

All that begins ...

السلام عليكم

peace be upon you

## Raspberry Pi for Newbies



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February 2019

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- What is Raspberry Pi?
- Generations of Raspberry Pi

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- Hardware & Operating System
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- LibreELEC: Embedded Linux Entertainment Centre OS
- Kodi for digital audio and visual content

# Introduction

## What is Raspberry Pi?

- The Raspberry Pi (RPi) is a series of small single-board computers developed in the United Kingdom by the **Raspberry Pi Foundation** to promote the teaching of basic computer science in schools and in developing countries.
- This short workshop is designed for users with very little knowledge of Raspberry Pi to learn about different components on the Raspberry Pi 3 (RPi3) Model B+ board, to explore and try to figure out answers to the following questions:
  - What type of processor does RPi3 have?
  - How much RAM does the RPi3 have?
  - Does RPi3 have a WiFi interface? What about Bluetooth?
  - Where do you connect the power to?
  - Does the RPi3 have a MicroSD card? How much data can it hold?
  - What operating system does it use?
  - Can it share data with my Windows and Linux machines?





# Video

## Raspberry Pi 3: Newbie Introduction

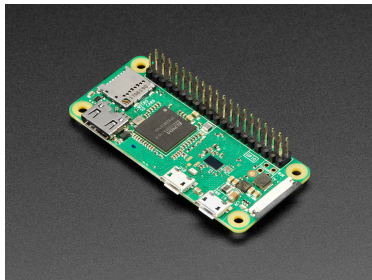
# Introduction

## Generations of Raspberry Pi

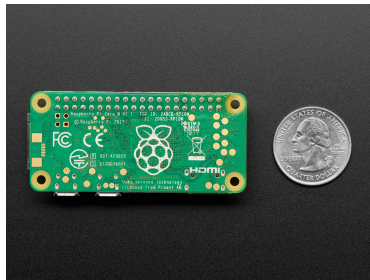
	Raspberry Pi	Raspberry Pi 2	Raspberry Pi 3
Released	2012-02	2015-02	2016-02
CPU	ARM1176JZF-S 700 MHz single core	ARM Cortex-A7 900 MHz quad core	ARM Cortex-A53 1,200 MHz quad core
RAM	512 MB	1 GB	1 GB
GPU	Broadcom Videocore IV 250 MHz	Broadcom Videocore IV 250 MHz	Broadcom Videocore IV 400 MHz
Storage	micro-SD	micro-SD	micro-SD
USB Ports	2 on Model B	4	4
WiFi	None	None	802.11n & Bluetooth 4.1
Video Output	HDMI/Composite	HDMI/Composite	HDMI/Composite
Audio Output	HDMI/Headphone	HDMI/Headphone	HDMI/Headphone

# Introduction

## Raspberry Pi Zero WH



(a) Top view



(b) Bottom view

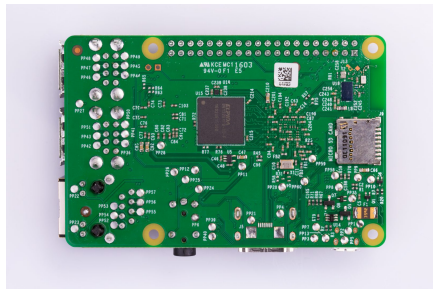
Figure 2: Raspberry Pi Zero WH.

# Introduction

## Raspberry Pi 3 Model B



(a) Top view



(b) Bottom view

Figure 3: Raspberry Pi 3 Model B board.

# Introduction

## Raspberry 3 Model B

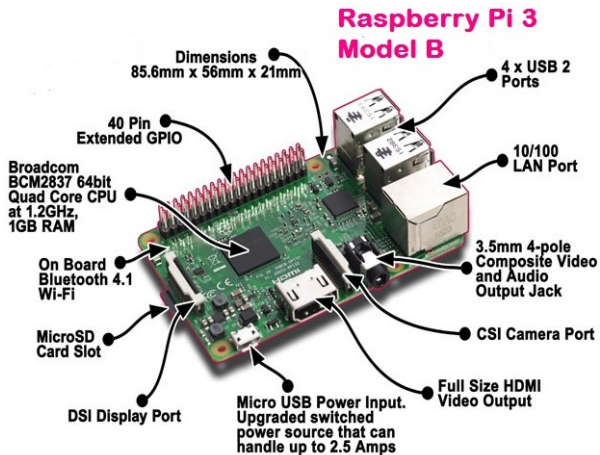
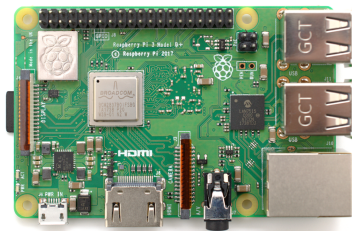


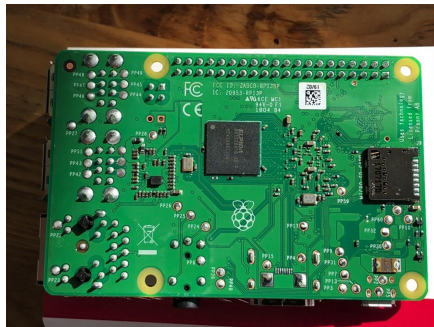
Figure 4: Components of Raspberry Pi 3 Model B board explained.

# Introduction

## Raspberry Pi 3 Model B+



(a) Top view



(b) Bottom view

Figure 5: Raspberry Pi 3 Model B+ board.

# Introduction

## Raspberry 3 Model B+: Specifications

**CPU:** Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC  
1.4GHz 64-bit quad-core ARM Cortex-A53 CPU

**Memory:** 1GB LPDDR2 SDRAM.

**Micro SD card slot:** Used to hold the Micro SD Card holding the operating system which will boot when RPi3 is powered on.

**Graphics Support:** VideoCore IV @ 400 MHz 3D graphics core, full-size HDMI

**Full HDMI Port:** Support HDMI (High-Definition Multimedia Interface) port which can be used to quickly connect RPi to HDMI Monitor. With HDMI Cable and Monitor we can add Screen to RPi.

**Audio/Video:** Combined 3.5mm audio jack and composite video

**Display interface (DSI):** enables RPi3 to interface with Display Module

**Camera interface (CSI):** enables RPi3 to interface with Camera Module

**Power:** 5V/2.5A DC power input

# Introduction

## Raspberry 3 Model B+: Specifications

- Ethernet Port:** Fast Ethernet (10/100 Mbit/s) port to access the Internet.
- Wi-Fi Support:** Built-in 802.11n Wireless LAN
- Bluetooth:** Built-in Bluetooth 4.1 Bluetooth Low Energy (BLE)
- USB Ports:** 4-USB ports which allow attaching four different USB devices like keyboard, mouse, etc.
- GPIO Pins:** supports 40 General Purpose Input Output (GPIO) pins. These digital input/output pins can be used to drive LED, switches, sensors, 'On the Go' (OTG) pendrives, etc.



# Raspberry Pi 3

## 3B+ and 3B Compared



Raspberry Pi 3B+ vs Raspberry Pi 3B

No	Specification	Raspberry Pi 3B+	Raspberry Pi 3B
1	Release Date	14th March 2018	29th Feb 2016
2	SOC Type (Processor)	Broadcom BCM2837B0 (with metal cover)	Broadcom BCM2837
3	Core Type	Cortex-A53 64-bit	
4	No. of Cores	4 Cores	
5	GPU	VideoCore IV	
6	CPU Clock	1.4 GHz	1.2 GHz
7	Memory	microSD	
8	RAM	1 GB LPDDR2	
9	Ethernet	Gigabit over USB 2.0 (Max 300Mbps)	Megabit (Max 100Mbps)
10	USB Port	4 x USB 2.0	
11	HDMI	1 x full size HDMI	
12	WiFi	802.11 b/g/n/ac (Shielded)	802.11 n
13	Bluetooth	4.2 (Shielded)	4.1 LE
14	Antenna	PCB Antenna (Similar to Rpi Zero W)	Chip Antenna
15	GPIO	40 pins	
16	Operating System	Latest Raspbian (> March 2018)	Backward compatible
17	Dimension	85mm x 56mm	
18	POE	Yes, with PoE HAT	No
19	Power Rating	1.13A @ 5V	1.34A @ 5V

# Raspberry Pi 3

## Connecting the Peripherals

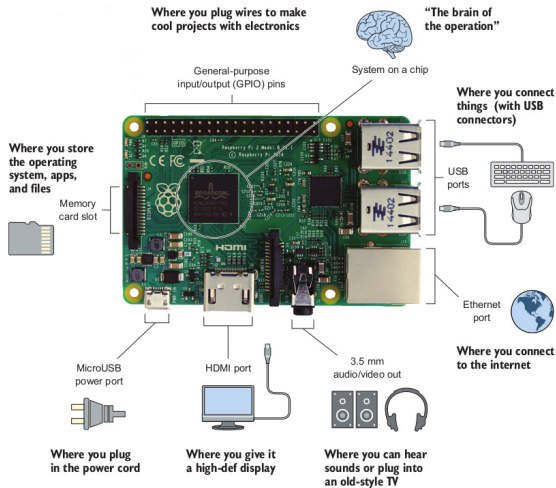


Figure 6: Stringing the Raspberry Pi (Heitz, 2016).

# Video

## Getting Started With The Raspberry Pi 3

- Before you can use your RPi3, you must install an operating system (OS) on an SD card. There are many to choose from.  
See <https://www.raspberrypi.org/downloads/>
- The OS recommended by Raspberry Pi Foundation on the first two generations is their own version of Linux, called **Raspbian**.
- RPi3 brings new capabilities and runs other distributions of Linux as well. We shall be looking at several different flavours of Linux
  - ① **Raspbian**,
  - ② **Ubuntu MATE**, and
  - ③ **Lubuntu**for **desktop computing** and **scientific computing** needs, and
  - ④ **LibreELEC**,for **media centre application**.
- RPi3 also runs
  - ⑤ **Windows 10 IoT core**,but it's primarily designed for developers and hardware hackers who want to prototype IoT appliances using RPi.

- **Raspbian** comes in two flavours: **Raspbian with PIXEL** & **Raspbian Lite**
  - **Raspbian with PIXEL** comes with several SDK, hence a good programming environment. It also includes LibreOFFICE suite, a web browser and e-mail app.

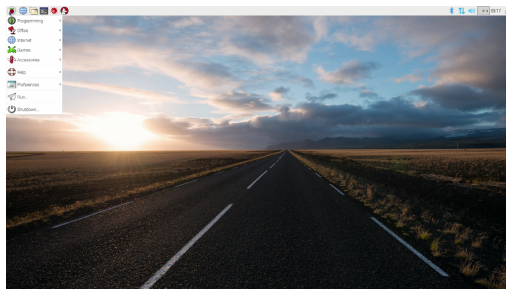


Figure 7: Raspbian desktop.

- **Raspbian Lite** boots to a command line and is fully customizable; you can add your choice of GUI, languages, web browser, and so on.
- <https://www.raspberrypi.org/downloads/raspbian/>

- **Ubuntu MATE** is a derivative of Ubuntu. It uses the MATE desktop environment as its default user interface.
- It comes as a ready-to-run image that fully supports the built-in Bluetooth and Wifi on RPi3. LibreOffice and Firefox are included, as does hardware accelerated video playback in VLC.

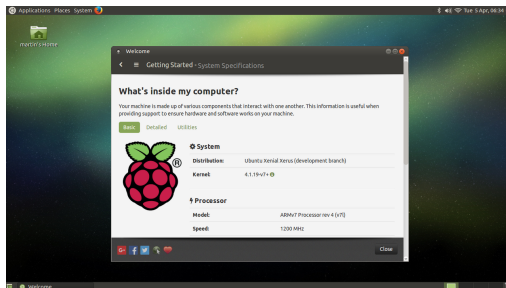


Figure 8: Ubuntu MATE desktop.

- <https://ubuntu-mate.org/raspberry-pi/>

- **Lubuntu** is a faster, more lightweight and energy saving, official flavour of Ubuntu using LXDE, the Lightweight X11 Desktop Environment.
- It is designed to be fast and easy to use. It has lots of applications for every daily need, while keeping your system light and responsive—ideal not only for old computers and netbooks, but for newer computers too making them lightening fast.

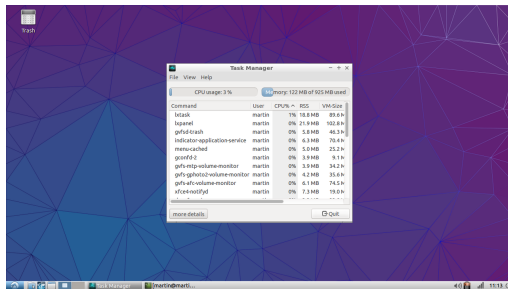


Figure 9: Lubuntu desktop.

- <http://lubuntu.me/>  
<https://wiki.kubuntu.org/Lubuntu/RaspberryPi>

# RPi3 for Desktop Computing

## Hardware & Operating System

- For desktop computing environment on RPi3B+ you will need
  - ① Micro SD card preinstalled with **Raspbian**, **Ubuntu MATE**, or **Lubuntu** OS and a case
  - ② Micro USB power cable: RPi3 requires a 2.5A power supply
  - ③ HDMI to VGA converter or HDMI cable



(a) RPi3 B+



(b) Micro SD



(c) Case



(d) Power adapter



(e) Video converter

- ④ Monitor or TV: If your monitor is DVI or VGA, you will need an adapter.
- ⑤ USB mouse & keyboard



# RPi3 for Desktop Computing

## Hardware & Operating System

- Optional extras:

- ⑥ USB storage e.g. OTG pendrive
- ⑦ USB speakers or headphones
- ⑧ Ethernet cable: You may use an Ethernet cable for a more reliable wired network connection.



(f) OTG pendrive



(g) USB speaker



(h) Ethernet cable

# RPi3 for Desktop Computing

## Software Tools

The standard **Ubuntu MATE** operating system for RPi3 comes with applications most commonly used for desktop computing which are grouped into:

- **Office suite**

- 1 LibreOffice
- 2 Abiword
- 3 gnumeric

- **Graphics**

- 1 Pinta
- 2 Gimp
- 3 Dia
- 4 Inkscape

- **Internet**

- 1 Firefox
- 2 Transmission
- 3 Pidgin

- **Audio & video**

- 1 vlc
- 2 Audacious
- 3 omxplayer

# RPi3 for Desktop Computing

## Software Tools

The standard **Lubuntu** operating system for RPi3 does not come as much endowed with applications as **Ubuntu MATE** but it is fast and lightweight, saving us the remaining CPU cycles for intensive computations.

- **Office suite**

- 1 LibreOffice
- 2 Abiword
- 3 gnumeric

- **Graphics**

- 1 Pinta
- 2 Gimp
- 3 Dia
- 4 Inkscape

- **Internet**

- 1 Firefox
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- **Audio & video**

- 1 vlc
- 2 Audacious
- 3 omxplayer

# RPi3 for Media Centre

## LibreELEC: Embedded Linux Entertainment Centre OS

- **LibreELEC** (“Libre Embedded Linux Entertainment Centre”) is a fork of OpenELEC, a small and very fast booting, open source **JeOS** (“Just enough Operating System”), specifically designed to run pre-configured **Kodi** media centre and
- Optionally, it runs third-party **Personal Video Recorder** (PVR) backend software which allows one to watch live TV, listen to radio, schedule recordings, etc..

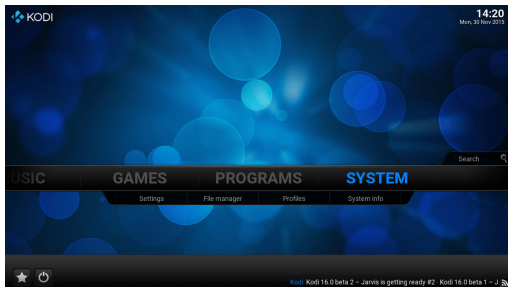


Figure 10: LibreELEC Home window.

- <https://libreelec.tv/about/>  
<https://seo-michael.co.uk/how-to-install-libreelec-on-raspberrypi/>

# RPi3 for Media Centre

## LibreELEC: Embedded Linux Entertainment Centre OS

- **LibreELEC** is efficient with a tiny disk and memory footprint, and provides cutting edge hardware support to deliver a set-top box **Kodi** media centre experience. You will need:
  - 1 Micro SD card preinstalled with **LibreELEC** OS
  - 2 Micro USB power cable: RPi3 requires a 2.5A power supply.
  - 3 USB mouse
  - 4 USB keyboard
  - 5 HDMI cable
  - 6 Monitor or TV (preferably): If your monitor is DVI or VGA, you will need an adapter.



Figure 11: Building a media centre with Raspberry Pi 3.

- LibreELEC turns RPi3 into a media centre and includes software, **Kodi**, for playing, downloading, streaming, and managing graphics, audio and video files.
  - **Control:** You can use a keyboard and mouse with Kodi, buy a TV remote with a USB receiver, or even use a presentation clicker with directional buttons.
  - You can also use a Kodi app on your smartphone; search for Kodi in your phone's app store. Once configured to connect to your Kodi RPi's IP address, you can use the on-screen remote control or browse the files from your phone and select what to play.
  - **Playing video files:** You can copy video files onto your RPi's SD card, or put them on a USB stick or external hard drive and play these files.
  - **Connecting a network drive:** You can connect to a network device e.g. Network Attached Storage (NAS) or services (NFS or SMB) on your local network by using a wired connection to access videos.
  - **Settings:** Kodi has a host of configurable options. You can change the screen resolution, choose a different skin, set up a screensaver, configure the file view, set localisation options, configure subtitles, and much more.
- <https://www.raspberrypi.org/documentation/usage/kodi/>

# Bibliography

- ① HEITZ, R. (2016): *Hello Raspberry Pi!*, Manning (ISBN: 9781617292453)
- ② RICHARDSON, M. & WALLACE, S. (2013): *Getting Started with Raspberry Pi*, O'Reilly (ISBN: 978-1-449-34421-4)
- ③ SOPER, M. E. (2017): *Expanding Your Raspberry Pi*, Apress (ISBN: 978-1-4842-2922-4)

...must end

- ...and I end my presentation with two supplications

رَبِّ زِدْنِي عِلْمًا

my Lord! increase me in knowledge

(TAA-HAA (20):114)

اللَّهُمَّ إِنَّا نَسْأَلُكَ عِلْمًا نَافِعًا

O Allah! We ask You for knowledge that is of benefit

(IBN MAJAH)