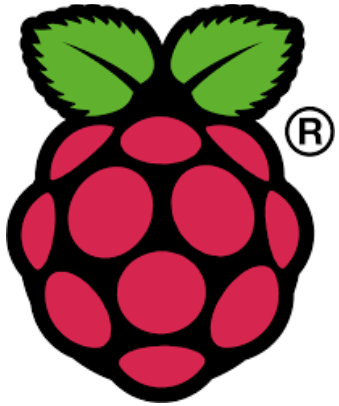
Internet of Things (IoT)

Lab 1



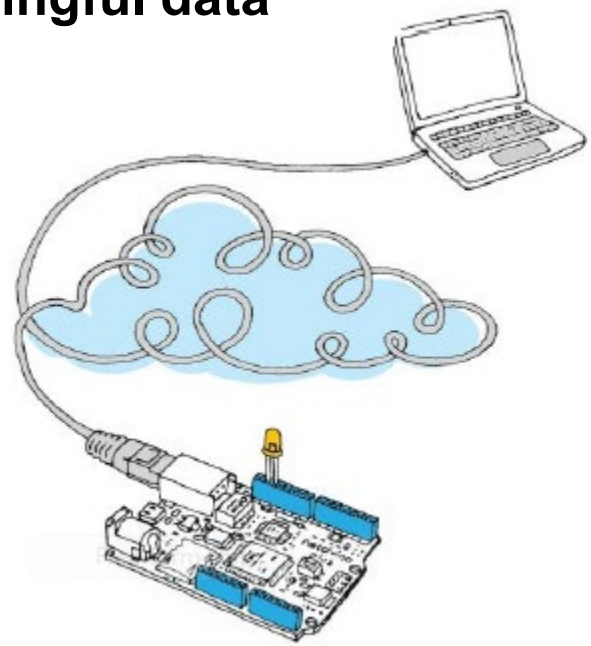
Learning outcomes:

At the end of this training, you should be able to:

- **understand IoT concepts**
- **set-up Raspberry Pi (RPi)**
- **install & configure necessary software**
- **use RPi to interface with sensors (IoT)**

Internet of Things (IoT):

- The **IoT** is the interconnection of physical objects with the existing Internet.
- Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M).
- **IoT is connecting devices to collect meaningful data without human intervention.**
- Kevin Ashton first used the phrase "Internet of Things" in a 1999 presentation on RFID & the Supply Chain at Proctor and Gamble.



Internet vs. IoT

Internet:

- Computers, connected through Internet protocols
- Display or manipulate **documents**

IoT:

- Computers, **sensors** and **actuators** connected through Internet protocols
- Measure or manipulate **physical properties**

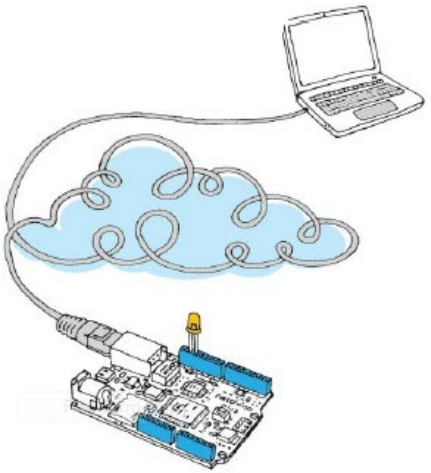
Motivation:

- Only 1% of physical world is connected to Internet
- Huge potential

Future:

- innovative business process
- operational efficiency
- new customer services/business growth
- allow remote control
- direct integration computer + physical world

- Result: automation in all fields



The IoT is:

Remote Control To Life (?!)

Smart Devices

Immersive Experiences

Real-Time Analysis

Accessible Anywhere

Global Storefront

RPi Features:

- The RPi is a credit-card sized computer
- Based on ARM1176JZFS
- Runs at 700MHz
- The SoC is a Broadcom BCM2835
- The GPU is capable of BluRay quality playback
- The RPi has 26 dedicated GPIO pins, including a UART, an i2c bus, a SPI bus with two chip selects, i2s audio, 3v3, 5v, and ground

- **Pi 1 MODEL A:** 256MB RAM one USB port and no Ethernet

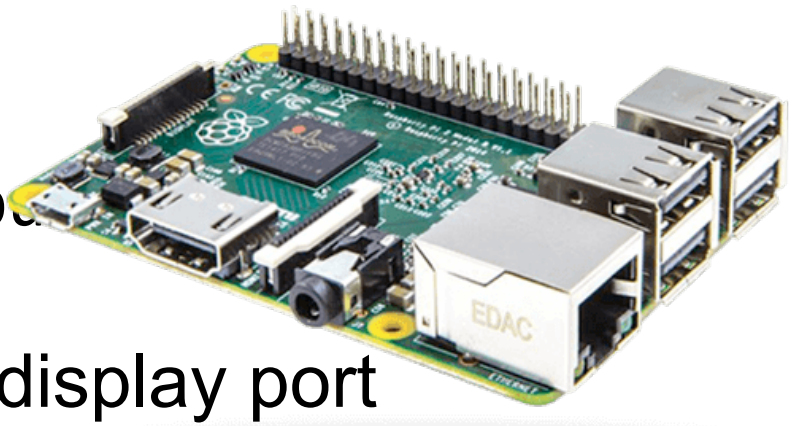
- **Pi 1 MODEL B:** 512MB RAM, 2 USB ports and an Ethernet port.

- **Pi 1 MODEL B+:** shares the same specs as the Model B, but comes with 4 USB ports

- **Pi 2 Model B:** A 900MHz quad-core ARM Cortex-A7 CPU, 1GB RAM

RPi 2 Model B Features:

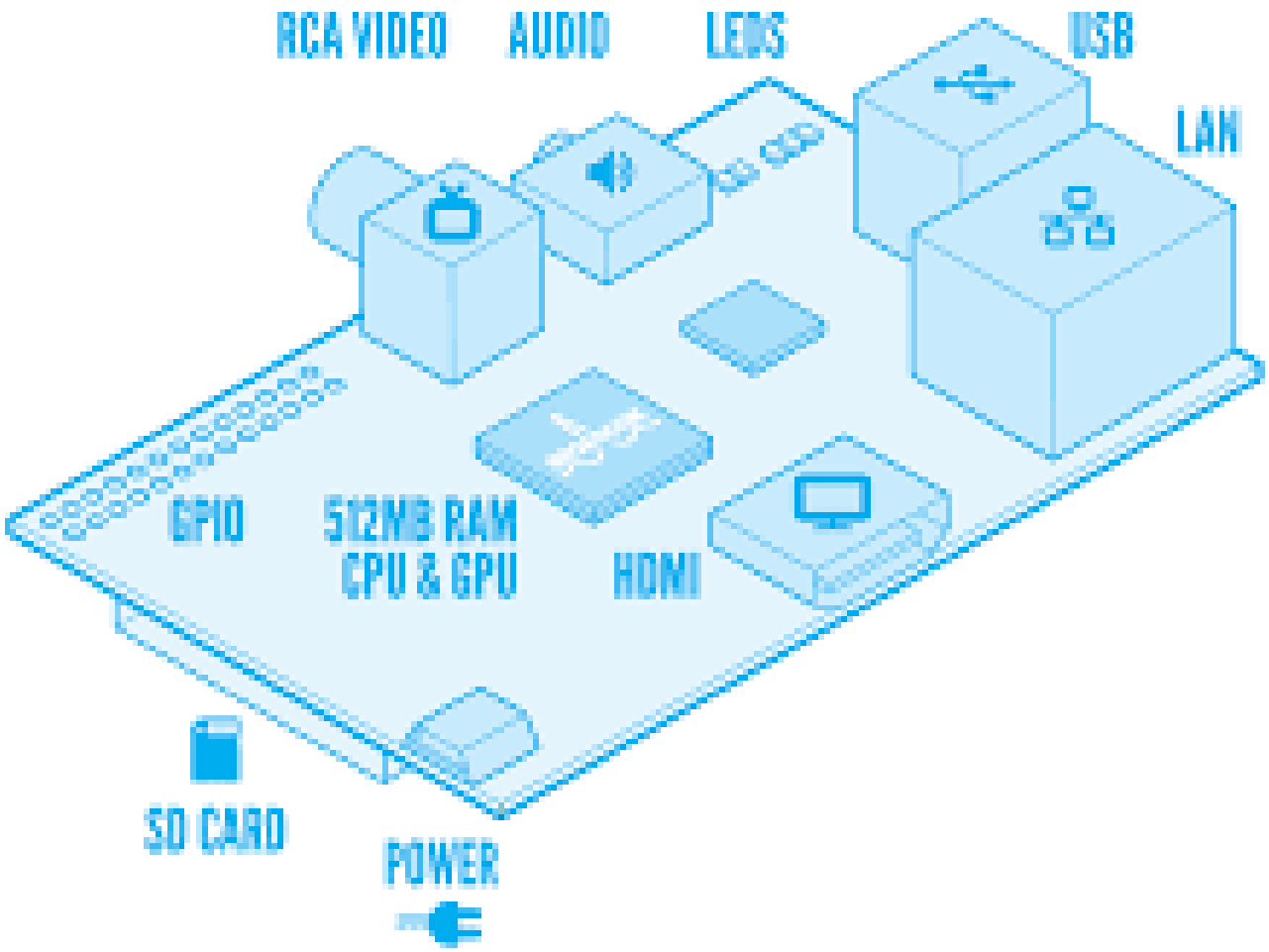
1. 8GB NOOBS Edition (Micro SD card)
2. 900MHz QUAD Core Broadcom BCM2836 processor with 1GB RAM
4. 4x USB 2.0 ports
5. HDMI and RCA video outpu
6. 40pin extended GPIO
7. CSI camera and & DSI display port
5. Micro USB power source
6. ARM GNU/Linux distributions/ Microsoft Windows 10 IoT Core.



RPi 3 Model B Features:

1. 8GB NOOBS Edition (Micro SD card)
2. 1.2GHz QUAD Core Broadcom BCM2837 64bit ARMv8 processor
3. Wi-Fi on board
4. Bluetooth Low Energy (BLE) on board
5. 40pin extended GPIO
6. Multiple ports: 4 USB Ports, Full size HDMI, 4 Pole Stereo output and composite video port, CSI camera and & DSI display port
7. Micro USB power source

RASPBERRY PI MODEL B



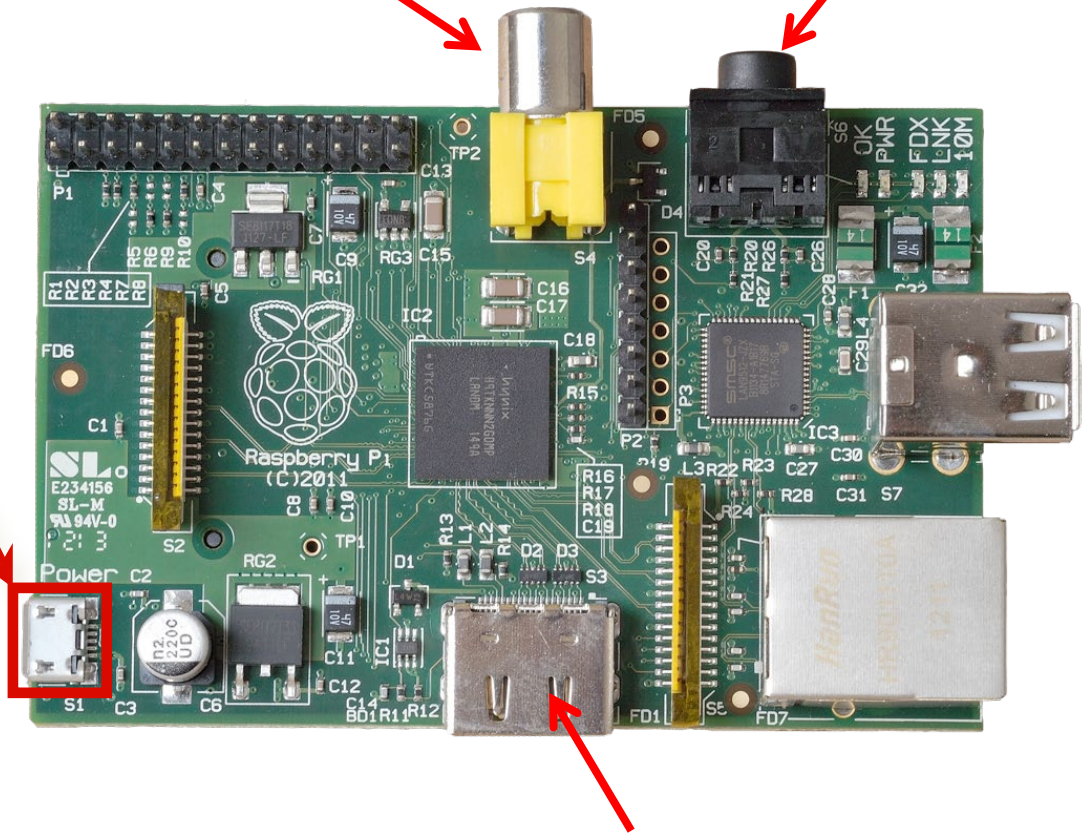
The board details:

RCA Video
(works with most older TVs)

Audio headphone socket

5v micro
USB
connector

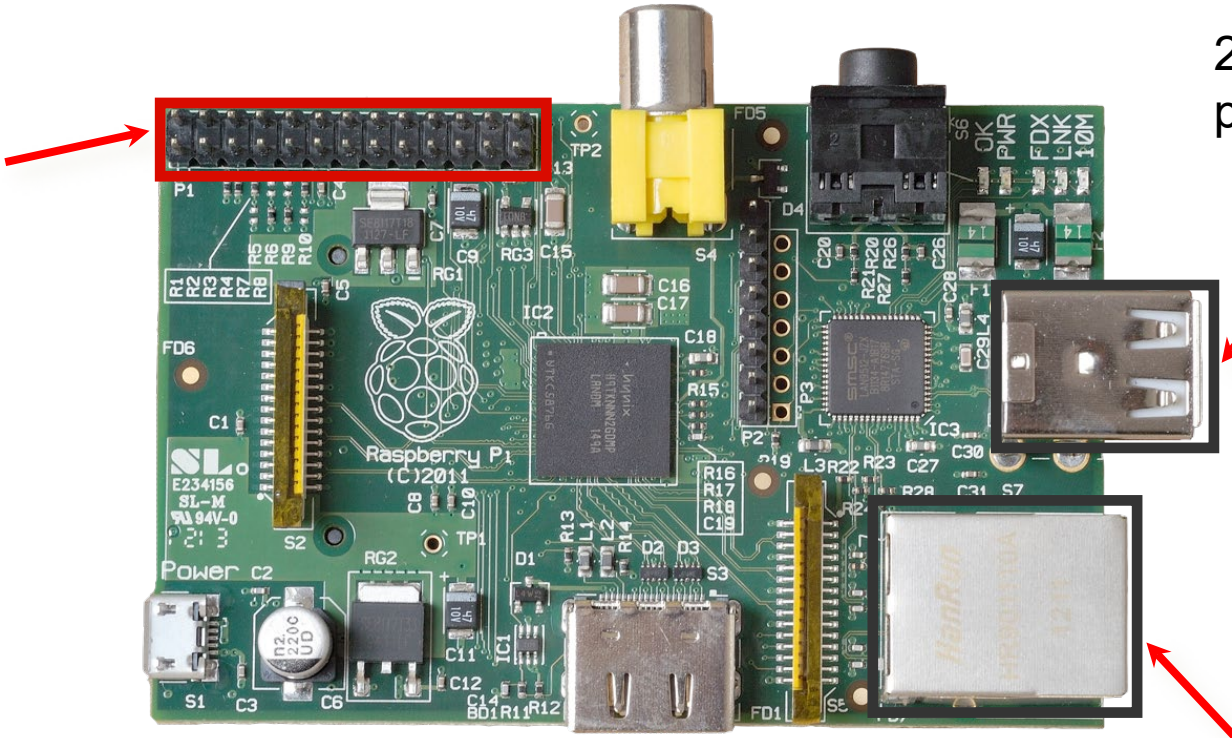
(Similar to the one on a lot of mobile phones!)



HDMI Audio & Video
(works with modern TVs and DVI monitors)

The board details:

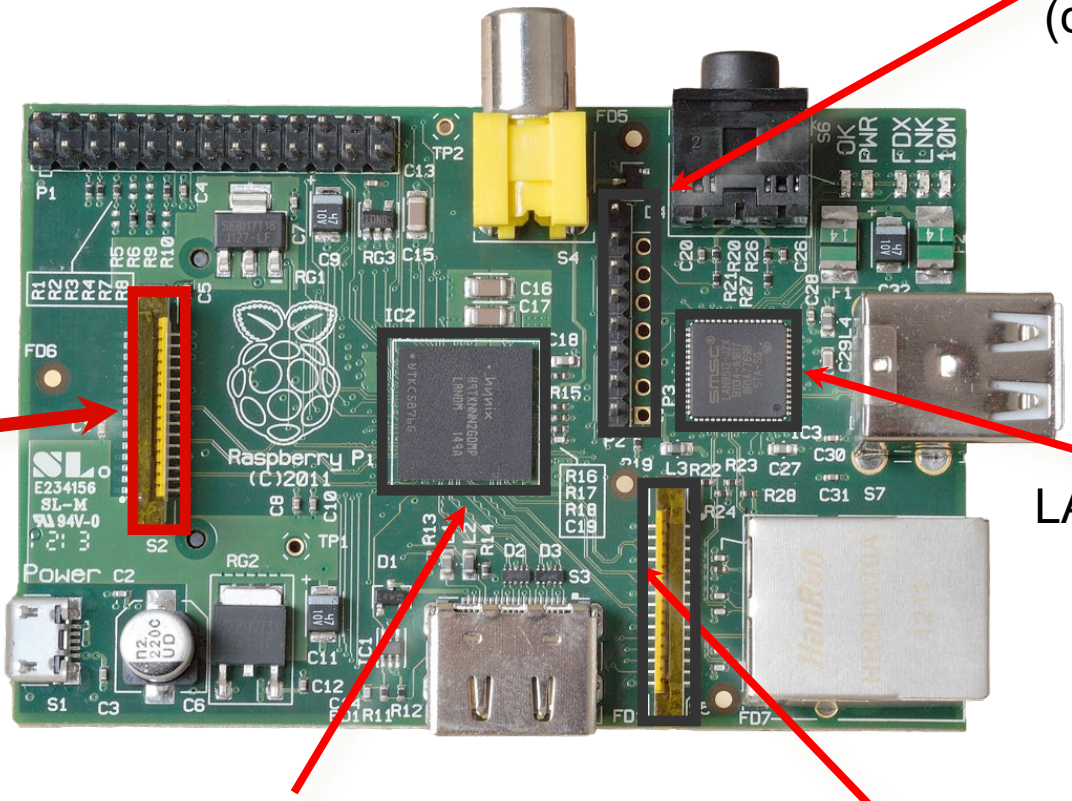
GPIO (General Purpose Input & Output)



2 x USB 2.0 ports

10/100Mb Ethernet

The board details:



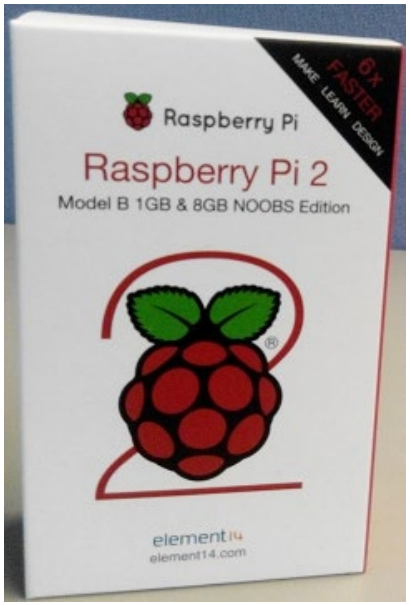
The board details:

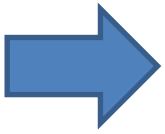
SD Card Slot
(supports SD cards up to 32GB)

Unpacking RPi:

The box contains the following items:

1. RPi board
2. Micro USB power cable
3. Micro SD card preinsatlled with NOOBS (need to order separately)

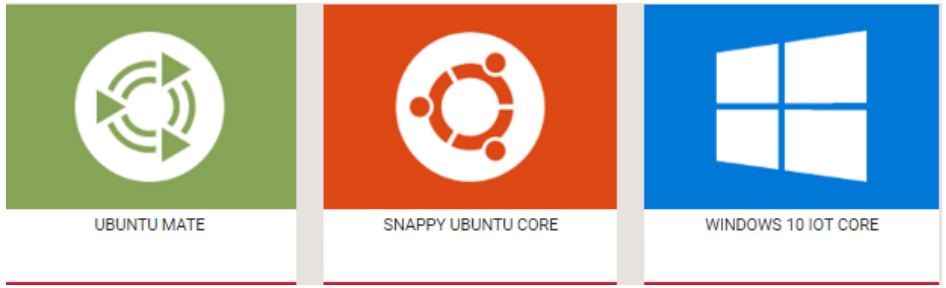




Pre-installed SD card

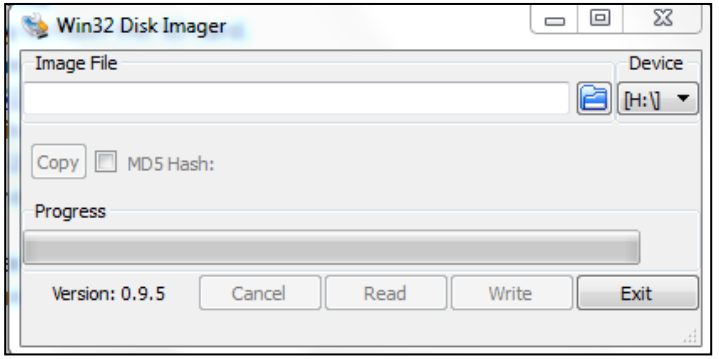
FIRST BOOT:

- Plug in your keyboard, mouse, and monitor cables.
- Now plug the USB power cable into your RPi.
- Your RPi will boot, and a window will appear with a list of different OS that you can install. Select the tick box next to **Raspbian** and click on Install.
- Raspbian will then run through its installation process. Note that this can take a while.
- When the install process has completed, the RPi configuration menu (raspi-config) will load. Here you are able to set the time and date for your region, enable a Raspberry Pi camera board, or even create users. You can exit this menu by using **Tab** on your keyboard to move to Finish.



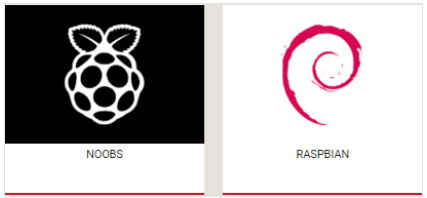
Using your own SD Card:

- **Raspbian** is the Foundation's official supported Operating System (OS).
- **NOOBS(New Out Of Box Software)** is an easy OS installer which contains Raspbian.
- You need **8GB** or above SD card
- Download the raspberry pi image from (https://www.raspberrypi.org/downloads)



- Extract the file to any location of your Hard Disk
- Then, get a program ready to flash the SD card.
    - Download **Win32DiskImager**

      (https://sourceforge.net/projects/win32diskimager/)
    - Extract the archive
    - Right click Win32DiskImager.exe, and click "Run as Administrator"
    - Insert the SD card into your SD card reader
    - "Browse" to select the extracted *.img file
    - Select the SD card reader - Should be "E:\" or "G:\"

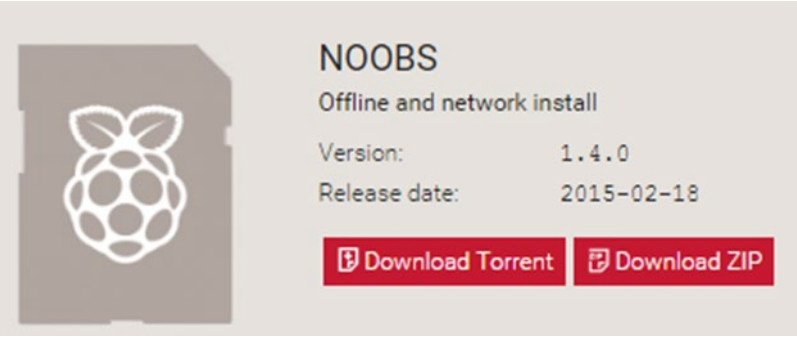


Raspbian OS:

- Raspbian is what is an “Operating System” (OS)
  - Similar to windows running on your home PC, the RPi requires an OS to work
  - Raspbian is a special-purpose distribution based on Debian (a variant of linux)
- The OS is what lets the raspberry pi not only run programs, but run multiple programs concurrently
- It accomplishes this with a “scheduler” in the OS
  - Simply put, this makes programs “take turns”
  - Only one program is actually executing at any one time

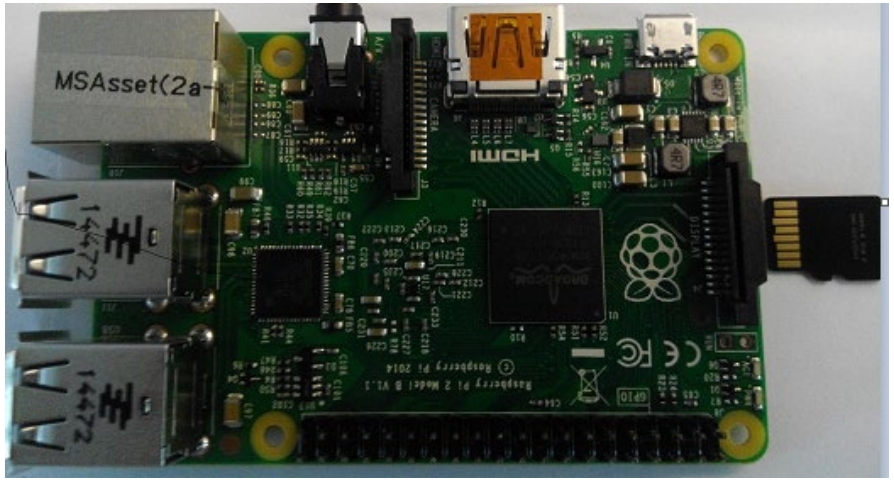
NOOBS:

- The pre-installed SD card comes with the following software:
- Raspbian OS
- Python Interpreter
- IDLE3
- C compiler
- Lightweight (lighttpd) web server
- Web Browser (Midori) etc.



Getting ready:

1. Begin by slotting your MicroSD card into the slot.
2. Plug in USB keyboard and Mouse in to any of the USB slots on the RPi
3. Connect HDMI cable to Monitor
4. Plug-in Ethernet Cable
5. Plug in the micro USB power cable to RPi. This action will turn on and boot the RPi.



Logging in:

1. Once your RPi has completed the boot process, a login prompt will appear. The default login for RPi is username: **pi**
   password: **raspberry**
   (you will not see any writing appear)

2. After you have successfully logged, you will see the Command line prompt
   pi@raspberrypi~$

3. To load the GUI, type **startx** and press enter on the keyboard.

Other Software Installation:

The software package contains:

- Raspbian OS
- Python Interpreter
- IDLE3
- C compiler
- Lightweight (lighttpd) web server
- Web Browser (Midori) etc.

Installing other software:

pi@raspberry ~ $ sudo apt-get update #to get updates

Setting up an Apache web server on a RPi

(https://www.raspberrypi.org/documentation/remote-access/web-server/apache.md)

>>> sudo apt-get install apache2 –y

PHP installation:

>>> sudo apt-get install php5 libapache2-mod-php5 -y

Install MySQL server:

>>> apt-get install mysql-server mysql-client

User Modes

There are two user “modes” you can work with in Linux.
One is a user mode with basic access privileges

User name: pi
pi@raspberrypi:/home/pi#

Administrator (super user, or root)

User name: su
To change from user to Admin:

pi@raspberrypi:/home/pi# sudo su
root@raspberrypi:/home/pi#

Try out these commands:

Launch LXTerminal and type the following commands:

pi@raspberry ~ $ date # to view the date

pi@raspberry ~ $ help

pi@raspberry ~ $ cd /var/www # to navigate to the directory

pi@raspberry ~ $ cd #to return to the previous directory

pi@raspberry ~ $ ifconfig # to check the IP address

pi@raspberry ~ $ ls # to list files in the directory

pi@raspberry ~ $ nano abc.py # To open a file using nano text editor

pi@raspberry ~ $ sudo su # to login as super admin(root)

pi@raspberry ~ $ apt-get update #Updates your version of Raspbian.

Try out these commands:

Launch LXTerminal and type the following commands:

pi@raspberry ~ $ apt-get upgrade: Upgrades all of the software packages you have installed.

pi@raspberry ~ $ clear: Clears the terminal screen of previously run commands and text.

pi@raspberry ~ $ poweroff: To shutdown immediately

pi@raspberry ~ $ raspi-config: Opens the configuration settings menu.

pi@raspberry ~ $ reboot: To reboot immediately.

pi@raspberry ~ $ shutdown -h now: To shutdown immediately

pi@raspberry ~ $ startx: Opens the GUI (Graphical User Interface).

pi@raspberry ~ $ cat example.txt: Displays the contents of the file example.txt.

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