

# TUTORIAL 4: SETTING UP THE WIRELESS NETWORK

THE F1/10 TEAM

## INTRODUCTION

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This tutorial covers the configurations required to be made on the Jetson and laptop in order to setup the point to point wireless connection between them using ubiquiti pico station.

## SETTING UP THE JETSON'S ETHERNET:

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Connect the Jetson to display via HDMI port. Also make sure you have a USB mouse and Keyboard connected to it.

### Physically connect the Jetson to PicoStation 2HP

- Plug in the POE (power over ethernet) injector
- Plug the PicoStation into the POE port
- Connect this system into Jetson's LAN port

### Configure the Jetson for a static IP on the 192.168.1.x subnet

- Open network connections on Jetson
- Go to the "wired" tab
- Edit the ethernet connection
- Go to the "IPv4" Settings tab
- Edit the settings as follows:
  - Method: Manual
  - Address: 192.168.1.x (x = anynumber) (The video tutorials in further lectures will use: 192.168.1.1 to connect to Jetson via SSH. Make sure you remember the value of x you set here while following future videos.
  - Netmask : 255.255.255.0
  - Gateway : 192.168.1.x
  - Save -> Close
- The network should say connected, you might need to select 'wired connection 1' from the wireless toolbar and/or unplug and replug the wires

## CONFIGURING THE PICO STATION

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You must still be connected to the PicoStation via an ethernet connection or the PicoStation's previously setup network (if there is one) before continuing.

### Connecting to the Pico Station

- Open a web browser and access the PicoStation's IP address
  - Default IP address is 192.168.1.20
  - enter http://[IP address]



- Note: IP address can be changed
- Enter username and password when prompted
  - Default username: ubnt
  - Default password: ubnt
  - Note: Username and password can be changed

## Configuring the PicoStation

- Go to the "WIRELESS" tab
- Change the settings to the following:
  - Wireless Mode: Access Point
  - SSID: [desired SSID]
    - \* example: My network
  - Country Code: United States
  - IEEE 208.11 Mode: B/G/N mixed
  - Channel Spectrum Width: 20 MHz
  - Channel Shifting: Disabled
  - Channel: 1-2412 MHz
  - Output Power: no greater than 27 dBm (U.S. regulation)
  - Data Rate Module: Default
  - Security: WPA2
  - WPA Authentication : PSK
  - WPA Preshared Key : Your Password

The screenshot shows the PicoStation M2 web interface with the 'NETWORK' tab selected. The settings are as follows:

- Network Role:** Network Mode: Bridge, Disable Network: None
- Configuration Mode:** Configuration Mode: Simple
- Management Network Settings:**
  - Management IP Address:  DHCP,  Static
  - IP Address: 192.168.1.20
  - Netmask: 255.255.255.0
  - Gateway IP: 192.168.1.1
  - Primary DNS IP: (empty)
  - Secondary DNS IP: (empty)
  - MTU: 1500
  - Management VLAN:  Enable
  - Auto IP Aliasing:  Enable
  - STP:  Enable

A 'Change' button is located at the bottom right of the settings area.

- Go to the "NETWORK" tab
- Change the settings to the following:
  - Network Mode: Bridge
  - Disable Network: None
  - Bridge IP Address: Static
  - IP Address: 192.168.1.20
  - Netmask: 255.255.255.0
  - Gateway IP: 192.168.1.1
  - Change -> Apply

## SETTING UP THE REMOTE SYSTEM'S WIRELESS

### Setting up the wireless

- Go back to your Network Connections
- Go to the "Wireless" tab
- Add a new wireless connection
  - Name it after the intended robot
  - Give it the same SSID that you gave the PicoStation
  - Go to "IPv4 Settings" tab
  - Change the settings as follows:
    - \* Method: Manual
    - \* Address: 192.168.1.x (x=any number, 110 in our case for future examples)
    - \* Netmask: 255.255.255.0
    - \* Gateway: 192.168.1.x (x=any number, 110 in our case)

– Save → Close

## Connecting via SSH

Now once you are connected to the wireless network, you can ssh into the Jetson from your remote system's terminal, using following command:

```
ssh ubuntu@192.168.1.1
```

Here "ubuntu" is the username setup in Jetson and the ip shown is the IP configured in the first step in setting up of pico station.

## ESTABLISHING ROS OVER NETWORK

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In order to let ROS communicate directly between you Jetson and remote system, and send messages to and fro, it requires a few minor configurations. While operating Jetson via remote system, you might need to see the data published over certain topics by scripts running on Jetson. You might need to visualize the location of the car, or the LiDAR scans or maybe the map of the surrounding. A GUI called Rviz allows this visuals but we cannot install that on Jetson. Establishing ROS to communicate over the network, will allow us to use this GUI to visualize data in this way. We will cover this visualization in the next tutorial.

To set this up, follow the steps below:

- On the terminal of remote system, when present working directory is the home folder, open ".bashrc" using any text editor.
- Add the lines :

```
export ROS_MASTER_URI=http://192.168.1.1:11311
export ROS_IP=192.168.1.110
```

- Whenever you want to revert this, replace it back by :

```
export ROS_HOSTNAME=localhost
export ROS_MASTER_URI=http://localhost:11311
```

- Open the hosts file under path : /etc/, and add the line :

```
192.168.1.1 ubuntu
```

Here it is assumed that the "ubuntu" is the account username in Jetson, and 192.168.1.1 is the IP address to which the wireless was setup on Jetson.

Now on the Jetson Side:

- Open the file .bashrc from home folder.
- Add the following line when you want to transfer data to remote system over network

```
export ROS_IP=192.168.1.1
```

- To revert it back to original settings, replace above line with :

```
export ROS_HOSTNAME=localhost
export ROS_MASTER_URI=http://localhost:11311
```

- Now navigate to the `"/etc/hosts"` file and add the following line to it: (The username refers to the username of your laptop. And the IP mentioned corresponding to the IP you used while setting up the remote system/laptop's wireless.

```
192.168.1.110 username
```