UNIVERSITÀ DEGLI STUDI DELLA BASILICATA



Corso di Sistemi Informativi
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Docente
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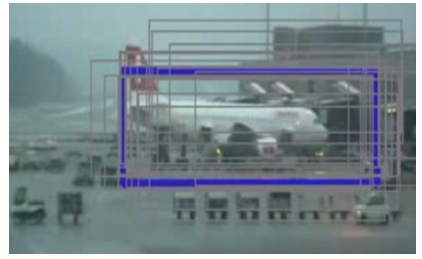
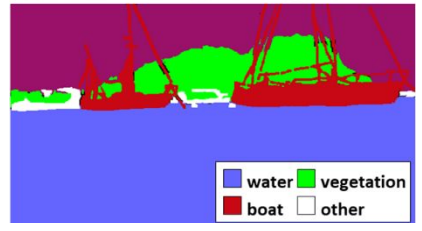
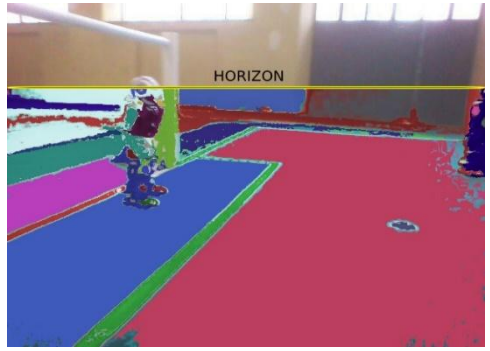
ROS launch file





Maggio 2019


roslaunch

roslaunch è un tool per semplificare

- il lancio di più nodi ROS
- il settaggio dei parametri

roslaunch utilizza i cosiddetti “launch file” che sono file XML contenenti la lista dei nodi da lanciare con i rispettivi parametri

roslaunch - sintassi

```
roslaunch <package> <launch file>
```

- i launch file hanno per convenzione un nome che termina con .launch

- `roscore` viene automaticamente lanciato quando si esegue `roslaunch`

Esempio launch file

```
<launch>
  <node name="talker" pkg="hello_ros" type="talker" output="screen"/>
  <node name="listener" pkg="hello_ros" type="listener" output="screen"/>
</launch>
```

- Il tag <node> contiene gli attributi per specificare il nome con cui il nome verrà inserito nel grafo di ROS, il package nel quale può essere trovato e il type, che è il filename dell'eseguibile

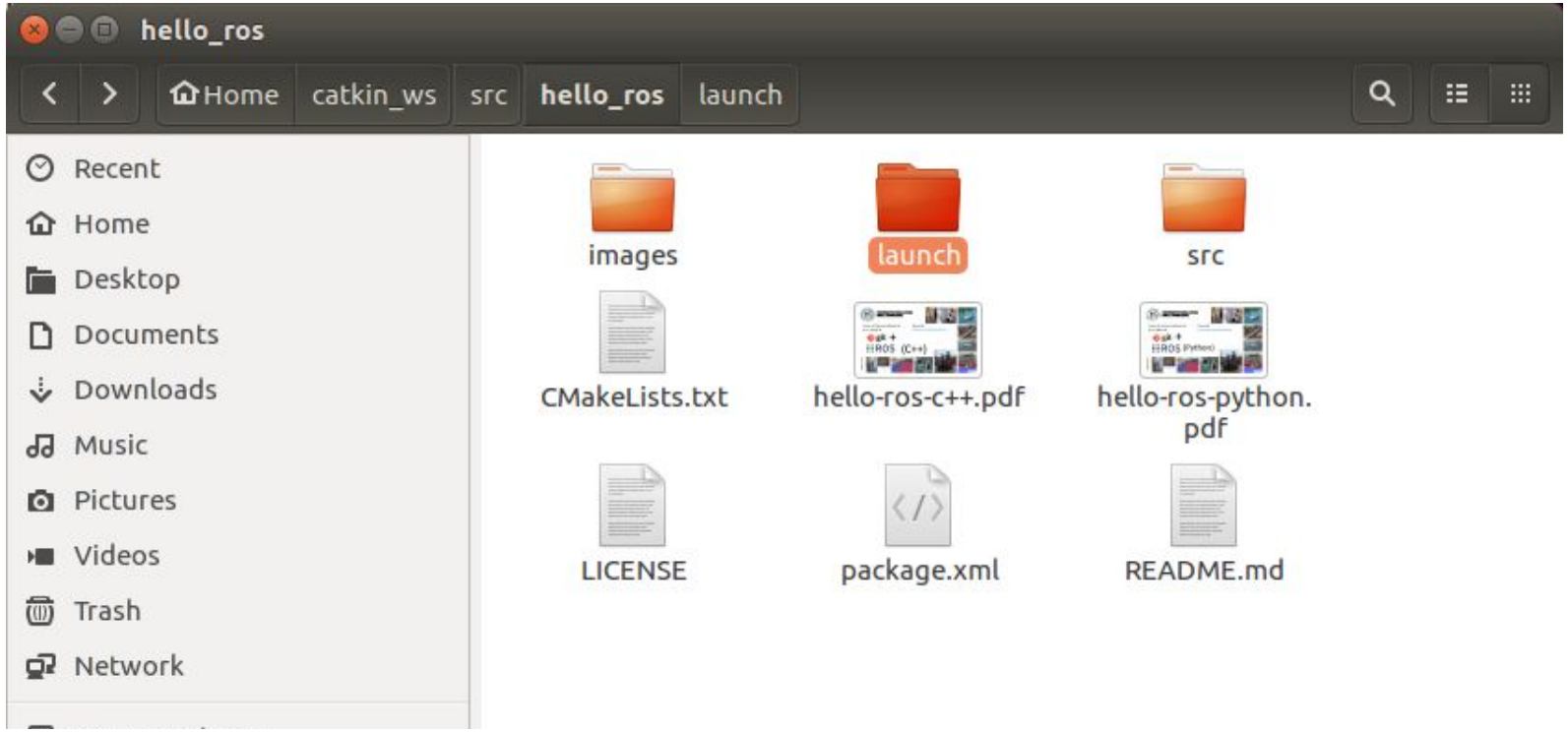
- L'attributo output posto a "screen" indica che i messaggi di log di ROS verranno mostrati sul terminale su cui verrà eseguito il comando roslaunch

hello_ros: git repo recap

```
bloisi@bloisi-U36SG:~/catkin_ws/src$ git clone https://github.com/dbloisi/hello_ros.git
Cloning into 'hello_ros'...
remote: Enumerating objects: 26, done.
remote: Counting objects: 100% (26/26), done.
remote: Compressing objects: 100% (26/26), done.
remote: Total 74 (delta 13), reused 0 (delta 0), pack-reused 48
Unpacking objects: 100% (74/74), done.
Checking connectivity... done.
bloisi@bloisi-U36SG:~/catkin_ws/src$ cd hello_ros
bloisi@bloisi-U36SG:~/catkin_ws/src/hello_ros$ ls
CMakeLists.txt     hello-ros-python.pdf  LICENSE      README.md
hello-ros-c++.pdf  images                package.xml  src
bloisi@bloisi-U36SG:~/catkin_ws/src/hello_ros$
```

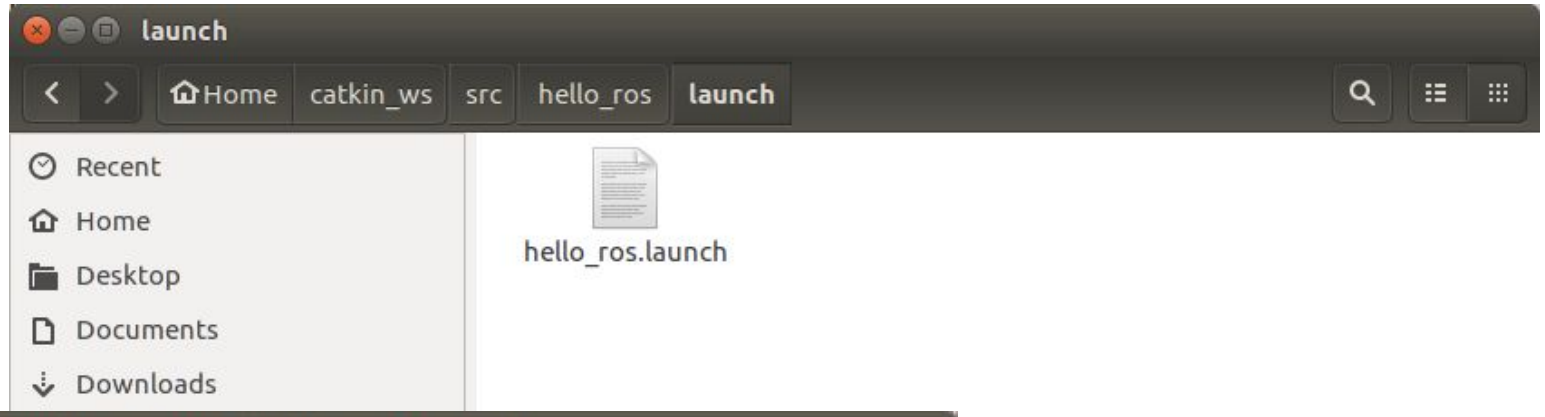
hello_ros launch file

Creiamo una cartella launch



hello_ros launch file

Creiamo dentro la cartella launch il file hello_ros.launch



hello_ros.launch (~/catkin_ws/src/hello_ros) - gedit

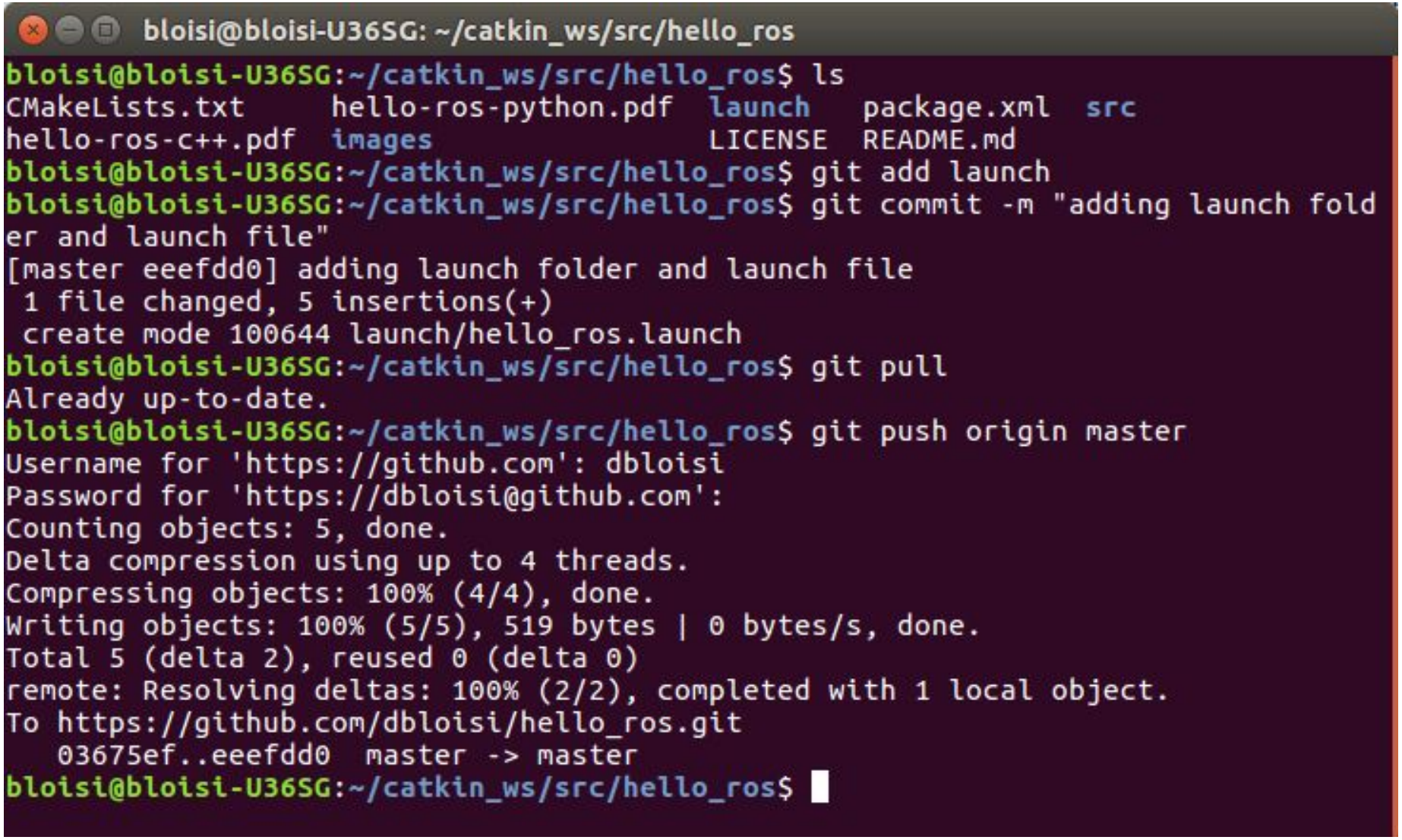
Open Save

```
1 <launch>
2     <node name="talker" pkg="hello_ros" type="talker"
  output="screen"/>
3     <node name="listener" pkg="hello_ros" type="listener"
  output="screen"/>
4 </launch>
5
```

hello_ros launch file: esecuzione

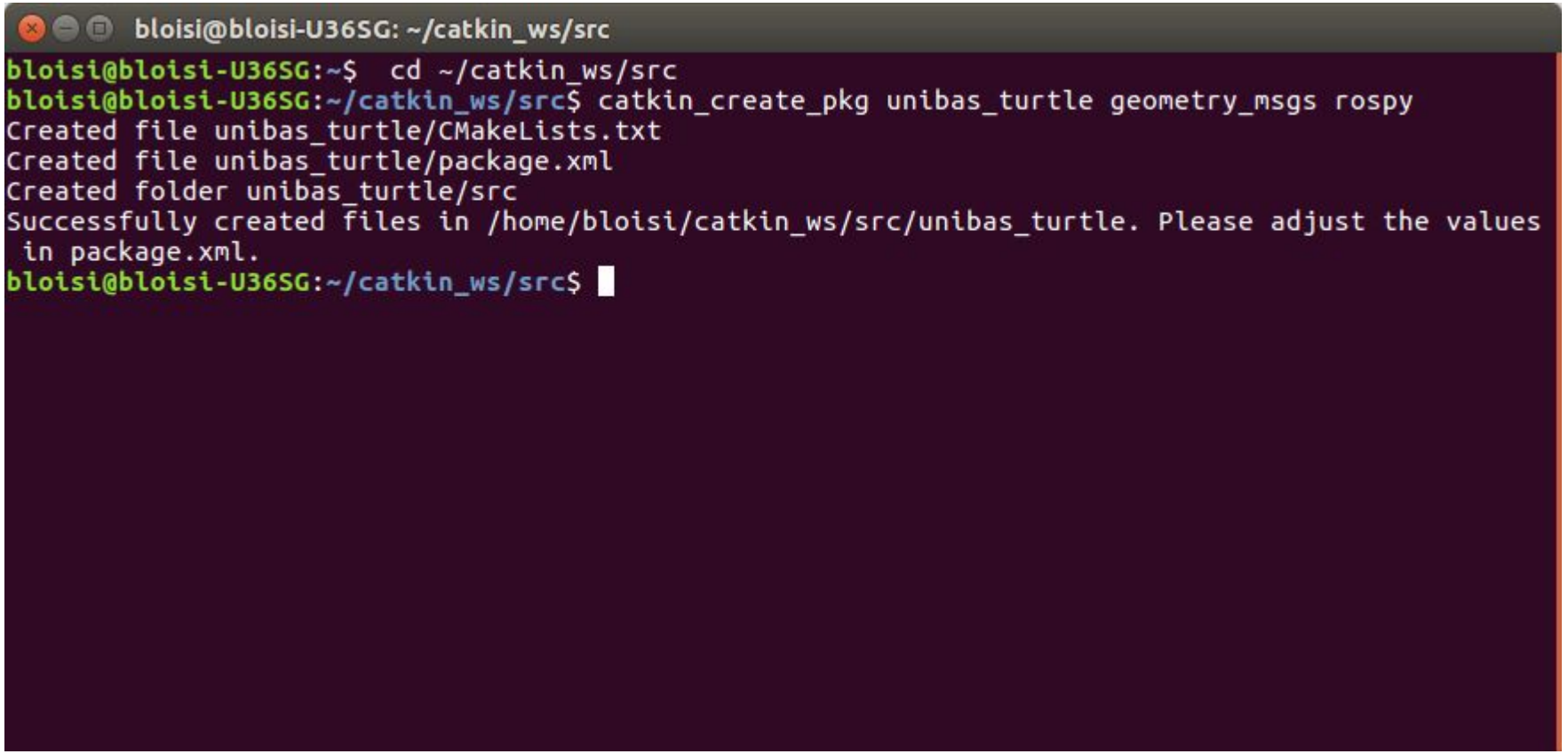
```
bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ roslaunch hello_ros hello_ros.launch
... logging to /home/bloisi/.ros/log/2977c8b2-716e-11e9-a68b-50465dde6884/roslau
nch-bloisi-U36SG-6381.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://localhost:41695/

SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.14

NODES
  /
    listener (hello_ros/listener)
    talker (hello_ros/talker)

auto-starting new master
process[master]: started with pid [6391]
ROS_MASTER_URI=http://localhost:11311

setting /run_id to 2977c8b2-716e-11e9-a68b-50465dde6884
process[rosout-1]: started with pid [6404]
started core service [/rosout]
process[talker-2]: started with pid [6408]
process[listener-3]: started with pid [6422]
[ INFO] [1557305357.648592063]: hello world 0
[ INFO] [1557305357.748768063]: hello world 1
[ INFO] [1557305357.848722995]: hello world 2
[ INFO] [1557305357.948727541]: hello world 3
[ INFO] [1557305357.949373170]: I heard: [hello world 3]
[ INFO] [1557305358.048732949]: hello world 4
[ INFO] [1557305358.049583276]: I heard: [hello world 4]
[ INFO] [1557305358.148735150]: hello world 5
[ INFO] [1557305358.149535192]: I heard: [hello world 5]
[ INFO] [1557305358.248783039]: hello world 6
```

hello_ros launch file: git



Package unibas_turtle

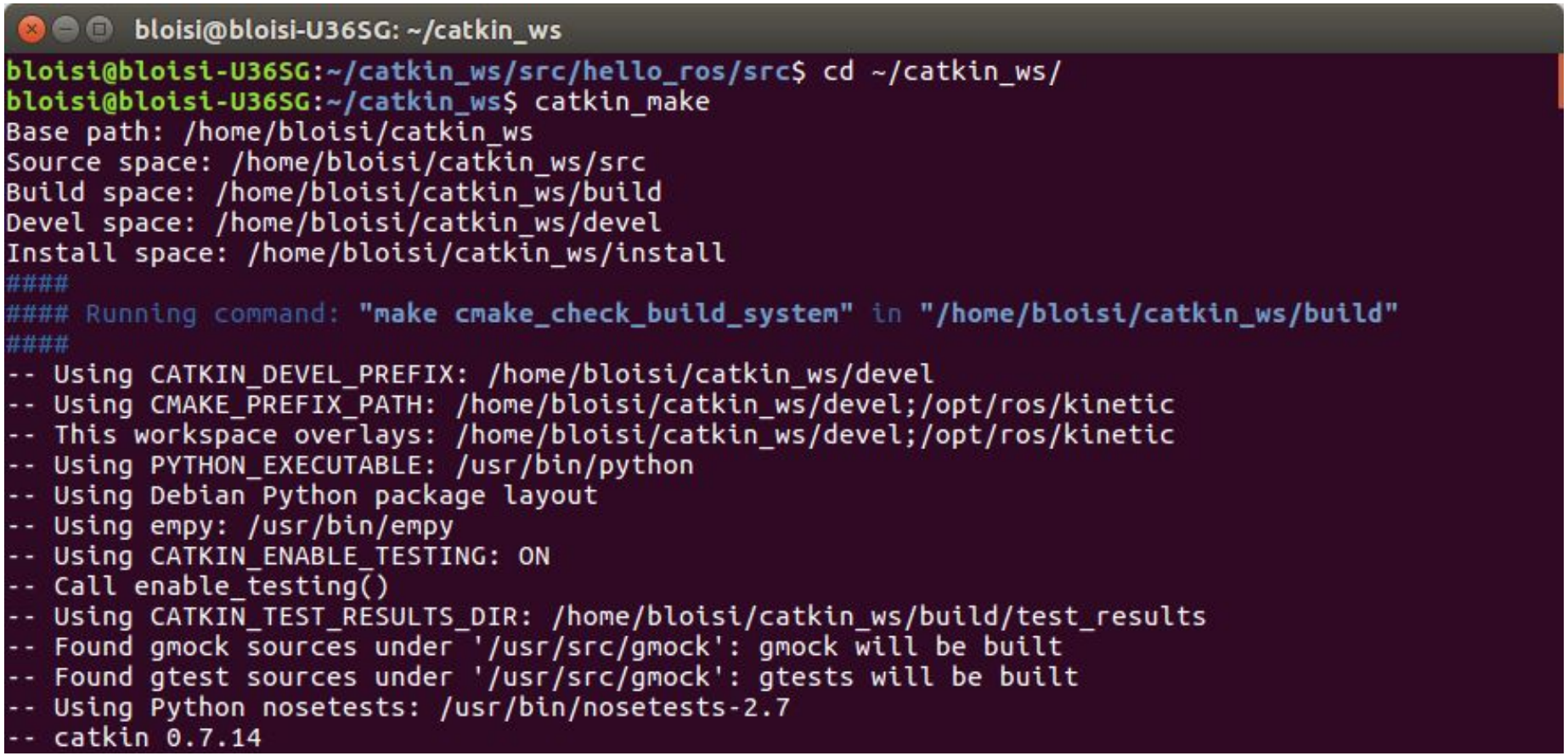
$ cd ~/catkin_ws/src
$ catkin_create_pkg unibas_turtle geometry_msgs rospy



http://wiki.ros.org/turtlesim/Tutorials/Moving%20in%20a%20Straight%20Line

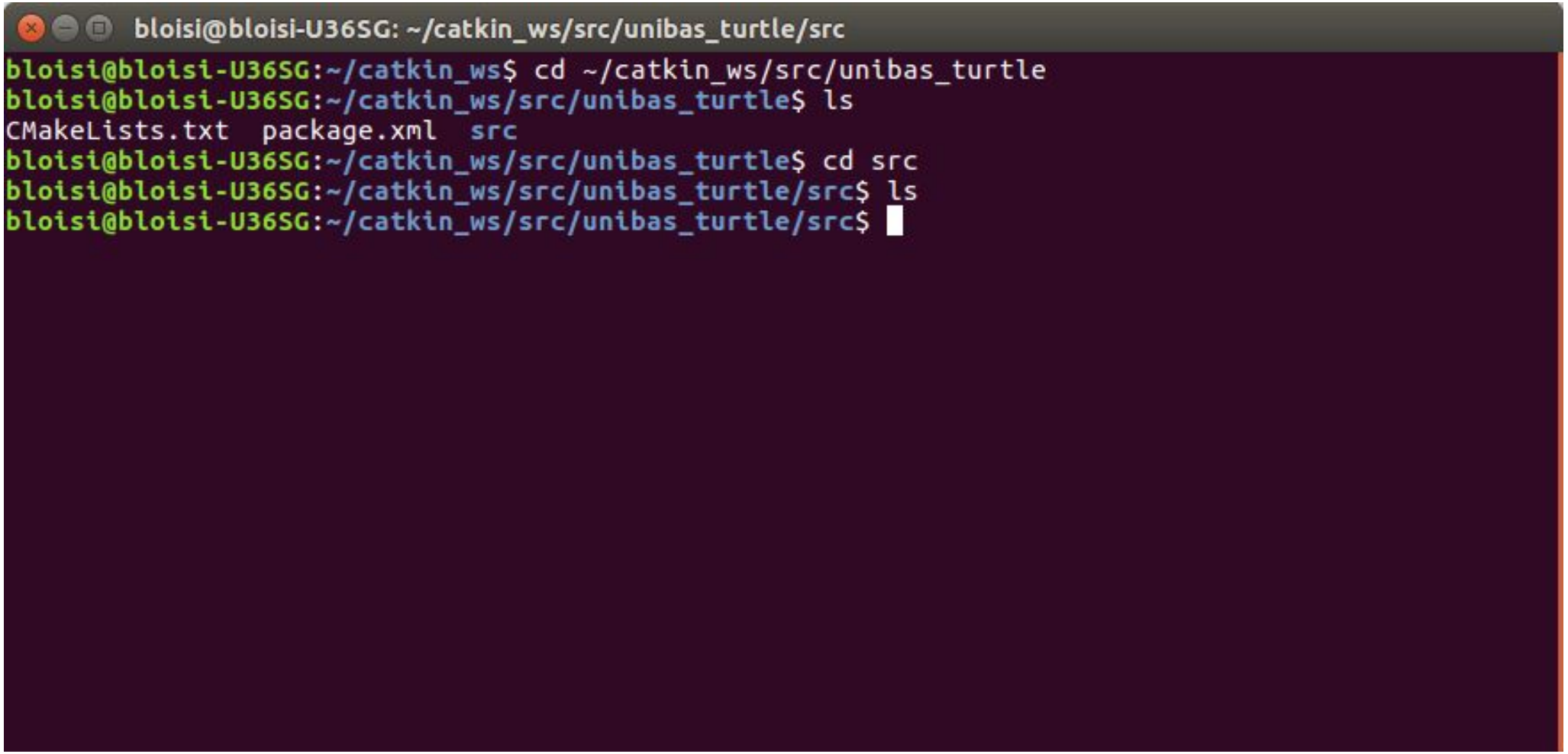
Package unibas_turtle

$ cd ~/catkin_ws
$ catkin_make



http://wiki.ros.org/turtlesim/Tutorials/Moving%20in%20a%20Straight%20Line

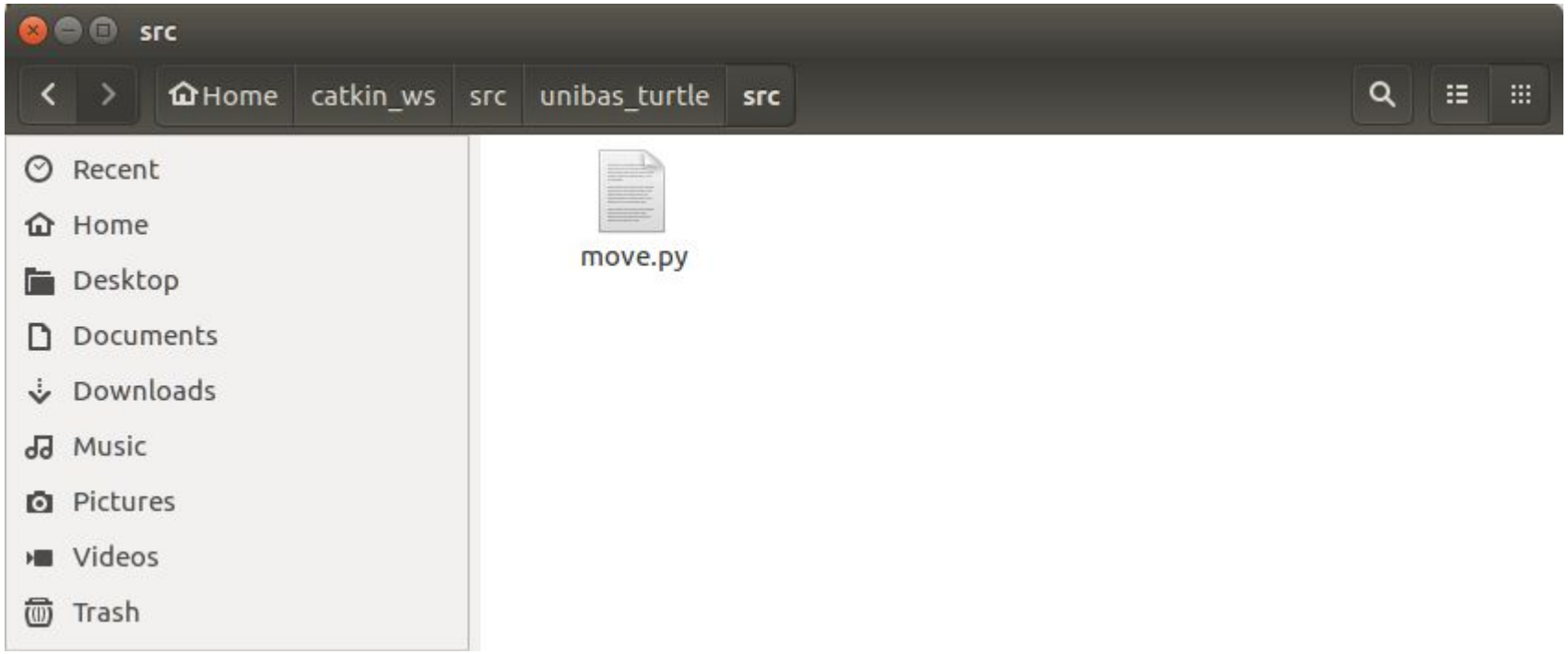
Package unibas_turtle: src

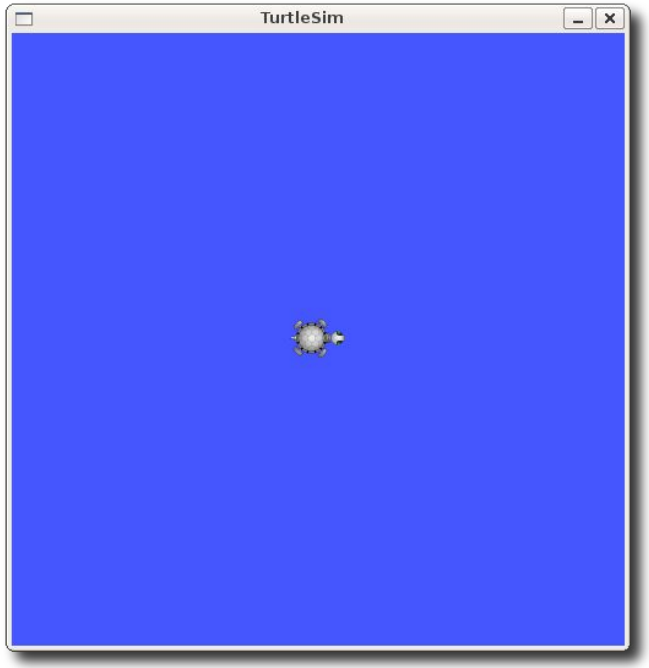


http://wiki.ros.org/turtlesim/Tutorials/Moving%20in%20a%20Straight%20Line

Package unibas_turtle: src

Creaiamo un file move.py per far muovere la tartaruga di turtlesim





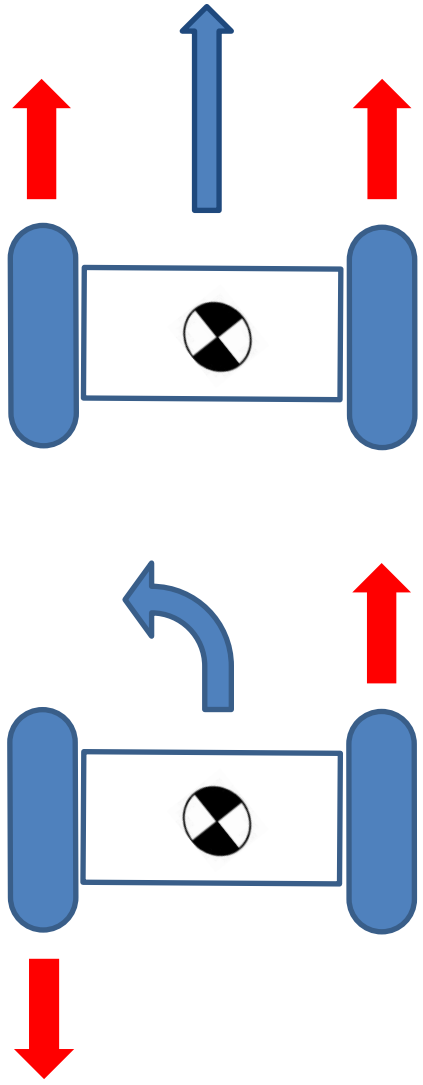
http://wiki.ros.org/turtlesim/Tutorials/Moving%20in%20a%20Straight%20Line
http://wiki.ros.org/turtlesim

idea

- Vogliamo far muovere la tartaruga controllandone la velocità
- Utilizziamo per la tartaruga il modello di un robot differenziale
- In questo modo possiamo utilizzare per il controllo la velocità lineare e la velocità angolare

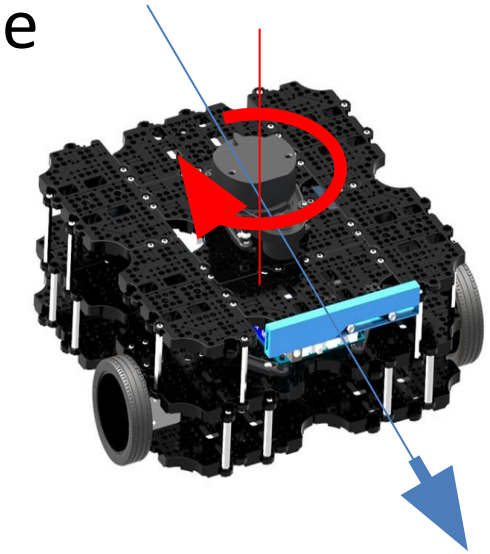
Differential drive robot

- Un robot differenziale su ruote è una base mobile avente due ruote motorizzate indipendenti
- Le ruote sono posizionate ai due lati opposti della scocca
- Il robot si muove in avanti quando entrambe le ruote gira in avanti, mentre gira sul posto quando una ruota gira in avanti e l'altra gira all'indietro



Movimento del robot

- Data la sua configurazione, un robot differenziale può muoversi solo in avanti o indietro lungo il suo asse longitudinale e può ruotare solo lungo il suo asse verticale
- Il robot non potrà muoversi di lato o verticalmente
- Per tali motivi ci bastano la componente lineare x e la componente angolare z per controllare il movimento
- Nel caso di un robot omnidirezionale, avremo anche una componente y per lo spostamento laterale
- Quante componenti avremo per un robot underwater?



Comandi di velocità in ROS

Per far muovere un robot in ROS è necessario pubblicare Twist messages sul topic cmd_vel

geometry_msgs/Twist Message

File: geometry_msgs/Twist.msg

Raw Message Definition

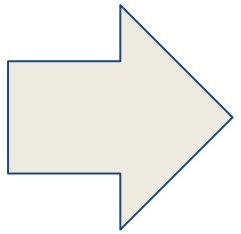
```
# This expresses velocity in free space broken into its linear and angular parts.
Vector3  linear
Vector3  angular
```

Compact Message Definition

```
geometry_msgs/Vector3 linear
geometry_msgs/Vector3 angular
```

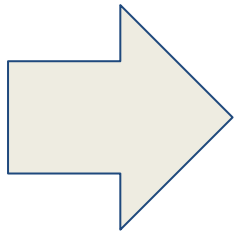
move.py

```
#!/usr/bin/env python
import rospy
from geometry_msgs.msg import Twist

def move():
    # Starts a new node
    rospy.init_node('robot_cleaner', anonymous=True)
    velocity_publisher = rospy.Publisher('/turtle1/cmd_vel', Twist, queue_size=10)
    vel_msg = Twist()
```



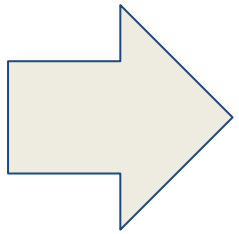
move.py

```
#Receiveing the user's input
print("Let's move your robot")
speed = input("Input your speed:")
distance = input("Type your distance:")
isForward = input("Foward?: ")#True or False

#Checking if the movement is forward or backwards
if(isForward):
    vel_msg.linear.x = abs(speed)
else:
    vel_msg.linear.x = -abs(speed)

#Since we are moving just in x-axis
vel_msg.linear.y = 0
vel_msg.linear.z = 0
vel_msg.angular.x = 0
vel_msg.angular.y = 0
vel_msg.angular.z = 0
```



move.py

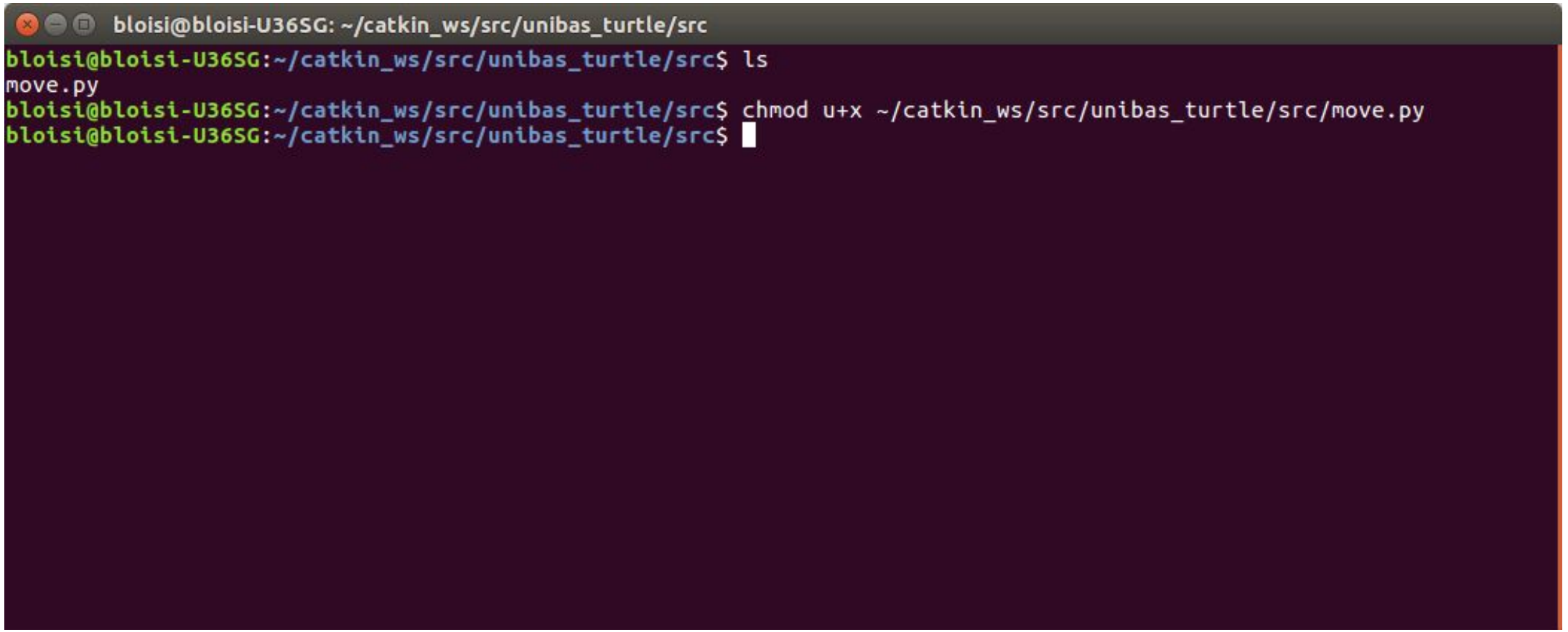
```
while not rospy.is_shutdown():
    #Setting the current time for distance calculus
    t0 = rospy.Time.now().to_sec()
    current_distance = 0

    #Loop to move the turtle in an specified distance
    while(current_distance < distance):
        #Publish the velocity
        velocity_publisher.publish(vel_msg)
        #Takes actual time to velocity calculus
        t1=rospy.Time.now().to_sec()
        #Calculates distancePoseStamped
        current_distance= speed*(t1-t0)
    #After the loop, stops the robot
    vel_msg.linear.x = 0
    #Force the robot to stop
    velocity_publisher.publish(vel_msg)
```



move.py

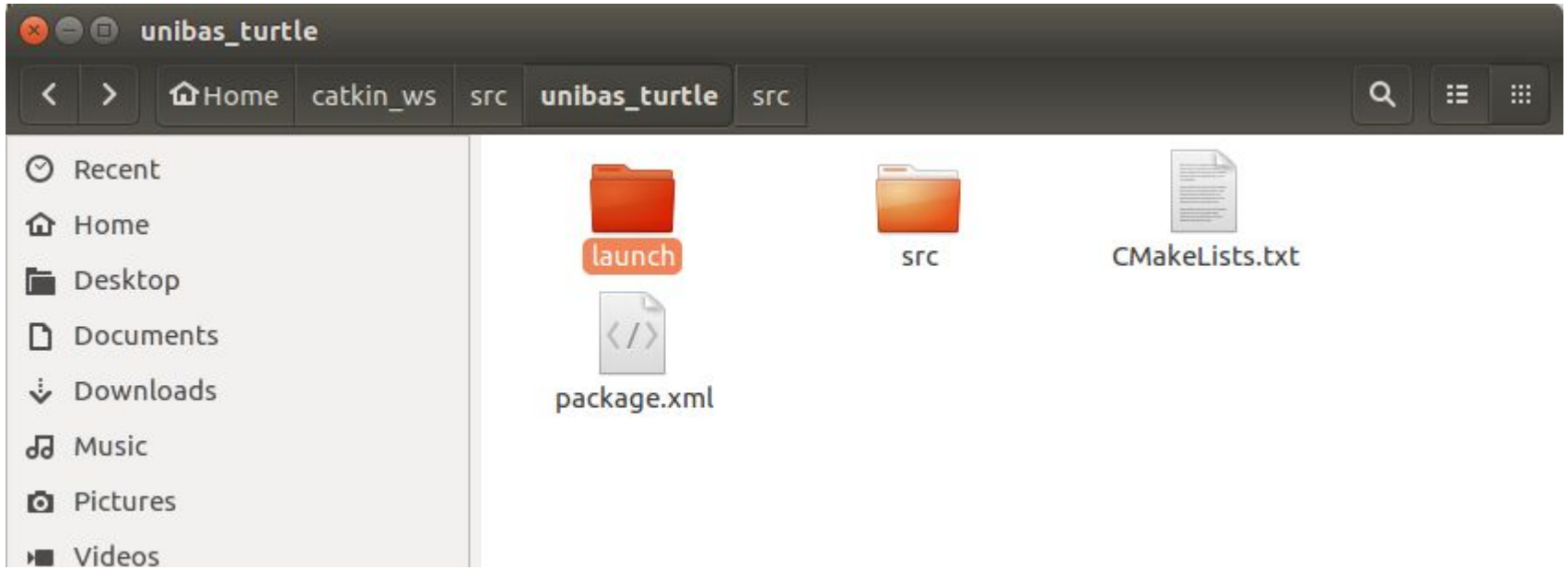
```
if __name__ == '__main__':
    try:
        #Testing our function
        move()
     except rospy.ROSInterruptException: pass
```

permessi per move.py



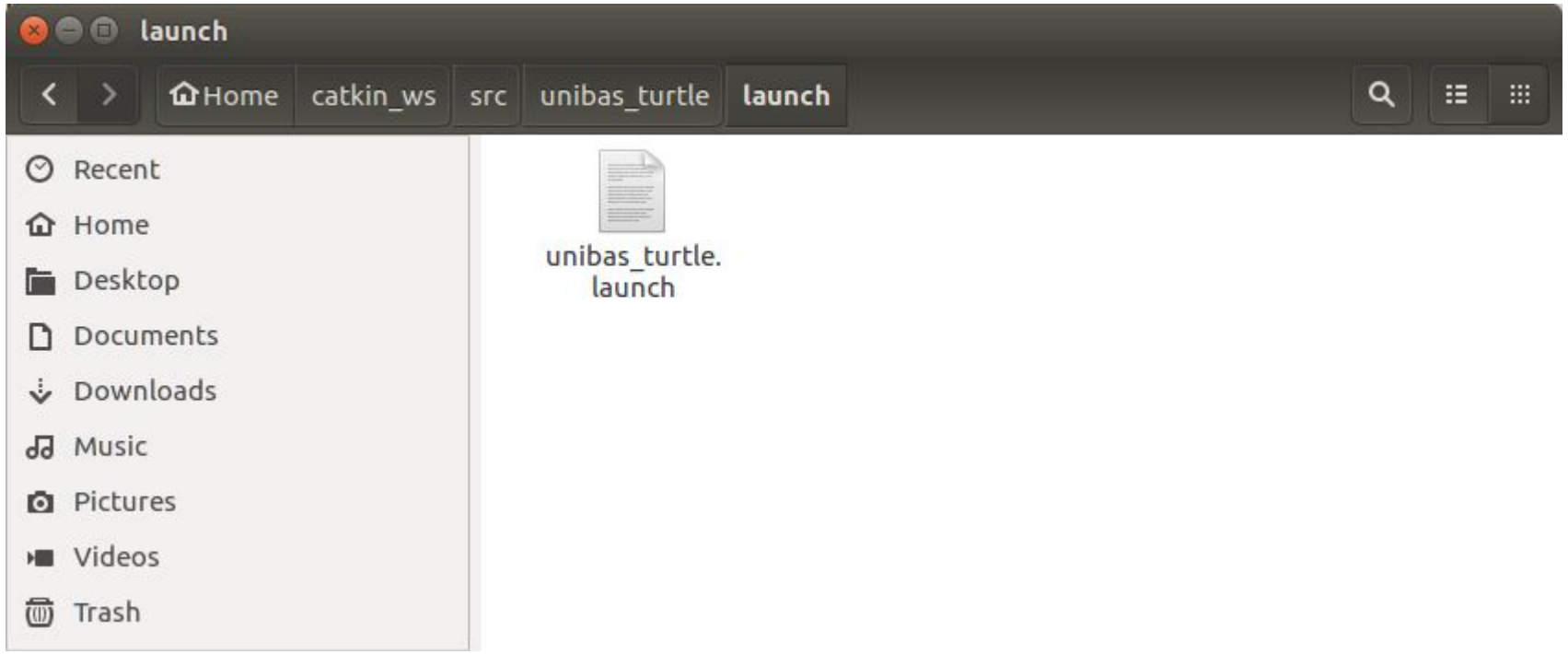
Launch file per unibas_turtle

Creiamo una cartella launch



Launch file per unibas_turtle

Creiamo un file unibas_turtle.launch dentro la cartella launch



unibas_turtle.launch

unibas_turtle.launch (~/catkin_ws/src/unibas_turtle/launch) - gedit

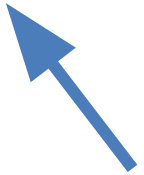
Open

```
1 <launch>
2     <node name="turtlesim_node" pkg="turtlesim" type="turtlesim_node" output="screen"/>
3     <node name="move" pkg="unibas_turtle" type="move.py" output="screen"/>
4 </launch>
5
```

Esempio roslaunch

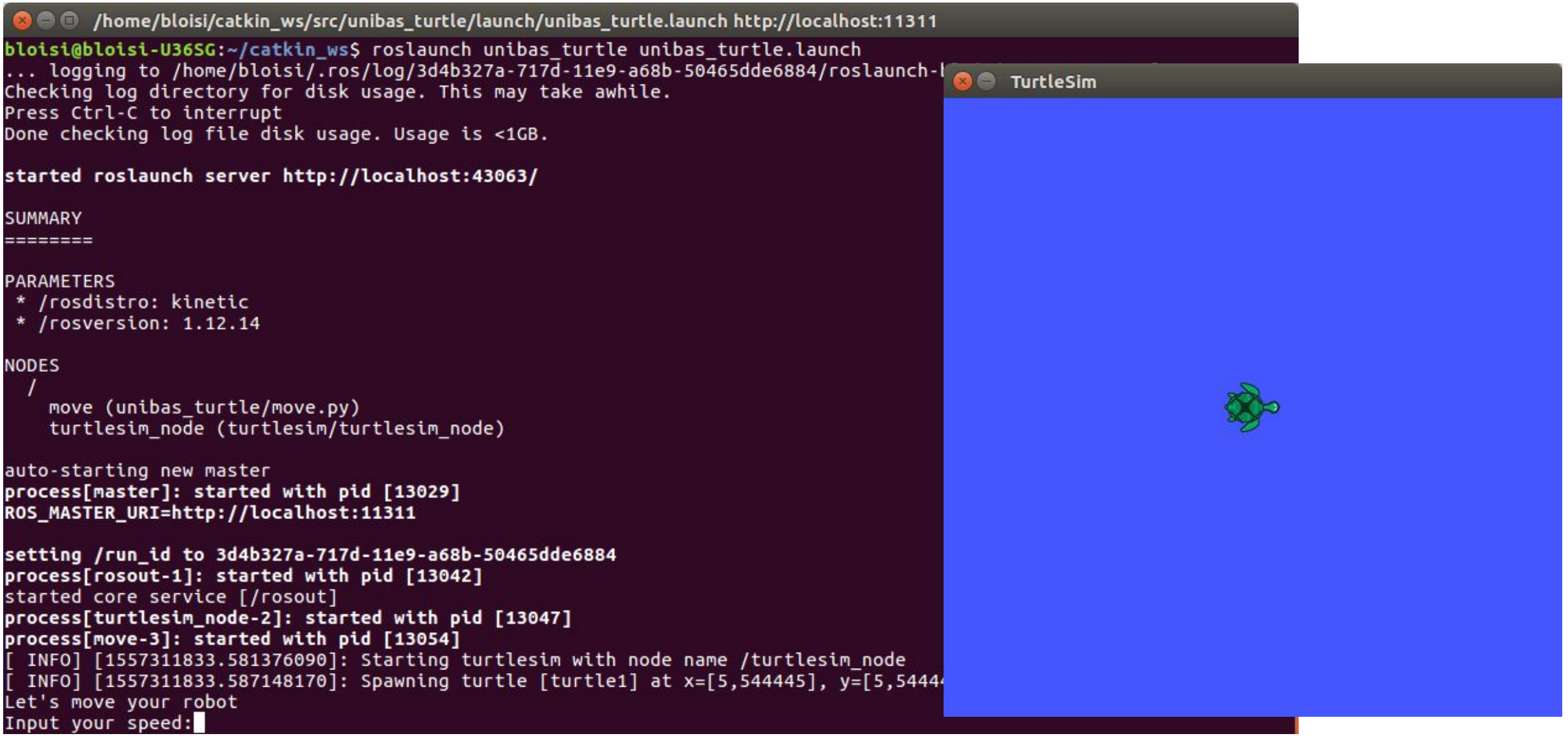
```
roslaunch unibas_turtle unibas_turtle.launch
```

ROS package name

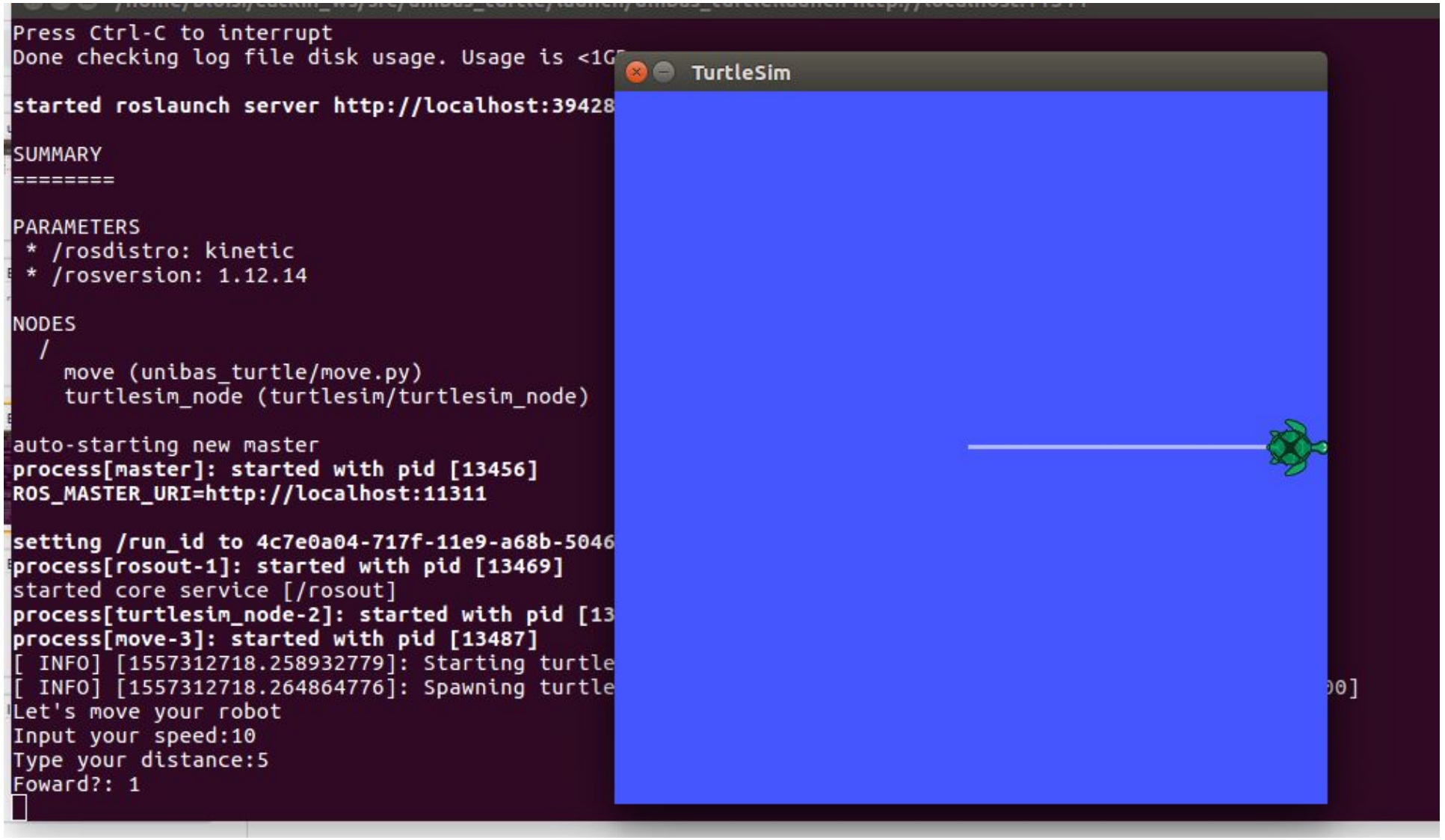


launch file name

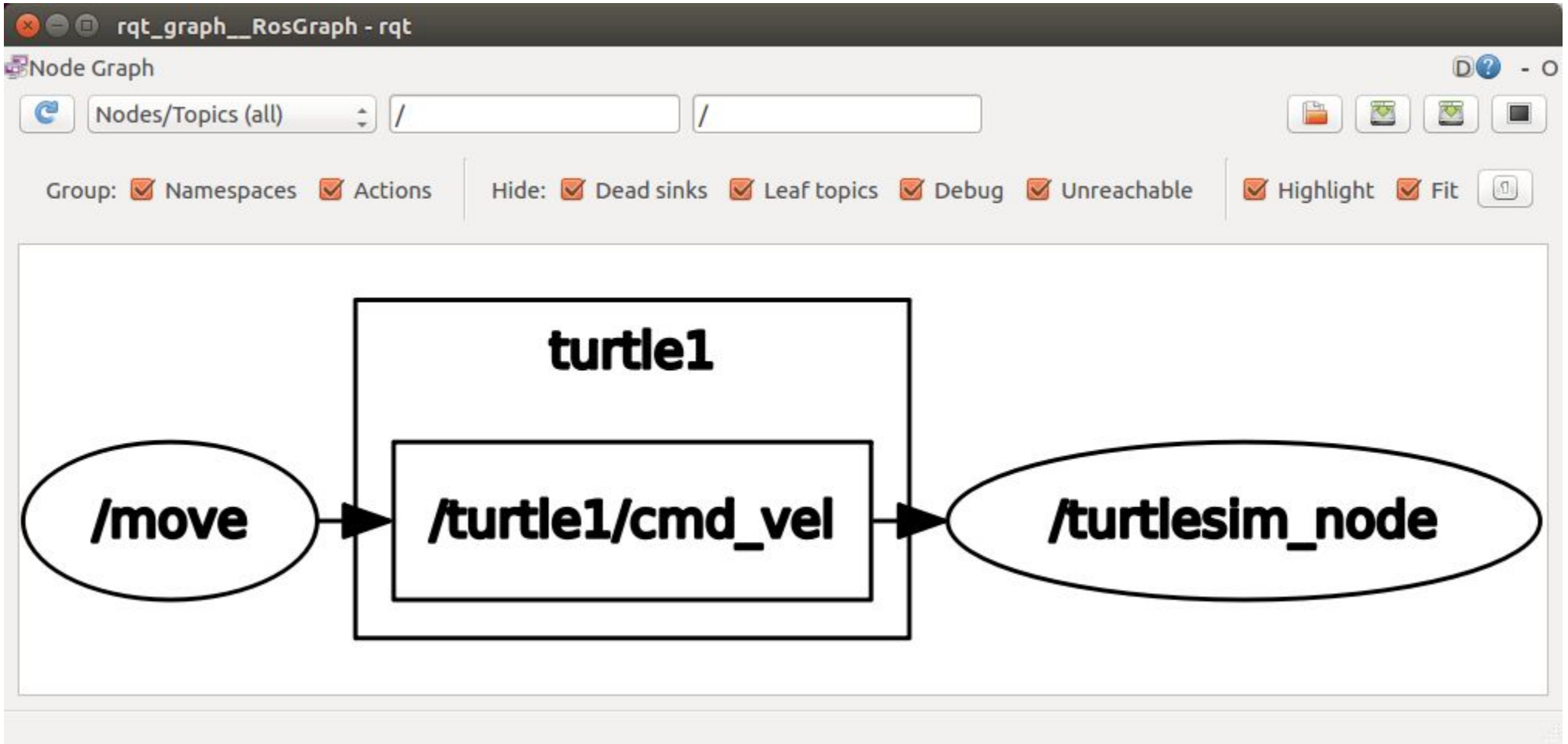
Esecuzione roslaunch



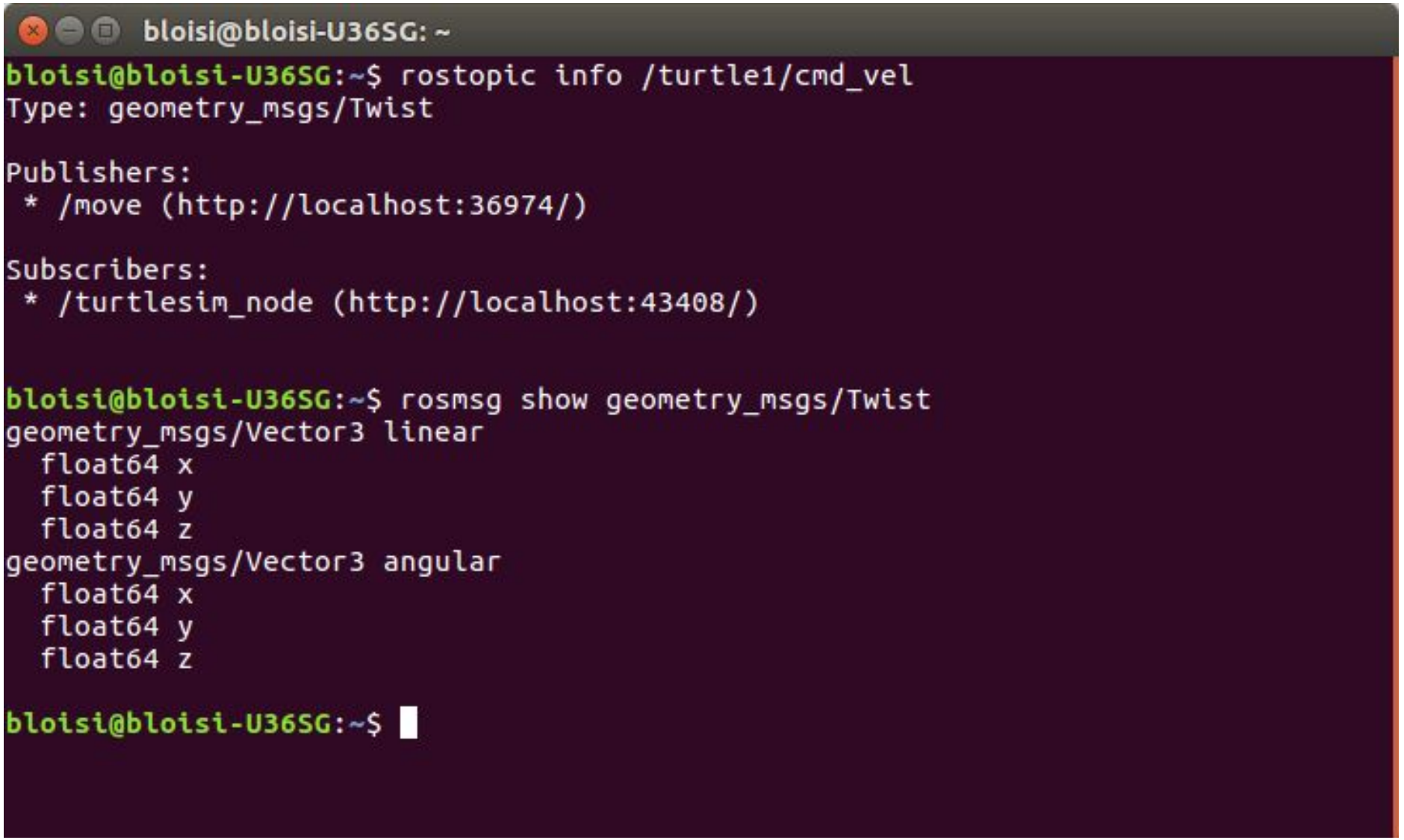
Esecuzione roslaunch



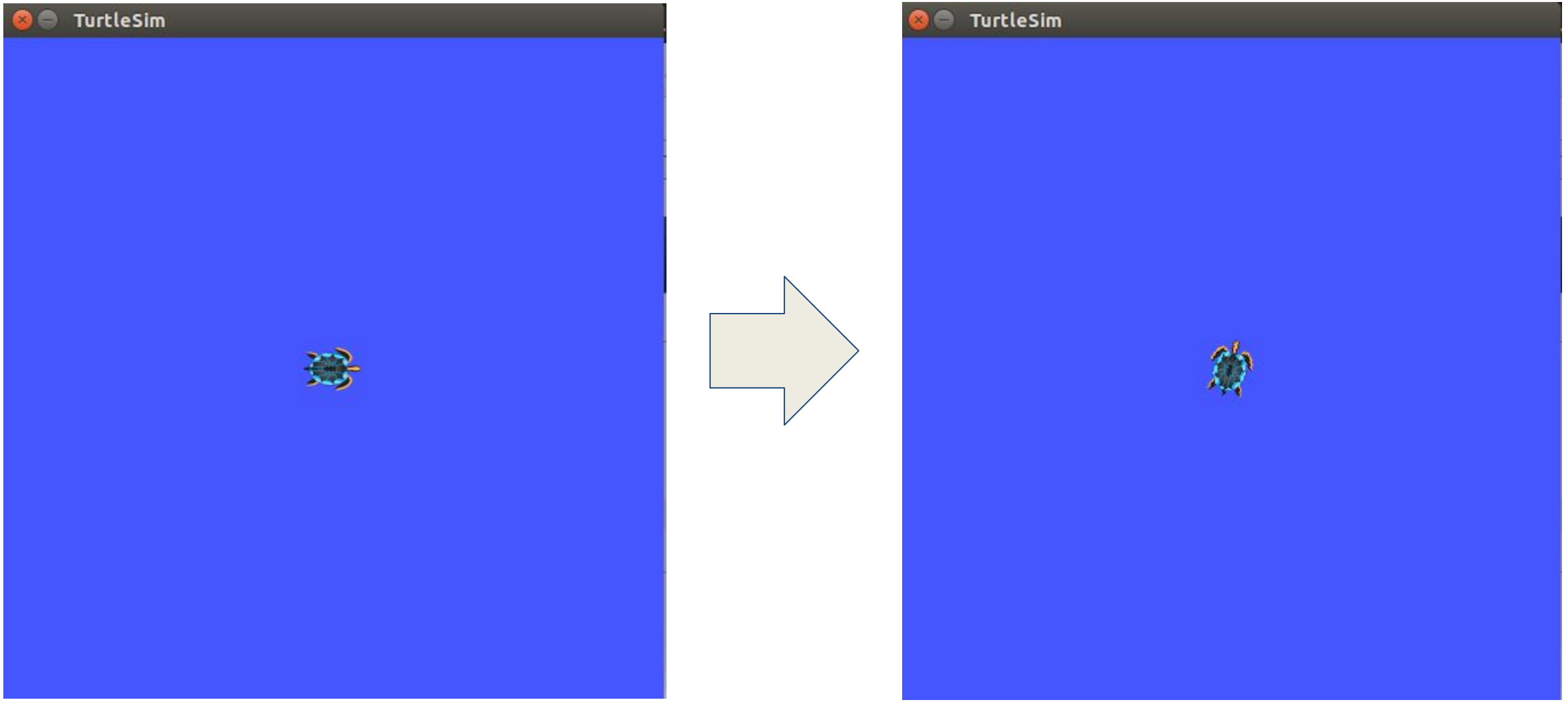
rqt_graph


rqt_graph__RosGraph - rqt
Node Graph
Nodes/Topics (all)
/
/
Group: Namespaces Actions
Hide: Dead sinks Leaf topics Debug Unreachable
Highlight Fit
turtle1
/move
/turtle1/cmd_vel
/turtlesim_node

topic e message



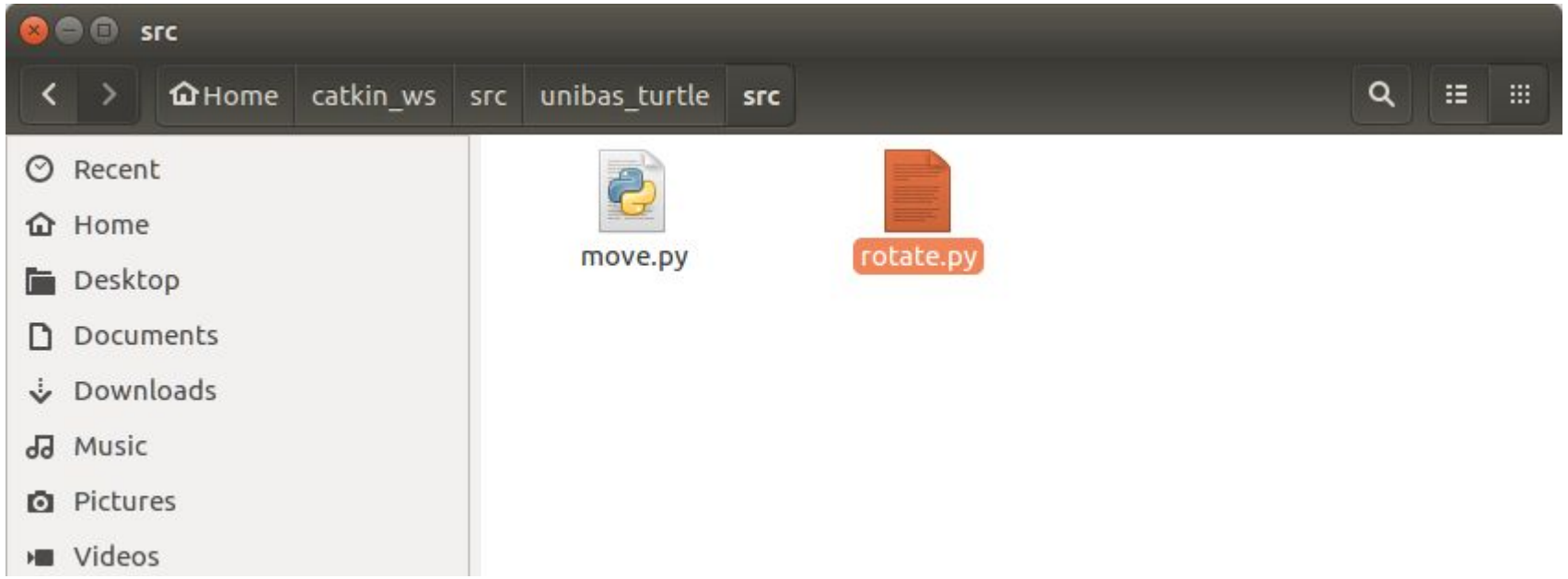
Rotating left and right



http://wiki.ros.org/turtlesim/Tutorials/Rotating%20Left%20and%20Right

creazione di rotate.py

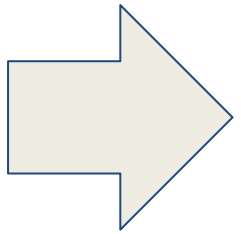
Creiamo un file rotate.py dentro la cartella src



http://wiki.ros.org/turtlesim/Tutorials/Rotating%20Left%20and%20Right

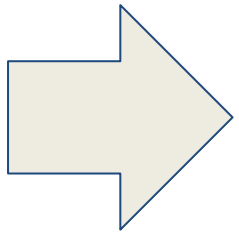
rotate.py

```
#!/usr/bin/env python
import rospy
from geometry_msgs.msg import Twist
PI = 3.1415926535897

def rotate():
    #Starts a new node
    rospy.init_node('robot_cleaner', anonymous=True)
    velocity_publisher = rospy.Publisher('/turtle1/cmd_vel', Twist, queue_size=10)
    vel_msg = Twist()
```



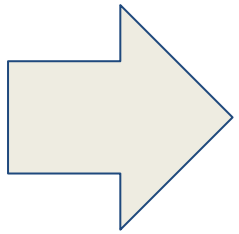
rotate.py

```
 # Receiveing the user's input
print("Let's rotate your robot")
speed = input("Input your speed (degrees/sec):")
angle = input("Type your distance (degrees):")
clockwise = input("Clockwise?: ") #True or false

#Converting from angles to radians
angular_speed = speed*2*PI/360
relative_angle = angle*2*PI/360

#We wont use linear components
vel_msg.linear.x=0
vel_msg.linear.y=0
vel_msg.linear.z=0
vel_msg.angular.x = 0
vel_msg.angular.y = 0
```



rotate.py

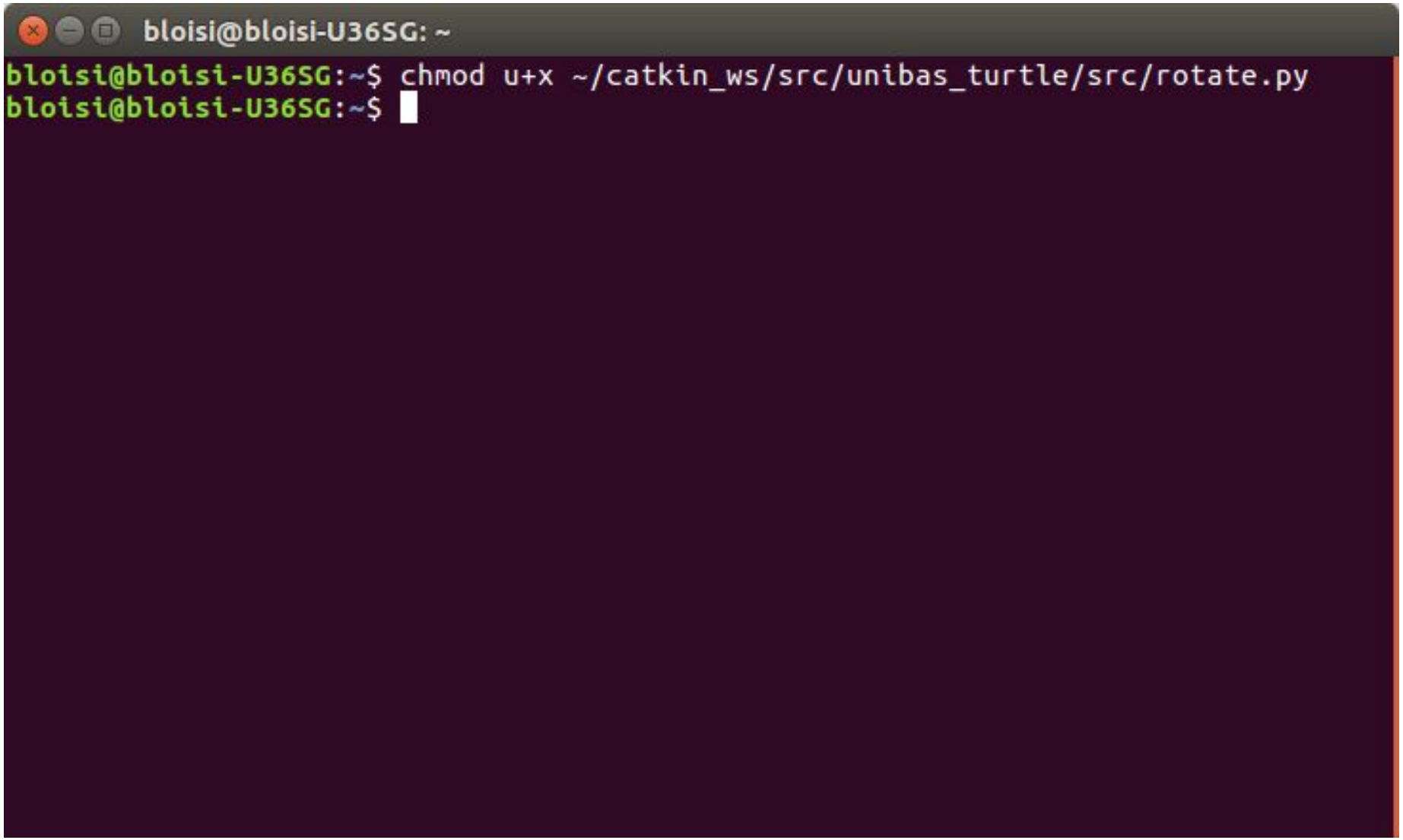
```
# Checking if our movement is CW or CCW
if clockwise:
    vel_msg.angular.z = -abs(angular_speed)
else:
    vel_msg.angular.z = abs(angular_speed)
# Setting the current time for distance calculus
t0 = rospy.Time.now().to_sec()
current_angle = 0

while(current_angle < relative_angle):
    velocity_publisher.publish(vel_msg)
    t1 = rospy.Time.now().to_sec()
    current_angle = angular_speed*(t1-t0)
```



rotate.py

```
    #Forcing our robot to stop
    vel_msg.angular.z = 0
    velocity_publisher.publish(vel_msg)
    rospy.spin()

if __name__ == '__main__':
    try:
        # Testing our function
        rotate()
    except rospy.ROSInterruptException:
         pass
```

permessi per rotate.py

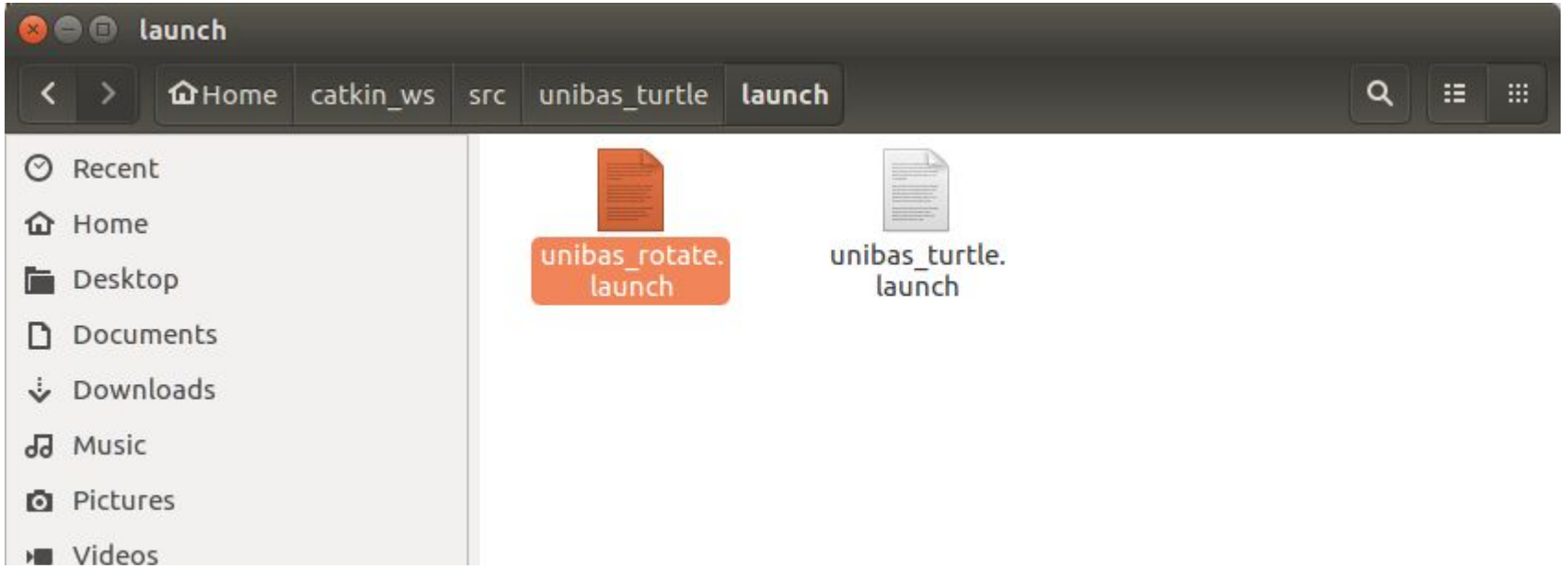


launch file per il nodo rotate

unibas_rotate.launch (~/catkin_ws/src/unibas_turtle/launch) - gedit

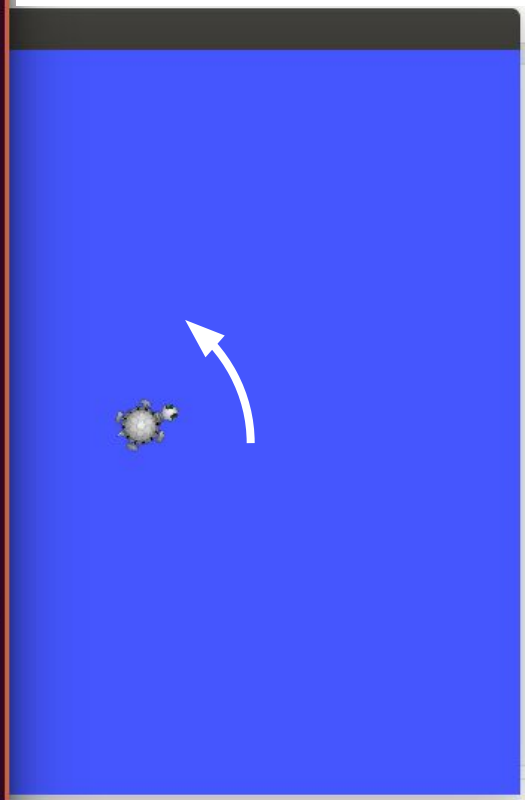
Open Save

```
1 <launch>
2     <node name="turtlesim_node" pkg="turtlesim" type="turtlesim_node" output="screen"/>
3     <node name="rotate" pkg="unibas_turtle" type="rotate.py" output="screen"/>
4 </launch>
5
```

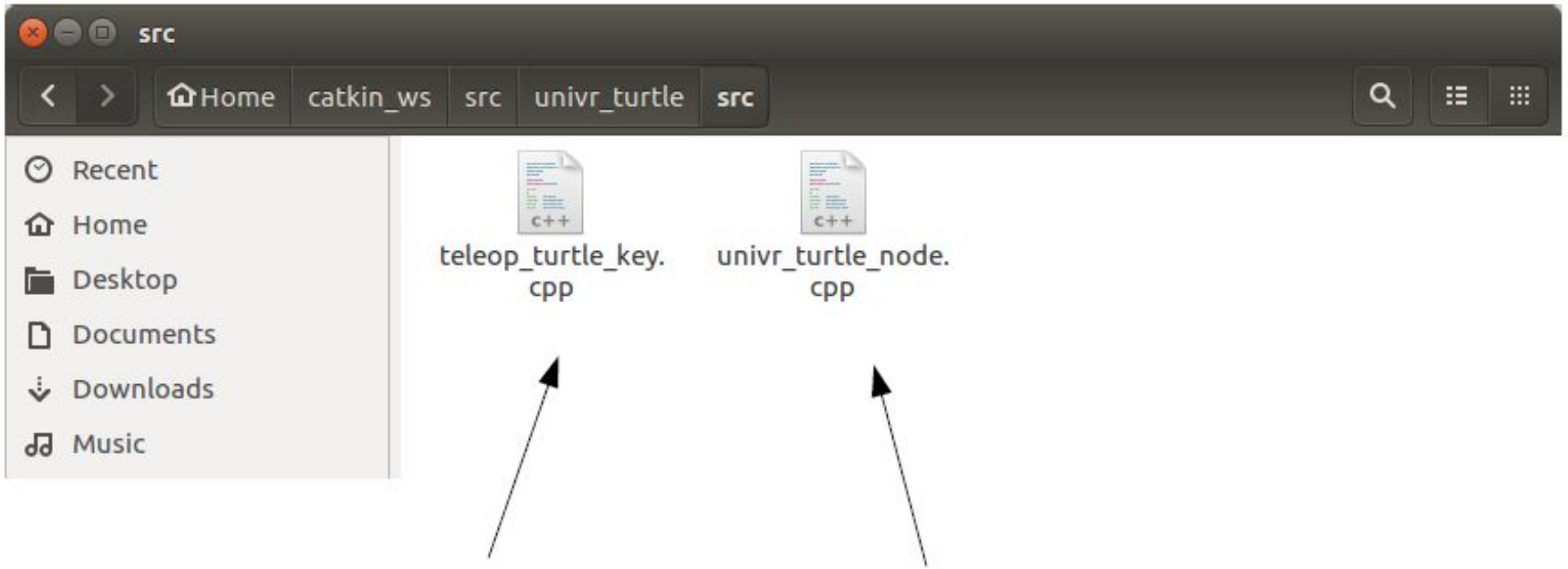


esecuzione per il nodo rotate

```
/home/bloisi/catkin_ws/src/unibas_turtle/launch/unibas_rotate.launch http://localhost:1
bloisi@bloisi-U36SG:~$ roslaunch unibas_turtle unibas_rotate.launch
... logging to /home/bloisi/.ros/log/f094ced0-7188-11e9-a68b-50465dde6884/roslau
nch-bloisi-U36SG-15722.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://localhost:35672/

SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.14

NODES
  /
    rotate (unibas_turtle/rotate.py)
    turtlesim_node (turtlesim/turtlesim_node)

auto-starting new master
process[master]: started with pid [15733]
ROS_MASTER_URI=http://localhost:11311

setting /run_id to f094ced0-7188-11e9-a68b-50465dde6884
process[rosout-1]: started with pid [15746]
started core service [/rosout]
process[turtlesim_node-2]: started with pid [15753]
process[rotate-3]: started with pid [15764]
[ INFO] [1557316858.857799883]: Starting turtlesim with node name /turtlesim_nod
e
[ INFO] [1557316858.864551185]: Spawning turtle [turtle1] at x=[5,544445], y=[5,
544445], theta=[0,000000]
Let's rotate your robot
Input your speed (degrees/sec):5
Type your distance (degrees):45
Clockwise?: 0
```



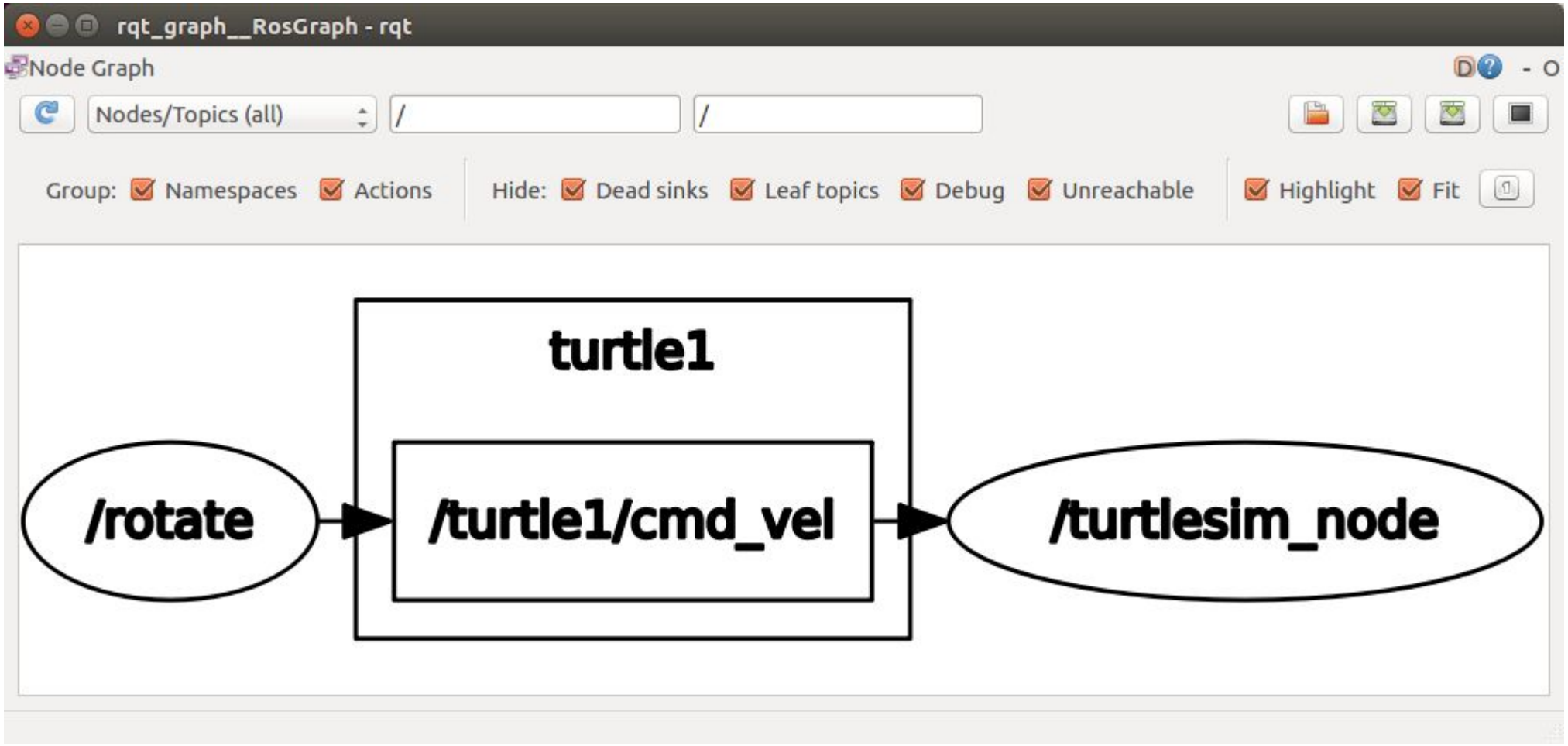
I nodi di univr_turtle



Nodo per la gestione della teleoperazione

nodo per il controllo in velocità della tartaruga

rqt_graph


rqt_graph__RosGraph - rqt
Node Graph
Nodes/Topics (all)
/
/
Group: Namespaces Actions
Hide: Dead sinks Leaf topics Debug Unreachable
Highlight Fit
turtle1
/rotate
/turtle1/cmd_vel
/turtlesim_node

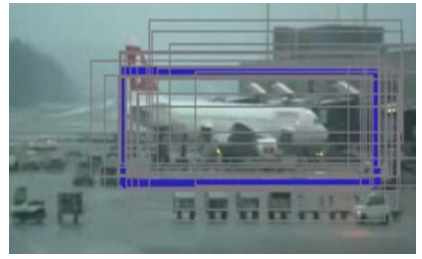
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA

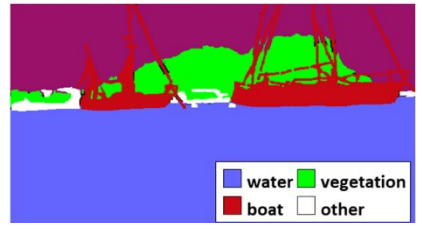


Corso di Sistemi Informativi
A.A. 2018/19

Docente
Domenico Daniele Bloisi

ROS launch file





Maggio 2019