Raspberry Pi

Aryanto

What will we be doing today?

First Half:

- Learn about the Raspberry Pi
- See demos of what the Pi can do
- Short break

Second Half:

- Setup the Raspberry Pi
- Learn how to use the command line
- See demos of the Pi Camera
- Learn how to use Python to interact with the Pi Camera

What is the Raspberry Pi?

- Affordable credit-card sized computer

- Plugs into a computer monitor or TV

- Uses standard keyboard and mouse

- Can browse the internet and play HD video

- Can also interact with the outside world!
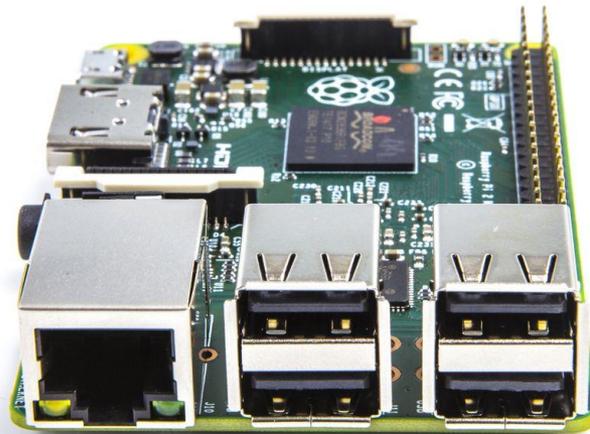
Raspberry Pi Foundation

Educational charity based in the UK

The Foundation's goal is to advance the education of adults and children in the field of computers, computer science, and related subjects.

https://www.raspberrypi.org/about
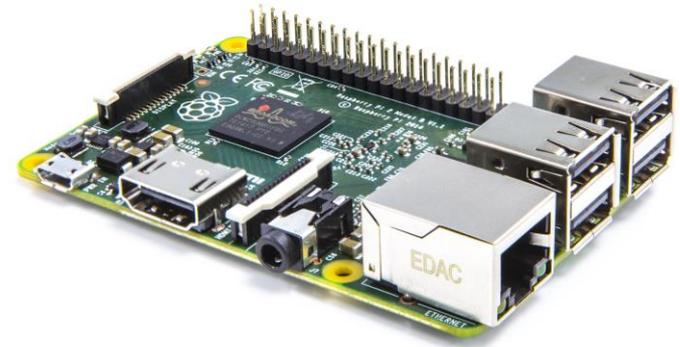
Why was the Pi created?

Concern over the decline in computer literacy

- In the 1990s most new Computer Science students were experienced hobbyist programmers.
- The 2000s were very different; a typical applicant may have only done a little web programming.

Your Raspberry Pi

Raspberry Pi 2 Model B Camera Kit

Camera Kit Contents

Raspberry Pi 2 B   Micro SD Card   WiFi Dongle

Raspberry Pi Case   Power Supply   Pi Camera
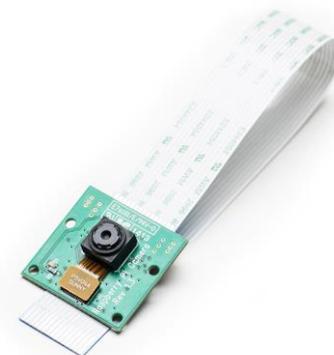
Raspberry Pi 2 Model B Stats

- 900MHz quad-core ARM Cortex-A7 CPU
- VideoCore IV 3D graphics core
- 1GB RAM
- 4 USB ports
- Full HDMI port
- Ethernet port
- Micro SD card slot
- Combined 3.5mm audio jack and composite video
- Camera and display interface
- 40 General Purpose Input / Output pins (GPIOs)
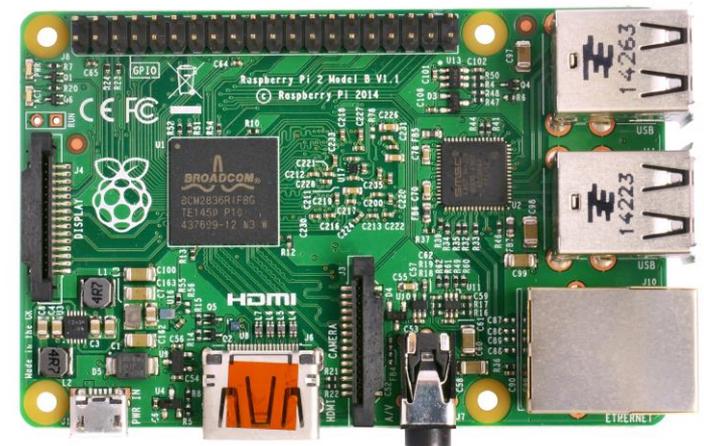
Helpful Websites

Official Raspberry Pi website

https://www.raspberrypi.org/

The MagPi, online Raspberry Pi magazine

https://www.raspberrypi.org/magpi/

PiWeekly, online Raspberry Pi newsletter

http://piweekly.net/

Raspberry Pi IV Beginners

https://www.youtube.com/user/RaspberryPiBeginners

The Raspberry Pi Guy

http://www.theraspberrypiguy.com/

What you can do with the PI
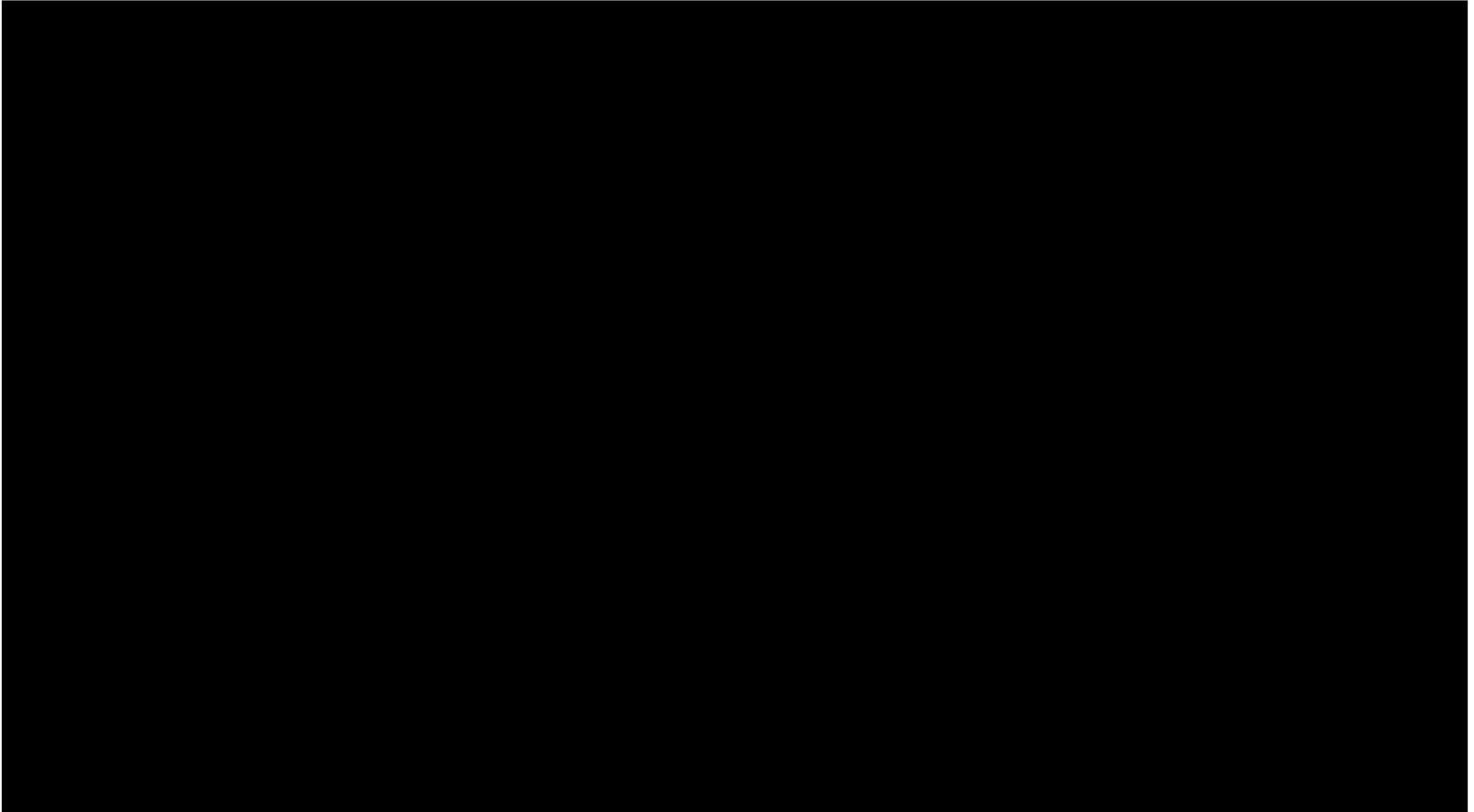
Raspberry Pi Demo

George Sparrow
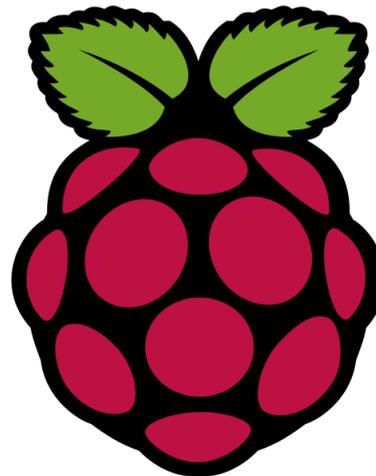
Hands-On: Assembling the Pi

Setup your Raspberry Pi components in front of you

Camera Kit Supplies

Additional Hardware

Hands-On: Assembling the Pi

1. Attach rubber adhesive feet to the Pi case
2. Examine how the pegs inside the case match holes on the Raspberry Pi
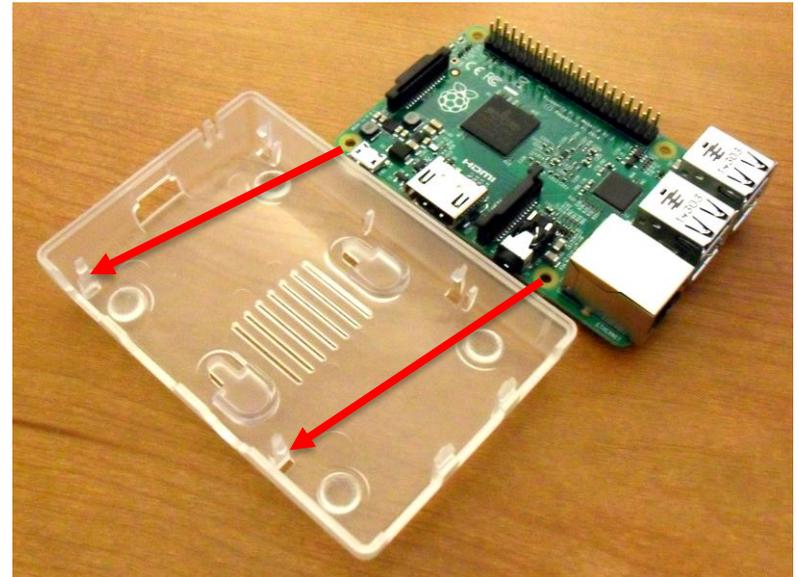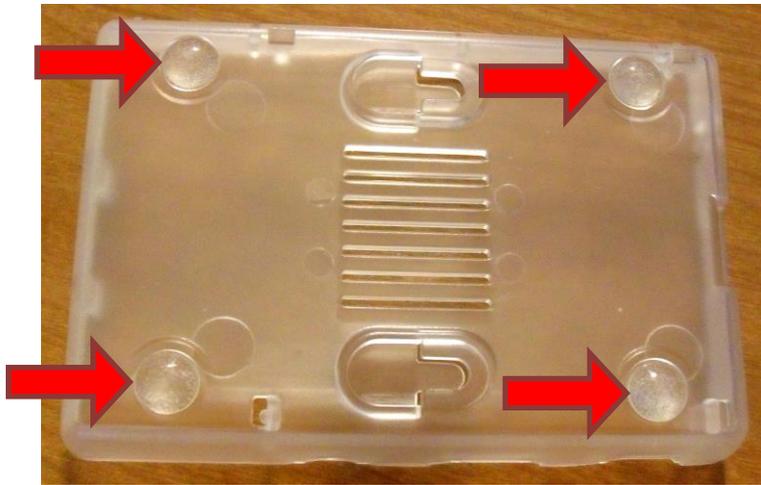
Hands-On: Assembling the Pi

3. Slide the Raspberry Pi into the case on the GPIO side with the small plastic clips next to the stand-off holes

4. Gently push down until it snaps into place on the opposite side
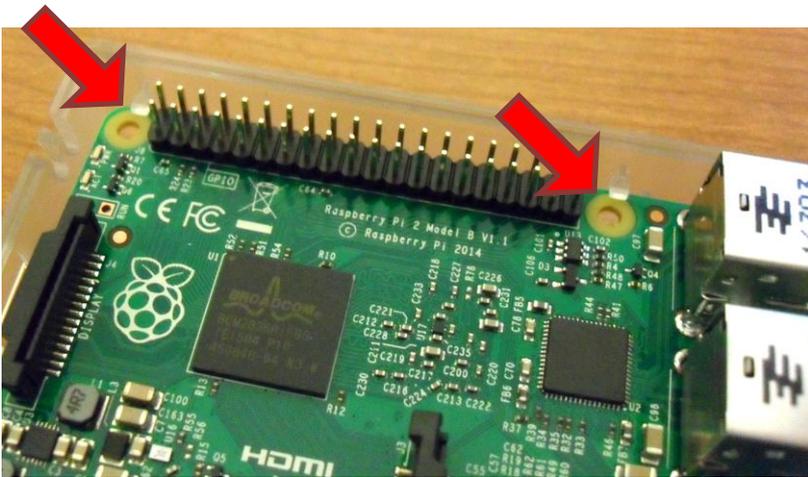
Hands-On: Assembling the Pi

5. Thread the camera cable into the top of the Pi case with the camera facing down and the tin contacts facing up
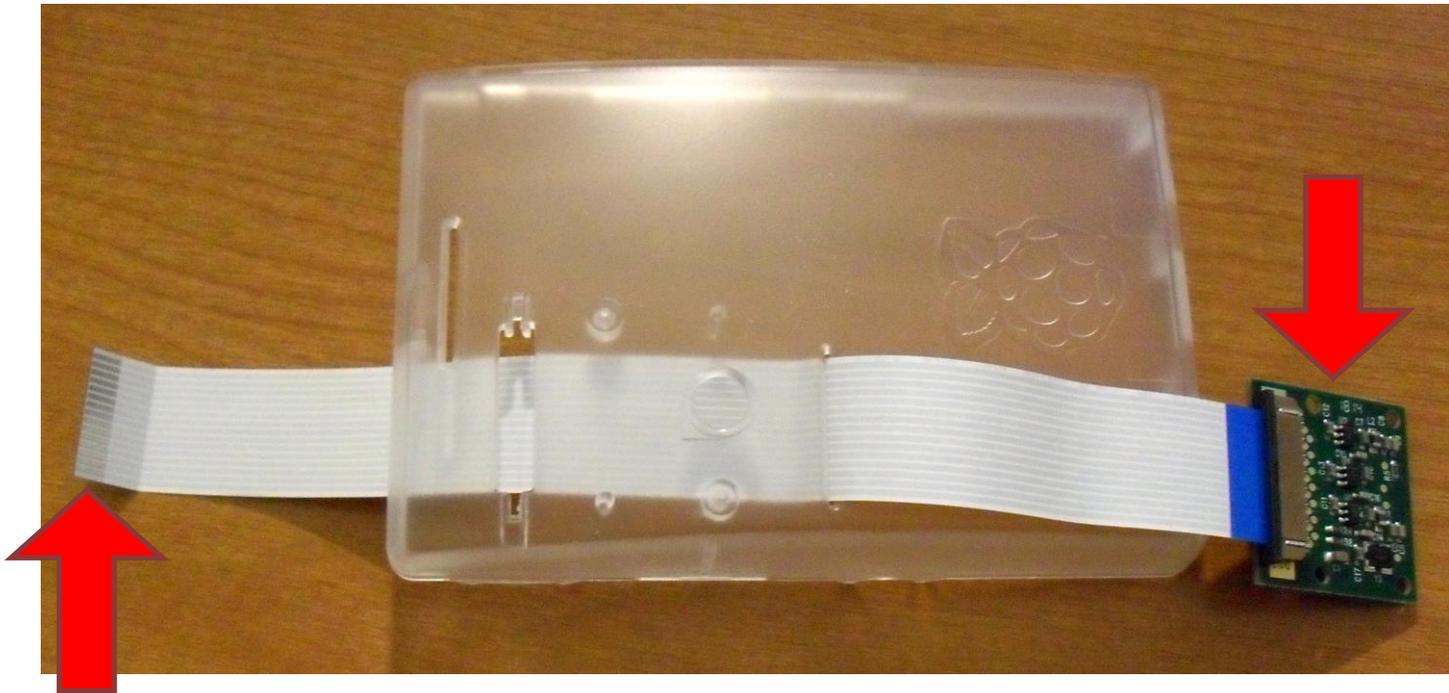
Hands-On: Assembling the Pi

6. Gently pull up the camera socket locking lever
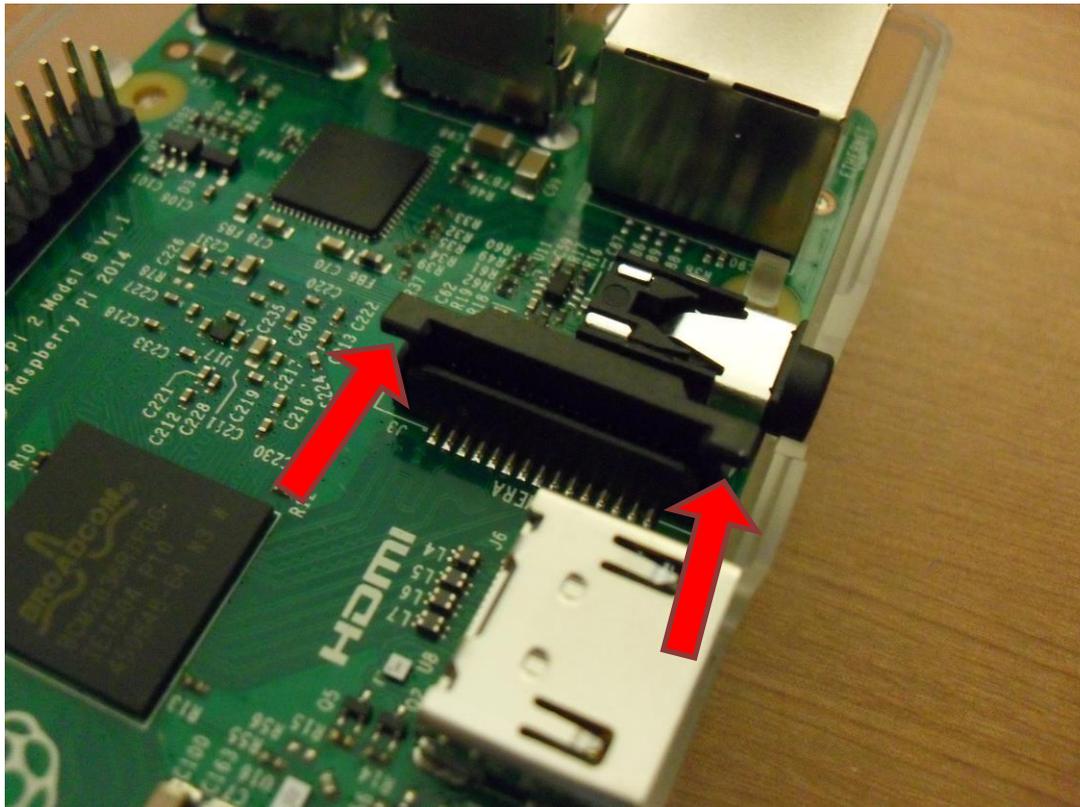
Hands-On: Assembling the Pi

7. Insert the camera cable evenly with the tin connecters facing the HDMI port and gently secure the locking lever
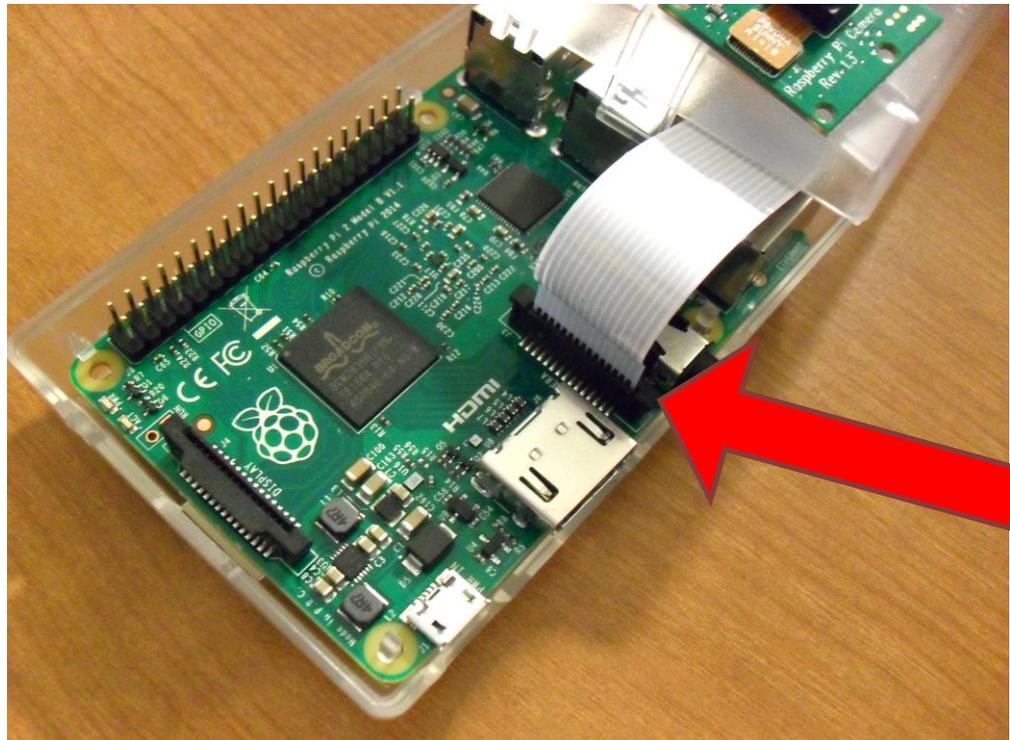
Hands-On: Assembling the Pi

8. Snap the two halves of the Pi case together
9. Insert the micro SD card into the slot on the underside of the Pi case
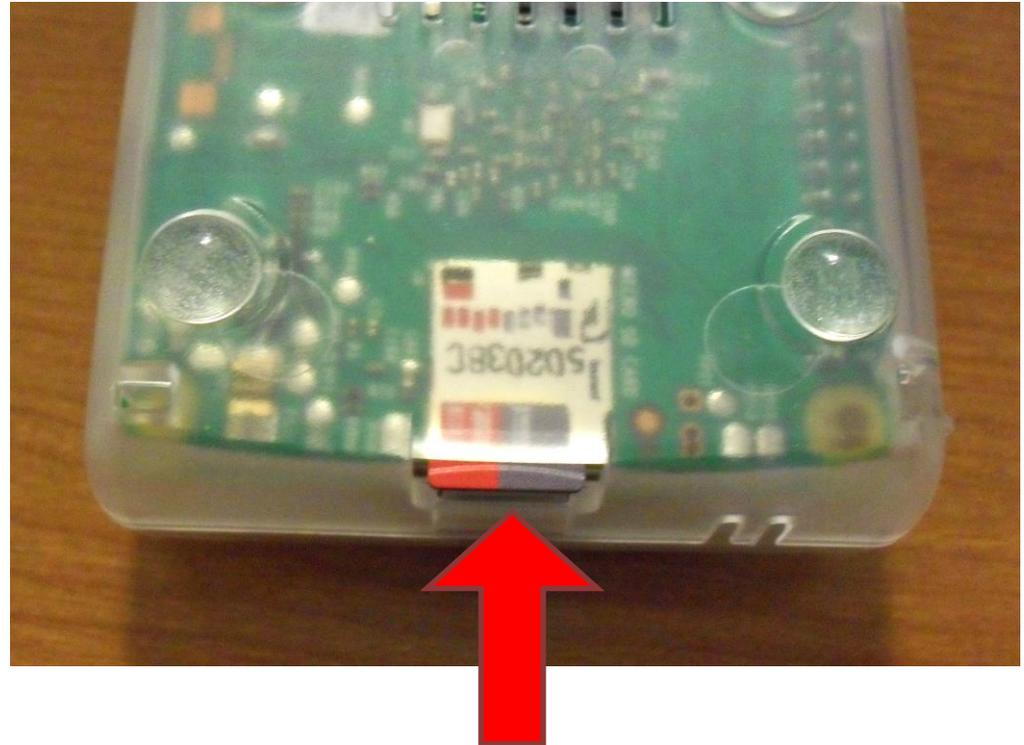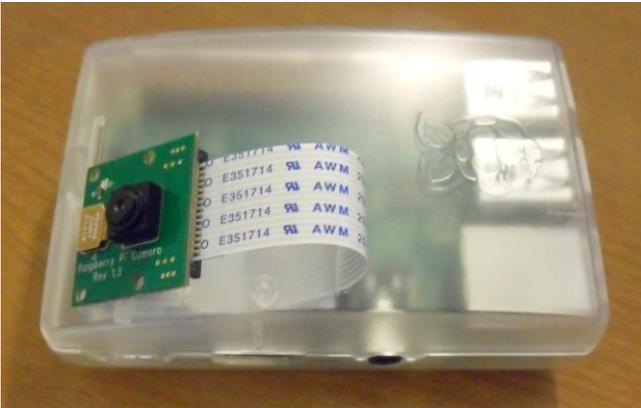
Hands-On: Assembling the Pi

10. Plug the USB WiFi dongle into one of the USB ports
11. Plug in keyboard and mouse
12. Plug in monitor using the HDMI port
13. Make sure monitor is turned on
14. Don't plug in the power supply just yet
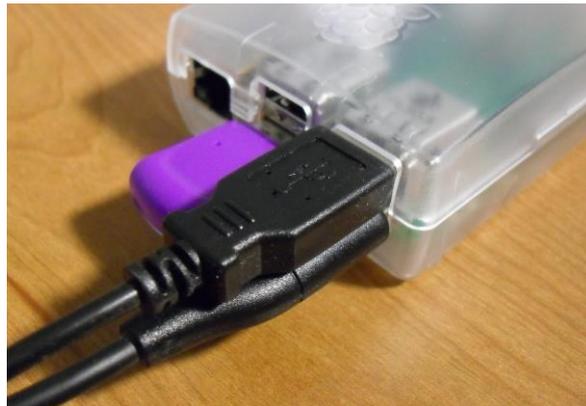
Hands-On: Assembling the Pi

Where is the power button?

- The Raspberry Pi doesn't have a power button. It boots up as soon as you plug in the power supply.

- If you've completed all the previous steps, plug in the power supply to boot the Raspberry Pi.
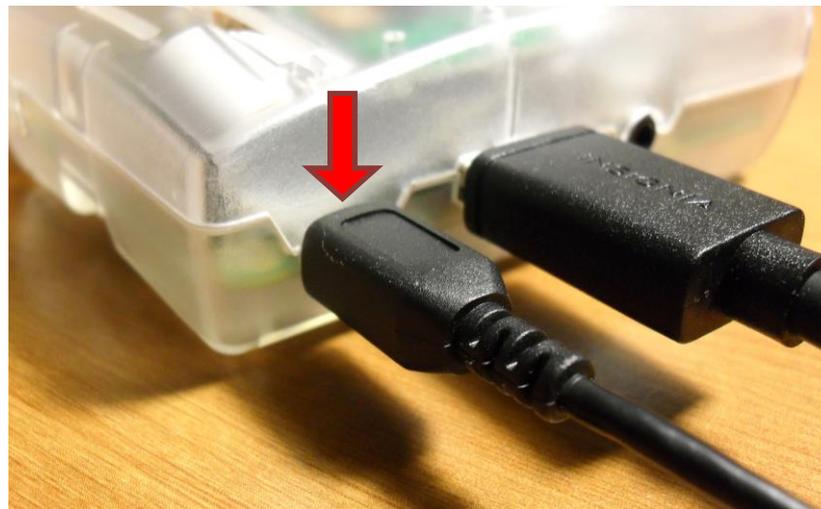
Hands-On: Configuring the Pi

Installing the Operating System

The micro SD that you have comes pre-installed with the Linux based Raspbian OS. Raspbian is a fork of another Linux distribution called Debian.
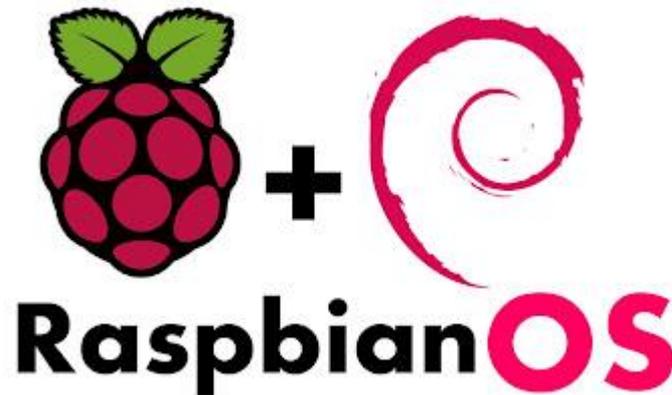
Hands-On: Configuring the Pi

How to log into the Raspberry Pi for the first time

You won't see the password as you type it. This is a Linux security feature.

Login: **pi**

Password: **raspberry**

Hands-On: Configuring the Pi

Configuring the Raspberry Pi for the first time

Launch the Raspberry Pi Configuration Tool

```
~$ sudo raspi-config
```


Raspberry Pi Software Configuration Tool (raspi-config)

Setup Options

1 Expand Filesystem   Ensures that all of the SD card storage is available to the OS
2 Change User Password   Change password for the default user (pi)
3 Enable Boot to Desktop/Scratch Choose whether to boot into a desktop environment, Scratch, or the command-line
4 Internationalisation Options Set up language and regional settings to match your location
5 Enable Camera   Enable this Pi to work with the Raspberry Pi Camera
6 Add to Rastrack   Add this Pi to the online Raspberry Pi Map (Rastrack)
7 Overclock   Configure overclocking for your Pi
8 Advanced Options   Configure advanced settings
9 About raspi-config   Information about this configuration tool

                    <Select>   <Finish>

Hands-On: Configuring the Pi

Setting the keyboard layout

1. Choose option **4 Internationalization Options**

Hands-On: Configuring the Pi

Setting the keyboard layout

2. Choose option **I3 Change Keyboard Layout**
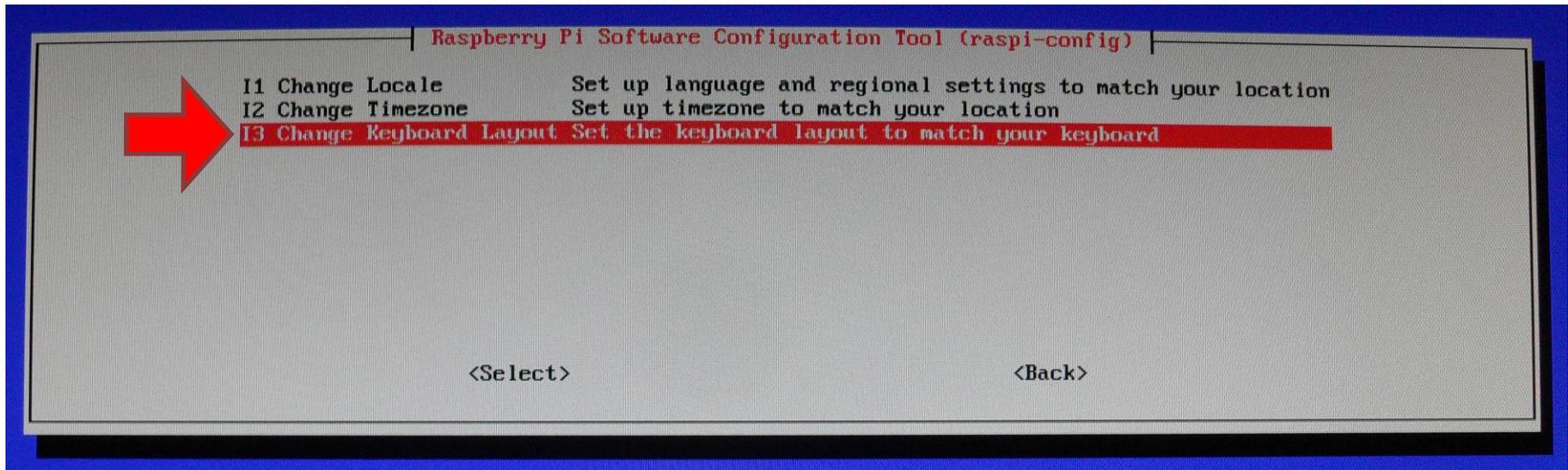
Hands-On: Configuring the Pi

Setting the keyboard layout

3. Choose an appropriate US keyboard type
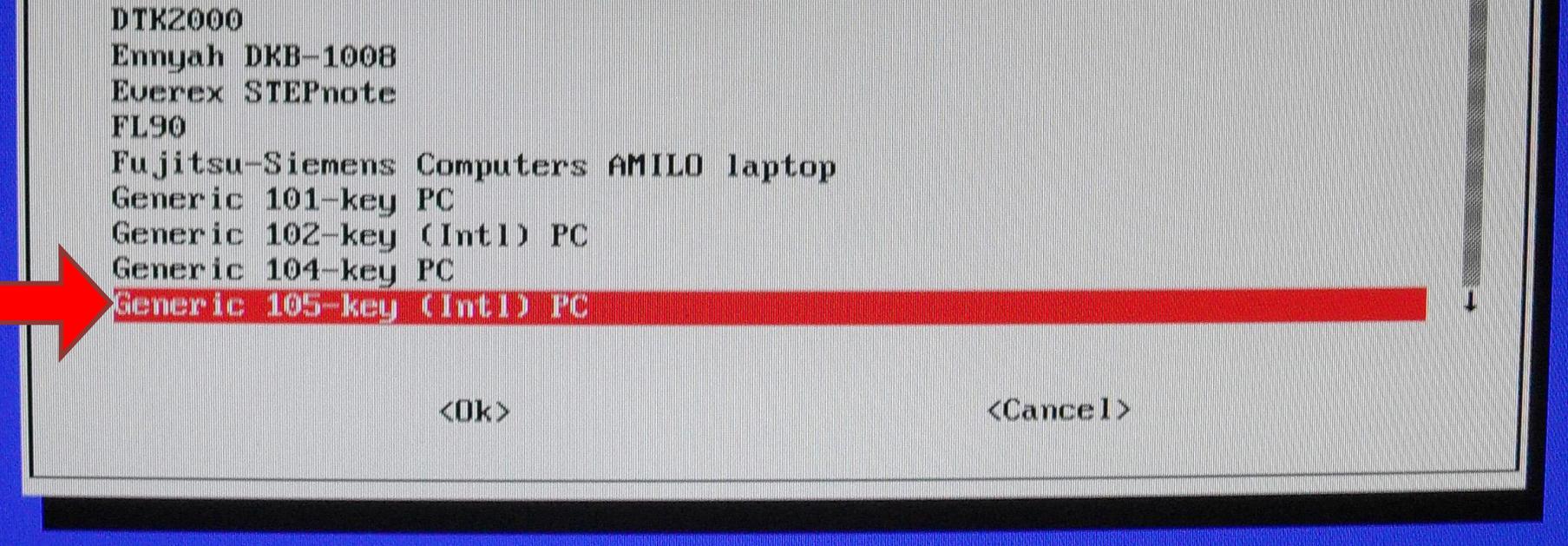
Hands-On: Configuring the Pi

Setting the keyboard layout

4. Choose **English (US)** for keyboard layout
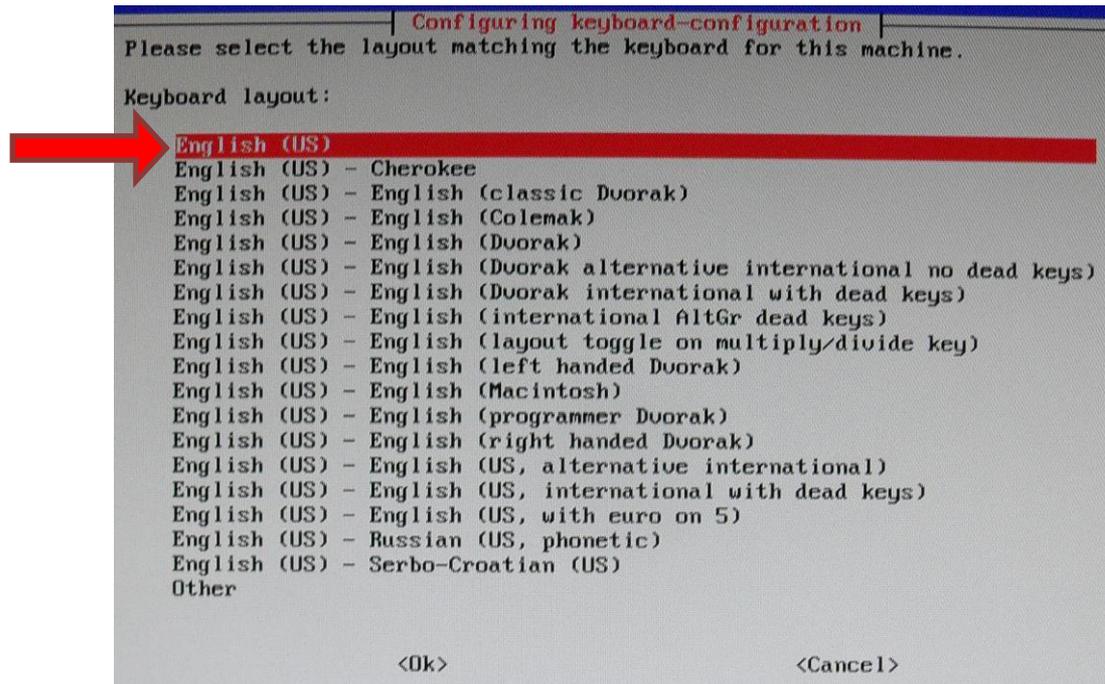
Hands-On: Configuring the Pi

Setting special command keys for the keyboard

5. Choose **the default for the keyboard layout**
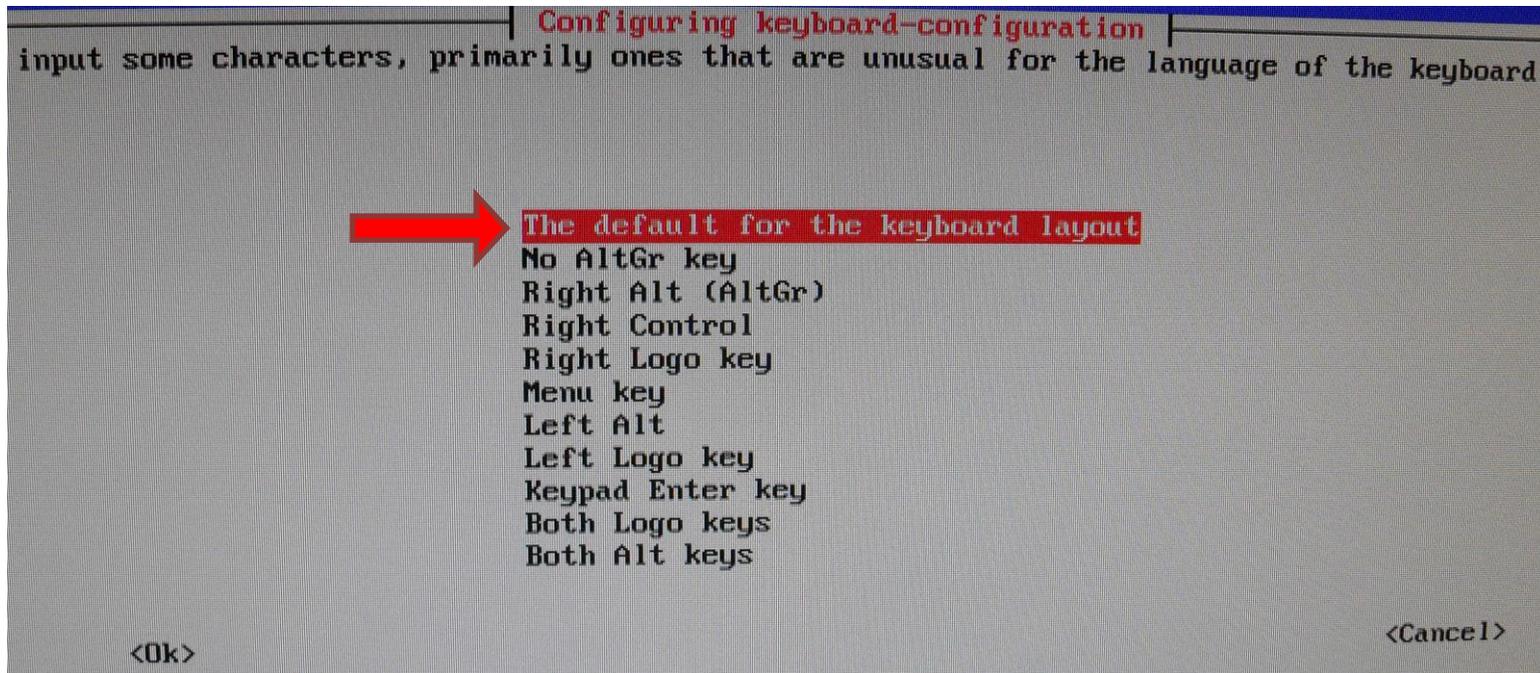
Hands-On: Configuring the Pi

Setting special command keys for the keyboard

6. Select **No** for the Control+Alt+Backspace command
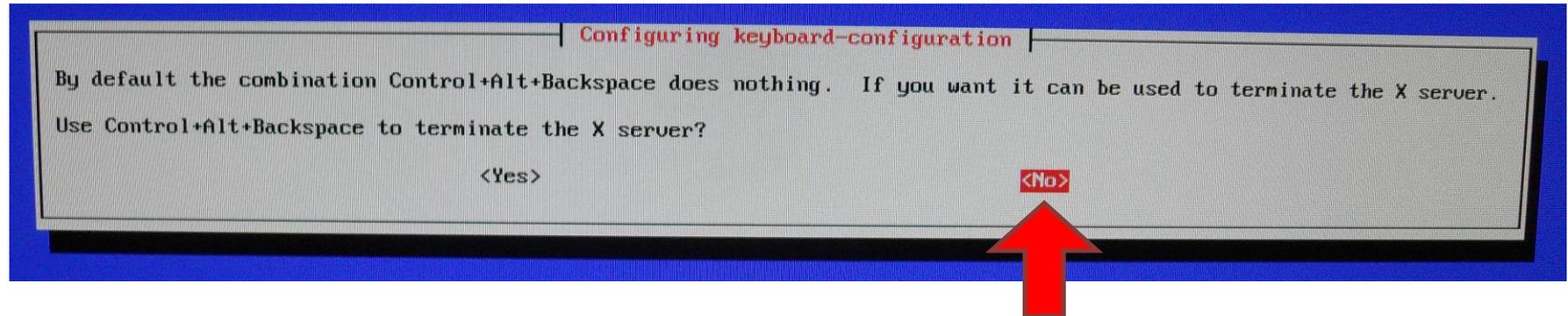
Hands-On: Configuring the Pi

Enabling the camera socket

7. Choose option **5 Enable Camera**

Hands-On: Configuring the Pi

Enabling the camera socket

    8. Select **Enable**
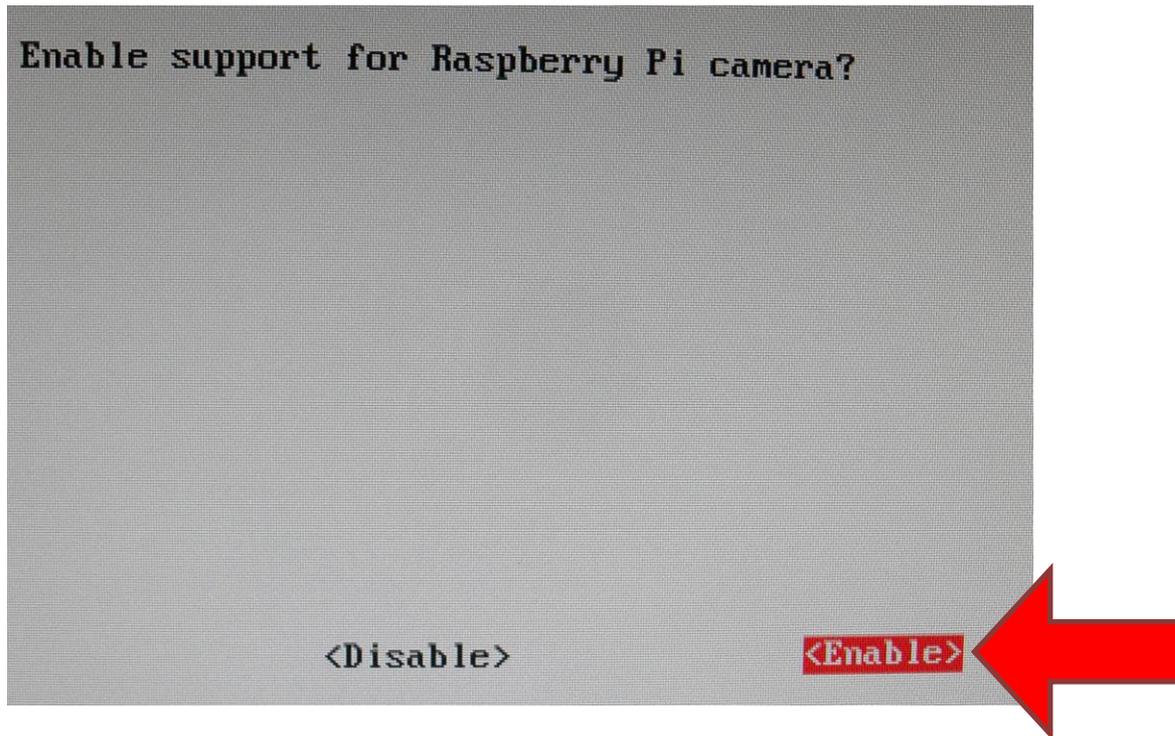
Hands-On: Configuring the Pi

Optional: Set to automatically boot to GUI

9. Choose option **3 Enable Boot to Desktop/Scratch**

Hands-On: Configuring the Pi

Optional: Set to automatically boot to GUI

10. Select **Log in as user 'pi' at the graphical desktop**
then select **Ok**
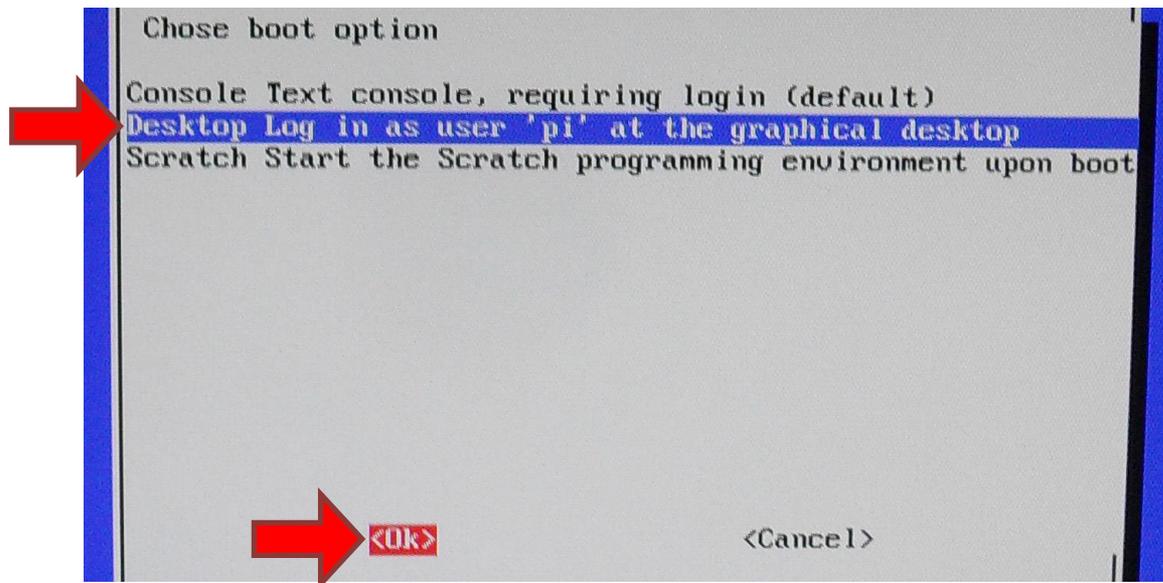
Hands-On: Configuring the Pi

Exit the configuration tool

11. Select **Finish**
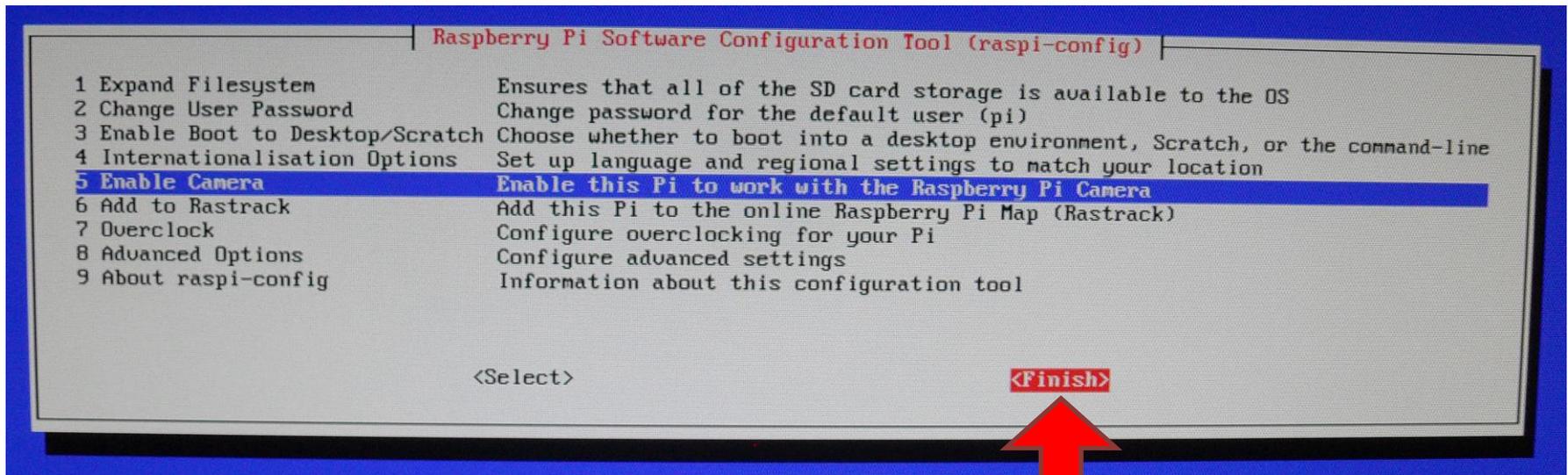
Hands-On: Configuring the Pi

Exit the configuration tool

12. Select **Yes** if prompted to reboot
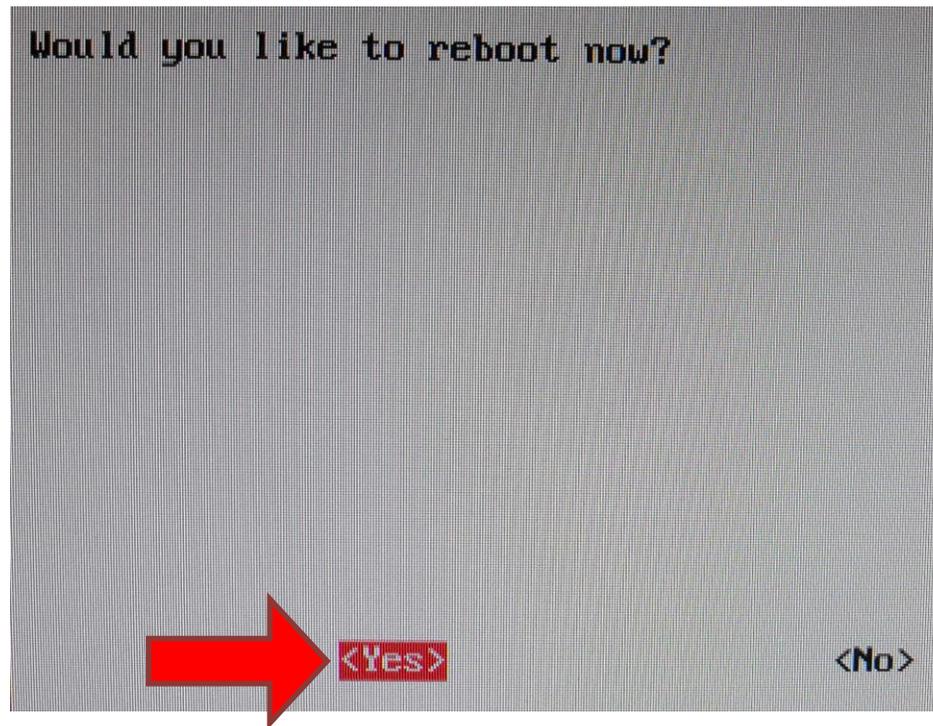
Hands-On: WiFi Setup

Login: **pi**

Password: **raspberry**
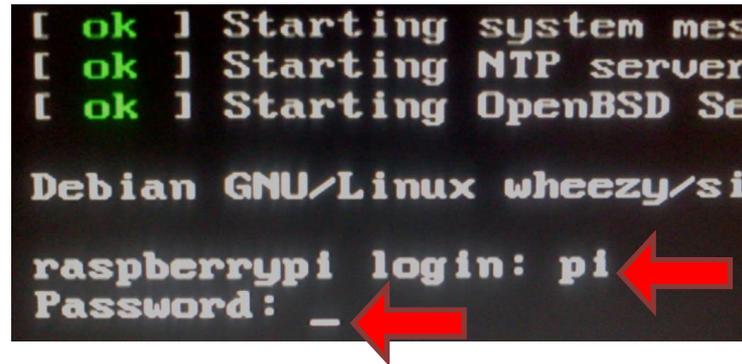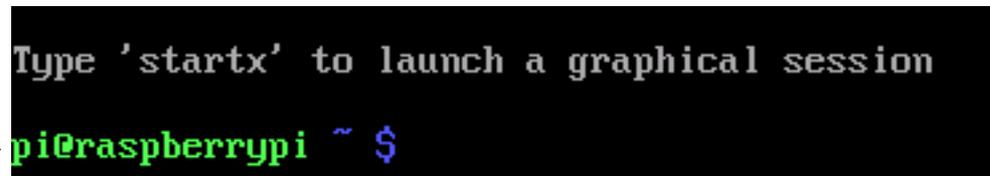
The Command Line
~$

Type the following command and press ENTER

~$ **startx**

Hands-On: WiFi Setup

The Raspbian Desktop
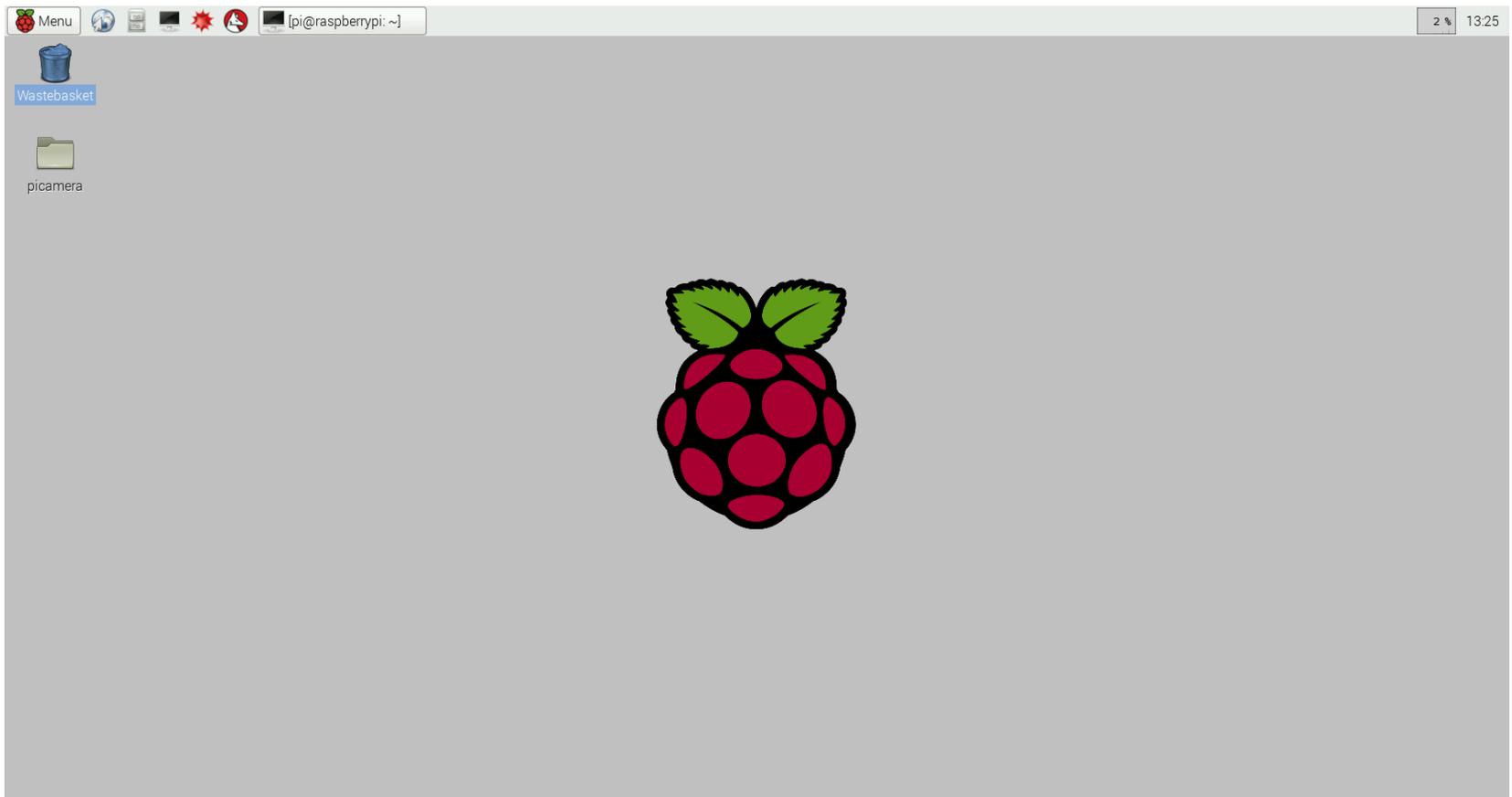
Hands-On: WiFi Setup

Confirm that the WiFi dongle has been detected

1. Click the **LXTerminal** button in the top left menu bar

2. Type the command below into the command line
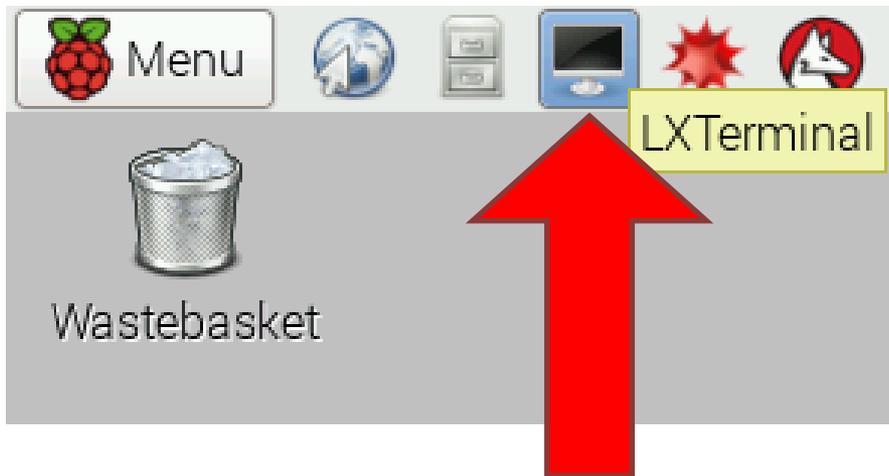
pi@raspberrypi ~ $

~$ ifconfig

Hands-On: WiFi Setup

Confirm that the WiFi dongle has been detected

3. You should see **wlan0** in the list
4. You can close the terminal by typing **exit** and pressing **ENTER** if **wlan0** is in the list


```
wlan0      Link encap:Ethernet  HWaddr 00:c1:41:29:39:97
           UP BROADCAST MULTICAST  MTU:1500  Metric:1
           RX packets:22 errors:0 dropped:0 overruns:0 frame:0
           TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:3428 (3.3 KiB)  TX bytes:5682 (5.5 KiB)

pi@raspberrypi ~ $
```

Hands-On: WiFi Setup

Connect to ND-Guest

5. Click the menu button find **Preferences**
6. From Preferences select **WiFi Configuration**
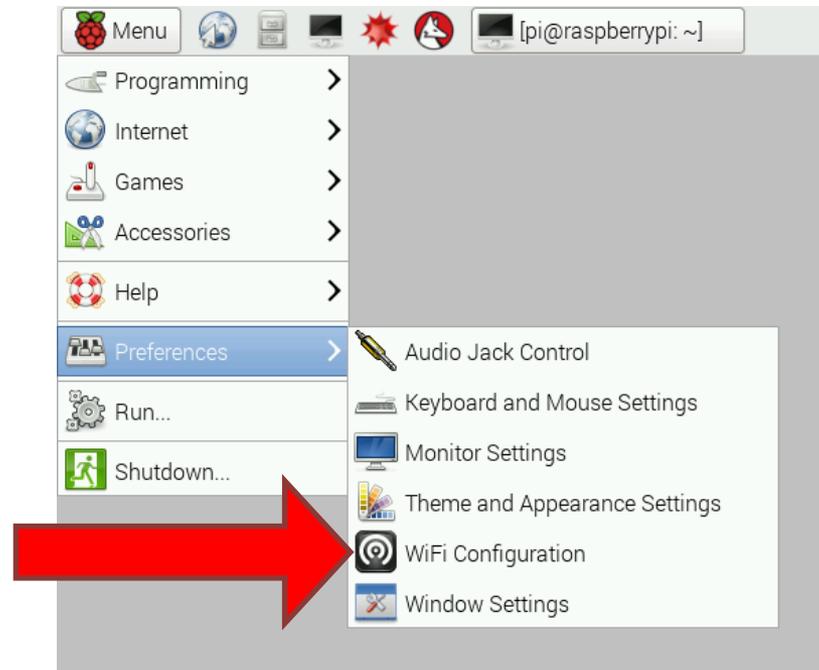
Hands-On: WiFi Setup

Connect to ND-Guest

7. Click the **Scan** button

8. Double click **ND-Guest** from the list
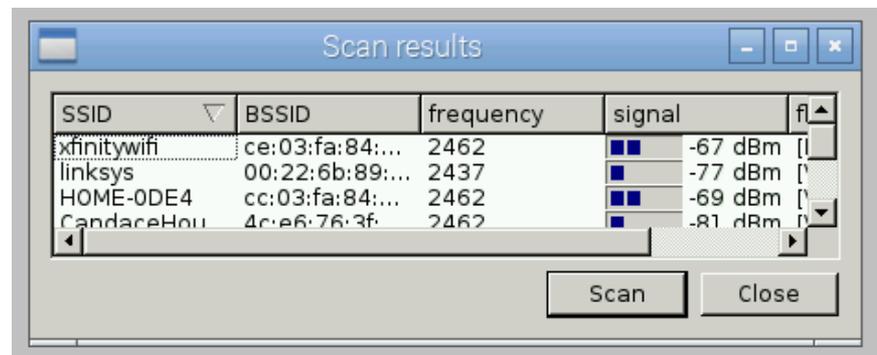
Hands-On: WiFi Setup

Connect to ND-Guest

9. Click on the **Add** button without making any changes to ND-Guest
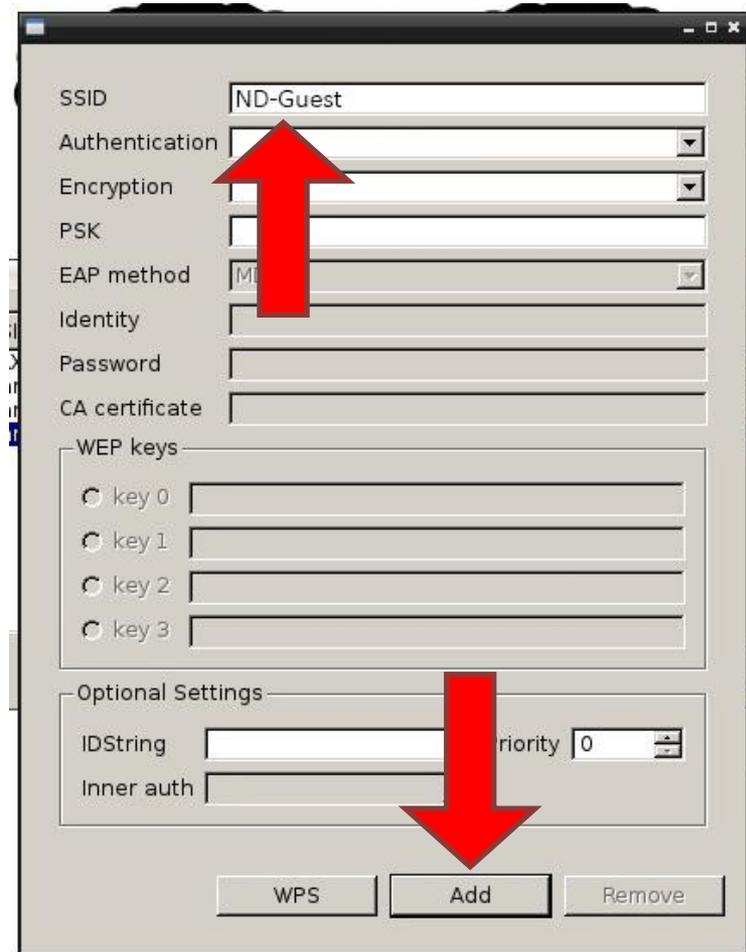
Hands-On: WiFi Setup

Connect to ND-Guest

10. Make sure **ND-Guest** is the selected network
11. Click the **Connect** button
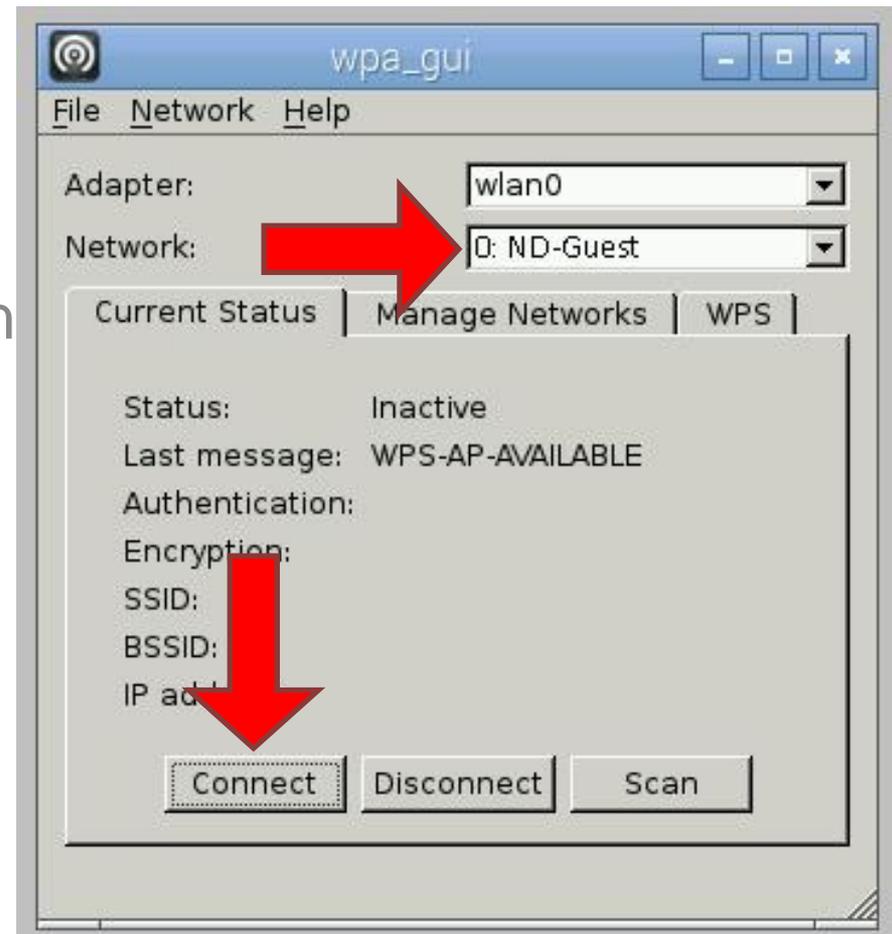
Hands-On: WiFi Setup

The Wifi connection should now be working

The WiFi Configuration Tool will be running in the background. You might see it in the top right corner of your screen.
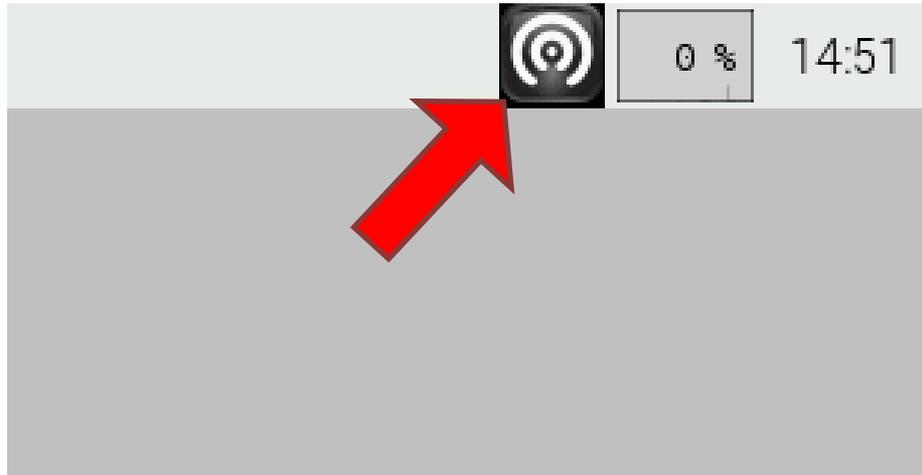
Hands-On: The Command Line

The command line gives you more control

Click on the **LXTerminal** button in the top left menu bar. This will give you access to a console that can do everything the GUI can and more.
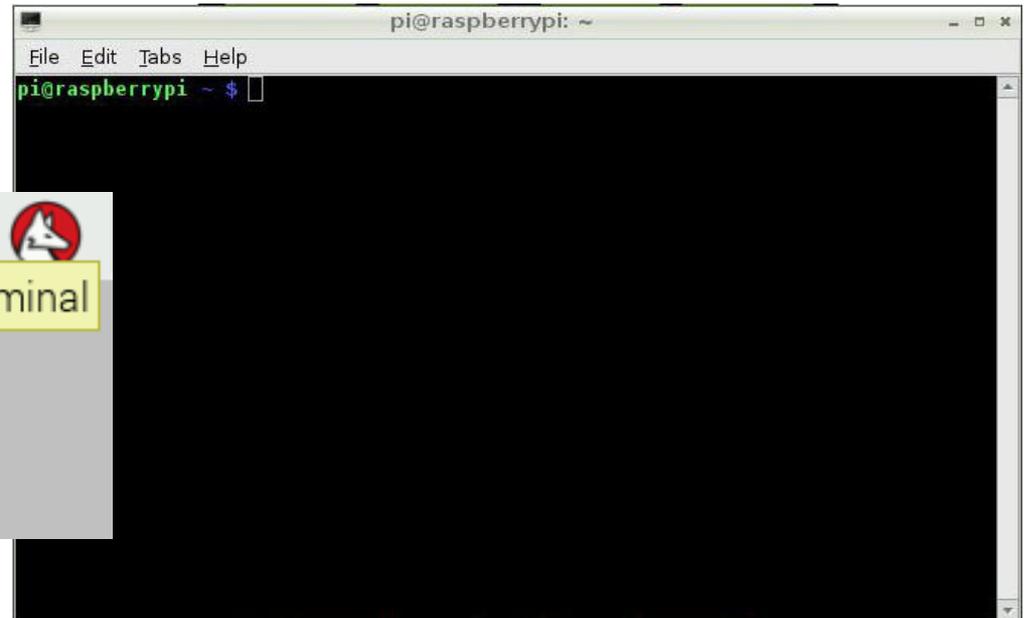
Hands-On: The Command Line

Learning how to use the command line

As we go through the command line lesson you can also have your file system opened in the GUI so you can see some of the changes we make.
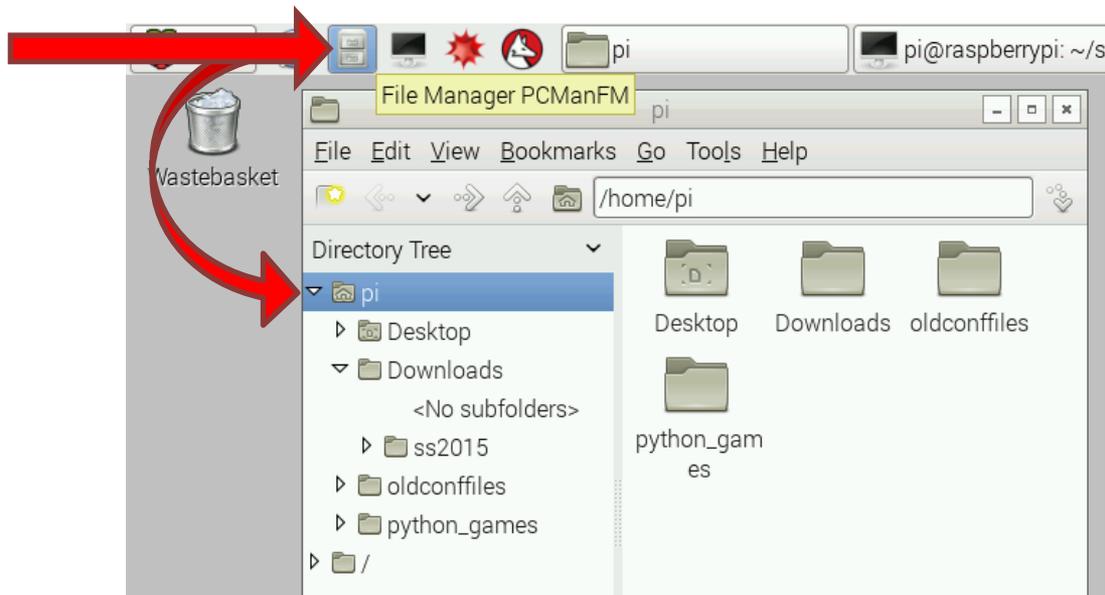
Hands-On: The Command Line

Learning how to use the command line

You may have already used a few different commands during this presentation.

```
~$ sudo raspi-config
~$ startx
~$ ifconfig
```

Now we can learn some more commands. Try each command as we go through them.

Hands-On: The Command Line

Learning how to use the command line

Echo will print the argument to the console.
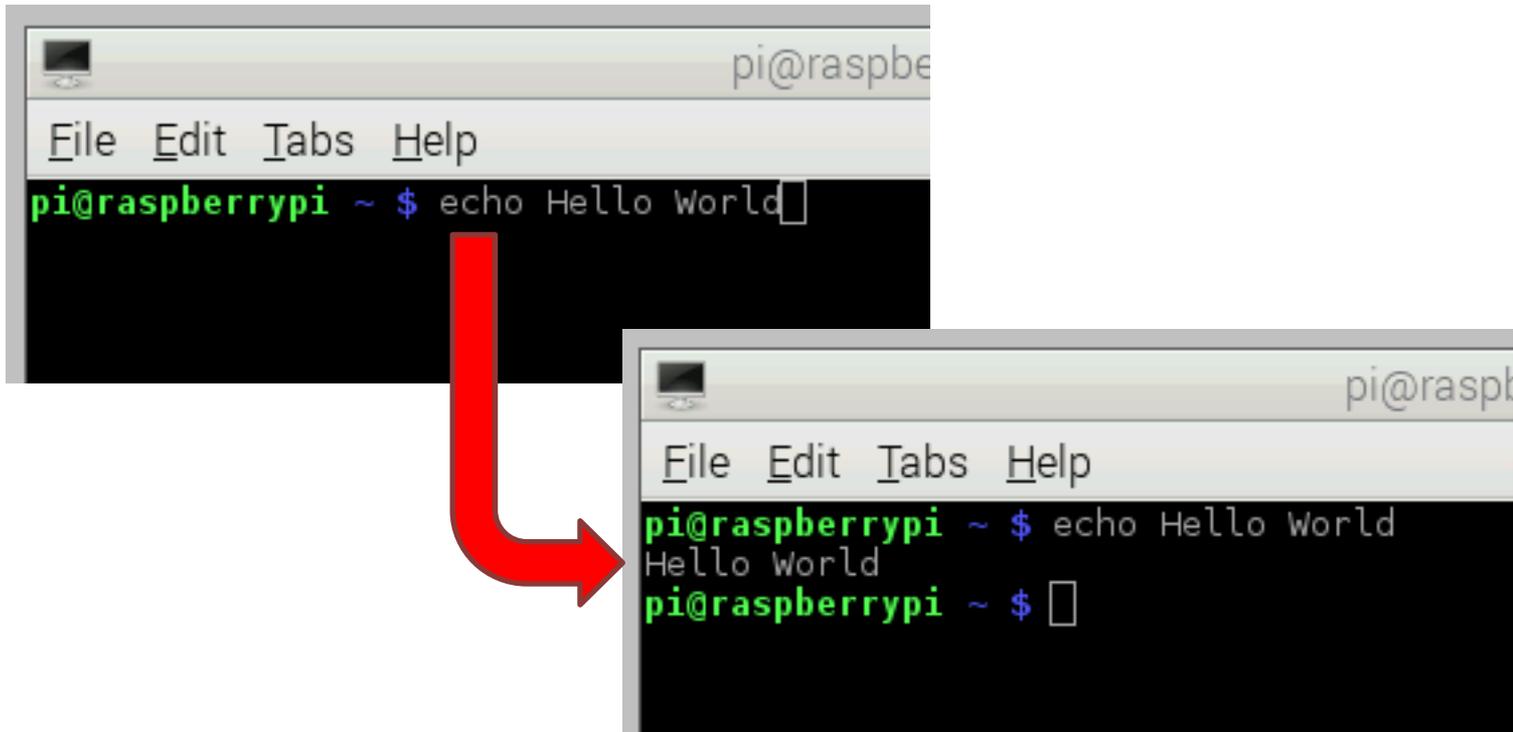
Hands-On: The Command Line

Learning how to use the command line

Man will show you the manual page for the argument.

Press Q on the keyboard to exit the manual page.
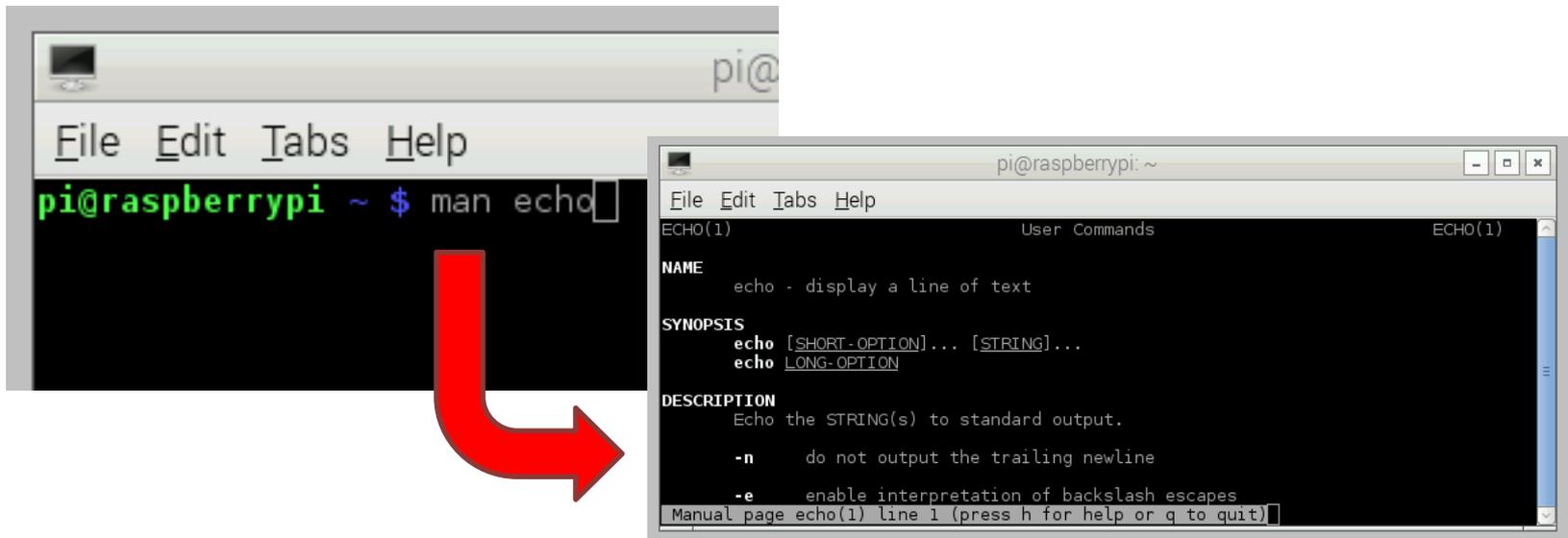
Hands-On: The Command Line

Learning how to use the command line

Apropos is used to search the manual page descriptions for the specified keyword. You can find commands with "copy" in their descriptions as an example.

Hands-On: The Command Line

Learning how to use the command line

Clear will move the prompt to the top of the console window. This effectively clears the console.
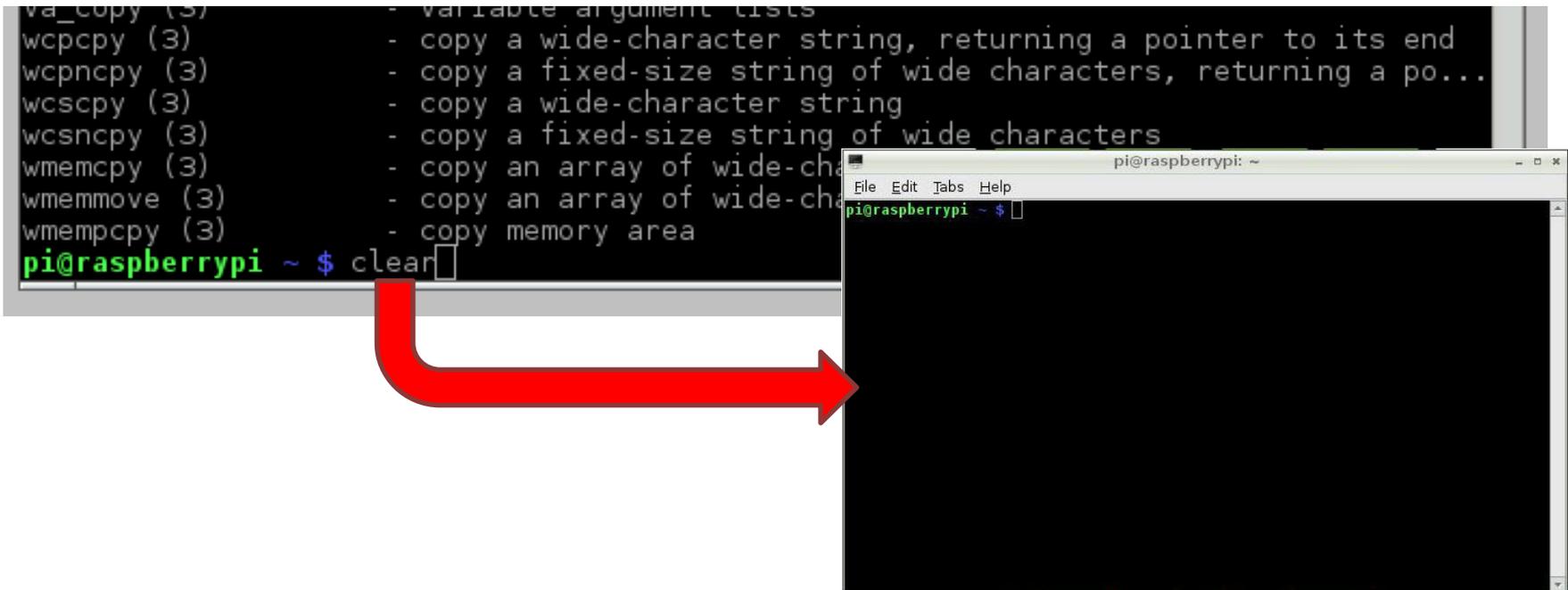
Hands-On: The Command Line

Learning how to use the command line

Pwd will print the current working directory path. This is basically "where you are" with this console.
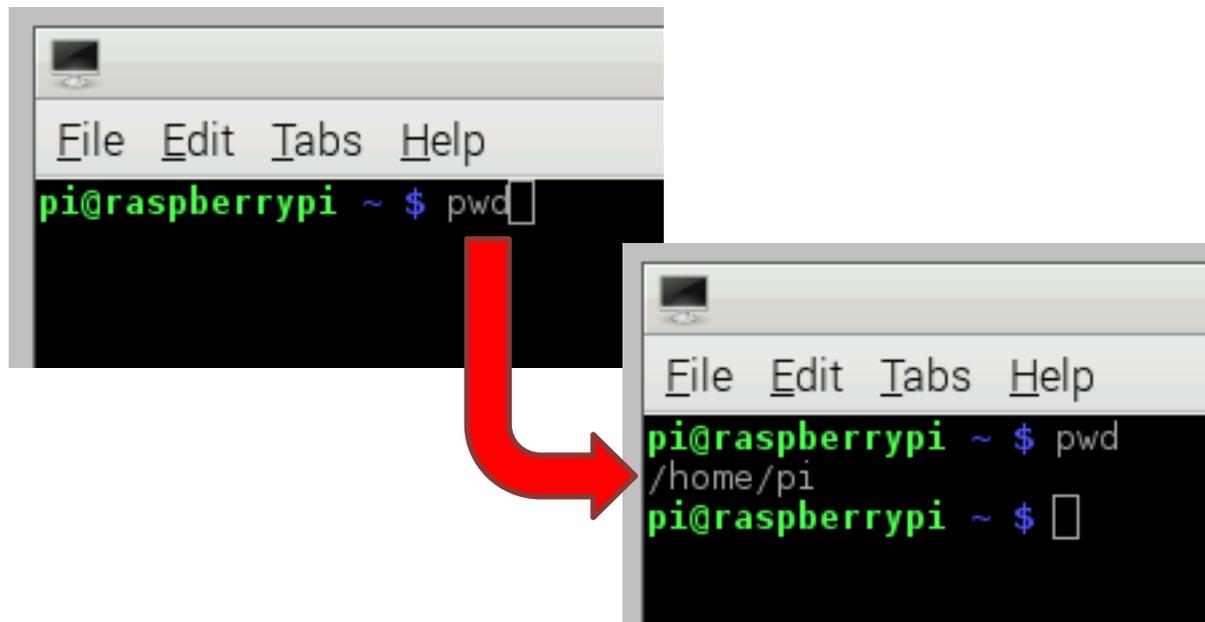
Hands-On: The Command Line

Learning how to use the command line

Ls will list the directories in the current working directory.
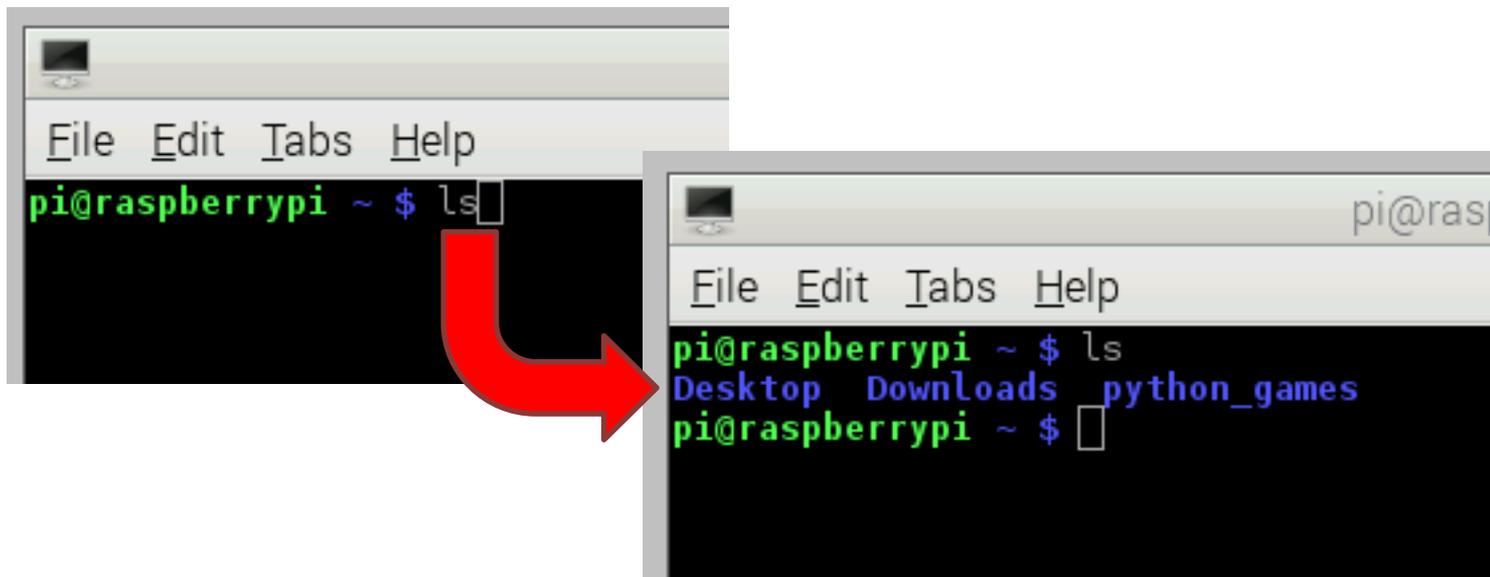
Hands-On: The Command Line

Learning how to use the command line

Most commands have options (arguments) that change their behavior. The options usually start with a "-" and are typed after the command.
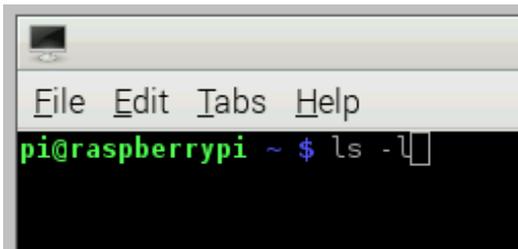
~$ `ls -a` ➡️ *Display hidden files*
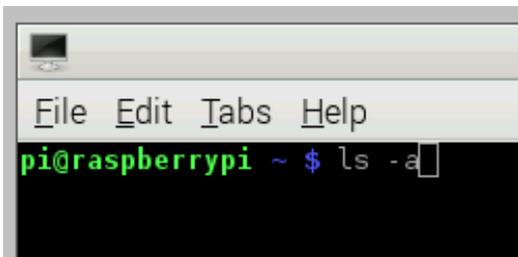
~$ `ls -l` ➡️ *List files in long format*

Hands-On: The Command Line

Learning how to use the command line

You can combine most arguments. Try using both "a" and "l" after the **ls** command.

Hands-On: The Command Line

Learning how to use the command line

Mkdir will create a new directory with the name you specify after the command. Use **mkdir** and then use **ls** to see the directory you created.
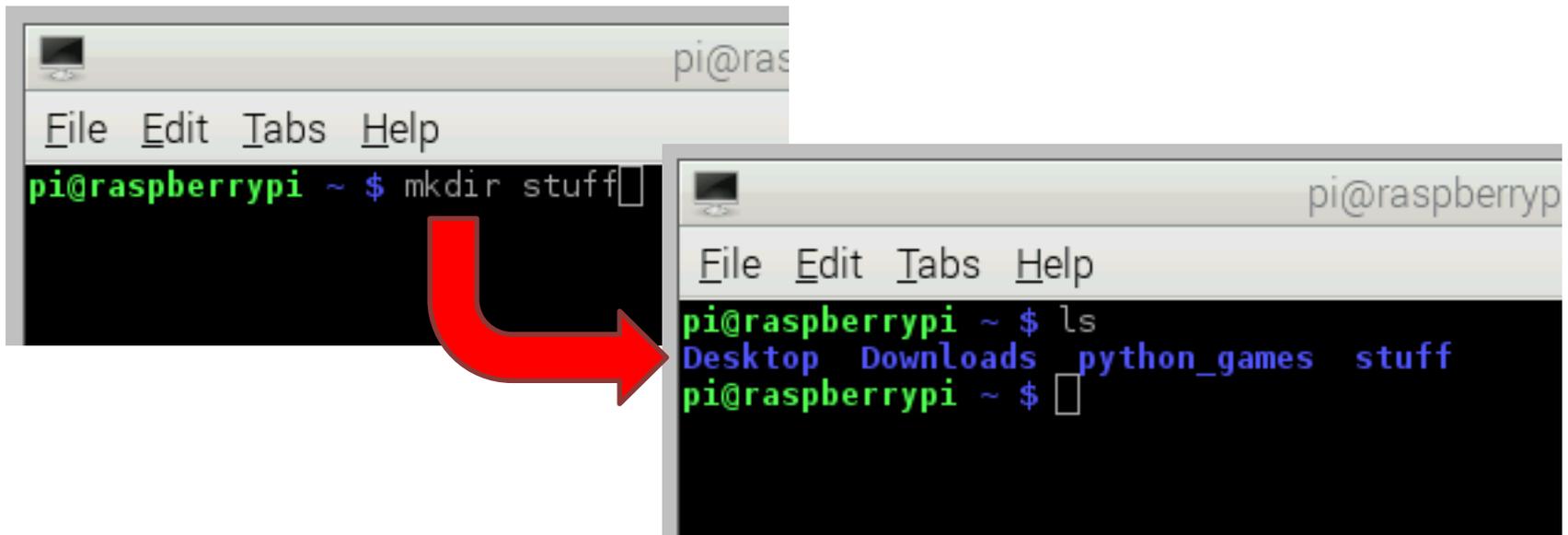
Hands-On: The Command Line

Learning how to use the command line

Cd is used to change the current working directory. Specify the directory or directory path after the command.

You can also use the **tab** key to auto-complete directory and file names in the console.
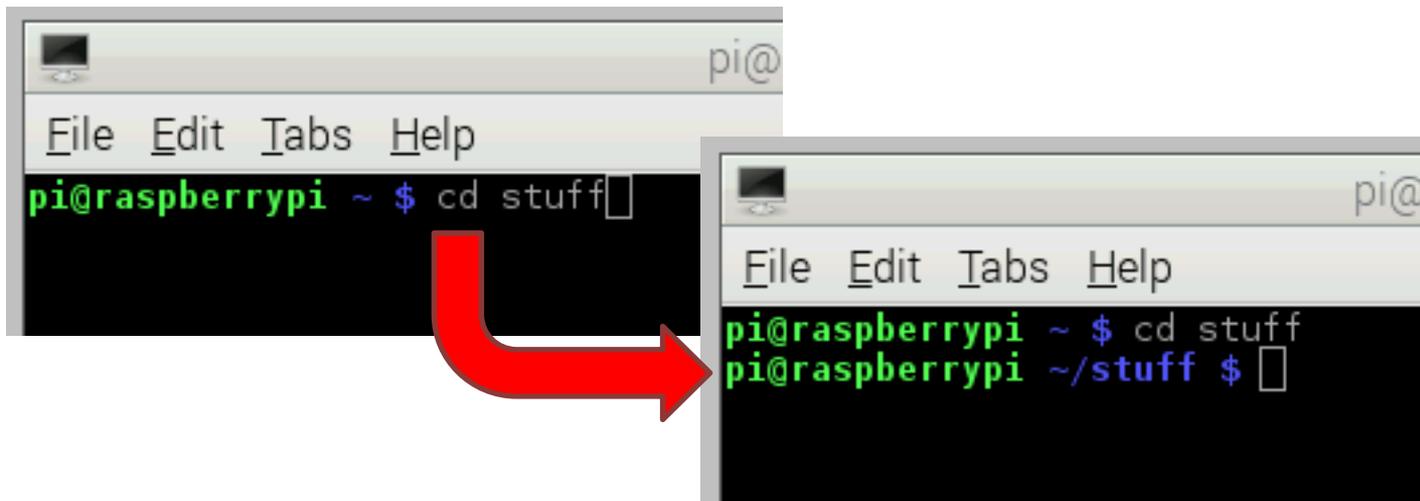
Hands-On: The Command Line

Learning how to use the command line

Type the **pwd** command again to see how the current working directory path has changed.
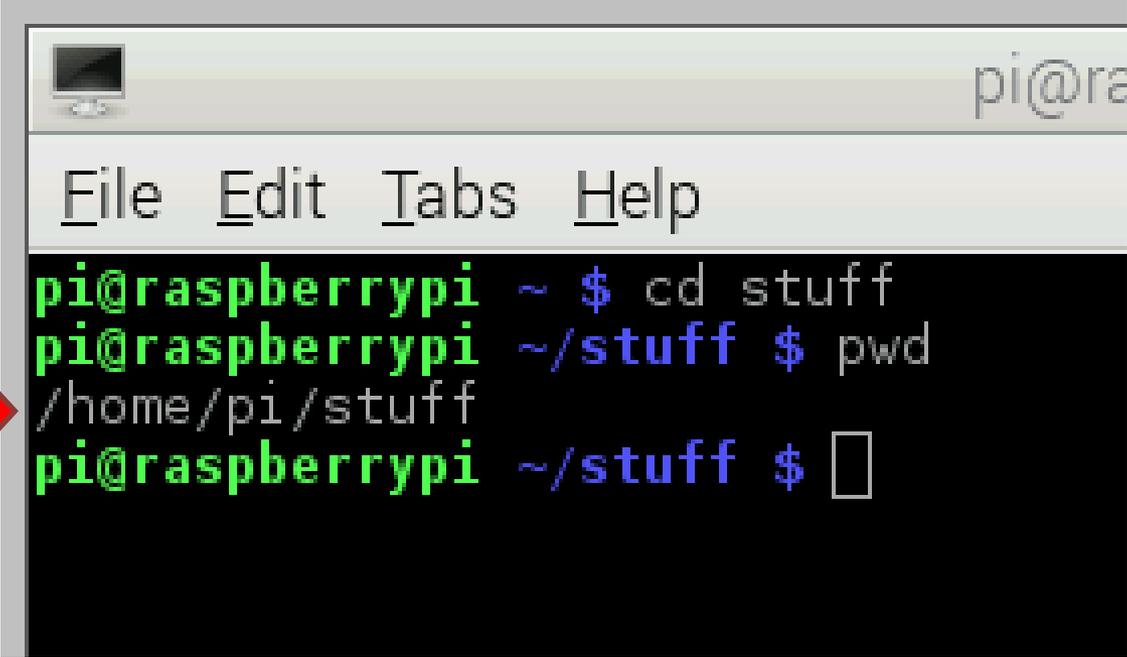
Hands-On: The Command Line

Learning how to use the command line

Create and open a simple text file with **leafpad myfile.txt**
This creates a text file called myfile.txt and opens it in a
text editor called LeafPad automatically.
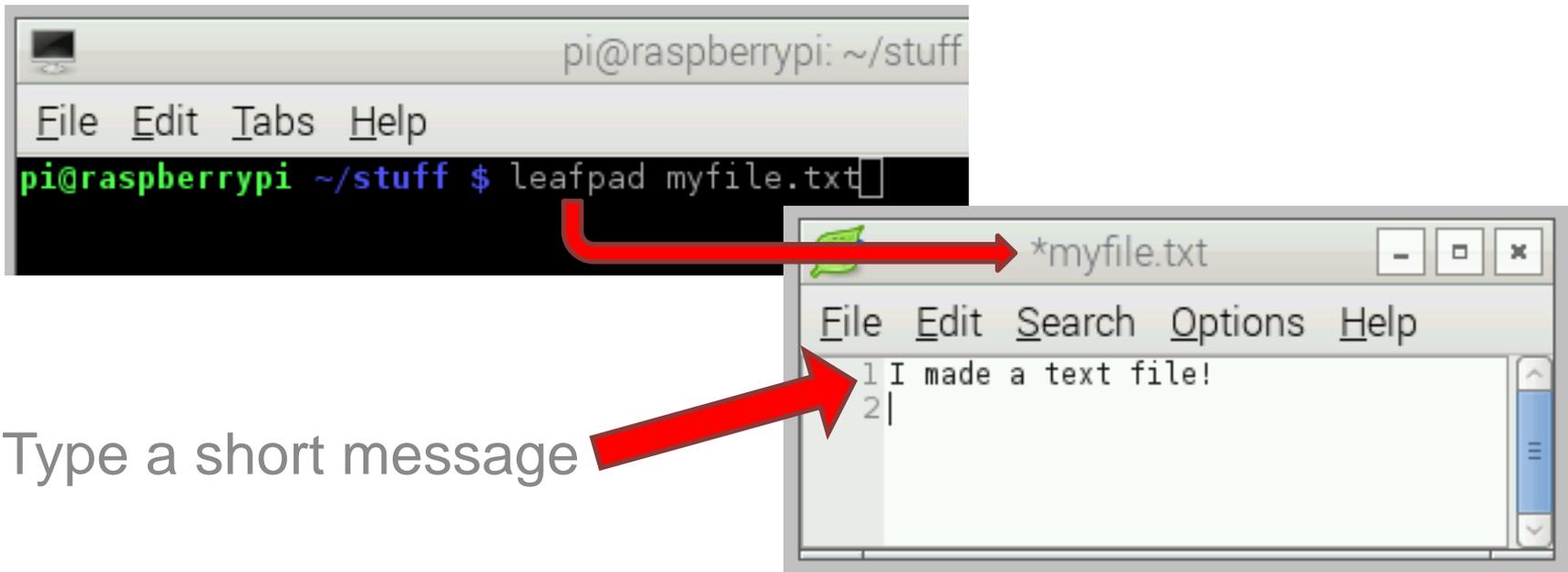
Type a short message

Hands-On: The Command Line

Learning how to use the command line

Use the **ls** command to see the new text file. If you want to view the contents of the text file without opening LeafPad back up, use the **cat** command followed by the file name.
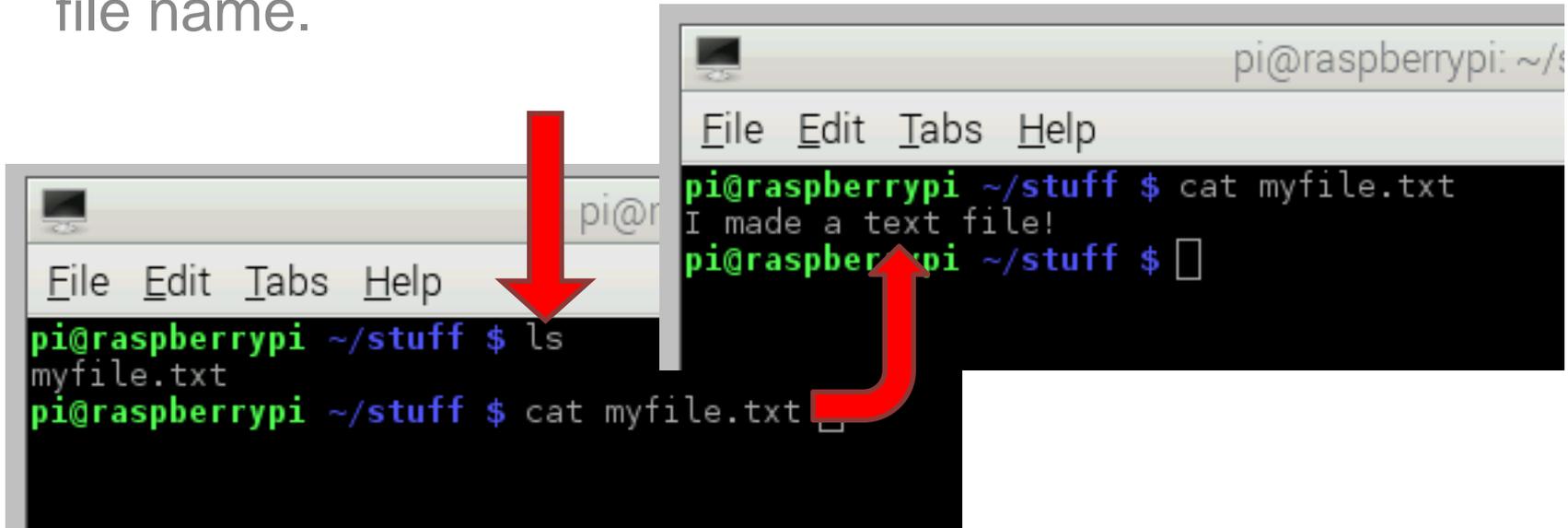
Hands-On: The Command Line

Learning how to use the command line

Cp will copy your file to the specified directory. In this example you can type **ls /home/pi** to see the copied file.
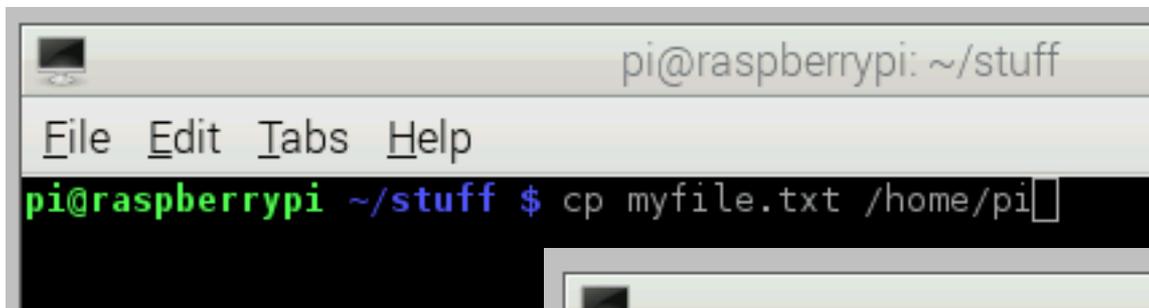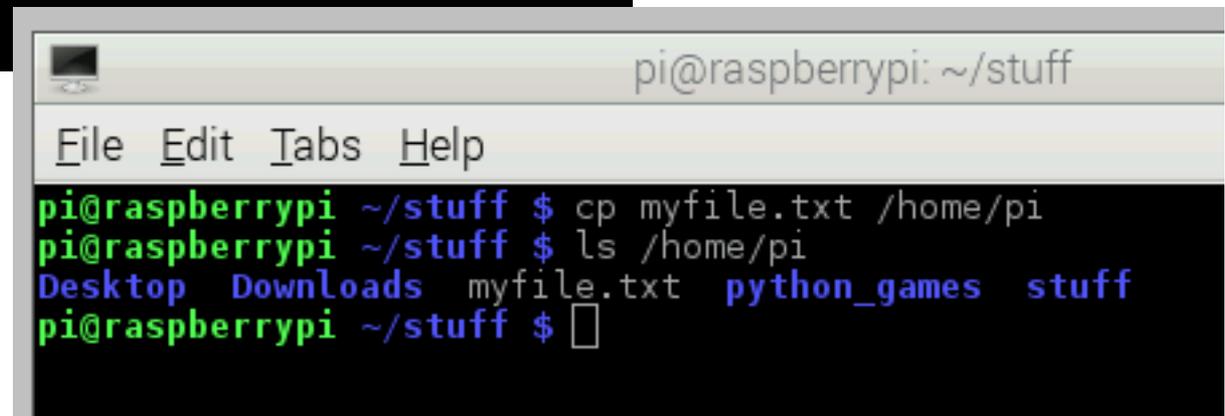
Hands-On: The Command Line

Learning how to use the command line

Rm will remove the specified file or files. Add the argument "-v" (verbose) to have an explanation of what is being done printed to the console.
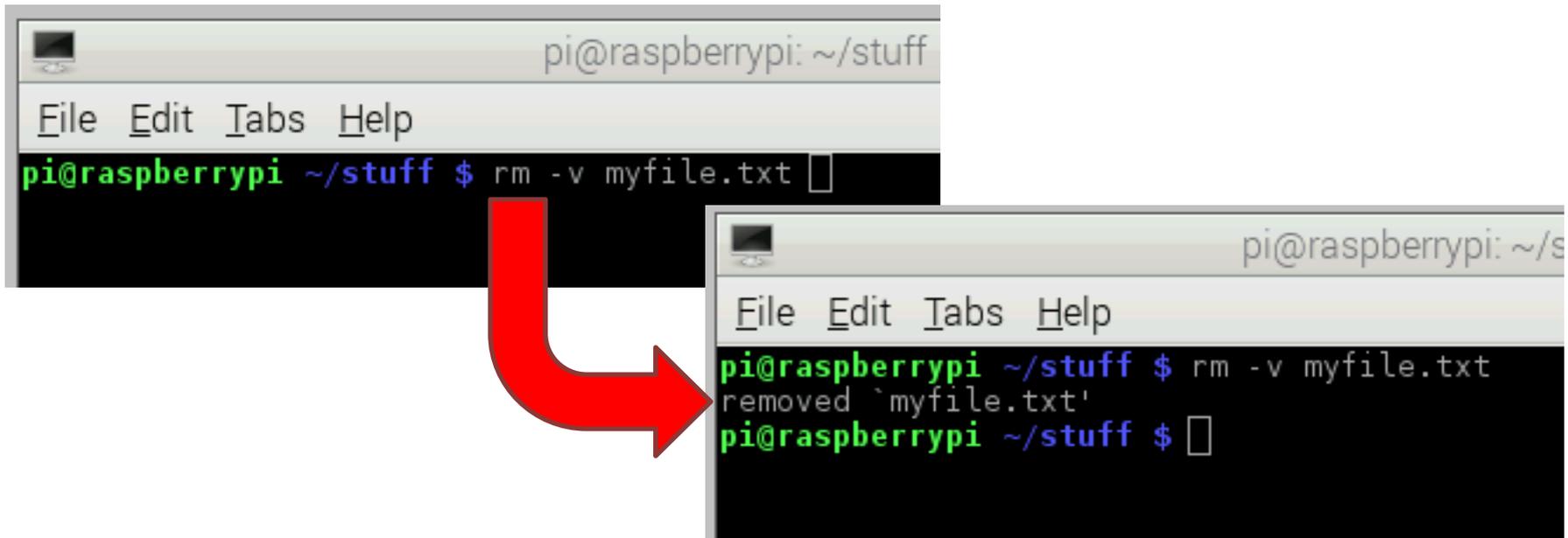
Hands-On: The Command Line

Learning how to use the command line

To navigate back one directory use **cd ..**

To return to your home directory use **cd ~**

Hands-On: The Command Line

Learning how to use the command line

Use **rmdir -v stuff** to remove that directory we created earlier in the lesson.
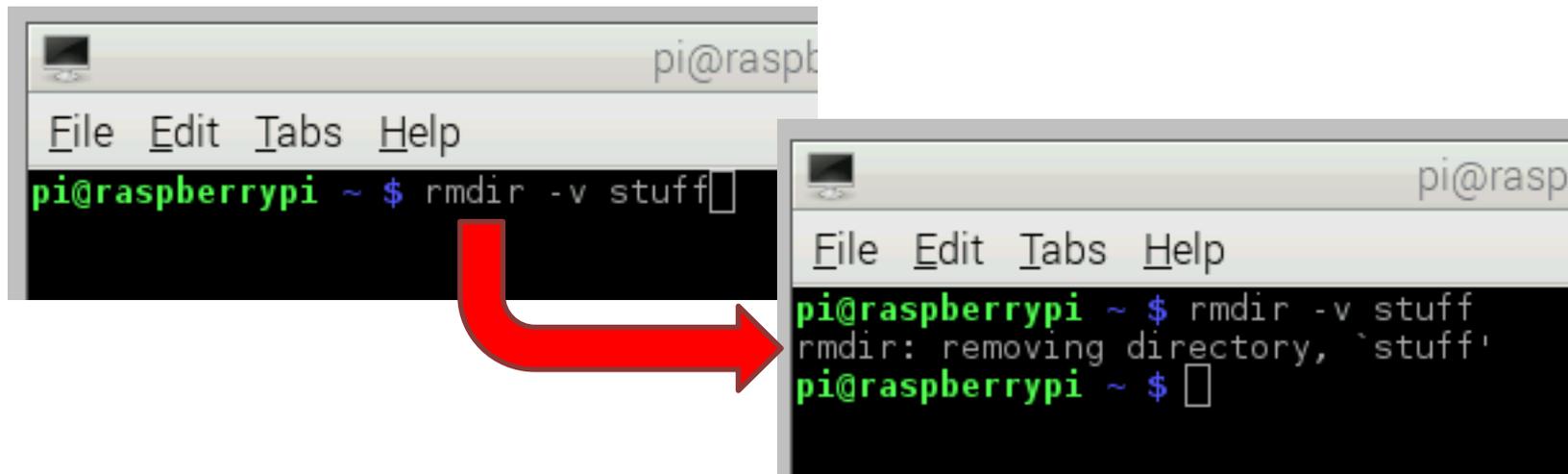
Hands-On: The Command Line

Updating the Raspberry Pi

- **Sudo** means Super-User DO and is followed by a command that requires the super-user to complete.

- **Apt-get** is a package manager that you use to install, update, and upgrade your software.

- **Wget** is used to access files from the internet.

Hands-On: The Command Line

Updating the Raspberry Pi

Use the following command to download a file I have prepared from the internet. The file will be downloaded into your current working directory.

```
~$ wget https:/www.dropbox.com/s/
    pLmz498wo3kgnpj/ss2015.tar
```

Hands-On: The Command Line

Updating the Raspberry Pi

You downloaded a type of archive called a **tar** file. To extract the contents of the tar file into your current directory, use the following command:

```
~$ tar -xvf ss2015.tar
```
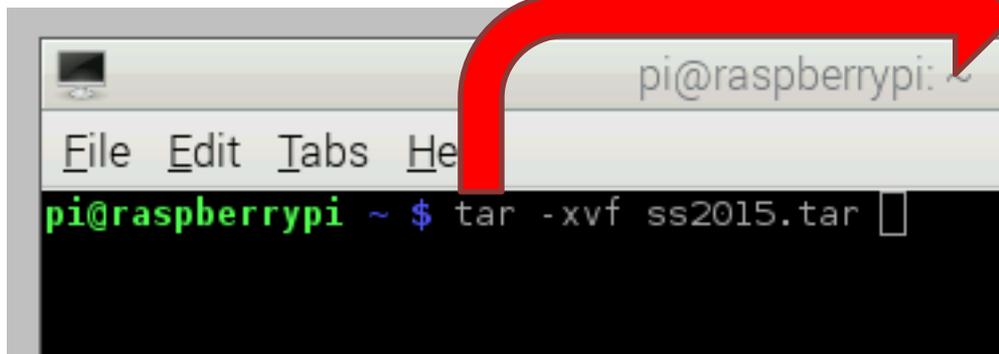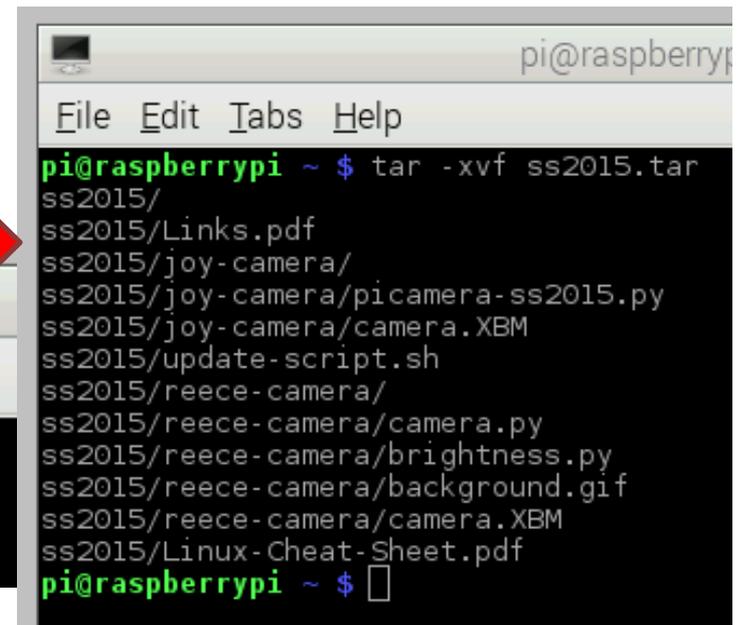
Hands-On: The Command Line

Updating the Raspberry Pi

The contents of the tar file will be displayed as they are extracted because of the "-v" option we used. You can use **cd ss2015** and **ls -l** to see the contents of the directory.
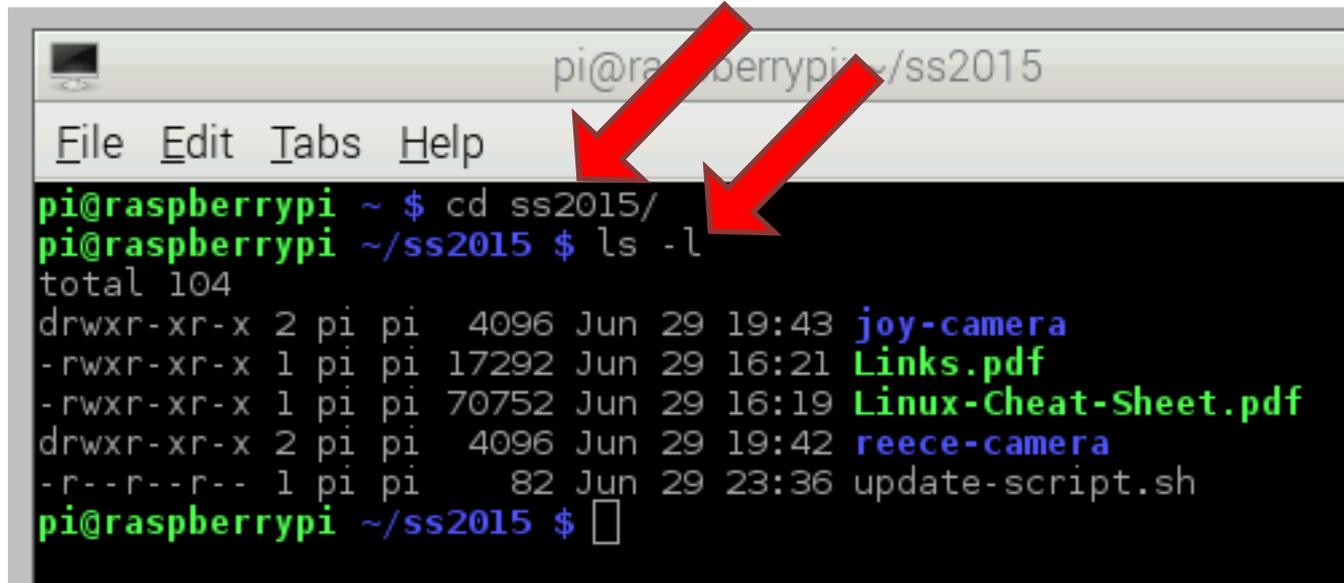
Hands-On: The Command Line

Updating the Raspberry Pi

A file called **update-script.sh** is in the ss2015 directory. This is a shell script. It's a text file that contains console commands that will execute if you run the shell script. Type **cat update-script.sh** to see the contents of the script.

```
~$ cat update-script.sh
```

Hands-On: The Command Line

Updating the Raspberry Pi

Try to run the shell script by typing the following:

~$ ./update-script.sh

What did it do?
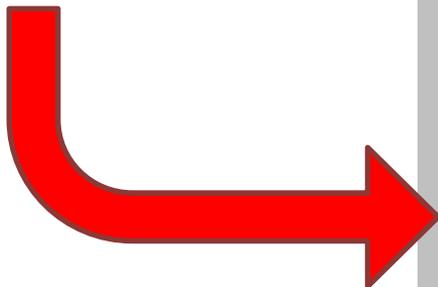
Hands-On: The Command Line

Updating the Raspberry Pi

You need to set permissions for the shell script file. Type **ls -l** to see the permissions for the files in **ss2015**.

R = read, **W** = write, **X** = execute

Owner Group World

r w x   r w x   r w x

```
drwxr-xr-x 2 pi pi  4096 Jun 29 15:42 reece-camera
-r--r--r-- 1 pi pi    70 Jun 30 01:41 update-script.sh
pi@raspberrypi ~/ss2015 $
```

Hands-On: The Command Line

Updating the Raspberry Pi

We want the file to have full permissions for the owner, and read/execute permissions for all others. We use the **chmod** command to accomplish this.

```
~$ chmod 755 update-script.sh
```

Hands-On: The Command Line

Updating the Raspberry Pi

You can use **ls -l** to see that the file now has the proper permissions.

`-rwxr-xr-x`

Hands-On: The Command Line

Updating the Raspberry Pi

Now you can run the shell script!

```
~$ ./update-script.sh
```

If you are prompted to confirm any of your updates, just press **Y** and then press **ENTER**. Also, the update may create the **oldconffiles** directory.

Raspberry Pi Demo

Mike Reece
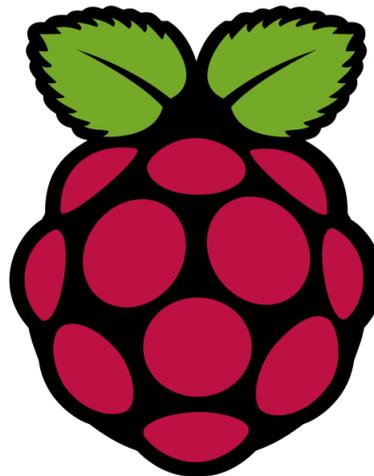
Hands-On: The Command Line

Installing the Python Pi Camera module

To install this module type the following:

```
~$ sudo apt-get install python-picamera
```

If you are prompted to confirm any of your updates, just press **Y** and then press **ENTER**.

Raspberry Pi Demo

Michael Joy
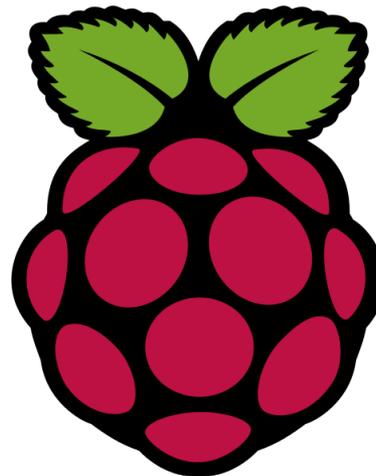
Hands-On: Python and PiCamera

Getting exposed to Python programming

Python is a fun and easy to learn programming language with wide use in the professional development world.

You'll only get a small taste of it here. There will be a 3 hour Python training session later in the week.

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Before we us Python, run this command in a console:

```
~$ raspistill -v -o ss2015.jpg
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

This command will take a picture with the Pi Camera using the default settings. The picture will be called "ss2015.jpg" (unless you called it something else).

The text that printed out are all options that we can control.

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Lets launch **IDLE** from the console, which is an integrated development environment for Python.
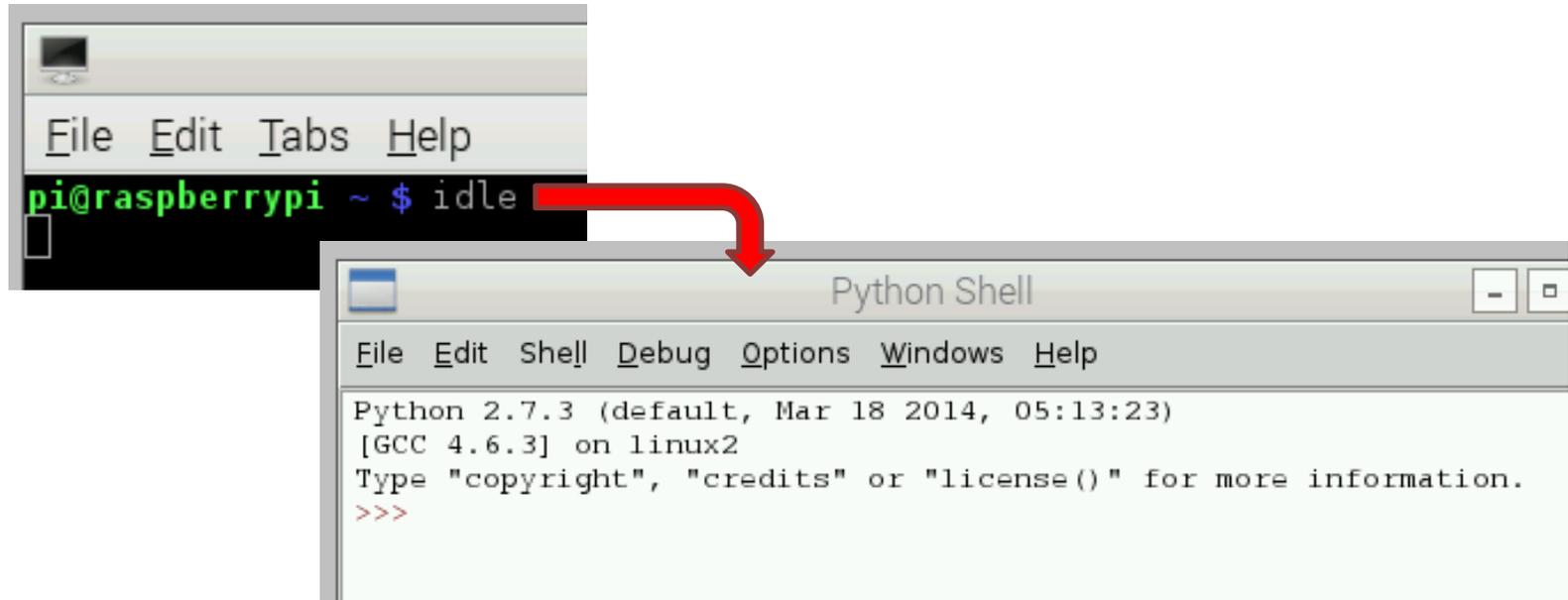
Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

First, you'll need to type **import os** and press ENTER so you have access to operating system functionality. This will let us call the raspistill command from inside of IDLE with Python.
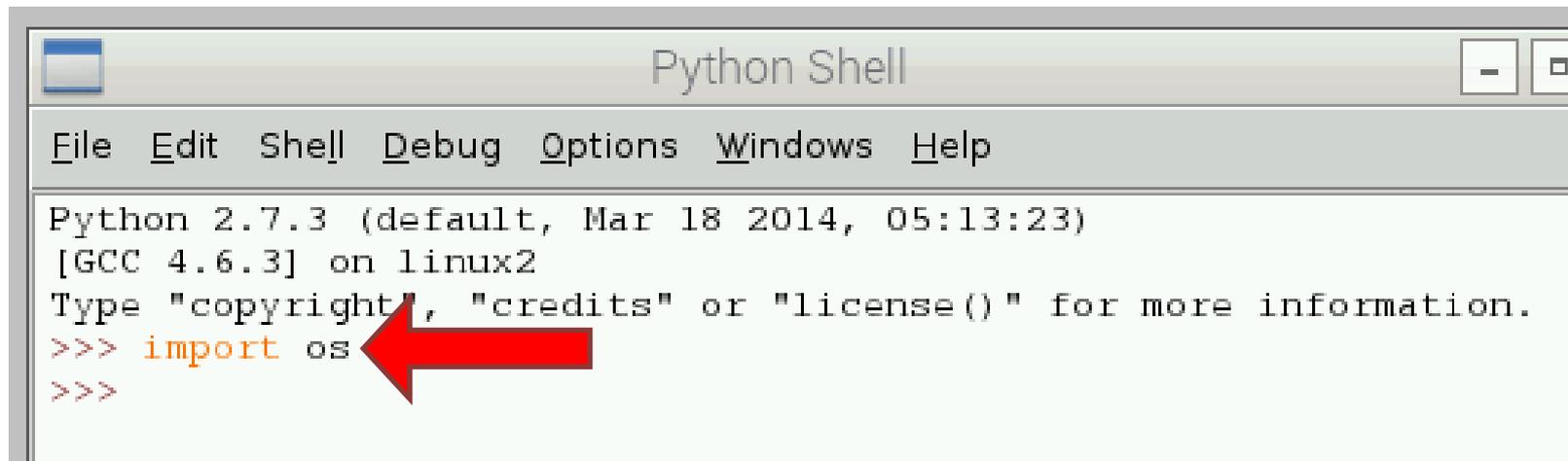
Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Now we can call the same command we used earlier in the console. To do that type the following:

`os.system("raspistill -v -o hello.jpg")`

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Now try using some of these options for the camera:

```
-w 600 -h 800 -q 70 -ifx cartoon
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

You can also take video with the camera:

```
os.system("raspivid -o myvideo.h264")
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Use this command to see a small preview of your video:

```
os.system("omxplayer --win '0 0 320 240' myvideo.h264")
```

Or this to see it full size:

```
os.system("omxplayer myvideo.h264")
```

```
0
>>> os.system("raspiv     myvideo.h264")
0
>>> os.system("omxplayer --win '0 0 320 240' myvideo.h264")
```

Hands-On: Python and PiCamera

Options for the raspistill and raspivid commands

-o	output file name (-o picture.jpg *or* vid.h264)
-w	width (-w 600)
-h	height (-h 800)
-sh	sharpness, -100 to 100 (-sh 75)
-co	contrast, -100 to 100 (-co 50)
-br	brightness, 0 to 100 (-br 65)
-sa	saturation, -100 to 100 (-sa 85)
-vf	vertically flip image
-hf	horizontally flip image

Hands-On: Python and PiCamera

Options for the raspistill and raspivid commands

-q   jpeg image quality, 0 to 100 (-q 70)

-ifx   image effects (-ifx negative, solarise, sketch,

                              oilpaint, hatch, pastel, film,

                              watercolour, emboss, blur,

                              cartoon, and more!)

There are many more options for the Pi Camera:

https://www.raspberrypi.org/documentation/raspbian/applications/camera.md

Raspberry Pi

Feel free to experiment with the remaining time

- To exit IDLE, type **exit()** and press **ENTER** or click the **X** in the top right corner.
- To shutdown your Raspberry Pi select **Shutdown** from the menu in the top left corner then press **OK**.

Thank You!