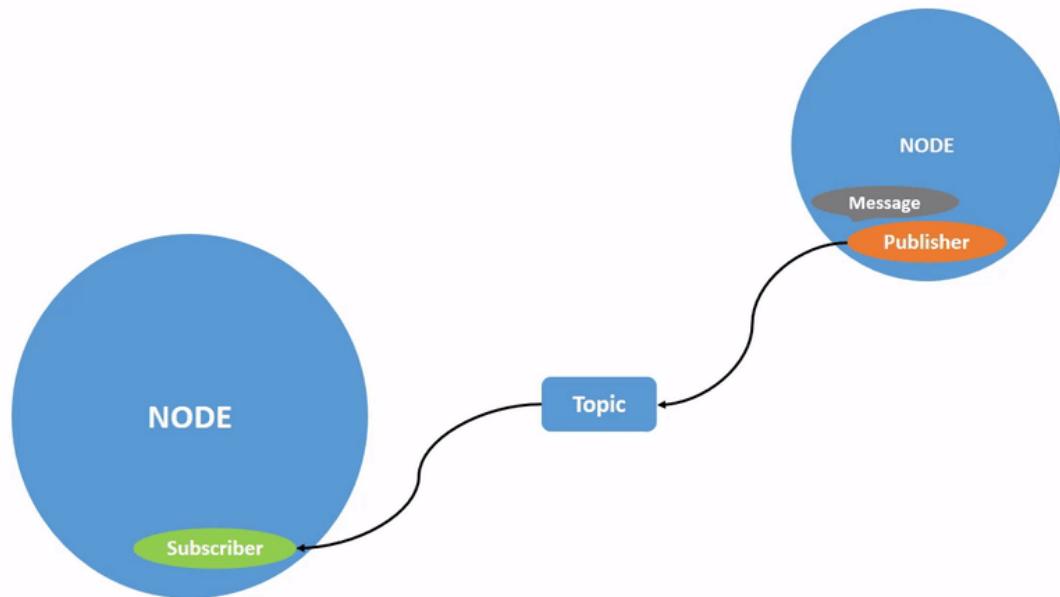


7、ROS2话题通讯

1、话题通讯简介

话题通讯是ROS2使用频率最高的一种通信方式，有发布者发布指定话题的数据，订阅者只要订阅了该话题的数据，就可以接收到数据。

话题通信是基于发布/订阅模型，如图：



话题数据传输的特性是从一个节点到另外一个节点，发送数据的对象称之为**发布者**，接收数据的对象称之为**订阅者**，每一个话题都需要有一个名字，传输的数据也需要有固定的数据类型。

接下来就说明下如何使用Python语言实现节点之间的话题通讯。

2、新建功能包

- 切换到工作空间src目录下
- 新建pkg_topic功能包

```
ros2 pkg create pkg_topic --build-type ament_python --dependencies rclpy --node-name publisher_demo
```

执行完上述命令，会创建pkg_topic功能包，同时会创建一个publisher_demo的节点，并且已经配置好相关的配置文件

```
publisher_demo.py u x
yahboomcar_ws > src > pkg_topic > pkg_topic > publisher_demo.py > ...
1 def main():
2     print('Hi from pkg_topic.')
3
4
5 if __name__ == '__main__':
6     main()
7
```

3、发布方实现

3.1 创建发布方

接下来编辑【publisher_demo.py】实现发布方的功能，添加如下代码：

```
#导入rclpy库
import rclpy
from rclpy.node import Node
#导入String字符串消息
from std_msgs.msg import String
#创建一个继承于Node基类的Topic_Pub节点子类 传入一个参数name
class Topic_Pub(Node):
    def __init__(self,name):
        super().__init__(name)
        #创建一个发布者，使用create_publisher的函数，传入的参数分别是：
        #话题数据类型、话题名称、保存消息的队列长度
        self.pub = self.create_publisher(String,"/topic_demo",1)
        #创建一个定时器，间隔1s进入中断处理函数，传入的参数分别是：
        #中断函数执行的间隔时间，中断处理函数
        self.timer = self.create_timer(1,self.pub_msg)
    #定义中断处理函数
    def pub_msg(self):
        msg = String() #创建一个String类型的变量msg
        msg.data = "Hi,I send a message." #给msg里边的data赋值
        self.pub.publish(msg) #发布话题数据

#主函数
def main():
    rclpy.init() #初始化
    pub_demo = Topic_Pub("publisher_node") #创建Topic_Pub类对象，传入的参数就是节点的名字
    rclpy.spin(pub_demo) #执行rclpy.spin函数，里边传入一个参数，参数是刚才创建好的Topic_Pub类对象
    pub_demo.destroy_node() #销毁节点对象
    rclpy.shutdown() #关闭ROS2 Python接口
```

3.2 编辑配置文件

The screenshot shows the file structure of a ROS2 workspace named 'YAHBOOMCAR_ROS2_WS'. The 'src' directory contains several packages, including 'pkg_topic'. The 'setup.py' file is open in the editor. A red arrow points to the 'entry_points' section, specifically to the line 'publisher_demo = pkg_topic.publisher_demo:main'.

```
from setuptools import setup
package_name = 'pkg_topic'
setup(
    name=package_name,
    version='0.0.0',
    packages=[package_name],
    data_files=[
        ('share/ament_index/resource_index/packages',
         ['resource/' + package_name]),
        ('share/' + package_name, ['package.xml']),
    ],
    install_requires=['setuptools'],
    zip_safe=True,
    maintainer='root',
    maintainer_email='1461190907@qq.com',
    description='TODO: Package description',
    license='TODO: License declaration',
    tests_require=['pytest'],
    entry_points={
        'console_scripts': [
            'publisher_demo = pkg_topic.publisher_demo:main'
        ],
    },
)
```

3.3 编译功能包

- 编译功能包

```
colcon build --packages-select pkg_topic
```

- 在工作空间下刷新环境变量

The terminal window shows the command 'colcon build --packages-select pkg_topic' being run. It outputs the following log:

```
yahboom@yahboom-virtual-machine:~/workspace$ colcon build --packages-select pkg_topic
Starting >>> pkg_topic
/usr/lib/python3/dist-packages/setuptools/dist.py:723: UserWarning: Usage of dash-separated 'install-scripts' will not be supported in future versions. Please use the underscore name 'install_scripts' instead
  warnings.warn(
Finished <<< pkg_topic [0.66s]

Summary: 1 package finished [0.85s]
yahboom@yahboom-virtual-machine:~/workspace$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/workspace$
```

3.4 运行程序

- 刷新环境变量后运行命令

```
ros2 run pkg_topic publisher_demo
```

程序成功运行后是没有打印任何东西的，我们可以通过ros2 topic 工具来查看数据，首先，先查看这个是否有话题发布，开启另一个终端输入：

```
ros2 topic list
```

```
root@unbutu:~# ros2 topic list
/parameter_events
/rosout
/topic_demo
root@unbutu:~#
```

这个topic_demo就是程序里定义的话题数据了，接下来，我们用ros2 topic echo来打印下这个数据，终端输入：

```
ros2 topic echo /topic_demo
```

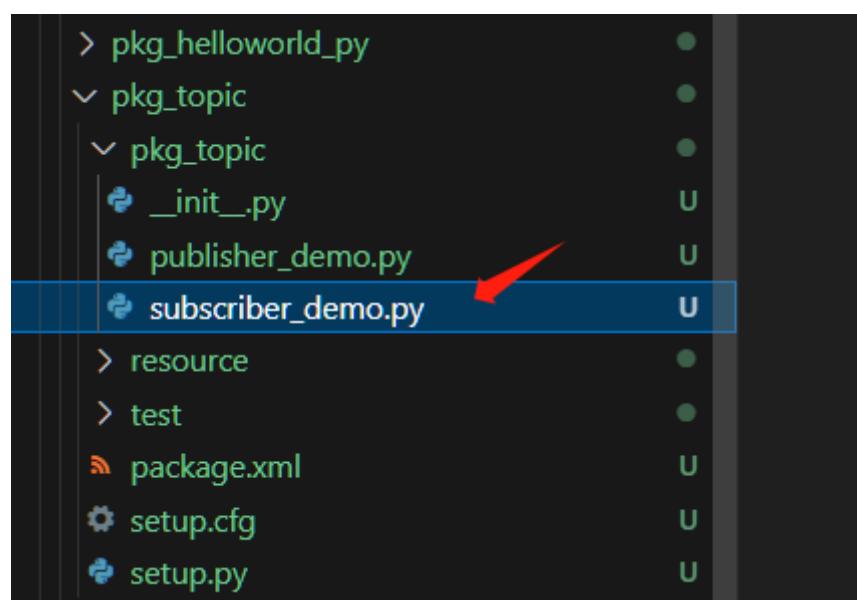
```
root@unbutu:~# ros2 topic echo /topic_demo
data: Hi,I send a message.
---
data: Hi,I send a message.
```

可以看出，终端打印的"Hi,I send a message."与我们代码里边的msg.data = "Hi,I send a message."一致。

4、订阅方实现

4.1 创建订阅方

在【publisher_demo.py】同级目录下新建文件【subscriber_demo.py】



接下来编辑【subscriber_demo.py】实现订阅方的功能，添加如下代码：

```
#导入相关的库
import rclpy
from rclpy.node import Node
from std_msgs.msg import String

class Topic_Sub(Node):
    def __init__(self, name):
        super().__init__(name)
        #创建订阅者使用的是create_subscription，传入的参数分别是：话题数据类型，话题名称，回调函数名称，队列长度
        self.sub =
    self.create_subscription(String, "/topic_demo", self.sub_callback, 1)

    #回调函数执行程序：打印接收的到信息
    def sub_callback(self, msg):
        # print(msg.data, flush=True)
        self.get_logger().info(msg.data)

def main():
    rclpy.init() #ROS2 Python接口初始化
    sub_demo = Topic_Sub("subscriber_node") # 创建对象并进行初始化
    rclpy.spin(sub_demo)
    sub_demo.destroy_node() #销毁节点对象
    rclpy.shutdown() #关闭ROS2 Python接口
```

4.2 编辑配置文件

The screenshot shows a terminal window with two panes. The left pane displays the directory structure of a ROS2 workspace named 'YAHBOOMCAR_ROS2_WS'. The right pane shows the content of the 'setup.py' file for the 'pkg_topic' package.

```
资源管理器 ...  
YAHBOOMCAR_ROS2_WS [容器 192... ]+ [-] ⏪ ⏴ ⏵ ⏶  
> .vscode  
> Rosmaster  
> software  
> temp  
yahboomcar ws ●  
> build  
> install  
> log  
src ●  
> laserscan_to_point_publisher  
> pkg_helloworld_py ●  
pkg_topic ●  
| pkg_topic ●  
| _init_.py u  
| publisher_demo.py u  
| subscriber_demo.py u  
| resource ●  
| test ●  
| package.xml u  
| setup.cfg u  
| setup.py u  
rf2o_laser_odometry  
robot_pose_publisher_ros2  
yahboom_app_save_map  
yahboom_web_savmap_interfaces  
yahboomcar_astra  
yahboomcar_bringup
```

```
setup.py x  
yahboomcar_ws > src > pkg_topic > setup.py > ...  
1 from setuptools import setup  
2  
3 package_name = 'pkg_topic'  
4  
5 setup(  
6     name=package_name,  
7     version='0.0.0',  
8     packages=[package_name],  
9     data_files=[  
10         ('share/ament_index/resource_index/packages',  
11             ['resource/' + package_name]),  
12         ('share/' + package_name, ['package.xml']),  
13     ],  
14     install_requires=['setuptools'],  
15     zip_safe=True,  
16     maintainer='root',  
17     maintainer_email='1461190907@qq.com',  
18     description='TODO: Package description',  
19     license='TODO: License declaration',  
20     tests_require=['pytest'],  
21     entry_points={  
22         'console_scripts': [  
23             'publisher_demo = pkg_topic.publisher_demo:main',  
24             'subscriber_demo = pkg_topic.subscriber_demo:main'  
25         ],  
26     },  
27 )
```

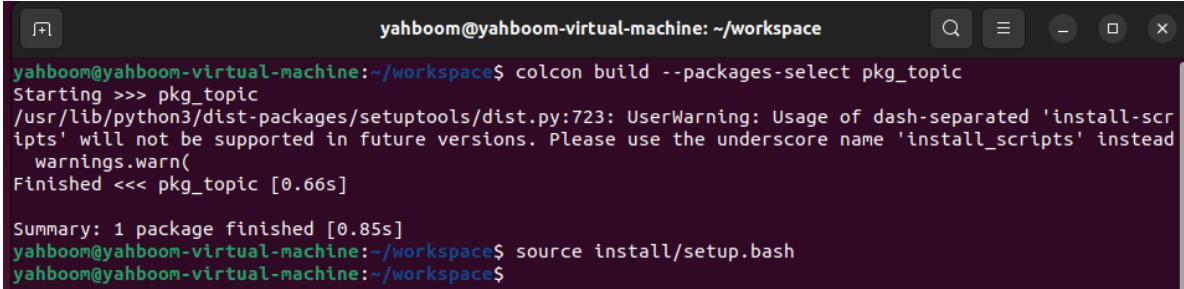
A red arrow points to the line 'subscriber_demo = pkg_topic.subscriber_demo:main' in the 'entry_points' section of the 'setup.py' file, indicating it is the target for configuration.

4.3 编译工作空间

- 编译功能包

```
colcon build --packages-select pkg_topic
```

- 在工作空间下刷新环境变量



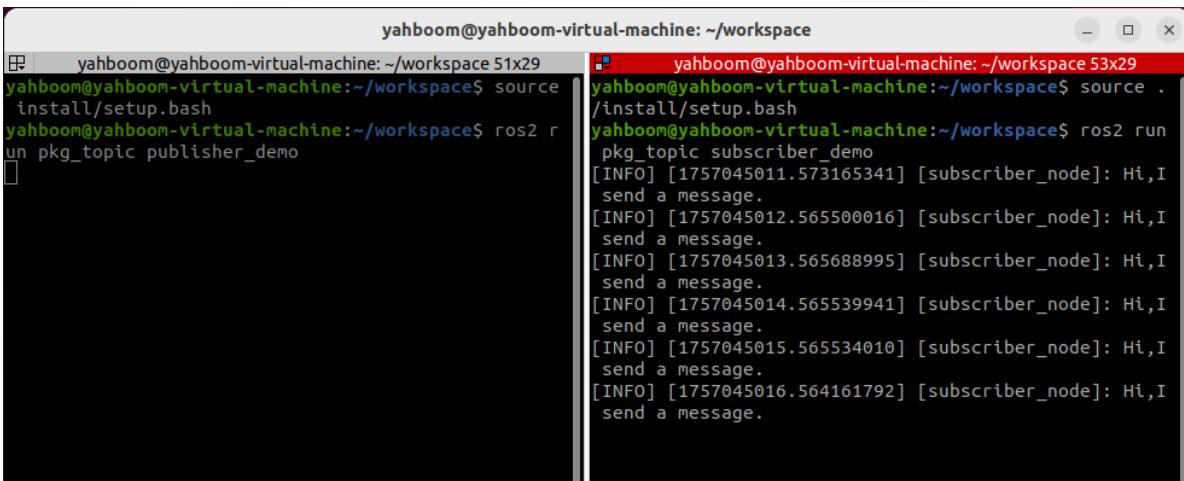
```
yahboom@yahboom-virtual-machine:~/workspace$ colcon build --packages-select pkg_topic
Starting >>> pkg_topic
/usr/lib/python3/dist-packages/setuptools/dist.py:723: UserWarning: Usage of dash-separated 'install-scr
ipts' will not be supported in future versions. Please use the underscore name 'install_scripts' instead
  warnings.warn(
Finished <<< pkg_topic [0.66s]

Summary: 1 package finished [0.85s]
yahboom@yahboom-virtual-machine:~/workspace$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/workspace$
```

4.4 运行程序

分割终端执行如下：

```
#启动发布者节点
ros2 run pkg_topic publisher_demo
#启动订阅者节点
ros2 run pkg_topic subscriber_demo
```



```
yahboom@yahboom-virtual-machine:~/workspace$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/workspace$ ros2 run pkg_topic publisher_demo
[INFO] [1757045011.573165341] [publisher_node]: Hi,I send a message.
[INFO] [1757045012.565500016] [publisher_node]: Hi,I send a message.
[INFO] [1757045013.565688995] [publisher_node]: Hi,I send a message.
[INFO] [1757045014.565539941] [publisher_node]: Hi,I send a message.
[INFO] [1757045015.565534010] [publisher_node]: Hi,I send a message.
[INFO] [1757045016.564161792] [publisher_node]: Hi,I send a message.

yahboom@yahboom-virtual-machine:~/workspace$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/workspace$ ros2 run pkg_topic subscriber_demo
[INFO] [1757045011.573165341] [subscriber_node]: Hi,I send a message.
[INFO] [1757045012.565500016] [subscriber_node]: Hi,I send a message.
[INFO] [1757045013.565688995] [subscriber_node]: Hi,I send a message.
[INFO] [1757045014.565539941] [subscriber_node]: Hi,I send a message.
[INFO] [1757045015.565534010] [subscriber_node]: Hi,I send a message.
[INFO] [1757045016.564161792] [subscriber_node]: Hi,I send a message.
```

如上图所示，运行订阅者这点的终端会打印发布者发布的/topic_demo的信息。