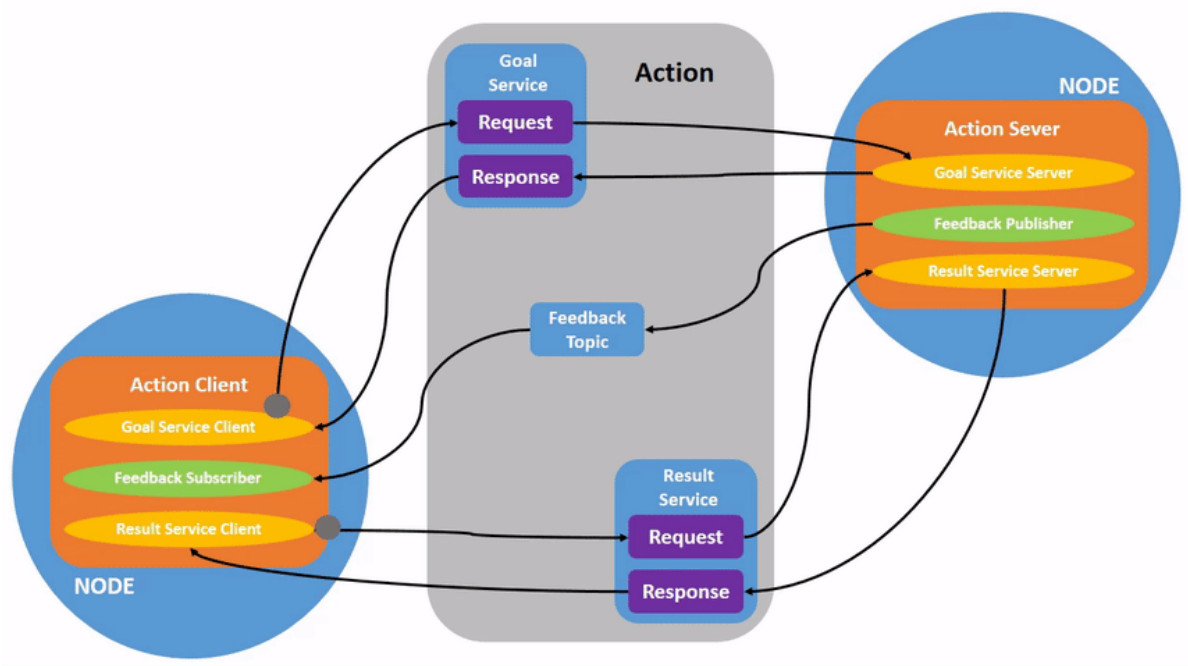
11.ROS2 action communication server

1. Introduction to action communication

Action communication is a communication model with continuous feedback. Between the communicating parties, the client sends request data to the server, and the server responds to the client.However, during the process from the server receiving the request to generating the final response, it will send continuous feedback information to the client.

Action Communication client/server model is as follows:



2. Case introduction

The action client submits an integer data N, the action server receives the request data and accumulates all integers between 1 and N, and returns the final result to the action client.And each time it is accumulated, the current operation progress is calculated and fed back to the action client.

This case is located in the factory docker container. The source code location is:

```
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/pkg_interfaces
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/pkg_action
```

3. Create a new function package

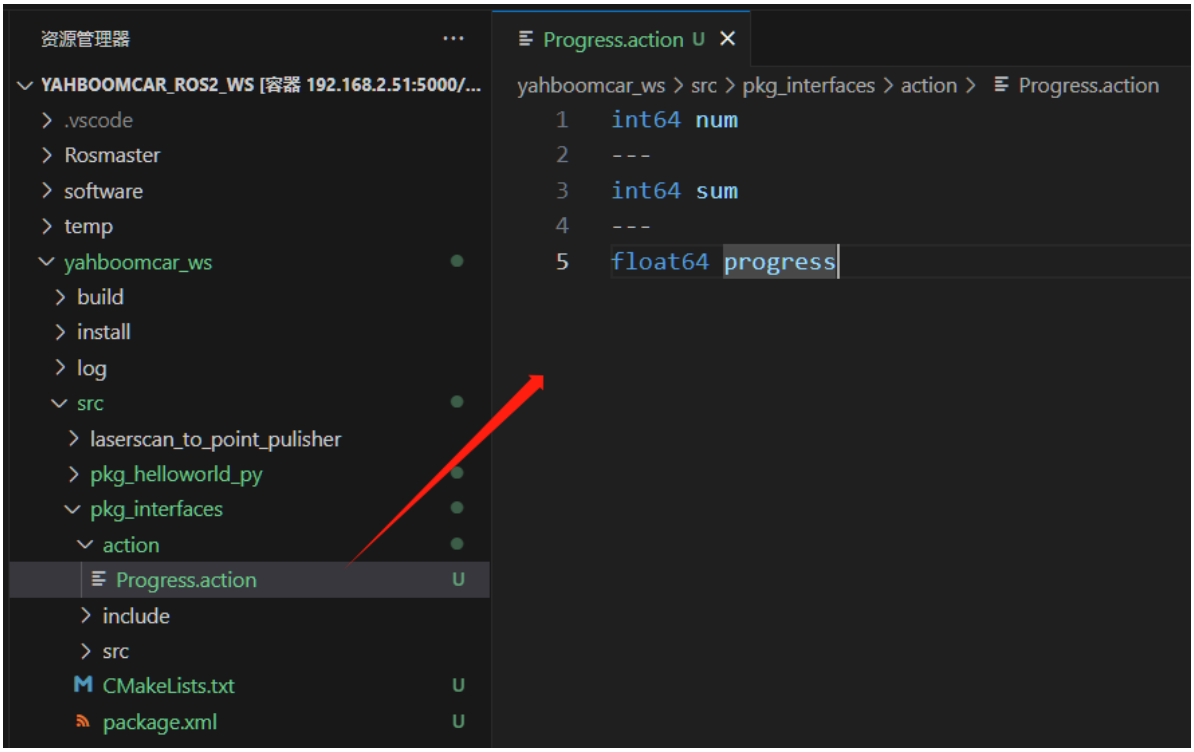
3.1. Create action communication interface function package

1. Action communication requires creating an action communication interface first, and then creating an action communication interface.

```
cd ~/yahboomcar_ros2_ws/yahboomcar_ws/src
ros2 pkg create --build-type ament_cmake pkg_interfaces
```

2. Then create an action folder under the pkg_interfaces function package, and create a new [Progress.action] file in the action folder. The file content is as follows:

```
int64 num
---
int64 sum
---
float64 progress
```

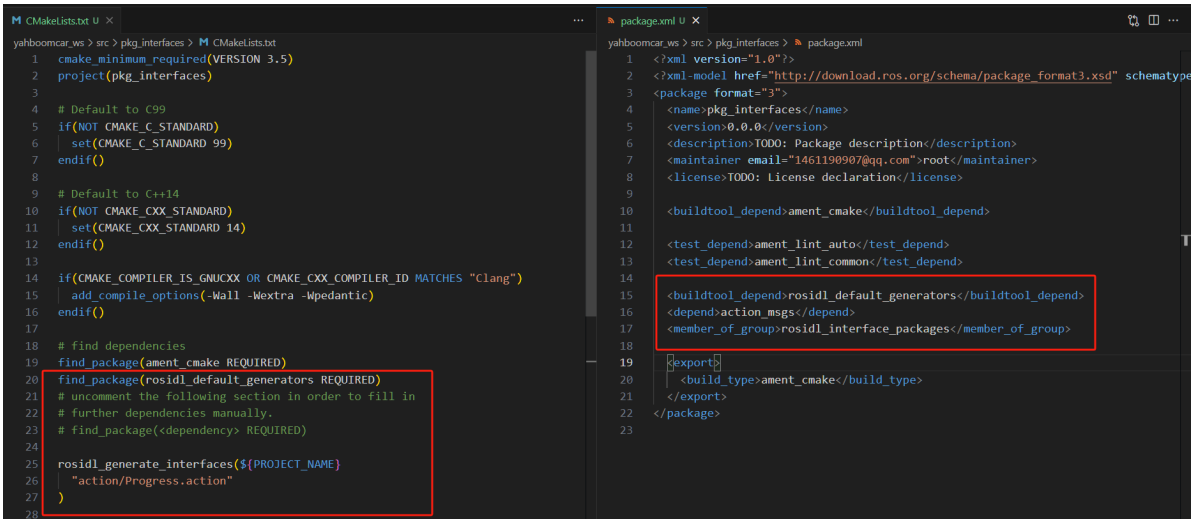


3. Some dependency packages need to be added to package.xml. The specific contents are as follows:

```
<buildtool_depend>rosidl_default_generators</buildtool_depend>
<depend>action_msgs</depend>
<member_of_group>rosidl_interface_packages</member_of_group>
```

4. Add the following configuration to CMakeLists.txt:

```
find_package(rosidl_default_generators REQUIRED)

rosidl_generate_interfaces(${PROJECT_NAME}
  "action/Progress.action"
)
```



5. Compile function package:

```
cd ~/yahboomcar_ros2_ws/yahboomcar_ws/src
colcon build --packages-select pkg_interfaces
```

6. After the compilation is completed, the C++ and Python files corresponding to the `Progress.action` file will be generated in the install directory under the workspace. We can also enter the workspace under the terminal and check the file definition and whether the compilation is normal through the following commands:

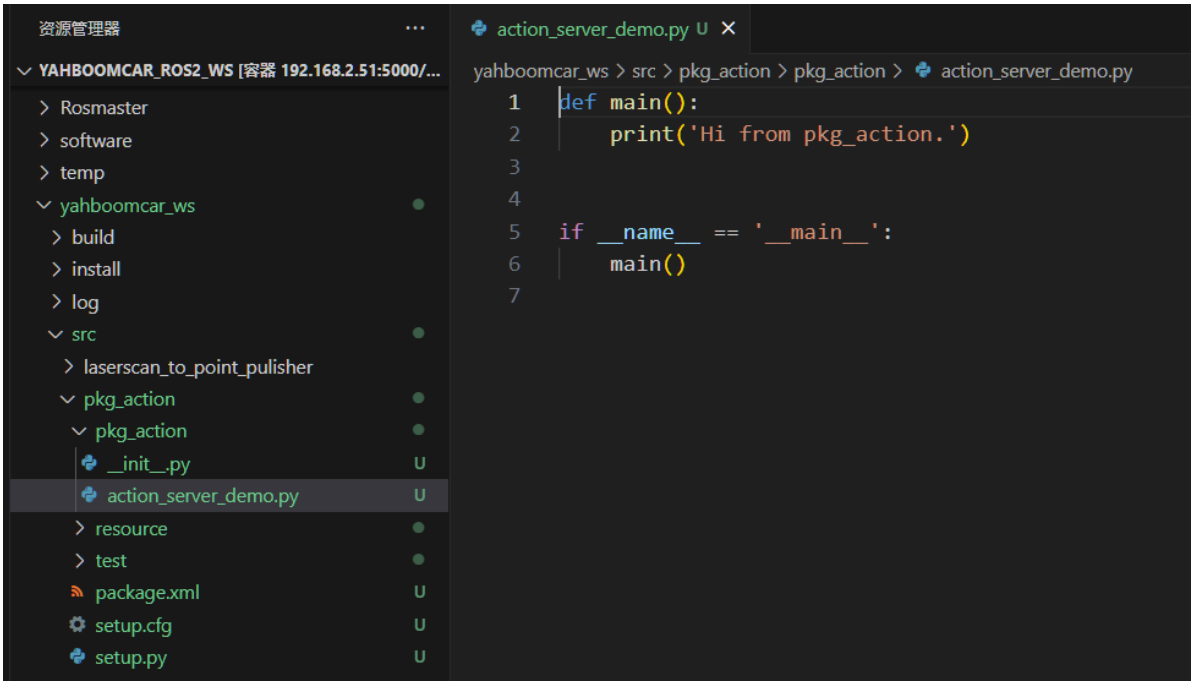
```
source install/setup.bash
ros2 interface show pkg_interfaces/action/Progress
```

Under normal circumstances, the terminal will output content consistent with the `Progress.action` file

3.2. Create action communication function package

```
cd ~/yahboomcar_ros2_ws/yahboomcar_ws/src
ros2 pkg create pkg_action --build-type ament_python --dependencies rclpy
pkg_interfaces --node-name action_server_demo
```

After executing the above command, the pkg_action function package will be created, and an action_server_demo node will be created, and the relevant configuration files have been configured.



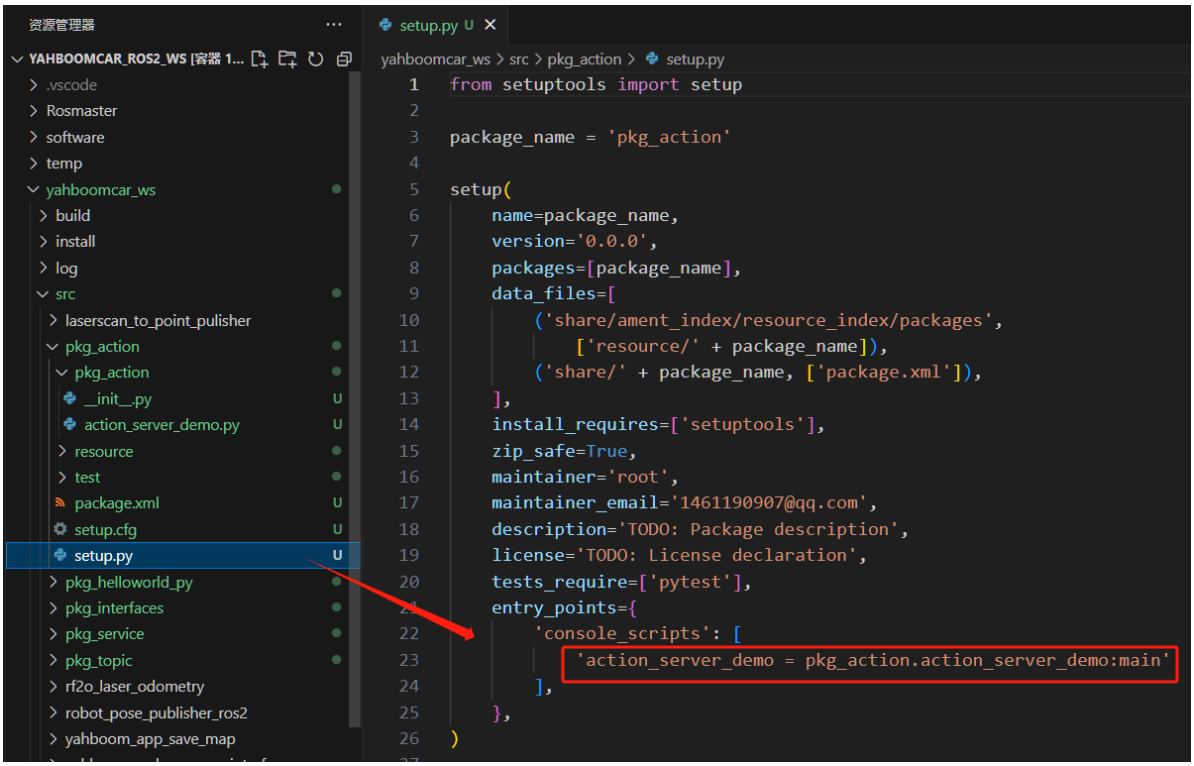
4. Server-side implementation

Next edit [action_server_demo.py] to implement the server-side functions and add the following code:

```
import time
import rclpy
from rclpy.action import ActionServer
from rclpy.node import Node

from pkg_interfaces.action import Progress


class Action_Server(Node):

    def __init__(self):
        super().__init__('progress_action_server')
        # Create action server
        self._action_server = ActionServer(
            self,
            Progress,
            'get_sum',
            self.execute_callback)
        self.get_logger().info('Action service has been started! ')

    def execute_callback(self, goal_handle):
        self.get_logger().info('Start executing the task....')


        # Generate continuous feedback;
        feedback_msg = Progress.Feedback()

        sum = 0
        for i in range(1, goal_handle.request.num + 1):
            sum += i
            feedback_msg.progress = i / goal_handle.request.num
```

```
            self.get_logger().info('continuous feedback: %.2f' %
feedback_msg.progress)
            goal_handle.publish_feedback(feedback_msg)
            time.sleep(1)

        # Generate final response.
        goal_handle.succeed()
        result = Progress.Result()
        result.sum = sum
        self.get_logger().info('Task completed! ')

        return result


def main(args=None):

    rclpy.init(args=args)
    # Call the spin function and pass in the node object
    Progress_action_server = Action_Server()
    rclpy.spin(Progress_action_server)
    Progress_action_server.destroy_node()
    # Release resources
    rclpy.shutdown()
```

5. Edit configuration file



6. Compile workspace

```
cd ~/yahboomcar_ros2_ws/yahboomcar_ws
colcon build --packages-select pkg_action
source install/setup.bash
```

7. Run program

Open a terminal:

```
ros2 run pkg_action action_server_demo
```

```
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws# ros2 run pkg_action action_server_demo
[INFO] [1698655793.746654229] [progress_action_server]: 动作服务已经启动!
```

Enter in another terminal:

```
ros2 action list
```

```
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws# ros2 action list
/get_sum
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws#
```

/get_sum is the action we need to call. Call it through the following command and enter it in the terminal:

```
ros2 action send_goal /get_sum pkg_interfaces/action/Progress num:\ 10\
```

Here we find the sum from 1 to 10:

```
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws# ros2 run pkg_action action_server_demo
[INFO] [1698656083.969110826] [progress_action_server]: 动作服务已经启动!
[INFO] [1698656086.785874392] [progress_action_server]: 开始执行任务....
[INFO] [1698656086.786558163] [progress_action_server]: 连续反馈: 0.10
[INFO] [1698656086.988069982] [progress_action_server]: 连续反馈: 0.20
[INFO] [1698656087.189707693] [progress_action_server]: 连续反馈: 0.30
[INFO] [1698656087.391339228] [progress_action_server]: 连续反馈: 0.40
[INFO] [1698656087.593014605] [progress_action_server]: 连续反馈: 0.50
[INFO] [1698656087.795406778] [progress_action_server]: 连续反馈: 0.60
[INFO] [1698656087.997475930] [progress_action_server]: 连续反馈: 0.70
[INFO] [1698656088.199655262] [progress_action_server]: 连续反馈: 0.80
[INFO] [1698656088.402166864] [progress_action_server]: 连续反馈: 0.90
[INFO] [1698656088.604606494] [progress_action_server]: 连续反馈: 1.00
[INFO] [1698656088.807212115] [progress_action_server]: 任务完成!
```

```
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws# ros2 action send_goal /get_sum pkg_interfaces/action/Progress num:\ 10\
Waiting for an action server to become available...
Sending goal:
     num: 10

Goal accepted with ID: f97430c5b72e464995b3b396c4f40226

Result:
    sum: 55

Goal finished with status: SUCCEEDED
root@unbutu:~/yahboomcar_ros2_ws/yahboomcar_ws#
```

The top of the picture above is the server, and the bottom is the client. You can see that during the calculation of the sum of 1 to 10, the server has been feeding back the progress of the calculation. Finally, it shows that the task is completed, and the client has also received feedback that the sum is 55.