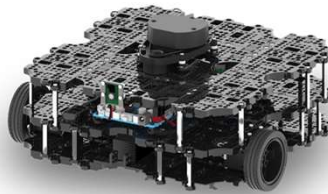




Introduction to ROS and Gazebo



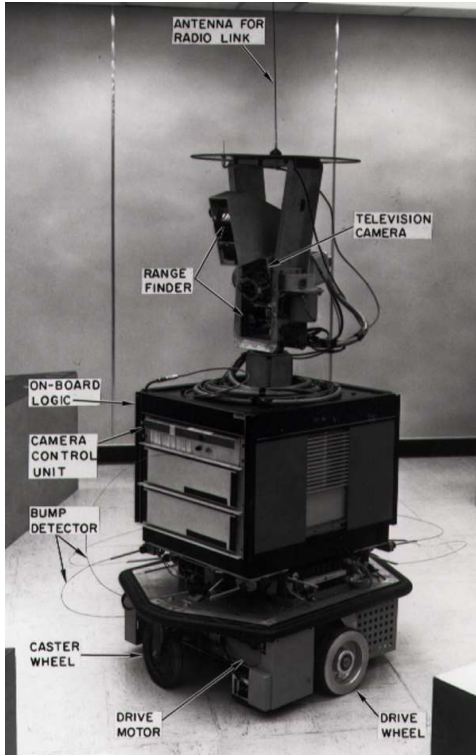
Mr.KRITTINUNT CHOBTRONG
krittinunt@gmail.com



History of Mobile Robot

Shakey the robot (1966-1972)

Stanford Research Institute Problem Solver (STRIPS)



Operating Environment

- Indoors
- Engineered

Sensors

- Wheel encoders
- Bump detector
- Sonar range finder
- Camera

The SmartTer Platform (2004-2007)

SICK and 3D SICK laser scanners

Omnidirectional and Monocular camera

Motion Estimation / Localization

- GPS system
- Optical Gyro
- Odometry

Internal car state sensors

- Vehicle state flags (engine, door, etc.)
- Engine data, gas pedal value

Camera for live video streaming

- Transmission range up to 2 km



PR2 (2010), WILLOW

Operating Environment

- Indoors and outdoors
- Onroad only

Sensors

- Wheel encoders
- Bumper
- IR sensors
- Laser range finder
- 3D nodding laser range finder
- Inertial measurement unit
- Pan-tilt stereo camera with texture projector (active)
- Pressure sensor and accelerometer inside hands



Mobile robot components

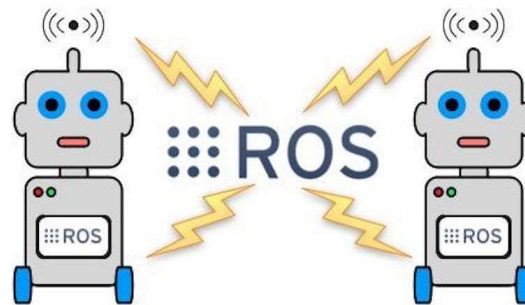
Basic of Mobile Robot Components

Hardware

- Base platform
- Energy Source
- Actuator
- Sensors
- Processor

Software

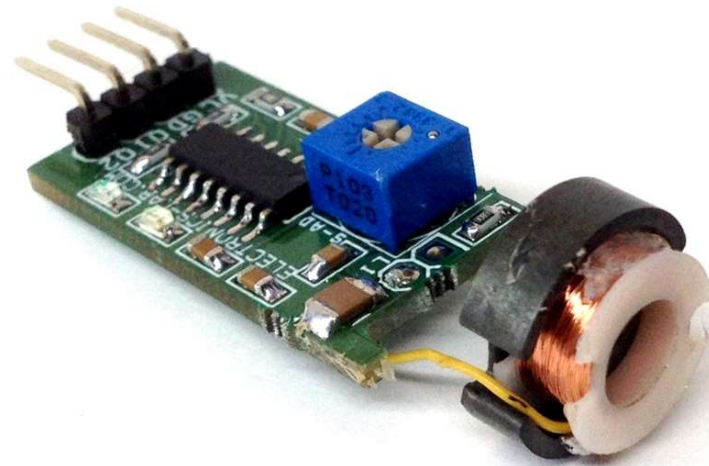
- Operating System
- Localization
- Mapping
- Motion Planning
- Visualization



Classification of Sensors

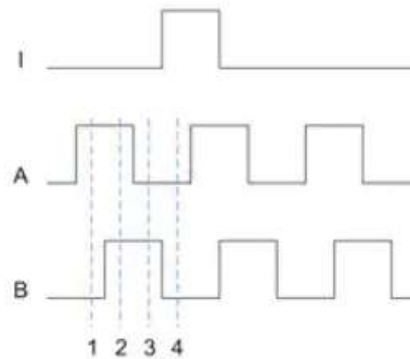
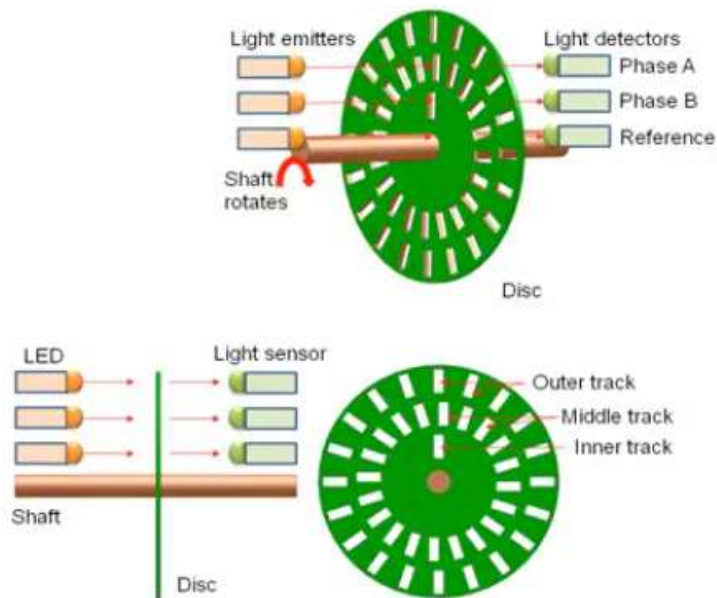
Tactile sensors

- Detection of physical contact
- Contact switches, bumpers optical barriers, Noncontact proximity sensors



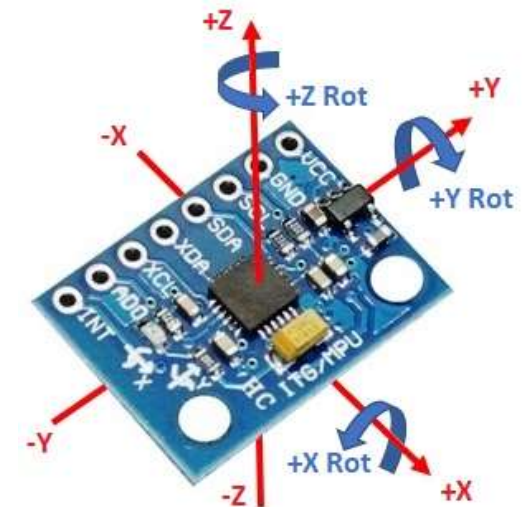
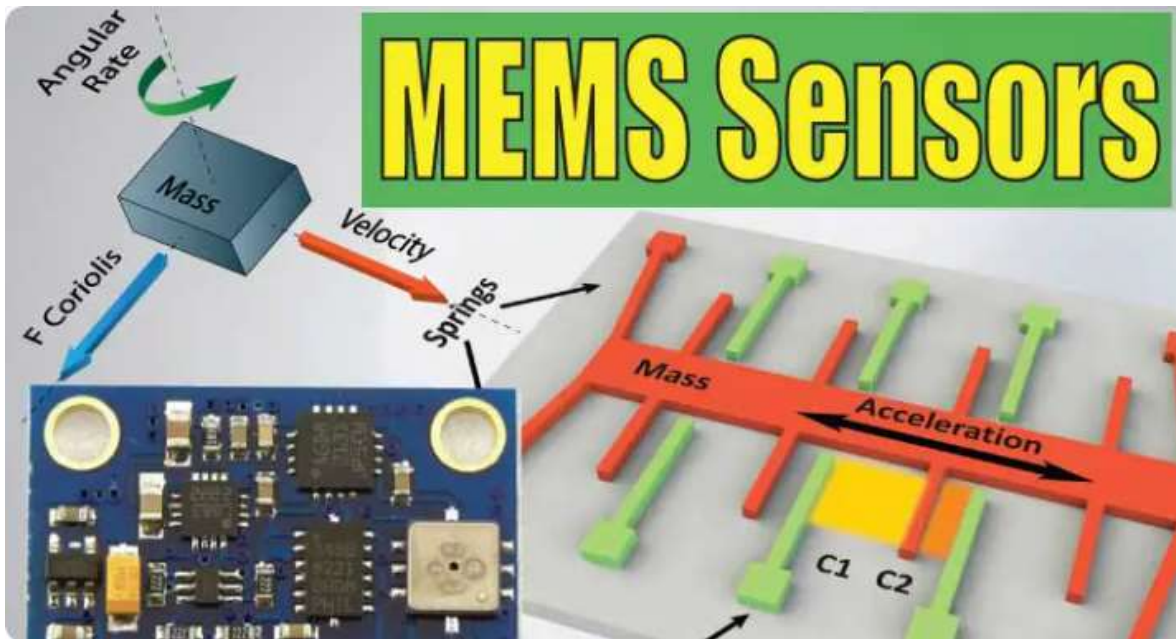
Wheel/motor sensors

- Wheel/motor speed and position
- Optical encoders, Magnetic encoders



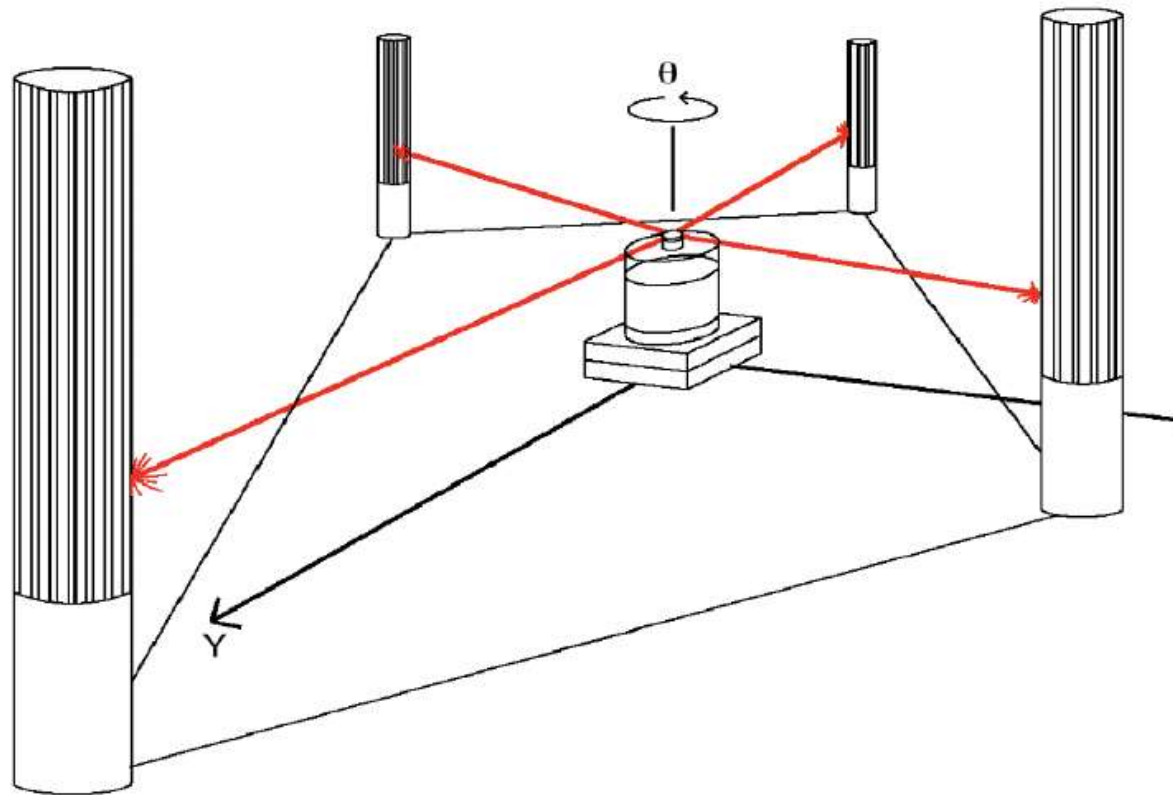
Heading sensors

- Orientation of the robot in relation to a fixed reference frame
- Compass, Gyroscopes, Inclinometers, Accelerometer



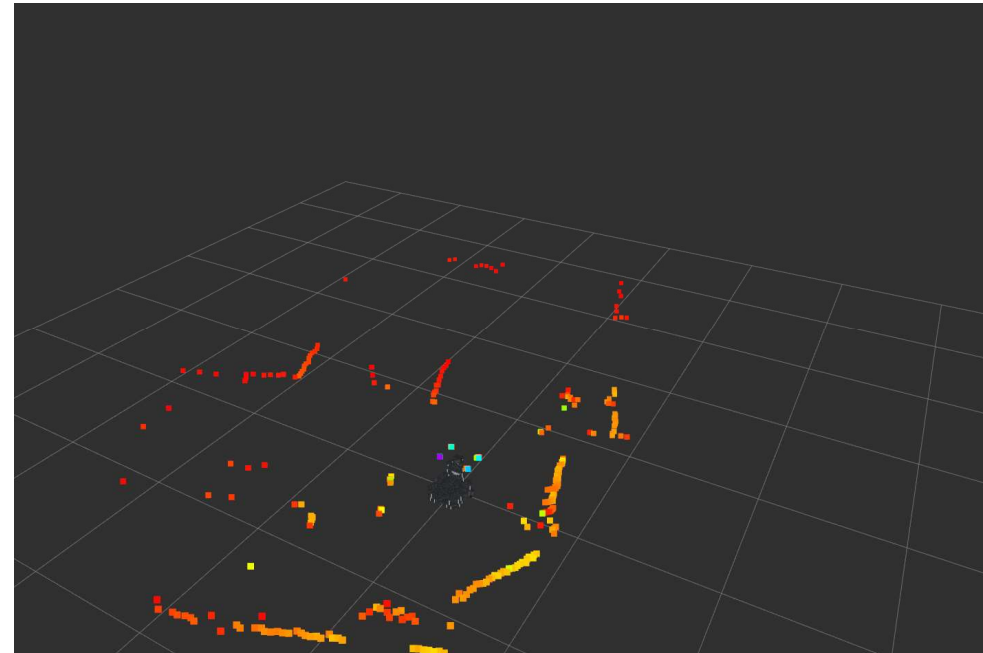
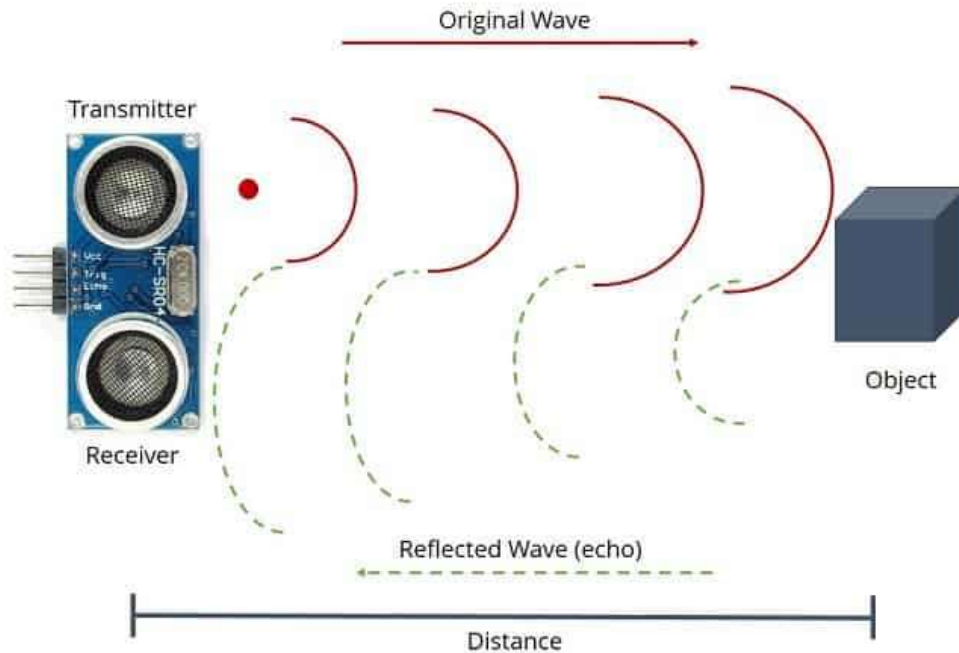
Ground-based positioning

- Localization in a fixed reference frame
- GPS, Active optical or RF beacons
Active ultrasonic beacons
Reflective beacons



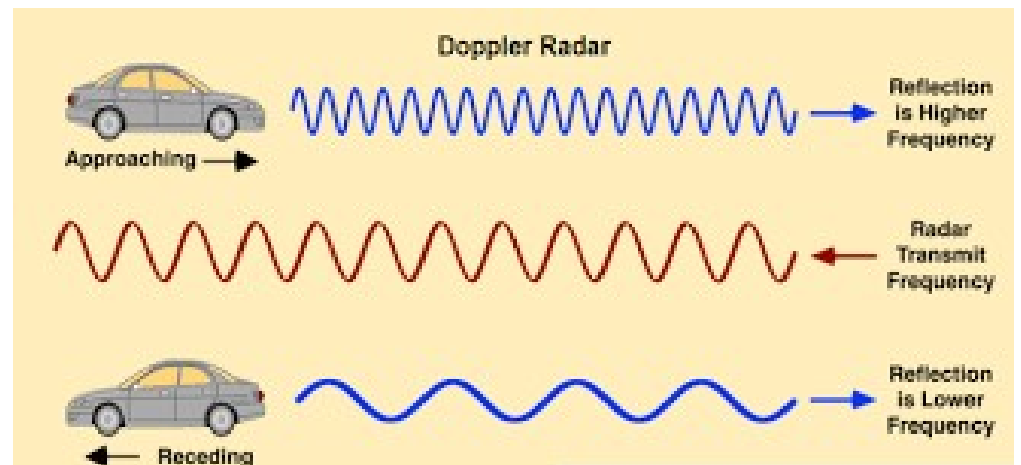
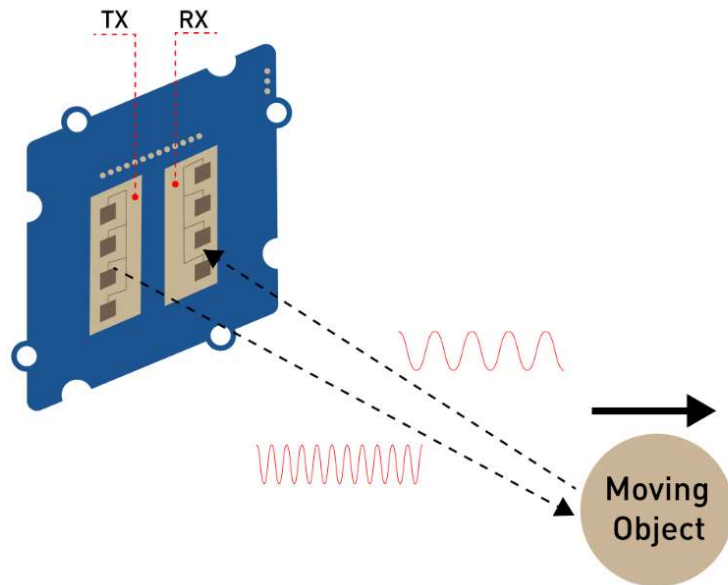
Active ranging

- Reflectivity, time-of-flight, and geo-metric triangulation
- Reflectivity sensors, Ultrasonic sensor, Laser rangefinder



Motion/speed sensors

- Speed relative to fixed or moving object
- Doppler radar, Doppler sound



Vision-based sensors

- Visual ranging, whole-image analysis, segmentation, object recognition
- CCD/CMOS camera Visual ranging packages Object tracking packages

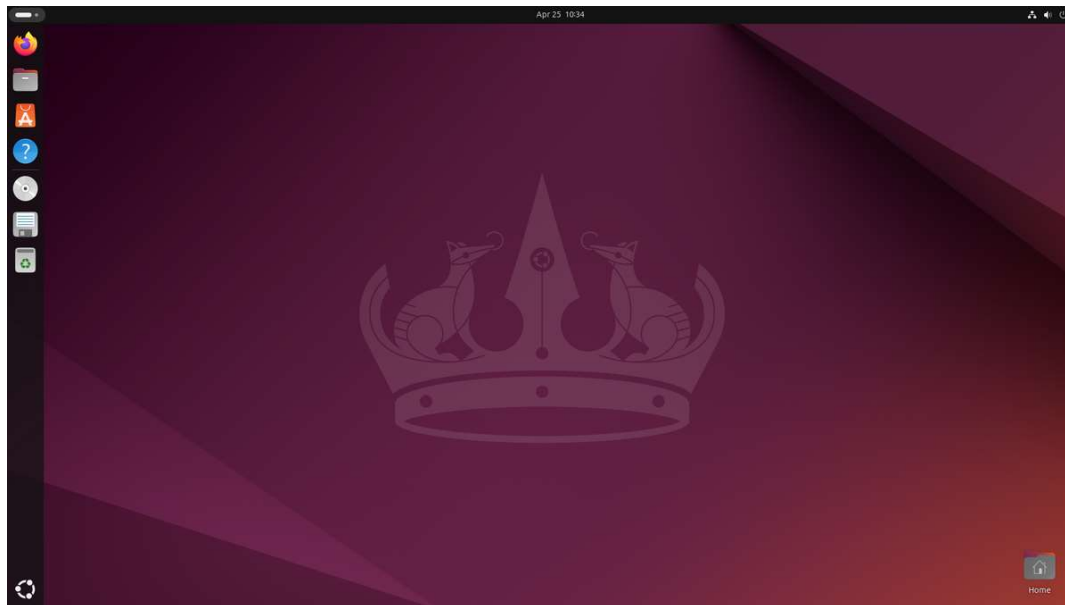


Ubuntu

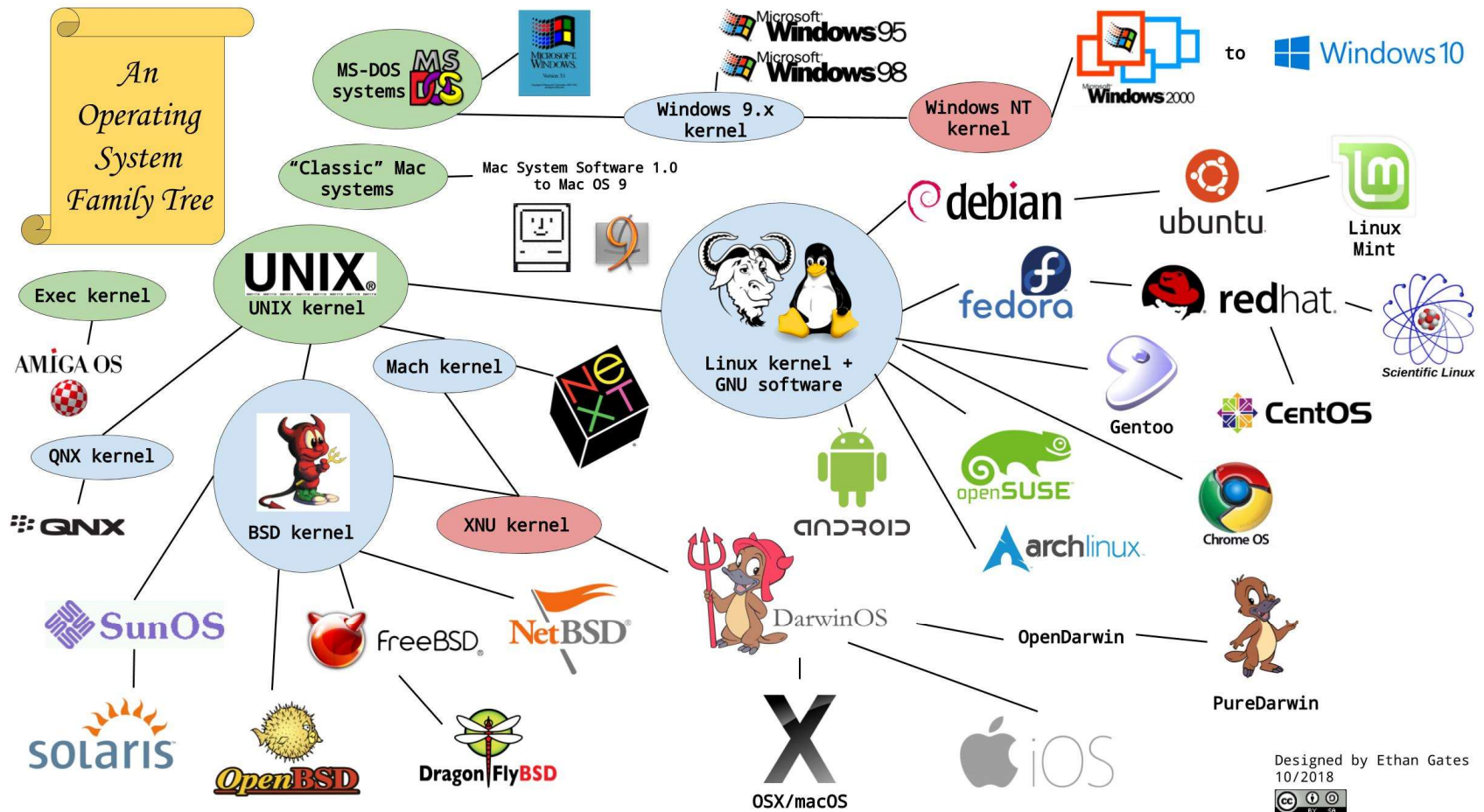
(Open-source Operating System)



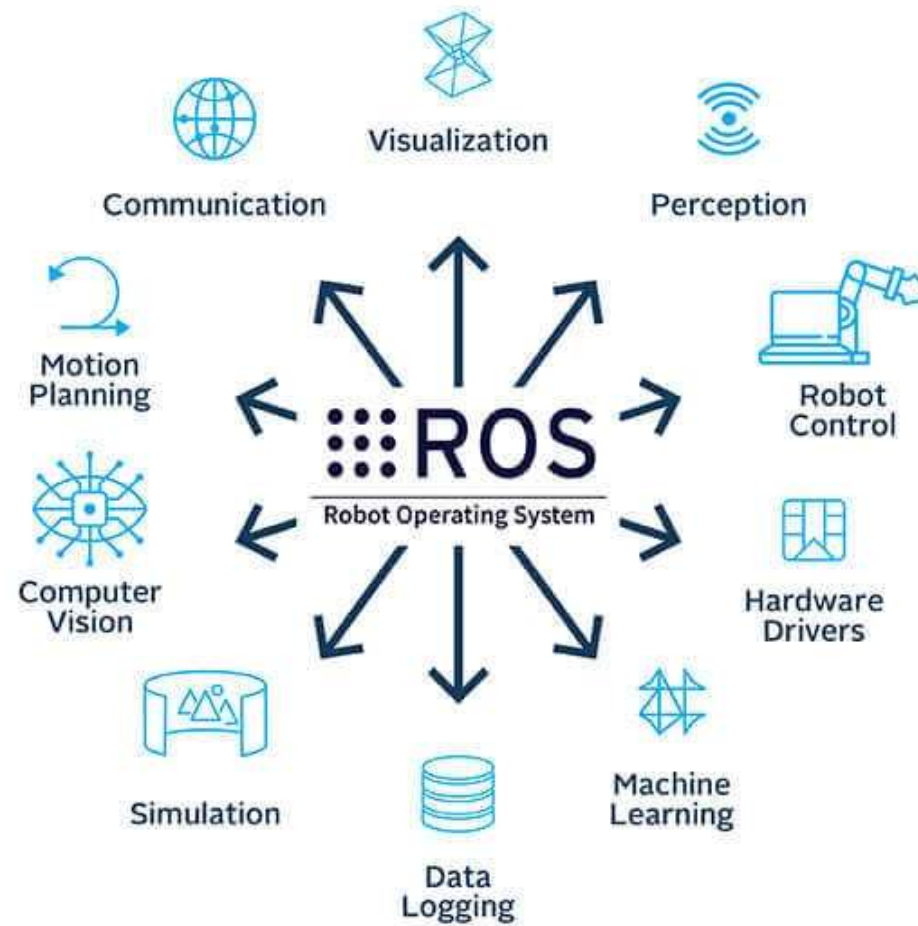
- Free to Use
- Better Community Support
- Secure
- Can revive older computers
- Perfect For Programmers
- Software Updates
- Customization



Operating system family



Robot Operating System (ROS)



ROS Key feature

Main client libraries

- Python
- C++
- Lisp

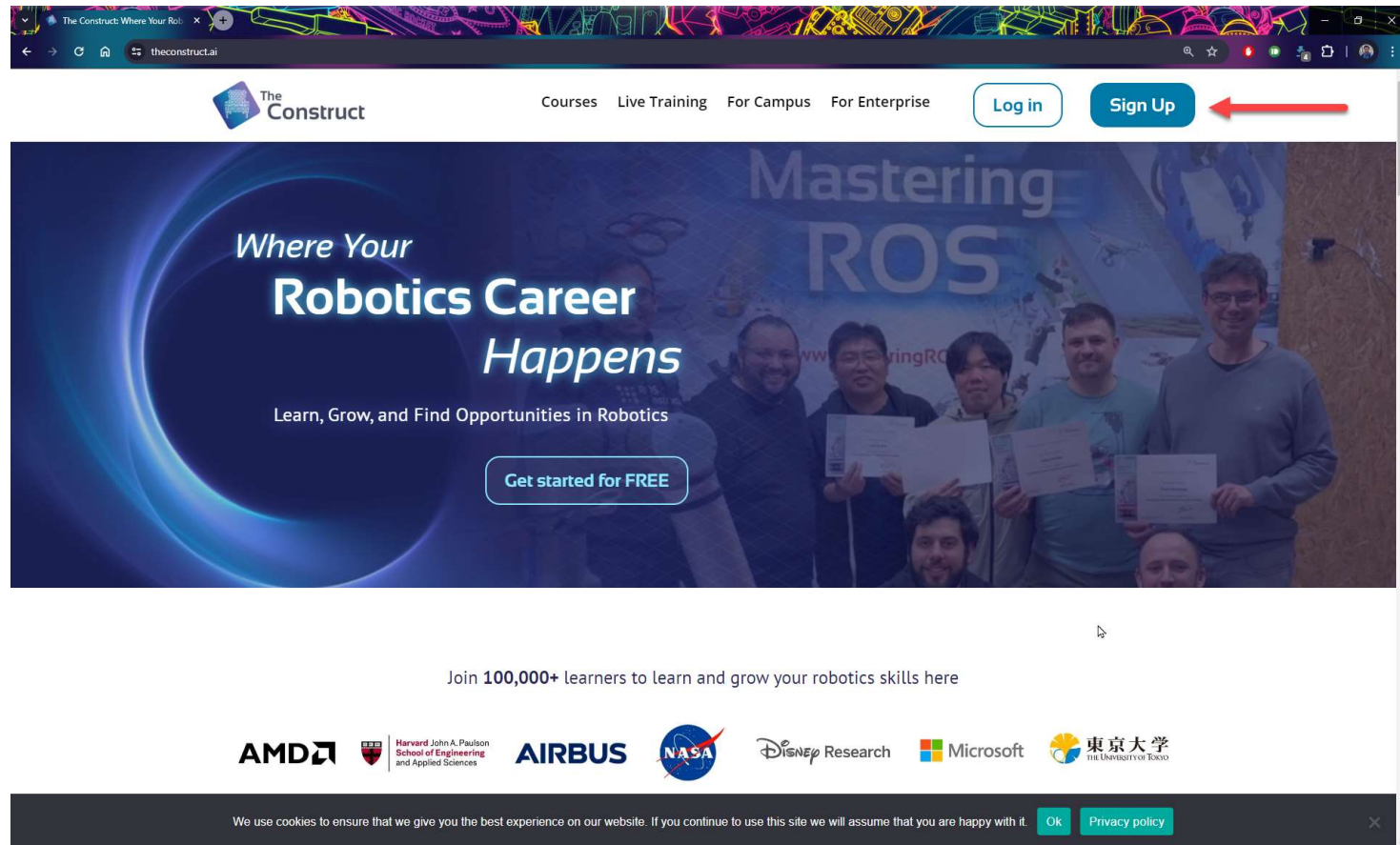
Experimental client library

- Java
- Lua



<https://www.theconstruct.ai>

The Construct is an e-learning platform for ROS and Robotics





The Construct



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 krittinunt@hotmail.com



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กล่องจดหมายเข้า 8

อีเมลขยะ 2

แบบร่าง

รายการที่ส่ง

รายการที่ถูกลบ 72

เก็บการ

บันทึกย่อ 1

contactus@thaifirm...

Conversation History

HostURL

ใบเสร็จ

สร้างโฟลเดอร์ใหม่

กลุ่ม

กลุ่มใหม่

Please confirm your email on The Construct

TC

The Construct <info@theconstruct.ai>

ถึง: คุณ

ส. 24/5/2024 18:00

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ตอบกลับทั้งหมด

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Team The Construct

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Email confirmation token

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Name/Description
Test_ROS_Project



Tags
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Distro
ROS Noetic

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1

Project Type

2

ROS Distro

3


Simulation

4


Project Data

Which ROS distribution do you want to use?


ROS 1




Noetic



Galactic



Humble



Iron

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This rosject does not have a notebook preview

About



Test_ROS_Project

No tags added for this rosject

ROS Noetic

Created on

2024-05-24

Fork count

-

0.00 KB

Last updated

2024-05-24

Python 2

File Edit View Insert Cell Kernel Widgets Help

Run C Markdown

README

This is your ROSJect documentation!

A place to present your ROS Project to the world!


How to customize it:

- Open your ROSJect
- Edit the default jupyter notebook file
(/home/user/notebook_ws/default.ipynb)
- Close or wait for it to be saved automatically
- Your **Readme** will be updated based on your notebook

#561


user:~\$


Development Studio works





How to create your own ROS Projects with ROSDS


The role of the main buttons

 For opening Web Shell

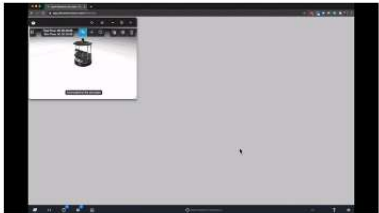
 For opening Code Editor

 For opening Jupyter Notebook

 For opening Gazebo






 For opening Graphical Tools

How to launch a simulation



Test_ROS_Project

07:51

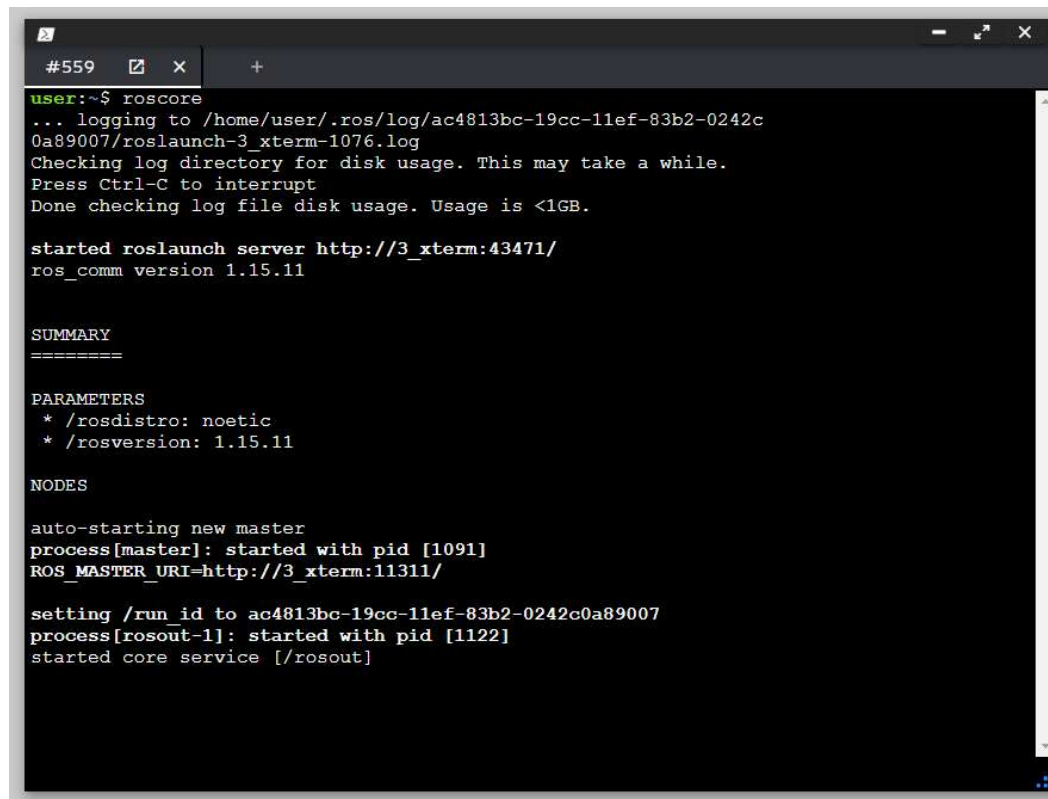
      

0 MB used out of 2048 MB allowed

ROS Nodes / roscore

roscore is the first thing you should run when using ROS.

\$roscore



```
#559 x +
user:~$ roscore
... logging to /home/user/.ros/log/ac4813bc-19cc-11ef-83b2-0242c0a89007/roslaunch-3_xterm-1076.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://3_xterm:43471/
ros_comm version 1.15.11

SUMMARY
=====

PARAMETERS
* /rostdistro: noetic
* /rosversion: 1.15.11

NODES

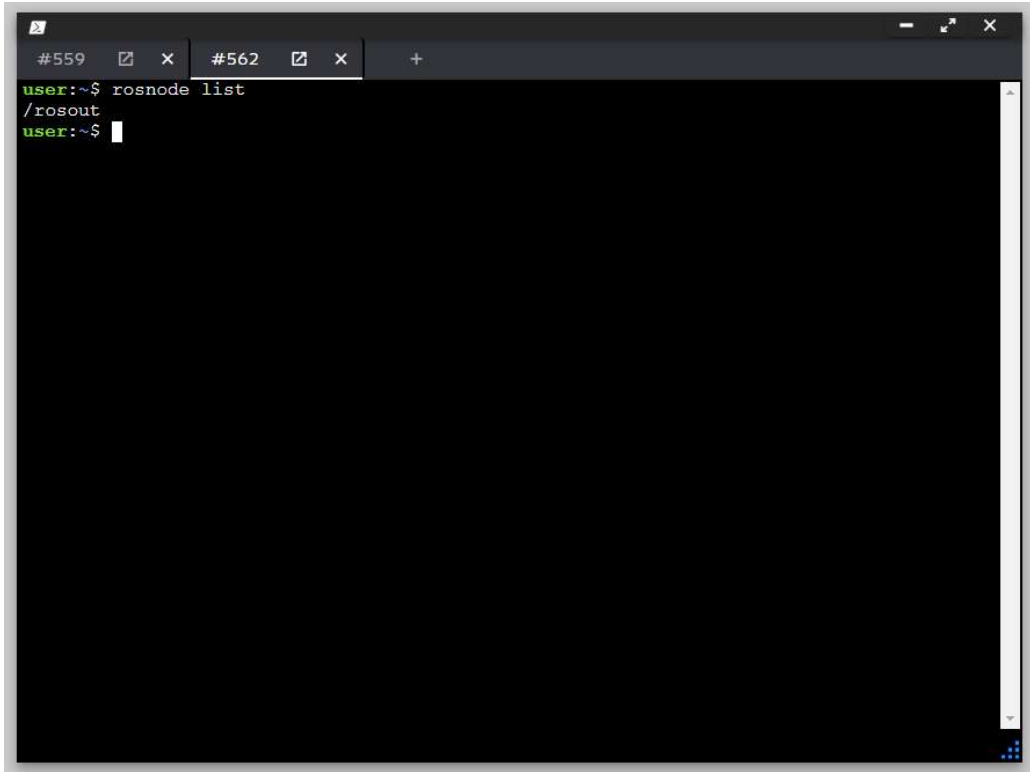
auto-starting new master
process[master]: started with pid [1091]
ROS_MASTER_URI=http://3_xterm:11311/

setting /run_id to ac4813bc-19cc-11ef-83b2-0242c0a89007
process[rosout-1]: started with pid [1122]
started core service [/rosout]
```

ROS Nodes / rosnode

rosgnode display information about the ROS nodes that are currently running

\$rosgnode list



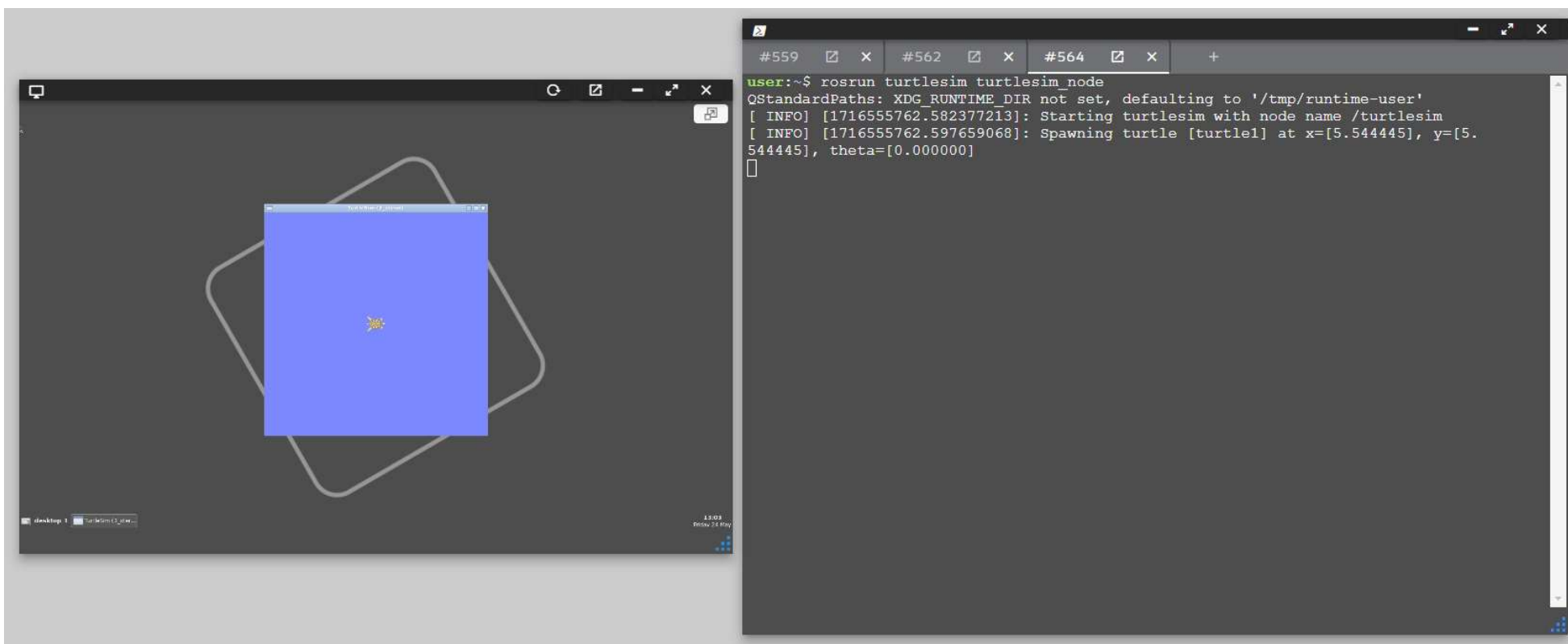
```
#559 x #562 x +
user:~$ rosgnode list
/rosgout
user:~$
```

A terminal window with a dark background and light green text. The window title bar shows two tabs: #559 and #562. The command 'rosgnode list' has been executed, resulting in the output '/rosgout'. The prompt 'user:~\$' is visible at the end of the line.

ROS Nodes / rosrn

rosrn allows you to use the package name to directly run a node within a package

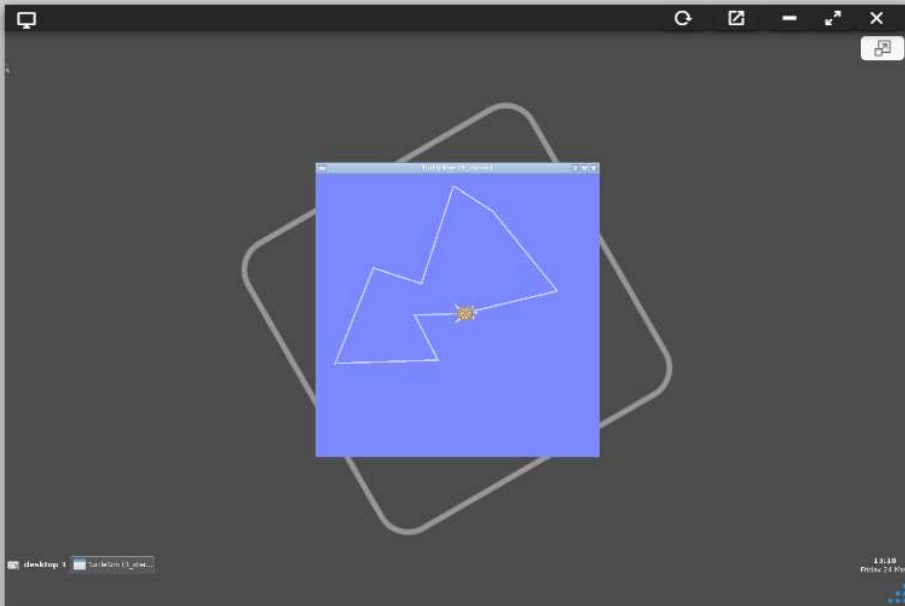
\$rosrn turtlesim turtlesim_node



ROS Node / Topics

Publishing the keystrokes on a topic

\$rosrun turtlesim turtle_teleop_key

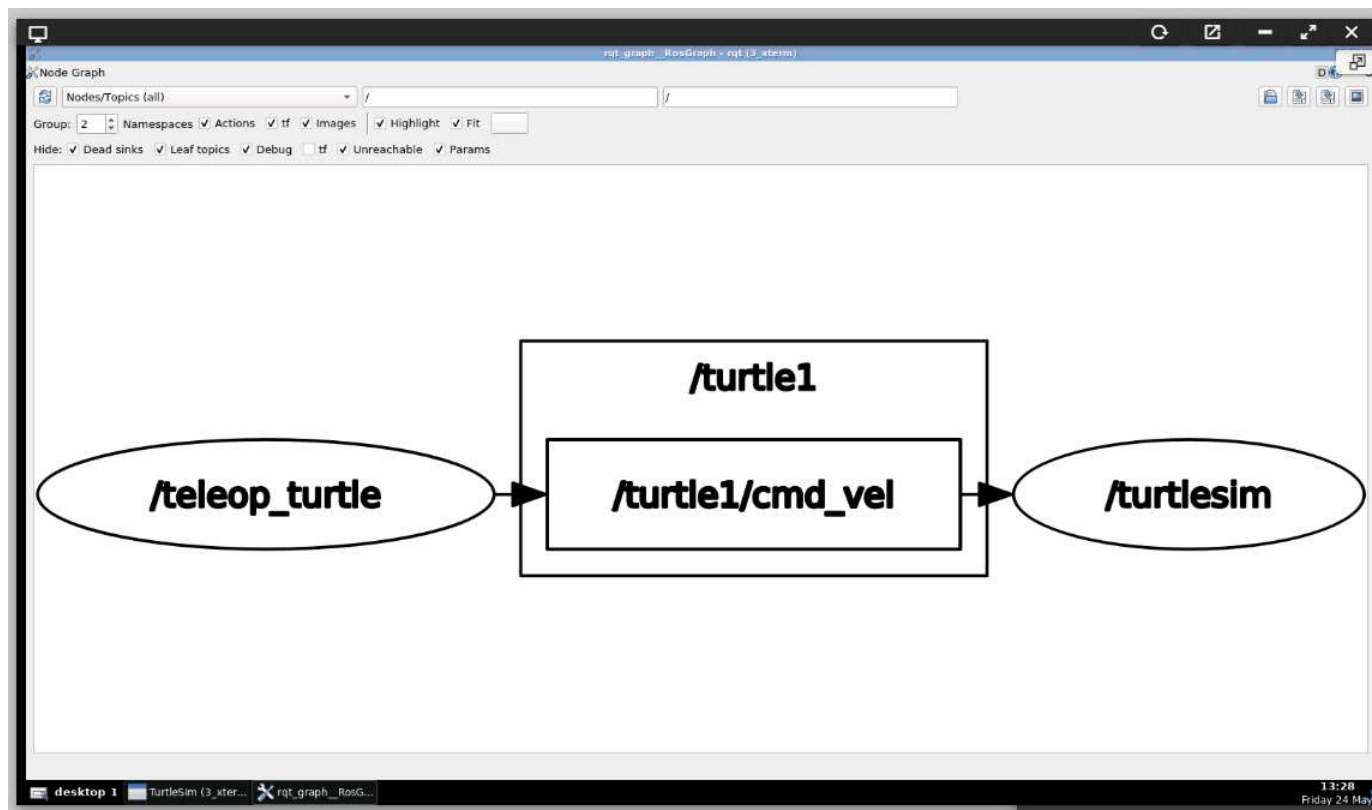


```
#559 [x] #562 [x] #564 [x] #566 [x] +
user:~$ rosrun turtlesim turtle_teleop_key
Reading from keyboard
-----
Use arrow keys to move the turtle. 'q' to quit.
```

ROS Node / Topics

ROS Graph

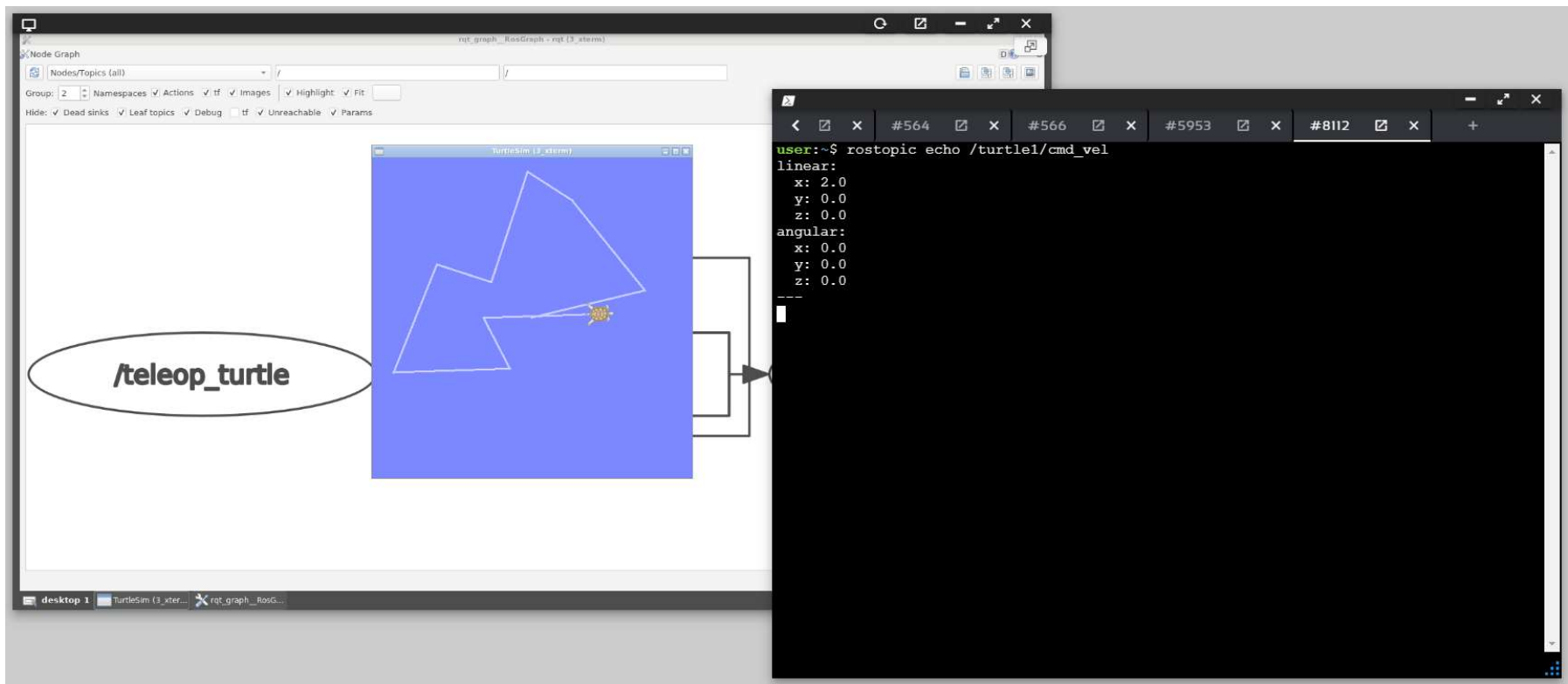
```
$roslaunch rqt_graph rqt_graph
```



ROS Node / Topics / Echo

Show data published

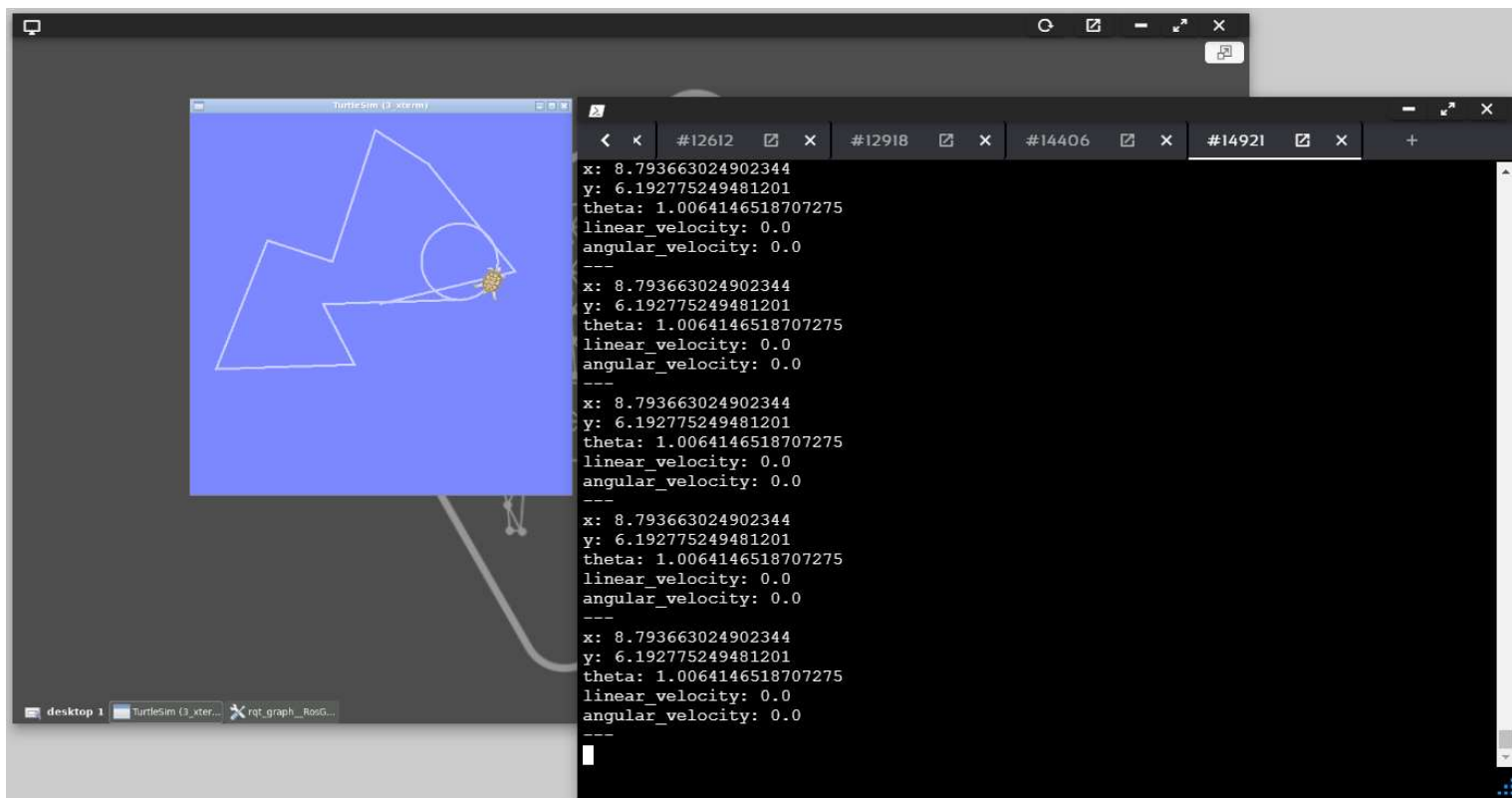
```
$rostopic echo /turtle1/cmd_vel
```



ROS Node / Topics / Echo

Show position data

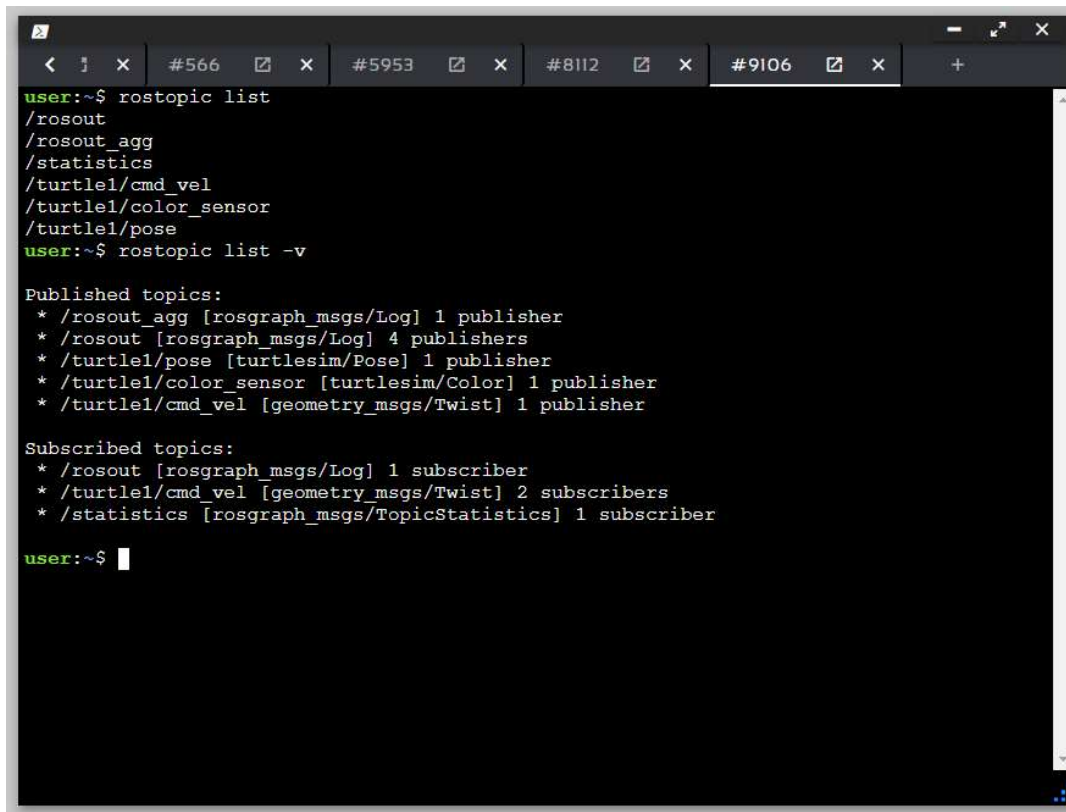
`$rostopic echo /turtle1/pose`



ROS Node / Topics / List

Show published and subscribed topics

\$rostopic list



```
user:~$ rostopic list
/rosout
/rosout_agg
/statistics
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
user:~$ rostopic list -v

Published topics:
* /rosout_agg [rosgraph_msgs/Log] 1 publisher
* /rosout [rosgraph_msgs/Log] 4 publishers
* /turtle1/pose [turtlesim/Pose] 1 publisher
* /turtle1/color_sensor [turtlesim/Color] 1 publisher
* /turtle1/cmd_vel [geometry_msgs/Twist] 1 publisher

Subscribed topics:
* /rosout [rosgraph_msgs/Log] 1 subscriber
* /turtle1/cmd_vel [geometry_msgs/Twist] 2 subscribers
* /statistics [rosgraph_msgs/TopicStatistics] 1 subscriber

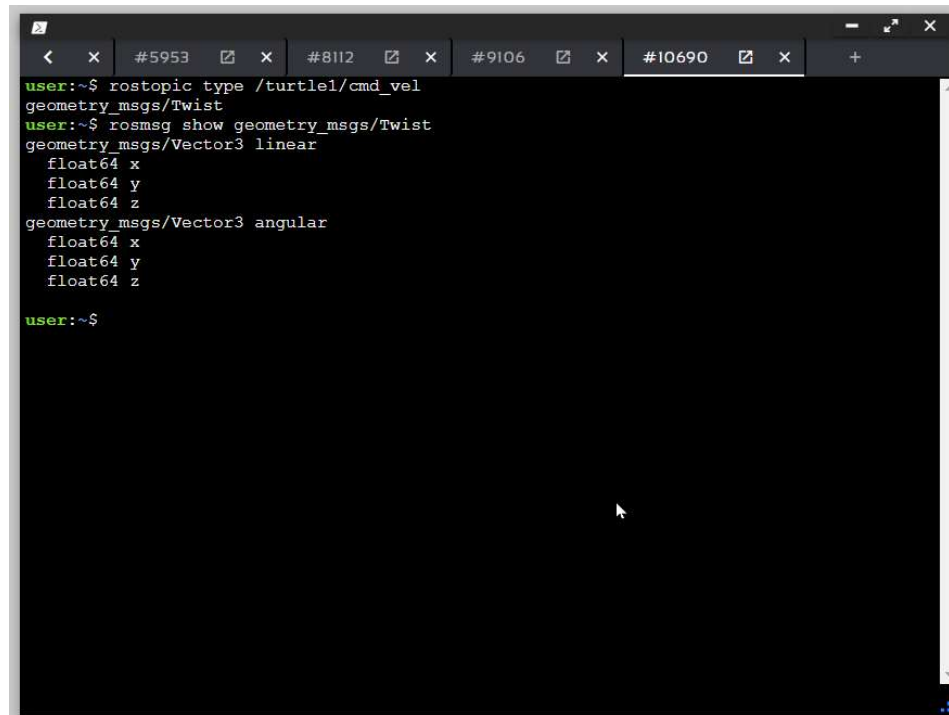
user:~$
```

ROS Node / Topics / Check type

Check type of I/O data parameters

```
$rostopic type /turtle1/cmd_vel
```

```
$rosmmsg show geometry_msgs/Twist
```

A terminal window with a dark background and light green text. The window has a title bar with several tabs labeled #5953, #8112, #9106, and #10690. The terminal shows the following commands and output:

```
user:~$ rostopic type /turtle1/cmd_vel
geometry_msgs/Twist
user:~$ rosmmsg show geometry_msgs/Twist
geometry_msgs/Vector3 linear
float64 x
float64 y
float64 z
geometry_msgs/Vector3 angular
float64 x
float64 y
float64 z
user:~$
```

ROS Node / Topics / Pub

Published data

```
$rostopic pub -1 /turtle1/cmd_vel geometry_msgs/Twist -- '[2.0, 0.0, 0.0]' '[0.0, 0.0, 1.8]'
```

