
ROS publishers and
ROS subscribers
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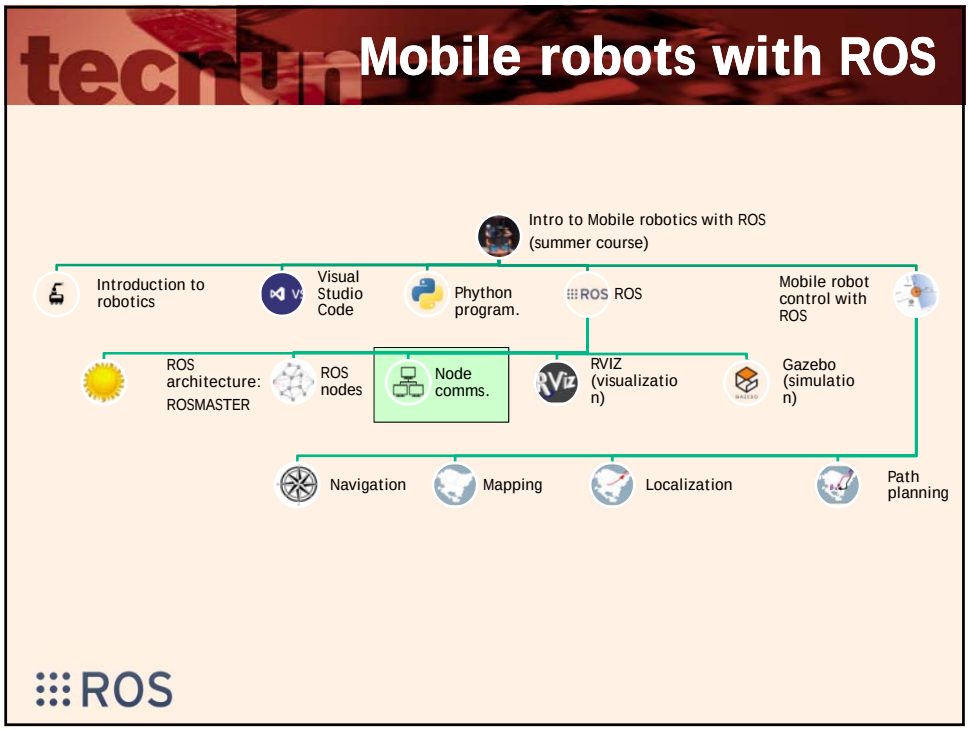
tecnun


tecnun
Mobile robots with ROS
Intro to Mobile robotics with ROS
(summer course)
Introduction to
robotics
Visual
Studio
Code
Phython
program.
ROS
Mobile robot
control with
ROS
ROS
architecture:
ROSMASTER
ROS
nodes
Node
comms.
RVIZ
(visualizatio
n)
Gazebo
(simulatio
n)
Navigation
Mapping
Localization
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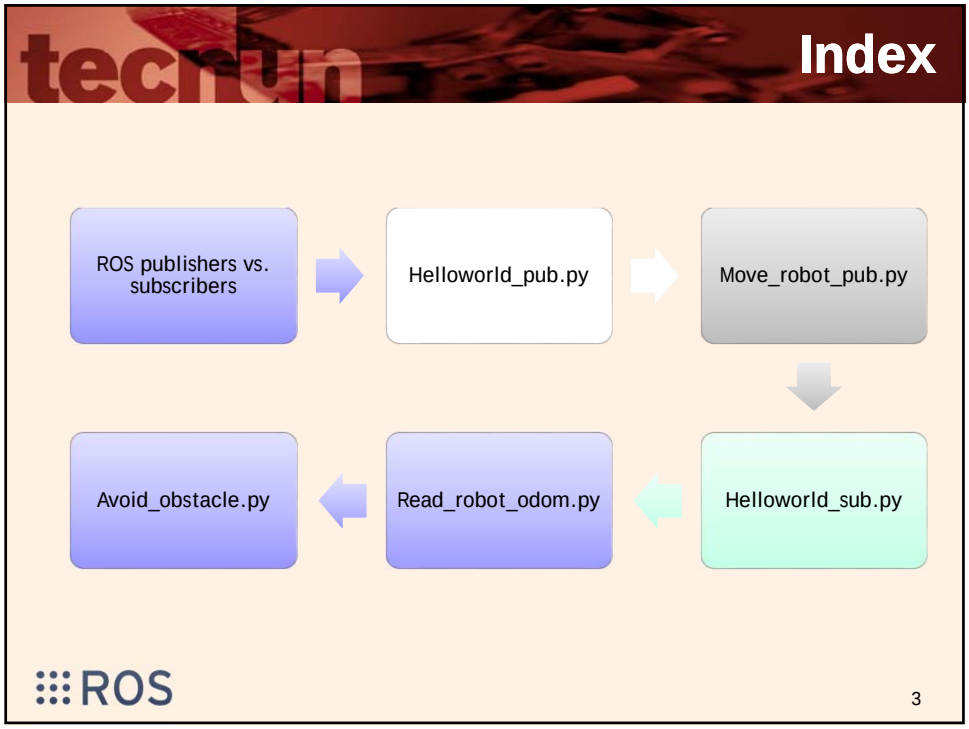
planning
ROS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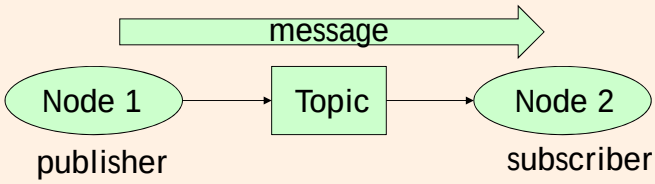
ROS publishers vs. subscribers
ROS

ROS publisher vs ROS subscriber

- A publisher is a node that keeps sending a message into a topic at a predefined rate
- Remember→ a topic is a pipe that interconnects nodes
- A subscriber reads the message in the topic sent by the publisher



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ROS publisher: helloworld_pub.py

```
#! /usr/bin/env python
import rospy
from std_msgs.msg import Int32

rospy.init_node('helloworld_publisher')
pub = rospy.Publisher('/counter', Int32, queue_size=1)
rate = rospy.Rate(0.2)
count = Int32()
count.data = 0

while not rospy.is_shutdown():
  pub.publish(count)
  count.data += 1
  rate.sleep()
```

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ROS publisher: helloworld_pub.py

```
#! /usr/bin/env python
import rospy                                # Import the Python library
for ROS
from std_msgs.msg import Int32              # Import the Int32 message
from the std_msgs package

rospy.init_node(' helloworld_publisher')         # Initiate a Node
named 'topic_publisher'
# Create a Publisher object, that will publish on the /counter topic
pub = rospy.Publisher('counter', Int32) #  messages of type Int32
rate = rospy.Rate(0.2)                    # Set a publish rate of 2 Hz
count = Int32()                          # Create a var of type Int32
count.data = 0                           # Initialize 'count' variable

# Create a loop that will go until someone stops the program execution
while not rospy.is_shutdown():
     # Publish the message within the 'count' variable
     pub.publish(count)
     count.data += 1                     # Increment 'count' variable
     rate.sleep()        # Make sure the publish rate maintains at 2 Hz
```

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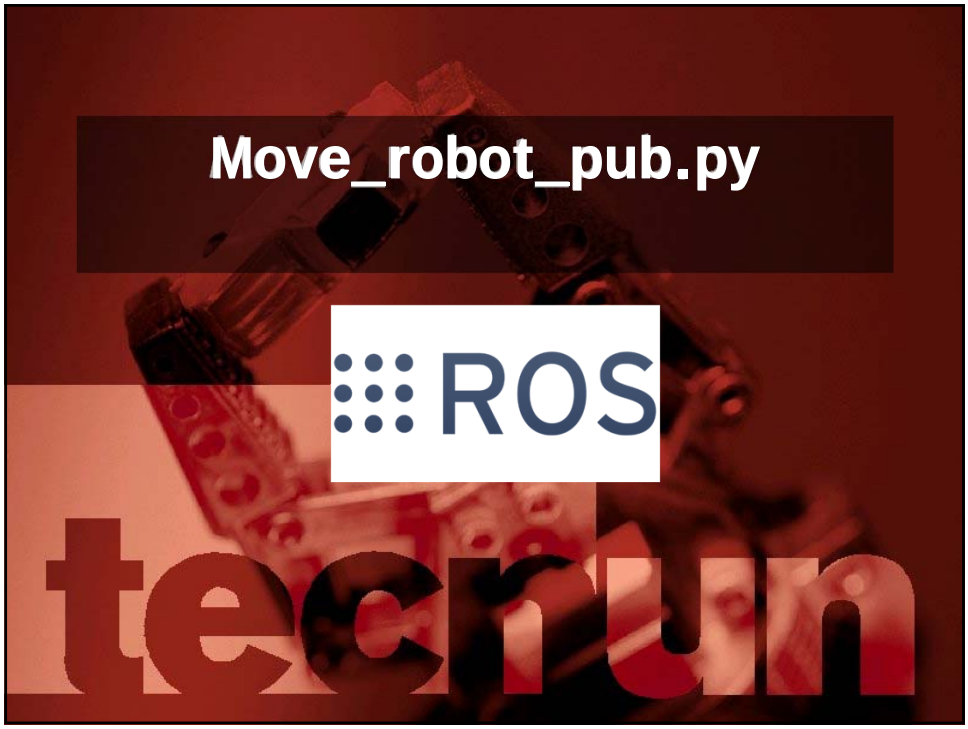

ROS publisher: move_robot_pub.launch

```
<launch>
   <node pkg="helloworld_pkg" type="move_robot.py"
name="move_robot_node" output="screen" />
</launch>
```

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ROS subscriber: helloworld_pub.py test

- Try the subscriber without running the publisher.
- We can simulate the publisher by:

```
> rostopic pub <topic_name> <message_type> <value>
```

- Run the subscriber and try this command:

```
> rostopic pub /counter std_msgs/Int32 28
```

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ROS publisher: move_robot.py

```
import rospy
from geometry_msgs.msg import Twist
rospy.init_node('move_robot_node')
pub = rospy.Publisher('/cmd_vel', Twist, queue_size=1)
rate = rospy.Rate(0.2)
move_cmd = Twist()
#differential motion: Vx,OMEGAz
#Move the robot with a linear velocity in the x axis
move_cmd.linear.x = 0.5
#Move the with an angular velocity in the z axis
move_cmd.angular.z = 0.5

while not rospy.is_shutdown():
    pub.publish(move_cmd)
    rate.sleep()
```

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ROS subscriber: helloworld_sub.py

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

import rospy
from std_msgs.msg import Int32

def callback(msg):
  print msg.data

rospy.init_node('helloworld_subscriber')
sub = rospy.Subscriber('counter', Int32, callback)
rospy.spin()
```

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ROS subscriber: helloworld_sub.py

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

import rospy
from std_msgs.msg import Int32

# a callback function that manages the incoming msg
def callback(msg):
    # Print the value 'data' inside 'msg'
    print msg.data

# Initiate a Node called ‘helloworld_subscriber'
rospy.init_node(‘helloworld_subscriber')

# Create a Subscriber object that will listen to the /counter topic
# the callback function will be called automatically each time it reads
# a new message
sub = rospy.Subscriber('/counter', Int32, callback)

rospy.spin()    # Create a loop that will keep the program in execution
```

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ROS subscriber: read_robot_odom.launch

```
<launch>
    <node pkg="helloworld_pkg" type="read_robot_odom.py"
name="read_robot_odom_node" output="screen" />
</launch>
```

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ROS subscriber: read_robot_odom.py

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

import rospy
from nav_msgs.msg import Odometry

def callback(msg):
  print msg # print the whole Odometry message
  # print msg.header # print the header section
  # print msg.pose # pose section

rospy.init_node('read_robot_odom_node')
sub = rospy.Subscriber('/odom', Odometry, callback)
rospy.spin()
```

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Avoid_obstacle: laser msg

- A code that makes the robot to avoid a obstacle in front of it→ reading the laser scan topic.

```
$ rosmsg show sensor_msgs/LaserScan
            std_msgs/Header header
              uint32 seq
              time stamp
              string frame_id
            float32 angle_min
            float32 angle_max
            float32 angle_increment
            float32 time_increment
            float32 scan_time
            float32 range_min
            float32 range_max
            float32[] ranges <-- Use only this one
            float32[] intensities
```

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Avoid_obstacle: launch

- Avoid_obstacle.launch

```
<launch>
   <node pkg="helloworld_pkg" type="avoid_obstacle.py"
name="avoid_obstacle_node" output="screen" />

</launch>
```

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Avoid obstacle (1 of 5)

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

def callback(msg):
  left=90
  frontleft=30
  frontright=330
  right=270
  front=0
  back=180

  #print len(msg.ranges)
```

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Avoid obstacle (2 of 5)

```
  #If the distance to an obstacle in front of the robot is bigger than
1 meter, the robot will move forward
  if msg.ranges[front] > 1 and msg.ranges[frontleft]>1 and
msg.ranges[frontleft]>1:
      move.linear.x = 0.2
      move.angular.z = 0.0


else:
 #If the distance to an obstacle in front of the robot is smaller than
1 meter, the robot will turn left
      if msg.ranges[front] <= 1:
         print "obstacle ahead, turning left"
         move.linear.x = -0.5
         move.angular.z = 5.0
```

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Avoid obstacle (3 of 5)

```
#If the distance to an obstacle at the front-left side of the robot is
smaller than 1 meters, the robot will turn right
      elif msg.ranges[frontleft] < 1:
         print "obstacle on the front-left, turning right"
         move.linear.x = -0.2
         move.angular.z = -2


     #If the distance to an obstacle at the front-right side of the
robot is smaller than 1 meters, the robot will turn left
      elif msg.ranges[frontright] < 1:
         print "obstacle on the front-right, turning left"
         move.linear.x = -0.2
         move.angular.z = 2
```

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Avoid obstacle (4 of 5)

```
 #If the distance to an obstacle at the left side of the robot is
smaller than 0.4 meters, the robot will turn right
  if msg.ranges[left] < 0.4:
         print "obstacle on the left, turning right"
         move.linear.x = 0.0
         move.angular.z = -1

     #If the distance to an obstacle at the right side of the robot is
smaller than 0.4 meters, the robot will turn left
  if msg.ranges[right] < 0.4:
         print "obstacle on the right, turning left"
         move.linear.x = 0.0
         move.angular.z = 1
```

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Avoid obstacle (5 of 5)

```
#print some info for debugging
 print "FL=",msg.ranges[frontleft],"F=",msg.ranges[front],
"FR=",msg.ranges[frontright],
"L=",msg.ranges[left],"R=",msg.ranges[right],"B=",msg.ranges[back]
   #publish the msg
  pub.publish(move)

#################### node main script  ############################
#node creation
rospy.init_node('avoid_obstacle_node')
#subscriber creation
sub = rospy.Subscriber('/scan', LaserScan, callback) #We subscribe to
the laser's topic
#publisher creation
pub = rospy.Publisher('/cmd_vel', Twist,queue_size=10)
move = Twist()

rospy.spin()
```

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Avoid obstacle launch gazebo simulation

- Create avoid_obstacle.launch
- Create avoid_obstacle.py
- Test with gazebo
  - Terminal 1

    ```
    roscore
    ```
  - Terminal 2

    ```
    export SVGA_VGPU10=0
    ```

  Try with veggie

  ```
  roslaunch prk_gazebo veggiebot_gazebo.launch
  ```

  Or try with turtlebot3 `${TB3_MODEL}=Burger|waffle|waffle_pi`

```
export TURTLEBOT3_MODEL=${TB3_MODEL}
roslaunch turtlebot3_gazebo turtlebot3_empty_world.launch
roslaunch turtlebot3_gazebo turtlebot3_world.launch
roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

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Avoid obstacle: robot cmds from a terminal

- Terminal 3 → activate robot
  - Console cmds
    - Vx→ linear speed along x-axis
    - Wz → angular speed along z-axis

```
rostopic pub /cmd_vel geometry_msgs/Twist "linear:
  x: Vx
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: Wz“
```

Try with different values, example:

Vx=0.0 or Vx=1.0 or Vx=-1.0 or

Wx=0.0 or Wx=1.0 or Wx=-1.0 or

- When you have tested the robot in gazebo can move, execute the python script

```
roslaunch helloworld_pkg avoid_obstacle.py
```

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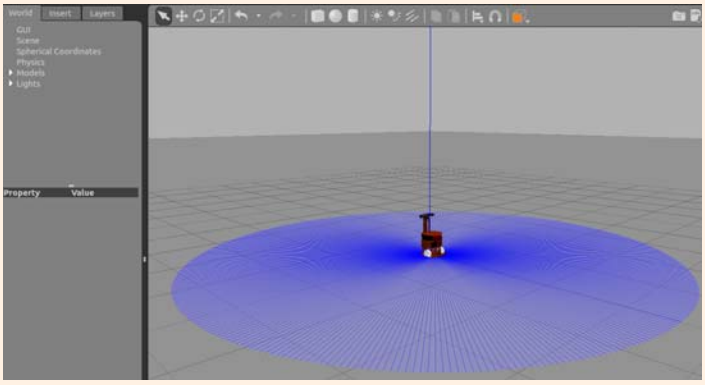
avoid obstacle: veggie in Gazebo



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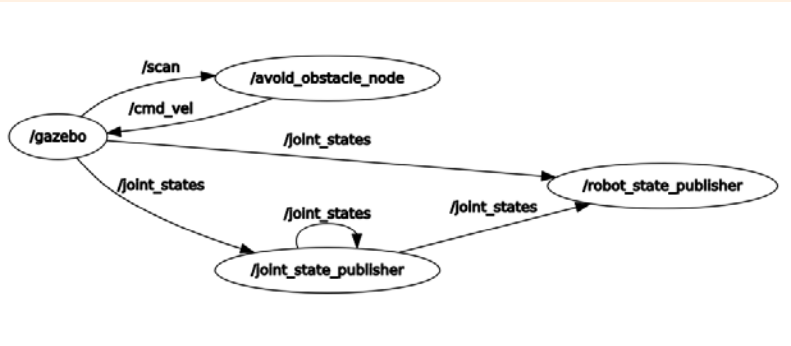
avoid obstacle: ROS graph

- Use rpt_graph for displaying the running nodes
- Or



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