OrangePi4SDR - Tutorial for the OrangePiMini2

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Introduction

The goal was to get a single-board computer able to execute Gnuradio tools quite smoothly with various SDR devices (USB dongles, HackRF, USRP development boards). Unfortunately, the RaspberryPi family (both PiB+ and Pi2) did not met such requirements due to a lack of throughput in the USB controller. This tutorial introduces another solution based on a Chinese alternative called OrangePi [1]. For the operating system, Debian Jessie (8.2 version) is used: `https://www.debian.org/releases/stable/`.

1 Requirements

1.1 Hardware

- An OrangePiMini2 (bought from Aliexpress[2]). Main features :
  - Allwinner H3 CPU (quad-core Cortex-A7 @ 1.6GHz)
  - 1GB RAM memory.
- A 5V/2A power supply such as [3, 4]. Otherwise, the OrangePi kit comes with an USB cable that works fine (an external computer is required).
- A μSD card: class 10 is the best.
- (of course, video and Ethernet cables)

1.2 Software

All OrangePi software parts are available from a Google Drive directory (click here). You need to get:

- **Debian_wheezy_mini.img.xz**: the minimal Debian Jessie image (without graphical user interface).
- **scriptbin_kernel.tar.gz**: the kernel image and boot-related stuff.
- Win32DiskImager from `http://sourceforge.net/projects/win32diskimager`.
- SDFormatter from `https://www.sdcard.org/downloads/formatter_4`.

It is assumed that you decompress `.xz` files somewhere on your computer. Other OS images can be downloaded from this Google Drive or directly from OrangePi website: `http://www.orangepi.org/downloadresources/`

2 Creating μSD image

This step was tested on Windows. Similar results are expected on Linux using `fdisk` and `dd` commands.

2.1 OS image

First of all, format your SD card:

- Connect your μSD card and open SDFormatter.
- Take care of the drive letter (it will erase **everything** in the device).
- Open **Option** menu and select *Yes* for **Format size adjustment**.
- Click on **Format** and answer *Yes* in the next popups $\Rightarrow$ Your card is ready !

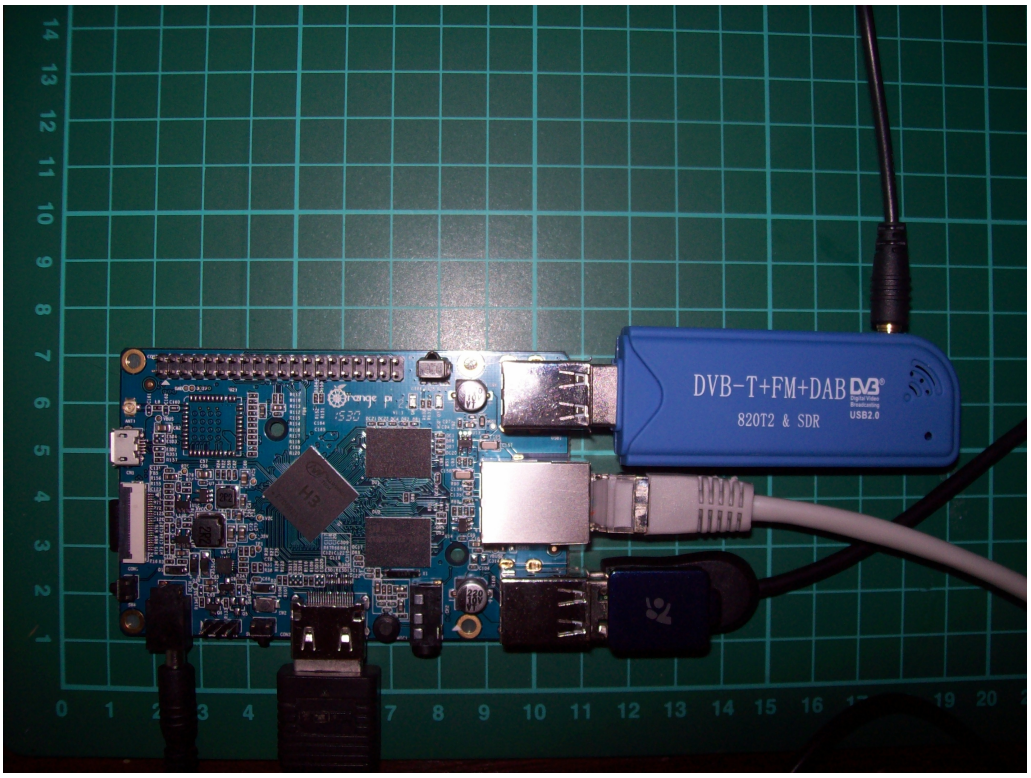
Then, you can copy the Debian minimal image using Win32DiskImager: check the device letter and look for the `Debian_jessie_mini.img` OS image on your computer. Confirm and wait a few minutes...

2.2 Kernel and boot stuff

Once this step is done, disconnect and reconnect your μSD card. You should see a device called `BOOT` coming up: it contains the kernel image and boot-related stuff. These files are replaced with the latest ones available from OrangePi. Open the `BOOT` device in your explorer and erase everything inside. Then, from your `scriptbin_kernel` decompressed folder:

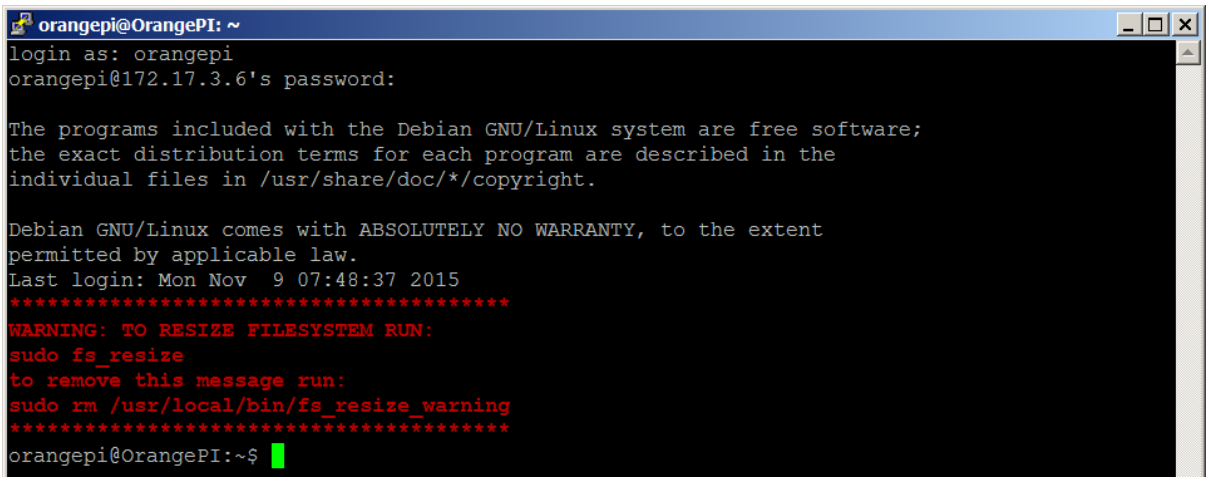
- Copy `script.bin.OPI-2_1080p60` and rename it as `script.bin`.
- Copy `uImage_OPI-2` and rename it as `uImage`.

Your μSD card is ready to boot on the OrangePiMini2 !



3 First boot

At first power-up, when asked for login/password, just use `orangepi`/`orangepi` (be careful, it is configured with a QWERTY keyboard layout by default). You should see a terminal like this:



3.1 Disk resize

The first step is to resize partitions to fit the maximum capacity of your μSD card. OrangePi already prepared a tool. Type `sudo fs_resize`:

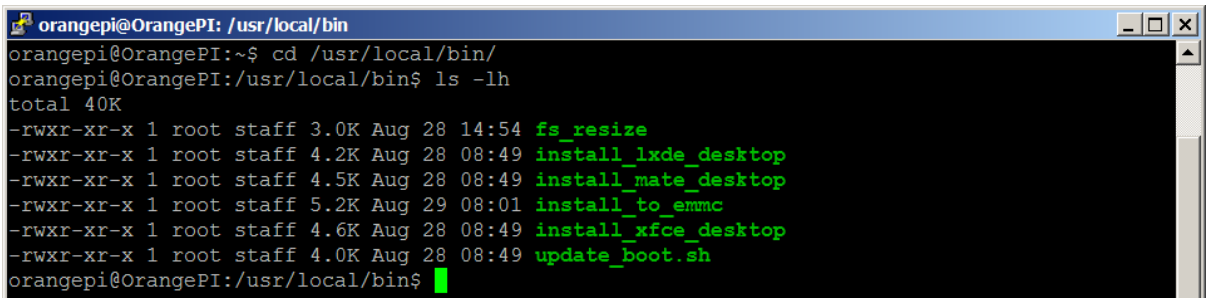
```
orangepi@OrangePI:~$ sudo fs_resize
sudo: unable to resolve host OrangePI

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for orangepi:

Disk /dev/mmcblk0: 14.9 GiB, 16021192704 bytes, 31291392 sectors
/dev/mmcblk0p1       40960  172031  131072   64M  b W95 FAT32
/dev/mmcblk0p2      172032 1656832 1484801  725M 83 Linux

  Max block: 31290368
   Part end: 1656832
 Part start: 172032

WARNING: Do you want to resize "/dev/mmcblk0p2" (y/N)?  y
PARTITION RESIZED.
*******************************************
Rootfs Extended. Please REBOOT to take effect
*******************************************

orangepi@OrangePI:~$ sudo reboot
```

Then, reboot using `sudo reboot`.

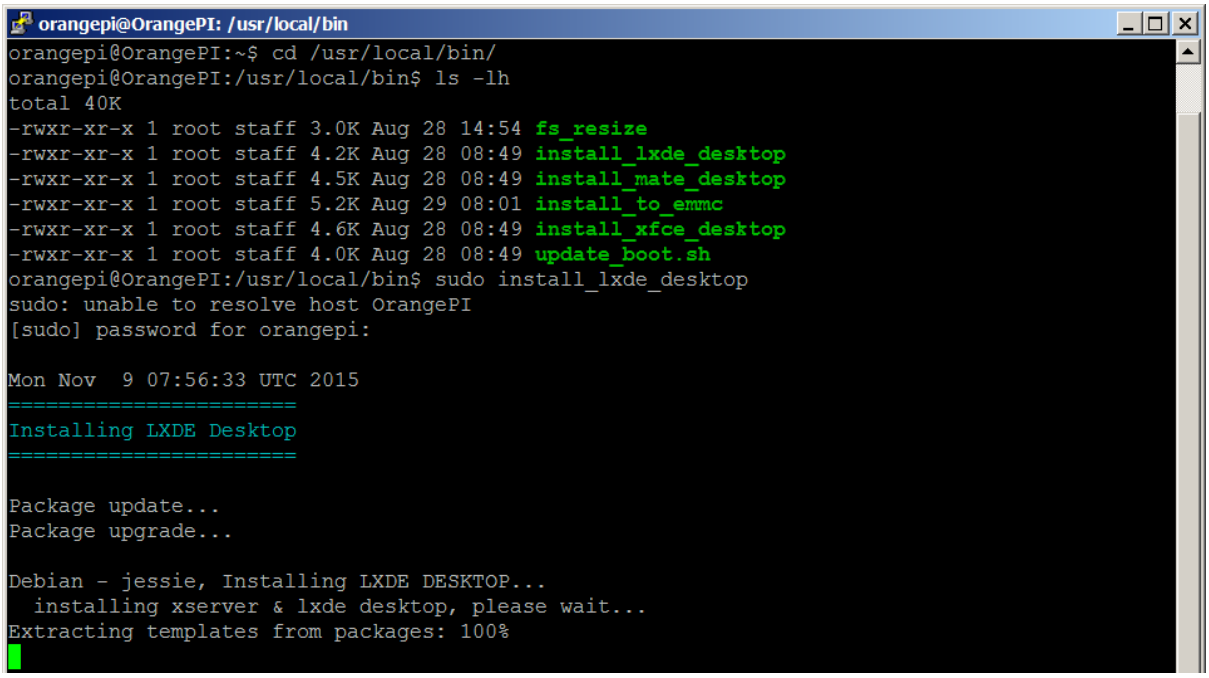
3.2 Desktop install

As this is a minimal Debian image, it does not come with a GUI but you can install whatever you want. In this tutorial, LXDE has been chosen for installation.

Thanks to OrangePi, there are already some scripts to install some GUIs such as LXDE, XFCE or Mate (a Gnome2 fork).



- Type `cd /usr/local/bin`.
- Type `sudo install_lxde_desktop` and wait a few minutes...

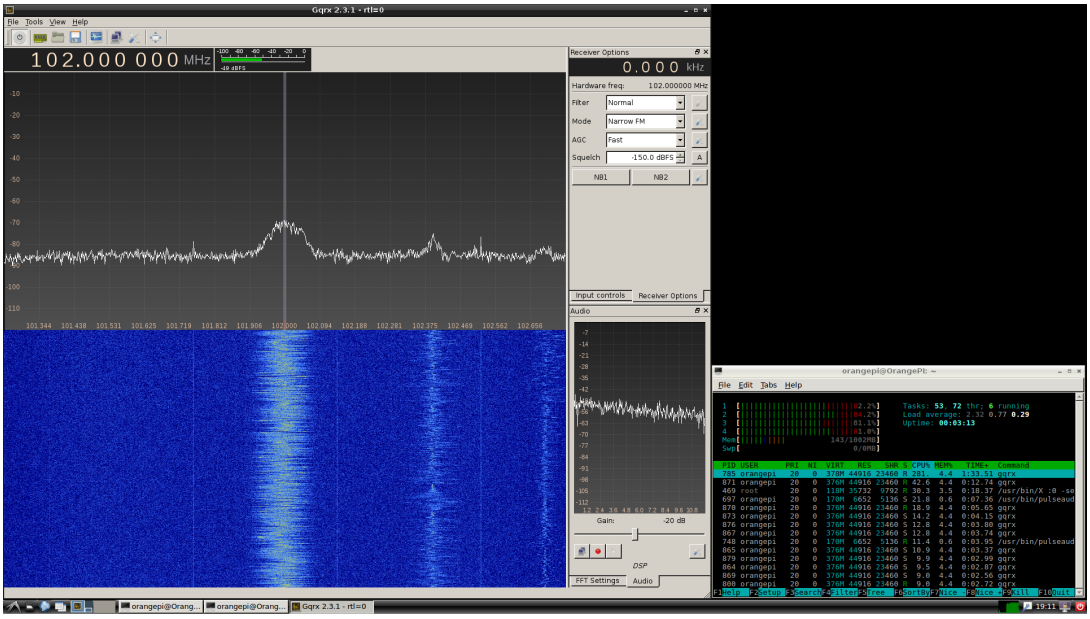


Reboot one last time...

4 Result

Tada !

After the login screen (still `orangepi`/`orangepi`), you get a fully functional desktop: you can install whatever you want. In the above figure, the goal was to install GQRX, Gnuradio and some other tools: it run quite smoothly ! (especially compared to RaspberryPis).



In this configuration, following binaries were installed:

```
sudo apt-get install gnuradio gnuradio-dev rtl-sdr librtlsdr*
   hackrf gpredict gqrx-sdr libhackrf*
```

5 References

References

[1] OrangePi. Orangepi website. `http://www.orangepi.org/`.

[2] Aliexpress. Orangepimini2. Full link here.

[3] Aliexpress. 5v/2a power supply. Full link here.

[4] Amazon. 5v/2a power supply. Full link here.