Appendix: Docker & ROS commands

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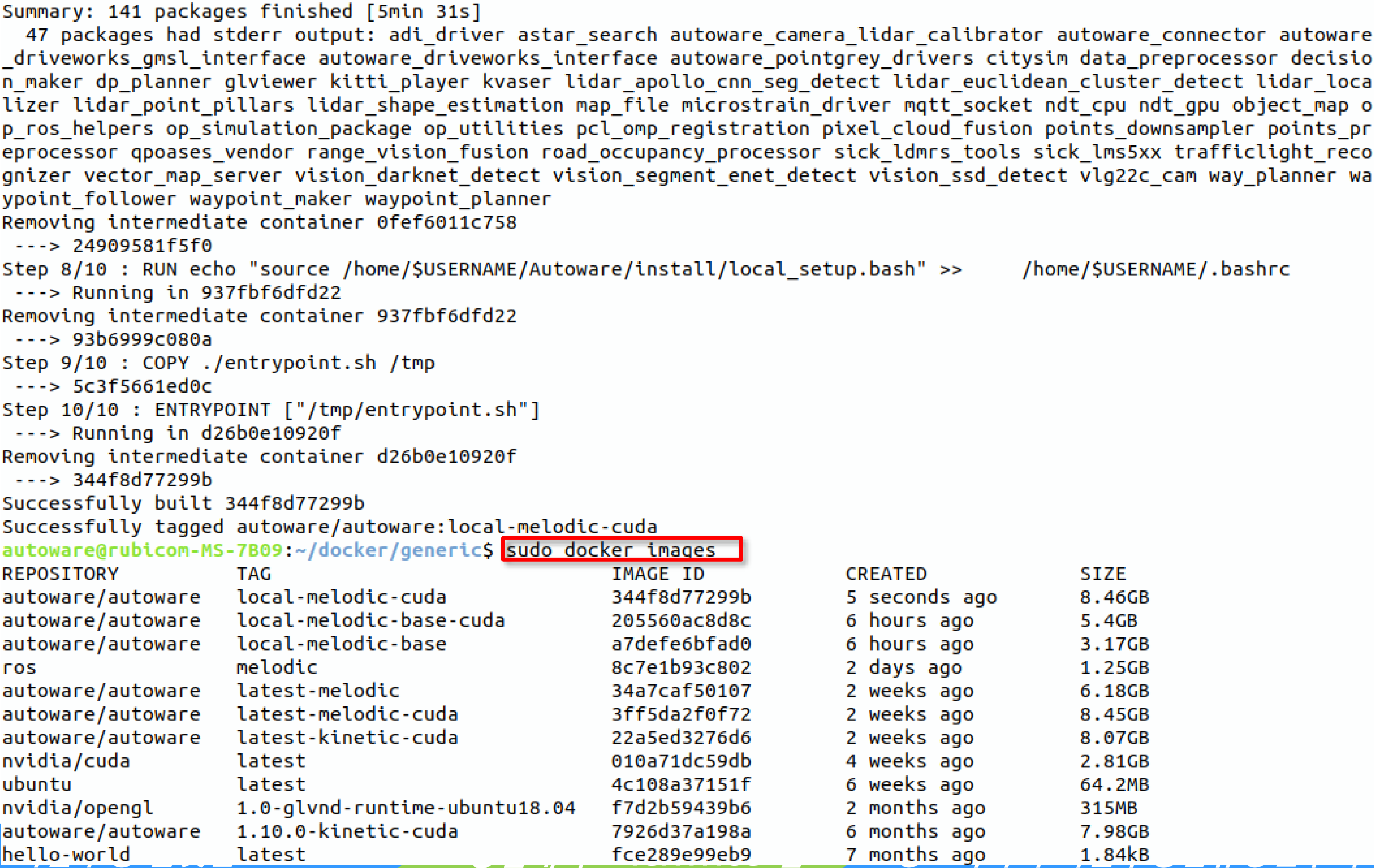
Basic Docker Commands

```
$ docker images          # docker image list 를 보여줌
$ docker ps              # docker container list를 보여줌
$ docker exec –it  CONTAINER_ID  COMMAND
                 # 이미 실행된 container에 접속하여 command를 실행함
$ docker save IMAGE_NAME  # docker image를 tar 파일 형식으로 출력함
$ docker rmi IMAGE_ID       # docker image를 삭제함
$ docker load < IMAGE.tar.gz  # docker image 파일을 설치함
$ docker commit  CONTAINER_ID  IMAGE_NAME
      # 주어진 container의 변경 사항을 모두 저장한 docker image를 생성함
```

Basic Docker Commands

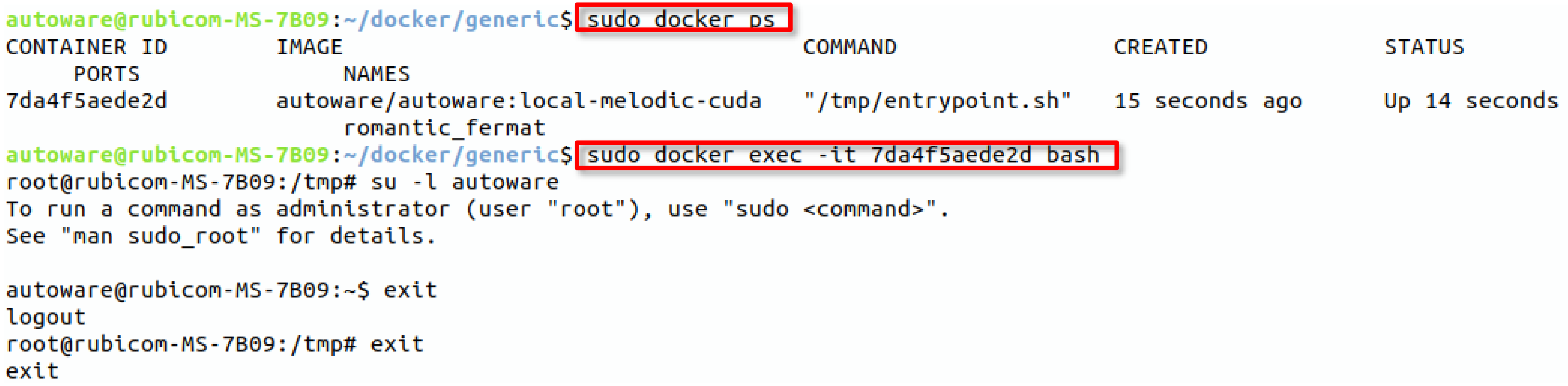
- $ docker images # docker image list 를 보여줌



```
Summary: 141 packages finished [5min 31s]
  47 packages had stderr output: adi_driver astar_search autoware_camera_lidar_calibrator autoware_connector autoware
_driveworks_gmsl_interface autoware_driveworks_interface autoware_pointgrey_drivers citysim data_preprocessor decisio
n_maker dp_planner glviewer kitti_player kvaser lidar_apollo_cnn_seg_detect lidar_euclidean_cluster_detect lidar_loca
lizer lidar_point_pillars lidar_shape_estimation map_file microstrain_driver mqtt_socket ndt_cpu ndt_gpu object_map o
p_ros_helpers op_simulation_package op_utilities pcl_omp_registration pixel_cloud_fusion points_downsampler points_pr
eprocessor qpoases_vendor range_vision_fusion road_occupancy_processor sick_ldmrs_tools sick_lms5xx trafficlight_reco
gnizer vector_map_server vision_darknet_detect vision_segment_enet_detect vision_ssd_detect vlg22c_cam way_planner wa
ypoint_follower waypoint_maker waypoint_planner
Removing intermediate container 0fef6011c758
 ---> 24909581f5f0
Step 8/10 : RUN echo "source /home/$USERNAME/Autoware/install/local_setup.bash" >>     /home/$USERNAME/.bashrc
 ---> Running in 937fbf6dfd22
Removing intermediate container 937fbf6dfd22
 ---> 93b6999c080a
Step 9/10 : COPY ./entrypoint.sh /tmp
 ---> 5c3f5661ed0c
Step 10/10 : ENTRYPOINT ["/tmp/entrypoint.sh"]
 ---> Running in d26b0e10920f
Removing intermediate container d26b0e10920f
 ---> 344f8d77299b
Successfully built 344f8d77299b
Successfully tagged autoware/autoware:local-melodic-cuda
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker images
REPOSITORY          TAG                             IMAGE ID            CREATED             SIZE
autoware/autoware   local-melodic-cuda              344f8d77299b        5 seconds ago       8.46GB
autoware/autoware   local-melodic-base-cuda         205560ac8d8c        6 hours ago         5.4GB
autoware/autoware   local-melodic-base              a7defe6bfad0        6 hours ago         3.17GB
ros                 melodic                         8c7e1b93c802        2 days ago          1.25GB
autoware/autoware   latest-melodic                  34a7caf50107        2 weeks ago         6.18GB
autoware/autoware   latest-melodic-cuda             3ff5da2f0f72        2 weeks ago         8.45GB
autoware/autoware   latest-kinetic-cuda             22a5ed3276d6        2 weeks ago         8.07GB
nvidia/cuda         latest                          010a71dc59db        4 weeks ago         2.81GB
ubuntu              latest                          4c108a37151f        6 weeks ago         64.2MB
nvidia/opengl       1.0-glvnd-runtime-ubuntu18.04   f7d2b59439b6        2 months ago        315MB
autoware/autoware   1.10.0-kinetic-cuda             7926d37a198a        6 months ago        7.98GB
hello-world         latest                          fce289e99eb9        7 months ago        1.84kB
```

Basic Docker Commands

- $ docker ps   # docker container list를 보여줌
- $ docker exec –it CONTAINER_ID COMMAND
  # 이미 실행된 container에 접속하여 command를 실행함

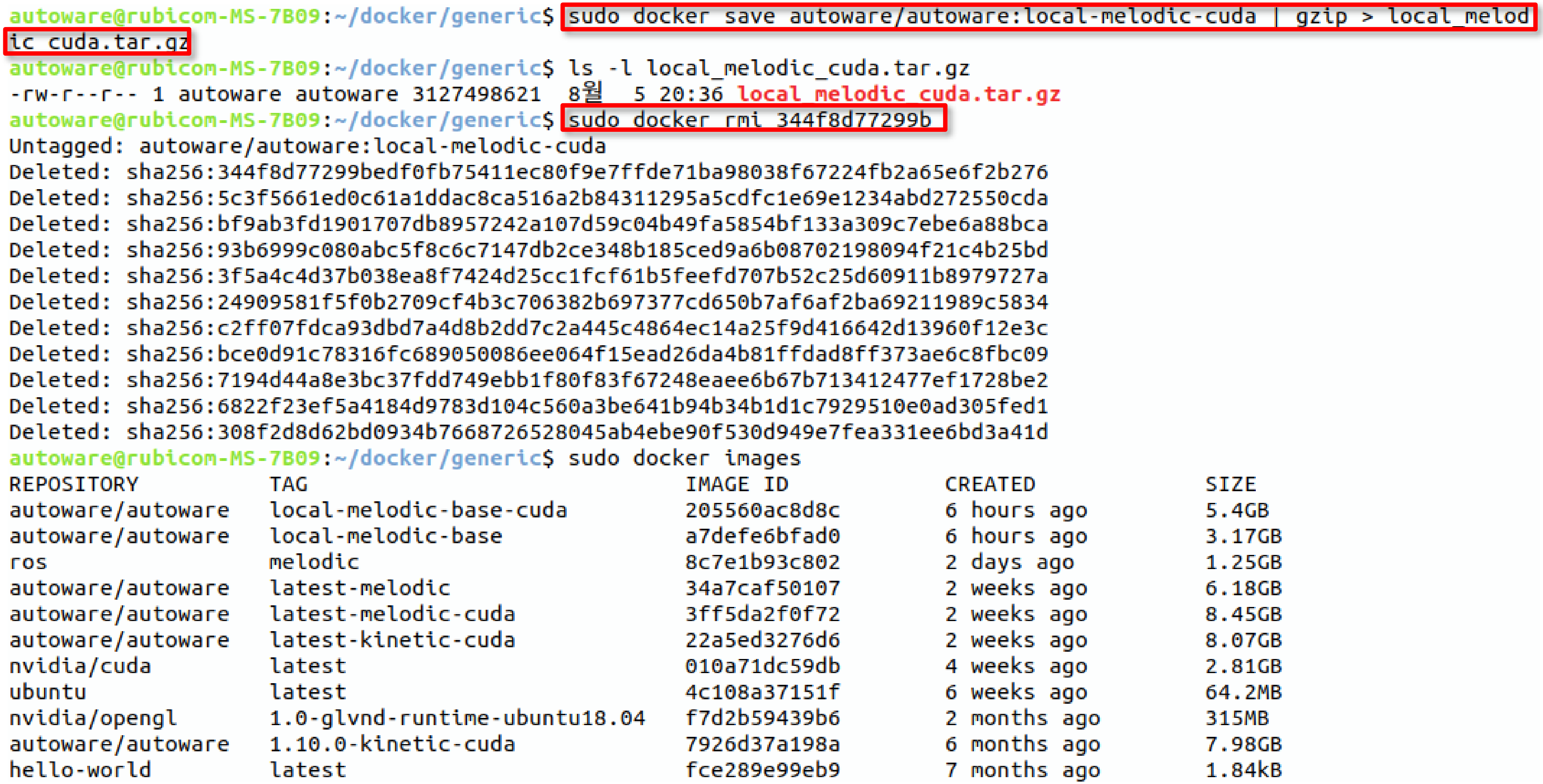


```
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker ps
CONTAINER ID        IMAGE                                COMMAND                CREATED             STATUS
     PORTS               NAMES
7da4f5aede2d        autoware/autoware:local-melodic-cuda   "/tmp/entrypoint.sh"   15 seconds ago      Up 14 seconds
                         romantic_fermat
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker exec -it 7da4f5aede2d bash
root@rubicom-MS-7B09:/tmp# su -l autoware
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

autoware@rubicom-MS-7B09:~$ exit
logout
root@rubicom-MS-7B09:/tmp# exit
exit
```

Basic Docker Commands

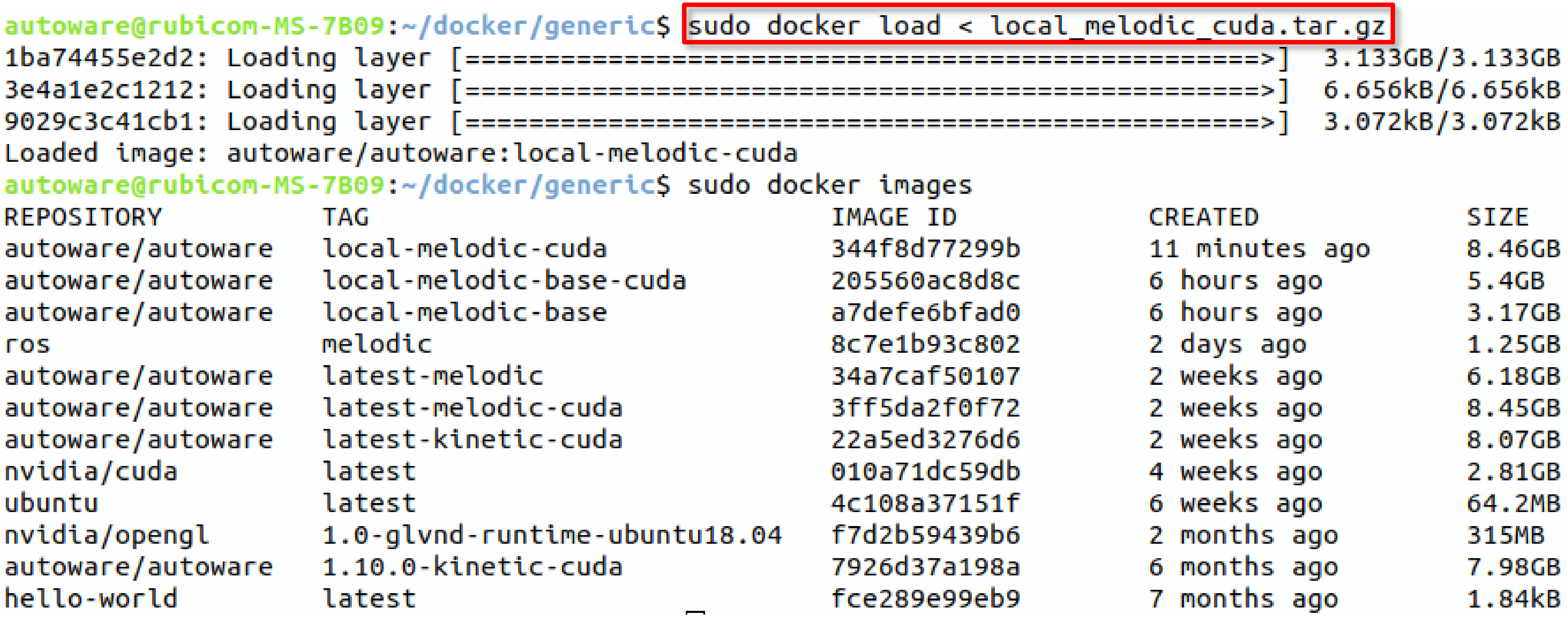
- $ docker save IMAGE_NAME # docker image를 tar 파일 형식으로 출력함
- $ docker rmi IMAGE_ID # docker image를 삭제함



```
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker save autoware/autoware:local-melodic-cuda | gzip > local_melod
ic_cuda.tar.gz
autoware@rubicom-MS-7B09:~/docker/generic$ ls -l local_melodic_cuda.tar.gz
-rw-r--r-- 1 autoware autoware 3127498621  8월  5 20:36 local_melodic_cuda.tar.gz
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker rmi 344f8d77299b
Untagged: autoware/autoware:local-melodic-cuda
Deleted: sha256:344f8d77299bedf0fb75411ec80f9e7ffde71ba98038f67224fb2a65e6f2b276
Deleted: sha256:5c3f5661ed0c61a1ddac8ca516a2b84311295a5cdfc1e69e1234abd272550cda
Deleted: sha256:bf9ab3fd1901707db8957242a107d59c04b49fa5854bf133a309c7ebe6a88bca
Deleted: sha256:93b6999c080abc5f8c6c7147db2ce348b185ced9a6b08702198094f21c4b25bd
Deleted: sha256:3f5a4c4d37b038ea8f7424d25cc1fcf61b5feefd707b52c25d60911b8979727a
Deleted: sha256:24909581f5f0b2709cf4b3c706382b697377cd650b7af6af2ba69211989c5834
Deleted: sha256:c2ff07fdca93dbd7a4d8b2dd7c2a445c4864ec14a25f9d416642d13960f12e3c
Deleted: sha256:bce0d91c78316fc689050086ee064f15ead26da4b81ffdad8ff373ae6c8fbc09
Deleted: sha256:7194d44a8e3bc37fdd749ebb1f80f83f67248eaee6b67b713412477ef1728be2
Deleted: sha256:6822f23ef5a4184d9783d104c560a3be641b94b34b1d1c7929510e0ad305fed1
Deleted: sha256:308f2d8d62bd0934b7668726528045ab4ebe90f530d949e7fea331ee6bd3a41d
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker images
REPOSITORY          TAG                              IMAGE ID            CREATED             SIZE
autoware/autoware   local-melodic-base-cuda          205560ac8d8c        6 hours ago         5.4GB
autoware/autoware   local-melodic-base               a7defe6bfad0        6 hours ago         3.17GB
ros                 melodic                          8c7e1b93c802        2 days ago          1.25GB
autoware/autoware   latest-melodic                   34a7caf50107        2 weeks ago         6.18GB
autoware/autoware   latest-melodic-cuda              3ff5da2f0f72        2 weeks ago         8.45GB
autoware/autoware   latest-kinetic-cuda              22a5ed3276d6        2 weeks ago         8.07GB
nvidia/cuda         latest                           010a71dc59db        4 weeks ago         2.81GB
ubuntu              latest                           4c108a37151f        6 weeks ago         64.2MB
nvidia/opengl       1.0-glvnd-runtime-ubuntu18.04    f7d2b59439b6        2 months ago        315MB
autoware/autoware   1.10.0-kinetic-cuda              7926d37a198a        6 months ago        7.98GB
hello-world         latest                           fce289e99eb9        7 months ago        1.84kB
```

Basic Docker Commands

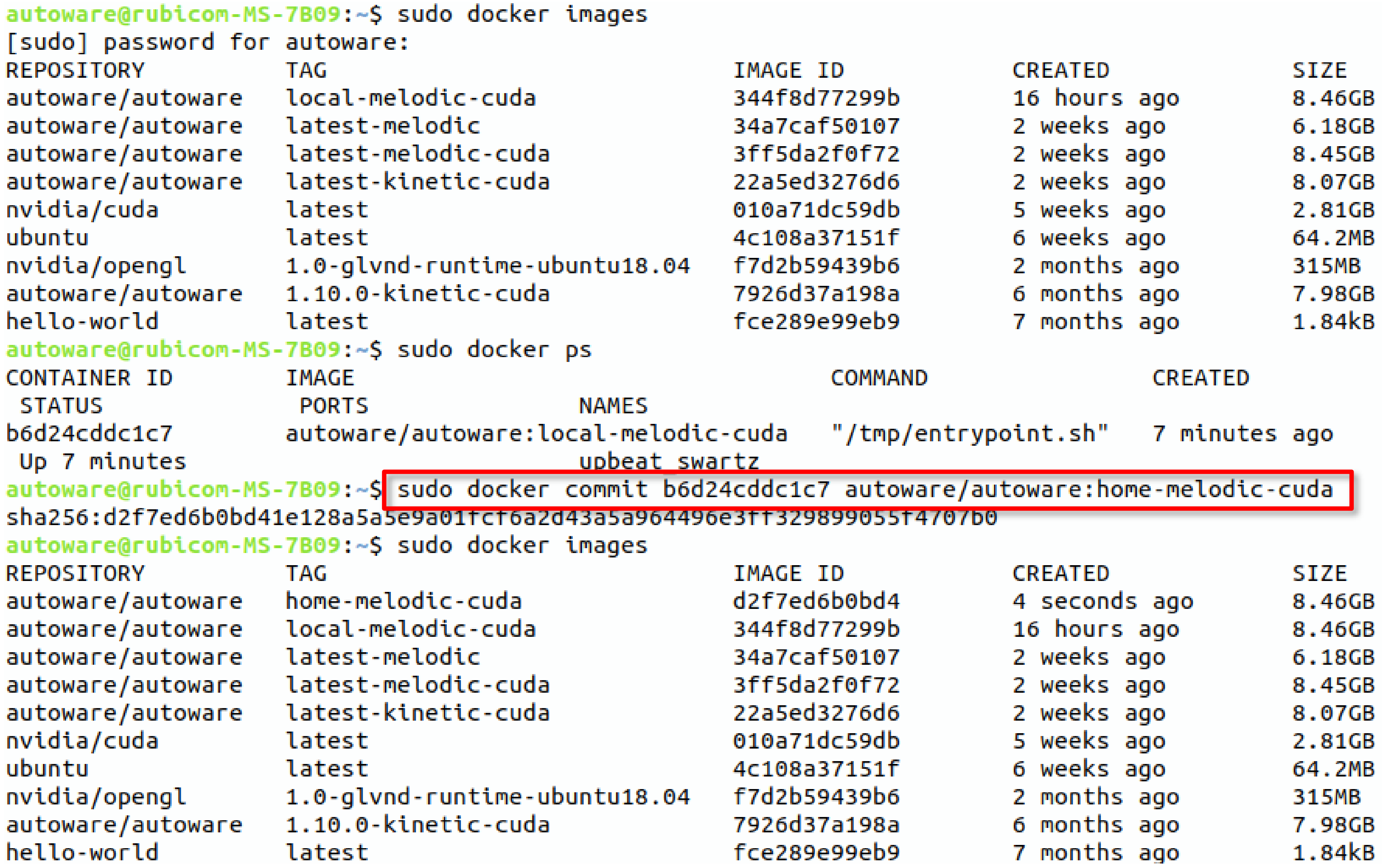
- $ docker load < IMAGE.tar.gz   # docker image 파일을 설치함



```
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker load < local_melodic_cuda.tar.gz
1ba74455e2d2: Loading layer [==================================================>]  3.133GB/3.133GB
3e4a1e2c1212: Loading layer [==================================================>]  6.656kB/6.656kB
9029c3c41cb1: Loading layer [==================================================>]  3.072kB/3.072kB
Loaded image: autoware/autoware:local-melodic-cuda
autoware@rubicom-MS-7B09:~/docker/generic$ sudo docker images
REPOSITORY          TAG                              IMAGE ID            CREATED             SIZE
autoware/autoware   local-melodic-cuda               344f8d77299b        11 minutes ago      8.46GB
autoware/autoware   local-melodic-base-cuda          205560ac8d8c        6 hours ago         5.4GB
autoware/autoware   local-melodic-base               a7defe6bfad0        6 hours ago         3.17GB
ros                 melodic                          8c7e1b93c802        2 days ago          1.25GB
autoware/autoware   latest-melodic                   34a7caf50107        2 weeks ago         6.18GB
autoware/autoware   latest-melodic-cuda              3ff5da2f0f72        2 weeks ago         8.45GB
autoware/autoware   latest-kinetic-cuda              22a5ed3276d6        2 weeks ago         8.07GB
nvidia/cuda         latest                           010a71dc59db        4 weeks ago         2.81GB
ubuntu              latest                           4c108a37151f        6 weeks ago         64.2MB
nvidia/opengl       1.0-glvnd-runtime-ubuntu18.04    f7d2b59439b6        2 months ago        315MB
autoware/autoware   1.10.0-kinetic-cuda              7926d37a198a        6 months ago        7.98GB
hello-world         latest                           fce289e99eb9        7 months ago        1.84kB
```

Basic Docker Commands

- $ docker commit CONTAINER_ID IMAGE_NAME # 주어진 container의 변경 사항을 모두 저장한 docker image를 생성함



```
autoware@rubicom-MS-7B09:~$ sudo docker images
[sudo] password for autoware:
REPOSITORY          TAG                             IMAGE ID            CREATED             SIZE
autoware/autoware   local-melodic-cuda              344f8d77299b        16 hours ago        8.46GB
autoware/autoware   latest-melodic                  34a7caf50107        2 weeks ago         6.18GB
autoware/autoware   latest-melodic-cuda             3ff5da2f0f72        2 weeks ago         8.45GB
autoware/autoware   latest-kinetic-cuda             22a5ed3276d6        2 weeks ago         8.07GB
nvidia/cuda         latest                          010a71dc59db        5 weeks ago         2.81GB
ubuntu              latest                          4c108a37151f        6 weeks ago         64.2MB
nvidia/opengl       1.0-glvnd-runtime-ubuntu18.04   f7d2b59439b6        2 months ago        315MB
autoware/autoware   1.10.0-kinetic-cuda             7926d37a198a        6 months ago        7.98GB
hello-world         latest                          fce289e99eb9        7 months ago        1.84kB
autoware@rubicom-MS-7B09:~$ sudo docker ps
CONTAINER ID        IMAGE                                  COMMAND                CREATED
 STATUS              PORTS               NAMES
b6d24cddc1c7        autoware/autoware:local-melodic-cuda   "/tmp/entrypoint.sh"   7 minutes ago
 Up 7 minutes                            upbeat_swartz
autoware@rubicom-MS-7B09:~$ sudo docker commit b6d24cddc1c7 autoware/autoware:home-melodic-cuda
sha256:d2f7ed6b0bd41e128a5a5e9a01fcf6a2d43a5a964496e3ff329899055f4707b0
autoware@rubicom-MS-7B09:~$ sudo docker images
REPOSITORY          TAG                             IMAGE ID            CREATED             SIZE
autoware/autoware   home-melodic-cuda               d2f7ed6b0bd4        4 seconds ago       8.46GB
autoware/autoware   local-melodic-cuda              344f8d77299b        16 hours ago        8.46GB
autoware/autoware   latest-melodic                  34a7caf50107        2 weeks ago         6.18GB
autoware/autoware   latest-melodic-cuda             3ff5da2f0f72        2 weeks ago         8.45GB
autoware/autoware   latest-kinetic-cuda             22a5ed3276d6        2 weeks ago         8.07GB
nvidia/cuda         latest                          010a71dc59db        5 weeks ago         2.81GB
ubuntu              latest                          4c108a37151f        6 weeks ago         64.2MB
nvidia/opengl       1.0-glvnd-runtime-ubuntu18.04   f7d2b59439b6        2 months ago        315MB
autoware/autoware   1.10.0-kinetic-cuda             7926d37a198a        6 months ago        7.98GB
hello-world         latest                          fce289e99eb9        7 months ago        1.84kB
```

Basic ROS commands

- $ roslaunch PKG_NAME LAUNCH_FILE_NAME

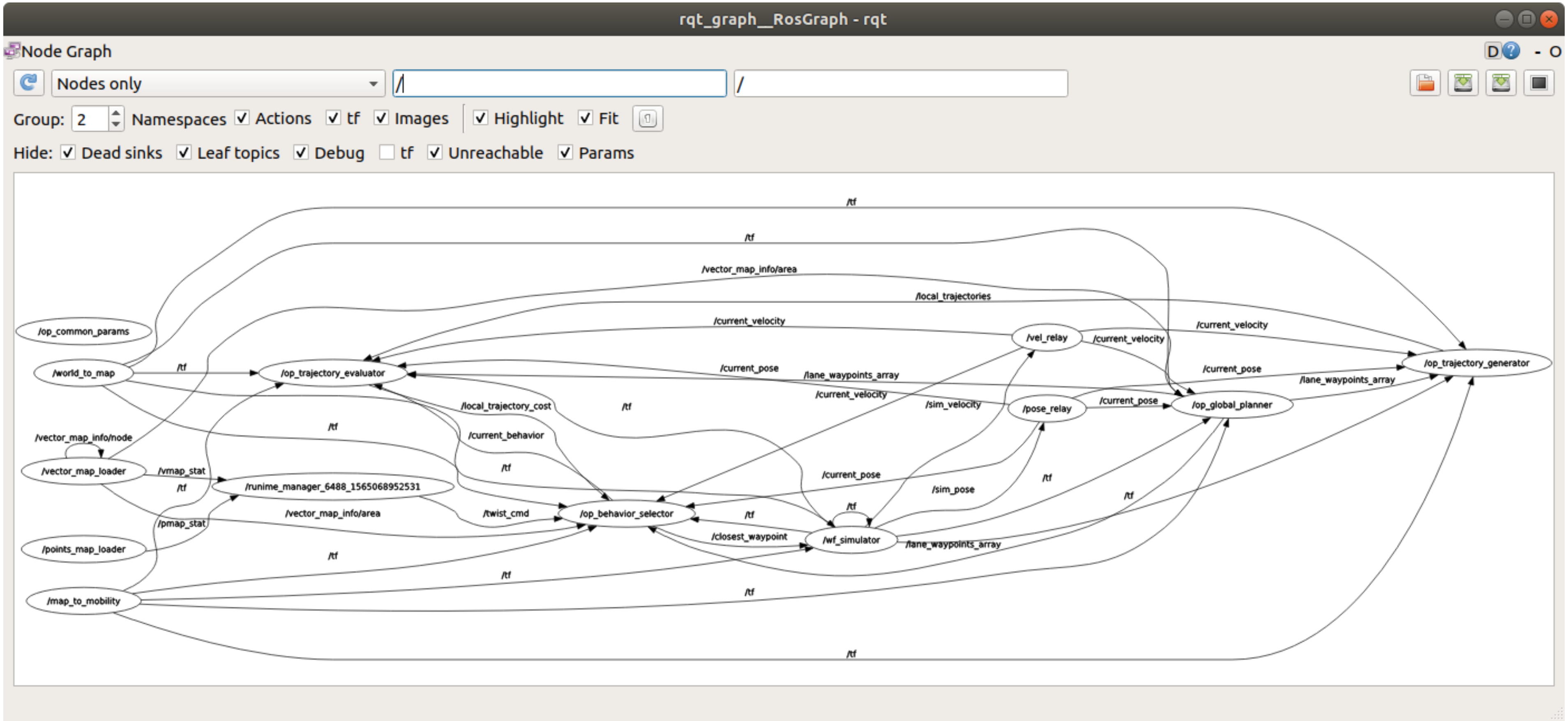
  # 주어진 pkg 안에 명명한 launch file을 실행함

  # 하나의 launch file은 여러 개의 ros node들을 실행하도록 작성됨
- $ rqt_graph # ROS node들 간에 topic 연결들을 그래프로 보여줌
- $ rostopic echo TOPIC_NAME

  # 주어진 topic에서 발행되는 메시지들을 출력함

Basic ROS commands

- $ rqt_graph # ROS node들 간에 topic 연결들을 그래프로 보여줌



rqt_graph__RosGraph - rqt

Node Graph

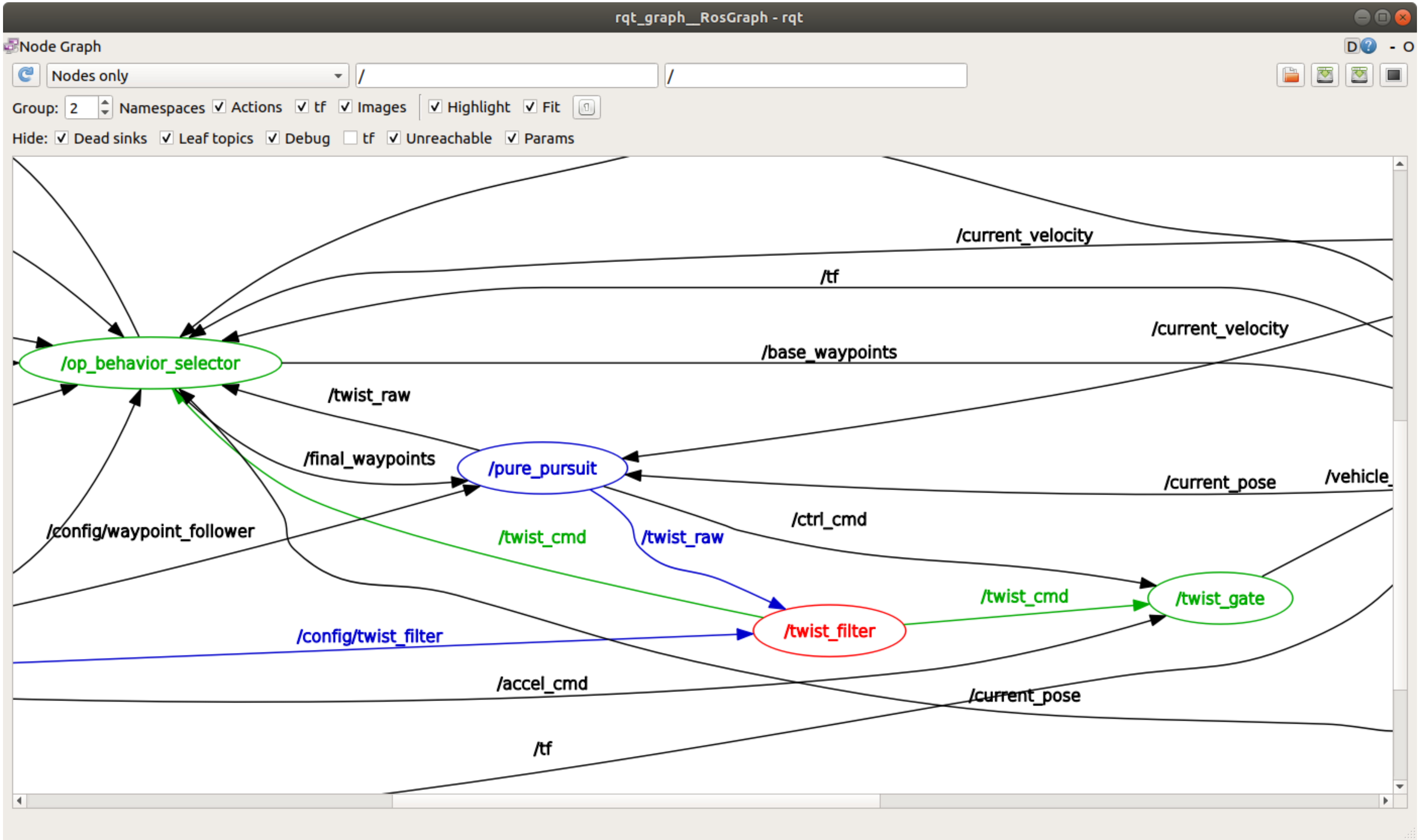
Nodes only ▾ / /

Group: 2 Namespaces ☑ Actions ☑ tf ☑ Images ☑ Highlight ☑ Fit

Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug □ tf ☑ Unreachable ☑ Params

Basic ROS commands

- $ rqt_graph # ROS node들 간에 topic 연결들을 그래프로 보여줌



rqt_graph__RosGraph - rqt

Node Graph

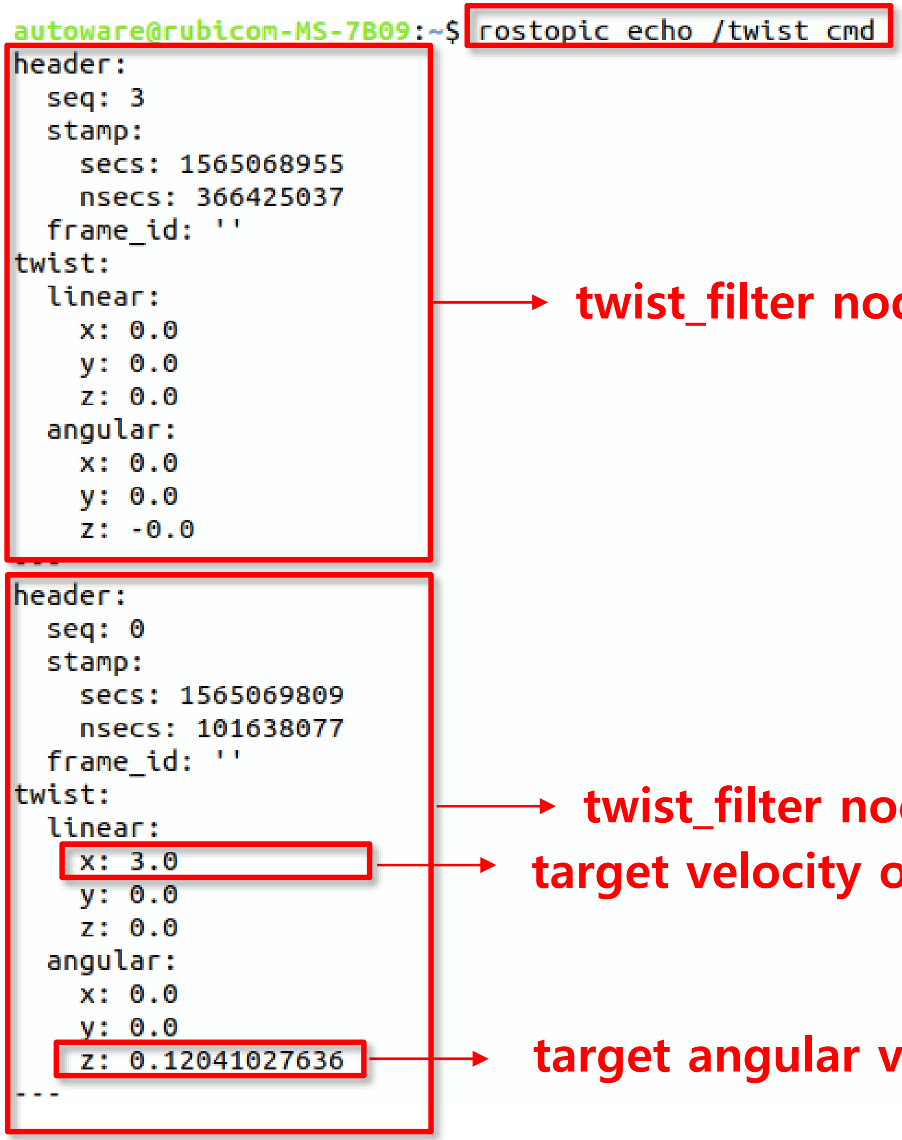
Nodes only / /

Group: 2 Namespaces ☑ Actions ☑ tf ☑ Images ☑ Highlight ☑ Fit

Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug □ tf ☑ Unreachable ☑ Params

Basic ROS commands

- $ rostopic echo TOPIC_NAME # 주어진 topic에서 발행되는 메시지들을 출력함



```
autoware@rubicom-MS-7B09:~$ rostopic echo /twist_cmd
header:
  seq: 3
  stamp:
    secs: 1565068955
    nsecs: 366425037
  frame_id: ''
twist:
  linear:
    x: 0.0
    y: 0.0
    z: 0.0
  angular:
    x: 0.0
    y: 0.0
    z: -0.0
---
header:
  seq: 0
  stamp:
    secs: 1565069809
    nsecs: 101638077
  frame_id: ''
twist:
  linear:
    x: 3.0
    y: 0.0
    z: 0.0
  angular:
    x: 0.0
    y: 0.0
    z: 0.12041027636
---
```

twist_filter node가 실행되기 전에 출력된 메시지

twist_filter node가 실행된 후에 출력된 메시지

target velocity of vehicle

target angular velocity of vehicle

Thank you!!