Installing Raspberry OS

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Introduction

Before start using the Raspberry Pi 3 single board computer - RPi -, we must first install the operating system - OS -. We have chosen Raspberry OS, formerly known as Raspbian, because it is the most stable and used Linux distribution for the RPi.

The steps to install the OS on the RPi are as follows:

- download the newest OS image
- write the OS image to the Micro SD Flash memory
- create a file in the boot partition to allow access via ssh
- boot the RPi with the new OS image
- configure wireless connection
- lastly, update and upgrade

The entire procedure described was carried out on the GNU/Linux platform.

This document, as well as some application programs for the RPi, can be downloaded from `github`, `https://github.com/lizard20/raspberryPi3`

Requirements

In this approach, we don't require an extra monitor, keyboard or mouse. We are going to install and configure Raspberry OS to access RPi via Ehernet or wireless connection. We assume that you have a computer with Internet connection, either through a modem or a router, figure 1.
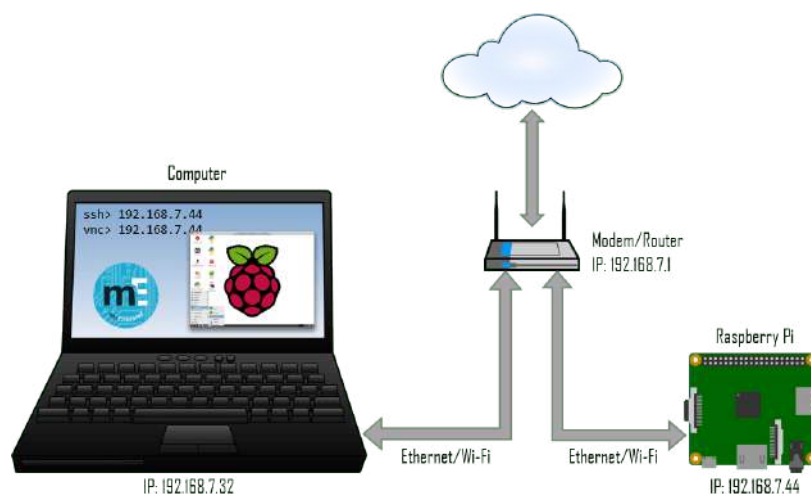

Figure 1. Connection between computer, RPi and modem

Components and accessories

1. Raspberry Pi 3 card

2. Micro SD Flash memory class 10 or greater with adapter, and a capacity of at least 8 GB

3. 5 Volts, 2.5 Amperes Power Supply

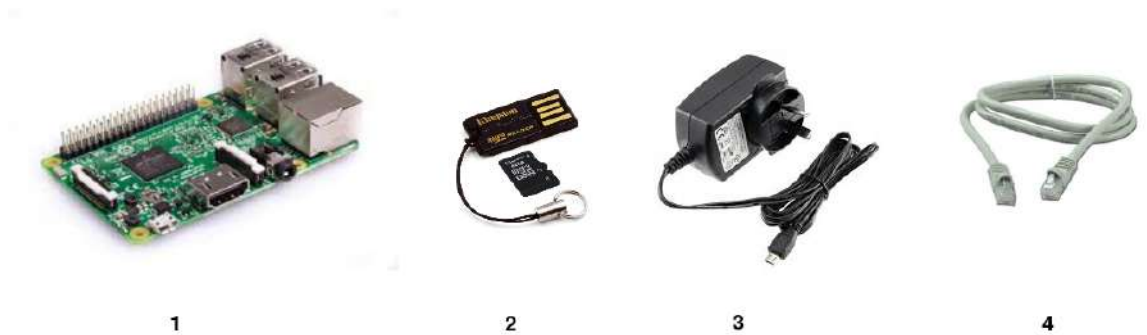4. CAT 5 Ethernel cable, this is used only once to configure wireless connection, figure 2

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Figure 2. Components and accessories

Download and install the Raspberry Pi Imager program

1. Go to `https://www.raspberrypi.org/downloads/`

2. Here, there are three options, figure 3

Figure 3. Downloads

3. Click on `Raspberry Pi Imager for Ubuntu` and save the `imager_amd64.deb` file

4. Install the `imager.amd64.deb` program. Open a `shell` [1] and execute the following command

   `pc@desktop:~ $` **`sudo dpkg -i imager_amd64.deb`**

Dowload the OS image and write it to Micro SD Flash memory

1. Insert the Flash memory into your computer

2. Execute `Raspberry Pi imager`, figure 4

3. Click on `CHOSE OS`, in this section you will also find other options. Choose between:

   `Rapsberry Pi OS Lite (32-bits)` or `Rapsberry Pi OS Full (32-bits)`

4. Next, click on `CHOOSE SD CARD`.

5. And finally, click on `WRITE`.

   In my case, I chose `Rapsberry Pi OS Lite (32-bits)`. It's the lighter option, although it lacks a desktop environment.

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[1] `pc@desktop`, is the prompt of the shell opened on your desktop or laptop computer. While `pi@raspberrypi`, is the prompt of the shell opened on the Raspberry

Figure 4. Raspberry Pi imager

6. When this process is completed, the program will ask you to remove the Micro SD memory from your computer

Configuration for access via ssh

1. We are not yet ready to establish comunication with the RPi. Before, we have to create a file to gain access through the Ethernet connection. Insert the Micro SD memory back into your computer.

   To identify the device, execute

   ```
   pc@desktop:~ $ lsblk


   NAME     MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
   . .. ..... .... ...... ..... ..... .... .....
   sde      8:64   1    7.4G  0 disk
   |-sde1   8:65   1    256M  0 part /media/boot
   |-sde2   8:66   1    7.2G  0 part /media/rootfs
   ```

   The command displays the device name and the mount points. These values may be different on your computer

2. Once the device and the mount points have been identified, create a file named `ssh` on the boot partition

   ```
   pc@desktop:~ $ sudo touch /media/boot/ssh
   ```

3. Copy the text "`ssh -X pi@<IP>`" to the `ssh` file

   ```
   pc@desktop:~ $ sudo echo "ssh -X pi@<IP>" > media/boot/ssh
   pc@desktop:~ $ sync
   ```

4. Verify that the text has been copied correctly

   ```
   pc@desktop:~ $ cat media/boot/ssh


   ssh -X pi@<IP>
   ```

5. Umount `boot` and `rootfs` partitions

   ```
   pc@desktop:~ $ sudo umount /media/boot
   pc@desktop:~ $ sudo umount /media/rootfs
   ```

Boot RPi and establish connection via Ethernet

1. Insert the Micro SD memory into the RPi's slot

2. Connect the Ethernet cable, between the RPi and the modem, figure 1

3. Turn on the RPi

4. To find the `IP` number assigned to the RPi use the `nmap` command. If it was not installed on your computer, execute the following command to install it

   ```
   pc@desktop:~ $ sudo apt install nmap
   ```

5. Next, execute `nmap` to discover the `IP` number assigned to the RPi

   ```
   pc@desktop:~ $ sudo nmap -F 192.168.1.0/24
   ```

   ```
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   Starting Nmap 7.60 ( https://nmap.org ) at 2020-07-09 06:59 CDT
   Nmap scan report for 192.168.1.64
   Host is up (0.00032s latency).
   Not shown: 99 closed ports
   PORT    STATE SERVICE
   22/tcp open  ssh
   MAC Address: B8:27:EB:35:C0:FD (Raspberry Pi Foundation)
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   ```

6. The `IP` number assigned to the RPi is: `192.168.1.64`

7. Execute the `ssh` command - secure shell - to connect to the RPi.

   ```
   pc@desktop:~ $ ssh -X pi@192.168.1.64
   ```

8. The `login` and `password` are the following:

   ```
   login: pi
   password: raspberry
   ```

Configure Wi-Fi

1. Once we have established communication with the "Rpi", we now proceed to set up Wi-Fi. Execute the raspberry configuration program, figure 5
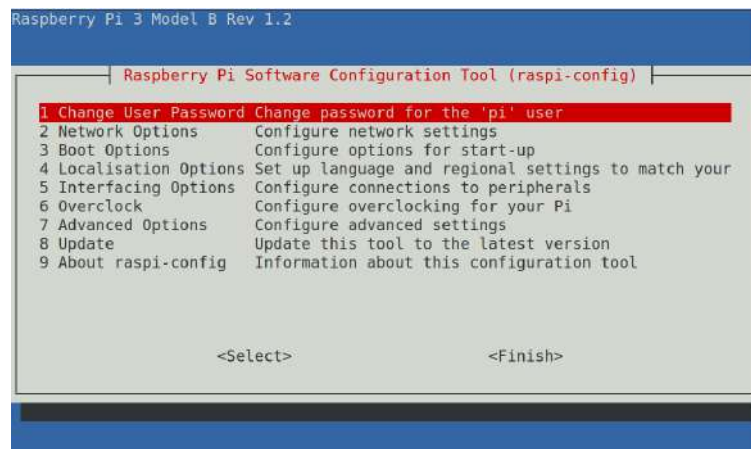
   ```
   pi@raspberrypi:~ $ sudo raspi-config
   ```


Figure 5. Raspberry configuration tool

1. Select: `2 Network options`
2. Select: `N2 Wireless LAN`

3. Select: `the country`
4. Introduce your modem data: `SSID`[2] and `password`.
5. Select `<Finish>`
6. Turn off the RPi, executing

   ```
   pi@raspberrypi:~ $ sudo shutdown -h now
   ```

7. Turn the power supply off and disconnect the Ethernet cable

Wireless communication

1. Turn on the RPi

2. Execute the nmap command

   ```
   pc@desktop:~ $ sudo nmap -F 192.168.1.0/24


   Starting Nmap 7.60 ( https://nmap.org ) at 2020-07-09 10:07 CDT
   Nmap scan report for 192.168.1.65
   Host is up (0.016s latency).
   Not shown: 99 closed ports
   PORT    STATE SERVICE
   22/tcp open  ssh
   MAC Address: B8:27:EB:60:95:A8 (Raspberry Pi Foundation)
   ```

3. The `IP` number assigned to the RPi is: `192.168.1.65`

4. Now, we can connect to the RPi via Wi-Fi, execute the `ssh` command

   ```
   pc@desktop:~ $ ssh -X pi@192.168.1.65
   ```

5. Enter `login` and `password`

   ```
   login: pi
   password: raspberry
   ```

If you have reached this point it is that you have established wireless communication with the RPi.

Update and upgrade

1. Look for updates and install them

   ```
   pi@raspberrypi:~ $ sudo apt update
   ```

2. Upgrade

   ```
   pi@raspberrypi:~ $ sudo apt upgrade
   ```

3. Reboot

   ```
   pi@raspberrypi:~ $ sudo shutdown -r now
   ```

Now, we have the most recent version of the operating system installed on the RPi

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[2] Service Set Identifier