Raspberry Pi Setup Tutorial

The Raspberry Pi is basically a miniature linux-based computer. It has an ARM processor on it, specifically the ARM1176JZF-S 700 MHz processor. This is the main reason why we are using the Pi for CSE30!

This tutorial aims at teaching you how to setup your Pi with your laptop (not the lab machines) using a direct Ethernet connection between the two.

Note 1: Other slightly different methods may work, but it's not guaranteed, and you'll be on your own.

Note 2: You can use your Raspberry Pi as a desktop if you have access to a monitor with HDMI input, a USB mouse, USB keyboard and a direct Ethernet connection to your home router. Follow the tutorial below to setup:
 http://www.raspberrypi.org/learning/getting-started-with-raspberry-pi-lesson/

If you are satisfied with this configuration, you don't have to go through the rest of this tutorial. However, if you would like to connect to your Pi from your laptop using a direct Ethernet connection, please read on. We begin with a few important notes on how to behave with your Pi.

Note 3: ONLY make or remove any connection when the Pi's power is OFF (see Step 1 below).

Note 4: ONLY remove or plug-in the SD card from/to the Pi when the Pi OS (Raspbian) has been properly shut down, and the PI's power has been removed. Otherwise it is likely that the information on the card will be corrupted, and you'll have to re-load the Pi with a clean image (contents, including the OS). Also note that if the SD card is corrupted, it is likely that you will have lost any information of your own, like your programs, that were on the card. Backup early, backup often.

1. Put the correct OS image on your SD card. To do this, you will need an SD card reader on your laptop. If you don't have access to one, contact a TA or the instructor. Be sure to bring your SD card with you. If you have a SD card reader on your laptop, keep reading.

    Note: You have to do this step only once (initially) or if your SD card gets corrupted.

2. Burn the image onto the SD card. On the MAC OSX, you can use the ApplePiBaker app to do this, which is available for download here: http://www.tweaking4all.com/hardware/raspberry-pi/macosx-apple-pi-baker/

3. Make sure you eject your SD card properly before physically removing it from the laptop's SD card reader.

4. Power off the Pi by removing its power supply connector (micro-USB), if it isn't already.

5. Remove all other connections from the Pi

6. Connect the Ethernet cable between the Pi and your laptop computer

7. On your laptop: Give a static IP address to the Ethernet port of your laptop, specifically use 192.168.2.12. To do this on a MAC OSX, you need to go to System Preferences-> Ethernet and set the static IP as shown in the image below:
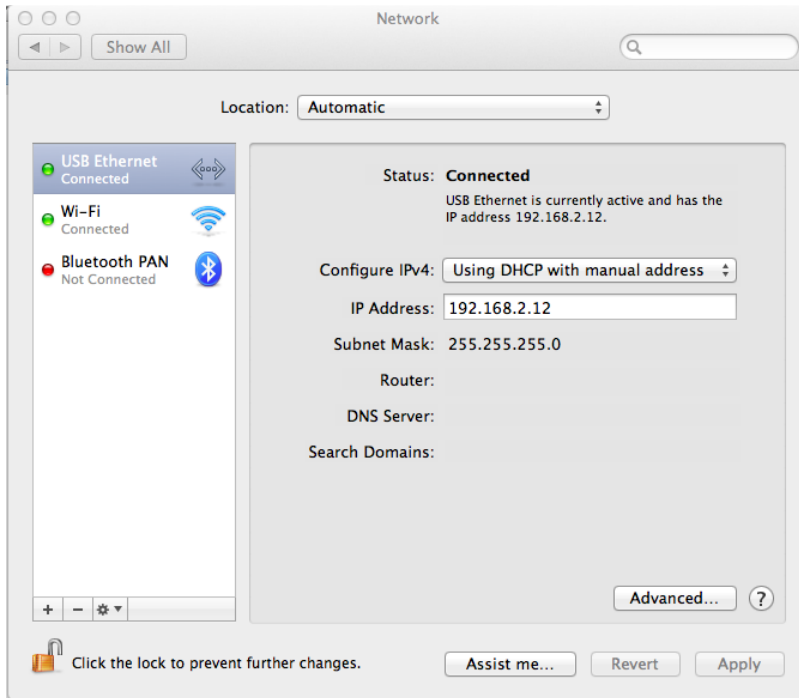

For Windows users, go to the start menu and search for Network and Sharing Center, and then click on change adapter settings on the left. Right click on your Ethernet or local area connection and click properties, then scroll down to TCP/IPv4 and click properties. Fill out the IP and subnet as shown.
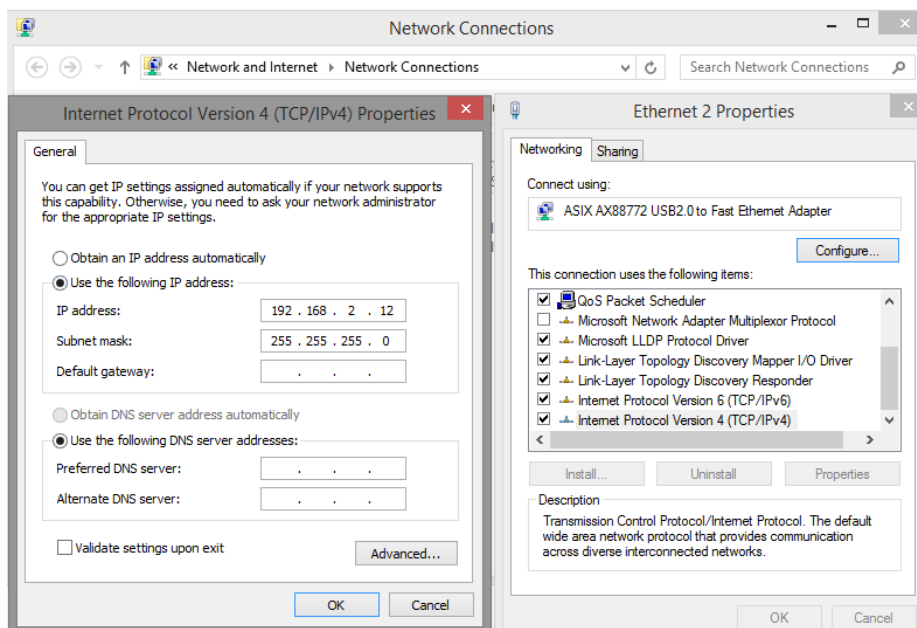
8. Plug in your SD card into the Pi and power it on by plugging its supply into the micro-USB socket. (DO NOT plug the connector into a USB socket, with or without an adapter.)

9. It will take many seconds for the Pi to finish booting to its OS (Raspbian) and then successfully coming up on the network.
   [Sequence of events as indicated by the Pi's LED indicators:

   a. Power LED (red) lights continually after power supply is plugged in.
   b. ACTivity LED (yellow) blinks randomly while OS boots, and actually whenever the Pi is running a program (the OS is a program).

10. After the Pi's activity light blinks for about 10-20 seconds, it will be ready to connect to it remotely from another computer.

11. Connect to the Pi from your laptop using SSH.
    If you are a MAC user you can use the ssh command as follows:
    a. Open a terminal/command window on the PC.
    b. Enter the following command on the command line in the window:
       `ssh pi@spispis-30XXX.local`
    c. If you get a 'host name unresolved' error, try `ssh pi@192.168.2.2`

    If you are a Windows user, download Putty and open putty.exe. Type in pi@192.168.2.2 (the IP address of the Raspberry Pi) in the host name field and make sure the SSH bubble is clicked so it looks like the picture below:
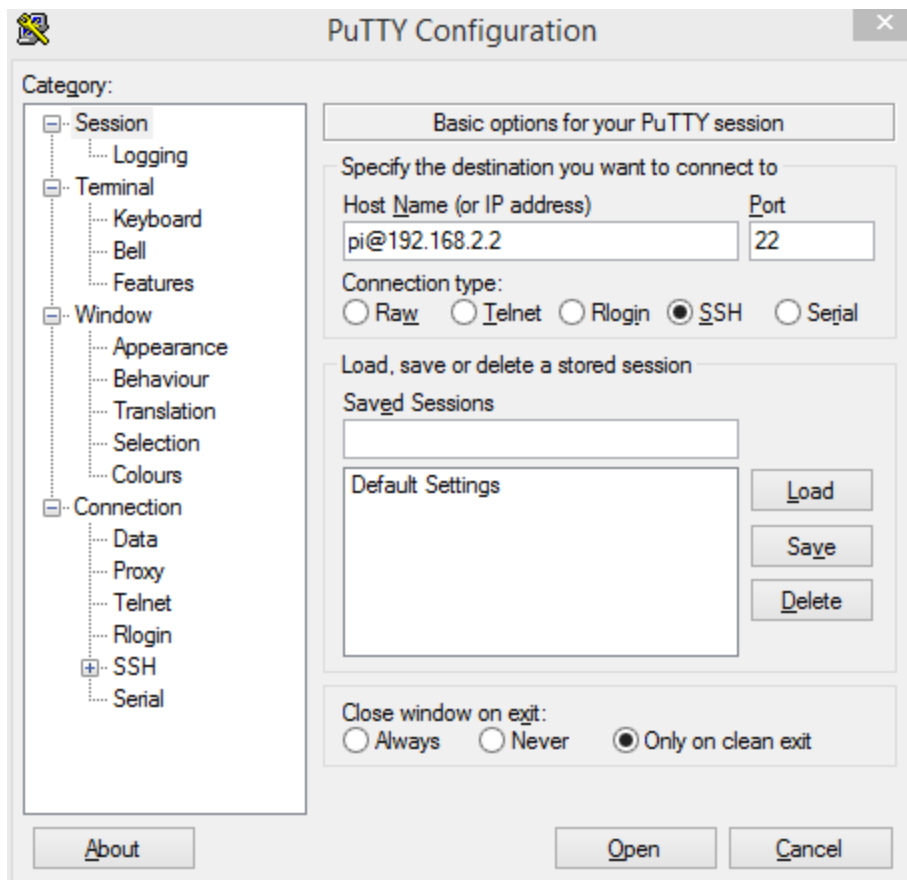
a. If all is well, you will be prompted for your password. When a password is requested (almost immediately) enter: "`raspberry`", which will be displayed as: "`*********`" or nothing at all.

b. If successful, a new line will appear in the Pi's terminal window containing the Pi's command prompt, which will include the Pi's hostname as well as other information as shown below:

```
● ● ●                    ⌂ diba — pi@rpi: ~ — ssh — 80×24
Dibas—MacBook—Air:~ diba$ ssh pi@rpi.local
pi@rpi.local's password:
Linux rpi 3.10.25+ #622 PREEMPT Fri Jan 3 18:41:00 GMT 2014 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Jul 29 01:17:26 2014 from 192.168.2.12
pi@rpi ~ $ ▮
```

12. If you get here, you are now talking to the Pi from your laptop via Ethernet. You can enter any Raspbian-OS command, as well as execute your own programs written for the Pi.
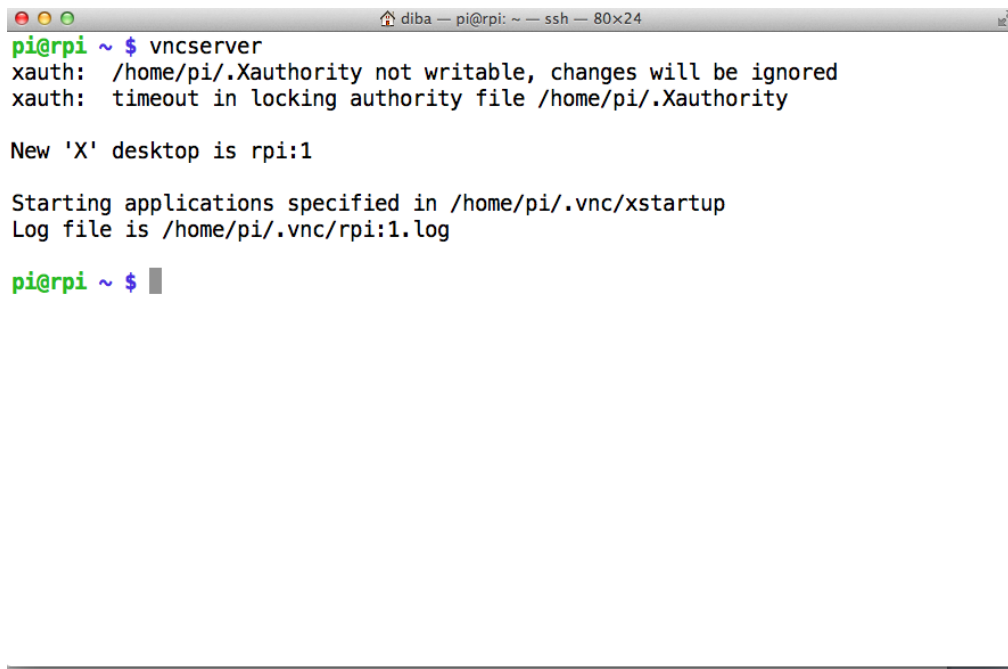
13. Running Raspbian-OS commands
a. Enter: "`ls -la`". A list of the contents of your home directory will appear, including file/directory names, as well as other info whose definitions can be found elsewhere (enter: "`man ls | less`"; hit a `space` to go forward a page, the character "`b`" to go back a page, and the character "`q`" to quit the display program).
b. Enter: "`uname -a`". The hostname "`rpi`" will appear along with other info.

14. Change the hostname to make it unique. (At a later point you may choose to connect to your Pi via the campus WiFi, in which case the WiFi will get confused if multiple Pis show up with the same hostname, and bad things will happen.)
a. In the Pi's terminal window enter: "`sudo raspi-config`".
b. A menu will appear. Use the down/up-arrow keys to choose an option. Choose: "`advanced configurations`". Use the 'tab' key to highlight the '`select`' field and hit the 'Enter' or 'Return', etc., key.
c. Another menu will appear. Choose: "*A2*" as in the prior step, select it, and follow the prompts to enter a new hostname, which is (GOTO the next step).
d. Decide on a new hostname. It MUST be unique. It may have the form: **"`spispis-30XXX`",** where '`XXX`' is the unique part of your cse30 account on ieng6. **If you want to connect to your pi using the hostname on the campus wifi, you should precede the host name with "spispis-30". Be sure to give a unique hostname as directed above**
e. **Next you should change your password using the same raspi-config tool. Make sure you write down your password somewhere and don't forget it.**
f. The graphical interface will ask you if you would like to reboot – select 'Yes'
g. If you selected 'No' by mistake for the above question, then explicitly reboot by typing the command "`sudo shutdown -h now`" on the Pi's command line interface.

15. On the next boot, look at the Pi's command prompt: its new hostname (`spispis-30XXX`) should be part of it.

16. Want a graphical desktop interface? If you prefer to work using a graphical interface, install a remote desktop application on your laptop. I recommend CoRD for MAC OSX users. You can download it here: http://cord.sourceforge.net/ . On windows you can use the built in "Remote Desktop Connection" application (search for it in the start menu).

17. Once you have ssh-ed into the Pi as described previously, Enter "`vncserver`" on the command line of your Pi. You should see the output as follows:

```
●○○                    ⌂ diba — pi@rpi: ~ — ssh — 80×24
pi@rpi ~ $ vncserver
xauth:  /home/pi/.Xauthority not writable, changes will be ignored
xauth:  timeout in locking authority file /home/pi/.Xauthority

New 'X' desktop is rpi:1

Starting applications specified in /home/pi/.vnc/xstartup
Log file is /home/pi/.vnc/rpi:1.log

pi@rpi ~ $ █
```

On a mac, use CoRD to connect to the Pi with its new hostname (spispis-30XXX).
On windows use Remote Desktop Connection and connect to Pi with the same IP address used to SSH in (192.168.2.2).
Enter your login credentials 'pi' and password 'raspberry', as before. You should be able to see the graphical interface as shown below:
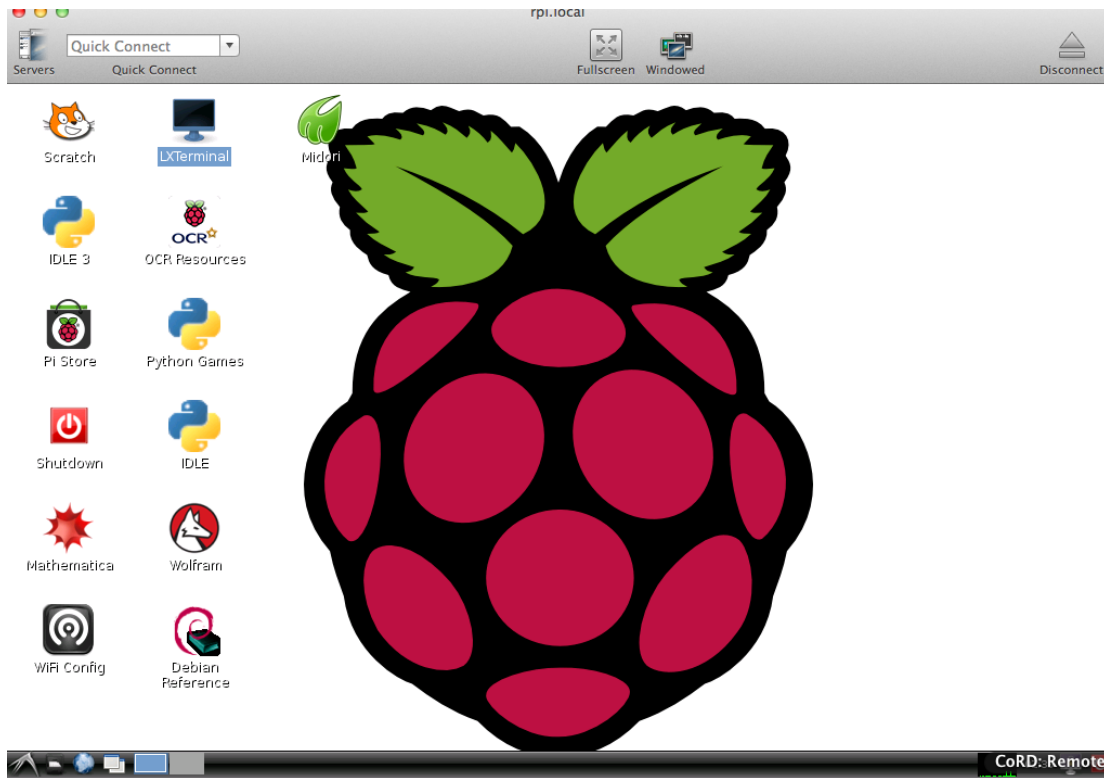
Now you can use the LXTerminal to program or explore connecting to your Pi over WiFi by clicking on the WiFi Config icon.

18. Configuring the WiFi on Campus Wifi. First make sure you have completed step 14(d) where you have given a unique name to your pi with the prefix spispis-30. Also make sure you have changed the password from raspberry. Also make sure you have access to campus WiFi. If you are on a home network , you will need different configurations (see step 19). To configure the Wifi, first plug in the wifi dongle into one of the USB ports of the Pi. The power up the Pi. Connect to the Pi via remote desktop as before (following step 17). Open the WiFi Config tool on the desktop.
    a. Under Manage Networks, click on Scan. This should show you the different UCSD_PROTECTED stations that you can connect to. Click on the one with the best signal strength. This will allow you to configure your setting.
    b. Use the configuration settings in the picture below, replacing dimirza with your AD directory name and Password with your password. Click the Save button.
    c. Click on the "Current Status" tab and wait until you get a stable IP address. You may experience a cycling behavior where an IP address is obtained and then lost again. Just wait for it to stabilities.
    d. Shutdown using the command sudo halt at the terminal and restart your Pi
    e. You should now be able to remotely connect to the Pi using the hostname spispis-30xxx.dynamic.ucsd.edu Try to remotely ssh to your Pi using this host name. From this point on you would not need the Ethernet cable as long as your Pi is connected to the Wifi network
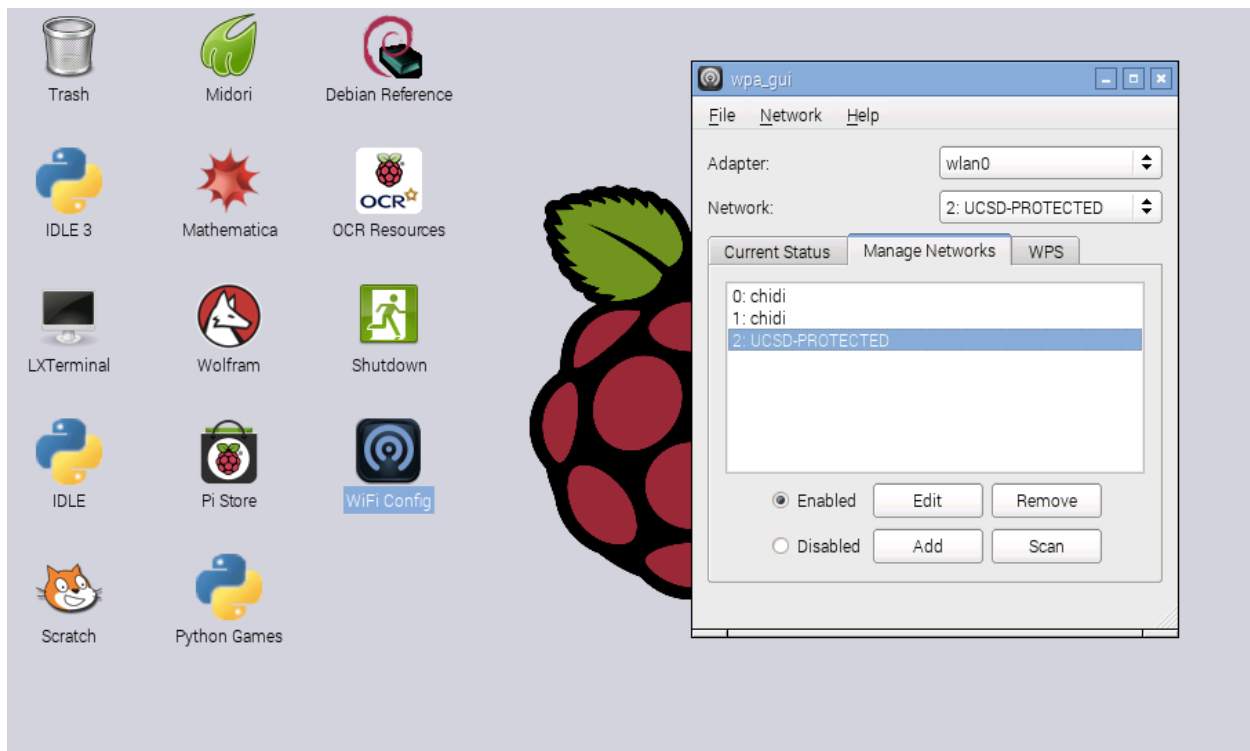
Configurations for connecting to campus WiFi
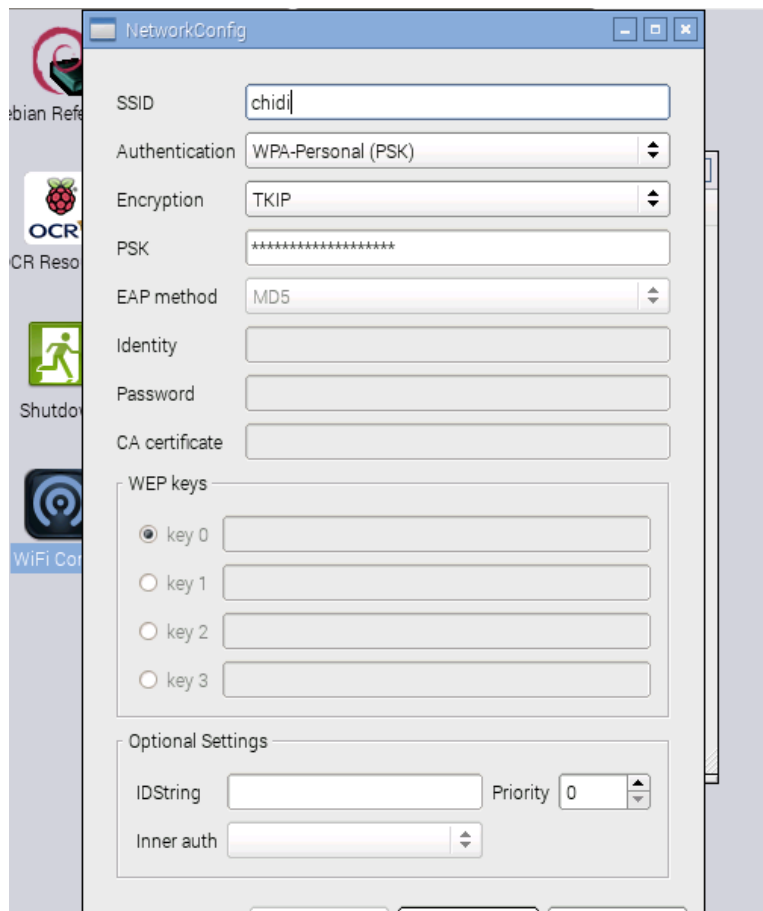
19. To configure the WiFi for your home network use the settings in the above picture.
    If you are connected on your home WiFi network, you cannot ssh into your pi using the spispis-30xxx.dynamic.ucsd.edu host name. If you don't have an Ethernet cable, you can discover your Pi's IP. If you have a MAC, open a terminal and type "ping 192.168.1.255". Following that type "arp –a". One of the IP addresses that shows up is your Pi's and you should be able to connect to it.

20. Important: Always do a clean shutdown, power-off and remove the SD card as follows:
    a. On the Pi's command line enter: "`sudo shutdown –h now`". This puts the Pi's OS in a nice state to have power removed. It takes a few seconds. Wait for the Pi's terminal window to either disappear, or a message on your laptop's desktop to appear saying something about a stopped network connection. Wait 10 seconds.
    b. Power-off the Pi by unplugging the power cable (from micro-USB) connector.
    c. Wait 20 seconds (count to 20). This lets the energy stored in the Pi's electronic components dissipate to ground, making it safe to remove components/cables from the Pi. (Otherwise the SD card may be corrupted, or in an unlikely scenario, physical damage will have occurred.)
    d. Remove the SD card from the Pi. Make a copy of it.

21. Now you are all set to have fun programming the Pi!!