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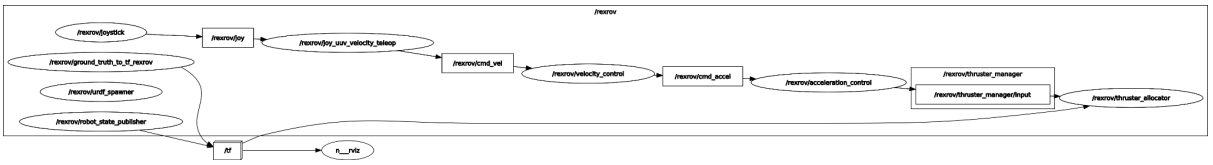
Task 1

Rqt_graph



In order to retrieve information about the nodes, topics, services, and messages from "uuv_gazebo/rexrov_default.launch", I had to first launch the file by using the following command: `roslaunch uuv_gazebo rexrov_default.launch`.

By using the command `rosrun rqt_graph rqt_graph` we are able to have a graph visualization of /rexrov and its current active nodes and topics.

Nodes

If we would like to get specific information about every node's topic we can use `rostopic list` to list the topics and `rostopic info [topic]`, and the same can be done for services, we would only need to change topic by service. However, I mostly used `rosnode list` and `rosnode info [node]` to better understand the graph.

By using `rosnode list` I was able to get a lost of all the nodes:

1. /rexrov/acceleration_control
2. /rexrov/ground_truth_to_tf_rexrov
3. /rexrov/joy_uuv_velocity_teleop
4. /rexrov/joystick
5. /rexrov/robot_state_publisher
6. /rexrov/thruster_allocator
7. /rexrov/urdf_spawner
8. /rexrov/velocity_control
9. /rosout
10. /rviz

/rexrov/acceleration_control

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/acceleration_control
--------------------------------------------------------------------------------
Node [/rexrov/acceleration_control]
Publications:
 * /rexrov/thruster_manager/input [geometry_msgs/Wrench]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/cmd_accel [geometry_msgs/Accel]
 * /rexrov/cmd_force [unknown type]

Services:
 * /rexrov/acceleration_control/get_loggers
 * /rexrov/acceleration_control/set_logger_level


contacting node http://aguacateubuntu:38491/ ...
Pid: 29630
Connections:
 * topic: /rosout
    * to: /rosout
    * direction: outbound (38061 - 10.82.57.126:40206) [9]
    * transport: TCPROS
 * topic: /rexrov/thruster_manager/input
    * to: /rexrov/thruster_allocator
    * direction: outbound (38061 - 10.82.57.126:40216) [16]
    * transport: TCPROS
 * topic: /rexrov/cmd_accel
    * to: /rexrov/velocity_control (http://aguacateubuntu:33137/)
    * direction: inbound
    * transport: TCPROS
```

This node has two publishers of message type geometry_msgs and rosgraph_msgs. A message defines the structure of the data that is passed between nodes. The /rexrov/thruster_manager/input topic is a publisher to this node and it is a subscriber to the active node /rexrov/thruster_allocator. Along with services /rexrov/acceleration_control/get_loggers and /rexrov/acceleration_control/set_logger_level of type roscpp/GetLoggers and roscpp/SetLoggerLevel.

By using rostopic info `/rexrov/thruster_manager/input` , we are able to retrieve this information.

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rostopic info /rexrov/thr
uster_manager/input
Type: geometry_msgs/Wrench

Publishers:
 * /rexrov/acceleration_control (http://aguacateubuntu:45023/)

Subscribers:
 * /rexrov/thruster_allocator (http://aguacateubuntu:45395/)
```

/rexrov/ground_truth_to_tf_rexrov

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/ground_truth_to_tf_rexrov

--------------------------------------------------------------------------------
Node [/rexrov/ground_truth_to_tf_rexrov]
Publications:
 * /rexrov/ground_truth_to_tf_rexrov/euler [geometry_msgs/Vector3Stamped]
 * /rexrov/ground_truth_to_tf_rexrov/pose [geometry_msgs/PoseStamped]
 * /rosout [rosgraph_msgs/Log]
 * /tf [tf2_msgs/TFMessage]

Subscriptions:
 * /rexrov/pose_gt [unknown type]

Services:
 * /rexrov/ground_truth_to_tf_rexrov/get_loggers
 * /rexrov/ground_truth_to_tf_rexrov/set_logger_level
```

This node has four publishers of message type geometry_msgs, rosgraph_msgs, and tf2_msgs. The /rexrov/ground_truth_to_tf_rexrov/euler topic is only a publisher to this node. The /rexrov/ground_truth_to_tf_rexrov/pose is only a publisher to this node. This node is subscribed to only one topic and has two services of get_loggers and set_loggers_level.

/rexrov/robot_state_publisher

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/robot_state_publisher
--------------------------------------------------------------------------------
Node [/rexrov/robot_state_publisher]
Publications:
 * /rosout [rosgraph_msgs/Log]
 * /tf [tf2_msgs/TFMessage]
 * /tf_static [tf2_msgs/TFMessage]

Subscriptions:
 * /rexrov/joint_states [unknown type]

Services:
 * /rexrov/robot_state_publisher/get_loggers
 * /rexrov/robot_state_publisher/set_logger_level
```

This node has three publishers of message type rosgraph_msgs and tf2_msgs. The /tf topic has a publisher to this node and to /rexrov/robot_state_publisher. The /tf_static is only a publisher to this node. This node is subscribed to only one topic and has two services of get_loggers and set_loggers_level.

/rexrov/joy_uuv_velocity_teleop

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/joy_uuv_v
elocity_teleop
--------------------------------------------------------------------------------
Node [/rexrov/joy_uuv_velocity_teleop]
Publications:
 * /rexrov/cmd_vel [geometry_msgs/Twist]
 * /rexrov/home_pressed [std_msgs/Bool]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/joy [sensor_msgs/Joy]

Services:
 * /rexrov/joy_uuv_velocity_teleop/get_loggers
 * /rexrov/joy_uuv_velocity_teleop/set_logger_level
```

This node has three publishers of message type geometry_msgs, std_msgs, and rosgraph_msgs. The /rexrov/cmd_vel topic is only a publisher to this node. The /rexrov/home_pressed is only a publisher to this node. This node is subscribed to only one topic and has two services of get_loggers and set_loggers_level.

/rviz

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rviz
--------------------------------------------------------------------------------
Node [/rviz]
Publications:
 * /clicked_point [geometry_msgs/PointStamped]
 * /initialpose [geometry_msgs/PoseWithCovarianceStamped]
 * /move_base_simple/goal [geometry_msgs/PoseStamped]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/current_velocity_marker [unknown type]
 * /rexrov/current_velocity_marker_array [unknown type]
 * /rexrov/dvl_sonar0 [unknown type]
 * /rexrov/dvl_sonar1 [unknown type]
 * /rexrov/dvl_sonar2 [unknown type]
 * /rexrov/dvl_sonar3 [unknown type]
 * /rexrov/pose_gt [unknown type]
 * /rexrov/rexrov/camera/camera_image [unknown type]
 * /tf [tf2_msgs/TFMessage]
 * /tf_static [tf2_msgs/TFMessage]

Services:
 * /rviz/get_loggers
 * /rviz/load_config
 * /rviz/reload_shaders
 * /rviz/save_config
 * /rviz/set_logger_level
```

This node has four publishers of message type geometry_msgs and rosgraph_msgs. This node is subscribed to ten topics and has five services.

/rosout

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rosout
--------------------------------------------------------------------------------
Node [/rosout]
Publications:
 * /rosout_agg [rosgraph_msgs/Log]

Subscriptions:
 * /rosout [rosgraph_msgs/Log]

Services:
 * /rosout/get_loggers
 * /rosout/set_logger_level
```

/rosout is the name of the console log reporting mechanism in ROS. It can be thought as comprising several components: The `rosout` node for subscribing, logging, and republishing the messages

/rexrov/velocity_control

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/velocity_
control
--------------------------------------------------------------------------------
Node [/rexrov/velocity_control]
Publications:
 * /rexrov/cmd_accel [geometry_msgs/Accel]
 * /rexrov/velocity_control/parameter_descriptions [dynamic_reconfigure/ConfigDescrip
tion]
 * /rexrov/velocity_control/parameter_updates [dynamic_reconfigure/Config]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/cmd_vel [geometry_msgs/Twist]
 * /rexrov/pose_gt [unknown type]

Services:
 * /rexrov/velocity_control/get_loggers
 * /rexrov/velocity_control/set_logger_level
 * /rexrov/velocity_control/set_parameters
```

This node has four publishers of message type geometry_msgs, dynamic_reconfigure, and rosgraph_msgs. The /rexrov/cmd_accel, /rexrov/velocity_control/parameter_updates, and /rexrov/velocity_control/parameter_descriptions topics are only a publisher to this node.
This node is subscribed to two topics and has three services of get_loggers and set_loggers_level.

/rexrov/urdf_spawner

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/urdf_spaw
ner
--------------------------------------------------------------------------------
Node [/rexrov/urdf_spawner]
Publications:
 * /rosout [rosgraph_msgs/Log]

Subscriptions: None

Services:
 * /rexrov/urdf_spawner/get_loggers
 * /rexrov/urdf_spawner/set_logger_level
```

This node has one publisher of message type rosgraph_msgs. This node is subscribed to no topics and has two services of get_loggers and set_loggers_level.

/rexrov/joystick

```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/joystick
--------------------------------------------------------------------------------
Node [/rexrov/joystick]
Publications:
 * /diagnostics [diagnostic_msgs/DiagnosticArray]
 * /rexrov/joy [sensor_msgs/Joy]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/joy/set_feedback [unknown type]

Services:
 * /rexrov/joystick/get_loggers
 * /rexrov/joystick/set_logger_level
```

This node has three publishers of message type diagnostic_msgs, sensor_msgs, and rosgraph_msgs. The /diagnostics and /rexrov/joy topics are only a publisher to this node. This node is subscribed to only one topic and has two services of get_loggers and set_loggers_level.

/rexrov/thruster_allocator

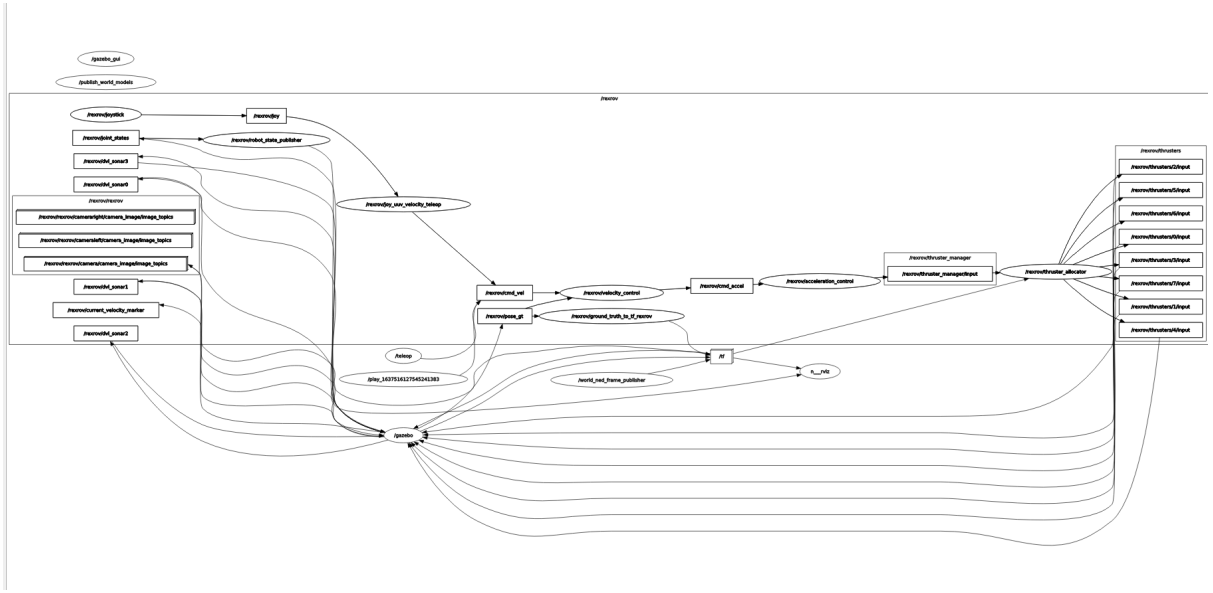
```
vsancnaj@aguacateubuntu:~/catkin_ws/src/uuv_simulator$ rosnode info /rexrov/thruster_
allocator
--------------------------------------------------------------------------------
Node [/rexrov/thruster_allocator]
Publications:
 * /rexrov/thrusters/0/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/1/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/2/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/3/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/4/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/5/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/6/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rexrov/thrusters/7/input [uuv_gazebo_ros_plugins_msgs/FloatStamped]
 * /rosout [rosgraph_msgs/Log]

Subscriptions:
 * /rexrov/thruster_manager/input [geometry_msgs/Wrench]
 * /rexrov/thruster_manager/input_stamped [unknown type]
 * /tf [tf2_msgs/TFMessage]
 * /tf_static [tf2_msgs/TFMessage]

Services:
 * /rexrov/thruster_allocator/get_loggers
 * /rexrov/thruster_allocator/set_logger_level
 * /rexrov/thruster_allocator/tf2_frames
 * /rexrov/thruster_manager/get_config
 * /rexrov/thruster_manager/get_thruster_curve
 * /rexrov/thruster_manager/get_thrusters_info
 * /rexrov/thruster_manager/set_config
```

This node has nine publishers of message type uuv_gazebo_ros_plugins_msgs It is subscribes to four topics and has seven services.

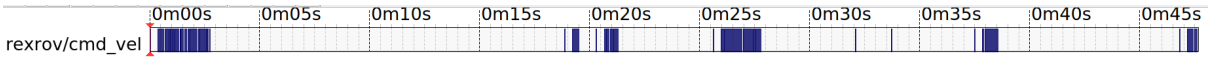
Task 2

Part B

Rqt_graph



Trajectory Plot



Task 4

Part B

The completed URDF file has 5 thrusters.

1. One for vertical ascend and submerge function
2. Two for sideways movement left and right without tilt.
3. 3 for maximum thrust from behind and reverse movement.

This was decided for optimal mobility and easy use since the ROV in question was never intended for specialized cases.

Point Division

We divided the work by questions and for some parts of those questions

1. Valentina 25 pts
2. Yassine & Valentina
    a. Yassine 10 pts & Valentina 5 pts
    b. Valentina 5 pts
3. Yassine 20 pts
4. Yasar 35 pts

Name	Percentages
Valentina	35 %
Yassine	30 %
Yasar	35 %