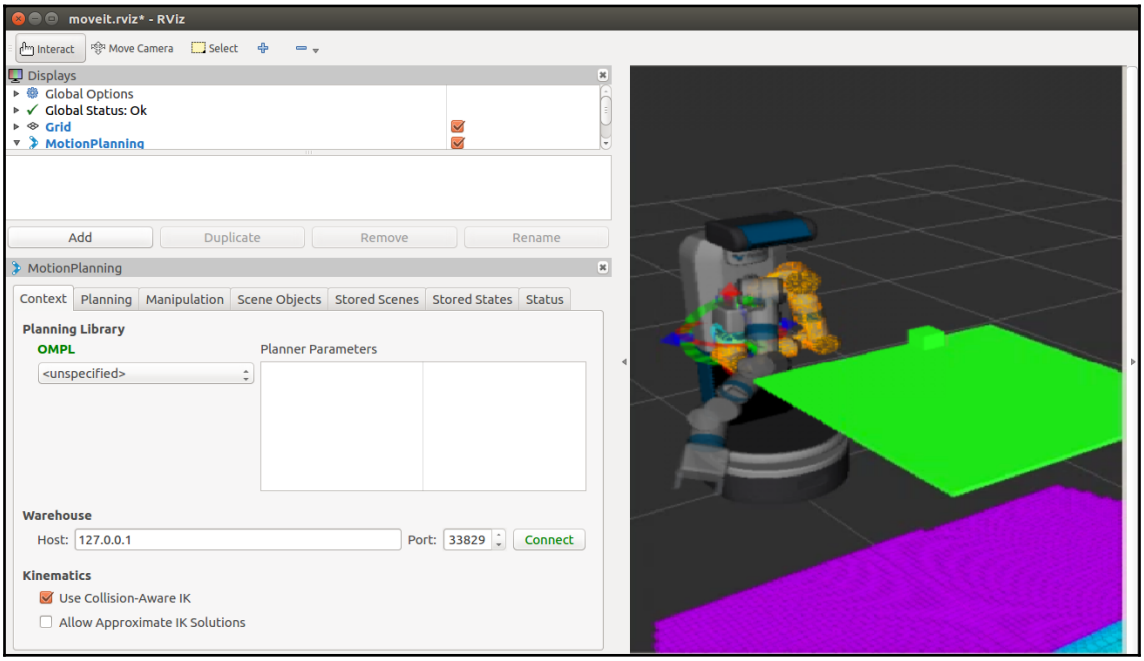

RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
base_link
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: W…
Fixed Frame
No tf data. Actual erro…
Grid
PointCloud
PointCloud2
Status: Ok
Topic
/head_camera/depth_r…
Unreliable
Selectable
Style
Flat Squares
Size (m)
0.01
Alpha
1
Decay Time
0
Position Transfor…
Color Transformer
Queue Size
10
Topic
sensor_msgs/PointCloud2 topic to subscribe to.
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz)
Zero
Current View
Orbit (rviz)
Near Clip …
0.01
Invert Z Axis
Target Fra…
<Fixed Frame>
Distance
10
Focal Shap…
0.05
Focal Shap…
Yaw
0.785398
Pitch
0.785398
Focal Point
0; 0; 0
Save
Remove
Rename
Time
ROS Time:
1529840582.13
ROS Elapsed:
218.98
Wall Time:
1529840582.16
Wall Elapsed:
218.96
Experimental
Reset
31 fps

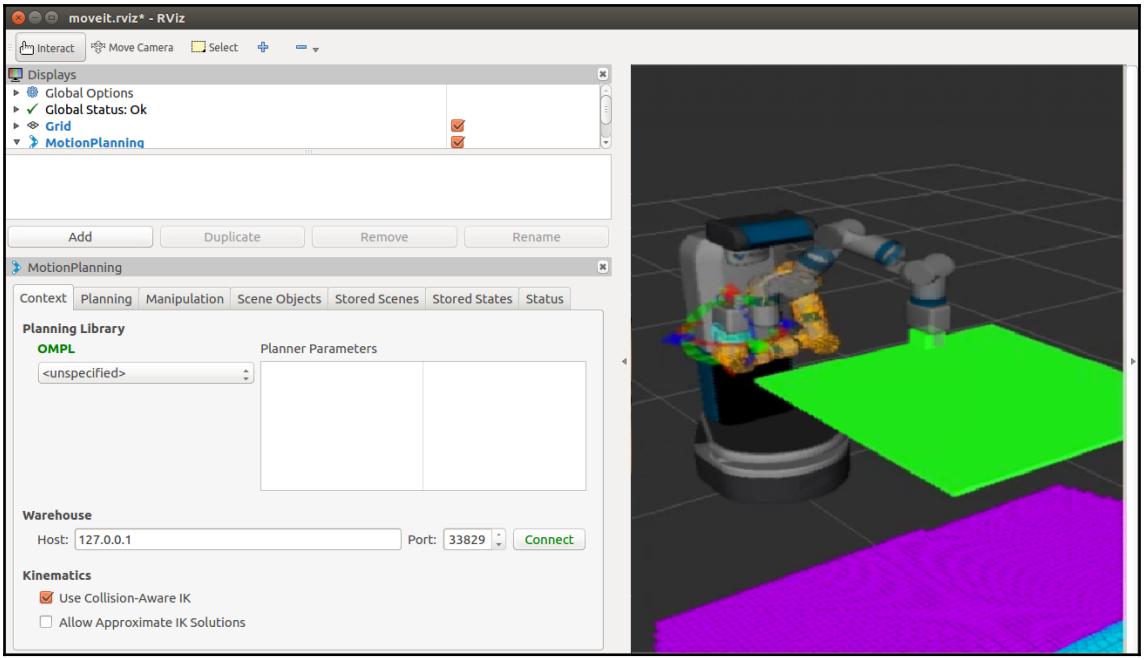

File Panels Help
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions
Reset
31 fps

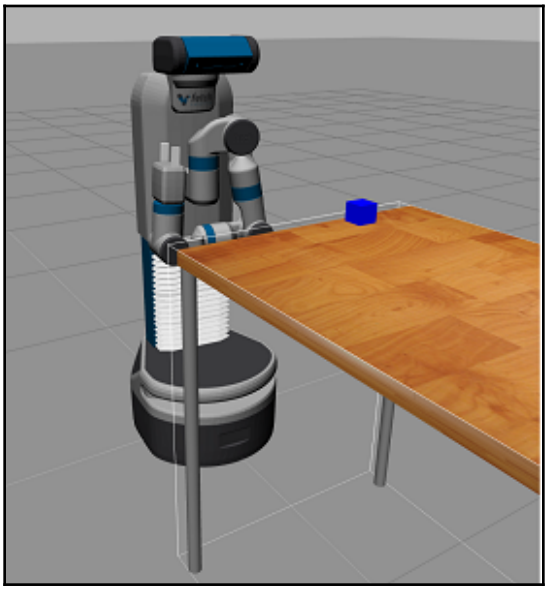

MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Query
Select Start State:
Select Goal State:
start
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.

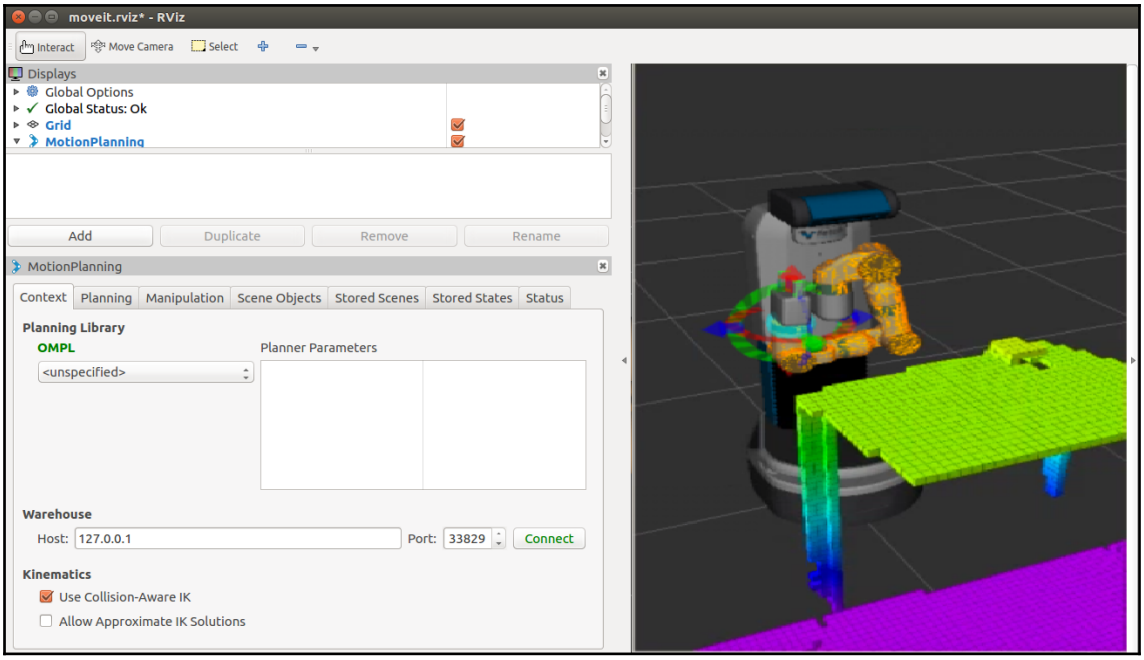

Options
Planning Time (s): 5.00
Planning Attempts: 7.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.

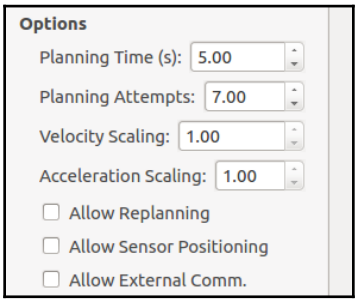

moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions

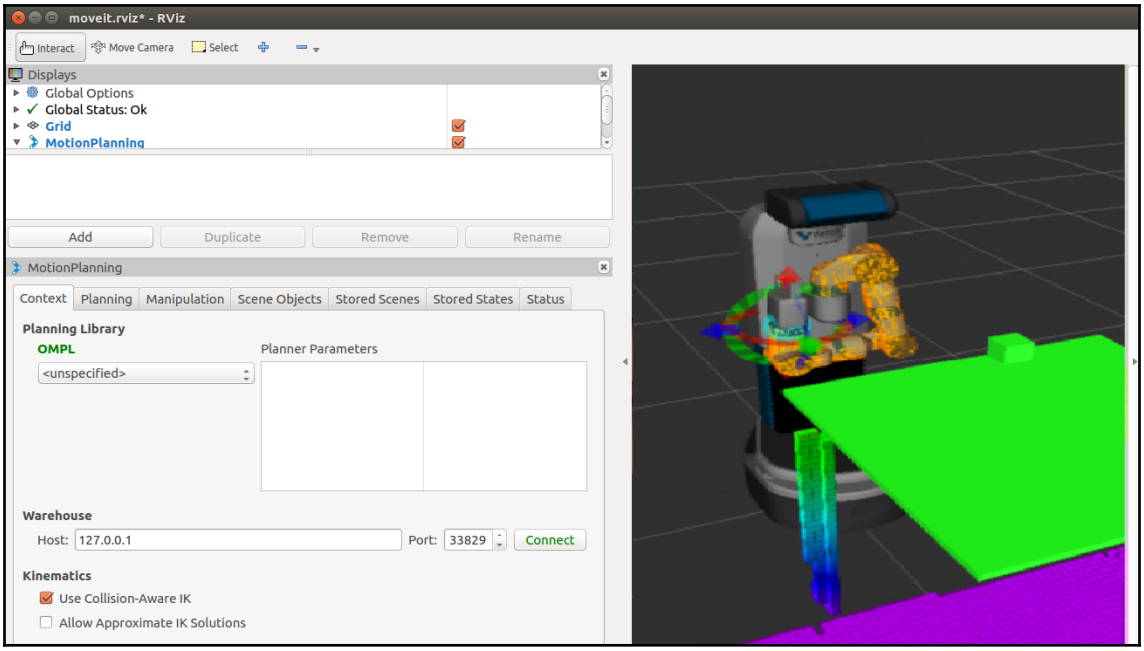

moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions

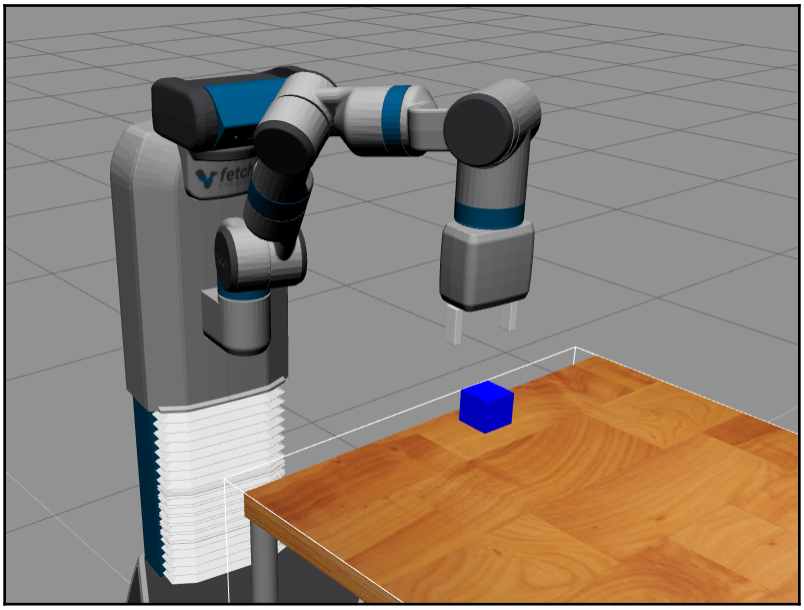

moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions



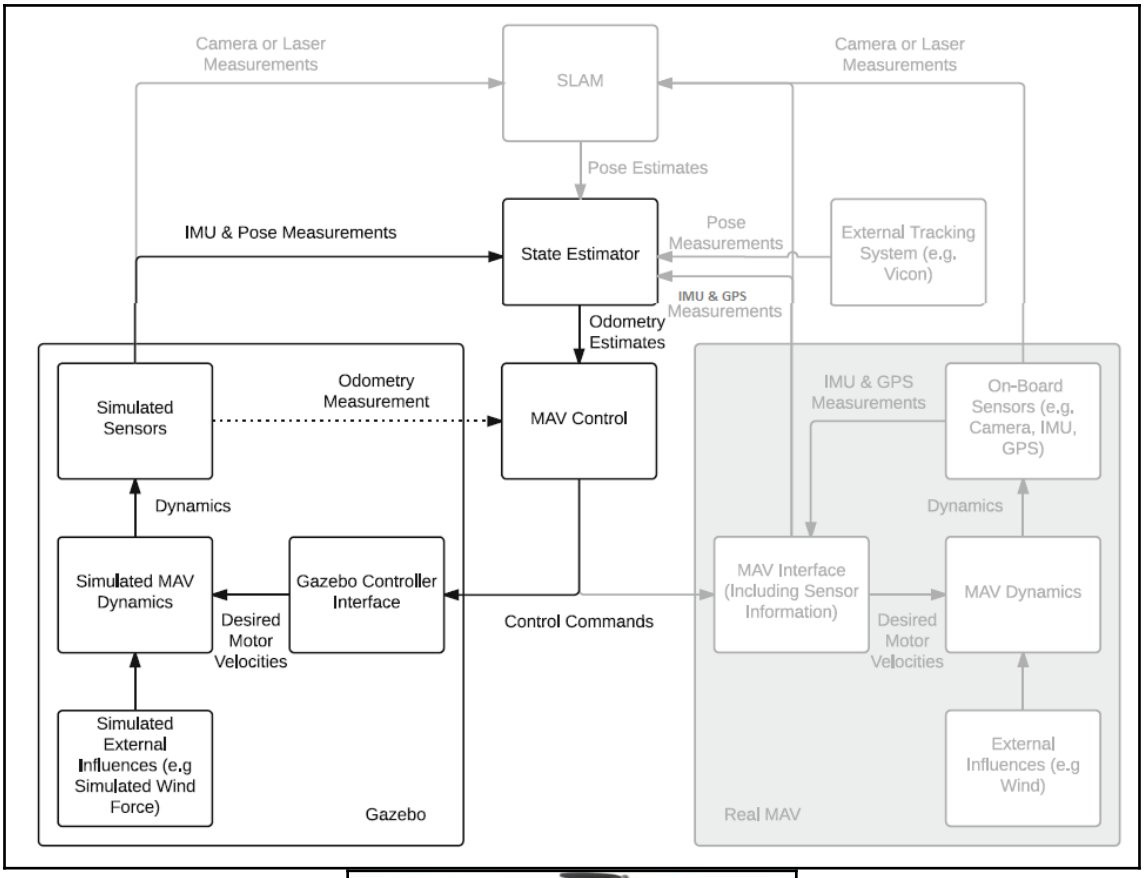

moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions

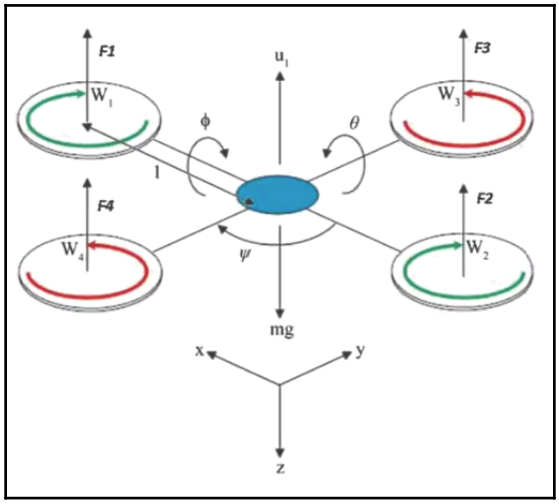

Options
Planning Time (s): 5.00
Planning Attempts: 7.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.


moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
Planner Parameters
<unspecified>
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions



Chapter 9: Micro Aerial Vehicles in ROS


Camera or Laser Measurements
SLAM
Camera or Laser Measurements
Pose Estimates
IMU & Pose Measurements
State Estimator
Pose Measurements
External Tracking System (e.g. Vicon)
IMU & GPS Measurements
Odometry Estimates
Simulated Sensors
Odometry Measurement
MAV Control
IMU & GPS Measurements
On-Board Sensors (e.g. Camera, IMU, GPS)
Dynamics
Dynamics
Simulated MAV Dynamics
Gazebo Controller Interface
MAV Interface (Including Sensor Information)
MAV Dynamics
Desired Motor Velocities
Control Commands
Desired Motor Velocities
Simulated External Influences (e.g Simulated Wind Force)
External Influences (e.g Wind)
Gazebo
Real MAV



rotors_simulator

rotors_control
- Roll, pitch, yawrate, thrust controller
- Position controller

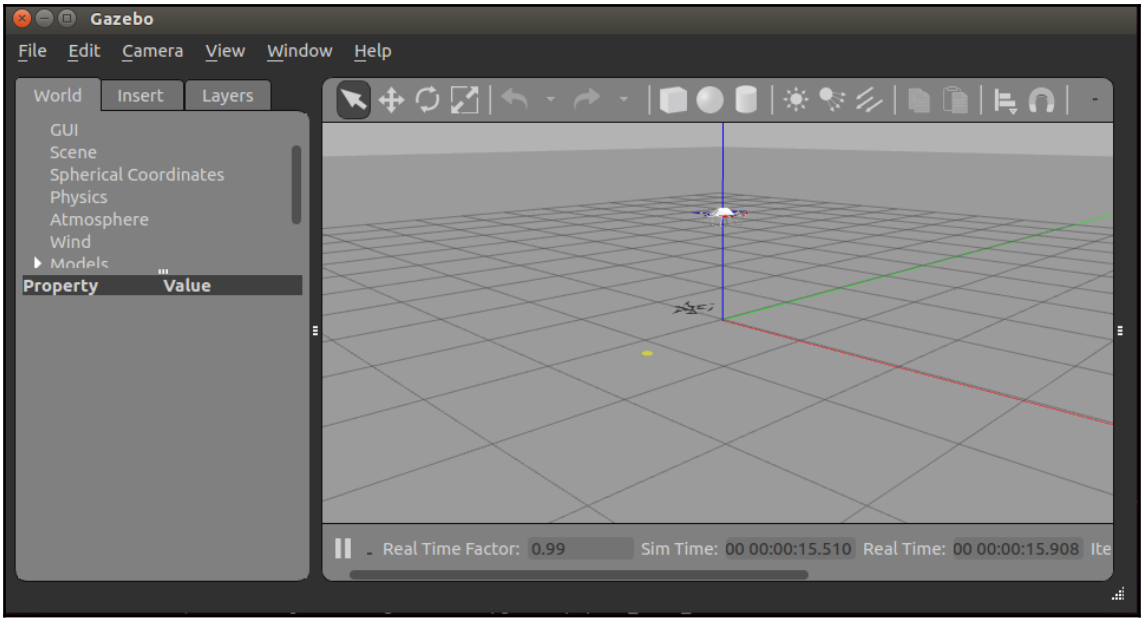
rotors_description
- URDF files
  --> Sensors
  --> MAV models
  --> Component macros
- Mesh files

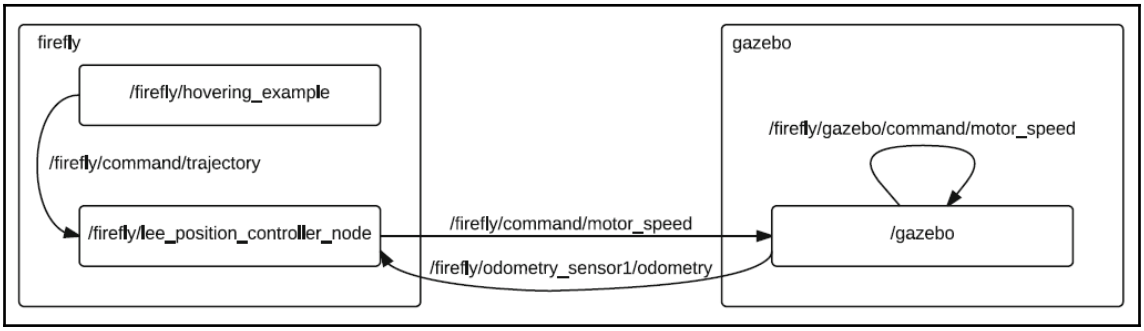
rotors_gazebo
- launch files
- resources
  --> yaml files
  --> odometry_sample_images
- src
  --> hovering example
  --> waypoint_publisher
- Gazebo worlds

rotors_gazebo_plugins
- Bag plugin
- Controller interface plugin
- IMU plugin
- Motor model plugin
- Multirotor base plugin
- Octomap plugin
- Odometry plugin
- Wind plugin

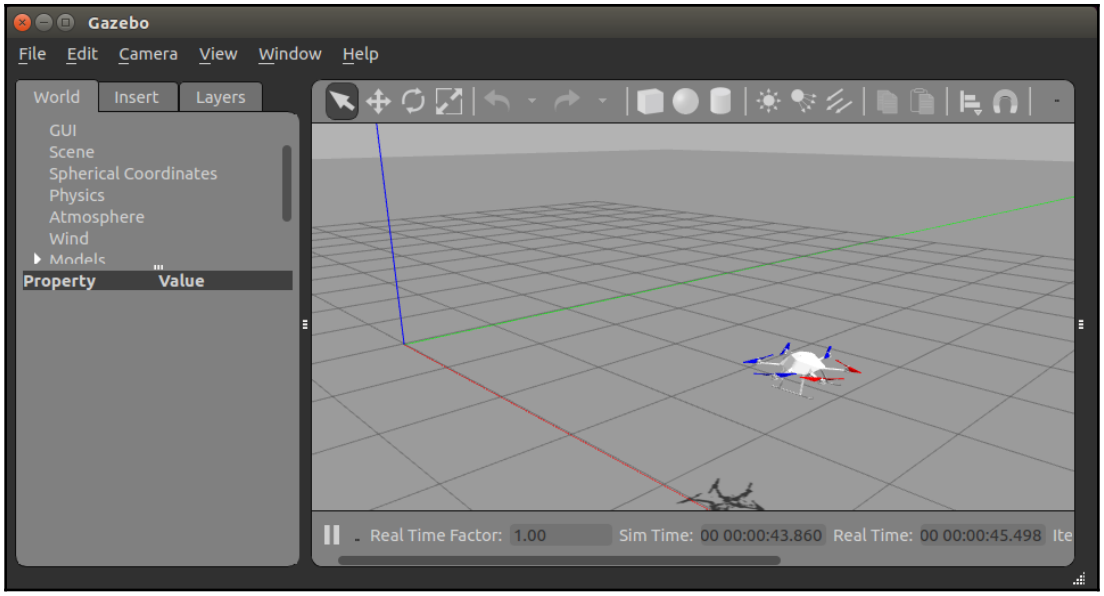
rotors_joy_interface
- Joystick interface to control a MAV via roll, pitch, yaw-rate thrust commands

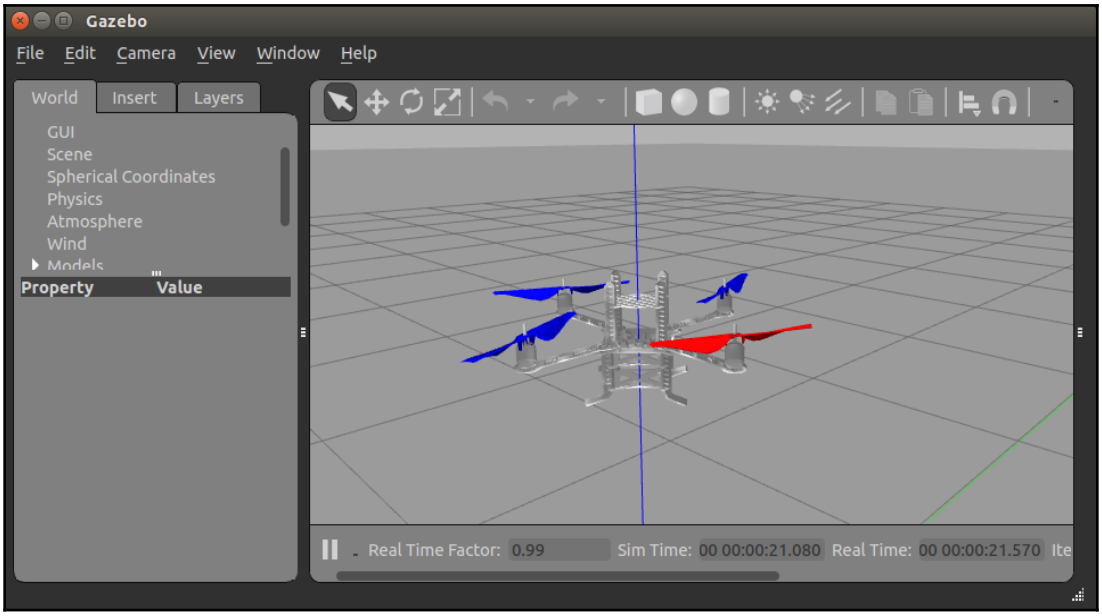
rotors_evaluation
- src
  --> disturbance_eval
  --> hovering_eval
  --> disturbance_eval
  --> test_eval
  --> waypoints_eval

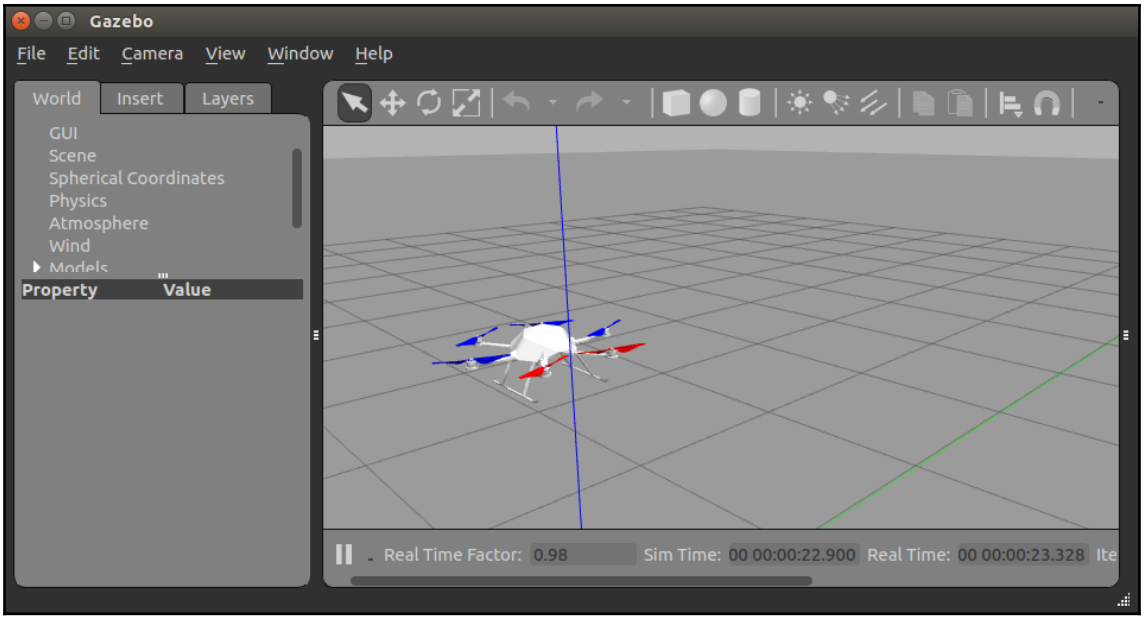

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Property Value
Real Time Factor: 0.99
Sim Time: 00 00:00:15.510
Real Time: 00 00:00:15.908

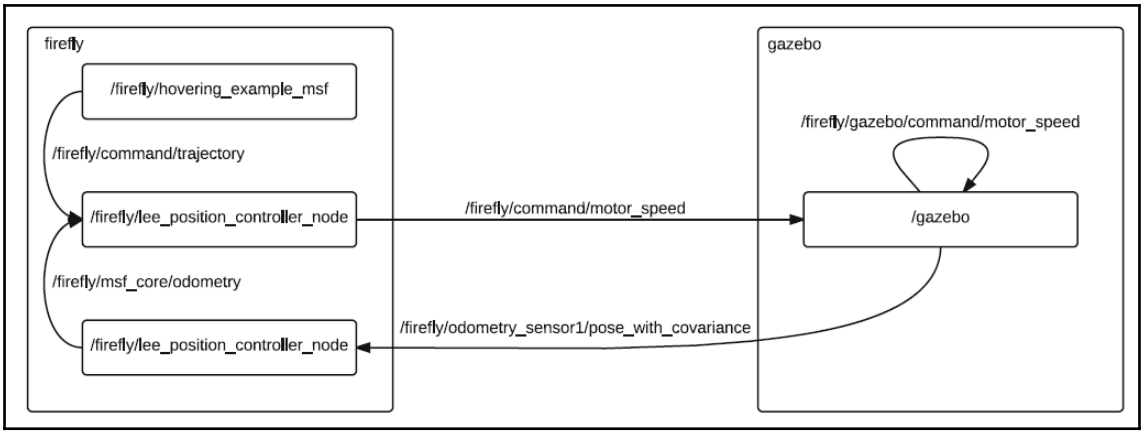

firefly
/firefly/hovering_example
/firefly/command/trajectory
/firefly/lee_position_controller_node
/firefly/command/motor_speed
/firefly/odometry_sensor1/odometry
gazebo
/firefly/gazebo/command/motor_speed
/gazebo

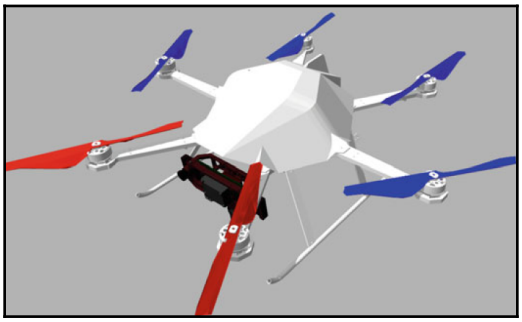
```
kbipin@kumar:~/catkin_ws$ rostopic list
/clock
/firefly/command/motor_speed
/firefly/command/pose
/firefly/command/trajectory
/firefly/gazebo/command/motor_speed
/firefly/ground_truth/imu
/firefly/ground_truth/odometry
/firefly/ground_truth/pose
/firefly/ground_truth/pose_with_covariance
/firefly/ground_truth/position
/firefly/ground_truth/transform
/firefly/imu
/firefly/joint_states
/firefly/motor_speed
/firefly/motor_speed/0
/firefly/motor_speed/1
/firefly/motor_speed/2
/firefly/motor_speed/3
/firefly/motor_speed/4
/firefly/motor_speed/5
/firefly/odometry_sensor1/odometry
/firefly/odometry_sensor1/pose
/firefly/odometry_sensor1/pose_with_covariance
/firefly/odometry_sensor1/position
/firefly/odometry_sensor1/transform
/firefly/wind_speed
```

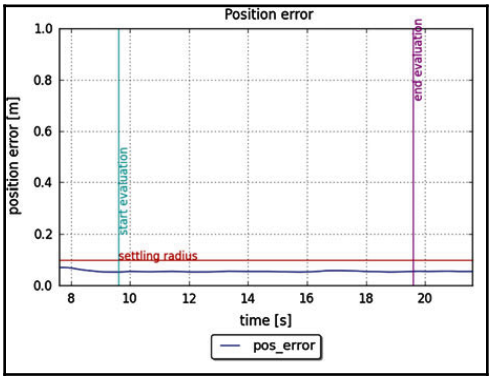


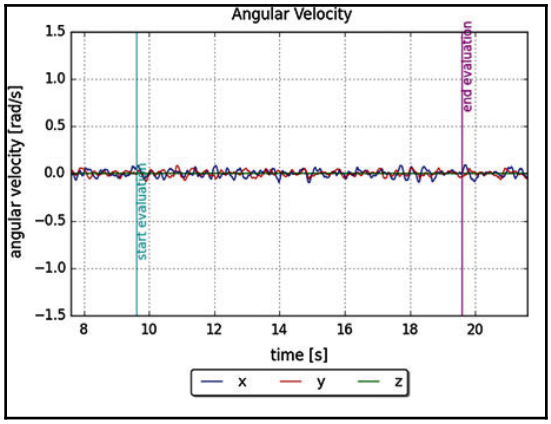

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Property Value
Real Time Factor: 0.99 Sim Time: 00 00:00:21.080 Real Time: 00 00:00:21.570

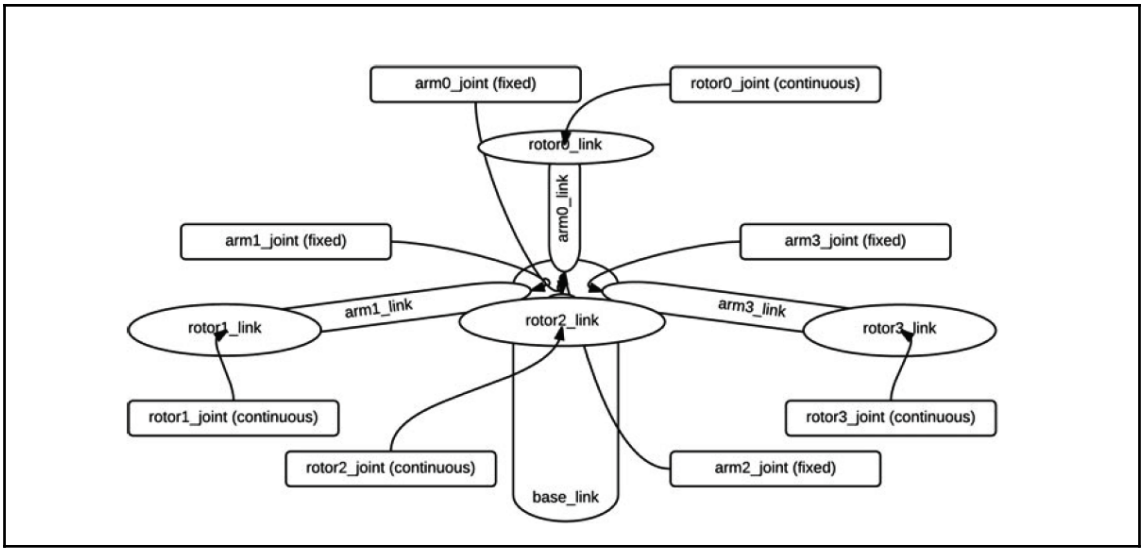

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Property Value
Real Time Factor: 0.98 Sim Time: 00 00:00:22.900 Real Time: 00 00:00:23.328

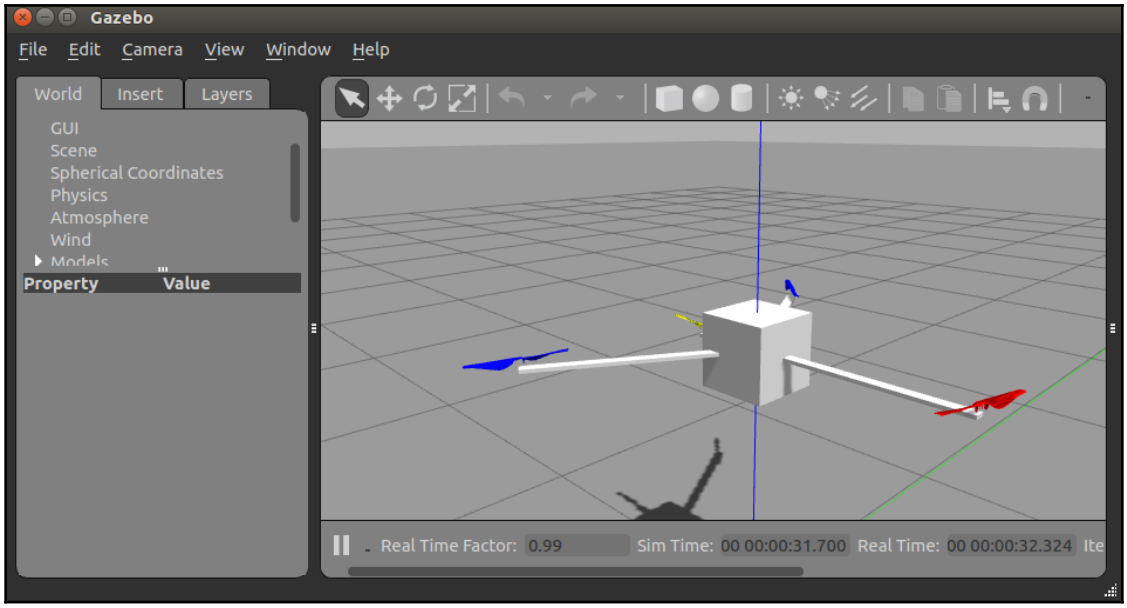

firefly
/firefly/hovering_example_msf
/firefly/command/trajectory
/firefly/lee_position_controller_node
/firefly/msf_core/odometry
/firefly/lee_position_controller_node
/firefly/command/motor_speed
/firefly/odometry_sensor1/pose_with_covariance
gazebo
/firefly/gazebo/command/motor_speed
/gazebo

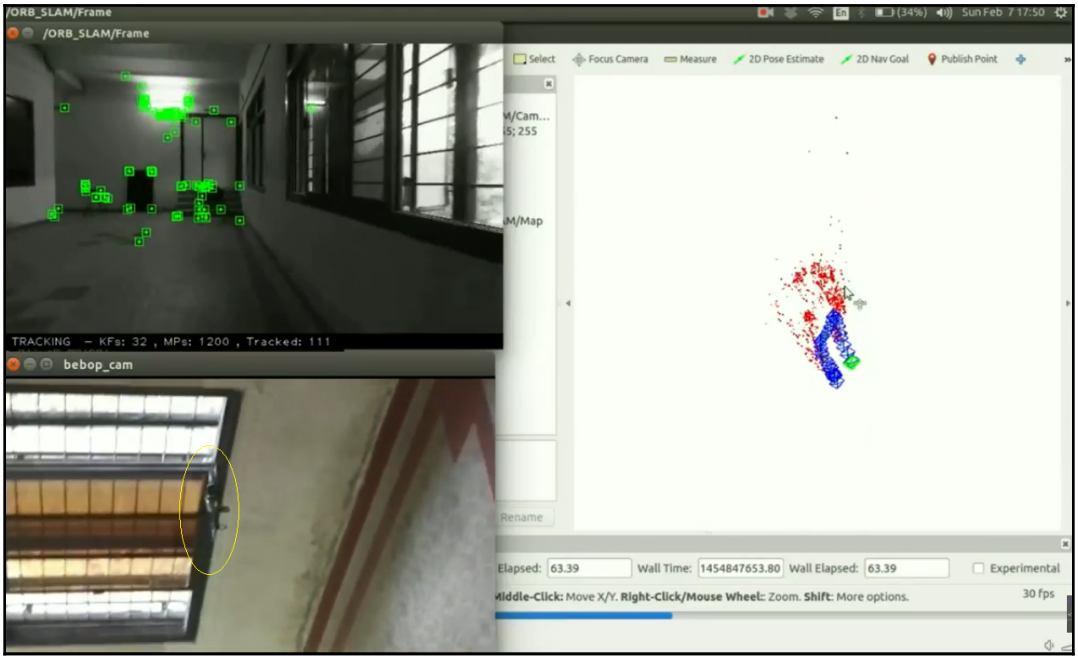


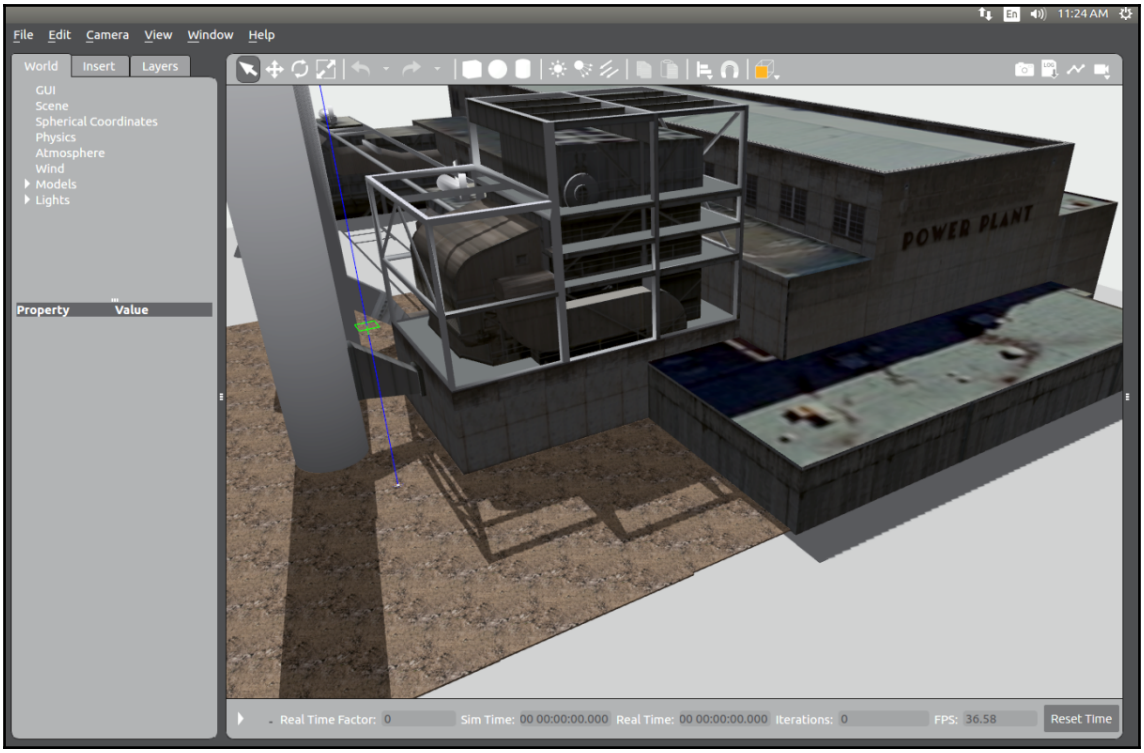

Position error
position error [m]
1.0
0.8
0.6
0.4
0.2
0.0
start evaluation
end evaluation
settling radius
8
10
12
14
16
18
20
time [s]
pos_error

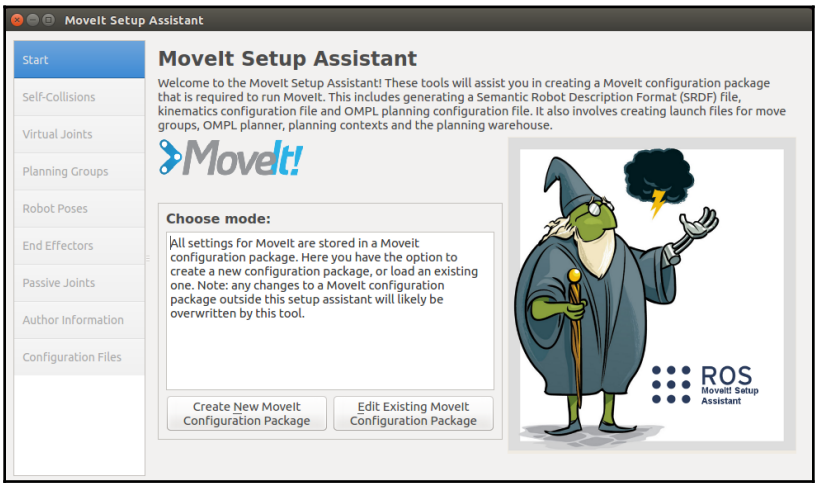

Angular Velocity
angular velocity [rad/s]
time [s]
start evaluation
end evaluation
x
y
z

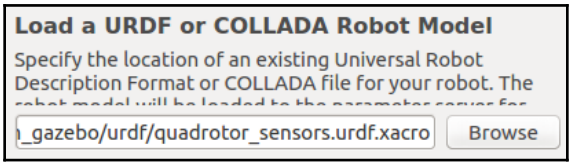

arm0_joint (fixed)
rotor0_joint (continuous)
arm0_link
arm1_joint (fixed)
arm3_joint (fixed)
arm1_link
arm3_link
rotor1_link
rotor2_link
rotor3_link
rotor1_joint (continuous)
rotor3_joint (continuous)
rotor2_joint (continuous)
arm2_joint (fixed)
base_link

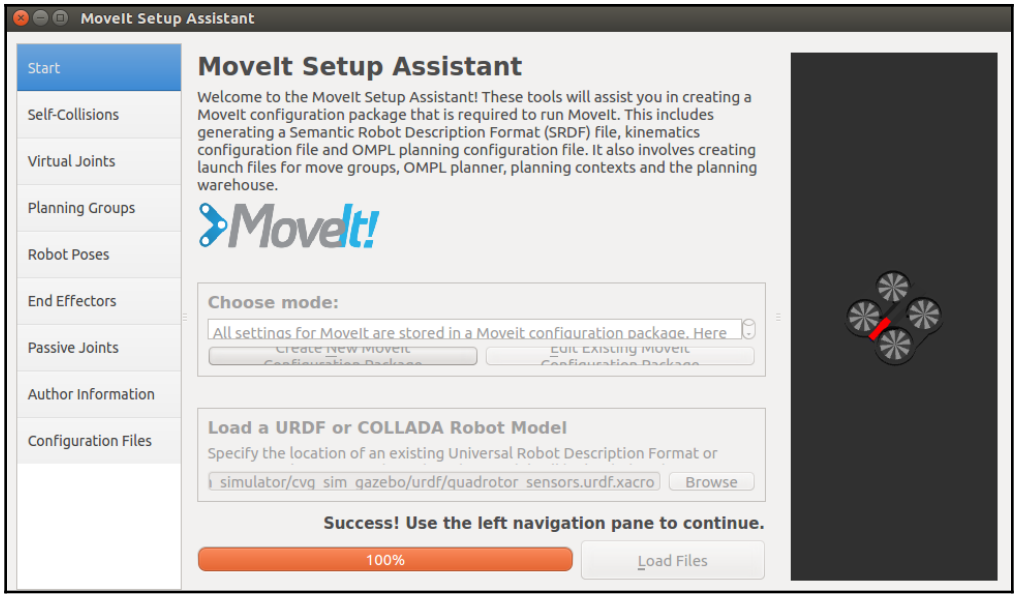

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Property Value
Real Time Factor: 0.99
Sim Time: 00 00:00:31.700
Real Time: 00 00:00:32.324

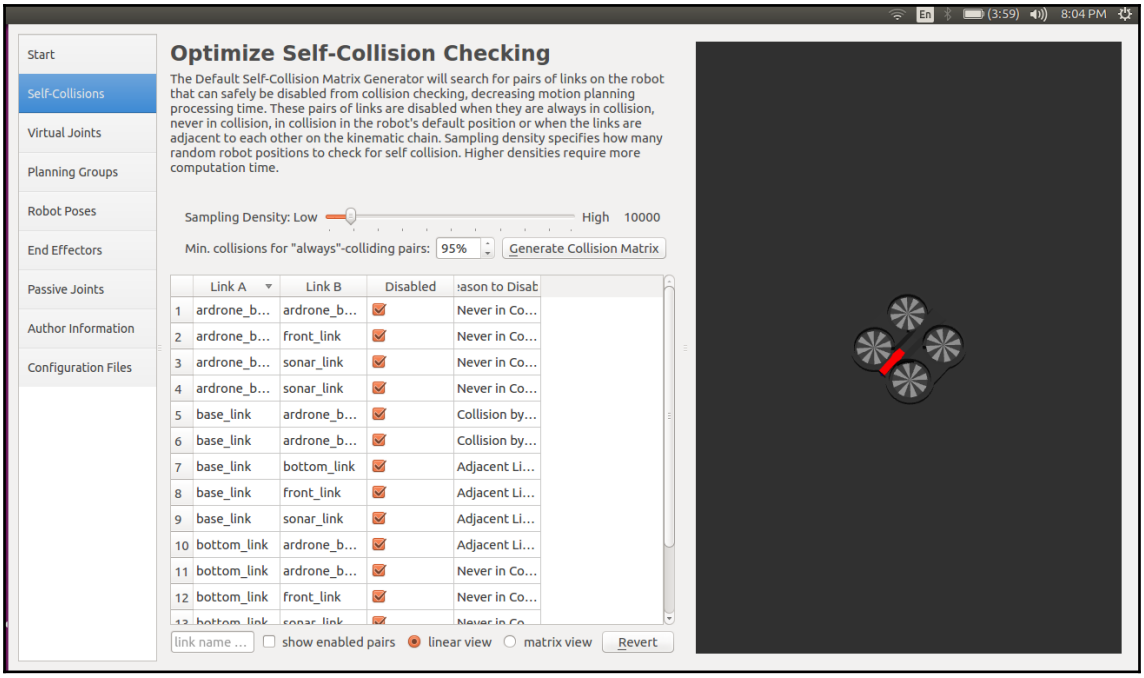

/ORB_SLAM/Frame
/ORB_SLAM/Frame
TRACKING – KFs: 32 , MPs: 1200 , Tracked: 111
bebop_cam
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Rename
Elapsed: 63.39
Wall Time: 1454847653.80
Wall Elapsed: 63.39
Experimental
Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
30 fps

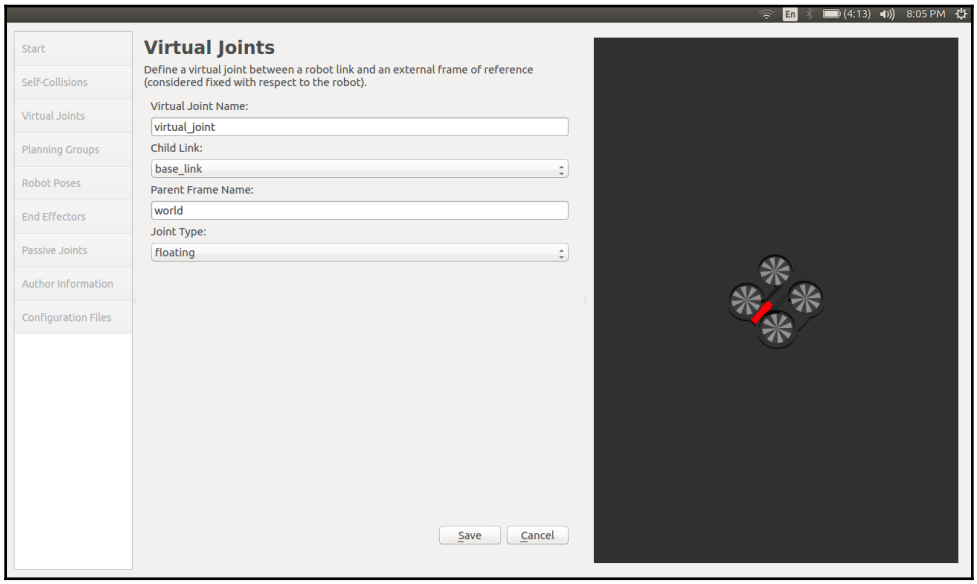

11:24 AM
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
POWER PLANT
Real Time Factor: 0 Sim Time: 00 00:00:00.000 Real Time: 00 00:00:00.000 Iterations: 0 FPS: 36.58
Reset Time

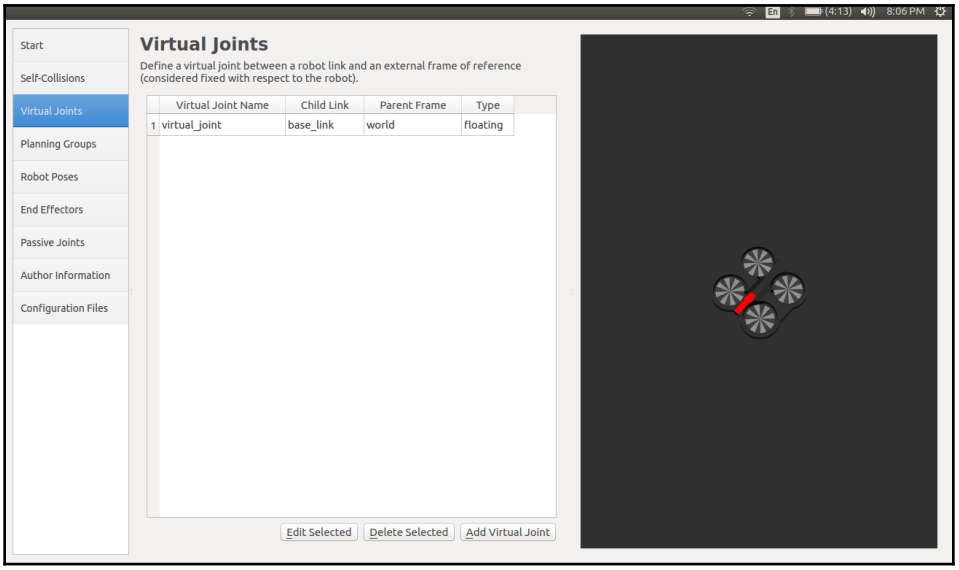

MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
MoveIt Setup Assistant
Welcome to the MoveIt Setup Assistant! These tools will assist you in creating a MoveIt configuration package that is required to run MoveIt. This includes generating a Semantic Robot Description Format (SRDF) file, kinematics configuration file and OMPL planning configuration file. It also involves creating launch files for move groups, OMPL planner, planning contexts and the planning warehouse.
MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here you have the option to create a new configuration package, or load an existing one. Note: any changes to a MoveIt configuration package outside this setup assistant will likely be overwritten by this tool.
Create New MoveIt Configuration Package
Edit Existing MoveIt Configuration Package
ROS
MoveIt! Setup Assistant

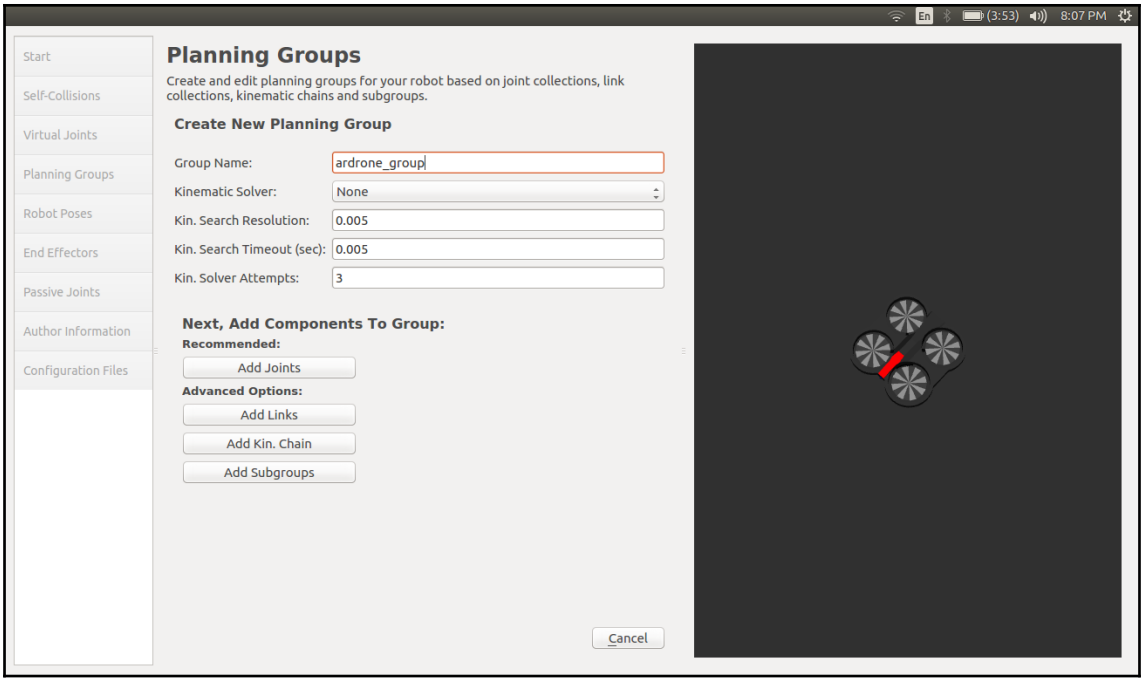

Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or COLLADA file for your robot. The
_gazebo/urdf/quadrotor_sensors.urdf.xacro
Browse

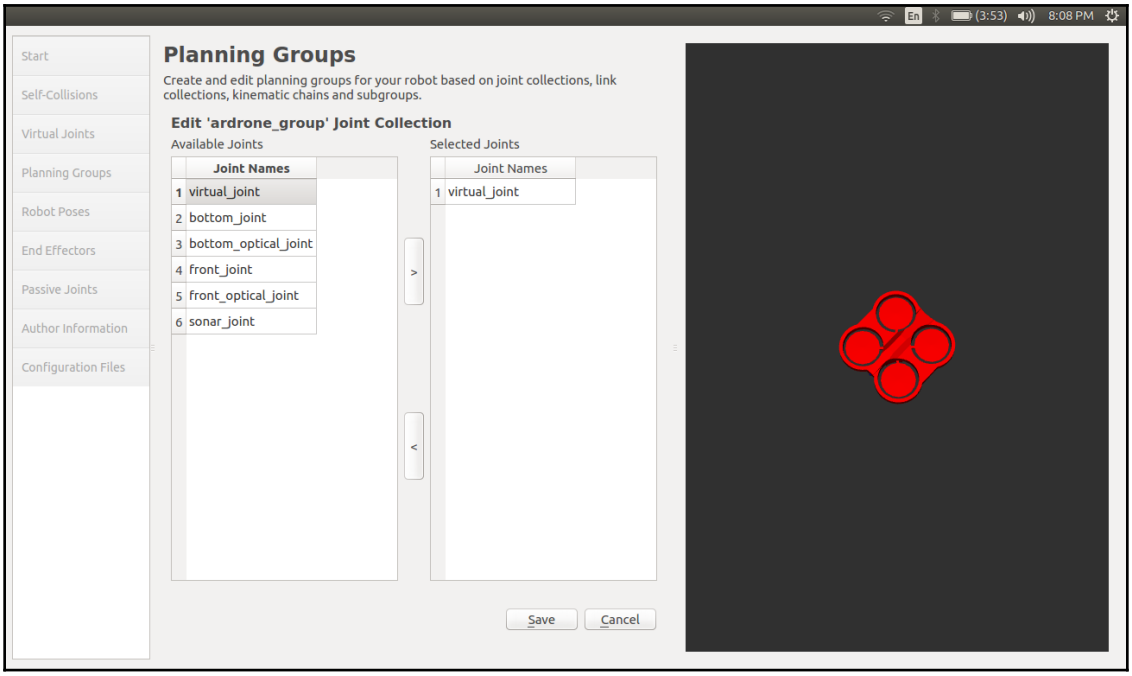

MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
MoveIt Setup Assistant
Welcome to the MoveIt Setup Assistant! These tools will assist you in creating a MoveIt configuration package that is required to run MoveIt. This includes generating a Semantic Robot Description Format (SRDF) file, kinematics configuration file and OMPL planning configuration file. It also involves creating launch files for move groups, OMPL planner, planning contexts and the planning warehouse.
MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here
Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or
simulator/cvg_sim_gazebo/urdf/quadrotor_sensors.urdf.xacro
Browse
Success! Use the left navigation pane to continue.
100%
Load Files

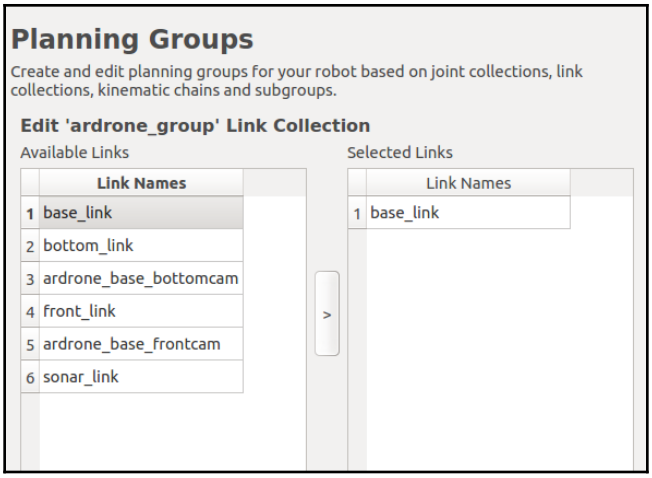

En
(3:59)
8:04 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Optimize Self-Collision Checking
The Default Self-Collision Matrix Generator will search for pairs of links on the robot that can safely be disabled from collision checking, decreasing motion planning processing time. These pairs of links are disabled when they are always in collision, never in collision, in collision in the robot's default position or when the links are adjacent to each other on the kinematic chain. Sampling density specifies how many random robot positions to check for self collision. Higher densities require more computation time.
Sampling Density: Low
High
10000
Min. collisions for "always"-colliding pairs:
95%
Generate Collision Matrix
Link A
Link B
Disabled
ason to Disab
1 ardrone_b... ardrone_b... Never in Co...
2 ardrone_b... front_link Never in Co...
3 ardrone_b... sonar_link Never in Co...
4 ardrone_b... sonar_link Never in Co...
5 base_link ardrone_b... Collision by...
6 base_link ardrone_b... Collision by...
7 base_link bottom_link Adjacent Li...
8 base_link front_link Adjacent Li...
9 base_link sonar_link Adjacent Li...
10 bottom_link ardrone_b... Adjacent Li...
11 bottom_link ardrone_b... Never in Co...
12 bottom_link front_link Never in Co...
link name ...
show enabled pairs
linear view
matrix view
Revert

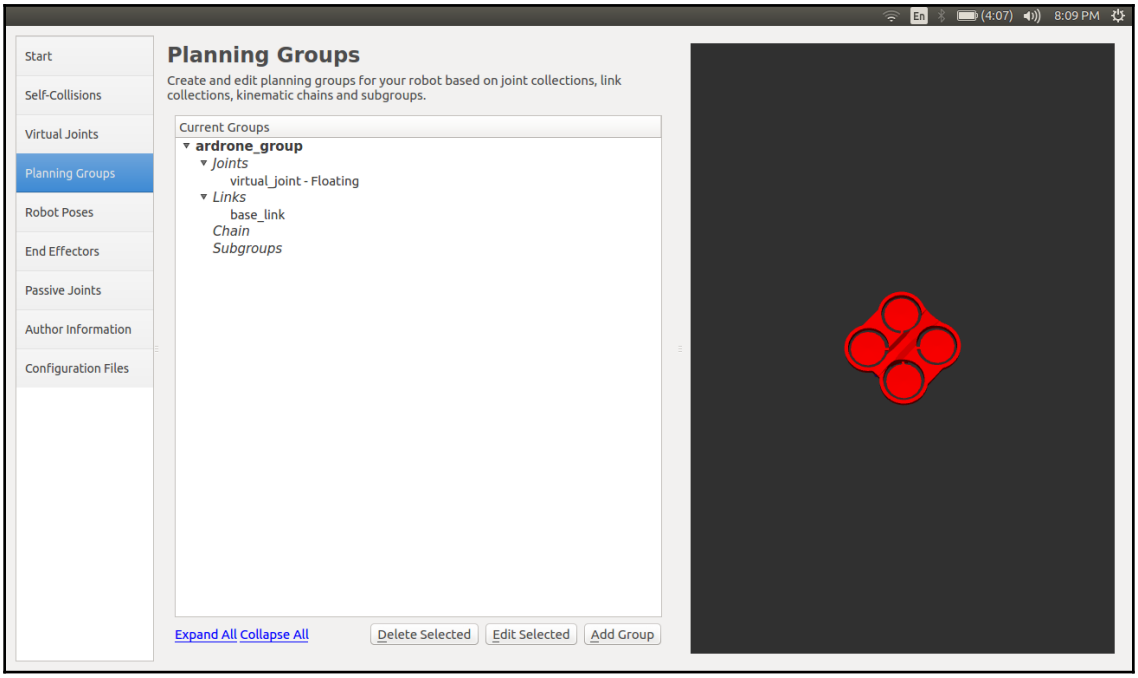

En
(4:13)
8:05 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Virtual Joints
Define a virtual joint between a robot link and an external frame of reference (considered fixed with respect to the robot).
Virtual Joint Name:
virtual_joint
Child Link:
base_link
Parent Frame Name:
world
Joint Type:
floating
Save
Cancel

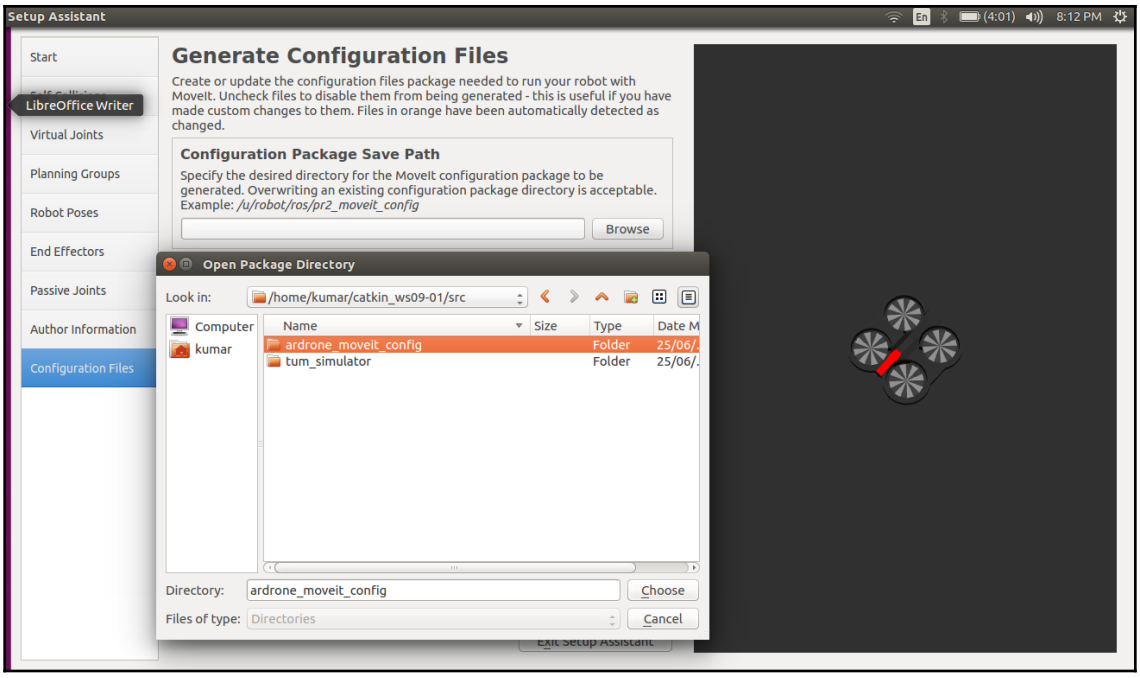

En
(4:13)
8:06 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Virtual Joints
Define a virtual joint between a robot link and an external frame of reference (considered fixed with respect to the robot).
Virtual Joint Name
Child Link
Parent Frame
Type
1
virtual_joint
base_link
world
floating
Edit Selected
Delete Selected
Add Virtual Joint

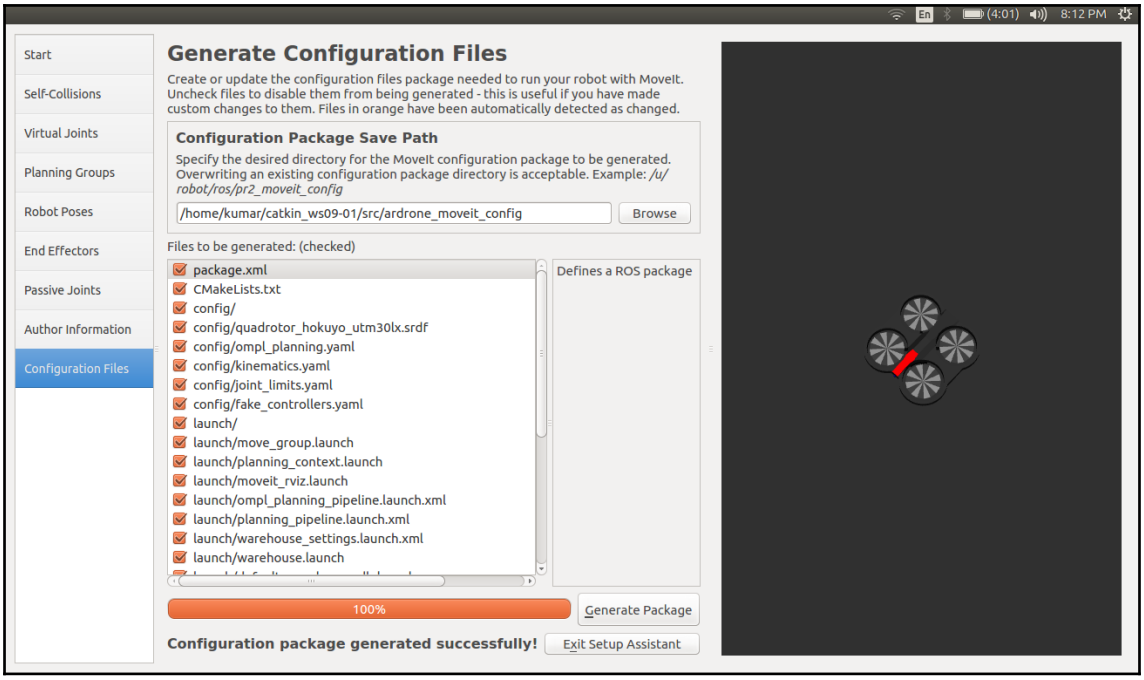

En
(3:53)
8:07 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Create New Planning Group
Group Name:
ardrone_group
Kinematic Solver:
None
Kin. Search Resolution:
0.005
Kin. Search Timeout (sec):
0.005
Kin. Solver Attempts:
3
Next, Add Components To Group:
Recommended:
Add Joints
Advanced Options:
Add Links
Add Kin. Chain
Add Subgroups
Cancel

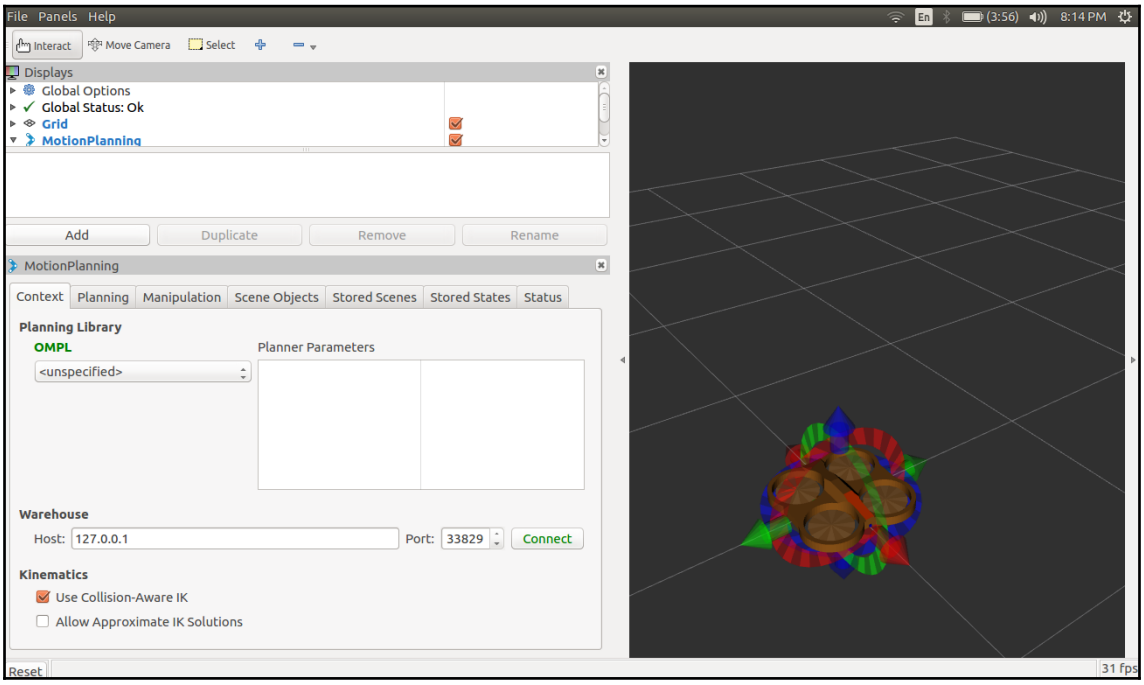

En
(3:53)
8:08 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Edit 'ardrone_group' Joint Collection
Available Joints
Joint Names
1 virtual_joint
2 bottom_joint
3 bottom_optical_joint
4 front_joint
5 front_optical_joint
6 sonar_joint
>
<
Selected Joints
Joint Names
1 virtual_joint
Save
Cancel

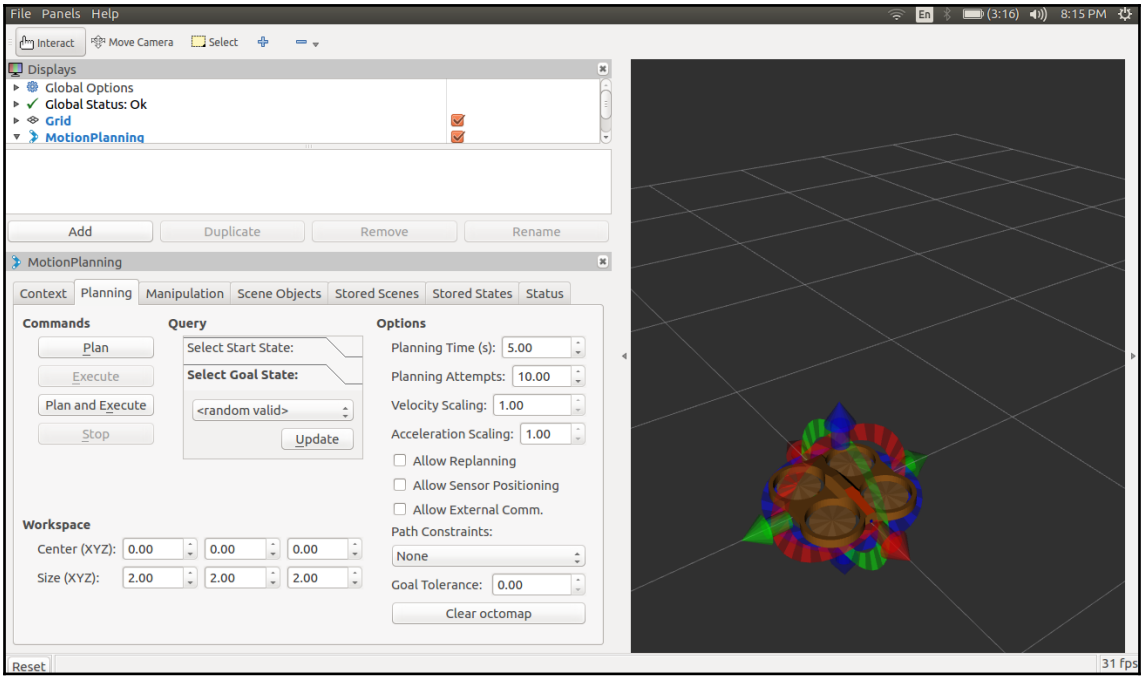

Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Edit 'ardrone_group' Link Collection
Available Links
Link Names
1 base_link
2 bottom_link
3 ardrone_base_bottomcam
4 front_link
5 ardrone_base_frontcam
6 sonar_link
>
Selected Links
Link Names
1 base_link

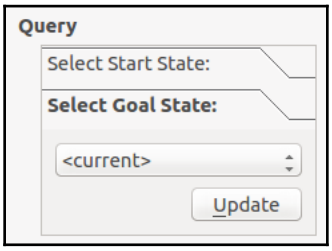

En
(4:07)
8:09 PM
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Current Groups
ardrone_group
Joints
virtual_joint - Floating
Links
base_link
Chain
Subgroups
Expand All Collapse All
Delete Selected
Edit Selected
Add Group

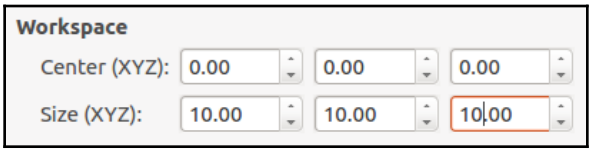

Setup Assistant
En
(4:01)
8:12 PM
Start
LibreOffice Writer
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. Uncheck files to disable them from being generated - this is useful if you have made custom changes to them. Files in orange have been automatically detected as changed.
Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
Browse
Open Package Directory
Look in:
/home/kumar/catkin_ws09-01/src
Computer
kumar
Name
Size
Type
Date M
ardrone_moveit_config
Folder
tum_simulator
Folder
Directory:
ardrone_moveit_config
Choose
Files of type:
Directories
Cancel

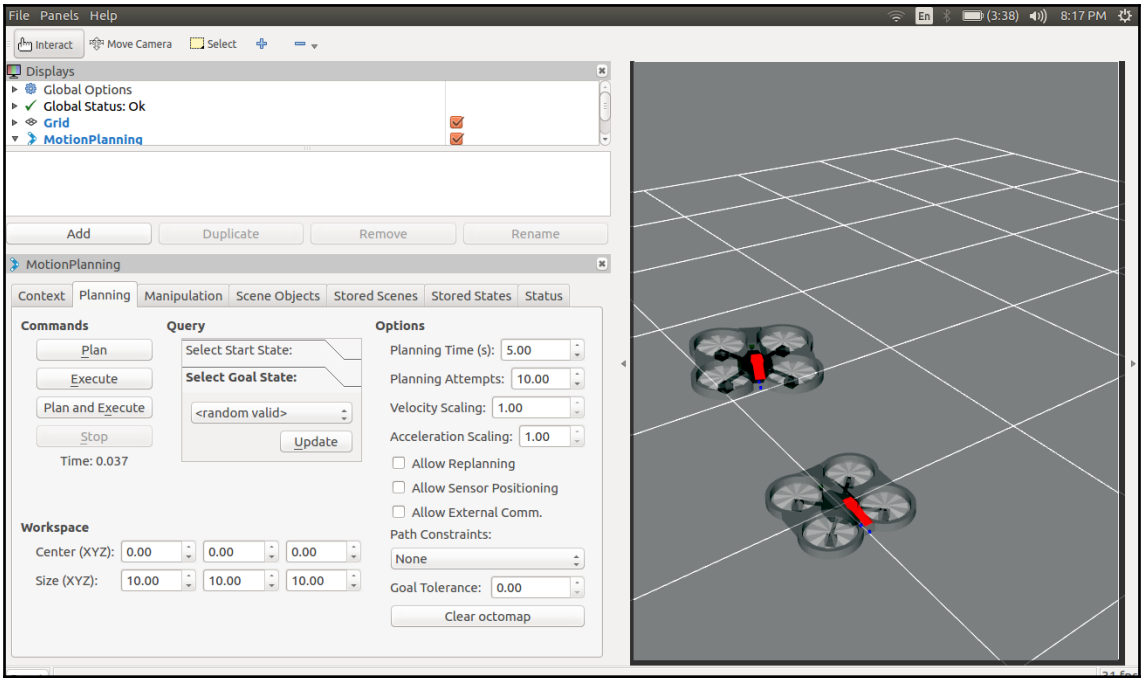

Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. Uncheck files to disable them from being generated - this is useful if you have made custom changes to them. Files in orange have been automatically detected as changed.
Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
/home/kumar/catkin_ws09-01/src/ardrone_moveit_config
Browse
Files to be generated: (checked)
package.xml
CMakeLists.txt
config/
config/quadrotor_hokuyo_utm30lx.srdf
config/ompl_planning.yaml
config/kinematics.yaml
config/joint_limits.yaml
config/fake_controllers.yaml
launch/
launch/move_group.launch
launch/planning_context.launch
launch/moveit_rviz.launch
launch/ompl_planning_pipeline.launch.xml
launch/planning_pipeline.launch.xml
launch/warehouse_settings.launch.xml
launch/warehouse.launch
Defines a ROS package
100%
Generate Package
Configuration package generated successfully!
Exit Setup Assistant

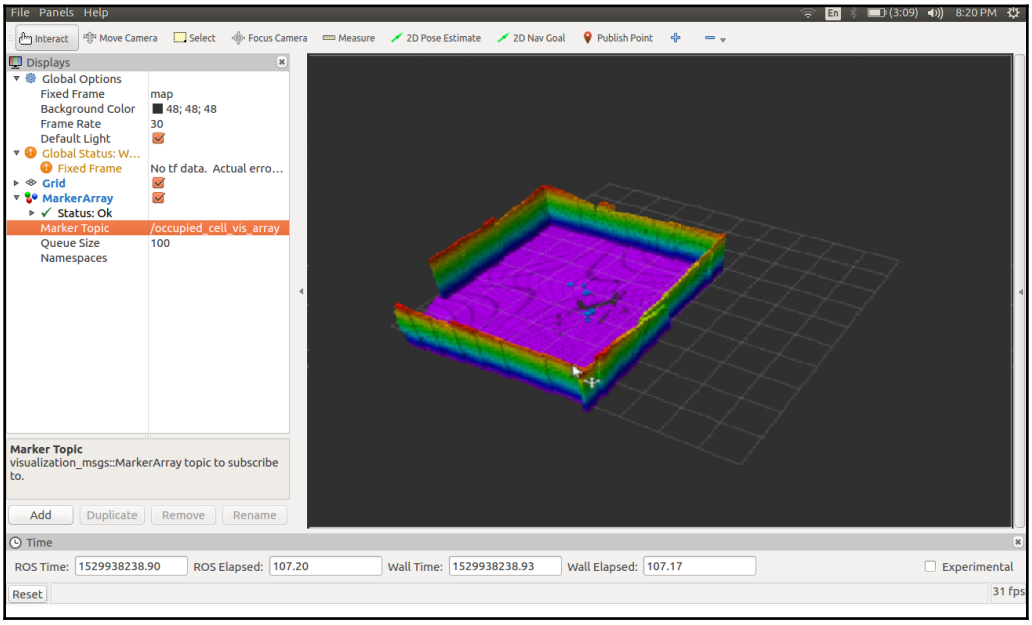

File Panels Help
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Planner Parameters
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions
Reset
31 fps

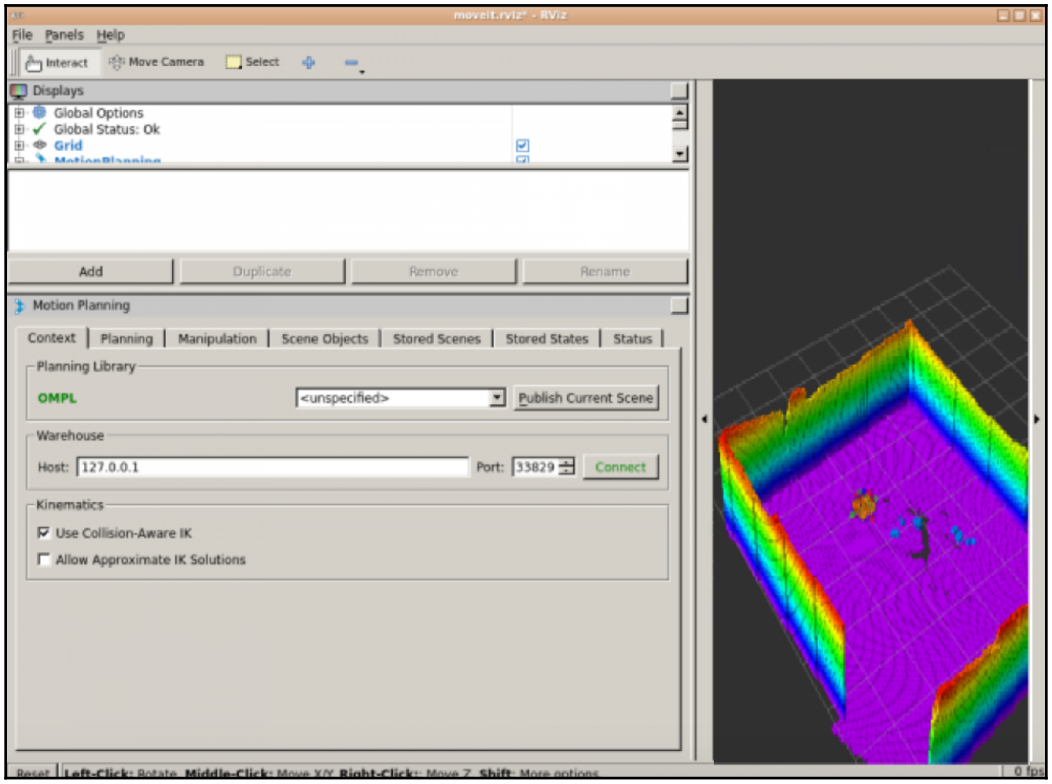

File Panels Help
8:15 PM
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Query
Select Start State:
Select Goal State:
<random valid>
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00
Reset
31 fps

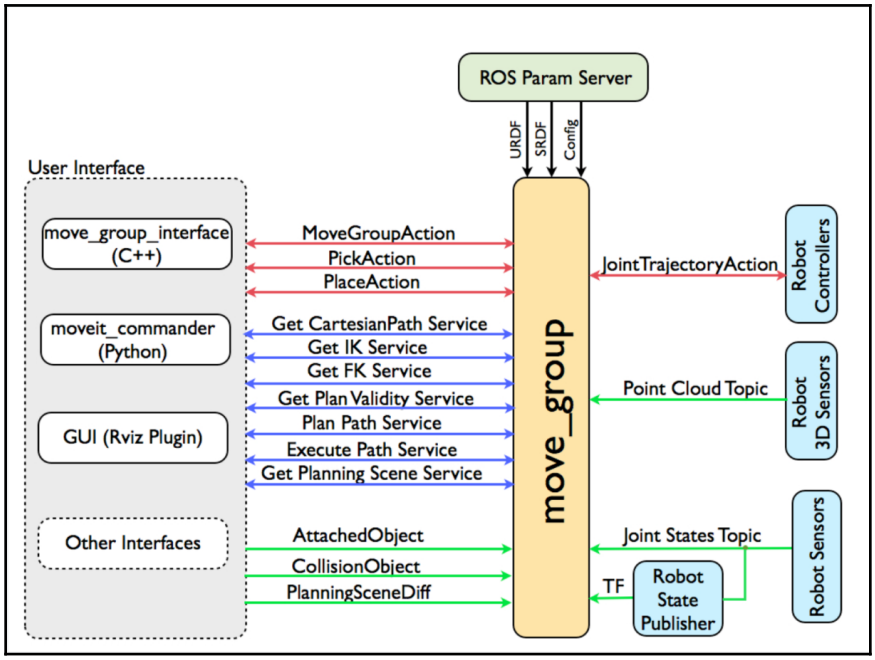

Query
Select Start State:
Select Goal State:
<current>
Update


Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 10.00 10.00 10.00


File Panels Help
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Time: 0.037
Query
Select Start State:
Select Goal State:
<random valid>
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 10.00 10.00 10.00


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: W...
Fixed Frame No tf data. Actual erro...
Grid
MarkerArray
Status: Ok
Marker Topic /occupied_cell_vis_array
Queue Size 100
Namespaces
Marker Topic
visualization_msgs::MarkerArray topic to subscribe to.
Add
Duplicate
Remove
Rename
Time
ROS Time: 1529938238.90
ROS Elapsed: 107.20
Wall Time: 1529938238.93
Wall Elapsed: 107.17
Experimental
Reset
31 fps

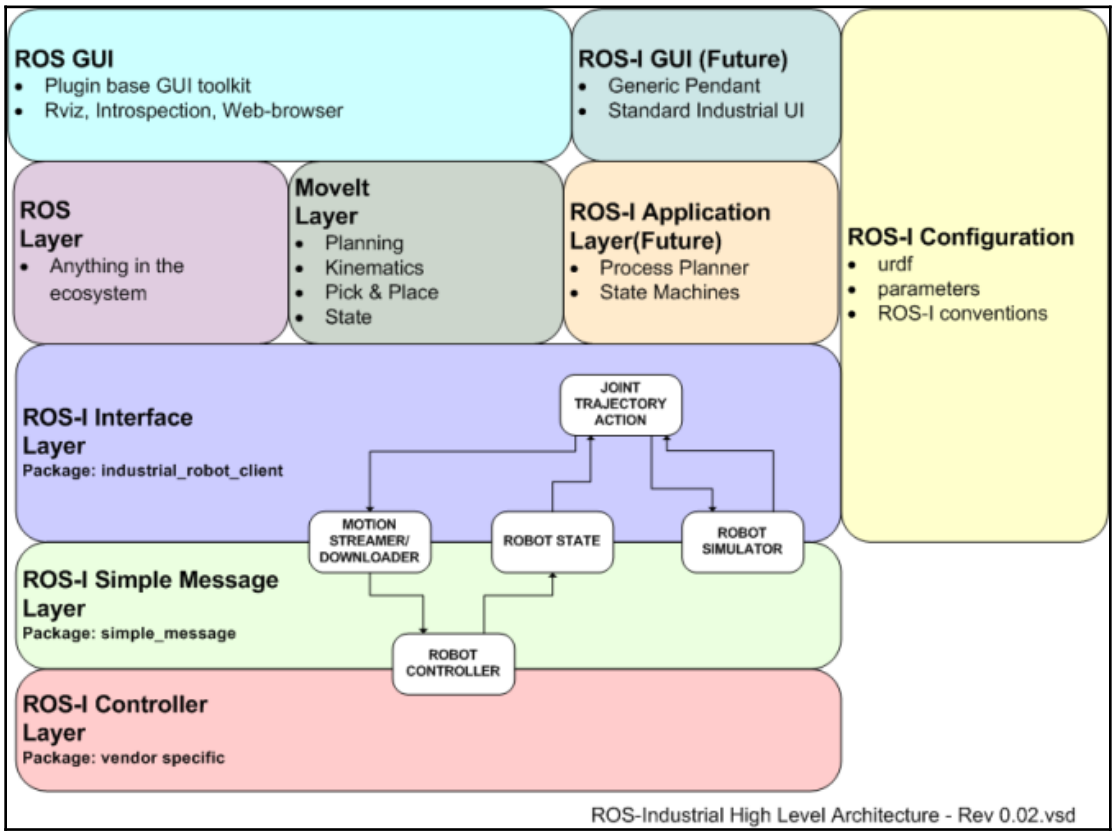

moveit.rviz* - RViz
File Panels Help
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
Add
Duplicate
Remove
Rename
Motion Planning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Planning Library
OMPL
<unspecified>
Publish Current Scene
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Kinematics
Use Collision-Aware IK
Allow Approximate IK Solutions
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click: Move Z. Shift: More options.
0 fps

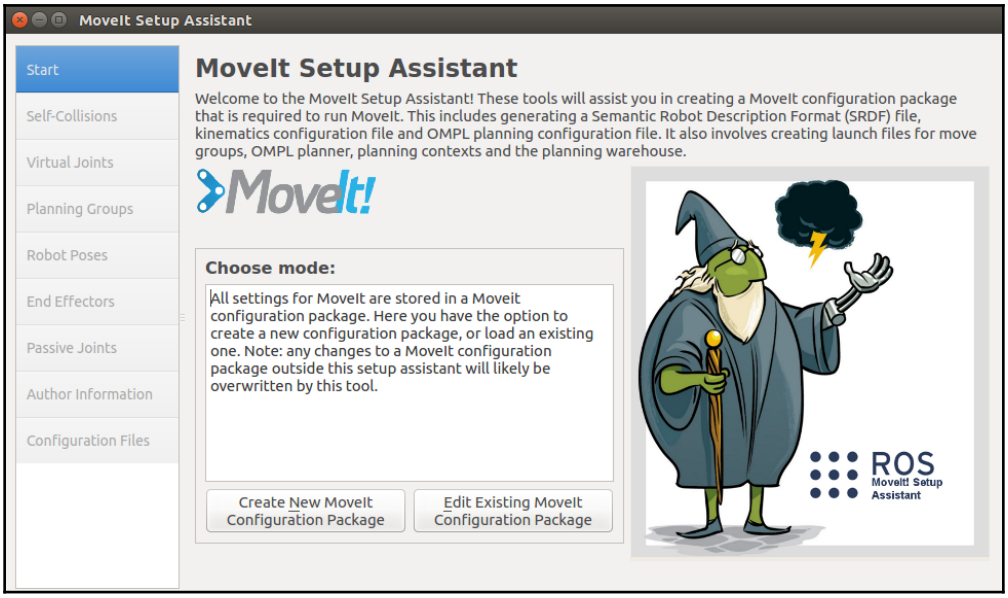

ROS Param Server
URDF
SRDF
Config
User Interface
move_group_interface (C++)
moveit_commander (Python)
GUI (Rviz Plugin)
Other Interfaces
MoveGroupAction
PickAction
PlaceAction
Get CartesianPath Service
Get IK Service
Get FK Service
Get Plan Validity Service
Plan Path Service
Execute Path Service
Get Planning Scene Service
AttachedObject
CollisionObject
PlanningSceneDiff
move_group
JointTrajectoryAction
Point Cloud Topic
Joint States Topic
TF
Robot State Publisher
Robot Controllers
Robot 3D Sensors
Robot Sensors

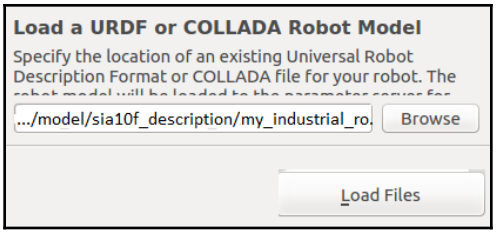

Parrot AR Drone
Parrot Bebop Drone

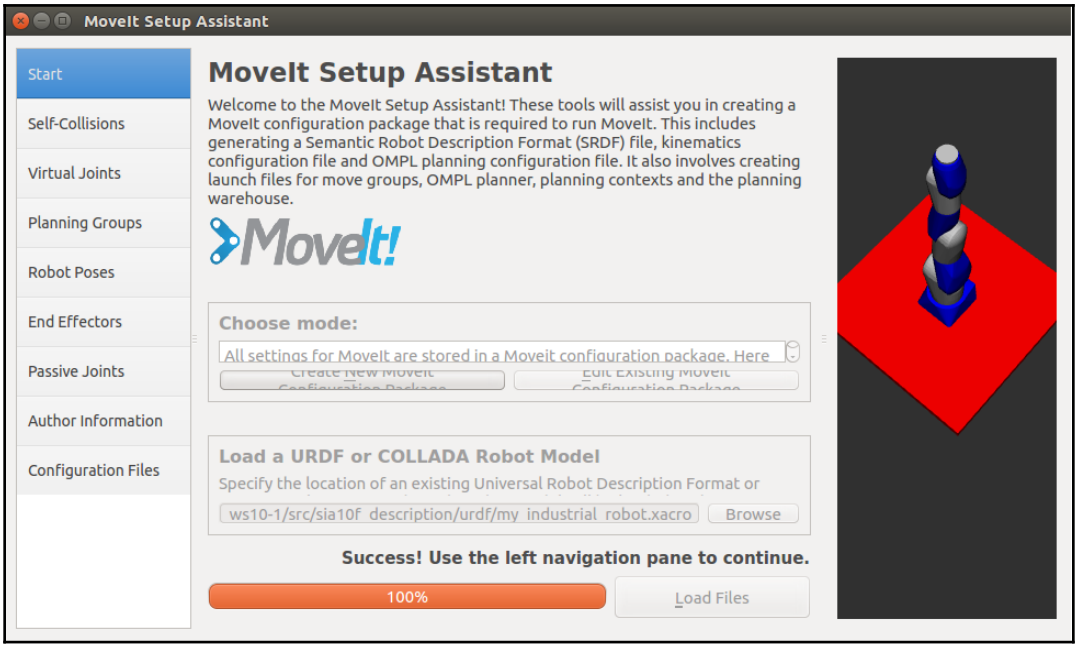

Pelican/Hummingbird
Firefly

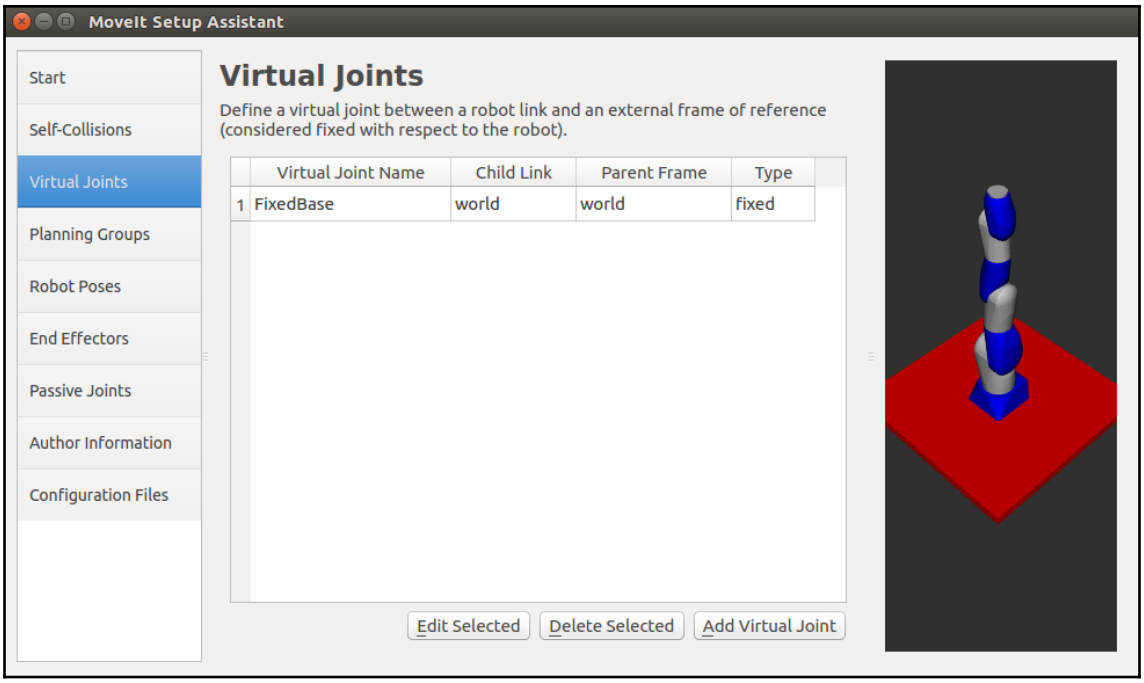
Chapter 10: ROS-Industrial (ROS-I)

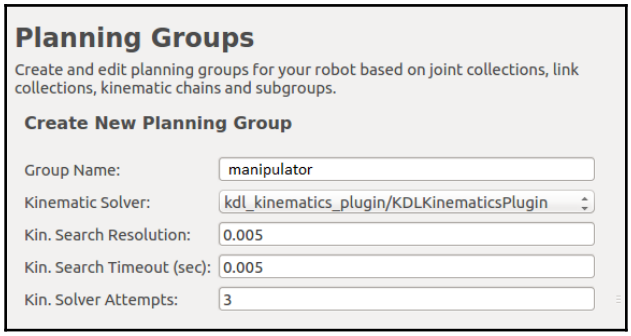


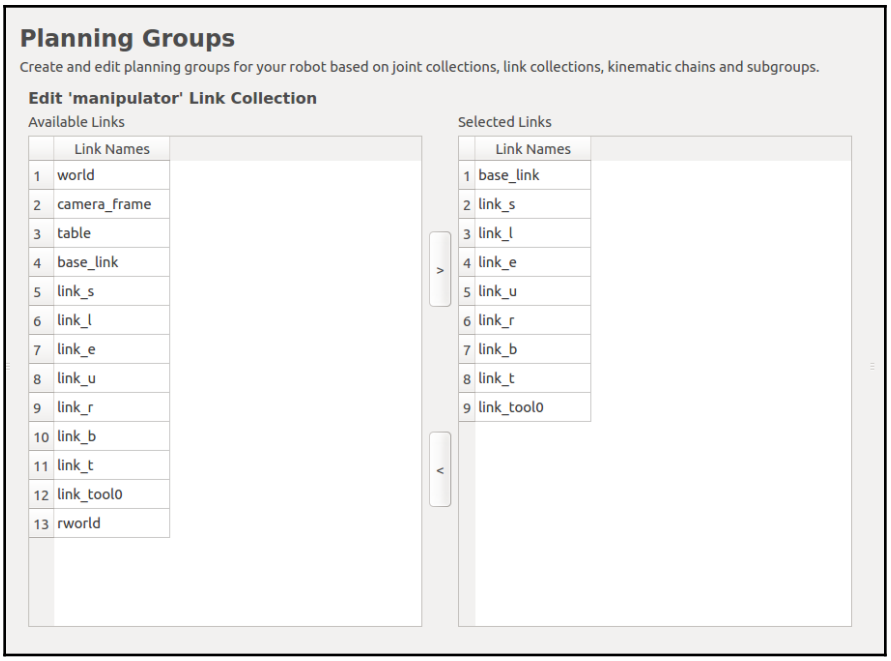

MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
MoveIt Setup Assistant
Welcome to the MoveIt Setup Assistant! These tools will assist you in creating a MoveIt configuration package that is required to run MoveIt. This includes generating a Semantic Robot Description Format (SRDF) file, kinematics configuration file and OMPL planning configuration file. It also involves creating launch files for move groups, OMPL planner, planning contexts and the planning warehouse.
MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here you have the option to create a new configuration package, or load an existing one. Note: any changes to a MoveIt configuration package outside this setup assistant will likely be overwritten by this tool.
Create New MoveIt Configuration Package
Edit Existing MoveIt Configuration Package
ROS
MoveIt! Setup Assistant


Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or COLLADA file for your robot. The
.../model/sia10f_description/my_industrial_ro.
Browse
Load Files


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
MoveIt Setup Assistant
Welcome to the MoveIt Setup Assistant! These tools will assist you in creating a MoveIt configuration package that is required to run MoveIt. This includes generating a Semantic Robot Description Format (SRDF) file, kinematics configuration file and OMPL planning configuration file. It also involves creating launch files for move groups, OMPL planner, planning contexts and the planning warehouse.
MoveIt!
Choose mode:
All settings for MoveIt are stored in a MoveIt configuration package. Here
Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or
ws10-1/src/sia10f_description/urdf/my_industrial_robot.xacro
Browse
Success! Use the left navigation pane to continue.
100%
Load Files


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Virtual Joints
Define a virtual joint between a robot link and an external frame of reference (considered fixed with respect to the robot).
Virtual Joint Name
Child Link
Parent Frame
Type
1
FixedBase
world
world
fixed
Edit Selected
Delete Selected
Add Virtual Joint


Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Create New Planning Group
Group Name:
manipulator
Kinematic Solver:
kdl_kinematics_plugin/KDLKinematicsPlugin
Kin. Search Resolution:
0.005
Kin. Search Timeout (sec):
0.005
Kin. Solver Attempts:
3


Planning Groups
Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.
Edit 'manipulator' Link Collection
Available Links
Link Names
1 world
2 camera_frame
3 table
4 base_link
5 link_s
6 link_l
7 link_e
8 link_u
9 link_r
10 link_b
11 link_t
12 link_tool0
13 rworld
>
<
Selected Links
Link Names
1 base_link
2 link_s
3 link_l
4 link_e
5 link_u
6 link_r
7 link_b
8 link_t
9 link_tool0

Planning Groups

Create and edit planning groups for your robot based on joint collections, link collections, kinematic chains and subgroups.

Current Groups

- **manipulator**
  - *Joints*
    - joint_t - Revolute
    - joint_b - Revolute
    - joint_r - Revolute
    - joint_e - Revolute
    - joint_u - Revolute
    - joint_l - Revolute
    - joint_s - Revolute
    - table_to_robot - Fixed
  - *Links*
    - base_link
    - link_s
    - link_l
    - link_e
    - link_u
    - link_r
    - link_b
    - link_t
    - link_tool0
  - *Chain*
  - *Subgroups*

MoveIt Setup Assistant

- Start
- Self-Collisions
- Virtual Joints
- Planning Groups
- Robot Poses
- End Effectors
- Passive Joints
- Author Information
- Configuration Files

Robot Poses

Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like *folded arms*.

Pose Name: allZeros

Planning Group: manipulator

joint_s 0.0

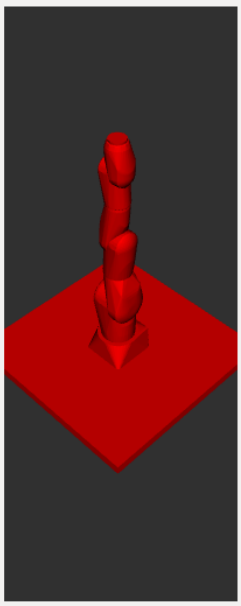
joint_l 0.0

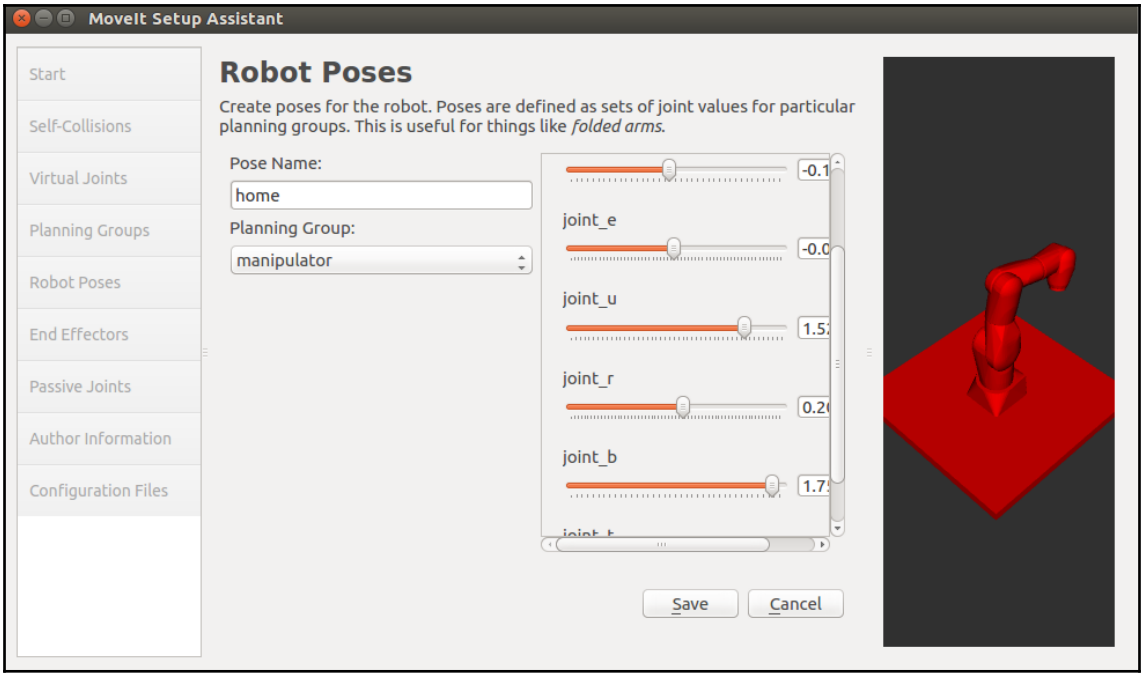
joint_e 0.0

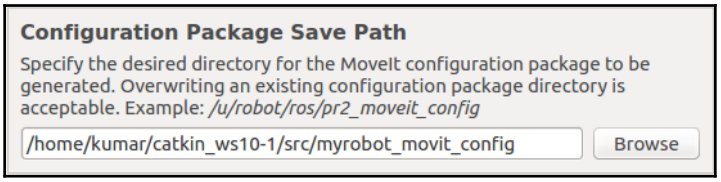
joint_u 0.0

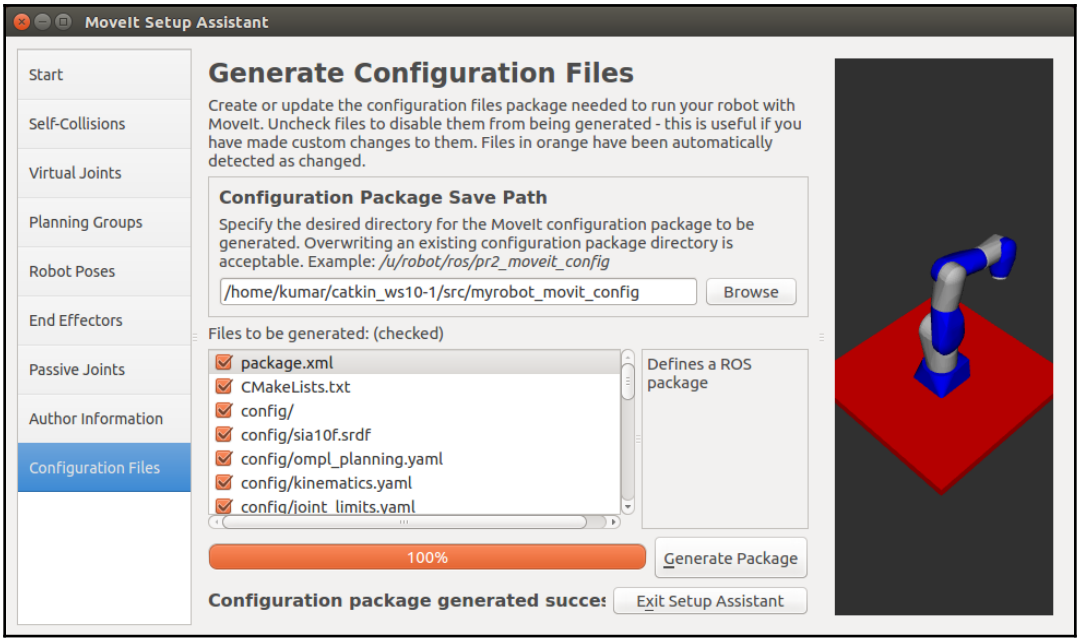
joint_r 0.0

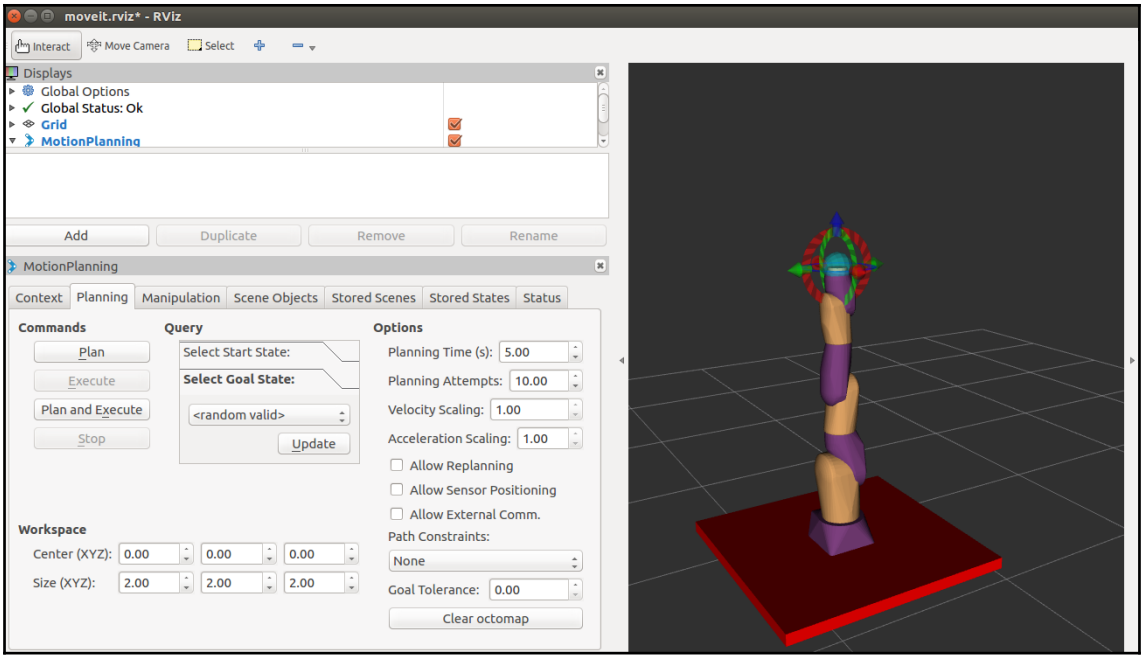
Save Cancel



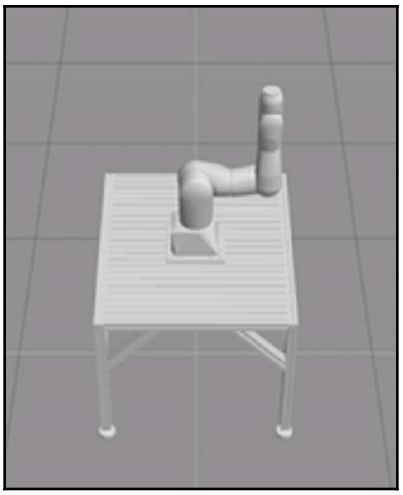

MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Robot Poses
Create poses for the robot. Poses are defined as sets of joint values for particular planning groups. This is useful for things like folded arms.
Pose Name:
home
Planning Group:
manipulator
joint_e
joint_u
joint_r
joint_b
Save
Cancel

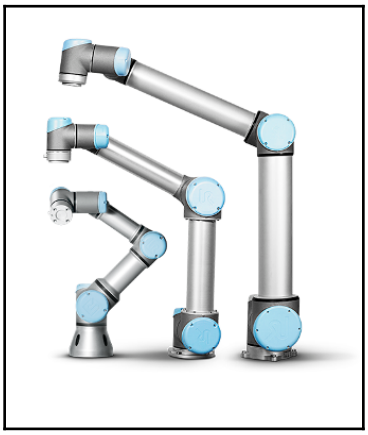

Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
/home/kumar/catkin_ws10-1/src/myrobot_movit_config
Browse


MoveIt Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
Author Information
Configuration Files
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. Uncheck files to disable them from being generated - this is useful if you have made custom changes to them. Files in orange have been automatically detected as changed.
Configuration Package Save Path
Specify the desired directory for the MoveIt configuration package to be generated. Overwriting an existing configuration package directory is acceptable. Example: /u/robot/ros/pr2_moveit_config
/home/kumar/catkin_ws10-1/src/myrobot_movit_config
Browse
Files to be generated: (checked)
package.xml
CMakeLists.txt
config/
config/sia10f.srdf
config/ompl_planning.yaml
config/kinematics.yaml
config/joint_limits.yaml
Defines a ROS package
100%
Generate Package
Configuration package generated succes
Exit Setup Assistant


moveit.rviz* - RViz
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Stop
Query
Select Start State:
Select Goal State:
<random valid>
Update
Options
Planning Time (s): 5.00
Planning Attempts: 10.00
Velocity Scaling: 1.00
Acceleration Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00

```
/sia10f/joint_trajectory_controller/follow_joint_trajectory/cancel
/sia10f/joint_trajectory_controller/follow_joint_trajectory/feedback
/sia10f/joint_trajectory_controller/follow_joint_trajectory/goal
/sia10f/joint_trajectory_controller/follow_joint_trajectory/result
/sia10f/joint_trajectory_controller/follow_joint_trajectory/status
```





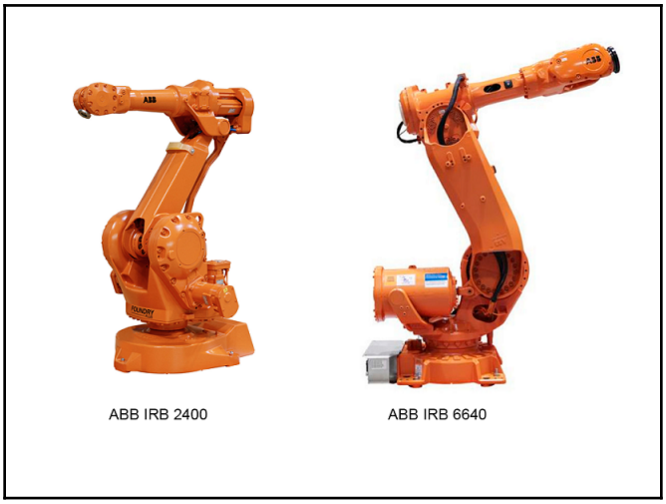
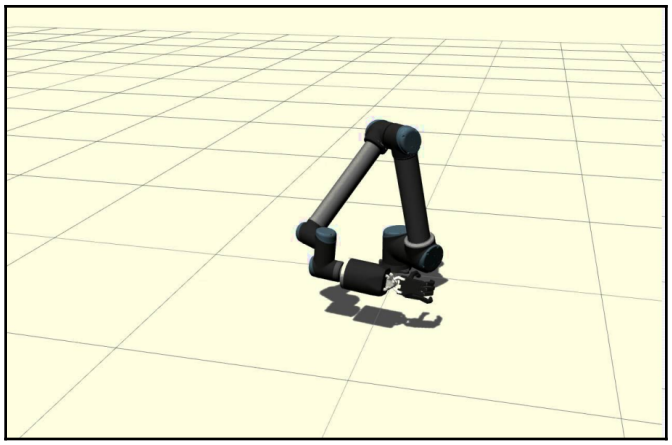
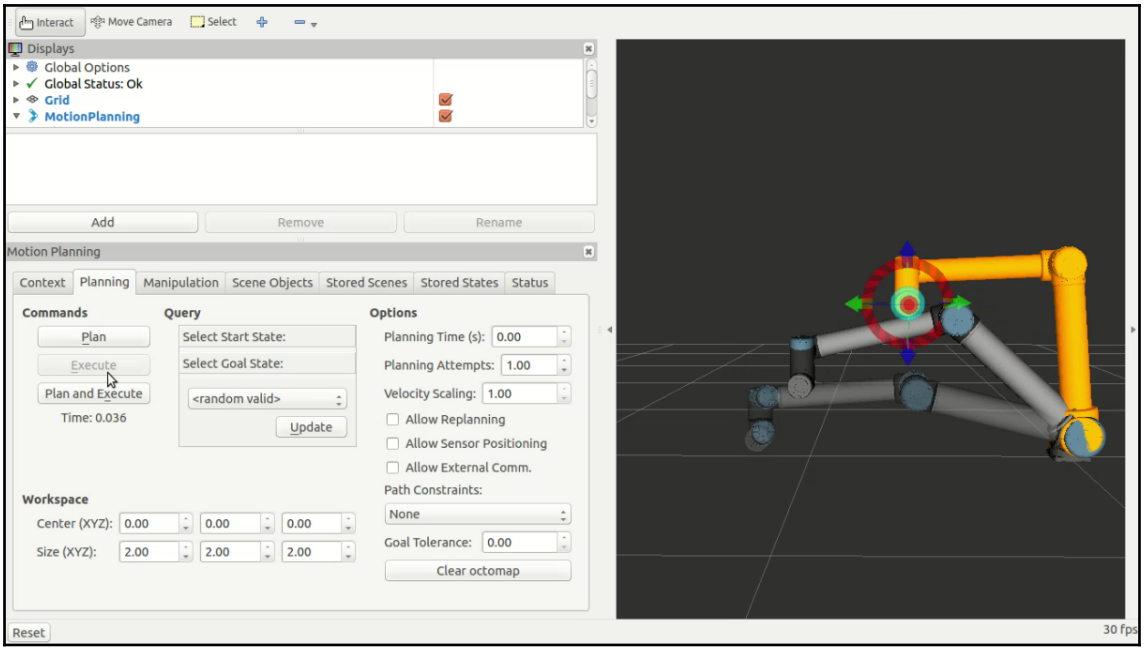
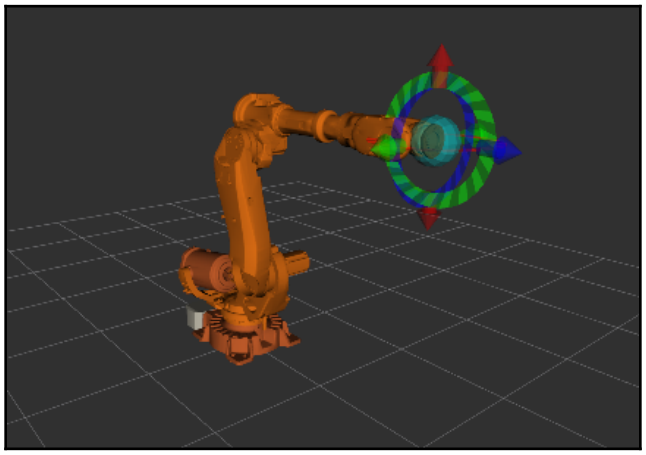


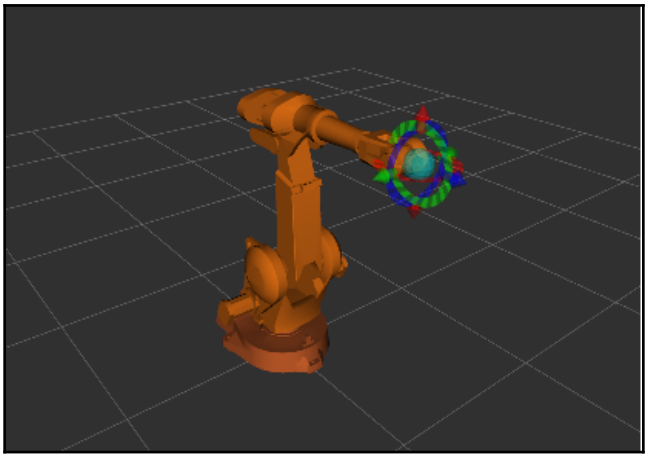
ABB IRB 2400

ABB IRB 6640




Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
MotionPlanning
Add
Remove
Rename
Motion Planning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Status
Commands
Plan
Execute
Plan and Execute
Time: 0.036
Query
Select Start State:
Select Goal State:
<random valid>
Update
Options
Planning Time (s): 0.00
Planning Attempts: 1.00
Velocity Scaling: 1.00
Allow Replanning
Allow Sensor Positioning
Allow External Comm.
Path Constraints:
None
Goal Tolerance: 0.00
Clear octomap
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00
Reset
30 fps

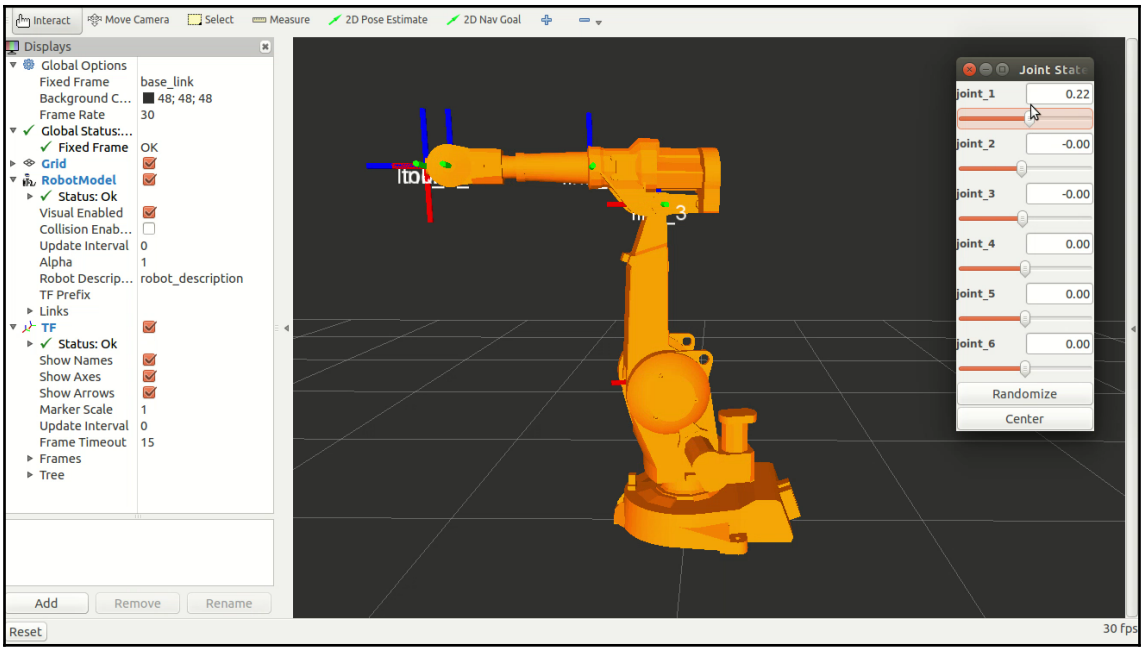


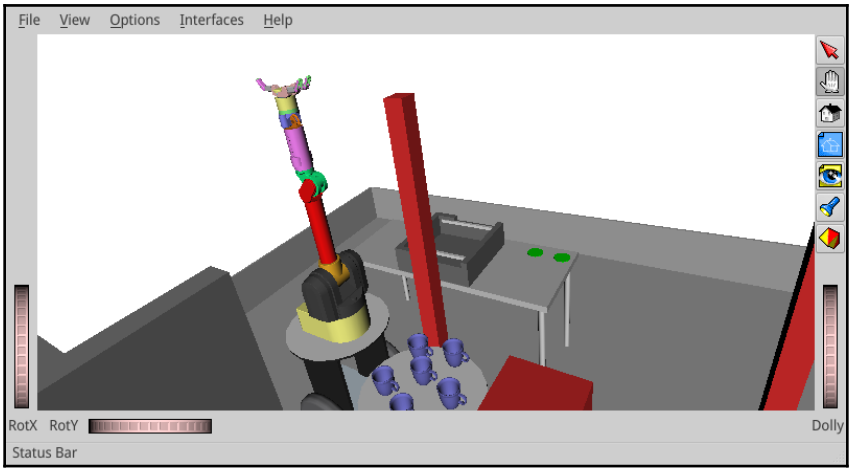


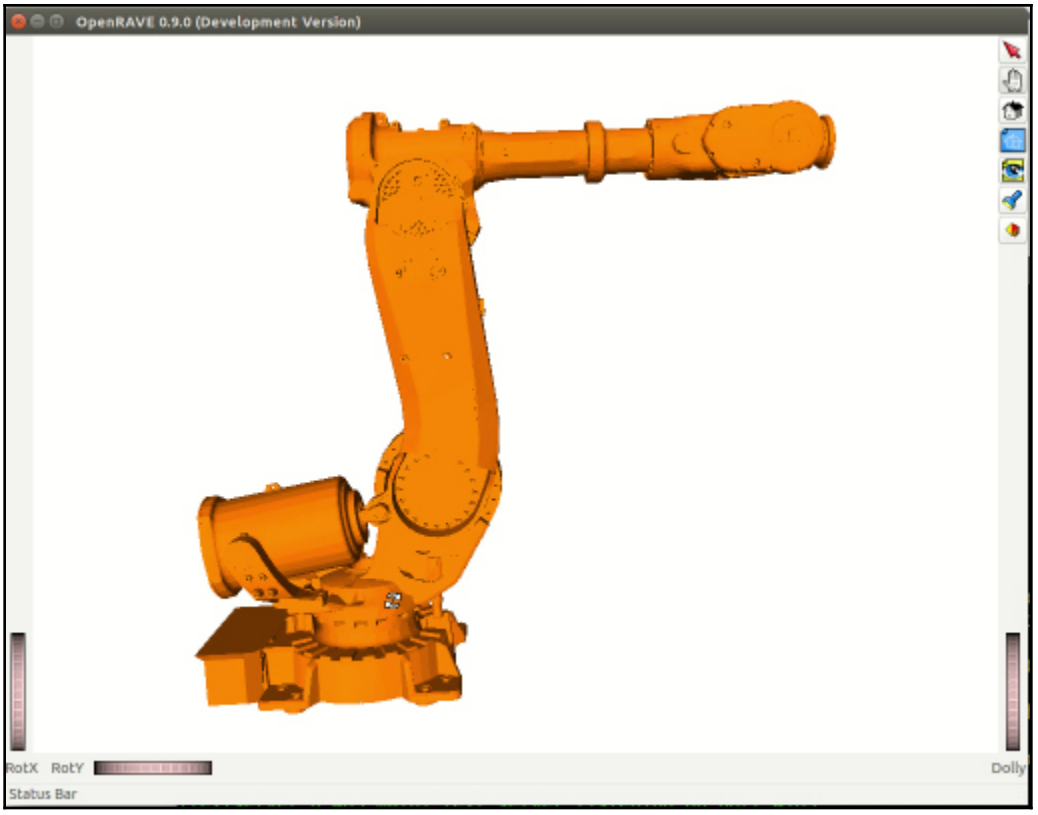
- config
- launch
- meshes
- tests
- urdf
- CHANGELOG.rst
- CMakeLists.txt
- package.xml
- readme.md

- load_irb2400.launch
- load_irb2400_12_155.launch
- robot_interface_download_irb2400.launch
- robot_state_visualize_irb2400.launch
- robot_state_visualize_irb2400_12_155.la...
- test_irb2400.launch
- test_irb2400_12_155.launch

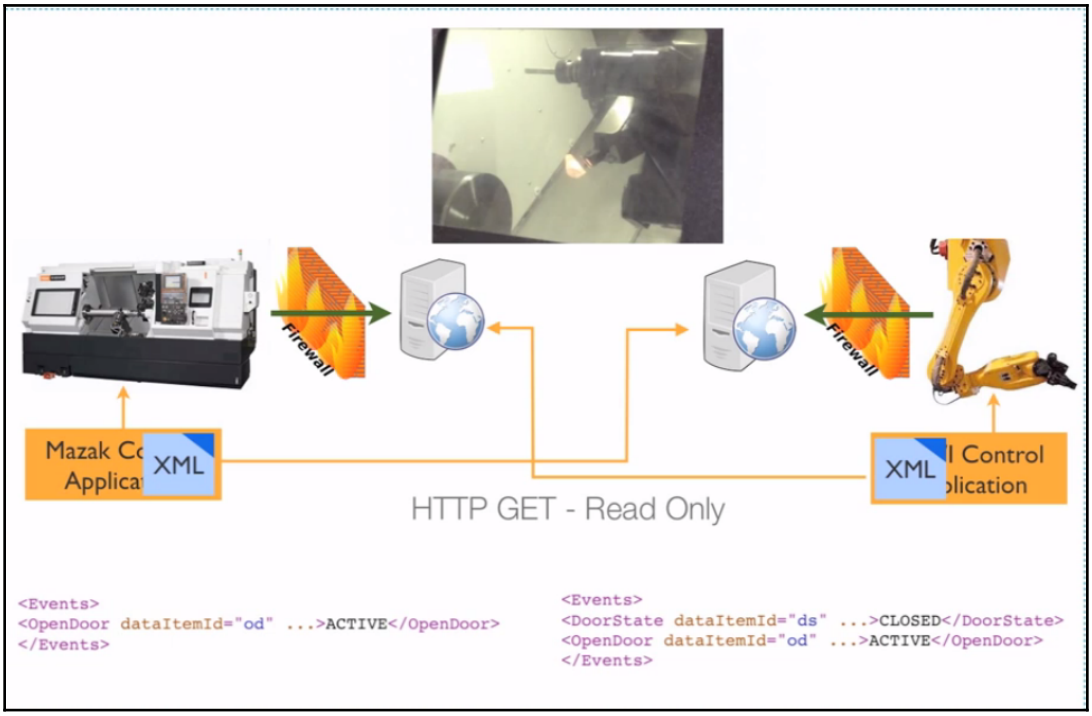

irb2400.urdf
irb2400.xacro
irb2400_12_155.xacro
irb2400_12_155_macro.xacro
irb2400_macro.xacro

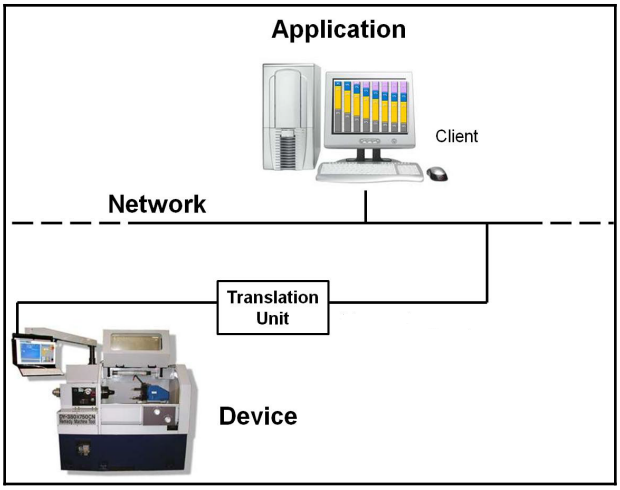

Interact
Move Camera
Select
Measure
2D Pose Estimate
2D Nav Goal
Displays
Global Options
Fixed Frame
base_link
Background C...
48; 48; 48
Frame Rate
30
Global Status:...
Fixed Frame
OK
Grid
RobotModel
Status: Ok
Visual Enabled
Collision Enab...
Update Interval
0
Alpha
1
Robot Descrip...
robot_description
TF Prefix
Links
TF
Status: Ok
Show Names
Show Axes
Show Arrows
Marker Scale
1
Update Interval
0
Frame Timeout
15
Frames
Tree
Add
Remove
Rename
Reset
Joint Stat
joint_1
0.22
joint_2
-0.00
joint_3
-0.00
joint_4
0.00
joint_5
0.00
joint_6
0.00
Randomize
Center
30 fps


File View Options Interfaces Help
RotX RotY
Dolly
Status Bar


OpenRAVE 0.9.0 (Development Version)
RotX RotY
Dolly
Status Bar

name	index	parents
base_link	0	
mounting_link	1	base_link
link1_rotate	2	mounting_link
link2	3	link1_rotate
link3	4	link2
link4	5	link3
link5	6	link4
link6_wrist	7	link5
tool_link	8	link6_wrist


Firewall
Firewall
XML
XML
HTTP GET - Read Only
<Events>
<OpenDoor dataItemId="od" ...>ACTIVE</OpenDoor>
</Events>
<Events>
<DoorState dataItemId="ds" ...>CLOSED</DoorState>
<OpenDoor dataItemId="od" ...>ACTIVE</OpenDoor>
</Events>


Application
Client
Network
Translation Unit
Device

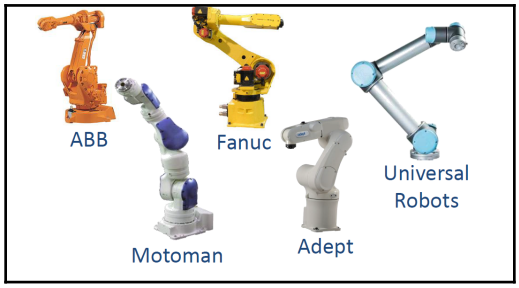
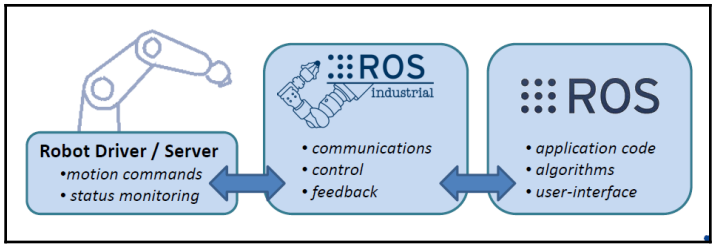
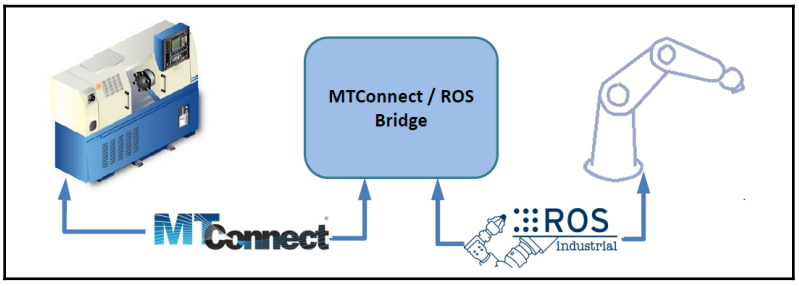
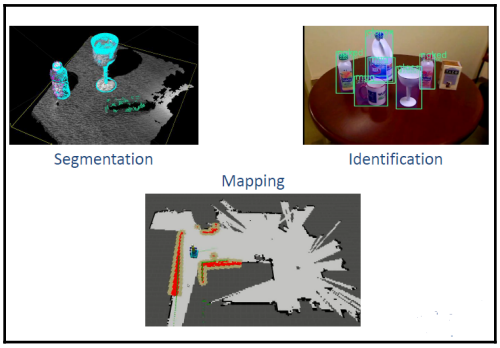


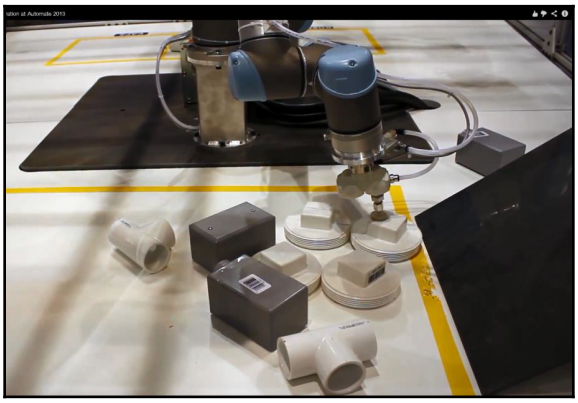
ABB
Fanuc
Universal Robots
Motoman
Adept


Robot Driver / Server
•motion commands
• status monitoring
ROS industrial
• communications
• control
• feedback
ROS
• application code
• algorithms
• user-interface

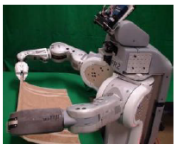

SICK


MTConnect / ROS Bridge
MTConnect
ROS industrial


Segmentation
Identification
Mapping



cook breakfast



fold laundry

play pool

bake cookies

fetch beer

scoop poop

Index