

LAB 01 Report

Mobile Robotics: Introduction to ROS2

Name: LALAGUI Baraa Fatima Zohra

Group: 02

ROS2: robot operating system, is an SDK to build robot applications

- Basic Concepts and tools:
 - Turtlesim: simulator
 - Nodes:

To run a node:

```
ros2 run <package_name> <executable_name>
```

```
ros2 run turtlesim turtlesim_node
```

```
ubuntu@humble-vm-baraa: ~ 80x11

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
ubuntu@humble-vm-baraa:~$ xvfb-run ros2 run turtlesim turtlesim_node
[INFO] [1731519808.849112233] [turtlesim]: Starting turtlesim with node name /turtlesim
[INFO] [1731519808.853255534] [turtlesim]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445], theta=[0.000000]
```

To see the list of nodes

```
ubuntu@humble-vm-baraa:~$ ros2 node list
/turtlesim
```

To run a teleop node:

```
ubuntu@humble-vm-baraa:~$ ros2 run turtlesim turtle_teleop_key
Reading from keyboard
-----
Use arrow keys to move the turtle.
Use G|B|V|C|D|E|R|T keys to rotate to absolute orientations. 'F' to cancel a rotation.
'Q' to quit.

ubuntu@humble-vm-baraa: ~ 80x11
ubuntu@humble-vm-baraa:~$ xvfb-run ros2 run turtlesim turtlesim_node
[INFO] [1731519808.849112233] [turtlesim]: Starting turtlesim with node name /turtlesim
[INFO] [1731519808.853255534] [turtlesim]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445], theta=[0.000000]

[INFO] [1731520160.591004291] [turtlesim]: Rotation goal completed successfully
[INFO] [1731520167.005867476] [turtlesim]: Rotation goal completed successfully
[INFO] [1731520172.094146392] [turtlesim]: Rotation goal completed successfully
[INFO] [1731520173.726120382] [turtlesim]: Rotation goal completed successfully
[INFO] [1731520176.686753436] [turtlesim]: Rotation goal completed successfully
```

```
ubuntu@humble-vm-baraa: ~ 64x16
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ubuntu@humble-vm-baraa:~$ sudo apt install xvfb
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
xvfb is already the newest version (2:21.1.4-2ubuntu1.7~22.04.12
).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ubuntu@humble-vm-baraa:~$ export DISPLAY=:1
xvfb-run -a ros2 run turtlesim turtlesim_node --ros-args --remap
__node:=my_turtle
[INFO] [1731585556.033603756] [my_turtle]: Starting turtlesim wi
th node name /my_turtle
[INFO] [1731585556.037138064] [my_turtle]: Spawning turtle [turt
le1] at x=[5.544445], y=[5.544445], theta=[0.000000]
```

```
ubuntu@humble-vm-baraa:~$ ros2 node list
/my_turtle
/teleop_turtle
/turtlesim
```

To know information about a node:

```
ubuntu@humble-vm-baraa:~$ ros2 node info /my_turtle
/my_turtle
Subscribers:
  /parameter_events: rcl_interfaces/msg/ParameterEvent
  /turtle1/cmd_vel: geometry_msgs/msg/Twist
Publishers:
  /parameter_events: rcl_interfaces/msg/ParameterEvent
  /rosout: rcl_interfaces/msg/Log
  /turtle1/color_sensor: turtlesim/msg/Color
  /turtle1/pose: turtlesim/msg/Pose
Service Servers:
  /clear: std_srvs/srv/Empty
  /kill: turtlesim/srv/Kill
  /my_turtle/describe_parameters: rcl_interfaces/srv/DescribeParameters
  /my_turtle/get_parameter_types: rcl_interfaces/srv/GetParameterTypes
  /my_turtle/get_parameters: rcl_interfaces/srv/GetParameters
  /my_turtle/list_parameters: rcl_interfaces/srv/ListParameters
  /my_turtle/set_parameters: rcl_interfaces/srv/SetParameters
  /my_turtle/set_parameters_atomically: rcl_interfaces/srv/SetParametersAt
omically
  /reset: std_srvs/srv/Empty
  /spawn: turtlesim/srv/Spawn
  /turtle1/set_pen: turtlesim/srv/SetPen
  /turtle1/teleport_absolute: turtlesim/srv/TeleportAbsolute
  /turtle1/teleport_relative: turtlesim/srv/TeleportRelative
Service Clients:

Action Servers:
  /turtle1/rotate_absolute: turtlesim/action/RotateAbsolute
Action Clients:
```

- Topics:

To see the list of Topics

```

ubuntu@humble-vm-baraa:~$ ros2 topic list
/parameter_events
/rosout
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
ubuntu@humble-vm-baraa:~$ ros2 topic list -t
/parameter_events [rcl_interfaces/msg/ParameterEvent]
/rosout [rcl_interfaces/msg/Log]
/turtle1/cmd_vel [geometry_msgs/msg/Twist]
/turtle1/color_sensor [turtlesim/msg/Color]
/turtle1/pose [turtlesim/msg/Pose]

```

Details about a topic

```

ubuntu@humble-vm-baraa:~$ ros2 topic echo turtle1/cmd_vel
linear:
  x: 0.0
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: 2.0
---
linear:
  x: 0.0
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: -2.0

```

information about the topic

```

ubuntu@humble-vm-baraa:~$ ros2 topic info /turtle1/cmd_vel
Type: geometry_msgs/msg/Twist
Publisher count: 1
Subscription count: 3

```

To see what structure of data the topic can receive

```

ubuntu@humble-vm-baraa:~$ ros2 interface show geometry_msgs/msg/Twist
# This expresses velocity in free space broken into its linear and angular parts.

Vector3  linear
  float64 x
  float64 y
  float64 z
Vector3  angular
  float64 x
  float64 y
  float64 z

```

To publish data into a topic, optionally at rate 1hz:

```

ubuntu@humble-vm-baraa:~$ ros2 topic pub --once /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear:{x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0, y: 0.0, z: 1.8}}"
publisher: beginning loop
publishing #1: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=1.8))

```

```

ubuntu@humble-vm-baraa:~$ ros2 topic pub --rate 1 /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear:{x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0, y: 0.0, z: 1.8}}"
publisher: beginning loop
publishing #1: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=1.8))

publishing #2: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=1.8))

publishing #3: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=1.8))

publishing #4: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=1.8))

```

```
---
x: 6.373311996459961
y: 5.178264617919922
theta: 2.2911999225616455
linear_velocity: 0.0
angular_velocity: 0.0
---
x: 4.690451622009277
y: 5.925806522369385
theta: -0.8687853217124939
linear_velocity: 0.0
angular_velocity: 0.0
---
x: 6.373311996459961
y: 5.178264617919922
theta: 2.2911999225616455
linear_velocity: 0.0
angular_velocity: 0.0
---
```

```
ubuntu@humble-vm-baraa:~$ ros2 topic hz /turtle1/p
ose
average rate: 62.598
      min: 0.015s max: 0.017s std dev: 0.00046s
window: 64
average rate: 62.559
      min: 0.015s max: 0.017s std dev: 0.00054s
window: 127
average rate: 82.359
      min: 0.002s max: 0.020s std dev: 0.00544s
window: 250
average rate: 92.990
      min: 0.001s max: 0.020s std dev: 0.00577s
```

- Services:

Services list

```
^Cubuntu@humble-vm-baraa:~$ ros2 service list
/clear
/kill
/my_turtle/describe_parameters
/my_turtle/get_parameter_types
/my_turtle/get_parameters
/my_turtle/list_parameters
/my_turtle/set_parameters
/my_turtle/set_parameters_atomically
/reset
/spawn
/teleop_turtle/describe_parameters
/teleop_turtle/get_parameter_types
/teleop_turtle/get_parameters
/teleop_turtle/list_parameters
/teleop_turtle/set_parameters
/teleop_turtle/set_parameters_atomically
/turtle1/set_pen
/turtle1/teleport_absolute
/turtle1/teleport_relative
/turtlesim/describe_parameters
/turtlesim/get_parameter_types
/turtlesim/get_parameters
/turtlesim/list_parameters
/turtlesim/set_parameters
/turtlesim/set_parameters_atomically
```

A service type exploration

```
ubuntu@humble-vm-baraa:~$ ros2 service type /clear
std_srvs/srv/Empty
```

Service list with type:

```
ubuntu@humble-vm-baraa:~$ ros2 service list -t
/clear [std_srvs/srv/Empty]
/kill [turtlesim/srv/Kill]
/my_turtle/describe_parameters [rcl_interfaces/srv/DescribeParameters]
/my_turtle/get_parameter_types [rcl_interfaces/srv/GetParameterTypes]
/my_turtle/get_parameters [rcl_interfaces/srv/GetParameters]
/my_turtle/list_parameters [rcl_interfaces/srv/ListParameters]
/my_turtle/set_parameters [rcl_interfaces/srv/SetParameters]
/my_turtle/set_parameters_atomically [rcl_interfaces/srv/SetParametersAtomically]
/reset [std_srvs/srv/Empty]
/spawn [turtlesim/srv/Spawn]
/teleop_turtle/describe_parameters [rcl_interfaces/srv/DescribeParameters]
/teleop_turtle/get_parameter_types [rcl_interfaces/srv/GetParameterTypes]
/teleop_turtle/get_parameters [rcl_interfaces/srv/GetParameters]
/teleop_turtle/list_parameters [rcl_interfaces/srv/ListParameters]
/teleop_turtle/set_parameters [rcl_interfaces/srv/SetParameters]
/teleop_turtle/set_parameters_atomically [rcl_interfaces/srv/SetParametersAtomically]
/turtle1/set_pen [turtlesim/srv/SetPen]
/turtle1/teleport_absolute [turtlesim/srv/TeleportAbsolute]
/turtle1/teleport_relative [turtlesim/srv/TeleportRelative]
/turtlesim/describe_parameters [rcl_interfaces/srv/DescribeParameters]
/turtlesim/get_parameter_types [rcl_interfaces/srv/GetParameterTypes]
/turtlesim/get_parameters [rcl_interfaces/srv/GetParameters]
/turtlesim/list_parameters [rcl_interfaces/srv/ListParameters]
/turtlesim/set_parameters [rcl_interfaces/srv/SetParameters]
/turtlesim/set_parameters_atomically [rcl_interfaces/srv/SetParametersAtomically]
```

Exploring services of a type

```
ubuntu@humble-vm-baraa:~$ ros2 service find std_srvs/srv/Empty
/clear
/reset
```

Trying the spawn service

```
ubuntu@humble-vm-baraa:~$ ros2 interface show turtlesim/srv/Spawn
float32 x
float32 y
float32 theta
string name # Optional. A unique name will be created and returned if this is empty
---
string name
```

Trying the empty services:

```
ubuntu@humble-vm-baraa:~$ ros2 interface show std_srvs/srv/Empty
---
```

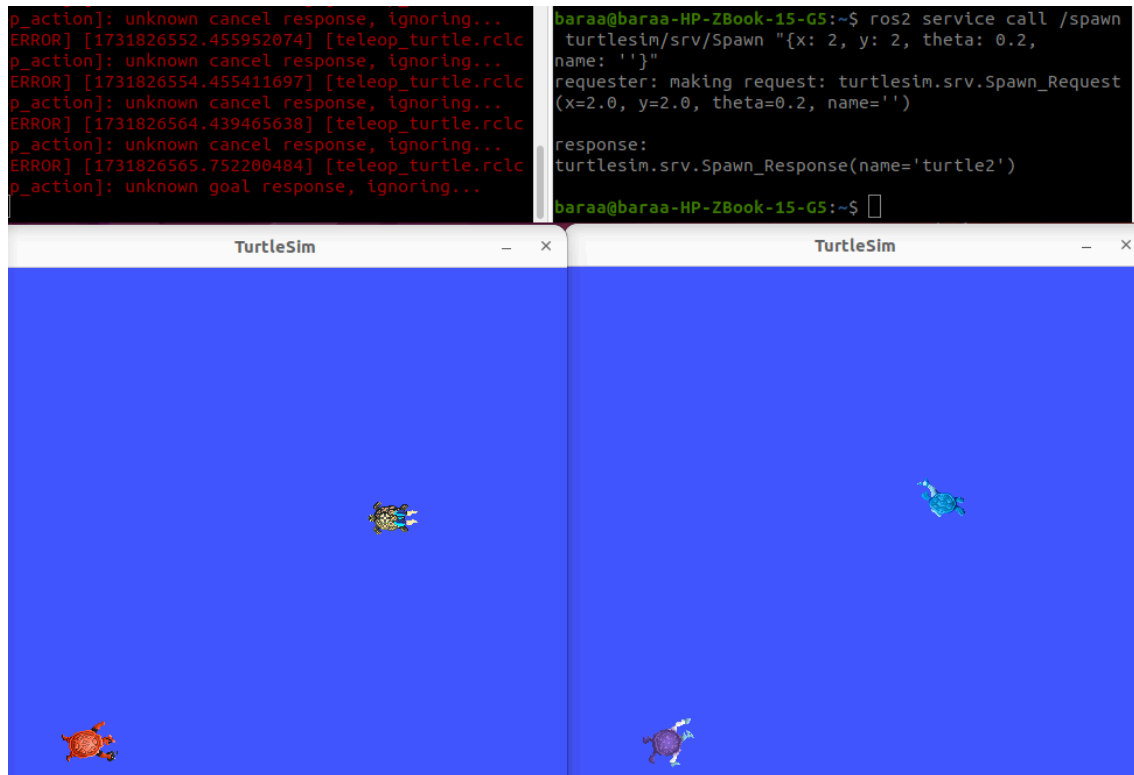
service calls:

```
ubuntu@humble-vm-baraa:~$ ros2 service call /clear std_srvs/srv/Empty
waiting for service to become available...
requester: making request: std_srvs.srv.Empty_Request()

response:
std_srvs.srv.Empty_Response()
```

```
ubuntu@humble-vm-baraa:~$ ros2 service call /spawn turtlesim/srv/Spawn "
{x: 2, y: 2, theta: 0.2, name: 'kiki'}"
requester: making request: turtlesim.srv.Spawn_Request(x=2.0, y=2.0, theta=0.2, name='kiki')

response:
turtlesim.srv.Spawn_Response(name='kiki')
```

- Parameters:

Parameters list

```

ubuntu@humble-vm-baraa:~$ ros2 param list
/my_turtle:
  background_b
  background_g
  background_r
  qos_overrides./parameter_events.publisher.depth
  qos_overrides./parameter_events.publisher.durability
  qos_overrides./parameter_events.publisher.history
  qos_overrides./parameter_events.publisher.reliability
  use_sim_time
/teleop_turtle:
  qos_overrides./parameter_events.publisher.depth
  qos_overrides./parameter_events.publisher.durability
  qos_overrides./parameter_events.publisher.history
  qos_overrides./parameter_events.publisher.reliability
  scale_angular
  scale_linear
  use_sim_time
/turtlesim:
  background_b
  background_g
  background_r
  qos_overrides./parameter_events.publisher.depth
  qos_overrides./parameter_events.publisher.durability
  qos_overrides./parameter_events.publisher.history
  qos_overrides./parameter_events.publisher.reliability
  use_sim_time

```

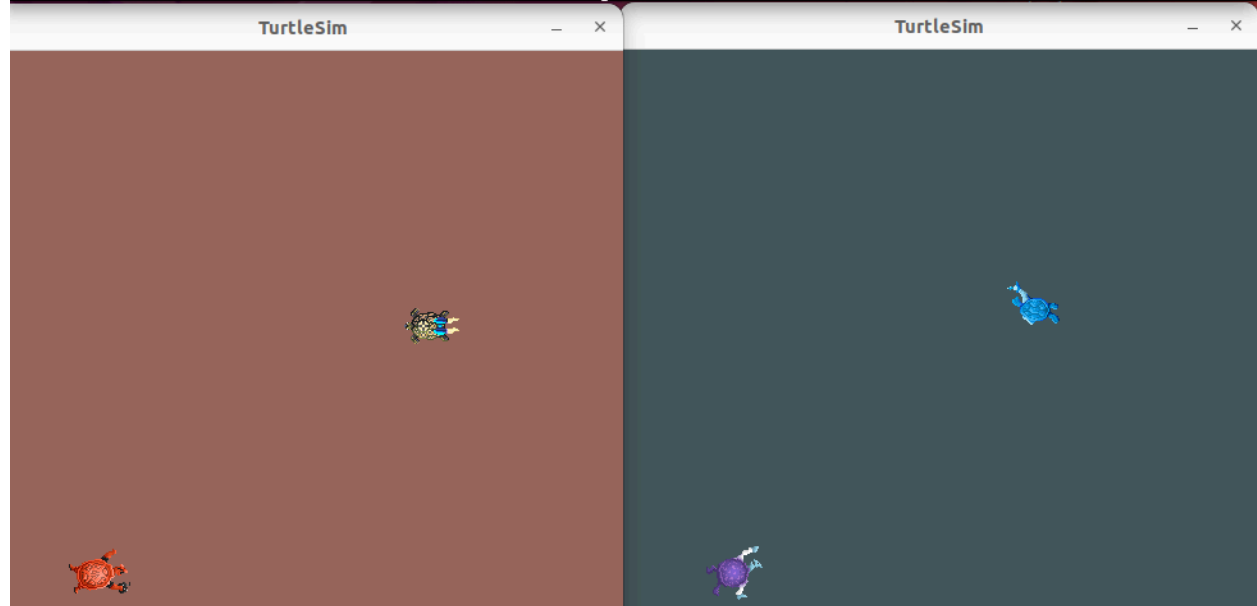
Setting and getting the parameters and changing them

```
ubuntu@humble-vm-baraa:~$ ros2 param get /my_turtle background_r
Integer value is: 69
ubuntu@humble-vm-baraa:~$ ros2 param get /my_turtle background_g
Integer value is: 86
ubuntu@humble-vm-baraa:~$ ros2 param get /my_turtle background_b
Integer value is: 255
```

```
ubuntu@humble-vm-baraa:~$ ros2 param set /my_turtle background_b 100
Set parameter successful
```

```
p_action]: unknown cancel response, ignoring...
ERROR] [1731826552.455952074] [teleop_turtle.rcl
p_action]: unknown cancel response, ignoring...
ERROR] [1731826554.455411697] [teleop_turtle.rcl
p_action]: unknown cancel response, ignoring...
ERROR] [1731826564.439465638] [teleop_turtle.rcl
p_action]: unknown cancel response, ignoring...
ERROR] [1731826565.752200484] [teleop_turtle.rcl
p_action]: unknown goal response, ignoring...
```

```
baraa@baraa-HP-ZBook-15-G5:~$ ros2 param set /turtlesim background_g 100
Set parameter successful
baraa@baraa-HP-ZBook-15-G5:~$ ros2 param set /turtlesim background_b 90
Set parameter successful
baraa@baraa-HP-ZBook-15-G5:~$ ros2 param set /my_turtle background_b 90
Set parameter successful
baraa@baraa-HP-ZBook-15-G5:~$
```



Parameters of a node:

```
ubuntu@humble-vm-baraa:~$ ros2 param dump /my_turtle
/my_turtle:
  ros__parameters:
    background_b: 100
    background_g: 86
    background_r: 69
    qos_overrides:
      /parameter_events:
        publisher:
          depth: 1000
          durability: volatile
          history: keep_last
          reliability: reliable
    use_sim_time: false
```

Parameters dump into a file

```
ubuntu@humble-vm-baraa:~$ ros2 param dump /my_turtle > my_turtle.yaml
ubuntu@humble-vm-baraa:~$ ros2 param load /my_turtle my_turtle.yaml
Set parameter background_b successful
Set parameter background_g successful
Set parameter background_r successful
Set parameter qos_overrides./parameter_events.publisher.depth failed: parameter 'qos_overrides./parameter_events.publisher.depth' cannot be set because it is read-only
Set parameter qos_overrides./parameter_events.publisher.durability failed: parameter 'qos_overrides./parameter_events.publisher.durability' cannot be set because it is read-only
Set parameter qos_overrides./parameter_events.publisher.history failed: parameter 'qos_overrides./parameter_events.publisher.history' cannot be set because it is read-only
Set parameter qos_overrides./parameter_events.publisher.reliability failed: parameter 'qos_overrides./parameter_events.publisher.reliability' cannot be set because it is read-only
Set parameter use_sim_time successful
ubuntu@humble-vm-baraa:~$
```

- Actions:

```
ubuntu@humble-vm-baraa:~$ ros2 action list
/turtle1/rotate_absolute
ubuntu@humble-vm-baraa:~$ ros2 action list -t
/turtle1/rotate_absolute [turtlesim/action/RotateAbsolute]
```

```
ubuntu@humble-vm-baraa:~$ ros2 interface show turtlesim/action/RotateAbsolute
# The desired heading in radians
float32 theta
---
# The angular displacement in radians to the starting position
float32 delta
---
# The remaining rotation in radians
float32 remaining
```

```
ubuntu@humble-vm-baraa:~$ ros2 action send_goal /turtle1/rotate
_absolute turtlesim/action/RotateAbsolute "{theta: 1.57}"
Waiting for an action server to become available...
Sending goal:
  theta: 1.57

Goal accepted with ID: 786ed0d6e6db453fbc62bfea0b54db75

Result:
  delta: -1.5360000133514404

Goal finished with status: SUCCEEDED
```

```
ubuntu@humble-vm-baraa:~$ ros2 action send_goal /turtle1/rotate
_absolute turtlesim/action/RotateAbsolute "{theta: 1.57}" --feedback
Waiting for an action server to become available...
Sending goal:
  theta: 1.57

Feedback:
  remaining: 0.018000006675720215

Goal accepted with ID: c4264a9031ca4e799aea70b7ac898aa4

Result:
  delta: 0.0

Goal finished with status: SUCCEEDED
```

```
ubuntu@humble-vm-baraa:~$ ros2 action send_goal /turtle1/rotate
_absolute turtlesim/action/RotateAbsolute "{theta: -1.57}" --feedback
Waiting for an action server to become available...
Sending goal:
  theta: -1.57

Feedback:
  remaining: -0.14600002765655518

Goal accepted with ID: 398d3e96e1e149f183956e2ab1f30077

Feedback:
  remaining: -0.12999999523162842

Feedback:
  remaining: -0.11400008201599121

Feedback:
  remaining: -0.09800004959106445

Feedback:
  remaining: -0.0820000171661377

Feedback:
  remaining: -0.06600010395050049

Feedback:
  remaining: -0.05000007152557373

Feedback:
  remaining: -0.03400003910064697

Feedback:
  remaining: -0.018000006675720215

Result:
  delta: 0.12800000607967377

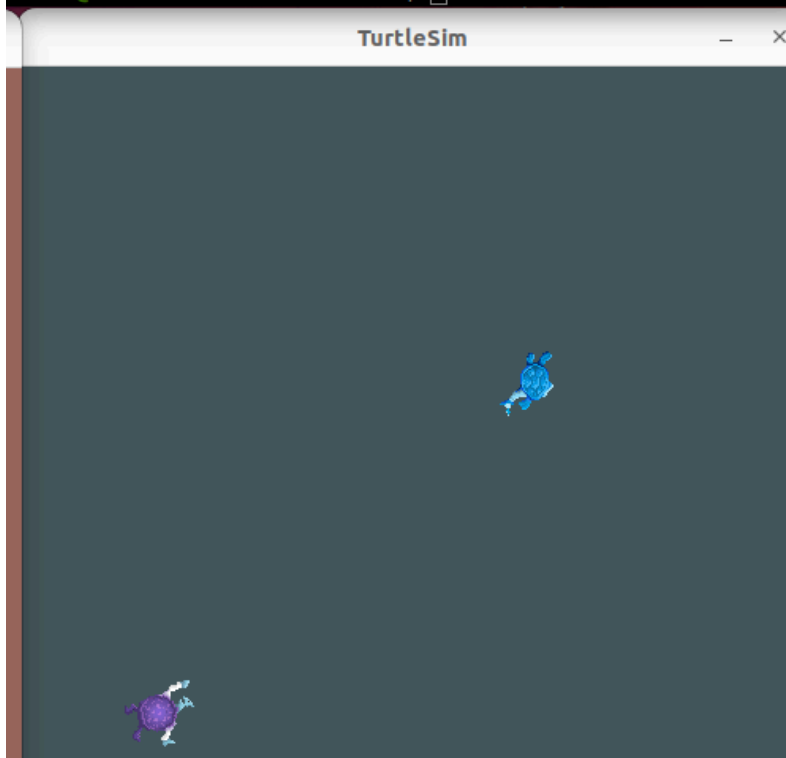
Goal finished with status: SUCCEEDED
```

```
baraa@baraa-HP-ZBook-15-G5:~$ ros2 action send_goal /turtle1/rotate_absolute turtlesim/action/RotateAbsolute "{theta: -1.57}"
Waiting for an action server to become available...
Sending goal:
  theta: -1.57

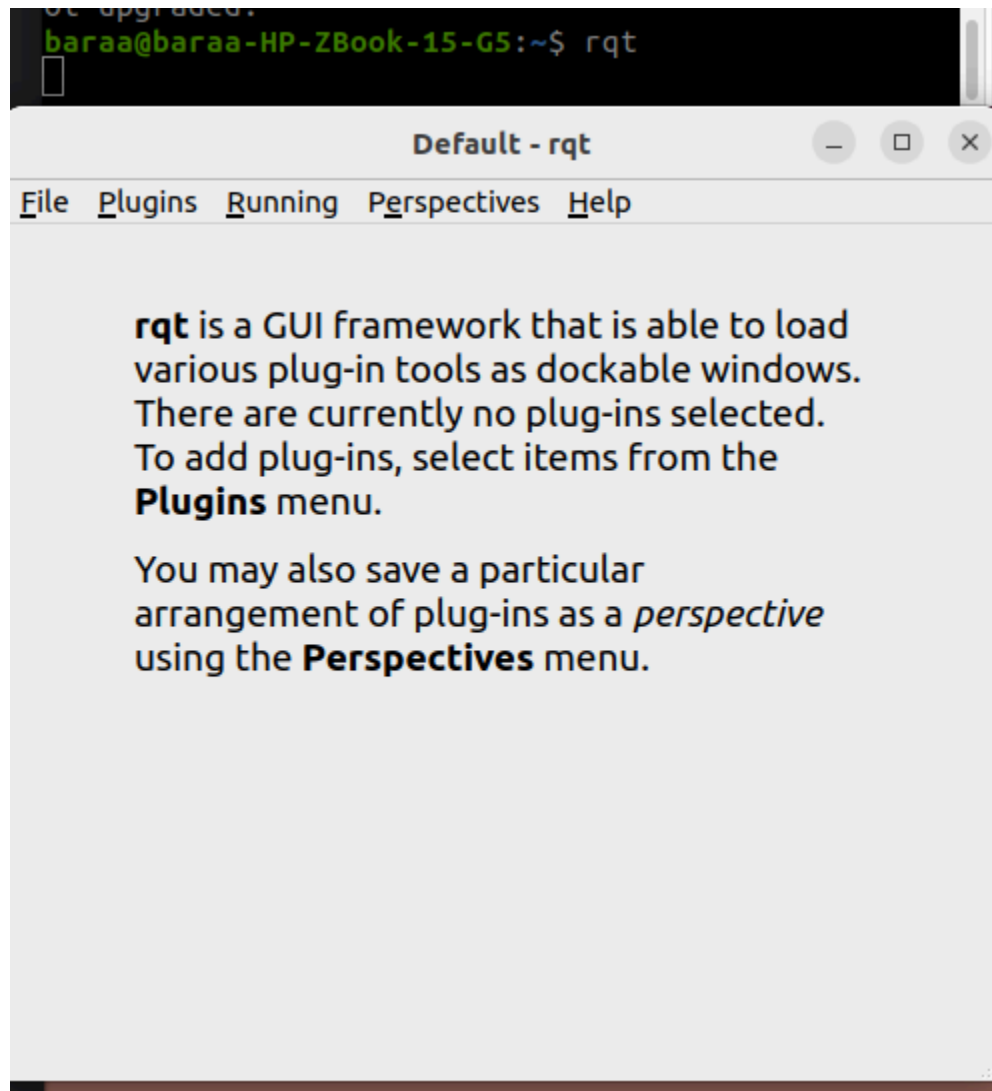
Goal accepted with ID: 5d9211eaadbe438686cedc6b710d7851

[WARN] [1731827324.561062404] [_ros2cli_send_goal_turtlesim_action_RotateAbsolute]: Ignoring unexpected goal response. There may be more than one action server for the action '/turtle1/rotate_absolute'
Result:
  delta: -1.5520000457763672

Goal finished with status: SUCCEEDED
baraa@baraa-HP-ZBook-15-G5:~$
```



- RQT:



Running a service

File Plugins Running Perspectives Help

Service Caller

Service /spawn

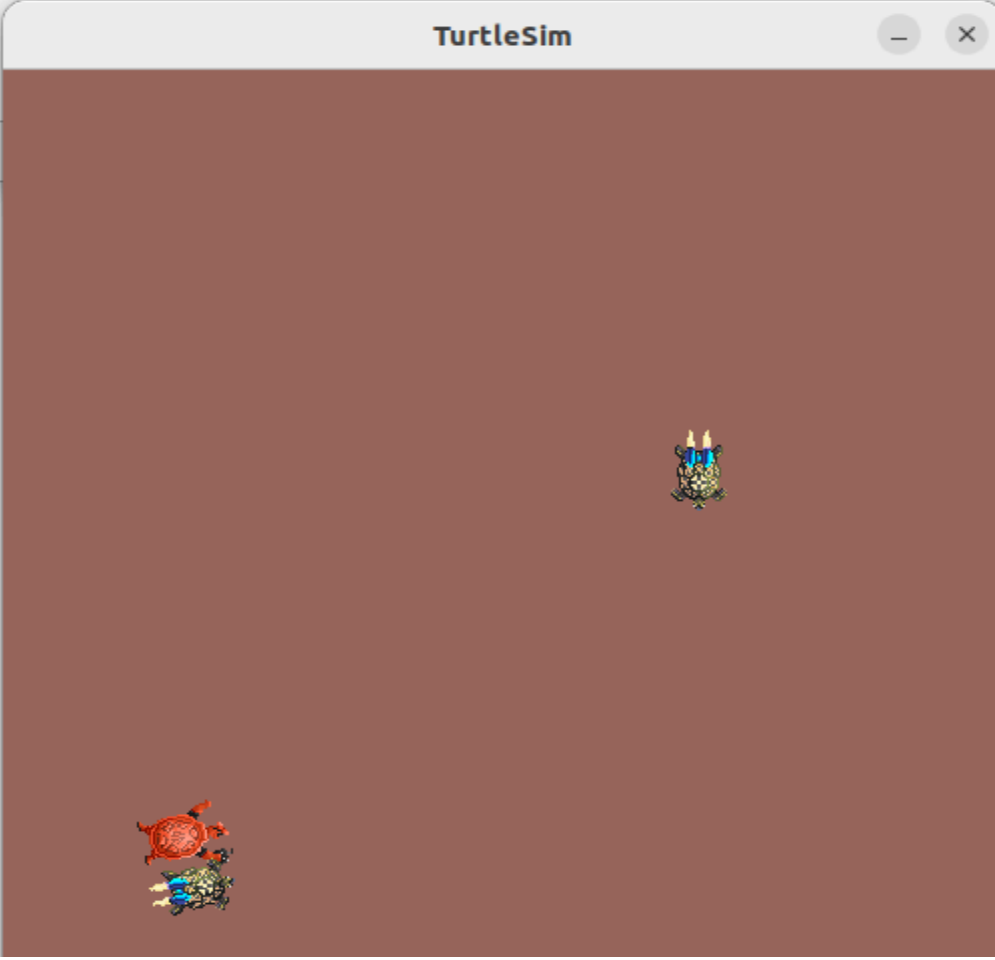
Request

Topic	Type	Expression
▼ /spawn	turtlesim/srv/Spawn	
x	float	1.0
y	float	1.0
theta	float	0.0
name	string	'turtle2'

Response

Field	Type	Value
▼ /	turtlesim/srv/Spawn.Response	
name	string	"

TurtleSim



Changing parameters:

Default - rqt

File Plugins Running Perspectives Help

Service Caller

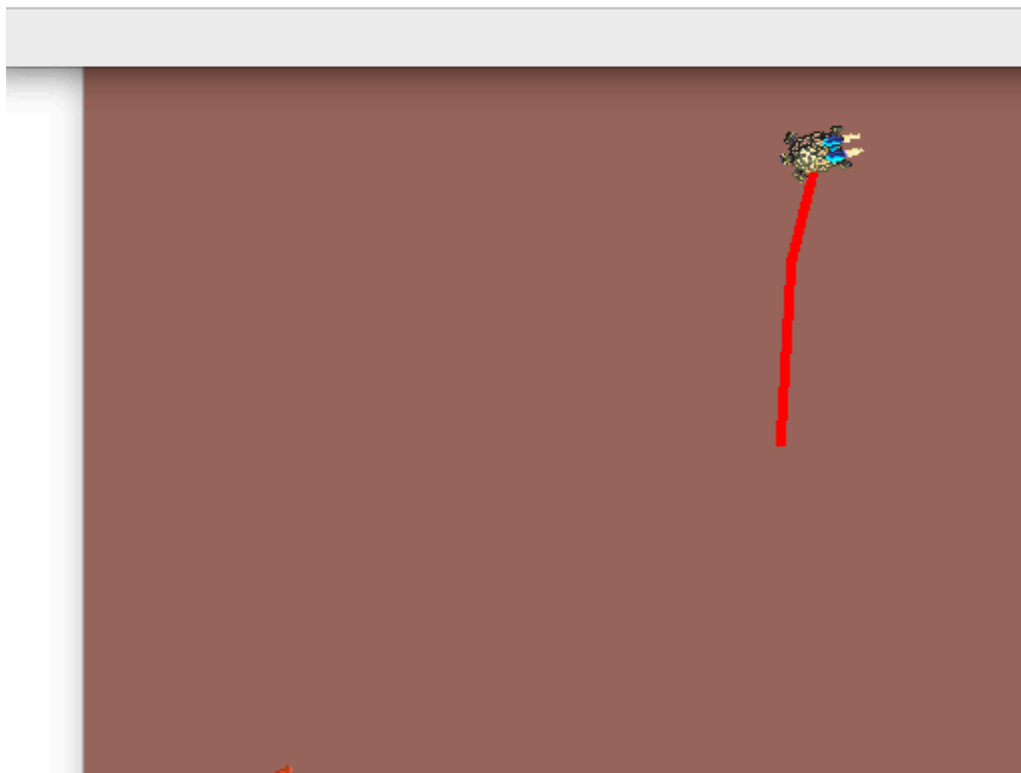
Service

Request

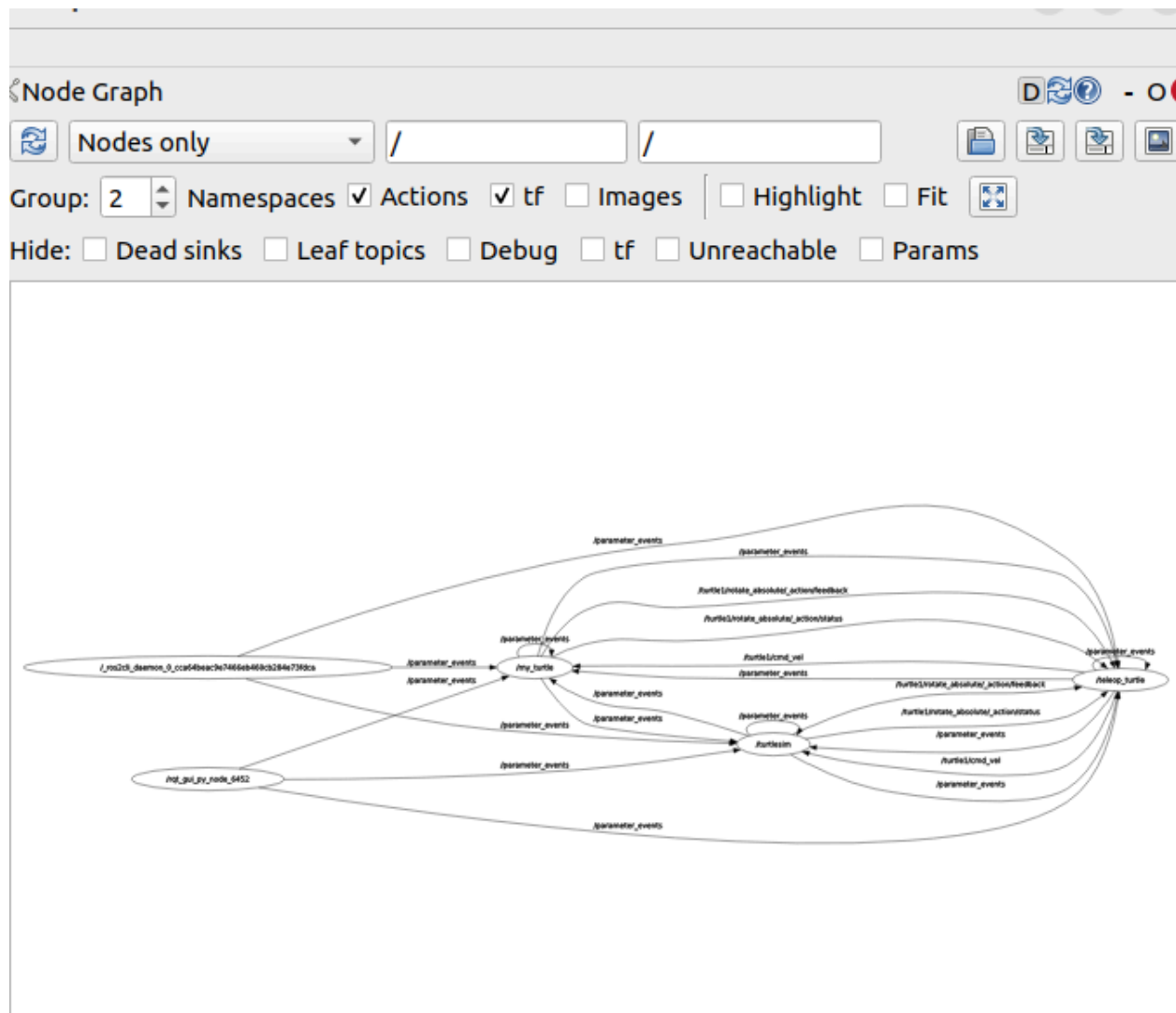
Topic	Type	Expression
▼ /turtle1/set_pen turtlesim/srv/SetPen		
r	uint8	255
g	uint8	0
b	uint8	0
width	uint8	5
off	uint8	0

Response

Field	Type	Value
/	turtlesim/srv/SetPen.Response	



Node Graph



rqt_console__Console - rqt

Console

Displaying 0 messages

Fit Columns

#	Message	Severity	Node	Stamp	Location
---	---------	----------	------	-------	----------

Exclude Messages...

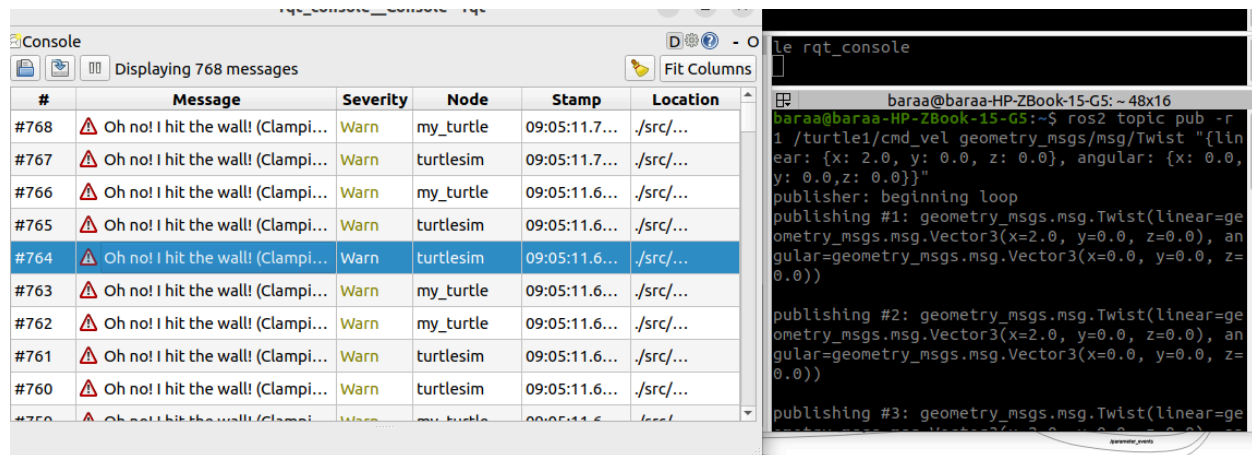
☒ ...with severities: Debug Info Warn Error Fatal

Highlight Messages...

☒ ...containing: ☐ Regex

```
baraa@baraa-HP-ZBook-15-G5: ~ 31x19
baraa@baraa-HP-ZBook-15-G5:~$ r
os2 run rqt_console rqt_console
```

The console



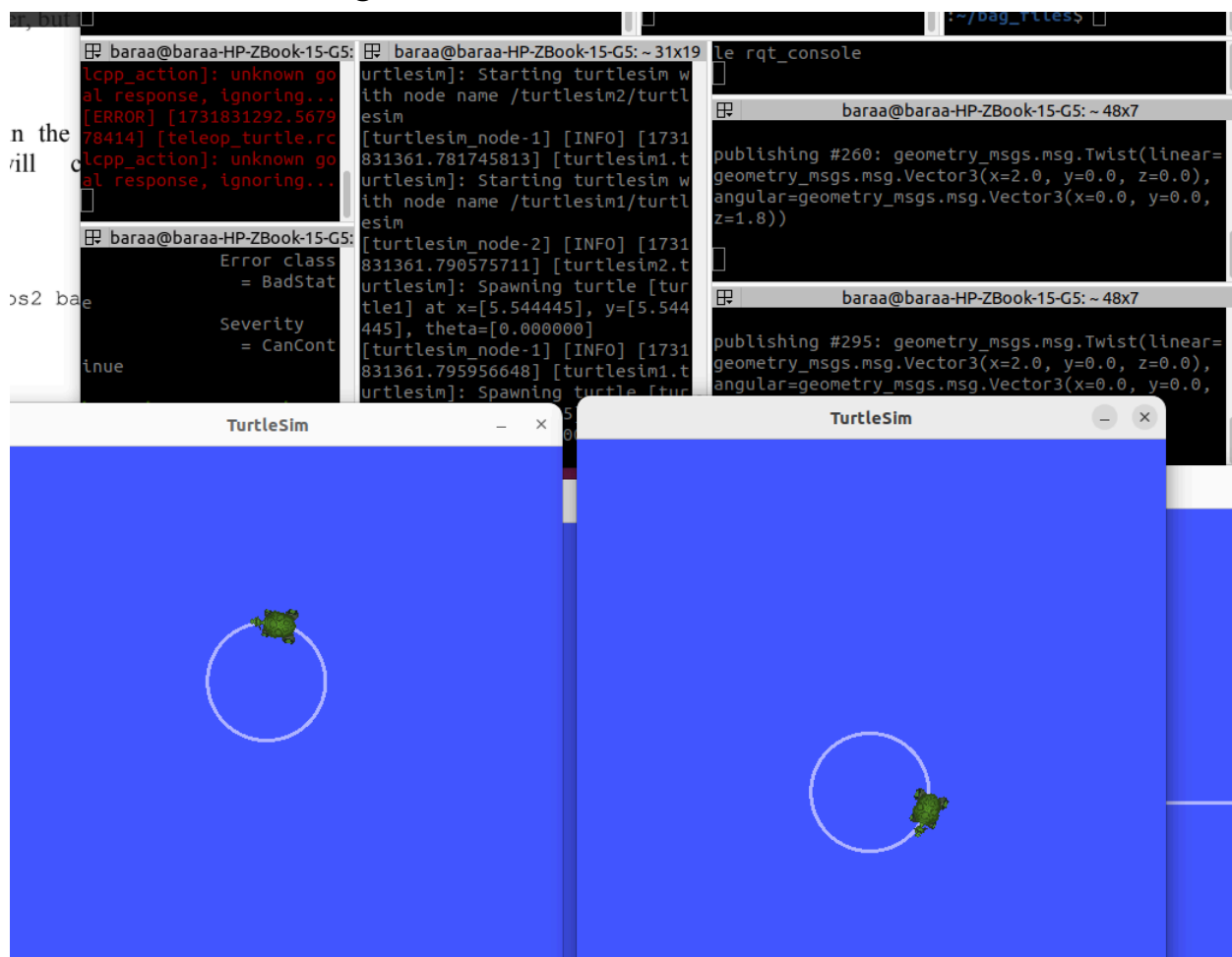
The screenshot shows the `rqt_console` window displaying 768 messages. The messages are filtered by severity (Warn) and node (my_turtle, turtlesim). The messages are as follows:

#	Message	Severity	Node	Stamp	Location
#768	Oh no! I hit the wall! (Clampi...	Warn	my_turtle	09:05:11.7...	./src/...
#767	Oh no! I hit the wall! (Clampi...	Warn	turtlesim	09:05:11.7...	./src/...
#766	Oh no! I hit the wall! (Clampi...	Warn	my_turtle	09:05:11.6...	./src/...
#765	Oh no! I hit the wall! (Clampi...	Warn	turtlesim	09:05:11.6...	./src/...
#764	Oh no! I hit the wall! (Clampi...	Warn	turtlesim	09:05:11.6...	./src/...
#763	Oh no! I hit the wall! (Clampi...	Warn	my_turtle	09:05:11.6...	./src/...
#762	Oh no! I hit the wall! (Clampi...	Warn	my_turtle	09:05:11.6...	./src/...
#761	Oh no! I hit the wall! (Clampi...	Warn	turtlesim	09:05:11.6...	./src/...
#760	Oh no! I hit the wall! (Clampi...	Warn	turtlesim	09:05:11.6...	./src/...
#759	Oh no! I hit the wall! (Clampi...	Warn	my_turtle	09:05:11.6...	./src/...

The terminal window shows the following commands and output:

```
baraa@baraa-HP-ZBook-15-G5: ~ 48x16
baraa@baraa-HP-ZBook-15-G5:~$ ros2 topic pub -r 1 /turtle1/cmd_vel geometry_msgs/msg/Twist "{lin
ear: {x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0,
y: 0.0, z: 0.0}}"
publisher: beginning loop
publishing #1: geometry_msgs.msg.Twist(linear=ge
ometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), an
gular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=
0.0))
publishing #2: geometry_msgs.msg.Twist(linear=ge
ometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), an
gular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=
0.0))
publishing #3: geometry_msgs.msg.Twist(linear=ge
ometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0), an
gular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=
0.0))
```

- Launching nodes:



The screenshot shows the terminal output for launching `turtlesim` nodes. The terminal output is as follows:

```
baraa@baraa-HP-ZBook-15-G5:~$ ros2 launch turtlesim turtlesim1.launch.py
[INFO] [1731831361.781745813] [turtlesim1.turtlesim]: Starting turtlesim w
ith node name /turtlesim1/turtle
[INFO] [1731831361.790575711] [turtlesim2.turtlesim]: Starting turtlesim w
ith node name /turtlesim2/turtle
[INFO] [1731831361.795956648] [turtlesim1.turtlesim]: Spawning turtle [tur
tle1] at x=[5.544445], y=[5.544445], theta=[0.000000]
[INFO] [1731831361.795956648] [turtlesim2.turtlesim]: Spawning turtle [tur
tle2] at x=[5.544445], y=[5.544445], theta=[0.000000]
```

The terminal also shows the following error messages:

```
[ERROR] [1731831361.781745813] [turtlesim1.turtlesim]: [teleop_turtle.rc
lcpp_action]: unknown goal response, ignoring...
[ERROR] [1731831361.781745813] [turtlesim2.turtlesim]: [teleop_turtle.rc
lcpp_action]: unknown goal response, ignoring...
```

The terminal also shows the following error messages:

```
Error class
= BadStat
Severity
= CanCont
Continue
```

The terminal also shows the following error messages:

```
publishing #260: geometry_msgs.msg.Twist(linear=
geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0),
angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0,
z=1.8))
publishing #295: geometry_msgs.msg.Twist(linear=
geometry_msgs.msg.Vector3(x=2.0, y=0.0, z=0.0),
angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0,
z=0.0))
```

The screenshot also shows two `TurtleSim` windows. The left window shows a turtle (green) moving in a circle (white) on a blue background. The right window shows a turtle (green) moving in a circle (white) on a blue background.

- Recording and playing back data:

```
baraa@baraa-HP-ZBook-15-G5:~/bag_files$ ls
rosbag2_2024_11_17-09_13_33
baraa@baraa-HP-ZBook-15-G5:~/bag_files$ ros2 bag in
fo rosbag2_2024_11_17-09_13_33

Files:                rosbag2_2024_11_17-09_13_33_0.db
3
Bag size:             25.0 KiB
Storage id:           sqlite3
Duration:             0.000000000s
Start:               Apr 12 2262 00:47:16.854775807 (
9223372036.854775807)
End:                 Apr 12 2262 00:47:16.854775807 (
9223372036.854775807)
Messages:             0
Topic information: Topic: /turtle1/cmd_vel | Type:
geometry_msgs/msg/Twist | Count: 0 | Serialization
Format: cdr

baraa@baraa-HP-ZBook-15-G5:~/bag_files$
```

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ rosdep install
-i --from-path src --rosdistro humble -y
#All required rosdeps installed successfully
```

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ colcon build
[0.691s] WARNING:colcon.colcon_core.package_selection:Some selected packages are already built in one or more
underlay workspaces:
'turtlesim' is in: /opt/ros/humble
If a package in a merged underlay workspace is overridden and it installs headers, then all packages in the
overlay must sort their include directories by workspace order. Failure to do so may result in build failure
or undefined behavior at run time.
If the overridden package is used by another package in any underlay, then the overriding package in the ove
rly must be API and ABI compatible or undefined behavior at run time may occur.

If you understand the risks and want to override a package anyways, add the following to the command line:
--allow-overriding turtlesim

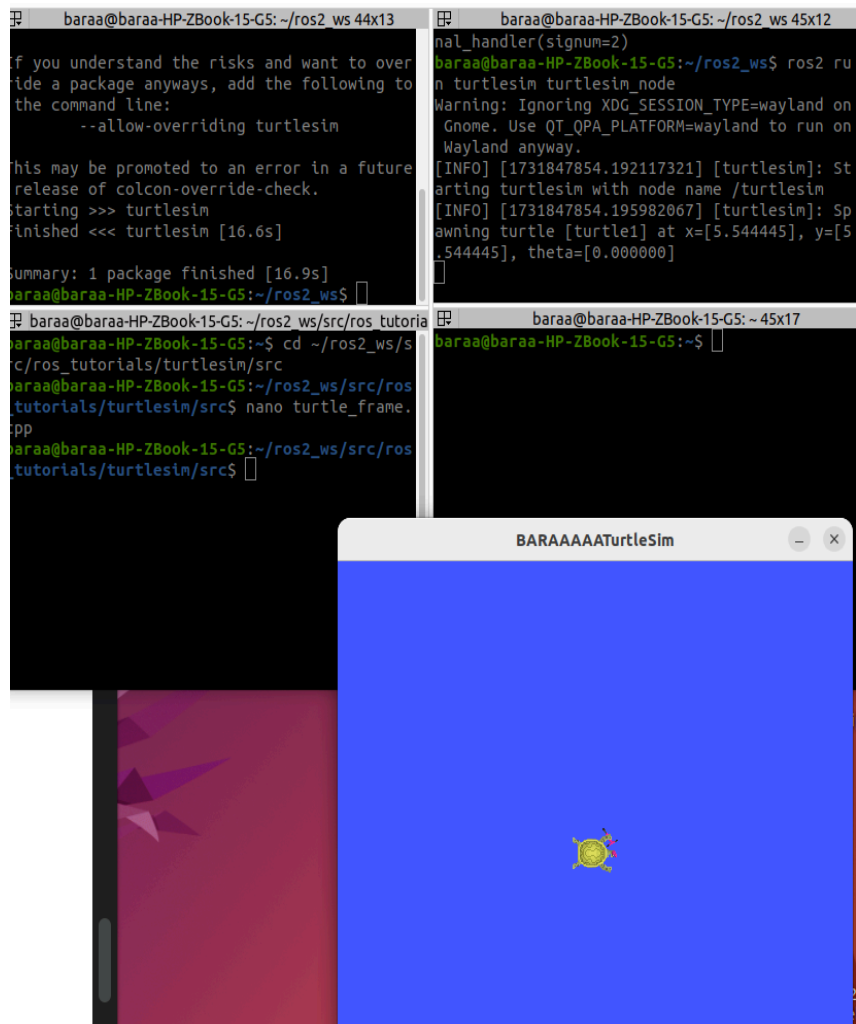
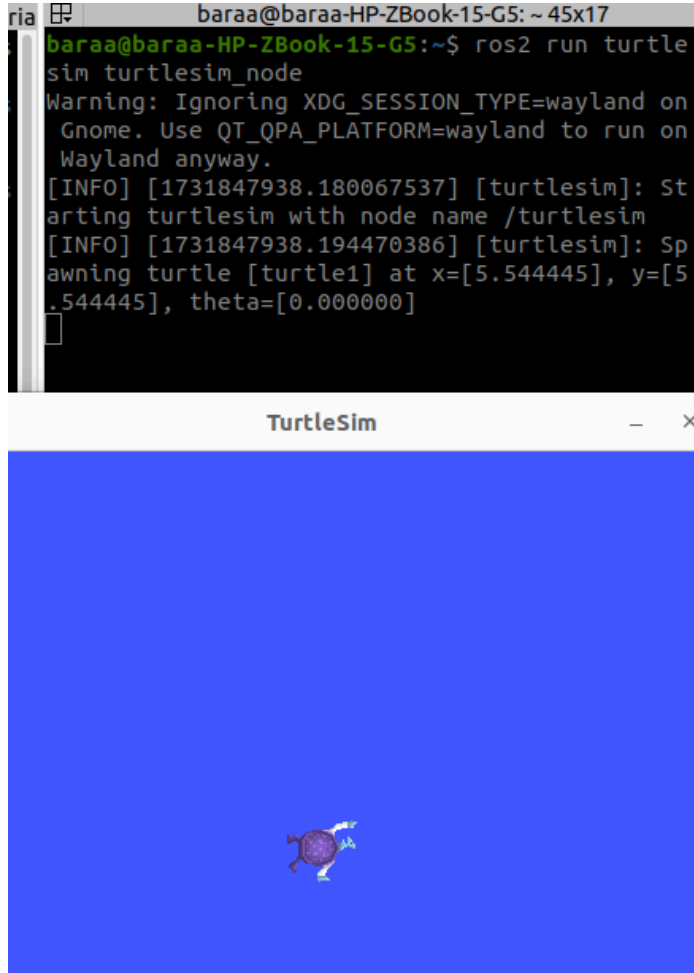
This may be promoted to an error in a future release of colcon-override-check.
Starting >>> turtlesim
[Processing: turtlesim]
Finished <<< turtlesim [36.2s]
Summary: 1 package finished [36.8s]
```

- Workspace

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ source install/setup.bash
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ ros2 run turtlesim turtlesim_node
Warning: Ignoring XDG_SESSION_TYPE=wayland on Gnome. Use QT_QPA_PLATFORM=wayland to run on Wayland anyway.
[INFO] [1731845628.762583272] [turtlesim]: Starting turtlesim with node name /turtlesim
[INFO] [1731845628.778751183] [turtlesim]: Spawning turtle [turtle1] at x=[5.544445], y=[5.544445], theta=[0.000000]
```



Overlay and underlay difference



- Building Package:

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws/src$ ros2 pkg create --build-  
type ament_cmake --license Apache-2.0 cpp_pubsub  
going to create a new package  
package name: cpp_pubsub  
destination directory: /home/baraa/ros2_ws/src  
package format: 3  
version: 0.0.0  
description: TODO: Package description  
maintainer: ['baraa <baraa@todo.todo>']  
licenses: ['Apache-2.0']  
build type: ament_cmake  
dependencies: []  
creating folder ./cpp_pubsub  
creating ./cpp_pubsub/package.xml  
creating source and include folder  
creating folder ./cpp_pubsub/src  
creating folder ./cpp_pubsub/include/cpp_pubsub  
creating ./cpp_pubsub/CMakeLists.txt
```

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ colcon build --packag  
es-select cpp_pubsub  
Starting >>> cpp_pubsub  
Finished <<< cpp_pubsub [0.15s]  
  
Summary: 1 package finished [0.41s]
```

Trying the talker created

```
baraa@baraa-HP-ZBook-15-G5:~/ros2_ws$ ros2 run cpp_pubsub talker  
[INFO] [1731850933.133799667] [minimal_publisher]: Publishing: 'Hi, greetings from BARAA 0'  
[INFO] [1731850933.633796632] [minimal_publisher]: Publishing: 'Hi, greetings from BARAA 1'  
[INFO] [1731850934.133790538] [minimal_publisher]: Publishing: 'Hi, greetings from BARAA 2'  
[INFO] [1731850934.633859906] [minimal_publisher]: Publishing: 'Hi, greetings from BARAA 3'  
[INFO] [1731850935.133884981] [minimal_publisher]: Publishing: 'Hi, greetings from BARAA 4'
```