

Raspberry Pi 3 and Linux

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1. Download the NOOBS installer from: www.raspberrypi.org/downloads/ The current version as of this writing is v2.4.4 (9/8/17).
2. Download and install SD Card Formatter from: https://www.sdcard.org/downloads/formatter_4/
3. Insert your SD card into a card reader attached to your computer. You should have a micro SD card that is at least 8GB (but no more than 32GB) and “Class 10”. It can be put into a standard-size SD card adapter and the SD card adapter then inserted into a SD card slot on your computer (or into a USB card reader attached to your computer).
4. Fully format the SD card using the SD Card Formatter program (i.e., use the “Overwrite format” option)
5. Unzip the files from the NOOBS download into a folder on your computer. (There should be 3 directories and 17 files)
6. Copy these 20 files and directories to the micro SD card’s root directory.
7. Now take the micro SD card and put it into the card slot on the RPi.
8. Plug in the power to the RPi and let it boot up. You should have a display attached to the HDMI port and a mouse and keyboard attached by USB port – either wired or via a USB dongle that came with your keyboard and/or mouse.
9. The initial screen will prompt you to pick an operating system to install. Choose Raspbian.
10. As the RPi boots up a lot of stuff will scroll by on the screen. Eventually you will see the graphical user interface screen that looks a lot like a typical windows interface.
11. Your next job is to configure a few things, like the locale, time zone, keyboard type, etc. Click on the raspberry in the upper left corner of the screen, then “Preferences” and then “Raspberry Pi Configuration”.

At the Linux command prompt there are a number of commands that are useful to know:

sudo poweroff	shutdown and turn off
sudo shutdown -h now	shutdown and turn off
sudo reboot	shutdown and reboot
sudo shutdown -r now	shutdown and reboot
sudo raspi-config	run the configuration program (alternative to GUI Preferences)
startx	start the graphical user interface
clear	clear command window
idle3	run the Python 3 shell
pwd	show the path of the current working directory
ls	show list of files (can use wildcard character ‘*’ for name or extension)
ls -al	show an expanded list of all files (ls ~, ls -lh, ls -l, ls -a)
cd <dir>	change directory to <dir>
cd ~	change to the /home/pi directory (for user pi)
cd ..	change to next higher level directory
cd /	change to the root directory
mkdir <dir>	make a new directory <dir>
rmdir <dir>	remove a directory
rm <filename>	remove (delete) a file
cp <filename> <dir>	copy a file to a given directory
mv	move or rename file
df	display disk free file space (df -h)
du	display disk usage (du -s)

<code>free -m</code>	display memory usage
<code>sudo fdisk -l</code>	display mounted volumes
<code>cat <filename></code>	display contents of a file
<code>less <filename></code>	view contents of a file
<code>find / -mtime 1</code>	search for files changed in the last day
<code>find ~ -atime 100</code>	find all files in your home folder accessed more than 100 days ago
<code>find / -iname *.pdf</code>	find all pdf files anywhere on the computer (case insensitive search)
<code>find / -name game</code>	find file named 'game' anywhere on the computer
<code>find ~ -name game</code>	Search for 'game' in the users home folder
<code>find / -exec</code>	find all of the executable files on your computer
<code>find / -name *.mp3</code>	find all files with the extension mp3
<code>touch <file1> <file2> ...</code>	create files OR update timestamp on existing file(s)
<code>chmod</code>	change file owner
<code>nano</code>	run the text editor
<code>man <cmd></code>	display the Linux manual entry for the specified command
<code>man ls</code>	search manual for information on the ls command
<code>man -k browser</code>	search for info on browser program
<code>sudo apt-get dist-upgrade</code>	get the latest version of Raspian
<code>sudo apt-get update</code>	refresh the list of available programs
<code>sudo apt-get upgrade</code>	get the latest version of programs
<code>sudo apt-get install <app></code>	get the app and install it (like: xscreensaver)
<code>sudo apt-get purge <app></code>	remove the given app
<code>leafpad --tab-width=4 %f</code>	Start the LeafPad text editor with 4-space tabs

Setting up a remote connection to a Raspberry Pi from a PC

1. Since you will be setting up a remote connection to the RPi that anyone could use, you need to change the default password. There are two ways. The simple way is to use the GUI. Click on the raspberry in the upper left corner of the screen. Select: Preferences → Raspberry Pi Configuration → System tab → and then click on 'Change Password'.
2. Next, make sure SSH and VNC are turned on. Using the same menu options as in step 1 above, click on the Interfaces tab and then set both SSH and VNC to 'Enable'.
3. The final step is to find out what the IP address is. Find this IP address by running the following command in a command window:

```
ifconfig
```

If you are connected via the built-in WiFi connection, look at the inet address for 'wlan0:'

If you are connected via the Ethernet wired port, look at the address for 'eth0:'.

Write down this IP address. You'll need it in step 6 below.

4. On your PC, download and install RealVNC Viewer. The Viewer software is free.
5. You're all set. Run the VNC Viewer program on your PC and enter the IP address from step 4. Be sure to append the session number 1 after the IP (not a port), as in: **192.168.0.50:1**
This will give you a GUI connection to your RPi.
6. Alternatively... Download and install PuTTY on your PC (<http://www.putty.org/>). This program will connect with the RPi via SSH and give you a command-line interface instead of a GUI one.

Camera installation with the ribbon cable

<code>sudo apt-get install fbi</code>	install the image viewer program
<code>fbi imagename.jpg -</code>	view image stored in the jpg file
<code>raspistill -o imagename.jpg</code>	activate the camera and store an image in the file
<code>raspivid -o video.h264</code>	records a 5-second video
<code>raspivid -t 6000 -o video.h264</code>	record a 60-second video
<code>raspivid --help</code>	display help

Printer support installation

```
sudo apt-get install cups
sudo usermod -a -G lpadmin pi
sudo nano /etc/cups/cupsd.conf #Make the following changes (bold) to the file
```

```
# Listen localhost:631
Port 631
```

```
< Location />
Order allow,deny
Allow @local
< /Location>
```

```
< Location /admin >
Order allow,deny
Allow @local
< /Location >
```

```
< Location /admin/conf >
AuthType Default
Require user @SYSTEM
```

```
Order allow,deny
Allow @local
< /Location >
```

```
sudo /etc/init.d/cups restart
```

```
http://192.168.0.85:631
```

Go to Administration tab → Add Printer → enter credentials → select printer to add → edit settings

Concepts to know

- RPi
 - Powering a RPi – 1.2amps min. Best is a 2.5amp power adapter. Or, use a battery
 - Measure power usage with a USB digital meter
- NOOBS distribution
 - Download NOOBS from: www.raspberrypi.com/downloads
 - Create an SD installation disk – SD Card formatter program (www.sdcard.org/downloads/)
 - Flipping the screen 180 degrees. In `/boot/config.txt` add: `lcd_rotate=2`
- Raspbian Linux
 - Booting to LXDE or terminal screen
 - You can edit or add items on the menu. Like: `leafpad --tab-width=4 %f`
 - Key commands:

- ls list files, like the DOS dir
- cd change directory
- rm remove file
- rmdir remove directory
- mkdir make directory
- cp copy file
- mv move or rename file
- find find files
- sudo prefix to use 'super user'
- ifconfig internet info
- iwconfig wifi info
- fdisk l list of attached storage
- df disk free space
- du disk usage
- pwd present working directory
- help(modules) show installed modules
- help('sys') show help on a module, like 'sys' or 'math'
- man show manual documentation
- pip installer install Python modules
- shutdown turn off RPi
- ping test internet connection
- |more and |less piping
- sudo apt-get install prog Install programs

- SD cards, USB storage device
 - Choosing an SD card – 10x, 8-32GB
 - sudo fdisk l
 - Mounting an external drive
- root vs normal user (pi, root)
 - Using “sudo”
- The BASH command shell and prompt (TUI)
- LXDE user interface (GUI) – “Linux X11 Desktop Environment”. “startx” command
- Configuration – at terminal screen: sudo raspi-config, in LXDE
- 7” screen is upside down – insert the following command at the end of the /boot/config.txt file:

```
lcd_rotate = 2
```
- SSH and VNC
 - Turn SSH and VNC servers on in the config settings.
 - Download and use PuTTY and/or RealVNC Viewer on your PC
 - Use ifconfig command in the RPi terminal window to determine its IP address
- PuTTY and Real VNC Viewer – download for PC
- Nano and Leafpad – Text editors
- Idle – Python IDE
- PyCharm – Full-featured IDE for Python
- WiFi – Setting up on GUI screen – upper right corner icon
- Unified File System
 - There are no drive letters in Linux. You must “mount” drives to a location in the file system
 - LXDE automatically mounts drives
- www.learnpython.org
- www.inventwithpython.com
- Python
 - Using modules – built-in, pre-installed, downloaded (using pip), search pathing (sys.path)
 - dir(sys) – display a list of functions in the sys module
 - help(sys) – display help about the sys module
 - Indents and line breaks matter in Python code. Use tabs or spaces for indenting. But don't try to mix them in the same file.

(XXX) Setting up a remote connection to a Raspberry Pi from a PC

1. Since you will be setting up a remote connection to the RPi that anyone could use, you need to change the default password. There are two ways. The simple way is to use the GUI. Click on the raspberry in the upper left corner of the screen. Select: Preferences → Raspberry Pi Configuration → System tab → and then click on 'Change Password'.
2. Next, make sure SSH and VNC are turned on. Using the same menu options as in step 1 above, click on the Interfaces tab and then set both SSH and VNC to 'Enable'.
3. Alternatively, download and install TightVNC Server. Open up a command window and enter:

```
sudo apt-get install tightvncserver  
tightvncserver :1  
(Not sure about needing to run this: sudo vncserver :1)
```

This will install and then run Tight VNC Server on port 1.

4. The final step is to find out what the IP address is. Find this IP address by running the following command in the same command window:

```
ifconfig
```

If you are connected via the built-in WiFi connection, look at the inet address for 'wlan0:'

If you are connected via the Ethernet wired port, look at the address for 'eth0:'.

Write down this IP address. You'll need it in step 6 below.

5. On your PC, download and install RealVNC Viewer. The Viewer software is free.
6. On your PC, download and install TightVNC by going to:
<https://www.tightvnc.com/download.php>
and picking the 'Installer for Windows'
When installing, pick the 'Typical' setup. Choose the defaults on the next screen. Then enter passwords.
7. You're all set. Run the VNC Viewer program on your PC and enter the IP address from step 4. Be sure to append the port number 1 after the IP, as in: **192.168.0.50:1**
This will give you a GUI connection to your RPi.

Making TightVNC Server Auto Start When Booting the RPi

1. Open a command window. Change to the home/pi directory by typing in: **cd /home/pi**
2. Go into the hidden config directory by typing: **cd .config**
3. Create a new folder named "autostart" within the ".config" folder by typing:

```
sudo mkdir autostart"
```
4. Enter into the folder you just created by typing: **cd autostart**
5. Create a new configuration file that will tell the OS to start VNC upon bootup by typing:

```
sudo nano tightvnc.desktop
```

This will open the text editor within the command window.

6. Enter the following into the text file:

```
[Desktop Entry]  
Type=Application  
Name=TightVNC
```

```
Exec=vncserver:1  
StartupNotify=false
```

Press <Ctrl+O> to save the changes and <Ctrl+X> to exit the text editor.

Your Pi will automatically start the TightVNC Server every time it boots up!