

# QCar

## Software – ROS User Manual

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## A. Overview

Prior to running sample ROS applications please read through the [User Manual - Software Python](#) before continuing with this document. The ROS code examples and this user manual are using Python and our Quanser Python Library. C++ functions are available for **advanced users**. By default the QCar comes with ROS (melodic) and ROS(Dashing) installed.

**Note:** The `~/.bashrc` does not auto-source either of the two ROS distributions as this is application specific. If you wish to stick to one development environment change the `~/.bashrc` to source the specific ROS distribution you'll use.

**Note:** This user manual assumes users have the fundamental knowledge of ROS.

Please check <https://docs.ros.org/en/dashing/index.html> for help with ROS Dashing, or

The overall Node design process is described in Figure 1 below.

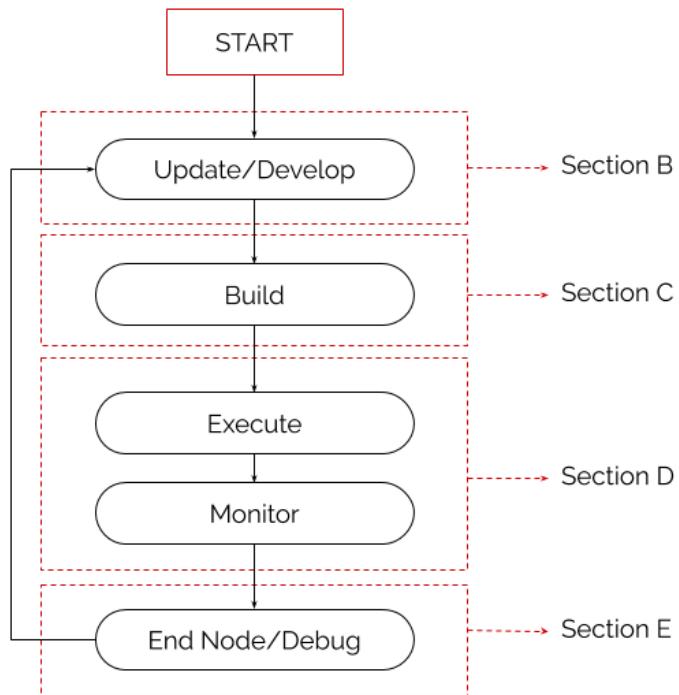


Figure 1. Process diagram for ROS code deployment

## B. Update/Development Details

Please refer to the [Quick Start Guide](#) for links regarding the latest ROS software packages for the QCar.

Please check **Section B** in [User Manual - Software Python](#) to make sure all the python modules and Quanser Application Libraries are installed. When developing ROS1 or ROS2 nodes, please use the `python3` environment for better usage of our python library.

```
#!/usr/env python3
```

ROS nodes can be found in the following location `examples\self_driving_car_studio\qcar`

For ROS Melodic:

To check the list of installed ROS1 packages please run the following command:

```
nvidia@qcar-****:~$ rospack list-names
```

For ROS Melodic look for the subfolders called:

- `ros1_cpp`
- `ros1_python`

Copy the content of either folder to the `ros1` directory on the QCar. Keep in mind you cannot run both the python and C++ nodes from the same ROS1 workspace on the QCar.

For ROS Dashing:

To check the list of installed ROS2 packages please run the following command:

```
nvidia@qcar-****:~$ ros2 pkg list
```

For ROS Dashing look for the subfolder called:

- `ros2`

Copy the content of the `ros2` folder to the `ros2` directory on the QCar.

## C. Build

For ROS1

When building the package for the first time, please make sure `catkin_make` uses python3:

```
nvidia@qcar-****:~$ catkin_make -DPYTHON_EXECUTABLE=/usr/bin/python3
```

Later builds can run without specifying your python version as it has set `python3` as default python environment. If you only want to build one single ROS package you can add `--pkg package_name` after `catkin_make`. After finishing building, please make sure to source your `devel/setup.bash` file.

**NOTE:** *Do not run `catkin_make` while in sudo authority.* The best solution we have is for you to make a new `ros1` workspace.

For ROS2

When building the `ros2` package for the first time, please use the `colcon build` command:

```
nvidia@qcar-****:~$ colcon build --symlink-install
```

**NOTE:** *Do not run `colcon build` while in sudo authority.* The best solution we have is for you to make a new `ros2` workspace.

## D. Executing and Monitoring Nodes

For ROS1

Nodes can be ran using a `.launch` file or individually.

Sequence of steps for running nodes individually:

### Terminal session 1

1. Open a terminal session and source ros using the command:

```
nvidia@qcar-*****:~$ source /opt/ros/melodic/setup.bash
```

2. Start the roscore server

```
nvidia@qcar-*****:~$ roscore
```

### Terminal session 2 ( or more)

1. Switch the terminal to sudo authority:

```
nvidia@qcar-*****:~$ sudo -s
```

2. Source the ROS

```
nvidia@qcar-*****:~# source /opt/ros/melodic/setup.bash
```

3. Use rosrun to run the specific node

```
nvidia@qcar-*****:~# rosrun qcar <qcar node name>
```

if you are viewing your ROS nodes from a Ground Control Station, please make sure to have **XLaunch** set up properly. See the [User Manual – Connectivity](#) for more information on this.

Use standard command `rostopic list/echo/hz/info` to monitor the topics that each node is sending/receiving.

Hint: Use `image_view` to view camera streams

For ROS2

### Terminal session 1 (or more)

1. Switch the terminal to sudo authority:

```
nvidia@qcar-*****:~$ sudo -s
```

2. Source ROS

```
nvidia@qcar-*****:~# source /opt/ros/dashing/setup.bash
```

3. Run each ROS node

```
nvidia@qcar-*****:~# ros2 run qcar <node name>
```

## E. Stop Node & Troubleshooting

Press **Ctrl + C** to stop any ROS node/launch files. If the terminal hangs after pressing **Ctrl + C**, please press **Ctrl + Z** to refresh the terminal. When stopping a ROS node that involves motor and/or Lidar, please run the python script with **sudo** authority called **HardwareStop.py**. In the provided resources this script can be found under **examples/self\_driving\_car\_studio/qcar/hardware\_tests**

For general troubleshooting, users can still use the **try/except/finally** structure in their ROS codes to get error messages. Please view **Section E** in **User Manual - Software Python** for more information on this structure.

For ROS troubleshooting, users can use either the go-to command **ros2t** or look for more information at <http://wiki.ros.org/ROS/Troubleshooting>.

## F. Ros-to-Ros Communication

The QCar was built around ROS2, but with the vast libraries built around ROS1, sometimes you need to mix ROS1 and ROS2 nodes. ROS-to-ROS communication can be done in multiple ways. This section will explain how to setup a QCar-to-Ubuntu PC communication using a ROS2 package called **ros1\_bridge**.

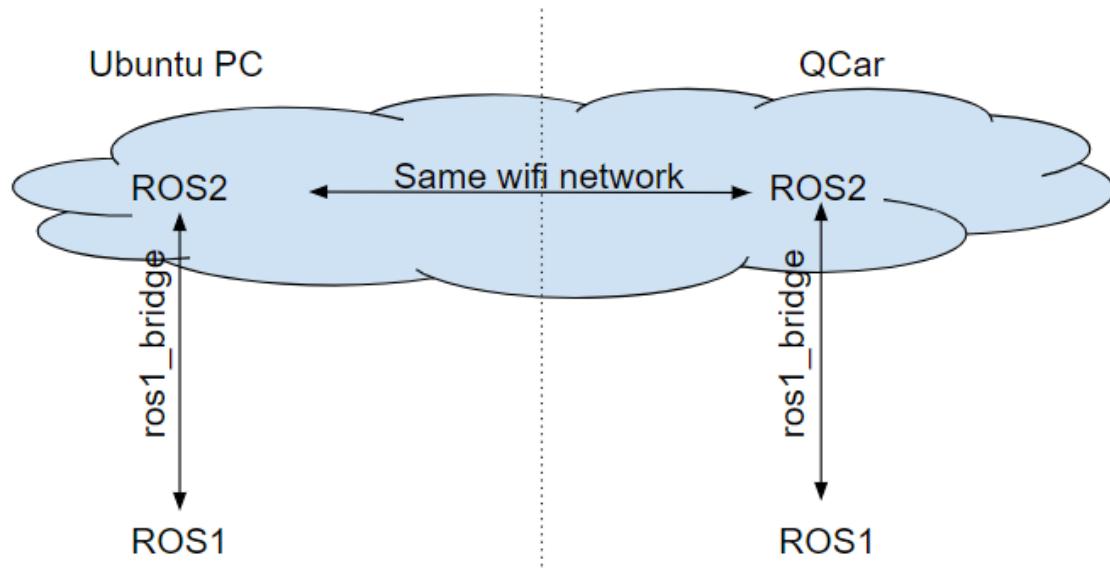


Figure 1: Visual Diagram of QCar-to-Ubuntu PC communication using a **ros1\_bridge**

All the topics that are published by a ROS2 device can be subscribed by other ROS2 devices if they are in the same network.

### Only Using ROS2?

If you are just using ROS2 as your main development platform and are running ROS2 on both QCar and the Ubuntu PC, then the ROS-to-ROS communication does **not need extra setup**.

## Using ROS1 on either or both platform?

If users will also use ROS1 on either or both platforms, then they need to download a ROS2 package called **ros1\_bridge**. This package will bring all the topics from ROS1 environment to ROS2 or vice-versa.

A typical use case is a ROS1 node on the QCar capturing a CSI image which needs to be used by a ROS 1 node on a remote machine. Using the **ros1\_bridge** on the QCar, ROS2 on the QCar will bring that topic from ROS1 and share it with the other ROS2 device **Ubuntu PC** on the same network. The **ros1\_bridge** on **Ubuntu PC** will detect that topic in the *ros2 topic list* and bring it to ROS1 on the **Ubuntu PC** where it can process the image for its application like reading a sign, lane detection, etc. The resulting command will then use the same tunnel to return to the ROS1 environment on QCar.

When measuring the performance, WiFi latency should be considered. See [User Manual – Connectivity](#) for discussion on WiFi configurations.

Please follow this link [https://github.com/ros2/ros1\\_bridge/blob/master/README.md](https://github.com/ros2/ros1_bridge/blob/master/README.md) to setup **ros1\_bridge** on each device.

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