F1tenth Platform

Virtual Machine Guide

Fall 2023

Note: You only need this guide if you are planning on using your VM to connect to the F1tenth car instead of your team's dedication laptop. To connect your team laptop to the car, use the quickstart guide.

One time setup

Configure packages on **local computer**

- Install the following packages on your local Ubuntu computer/VM

  a. ros-melodic-ackermann-msgs:
     i. *sudo apt-get update*
     ii. *sudo apt-get install ros-melodic-ackermann-msgs*

  b. ros-melodic-joy:
     i. *sudo apt-get install ros-melodic-joy*

  c. jstest-gtk:
     i. *sudo apt install –y jstest-gtk*

  d. ifconfig
     i. *sudo apt install net-tools*

One time setup

Configure packages on **local computer**

Git clone **move_base** in **catkin_ws/src**

git clone https://github.com/linklab-uva/move_base

- *Build the package:*

  cd .. && catkin_make

Pre Startup

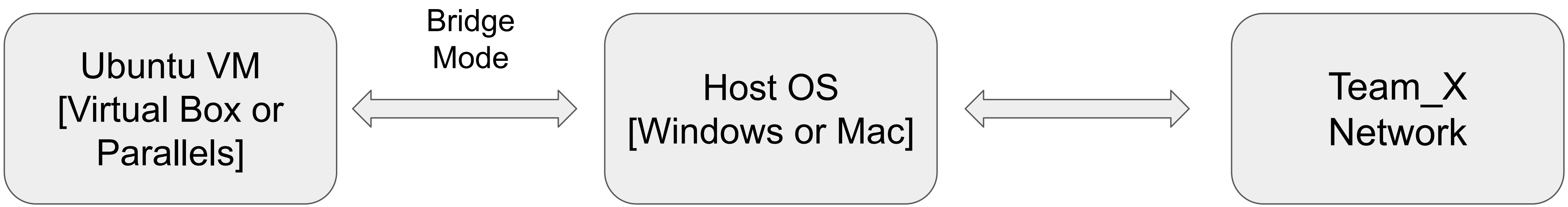
Connecting to the Racecar

1. Power up the Racecar (Red (rear) battery to DC power board using barrel jack)
2. Wait for Pico-station lights to come up
   a. *Wait until 2nd from bottom is flashing green light*
   b. *Pico-station is connected to Jetson*
3. Connect to you team's network (eg: team_9)
   a. Password: f110uva123
4. Network settings on local computer
   a. Set IP address as 192.168.1.X (where X is not 1 or 20)
   b. Set Netmask to 255.255.255.0
   c. Set gateway to 192.168.1.1

(For Virtual Machines, the network should be configured in bridge mode)

Your network config should be configured exactly like this

Use the IP settings below



Ubuntu VM [Virtual Box or Parallels]

Bridge Mode

Host OS [Windows or Mac]

Team_X Network

On Ubuntu VM

Connect to Team_X
Set the following Manual IP Settings:

IP: 192.168.1.100
Netmask: 255.255.255.0
G/W: 192.168.1.1

On Host OS:

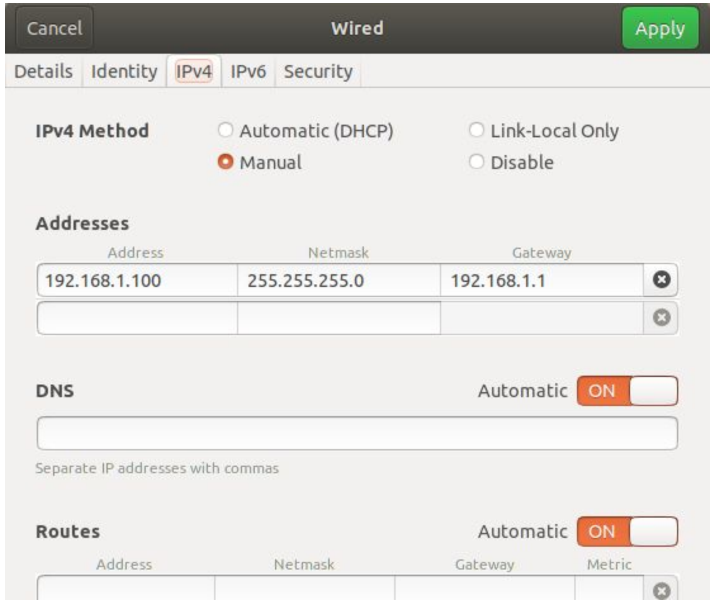
Connect to Team_X
Set the following Manual IP Settings:

IP: 192.168.1.50
Netmask: 255.255.255.0
G/W: 192.168.1.1

No changes needed on the racecar network.

Troubleshooting

1. connection issue in Virtualbox VM
   a. In the host computer: Connect to car's network and assign manual IP/gateway
   b. Launch VM with Bridged network config.
   c. Inside the VM, also assign a different manual IP on the same gateway/subnet



IPv4 Method

○ Automatic (DHCP) ○ Link-Local Only
● Manual ○ Disable

Addresses

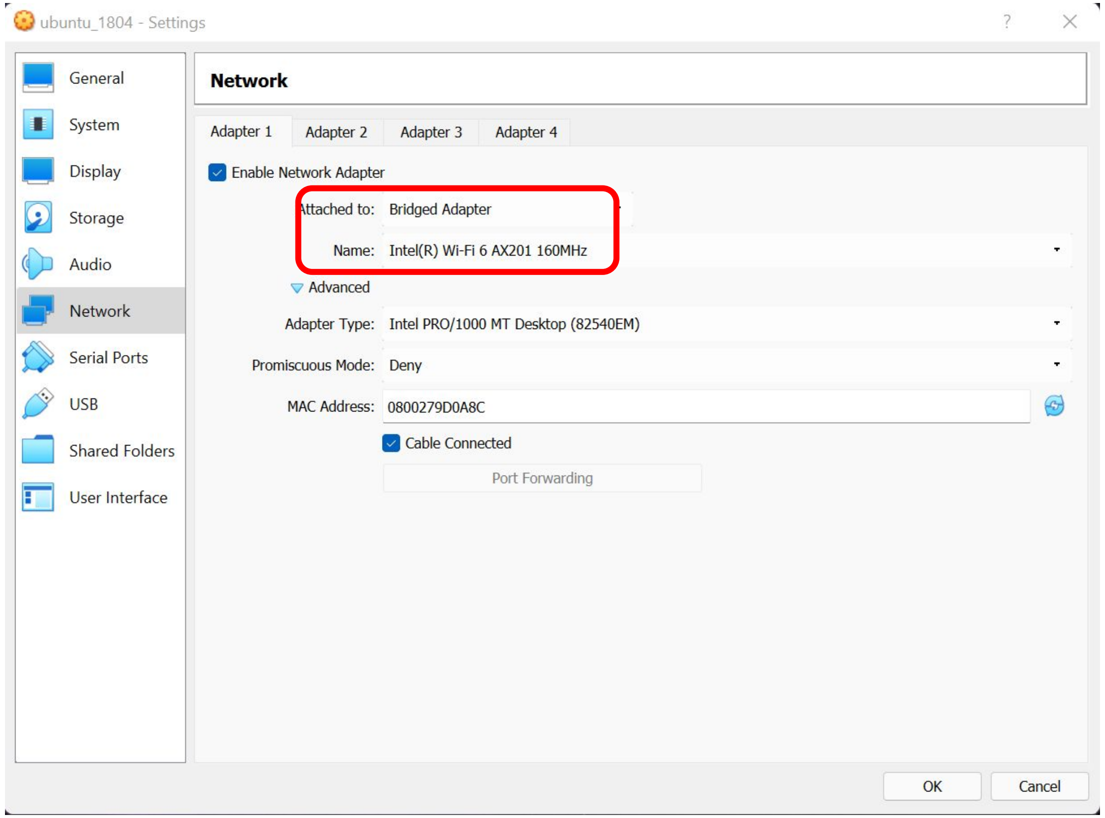
Address	Netmask	Gateway
192.168.1.100	255.255.255.0	192.168.1.1

DNS Automatic ON

Separate IP addresses with commas

Routes Automatic ON

Address	Netmask	Gateway	Metric



Network

☑ Enable Network Adapter

Attached to: Bridged Adapter

Name: Intel(R) Wi-Fi 6 AX201 160MHz

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

MAC Address: 0800279D0A8C

☑ Cable Connected

Configure ROS OVER NETWORK settings on Ubuntu VM

- We are telling our Ubuntu VM that the ros master will be running on the Nvidia TX2 and not on the local machine.

- Open .bashrc file in an editor (e.g., $ vi ~/.bashrc)

    - Add the following two lines at the end of .bashrc file:

        - export ROS_MASTER_URI=http://192.168.1.1:11311
        - export ROS_IP=192.168.1.100

Verify Network config

- Verify network configuration on the local computer/VM:
  - **ping 192.168.1.1** from the local computer/VM
- Use ssh on local computer
  - Open terminal: **ssh nvidia@192.168.1.1**
    - pass: nvidia (never change this)
    - First time authentication? Type “yes”
- Now from within the SSH session terminal, try to ping back your Ubuntu VM
  - **ping 192.168.1.100**

If you can SSH into the Nvidia Jetson TX2, and ping your Ubuntu VM from inside the SSH session then everything is set properly (i.e. your host OS, Ubuntu VM, and Nvidia are on the same Subnet)

Test F310 Joystick on the Ubuntu VM

- Connect the F310 joystick to the local computer
- **You need to give your Ubuntu VM access to the USB ports/ and specifically the Logitech joystick.**
- Use jstest-gtk to verify joystick functionality
  - To verify: jstest-gtk
  - Select joystick in GUI: (check if name is “Js0”)
  - Move axes and press buttons
  - Check response on GUI
  - No response: inform TA
- *If the port is not /js0 then you will need to edit the remote_teleop.launch file. This file is located in the VM in the move_base package. You can roscd move_base..then cd into /launch..and edit the port in the launch file.*

Once the network and joycon test from the VM are successful you can follow the full startup sequence

Putting it all together: Startup Sequence

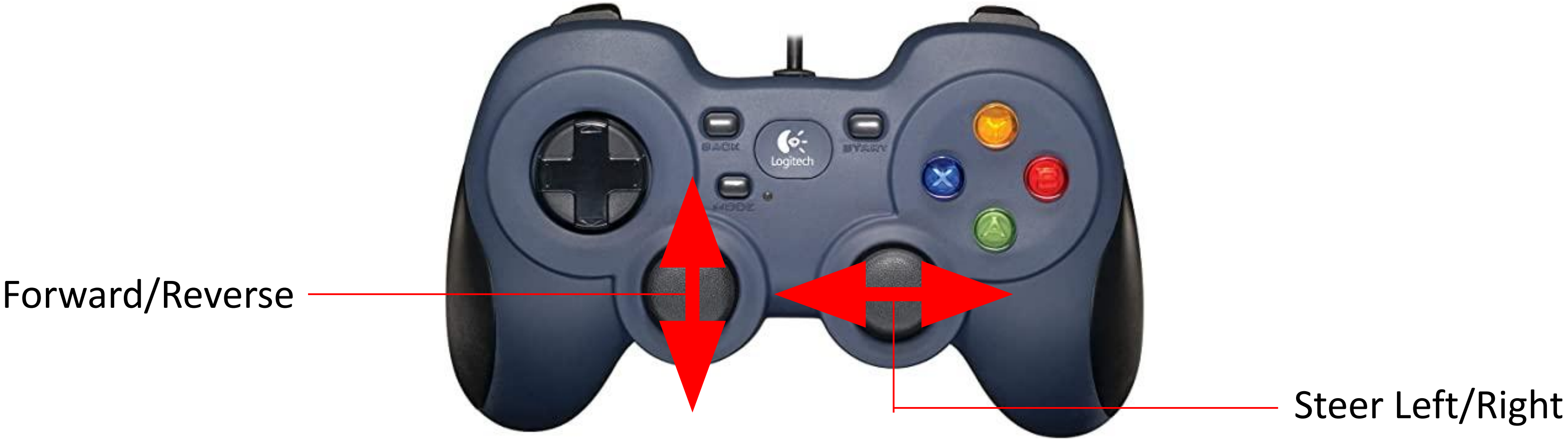
(follow this in strict order)

1. Plug the 3-Cell battery (Red/Rear) to the Power Board using the female DC barrel jack at the rear of the car [DO NOT plug in the 2-Cell battery (Blue/Bottom)].
2. The car should startup; verify lights on TX2, Pico Station, and Hokuyo Lidar.
   a. The 2nd from bottom Pico-station light to blink green.
   b. Wait for 1 minute (to allow Linux to fully boot up),
3. Connect local computer to your team’s network (eg: team_9)
   a. Verify IP configuration on host OS, and Ubuntu VM - Do the ping/SSH test from the VM into the Nvidia.
4. Connect F310 joystick to local computer and verify the correct port.

When all the above steps are successful, we are now ready to start the software on the car and on the Ubuntu VM

Teleoperation

- If you are just testing the car - please ensure the car is kept on a stand and the wheels are not touching any surface.
- Plug in the 2S battery (Blue/Bottom), watch out for polarity!
- Wait for 30 secs to allow the VESC to boot up.
- In a **SSH session on the Racecar >>**:
  - roslaunch move_base move_base.launch
- On **the Ubuntu VM:**
  - roslaunch move_base remote_teleop.launch



Offboard Control

Understanding the control sequence

- Racecar listens to /offboard/command topic
  - Type: ackermann_msgs::AckermannDrive
    - Subfield steering_angle: [-100, 100] = [max left, max right]; float with 0.0 center
    - Subfield speed: [-100, 100] = [max reverse, max forward]; float with 0.0 stop

Offboard Control

Enable offboard command passthrough

- Node ‘command_multiplexer’ uses ‘listen_offboard’ param to enable/disable offboard_control
  - On racecar: roslaunch move_base move_base.launch listen_offboard:=true
  - Launch remote teleop on local computer