

PRACTICAL - 5

AIM: Introduction to Raspberry Pi, its basic setup and configuration

Introduction to Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. The original Pi had a single-core 700MHz CPU and 256MB RAM, and the latest model has a quad-core 1.4GHz CPU with 1GB RAM. The main price point for Raspberry Pi has always been \$35 and all models have been \$35 or less, including the Pi Zero, which costs just \$5.

List of Raspberry Pi Models released:

- Pi 1 Model B (2012)
- Pi 1 Model A (2013)
- Pi 1 Model B+ (2014)
- Pi 1 Model A+ (2014)
- Pi 2 Model B (2015)
- Pi Zero (2015)
- Pi 3 Model B (2016)
- Pi Zero W (2017)
- Pi 3 Model B+ (2018)
- Pi 3 Model A+ (2019)

The Raspberry Pi operates in the open source ecosystem: it runs Linux (a variety of distributions), and its main supported operating system, Raspbian, is open source and runs a suite of open source software. The Raspberry Pi Foundation contributes to the Linux kernel and various other open source projects as well as releasing much of its own software as open source.



Fig 5.1 - The Raspberry Pi 3 Model B+

Comparison of Raspberry Pi Models

	Raspberry Pi 1 Model A	Raspberry Pi 1 Model A+	Raspberry Pi 1 Model B	Raspberry Pi 1 Model B+	Raspberry Pi 2 Model B	Raspberry Pi 3 Model B	Raspberry Pi Zero
Release Date	2013	2014	2012	2014	2015	2016	2015
SoC	Broadcom BCM2835	Broadcom BCM2835	Broadcom BCM2835	Broadcom BCM2835	Broadcom BCM2836	Broadcom BCM2837	Broadcom BCM2835
CPU Speed	700 Mhz ARM-1176JZF-S	700 Mhz ARM-1176JZF-S	700 MHz ARM-1176JZF-S	700 Mhz ARM-1176JZF-S	900 Mhz ARM-Cortex-A7	1.2 Ghz ARM-Cortex-A53	1 Ghz ARM1176JZF-S
Cores	1	1	1	1	4	4	1
SDRAM	256 MB	256 MB	512 MB	512 MB	1 GB	1 Gb	512 MB

	Raspberry Pi 1 Model A	Raspberry Pi 1 Model A+	Raspberry Pi 1 Model B	Raspberry Pi 1 Model B+	Raspberry Pi 2 Model B	Raspberry Pi 3 Model B	Raspberry Pi Zero
USB 2.0 Ports	1	1	2	4	4	4	1 (Micro-USB)
Ethernet	None	None	10/100 Mbit/s	10/100 Mbit/s	10/100 Mbit/s	10/100 Mbit/s	None
Bluetooth	None	None	None	None	None	4.1	None
WiFi	None	None	None	None	None	802.11n	None
Audio In	I ² S	I ² S	I ² S	I ² S	I ² S	I ² S	I ² S
Audio Out	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	Digital (mini-HDMI), analog GPIO PWM
Video In	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	None
Video Out	HDMI, Composite (RCA)	HDMI, Composite (TRRS)	HDMI, Composite (RCA)	HDMI, Composite (TRRS)	HDMI, Composite (TRRS)	HDMI, Composite (TRRS)	Mini-HDMI, GPIO Composite
External Storage	SD	MicroSD	SD	MicroSD	MicroSD	MicroSD	MicroSD

Setting up and Configuration of Raspberry Pi 3 Model B+

Requirements:

- USB Raspberry Pi Power Supply (2.5A/12.5W)
- microSD Card and Raspbian OS and microSD card reader(size >= 8GB)
- Ethernet cable (RJ45 Straight)
- Laptop with Windows OS/HDMI Cable with USB Keyboard and Mouse
- MobaXterm installed

Process

1. Insert the microSD card inside the MicroSD Card Reader and insert into the PC. Download the Raspbian OS (<https://www.raspberrypi.org/downloads/raspbian/>) Buster as per your requirements. Burn the ISO file to the SDCard.
2. Insert the microSD card inside behind the Raspberry Pi without booting on the Pi as shown in the figure.

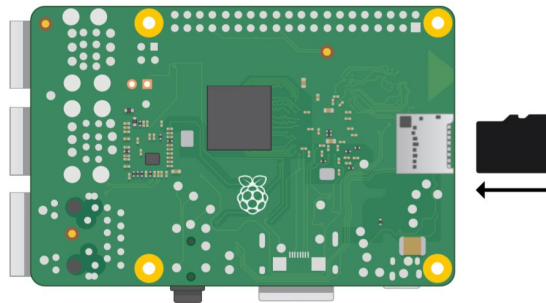


Fig 5.2 - Inserting microSD card in Raspberry Pi 3 Model B+

3. Connect the RJ45 Ethernet cable in the Ethernet port and to the computer's ethernet port. Open 'Network and Sharing center' and select the current internet properties. Switch to 'Sharing' tab in the 'Properties' window and select both the check marks and enable internet sharing to allow the raspberry pi to share the same IP address as the computer's. This allows the computer to connect to the pi using ssh and allow communication.

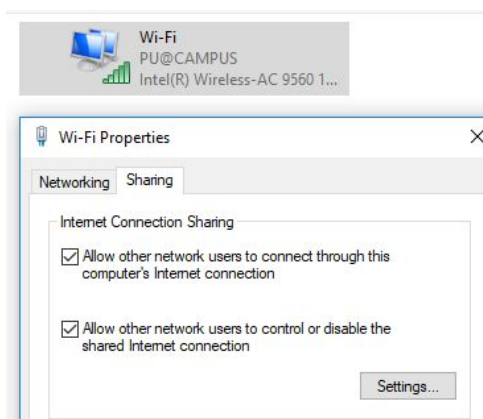


Fig 5.3 - Enabling Sharing in the Network and Sharing center

4. Remove the microSD card from the PI and connect it to the PC using the microSD card reader. Open the drive which is named 'boot' and create an empty file named 'ssh' with no extension to enable ssh connection to PI.

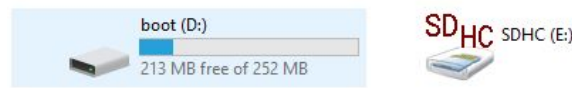


Fig 5.4 - Boot drive for Raspbian OS

5. After that remove the microSD card and put it back in the PI and then boot it with ethernet cable connected to the PC and the adapter connected to a USB connection to the PC.

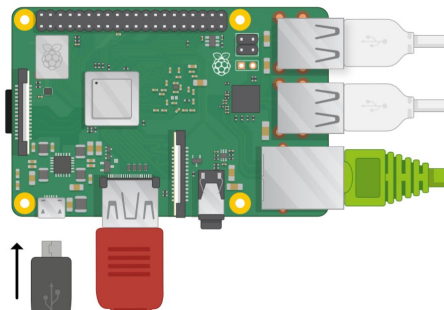


Fig 5.5 - Power supply to Raspberry Pi

6. Download and install MobaXterm, an application to allow ssh connection to the PI. Run MobaXterm and select 'Session' from top and then 'SSH'. In the remote host field, enter the IP address of your laptop. You can retrieve this from the command prompt by running 'ipconfig /all' and looking for the IPv4 address of the ethernet. Click OK, leave the rest of the settings. This will start the terminal to allow you to communicate with the PI.

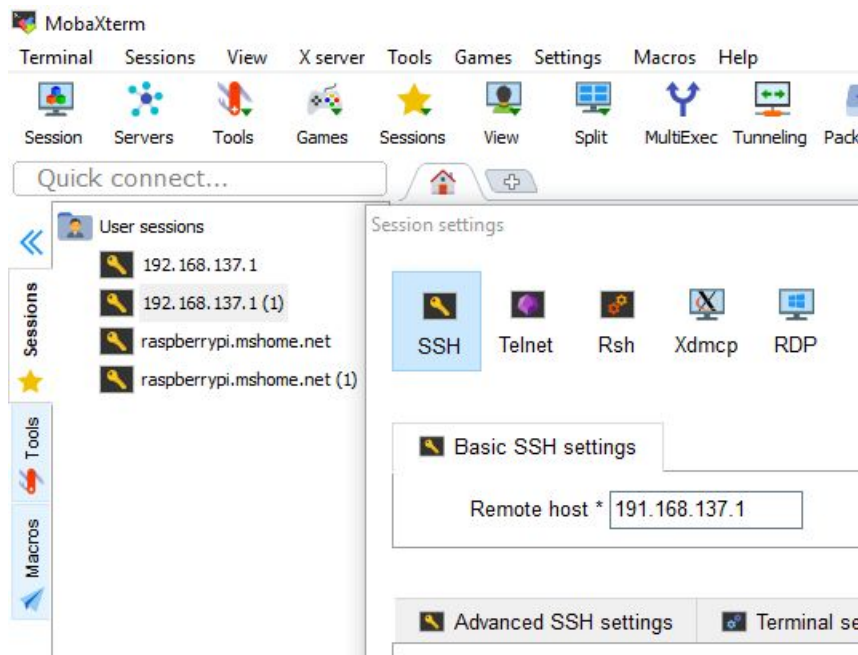


Fig 5.6 - MobaXterm Application with SSH settings

7. A terminal window will appear which will ask for the username and password for the PI. The default username is 'pi' and the password is 'raspberry'. Enter and you will be greeted with the PI homescreen.

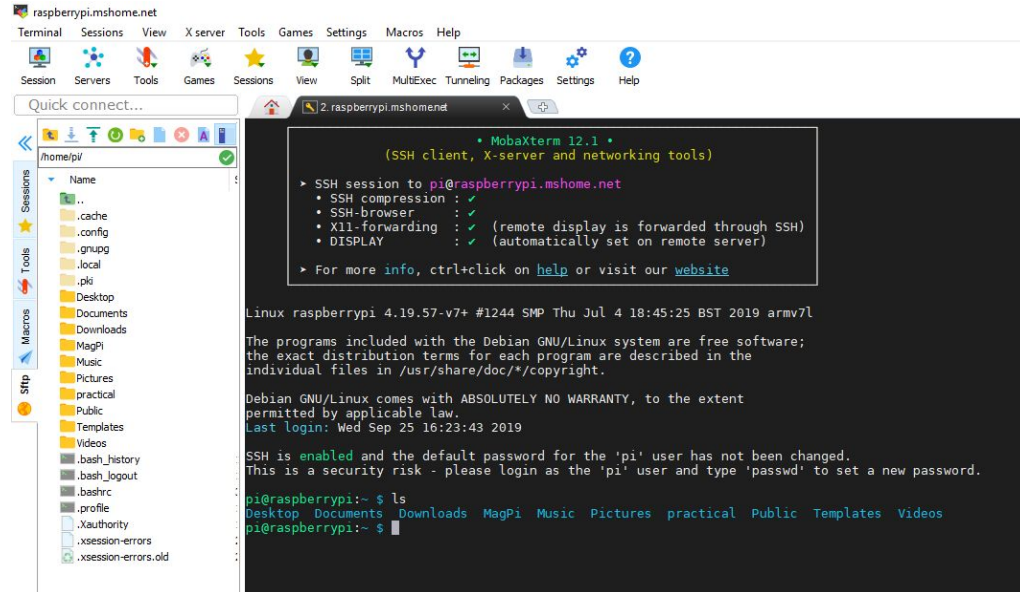


Fig 5.7 - Terminal connected to Raspberry Pi with SSH connection

8. The setup for terminal based PI is complete. To start a GUI type the command 'startlxde' in the terminal.

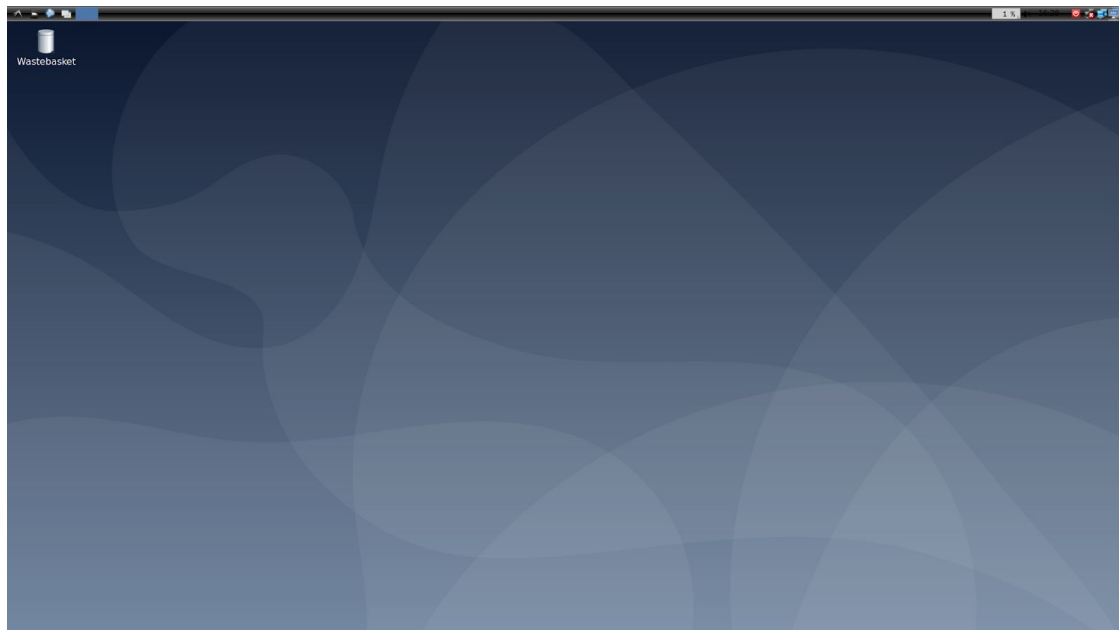


Fig 5.8 - LXDE GUI for Raspbian OS on Raspberry Pi