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REMOTE ROBOT CHALLENGE

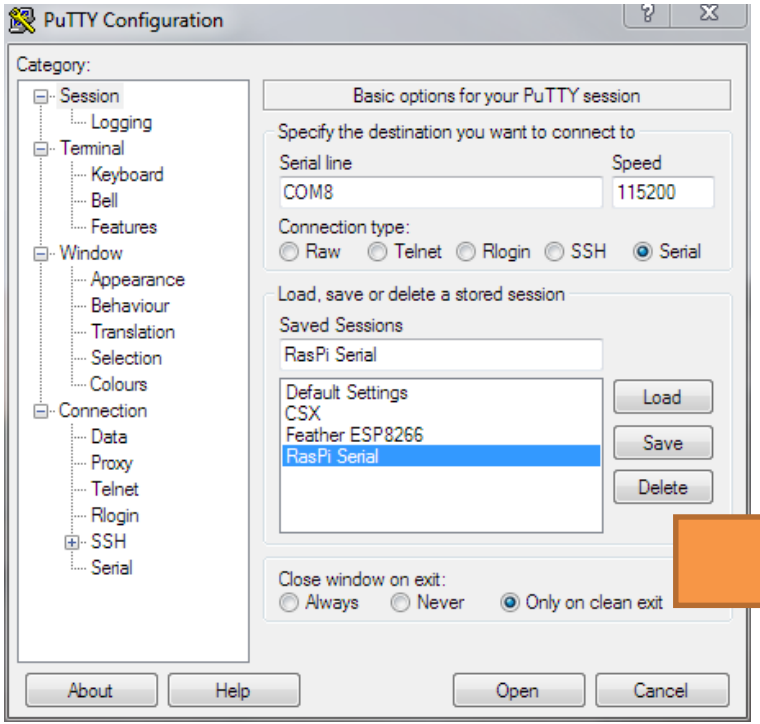
Wi-Fi with the Raspberry Pi
From the Command Line

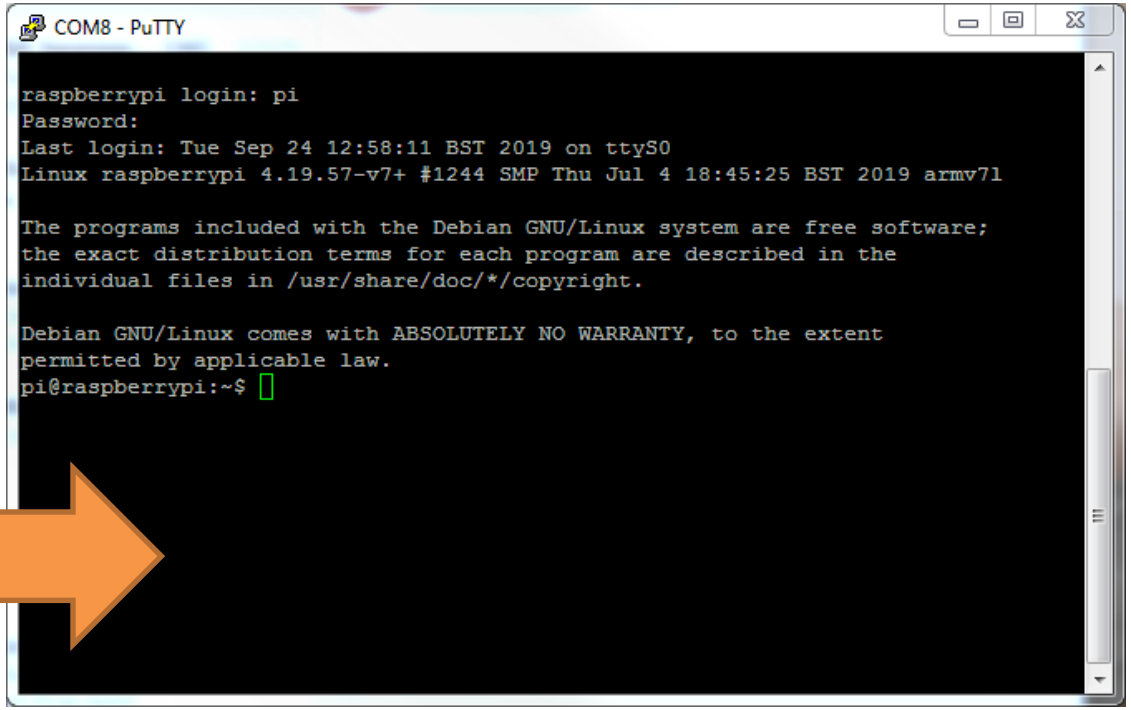
Consider a USB to Serial Console Cable!

- Eliminates the hassle of VNC, static IP, having a keyboard monitor and mouse, or a router/switch handy
- Simplifies debugging RasPi embedded in application
- Make sure the cable is 3.3v compatible on the TX/RX pins
- Enable serial console on the Pi
  - Append `enable_uart=1` to `/boot/config.txt`
  - Alternatively enabled in `raspi-config` utility
- Disable hardware flow control in serial client
- Clients
  - PuTTY – cross platform, gui
  - minicom – linux, cli

PuTTY Serial Session on Windows

Install any drivers, then use Window's Device Manager to find the serial (COM) device





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Raspbian Network Environments

`dhcpcd` (default)

- systemd service file: `dhcpcd.service`
- Configured with `/etc/dhcpcd.conf`

ifupdown (deprecated, disables dhcpcd if configured)

- systemd service file: `networking.service`
- Configured with the file `/etc/network/interfaces`

`systemd-networkd` (alternative, not as mature)

- systemd service file: `systemd-networkd.service`
- Configured with files in `/etc/systemd/network/`

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wpa_supplicant Package

- Primary set of utilities a Raspbian user will interact with to log on to wireless networks
- Network authentication and association is accomplished with `wpa_supplicant`, **dhcpcd** handles ip address assignment
- Supports WPA2 as well as WPA, WEP and open networks
- systemd service file: `wpa_supplicant.service`
- Configured with files in `/etc/wpa_supplicant/`
- The interactive cli tool `wpa_cli` can be used to scan for and connect to wireless networks as well as manage configuration file entries
- Config file entries, with obfuscated passphrases, for WPA2-Personal networks can be generated with `wpa_passphrase`

Connecting to the Mercury Router via CLI

- Raspbian 8 (Jessie) and later: use `wpa_cli` or add network details to `/etc/wpa_supplicant/wpa_supplicant.conf` with an editor
  - Earlier versions configure `/etc/network/interfaces` (outside scope of this guide)

- First steps
  - Find wireless interface name – by default it's `wlan0`, could be different if Predictable Network Interface Device Names is enabled
  - Verify that **dhcpcd** is running
    - Use the command `systemctl status dhcpcd.service`
    - Should return a message saying `active (running)`, press q to exit
    - If not one of the other environments is configured
  - Optional - change RasPi's host name with `raspi-config`
    - this is name your RasPi will have on the network

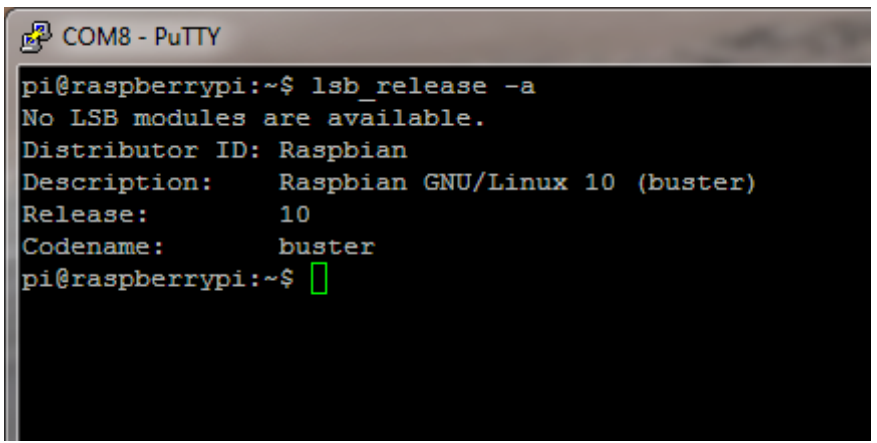
OS Version, Wireless Interface

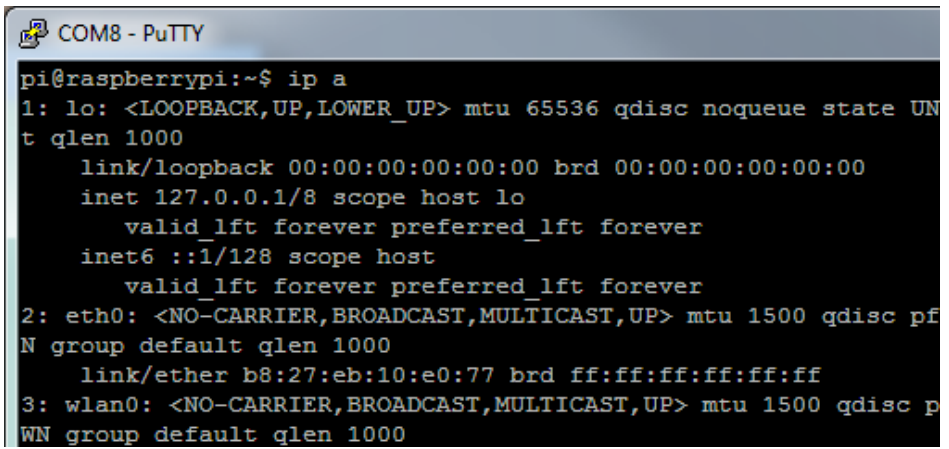
`lsb_release -a`

- Provides basic info about installed OS

`ip a`

- Use this command to view names and status of network devices





Connecting to the Mercury Router via CLI

- Next steps
  - Run the following command to initialize `wpa_supplicant`
    ```
    sudo wpa_supplicant -B -i wlan0 -c /etc/wpa_supplicant/wpa_supplicant.conf
    ```
  - Run `wpa_cli -i wlan0` to begin the configuration process
  - Add a network entry with `add_network`
    - the utility will return an entry number like 0
  - Set the network ssid with `set_network 0 ssid “MERCURY”`
  - Specify that it is an open network with `set_network 0 key_mgmt NONE`
  - Specify that it is a hidden network with `set_network 0 scan_ssid 1`
  - Issue `enable 0` to enable that network entry in the config file
  - Issue `save_config` to save the configuration

Connecting to the Mercury Router via CLI

- Final Steps
  - Use `quit` to exit `wpa_cli`
  - Issue `cat /etc/wpa_supplicant/wpa_supplicant.conf` to inspect the config file. You should see something similar to the following

```
pi@raspberrypi:~$ cat /etc/wpa_supplicant/wpa_supplicant.conf
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
country=US

network={
        ssid="MERCURY"
        scan_ssid=1
        key_mgmt=NONE
}
```

  - If the network entry looks good, run `wpa_cli -i wlan0` and at the interactive prompt issue the `reconfigure` command so `wpa_supplicant` reloads the config file
  - Issue `select_network 0` to connect to the network

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wpa_cli Useful Commands

- `list_networks` – list configured networks
- `select_network #` – select a network entry in the config file to connect to, # = network id from it's position in the file. Can be obtained with the `list_networks command` as well.
- `remove_network #` – remove network from config file
- `status` – get current connection status
- `help [command]` – show command usage
- `quit` – exit `wpa_cli`

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References

- Setting WiFi up via the command line
  https://www.raspberrypi.org/documentation/configuration/wireless/wireless-cli.md
- Linux WPA/WPA2/IEEE 802.1X Supplicant
  https://w1.fi/wpa_supplicant/
- Another Raspbian Desktop User Interface Update (mentions dhcpcd)
  https://www.raspberrypi.org/blog/another-raspbian-desktop-user-interface-update/
- How to correctly restart wpa_supplicant debug with networkd-systemd?
  https://raspberrypi.stackexchange.com/questions/89707/how-to-correctly-restart-wpa-supplicant-debug-with-networkd-systemd
- Differences between /etc/dhcpcd.conf and /etc/network/interfaces?
  https://raspberrypi.stackexchange.com/questions/39785/differences-between-etc-dhcpcd-conf-and-etc-network-interfaces
- Adafruit's Raspberry Pi Lesson 5 - Using a Console Cable
  https://learn.adafruit.com/adafruits-raspberry-pi-lesson-5-using-a-console-cable/overview