Note: This tutorial assumes that you have completed the previous tutorials: understanding ROS topics (/ROS/Tutorials/UnderstandingTopics).

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Understanding ROS Services and Parameters

Description: This tutorial introduces ROS services, and parameters as well as using the rosservice (/rosservice) and rosparam (/rosparam) commandline tools.

Tutorial Level: BEGINNER

Next Tutorial: Using rqt_console and roslaunch (/ROS/Tutorials/UsingRqtconsoleRoslaunch)

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Assuming your `turtlesim_node` is still running from the last tutorial, let's look at what services the turtlesim provides:

1. ROS Services

Services are another way that nodes can communicate with each other. Services allow nodes to send a **request** and receive a **response**.

2. Using rosservice

`rosservice` can easily attach to ROS's client/service framework with services. `rosservice` has many commands that can be used on services, as shown below:

Usage:

```
rosservice list         print information about active services
rosservice call         call the service with the provided args
rosservice type         print service type
rosservice find         find services by service type
rosservice uri          print service ROSRPC uri
```

2.1 rosservice list

```
$ rosservice list
```

The `list` command shows us that the turtlesim node provides nine services: `reset`, `clear`, `spawn`, `kill`, `turtle1/set_pen`, `/turtle1/teleport_absolute`, `/turtle1/teleport_relative`, `turtlesim/get_loggers`, and `turtlesim/set_logger_level`. There are also two services related to the separate `rosout` node: `/rosout/get_loggers` and `/rosout/set_logger_level`.

```
/clear
/kill
/reset
/rosout/get_loggers
/rosout/set_logger_level
/spawn
/teleop_turtle/get_loggers
/teleop_turtle/set_logger_level
/turtle1/set_pen
/turtle1/teleport_absolute
/turtle1/teleport_relative
/turtlesim/get_loggers
/turtlesim/set_logger_level
```

Let's look more closely at the `clear` service using `rosservice type`:

2.2 rosservice type

Usage:

```
rosservice type [service]
```

Let's find out what type the clear service is:

```
$ rosservice type /clear
```

```
std_srvs/Empty
```

This service is empty, this means when the service call is made it takes no arguments (i.e. it sends no data when making a **request** and receives no data when receiving a **response**). Let's call this service using `rosservice call`:

2.3 rosservice call

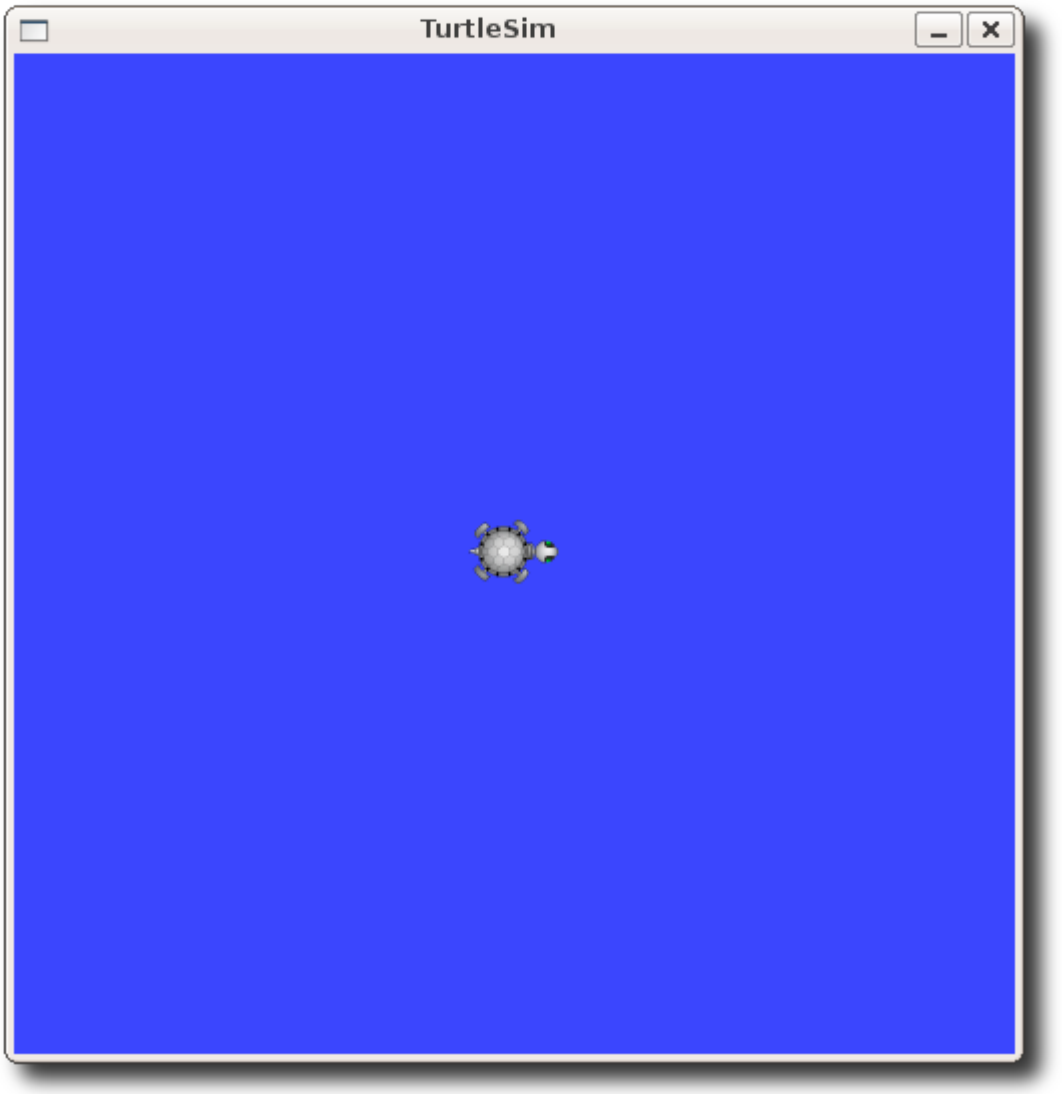
Usage:

```
rosservice call [service] [args]
```

Here we'll call with no arguments because the service is of type empty:

```
$ rosservice call /clear
```

This does what we expect, it clears the background of the `turtlesim_node`.



Let's look at the case where the service has arguments by looking at the information for the service spawn:

```
$ rosservice type /spawn | rossrv show
```

```
float32 x
float32 y
float32 theta
string name
---
string name
```

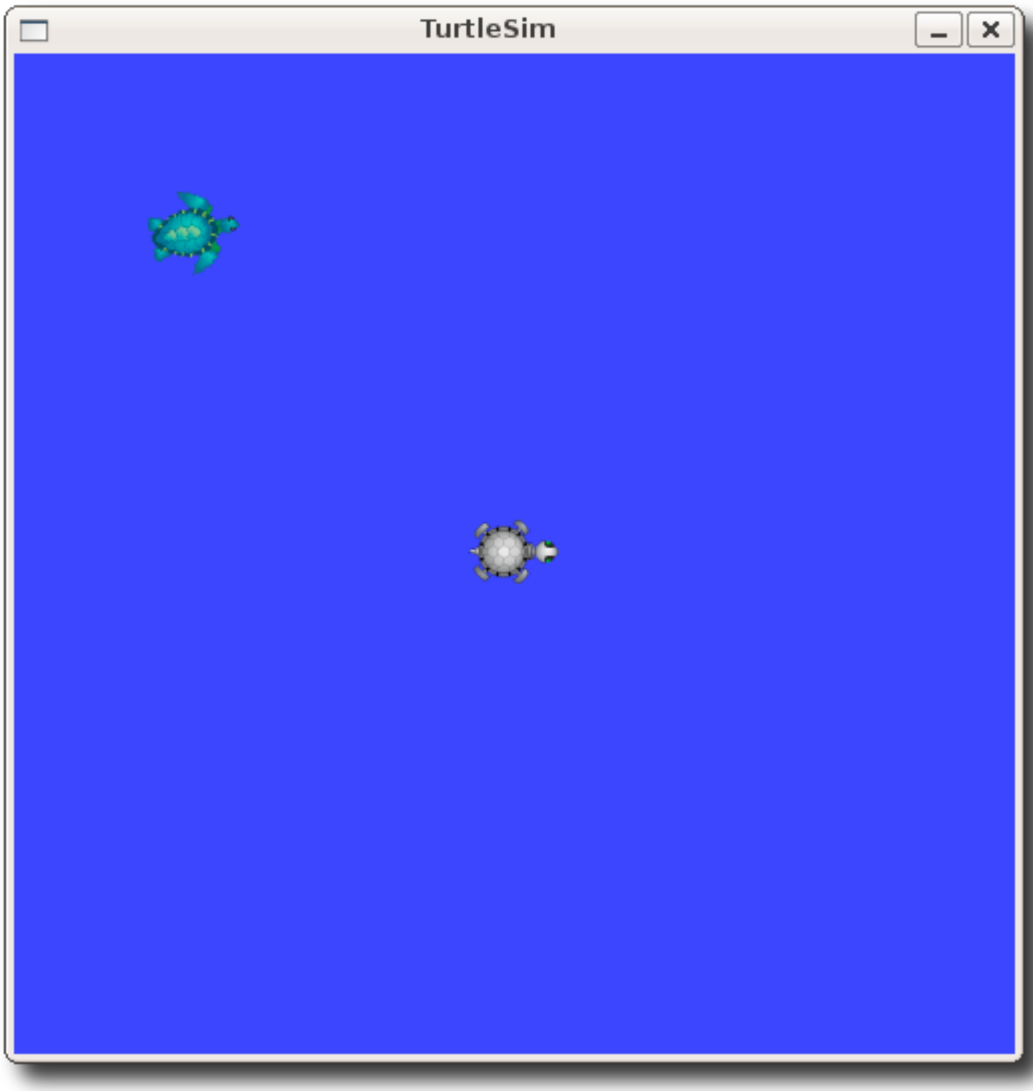
This service lets us spawn a new turtle at a given location and orientation. The name field is optional, so let's not give our new turtle a name and let turtlesim create one for us.

```
$ rosservice call /spawn 2 2 0.2 ""
```

The service call returns with the name of the newly created turtle

```
name: turtle2
```

Now our turtlesim should look like this:



3. Using rosparam

`rosparam` allows you to store and manipulate data on the ROS Parameter Server (/Parameter%20Server). The Parameter Server can store integers, floats, boolean, dictionaries, and lists. rosparam uses the YAML markup language for syntax. In simple cases, YAML looks very natural: `1` is an integer, `1.0` is a float, `one` is a string, `true` is a boolean, `[1, 2, 3]` is a list of integers, and `{a: b, c: d}` is a dictionary. `rosparam` has many commands that can be used on parameters, as shown below:

Usage:

```
rosparam set            set parameter
rosparam get            get parameter
rosparam load           load parameters from file
rosparam dump           dump parameters to file
rosparam delete         delete parameter
rosparam list           list parameter names
```

Let's look at what parameters are currently on the param server:

3.1 rosparam list

```
$ rosparam list
```

Here we can see that the turtlesim node has three parameters on the param server for background color:

```
/background_b
/background_g
/background_r
/rosdistro
/roslaunch/uris/host_57aea0986fef__34309
/rosversion
/run_id
```

Let's change one of the parameter values using `rosparam set`:

3.2 rosparam set and rosparam get

Usage:

```
rosparam set [param_name]
rosparam get [param_name]
```

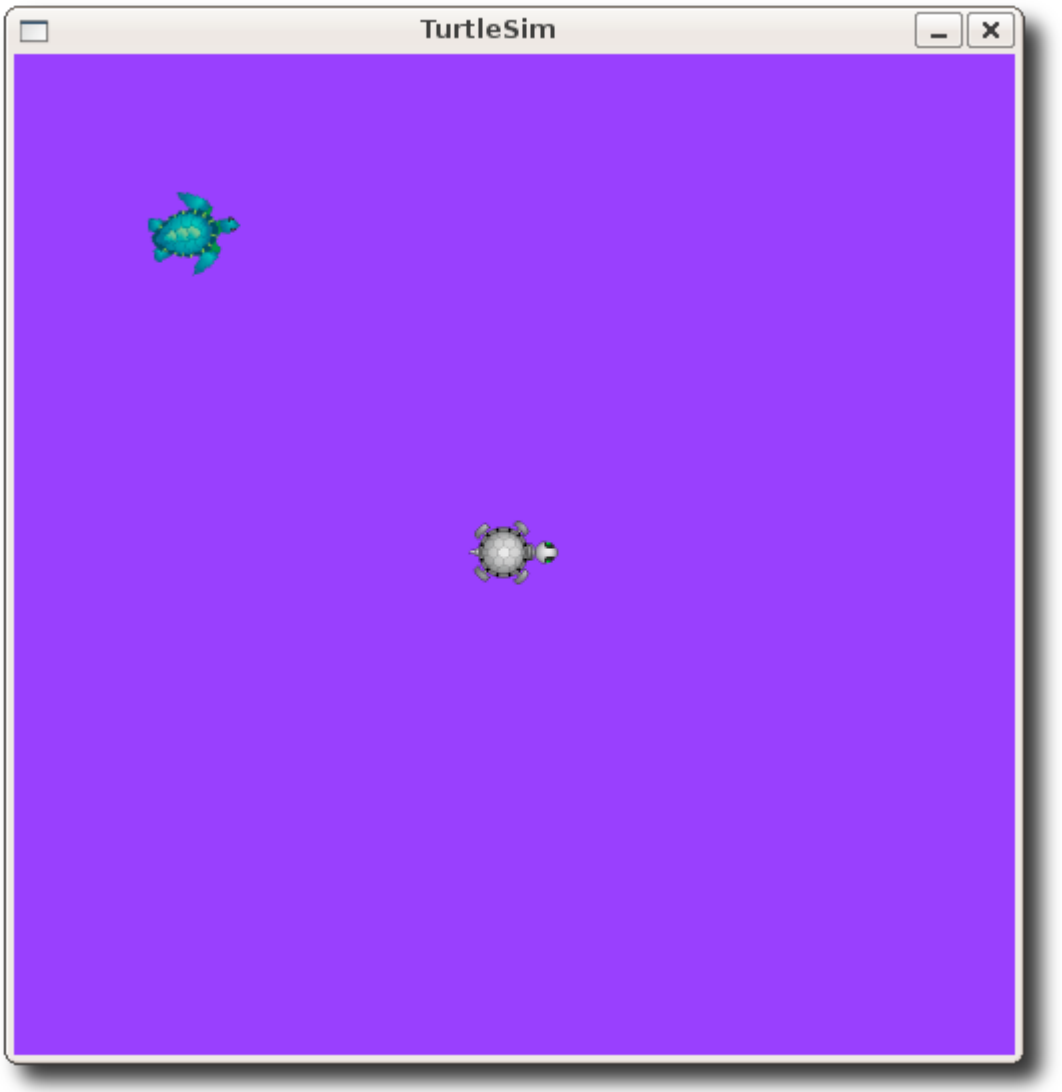
Here will change the red channel of the background color:

```
$ rosparam set /background_r 150
```

This changes the parameter value, now we have to call the clear service for the parameter change to take effect:

```
$ rosservice call /clear
```

Now our turtlesim looks like this:



Now let's look at the values of other parameters on the param server. Let's get the value of the green background channel:

```
$ rosparam get /background_g
```

```
86
```

We can also use `rosparam get /` to show us the contents of the entire Parameter Server.

```
$ rosparam get /
```

```
background_b: 255
background_g: 86
background_r: 150
roslaunch:
  uris: {'aqy:51932': 'http://aqy:51932/'}
run_id: e07ea71e-98df-11de-8875-001b21201aa8
```

You may wish to store this in a file so that you can reload it at another time. This is easy using `rosparam`:

3.3 rosparam dump and rosparam load

Usage:

```
rosparam dump [file_name] [namespace]
rosparam load [file_name] [namespace]
```

Here we write all the parameters to the file params.yaml

```
$ rosparam dump params.yaml
```

You can even load these yaml files into new namespaces, e.g. `copy`:

```
$ rosparam load params.yaml copy
$ rosparam get /copy/background_b
```

```
255
```

Now that you understand how ROS services and params work, let's try using rqt_console and roslaunch (/ROS/Tutorials/UsingRqtconsoleRoslaunch)