

POLITECNICO DI MILANO

AUTONOMOUS VEHICLES

S. Arrigoni



POLITECNICO
MILANO 1863



Introduction to ROS + MATLAB

Software requirements



- Matlab 2022a(recommended) / 2022b
- Type in command window: rosin

```
>> rosin
Launching ROS Core...
Invalid Python executable: ''. Use pyenv function to set the path to the Python executable and retry the
command.
```

- Install python (3.9.2) from <https://www.python.org/> and type

```
>> pyenv('Version', '/usr/bin/python3.9')
```



Software requirements

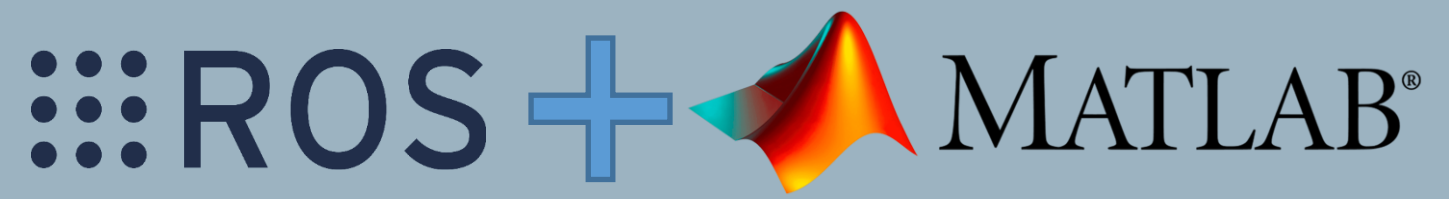


- Matlab 2022a(recommended) / 2022b
- Type in command window (again): rosin

```
>> rosin
Launching ROS Core...
Creating a Python virtual environment...Done.
Adding required Python packages to virtual environment...Done.
Done in 0.60235 seconds.
Initializing ROS master on http://192.168.1.77:11311.
Initializing global node /matlab_global_node_70367 with NodeURI http://arrige66:59118/ and MasterURI ht
>> |
```



If you install 2022b you will have to fix a couple of things more...



Intro

Modified Publisher (python)

```
#!/usr/bin/env python
import rospy
from std_msgs.msg import Float32

def say_something():
    pub = rospy.Publisher('rndm_number', Float32, queue_size=10)
    rospy.init_node('publisher_node', anonymous=False)
    rate = rospy.Rate(1) # 10hz
    start=rospy.get_time()
    while not rospy.is_shutdown():
        timer=rospy.get_time()
        msg = timer-start
        rospy.loginfo(msg)
        pub.publish(msg)
        rate.sleep()
if __name__ == '__main__':
    try:
        say_something()
    except rospy.ROSInterruptException:
        pass
```

Float type

New topic name and frequency

Loginfo: display and store in /rosout

Verify

Compile the node and run it!

Check nodes	<i>rostopic list</i>
Check topics	<i>rostopic list</i>
See topic	<i>rostopic echo /rndm_number</i>

```
^Craibuntu@RaiBuntu66:~/ws_folder$ rostopic echo /rndm_number
data: 9.001220703125
---
data: 10.001298904418945
---
data: 11.001474380493164
---
data: 12.00144100189209
---
data: 13.001433372497559
---
data: 14.001218795776367
---
data: 15.001434326171875
---
data: 16.001399993896484
```

Let's connect Matlab to ROS

Initialize Ros Master

rosinit

rosinit('ip_address of the master if any')

```
>> rosinit
The value of the ROS_MASTER_URI environment variable, http://localhost:11311, will be used to connect to the ROS master.
The value of the ROS_HOSTNAME environment variable, localhost, will be used to set the advertised address for the ROS node.
Initializing global node /matlab_global_node_83857 with NodeURI http://localhost:44665/ and MasterURI http://localhost:11311.
>>
```


Let's connect Matlab to ROS

Check if it's working

rostopic list

rostopic echo

```
>> rostopic list
/rndm_number
/rosout
/rosout_agg
/tf
>> rostopic echo /rndm_number

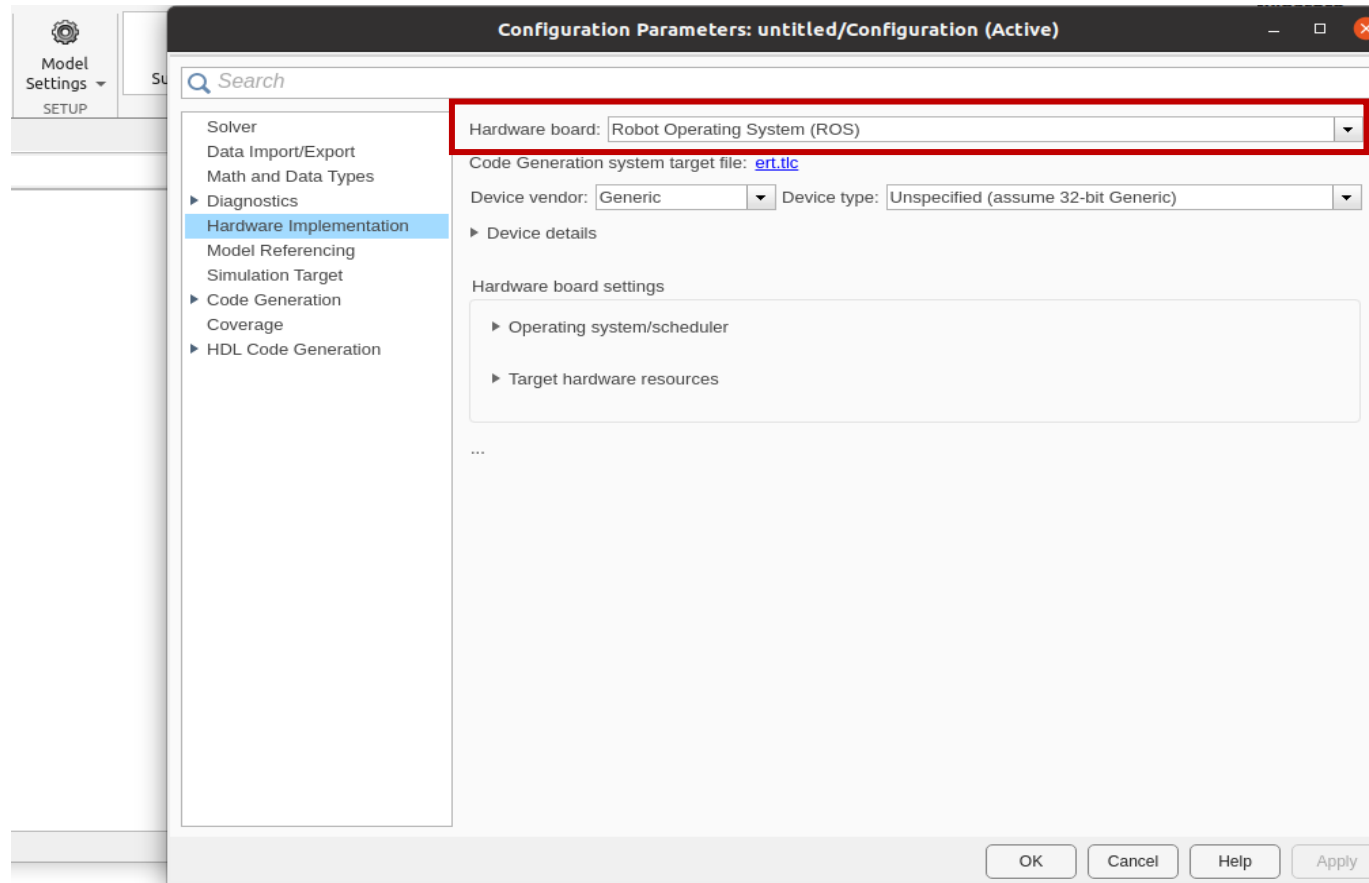
Data : 212.0012664794922
---

Data : 213.00146484375
---

Data : 214.0012359619141
---
```

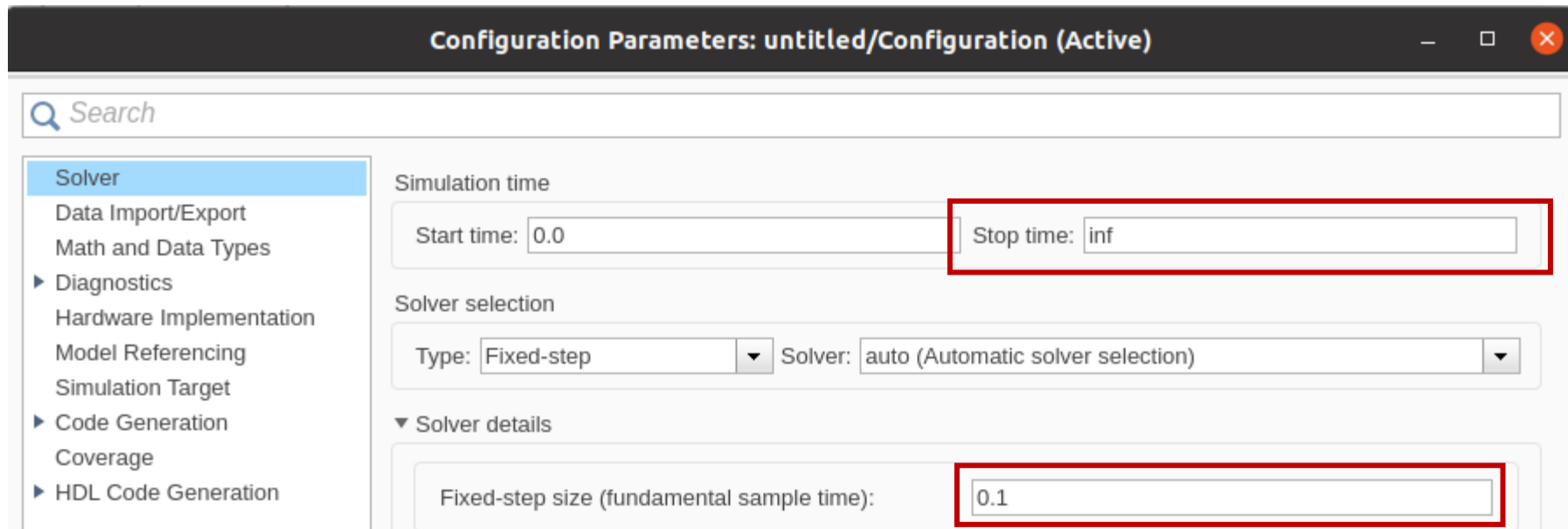
Let's define a Simulink node

Initialize Simulink with ROS Toolbox 1/3



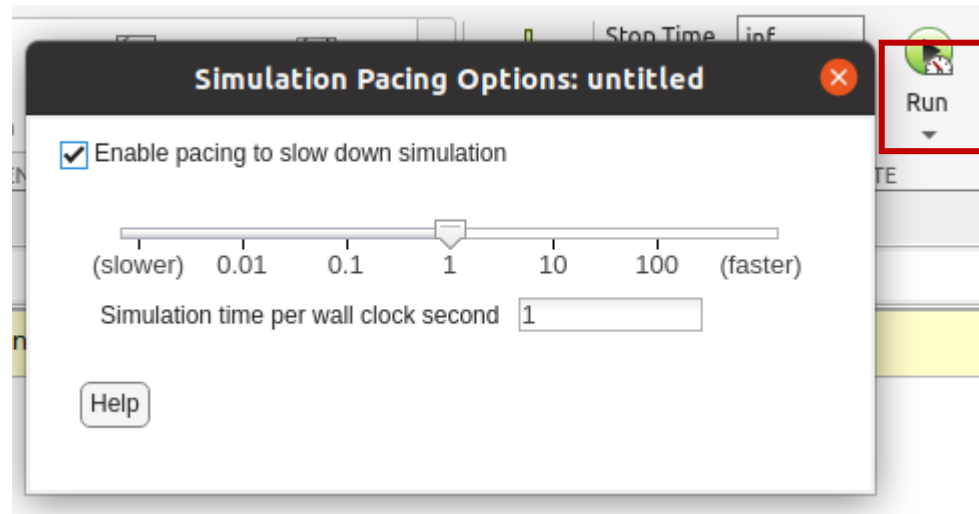
Let's define a Simulink node

Initialize Simulink with ROS Toolbox 2/3



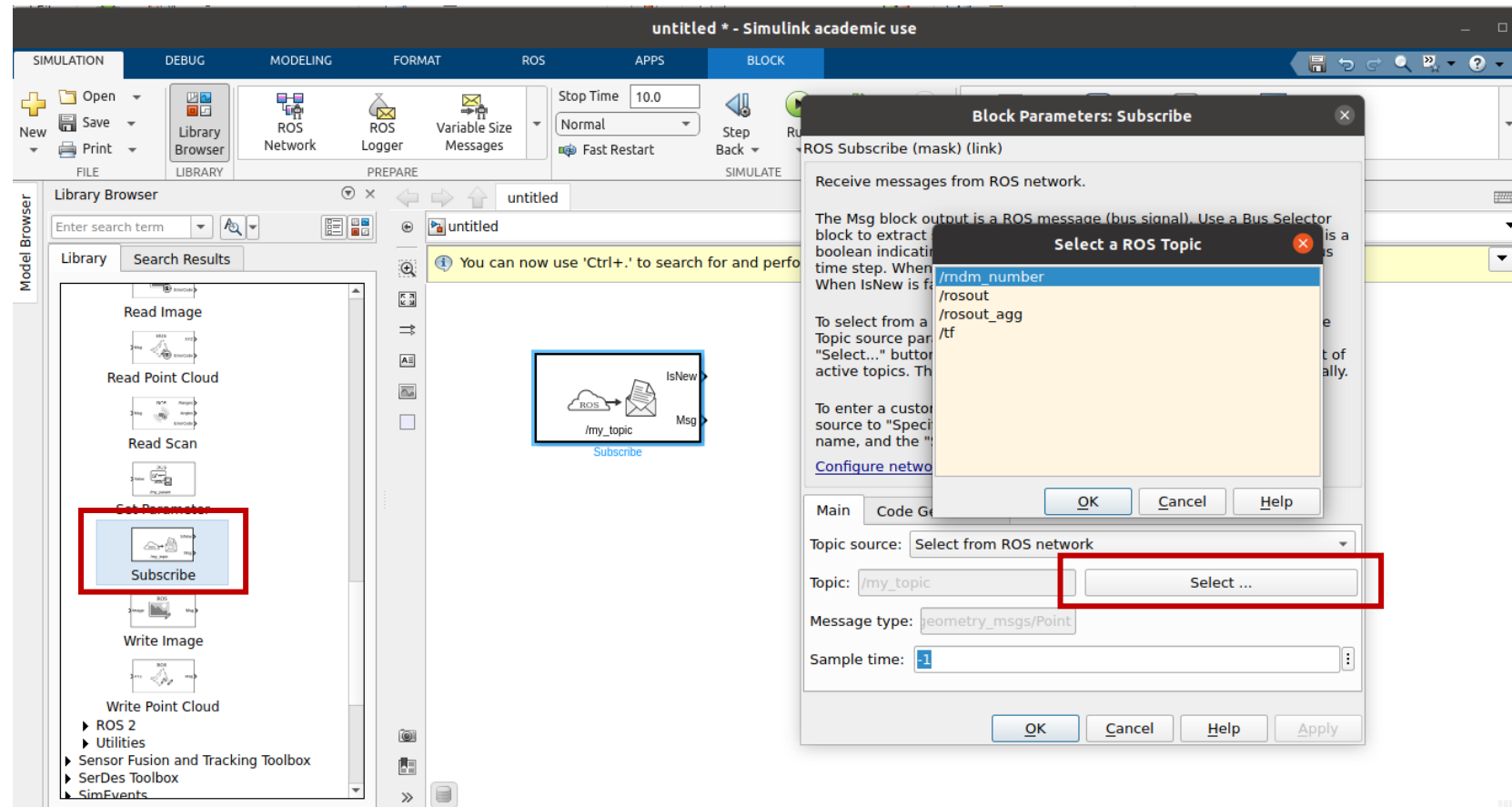
Let's define a Simulink node

Initialize Simulink with ROS Toolbox 3/3



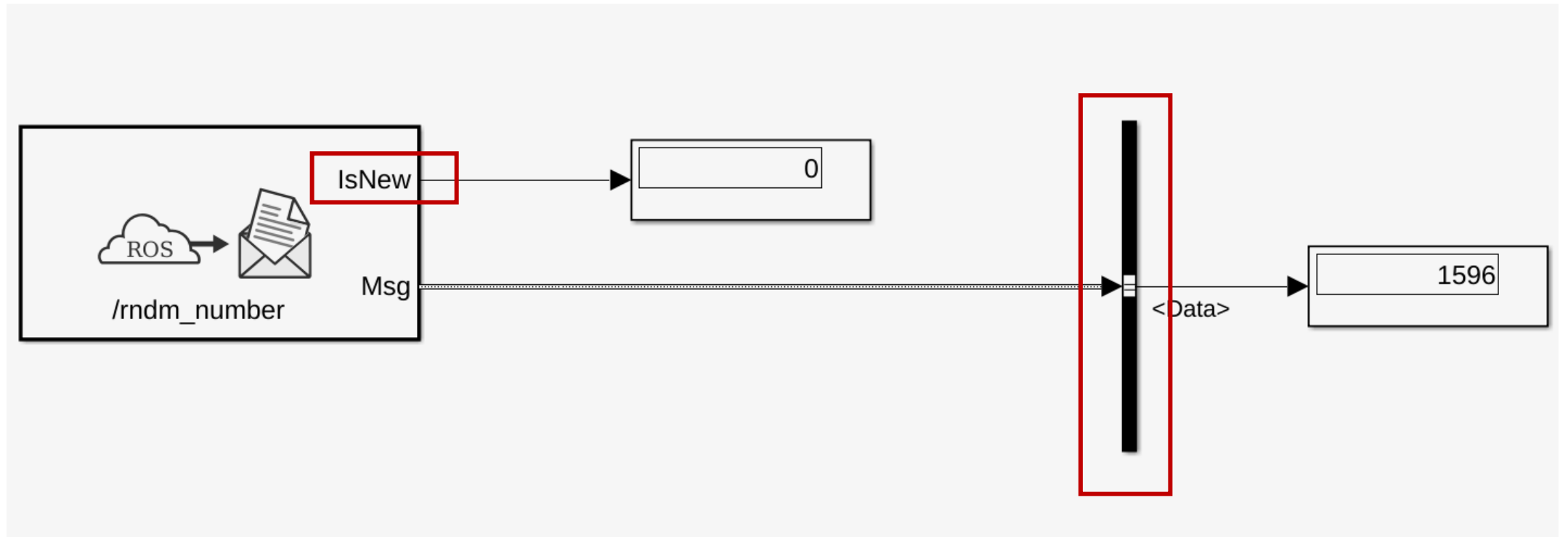
Let's define a publisher - subscriber

Let's define the subscriber



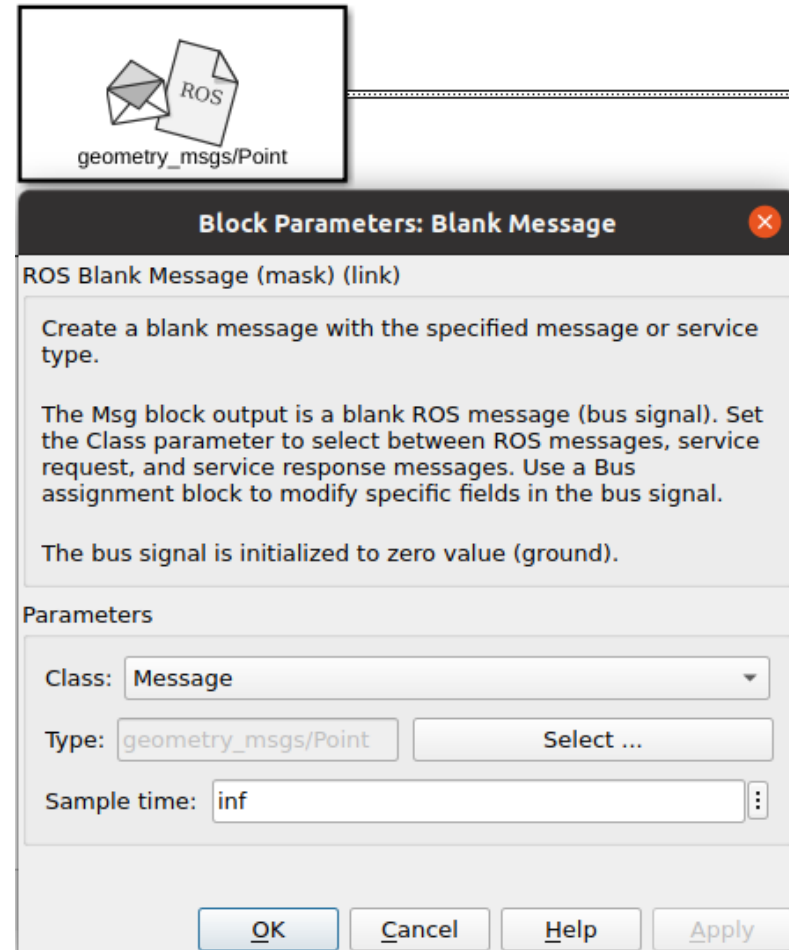
Let's define a publisher - subscriber

Subscriber block



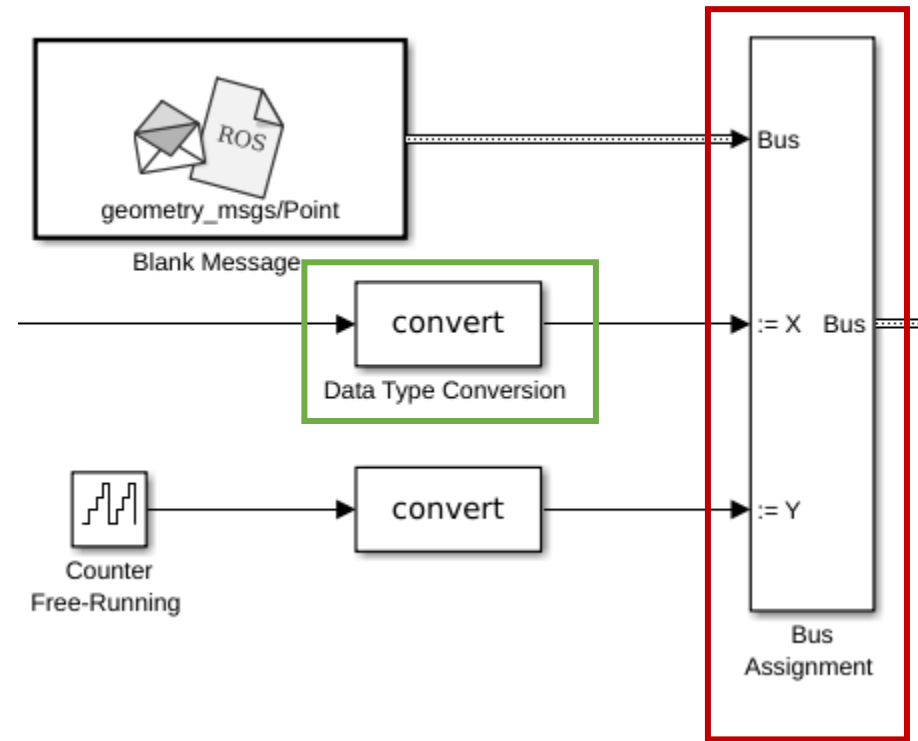
Let's define a publisher - subscriber

Let's define the publisher:
blank message



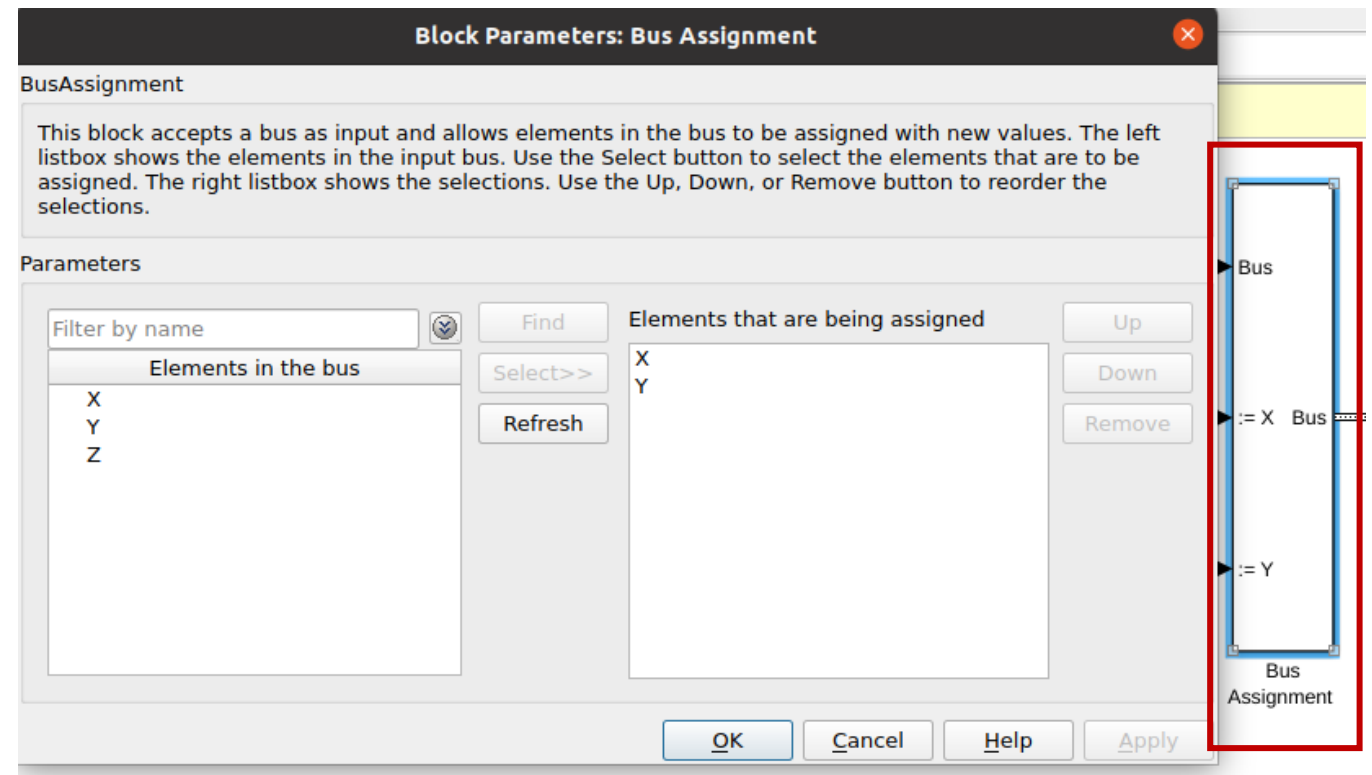
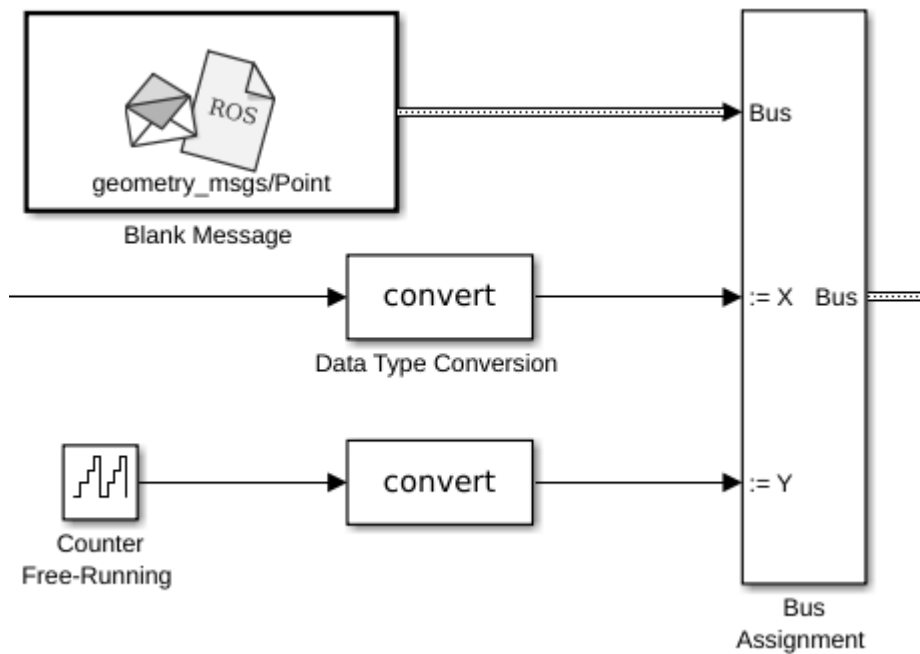
Let's define a publisher - subscriber

Let's add some data in the message



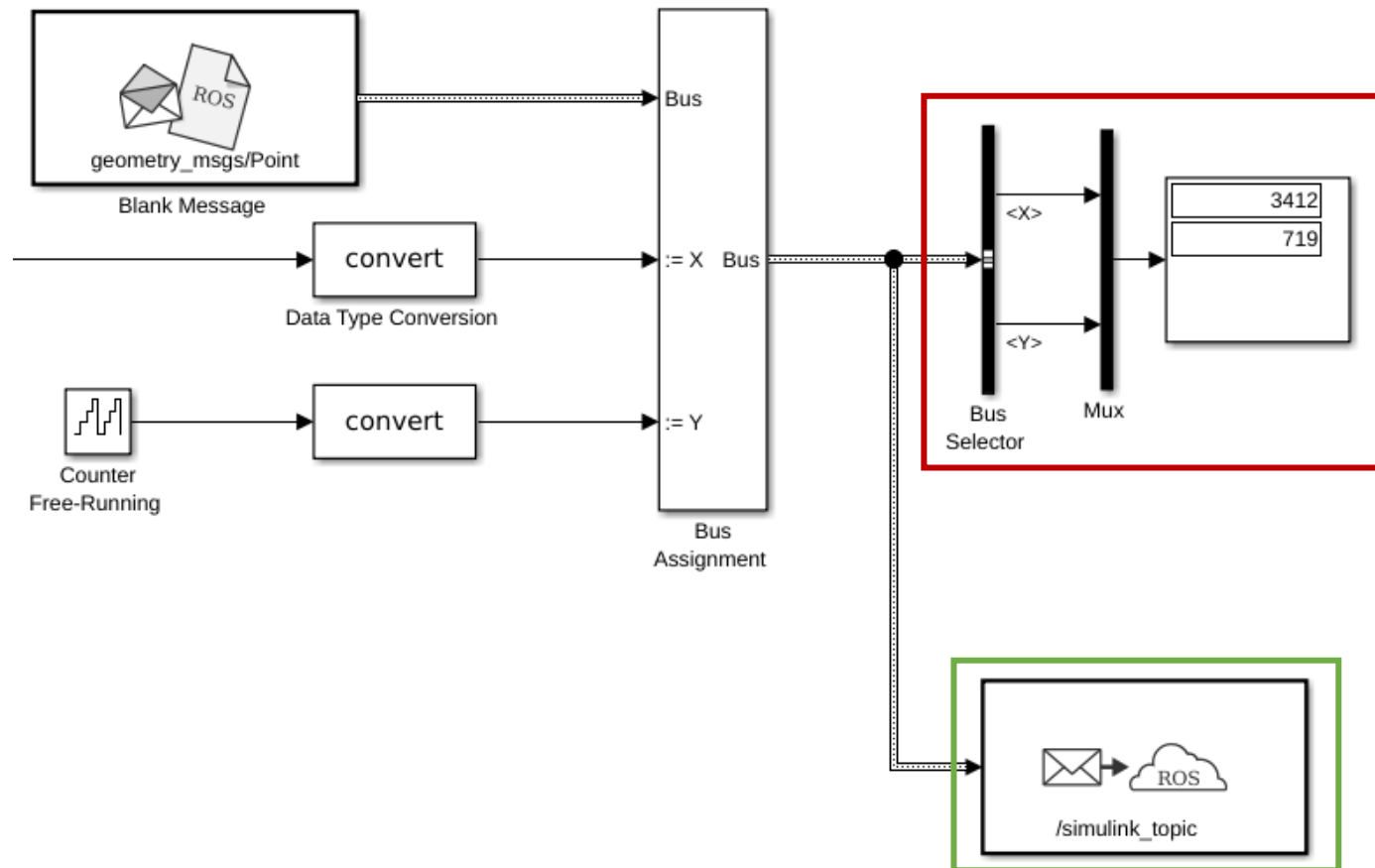
Let's define a publisher - subscriber

Bus assignment



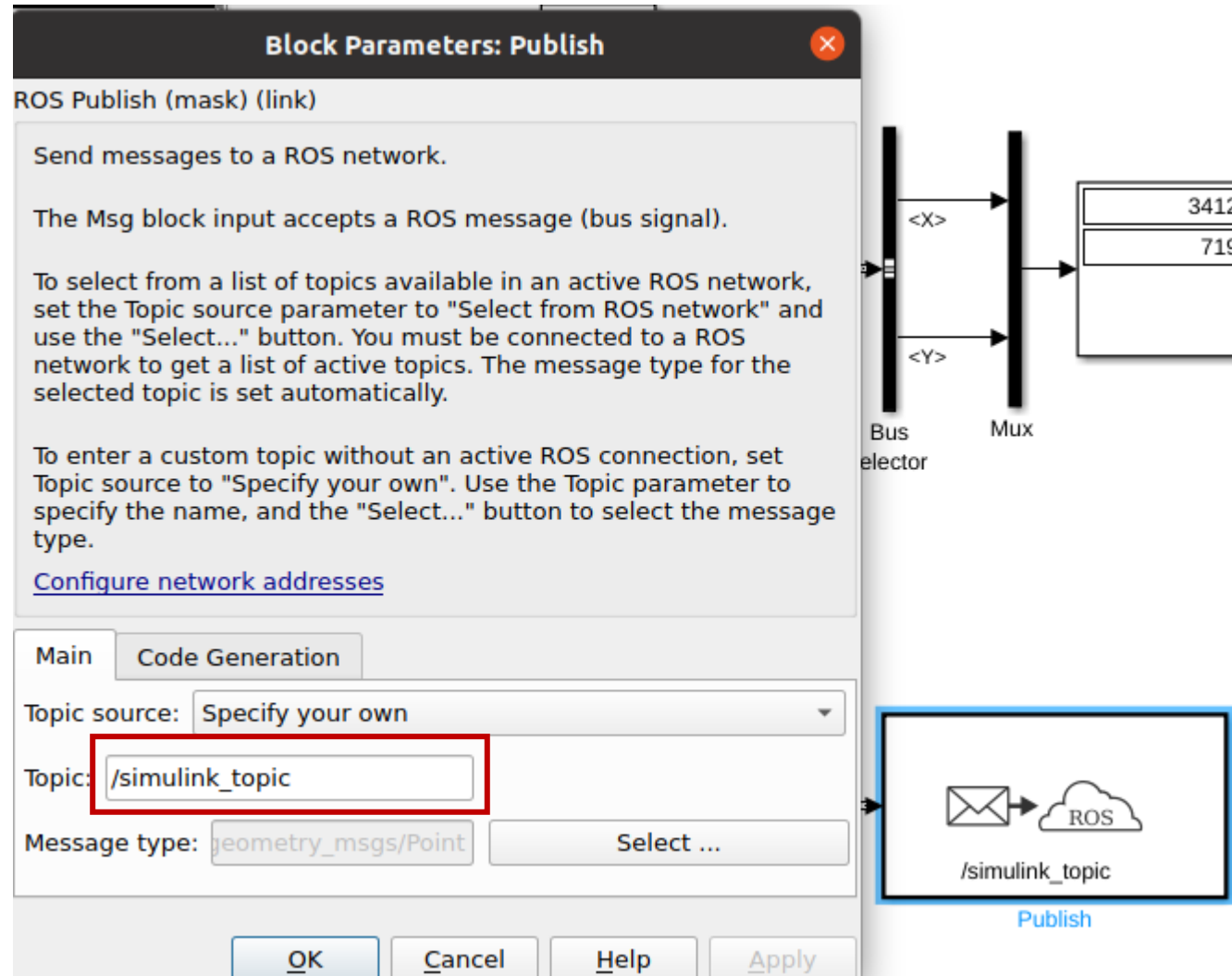
Let's define a publisher - subscriber

Let's complete the publisher



Let's define a publisher - subscriber

computation block



Verify

Run the node and check it!

Check topics *rostopic list*

```
^Craibuntu@RaiBuntu66:~/ws_folder$ rostopic list
/rndm_number
/rosout
/rosout_agg
/simulink_topic
/tf
```

see topic *rostopic echo /simulink_topic*

```
^Craibuntu@RaiBuntu66:~/ws_folder$ rostopic echo /simulink_topic
x: 37.000980377197266
y: 216.0
z: 0.0
```

verify frequency *rostopic hz /simulink_topic*

```
raibuntu@RaiBuntu66:~/ws_folder$ rostopic hz /simulink_topic
subscribed to [/simulink_topic]
average rate: 11.398
   min: 0.000s max: 0.101s std dev: 0.02949s window: 12
average rate: 10.690
   min: 0.000s max: 0.101s std dev: 0.02220s window: 22
average rate: 10.457
   min: 0.000s max: 0.101s std dev: 0.01852s window: 32
average rate: 10.342
   min: 0.000s max: 0.101s std dev: 0.01621s window: 42
average rate: 10.273
   min: 0.000s max: 0.102s std dev: 0.01460s window: 52
average rate: 10.228
```




Intro

Let's initialize Gazebo

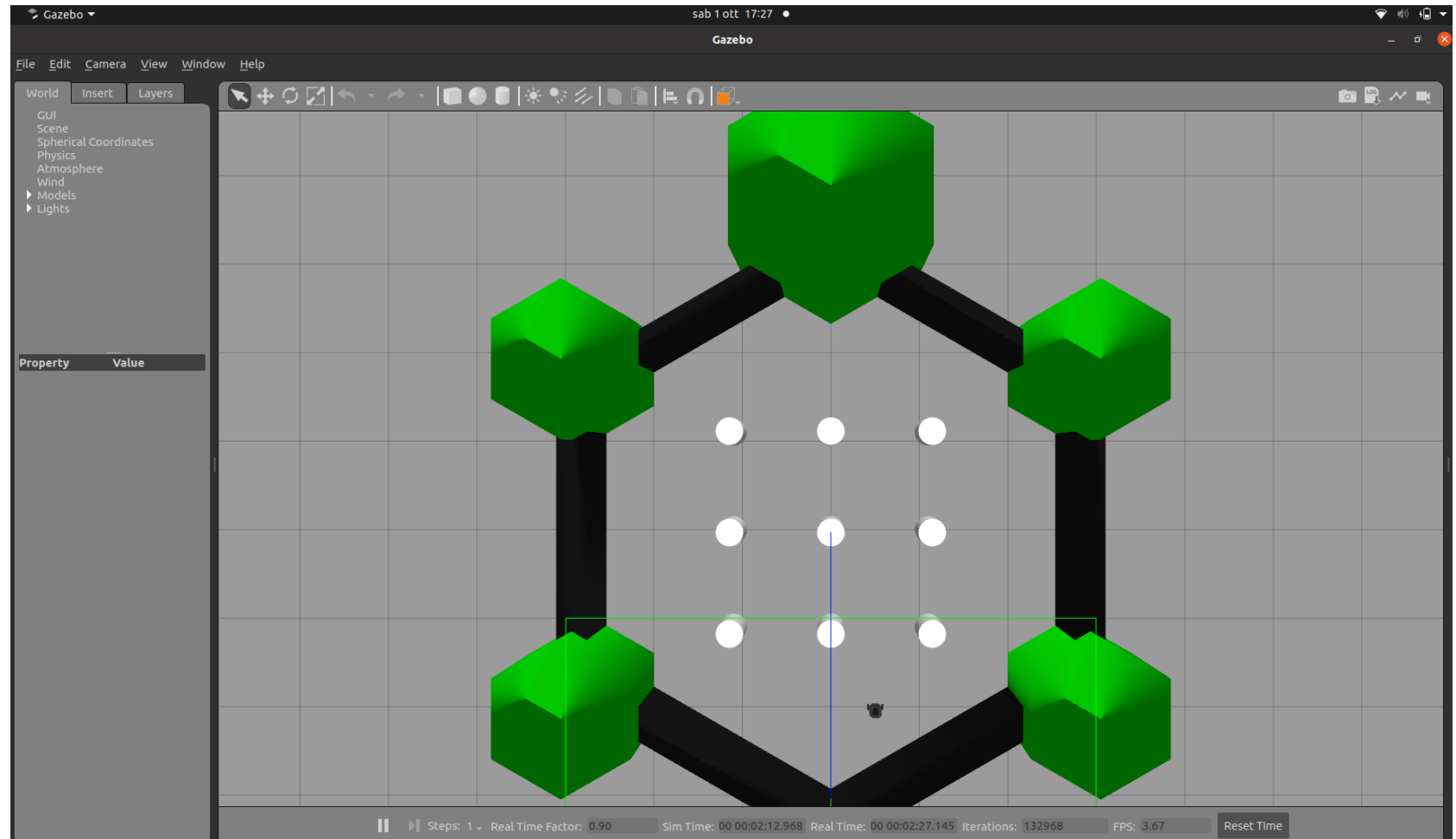
Let's start an example in ROS 1/2

Open a new terminal and initialize gazebo

```
$ export TURTLEBOT3_MODEL=burger  
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

Let's initialize Gazebo

Gazebo



Let's initialize Gazebo

Let's start an example in ROS 2/2

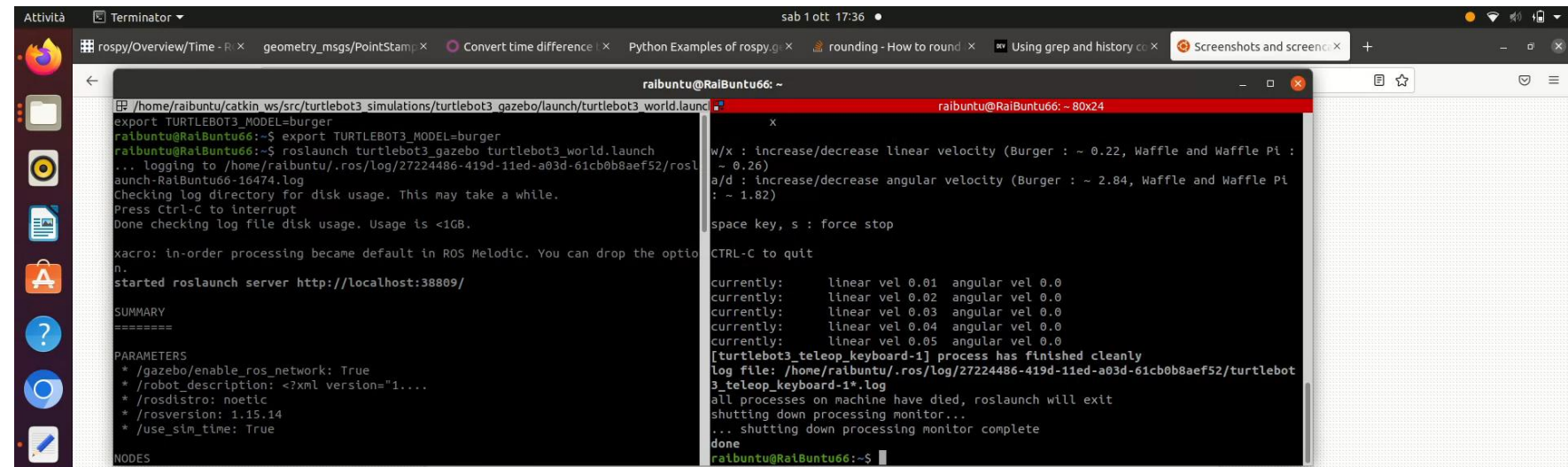
in a new terminal let's run a control example

```
raibuntu@Raibuntu66: ~$ cd /home/raibuntu/catkin_ws/src/turtlebot3_simulations/turtlebot3_gazebo/launch/turtlebot3_world.launch
export TURTLEBOT3_MODEL=burger
raibuntu@Raibuntu66:~$ export TURTLEBOT3_MODEL=burger
raibuntu@Raibuntu66:~$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
... logging to /home/raibuntu/.ros/log/27224486-419d-11ed-a03d-61cb0b8aef52/rosl
```

```
raibuntu@Raibuntu66: ~ 80x24
raibuntu@Raibuntu66:~$ export TURTLEBOT3_MODEL=burger
raibuntu@Raibuntu66:~$ roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
... logging to /home/raibuntu/.ros/log/27224486-419d-11ed-a03d-61cb0b8aef52/rosl
sl launch-Raibuntu66-17757.log
```


Let's initialize Gazebo

Expected result...



```
raibuntu@Raibuntu66: ~  
export TURTLEBOT3_MODEL=burger  
raibuntu@Raibuntu66:~$ export TURTLEBOT3_MODEL=burger  
raibuntu@Raibuntu66:~$ roslaunch turtlebot3_gazebo turtlebot3_world.launch  
... logging to /home/raibuntu/.ros/log/27224486-419d-11ed-a03d-61cb0b8aef52/ros1  
launch-Raibuntu66-16474.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.  
  
xacro: in-order processing became default in ROS Melodic. You can drop the option.  
started roslaunch server http://localhost:38809/  
  
SUMMARY  
=====  
PARAMETERS  
* /gazebo/enable_ros_network: True  
* /robot_description: <?xml version="1....  
* /roslaunch: noetic  
* /rosversion: 1.15.14  
* /use_sim_time: True  
  
NODES
```

```
w/x : increase/decrease linear velocity (Burger : ~ 0.22, Waffle and Waffle Pi : ~ 0.26)  
a/d : increase/decrease angular velocity (Burger : ~ 2.84, Waffle and Waffle Pi : ~ 1.82)  
  
space key, s : force stop  
  
CTRL-C to quit  
  
currently: linear vel 0.01 angular vel 0.0  
currently: linear vel 0.02 angular vel 0.0  
currently: linear vel 0.03 angular vel 0.0  
currently: linear vel 0.04 angular vel 0.0  
currently: linear vel 0.05 angular vel 0.0  
[turtlebot3_teleop_keyboard-1] process has finished cleanly  
log file: /home/raibuntu/.ros/log/27224486-419d-11ed-a03d-61cb0b8aef52/turtlebot3_teleop_keyboard-1*.log  
all processes on machine have died, roslaunch will exit  
shutting down processing monitor...  
... shutting down processing monitor complete  
done  
raibuntu@Raibuntu66:~$
```

1. Press **Ctrl+Alt+Shift+R** to start recording what is on your screen.
A red circle is displayed in the top right corner of the screen when the recording is in progress.
2. Once you have finished, press **Ctrl+Alt+Shift+R** again to stop the recording.
3. The video is automatically saved in your Videos folder in your home folder, with a file name that starts with Screencast and includes the date and time it was taken.

If you do not have a Videos folder, the videos will be saved in your home folder instead.

Ulteriori informazioni
Trucchi e suggerimenti — Get the most out of GNOME with these handy tips.

You can choose the **displayed language** by adding a language suffix to the web address so it ends with e.g. `.html.en` or `.html.de`. If the web address has no language suffix, the preferred language specified in your web browser's settings is used. For your convenience: [\[Change to English Language \]](#) [\[Change to Browser's Preferred Language \]](#)

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That's it for today...

See you next time!

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