Chapter 1: Getting Started with ROS

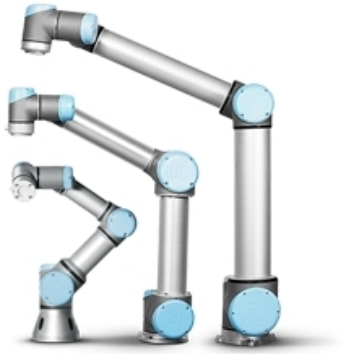
Distro	Release date	Poster	*Tuturtle*, turtle in tutorial	EOL date
ROS Melodic Morenia **(Recommended)**	May 23rd, 2018			May, 2023 (Bionic EOL)
ROS Lunar Loggerhead	May 23rd, 2017			May,2019
ROS Kinetic Kame	May 23rd, 2016			April, 2021 (Xenial EOL)

(a)

(b)

(c)

(d)



(e)

(a)

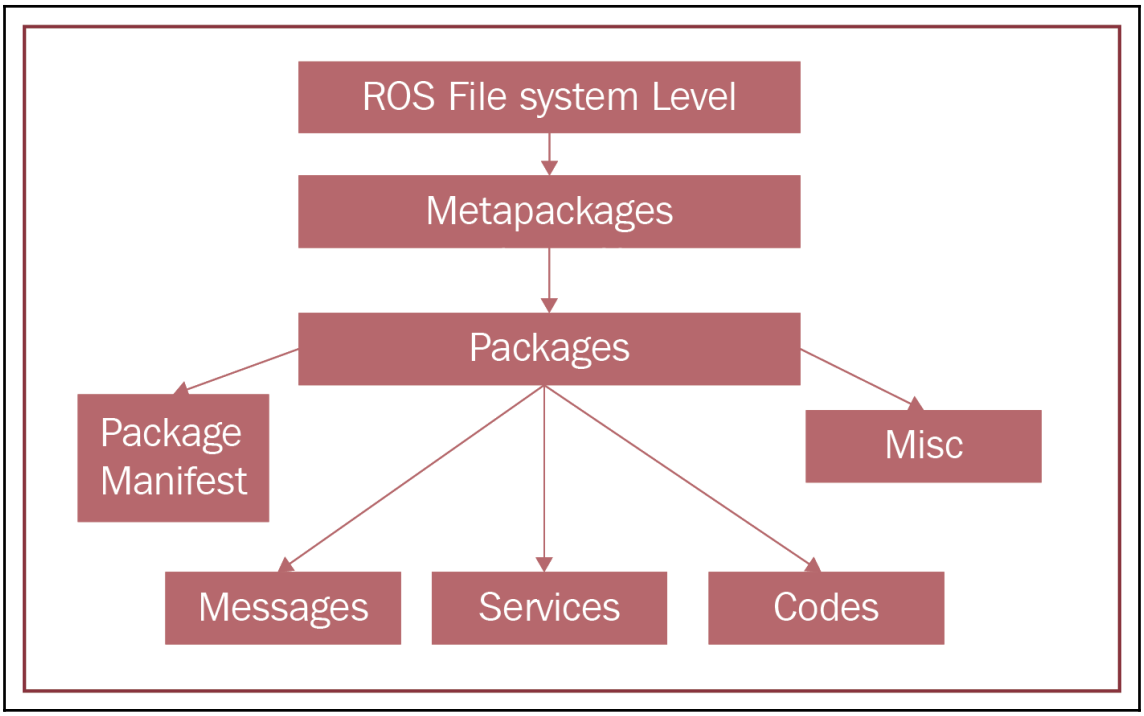
(b)

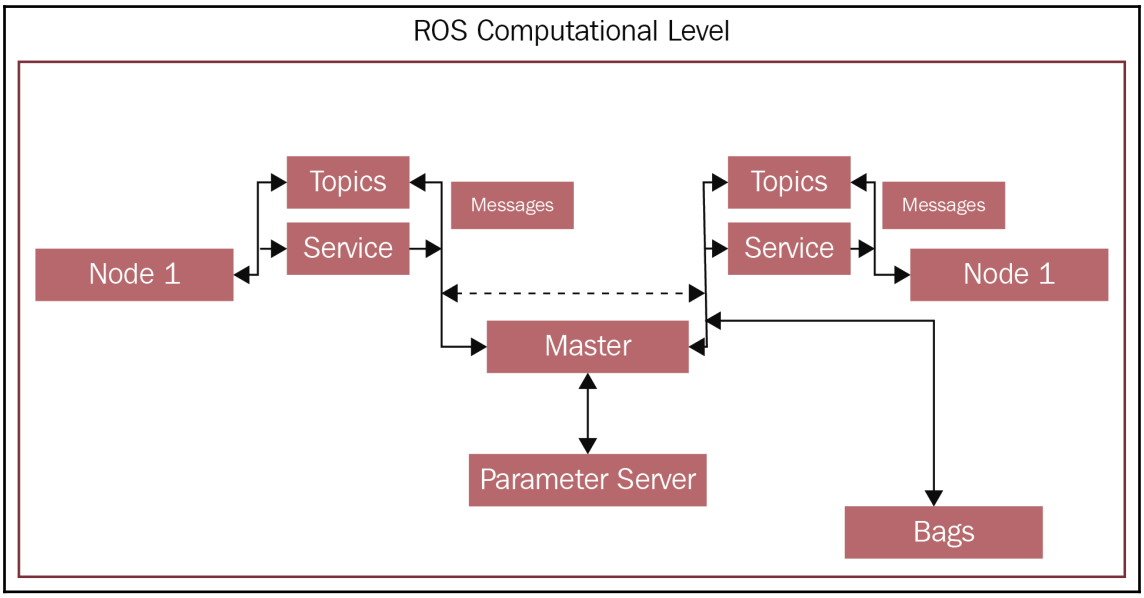
(c)

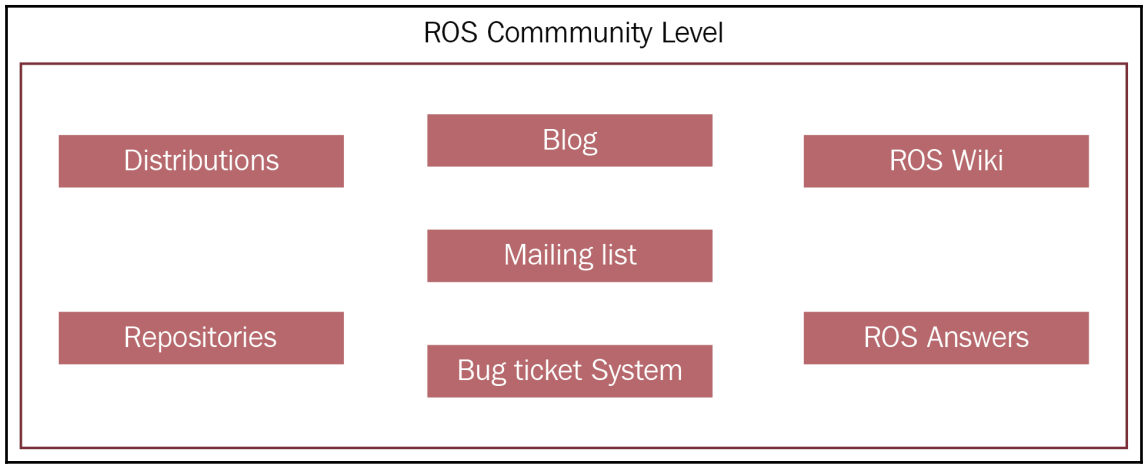
(d)

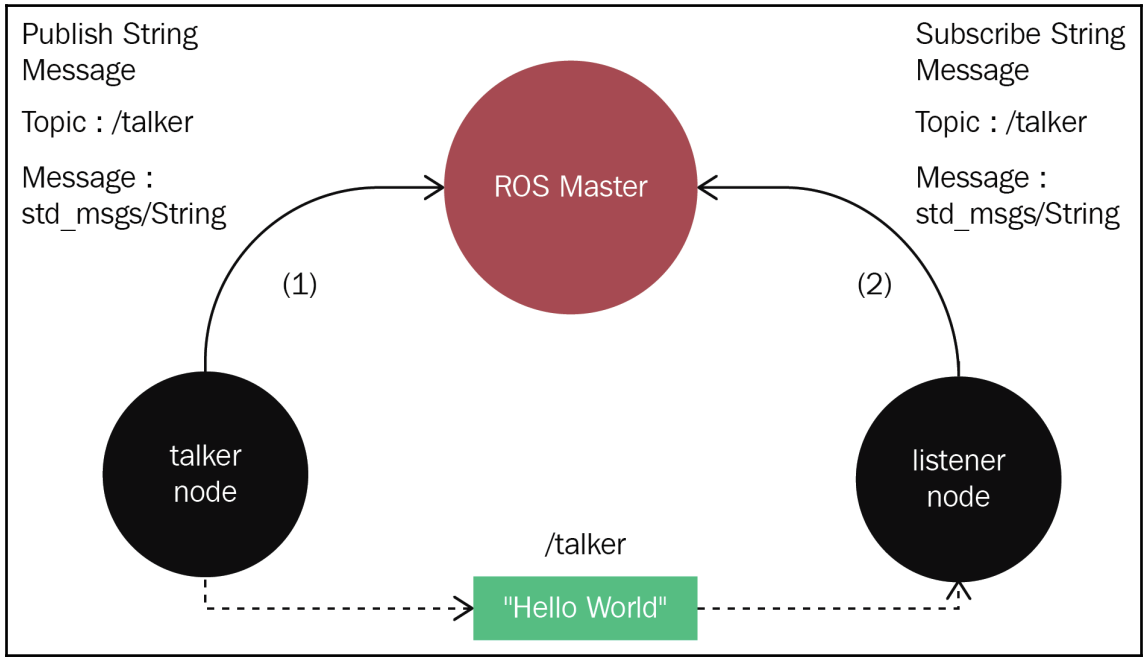
(e)

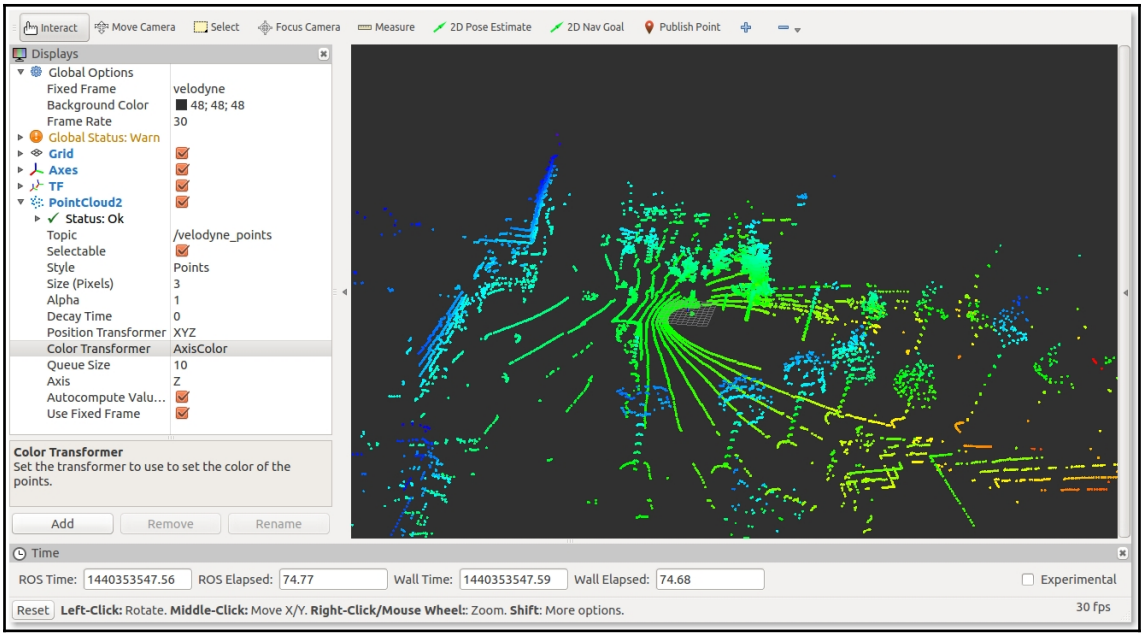
(f)

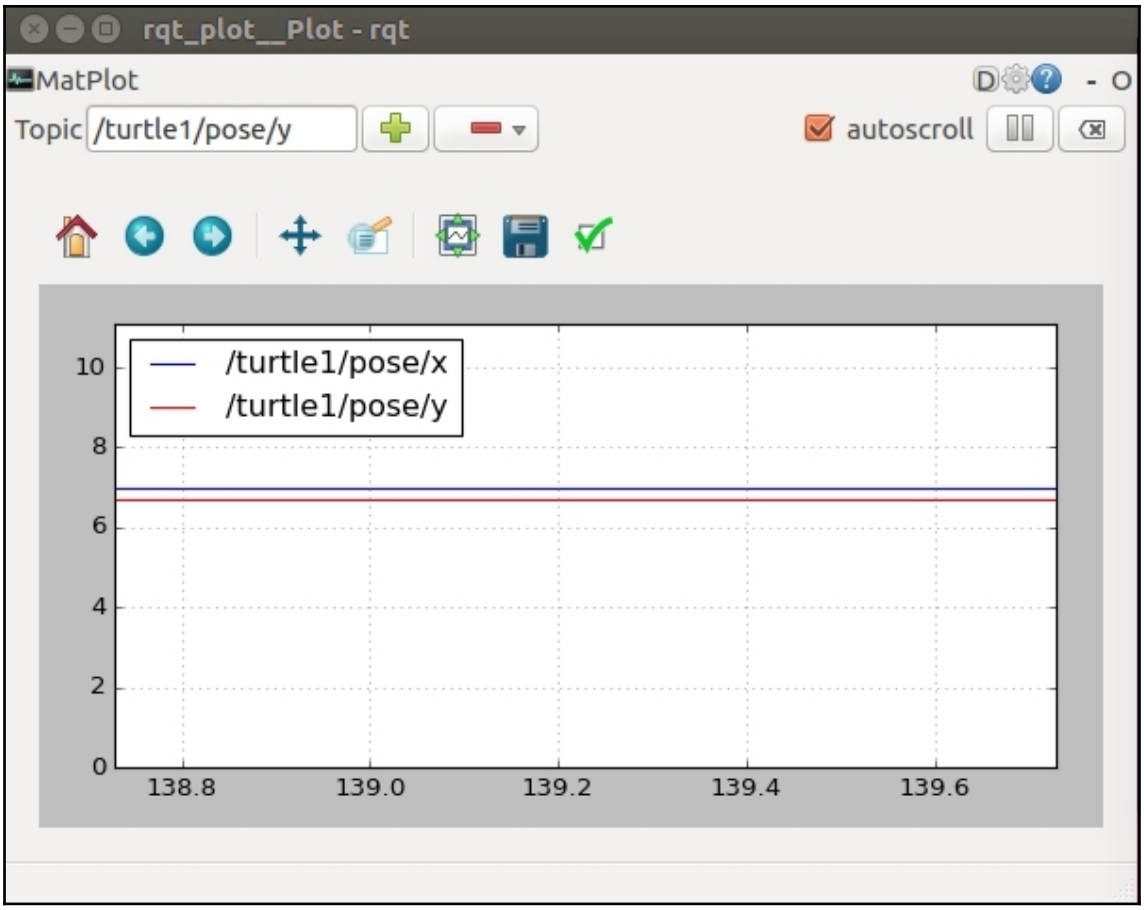

ROS File system Level
Metapackages
Packages
Package Manifest
Misc
Messages
Services
Codes

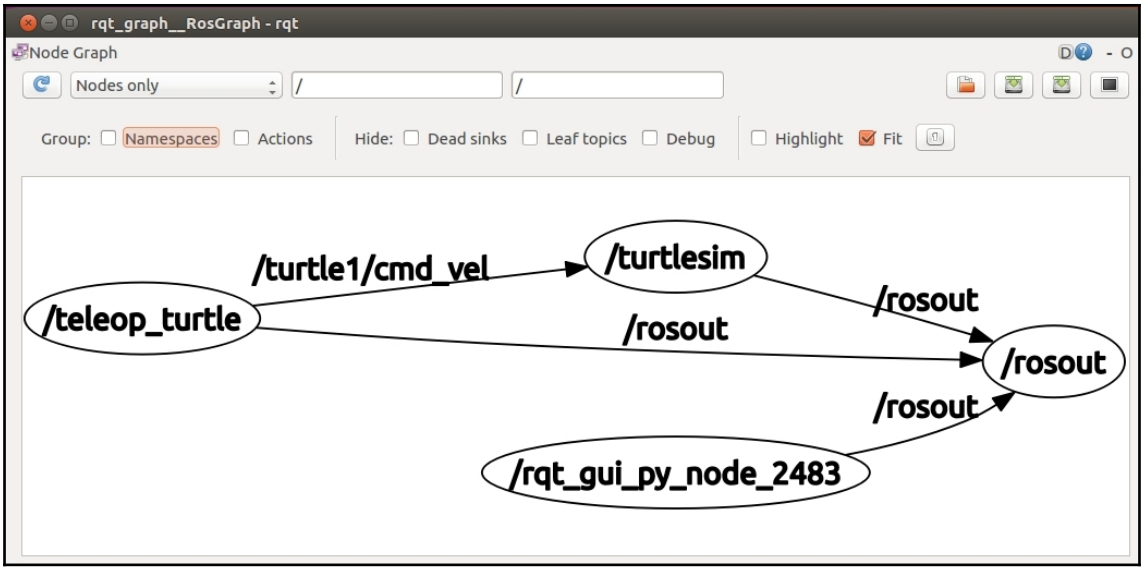

ROS Computational Level
Topics
Service
Messages
Node 1
Topics
Service
Messages
Node 1
Master
Parameter Server
Bags

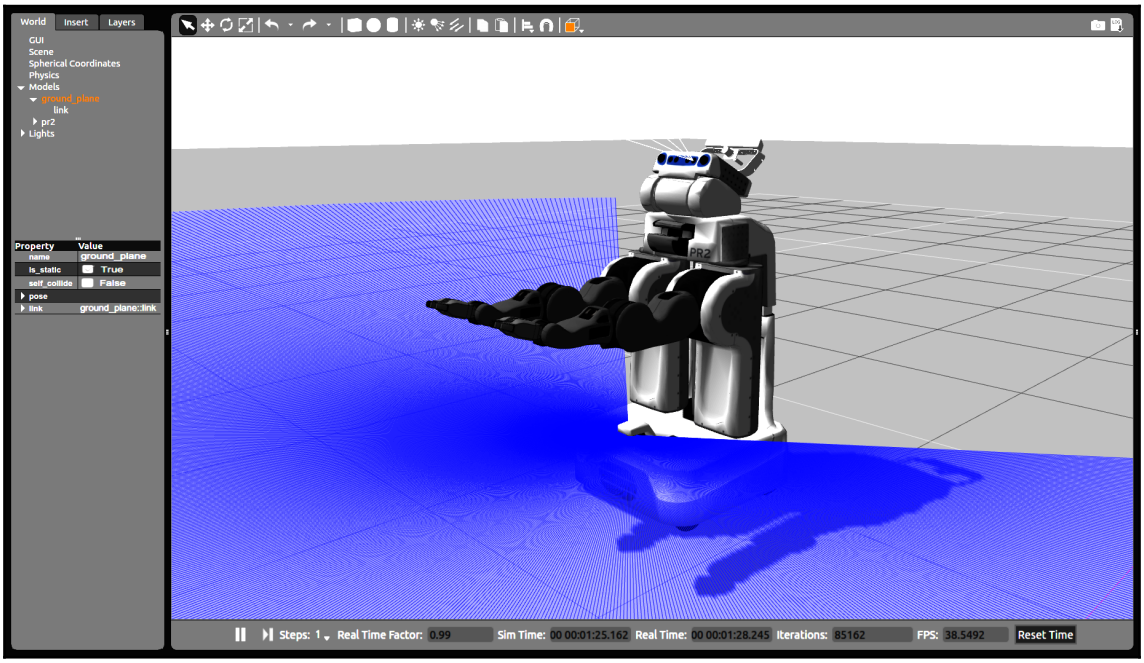

ROS Commmunity Level
Distributions
Blog
ROS Wiki
Mailing list
Repositories
ROS Answers
Bug ticket System


Publish String Message
Topic : /talker
Message : std_msgs/String
Subscribe String Message
Topic : /talker
Message : std_msgs/String
ROS Master
(1)
(2)
talker node
listener node
/talker
"Hello World"


Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
velodyne
Background Color
48; 48; 48
Frame Rate
30
Global Status: Warn
Grid
Axes
TF
PointCloud2
Status: Ok
Topic
/velodyne_points
Selectable
Style
Points
Size (Pixels)
3
Alpha
1
Decay Time
0
Position Transformer
XYZ
Color Transformer
AxisColor
Queue Size
10
Axis
Z
Autocompute Valu...
Use Fixed Frame
Color Transformer
Set the transformer to use to set the color of the points.
Add
Remove
Rename
Time
ROS Time:
1440353547.56
ROS Elapsed:
74.77
Wall Time:
1440353547.59
Wall Elapsed:
74.68
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
30 fps


rqt_plot__Plot - rqt
MatPlot
Topic /turtle1/pose/y
autoscroll
/turtle1/pose/x
/turtle1/pose/y
10
8
6
4
2
0
138.8
139.0
139.2
139.4
139.6


rqt_graph__RosGraph - rqt
Node Graph
Nodes only
/
/
Group:
Namespaces
Actions
Hide:
Dead sinks
Leaf topics
Debug
Highlight
Fit
/turtle1/cmd_vel
/turtlesim
/teleop_turtle
/rosout
/rosout
/rosout
/rosout
/rqt_gui_py_node_2483


World
Insert
Layers
GUI
Scene
Spherical Coordinates
Physics
Models
ground_plane
link
pr2
Lights
Property
Value
name
ground_plane
is_static
True
self_collide
False
pose
link
ground_plane::link
Steps: 1
Real Time Factor: 0.99
Sim Time: 00 00:01:25.162
Real Time: 00 00:01:28.245
Iterations: 85162
FPS: 38.5492
Reset Time

ROS Kinetic Kame

Released May, 2016

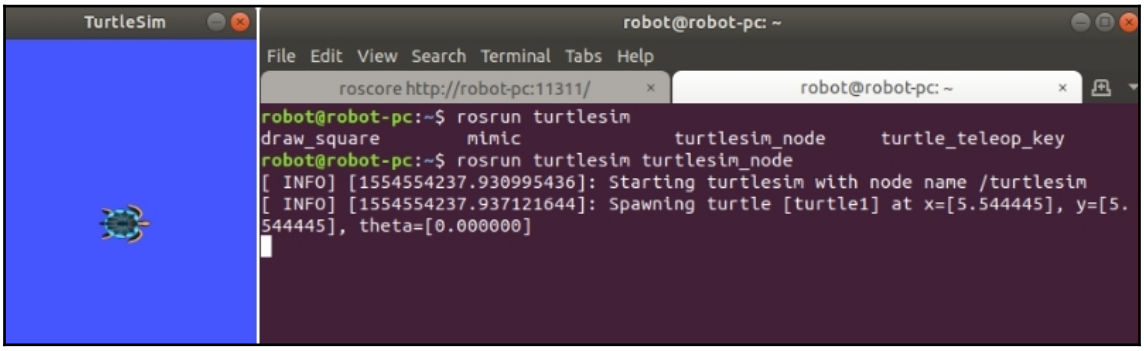
LTS, supported until April, 2021

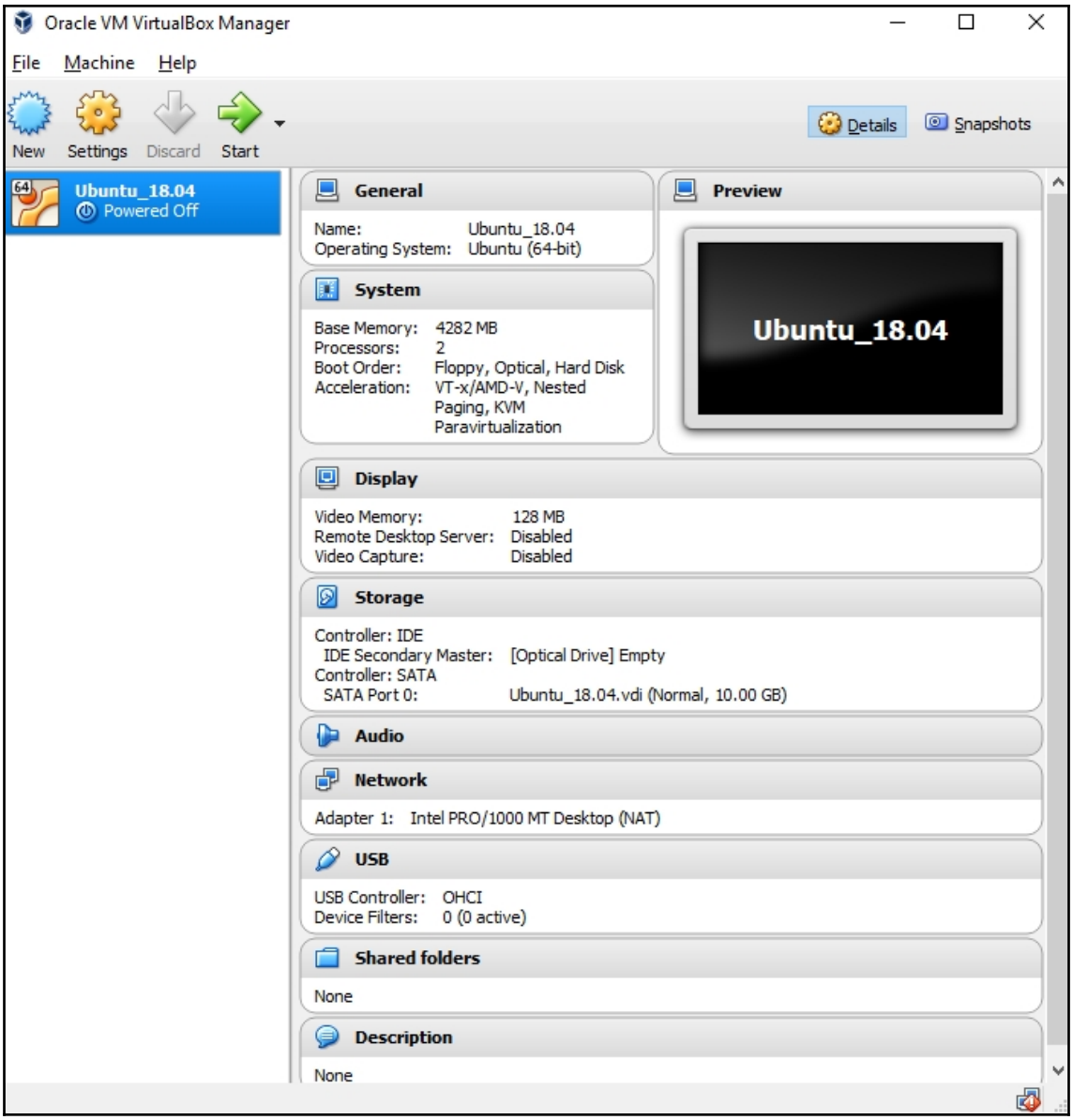
ROS Melodic Morenia

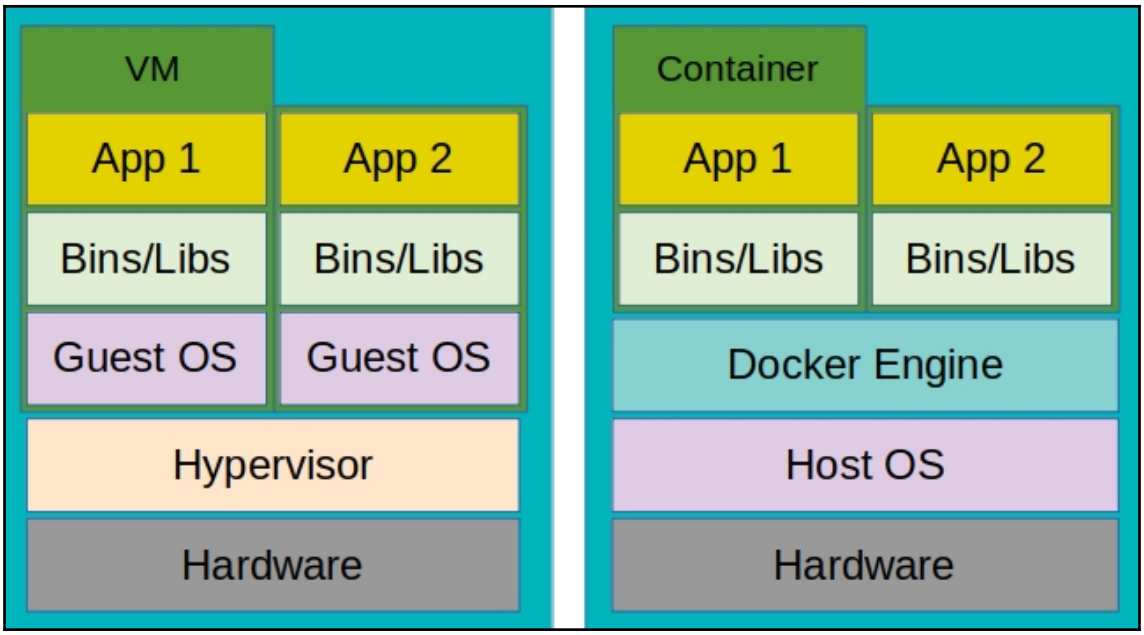
Released May, 2018

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:
Server for India
Installable from CD-ROM/DVD
Cdrom with Ubuntu 18.04 'Bionic Beaver'
Officially supported
Restricted copyright
Revert
Close


TurtleSim
robot@robot-pc: ~
File Edit View Search Terminal Tabs Help
roscore http://robot-pc:11311/
robot@robot-pc: ~
robot@robot-pc:~$ rosrun turtlesim
draw_square mimic turtlesim_node turtle_teleop_key
robot@robot-pc:~$ rosrun turtlesim turtlesim_node
[INFO] [1554554237.930995436]: Starting turtlesim with node name /turtlesim
[INFO] [1554554237.937121644]: Spawning turtle [turtle1] at x=[5.544445], y=[5.
544445], theta=[0.000000]


Oracle VM VirtualBox Manager
File
Machine
Help
New
Settings
Discard
Start
Details
Snapshots
Ubuntu_18.04
Powered Off
General
Name: Ubuntu_18.04
Operating System: Ubuntu (64-bit)
System
Base Memory: 4282 MB
Processors: 2
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization
Preview
Ubuntu_18.04
Display
Video Memory: 128 MB
Remote Desktop Server: Disabled
Video Capture: Disabled
Storage
Controller: IDE
IDE Secondary Master: [Optical Drive] Empty
Controller: SATA
SATA Port 0: Ubuntu_18.04.vdi (Normal, 10.00 GB)
Audio
Network
Adapter 1: Intel PRO/1000 MT Desktop (NAT)
USB
USB Controller: OHCI
Device Filters: 0 (0 active)
Shared folders
None
Description
None

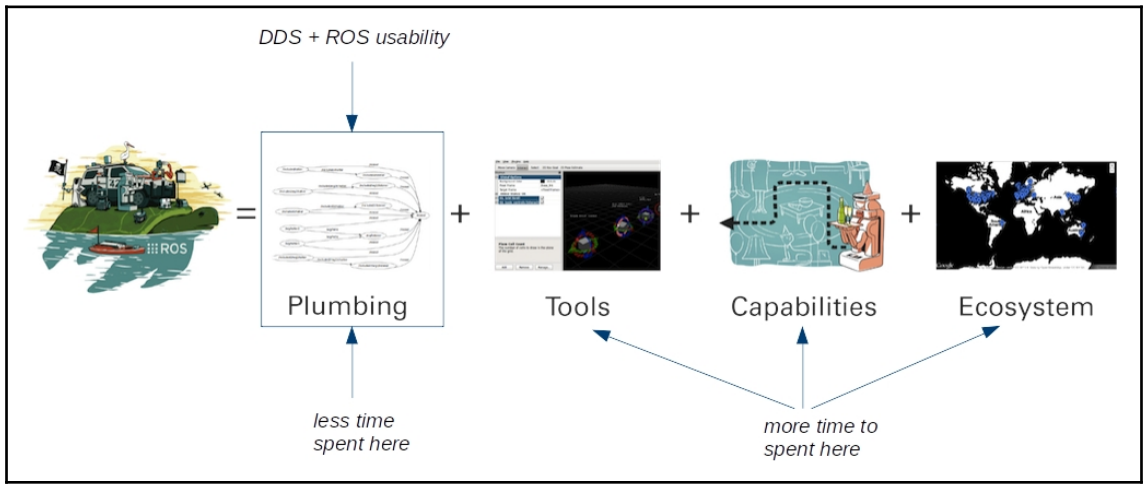


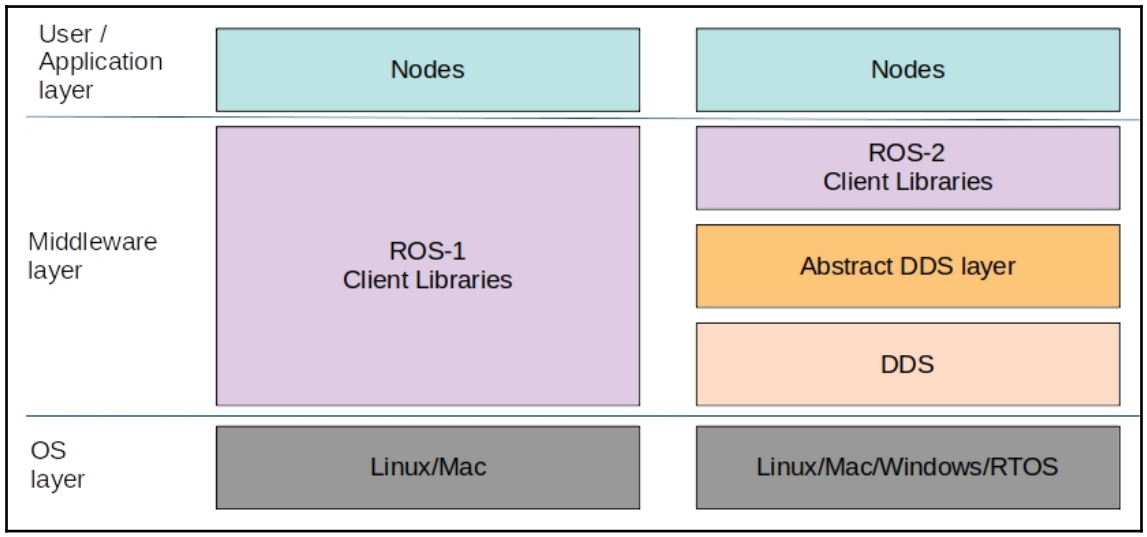

```
robot@robot-pc: ~
File  Edit  View  Search  Terminal  Help
robot@robot-pc:~$ docker pull ros:melodic-ros-core
Got permission denied while trying to connect to the Docker daemon socket at uni
x:///var/run/docker.sock: Post http://%2Fvar%2Frun%2Fdocker.sock/v1.39/images/cr
eate?fromImage=ros&tag=melodic-ros-core: dial unix /var/run/docker.sock: connect
: permission denied
robot@robot-pc:~$
```

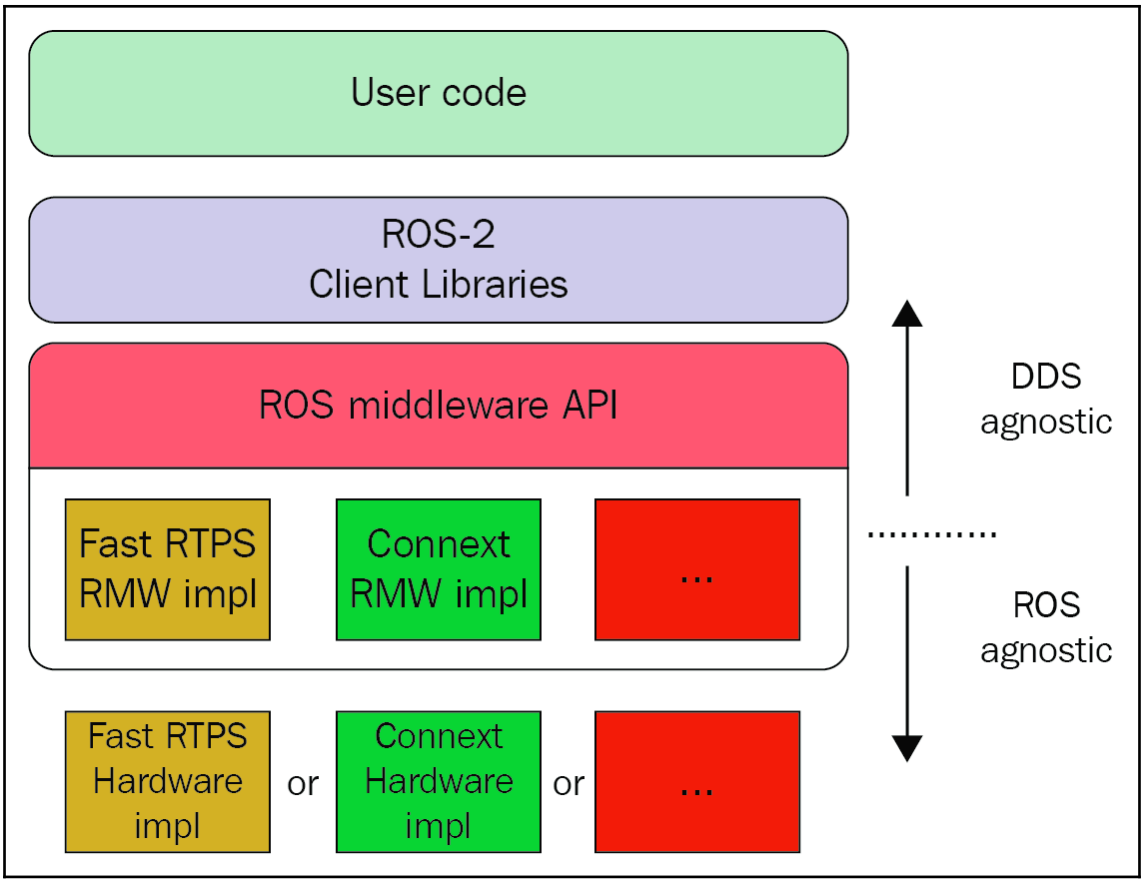
```
robot@robot-pc: ~
File  Edit  View  Search  Terminal  Help
robot@robot-pc:~$ sudo docker pull ros:melodic-ros-core
melodic-ros-core: Pulling from library/ros
898c46f3b1a1: Pull complete
63366dfa0a50: Pull complete
041d4cd74a92: Pull complete
6e1bee0f8701: Pull complete
10919d32ef8c: Pull complete
1eb57d992df7: Pull complete
8ab15ff6826b: Pull complete
9e991e401fe9: Pull complete
c480623e718f: Pull complete
1631db7515a9: Pull complete
e5e8853cd2e7: Pull complete
dd7336f76ae5: Pull complete
Digest: sha256:079d52500be7540cd7514edca432cd3b302814d58c0aeb3affea49a3aece01dd
Status: Downloaded newer image for ros:melodic-ros-core
robot@robot-pc:~$
```

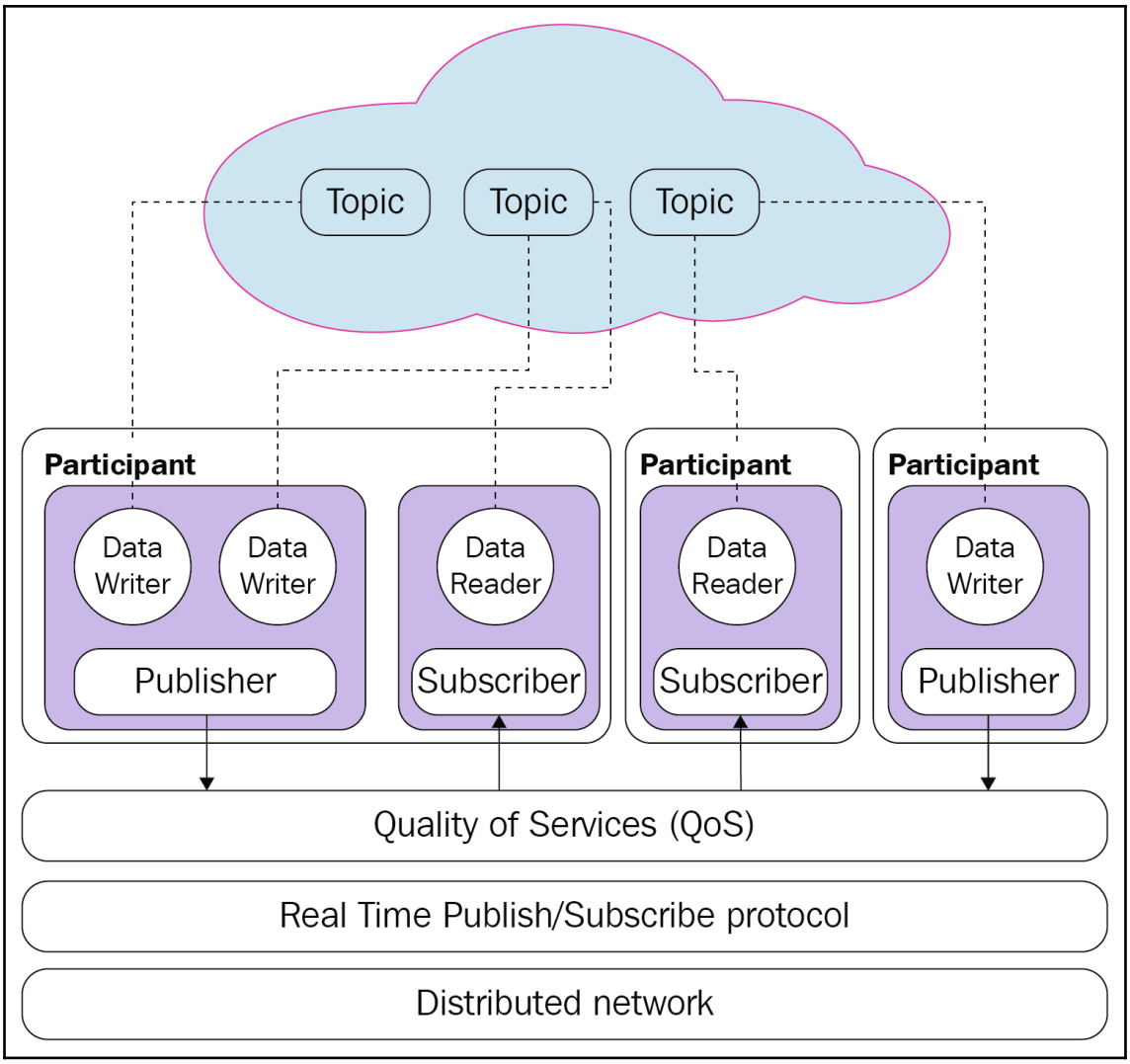

```
robot@robot-pc: ~
File  Edit  View  Search  Terminal  Help

robot@robot-pc:~$ echo $ROS_PACKAGE_PATH
/home/robot/catkin_ws/src:/opt/ros/melodic/share
robot@robot-pc:~$
```

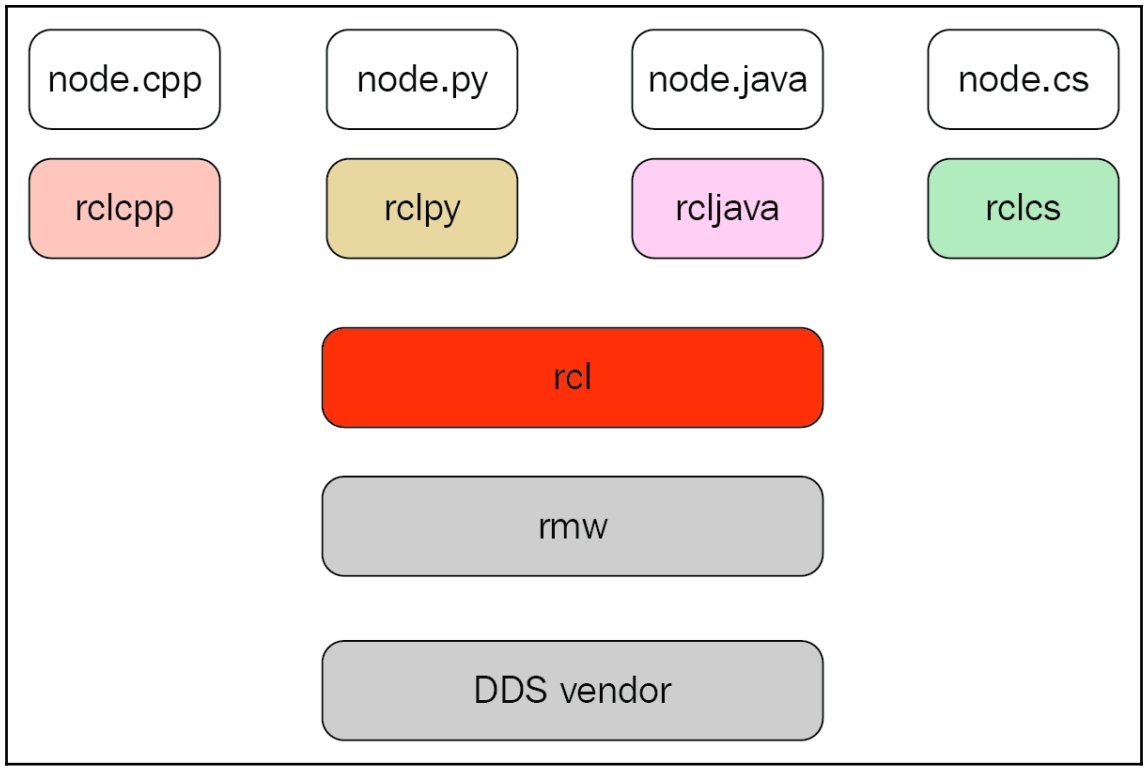
Chapter 2: Introduction to ROS-2 and Its Capabilities

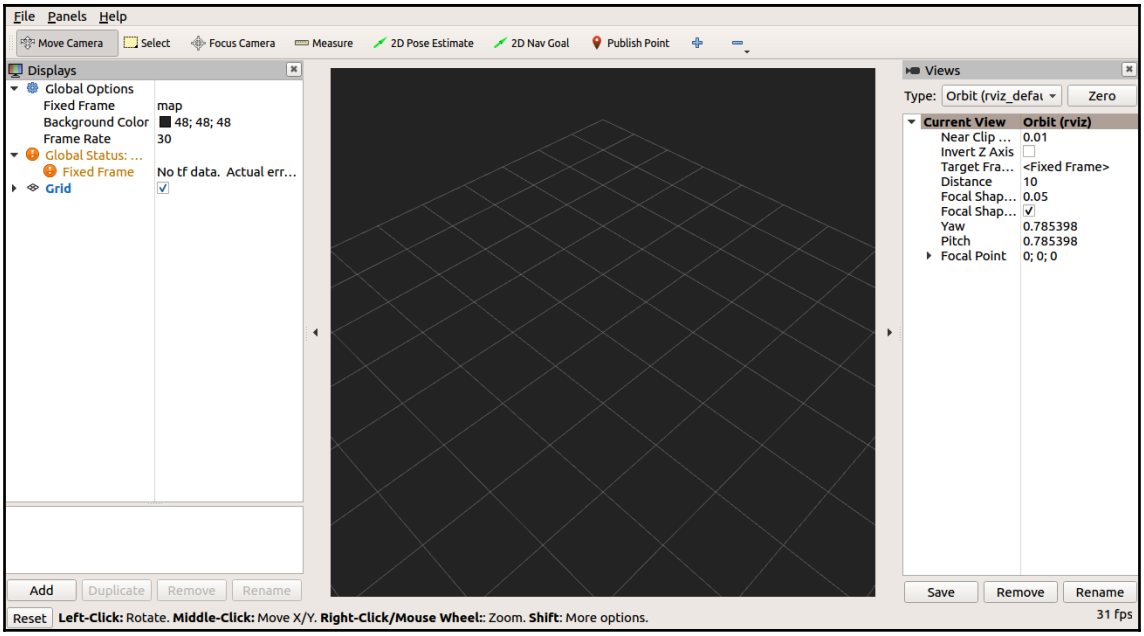


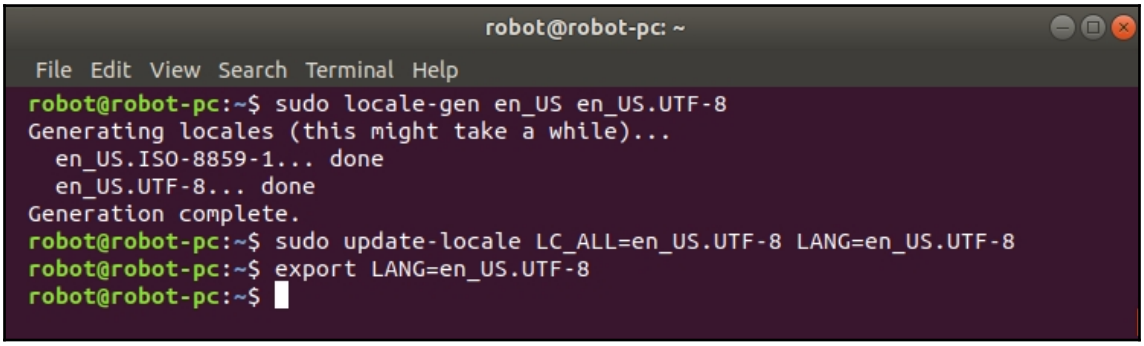


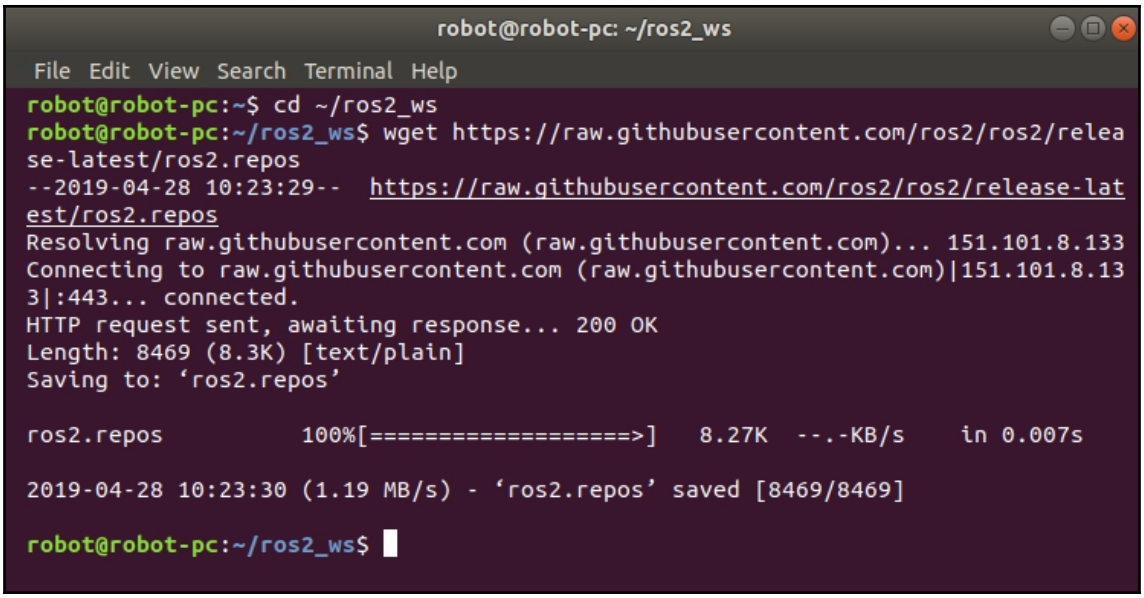

User code
ROS-2
Client Libraries
ROS middleware API
Fast RTPS
RMW impl
Connext
RMW impl
...
Fast RTPS
Hardware
impl
or
Connext
Hardware
impl
or
...
DDS
agnostic
ROS
agnostic

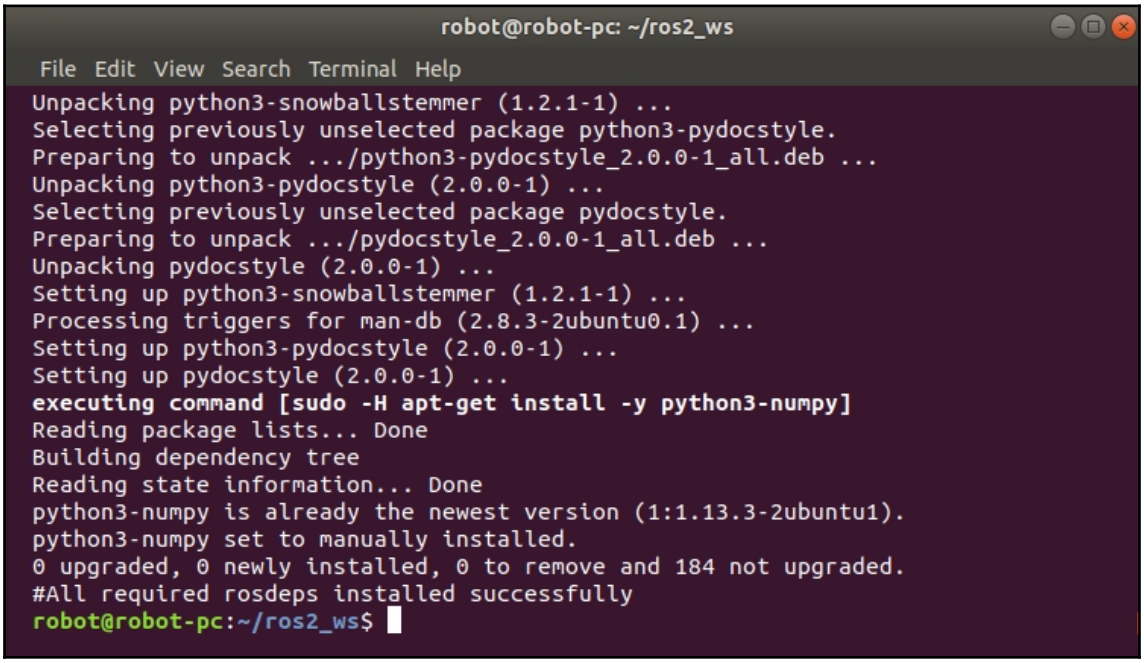

Topic
Topic
Topic
Participant
Data Writer
Data Writer
Publisher
Data Reader
Subscriber
Participant
Data Reader
Subscriber
Participant
Data Writer
Publisher
Quality of Services (QoS)
Real Time Publish/Subscribe protocol
Distributed network

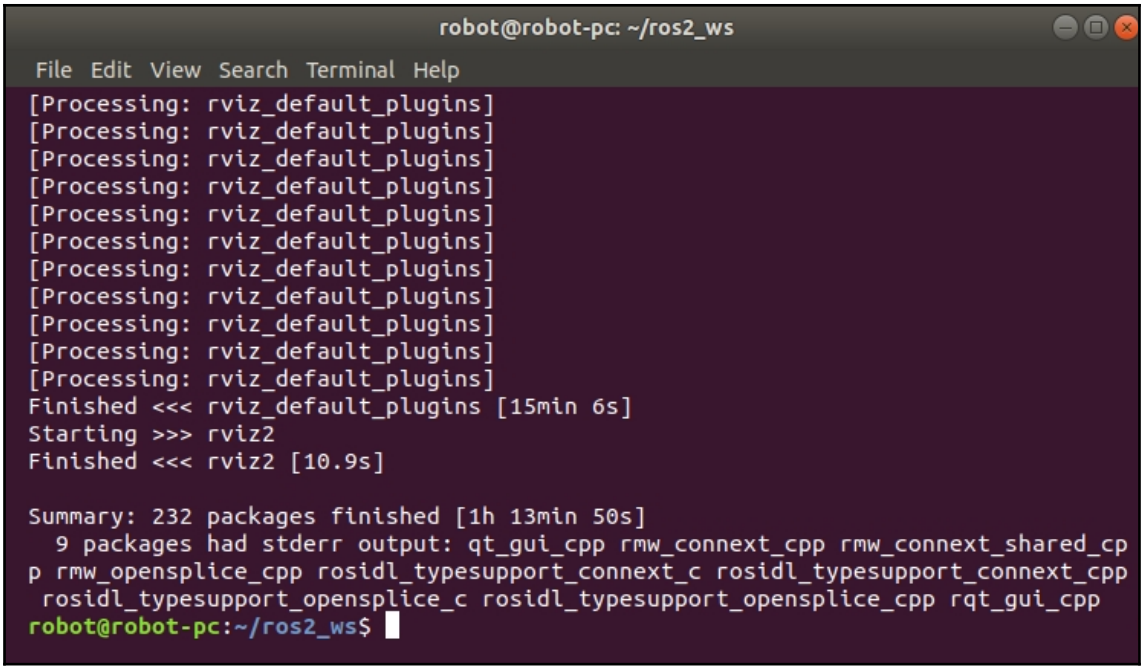

node.cpp
node.py
node.java
node.cs
rclcpp
rclpy
rcljava
rclcs
rcl
rmw
DDS vendor

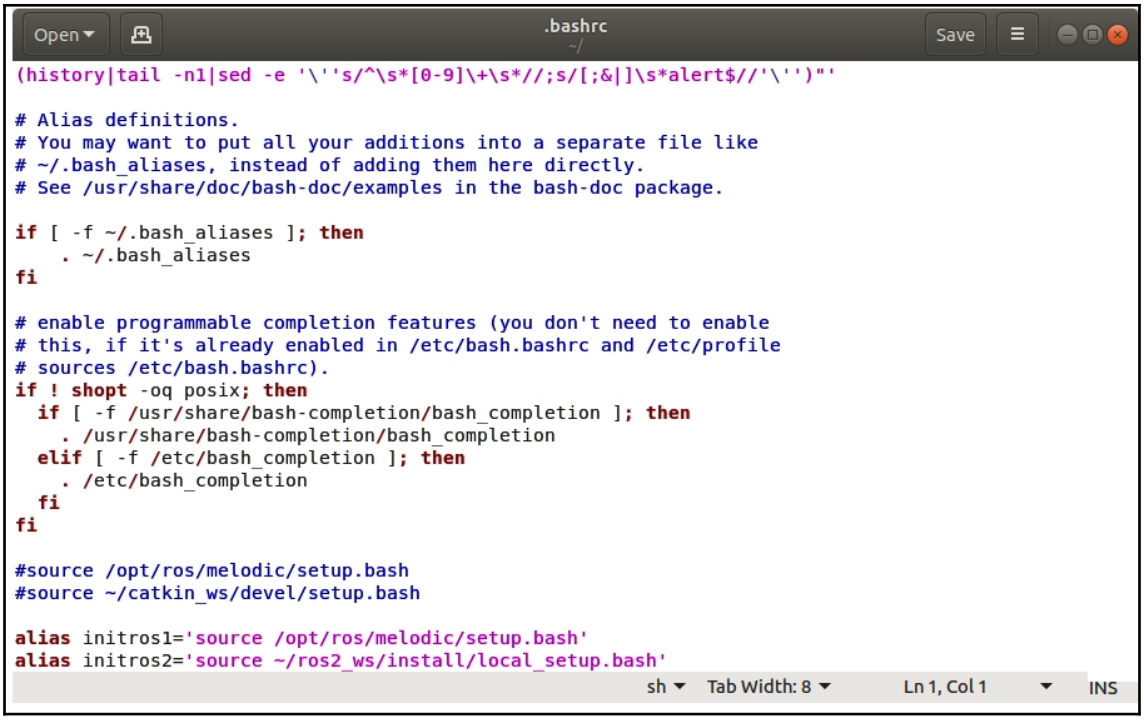

File Panels Help
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Global Status: ...
Fixed Frame
No tf data. Actual err...
Grid
Add
Duplicate
Remove
Rename
Views
Type:
Orbit (rviz_defa
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
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

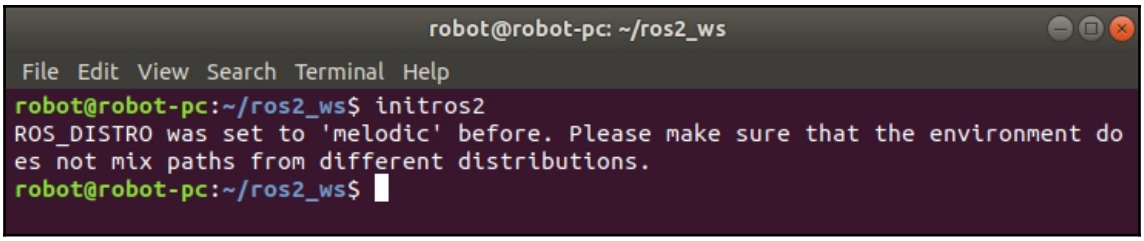

robot@robot-pc: ~
File Edit View Search Terminal Help
robot@robot-pc:~$ sudo locale-gen en_US en_US.UTF-8
Generating locales (this might take a while)...
en_US.ISO-8859-1... done
en_US.UTF-8... done
Generation complete.
robot@robot-pc:~$ sudo update-locale LC_ALL=en_US.UTF-8 LANG=en_US.UTF-8
robot@robot-pc:~$ export LANG=en_US.UTF-8
robot@robot-pc:~$

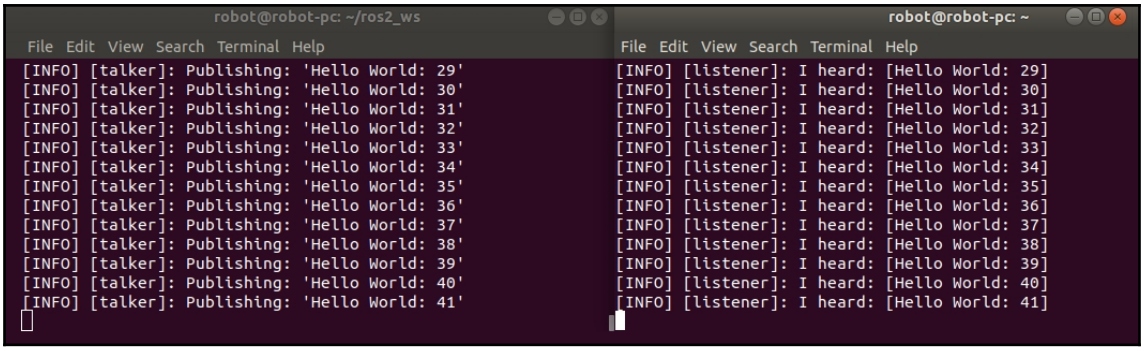

robot@robot-pc: ~/ros2_ws
File Edit View Search Terminal Help
robot@robot-pc:~$ cd ~/ros2_ws
robot@robot-pc:~/ros2_ws$ wget https://raw.githubusercontent.com/ros2/ros2/release-latest/ros2.repos
--2019-04-28 10:23:29-- https://raw.githubusercontent.com/ros2/ros2/release-latest/ros2.repos
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 151.101.8.133
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|151.101.8.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 8469 (8.3K) [text/plain]
Saving to: 'ros2.repos'
ros2.repos 100%[==========>] 8.27K --.-KB/s in 0.007s
2019-04-28 10:23:30 (1.19 MB/s) - 'ros2.repos' saved [8469/8469]
robot@robot-pc:~/ros2_ws$

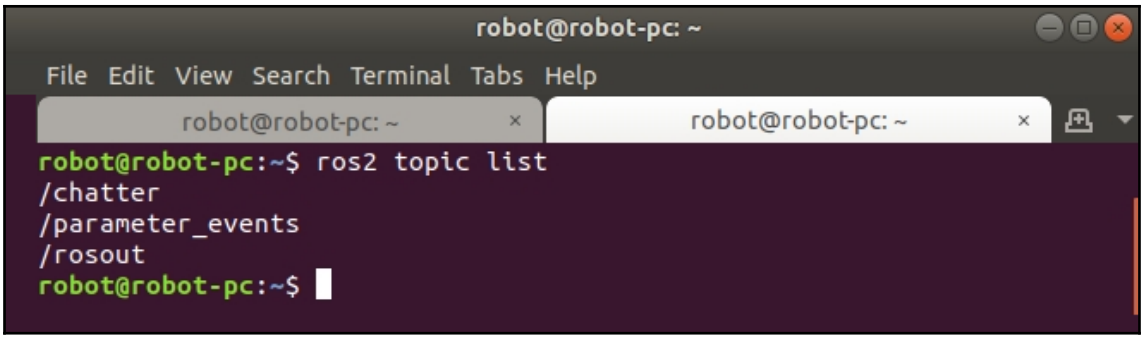

robot@robot-pc: ~/ros2_ws
File Edit View Search Terminal Help
Unpacking python3-snowballstemmer (1.2.1-1) ...
Selecting previously unselected package python3-pydocstyle.
Preparing to unpack .../python3-pydocstyle_2.0.0-1_all.deb ...
Unpacking python3-pydocstyle (2.0.0-1) ...
Selecting previously unselected package pydocstyle.
Preparing to unpack .../pydocstyle_2.0.0-1_all.deb ...
Unpacking pydocstyle (2.0.0-1) ...
Setting up python3-snowballstemmer (1.2.1-1) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Setting up python3-pydocstyle (2.0.0-1) ...
Setting up pydocstyle (2.0.0-1) ...
executing command [sudo -H apt-get install -y python3-numpy]
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3-numpy is already the newest version (1:1.13.3-2ubuntu1).
python3-numpy set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 184 not upgraded.
#All required rosdeps installed successfully
robot@robot-pc:~/ros2_ws$

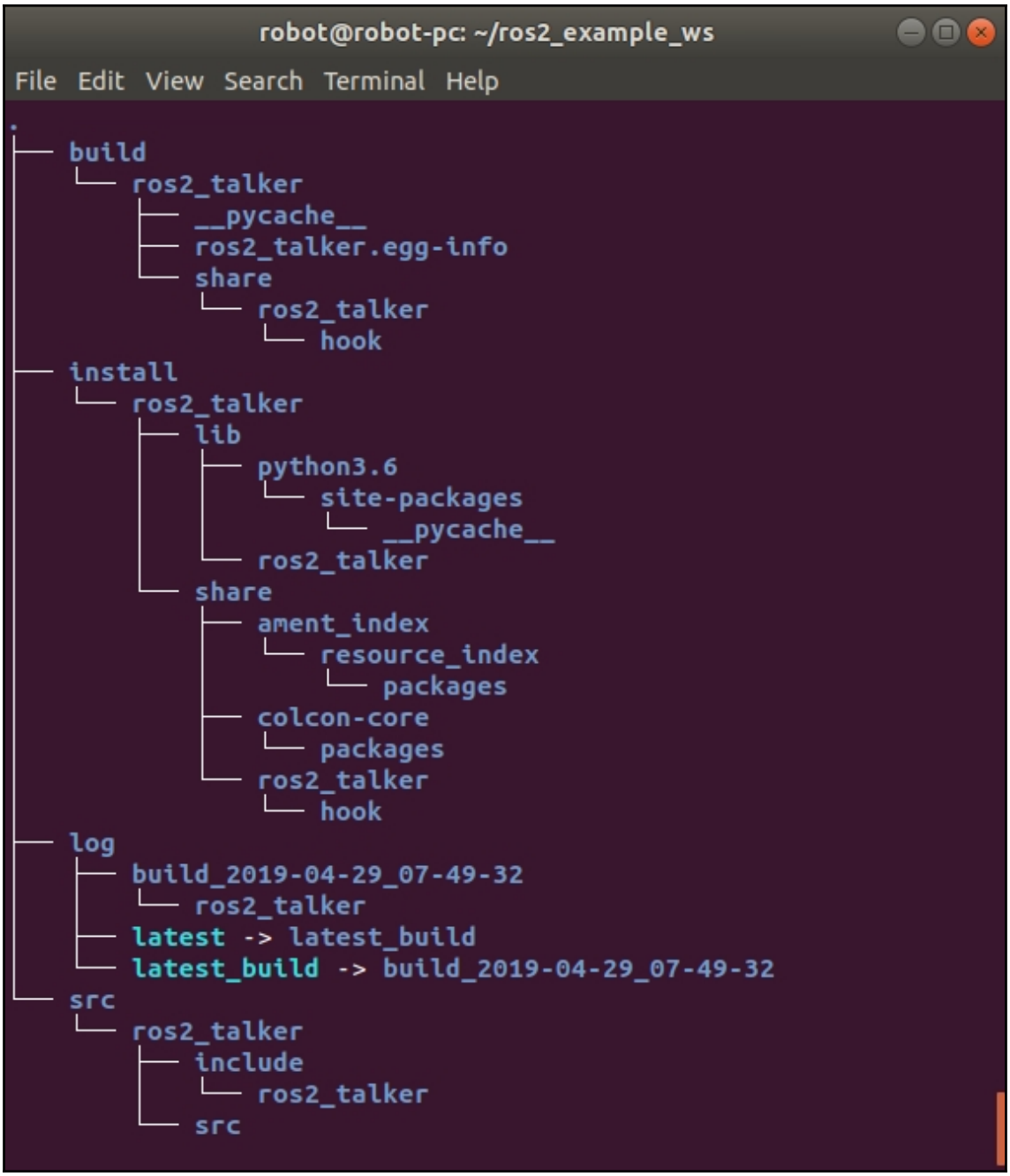

robot@robot-pc: ~/ros2_ws
File Edit View Search Terminal Help
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
[Processing: rviz_default_plugins]
Finished <<< rviz_default_plugins [15min 6s]
Starting >>> rviz2
Finished <<< rviz2 [10.9s]
Summary: 232 packages finished [1h 13min 50s]
9 packages had stderr output: qt_gui_cpp rmw_connext_cpp rmw_connext_shared_cp
p rmw_opensplice_cpp rosidl_typesupport_connext_c rosidl_typesupport_connext_cpp
rosidl_typesupport_opensplice_c rosidl_typesupport_opensplice_cpp rqt_gui_cpp
robot@robot-pc:~/ros2_ws$

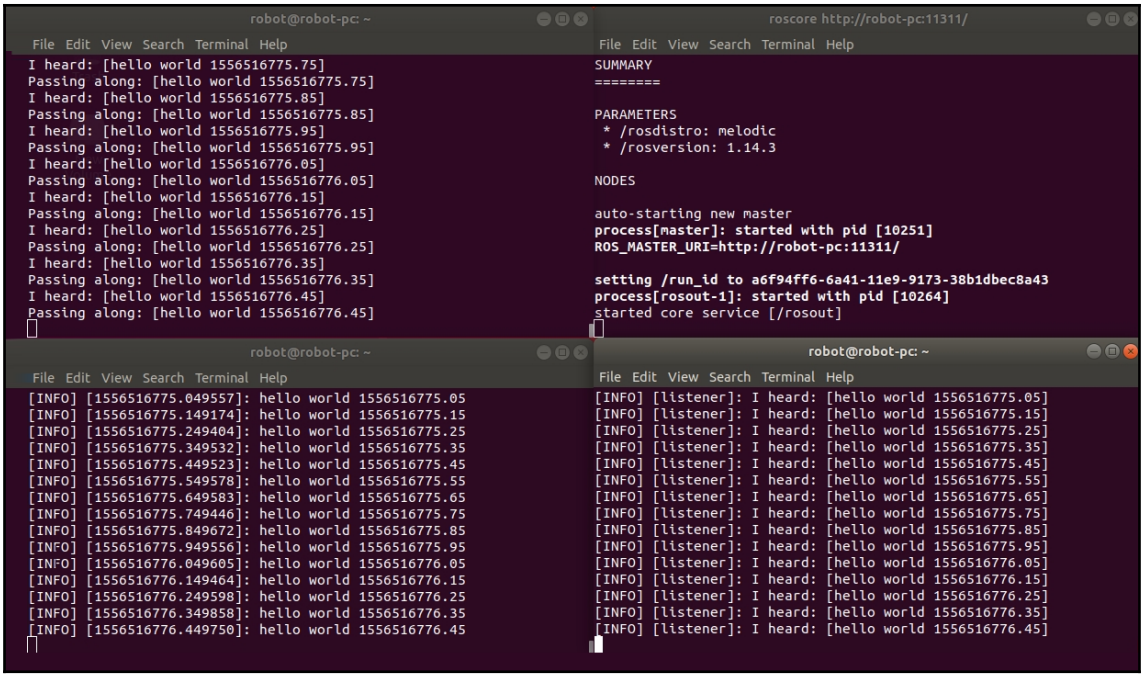

Open
.bashrc
~/
Save
(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[;&|]\s*alert$//'\'')"'
# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.
if [-f ~/.bash_aliases]; then
. ~/.bash_aliases
fi
# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
if [-f /usr/share/bash-completion/bash_completion]; then
. /usr/share/bash-completion/bash_completion
elif [-f /etc/bash_completion]; then
. /etc/bash_completion
fi
fi
#source /opt/ros/melodic/setup.bash
#source ~/catkin_ws/devel/setup.bash
alias initros1='source /opt/ros/melodic/setup.bash'
alias initros2='source ~/ros2_ws/install/local_setup.bash'
sh
Tab Width: 8
Ln 1, Col 1
INS


robot@robot-pc: ~/ros2_ws
File Edit View Search Terminal Help
robot@robot-pc:~/ros2_ws$ initros2
ROS_DISTRO was set to 'melodic' before. Please make sure that the environment do
es not mix paths from different distributions.
robot@robot-pc:~/ros2_ws$

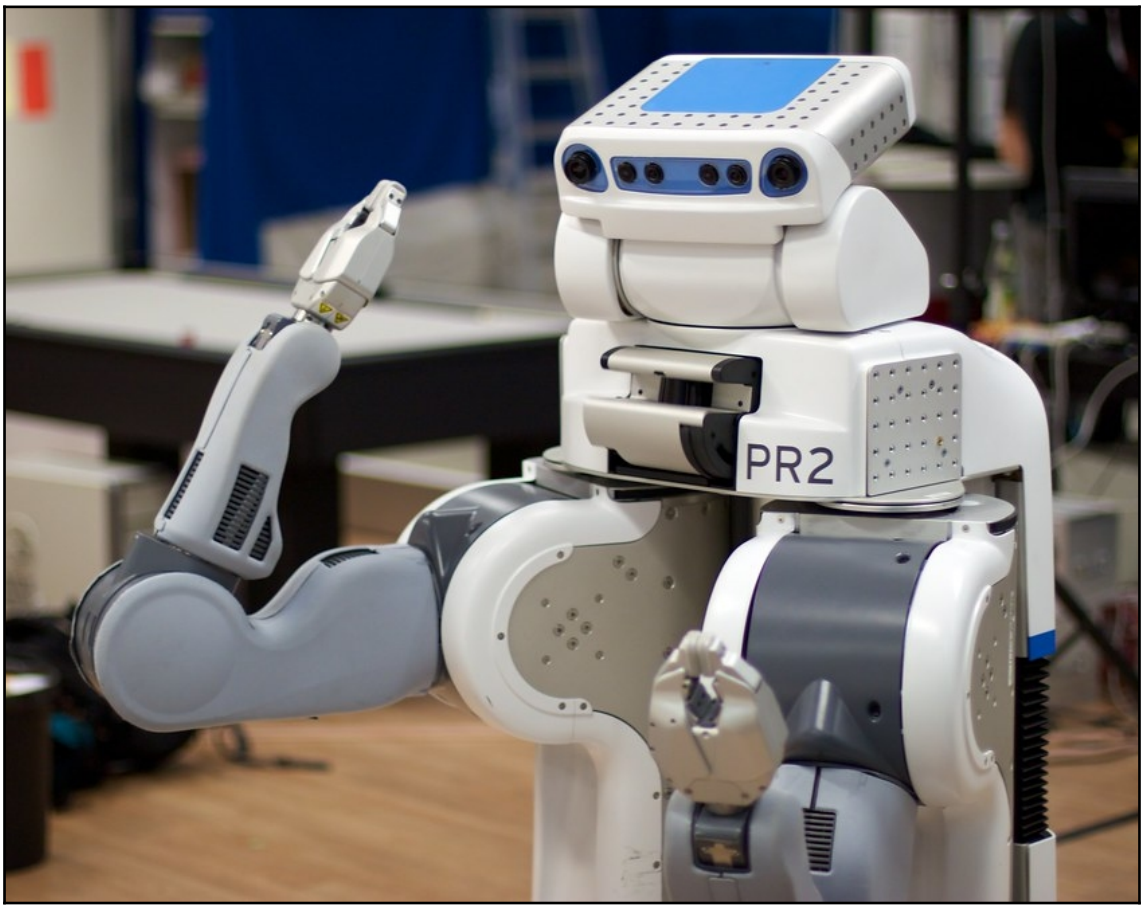

robot@robot-pc: ~/ros2_ws
File Edit View Search Terminal Help
[INFO] [talker]: Publishing: 'Hello World: 29'
[INFO] [talker]: Publishing: 'Hello World: 30'
[INFO] [talker]: Publishing: 'Hello World: 31'
[INFO] [talker]: Publishing: 'Hello World: 32'
[INFO] [talker]: Publishing: 'Hello World: 33'
[INFO] [talker]: Publishing: 'Hello World: 34'
[INFO] [talker]: Publishing: 'Hello World: 35'
[INFO] [talker]: Publishing: 'Hello World: 36'
[INFO] [talker]: Publishing: 'Hello World: 37'
[INFO] [talker]: Publishing: 'Hello World: 38'
[INFO] [talker]: Publishing: 'Hello World: 39'
[INFO] [talker]: Publishing: 'Hello World: 40'
[INFO] [talker]: Publishing: 'Hello World: 41'
robot@robot-pc: ~
File Edit View Search Terminal Help
[INFO] [listener]: I heard: [Hello World: 29]
[INFO] [listener]: I heard: [Hello World: 30]
[INFO] [listener]: I heard: [Hello World: 31]
[INFO] [listener]: I heard: [Hello World: 32]
[INFO] [listener]: I heard: [Hello World: 33]
[INFO] [listener]: I heard: [Hello World: 34]
[INFO] [listener]: I heard: [Hello World: 35]
[INFO] [listener]: I heard: [Hello World: 36]
[INFO] [listener]: I heard: [Hello World: 37]
[INFO] [listener]: I heard: [Hello World: 38]
[INFO] [listener]: I heard: [Hello World: 39]
[INFO] [listener]: I heard: [Hello World: 40]
[INFO] [listener]: I heard: [Hello World: 41]


robot@robot-pc: ~
File Edit View Search Terminal Tabs Help
robot@robot-pc: ~
robot@robot-pc: ~
robot@robot-pc:~$ ros2 topic list
/chatter
/parameter_events
/rosout
robot@robot-pc:~$


robot@robot-pc: ~/ros2_example_ws
File Edit View Search Terminal Help
.
├── build
│   └── ros2_talker
│   ├── __pycache__
│   ├── ros2_talker.egg-info
│   └── share
│   └── ros2_talker
│   └── hook
├── install
│   └── ros2_talker
│   ├── lib
│   │   ├── python3.6
│   │   │   └── site-packages
│   │   │   └── __pycache__
│   │   └── ros2_talker
│   └── share
│   ├── ament_index
│   │   └── resource_index
│   │   └── packages
│   ├── colcon-core
│   │   └── packages
│   └── ros2_talker
│   └── hook
├── log
│   ├── build_2019-04-29_07-49-32
│   │   └── ros2_talker
│   ├── latest -> latest_build
│   └── latest_build -> build_2019-04-29_07-49-32
└── src
    └── ros2_talker
        ├── include
        │   └── ros2_talker
        └── src


robot@robot-pc: ~
File Edit View Search Terminal Help
I heard: [hello world 1556516775.75]
Passing along: [hello world 1556516775.75]
I heard: [hello world 1556516775.85]
Passing along: [hello world 1556516775.85]
I heard: [hello world 1556516775.95]
Passing along: [hello world 1556516775.95]
I heard: [hello world 1556516776.05]
Passing along: [hello world 1556516776.05]
I heard: [hello world 1556516776.15]
Passing along: [hello world 1556516776.15]
I heard: [hello world 1556516776.25]
Passing along: [hello world 1556516776.25]
I heard: [hello world 1556516776.35]
Passing along: [hello world 1556516776.35]
I heard: [hello world 1556516776.45]
Passing along: [hello world 1556516776.45]
roscore http://robot-pc:11311/
File Edit View Search Terminal Help
SUMMARY
========
PARAMETERS
* /rosdistro: melodic
* /rosversion: 1.14.3
NODES
auto-starting new master
process[master]: started with pid [10251]
ROS_MASTER_URI=http://robot-pc:11311/
setting /run_id to a6f94ff6-6a41-11e9-9173-38b1dbec8a43
process[rosout-1]: started with pid [10264]
started core service [/rosout]
robot@robot-pc: ~
File Edit View Search Terminal Help
[INFO] [1556516775.049557]: hello world 1556516775.05
[INFO] [1556516775.149174]: hello world 1556516775.15
[INFO] [1556516775.249404]: hello world 1556516775.25
[INFO] [1556516775.349532]: hello world 1556516775.35
[INFO] [1556516775.449523]: hello world 1556516775.45
[INFO] [1556516775.549578]: hello world 1556516775.55
[INFO] [1556516775.649583]: hello world 1556516775.65
[INFO] [1556516775.749446]: hello world 1556516775.75
[INFO] [1556516775.849672]: hello world 1556516775.85
[INFO] [1556516775.949556]: hello world 1556516775.95
[INFO] [1556516776.049605]: hello world 1556516776.05
[INFO] [1556516776.149464]: hello world 1556516776.15
[INFO] [1556516776.249598]: hello world 1556516776.25
[INFO] [1556516776.349858]: hello world 1556516776.35
[INFO] [1556516776.449750]: hello world 1556516776.45
robot@robot-pc: ~
File Edit View Search Terminal Help
[INFO] [listener]: I heard: [hello world 1556516775.05]
[INFO] [listener]: I heard: [hello world 1556516775.15]
[INFO] [listener]: I heard: [hello world 1556516775.25]
[INFO] [listener]: I heard: [hello world 1556516775.35]
[INFO] [listener]: I heard: [hello world 1556516775.45]
[INFO] [listener]: I heard: [hello world 1556516775.55]
[INFO] [listener]: I heard: [hello world 1556516775.65]
[INFO] [listener]: I heard: [hello world 1556516775.75]
[INFO] [listener]: I heard: [hello world 1556516775.85]
[INFO] [listener]: I heard: [hello world 1556516775.95]
[INFO] [listener]: I heard: [hello world 1556516776.05]
[INFO] [listener]: I heard: [hello world 1556516776.15]
[INFO] [listener]: I heard: [hello world 1556516776.25]
[INFO] [listener]: I heard: [hello world 1556516776.35]
[INFO] [listener]: I heard: [hello world 1556516776.45]

Chapter 3: Building an Industrial Mobile Manipulator

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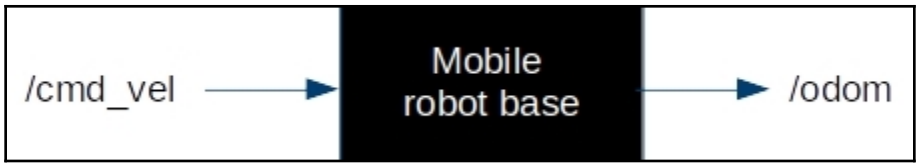
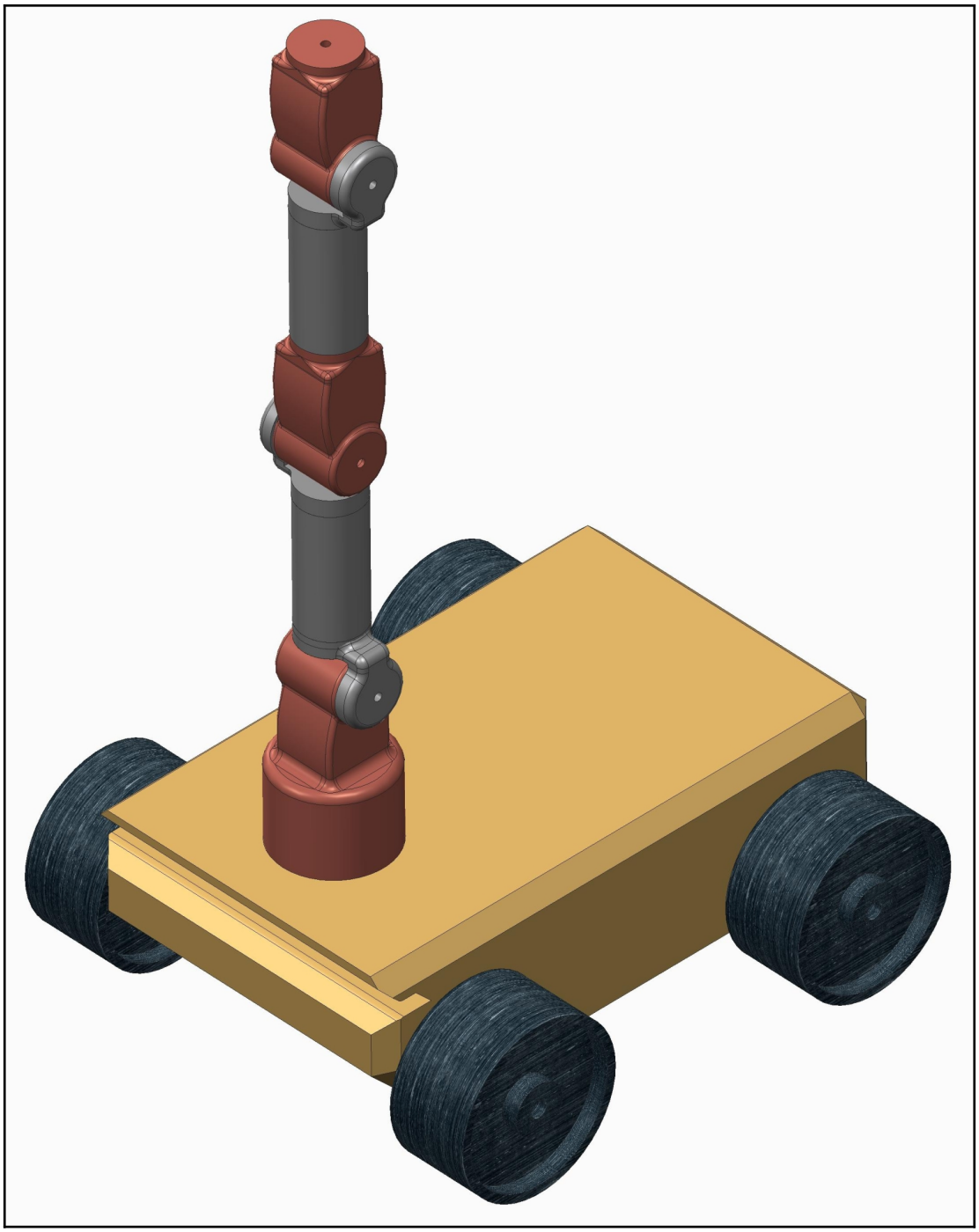
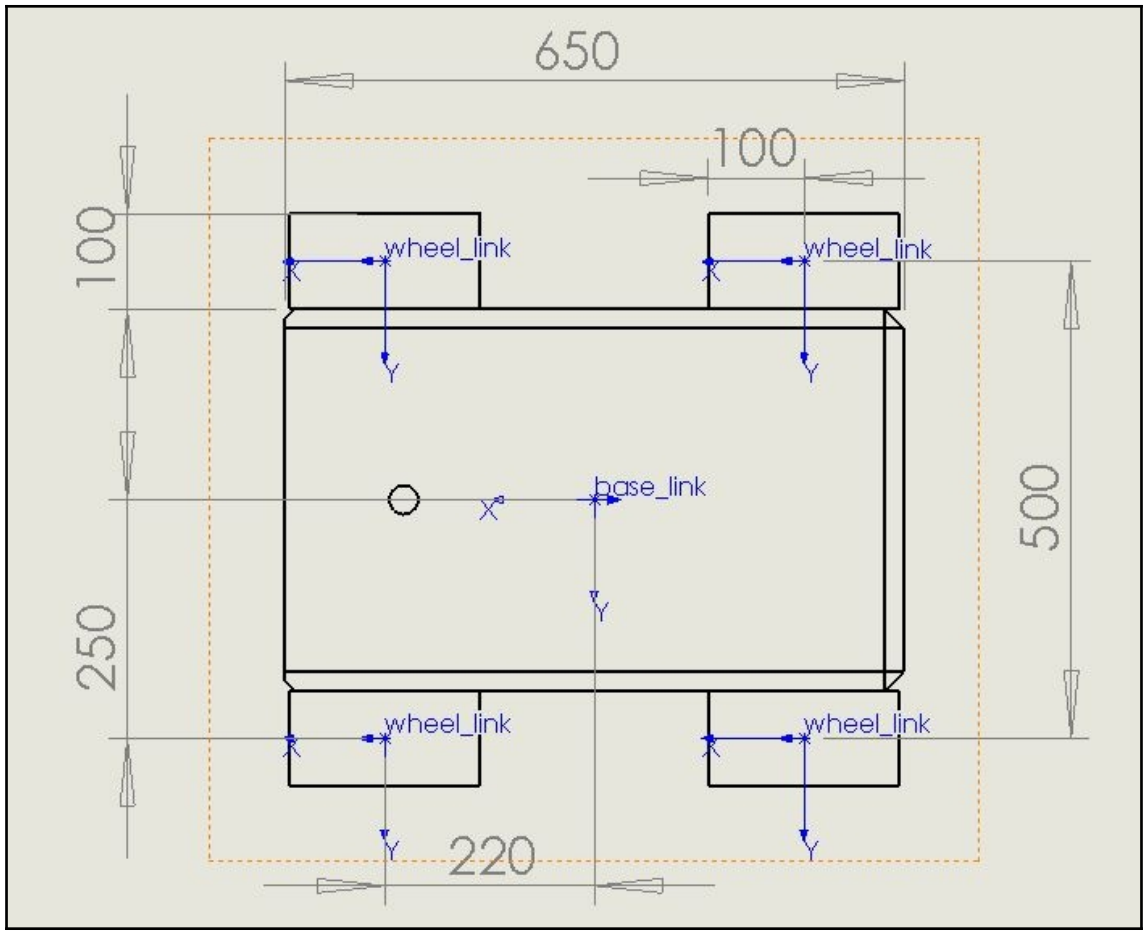
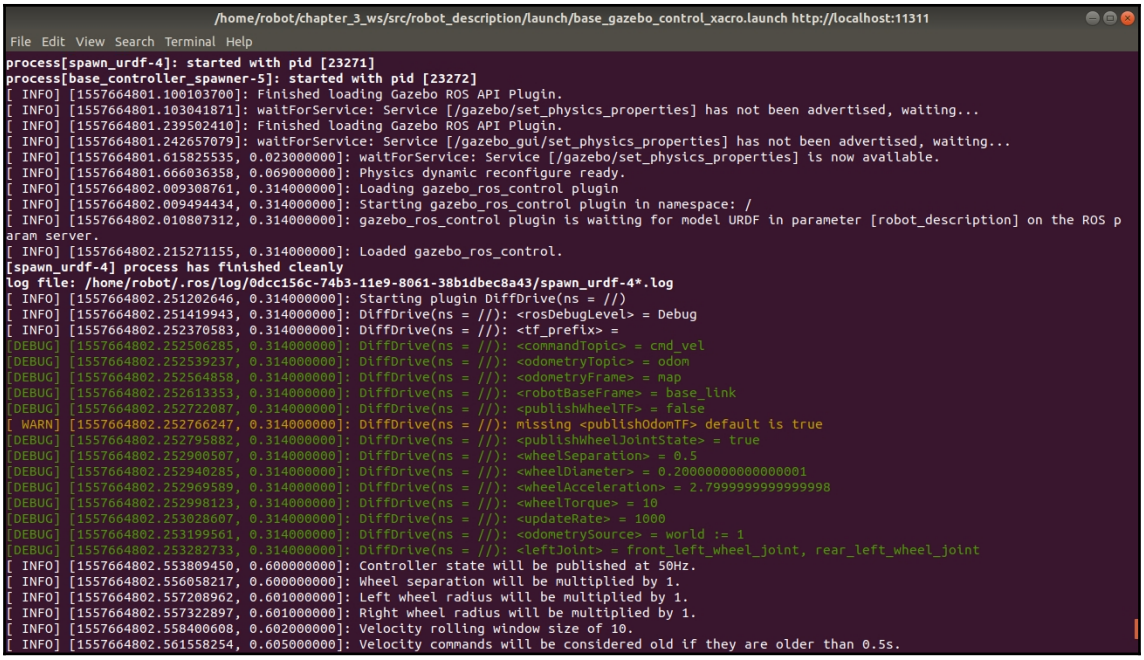
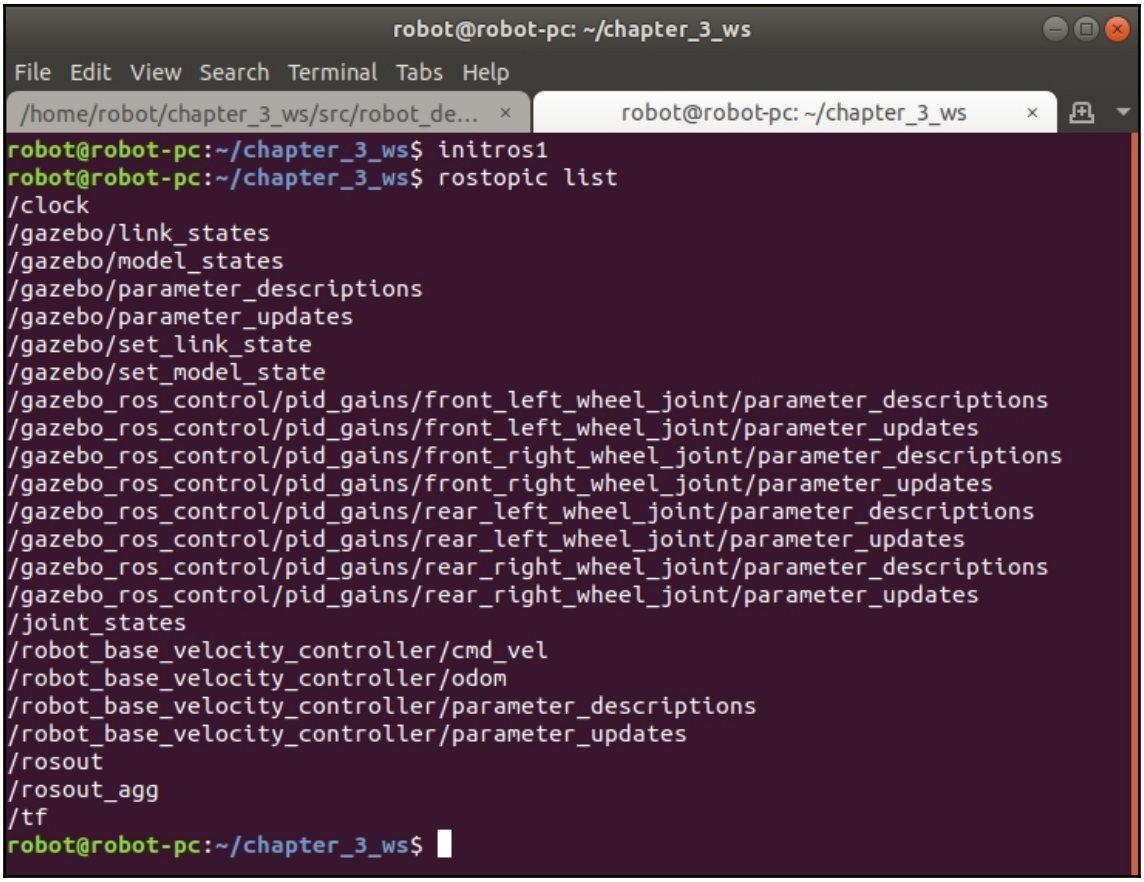
REEM-C
Humanoid research platform
100% ROS Based
Human-size 1.65m 80kg
Navigation
Vision
HRI
AI
TIAGo
Your best research partner
100% ROS Based
Lifting torso - 7 DoF arm - 2 DoF head
Navigation
Vision
HRI
AI
TIAGo

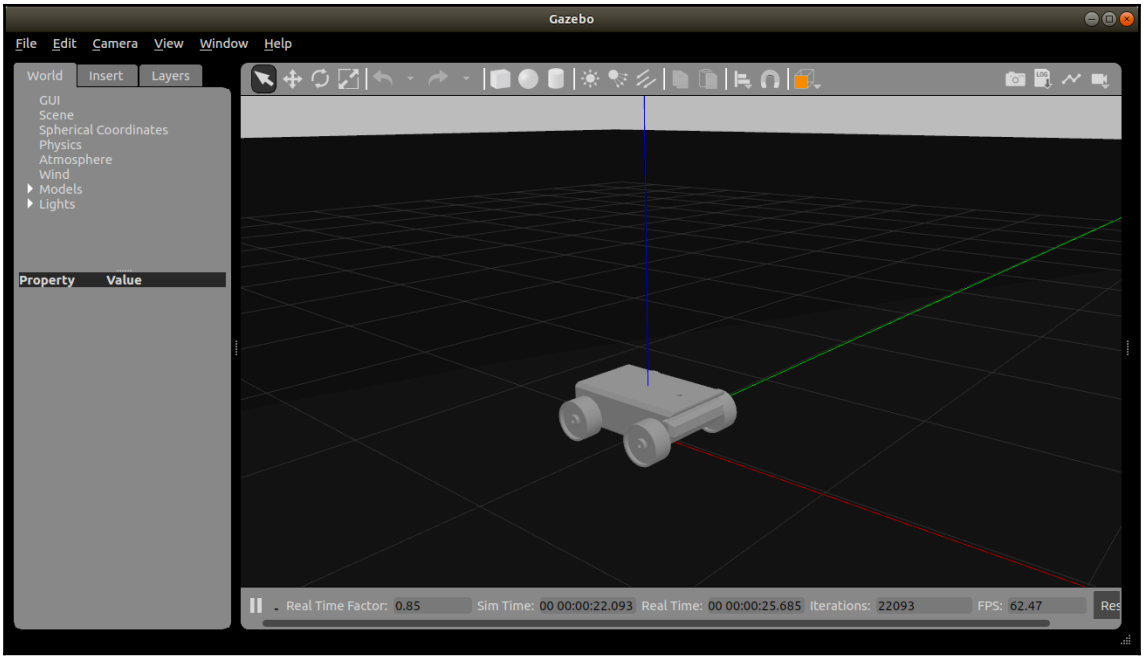

/cmd_vel
Mobile
robot base
/odom



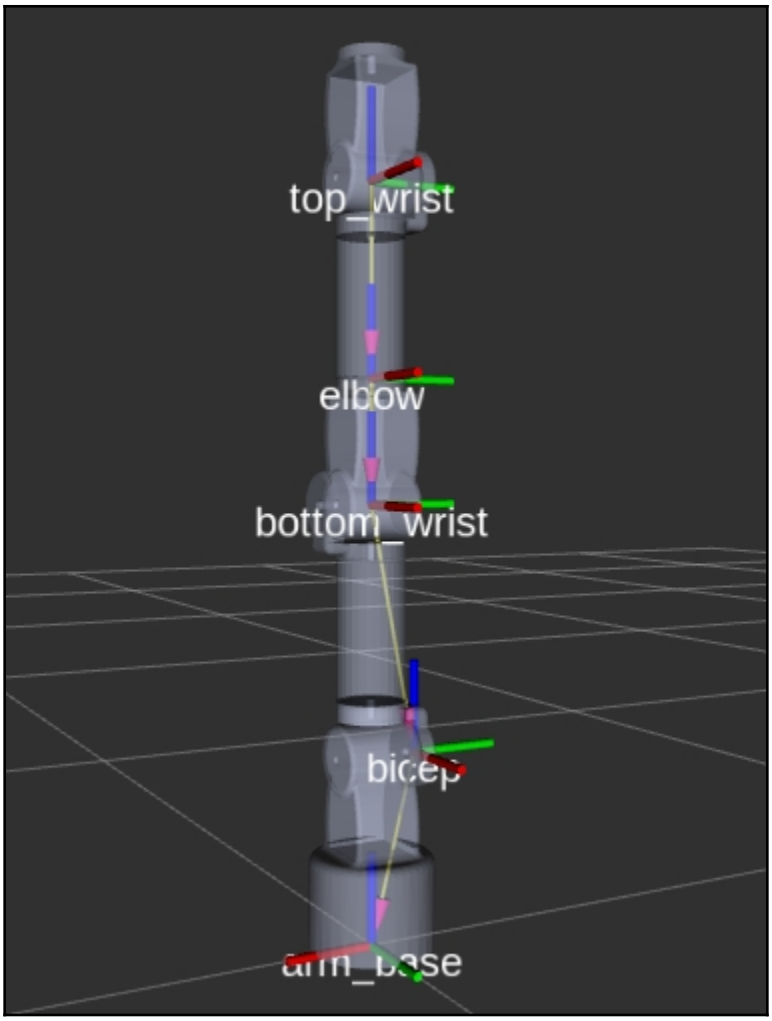

650
100
100
wheel_link
wheel_link
base_link
500
250
wheel_link
wheel_link
220

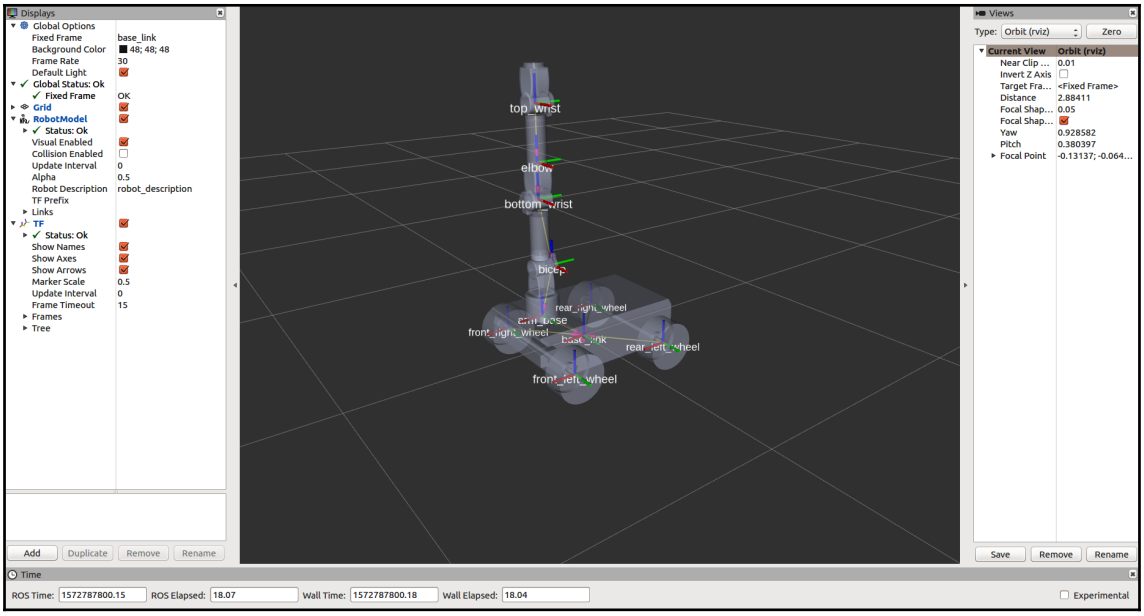

/home/robot/chapter_3_ws/src/robot_description/launch/base_gazebo_control_xacro.launch http://localhost:11311
File Edit View Search Terminal Help
process[spawn_urdf-4]: started with pid [23271]
process[base_controller_spawner-5]: started with pid [23272]
[INFO] [1557664801.100103700]: Finished loading Gazebo ROS API Plugin.
[INFO] [1557664801.103041871]: waitForService: Service [/gazebo/set_physics_properties] has not been advertised, waiting...
[INFO] [1557664801.239502410]: Finished loading Gazebo ROS API Plugin.
[INFO] [1557664801.242657079]: waitForService: Service [/gazebo_gui/set_physics_properties] has not been advertised, waiting...
[INFO] [1557664801.615825535, 0.023000000]: waitForService: Service [/gazebo/set_physics_properties] is now available.
[INFO] [1557664801.666036358, 0.069000000]: Physics dynamic reconfigure ready.
[INFO] [1557664802.009308761, 0.314000000]: Loading gazebo_ros_control plugin
[INFO] [1557664802.009494434, 0.314000000]: Starting gazebo_ros_control plugin in namespace: /
[INFO] [1557664802.010807312, 0.314000000]: gazebo_ros_control plugin is waiting for model URDF in parameter [robot_description] on the ROS p
aram server.
[INFO] [1557664802.215271155, 0.314000000]: Loaded gazebo_ros_control.
[spawn_urdf-4] process has finished cleanly
log file: /home/robot/.ros/log/0dcc156c-74b3-11e9-8061-38b1dbec8a43/spawn_urdf-4*.log
[INFO] [1557664802.251202646, 0.314000000]: Starting plugin DiffDrive(ns = //)
[INFO] [1557664802.251419943, 0.314000000]: DiffDrive(ns = //): <rosDebugLevel> = Debug
[INFO] [1557664802.252370583, 0.314000000]: DiffDrive(ns = //): <tf_prefix> =
[DEBUG] [1557664802.252506285, 0.314000000]: DiffDrive(ns = //): <commandTopic> = cmd_vel
[DEBUG] [1557664802.252539237, 0.314000000]: DiffDrive(ns = //): <odometryTopic> = odom
[DEBUG] [1557664802.252564858, 0.314000000]: DiffDrive(ns = //): <odometryFrame> = map
[DEBUG] [1557664802.252613353, 0.314000000]: DiffDrive(ns = //): <robotBaseFrame> = base_link
[DEBUG] [1557664802.252722087, 0.314000000]: DiffDrive(ns = //): <publishWheelTF> = false
[WARN] [1557664802.252766247, 0.314000000]: DiffDrive(ns = //): missing <publishOdomTF> default is true
[DEBUG] [1557664802.252795882, 0.314000000]: DiffDrive(ns = //): <publishWheelJointState> = true
[DEBUG] [1557664802.252900507, 0.314000000]: DiffDrive(ns = //): <wheelSeparation> = 0.5
[DEBUG] [1557664802.252940285, 0.314000000]: DiffDrive(ns = //): <wheelDiameter> = 0.20000000000000001
[DEBUG] [1557664802.252969589, 0.314000000]: DiffDrive(ns = //): <wheelAcceleration> = 2.7999999999999998
[DEBUG] [1557664802.252998123, 0.314000000]: DiffDrive(ns = //): <wheelTorque> = 10
[DEBUG] [1557664802.253028607, 0.314000000]: DiffDrive(ns = //): <updateRate> = 1000
[DEBUG] [1557664802.253199561, 0.314000000]: DiffDrive(ns = //): <odometrySource> = world := 1
[DEBUG] [1557664802.253282733, 0.314000000]: DiffDrive(ns = //): <leftJoint> = front_left_wheel_joint, rear_left_wheel_joint
[INFO] [1557664802.553809450, 0.600000000]: Controller state will be published at 50Hz.
[INFO] [1557664802.556058217, 0.600000000]: Wheel separation will be multiplied by 1.
[INFO] [1557664802.557208962, 0.601000000]: Left wheel radius will be multiplied by 1.
[INFO] [1557664802.557322897, 0.601000000]: Right wheel radius will be multiplied by 1.
[INFO] [1557664802.558400608, 0.602000000]: Velocity rolling window size of 10.
[INFO] [1557664802.561558254, 0.605000000]: Velocity commands will be considered old if they are older than 0.5s.


robot@robot-pc: ~/chapter_3_ws
File Edit View Search Terminal Tabs Help
/home/robot/chapter_3_ws/src/robot_de...
robot@robot-pc: ~/chapter_3_ws
robot@robot-pc:~/chapter_3_ws$ initros1
robot@robot-pc:~/chapter_3_ws$ rostopic list
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/gazebo_ros_control/pid_gains/front_left_wheel_joint/parameter_descriptions
/gazebo_ros_control/pid_gains/front_left_wheel_joint/parameter_updates
/gazebo_ros_control/pid_gains/front_right_wheel_joint/parameter_descriptions
/gazebo_ros_control/pid_gains/front_right_wheel_joint/parameter_updates
/gazebo_ros_control/pid_gains/rear_left_wheel_joint/parameter_descriptions
/gazebo_ros_control/pid_gains/rear_left_wheel_joint/parameter_updates
/gazebo_ros_control/pid_gains/rear_right_wheel_joint/parameter_descriptions
/gazebo_ros_control/pid_gains/rear_right_wheel_joint/parameter_updates
/joint_states
/robot_base_velocity_controller/cmd_vel
/robot_base_velocity_controller/odom
/robot_base_velocity_controller/parameter_descriptions
/robot_base_velocity_controller/parameter_updates
/rosout
/rosout_agg
/tf
robot@robot-pc:~/chapter_3_ws$

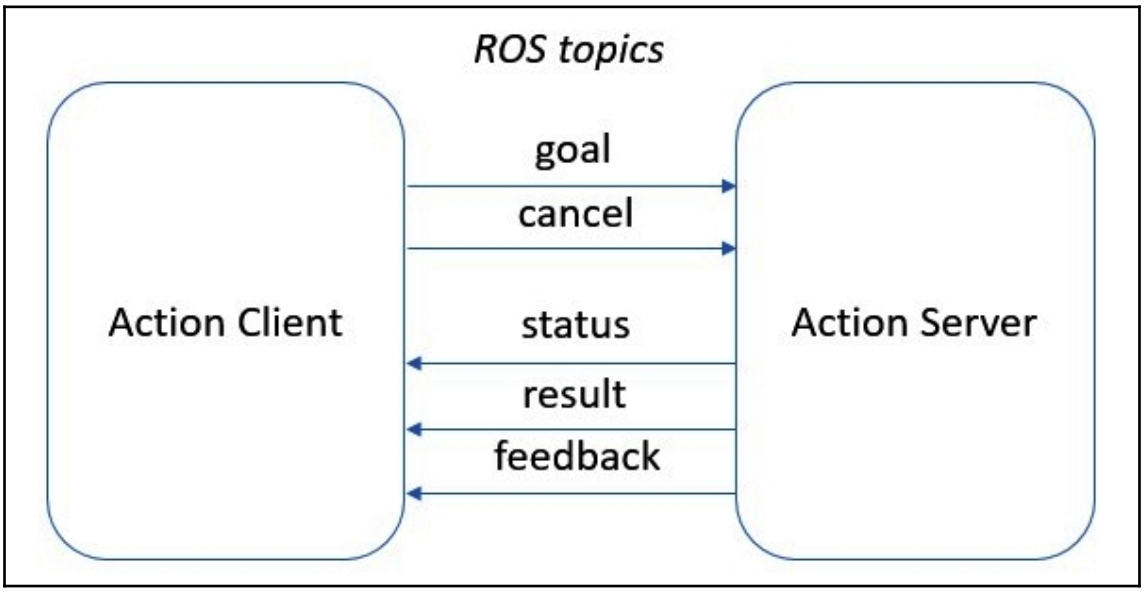

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0.85 Sim Time: 00 00:00:22.093 Real Time: 00 00:00:25.685 Iterations: 22093 FPS: 62.47

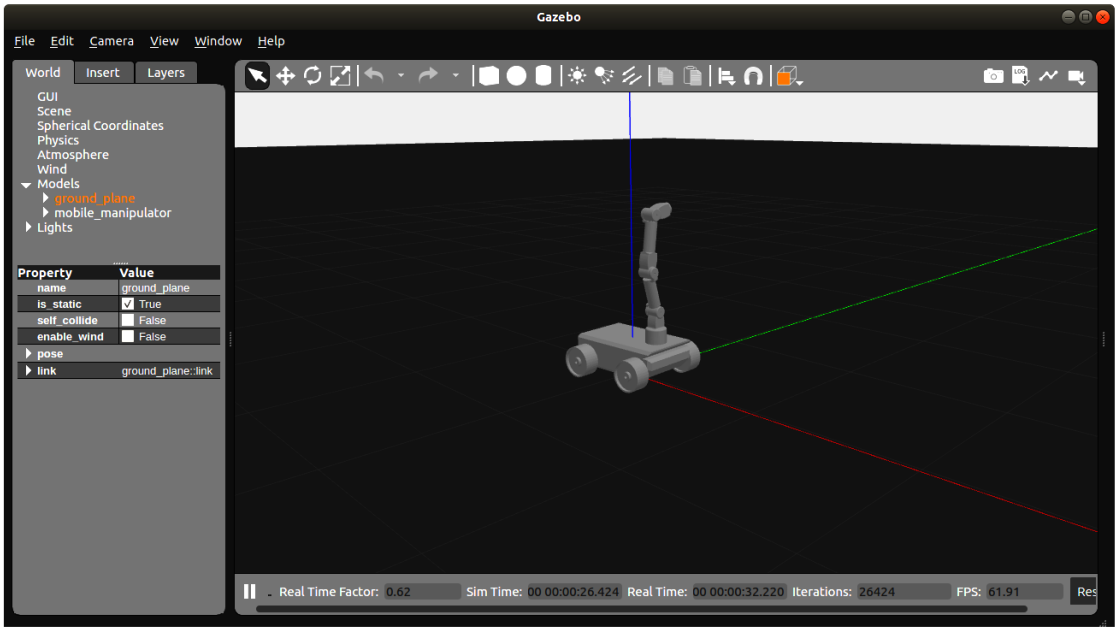

/arm_controller/command
Robot arm
/joint_states


top_wrist
elbow
bottom_wrist
bicep
arm_base


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 0.5
Robot Description robot_description
TF Prefix
Links
TF
Status: Ok
Show Names
Show Axes
Show Arrows
Marker Scale 0.5
Update Interval 0
Frame Timeout 15
Frames
Tree
Add
Duplicate
Remove
Rename
top_wrist
elbow
bottom_wrist
bicep
rear_right_wheel
front_right_wheel
base_link
rear_left_wheel
front_left_wheel
Views
Type: Orbit (rviz)
Zero
Current View Orbit (rviz)
Near Clip … 0.01
Invert Z Axis
Target Fra… <Fixed Frame>
Distance 2.88411
Focal Shap… 0.05
Focal Shap…
Yaw 0.928582
Pitch 0.380397
Focal Point -0.13137; -0.064…
Save
Remove
Rename
Time
ROS Time: 1572787800.15
ROS Elapsed: 18.07
Wall Time: 1572787800.18
Wall Elapsed: 18.04
Experimental

Chapter 4: Handling Complex Robot Tasks Using State Machines

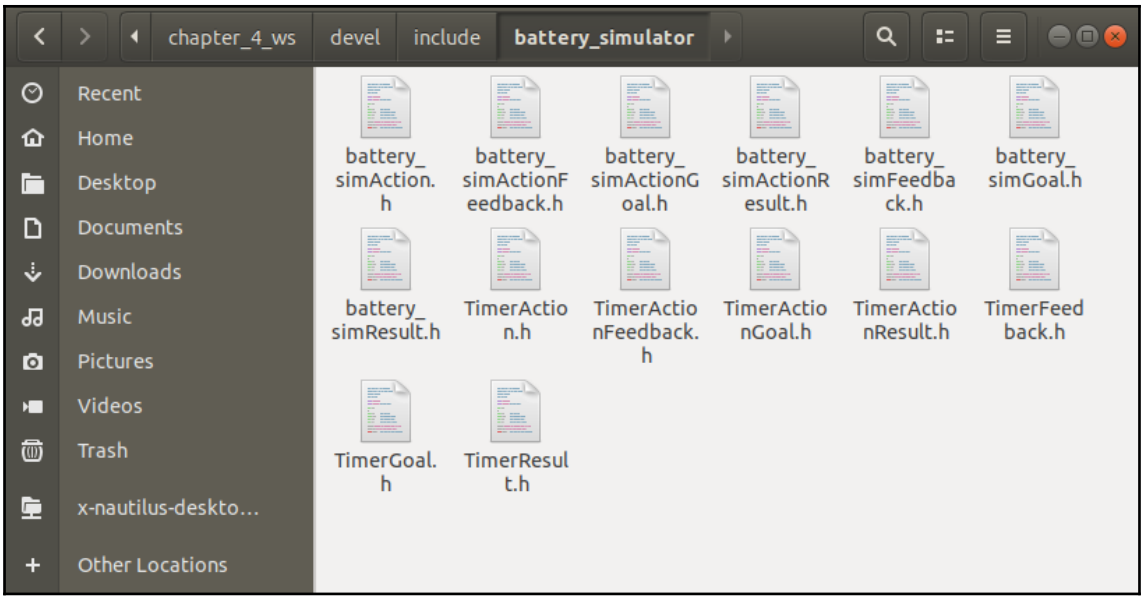


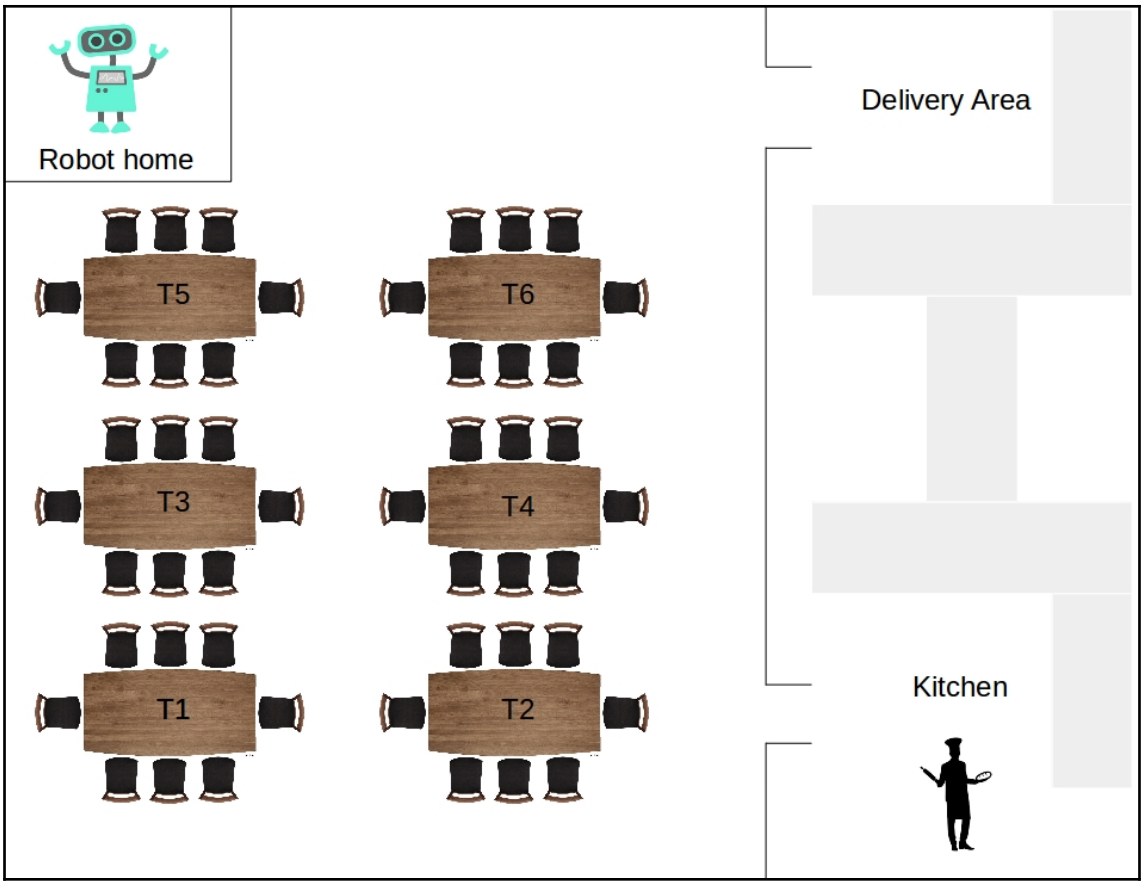


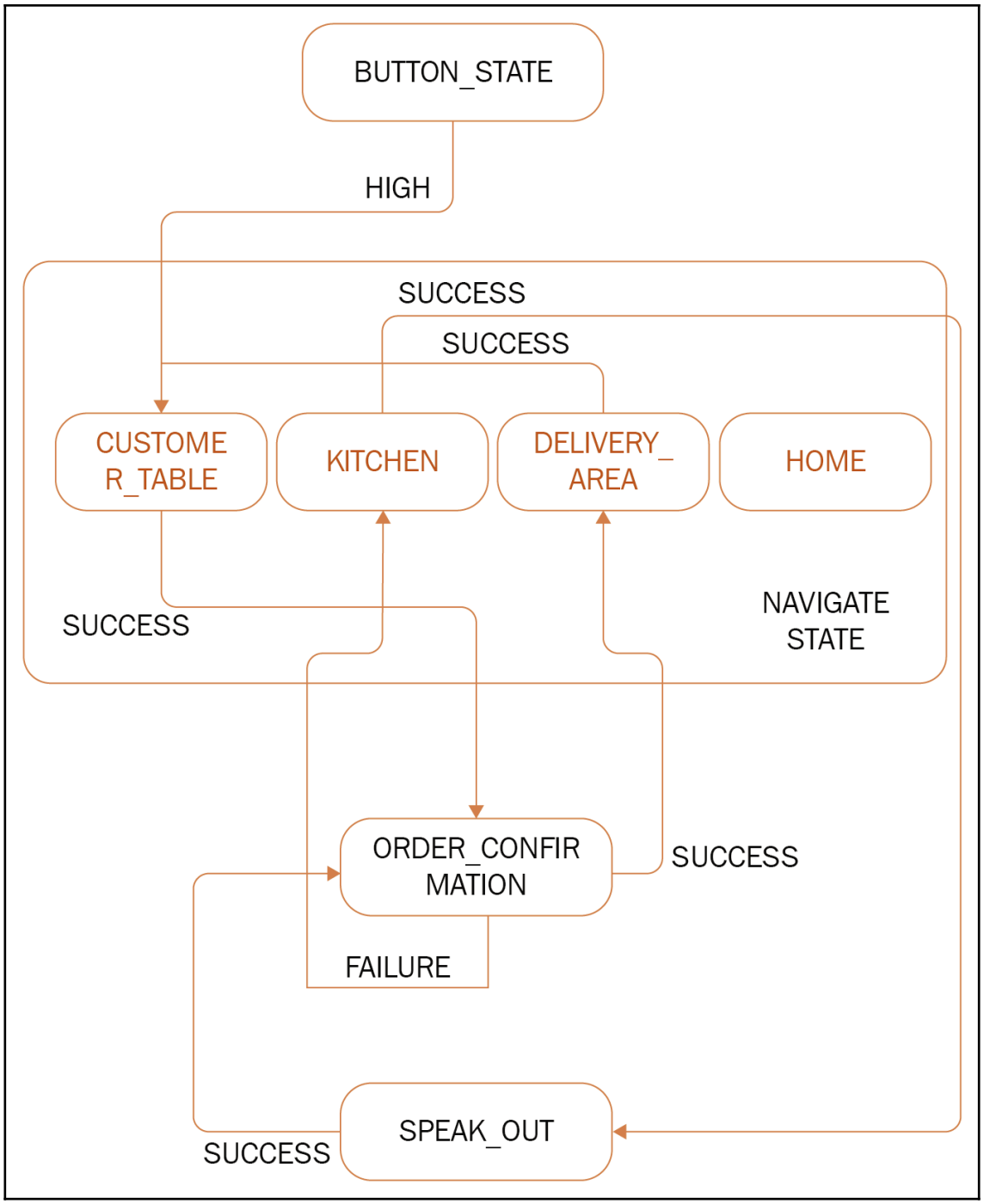
(a) Gazebo view

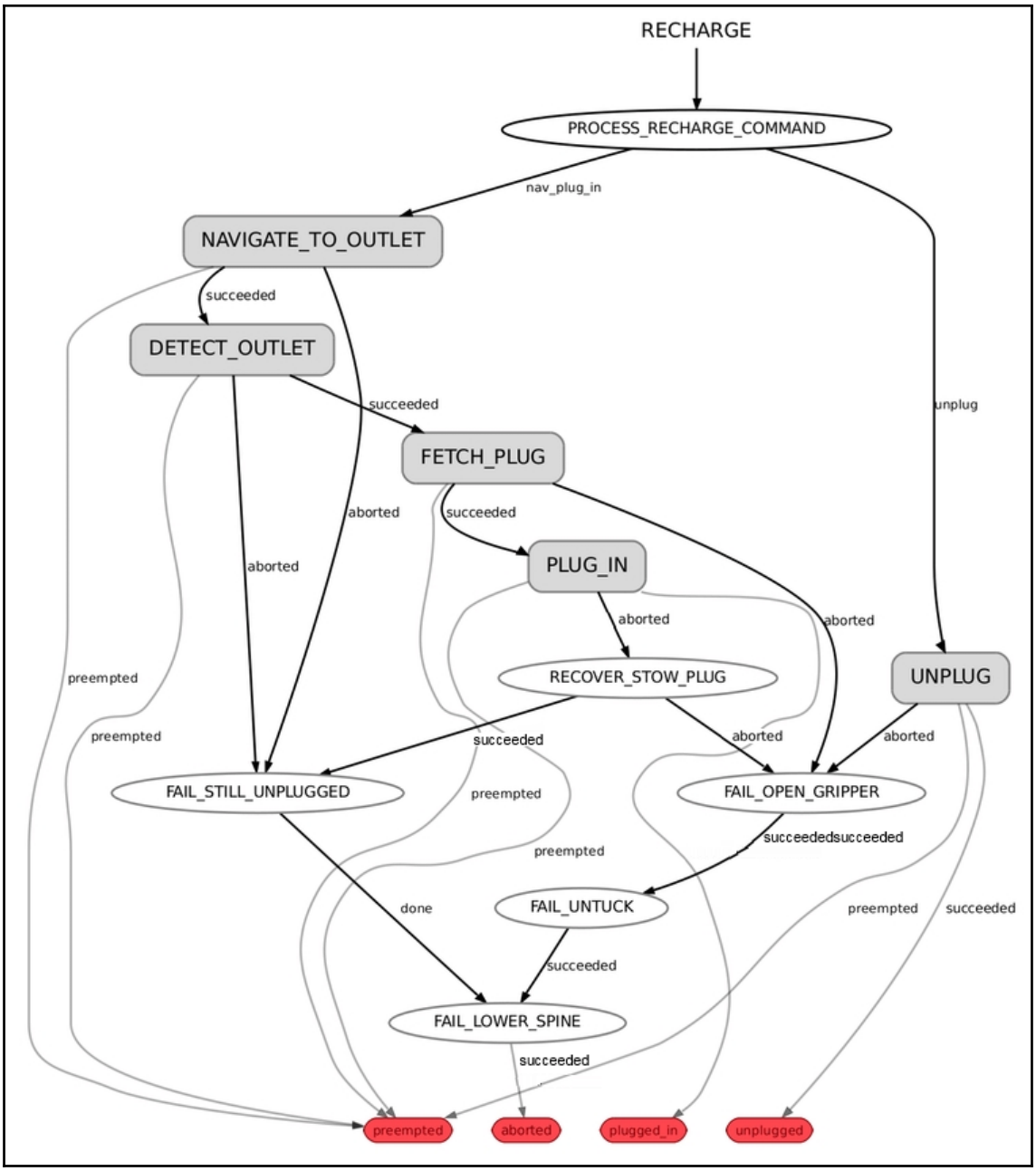
```
/arm_controller/command
/arm_controller/follow_joint_trajectory/cancel
/arm_controller/follow_joint_trajectory/feedback
/arm_controller/follow_joint_trajectory/goal
/arm_controller/follow_joint_trajectory/result
/arm_controller/follow_joint_trajectory/status
/arm_controller/state
```

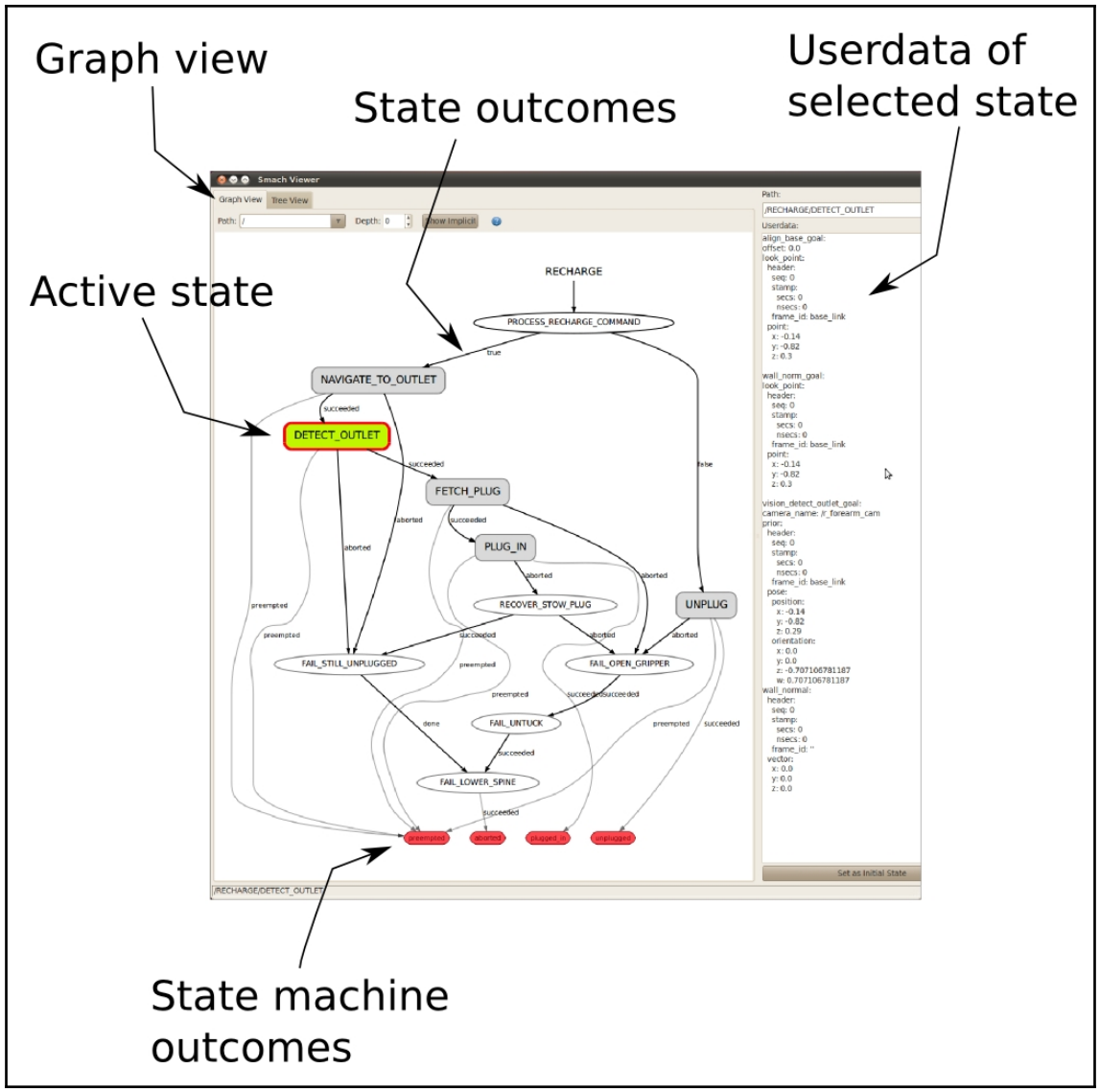
(b) Rostopic list

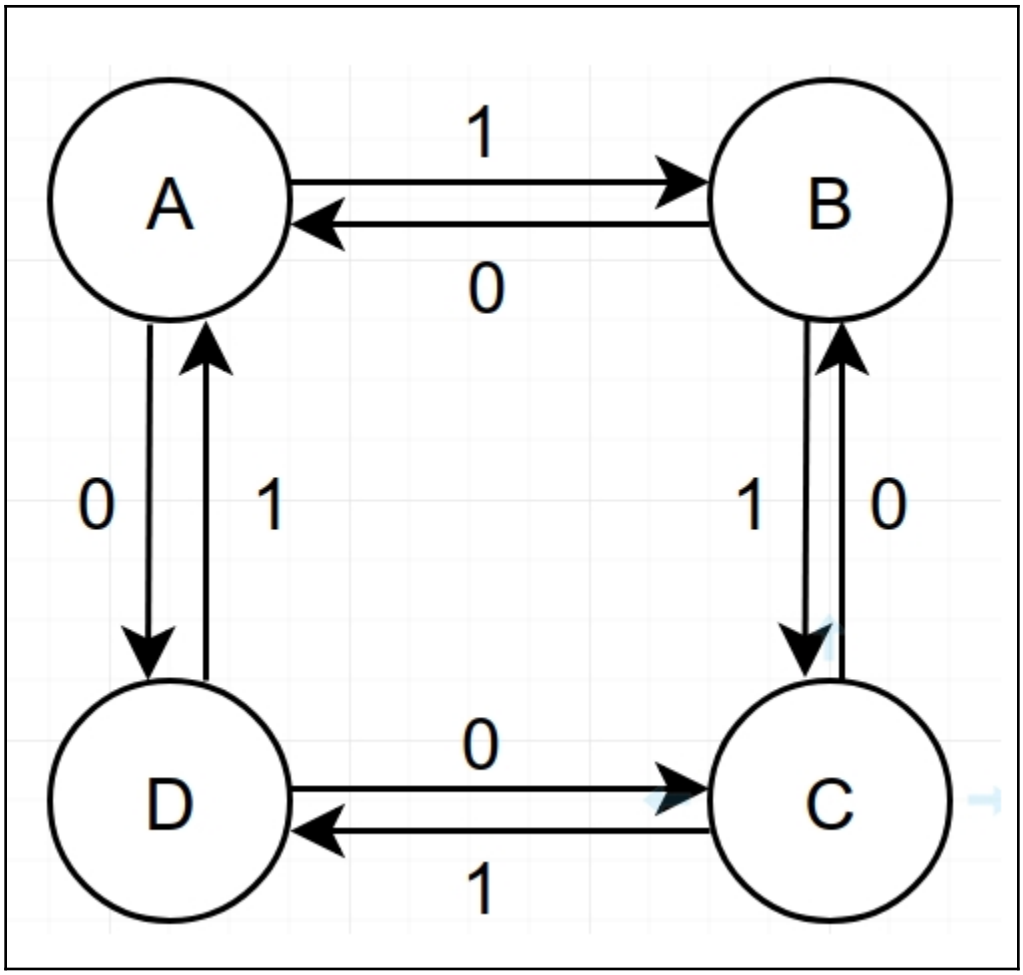

chapter_4_ws
devel
include
battery_simulator
Recent
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
Trash
x-nautilus-deskto…
Other Locations
battery_simAction.h
battery_simActionFeedback.h
battery_simActionGoal.h
battery_simActionResult.h
battery_simFeedback.h
battery_simGoal.h
battery_simResult.h
TimerAction.h
TimerActionFeedback.h
TimerActionGoal.h
TimerActionResult.h
TimerFeedback.h
TimerGoal.h
TimerResult.h

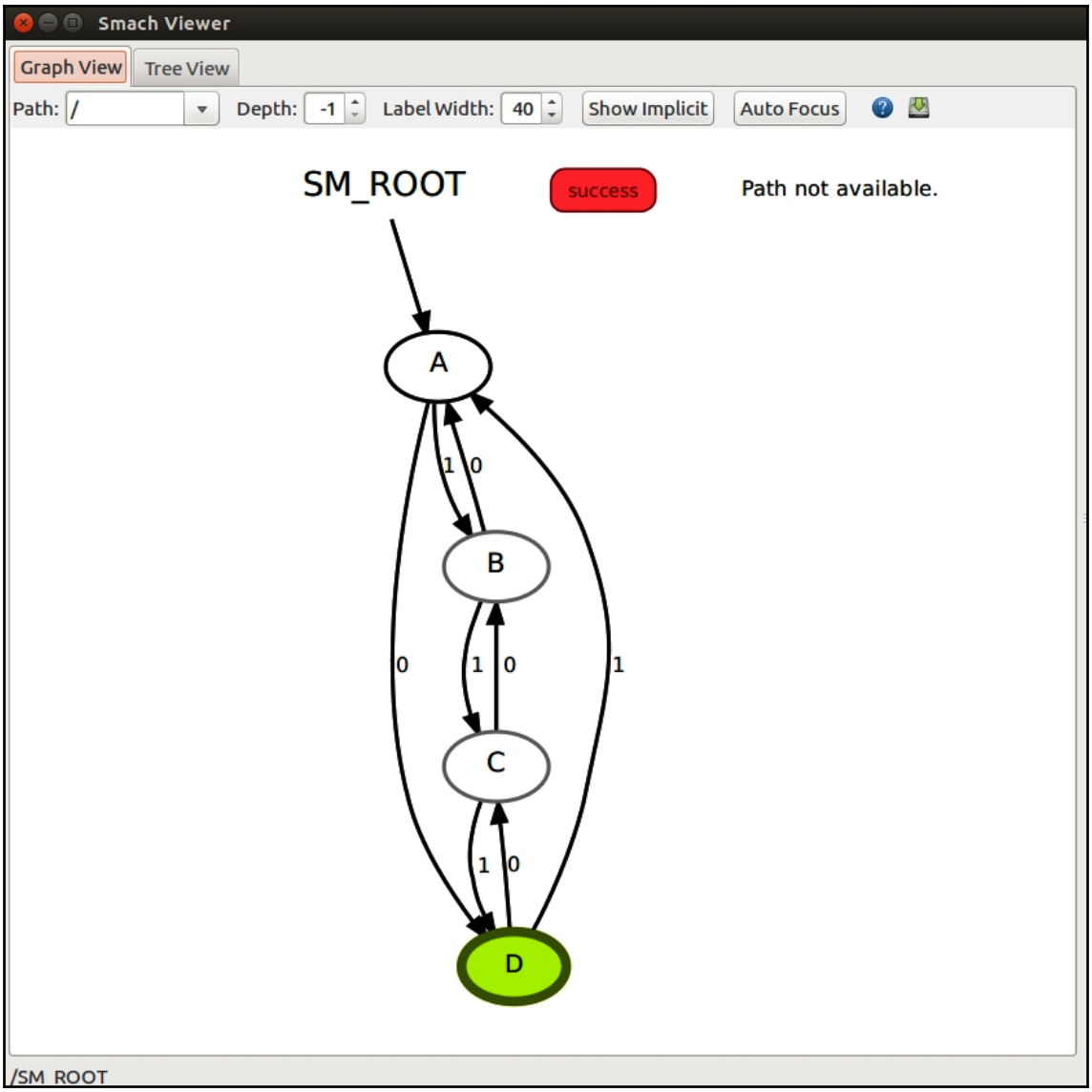

Robot home
Delivery Area
T5
T6
T3
T4
T1
T2
Kitchen

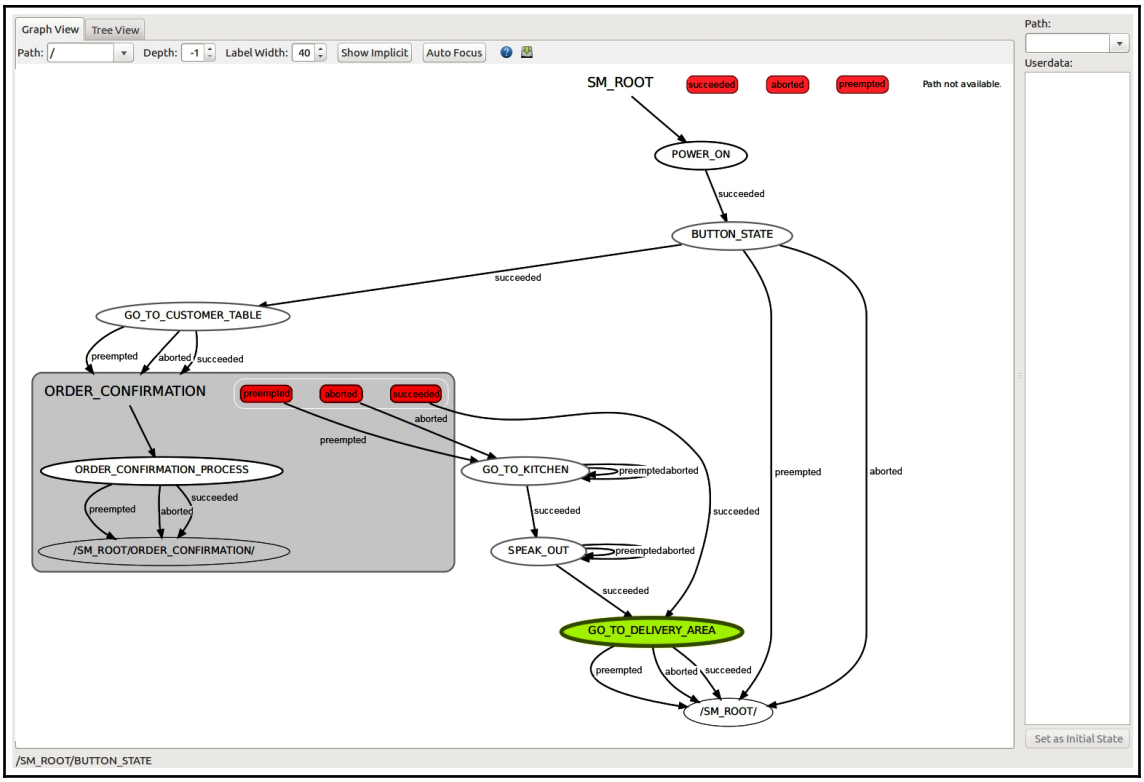

BUTTON_STATE
HIGH
SUCCESS
SUCCESS
CUSTOME R_TABLE
KITCHEN
DELIVERY_ AREA
HOME
SUCCESS
NAVIGATE STATE
ORDER_CONFIR MATION
SUCCESS
FAILURE
SPEAK_OUT
SUCCESS


RECHARGE
PROCESS_RECHARGE_COMMAND
nav_plug_in
NAVIGATE_TO_OUTLET
succeeded
DETECT_OUTLET
succeeded
unplug
FETCH_PLUG
aborted
succeeded
aborted
PLUG_IN
aborted
aborted
preempted
RECOVER_STOW_PLUG
UNPLUG
preempted
succeeded
aborted
aborted
FAIL_STILL_UNPLUGGED
preempted
FAIL_OPEN_GRIPPER
succeededsucceeded
preempted
done
FAIL_UNTUCK
preempted
succeeded
succeeded
FAIL_LOWER_SPINE
succeeded
preempted
aborted
plugged_in
unplugged

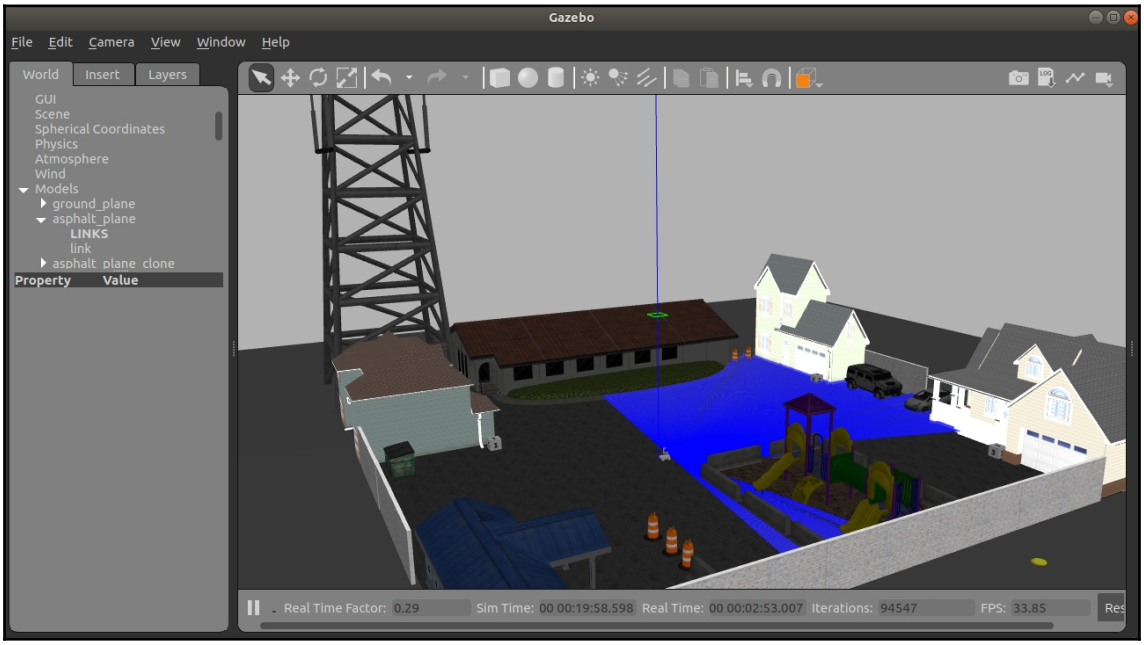

Graph view
State outcomes
Userdata of selected state
Active state
State machine outcomes
Smach Viewer
Graph View
Tree View
Path:
Depth:
Show Implicit
RECHARGE
PROCESS_RECHARGE_COMMAND
NAVIGATE_TO_OUTLET
DETECT_OUTLET
FETCH_PLUG
PLUG_IN
RECOVER_STOW_PLUG
UNPLUG
FAIL_STILL_UNPLUGGED
FAIL_OPEN_GRIPPER
FAIL_UNTUCK
FAIL_LOWER_SPINE
true
false
succeeded
aborted
preempted
done
/RECHARGE/DETECT_OUTLET
Userdata:
Set as Initial State

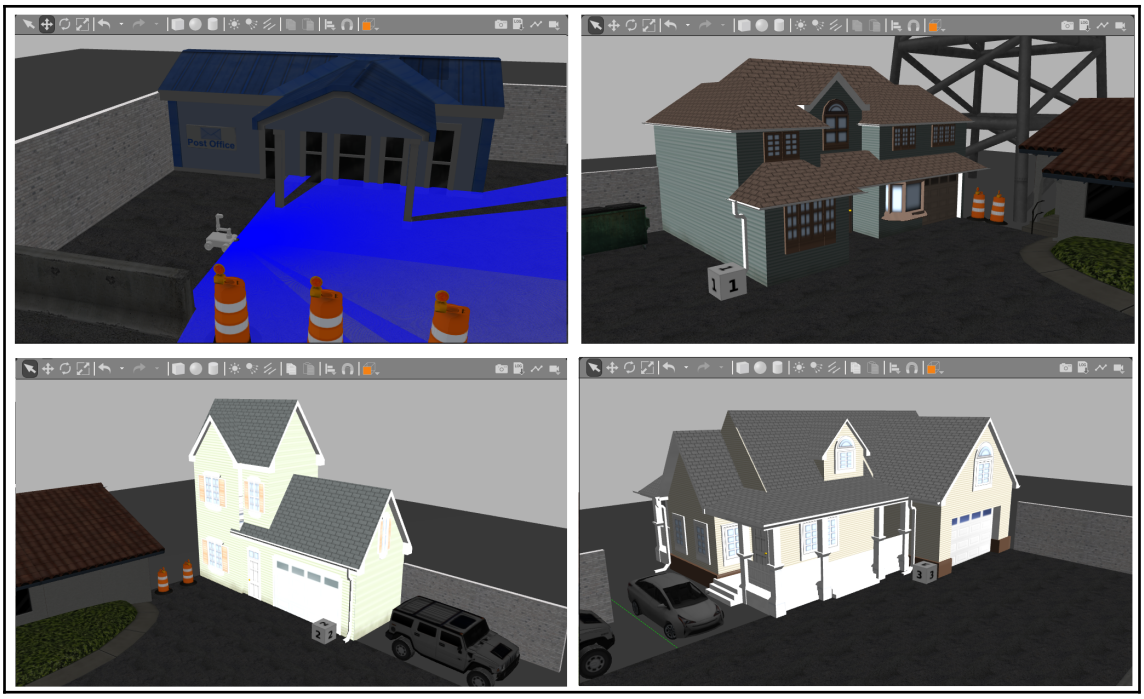

A
B
C
D
1
0
0
1
1
0
0
1

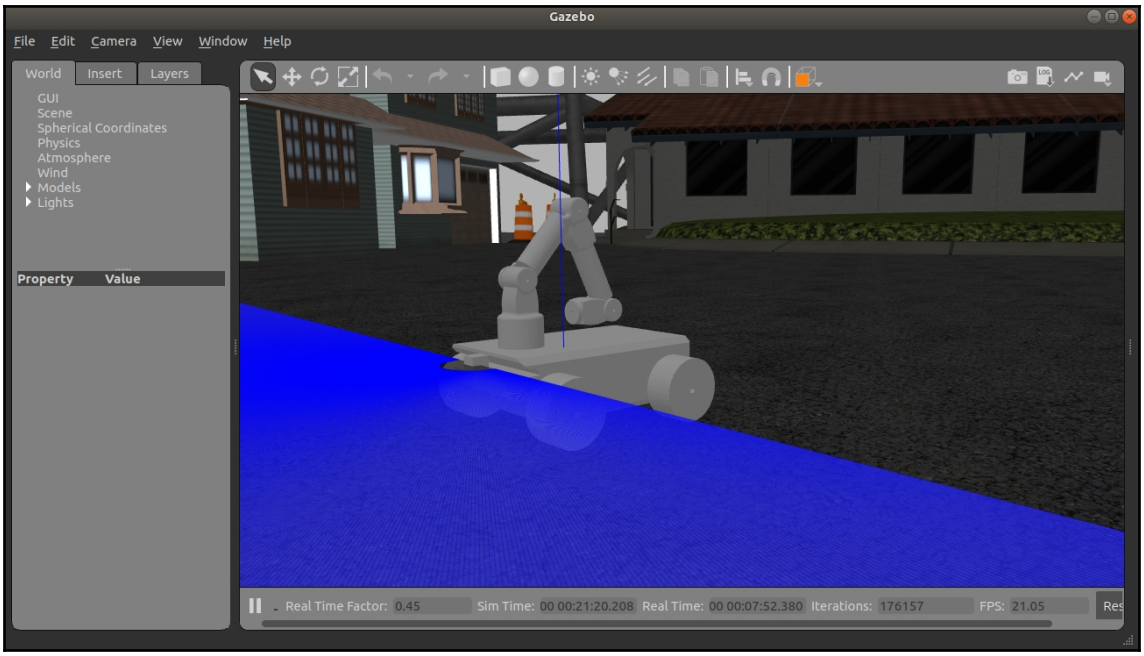

Smach Viewer
Graph View
Tree View
Path: /
Depth: -1
Label Width: 40
Show Implicit
Auto Focus
SM_ROOT
success
Path not available.
A
B
C
D
1
0
1
0
0
1
0
1
0
/SM_ROOT

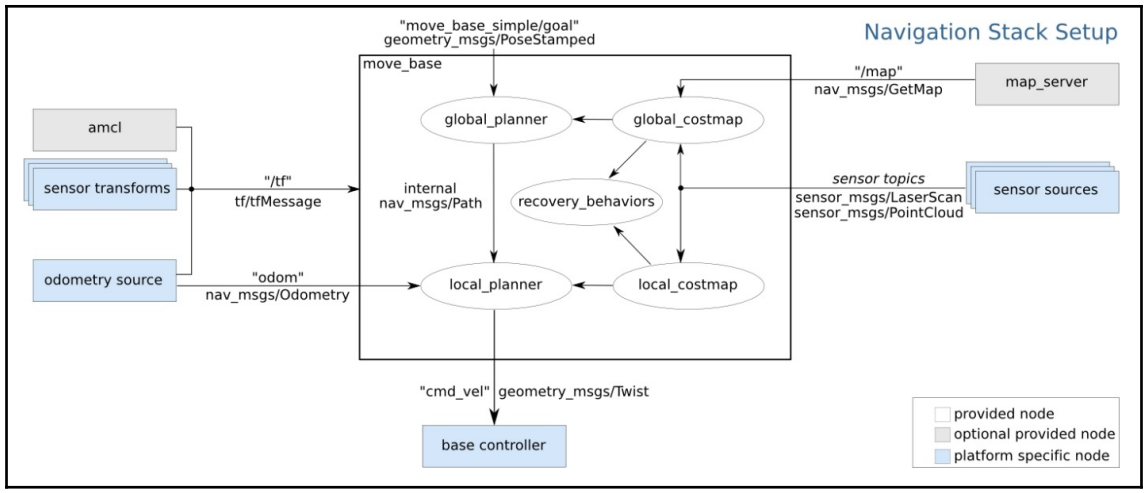

Graph View
Tree View
Path: /
Depth: -1
Label Width: 40
Show Implicit
Auto Focus
Path:
Userdata:
SM_ROOT
succeeded
aborted
preempted
Path not available.
POWER_ON
succeeded
BUTTON_STATE
succeeded
GO_TO_CUSTOMER_TABLE
preempted
aborted
succeeded
ORDER_CONFIRMATION
preempted
aborted
succeeded
aborted
preempted
ORDER_CONFIRMATION_PROCESS
preempted
aborted
succeeded
/SM_ROOT/ORDER_CONFIRMATION/
GO_TO_KITCHEN
preempted
aborted
succeeded
preempted
aborted
succeeded
SPEAK_OUT
preempted
aborted
succeeded
GO_TO_DELIVERY_AREA
preempted
aborted
succeeded
/SM_ROOT/
Set as Initial State
/SM_ROOT/BUTTON_STATE

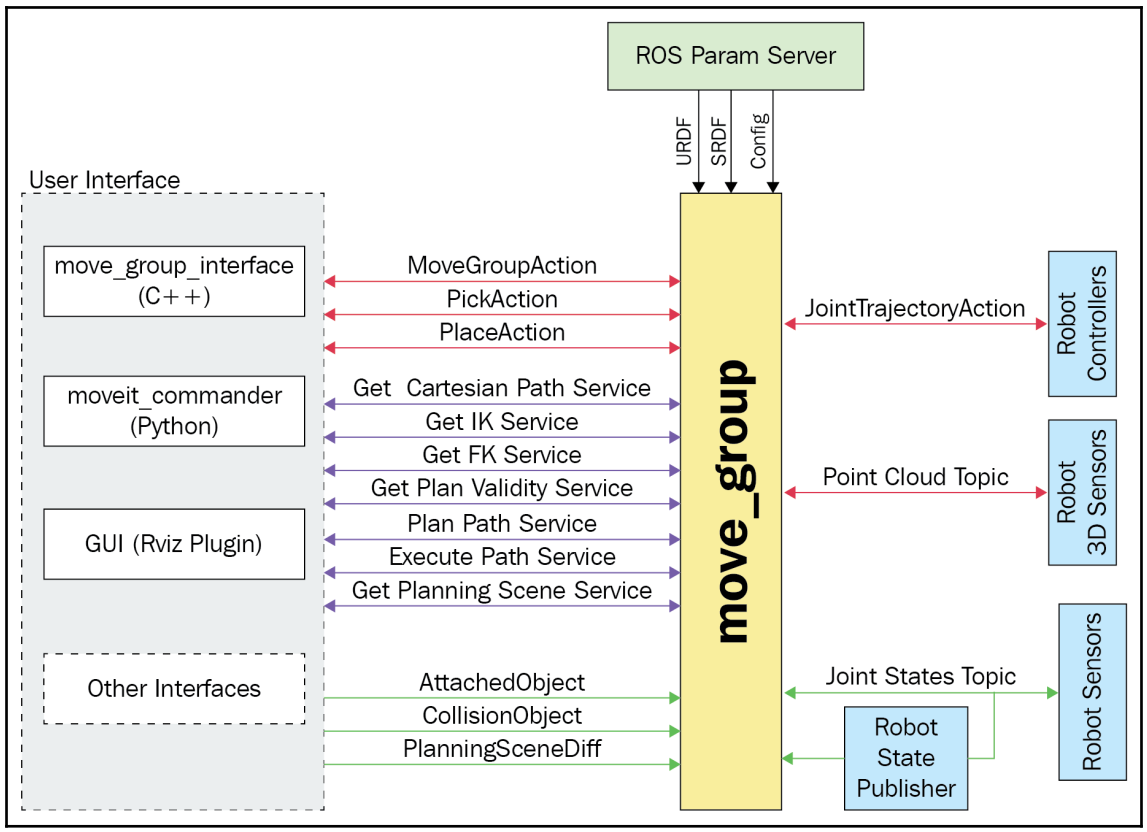
Chapter 5: Building an Industrial Application

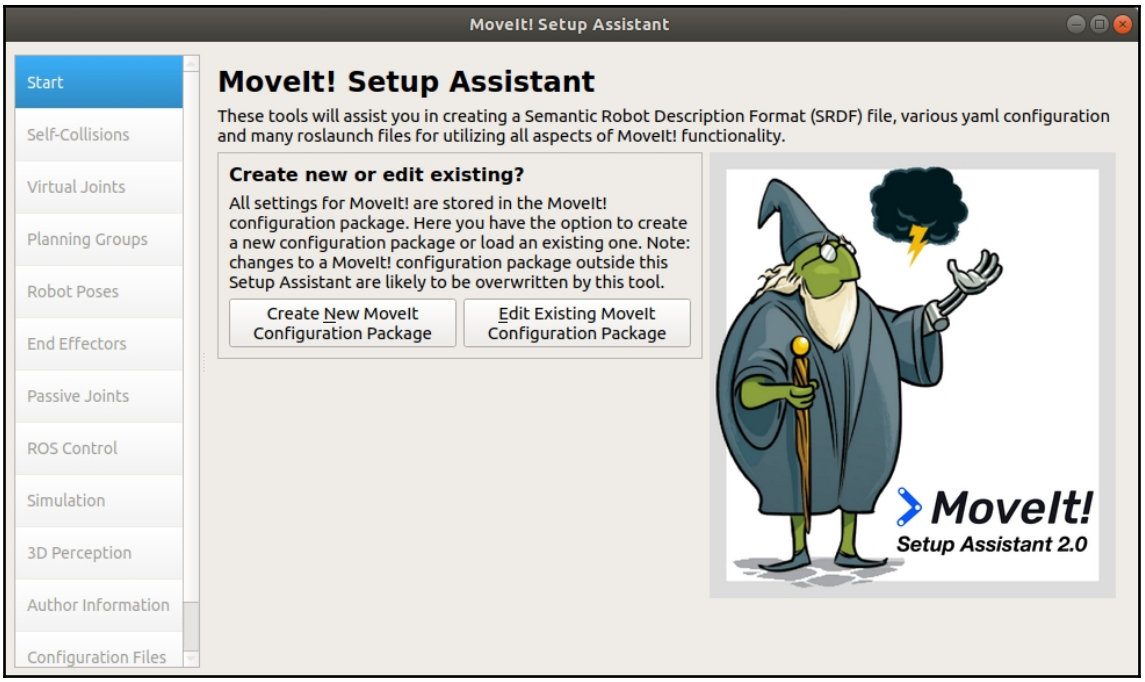


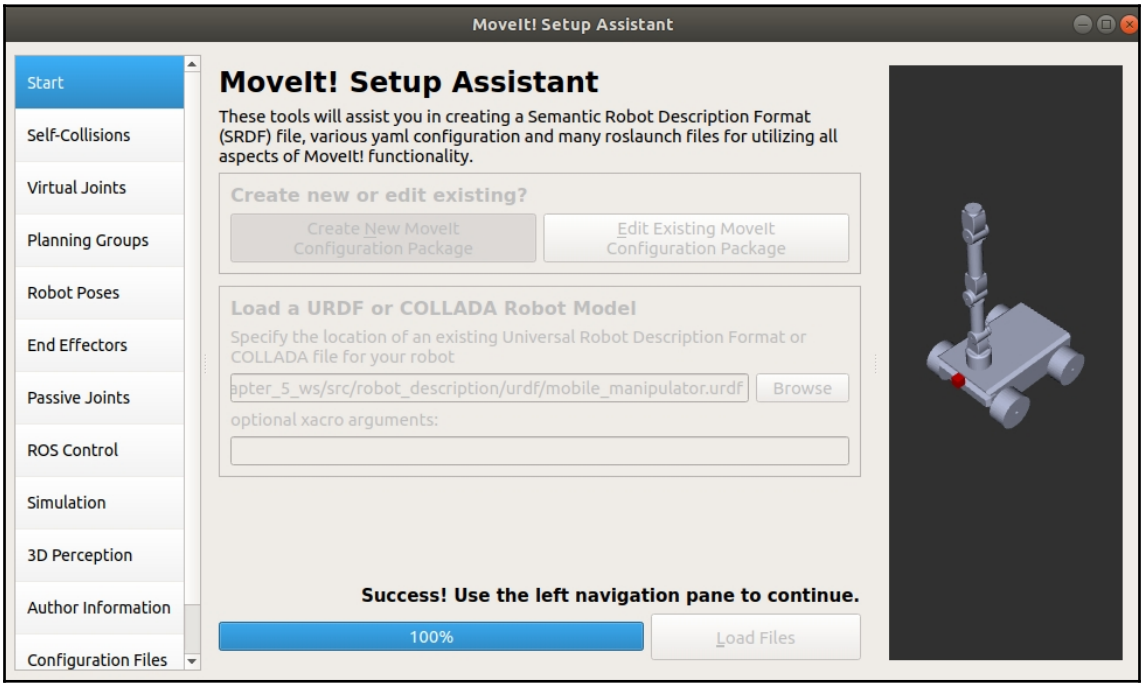

Post Office

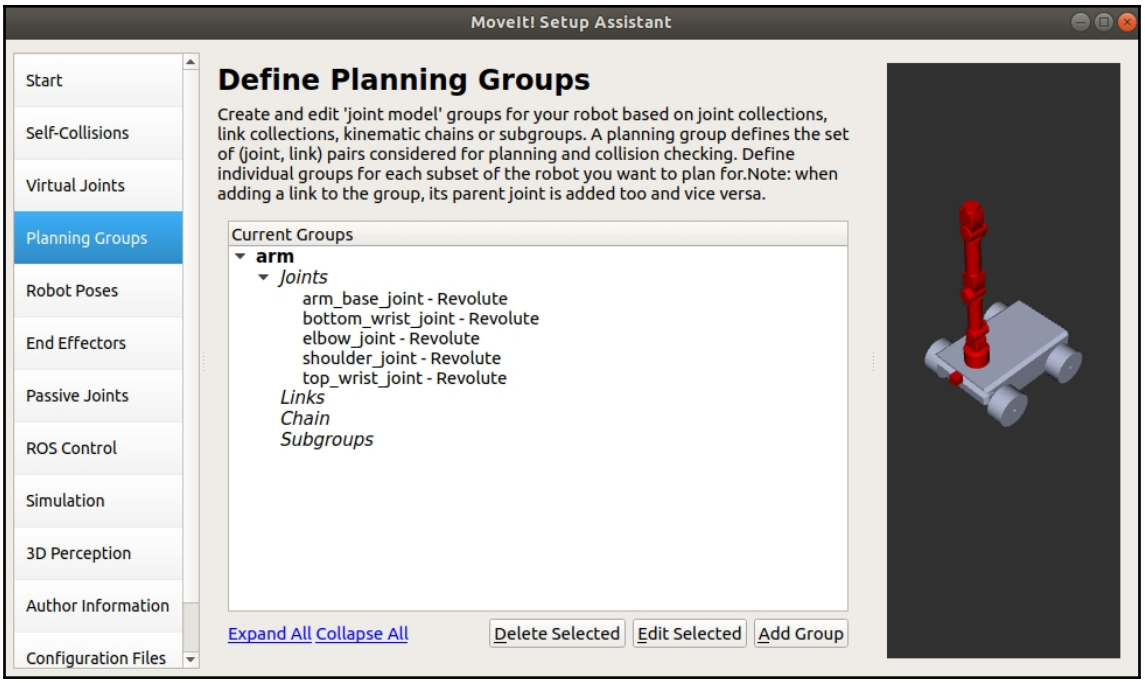

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0.45 Sim Time: 00 00:21:20.208 Real Time: 00 00:07:52.380 Iterations: 176157 FPS: 21.05

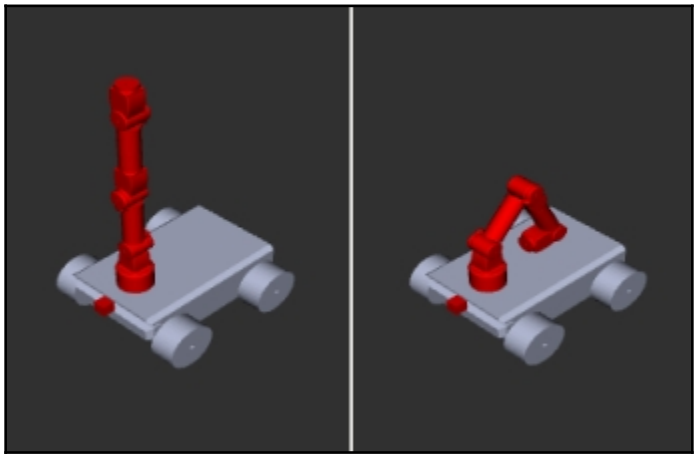

Navigation Stack Setup
"move_base_simple/goal"
geometry_msgs/PoseStamped
move_base
"/map"
nav_msgs/GetMap
map_server
amcl
global_planner
global_costmap
sensor transforms
"/tf"
tf/tfMessage
internal
nav_msgs/Path
recovery_behaviors
sensor topics
sensor_msgs/LaserScan
sensor_msgs/PointCloud
sensor sources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

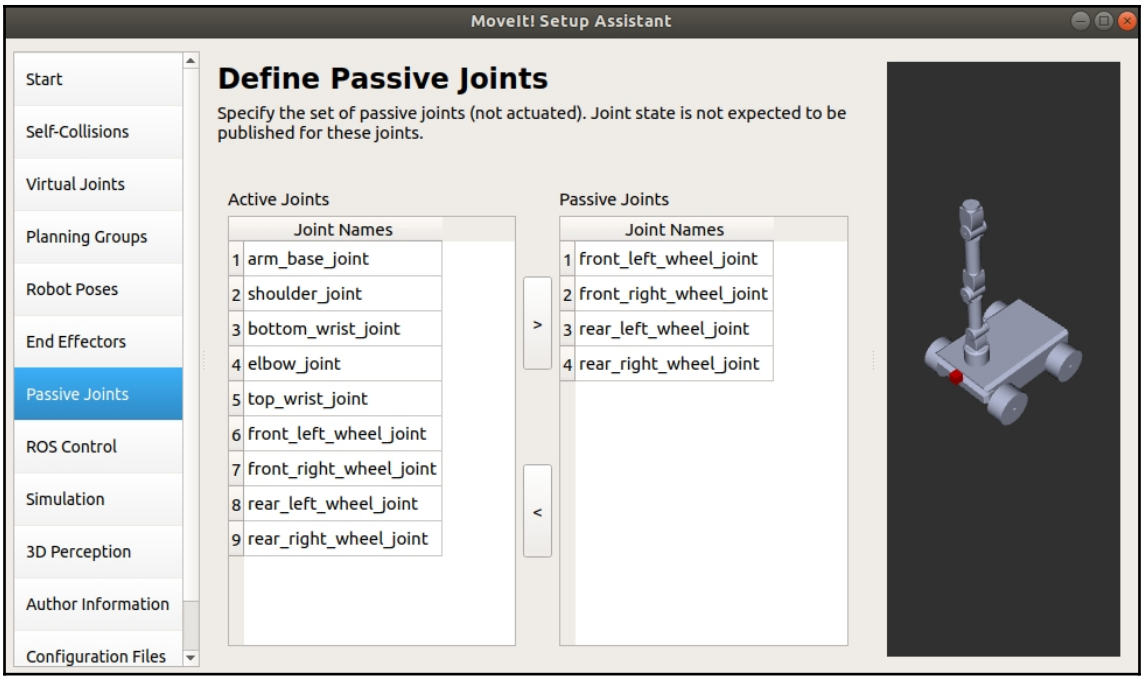

ROS Param Server
URDF
SRDF
Config
User Interface
move_group_interface
(C++)
moveit_commander
(Python)
GUI (Rviz Plugin)
Other Interfaces
MoveGroupAction
PickAction
PlaceAction
Get Cartesian Path Service
Get IK Service
Get FK Service
Get Plan Validity Service
Plan Path Service
Execute Path Service
Get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

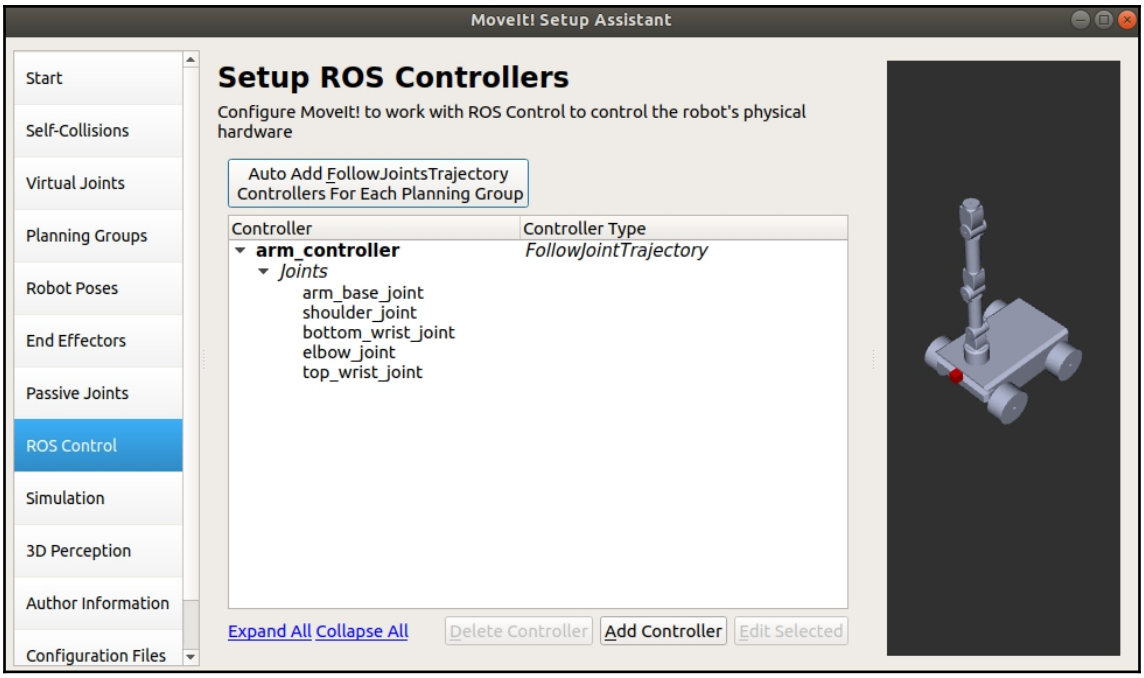

MoveIt! Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
MoveIt! Setup Assistant
These tools will assist you in creating a Semantic Robot Description Format (SRDF) file, various yaml configuration and many roslaunch files for utilizing all aspects of MoveIt! functionality.
Create new or edit existing?
All settings for MoveIt! are stored in the MoveIt! configuration package. Here you have the option to create a new configuration package or load an existing one. Note: changes to a MoveIt! configuration package outside this Setup Assistant are likely to be overwritten by this tool.
Create New MoveIt Configuration Package
Edit Existing MoveIt Configuration Package
MoveIt!
Setup Assistant 2.0

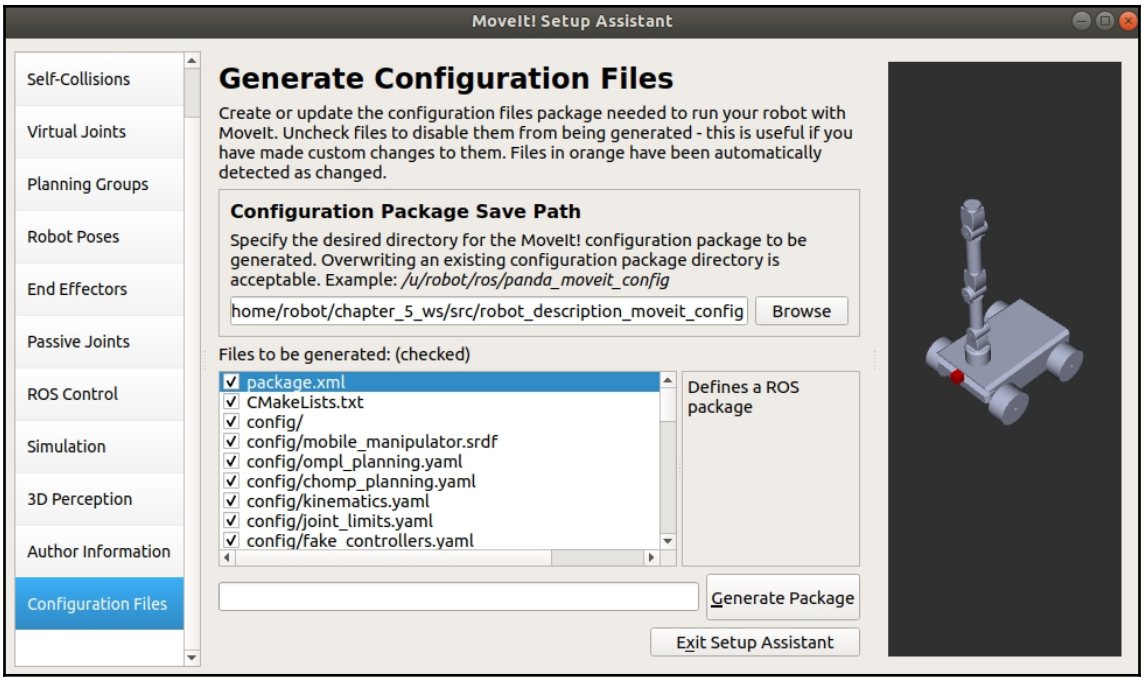

MoveIt! Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
MoveIt! Setup Assistant
These tools will assist you in creating a Semantic Robot Description Format (SRDF) file, various yaml configuration and many roslaunch files for utilizing all aspects of MoveIt! functionality.
Create new or edit existing?
Create New MoveIt Configuration Package
Edit Existing MoveIt Configuration Package
Load a URDF or COLLADA Robot Model
Specify the location of an existing Universal Robot Description Format or COLLADA file for your robot
apter_5_ws/src/robot_description/urdf/mobile_manipulator.urdf
Browse
optional xacro arguments:
Success! Use the left navigation pane to continue.
100%
Load Files

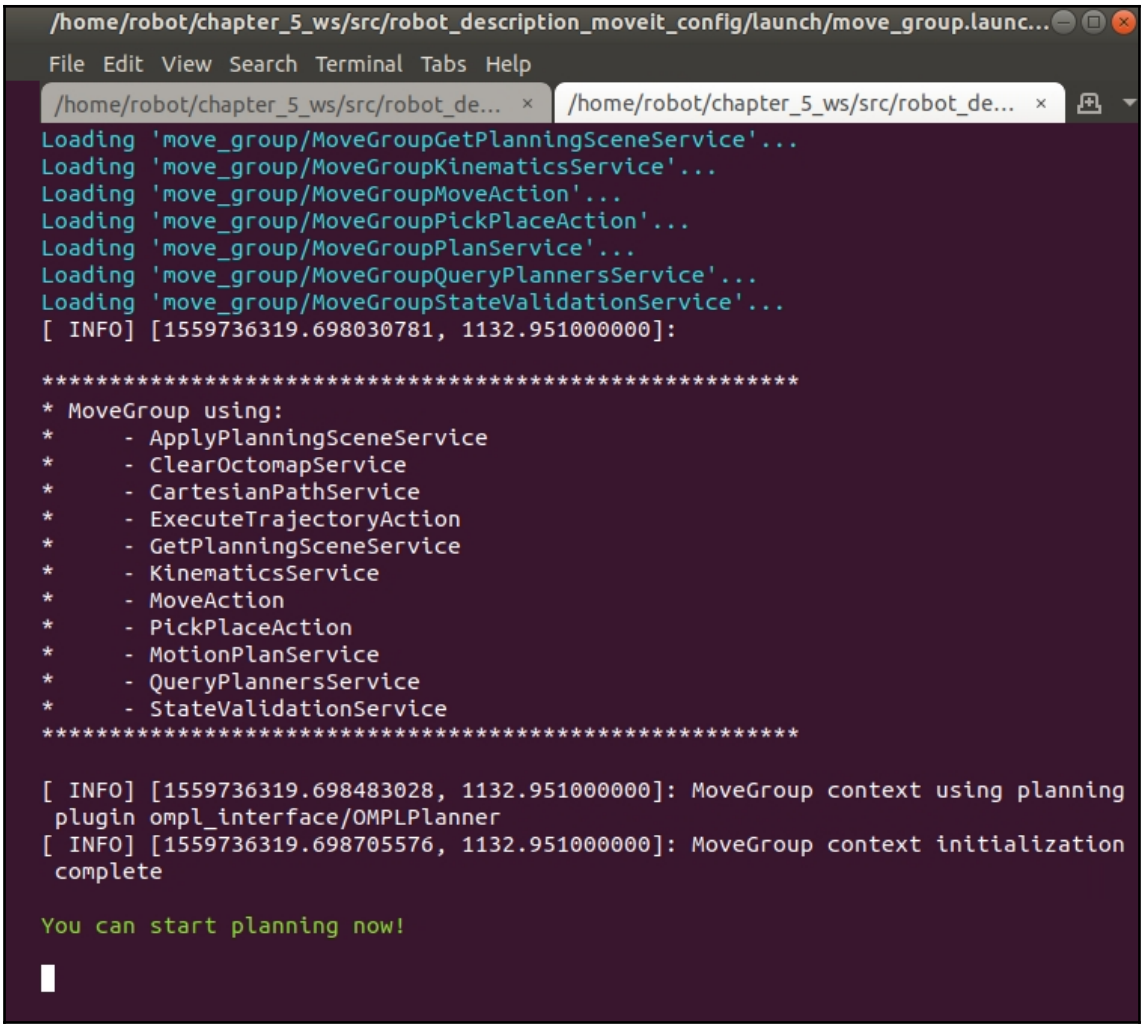

MoveIt! Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
Define Planning Groups
Create and edit 'joint model' groups for your robot based on joint collections, link collections, kinematic chains or subgroups. A planning group defines the set of (joint, link) pairs considered for planning and collision checking. Define individual groups for each subset of the robot you want to plan for.Note: when adding a link to the group, its parent joint is added too and vice versa.
Current Groups
arm
Joints
arm_base_joint - Revolute
bottom_wrist_joint - Revolute
elbow_joint - Revolute
shoulder_joint - Revolute
top_wrist_joint - Revolute
Links
Chain
Subgroups
Expand All Collapse All
Delete Selected
Edit Selected
Add Group

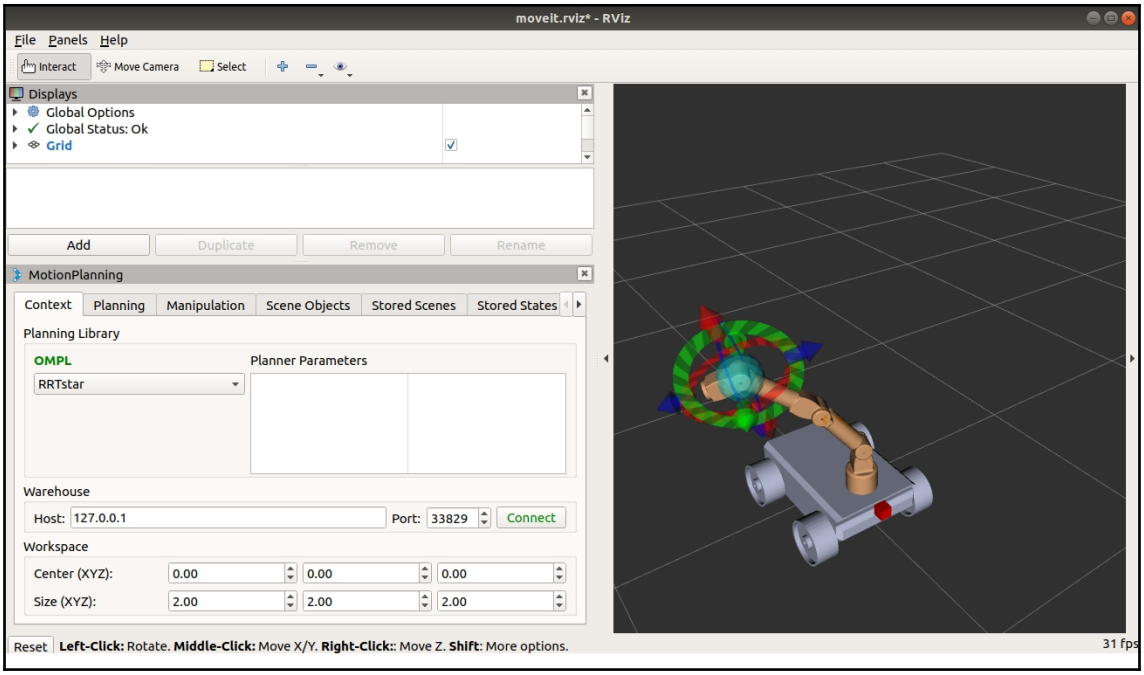


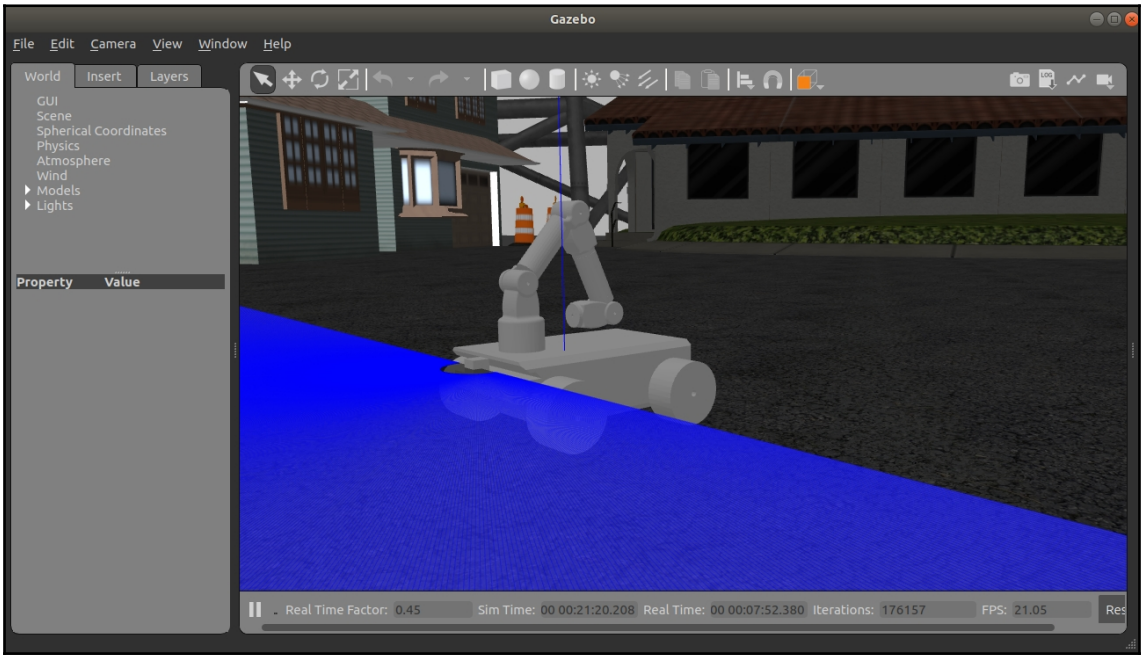

MoveIt! Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
Define Passive Joints
Specify the set of passive joints (not actuated). Joint state is not expected to be published for these joints.
Active Joints
Joint Names
1 arm_base_joint
2 shoulder_joint
3 bottom_wrist_joint
4 elbow_joint
5 top_wrist_joint
6 front_left_wheel_joint
7 front_right_wheel_joint
8 rear_left_wheel_joint
9 rear_right_wheel_joint
>
<
Passive Joints
Joint Names
1 front_left_wheel_joint
2 front_right_wheel_joint
3 rear_left_wheel_joint
4 rear_right_wheel_joint


MoveIt! Setup Assistant
Start
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
Setup ROS Controllers
Configure MoveIt! to work with ROS Control to control the robot's physical hardware
Auto Add FollowJointsTrajectory Controllers For Each Planning Group
Controller
Controller Type
arm_controller
FollowJointTrajectory
Joints
arm_base_joint
shoulder_joint
bottom_wrist_joint
elbow_joint
top_wrist_joint
Expand All Collapse All
Delete Controller
Add Controller
Edit Selected

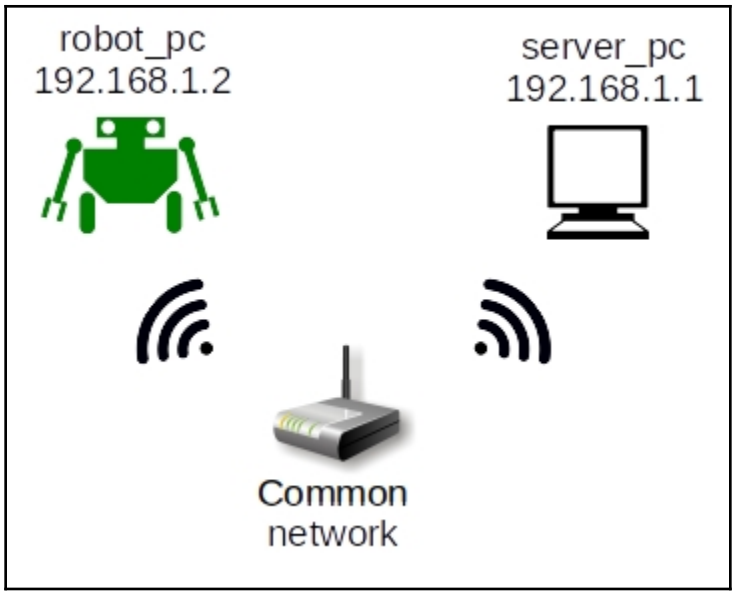

MoveIt! Setup Assistant
Self-Collisions
Virtual Joints
Planning Groups
Robot Poses
End Effectors
Passive Joints
ROS Control
Simulation
3D Perception
Author Information
Configuration Files
Generate Configuration Files
Create or update the configuration files package needed to run your robot with MoveIt. 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/panda_moveit_config
home/robot/chapter_5_ws/src/robot_description_moveit_config
Browse
Files to be generated: (checked)
package.xml
CMakeLists.txt
config/
config/mobile_manipulator.srdf
config/ompl_planning.yaml
config/chomp_planning.yaml
config/kinematics.yaml
config/joint_limits.yaml
config/fake_controllers.yaml
Defines a ROS package
Generate Package
Exit Setup Assistant

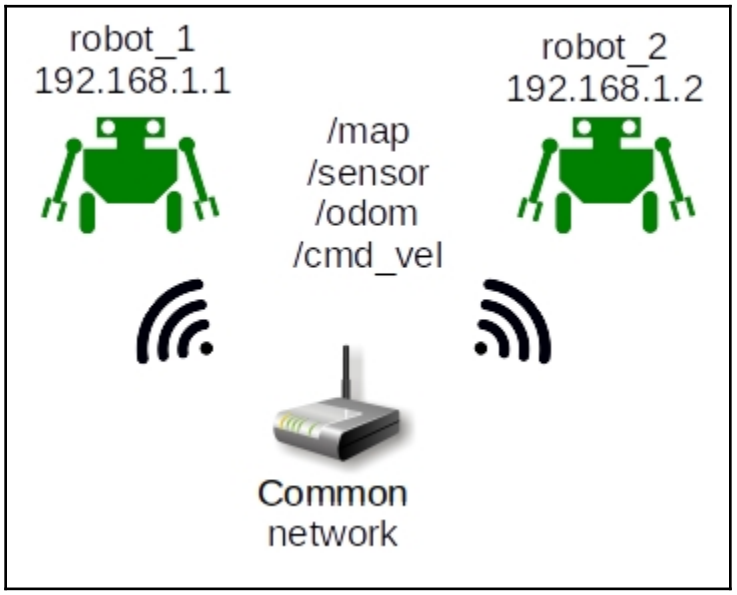

/home/robot/chapter_5_ws/src/robot_description_moveit_config/launch/move_group.launc...
File Edit View Search Terminal Tabs Help
/home/robot/chapter_5_ws/src/robot_de...
/home/robot/chapter_5_ws/src/robot_de...
Loading 'move_group/MoveGroupGetPlanningSceneService'...
Loading 'move_group/MoveGroupKinematicsService'...
Loading 'move_group/MoveGroupMoveAction'...
Loading 'move_group/MoveGroupPickPlaceAction'...
Loading 'move_group/MoveGroupPlanService'...
Loading 'move_group/MoveGroupQueryPlannersService'...
Loading 'move_group/MoveGroupStateValidationService'...
[INFO] [1559736319.698030781, 1132.951000000]:
****
* MoveGroup using:
*   - ApplyPlanningSceneService
*   - ClearOctomapService
*   - CartesianPathService
*   - ExecuteTrajectoryAction
*   - GetPlanningSceneService
*   - KinematicsService
*   - MoveAction
*   - PickPlaceAction
*   - MotionPlanService
*   - QueryPlannersService
*   - StateValidationService
****
[INFO] [1559736319.698483028, 1132.951000000]: MoveGroup context using planning plugin ompl_interface/OMPLPlanner
[INFO] [1559736319.698705576, 1132.951000000]: MoveGroup context initialization complete
You can start planning now!

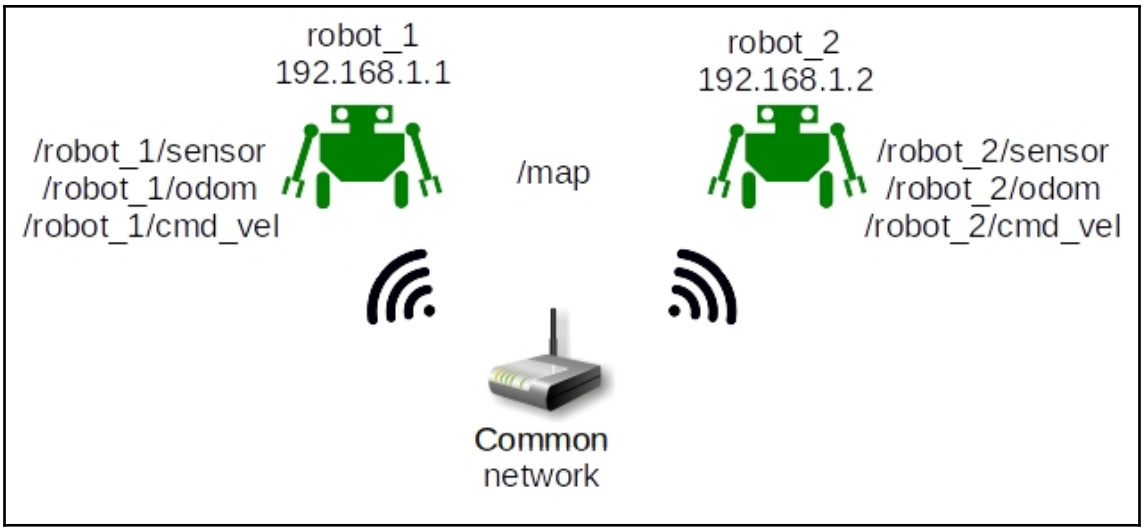

moveit.rviz* - RViz
File Panels Help
Interact
Move Camera
Select
Displays
Global Options
Global Status: Ok
Grid
Add
Duplicate
Remove
Rename
MotionPlanning
Context
Planning
Manipulation
Scene Objects
Stored Scenes
Stored States
Planning Library
OMPL
Planner Parameters
RRTstar
Warehouse
Host: 127.0.0.1
Port: 33829
Connect
Workspace
Center (XYZ): 0.00 0.00 0.00
Size (XYZ): 2.00 2.00 2.00
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click:: Move Z. Shift: More options.
31 fps

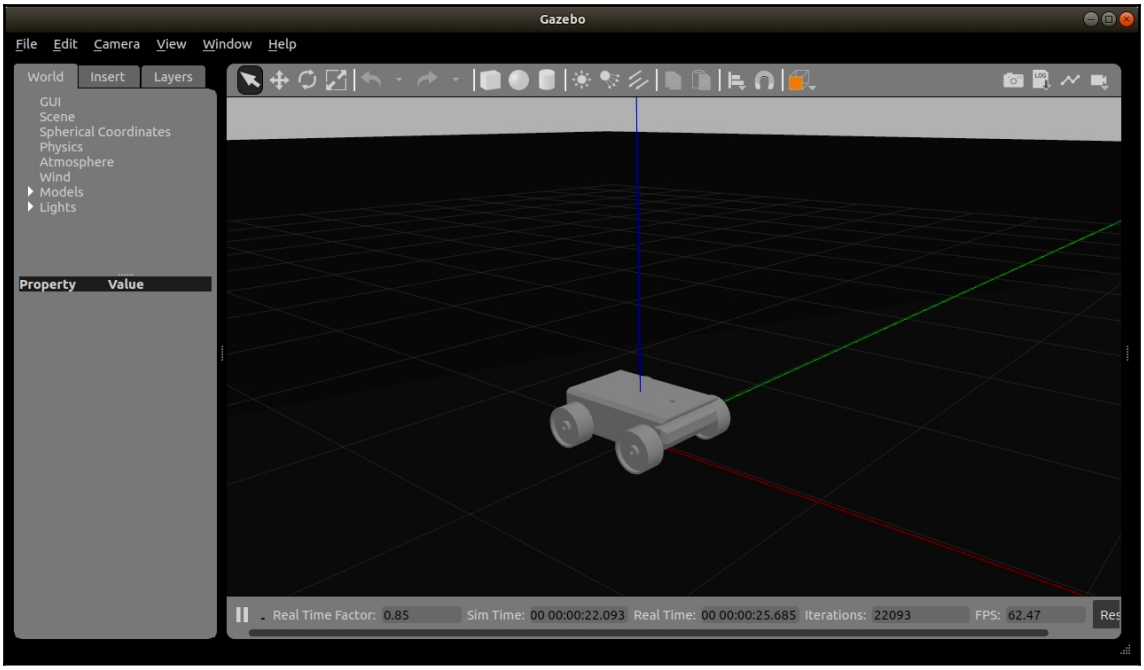

Gazebo
File Edit Camera View Window Help
World
Insert
Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property
Value
Real Time Factor: 0.45
Sim Time: 00 00:21:20.208
Real Time: 00 00:07:52.380
Iterations: 176157
FPS: 21.05

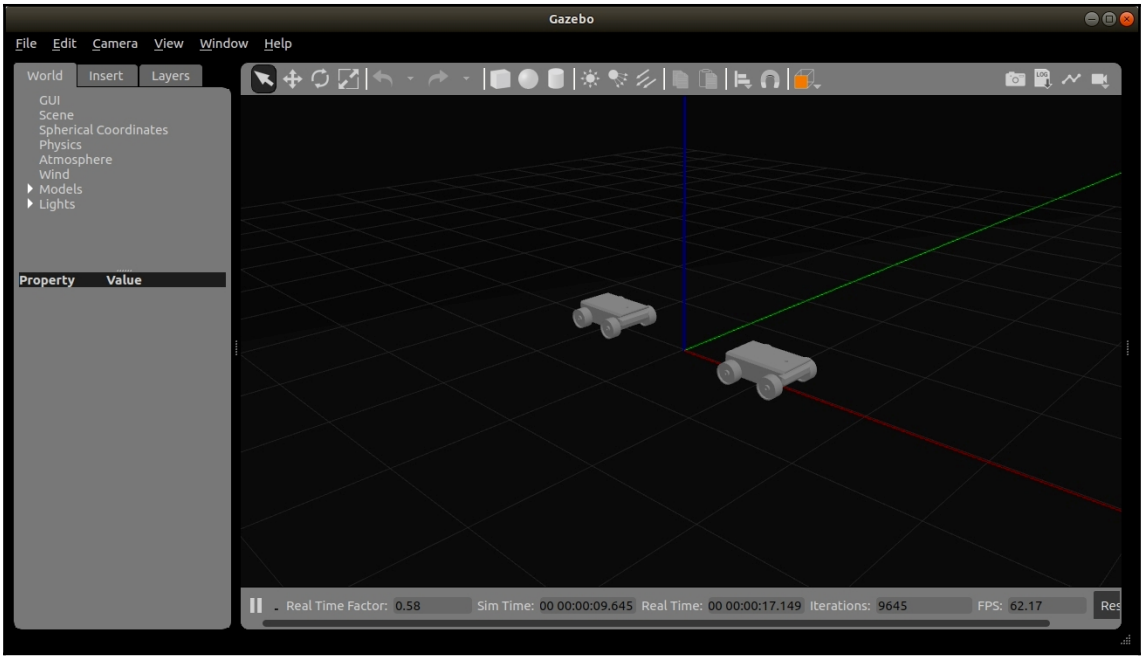
Chapter 6: Multi-Robot Collaboration

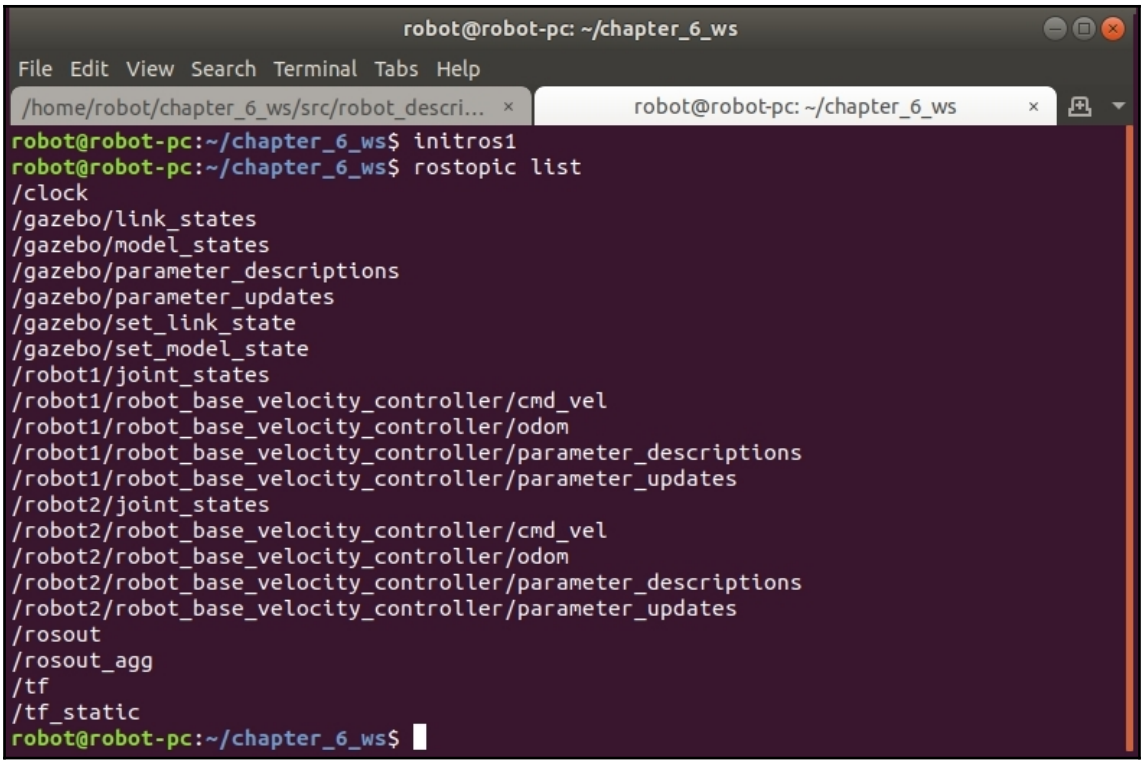

robot_pc
192.168.1.2
server_pc
192.168.1.1
Common
network

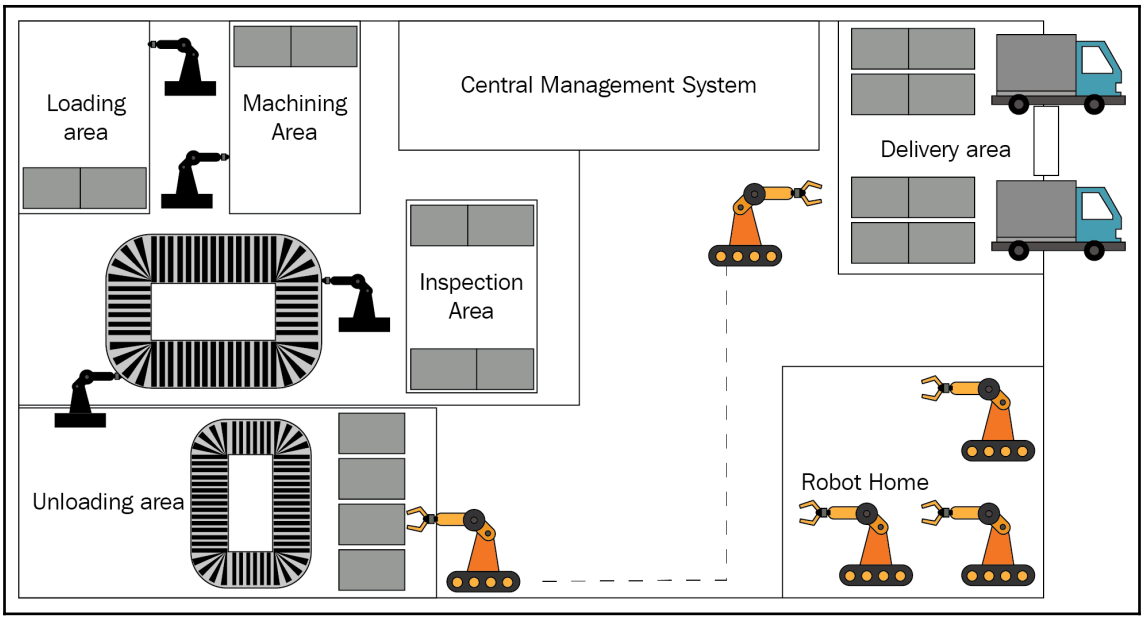

robot_1
192.168.1.1
robot_2
192.168.1.2
/map
/sensor
/odom
/cmd_vel
Common
network

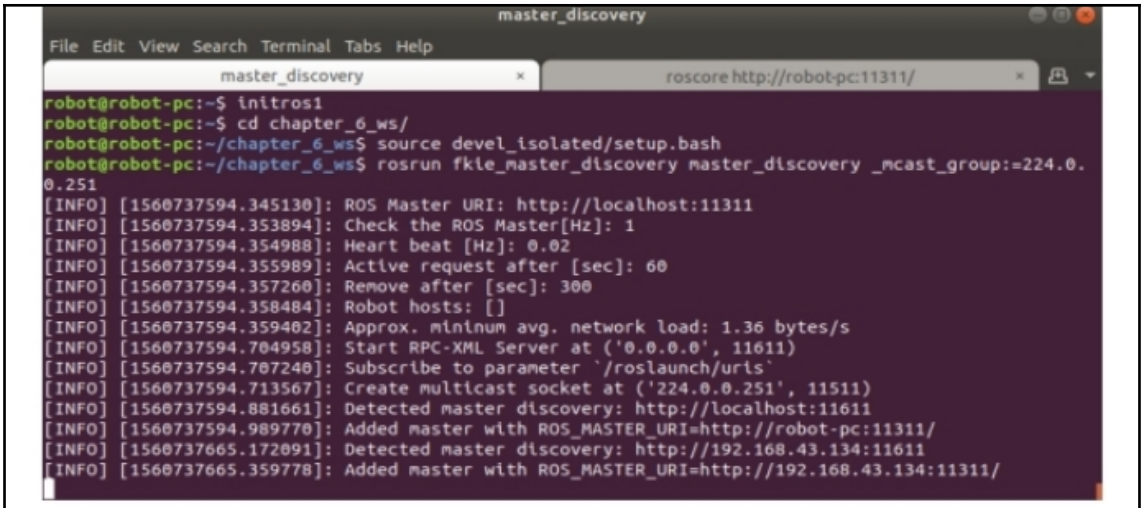

robot_1
192.168.1.1
/robot_1/sensor
/robot_1/odom
/robot_1/cmd_vel
/map
robot_2
192.168.1.2
/robot_2/sensor
/robot_2/odom
/robot_2/cmd_vel
Common
network


Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0.85 Sim Time: 00 00:00:22.093 Real Time: 00 00:00:25.685 Iterations: 22093 FPS: 62.47

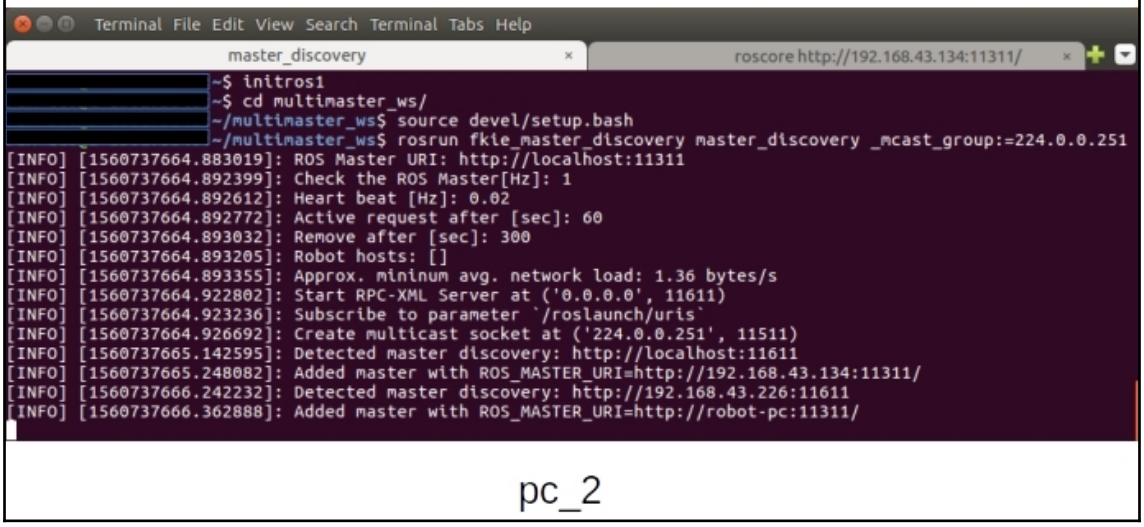

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0.58 Sim Time: 00 00:00:09.645 Real Time: 00 00:00:17.149 Iterations: 9645 FPS: 62.17


robot@robot-pc: ~/chapter_6_ws
File Edit View Search Terminal Tabs Help
/home/robot/chapter_6_ws/src/robot_descri...
robot@robot-pc: ~/chapter_6_ws
robot@robot-pc:~/chapter_6_ws$ initros1
robot@robot-pc:~/chapter_6_ws$ rostopic list
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/robot1/joint_states
/robot1/robot_base_velocity_controller/cmd_vel
/robot1/robot_base_velocity_controller/odom
/robot1/robot_base_velocity_controller/parameter_descriptions
/robot1/robot_base_velocity_controller/parameter_updates
/robot2/joint_states
/robot2/robot_base_velocity_controller/cmd_vel
/robot2/robot_base_velocity_controller/odom
/robot2/robot_base_velocity_controller/parameter_descriptions
/robot2/robot_base_velocity_controller/parameter_updates
/rosout
/rosout_agg
/tf
/tf_static
robot@robot-pc:~/chapter_6_ws$

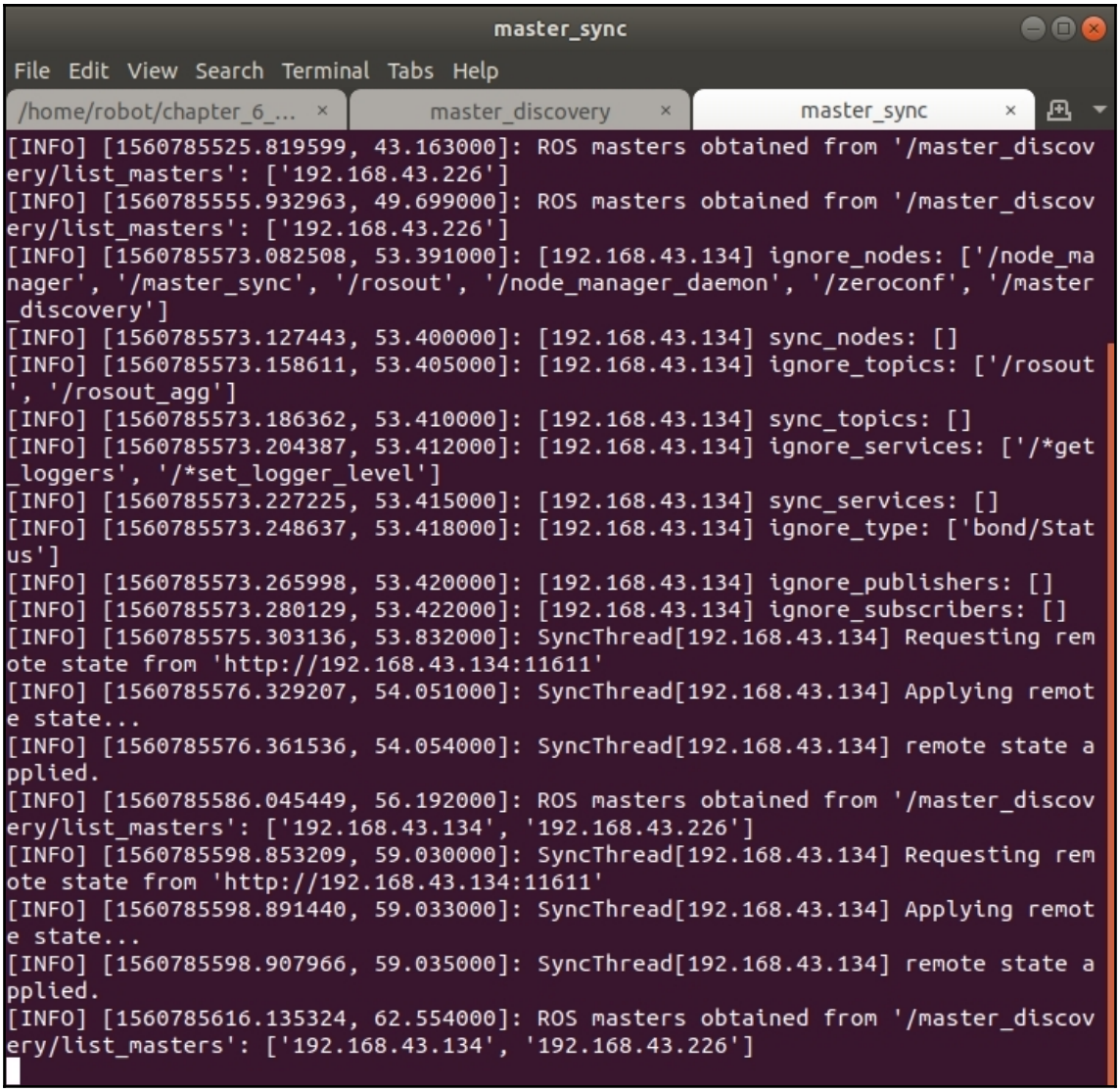

Loading
area
Machining
Area
Central Management System
Delivery area
Inspection
Area
Unloading area
Robot Home

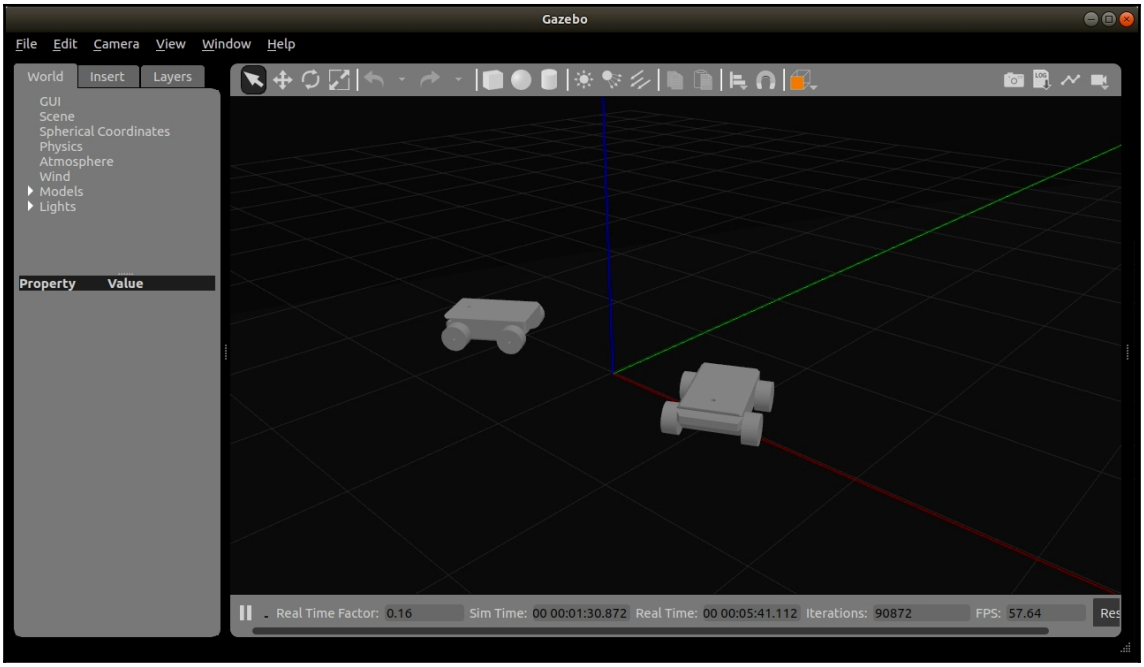

master_discovery
File Edit View Search Terminal Tabs Help
master_discovery
roscore http://robot-pc:11311/
robot@robot-pc:~$ initros1
robot@robot-pc:~$ cd chapter_6_ws/
robot@robot-pc:~/chapter_6_ws$ source devel_isolated/setup.bash
robot@robot-pc:~/chapter_6_ws$ rosrun fkie_master_discovery master_discovery _mcast_group:=224.0.0.251
[INFO] [1560737594.345130]: ROS Master URI: http://localhost:11311
[INFO] [1560737594.353894]: Check the ROS Master[Hz]: 1
[INFO] [1560737594.354988]: Heart beat [Hz]: 0.02
[INFO] [1560737594.355989]: Active request after [sec]: 60
[INFO] [1560737594.357260]: Remove after [sec]: 300
[INFO] [1560737594.358484]: Robot hosts: []
[INFO] [1560737594.359402]: Approx. mininum avg. network load: 1.36 bytes/s
[INFO] [1560737594.704958]: Start RPC-XML Server at ('0.0.0.0', 11611)
[INFO] [1560737594.707240]: Subscribe to parameter `/roslaunch/uris`
[INFO] [1560737594.713567]: Create multicast socket at ('224.0.0.251', 11511)
[INFO] [1560737594.881661]: Detected master discovery: http://localhost:11611
[INFO] [1560737594.989770]: Added master with ROS_MASTER_URI=http://robot-pc:11311/
[INFO] [1560737665.172091]: Detected master discovery: http://192.168.43.134:11611
[INFO] [1560737665.359778]: Added master with ROS_MASTER_URI=http://192.168.43.134:11311/

pc_1

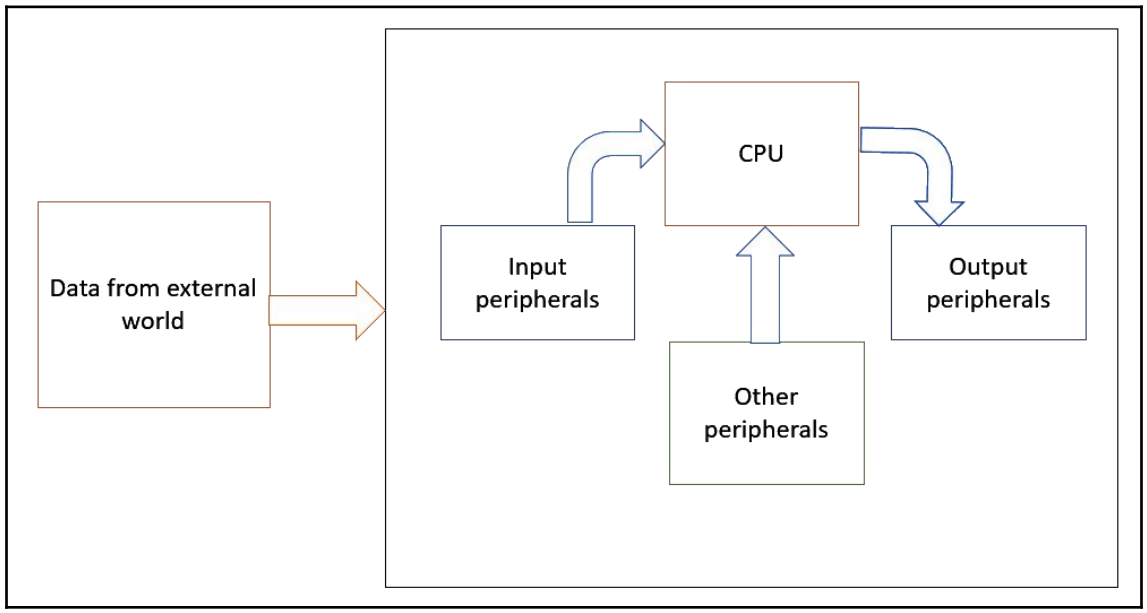

Terminal File Edit View Search Terminal Tabs Help
master_discovery
roscore http://192.168.43.134:11311/
~$ initros1
~$ cd multimaster_ws/
~/multimaster_ws$ source devel/setup.bash
~/multimaster_ws$ rosrun fkie_master_discovery master_discovery _mcast_group:=224.0.0.251
[INFO] [1560737664.883019]: ROS Master URI: http://localhost:11311
[INFO] [1560737664.892399]: Check the ROS Master[Hz]: 1
[INFO] [1560737664.892612]: Heart beat [Hz]: 0.02
[INFO] [1560737664.892772]: Active request after [sec]: 60
[INFO] [1560737664.893032]: Remove after [sec]: 300
[INFO] [1560737664.893205]: Robot hosts: []
[INFO] [1560737664.893355]: Approx. mininum avg. network load: 1.36 bytes/s
[INFO] [1560737664.922802]: Start RPC-XML Server at ('0.0.0.0', 11611)
[INFO] [1560737664.923236]: Subscribe to parameter `/roslaunch/uris`
[INFO] [1560737664.926692]: Create multicast socket at ('224.0.0.251', 11511)
[INFO] [1560737665.142595]: Detected master discovery: http://localhost:11611
[INFO] [1560737665.248082]: Added master with ROS_MASTER_URI=http://192.168.43.134:11311/
[INFO] [1560737666.242232]: Detected master discovery: http://192.168.43.226:11611
[INFO] [1560737666.362888]: Added master with ROS_MASTER_URI=http://robot-pc:11311/

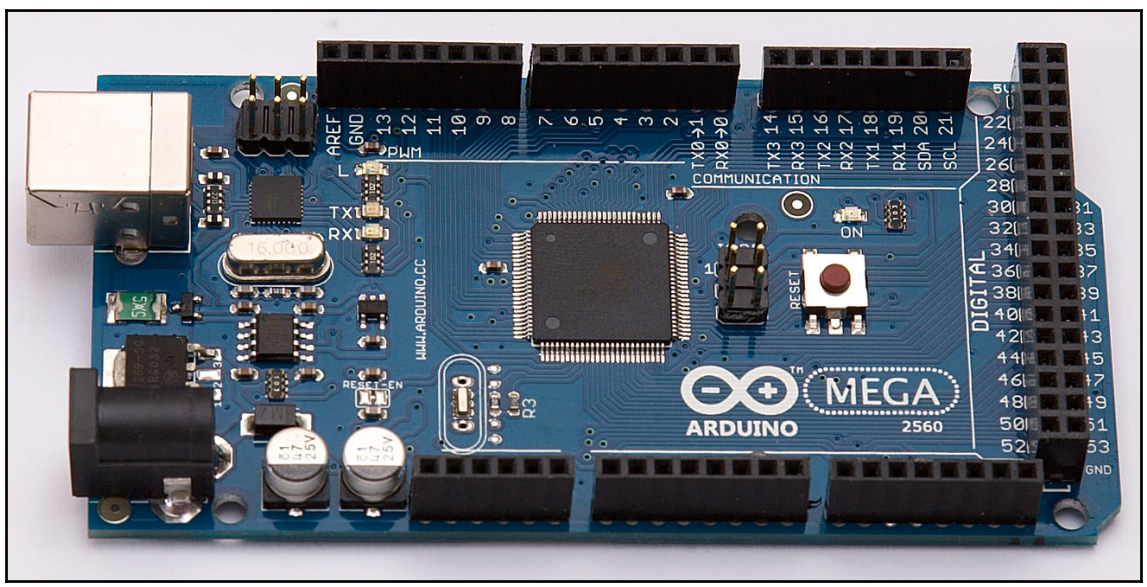
pc_2

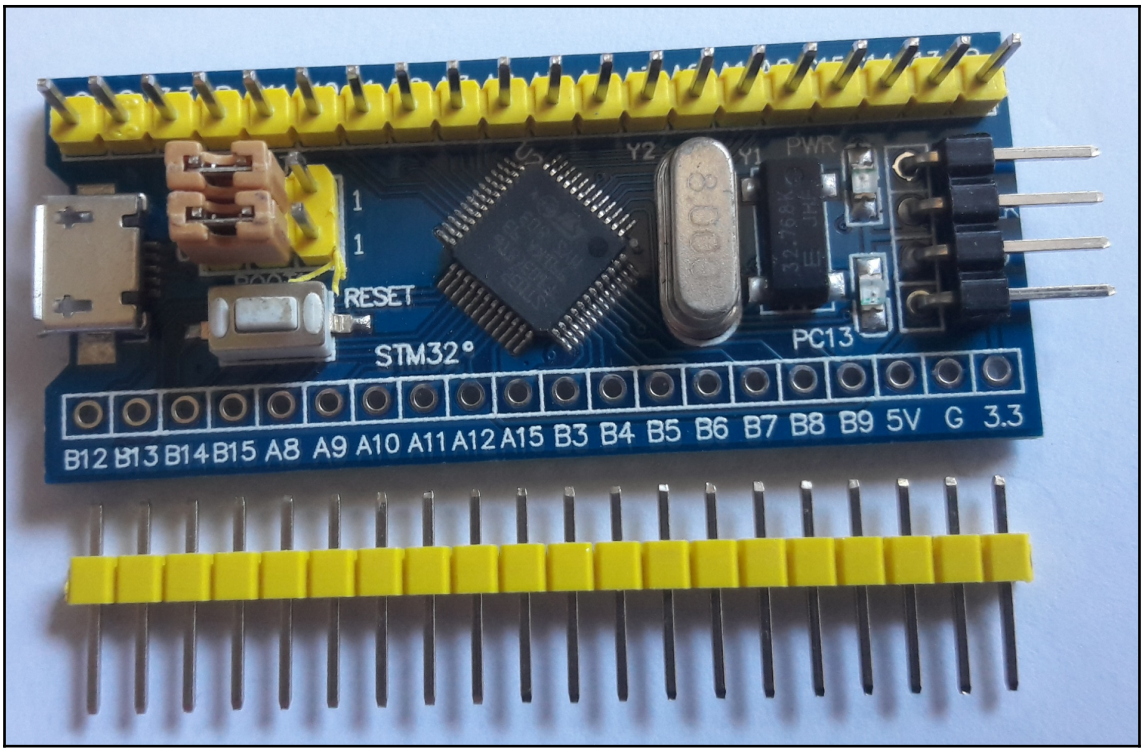

master_sync
File Edit View Search Terminal Tabs Help
/home/robot/chapter_6_...
master_discovery
master_sync
[INFO] [1560785525.819599, 43.163000]: ROS masters obtained from '/master_discovery/list_masters': ['192.168.43.226']
[INFO] [1560785555.932963, 49.699000]: ROS masters obtained from '/master_discovery/list_masters': ['192.168.43.226']
[INFO] [1560785573.082508, 53.391000]: [192.168.43.134] ignore_nodes: ['/node_manager', '/master_sync', '/rosout', '/node_manager_daemon', '/zeroconf', '/master_discovery']
[INFO] [1560785573.127443, 53.400000]: [192.168.43.134] sync_nodes: []
[INFO] [1560785573.158611, 53.405000]: [192.168.43.134] ignore_topics: ['/rosout', '/rosout_agg']
[INFO] [1560785573.186362, 53.410000]: [192.168.43.134] sync_topics: []
[INFO] [1560785573.204387, 53.412000]: [192.168.43.134] ignore_services: ['/*get_loggers', '/*set_logger_level']
[INFO] [1560785573.227225, 53.415000]: [192.168.43.134] sync_services: []
[INFO] [1560785573.248637, 53.418000]: [192.168.43.134] ignore_type: ['bond/Status']
[INFO] [1560785573.265998, 53.420000]: [192.168.43.134] ignore_publishers: []
[INFO] [1560785573.280129, 53.422000]: [192.168.43.134] ignore_subscribers: []
[INFO] [1560785575.303136, 53.832000]: SyncThread[192.168.43.134] Requesting remote state from 'http://192.168.43.134:11611'
[INFO] [1560785576.329207, 54.051000]: SyncThread[192.168.43.134] Applying remote state...
[INFO] [1560785576.361536, 54.054000]: SyncThread[192.168.43.134] remote state applied.
[INFO] [1560785586.045449, 56.192000]: ROS masters obtained from '/master_discovery/list_masters': ['192.168.43.134', '192.168.43.226']
[INFO] [1560785598.853209, 59.030000]: SyncThread[192.168.43.134] Requesting remote state from 'http://192.168.43.134:11611'
[INFO] [1560785598.891440, 59.033000]: SyncThread[192.168.43.134] Applying remote state...
[INFO] [1560785598.907966, 59.035000]: SyncThread[192.168.43.134] remote state applied.
[INFO] [1560785616.135324, 62.554000]: ROS masters obtained from '/master_discovery/list_masters': ['192.168.43.134', '192.168.43.226']

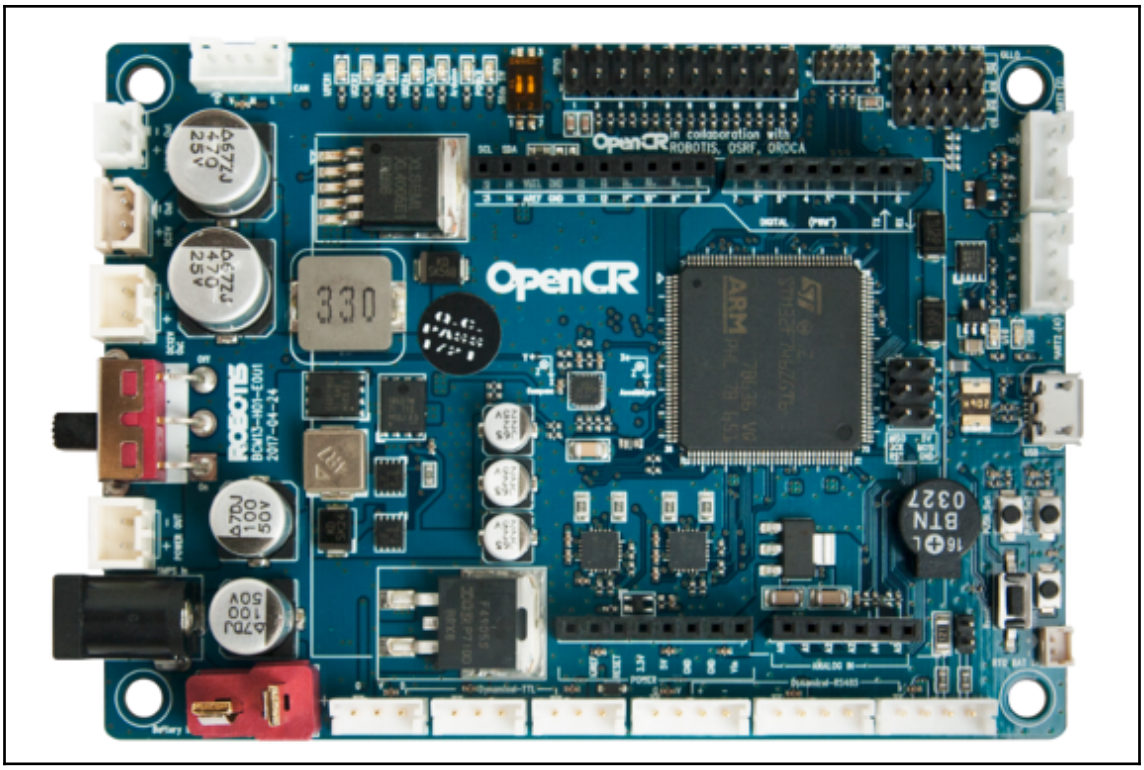

Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
Lights
Property Value
Real Time Factor: 0.16 Sim Time: 00 00:01:30.872 Real Time: 00 00:05:41.112 Iterations: 90872 FPS: 57.64

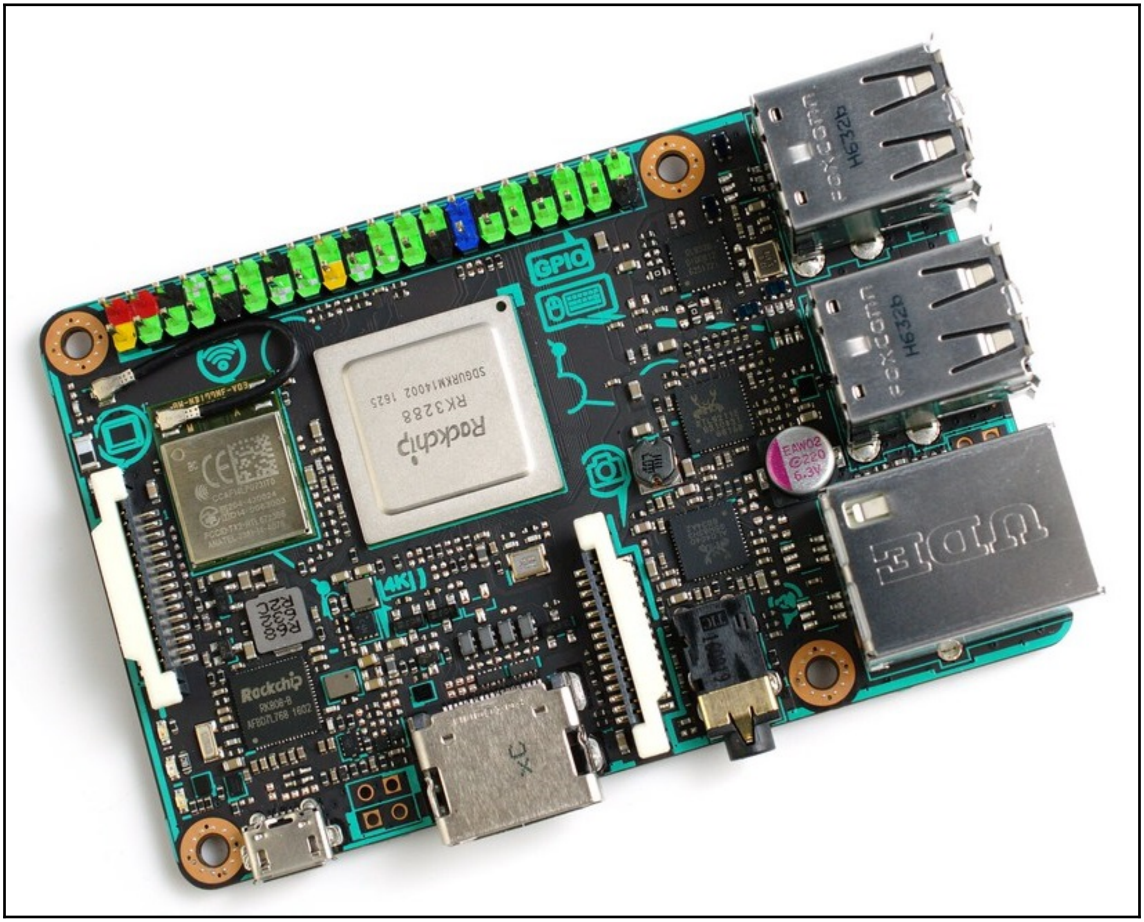
Chapter 7: ROS on Embedded Platforms and Their Control

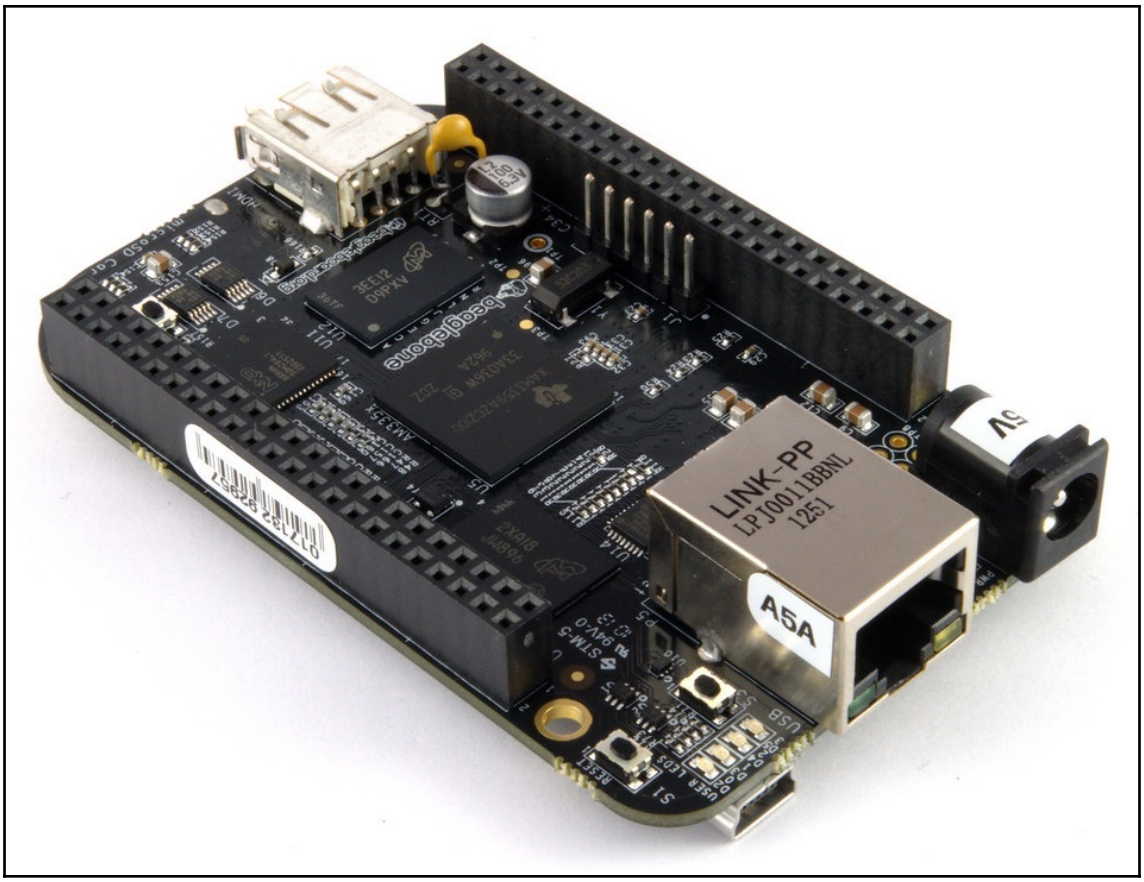


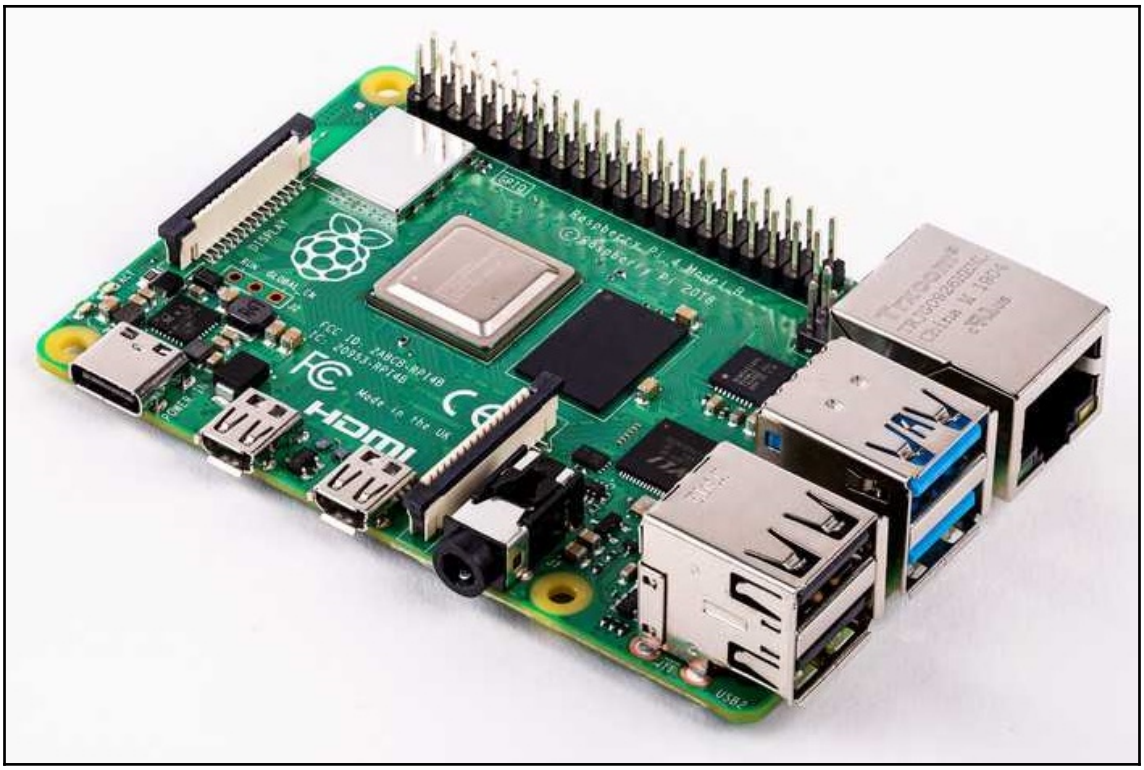


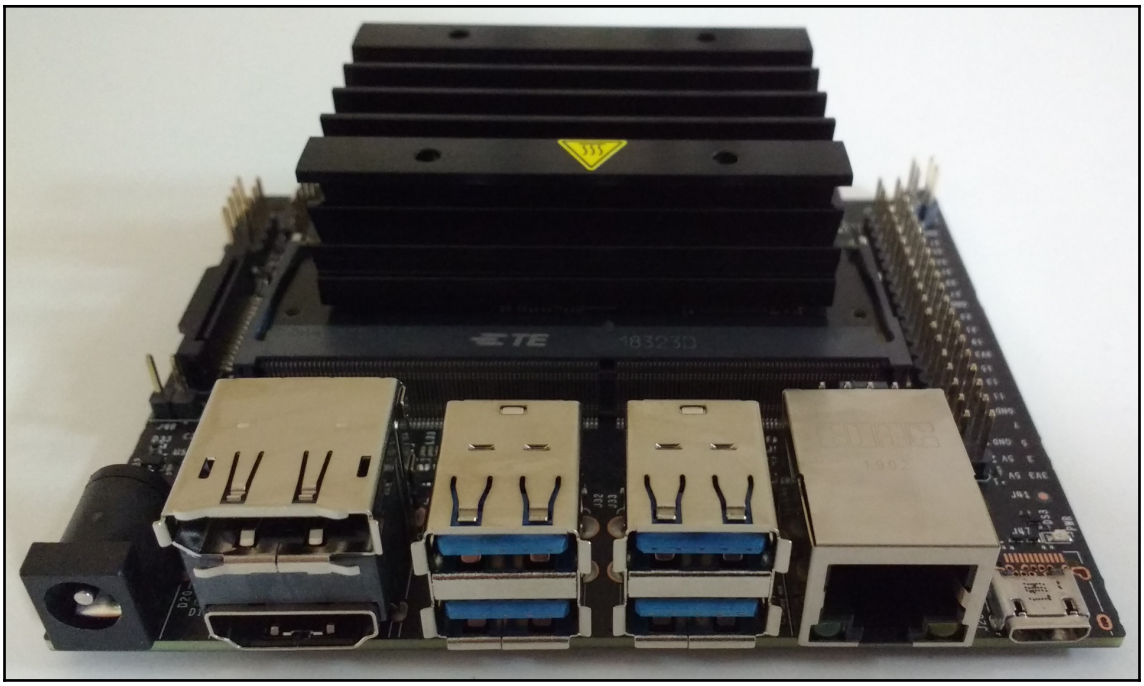

Y2
Y1
PWR
1
1
RESET
STM32°
PC13
B12 B13 B14 B15 A8 A9 A10 A11 A12 A15 B3 B4 B5 B6 B7 B8 B9 5V G 3.3

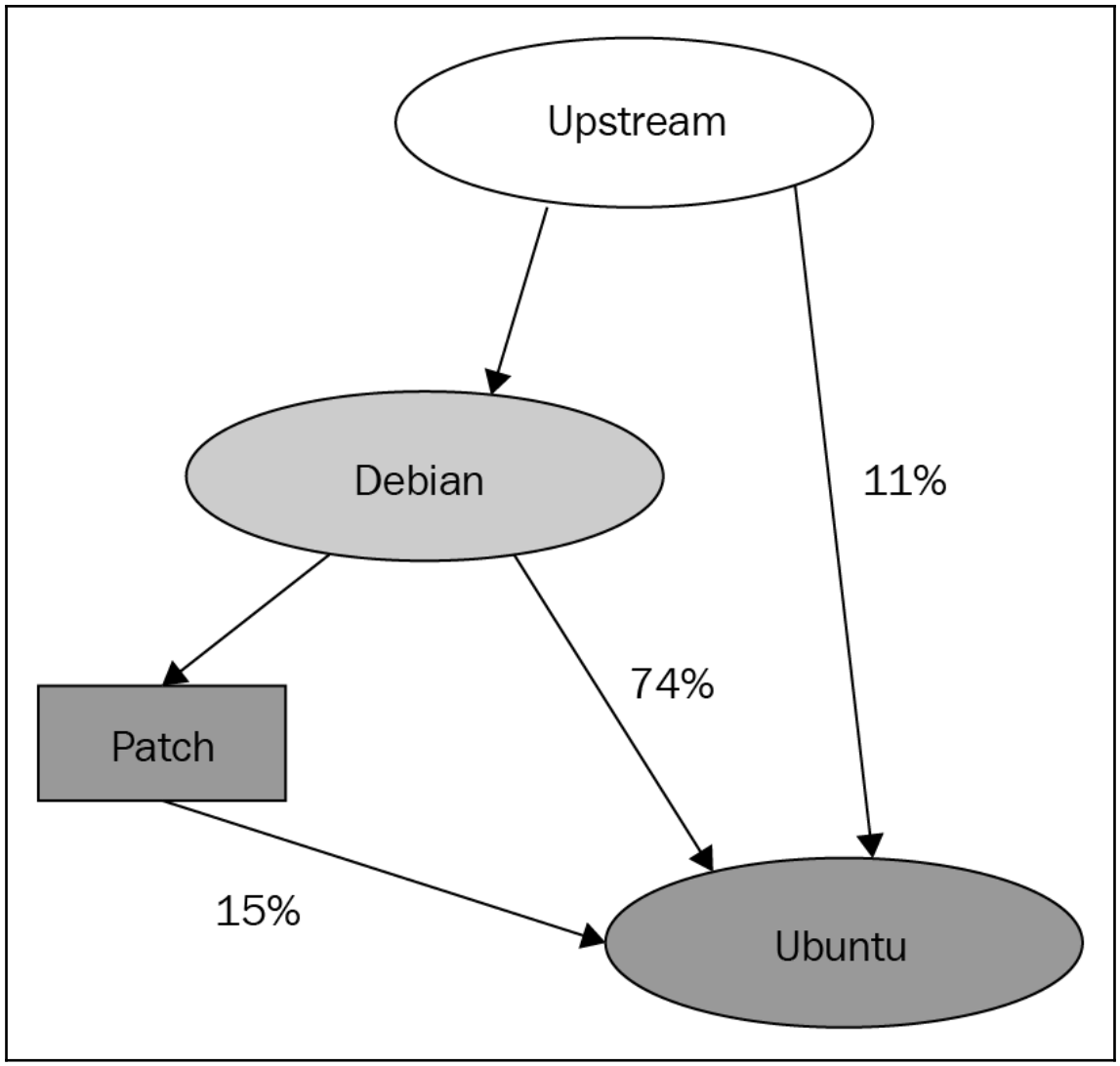

OpenCR
330

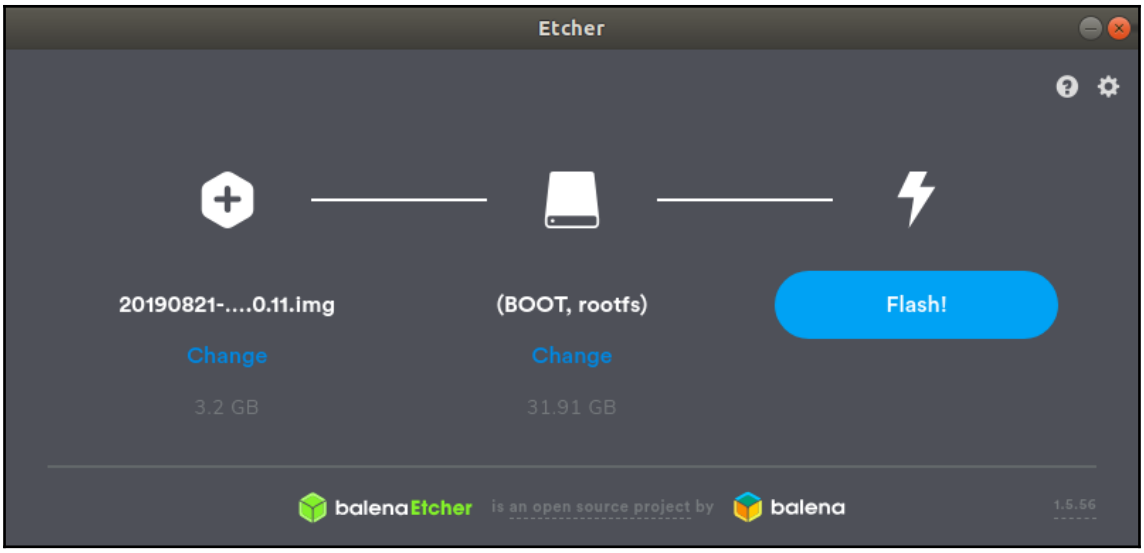

GPIO
Rockchip
RK3288
4K
Rockchip
RK808-B


LINK-PP
LPJ0011BBNL
1251
A5A

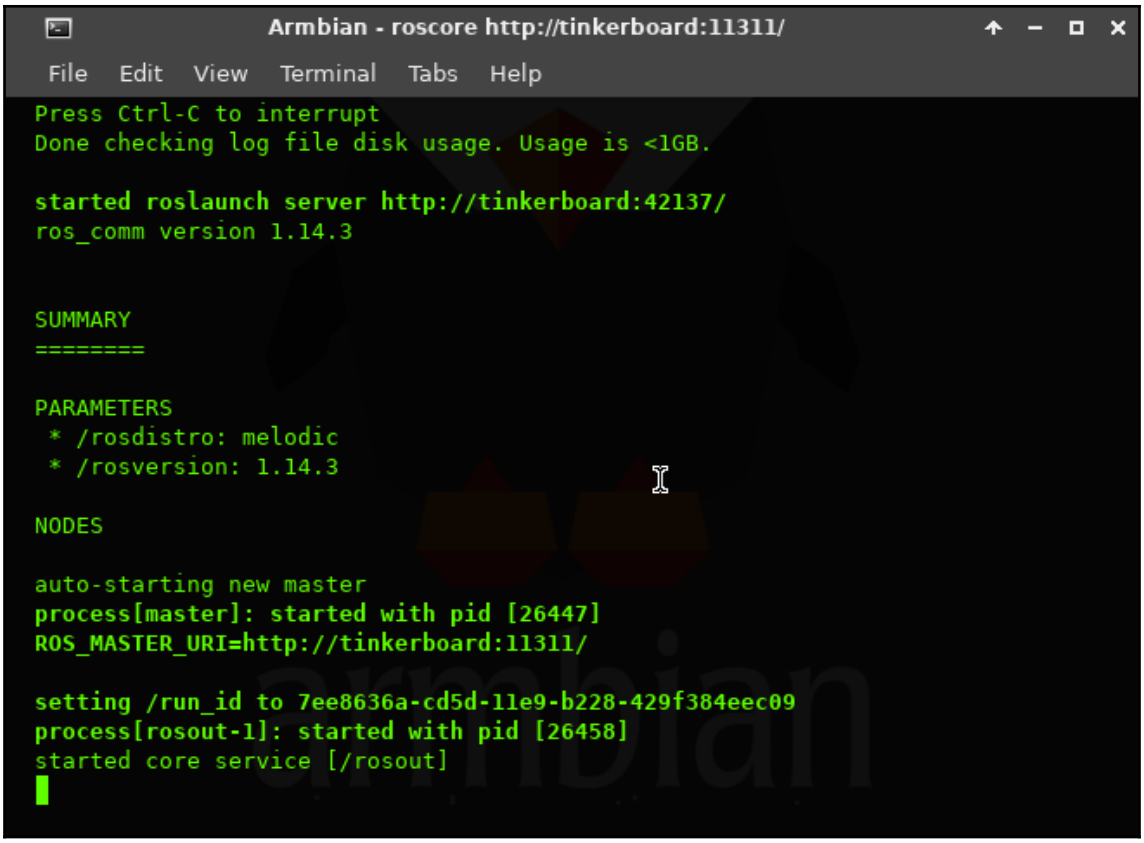


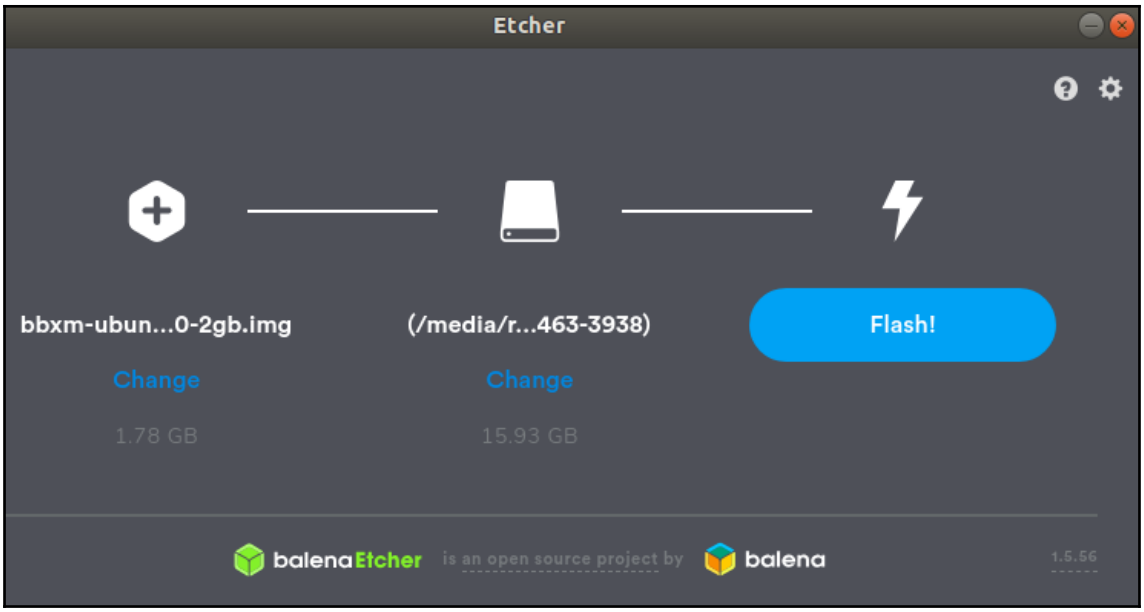


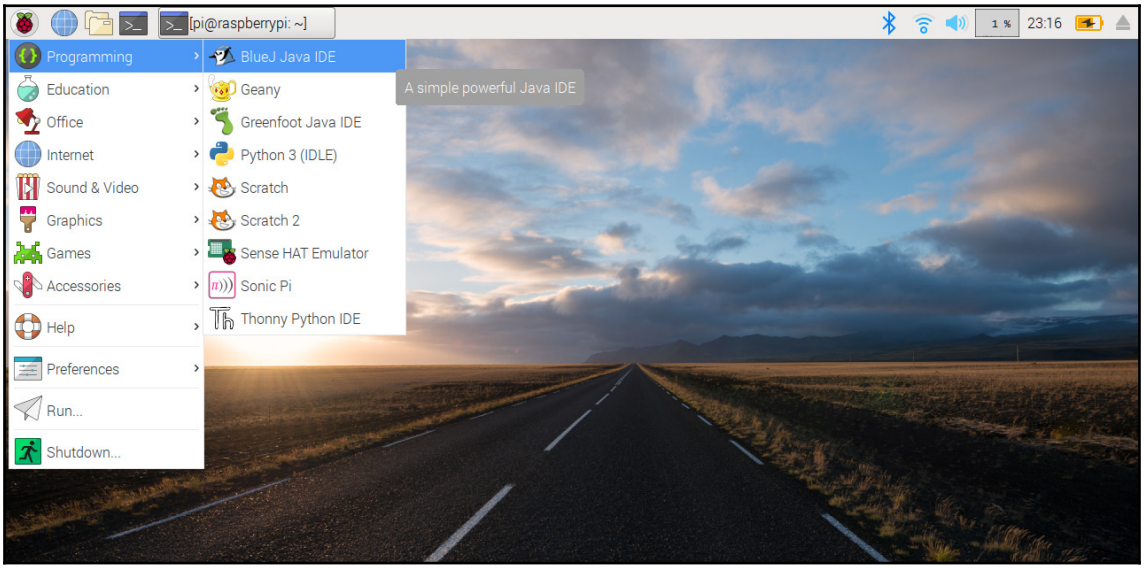

Upstream
Debian
11%
74%
Patch
15%
Ubuntu

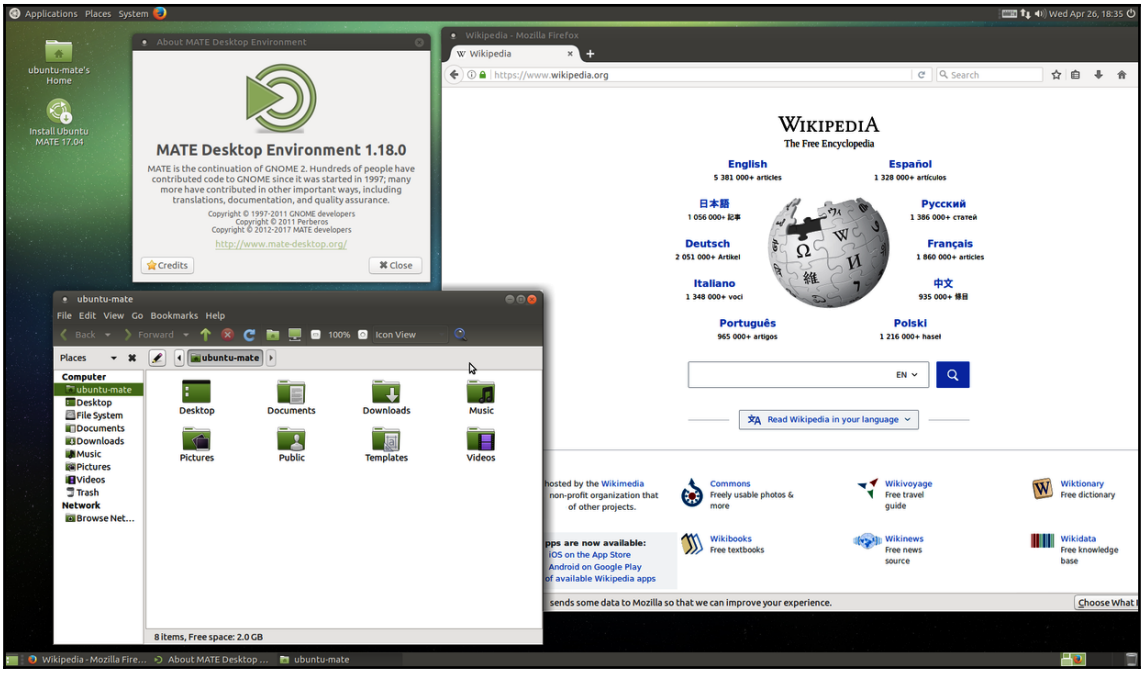

Etcher
20190821-....0.11.img
Change
3.2 GB
(BOOT, rootfs)
Change
31.91 GB
Flash!
balenaEtcher
is an open source project by
balena
1.5.56

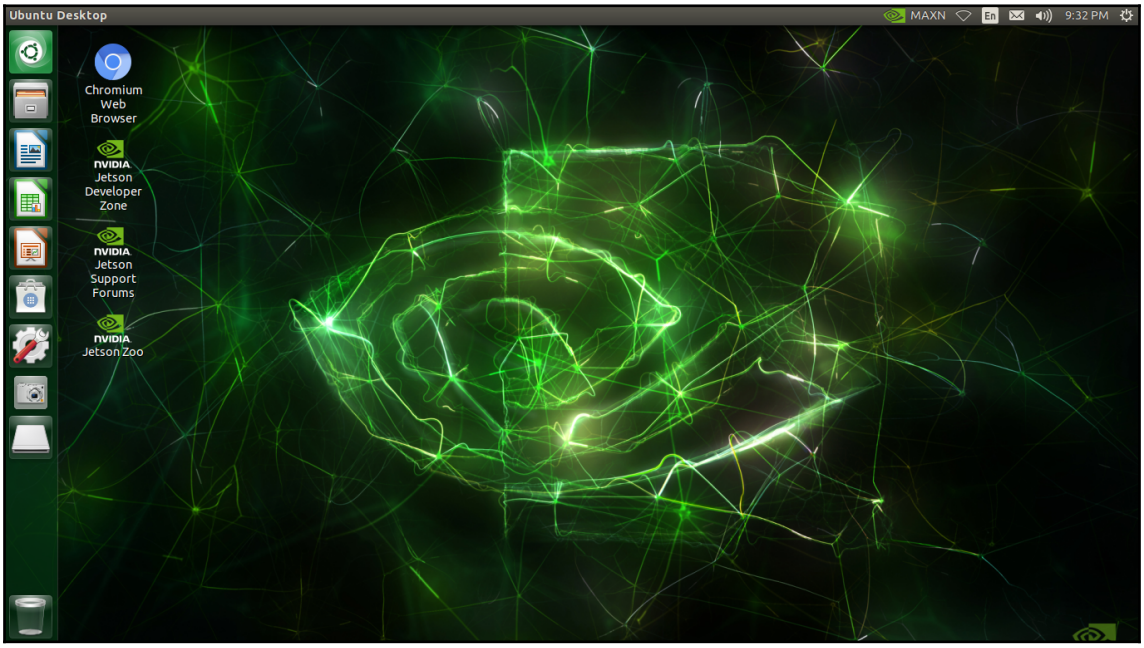

Applications
07:47
tinkerbot
armbian
universal operating system

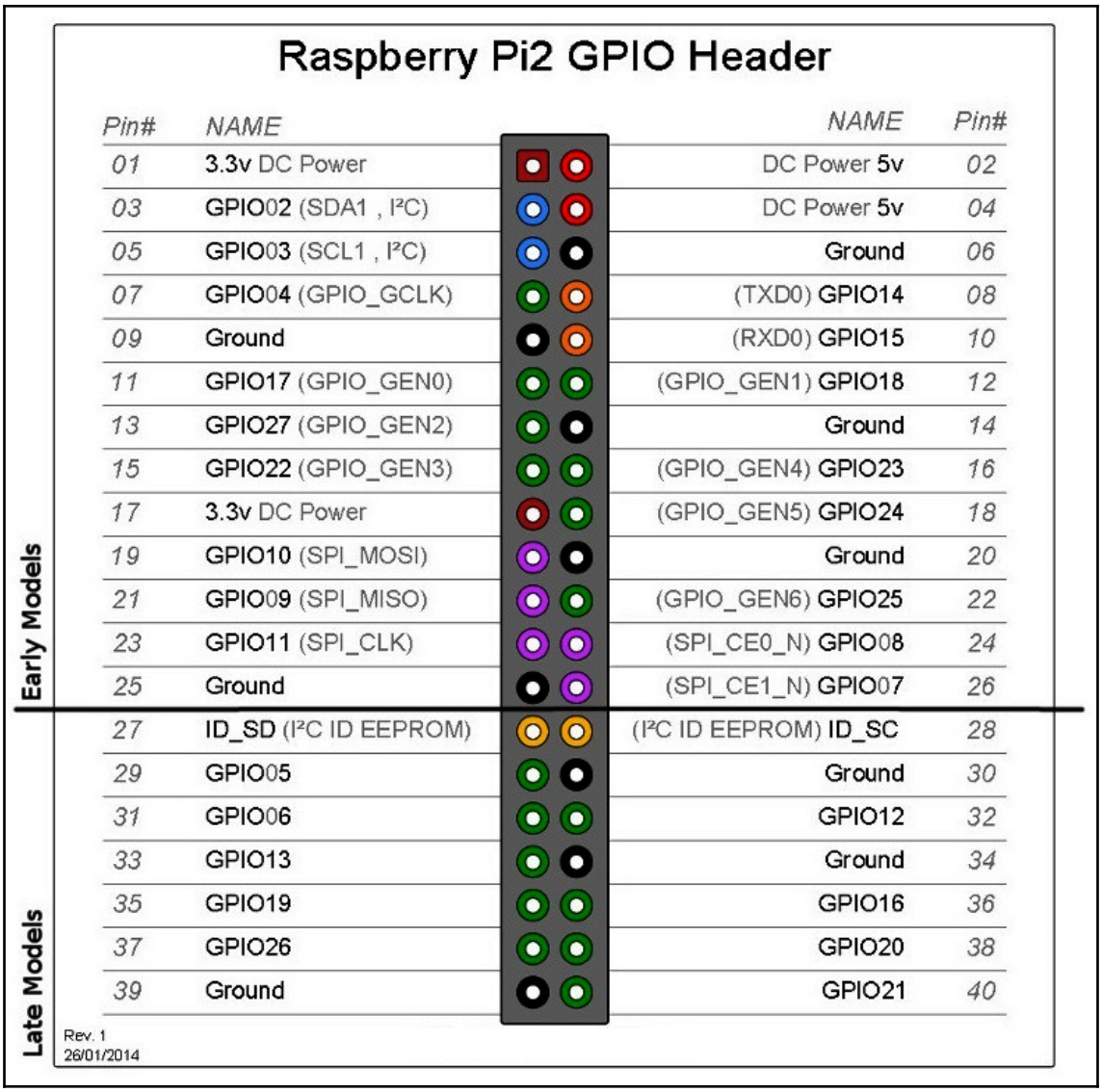

Armbian - roscore http://tinkerboard:11311/
File Edit View Terminal Tabs Help
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.
started roslaunch server http://tinkerboard:42137/
ros_comm version 1.14.3
SUMMARY
========
PARAMETERS
* /rosdistro: melodic
* /rosversion: 1.14.3
NODES
auto-starting new master
process[master]: started with pid [26447]
ROS_MASTER_URI=http://tinkerboard:11311/
setting /run_id to 7ee8636a-cd5d-11e9-b228-429f384eec09
process[rosout-1]: started with pid [26458]
started core service [/rosout]

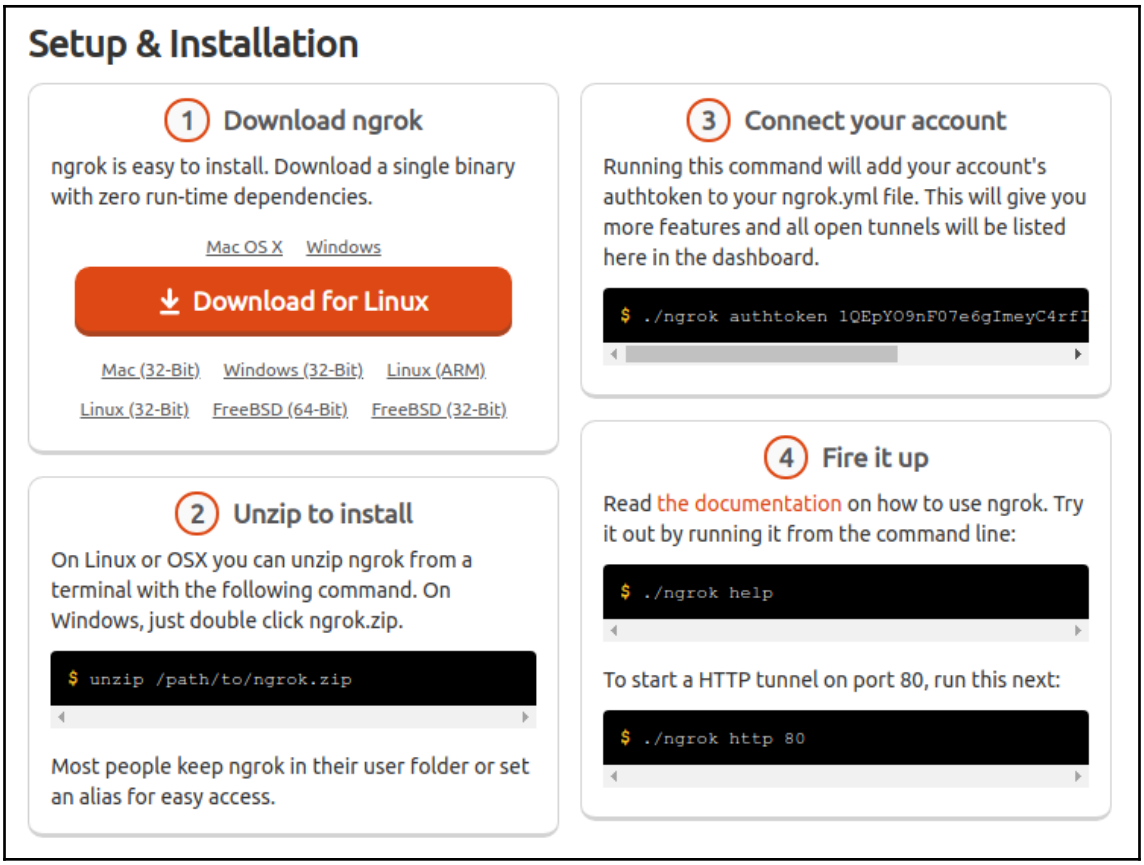

Etcher
bbxm-ubun...0-2gb.img
(/media/r...463-3938)
Flash!
Change
Change
1.78 GB
15.93 GB
balenaEtcher
is an open source project by
balena
1.5.56

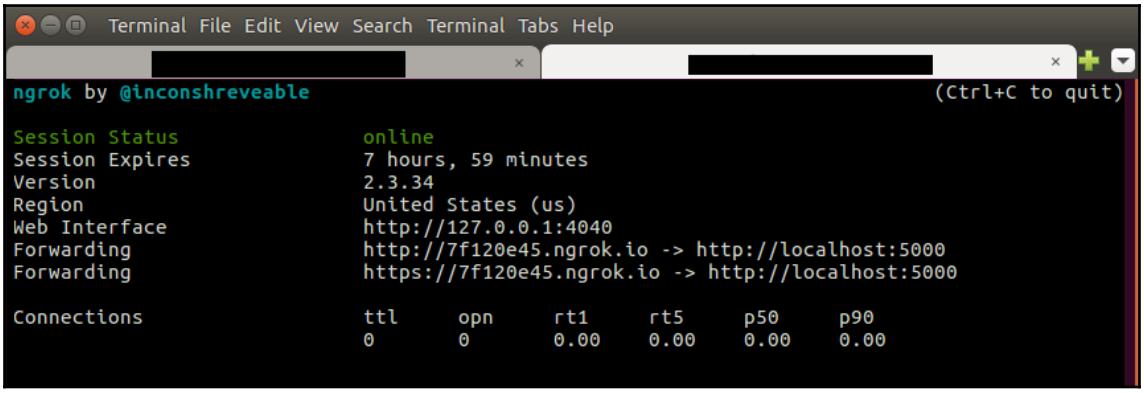

[pi@raspberrypi: ~]
23:16
Programming
Education
Office
Internet
Sound & Video
Graphics
Games
Accessories
Help
Preferences
Run...
Shutdown...
BlueJ Java IDE
Geany
Greenfoot Java IDE
Python 3 (IDLE)
Scratch
Scratch 2
Sense HAT Emulator
Sonic Pi
Thonny Python IDE
A simple powerful Java IDE

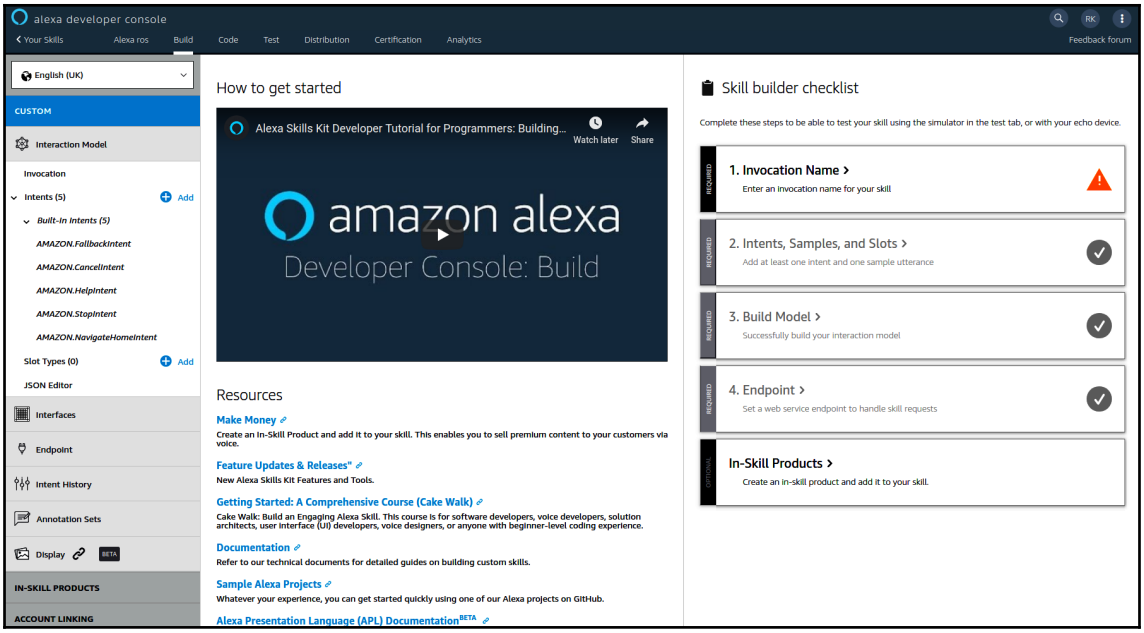

Applications Places System
Wed Apr 26, 18:35
ubuntu-mate's Home
Install Ubuntu MATE 17.04
About MATE Desktop Environment
MATE Desktop Environment 1.18.0
MATE is the continuation of GNOME 2. Hundreds of people have contributed code to GNOME since it was started in 1997; many more have contributed in other important ways, including translations, documentation, and quality assurance.
Copyright © 1997-2011 GNOME developers
Copyright © 2011 Perberos
Copyright © 2012-2017 MATE developers
http://www.mate-desktop.org/
Credits
Close
Wikipedia - Mozilla Firefox
Wikipedia
https://www.wikipedia.org
Search
WIKIPEDIA
The Free Encyclopedia
English
5 381 000+ articles
Español
1 328 000+ artículos
日本語
1 056 000+ 記事
Русский
1 386 000+ статей
Deutsch
2 051 000+ Artikel
Français
1 860 000+ articles
Italiano
1 348 000+ voci
中文
935 000+ 條目
Português
965 000+ artigos
Polski
1 216 000+ haseł
EN
Read Wikipedia in your language
ubuntu-mate
File Edit View Go Bookmarks Help
Back Forward 100% Icon View
Places
ubuntu-mate
Computer
ubuntu-mate
Desktop
File System
Documents
Downloads
Music
Pictures
Videos
Trash
Network
Browse Net...
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
8 items, Free space: 2.0 GB
Commons
Freely usable photos & more
Wikivoyage
Free travel guide
Wiktionary
Free dictionary
Wikibooks
Free textbooks
Wikinews
Free news source
Wikidata
Free knowledge base
Wikipedia - Mozilla Fire...
About MATE Desktop ...
ubuntu-mate

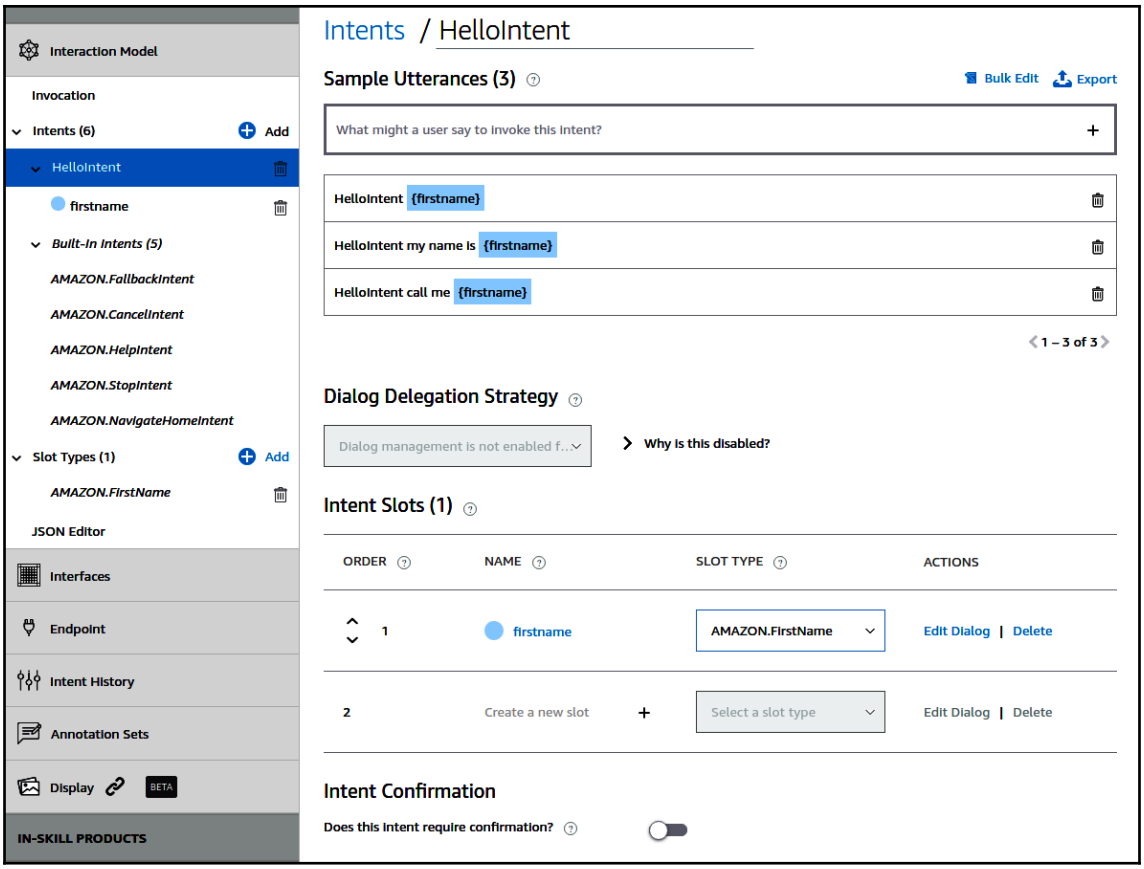

Ubuntu Desktop
MAXN
En
9:32 PM
Chromium Web Browser
NVIDIA Jetson Developer Zone
NVIDIA Jetson Support Forums
NVIDIA Jetson Zoo

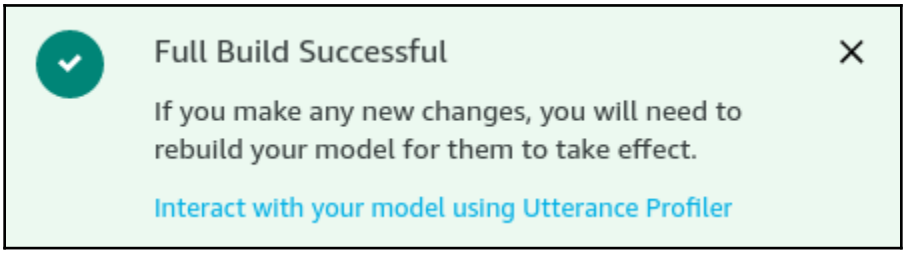

Raspberry Pi2 GPIO Header
Pin# NAME NAME Pin#
01 3.3v DC Power DC Power 5v 02
03 GPIO02 (SDA1 , I²C) DC Power 5v 04
05 GPIO03 (SCL1 , I²C) Ground 06
07 GPIO04 (GPIO_GCLK) (TXD0) GPIO14 08
09 Ground (RXD0) GPIO15 10
11 GPIO17 (GPIO_GEN0) (GPIO_GEN1) GPIO18 12
13 GPIO27 (GPIO_GEN2) Ground 14
15 GPIO22 (GPIO_GEN3) (GPIO_GEN4) GPIO23 16
17 3.3v DC Power (GPIO_GEN5) GPIO24 18
19 GPIO10 (SPI_MOSI) Ground 20
21 GPIO09 (SPI_MISO) (GPIO_GEN6) GPIO25 22
23 GPIO11 (SPI_CLK) (SPI_CE0_N) GPIO08 24
25 Ground (SPI_CE1_N) GPIO07 26
Early Models
27 ID_SD (I²C ID EEPROM) (I²C ID EEPROM) ID_SC 28
29 GPIO05 Ground 30
31 GPIO06 GPIO12 32
33 GPIO13 Ground 34
35 GPIO19 GPIO16 36
37 GPIO26 GPIO20 38
39 Ground GPIO21 40
Late Models
Rev. 1
26/01/2014

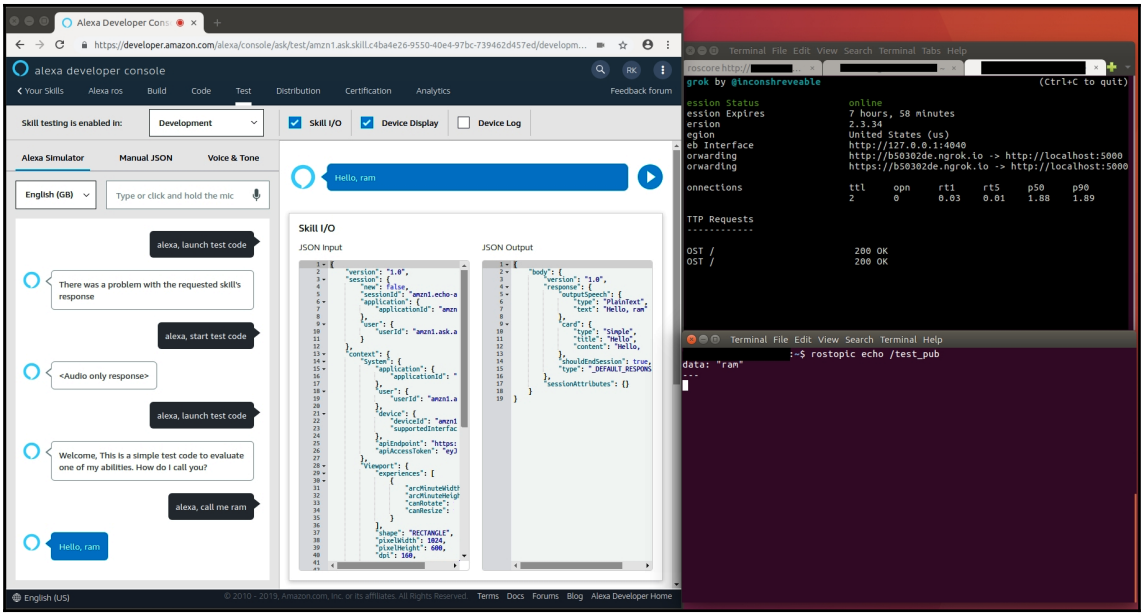

Setup & Installation
1 Download ngrok
ngrok is easy to install. Download a single binary with zero run-time dependencies.
Mac OS X Windows
Download for Linux
Mac (32-Bit) Windows (32-Bit) Linux (ARM)
Linux (32-Bit) FreeBSD (64-Bit) FreeBSD (32-Bit)
2 Unzip to install
On Linux or OSX you can unzip ngrok from a terminal with the following command. On Windows, just double click ngrok.zip.
$ unzip /path/to/ngrok.zip
Most people keep ngrok in their user folder or set an alias for easy access.
3 Connect your account
Running this command will add your account's authtoken to your ngrok.yml file. This will give you more features and all open tunnels will be listed here in the dashboard.
$ ./ngrok authtoken 1QEpYO9nF07e6gImeyC4rfI
4 Fire it up
Read the documentation on how to use ngrok. Try it out by running it from the command line:
$ ./ngrok help
To start a HTTP tunnel on port 80, run this next:
$ ./ngrok http 80


Terminal File Edit View Search Terminal Tabs Help
ngrok by @inconshreveable (Ctrl+C to quit)
Session Status online
Session Expires 7 hours, 59 minutes
Version 2.3.34
Region United States (us)
Web Interface http://127.0.0.1:4040
Forwarding http://7f120e45.ngrok.io -> http://localhost:5000
Forwarding https://7f120e45.ngrok.io -> http://localhost:5000
Connections ttl opn rt1 rt5 p50 p90
0 0 0.00 0.00 0.00 0.00

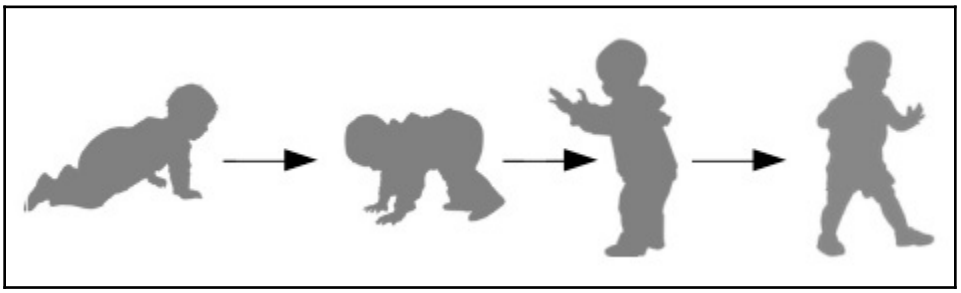

alexa developer console
Your Skills
Alexa ros
Build
Code
Test
Distribution
Certification
Analytics
Feedback forum
English (UK)
CUSTOM
Interaction Model
Invocation
Intents (5)
Add
Built-In Intents (5)
AMAZON.FallbackIntent
AMAZON.CancelIntent
AMAZON.HelpIntent
AMAZON.StopIntent
AMAZON.NavigateHomeIntent
Slot Types (0)
Add
JSON Editor
Interfaces
Endpoint
Intent History
Annotation Sets
Display
BETA
IN-SKILL PRODUCTS
ACCOUNT LINKING
How to get started
Alexa Skills Kit Developer Tutorial for Programmers: Building...
Watch later
Share
amazon alexa
Developer Console: Build
Resources
Make Money
Create an In-Skill Product and add it to your skill. This enables you to sell premium content to your customers via voice.
Feature Updates & Releases"
New Alexa Skills Kit Features and Tools.
Getting Started: A Comprehensive Course (Cake Walk)
Cake Walk: Build an Engaging Alexa Skill. This course is for software developers, voice developers, solution architects, user interface (UI) developers, voice designers, or anyone with beginner-level coding experience.
Documentation
Refer to our technical documents for detailed guides on building custom skills.
Sample Alexa Projects
Whatever your experience, you can get started quickly using one of our Alexa projects on GitHub.
Alexa Presentation Language (APL) Documentation BETA
Skill builder checklist
Complete these steps to be able to test your skill using the simulator in the test tab, or with your echo device.
REQUIRED
1. Invocation Name
Enter an invocation name for your skill
REQUIRED
2. Intents, Samples, and Slots
Add at least one intent and one sample utterance
REQUIRED
3. Build Model
Successfully build your interaction model
REQUIRED
4. Endpoint
Set a web service endpoint to handle skill requests
OPTIONAL
In-Skill Products
Create an in-skill product and add it to your skill.

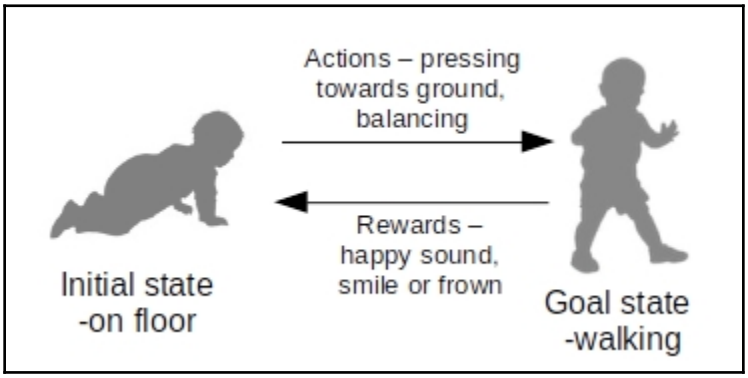

Interaction Model
Invocation
Intents (6)
Add
HelloIntent
firstname
Built-In Intents (5)
AMAZON.FallbackIntent
AMAZON.CancelIntent
AMAZON.HelpIntent
AMAZON.StopIntent
AMAZON.NavigateHomeIntent
Slot Types (1)
Add
AMAZON.FirstName
JSON Editor
Interfaces
Endpoint
Intent History
Annotation Sets
Display
BETA
IN-SKILL PRODUCTS
Intents / HelloIntent
Sample Utterances (3)
Bulk Edit
Export
What might a user say to invoke this intent?
HelloIntent {firstname}
HelloIntent my name is {firstname}
HelloIntent call me {firstname}
1 – 3 of 3
Dialog Delegation Strategy
Dialog management is not enabled f...
Why is this disabled?
Intent Slots (1)
ORDER
NAME
SLOT TYPE
ACTIONS
1
firstname
AMAZON.FirstName
Edit Dialog | Delete
2
Create a new slot
Select a slot type
Edit Dialog | Delete
Intent Confirmation
Does this intent require confirmation?

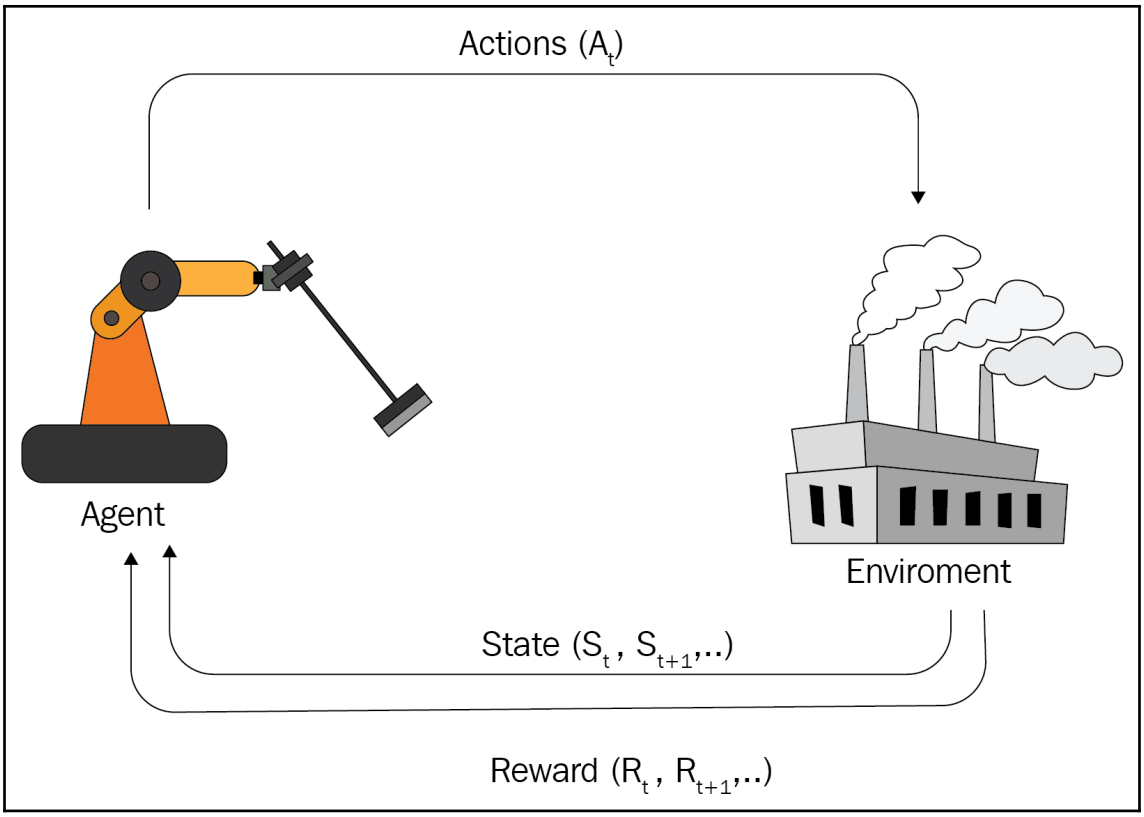

Full Build Successful
If you make any new changes, you will need to rebuild your model for them to take effect.
Interact with your model using Utterance Profiler

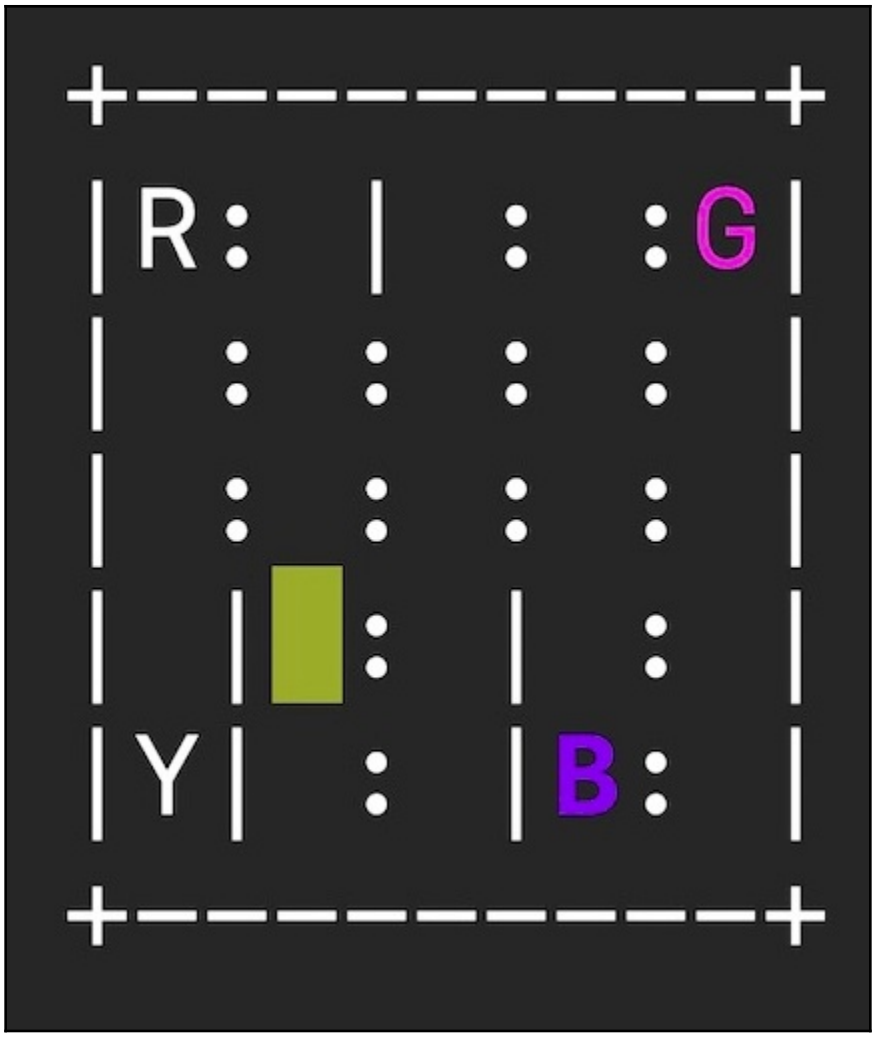

alexa developer console
Your Skills
Alexa ros
Build
Code
Test
Distribution
Certification
Analytics
Feedback forum
Skill testing is enabled in:
Development
Skill I/O
Device Display
Device Log
Alexa Simulator
Manual JSON
Voice & Tone
English (GB)
Type or click and hold the mic
alexa, launch test code
There was a problem with the requested skill's response
alexa, start test code
<Audio only response>
alexa, launch test code
Welcome, This is a simple test code to evaluate one of my abilities. How do I call you?
alexa, call me ram
Hello, ram
Hello, ram
Skill I/O
JSON Input
JSON Output
English (US)
Terms
Docs
Forums
Blog
Alexa Developer Home
grok by @inconshreveable
(Ctrl+C to quit)
online
7 hours, 58 minutes
2.3.34
United States (us)
http://127.0.0.1:4040
http://b50302de.ngrok.io -> http://localhost:5000
https://b50302de.ngrok.io -> http://localhost:5000
200 OK
200 OK
:~$ rostopic echo /test_pub
data: "ram"

Chapter 8: Reinforcement Learning and Robotics

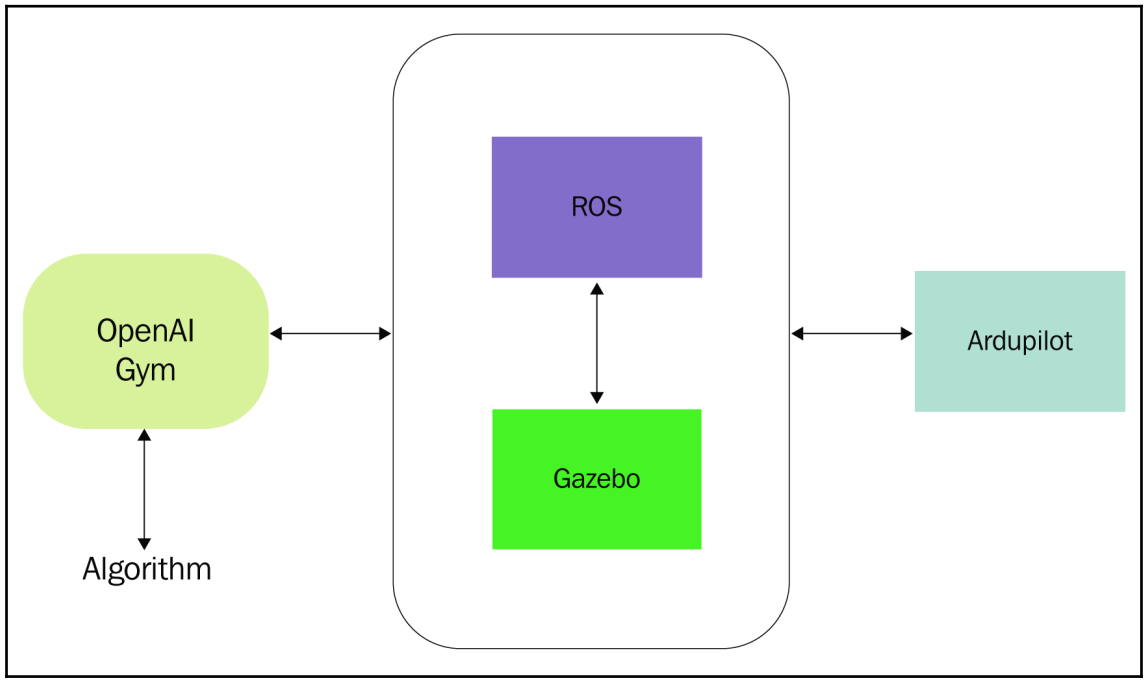


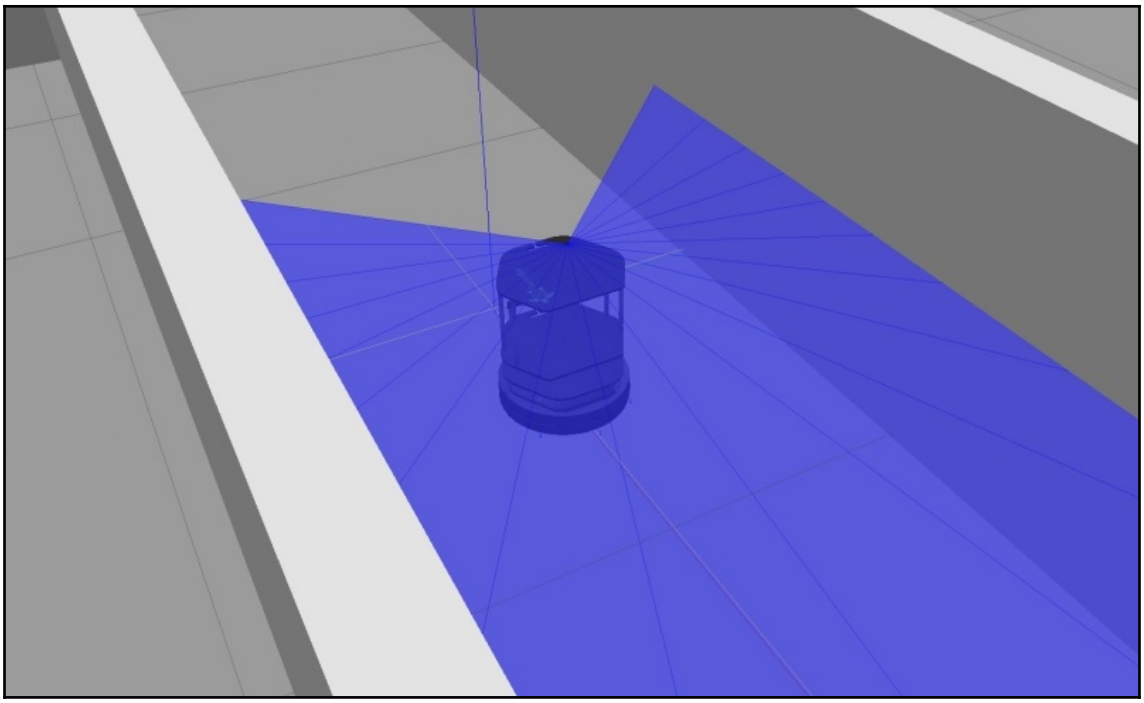


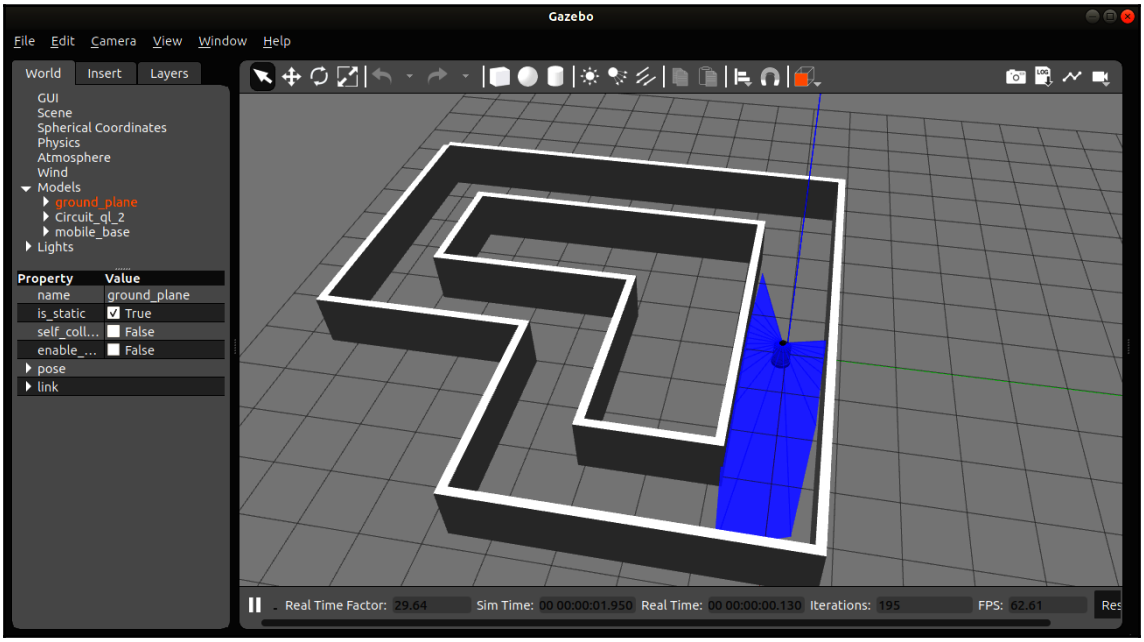

Actions (A_t)
Agent
Enviroment
State (S_t , S_{t+1},..)
Reward (R_t , R_{t+1},..)

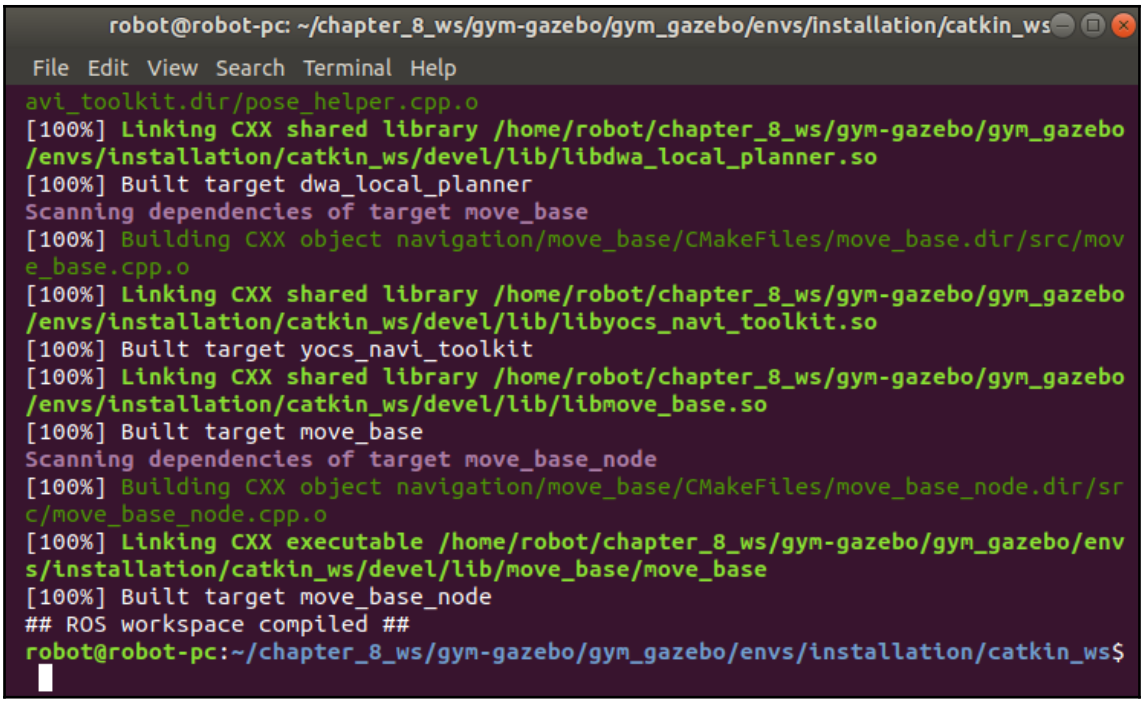

R
G
Y
B

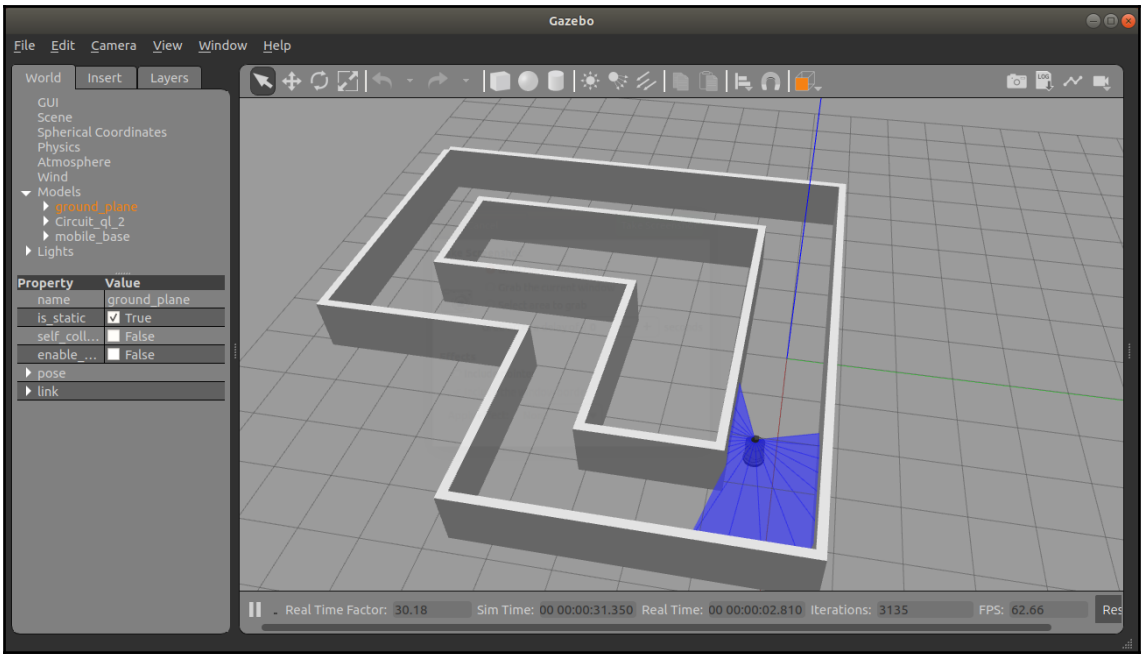
```
+---------+
|R: | : :G|
| : : : : |
| : : : : |
| | : |: : |
|Y| : |B: |
+---------+
  (North)

Timestep: 9
State: 378
Action: 1
Reward: -1
```

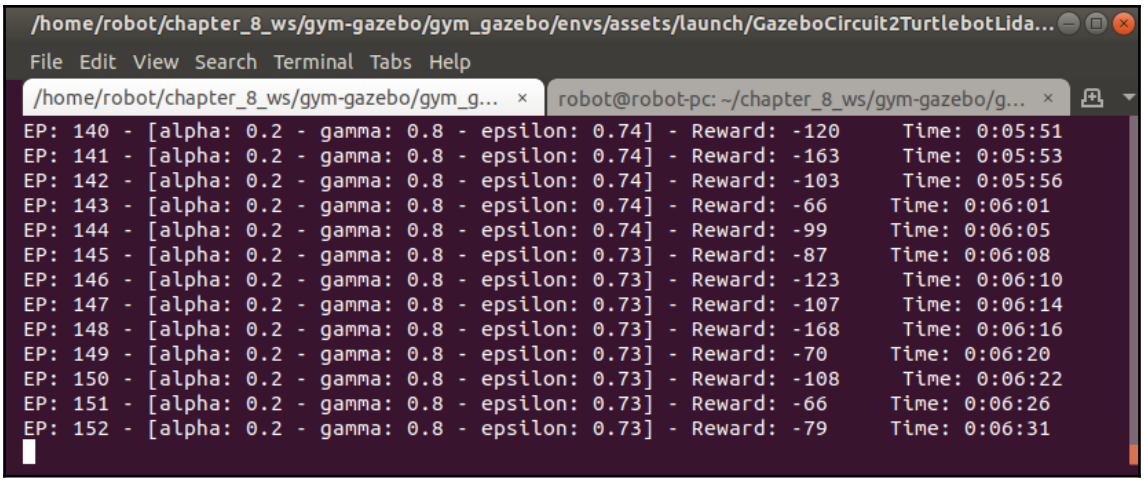


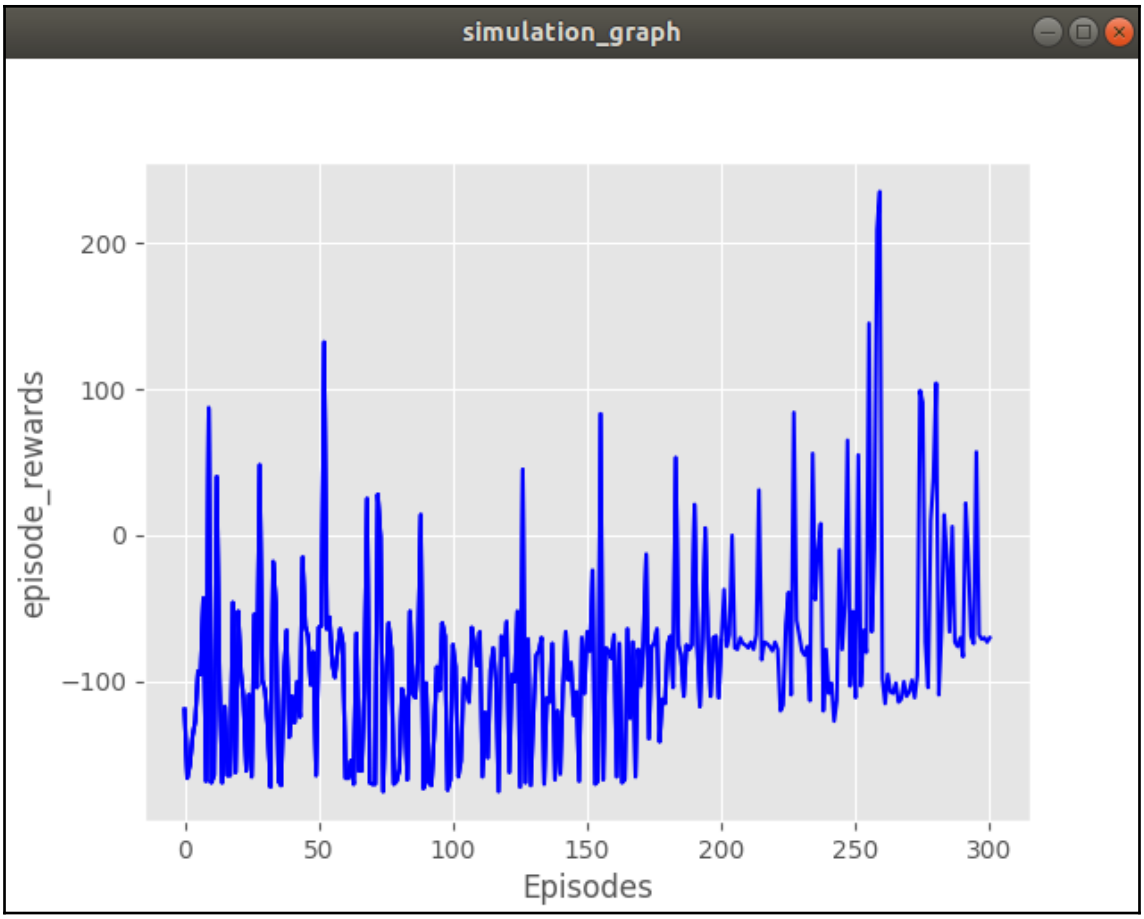



Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
ground_plane
Circuit_ql_2
mobile_base
Lights
Property Value
name ground_plane
is_static True
self_coll... False
enable_... False
pose
link
Real Time Factor: 29.64
Sim Time: 00 00:00:01.950
Real Time: 00 00:00:00.130
Iterations: 195
FPS: 62.61


robot@robot-pc: ~/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws
File Edit View Search Terminal Help
avi_toolkit.dir/pose_helper.cpp.o
[100%] Linking CXX shared library /home/robot/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws/devel/lib/libdwa_local_planner.so
[100%] Built target dwa_local_planner
Scanning dependencies of target move_base
[100%] Building CXX object navigation/move_base/CMakeFiles/move_base.dir/src/move_base.cpp.o
[100%] Linking CXX shared library /home/robot/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws/devel/lib/libyocs_navi_toolkit.so
[100%] Built target yocs_navi_toolkit
[100%] Linking CXX shared library /home/robot/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws/devel/lib/libmove_base.so
[100%] Built target move_base
Scanning dependencies of target move_base_node
[100%] Building CXX object navigation/move_base/CMakeFiles/move_base_node.dir/src/move_base_node.cpp.o
[100%] Linking CXX executable /home/robot/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws/devel/lib/move_base/move_base
[100%] Built target move_base_node
ROS workspace compiled
robot@robot-pc:~/chapter_8_ws/gym-gazebo/gym_gazebo/envs/installation/catkin_ws$


Gazebo
File Edit Camera View Window Help
World Insert Layers
GUI
Scene
Spherical Coordinates
Physics
Atmosphere
Wind
Models
ground_plane
Circuit_ql_2
mobile_base
Lights
Property Value
name ground_plane
is_static True
self_coll... False
enable_... False
pose
link
Real Time Factor: 30.18 Sim Time: 00 00:00:31.350 Real Time: 00 00:00:02.810 Iterations: 3135 FPS: 62.66

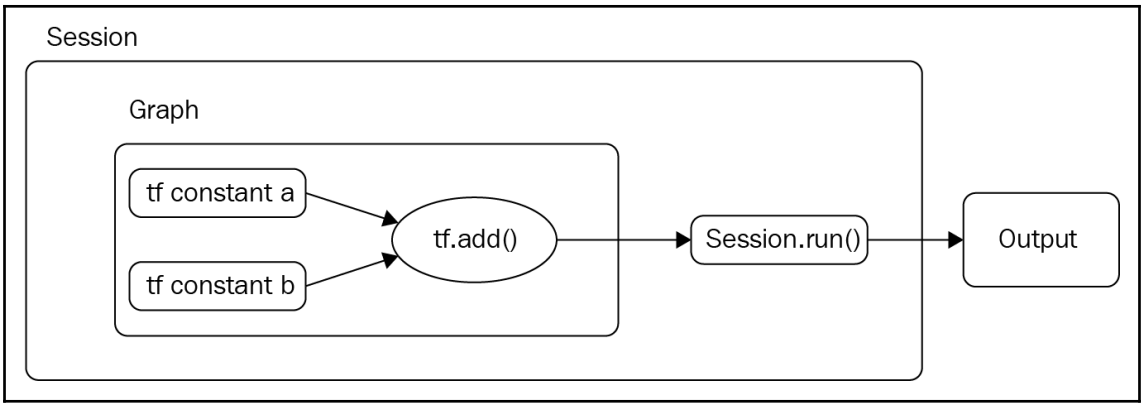

/home/robot/chapter_8_ws/gym-gazebo/gym_gazebo/envs/assets/launch/GazeboCircuit2TurtlebotLida...
File Edit View Search Terminal Tabs Help
/home/robot/chapter_8_ws/gym-gazebo/gym_g...
robot@robot-pc: ~/chapter_8_ws/gym-gazebo/g...
EP: 140 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.74] - Reward: -120 Time: 0:05:51
EP: 141 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.74] - Reward: -163 Time: 0:05:53
EP: 142 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.74] - Reward: -103 Time: 0:05:56
EP: 143 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.74] - Reward: -66 Time: 0:06:01
EP: 144 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.74] - Reward: -99 Time: 0:06:05
EP: 145 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -87 Time: 0:06:08
EP: 146 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -123 Time: 0:06:10
EP: 147 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -107 Time: 0:06:14
EP: 148 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -168 Time: 0:06:16
EP: 149 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -70 Time: 0:06:20
EP: 150 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -108 Time: 0:06:22
EP: 151 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -66 Time: 0:06:26
EP: 152 - [alpha: 0.2 - gamma: 0.8 - epsilon: 0.73] - Reward: -79 Time: 0:06:31


simulation_graph
episode_rewards
200
100
0
−100
0
50
100
150
200
250
300
Episodes

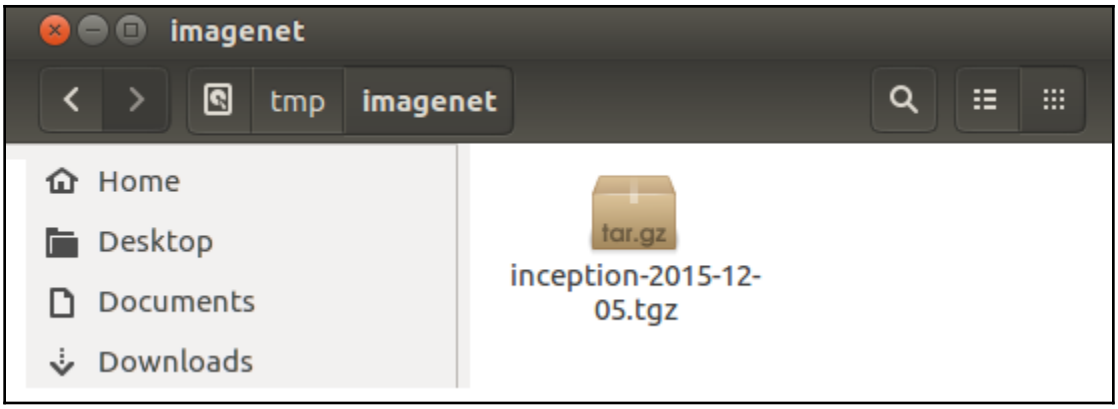
Chapter 9: Deep Learning Using ROS and TensorFlow

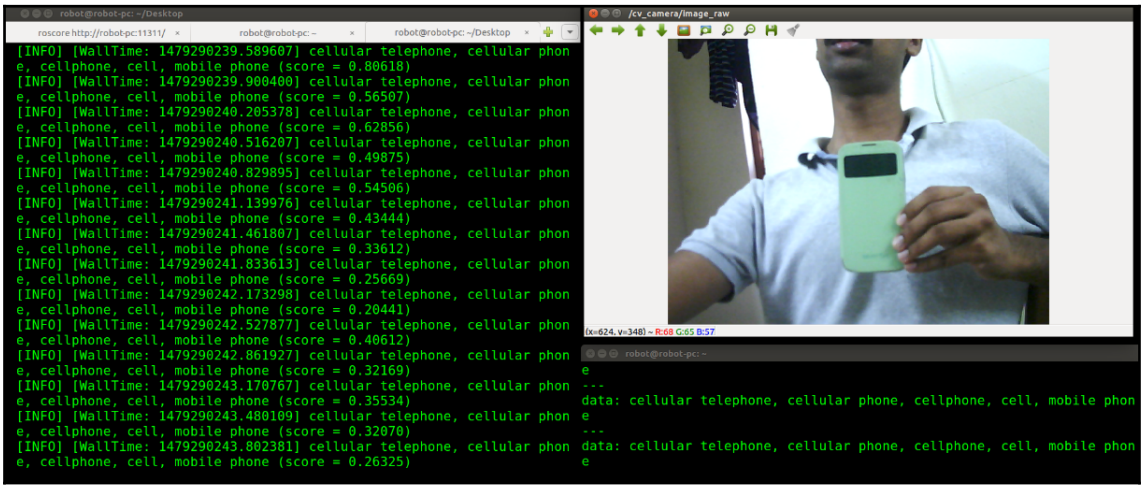
```
robot@robot-pc:~$ sudo pip install --upgrade $TF_BINARY_URL
The directory '/home/robot/.cache/pip/http' or its parent directory is not owned
 by the current user and the cache has been disabled. Please check the permissio
ns and owner of that directory. If executing pip with sudo, you may want sudo's
-H flag.
The directory '/home/robot/.cache/pip' or its parent directory is not owned by
he current user and caching wheels has been disabled. check the permissions and
owner of that directory. If executing pip with sudo, you may want sudo's -H flag
.
Collecting tensorflow==0.11.0rc1 from https://storage.googleapis.com/tensorflow/
linux/cpu/tensorflow-0.11.0rc1-cp27-none-linux_x86_64.whl
  Downloading https://storage.googleapis.com/tensorflow/linux/cpu/tensorflow-0.1
1.0rc1-cp27-none-linux_x86_64.whl (39.8MB)
    100% |████████████████████████████████| 39.8MB 42kB/s
Collecting mock>=2.0.0 (from tensorflow==0.11.0rc1)
  Downloading mock-2.0.0-py2.py3-none-any.whl (56kB)
    100% |████████████████████████████████| 61kB 122kB/s
Collecting protobuf==3.0.0 (from tensorflow==0.11.0rc1)
  Downloading protobuf-3.0.0-py2.py3-none-any.whl (342kB)
    100% |████████████████████████████████| 348kB 176kB/s
Collecting numpy>=1.11.0 (from tensorflow==0.11.0rc1)
  Downloading numpy-1.11.2-cp27-cp27mu-manylinux1_x86_64.whl (15.3MB)
    67% |█████████████████████           | 10.4MB 321kB/s eta 0:00:16
```

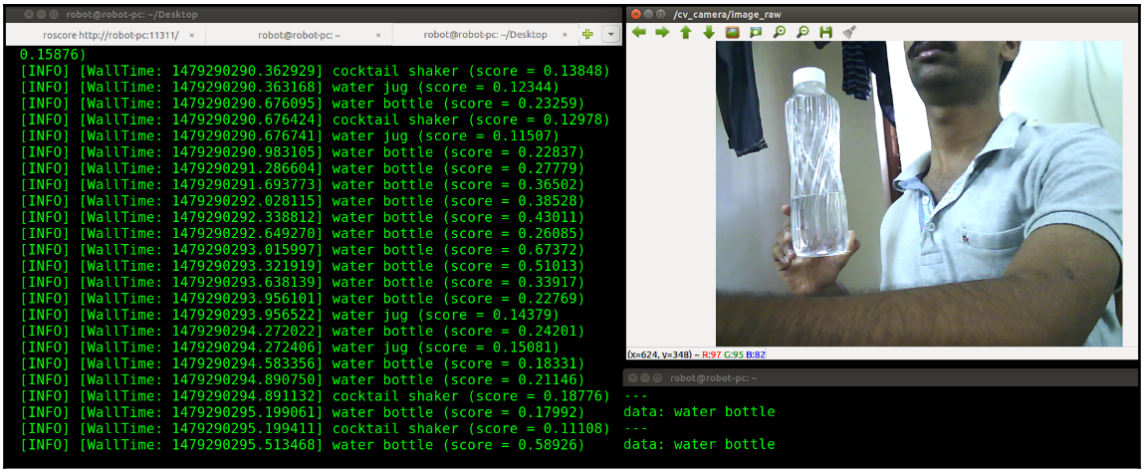
```
robot@robot-pc: ~
robot@robot-pc:~$ python
Python 2.7.11+ (default, Apr 17 2016, 14:00:29)
[GCC 5.3.1 20160413] on linux2
Type "help", "copyright", "credits" or "license" for more informati
on.
>>> import tensorflow as tf
>>> hello = tf.constant('Hello, TensorFlow!')
>>> sess = tf.Session()
>>> print(sess.run(hello))
Hello, TensorFlow!
>>> a = tf.constant(12)
>>> b = tf.constant(34)
>>> print(sess.run(a+b))
46
>>>
```

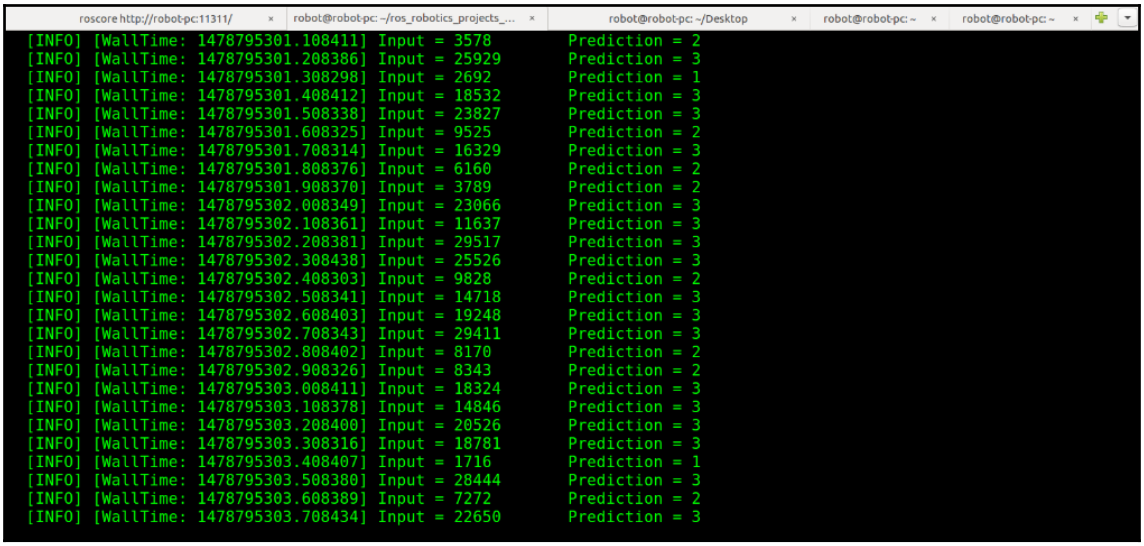

Session
Graph
tf constant a
tf constant b
tf.add()
Session.run()
Output

```
For i = 99

Result of matrix addition

[[ 2  4  6]
 [ 8 10 12]
 [14 16 18]]

Result of matrix multiplication

[[ 30  36  42]
 [ 66  81  96]
 [102 126 150]]

Result of scalar multiplication

[[150 180 210]
 [330 405 480]
 [510 630 750]]

Result of Number multiplication

[[ 2970  3564  4158]
 [ 6534  8019  9504]
 [10098 12474 14850]]
```

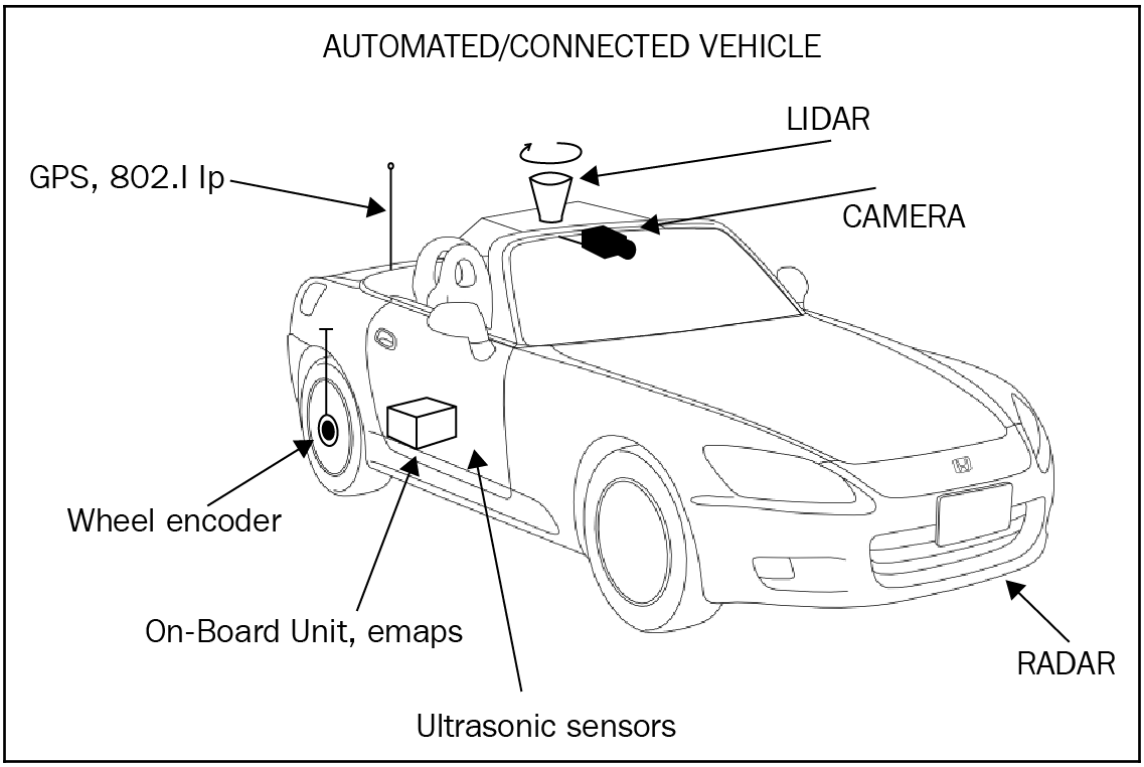

imagenet
tmp
imagenet
Home
Desktop
Documents
Downloads
tar.gz
inception-2015-12-05.tgz

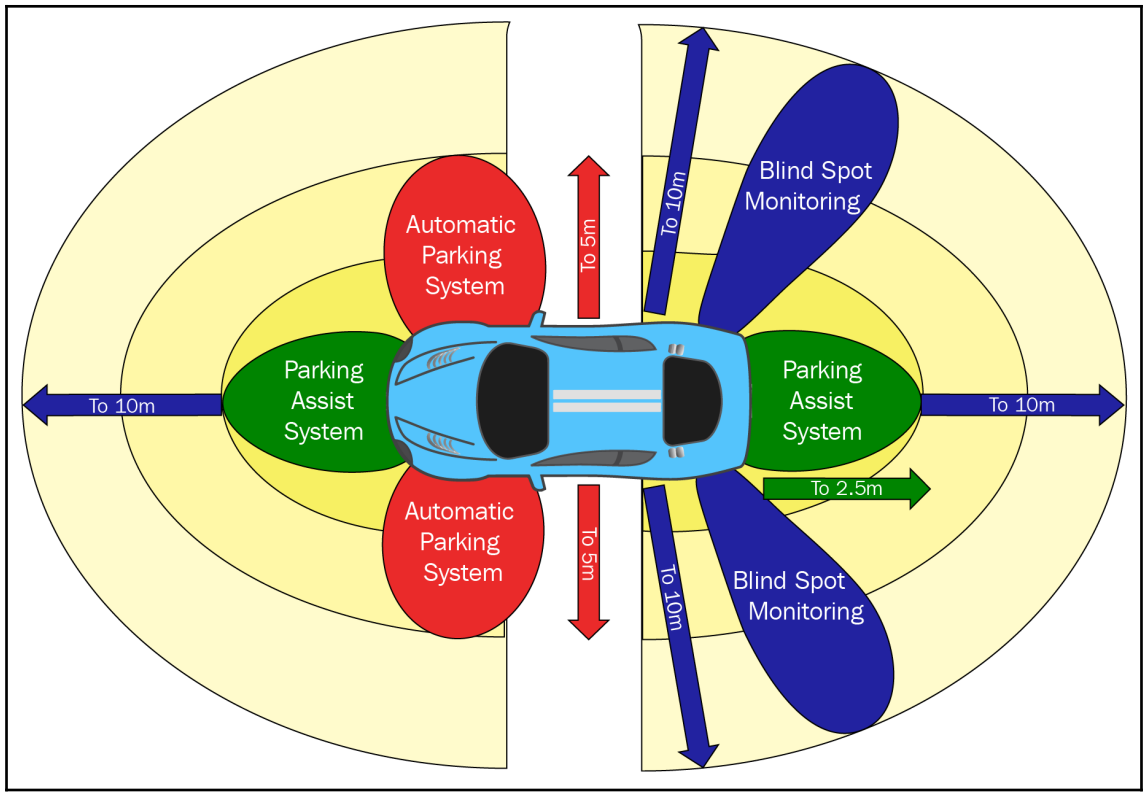

robot@robot-pc: ~/Desktop
roscore http://robot-pc:11311/
robot@robot-pc: ~
robot@robot-pc: ~/Desktop
[INFO] [WallTime: 1479290239.589607] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.80618)
[INFO] [WallTime: 1479290239.900400] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.56507)
[INFO] [WallTime: 1479290240.205378] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.62856)
[INFO] [WallTime: 1479290240.516207] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.49875)
[INFO] [WallTime: 1479290240.829895] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.54506)
[INFO] [WallTime: 1479290241.139976] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.43444)
[INFO] [WallTime: 1479290241.461807] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.33612)
[INFO] [WallTime: 1479290241.833613] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.25669)
[INFO] [WallTime: 1479290242.173298] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.20441)
[INFO] [WallTime: 1479290242.527877] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.40612)
[INFO] [WallTime: 1479290242.861927] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.32169)
[INFO] [WallTime: 1479290243.170767] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.35534)
[INFO] [WallTime: 1479290243.480109] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.32070)
[INFO] [WallTime: 1479290243.802381] cellular telephone, cellular phone, cellphone, cell, mobile phone (score = 0.26325)
/cv_camera/image_raw
(x=624, v=348) ~ R:68 G:65 B:57
robot@robot-pc: ~
e
---
data: cellular telephone, cellular phone, cellphone, cell, mobile phone
---
data: cellular telephone, cellular phone, cellphone, cell, mobile phone


robot@robot-pc: ~/Desktop
roscore http://robot-pc:11311/
robot@robot-pc: ~
robot@robot-pc: ~/Desktop
0.15876)
[INFO] [WallTime: 1479290290.362929] cocktail shaker (score = 0.13848)
[INFO] [WallTime: 1479290290.363168] water jug (score = 0.12344)
[INFO] [WallTime: 1479290290.676095] water bottle (score = 0.23259)
[INFO] [WallTime: 1479290290.676424] cocktail shaker (score = 0.12978)
[INFO] [WallTime: 1479290290.676741] water jug (score = 0.11507)
[INFO] [WallTime: 1479290290.983105] water bottle (score = 0.22837)
[INFO] [WallTime: 1479290291.286604] water bottle (score = 0.27779)
[INFO] [WallTime: 1479290291.693773] water bottle (score = 0.36502)
[INFO] [WallTime: 1479290292.028115] water bottle (score = 0.38528)
[INFO] [WallTime: 1479290292.338812] water bottle (score = 0.43011)
[INFO] [WallTime: 1479290292.649270] water bottle (score = 0.26085)
[INFO] [WallTime: 1479290293.015997] water bottle (score = 0.67372)
[INFO] [WallTime: 1479290293.321919] water bottle (score = 0.51013)
[INFO] [WallTime: 1479290293.638139] water bottle (score = 0.33917)
[INFO] [WallTime: 1479290293.956101] water bottle (score = 0.22769)
[INFO] [WallTime: 1479290293.956522] water jug (score = 0.14379)
[INFO] [WallTime: 1479290294.272022] water bottle (score = 0.24201)
[INFO] [WallTime: 1479290294.272406] water jug (score = 0.15081)
[INFO] [WallTime: 1479290294.583356] water bottle (score = 0.18331)
[INFO] [WallTime: 1479290294.890750] water bottle (score = 0.21146)
[INFO] [WallTime: 1479290294.891132] cocktail shaker (score = 0.18776)
[INFO] [WallTime: 1479290295.199061] water bottle (score = 0.17992)
[INFO] [WallTime: 1479290295.199411] cocktail shaker (score = 0.11108)
[INFO] [WallTime: 1479290295.513468] water bottle (score = 0.58926)
/cv_camera/image_raw
(x=624, y=348) ~ R:97 G:95 B:82
robot@robot-pc: ~
---
data: water bottle
---
data: water bottle


roscore http://robot-pc:11311/
robot@robot-pc: ~/ros_robotics_projects_...
robot@robot-pc: ~/Desktop
robot@robot-pc: ~
robot@robot-pc: ~
[INFO] [WallTime: 1478795301.108411] Input = 3578 Prediction = 2
[INFO] [WallTime: 1478795301.208386] Input = 25929 Prediction = 3
[INFO] [WallTime: 1478795301.308298] Input = 2692 Prediction = 1
[INFO] [WallTime: 1478795301.408412] Input = 18532 Prediction = 3
[INFO] [WallTime: 1478795301.508338] Input = 23827 Prediction = 3
[INFO] [WallTime: 1478795301.608325] Input = 9525 Prediction = 2
[INFO] [WallTime: 1478795301.708314] Input = 16329 Prediction = 3
[INFO] [WallTime: 1478795301.808376] Input = 6160 Prediction = 2
[INFO] [WallTime: 1478795301.908370] Input = 3789 Prediction = 2
[INFO] [WallTime: 1478795302.008349] Input = 23066 Prediction = 3
[INFO] [WallTime: 1478795302.108361] Input = 11637 Prediction = 3
[INFO] [WallTime: 1478795302.208381] Input = 29517 Prediction = 3
[INFO] [WallTime: 1478795302.308438] Input = 25526 Prediction = 3
[INFO] [WallTime: 1478795302.408303] Input = 9828 Prediction = 2
[INFO] [WallTime: 1478795302.508341] Input = 14718 Prediction = 3
[INFO] [WallTime: 1478795302.608403] Input = 19248 Prediction = 3
[INFO] [WallTime: 1478795302.708343] Input = 29411 Prediction = 3
[INFO] [WallTime: 1478795302.808402] Input = 8170 Prediction = 2
[INFO] [WallTime: 1478795302.908326] Input = 8343 Prediction = 2
[INFO] [WallTime: 1478795303.008411] Input = 18324 Prediction = 3
[INFO] [WallTime: 1478795303.108378] Input = 14846 Prediction = 3
[INFO] [WallTime: 1478795303.208400] Input = 20526 Prediction = 3
[INFO] [WallTime: 1478795303.308316] Input = 18781 Prediction = 3
[INFO] [WallTime: 1478795303.408407] Input = 1716 Prediction = 1
[INFO] [WallTime: 1478795303.508380] Input = 28444 Prediction = 3
[INFO] [WallTime: 1478795303.608389] Input = 7272 Prediction = 2
[INFO] [WallTime: 1478795303.708434] Input = 22650 Prediction = 3

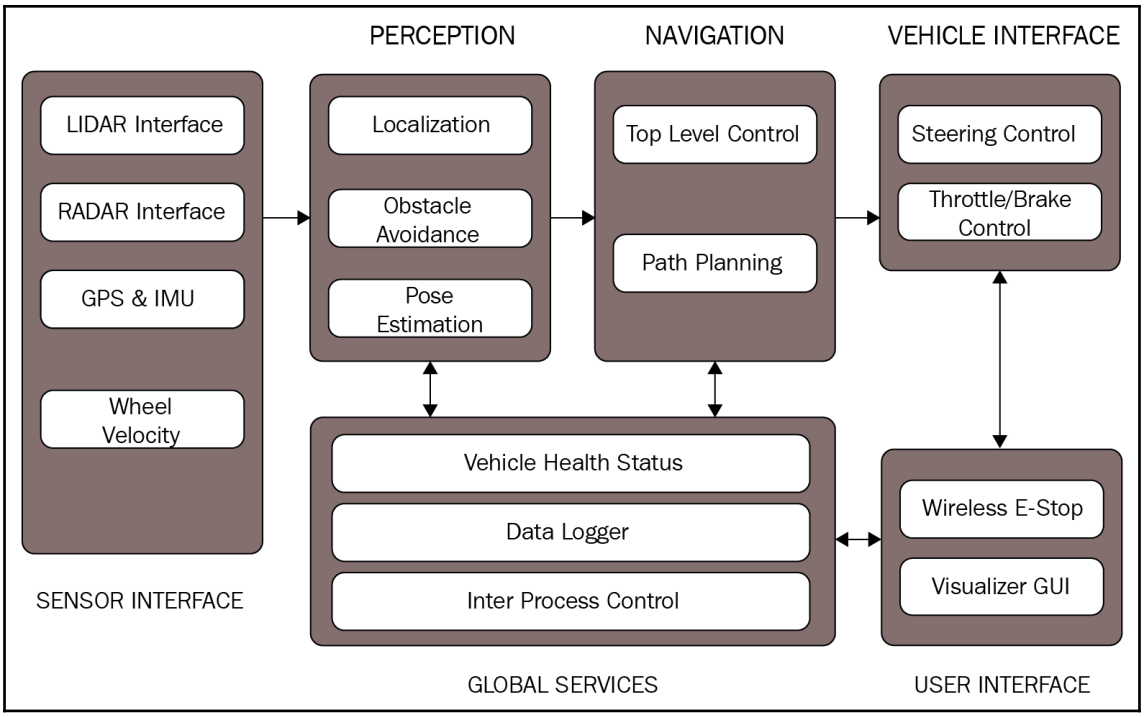
Chapter 10: Creating a Self-Driving Car Using ROS

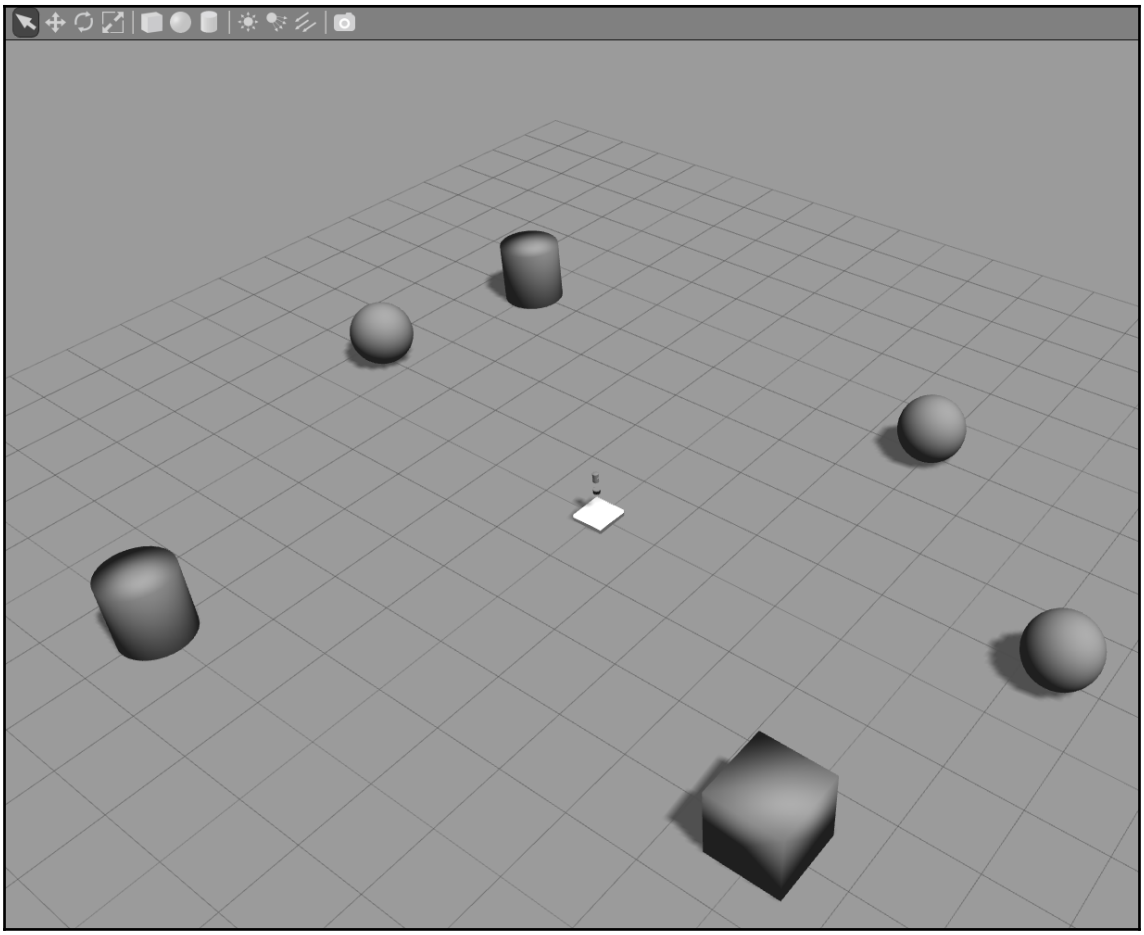

AUTOMATED/CONNECTED VEHICLE
LIDAR
GPS, 802.I Ip
CAMERA
Wheel encoder
On-Board Unit, emaps
Ultrasonic sensors
RADAR

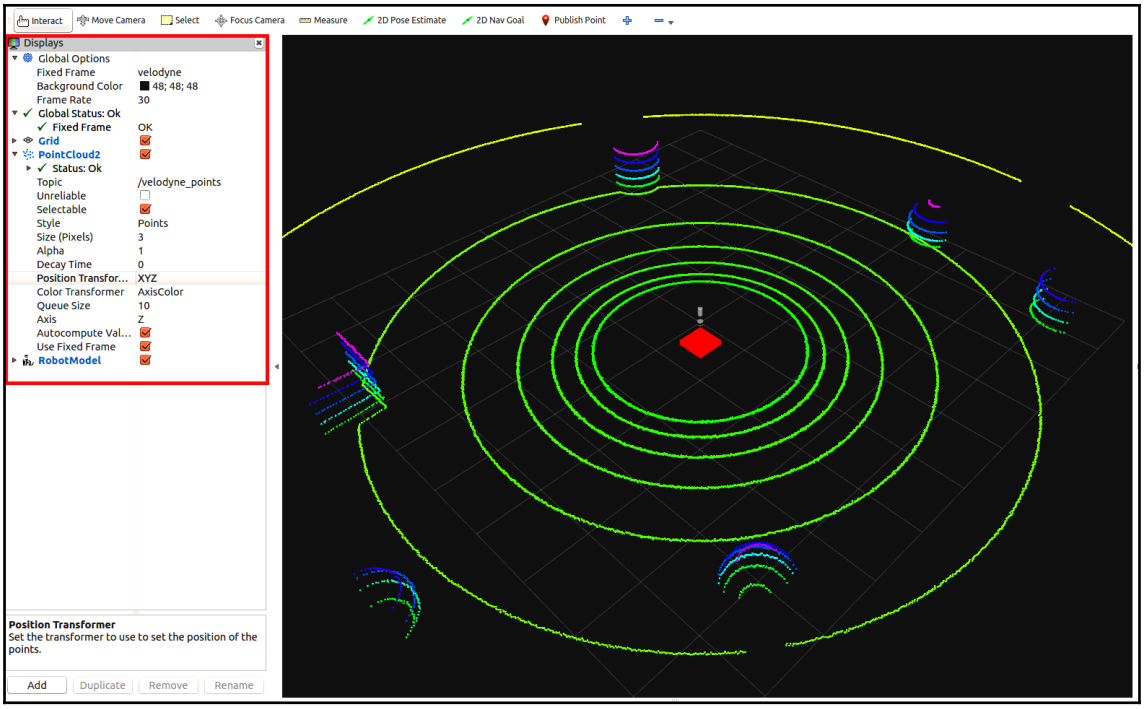

Automatic
Parking
System
To 5m
To 10m
Blind Spot
Monitoring
Parking
Assist
System
To 10m
Parking
Assist
System
To 10m
To 2.5m
Automatic
Parking
System
To 5m
To 10m
Blind Spot
Monitoring

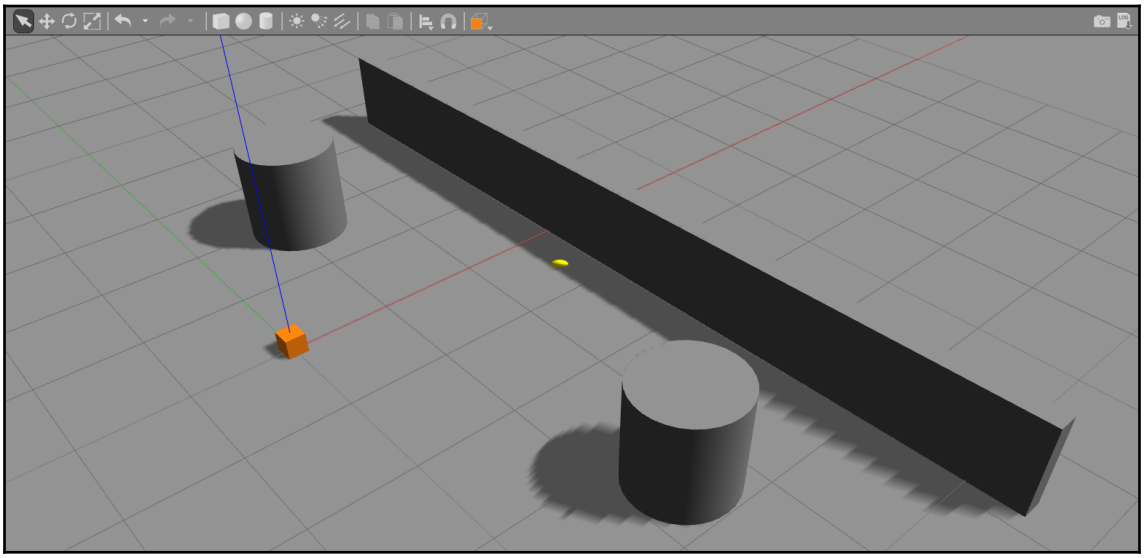

Velodyne
Velodyne
Velodyne
Velodyne

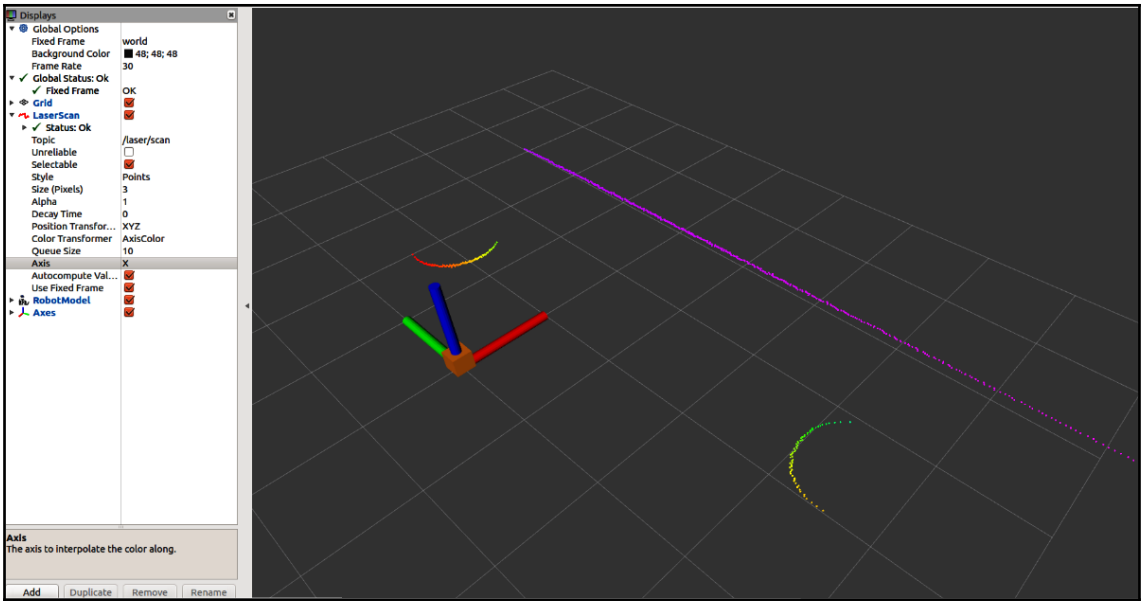

SICK

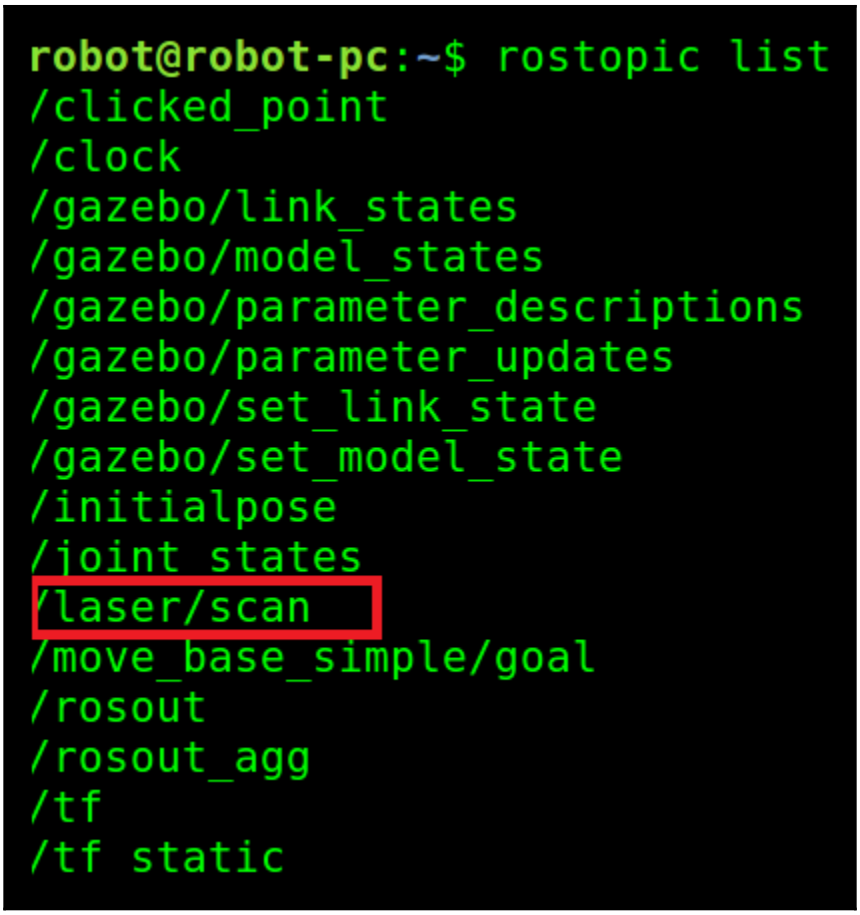

PERCEPTION
NAVIGATION
VEHICLE INTERFACE
LIDAR Interface
RADAR Interface
GPS & IMU
Wheel Velocity
SENSOR INTERFACE
Localization
Obstacle Avoidance
Pose Estimation
Top Level Control
Path Planning
Steering Control
Throttle/Brake Control
Vehicle Health Status
Data Logger
Inter Process Control
GLOBAL SERVICES
Wireless E-Stop
Visualizer GUI
USER INTERFACE

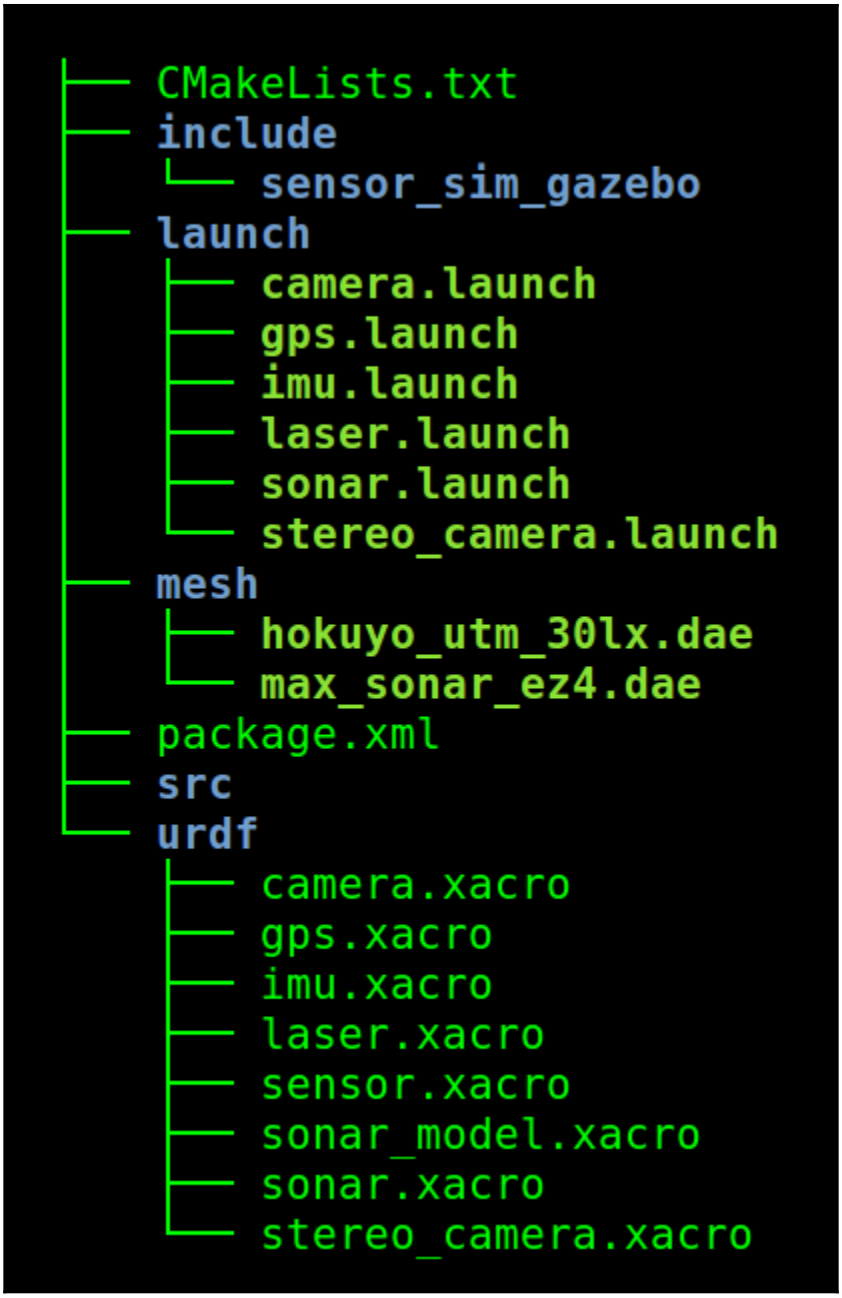


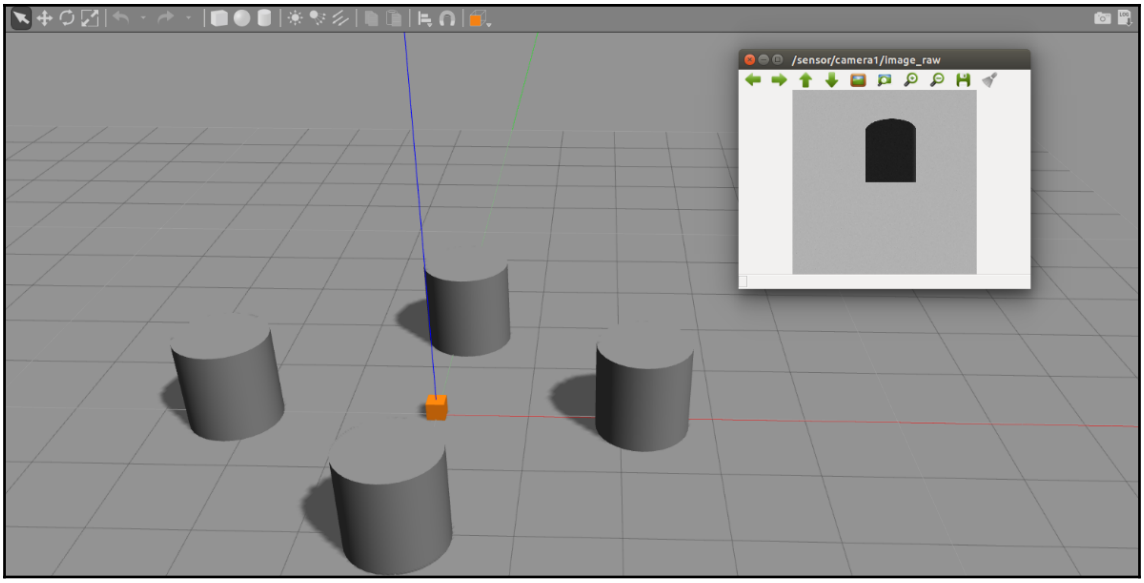

Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame velodyne
Background Color 48; 48; 48
Frame Rate 30
Global Status: Ok
Fixed Frame OK
Grid
PointCloud2
Status: Ok
Topic /velodyne_points
Unreliable
Selectable
Style Points
Size (Pixels) 3
Alpha 1
Decay Time 0
Position Transfor... XYZ
Color Transformer AxisColor
Queue Size 10
Axis Z
Autocompute Val...
Use Fixed Frame
RobotModel
Position Transformer
Set the transformer to use to set the position of the points.
Add
Duplicate
Remove
Rename

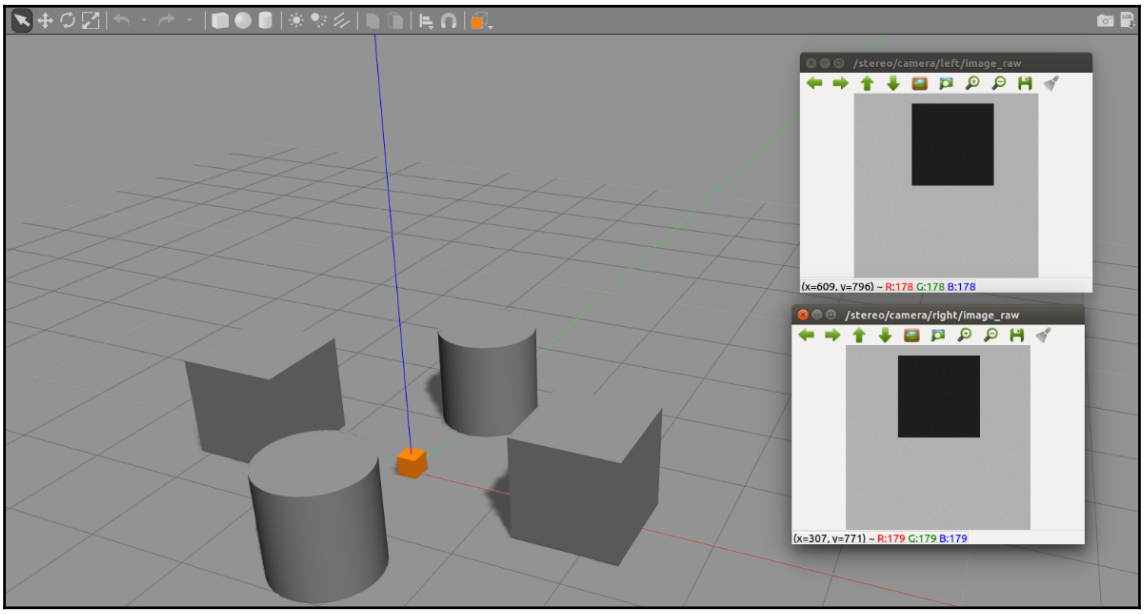



Displays
Global Options
Fixed Frame world
Background Color 48; 48; 48
Frame Rate 30
Global Status: Ok
Fixed Frame OK
Grid
LaserScan
Status: Ok
Topic /laser/scan
Unreliable
Selectable
Style Points
Size (Pixels) 3
Alpha 1
Decay Time 0
Position Transfor... XYZ
Color Transformer AxisColor
Queue Size 10
Axis X
Autocompute Val...
Use Fixed Frame
RobotModel
Axes
Axis
The axis to interpolate the color along.
Add
Duplicate
Remove
Rename


robot@robot-pc:~$ rostopic list
/clicked_point
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/initialpose
/joint_states
/laser/scan
/move_base_simple/goal
/rosout
/rosout_agg
/tf
/tf_static


CMakeLists.txt
include
sensor_sim_gazebo
launch
camera.launch
gps.launch
imu.launch
laser.launch
sonar.launch
stereo_camera.launch
mesh
hokuyo_utm_30lx.dae
max_sonar_ez4.dae
package.xml
src
urdf
camera.xacro
gps.xacro
imu.xacro
laser.xacro
sensor.xacro
sonar_model.xacro
sonar.xacro
stereo_camera.xacro


/sensor/camera1/image_raw

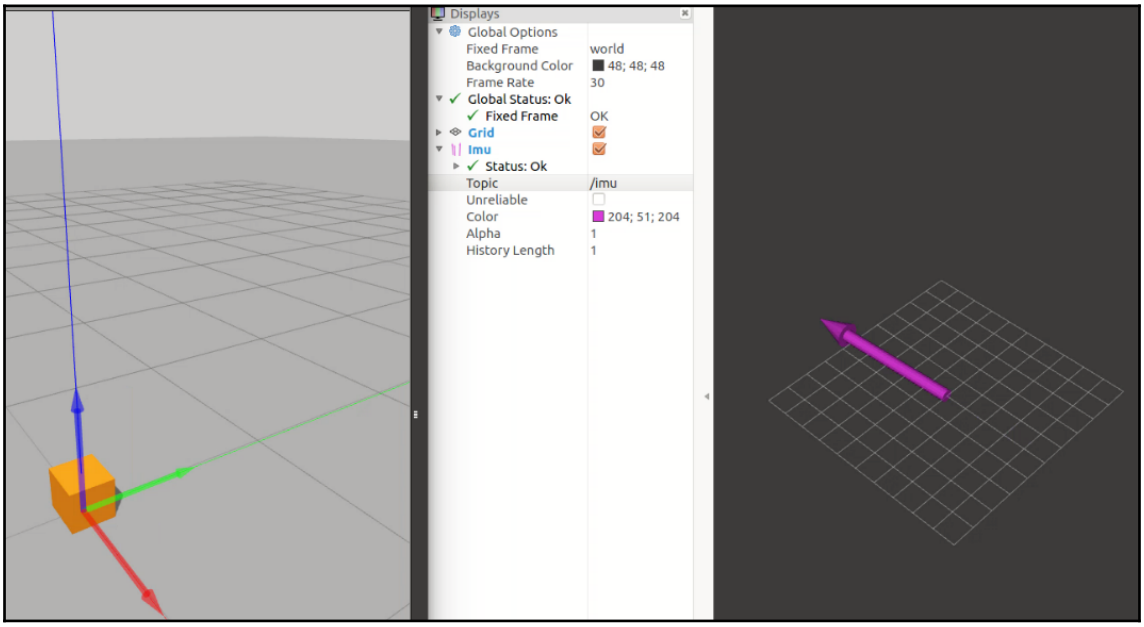

/stereo/camera/left/image_raw
(x=609, y=796) ~ R:178 G:178 B:178
/stereo/camera/right/image_raw
(x=307, y=771) ~ R:179 G:179 B:179

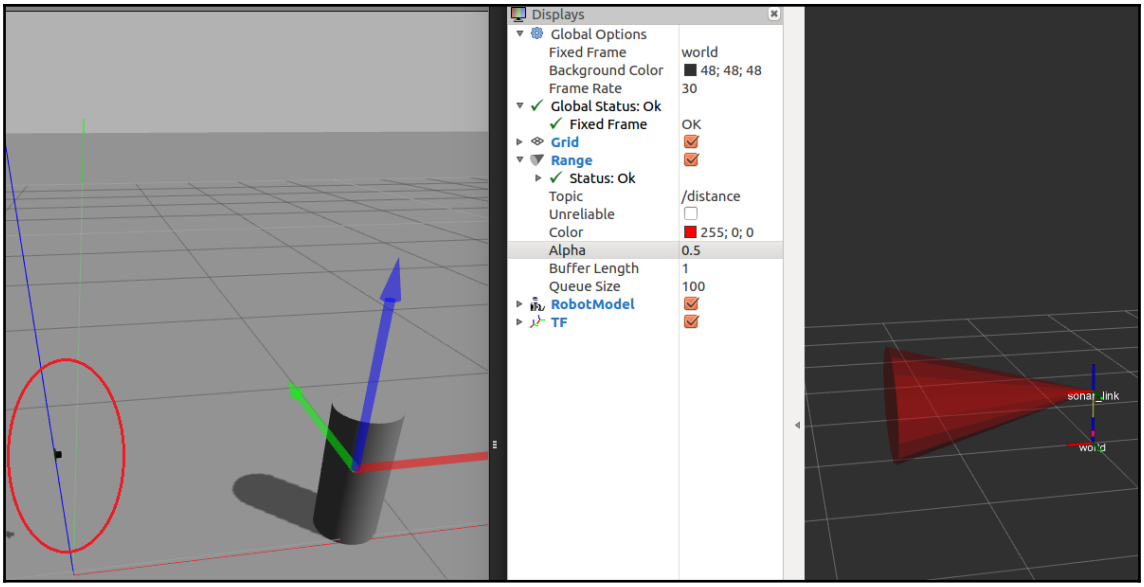
```
robot@robot-pc:~$ rostopic list
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/gps/fix
/gps/fix/position/parameter_descriptions
/gps/fix/position/parameter_updates
/gps/fix/status/parameter_descriptions
/gps/fix/status/parameter_updates
/gps/fix/velocity/parameter_descriptions
/gps/fix/velocity/parameter_updates
/gps/fix_velocity
/joint_states
/rosout
/rosout_agg
/tf
/tf_static
```

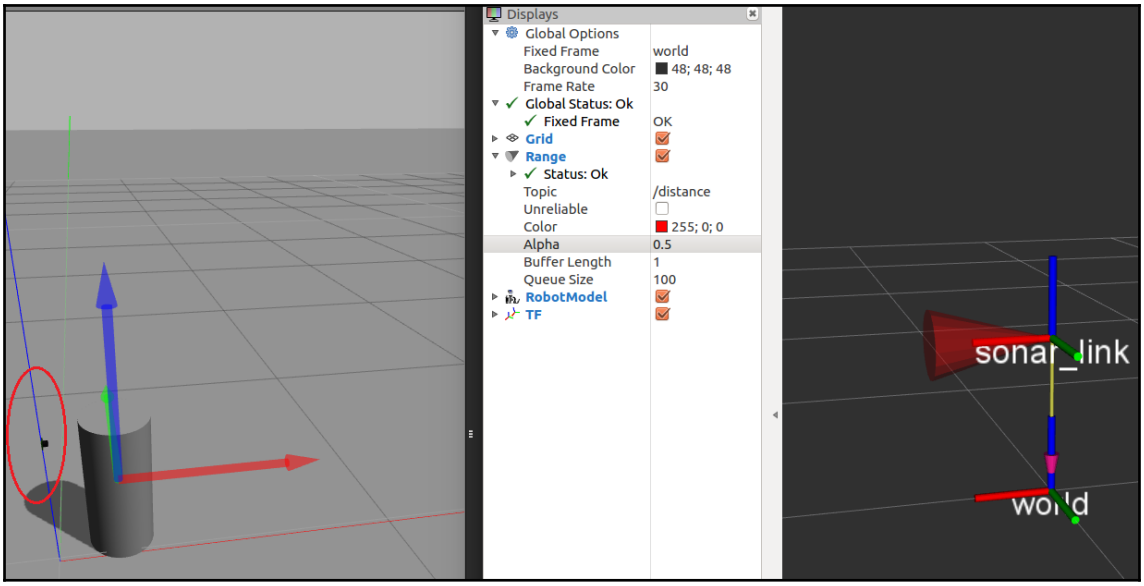
```
robot@robot-pc:~$ rostopic echo /gps/fix
header:
  seq: 161
  stamp:
    secs: 40
    nsecs: 500000000
  frame_id: sensor
status:
  status: 0
  service: 0
latitude: -30.0602249716
longitude: -51.17391374
altitude: 9.960587315
position_covariance: [0.0025010000000000006, 0.0, 0.0, 0.0, 0.00250100000
6, 0.0, 0.0, 0.0, 0.0025010000000000006]
position_covariance_type: 2
```

```
robot@robot-pc:~$ rostopic list
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/imu
/joint_states
/rosout
/rosout_agg
/tf
/tf_static
```

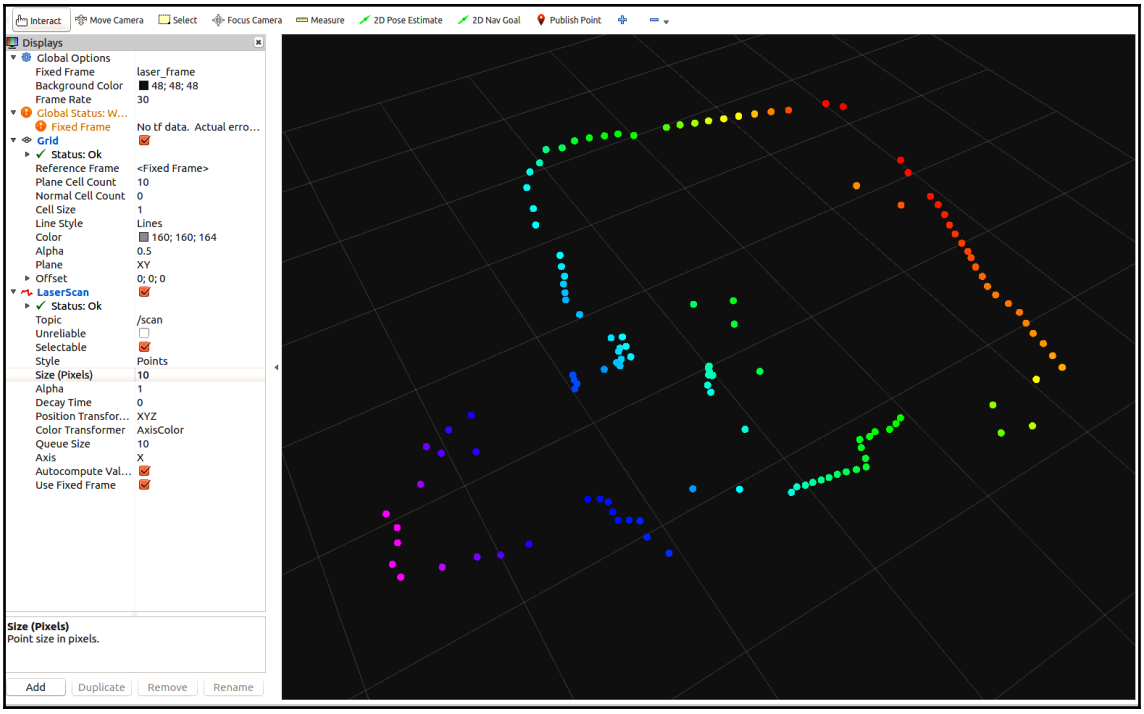
```
robot@robot-pc:~$ rostopic echo /imu
header:
  seq: 0
  stamp:
    secs: 24
    nsecs:  95000000
  frame_id: sensor
orientation:
  x: -9.88131291682e-324
  y: -9.88131291682e-324
  z: 8.87671670196e-17
  w: 1.0
orientation_covariance: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
angular_velocity:
  x: 3.95252516673e-321
  y: 3.95252516673e-321
  z: 0.0
angular_velocity_covariance: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
linear_acceleration:
  x: -1.95719626798e-20
  y: 8.93613280022e-20
  z: 7.28456264068e-12
```

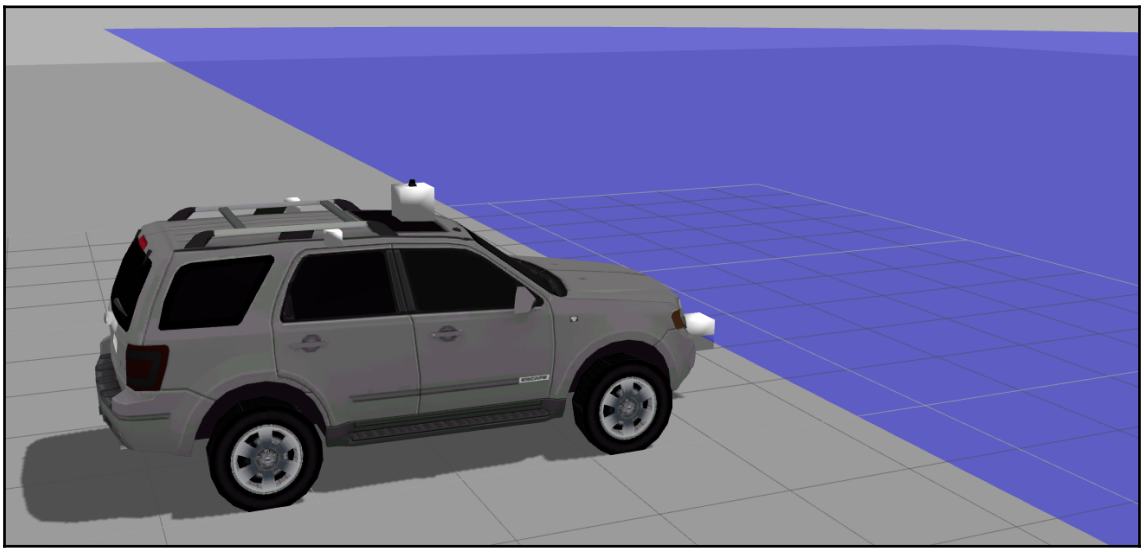



Displays
Global Options
Fixed Frame world
Background Color 48; 48; 48
Frame Rate 30
Global Status: Ok
Fixed Frame OK
Grid
Range
Status: Ok
Topic /distance
Unreliable
Color 255; 0; 0
Alpha 0.5
Buffer Length 1
Queue Size 100
RobotModel
TF

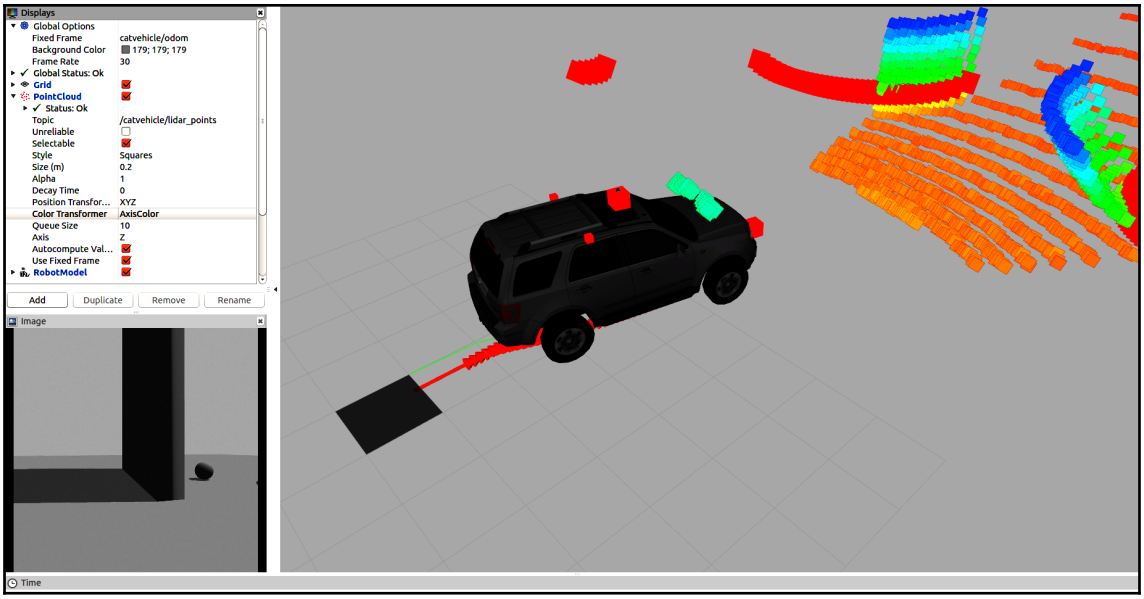

Displays
Global Options
Fixed Frame world
Background Color 48; 48; 48
Frame Rate 30
Global Status: Ok
Fixed Frame OK
Grid
Range
Status: Ok
Topic /distance
Unreliable
Color 255; 0; 0
Alpha 0.5
Buffer Length 1
Queue Size 100
RobotModel
TF

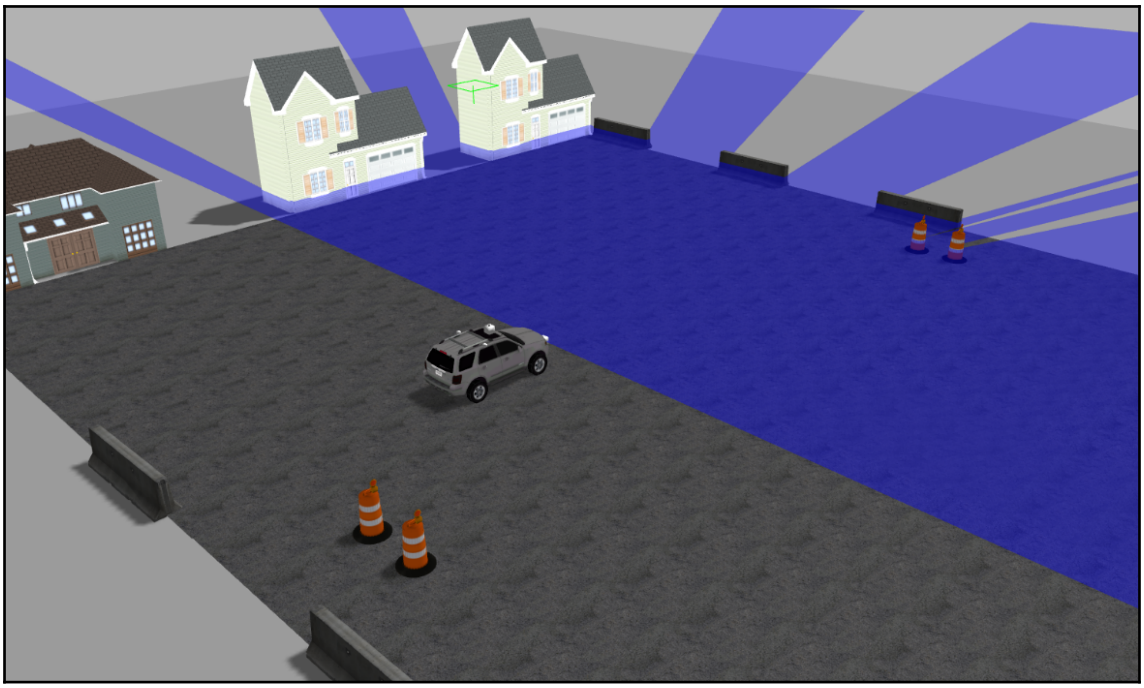

sweep

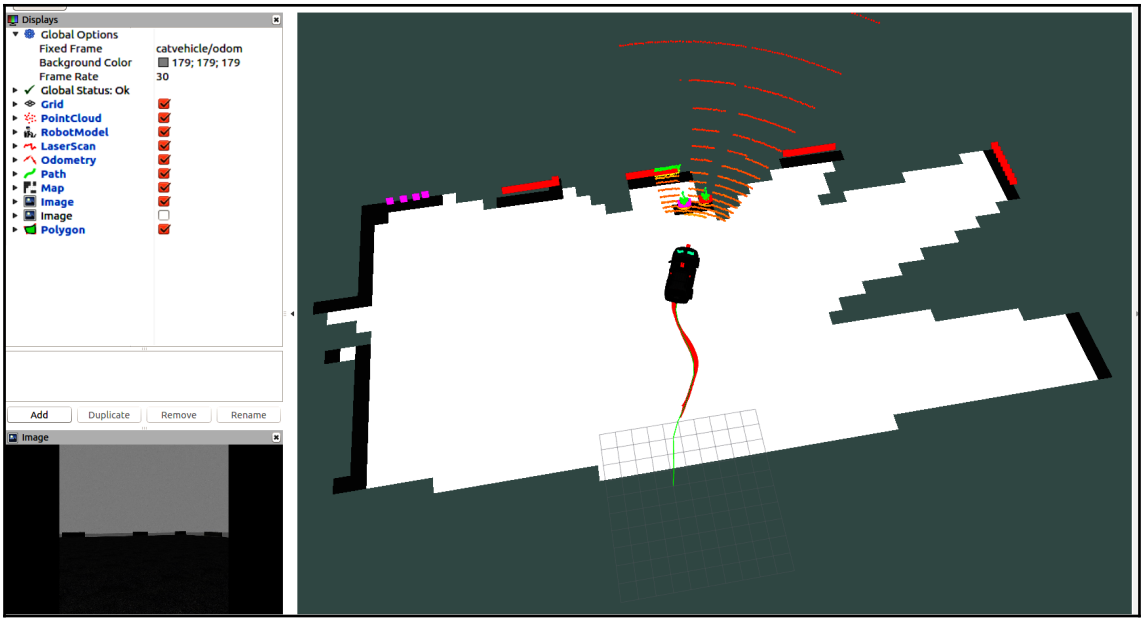

Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Displays
Global Options
Fixed Frame laser_frame
Background Color 48; 48; 48
Frame Rate 30
Global Status: W…
Fixed Frame No tf data. Actual erro…
Grid
Status: Ok
Reference Frame <Fixed Frame>
Plane Cell Count 10
Normal Cell Count 0
Cell Size 1
Line Style Lines
Color 160; 160; 164
Alpha 0.5
Plane XY
Offset 0; 0; 0
LaserScan
Status: Ok
Topic /scan
Unreliable
Selectable
Style Points
Size (Pixels) 10
Alpha 1
Decay Time 0
Position Transfor… XYZ
Color Transformer AxisColor
Queue Size 10
Axis X
Autocompute Val…
Use Fixed Frame
Size (Pixels)
Point size in pixels.
Add
Duplicate
Remove
Rename

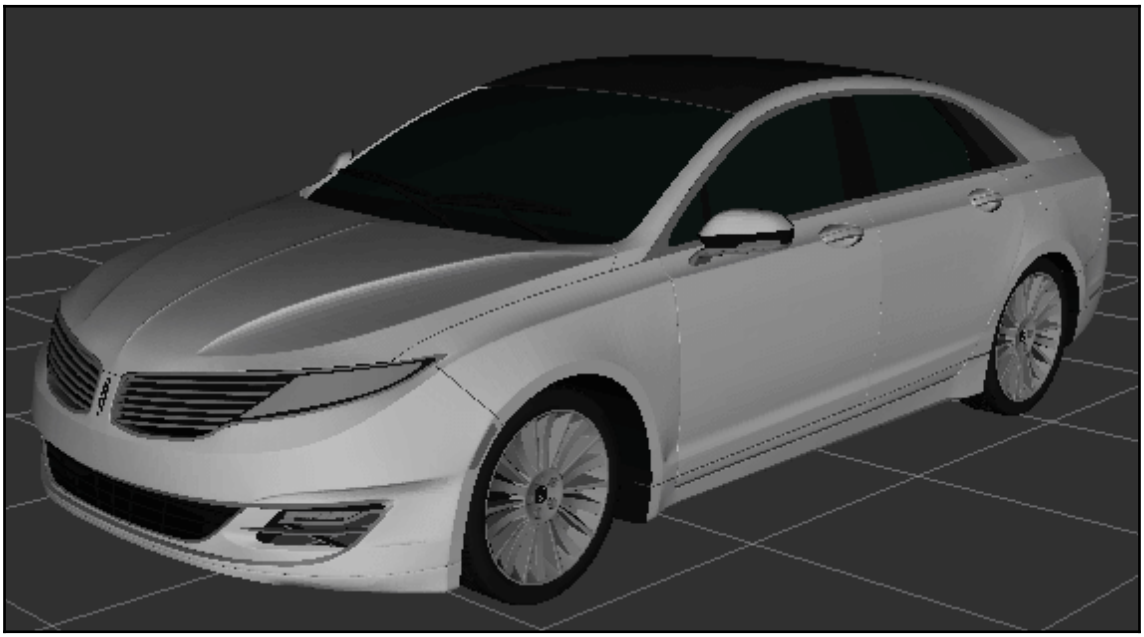


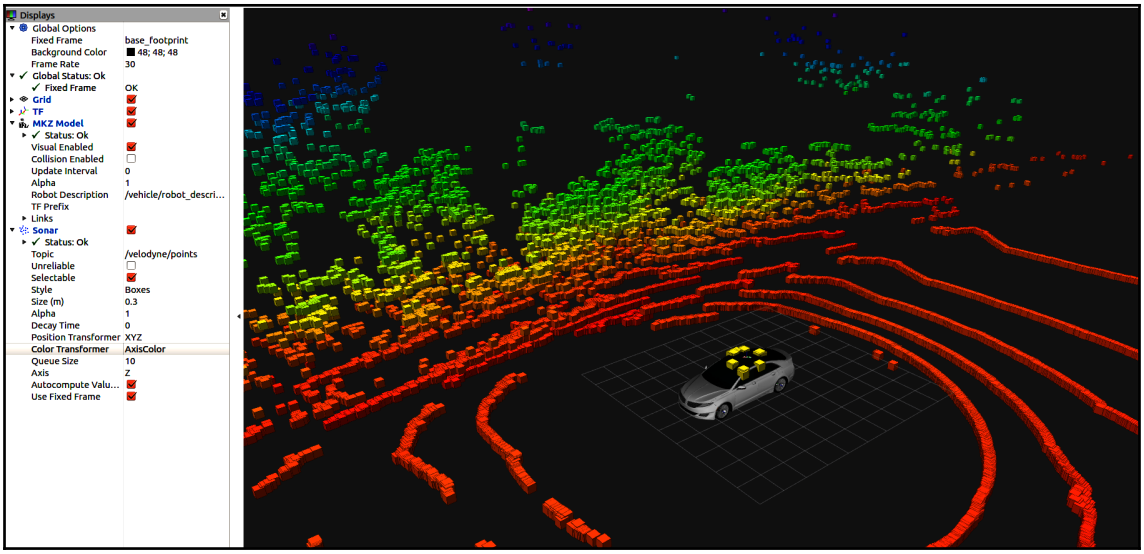
```
/catvehicle/cmd_vel
/catvehicle/cmd_vel_safe
/catvehicle/distanceEstimator/angle
/catvehicle/distanceEstimator/dist
/catvehicle/front_laser_points
/catvehicle/front_left_steering_position_controller/command
/catvehicle/front_right_steering_position_controller/command
/catvehicle/joint1_velocity_controller/command
/catvehicle/joint2_velocity_controller/command
/catvehicle/joint_states
/catvehicle/lidar_points
/catvehicle/odom
/catvehicle/path
/catvehicle/steering
/catvehicle/vel
/clock
/gazebo/link_states
/gazebo/model_states
/gazebo/parameter_descriptions
/gazebo/parameter_updates
/gazebo/set_link_state
/gazebo/set_model_state
/rosout
/rosout_agg
/tf
/tf_static
```

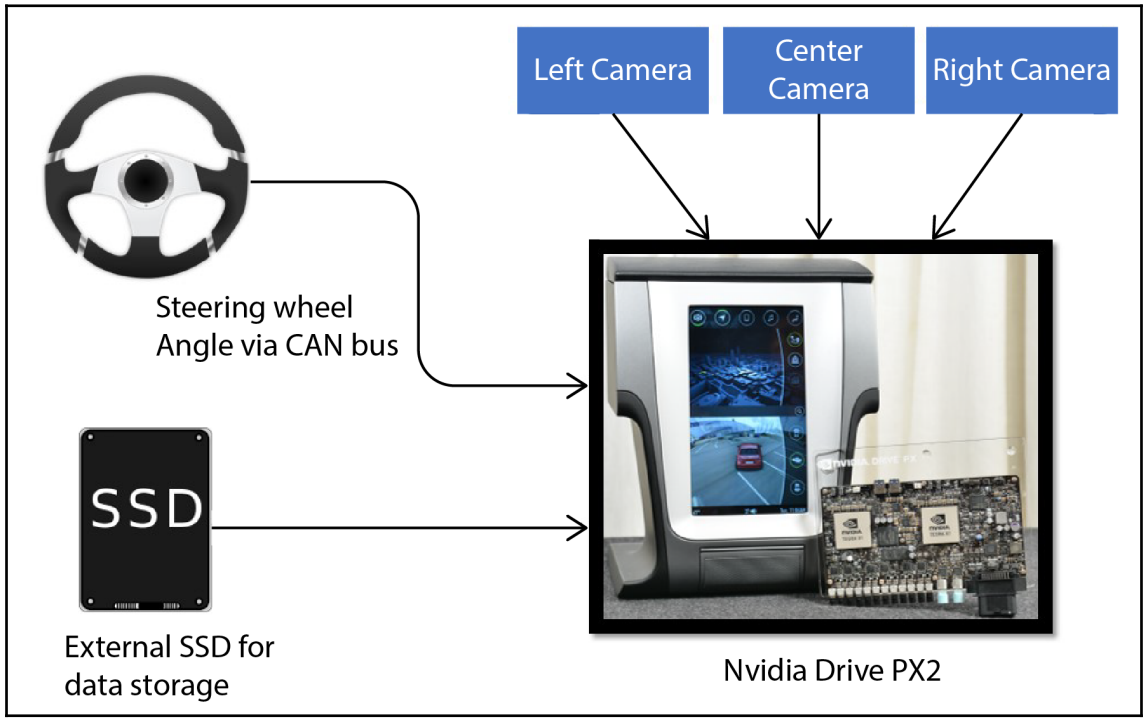

Displays
Global Options
Fixed Frame
catvehicle/odom
Background Color
179; 179; 179
Frame Rate
30
Global Status: Ok
Grid
PointCloud
Status: Ok
Topic
/catvehicle/lidar_points
Unreliable
Selectable
Style
Squares
Size (m)
0.2
Alpha
1
Decay Time
0
Position Transfor...
XYZ
Color Transformer
AxisColor
Queue Size
10
Axis
Z
Autocompute Val...
Use Fixed Frame
RobotModel
Add
Duplicate
Remove
Rename
Image
Time




Displays
Global Options
Fixed Frame
catvehicle/odom
Background Color
179; 179; 179
Frame Rate
30
Global Status: Ok
Grid
PointCloud
RobotModel
LaserScan
Odometry
Path
Map
Image
Image
Polygon
Add
Duplicate
Remove
Rename
Image

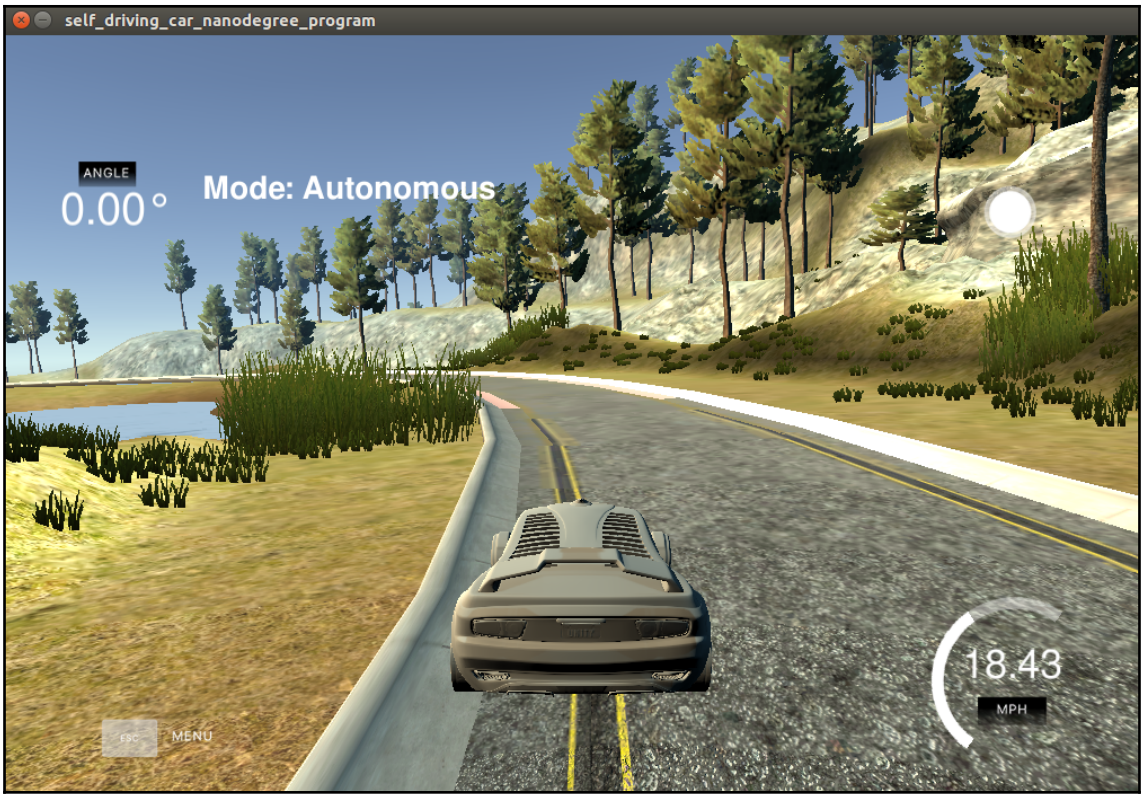



Displays
Global Options
Fixed Frame base_footprint
Background Color 48; 48; 48
Frame Rate 30
Global Status: Ok
Fixed Frame OK
Grid
TF
MKZ Model
Status: Ok
Visual Enabled
Collision Enabled
Update Interval 0
Alpha 1
Robot Description /vehicle/robot_descri...
TF Prefix
Links
Sonar
Status: Ok
Topic /velodyne/points
Unreliable
Selectable
Style Boxes
Size (m) 0.3
Alpha 1
Decay Time 0
Position Transformer XYZ
Color Transformer AxisColor
Queue Size 10
Axis Z
Autocompute Valu...
Use Fixed Frame


Left Camera
Center Camera
Right Camera
Steering wheel
Angle via CAN bus
SSD
External SSD for
data storage
Nvidia Drive PX2

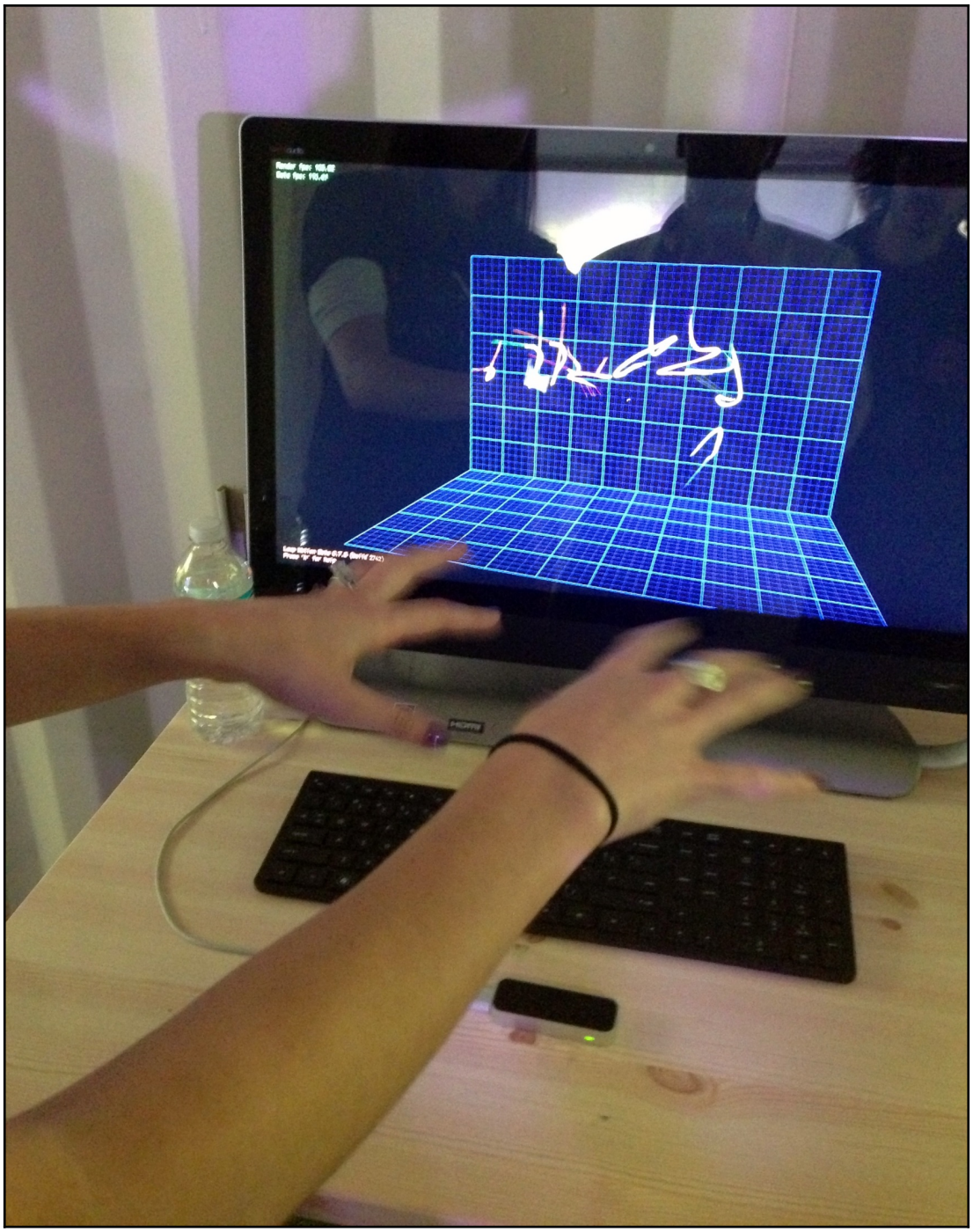

self_driving_car_nanodegree_program
CONTROLS
UDACITY
SELF-DRIVING CAR ENGINEER
TRAINING MODE
AUTONOMOUS MODE
Select Track

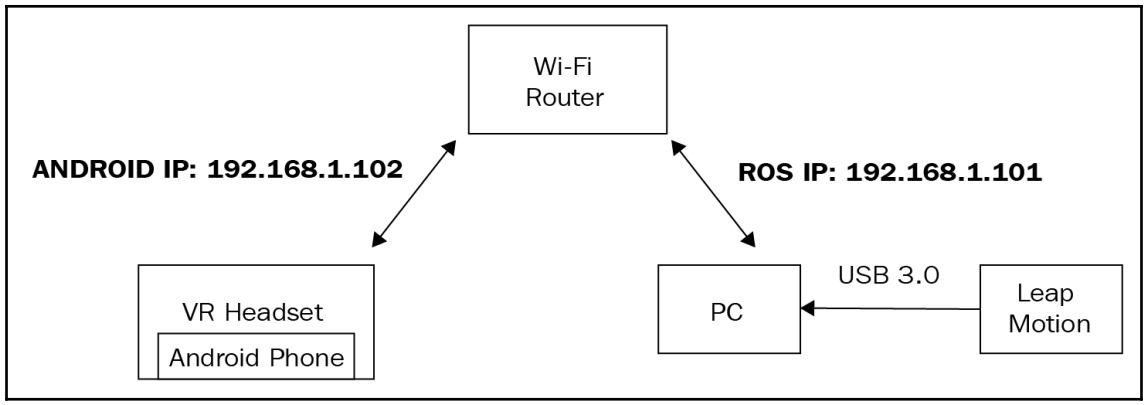

self_driving_car_nanodegree_program
ANGLE
0.00°
RECORD
0.00
MPH
ESC
MENU

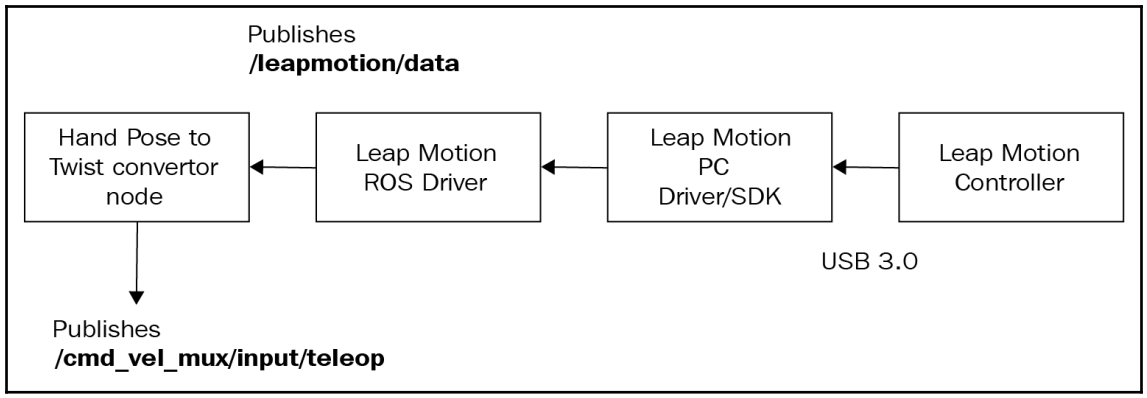

self_driving_car_nanodegree_program
ANGLE
0.00°
Mode: Autonomous
18.43
MPH
ESC
MENU

Chapter 11: Teleoperating Robots Using a VR Headset and Leap Motion

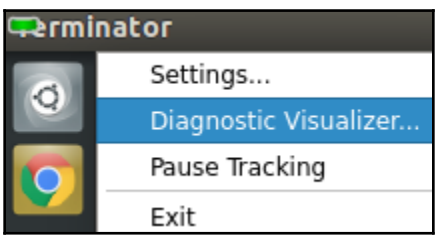

oculus

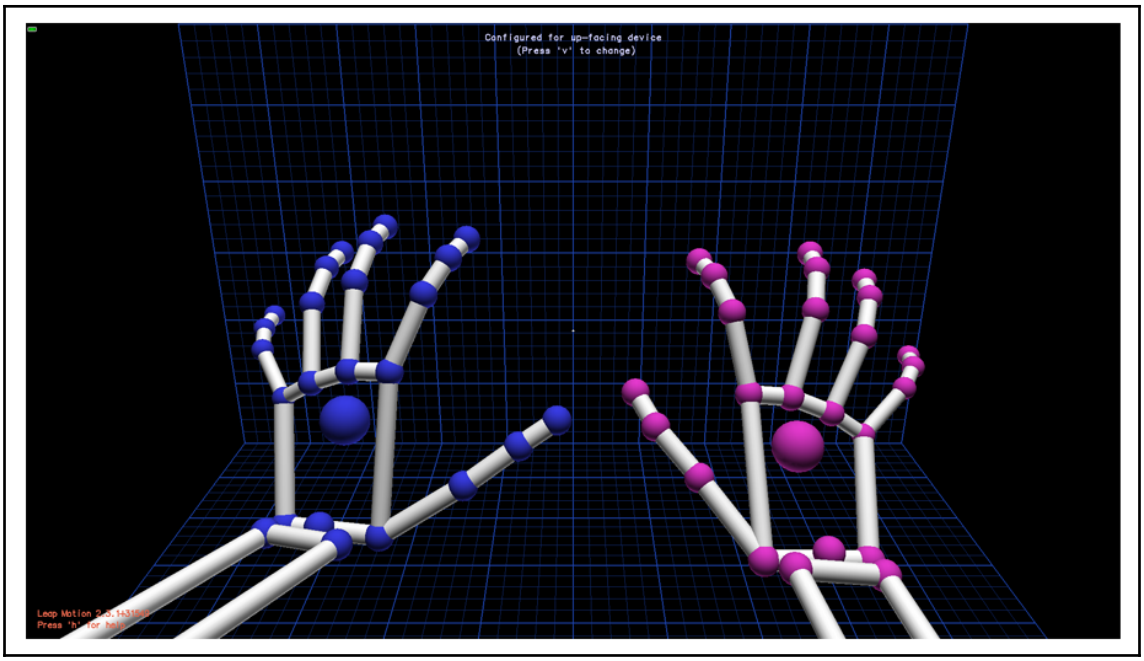






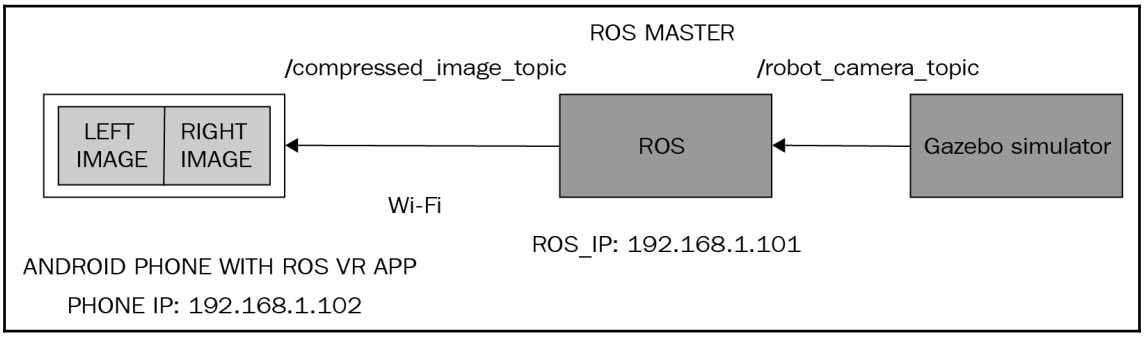

```
[10010.420978] usb 2-1.2: new high-speed USB device number 8 using ehci-pci
[10010.513671] usb 2-1.2: New USB device found, idVendor=f182, idProduct=0003
[10010.513682] usb 2-1.2: New USB device strings: Mfr=1, Product=2, SerialNumber=0
[10010.513688] usb 2-1.2: Product: Leap Dev Kit
[10010.513692] usb 2-1.2: Manufacturer: Leap Motion
[10010.514270] uvcvideo: Found UVC 1.00 device Leap Dev Kit (f182:0003)
lentin@lentin-Aspire-4755:~$
```



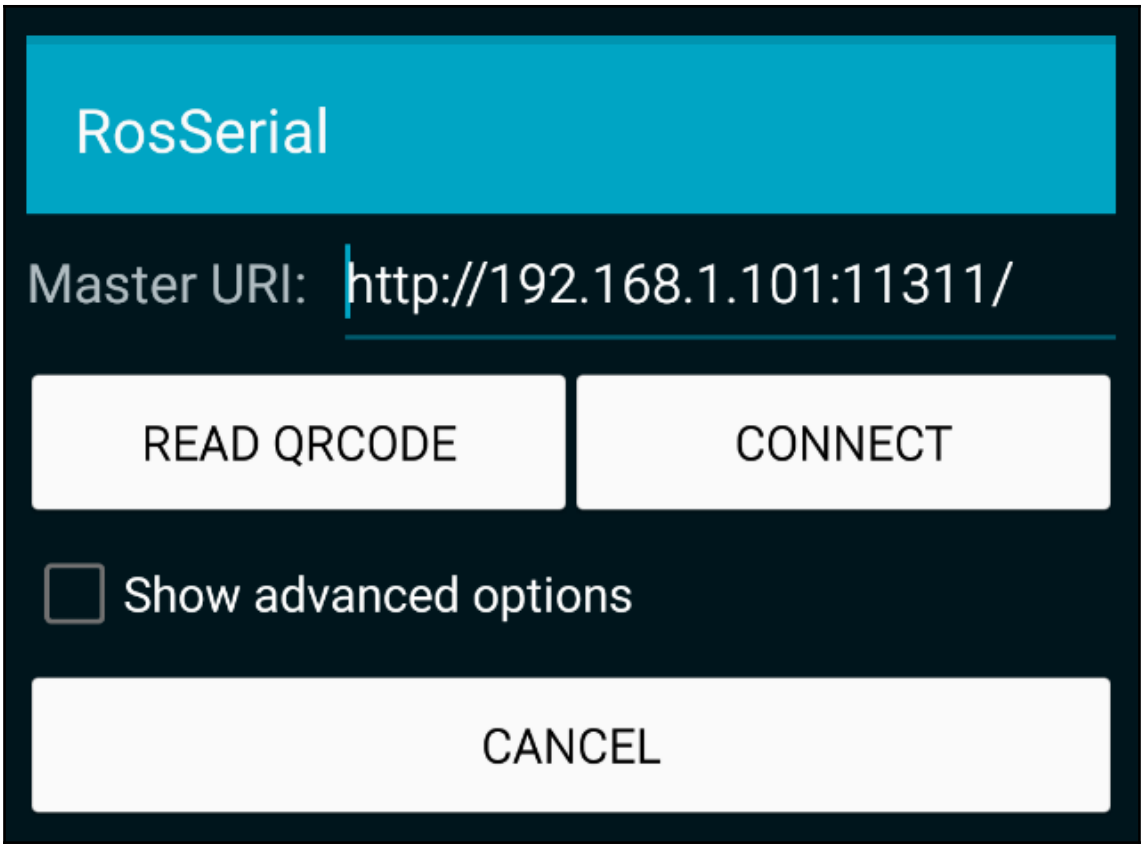



```
lentin@lentin-Aspire-4755:~$ rostopic list
/leapmotion/data
/rosout
/rosout_agg
```

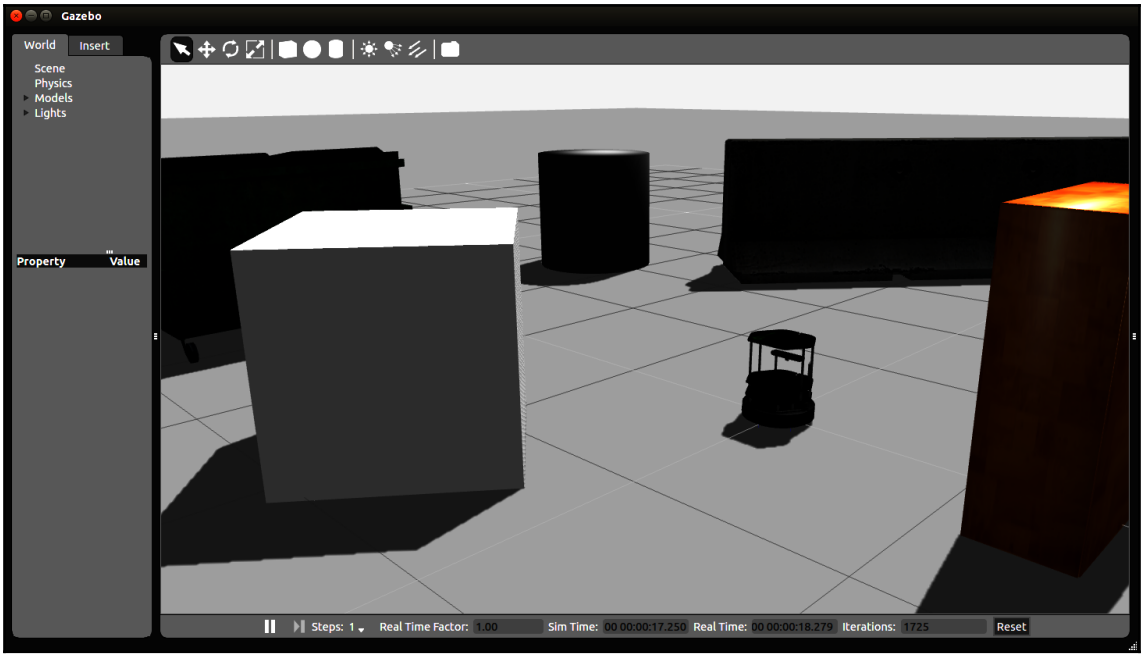
```
header:
  seq: 847
  stamp:
    secs: 0
    nsecs:
  frame_id: ''
direction:
  x: 0.24784040451
  y: 0.227308988571
  z: -0.941756725311
normal:
  x: 0.0999223664403
  y: -0.972898304462
  z: -0.208529144526
palmpos:
  x: -52.5600471497
  y: 173.553512573
  z: 66.0648040771
ypr:
  x: 25.602668997
  y: 13.5697675013
  z: 132.525765862
```

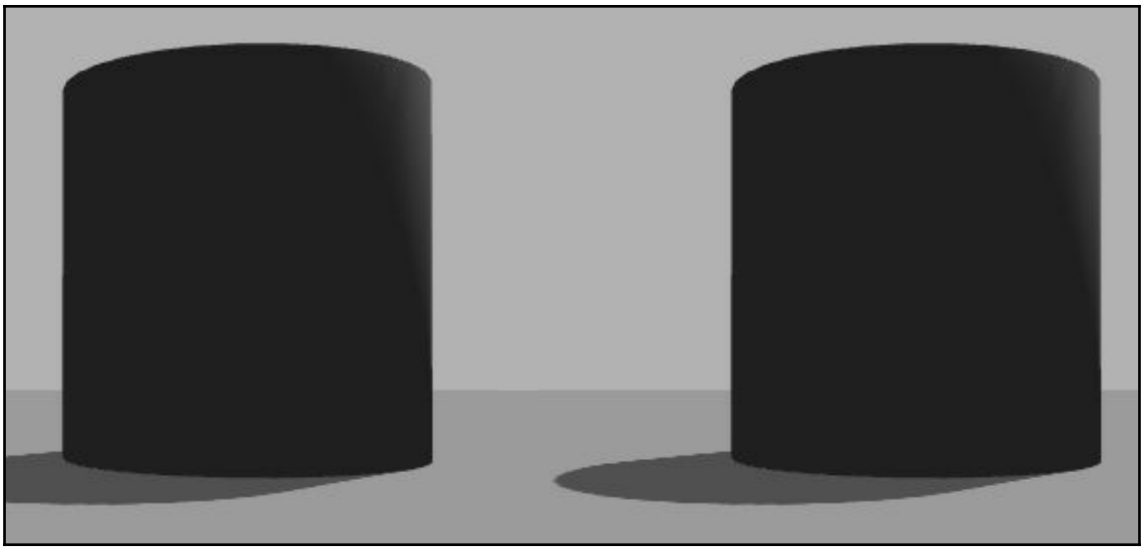



```
wlan0     Link encap:Ethernet  HWaddr 94:39:e5:4d:7d:da
          inet addr:192.168.1.101  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::9639:e5ff:fe4d:7dda/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1303 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1127 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1136655 (1.1 MB)  TX bytes:243000 (243.0 KB)
```



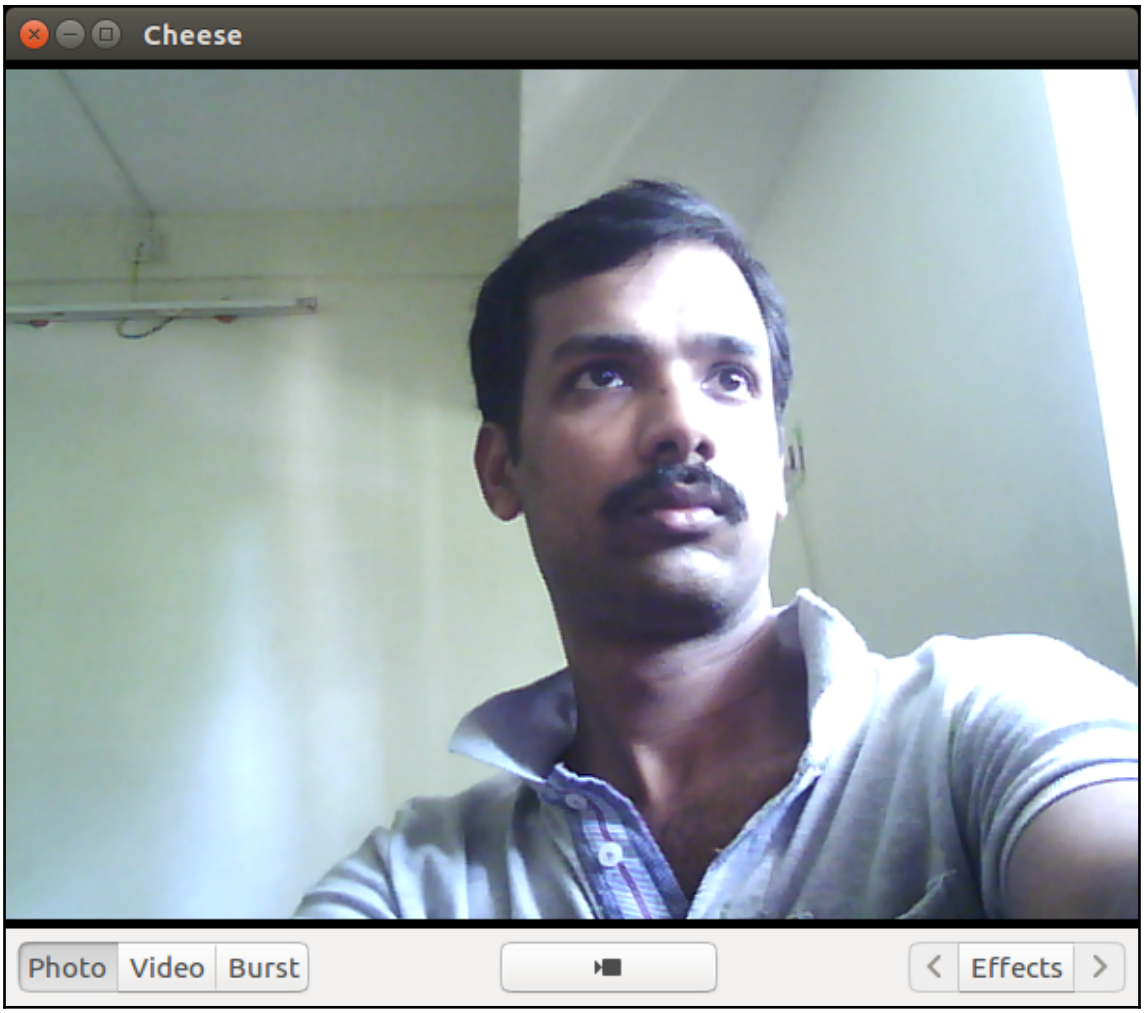

```
lentin@lentin-Aspire-4755:~$ rostopic list
/rosout
/rosout_agg
/usb_cam/image_raw/compressed
lentin@lentin-Aspire-4755:~$
```

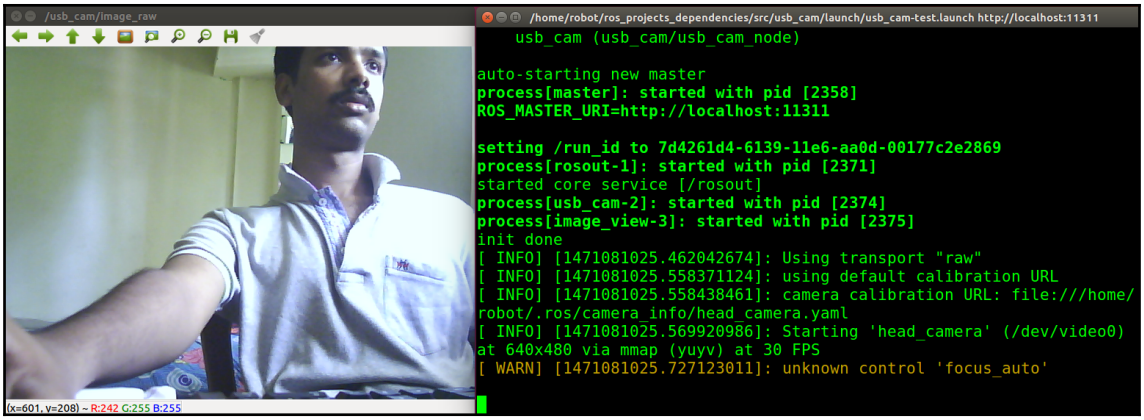

Gazebo
World
Insert
Scene
Physics
Models
Lights
Property
Value
Steps: 1
Real Time Factor: 1.00
Sim Time: 00 00:00:17.250
Real Time: 00 00:00:18.279
Iterations: 1725
Reset

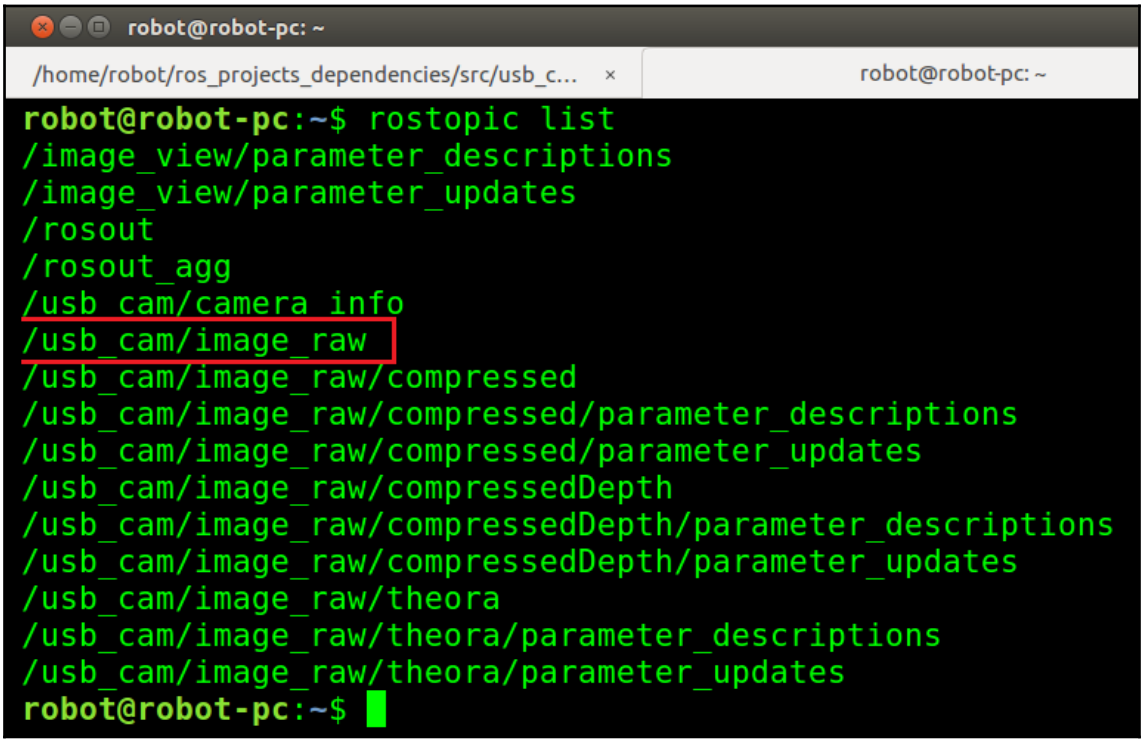


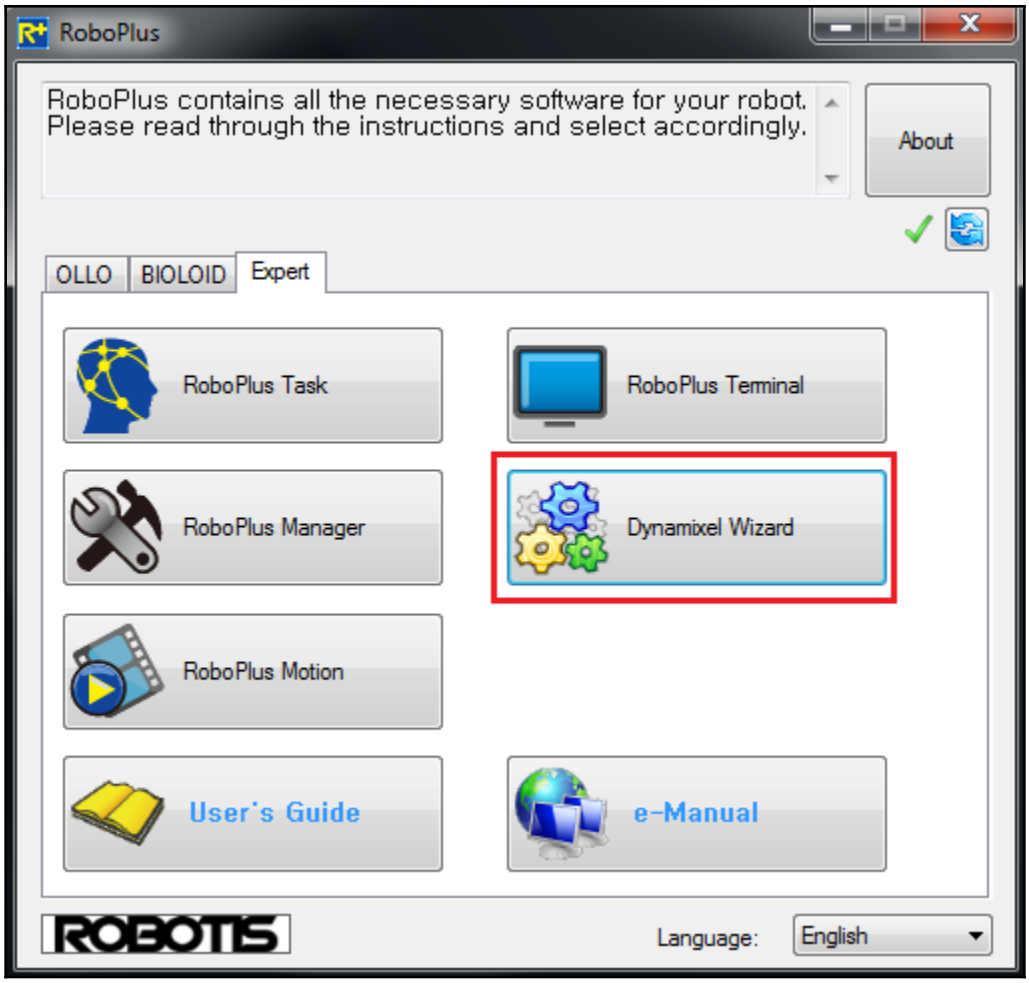
Chapter 12: Face Detection and Tracking Using ROS, OpenCV, and Dynamixel Servos

```
[   86.483102] usb 1-1.5: new high-speed USB device number 6 using ehci-pci
[   86.620403] usb 1-1.5: New USB device found, idVendor=0c45, idProduct=6340
[   86.620409] usb 1-1.5: New USB device strings: Mfr=2, Product=1, SerialNumber=3
[   86.620412] usb 1-1.5: Product: iBall Face2Face Webcam C12.0
[   86.620414] usb 1-1.5: Manufacturer: iBall Face2Face Webcam C12.0
[   86.620416] usb 1-1.5: SerialNumber: iBall Face2Face Webcam C12.0
[   86.657389] media: Linux media interface: v0.10
[   86.677503] Linux video capture interface: v2.00
[   86.703833] usb 1-1.5: 3:1: cannot get freq at ep 0x84
[   86.722072] usbcore: registered new interface driver snd-usb-audio
[   86.722096] uvcvideo: Found UVC 1.00 device iBall Face2Face Webcam C12.0 (0c45:6340)
[   86.735670] input: iBall Face2Face Webcam C12.0 as /devices/pci0000:00/0000:00:1a.0/
t/input16
[   86.735747] usbcore: registered new interface driver uvcvideo
[   86.735749] USB Video Class driver (1.1.1)
```

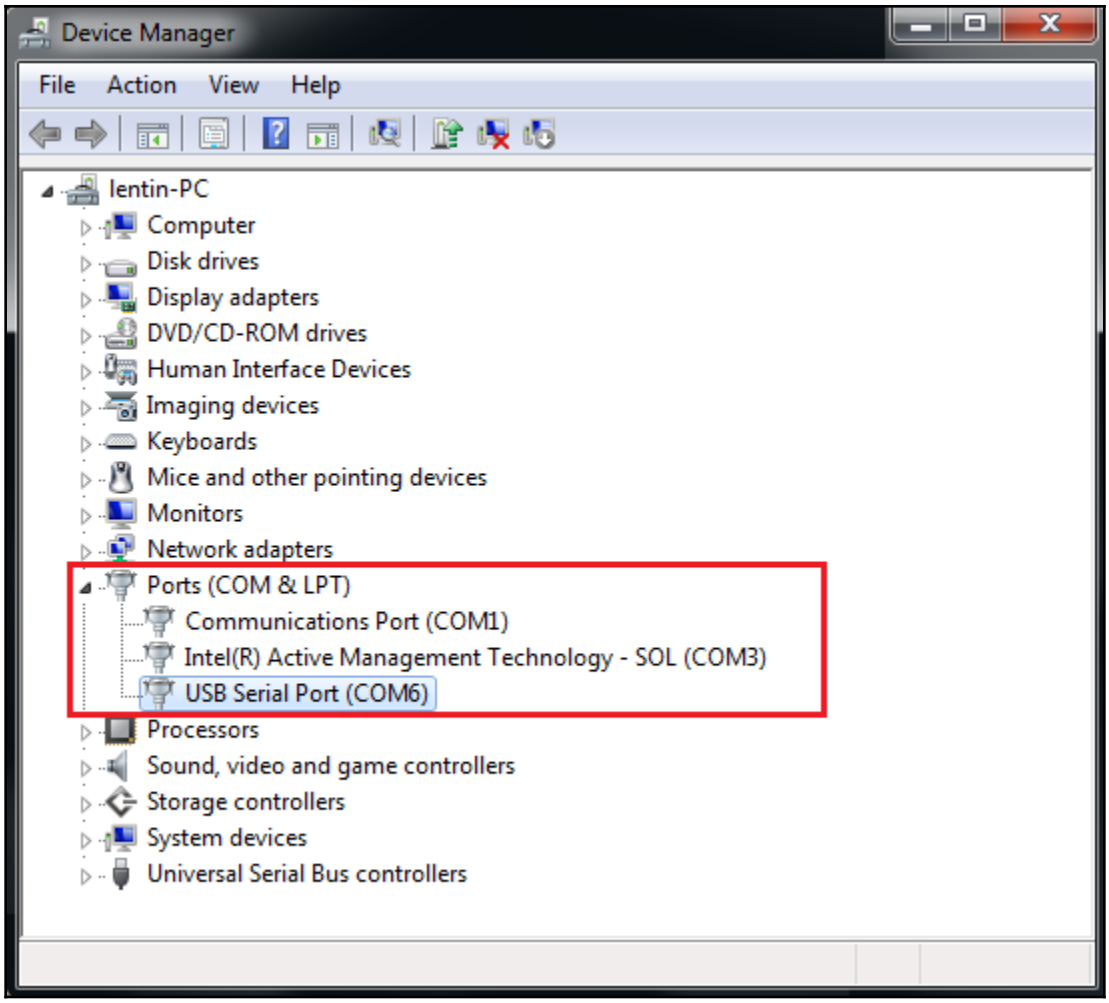

Cheese
Photo
Video
Burst
Effects

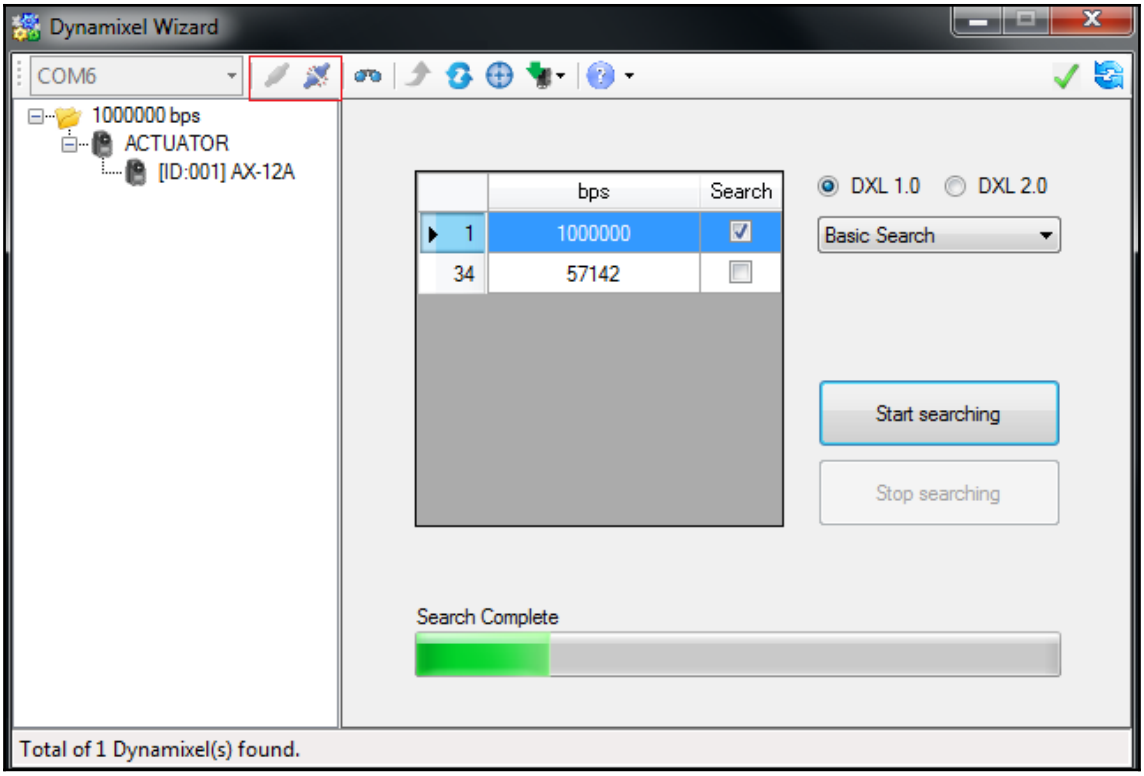

/usb_cam/image_raw
(x=601, y=208) ~ R:242 G:255 B:255
/home/robot/ros_projects_dependencies/src/usb_cam/launch/usb_cam-test.launch http://localhost:11311
usb_cam (usb_cam/usb_cam_node)
auto-starting new master
process[master]: started with pid [2358]
ROS_MASTER_URI=http://localhost:11311
setting /run_id to 7d4261d4-6139-11e6-aa0d-00177c2e2869
process[rosout-1]: started with pid [2371]
started core service [/rosout]
process[usb_cam-2]: started with pid [2374]
process[image_view-3]: started with pid [2375]
init done
[INFO] [1471081025.462042674]: Using transport "raw"
[INFO] [1471081025.558371124]: using default calibration URL
[INFO] [1471081025.55843846l]: camera calibration URL: file:///home/robot/.ros/camera_info/head_camera.yaml
[INFO] [1471081025.569920986]: Starting 'head_camera' (/dev/video0) at 640x480 via mmap (yuyv) at 30 FPS
[WARN] [1471081025.727123011]: unknown control 'focus_auto'

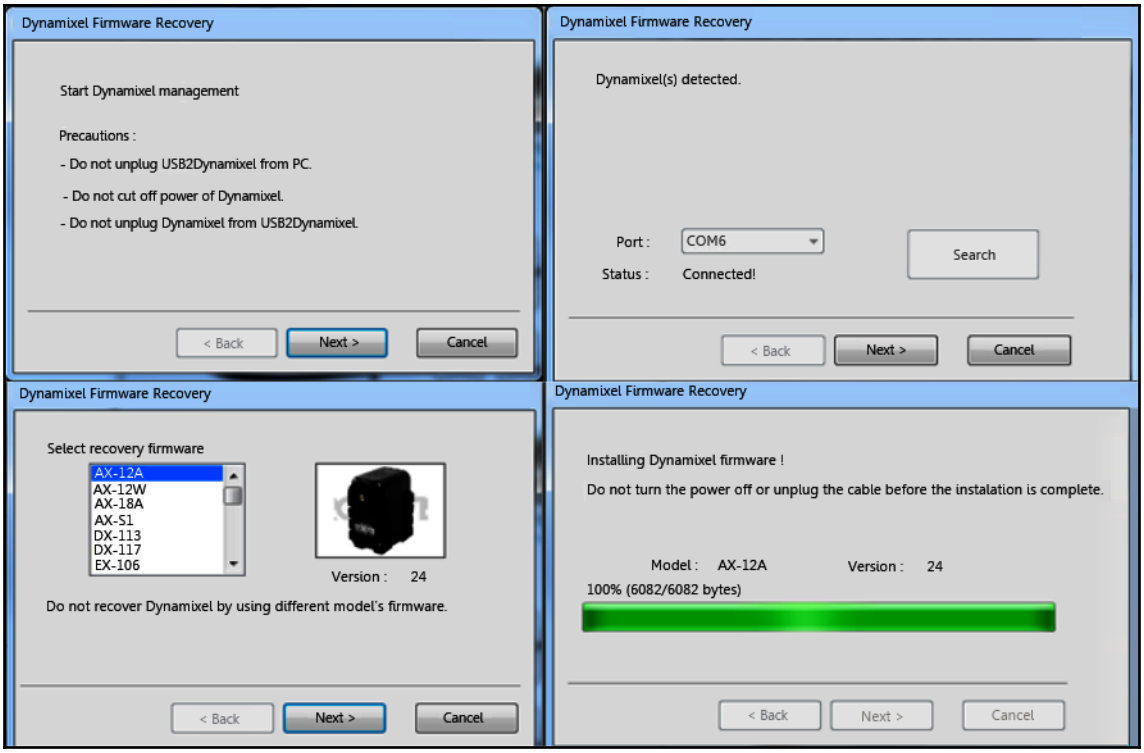

robot@robot-pc: ~
/home/robot/ros_projects_dependencies/src/usb_c...
robot@robot-pc: ~
robot@robot-pc:~$ rostopic list
/image_view/parameter_descriptions
/image_view/parameter_updates
/rosout
/rosout_agg
/usb_cam/camera_info
/usb_cam/image_raw
/usb_cam/image_raw/compressed
/usb_cam/image_raw/compressed/parameter_descriptions
/usb_cam/image_raw/compressed/parameter_updates
/usb_cam/image_raw/compressedDepth
/usb_cam/image_raw/compressedDepth/parameter_descriptions
/usb_cam/image_raw/compressedDepth/parameter_updates
/usb_cam/image_raw/theora
/usb_cam/image_raw/theora/parameter_descriptions
/usb_cam/image_raw/theora/parameter_updates
robot@robot-pc:~$


RoboPlus
RoboPlus contains all the necessary software for your robot.
Please read through the instructions and select accordingly.
About
OLLO
BIOLOID
Expert
RoboPlus Task
RoboPlus Terminal
RoboPlus Manager
Dynamixel Wizard
RoboPlus Motion
User's Guide
e-Manual
ROBOTIS
Language:
English

- Weight : 54.6g (AX-12A)
- Dimension : 32mm * 50mm * 40mm
- Resolution : 0.29°
- Gear Reduction Ratio : 254 : 1
- Stall Torque : 1.5N.m (at 12.0V, 1.5A)
- No load speed : 59rpm (at 12V)
- Running Degree : 0° ~ 300°, Endless Turn
- Running Temperature : -5℃ ~ +70℃
- Voltage : 9 ~ 12V (Recommended Voltage 11.1V)
- Command Signal : Digital Packet
- Protocol Type : Half duplex Asynchronous Serial Communication (8bit,1stop,No Parity)
- Link (Physical) : TTL Level Multi Drop (daisy chain type Connector)
- ID : 254 ID (0~253)
- Communication Speed : 7343bps ~ 1 Mbps
- Feedback : Position, Temperature, Load, Input Voltage, etc.
- Material : Engineering Plastic

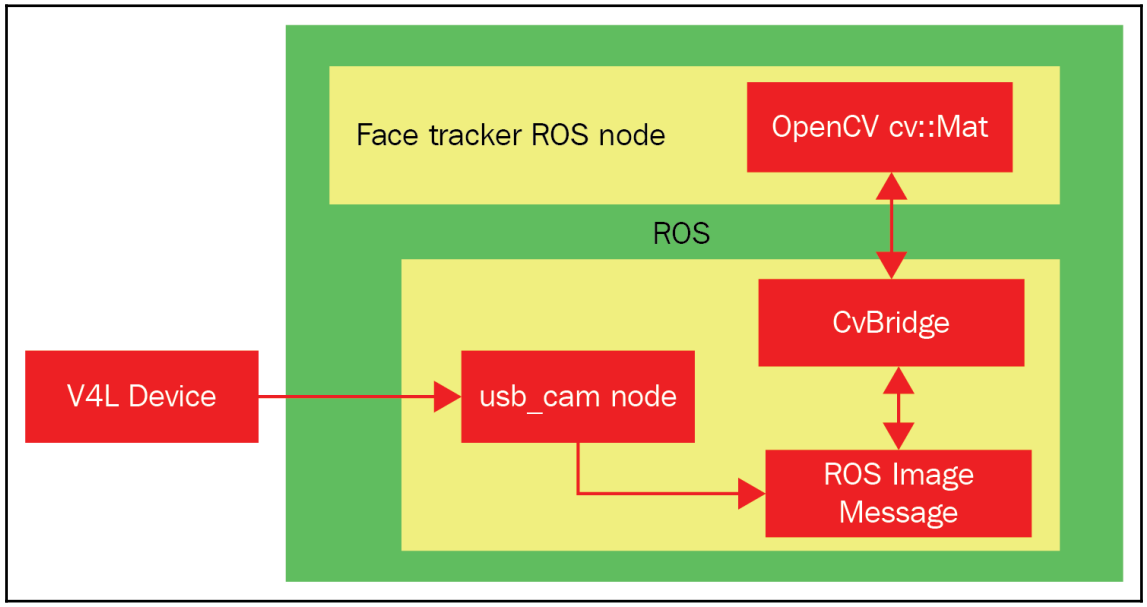

Device Manager
File
Action
View
Help
Ientin-PC
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
Imaging devices
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Ports (COM & LPT)
Communications Port (COM1)
Intel(R) Active Management Technology - SOL (COM3)
USB Serial Port (COM6)
Processors
Sound, video and game controllers
Storage controllers
System devices
Universal Serial Bus controllers

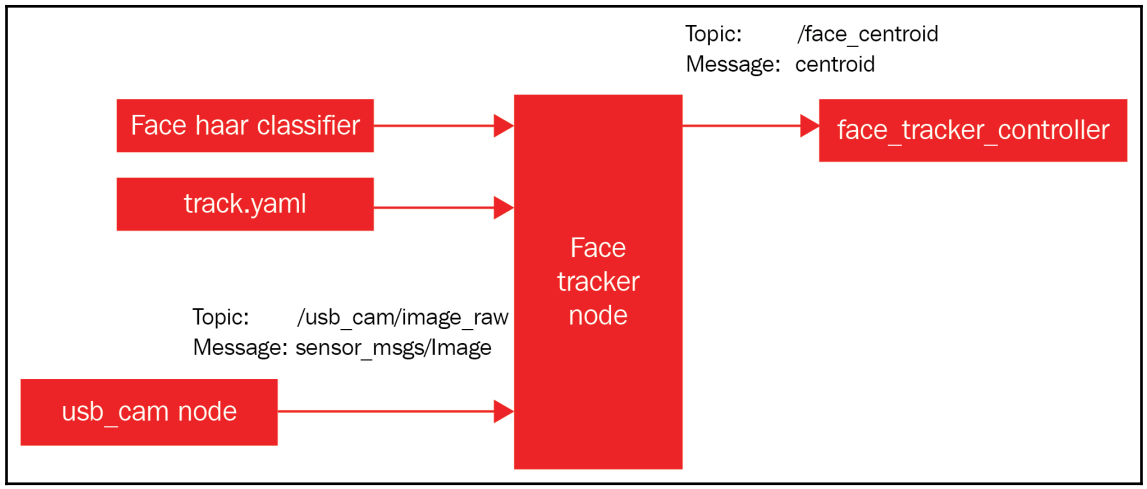

Dynamixel Wizard
COM6
1000000 bps
ACTUATOR
[ID:001] AX-12A
bps
Search
1
1000000
34
57142
DXL 1.0
DXL 2.0
Basic Search
Start searching
Stop searching
Search Complete
Total of 1 Dynamixel(s) found.

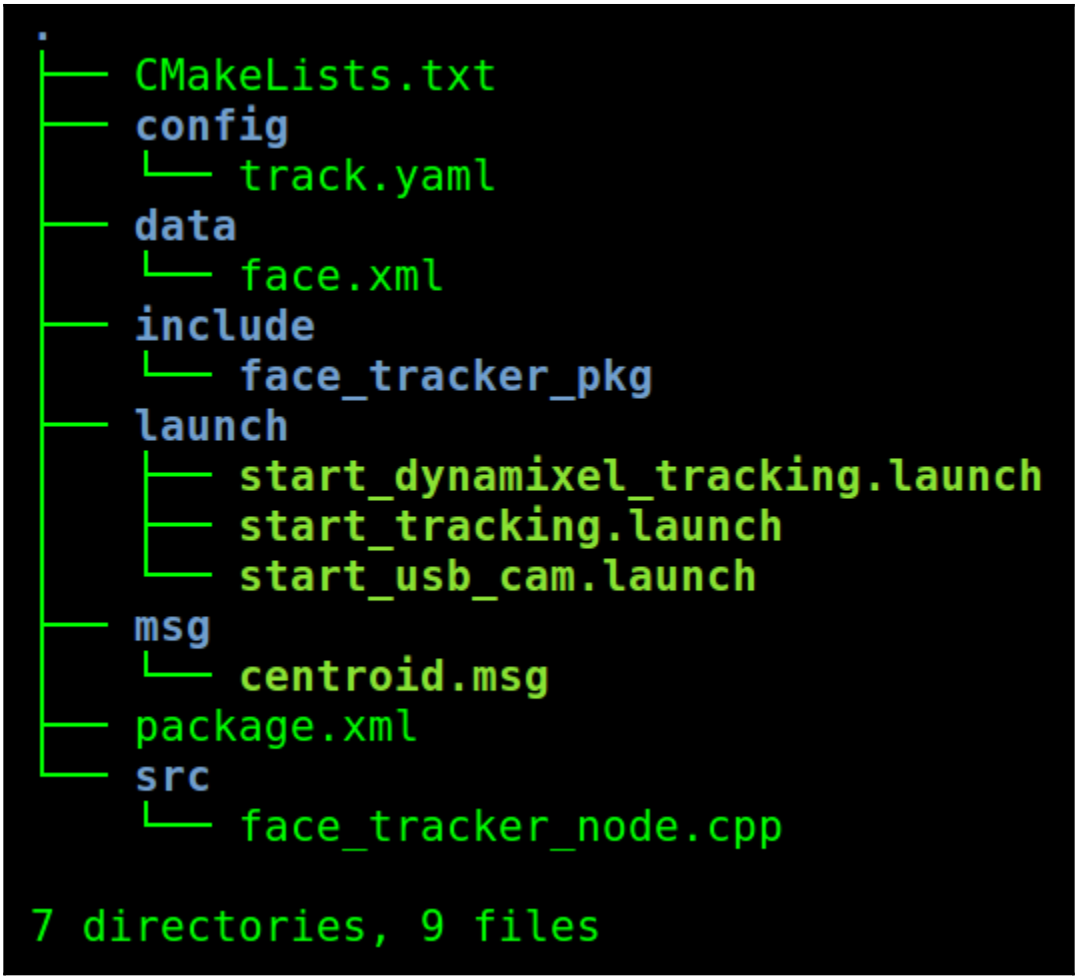

Dynamixel Firmware Recovery
Start Dynamixel management
Precautions :
- Do not unplug USB2Dynamixel from PC.
- Do not cut off power of Dynamixel.
- Do not unplug Dynamixel from USB2Dynamixel.
< Back
Next >
Cancel
Dynamixel Firmware Recovery
Dynamixel(s) detected.
Port :
COM6
Status :
Connected!
Search
< Back
Next >
Cancel
Dynamixel Firmware Recovery
Select recovery firmware
AX-12A
AX-12W
AX-18A
AX-S1
DX-113
DX-117
EX-106
Version : 24
Do not recover Dynamixel by using different model's firmware.
< Back
Next >
Cancel
Dynamixel Firmware Recovery
Installing Dynamixel firmware !
Do not turn the power off or unplug the cable before the instalation is complete.
Model : AX-12A
Version : 24
100% (6082/6082 bytes)
< Back
Next >
Cancel

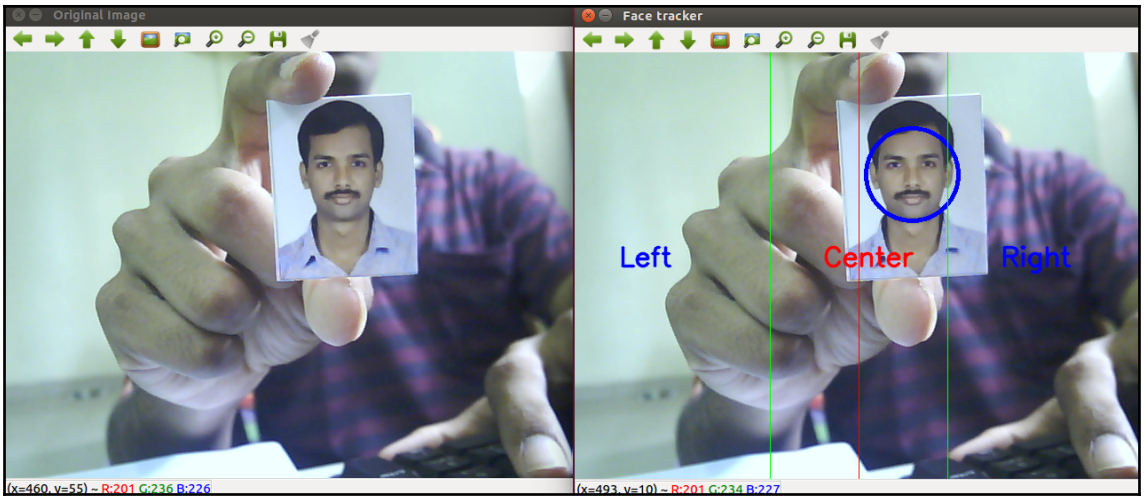
Addr	Description	Value
0	Model Number	12
2	Version of Firmware	24
3	ID	1
4	Baud Rate	1
5	Return Delay Time	250
6	CW Angle Limit (Joint / Wheel Mode)	0
8	CCW Angle Limit (Joint / Wheel Mode)	1023
11	The Highest Limit Temperature	70
12	The Lowest Limit Voltage	60
13	The Highest Limit Voltage	140
14	Max Torque	1023
16	Status Return Level	2
17	Alarm LED	0
18	Alarm Shutdown	37

Addr	Description	Value
14	Max Torque	1023
16	Status Return Level	2
17	Alarm LED	0
18	Alarm Shutdown	37
24	Torque Enable	1
25	LED	0
26	CW Compliance Margin	1
27	CCW Compliance Margin	1
28	CW Compliance Slope	32
29	CCW Compliance Slope	32
30	Goal Position	512
32	Moving Speed	83
34	Torque Limit	1023
36	Present Position	511

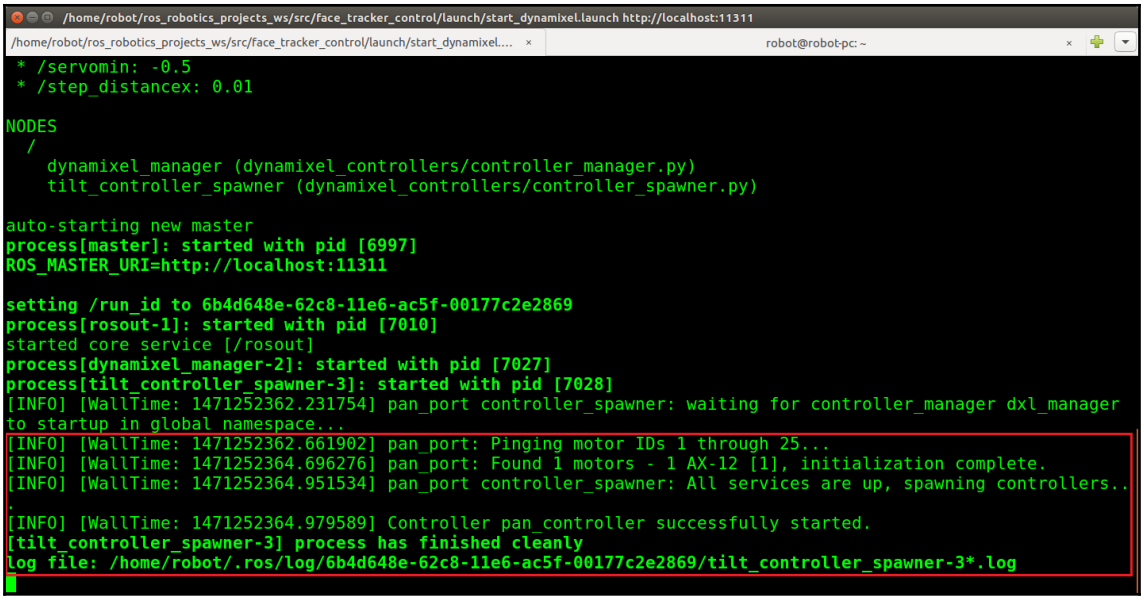


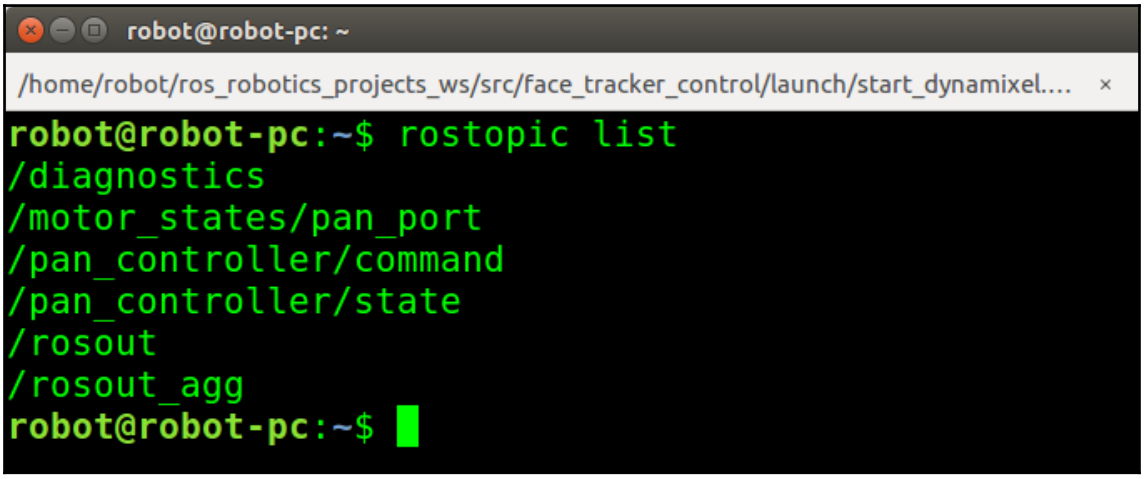

Topic: /face_centroid
Message: centroid
Face haar classifier
track.yaml
Face tracker node
face_tracker_controller
Topic: /usb_cam/image_raw
Message: sensor_msgs/Image
usb_cam node

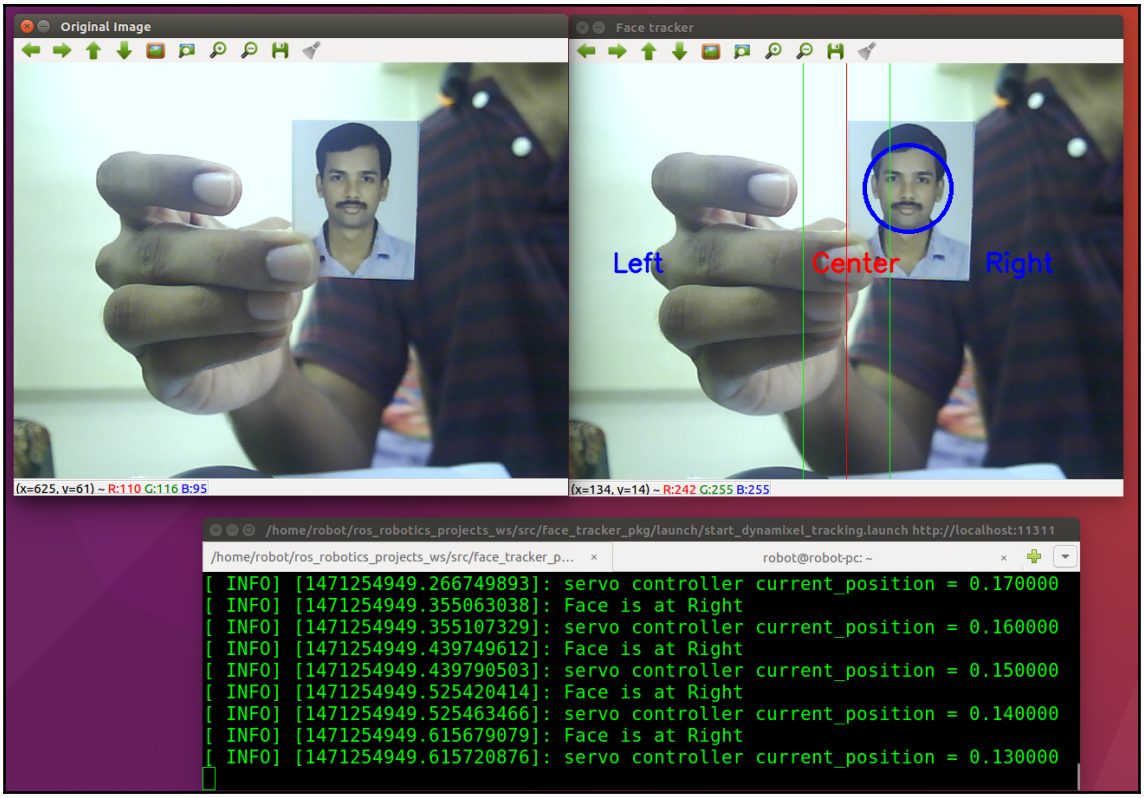

.
CMakeLists.txt
config
track.yaml
data
face.xml
include
face_tracker_pkg
launch
start_dynamixel_tracking.launch
start_tracking.launch
start_usb_cam.launch
msg
centroid.msg
package.xml
src
face_tracker_node.cpp
7 directories, 9 files




```
.
├── CMakeLists.txt
├── config
│   ├── pan.yaml
│   └── servo_param.yaml
├── include
│   └── face_tracker_control
├── launch
│   ├── start_dynamixel.launch
│   └── start_pan_controller.launch
├── msg
│   └── centroid.msg
├── package.xml
└── src
    └── face_tracker_controller.cpp

6 directories, 8 files
```


/home/robot/ros_robotics_projects_ws/src/face_tracker_control/launch/start_dynamixel.launch http://localhost:11311
/home/robot/ros_robotics_projects_ws/src/face_tracker_control/launch/start_dynamixel....
robot@robot-pc: ~
* /servomin: -0.5
* /step_distancex: 0.01
NODES
/
dynamixel_manager (dynamixel_controllers/controller_manager.py)
tilt_controller_spawner (dynamixel_controllers/controller_spawner.py)
auto-starting new master
process[master]: started with pid [6997]
ROS_MASTER_URI=http://localhost:11311
setting /run_id to 6b4d648e-62c8-11e6-ac5f-00177c2e2869
process[rosout-1]: started with pid [7010]
started core service [/rosout]
process[dynamixel_manager-2]: started with pid [7027]
process[tilt_controller_spawner-3]: started with pid [7028]
[INFO] [WallTime: 1471252362.231754] pan_port controller_spawner: waiting for controller_manager dxl_manager to startup in global namespace...
[INFO] [WallTime: 1471252362.661902] pan_port: Pinging motor IDs 1 through 25...
[INFO] [WallTime: 1471252364.696276] pan_port: Found 1 motors - 1 AX-12 [1], initialization complete.
[INFO] [WallTime: 1471252364.951534] pan_port controller_spawner: All services are up, spawning controllers...
[INFO] [WallTime: 1471252364.979589] Controller pan_controller successfully started.
[tilt_controller_spawner-3] process has finished cleanly
log file: /home/robot/.ros/log/6b4d648e-62c8-11e6-ac5f-00177c2e2869/tilt_controller_spawner-3*.log


robot@robot-pc: ~
/home/robot/ros_robotics_projects_ws/src/face_tracker_control/launch/start_dynamixel....
robot@robot-pc:~$ rostopic list
/diagnostics
/motor_states/pan_port
/pan_controller/command
/pan_controller/state
/rosout
/rosout_agg
robot@robot-pc:~$


Original Image
Face tracker
Left
Center
Right
(x=625, v=61) ~ R:110 G:116 B:95
(x=134, v=14) ~ R:242 G:255 B:255
/home/robot/ros_robotics_projects_ws/src/face_tracker_pkg/launch/start_dynamixel_tracking.launch http://localhost:11311
/home/robot/ros_robotics_projects_ws/src/face_tracker_p...
robot@robot-pc: ~
[INFO] [1471254949.266749893]: servo controller current_position = 0.170000
[INFO] [1471254949.355063038]: Face is at Right
[INFO] [1471254949.355107329]: servo controller current_position = 0.160000
[INFO] [1471254949.439749612]: Face is at Right
[INFO] [1471254949.439790503]: servo controller current_position = 0.150000
[INFO] [1471254949.525420414]: Face is at Right
[INFO] [1471254949.525463466]: servo controller current_position = 0.140000
[INFO] [1471254949.615679079]: Face is at Right
[INFO] [1471254949.615720876]: servo controller current_position = 0.130000