Understanding parameters

Goal: Learn how to get, set, save and reload parameters in ROS 2.

Tutorial level: Beginner

Time: 5 minutes

Contents

Background

A parameter is a configuration value of a node. You can think of parameters as node settings. A node can store parameters as integers, floats, booleans, strings, and lists. In ROS 2, each node maintains its own parameters. For more background on parameters, please see the concept document.

Prerequisites

This tutorial uses the turtlesim package.

As always, don't forget to source ROS 2 in every new terminal you open.

Tasks

1 Setup

Start up the two turtlesim nodes, `/turtlesim` and `/teleop_turtle`.

Open a new terminal and run:

```
ros2 run turtlesim turtlesim_node
```

Open another terminal and run:

```
ros2 run turtlesim turtle_teleop_key
```

2 ros2 param list

To see the parameters belonging to your nodes, open a new terminal and enter the command:

```
ros2 param list
```

You will see the node namespaces, `/teleop_turtle` and `/turtlesim`, followed by each node's parameters:

```
/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
```

Every node has the parameter `use_sim_time`; it's not unique to turtlesim.

Based on their names, it looks like `/turtlesim`'s parameters determine the background color of the turtlesim window using RGB color values.

To determine a parameter's type, you can use `ros2 param get`.

3 ros2 param get

To display the type and current value of a parameter, use the command:

```
ros2 param get <node_name> <parameter_name>
```

Let's find out the current value of `/turtlesim`'s parameter `background_g`:

```
ros2 param get /turtlesim background_g
```

Which will return the value:

```
Integer value is: 86
```

Now you know `background_g` holds an integer value.

If you run the same command on `background_r` and `background_b`, you will get the values `69` and `255`, respectively.

4 ros2 param set

To change a parameter's value at runtime, use the command:

```
ros2 param set <node_name> <parameter_name> <value>
```

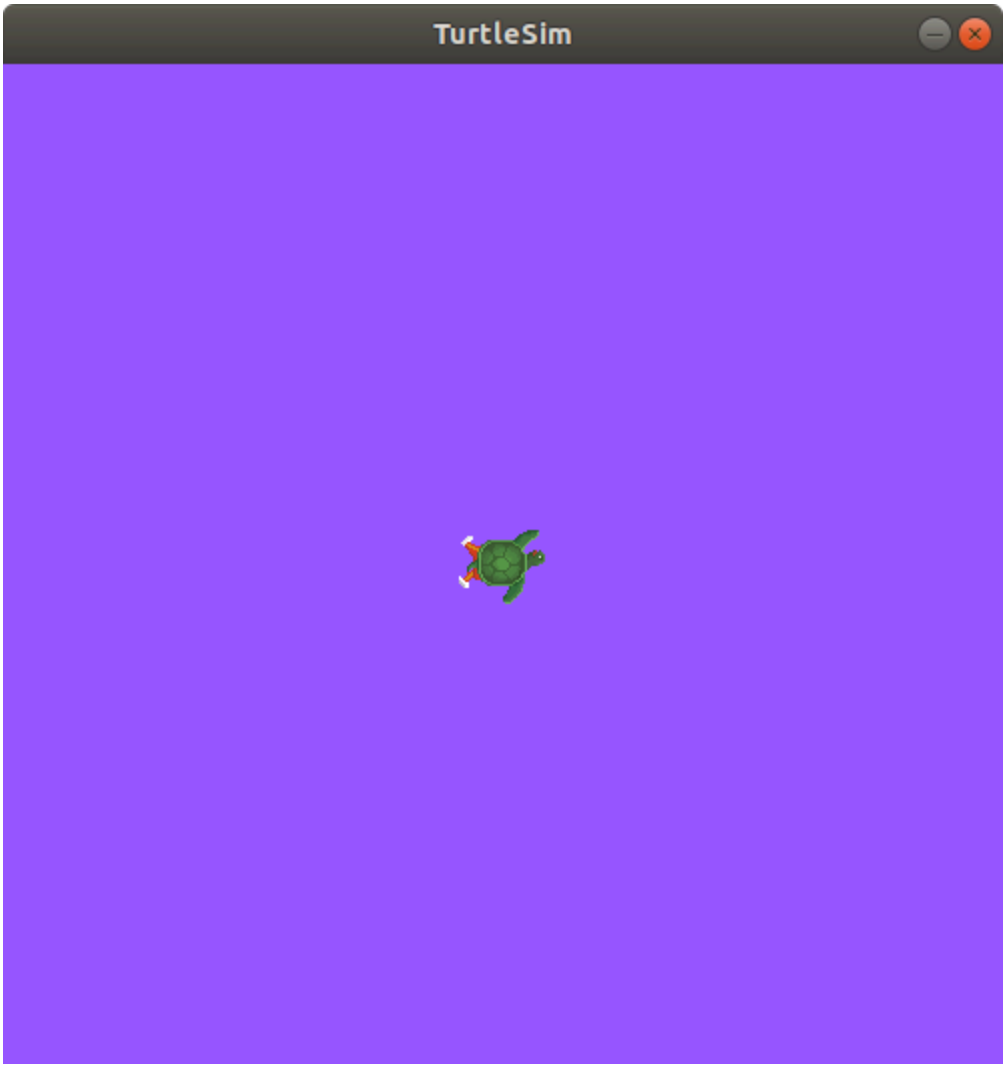
Let's change `/turtlesim`'s background color:

```
ros2 param set /turtlesim background_r 150
```

Your terminal should return the message:

```
Set parameter successful
```

And the background of your turtlesim window should change colors:



Setting parameters with the `set` command will only change them in your current session, not permanently. However, you can save your settings and reload them the next time you start a node.

5 ros2 param dump

You can view all of a node's current parameter values by using the command:

```
ros2 param dump <node_name>
```

The command prints to the standard output (stdout) by default but you can also redirect the parameter values into a file to save them for later. To save your current configuration of `/turtlesim`'s parameters into the file `turtlesim.yaml`, enter the command:

```
ros2 param dump /turtlesim > turtlesim.yaml
```

You will find a new file in the current working directory your shell is running in. If you open this file, you'll see the following content:

```
/turtlesim:
  ros__parameters:
    background_b: 255
    background_g: 86
    background_r: 150
    qos_overrides:
      /parameter_events:
        publisher:
          depth: 1000
          durability: volatile
          history: keep_last
          reliability: reliable
    use_sim_time: false
```

Dumping parameters comes in handy if you want to reload the node with the same parameters in the future.

6 ros2 param load

You can load parameters from a file to a currently running node using the command:

```
ros2 param load <node_name> <parameter_file>
```

To load the `turtlesim.yaml` file generated with `ros2 param dump` into `/turtlesim` node's parameters, enter the command:

```
ros2 param load /turtlesim turtlesim.yaml
```

Your terminal will return the message:

```
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
```

Note

Read-only parameters can only be modified at startup and not afterwards, that is why there are some warnings for the “qos_overrides” parameters.

7 Load parameter file on node startup

To start the same node using your saved parameter values, use:

```
ros2 run <package_name> <executable_name> --ros-args --params-file <file_name>
```

This is the same command you always use to start turtlesim, with the added flags `--ros-args` and `--params-file`, followed by the file you want to load.

Stop your running turtlesim node, and try reloading it with your saved parameters, using:

```
ros2 run turtlesim turtlesim_node --ros-args --params-file turtlesim.yaml
```

The turtlesim window should appear as usual, but with the purple background you set earlier.

Note

When a parameter file is used at node startup, all parameters, including the read-only ones, will be updated.

Summary

Nodes have parameters to define their default configuration values. You can `get` and `set` parameter values from the command line. You can also save the parameter settings to a file to reload them in a future session.

Next steps

Jumping back to ROS 2 communication methods, in the next tutorial you'll learn about actions.