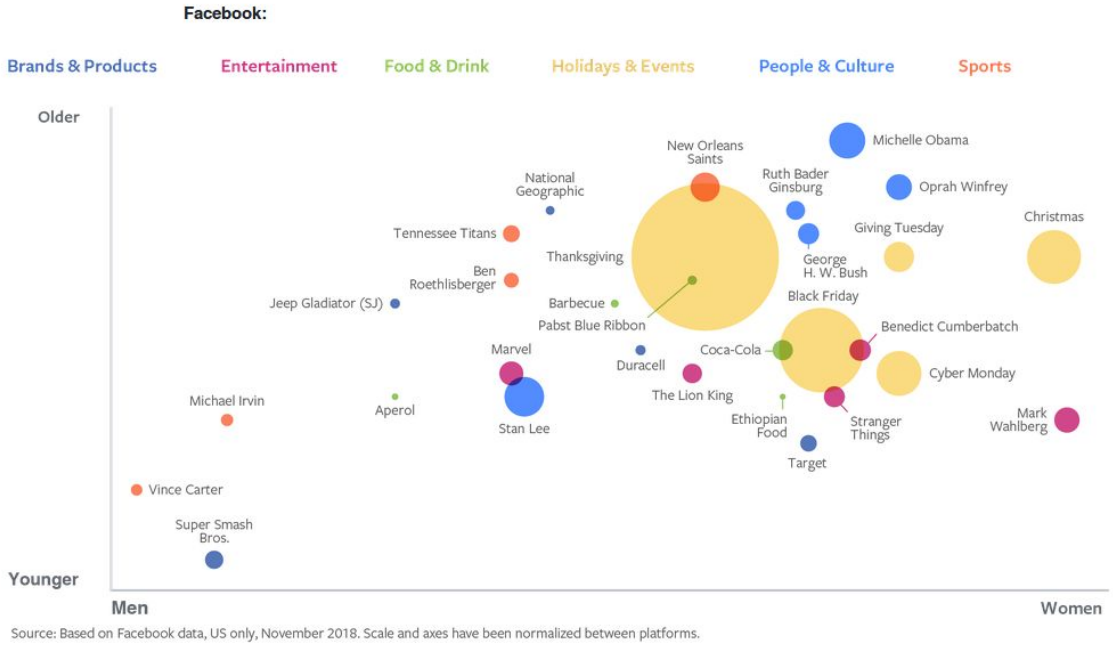
Communicating with ROS Topics

IRR S2019



ROS
Robot Operating System

What are ROS Topics

A topic is a named bus/buffer over which nodes exchange messages

- Unidirectional data stream
- Anonymous
- A Topic has a message type

- Queue: FIFO

A Python Publisher

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/scripts$ ls -l news_publisher1.py
-rwxrwxr-x 1 cjchung cjchung 378 Jan 11 23:04 news_publisher1.py
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/scripts$ gedit news_publisher1.py
```

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

import rospy
from std_msgs.msg import String

if __name__ == '__main__':
        rospy.init_node('news_publisher1')
        pub = rospy.Publisher("/news_topic1", String,  queue_size=10)

        rate = rospy.Rate(2)
        while not rospy.is_shutdown():
                msg = String()
                msg.data = "Topic 1 news"
                pub.publish(msg)
                rate.sleep()  # sleep 500ms
        rospy.loginfo("Node stopped")
```

Do not forget to run roscore!

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/scripts$ python news_publisher1.py
```

How to display nodes and messages

```
cjchung@Robofest:~$ rosnode list
/news_publisher1
/rosout
cjchung@Robofest:~$ rostopic list
/news_topic1
/rosout
/rosout_agg
cjchung@Robofest:~$ rostopic echo /news_topic1
data: "Topic 1 news"
---
data: "Topic 1 news"
---
data: "Topic 1 news"
---
data: "Topic 1 news"
---
data: "Topic 1 news"
---
data: "Topic 1 news"
---
```

A Python Subscriber

File name (news_subscriber1.py) can be different from the node name. But recommended to be same.

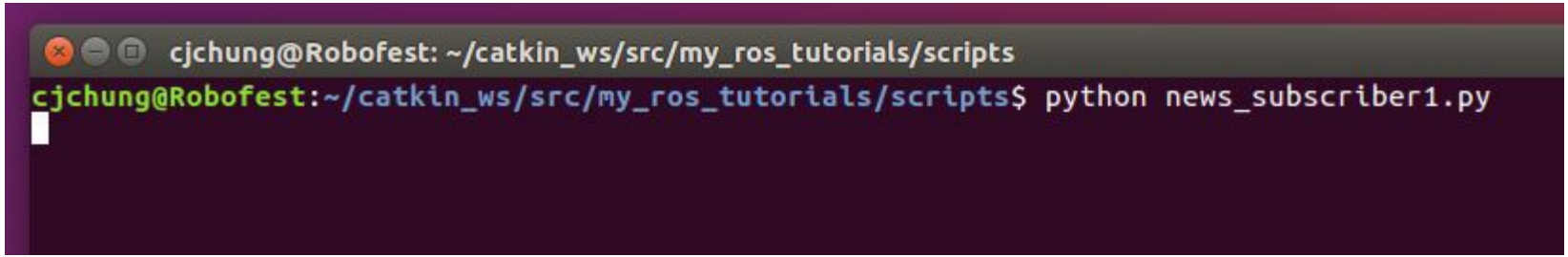
```
#!/usr/bin/env python

import rospy
from std_msgs.msg import String

def callback_receive_radio_data(msg):
        rospy.loginfo("Message received : ")
        rospy.loginfo(msg)


if __name__ == '__main__':
        rospy.init_node('news_subscriber1')
        sub = rospy.Subscriber("/news_topic1", String,
callback_receive_radio_data)
        rospy.spin()
```

Let’s run the subscriber without the publisher

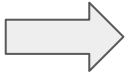


Nothing occurs...

Run the publisher & subscriber

```
cjchung@Robofest: ~/catkin_ws/src/my_ros_tutorials/scripts
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/scripts$ python news_subscriber1.py
[INFO] [1547675474.399497]: Message received :
[INFO] [1547675474.401742]: data: "Topic 1 news"
[INFO] [1547675474.898998]: Message received :
[INFO] [1547675474.900747]: data: "Topic 1 news"
[INFO] [1547675475.399477]: Message received :
[INFO] [1547675475.401116]: data: "Topic 1 news"
[INFO] [1547675475.898924]: Message received :
[INFO] [1547675475.900537]: data: "Topic 1 news"
[INFO] [1547675476.399329]: Message received :
[INFO] [1547675476.401041]: data: "Topic 1 news"
[INFO] [1547675476.899171]: Message received :
[INFO] [1547675476.900241]: data: "Topic 1 news"
[INFO] [1547675477.399283]: Message received :
[INFO] [1547675477.400947]: data: "Topic 1 news"
[INFO] [1547675477.898808]: Message received :
[INFO] [1547675477.900446]: data: "Topic 1 news"
[INFO] [1547675478.399476]: Message received :
[INFO] [1547675478.401017]: data: "Topic 1 news"
```

We can also use “rosrun”



```
cjchung@Robofest: ~
cjchung@Robofest:~$ rosrun my_ros_tutorials news_publisher1.py
```

Creating C++ Publisher (1/3)

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/src$ gedit news_publisher_cj.cpp
```

```cpp
#include <ros/ros.h>
#include <std_msgs/String.h>

int main (int argc, char **argv)
{
    ros::init(argc, argv, "news_publisher_cj");
    ros::NodeHandle nh;

    ros::Publisher pub = nh.advertise<std_msgs::String>("/news_topic1", 10);

    ros::Rate rate(4);
    while (ros::ok()) {
        std_msgs:: String msg;
        msg.data = "topic1 news by cj in c++";
        pub.publish(msg);
        rate.sleep();
    }
}
```

Creating C++ Publisher (2/3)

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/src$ cd ..
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials$ ls
CMakeLists.txt  include  package.xml  scripts  src
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials$ gedit CMakeLists.txt
```

```
## Declare a C++ executable
## With catkin_make all packages are built within a single CMake context
## The recommended prefix ensures that target names across packages don't collide
# add_executable(${PROJECT_NAME}_node src/my_ros_tutorials_node.cpp)

add_executable(hello_cpp_node src/hello.cpp)
target_link_libraries(hello_cpp_node ${catkin_LIBRARIES})

add_executable(hellos_cpp_node src/hellos.cpp)
target_link_libraries(hellos_cpp_node ${catkin_LIBRARIES})

add_executable(news_publisher_cj src/news_publisher_cj.cpp)
target_link_libraries(news_publisher_cj ${catkin_LIBRARIES})
```

Creating C++ Publisher (3/3)

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials$ cd
cjchung@Robofest:~$ cd catkin_ws/
cjchung@Robofest:~/catkin_ws$ catkin_make
```

```
Scanning dependencies of target news_publisher1
[ 16%] Building CXX object my_ros_tutorials/CMakeFiles/news_publisher1.dir/src/news
_publisher1.cpp.o
[ 50%] Built target hellos_cpp_node
[ 83%] Built target hello_cpp_node
[100%] Linking CXX executable /home/cjchung/catkin_ws/devel/lib/my_ros_tutorials/ne
ws_publisher1
[100%] Built target news_publisher_cj
cjchung@Robofest:~/catkin_ws$
```

Running & testing the C++ publisher node

```
cjchung@Robofest:~$ rosrun my_ros_tutorials news_publisher_cj
```

```
cjchung@Robofest:~$ rosnode list
/news_publisher_cj
/rosout
cjchung@Robofest:~$ rostopic list
/news_topic1
/rosout
/rosout_agg
cjchung@Robofest:~$ rostopic echo /news_topic1
data: "topic1 news by cj in c++"
---
data: "topic1 news by cj in c++"
---
data: "topic1 news by cj in c++"
---
data: "topic1 news by cj in c++"
---
data: "topic1 news by cj in c++"
---
```

Do not forget to run roscore first!

Creating C++ Subscriber (1/3)

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/src$ gedit news_subscriber_chris.cpp
```

```
#include <ros/ros.h>
#include <std_msgs/String.h>

void callback_receive_topic1data(const std_msgs::String& msg)
{
    ROS_INFO("Message received:  %s", msg.data.c_str());
}

int main (int argc, char **argv)
{
    ros::init(argc, argv, "news_subscriber_chris");
    ros::NodeHandle nh;

    ros::Subscriber sub = nh.subscribe("/news_topic1", 1000,
        callback_receive_topic1data);

    ros::spin();
}
```

Queue size 1000 > 10. To handle when messages are arriving too fast.

Creating C++ Subscriber (2/3)

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/src$ cd ..
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials$ ls
CMakeLists.txt  include  package.xml  scripts  src
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials$ gedit CMakeLists.txt
```

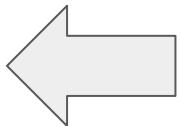
```
## Declare a C++ executable
## With catkin_make all packages are built within a single CMake context
## The recommended prefix ensures that target names across packages don't collide
# add_executable(${PROJECT_NAME}_node src/my_ros_tutorials_node.cpp)

add_executable(hello_cpp_node src/hello.cpp)
target_link_libraries(hello_cpp_node ${catkin_LIBRARIES})

add_executable(hellos_cpp_node src/hellos.cpp)
target_link_libraries(hellos_cpp_node ${catkin_LIBRARIES})

add_executable(news_publisher_cj src/news_publisher_cj.cpp)
target_link_libraries(news_publisher_cj ${catkin_LIBRARIES})

add_executable(news_subscriber_chris src/news_subscriber_chris.cpp)
target_link_libraries(news_subscriber_chris ${catkin_LIBRARIES})
```



Creating C++ Subscriber (3/3)

```
cjchung@Robofest:~$ cd catkin_ws/
cjchung@Robofest:~/catkin_ws$ catkin_make
```

...

```
[ 87%] Built target hello_cpp_node
[100%] Linking CXX executable /home/cjchung/catkin_ws/devel/lib/my_ros_tutorials/news_subscriber2
[100%] Built target news_subscriber_chris
cjchung@Robofest:~/catkin_ws$
```

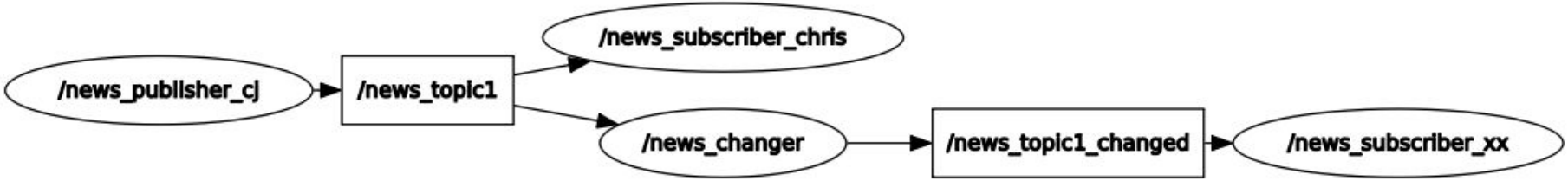
Running & testing C++ publisher/subscribe nodes

```
cjchung@Robofest:~$ rosrun my_ros_tutorials news_publisher_cj
```

```
cjchung@Robofest:~$ rosrun my_ros_tutorials news_subscriber_chris
[ INFO] [1548260925.945555560]: Message received:  topic1 news by cj in c++
[ INFO] [1548260926.195307676]: Message received:  topic1 news by cj in c++
[ INFO] [1548260926.445351755]: Message received:  topic1 news by cj in c++
[ INFO] [1548260926.695290719]: Message received:  topic1 news by cj in c++
[ INFO] [1548260926.945349432]: Message received:  topic1 news by cj in c++
[ INFO] [1548260927.195349347]: Message received:  topic1 news by cj in c++
[ INFO] [1548260927.445340491]: Message received:  topic1 news by cj in c++
[ INFO] [1548260927.695332137]: Message received:  topic1 news by cj in c++
[ INFO] [1548260927.945109529]: Message received:  topic1 news by cj in c++
[ INFO] [1548260928.195258439]: Message received:  topic1 news by cj in c++
[ INFO] [1548260928.445320513]: Message received:  topic1 news by cj in c++
[ INFO] [1548260928.695318371]: Message received:  topic1 news by cj in c++
[ INFO] [1548260928.945322028]: Message received:  topic1 news by cj in c++
```

$ rqt_graph

HW1: Create 4 nodes in C++ (4%)



- Due: 4 cpp files must be uploaded on Canvas by Jan 30, 5:45pm **and** demonstrate before 6pm in class.
- File name convention: news_publisher_YourName, news_subsciber_name1, news_changer, news_subscrber_name2
- **news_changer.cpp:** a basic data transformer - convert “/news_topic1” message to uppercases

HW1: Example Outputs (Expected Demo)

```
cjchung@Robofest:~$ rosrun my_ros_tutorials news_publisher_cj
```

```
cjchung@Robofest: ~
cjchung@Robofest:~$ rosrun my_ros_tutorials news_subscriber_chris
[ INFO] [1548257301.650850971]: Message received:  topic1 news by cj in c++
[ INFO] [1548257301.900635941]: Message received:  topic1 news by cj in c++
[ INFO] [1548257302.150569943]: Message received:  topic1 news by cj in c++
[ INFO] [1548257302.400576305]: Message received:  topic1 news by cj in c++
[ INFO] [1548257302.650615632]: Message received:  topic1 news by cj in c++
[ INFO] [1548257302.900564683]: Message received:  topic1 news by cj in c++
[ INFO] [1548257303.150598038]: Message received:  topic1 news by cj in c++
[ INFO] [1548257303.400668780]: Message received:  topic1 news by cj in c++
[ INFO] [1548257303.650672395]: Message received:  topic1 news by cj in c++
[ INFO] [1548257303.900673774]: Message received:  topic1 news by cj in c++
```

```
cjchung@Robofest:~/catkin_ws/src/my_ros_tutorials/src$ rosrun my_ros_tutorials
news_changer
```

```
cjchung@Robofest: ~/catkin_ws
cjchung@Robofest:~/catkin_ws$ rosrun my_ros_tutorials news_subscriber_xx
[ INFO] [1548257353.150963923]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257353.400849172]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257353.650716576]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257353.900851011]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257354.150854852]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257354.400850749]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257354.650953505]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257354.900935148]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257355.150973311]: Message received:  TOPIC1 NEWS BY CJ IN C++
[ INFO] [1548257355.400921776]: Message received:  TOPIC1 NEWS BY CJ IN C++
```

Launching multiple nodes?

roslaunch - covered next week