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Autonomous Vehicles Research Studio

Setup Guide – Communication Infrastructure

v 2.0 — 18th April 2023

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A. Communication Infrastructure

The ground control station PC is connected to the router via an ethernet cable (wired connection). The QBot 2 connects to the router over 2.4GHz wifi (SSID: Quanser_UVS). The QDrones 1/2 and QBot 2e connect to the router over the 5GHz wifi (SSID: Quanser_UVS-5G). This is illustrated in Figure 1 below.
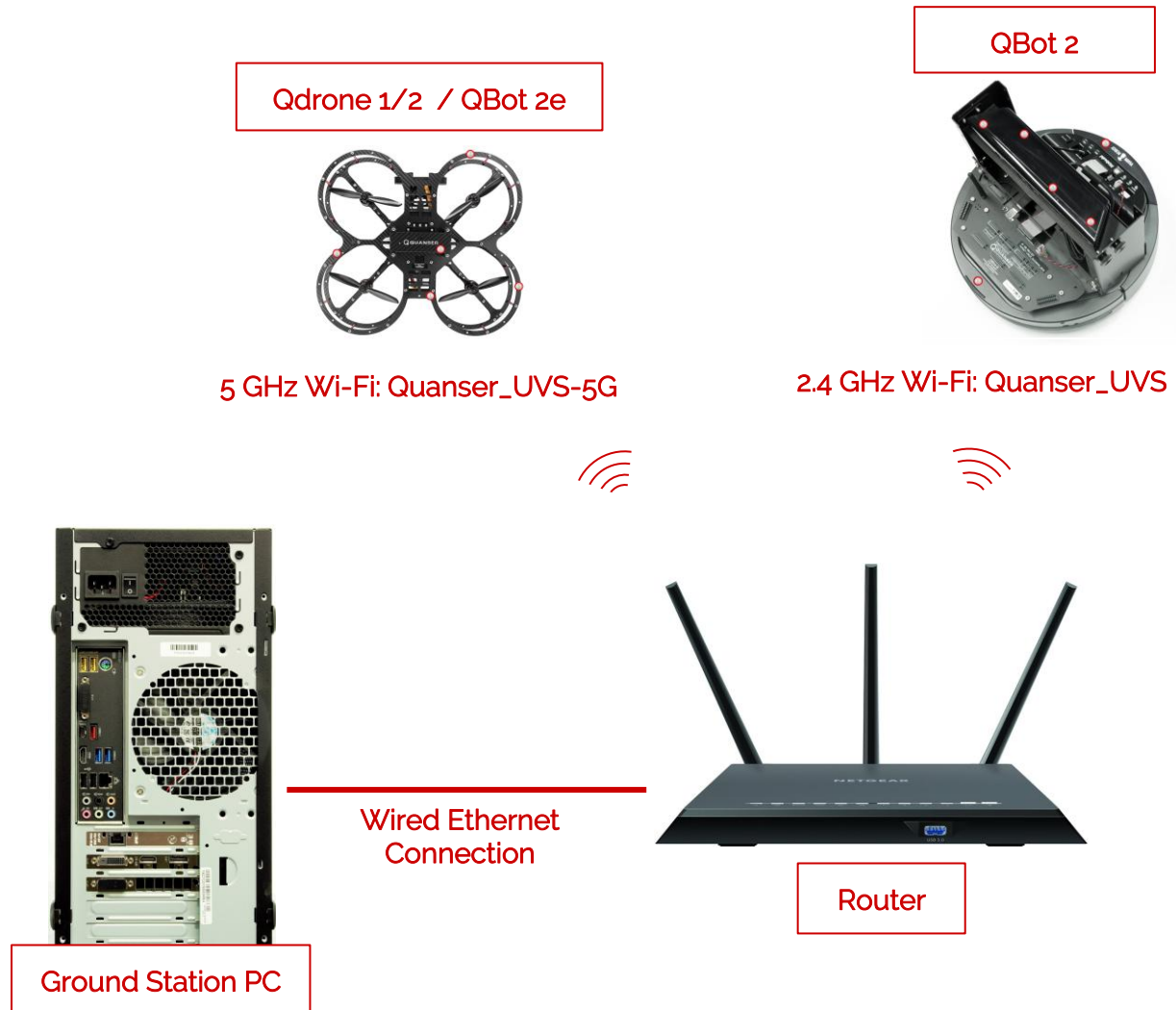

Figure 1. Communication Infrastructure

B. Checkpoint – Basic TCP/IP demo

1. After reading the Communications file for the product you have (product_communication.docx), turn the vehicle on.

2. In your **MATLAB Command Window**, type
   `>> qc_show_demos`

3. In the **QUARC Examples Help** page, scroll down and click on the `QUARC Basic Communications Demo` under **Communications**.

4. Click on **Open these Models** on the top right of the page, which opens two Simulink/QUARC models.

5. In the `quarc_basic_client_demo` model that loads, from the **HARDWARE** tab on top of your Simulink model, click on **Hardware Settings** (Gear Icon). (If using an older version, click on **Model Configuration Properties** under the **Simulation** drop menu.)

6. In this window, click on **Code Generation** on the left side of the window, click on **Browse** next to the **System target file** (Figure 2a) and select the appropriate target for your vehicle (Figure 2b).
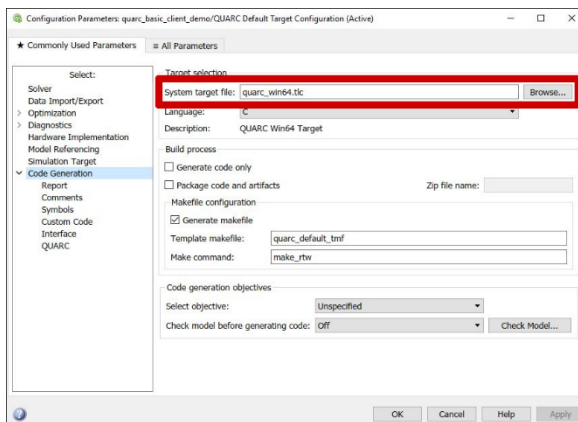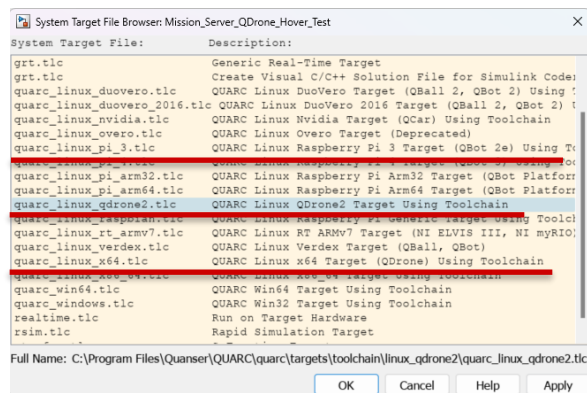
a. System target file.   b. QUARC targets for each product.

Figure 2: Setting target on models.

7. Expand **Code Generation** on the left side of the window, click on interface and set the **MEX-file arguments** (Figure 3) as follows:

   If using a QDrone 1: `'-w -d %d -uri %u','tcpip://QDrone0xxxxx.local:17001'` where QDrone0xxxxx refers to the hostname of the QDrone 1 you are using (found below the battery compartment plate).

If using a QBot or QDrone 2: `'-w -d %d -uri %u','tcpip://192.168.2.d:17001'`
Where 192.168.2.d refers to the IP of the vehicle you are using.
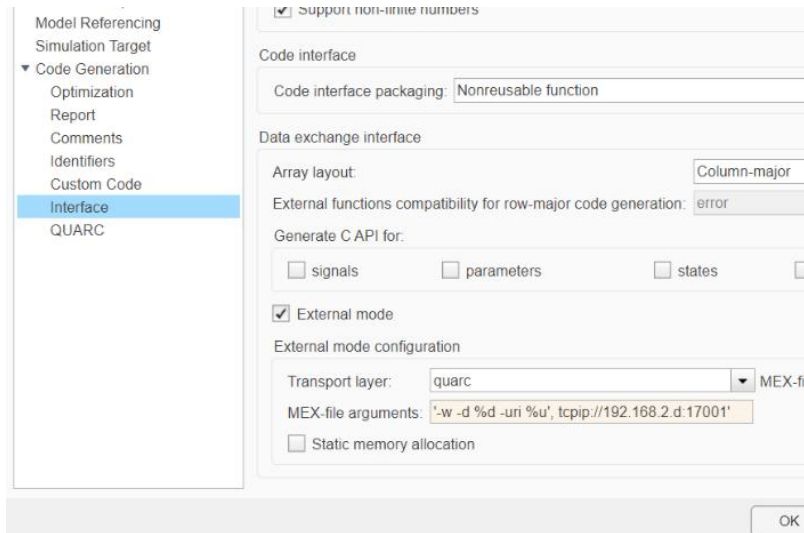
Press OK. The window should close.

Figure 3: Setting the MEX-file arguments under Model Configuration Properties for the desired vehicle.

8. In the same Simulink model, double click the Stream Client block, and change the URI of host to which to connect to (Figure 4):

> tcpip://192.168.2.5:18000

Note that the IP 192.168.2.5 must be changed if you set the ground control station IP to another address. See the Router to PC Connection in the setup documents.
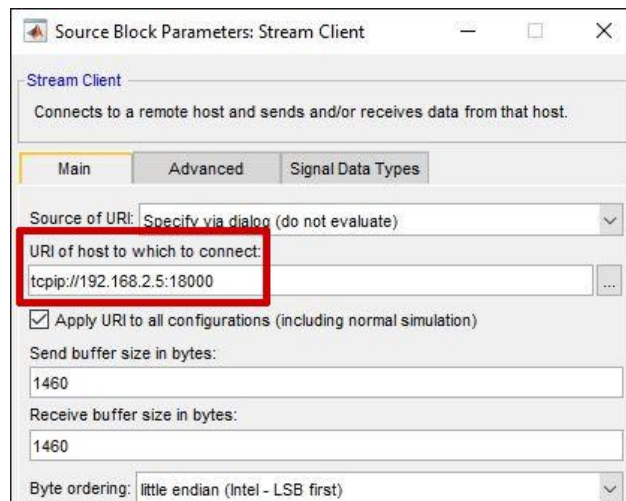

Figure 4: Setting the IP of the host in the Stream Client block.

9. On both the **quarc_basic_server_demo** and **quarc_basic_client_demo** click on the **HARDWARE** tab on the top menu, and then click the green play button (**Monitor & Tune**), It should build and start the model.

    Note: In case a model does not download (MATLAB Command Window returns a 'Failed to download …' error), you can try to manually **Deploy** it from the **QUARC** tab.
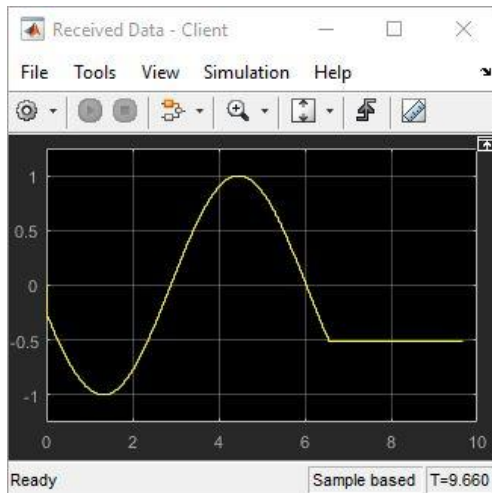
10. The **Received Data** and **Sent Data** scopes in both models should display data as shown in Figure 5 below. The Server sends a sine wave (Figure 5a), and the Client receives this (Figure 5c). The Client sends a sawtooth wave (Figure 5b), and the Server receives this (Figure 5d).
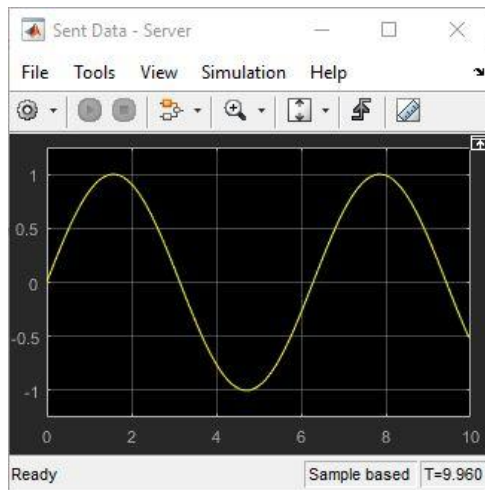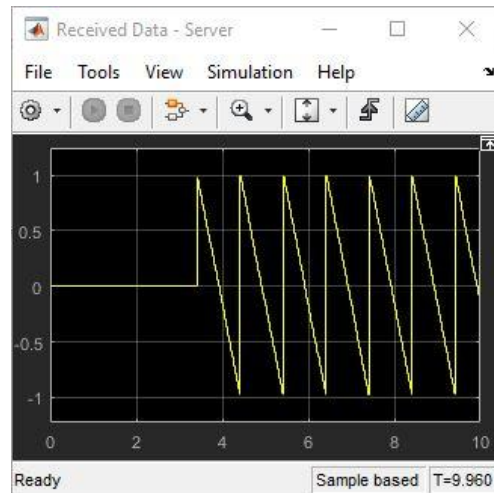

a. Server Sent Data (sent from PC)
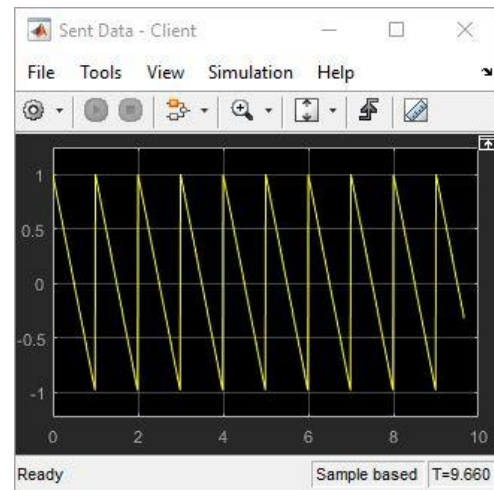
b. Client Sent Data (sent from vehicle)

c. Client Received Data (received on vehicle)

d. Server Received Data (received on PC)

Figure 5: Sent and Received Data scopes in the Basic TCP/IP Communications Demo

11. Stop both the models.

This completes the checkpoint task and confirms that your communication infrastructure is set up correctly. If you encounter any errors, make sure that all the steps prior to this checkpoint have been followed. If further issues persist, please contact Quanser technical support (tech@quanser.com).

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