ROS 설치와 구동 실습

1. ROS 설치하기 (https://wiki.ros.org/kinetic/Installation/Ubuntu)

- ROS 설치 과정 (ubuntu 16.04 버전)

1. sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'

2. cat /etc/apt/sources.list.d/ros-latest.list

```
soorim@soorim-virtual-machine:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.l
ist'
[sudo] password for soorim:
soorim@soorim-virtual-machine:~$ cat /etc/apt/sources.list.d/ros-latest.list
deb http://packages.ros.org/ros/ubuntu xenial main
soorim@soorim-virtual-machine:~$
```

3. sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654

```
soorim@soorim-virtual-machine:~$ sudo  apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
Executing: /tmp/tmp.uwo5Umv4YS/gpg.1.sh --keyserver
hkp://keyserver.ubuntu.com:80
--recv-key
C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
gpg: requesting key AB17C654 from hkp server keyserver.ubuntu.com
gpg: key AB17C654: public key "Open Robotics <info@osrfoundation.org>" imported
gpg: Total number processed: 1
gpg:               imported: 1  (RSA: 1)
soorim@soorim-virtual-machine:~$
```

-패키지 설치

1. sudo apt-get update

2. sudo apt-get install ros-kinetic-desktop-full (시간 걸림)

- rosdep 초기화

1. sudo rosdep init

```
soorim@soorim-virtual-machine:~$ sudo rosdep init
[sudo] password for soorim:
Wrote /etc/ros/rosdep/sources.list.d/20-default.list
Recommended: please run

        rosdep update
```

2. rosdep update

-웰 환경 설정

1. echo "source /opt/ros/kinetic/setup.bash" >> ~/.bashrc

2. source ~/.bashrc

- 추기로 필요한 도구 설치

sudo apt install python-rosinstall python-rosinstall-generator python-wstool build-essential

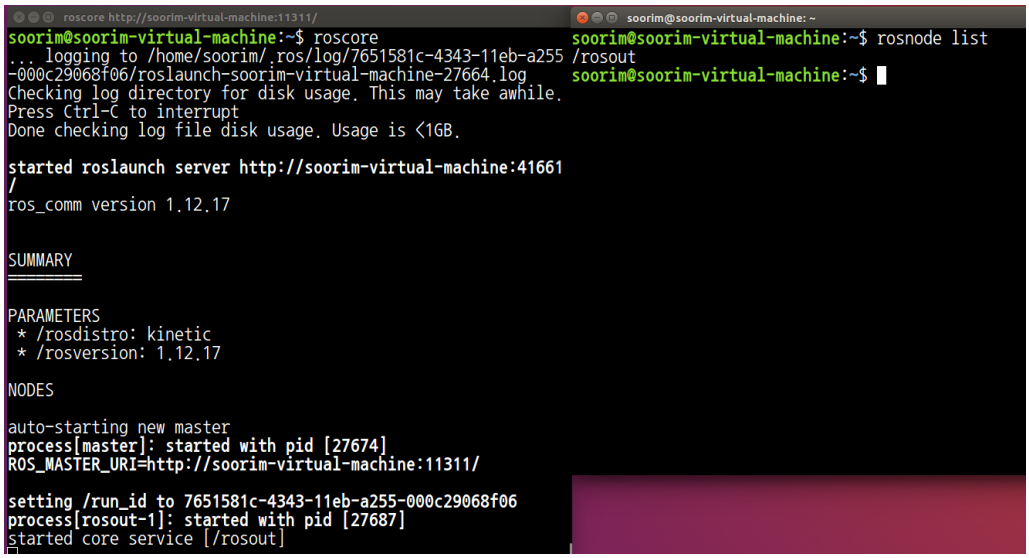
-설치 확인

roscore

```
soorim@soorim-virtual-machine:~$ roscore
... logging to /home/soorim/.ros/log/52ad5456-4343-11eb-a255-000c29068f06/roslaunch-soorim-virtual-machine-27601.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://soorim-virtual-machine:44425/
ros_comm version 1.12.17


SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.17

NODES

auto-starting new master
process[master]: started with pid [27612]
ROS_MASTER_URI=http://soorim-virtual-machine:11311/

setting /run_id to 52ad5456-4343-11eb-a255-000c29068f06
process[rosout-1]: started with pid [27625]
started core service [/rosout]
```

roscore창을 실행 상태에서 다른 터미널을 열고

rosnode list 명령



-디렉토리 만들기 (순서대로 보기)

```
soorim@soorim-virtual-machine:~$ pwd
/home/soorim
soorim@soorim-virtual-machine:~$ mkdir -p ~/xycar_ws/src
soorim@soorim-virtual-machine:~$ cd xycar_ws/
soorim@soorim-virtual-machine:~/xycar_ws$
```

catkin_make

```
soorim@soorim-virtual-machine:~/xycar_ws$ catkin_make
Base path: /home/soorim/xycar_ws
Source space: /home/soorim/xycar_ws/src
Build space: /home/soorim/xycar_ws/build
Devel space: /home/soorim/xycar_ws/devel
Install space: /home/soorim/xycar_ws/install
Creating symlink "/home/soorim/xycar_ws/src/CMakeLists.txt" pointing to "/opt/ro
s/kinetic/share/catkin/cmake/toplevel.cmake"
####
#### Running command: "cmake /home/soorim/xycar_ws/src -DCATKIN_DEVEL_PREFIX=/ho
me/soorim/xycar_ws/devel -DCMAKE_INSTALL_PREFIX=/home/soorim/xycar_ws/install -G
 Unix Makefiles" in "/home/soorim/xycar_ws/build"
```

cd

gedit .bashrc

```
soorim@soorim-virtual-machine:~/xycar_ws$ cd
soorim@soorim-virtual-machine:~$ gedit .bashrc
```

- 파일을 열고 마지막 줄 이후에 추가로 다음과 같이 작성

alias h='history'

alias cw='cd ~/xycar_ws'

alias cs='cd ~/xycar_ws/src'

alias cm='cd ~/xycar_ws && catkin_make'

source /opt/ros/kinetic/setup.bash

source ~/xycar_ws/devel/setup.bash

export ROS_MASTER_URO=http://localhost:11311

export ROS_HOSTNAME=localhost

```
# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi
source /opt/ros/kinetic/setup.bash

alias h='history'
alias cw='cd ~/xycar_ws'
alias cs='cd ~/xycar_ws/src'
alias cm='cd ~/xycar_ws && catkin_make'
source /opt/ros/kinetic/setup.bash
source ~/xycar_ws/devel/setup.bash
export ROS_MASTER_URO=http://localhost:11311
export ROS_HOSTNAME=localhost
```

catkin_make (수정 후 빌드 해주기)

2. 실습

- 터미널 4개 사용 !!

1 터미널

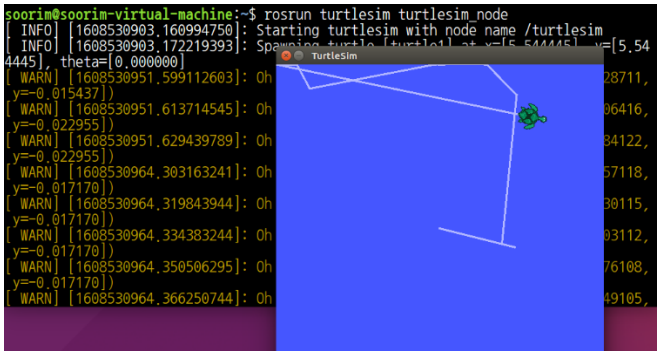
soorim@soorim-virtual-machine:~$ roscore

2 터미널 (거북이 창 만들기)

soorim@soorim-virtual-machine:~$ rosrun turtlesim turtlesim_node

[INFO] [1608530903.160994750]: Starting turtlesim with node name /turtlesim

[INFO] [1608530903.172219393]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445], theta=[0.000000]



3 터미널 (화살표로 거북이 움직이기 가능)

soorim@soorim-virtual-machine:~$ rosrun turtlesim turtle_teleop_key

Reading from keyboard

Use arrow keys to move the turtle.

4 터미널

soorim@soorim-virtual-machine:~$ rosnode list

/rosout

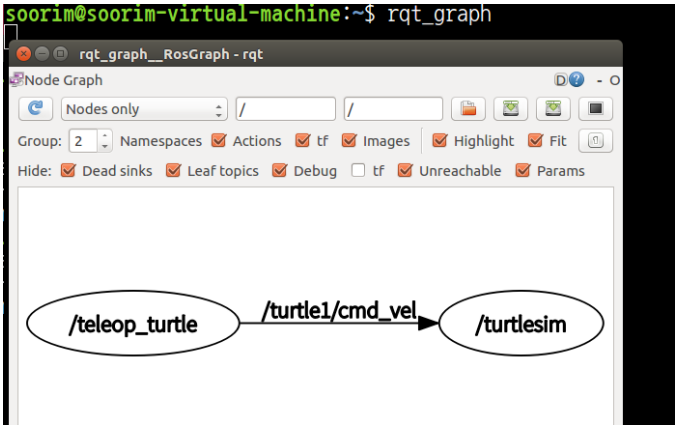
/teleop_turtle

/turtlesim

-그래프로 보기

soorim@soorim-virtual-machine:~$ rqt_graph

teleop_turtle에서 /trutlesim으로 화살표로 값을 날려줌



-좌표로 보기

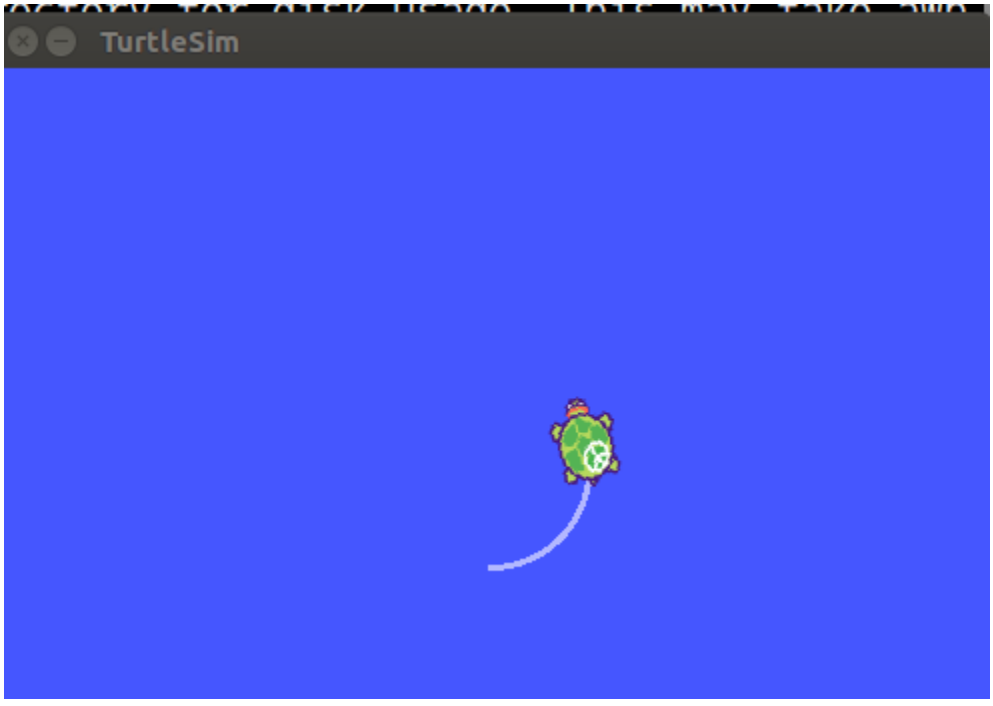
soorim@soorim-virtual-machine:~$ rostopic list

soorim@soorim-virtual-machine:~$ rostopic echo /turtle1/cmd_vel

```
^Csoorim@soorim-virtual-machine:~$ rostopic list
/rosout
/rosout_agg
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
soorim@soorim-virtual-machine:~$ rostopic echo /turtle1/cmd_vel
linear:
  x: 0.0
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: -2.0
---
```

- 거북이가 자동으로 명령어에 따라 원으로 회전

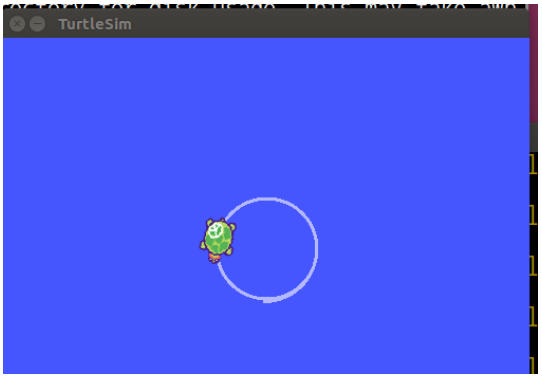
soorim@soorim-virtual-machine:~$ rostopic pub -1 /turtle1/cmd_vel geometry_msgs/Twist -- '[2.0, 0.0, 0.0]' '[0.0, 0.0, 1.8]'



'[2.0, 0.0, 0.0]' -> 선 속도(2.0 값이 커지면 크게 회전

'[0.0, 0.0, 1.8]' -> 각속도 (1.8값이 커지면 반경이 작아짐) 무한 반복할 때 (끄려면 ctrl-c)

soorim@soorim-virtual-machine:~$ rostopic pub /turtle1/cmd_vel geometry_msgs/Twist **-r 1** -- '[4.0, 0.0, 0.0]' '[0.0, 0.0, 3.8]'



- 패키지 만들기

soorim@soorim-virtual-machine:~$ cd ~/xycar_ws/src/

soorim@soorim-virtual-machine:~/xycar_ws/src$ catkin_create_pkg my_pkg1 std_msgs rospy

```
soorim@soorim-virtual-machine:~/xycar_ws/src$ catkin_create_pkg my_pkg1 std_msgs rospy
Created file my_pkg1/package.xml
Created file my_pkg1/CMakeLists.txt
Created folder my_pkg1/src
Successfully created files in /home/soorim/xycar_ws/src/my_pkg1. Please adjust the values in package.xml.
```

수정 후 빌드 하기

soorim@soorim-virtual-machine:~/xycar_ws/src$ catkin_make

만든 패키지 찾고 거기로 이동

```
soorim@soorim-virtual-machine:~/xycar_ws$ rospack find my_pkg1
/home/soorim/xycar_ws/src/my_pkg1
soorim@soorim-virtual-machine:~/xycar_ws$ rospack depends1 my_kpg1
[rospack] Error: no such package my_kpg1
soorim@soorim-virtual-machine:~/xycar_ws$ rospack depends1 my_pkg1
rospy
std_msgs
soorim@soorim-virtual-machine:~/xycar_ws$ roscd my_pkg1/
soorim@soorim-virtual-machine:~/xycar_ws/src/my_pkg1$
```

- my_pkg1안에서 실습1 (pub.py)

터미널 1

soorim@soorim-virtual-machine:~/xycar_ws/src/my_pkg1/src$ gedit pub.py

아래와 같이 작성!!!!!!!

```
#!/usr/bin/env python


import rospy

from geometry_msgs.msg import Twist


rospy.init_node('my_nome', anonymous=True)

pub=rospy.Publisher('/turtle1/cmd_vel', Twist, queue_size=10)


msg=Twist()

msg.linear.x=2.0

msg.linear.y=0.0

msg.linear.z=0.0

msg.angular.x=0.0

msg.angular.y=0.0

msg.angular.z=1.8


rate=rospy.Rate(1)


while not rospy.is_shutdown():

        pub.publish(msg)

        rate.sleep()
```

저장하면 바로 실행권한이 없기 때문에 따로 실행 권한 주기

```
soorim@soorim-virtual-machine:~/xycar_ws/src/my_pkg1/src$ ls -l
합계 4
-rw-rw-r-- 1 soorim soorim 381 12월 21 16:07 pub.py
soorim@soorim-virtual-machine:~/xycar_ws/src/my_pkg1/src$ chmod +x pub.py
soorim@soorim-virtual-machine:~/xycar_ws/src/my_pkg1/src$ ls -l
합계 4
-rwxrwxr-x 1 soorim soorim 381 12월 21 16:07 pub.py
```

터미널 2 (거북이 창 띄우기)

soorim@soorim-virtual-machine:~$ rosrun turtlesim turtlesim_node

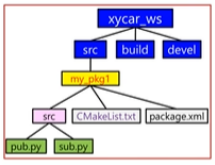
터미널 3 (생성한 파일 실행하기)

soorim@soorim-virtual-machine:~$ rosrun my_pkg1 pub.py

- my_pkg1안에서 실습2 (sub.py)

- ~/xycar_ws/src/my_pkg1/src 위치에,

  아래와 같은 프로그램을 sub.py 라는 이름으로 작성




```
#!/usr/bin/env python

import rospy
from turtlesim.msg import Pose

def callback(data):
    s = "Location: %.2f, %.2f" % (data.x, data.y)
    rospy.loginfo(rospy.get_caller_id() + s)

rospy.init_node("my_listener", anonymous=True)
rospy.Subscriber("/turtle1/pose", Pose, callback)
rospy.spin()
```

노드를 만들고

Subscriber 객체 생성

메시지를 수신하면 이 함수가 호출됨

Pub.py를 실행시킨 상태에서 새로 터미널을 열고 실행해야 함

```
soorim@soorim-virtual-machine:~$ rostopic list
/rosout
/rosout_agg
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
soorim@soorim-virtual-machine:~$ rostopic type /turtle1/pose
turtlesim/Pose
soorim@soorim-virtual-machine:~$ rosmsg show turtlesim/Pose
float32 x
float32 y
float32 theta
float32 linear_velocity
float32 angular_velocity

soorim@soorim-virtual-machine:~$ rostopic echo /turtle1/pose
x: 5.30262708664
y: 7.74344015121
theta: 3.33184671402
linear_velocity: 2.0
angular_velocity: 1.79999995232
---
x: 5.27139139175
y: 7.73648643494
theta: 3.3606467247
linear_velocity: 2.0
angular_velocity: 1.79999995232
```

-실습 과정 정리

```
$ cd ~/xycar_ws/src
$ catkin_create_pkg my_pkg1 std_msgs rospy
$ cm
$ cd ~/xycar_ws/src/my_pkg1/src
$ gedit sub.py
$ gedit pub.py
$ chmod +x sub.py pub.py
$ rosrun my_pkg1 pub.py
$ rosrun my_pkg1 sub.py
```