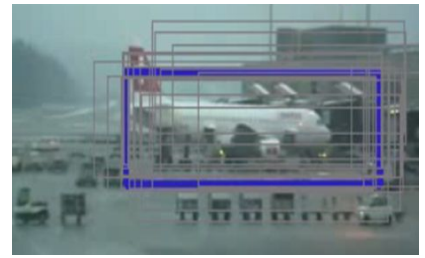
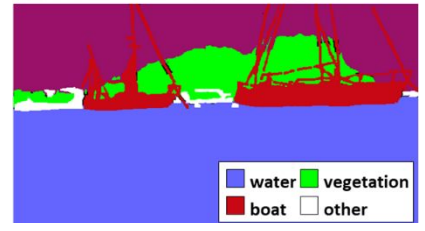






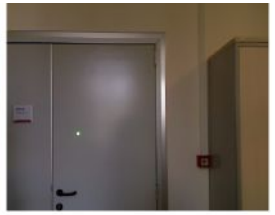
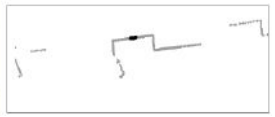
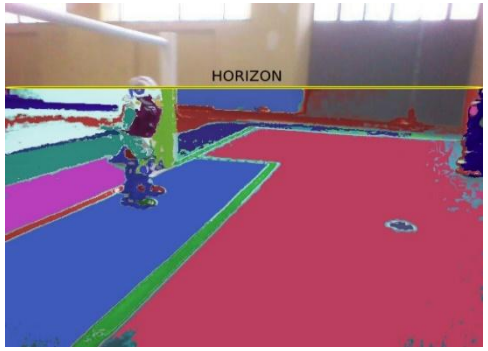


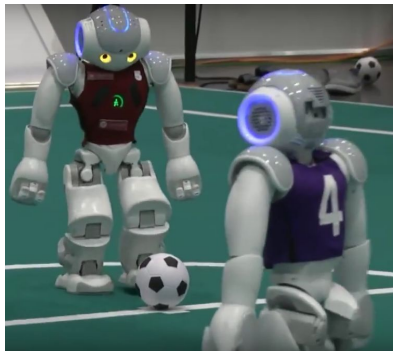
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA

Corso di Sistemi Informativi
A.A. 2018/19

Docente
Domenico Daniele Bloisi

rosbag




Maggio 2019

References and credits

Queste slide si basano sul materiale contenuto nel libro

YoonSeok Pyo, HanCheol Cho, RyuWoon Jung, TaeHoon Lim,
“ROS Robot Programming - A Handbook Written by TurtleBot3 Developers”
http://www.robotis.com/service/download.php?no=719

rosbag

- I dati contenuti nei messaggi ROS possono essere registrati in appositi file
- Il file che contiene i messaggi prende il nome di bag e ha l'estensione ".bag"
- Il vantaggio offerto dai file di bag è quello di avere una registrazione che può essere utilizzata più volte, riproducendo ogni volta l'esatto scenario operativo in cui la bag è stata registrata

rosbag per i dati dei sensori

- Un esempio dell'utilità dei file di bag è dato dalla registrazione dei messaggi contenenti i dati prodotti dai sensori del robot
- Durante gli esperimenti con il robot reale, i dati dei sensori possono essere registrati in una bag
- I messaggi registrati possono essere poi caricati senza la necessità di ripetere l'esperimento, permettendo così di sviluppare con maggiore facilità algoritmi che richiedano modifiche frequenti dei parametri

Usare rosbag

`rosbag` è un package ROS per creare, riprodurre e comprimere bag di messaggi. Una bag è un file contenente i dati relativi a messaggi serializzati

- `rosbag record` → record all the topics
- `rosbag info bag-name` → info on the recorded bag
- `rosbag play --pause bag-name` → play the recorded bag, starting paused
- `rosbag play -r #number bag-name` → play the recorded bag at rate #number

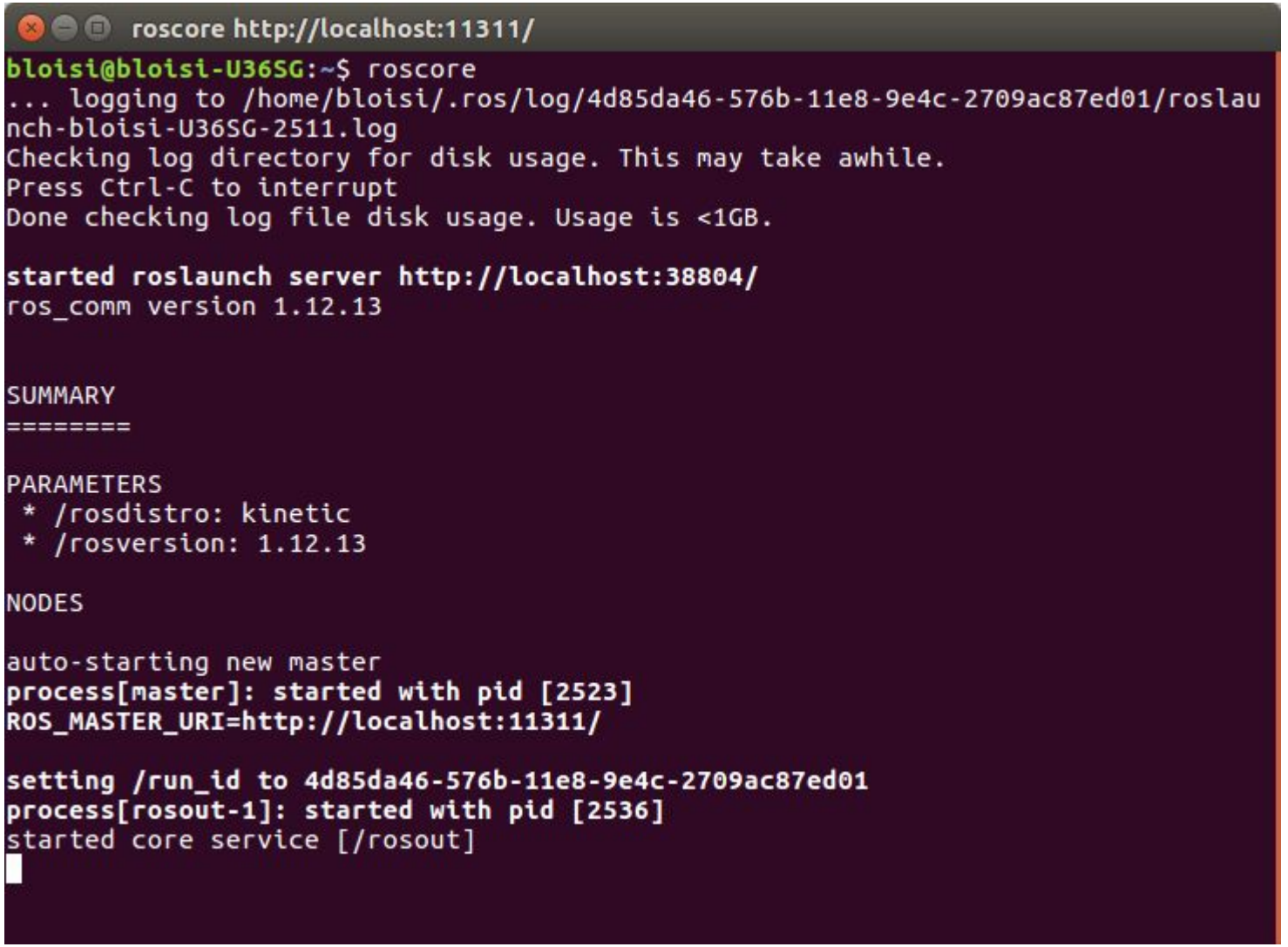
Comandi rosbag

Command	Description
rosbag record [OPTION] [TOPIC_NAME]	Record the message of a specific topic on the bsg file
rosbag info [FILE_NAME]	Check information of a bag file
rosbag play [FILE_NAME]	Play a specific bag file
rosbag compress [FILE_NAME]	Compress a specific bag file
rosbag decompress [FILE_NAME]	Decompresses a specific bag file
rosbag filter [INPUT_FILE] [OUTPUT_FILE] [OPTION]	Create a new bag file with the specific content removed
rosbag reindex bag [FILE_NAME]	Reindex
rosbag check bag [FILE_NAME]	Check if the specific bag file can be played in the current system
rosbag fix [INPUT_FILE] [OUTPUT_FILE] [OPTION]	Fix the bag file version that was saved as an incompatible version

Esempio rosbag

Apriamo un terminal e digitiamo

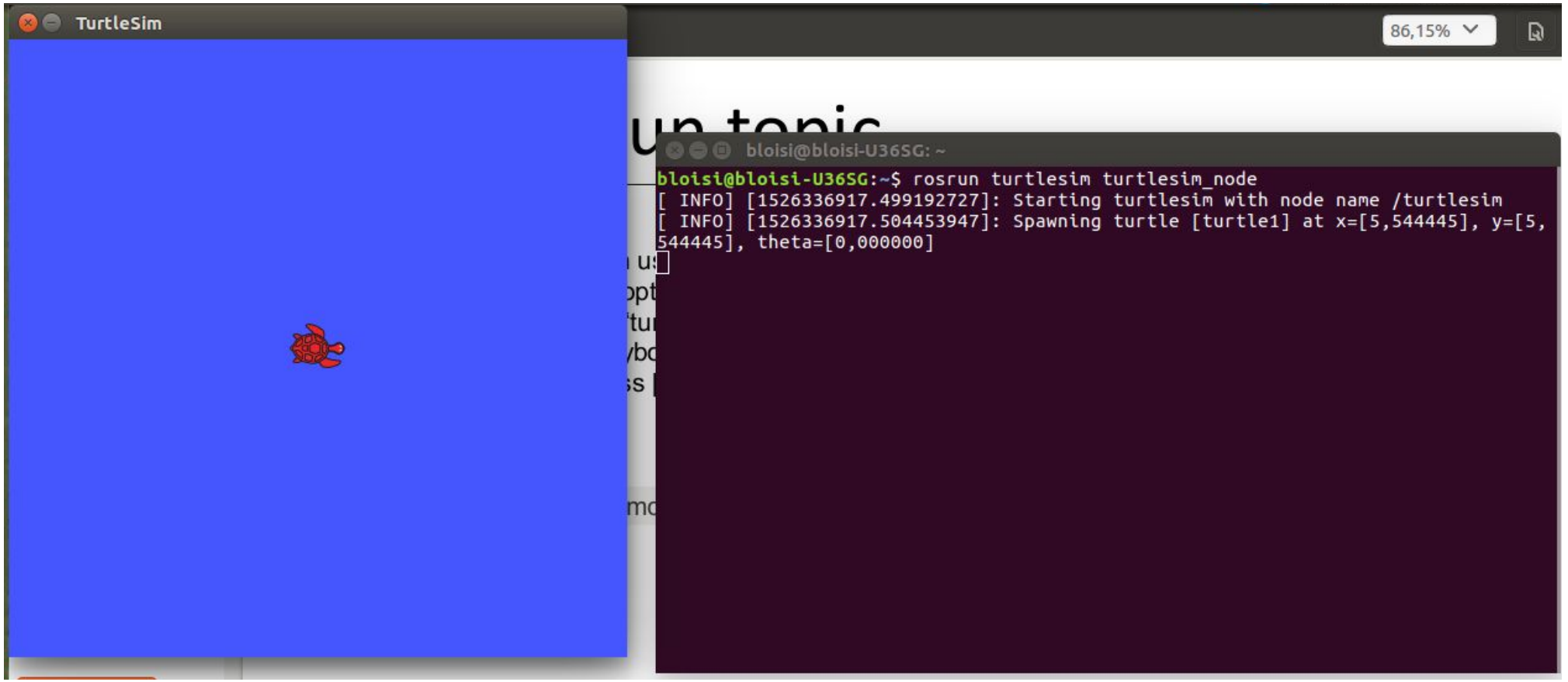
```
$ roscore
```



Esempio rosbag – turtlesim

Apriamo un secondo terminal e digitiamo

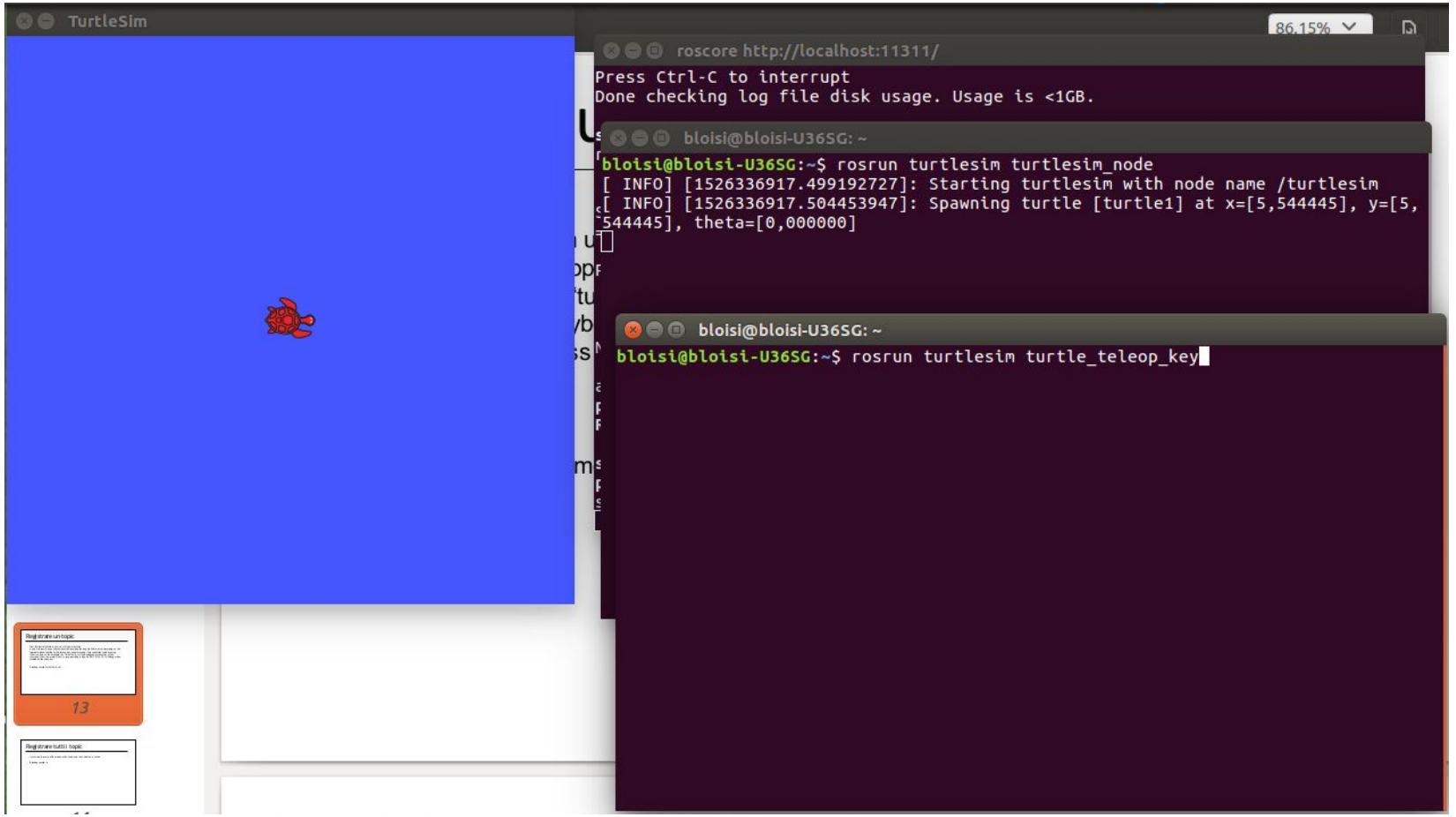
```
$ rosrun turtlesim turtlesim_node
```



Esempio rosbag - teleop

Apriamo un terzo terminal e digitiamo

```
$ rosrun turtlesim turtle_teleop_key
```

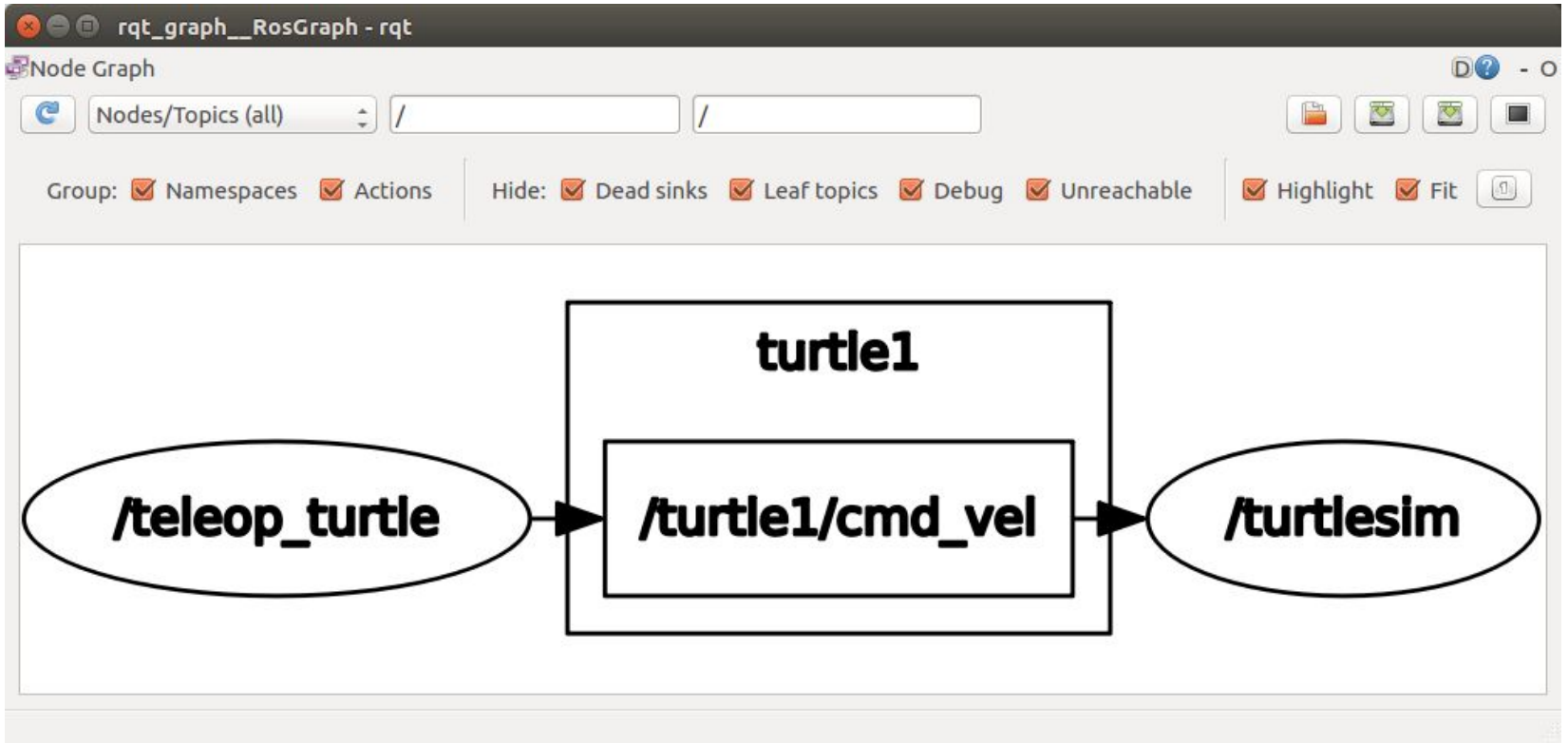


rqt_graph

Apriamo un quarto terminal e digitiamo

```
$ rqt_graph
```

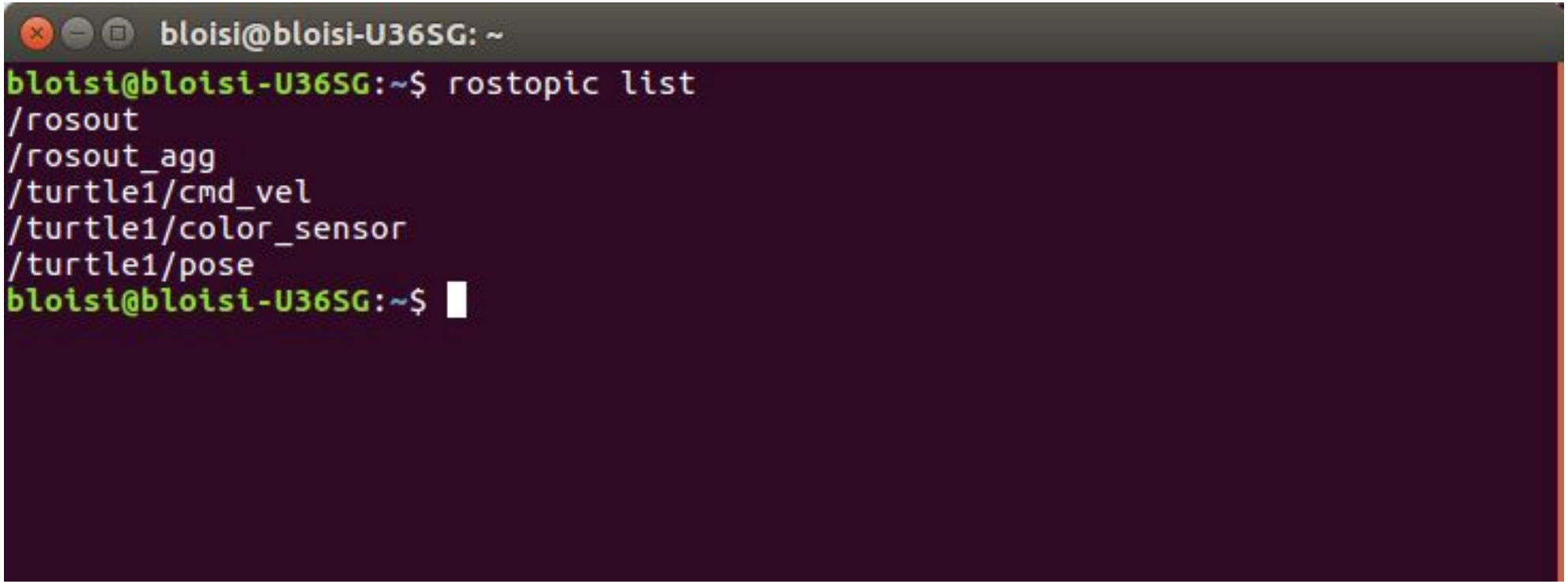
per verificare che i due nodi siano in collegamento tra loro



rostopic

Controlliamo anche a lista dei topic attivi

```
$ rostopic list
```



Registrare un topic

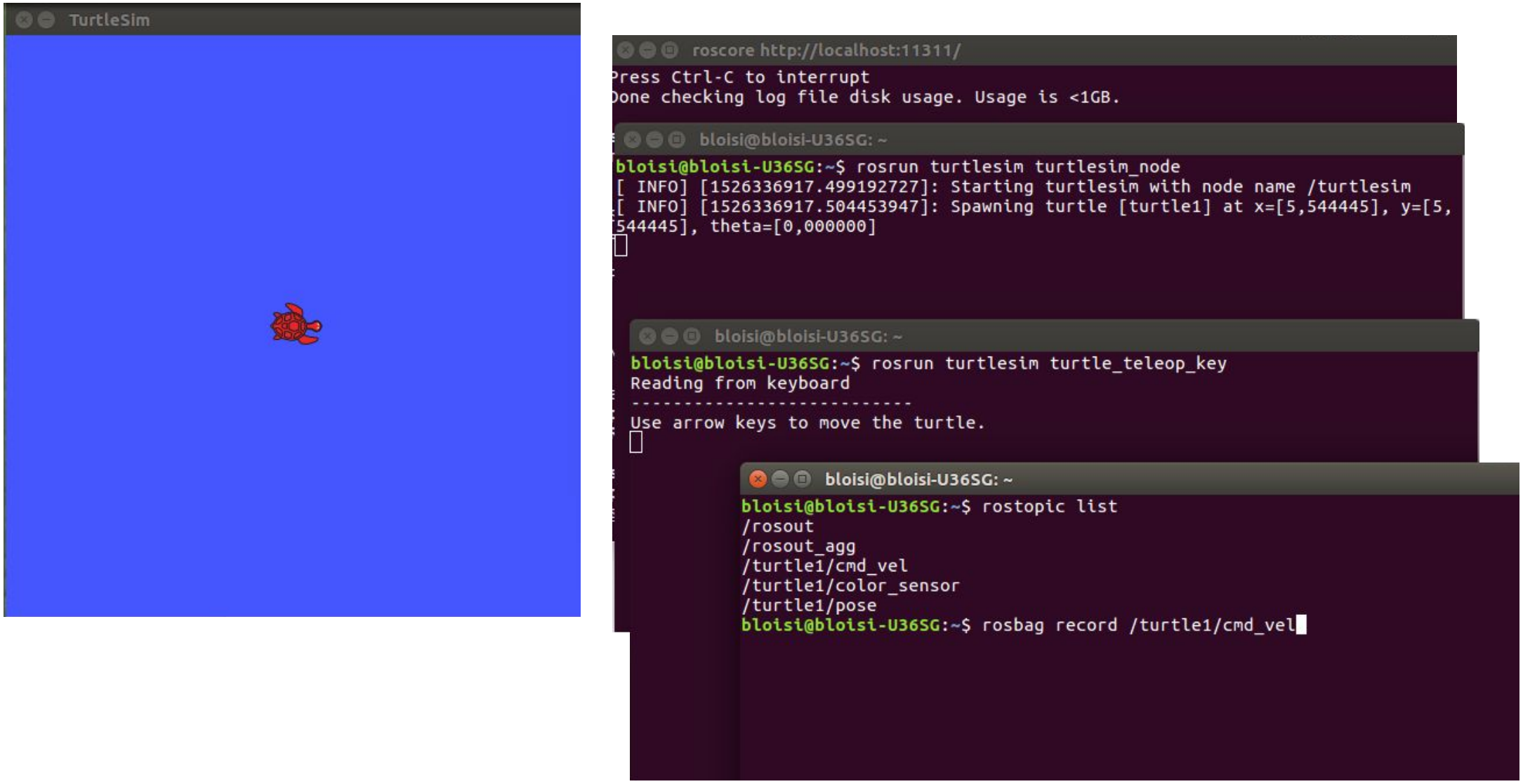
Tra tutti i topic attivi, possiamo scegliere quali registrare usando i comandi e le opzioni di rosbag

```
rosbag record <topic name>
```

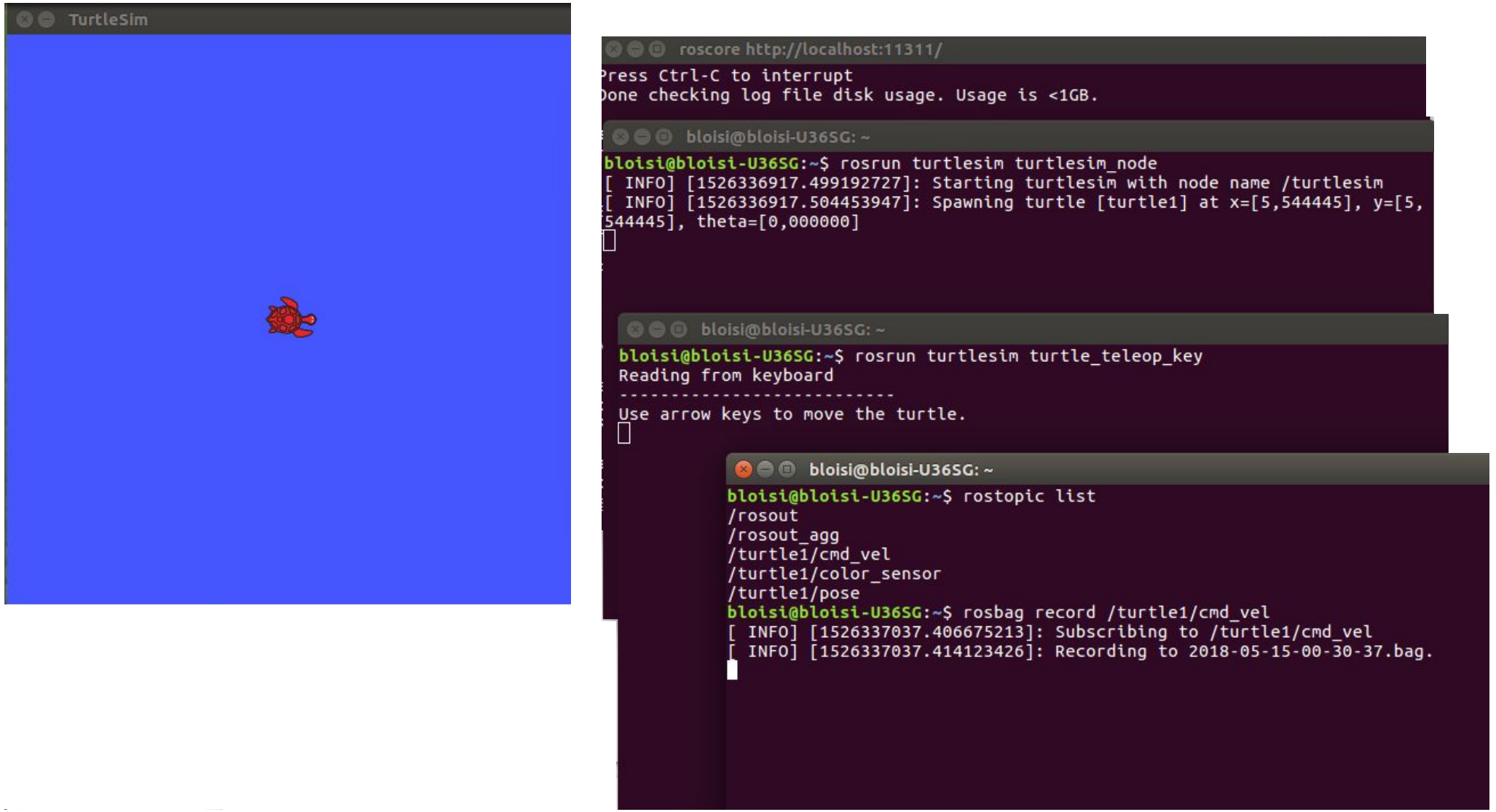
Per esempio, per registrare i comandi inviati tramite `cmd_vel` digitiamo

```
$ rosbag record /turtle1/cmd_vel
```

Esempio - Registrare un topic



Esempio – Registrazione in corso…



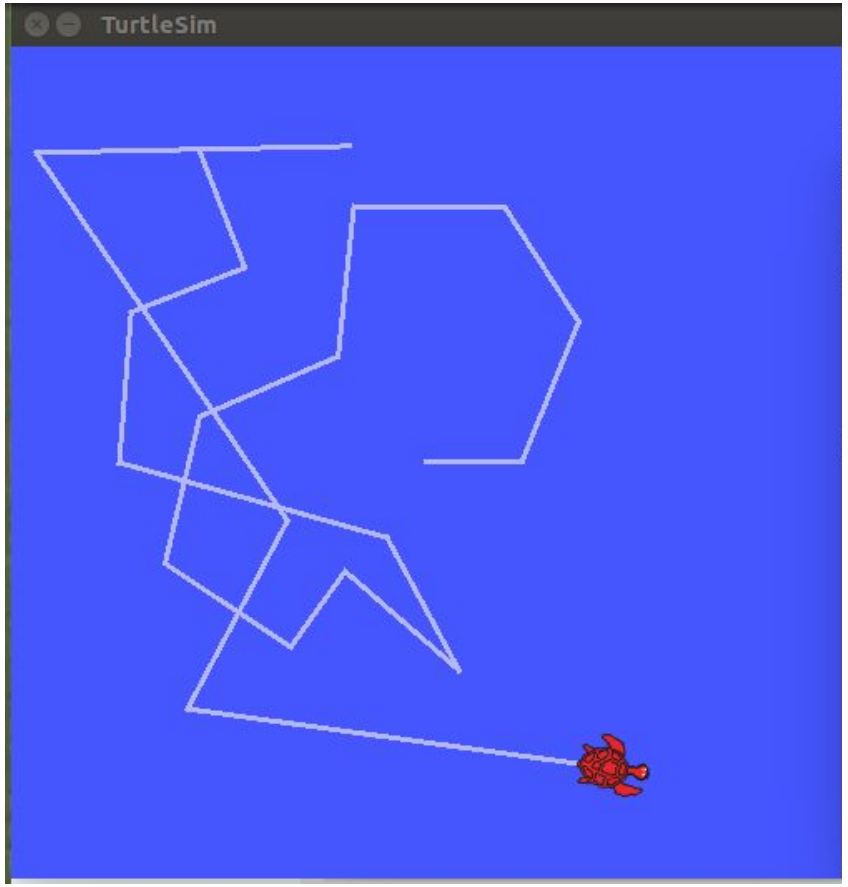
Registrare tutti i topic

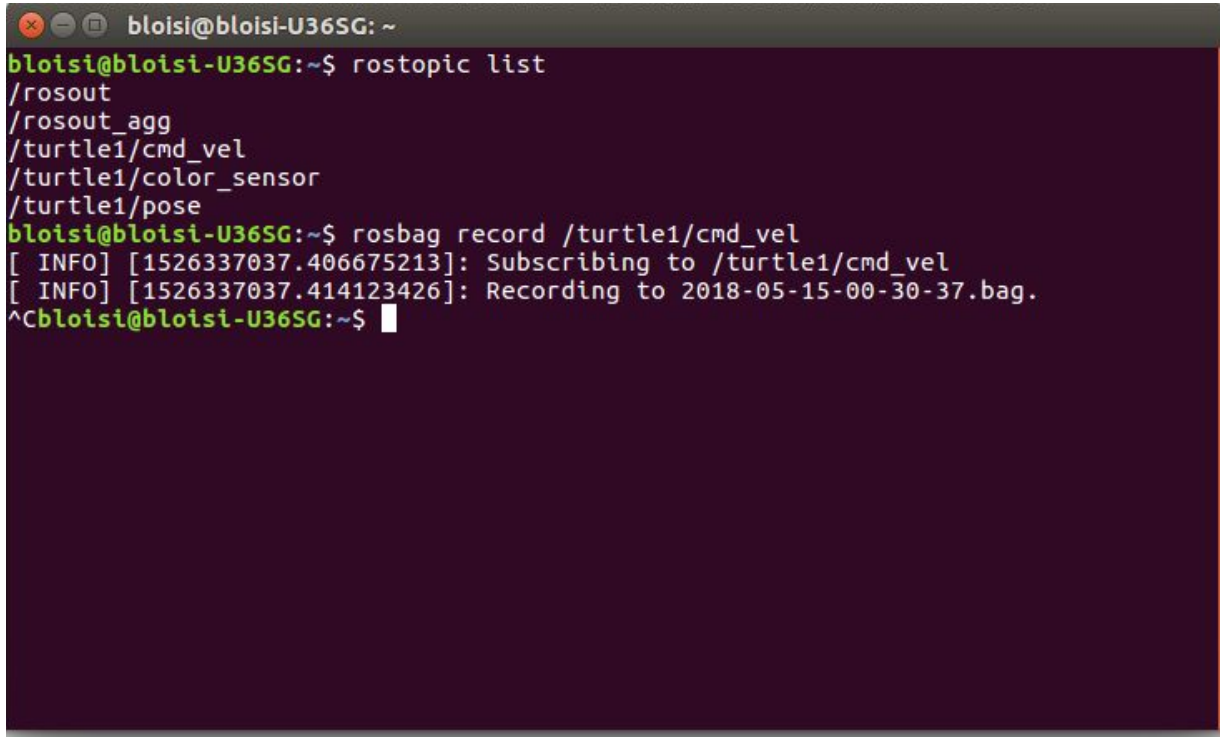
Se si vogliono registrare tutti i topic attivi, si può usare
l'opzione `-a`

```
$ rosbag record -a
```

Terminare la registrazione

[Ctrl-C] ci permette di terminare la registrazione della bag

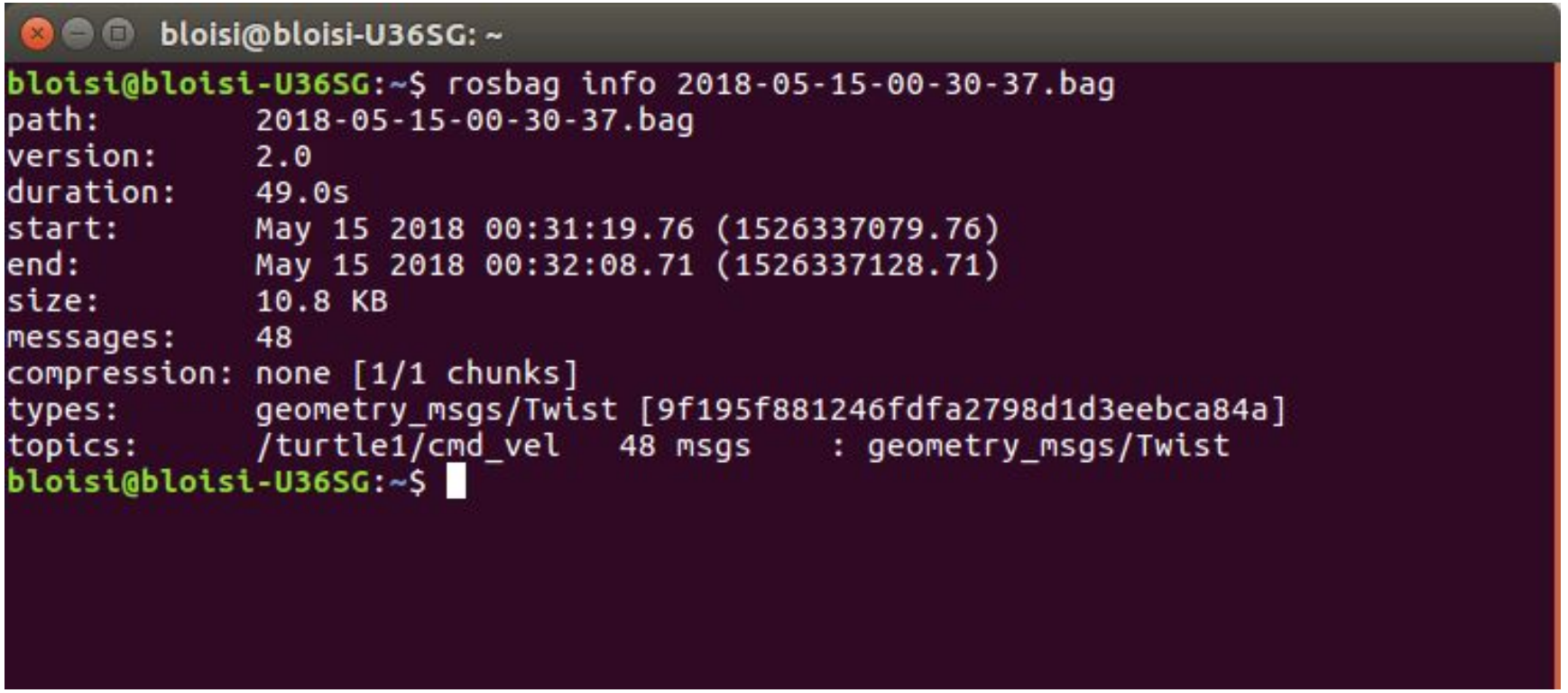




rosbag info

Il comando info stampa a video informazioni sulla bag fornita come parametro.
Nel nostro esempio, avremo informazioni sul file 2018-05-15-00-30-37.bag digitando

```
$ rosbag info 2018-05-15-00-30-37.bag
```



rosbag play

Ora che la bag è stata registrata, possiamo provare a riprodurla tramite

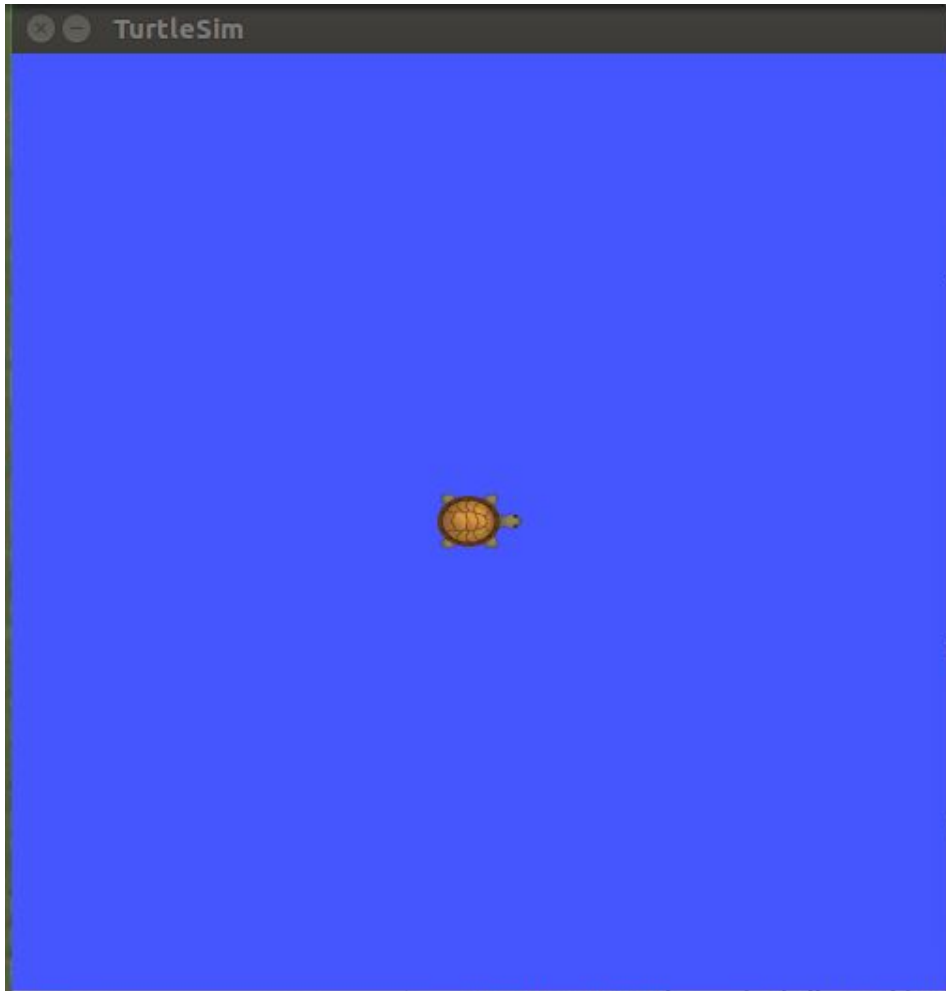
```
rosbag play <bagfile name>
```

Per esempio, per riprodurre la nostra bag

1. Terminiamo tutti i nodi attivi
2. Lanciamo il nodo turtlesim_node
3. Digitiamo

```
$ rosbag play 2018-05-15-00-30-37.bag
```

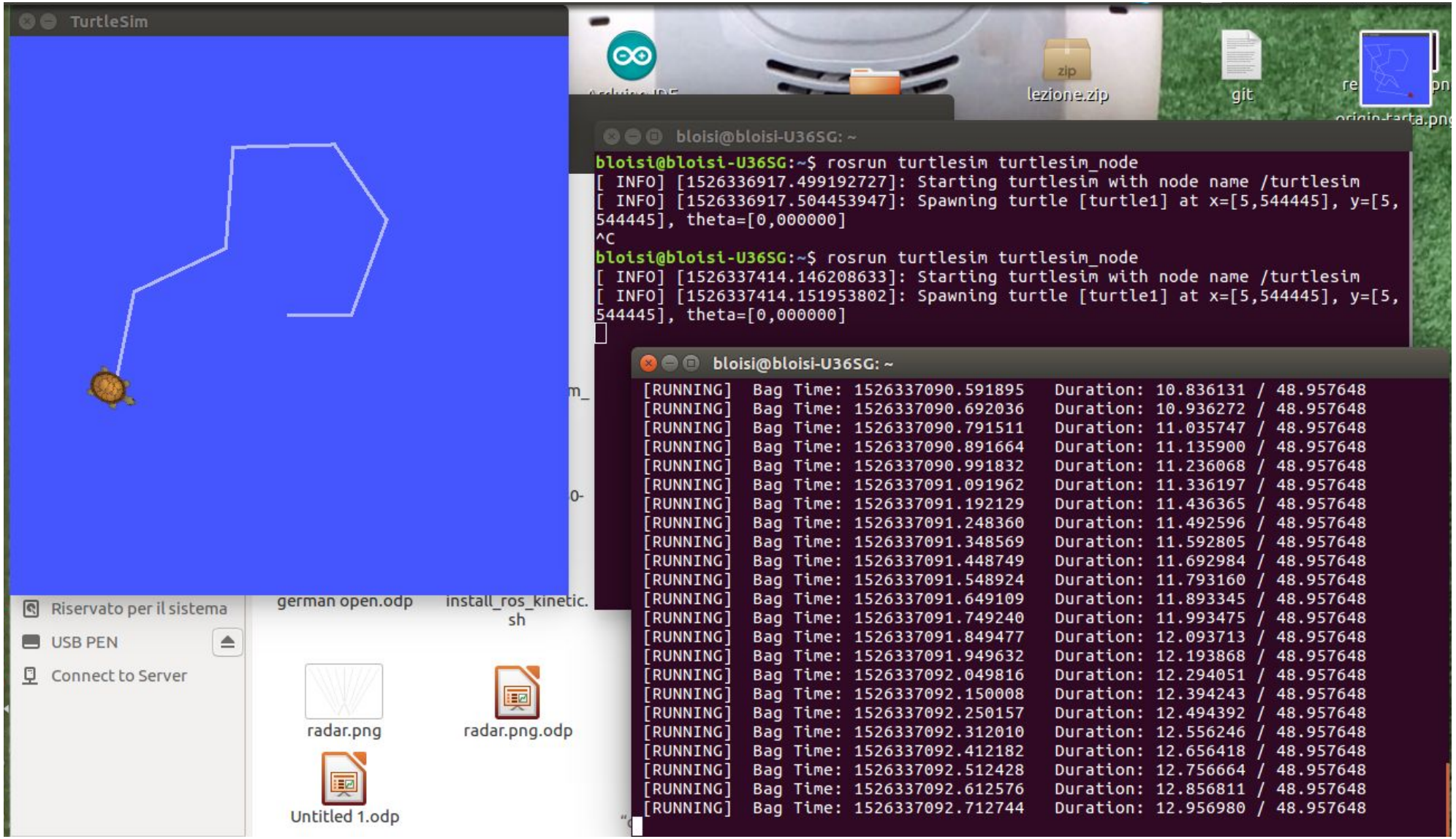
rosbag play – esecuzione



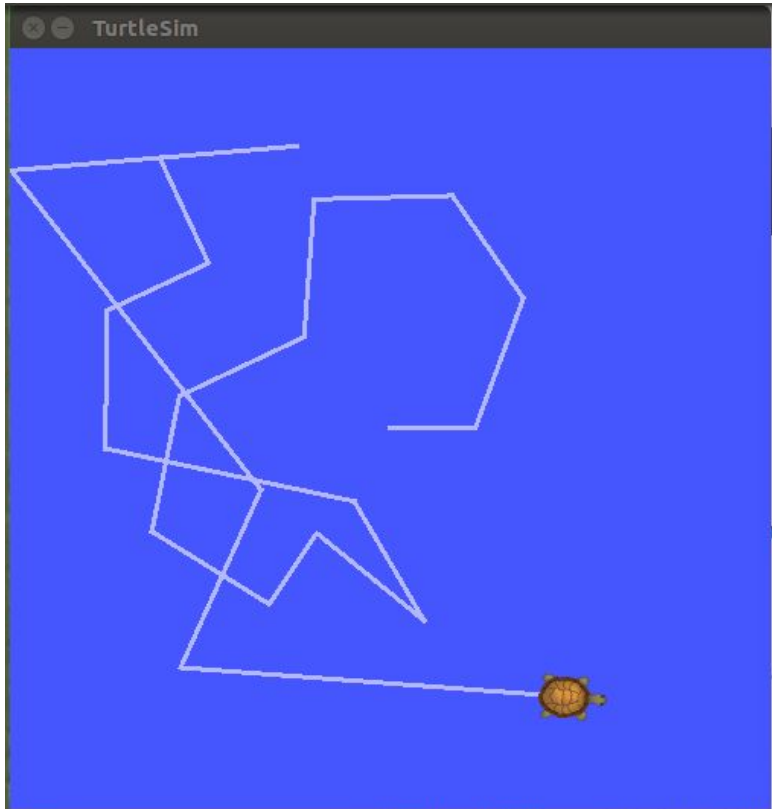

```
bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rosrun turtlesim turtlesim_node
[ INFO] [1526336917.499192727]: Starting turtlesim with node name /turtlesim
[ INFO] [1526336917.504453947]: Spawning turtle [turtle1] at x=[5,544445], y=[5,
544445], theta=[0,000000]
^C
bloisi@bloisi-U36SG:~$ rosrun turtlesim turtlesim_node
[ INFO] [1526337414.146208633]: Starting turtlesim with node name /turtlesim
[ INFO] [1526337414.151953802]: Spawning turtle [turtle1] at x=[5,544445], y=[5,
544445], theta=[0,000000]
```

```
bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rosbag play 2018-05-15-00-30-37.bag
```

rosbag play – esecuzione in corso



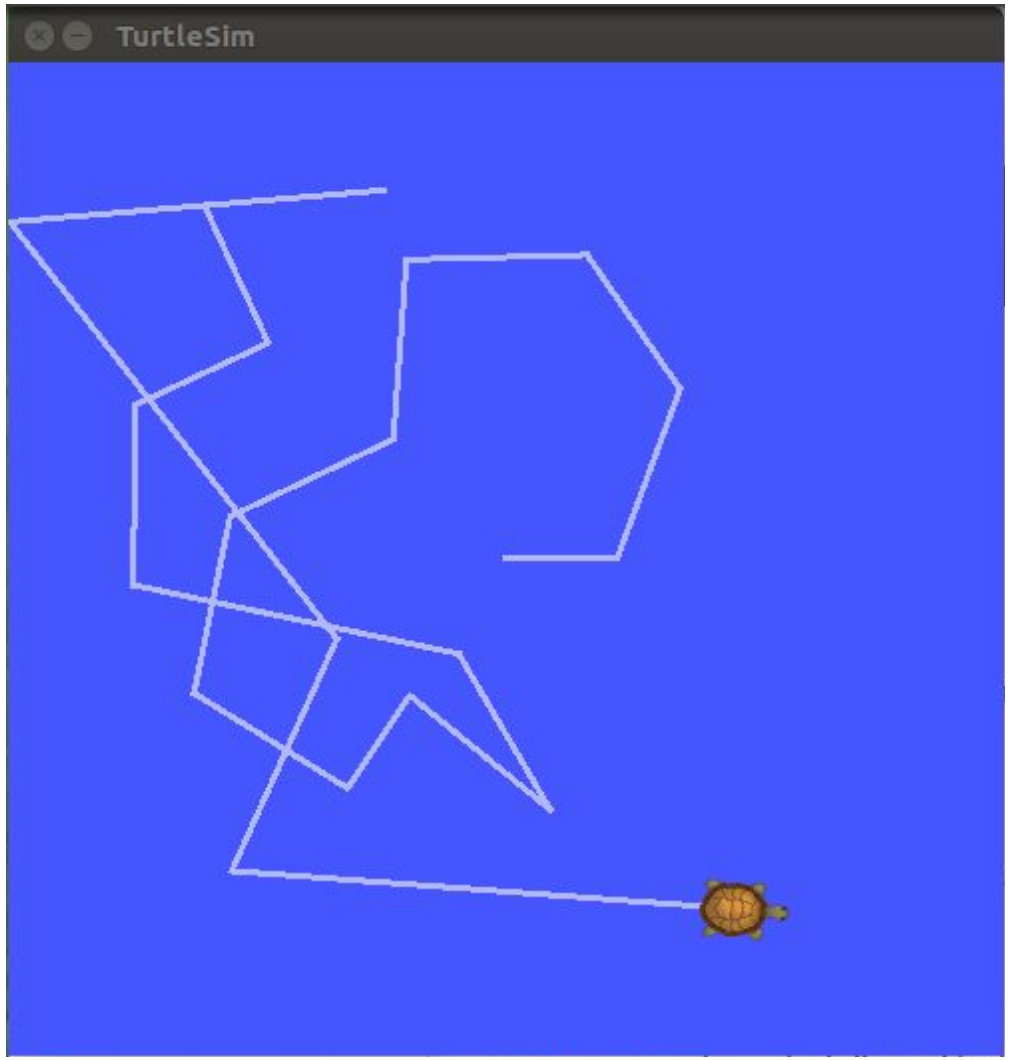
rosbag play – risultato finale

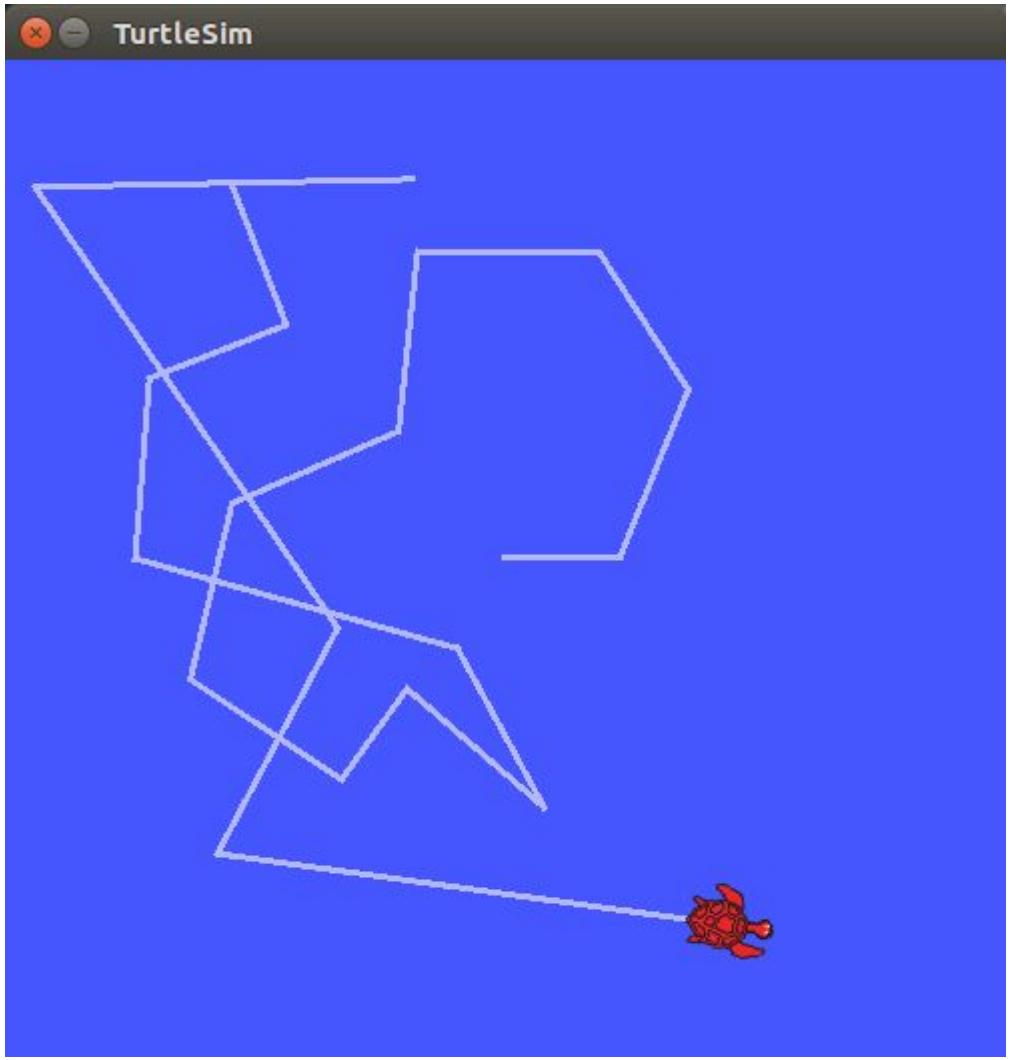



```
bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rosrun turtlesim turtlesim_node
[ INFO] [1526336917.499192727]: Starting turtlesim with node name /turtlesim
[ INFO] [1526336917.504453947]: Spawning turtle [turtle1] at x=[5,544445], y=[5,
544445], theta=[0,000000]
^C
bloisi@bloisi-U36SG:~$ rosrun turtlesim turtlesim_node
[ INFO] [1526337414.146208633]: Starting turtlesim with node name /turtlesim
[ INFO] [1526337414.151953802]: Spawning turtle [turtle1] at x=[5,544445], y=[5,
544445], theta=[0,000000]
```

```
bloisi@bloisi-U36SG: ~
[RUNNING]  Bag Time: 1526337126.557608   Duration: 46.801843 / 48.957648
[RUNNING]  Bag Time: 1526337126.657763   Duration: 46.901998 / 48.957648
[RUNNING]  Bag Time: 1526337126.757943   Duration: 47.002178 / 48.957648
[RUNNING]  Bag Time: 1526337126.858106   Duration: 47.102342 / 48.957648
[RUNNING]  Bag Time: 1526337126.958296   Duration: 47.202532 / 48.957648
[RUNNING]  Bag Time: 1526337127.058506   Duration: 47.302742 / 48.957648
[RUNNING]  Bag Time: 1526337127.158664   Duration: 47.402900 / 48.957648
[RUNNING]  Bag Time: 1526337127.258812   Duration: 47.503048 / 48.957648
[RUNNING]  Bag Time: 1526337127.358996   Duration: 47.603232 / 48.957648
[RUNNING]  Bag Time: 1526337127.459208   Duration: 47.703444 / 48.957648
[RUNNING]  Bag Time: 1526337127.559368   Duration: 47.803604 / 48.957648
[RUNNING]  Bag Time: 1526337127.659556   Duration: 47.903791 / 48.957648
[RUNNING]  Bag Time: 1526337127.759781   Duration: 48.004016 / 48.957648
[RUNNING]  Bag Time: 1526337127.857417   Duration: 48.101653 / 48.957648
[RUNNING]  Bag Time: 1526337127.957637   Duration: 48.201872 / 48.957648
[RUNNING]  Bag Time: 1526337128.057879   Duration: 48.302115 / 48.957648
[RUNNING]  Bag Time: 1526337128.158112   Duration: 48.402348 / 48.957648
[RUNNING]  Bag Time: 1526337128.258319   Duration: 48.502555 / 48.957648
[RUNNING]  Bag Time: 1526337128.358572   Duration: 48.602807 / 48.957648
[RUNNING]  Bag Time: 1526337128.458740   Duration: 48.702976 / 48.957648
[RUNNING]  Bag Time: 1526337128.558883   Duration: 48.803119 / 48.957648

Done.
bloisi@bloisi-U36SG:~$
```

rosbag play – confronto





I bag file possono essere molto grandi

Un bag file registrato per un breve periodo di tempo comporta la creazione di file aventi dimensioni contenute

Se, invece, si ha bisogno di registrare messaggi per un lungo periodo di tempo, allora la dimensione del bag file può crescere fino ad occupare molta memoria

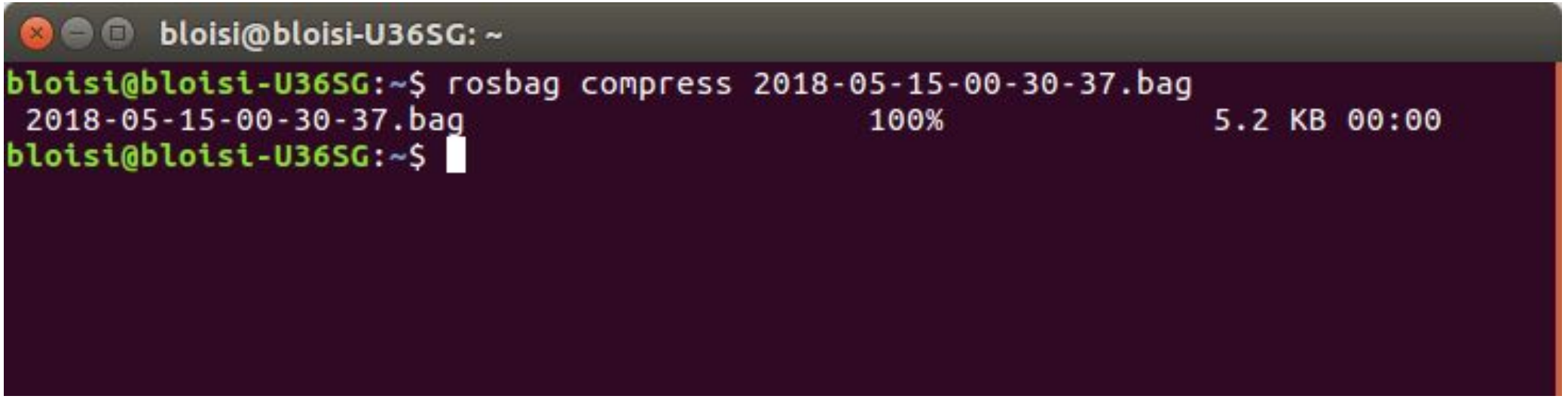
Si provi per esempio a scaricare la ROS bag a questo indirizzo

https://drive.google.com/file/d/1F8pd_Cc5n67cMkWdvTZphpi7zecRJDEJ/view?usp=sharing

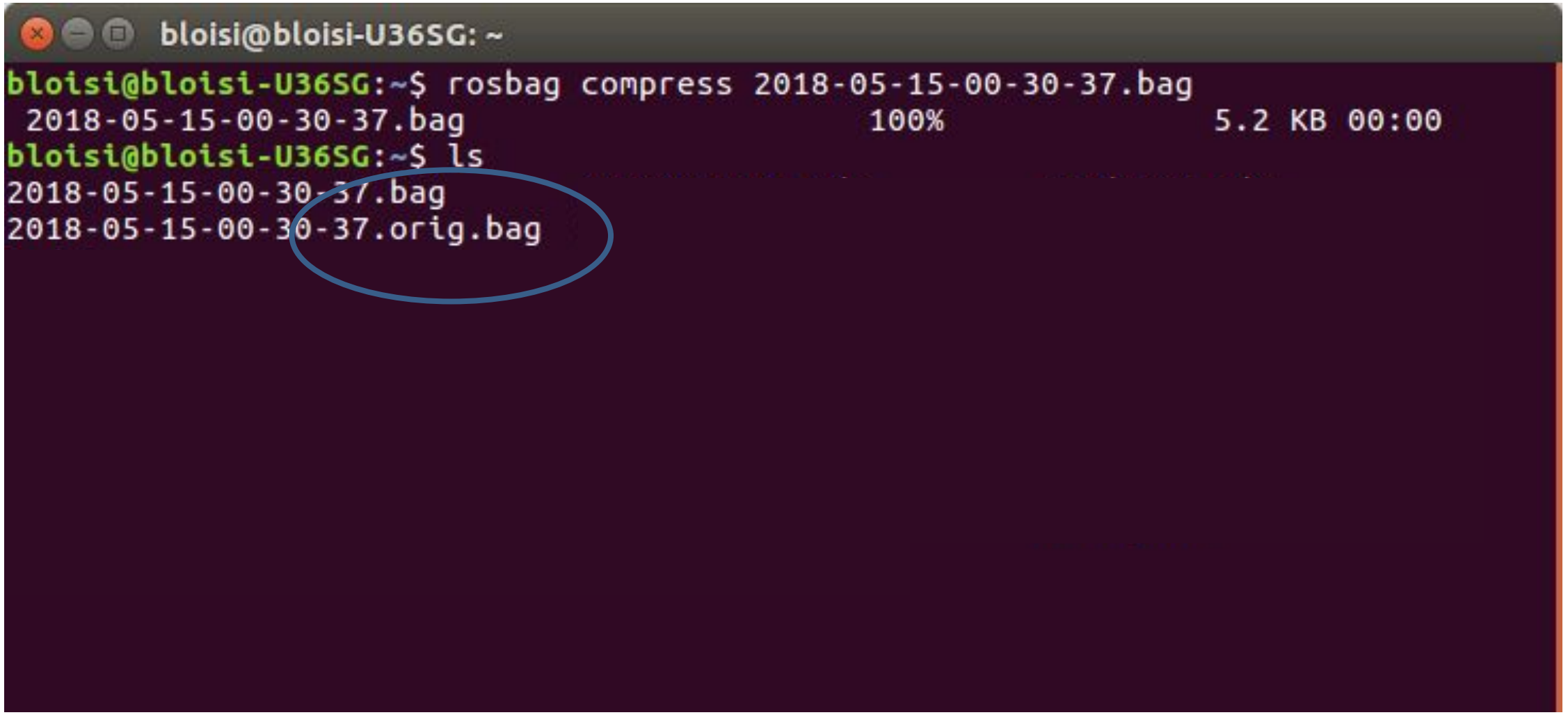
rosbag compress

ROS fornisce la possibilità di comprimere i bag file grazie all'opzione `compress`

```
$ rosbag compress 2018-05-15-00-30-37.bag
```



rosbag compress – esecuzione



rosbag decompress

Per riportare il bag file al suo formato originale, è possibile utilizzare `decompress`

```
$ rosbag decompress 2018-05-15-00-30-37.bag
```

rosbag con immagini

Una bag può contenere qualunque tipo di dato sia possibile inviare tramite i messaggi ROS

Le bag possono essere molto utili per la registrazioni di dati provenienti da telecamere montate su robot

In particolare, essendo presente un timestamp per ogni immagine, è possibile riprodurre fedelmente lo stream dati del sensore usato per effettuare le riprese

Image message

sensor_msgs/Image Message

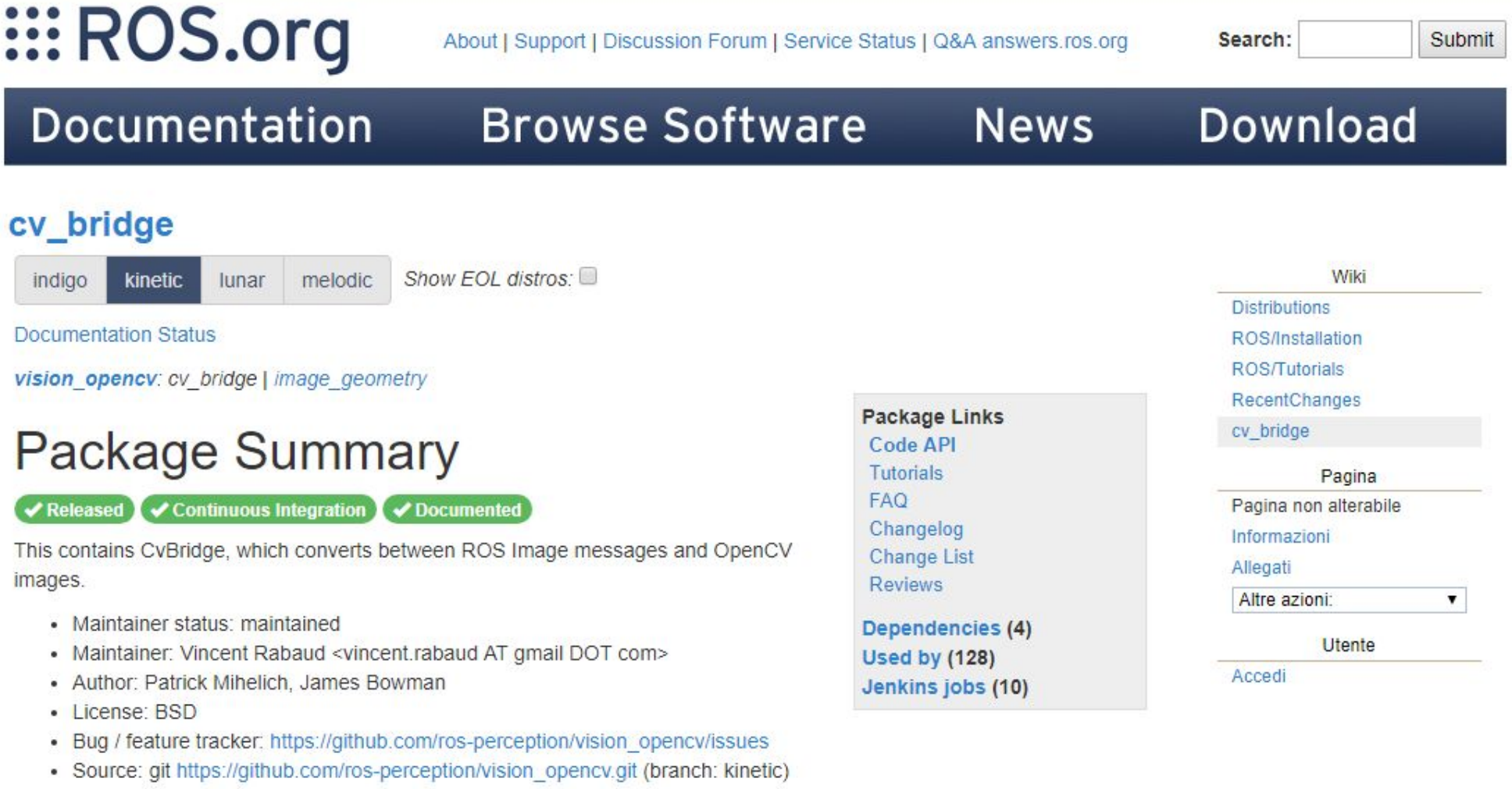
File: `sensor_msgs/Image.msg`

Raw Message Definition

```
# This message contains an uncompressed image
# (0, 0) is at top-left corner of image
#

Header header        # Header timestamp should be acquisition time of image
                     # Header frame_id should be optical frame of camera
                     # origin of frame should be optical center of camera
                     # +x should point to the right in the image
                     # +y should point down in the image
                     # +z should point into to plane of the image
                     # If the frame_id here and the frame_id of the CameraInfo
                     # message associated with the image conflict
                     # the behavior is undefined

uint32 height         # image height, that is, number of rows
uint32 width          # image width, that is, number of columns

# The legal values for encoding are in file src/image_encodings.cpp
# If you want to standardize a new string format, join
# ros-users@lists.sourceforge.net and send an email proposing a new encoding.

string encoding       # Encoding of pixels -- channel meaning, ordering, size
                      # taken from the list of strings in include/sensor_msgs/image_encodings.h
```

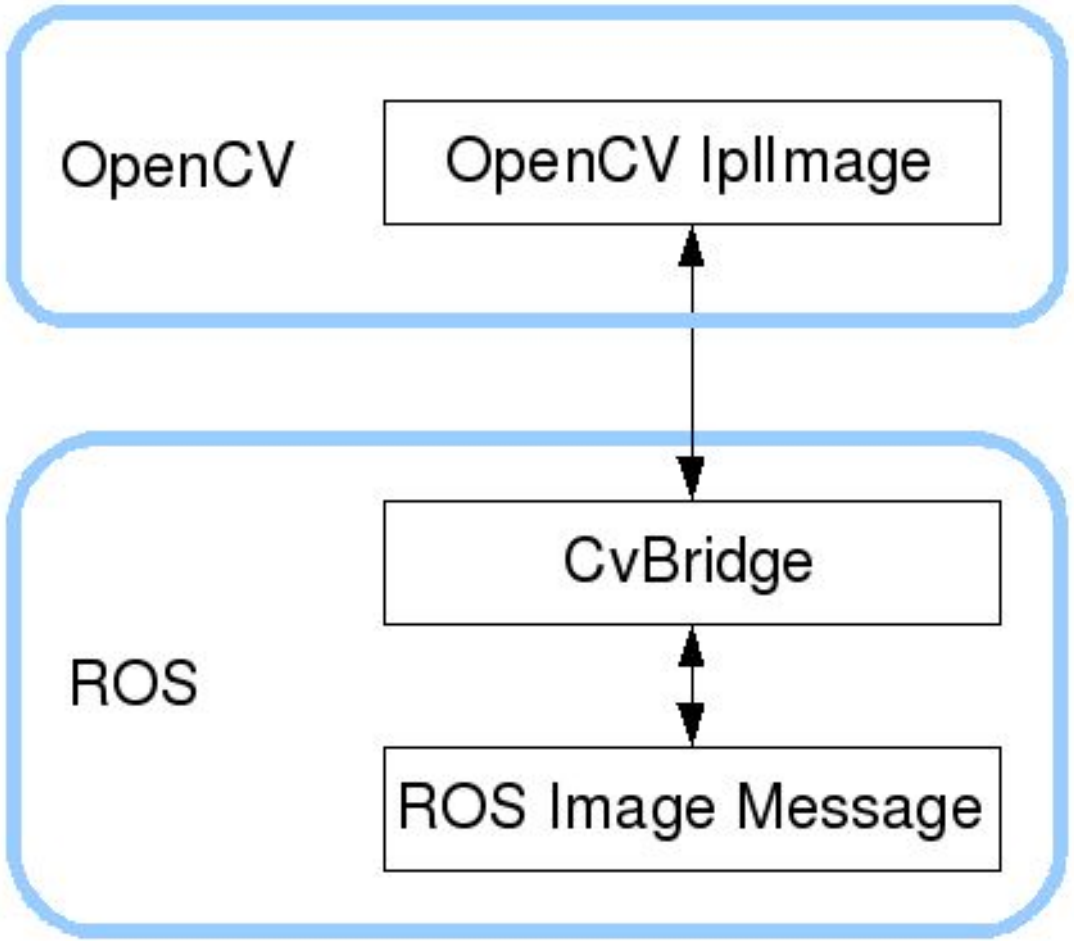
http://docs.ros.org/kinetic/api/sensor_msgs/html/msg/Image.html

cv_bridge



http://wiki.ros.org/cv_bridge

cv_bridge

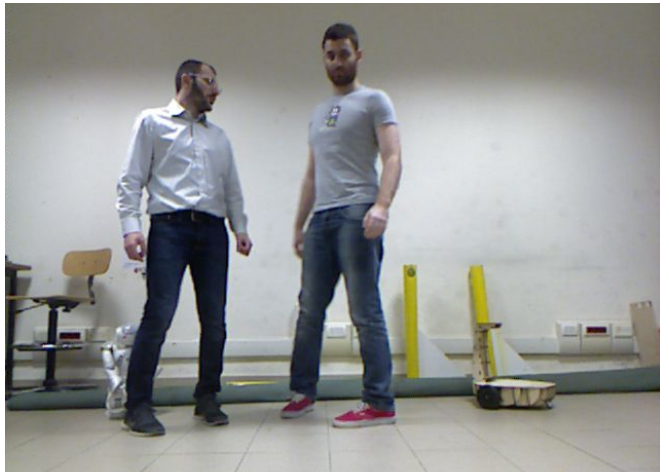


http://wiki.ros.org/cv_bridge

Esempio: unibas_viewer

rosbag acquisita con
un sensore RGBD

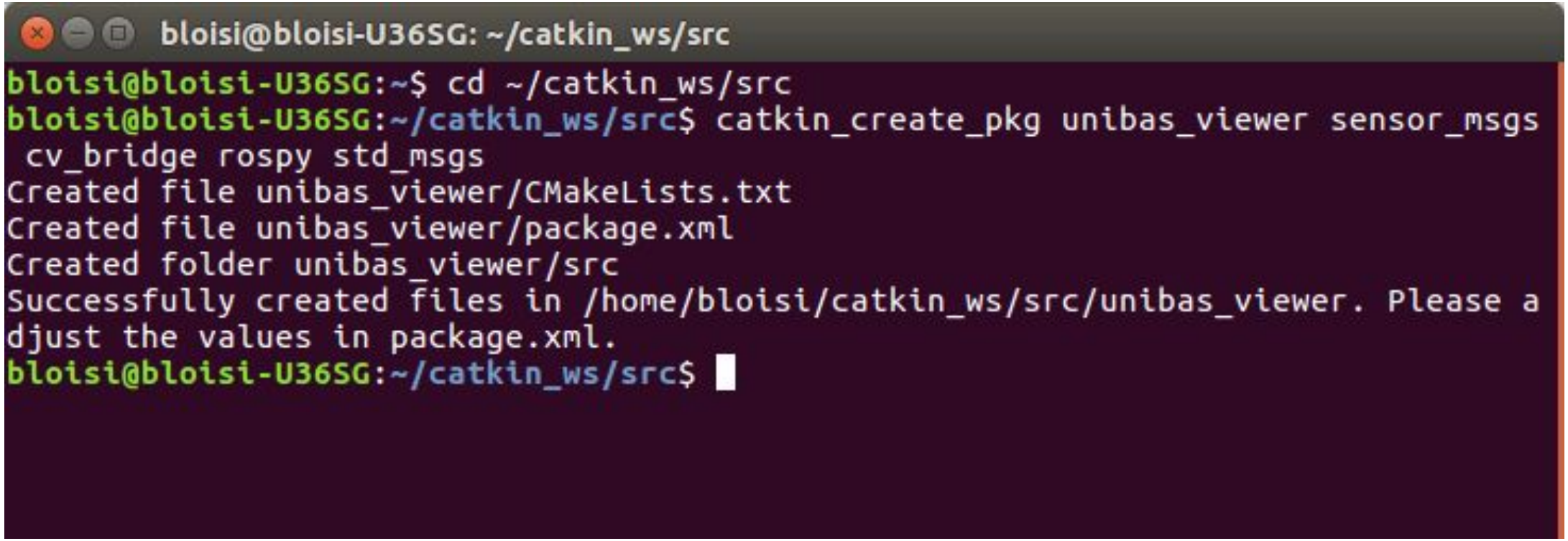
unibas_viewer



visualizzazione
immagine OpenCV

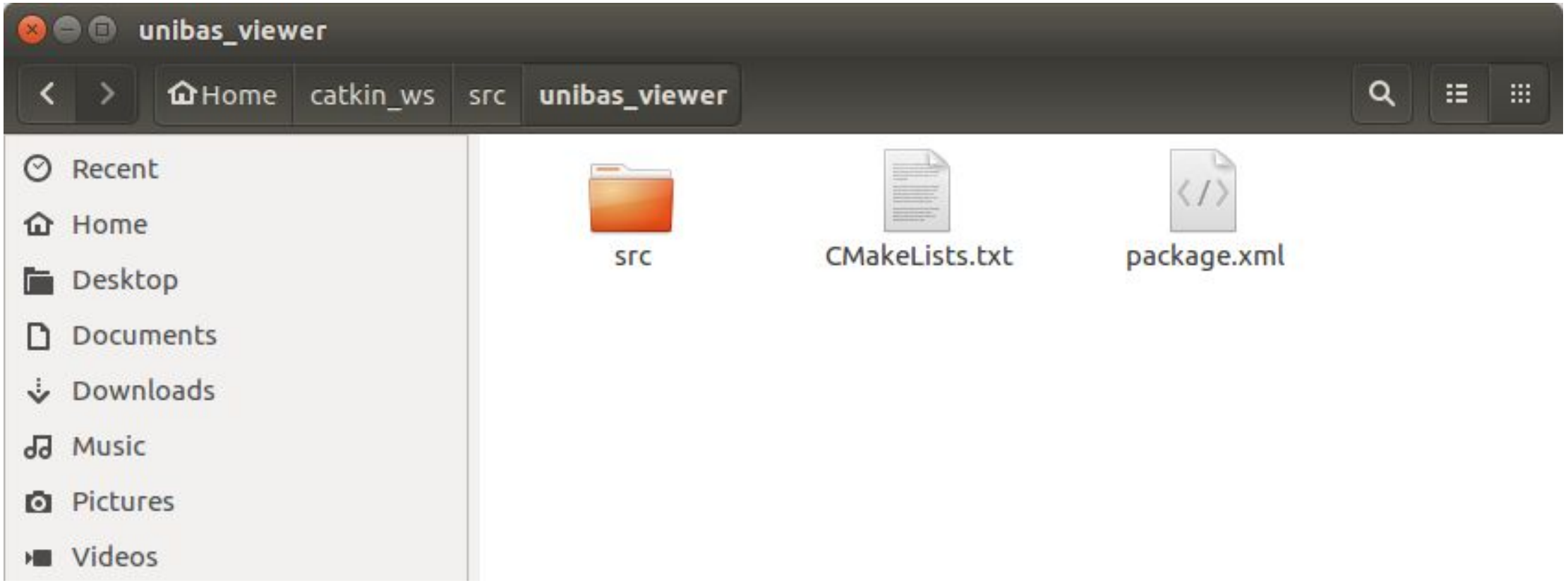
http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

creazione del nodo unibas_viewer



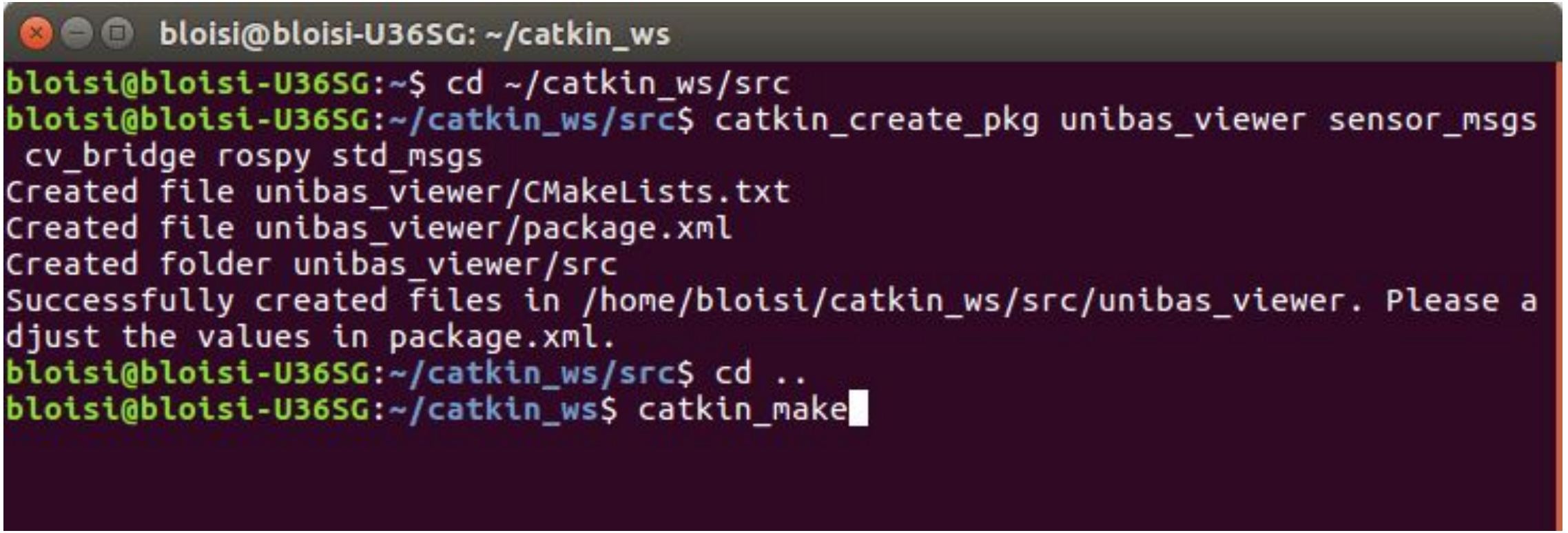
http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

cartella unibas_viewer



http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

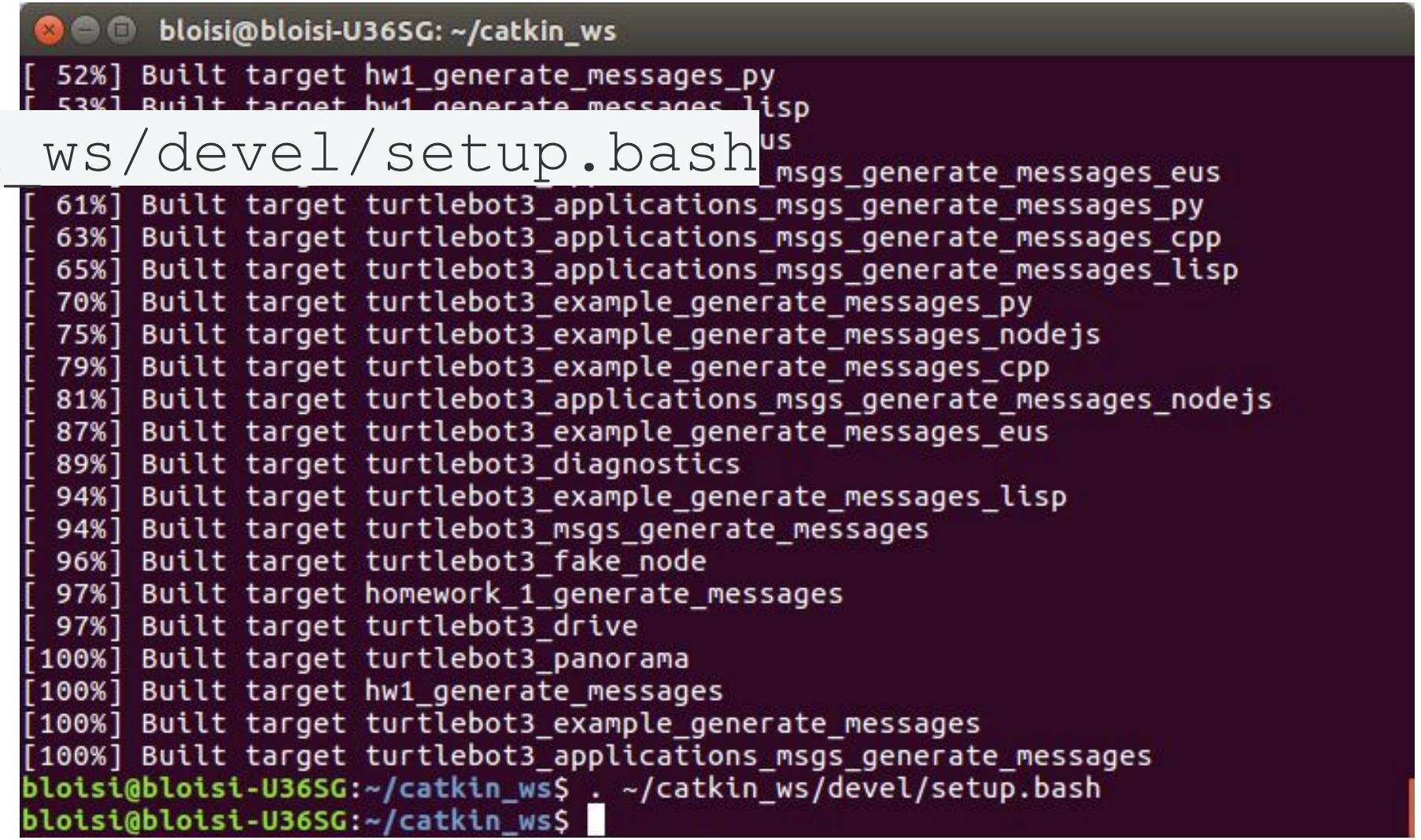
catkin_make



http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

settiamo l’ambiente ROS

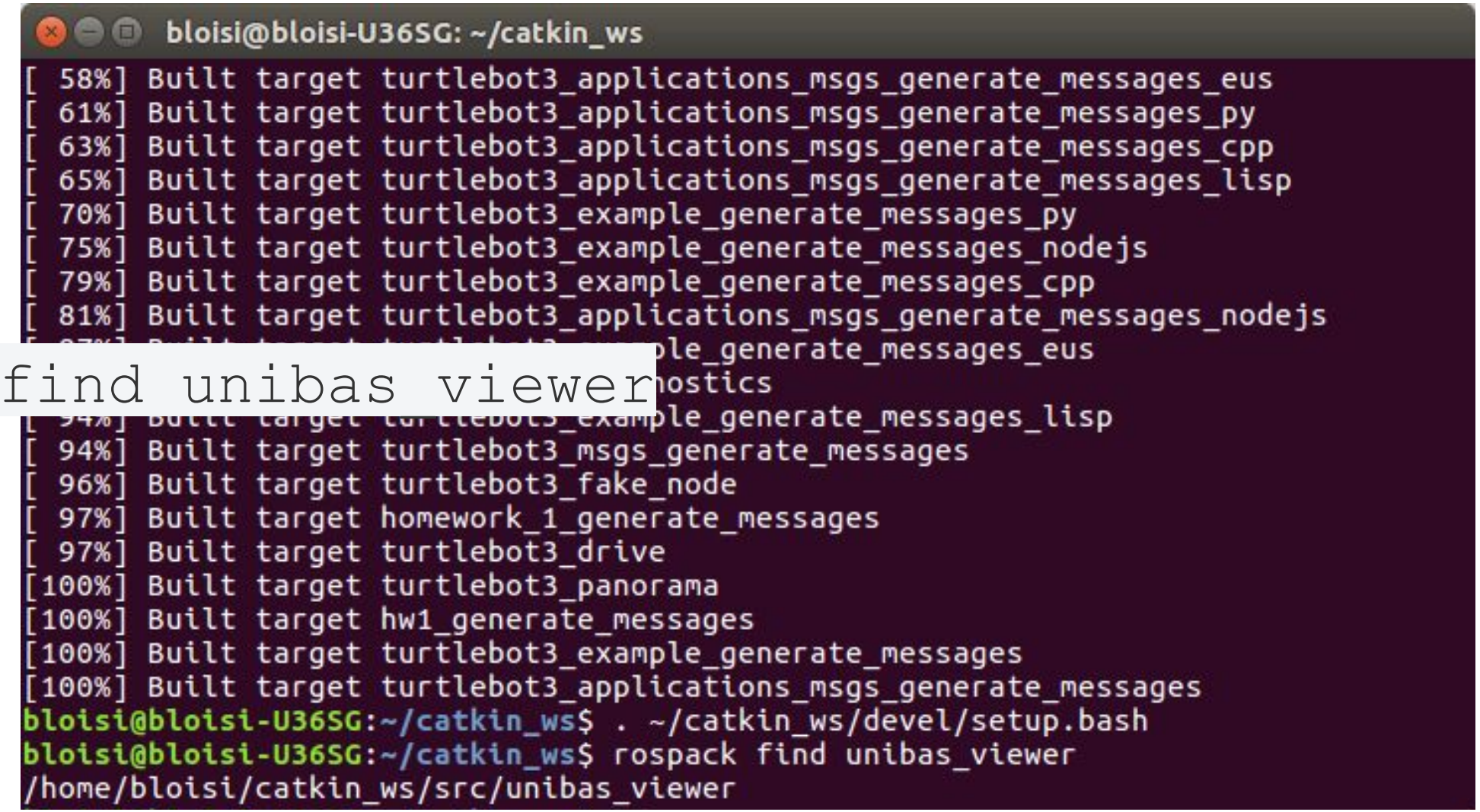
```
. ~/catkin_ws/devel/setup.bash
```



https://answers.ros.org/question/229365/do-i-really-need-to-source-catkin_wsdevelsetupbash/

rospack find

```
rospack find unibas viewer
```



creiamo unibas_viewer_node.py

http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

creiamo unibas_viewer_node.py

unibas_viewer_node.py (~/catkin_ws/src/unibas_viewer/src) - gedit

Open Save

```
1 #!/usr/bin/env python
2 from __future__ import print_function
3
4 import roslib
5 roslib.load_manifest('unibas_viewer')
6 import sys
7 import rospy
8 import cv2
9 from std_msgs.msg import String
10 from sensor_msgs.msg import Image
11 from cv_bridge import CvBridge, CvBridgeError
12
13 class unibas_viewer:
14
15   def __init__(self):
16     self.bridge = CvBridge()
17     self.image_sub = rospy.Subscriber("/camera/rgb/image_raw",Image,self.callback)
18
```

Python Tab Width: 8 Ln 26, Col 19 INS

http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

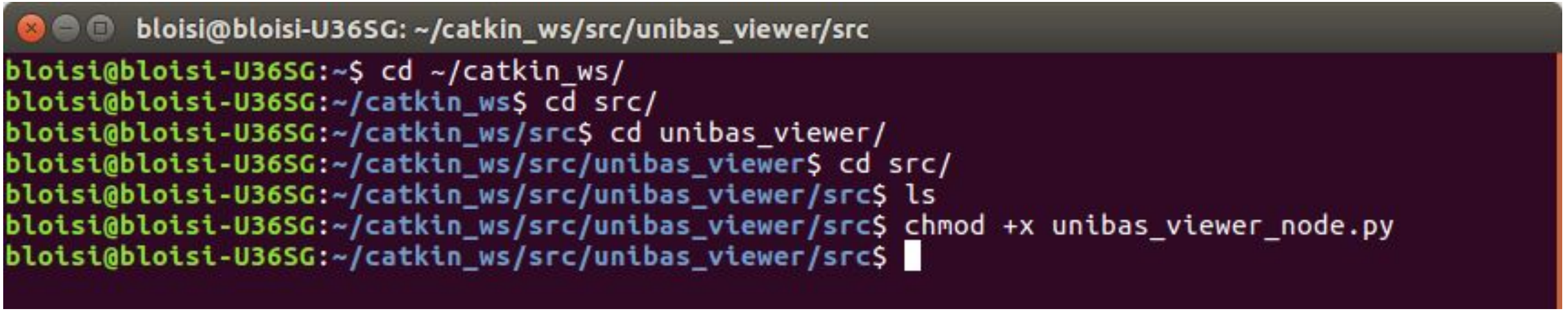
creiamo unibas_viewer_node.py

http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

creiamo unibas_viewer_node.py

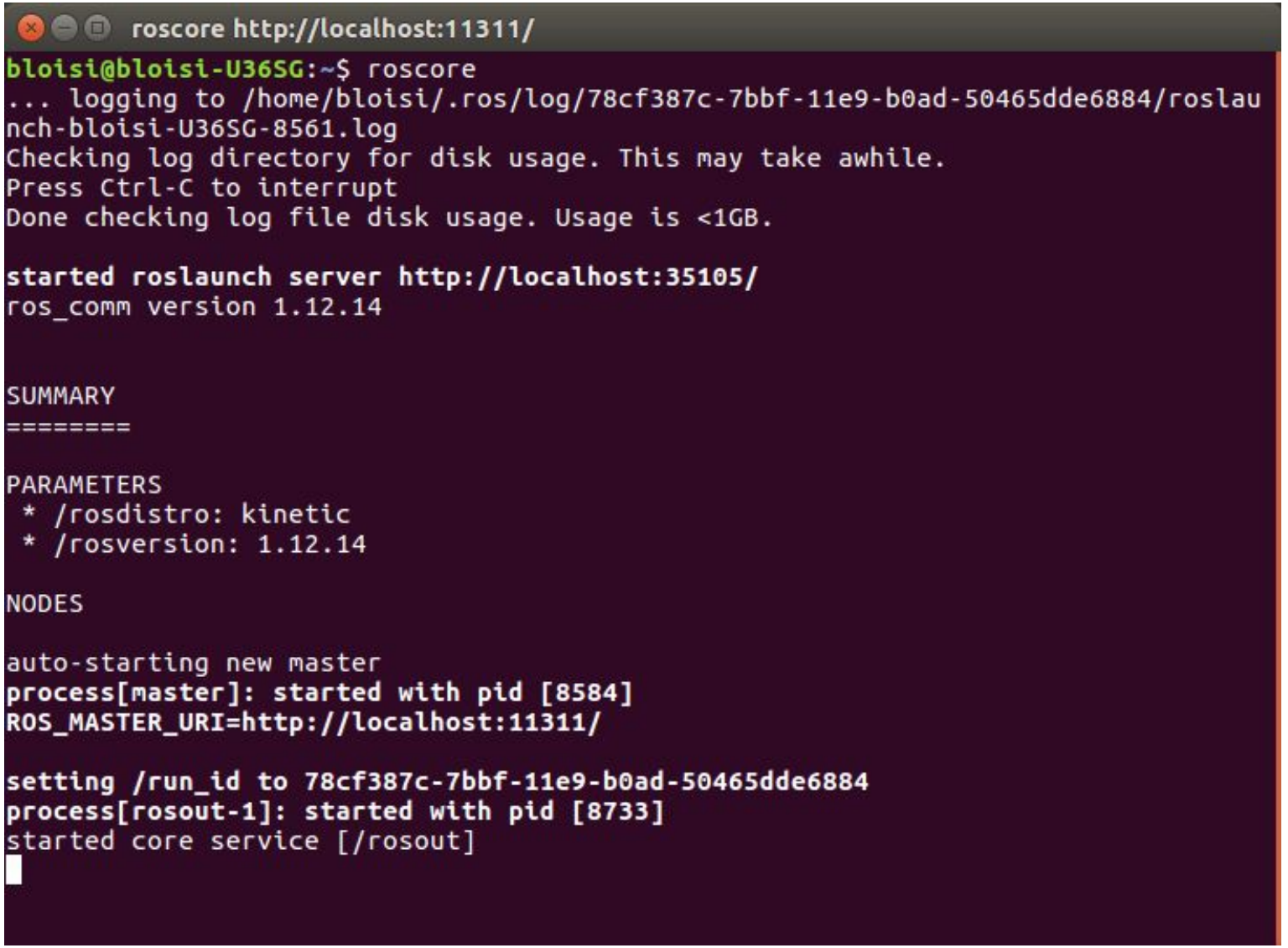
http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

permessi per unibas_viewer_node.py

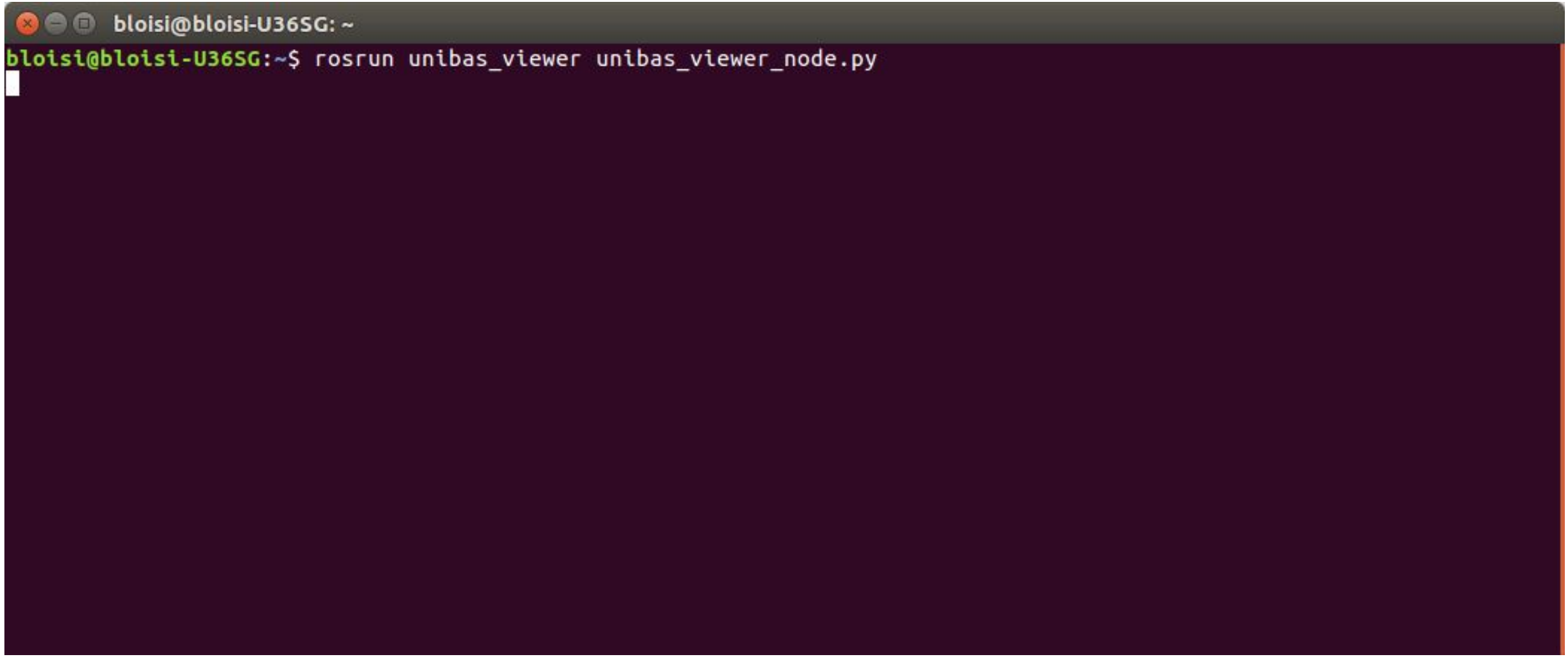


http://wiki.ros.org/cv_bridge/Tutorials/ConvertingBetweenROSImagesAndOpenCVImagesPython

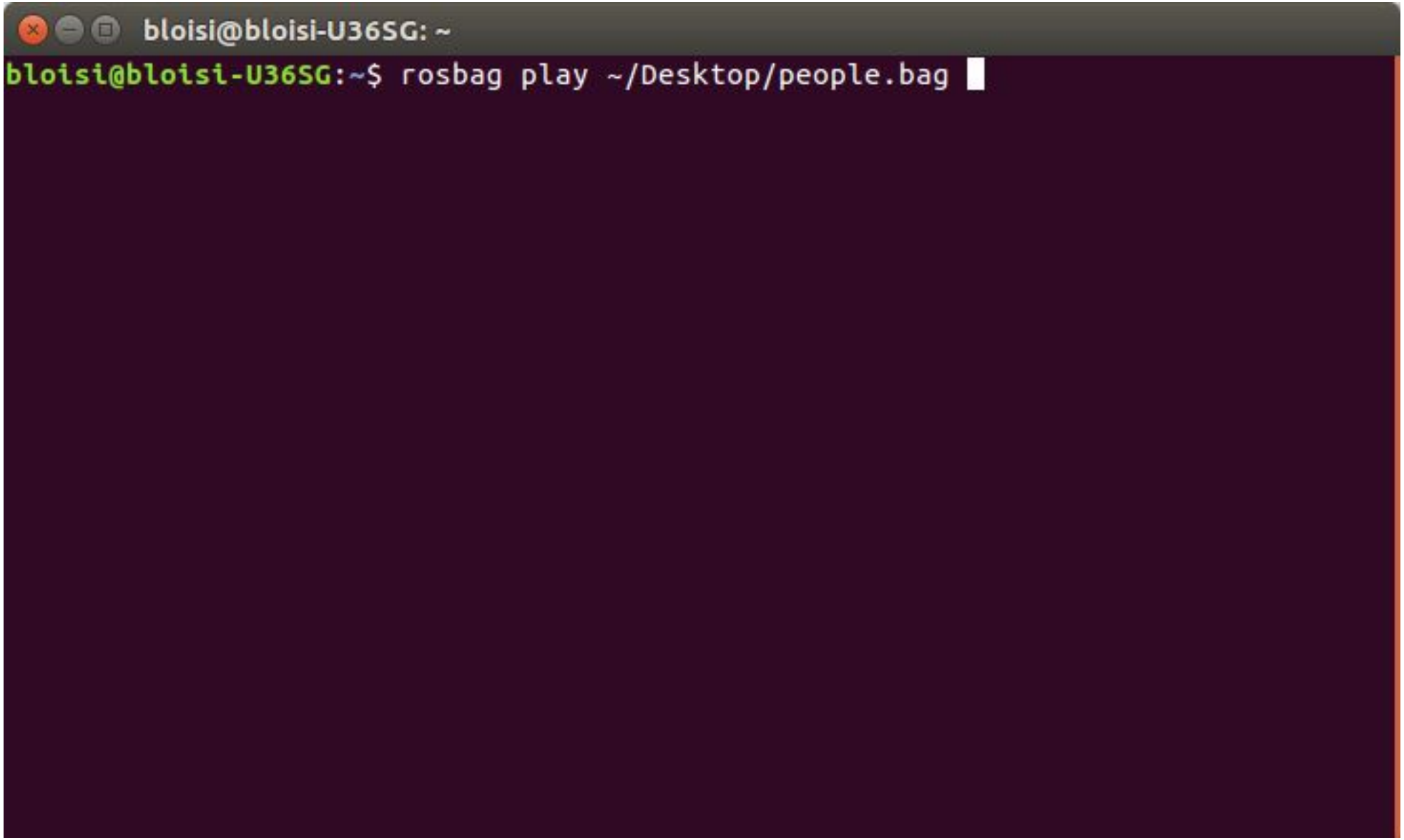
roscore


roscore http://localhost:11311/
bloisi@bloisi-U36SG:~$ roscore
... logging to /home/bloisi/.ros/log/78cf387c-7bbf-11e9-b0ad-50465dde6884/roslaunch-bloisi-U36SG-8561.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:35105/
ros_comm version 1.12.14
SUMMARY
========
PARAMETERS
* /rosdistro: kinetic
* /rosversion: 1.12.14
NODES
auto-starting new master
process[master]: started with pid [8584]
ROS_MASTER_URI=http://localhost:11311/
setting /run_id to 78cf387c-7bbf-11e9-b0ad-50465dde6884
process[rosout-1]: started with pid [8733]
started core service [/rosout]

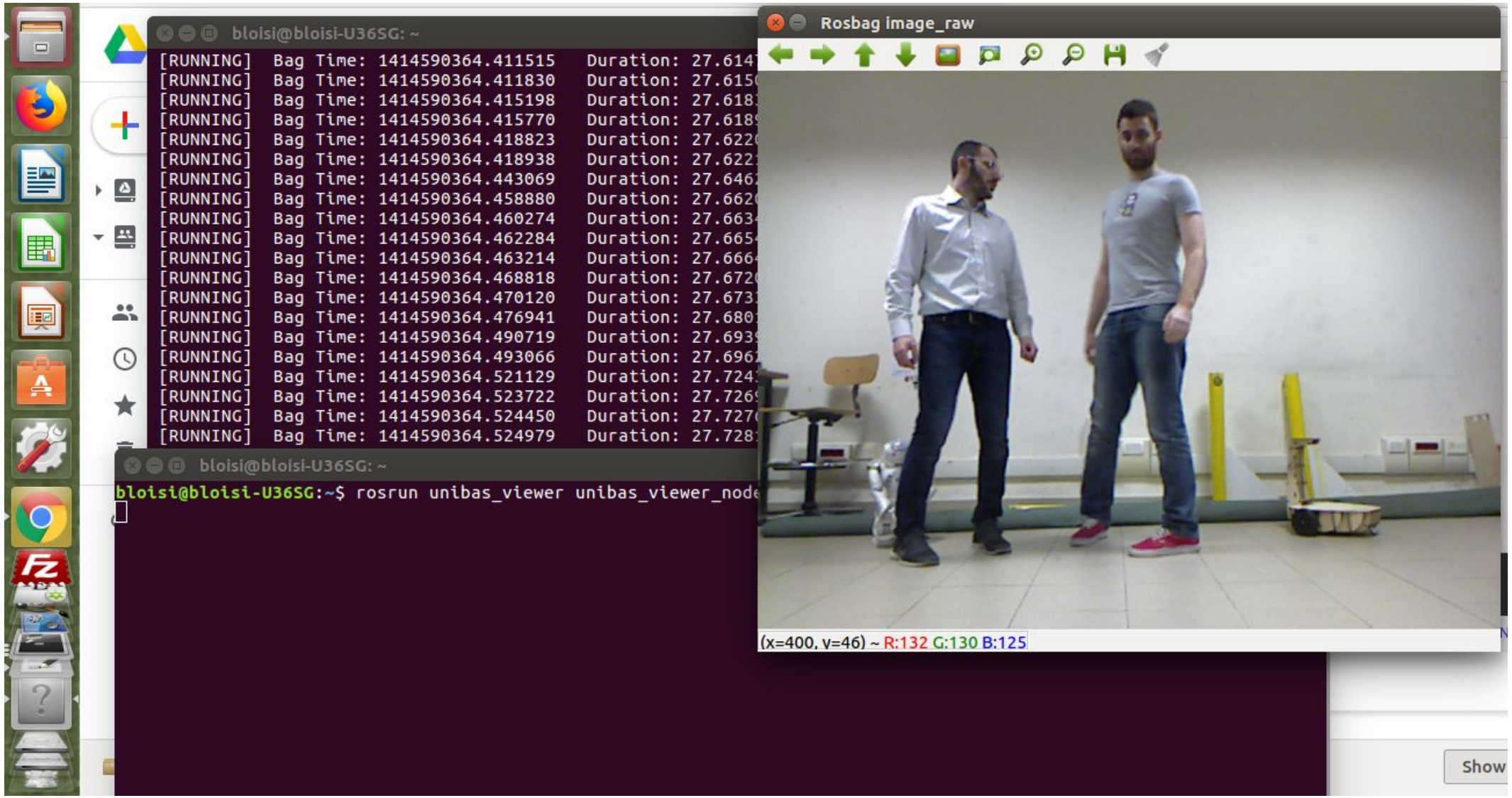
rosrun


bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rosrun unibas_viewer unibas_viewer_node.py

rosplay


bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rosbag play ~/Desktop/people.bag

visualizzazione



rostopic list

```
bloisi@bloisi-U36SG: ~
bloisi@bloisi-U36SG:~$ rostopic list
/camera/debayer/parameter_descriptions
/camera/debayer/parameter_updates
/camera/depth/image/compressed/parameter_descriptions
/camera/depth/image/compressed/parameter_updates
/camera/depth/image/compressedDepth/parameter_descriptions
/camera/depth/image/compressedDepth/parameter_updates
/camera/depth/image/theora/parameter_descriptions
/camera/depth/image/theora/parameter_updates
/camera/depth/image_raw/compressed/parameter_descriptions
/camera/depth/image_raw/compressed/parameter_updates
/camera/depth/image_raw/compressedDepth/parameter_descriptions
/camera/depth/image_raw/compressedDepth/parameter_updates
/camera/depth/image_raw/theora/parameter_descriptions
/camera/depth/image_raw/theora/parameter_updates
/camera/depth/image_rect/compressed/parameter_descriptions
/camera/depth/image_rect/compressed/parameter_updates
/camera/depth/image_rect/compressedDepth/parameter_descriptions
/camera/depth/image_rect/compressedDepth/parameter_updates
/camera/depth/image_rect/theora/parameter_descriptions
/camera/depth/image_rect/theora/parameter_updates
/camera/depth/image_rect_raw/compressed/parameter_descriptions
/camera/depth/image_rect_raw/compressed/parameter_updates
/camera/depth/image_rect_raw/compressedDepth/parameter_descriptions
/camera/depth/image_rect_raw/compressedDepth/parameter_updates
/camera/depth/image_rect_raw/theora/parameter_descriptions
/camera/depth/image_rect_raw/theora/parameter_updates
/camera/depth_rectify_depth/parameter_descriptions
/camera/depth_rectify_depth/parameter_updates
/camera/depth_registered/camera_info
/camera/depth_registered/disparity
/camera/depth_registered/hw_registered/image_rect_raw
/camera/depth_registered/hw_registered/image_rect_raw/compressed
/camera/depth_registered/hw_registered/image_rect_raw/compressed/parameter_descriptions
/camera/depth_registered/hw_registered/image_rect_raw/compressed/parameter_updates
/camera/depth_registered/hw_registered/image_rect_raw/compressedDepth
/camera/depth_registered/hw_registered/image_rect_raw/compressedDepth/parameter_descriptions
/camera/depth_registered/hw_registered/image_rect_raw/compressedDepth/parameter_updates
/camera/depth_registered/hw_registered/image_rect_raw/theora
```

rostopic list

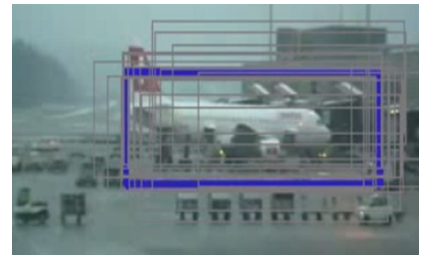
```
bloisi@bloisi-U36SG: ~
/camera/depth_registered/hw_registered/image_rect_raw/theora/parameter_descriptions
/camera/depth_registered/hw_registered/image_rect_raw/theora/parameter_updates
/camera/depth_registered/image_raw
/camera/depth_registered/image_raw/compressed
/camera/depth_registered/image_raw/compressed/parameter_descriptions
/camera/depth_registered/image_raw/compressed/parameter_updates
/camera/depth_registered/image_raw/compressedDepth
/camera/depth_registered/image_raw/compressedDepth/parameter_descriptions
/camera/depth_registered/image_raw/compressedDepth/parameter_updates
/camera/depth_registered/image_raw/theora
/camera/depth_registered/image_raw/theora/parameter_descriptions
/camera/depth_registered/image_raw/theora/parameter_updates
/camera/depth_registered/points
/camera/depth_registered/sw_registered/image_rect_raw/compressed/parameter_descriptions
/camera/depth_registered/sw_registered/image_rect_raw/compressed/parameter_updates
/camera/depth_registered/sw_registered/image_rect_raw/compressedDepth/parameter_descriptions
/camera/depth_registered/sw_registered/image_rect_raw/compressedDepth/parameter_updates
/camera/depth_registered/sw_registered/image_rect_raw/theora/parameter_descriptions
/camera/depth_registered/sw_registered/image_rect_raw/theora/parameter_updates
/camera/depth_registered_rectify_depth/parameter_descriptions
/camera/depth_registered_rectify_depth/parameter_updates
/camera/driver/parameter_descriptions
/camera/driver/parameter_updates
/camera/ir/image_raw/compressed/parameter_descriptions
/camera/ir/image_raw/compressed/parameter_updates
/camera/ir/image_raw/compressedDepth/parameter_descriptions
/camera/ir/image_raw/compressedDepth/parameter_updates
/camera/ir/image_raw/theora/parameter_descriptions
/camera/ir/image_raw/theora/parameter_updates
/camera/ir/image_rect_ir/compressed/parameter_descriptions
/camera/ir/image_rect_ir/compressed/parameter_updates
/camera/ir/image_rect_ir/compressedDepth/parameter_descriptions
/camera/ir/image_rect_ir/compressedDepth/parameter_updates
/camera/ir/image_rect_ir/theora/parameter_descriptions
/camera/ir/image_rect_ir/theora/parameter_updates
/camera/projector/camera_info
/camera/rectify_color/parameter_descriptions
/camera/rectify_color/parameter_updates
/camera/rectify_ir/parameter_descriptions
```

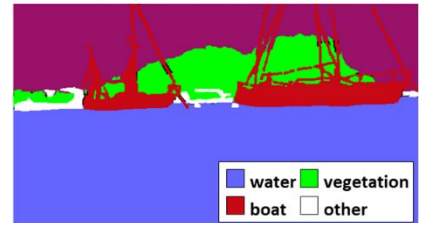
rostopic list

```
bloisi@bloisi-U36SG: ~
/camera/rgb/image_color/theora/parameter_updates
/camera/rgb/image_mono
/camera/rgb/image_mono/compressed
/camera/rgb/image_mono/compressed/parameter_descriptions
/camera/rgb/image_mono/compressed/parameter_updates
/camera/rgb/image_mono/compressedDepth/parameter_descriptions
/camera/rgb/image_mono/compressedDepth/parameter_updates
/camera/rgb/image_mono/theora
/camera/rgb/image_mono/theora/parameter_descriptions
/camera/rgb/image_mono/theora/parameter_updates
/camera/rgb/image_raw
/camera/rgb/image_raw/compressed
/camera/rgb/image_raw/compressed/parameter_descriptions
/camera/rgb/image_raw/compressed/parameter_updates
/camera/rgb/image_raw/compressedDepth/parameter_descriptions
/camera/rgb/image_raw/compressedDepth/parameter_updates
/camera/rgb/image_raw/theora
/camera/rgb/image_raw/theora/parameter_descriptions
/camera/rgb/image_raw/theora/parameter_updates
/camera/rgb/image_rect_color
/camera/rgb/image_rect_color/compressed
/camera/rgb/image_rect_color/compressed/parameter_descriptions
/camera/rgb/image_rect_color/compressed/parameter_updates
/camera/rgb/image_rect_color/compressedDepth/parameter_descriptions
/camera/rgb/image_rect_color/compressedDepth/parameter_updates
/camera/rgb/image_rect_color/theora
/camera/rgb/image_rect_color/theora/parameter_descriptions
/camera/rgb/image_rect_color/theora/parameter_updates
/camera/rgb/image_rect_mono
/camera/rgb/image_rect_mono/compressed
/camera/rgb/image_rect_mono/compressed/parameter_descriptions
/camera/rgb/image_rect_mono/compressed/parameter_updates
/camera/rgb/image_rect_mono/compressedDepth/parameter_descriptions
/camera/rgb/image_rect_mono/compressedDepth/parameter_updates
/camera/rgb/image_rect_mono/theora
/camera/rgb/image_rect_mono/theora/parameter_descriptions
/camera/rgb/image_rect_mono/theora/parameter_updates
/clock
```







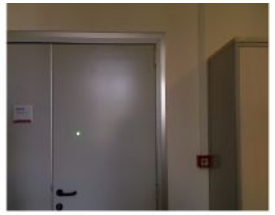
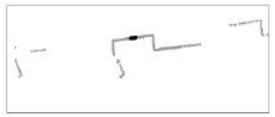
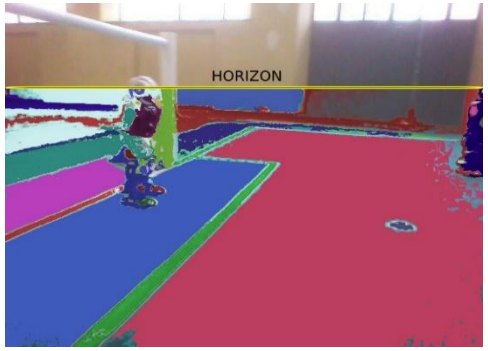


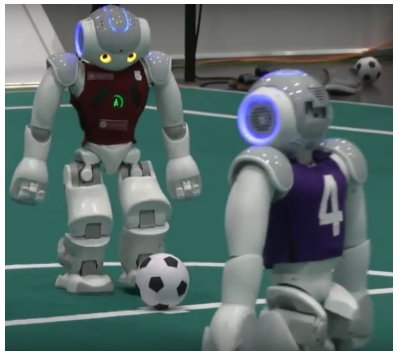
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA

Corso di Sistemi Informativi
A.A. 2018/19

Docente
Domenico Daniele Bloisi

rosbag




Maggio 2019