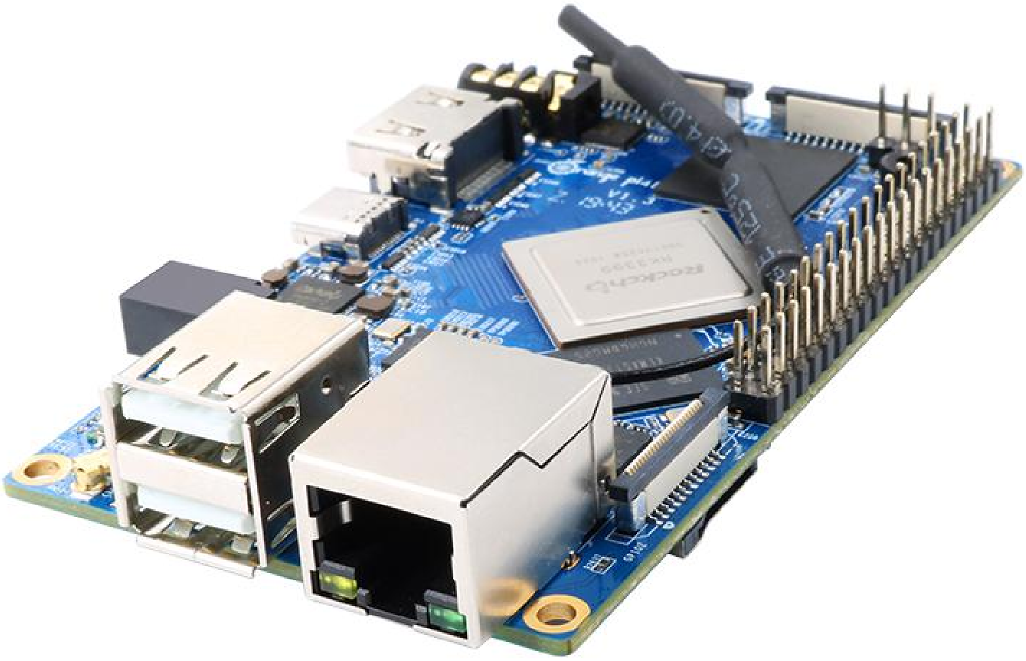
Orange Pi 4B
User Manual



History

Ver	Data	Author	Brief	Publish	Memo
1.0	2019-11-21	csy	Create document		
1.1	2020-01-03	csy	Update		

Content

I. Basic features of Orange Pi 4B

1. What is Orange Pi 4B?

Orange Pi is an open source single board card computer, a new generation of arm64 development board, which can run Android 8.1, Ubuntu and Debian operating systems. Orange Pi single board computer uses Rockchip RK3399 chip, and has 4GB LPDDR4 memory.

2. What the Orange Pi 4B does?

We can use it to build:

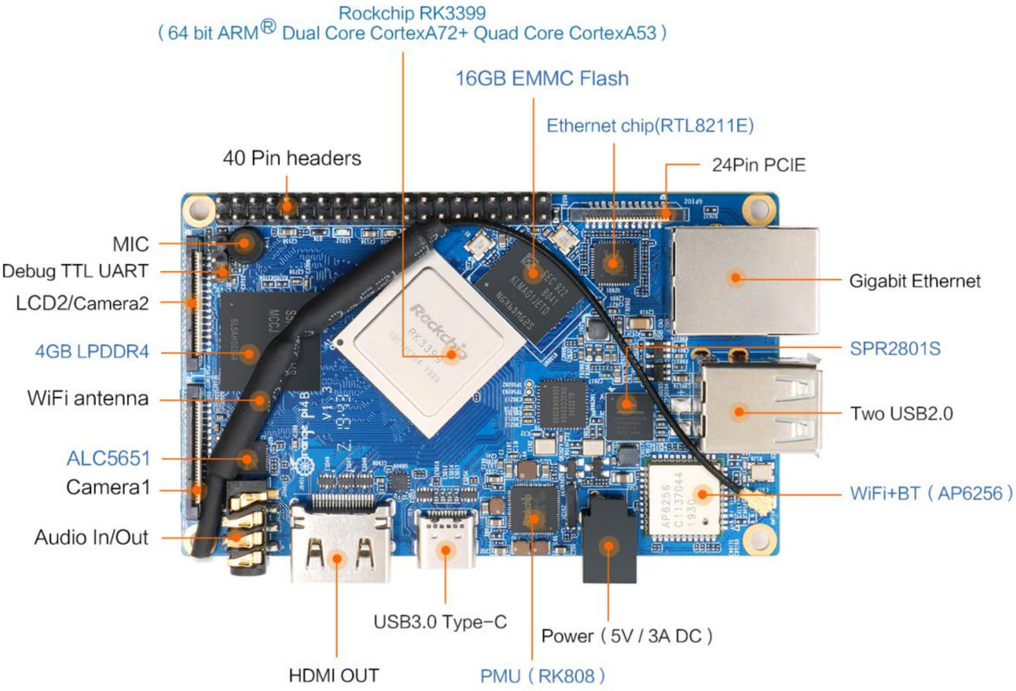
- A computer
- A web server
- Game console
- HD video player
- Speaker
- Android
- . . . . . .

There are many more features because Orange Pi 4B is open source.

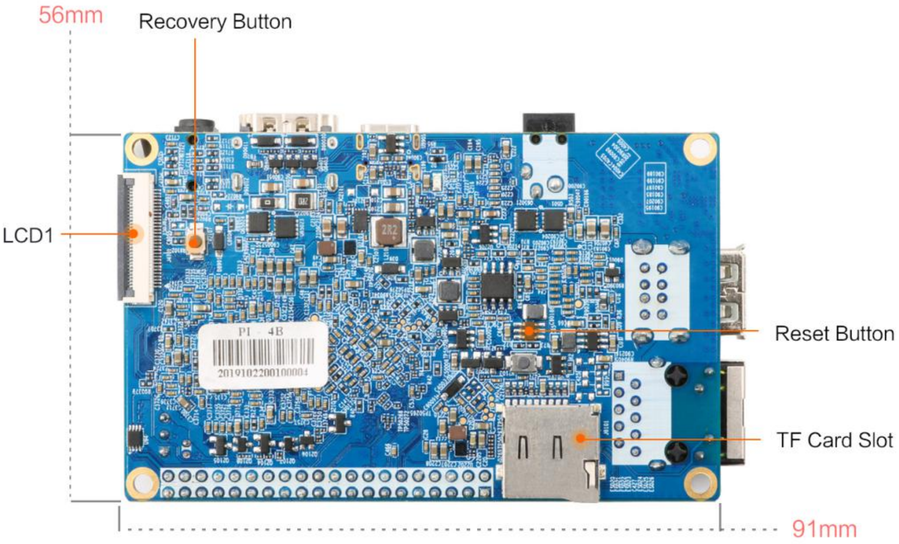
3. For whom the Orange Pi 4B designed?

Orange Pi 4B is not just a consumer product, it is also designed for anyone who wants to use technology to create and innovate. It is a very simple, interesting and practical tool that you can use to build the world around you.

Top view



Bottom view



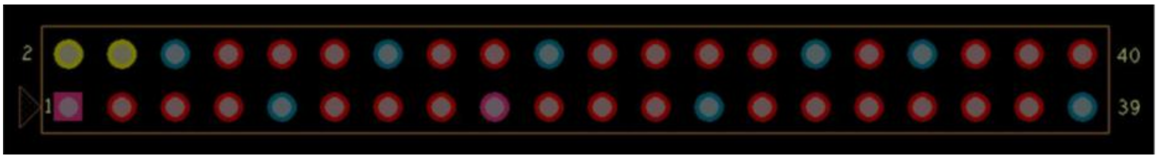
4. Orange Pi 4B hardware parameters

CPU	Rockchip RK3399 (28nm HKMG process) 6-core ARM® 64-bit processor ,main frequency speeds up to 2.0GHz Based on the large and small size core architecture of big.LITTLE : Dual-core Cortex-A72 (large core) + Quad-core Cortex-A53 (small core)
GPU	Mali-T864 GPU Supports OpenGL ES1.1/2.0/3.0/3.1, OpenVG1.1,OpenCL, DX11, support AFBC
NPU	SPR2801S, adopt MPE and APiM unique AI architecture Typical calculation power 2.8Tops, with 9.3Tops/W ultra high performance
Memory+Onboard Storage	Dual 4GB LPDDR4 + 16GB EMMC flash
Onboard WIFI+Bluetooth	AP6256, IEEE 802.11 a/b/g/n/ac, BT5.0
Network	10/100/1000Mbps Ethernet (Realtek RTL8211E)
Audio	Output: 3.5mm Jack and HDMI2.0a Input: MIC
Video Outputs	1 x HDMI 2.0 (Type-A), Supports 4K@60fps output 1 x DP 1.2 (Display Port) , Supports 4K@60fps output Supports Dual MIPI-DSI （4 lines per channel）
Camera	2 x MIPI-CSI(MIPI_RX0、MIPI_TX1/RX1)
USB	2 x USB2.0 HOST， 1 x USB3.0 Type-C
RTC	Support RTC, on-board battery backup interface
Debug UART	3pins Debug UART
GPIO	GPIO1 40 pins（1 x I2S、2 x I2C、1 x SPI/UART、8 x GPIO） GPIO2 24pin PCIE port
Key	Upgrade Key & Reset Key
Power Source	DC 5V/3A， TYPE-C 5V/3A
LED	Power led & Status led

OS Support	Android 8.1 Ubuntu 16.04 Ubuntu 18.04 Debian 9

5. GPIO specifications

The following figure is the GPIO pin function diagram of Orange Pi 4B:



PIN1	VCC3V3_SYS	PIN2	VCC5V0_SYS
PIN3	I2C2_SDA_3V0	PIN4	VCC5V0_SYS
PIN5	I2C2_SCL_3V0	PIN6	GND
PIN7	GPIO4_C6/PWM1	PIN8	I2C3_SCL
PIN9	GND	PIN10	I2C3_SDA
PIN11	GPIO1_A1	PIN12	GPIO1_C2
PIN13	GPIO1_A3	PIN14	GND
PIN15	GPIO2_D4	PIN16	GPIO1_C6
PIN17	GND	PIN18	GPIO1_C7
PIN19	UART4_TX	PIN20	GND
PIN21	UART4_RX	PIN22	GPIO1_D0
PIN23	SPI1_CLK	PIN24	SPI1_CSn0
PIN25	GND	PIN26	GPIO4_C5
PIN27	I2C2_SDA	PIN28	I2C2_SCL
PIN29	I2S0_LRCK_RX	PIN30	GND
PIN31	I2S0_LRCK_TX	PIN32	I2S_CLK
PIN33	I2S0_SCLK	PIN34	GND
PIN35	I2S0_SDI0	PIN36	I2S0_SDO0
PIN37	I2S0_SDI1SDO3	PIN38	I2S0_SDI2SDO2
PIN39	GND	PIN40	I2S0_SDI3SDO1

II. Development board instructions

1. What to do with Orange Pi 4B?

To start your OrangePi 4B, first prepare the following hardware:

- Orange Pi 4B Development Board
- TF card, minimum 8GB capacity, class 10, it is recommended to use brand TF card, such as: SanDisk 16G TF card (optional, Android system does not require a TF card)
- One 5V / 3A or more power adapter (both DC and TYPEC interfaces)
- USB to TTL serial port (optional, for debugging or operation on PC)
- A monitor or TV with HDMI input (or optional LCD accessory)
- A USB keyboard and mouse, and a USB HUB is required when connecting more USB devices at the same time
- For a compiling host, the configuration should preferably meet the following conditions:

  64-bit CPU
  8 GB and above
  100GB of free disk space

The operating system can be **Ubuntu14.04 Ubuntu18.04**

2. How to start Orange Pi 4B?

Connect the HDMI interface of the development board to the display via an HDMI cable, plug the power adapter into a live socket, and plug the power cable interface into the development board. The development board EMMC is pre-installed with the Android system and will automatically turn on when it is powered on.

During normal system startup, the power light is on and the status light is blinking.

If you need to use linux system, please refer to the linux system programming chapter.

3. Notes on using the serial port

OrangePi 4 uses a baud rate of 1500000. If the serial board uses a cp210x chip, garbled characters will appear on ubuntu18.04. This problem does not exist on ubuntu14.04. After verification, using the cp210x driver with a lower version of the kernel can solve this problem, so Ubuntu 18.04 requires customers to port the lower version of the driver themselves.

The reference method is given below, using cp210x.c with 4.4 kernel.

```
git clone https://github.com/baiywt/cp210x.git
cd cp210x/
make
```

Remove the original cp210x driver for Ubuntu 18.04.

```
sudo rm -rf /lib/modules/$(unam-r)/kernel/drivers/usb/serial/cp210x.ko
```

Copy the compiled cp210x driver to the system directory

```
sudo cp ./cp210x.ko /lib/modules/$(uname -r)/kernel/drivers/usb/serial/
```

Uninstall the original driver

```
sudo rmmod cp210x
```

Install new driver

```
sudo modprobe cp210x
```

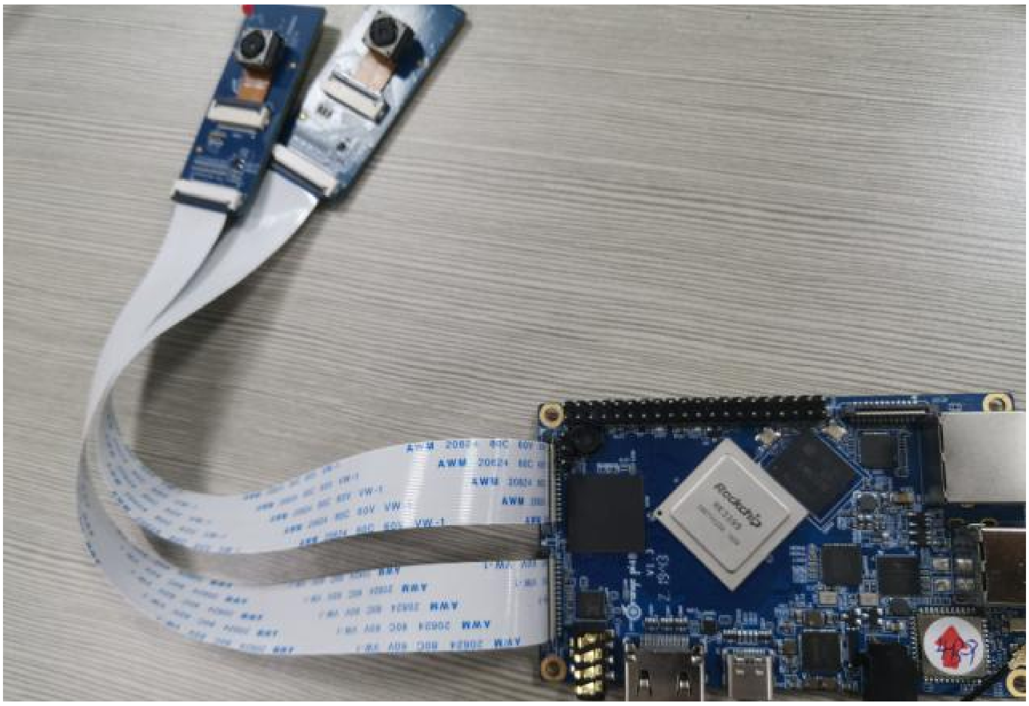
III. Instructions for using the Android system

1. Take photos and videos with MIPI camera

Under the Android system, OrangePi 4B can be used with OV13850 camera to take photos and videos, connect the camera to the MIPI interface of OrangePi4, boot into the Android system, and use the camera application that comes with the system to complete the photos and videos. The operation is the same as Android phones .

OrangePi 4B can connect up to two MIPI cameras simultaneously, one for the front and the other for the rear.

The connection method is shown in the following figure:

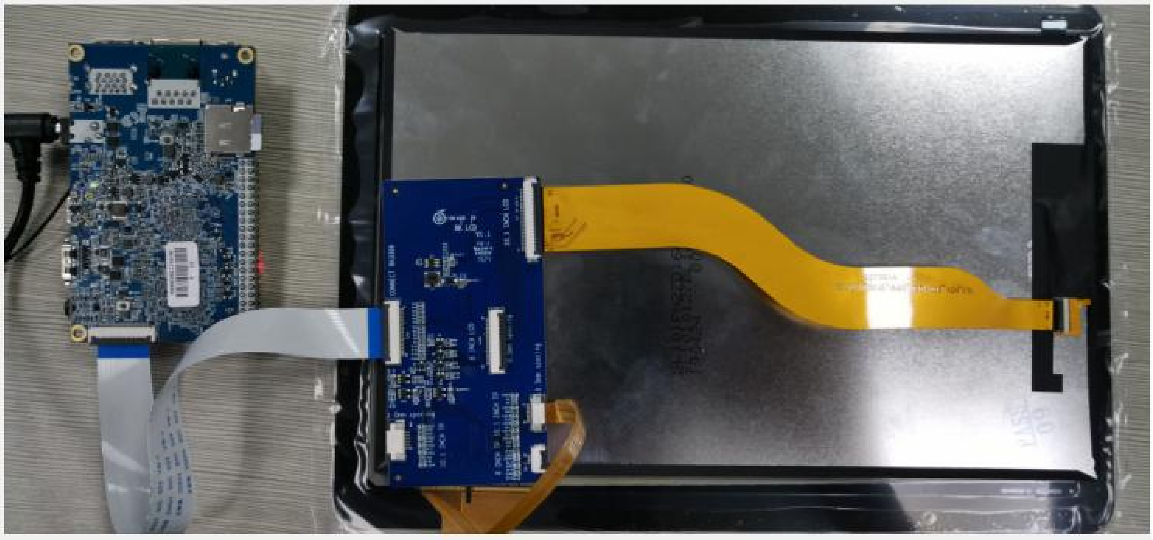


2. Use MIPI screen

The official website releases Android mirroring to support MIPI screen and HDMI output, just connect the screen to the LCD1 interface.

To connect two MIPI screens, you need to turn off the support of camera2 and open the configuration of LCD2. For details, please refer to the documentation under the RKDocs folder in the Android source code.

The connection method is shown in the figure:



3. Use adb

If you need to change the system files for the first startup, you need to turn off the security verification (Note: You don't need to close the apk installation), you need to restart after closing the security verification.

```
adb root
adb disable-verity
adb reboot
```

Remount

```
adb root
adb remount
```

transfer files

```
adb push example.txt /system/
```

Note: Some USB Type-C cables do not support adb, so you can change the USB Type-C cable in this case.

4. Dual screen different display demo use

1) Connect OrangePi 4B to HDMI display and LCD1 to mipi screen

2)install dualscreen.apk, copy the test.mp4 file to the / sdcard / directory of the Android system, you can use the following command

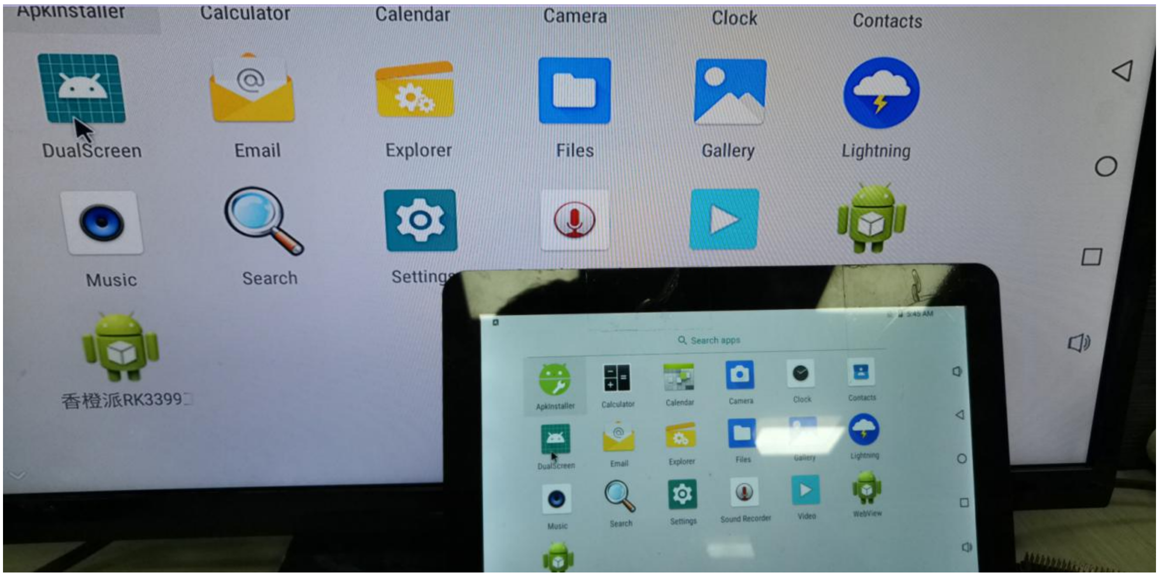
adb install dualscreen.apk

adb push test.mp4 / sdcard /

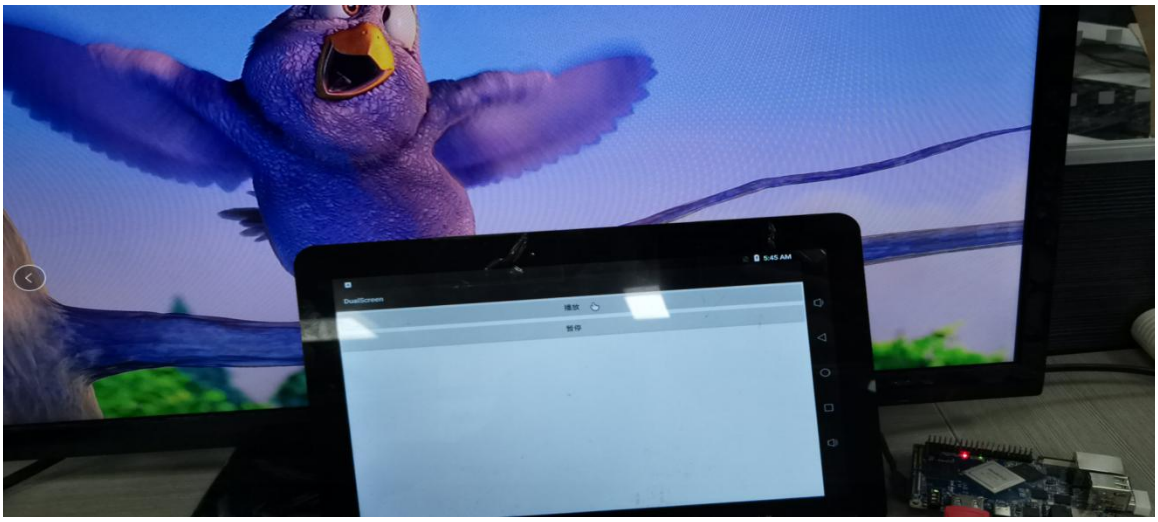
Ranch

3) Click Settings-》Apps & notifications-》App info-》DualScreen-》Permissions-》on the desktop to open the Storage permission

4) Click on the DualScreen icon



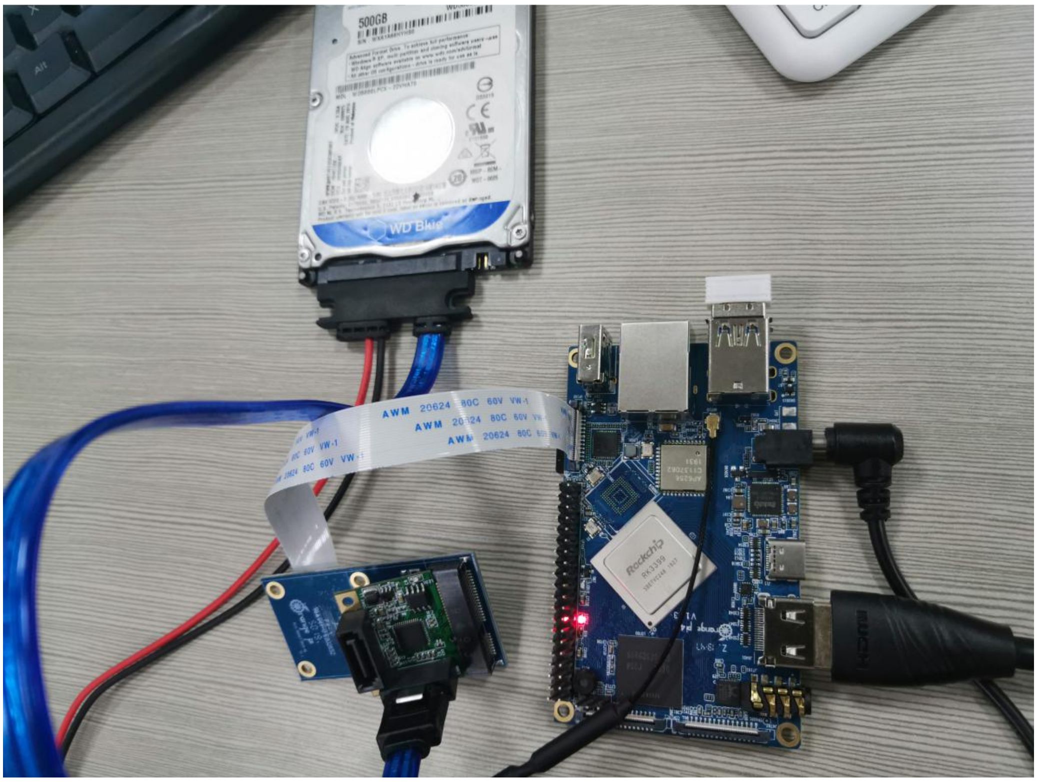
5) Click play to start playing test.mp4



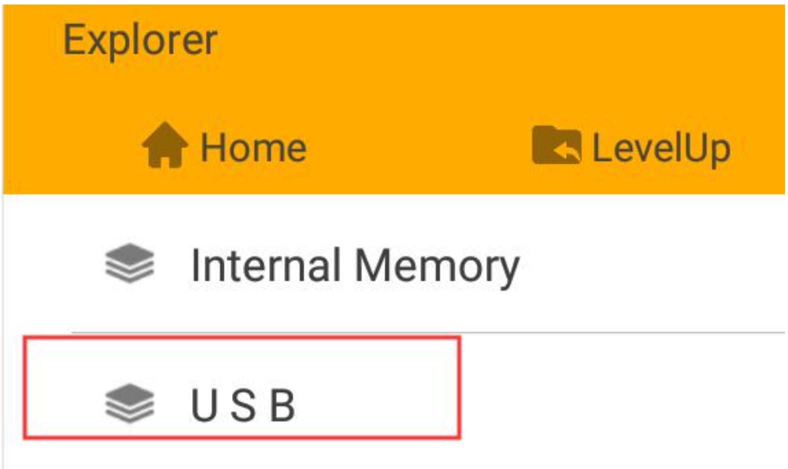
5. PCIE interface test

Currently, Android 8.1 system only supports PCIE to SATA (ASM1062). Drivers for other PCIE devices have not yet been adapted.

Connect the PCIE small board to the board interface through a 24-pin reverse cable. Then connect the ASM1062 small board to the PCIE small board, connect the hard disk to the ASM1062, and start the board. The system will recognize the device and mount the hard disk automatically.



In Android, you can open the file manager to see the mounted device.



IV. Instructions for Linux systems

1. Linux boot light description

The on board LED will light red and green after the start up

2. Login account and password

Username orangepi, password: orangepi

3. Extend rootfs partition

After the system is started for the first time, it will automatically expand the capacity without manual expansion. If the user finds that the expansion is not successful, run the following command to expand the capacity.

```
resize-helper
```

4. Time zone setting (take Shanghai, China as an example)

```
cp /usr/share/zoneinfo/Asia/Shanghai /etc/localtime
```

5. Test recording and playback

Enter the following command to test the microphone recording

```
arecord -Dhw:0,0 -r8000 -f cd audio.wav
```

3.5 headphone jack output sound

```
aplay  -Dhw:0,0  audio.wav
```

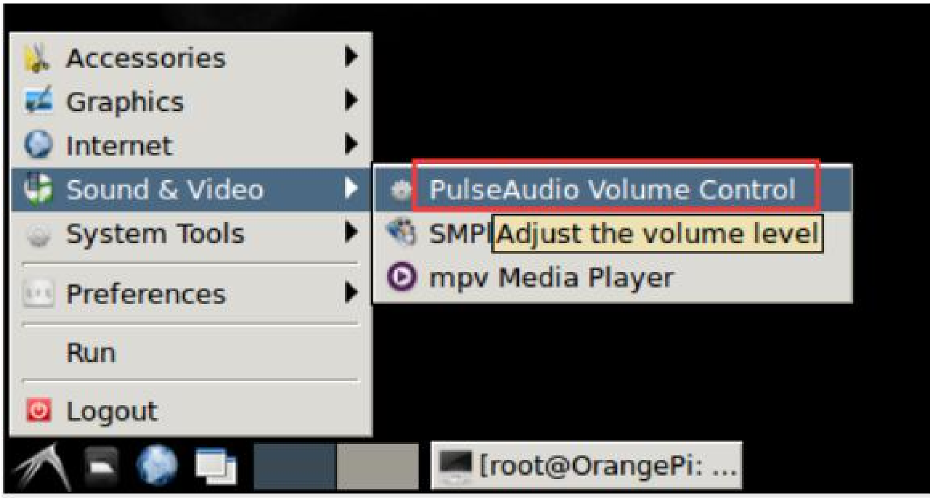
HDMI output sound

```
aplay  -Dhw:1,0  audio.wav
```

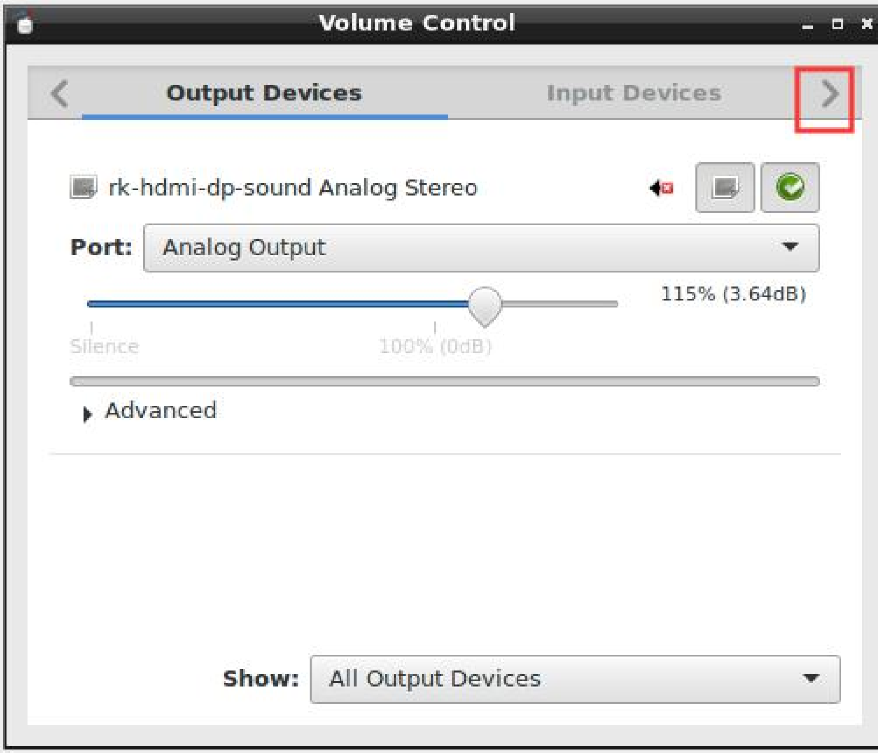
You can also modify the /etc/asound.conf file to configure the default output

6. HDMI and 3.5 audio switching

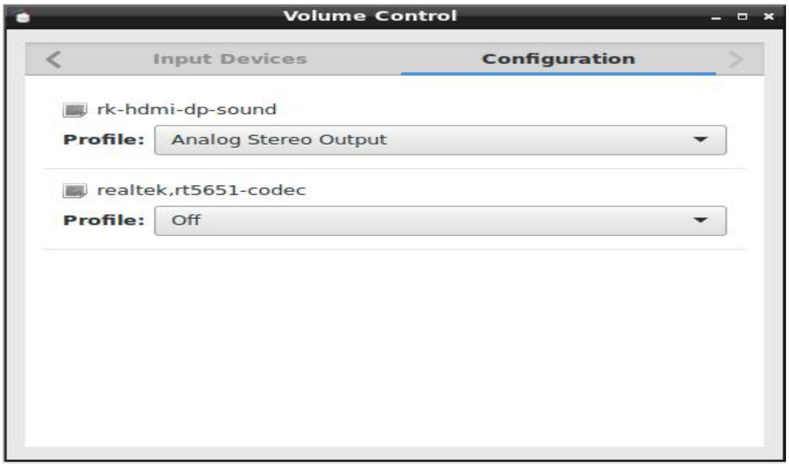
Use mplayer to play a piece of audio, open PulseAudio Volume Control application



Click the arrow in the figure below to switch to the Configuration column



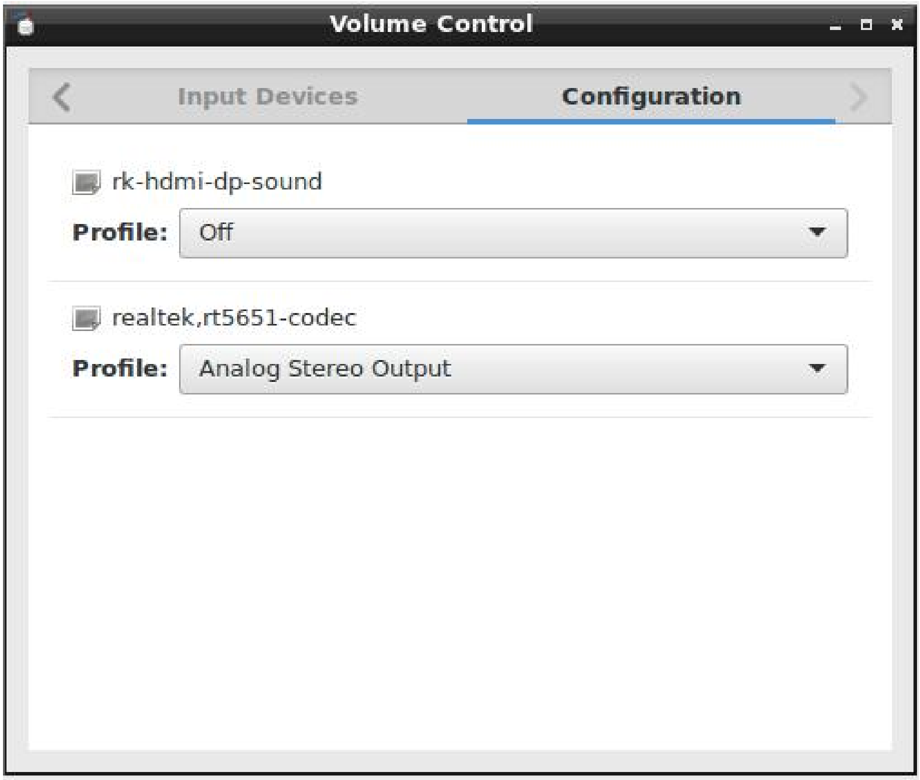
Configure as shown below, the sound is output from HDMI.



rk-hdmi-dp-sound
Profile: Analog Stereo Output

realtek,rt5651-codec
Profile: Off

The sound is output from the headphones.



rk-hdmi-dp-sound
Profile: Off

realtek,rt5651-codec
Profile: Analog Stereo Output

7. WIFI configuration method

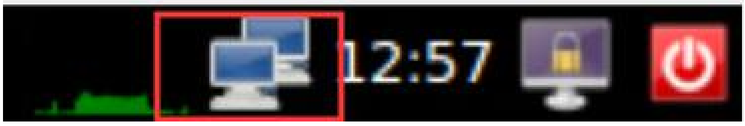
- Modify the configuration file (for server version)

Add the following configuration to / etc / network / interface and restart

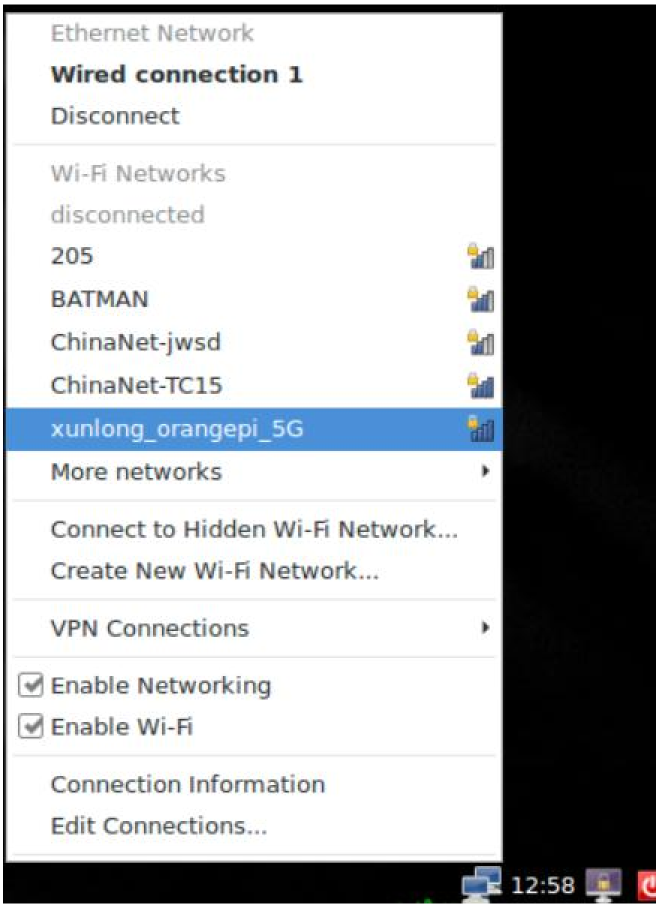
```
auto wlan0
iface wlan0 inet dhcp
wpa-ssid orangepi                //Fill in the WIFI account here（orangepi）
wpa-psk orangepi                 //Fill in the WIFI password here（orangepi）
```

- Graphical interface configuration

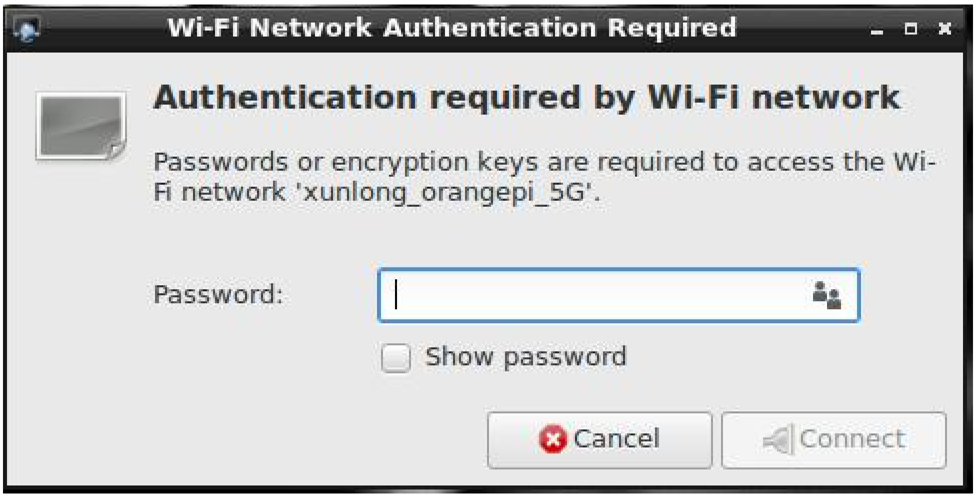
Click on the Network Manager icon in the lower right corner of the desktop



Click on the hotspot named xunlong_orangepi_5G.



Enter password to connect



Authentication required by Wi-Fi network

Passwords or encryption keys are required to access the Wi-Fi network 'xunlong_orangepi_5G'.

Password:

8. Transfer files using Bluetooth

Execute the following command to initialize Bluetooth

```
$ sudo bluetooth.sh
```

Download blueman tool for testing

```
sudo apt-get -y install blueman
```

9. Using the OV13850 camera

After starting the system, open a command line terminal

Run the following command. If the following message appears, the camera is working normally. If there is no such message, please check whether the camera is connected properly.

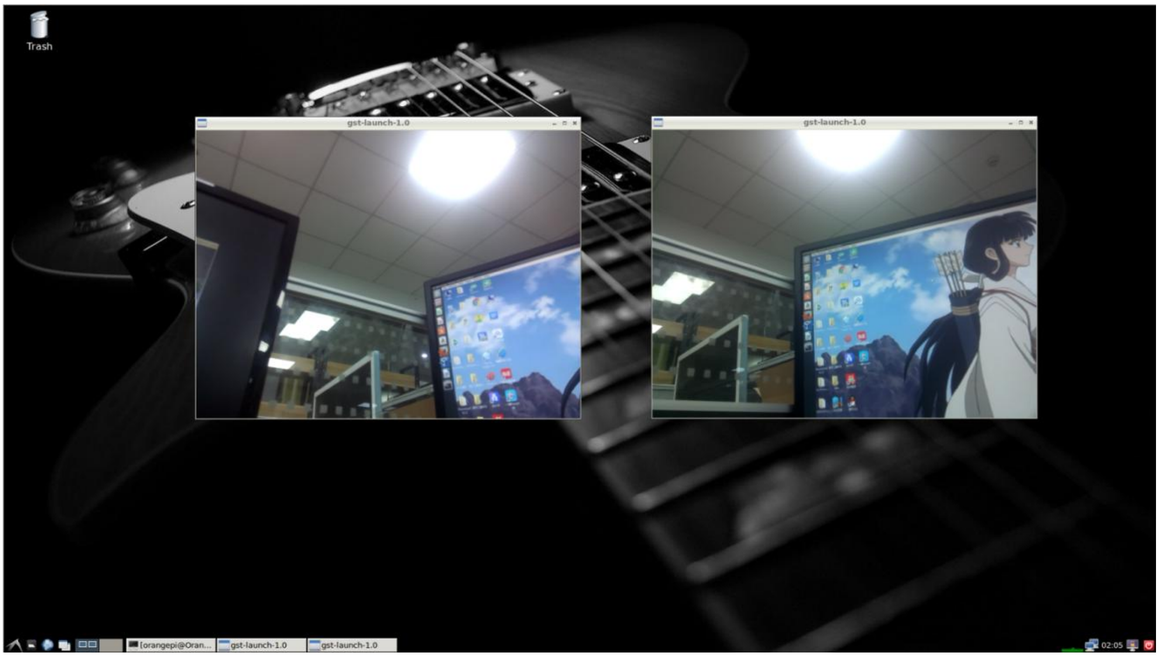
```
$ dmesg |grep Async
[    1.378648] rkisp1: Async subdev notifier completed
```

Execute the following command to open the camera

```
$ test_camera-gst.sh
```

Turn on two cameras at the same time

```
$ test_camera-dual.sh
```



Use the command to take a picture and generate a jpg picture in the / home / orangepi directory

```
$ test_camera-capture.sh
```

Use the command to record. The hardware encoding is used when recording. Generate video file output.ts in / home / orangepi

```
$ test_camera-record.sh
```

10. Use MIPI screen

Download the Linux source code and make the following changes in dts

```
--- a/arch/arm64/boot/dts/rockchip/rk3399-orangepi-lcd.dtsi
+++ b/arch/arm64/boot/dts/rockchip/rk3399-orangepi-lcd.dtsi
@@ -40,12 +40,12 @@
              max-x = <800>;
              max-y = <1280>;
              tp-size = <101>;   // <911> for 8 inch // <101> for 10
inch
-             status = "disable";
+             status = "okay";
        };
 };
 &dsi {
-       status = "disable";
+       status = "okay";
       panel@1 {
              compatible = "simple-panel-dsi";
              reg = <0>;
```

After recompiling and replacing the kernel, LCD1 is connected to the MIPI screen test.

The default is portrait screen, you can use xrandr -o left to flip the screen.

11. PCIE interface test

At present, the Linux system (v1.2 and above) is compatible with PCIE to SATA (ASM1062) and RTL8822BE network cards. Drivers for other PCIE devices have not yet been adapted.

- **RTL8822BE network card test**

After inserting the RTL8822BE wireless network card module according to the method shown in the figure below, start the system, and the system will automatically identify and load the 8822be.ko kernel module.

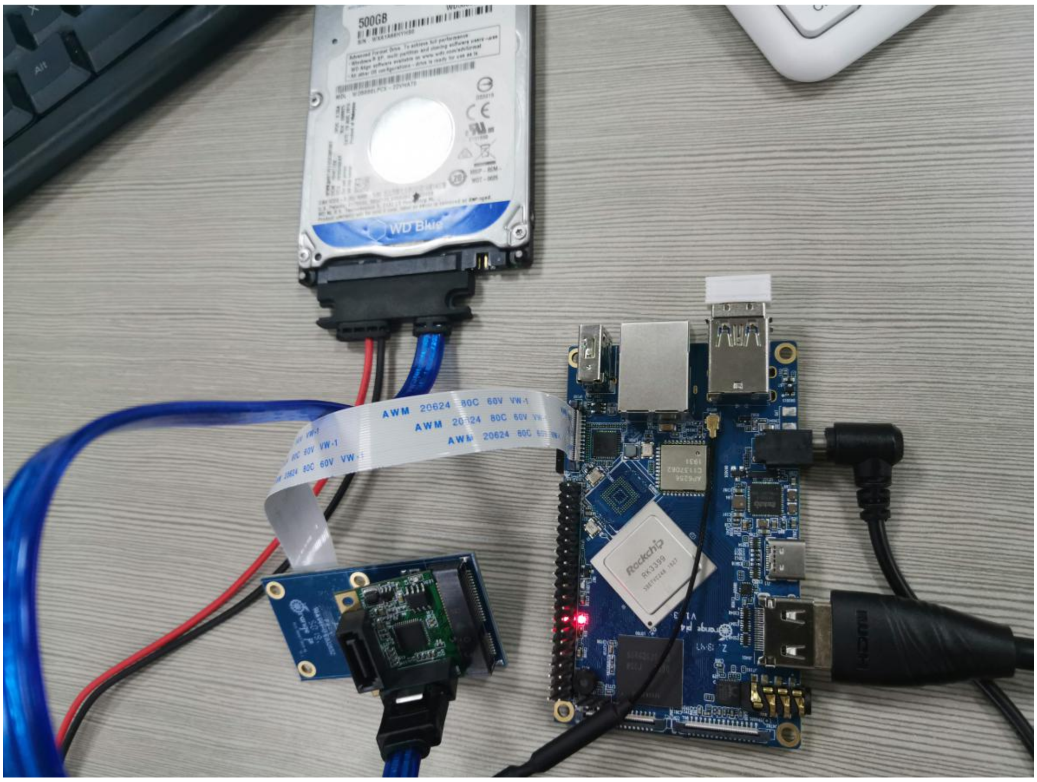
The lsmod command can be used to check whether the driver is successfully loaded, and the ifconfig command can be used to view the PCIE

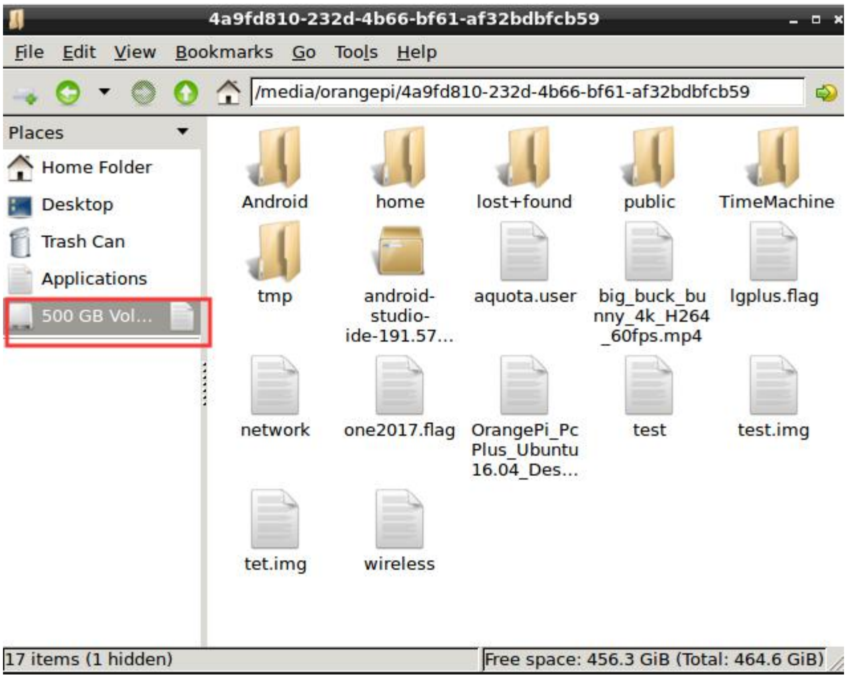
The network node corresponding to the wireless network card.

```
root@OrangePi:~# lsmod
Module                  Size  Used by
8822be               2420736  0

root@OrangePi:~# ifconfig wlp1s0
wlp1s0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether f8:da:0c:5a:00:6f  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 83  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions
```

- **PCIE to SATA test**

Connect the PCIE small board to the board interface through a 24-pin reverse cable. Then connect the ASM1062 small board to the PCIE small board, connect the hard disk to the ASM1062, and start the board. The system will recognize the hard disk device**.**

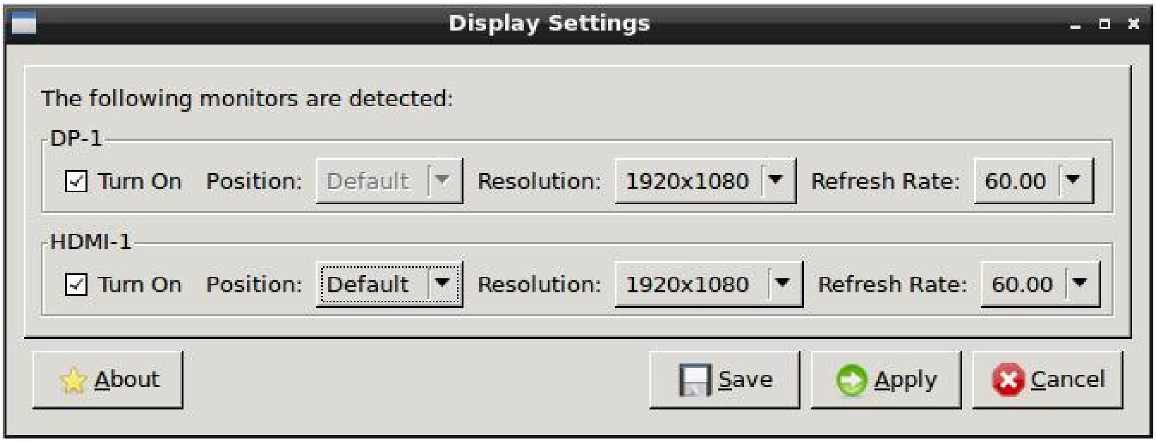



4a9fd810-232d-4b66-bf61-af32bdbfcb59
File Edit View Bookmarks Go Tools Help
/media/orangepi/4a9fd810-232d-4b66-bf61-af32bdbfcb59
Places
Home Folder
Desktop
Trash Can
Applications
500 GB Vol...
Android
home
lost+found
public
TimeMachine
tmp
android-studio-ide-191.57...
aquota.user
big_buck_bunny_4k_H264_60fps.mp4
lgplus.flag
network
one2017.flag
OrangePi_PcPlus_Ubuntu16.04_Des...
test
test.img
tet.img
wireless
17 items (1 hidden)
Free space: 456.3 GiB (Total: 464.6 GiB)

12. Dual screen display instructions

OrangePi 4 can support typeC to HDMI in addition to a second display.

In the Linux system, you can set the dual-screen display mode through the interface. Use the mouse to click on menu-》 Preferences-》 Monitor Settings


Display Settings

The following monitors are detected:

DP-1

☑ Turn On Position: Default Resolution: 1920x1080 Refresh Rate: 60.00

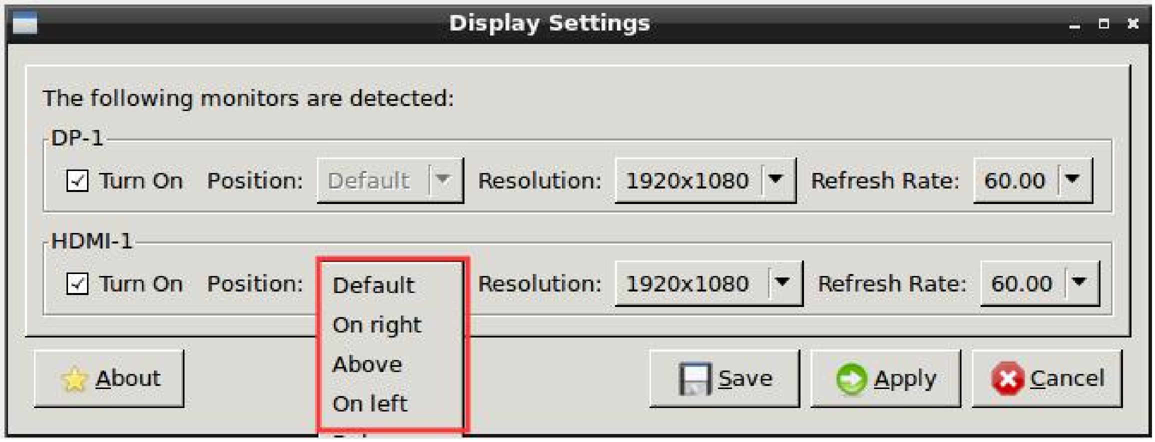
HDMI-1

☑ Turn On Position: Default Resolution: 1920x1080 Refresh Rate: 60.00

You can see that there are two display devices under the current system, which are DP-1 and HDMI-1.

Dual-screen display supports dual-screen simultaneous display mode and dual-screen different display mode. Different display modes Support On Right, Above, On Left, Below.

Set Position in Display Settings, you can switch the display mode of dual screen.


Display Settings

The following monitors are detected:

DP-1

☑ Turn On Position: Default Resolution: 1920x1080 Refresh Rate: 60.00

HDMI-1

☑ Turn On Position: Resolution: 1920x1080 Refresh Rate: 60.00

In addition, the Linux system also supports dual MIPI DSI output (the official website image is not supported, software needs to be modified)

13. Install Chinese input method

Reference document

https://github.com/baiywt/docs

14. Test GPU

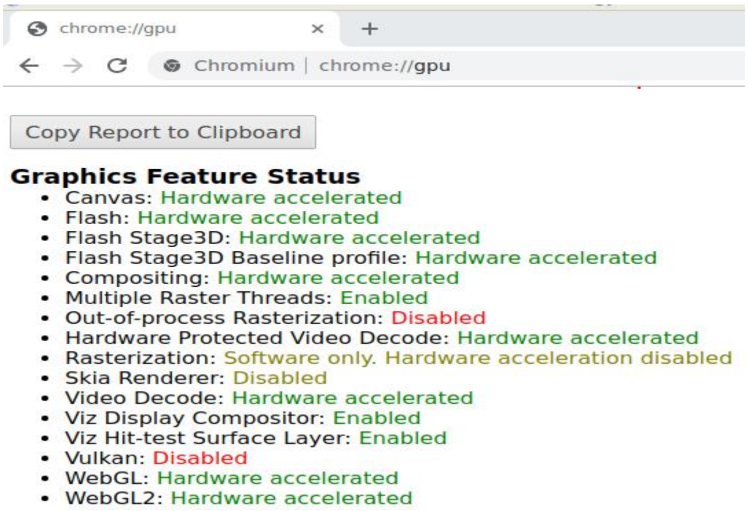
Install test software

```
$ sudo apt install glmark2-es2
```

Run the test, you can see the GPU running points.

```
glmark2-es2
```

The system's pre-installed Chromium web browser has hardware acceleration enabled by default and supports WebGL. You can enter the URL chrome: // gpu for hardware acceleration. As shown below.



Graphics Feature Status

- Canvas: Hardware accelerated
- Flash: Hardware accelerated
- Flash Stage3D: Hardware accelerated
- Flash Stage3D Baseline profile: Hardware accelerated
- Compositing: Hardware accelerated
- Multiple Raster Threads: Enabled
- Out-of-process Rasterization: Disabled
- Hardware Protected Video Decode: Hardware accelerated
- Rasterization: Software only. Hardware acceleration disabled
- Skia Renderer: Disabled
- Video Decode: Hardware accelerated
- Viz Display Compositor: Enabled
- Viz Hit-test Surface Layer: Enabled
- Vulkan: Disabled
- WebGL: Hardware accelerated
- WebGL2: Hardware accelerated

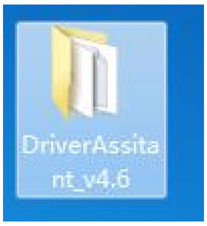
V. Android firmware burning

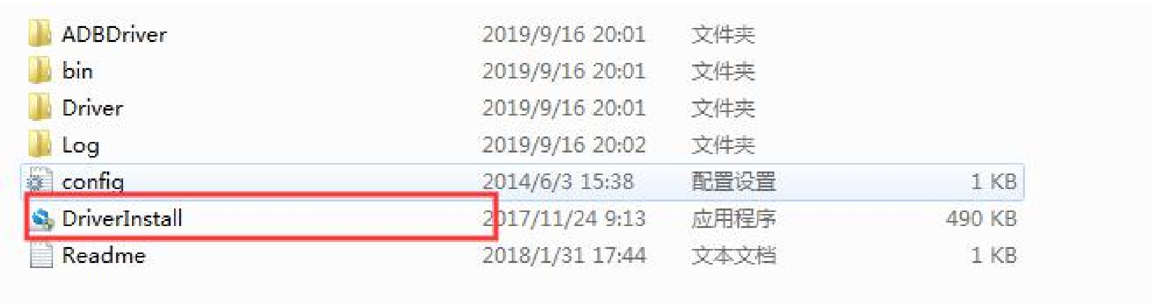
Preparations: TYPEC data line; android firmware, programming tools and drivers (in the official website Baidu cloud download)
Burn the system to EMMC as follows:

1. Enter loader mode to flash to EMMC

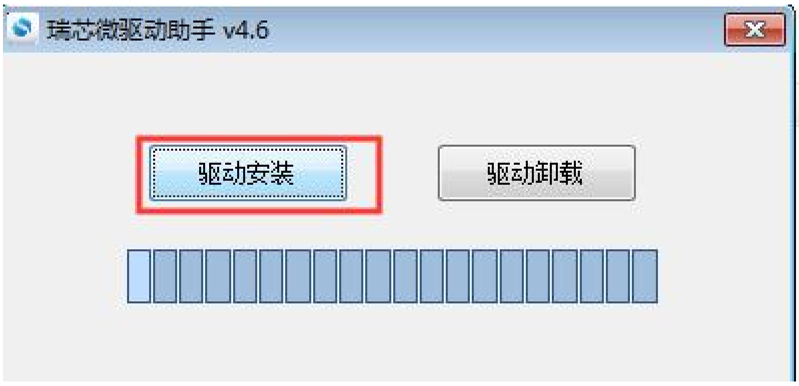
- **The host is win7 system**

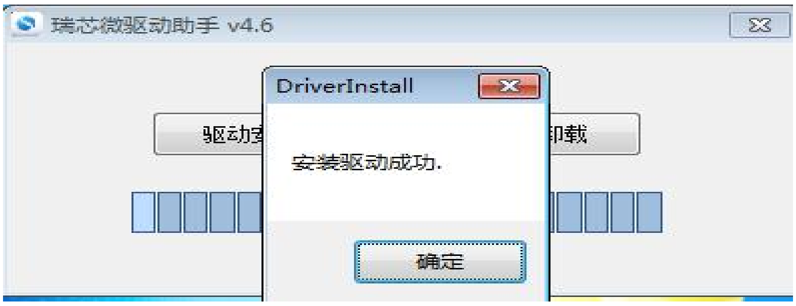
(1) Install Rockchip MicroDrive





ADBDriver	2019/9/16 20:01	文件夹	
bin	2019/9/16 20:01	文件夹	
Driver	2019/9/16 20:01	文件夹	
Log	2019/9/16 20:02	文件夹	
config	2014/6/3 15:38	配置设置	1 KB
DriverInstall	2017/11/24 9:13	应用程序	490 KB
Readme	2018/1/31 17:44	文本文档	1 KB





安装驱动成功.

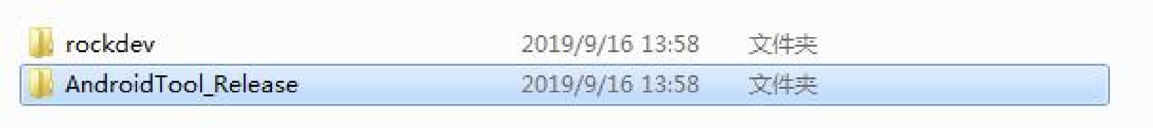
(2) Connect OrangePi 4B to DC power adapter first, and then connect OrangePi 4B and PC through Type-C data cable.

(3) Hold down the rescover key and press the reset key lightly. At this time, the OrangePi 4 enters the loader mode.

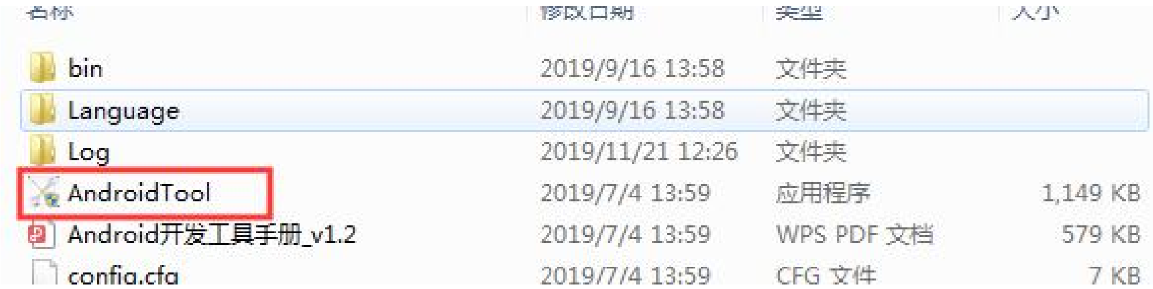
At this time, if you connect the serial port, you will see the following information:

```
#Boot ver: 0000-00-00#0.00
empty serial no.
normal boot.
checkKey
vbus = 1
rockusb key pressed.
```

(4) Open AndroidTool

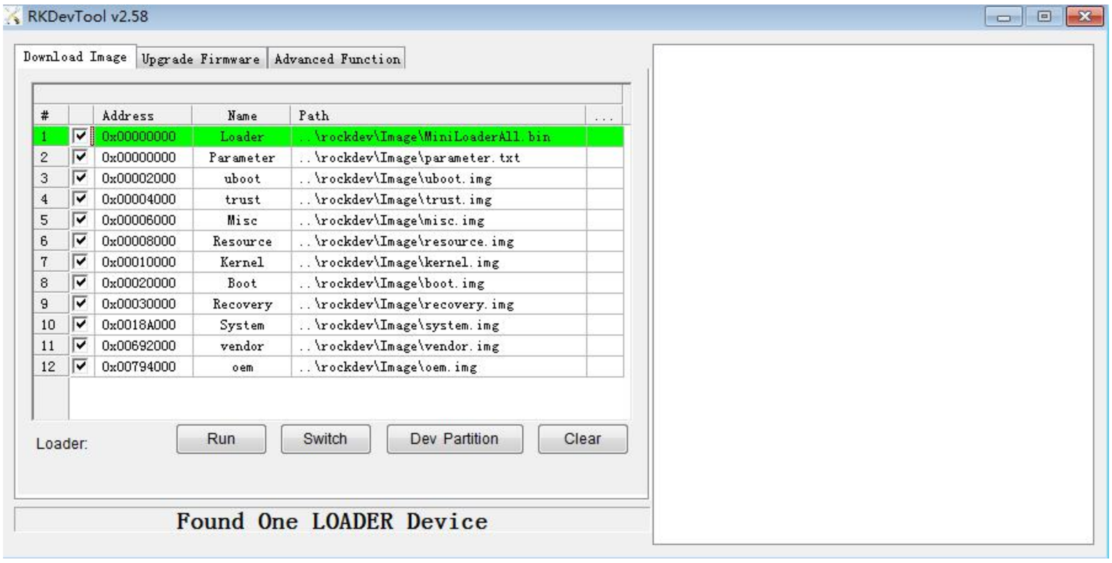


rockdev	2019/9/16 13:58	文件夹
AndroidTool_Release	2019/9/16 13:58	文件夹



名称	修改日期	类型	大小
bin	2019/9/16 13:58	文件夹	
Language	2019/9/16 13:58	文件夹	
Log	2019/11/21 12:26	文件夹	
AndroidTool	2019/7/4 13:59	应用程序	1,149 KB
Android开发工具手册_v1.2	2019/7/4 13:59	WPS PDF 文档	579 KB
config.cfg	2019/7/4 13:59	CFG 文件	7 KB

The Loader device will be displayed below the tool, as shown in the figure below.



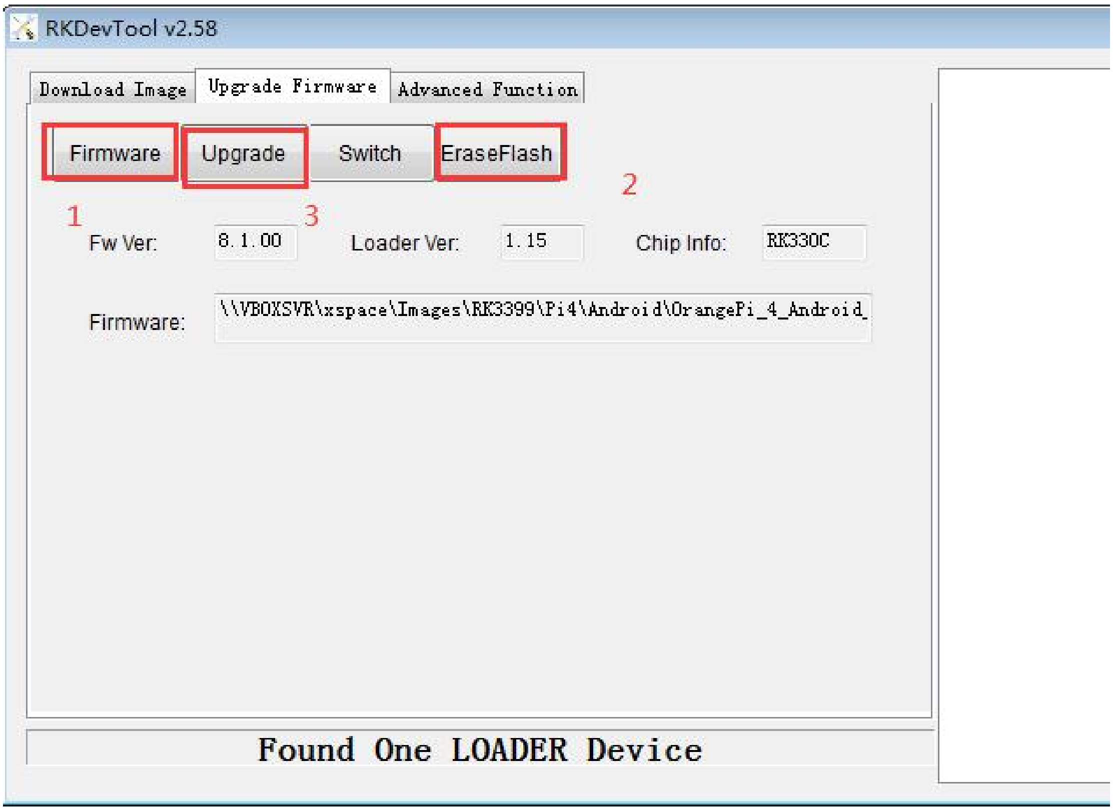
#		Address	Name	Path	...
1	☑	0x00000000	Loader	..\rockdev\Image\MiniLoaderAll.bin	
2	☑	0x00000000	Parameter	..\rockdev\Image\parameter.txt	
3	☑	0x00002000	uboot	..\rockdev\Image\uboot.img	
4	☑	0x00004000	trust	..\rockdev\Image\trust.img	
5	☑	0x00006000	Misc	..\rockdev\Image\misc.img	
6	☑	0x00008000	Resource	..\rockdev\Image\resource.img	
7	☑	0x00010000	Kernel	..\rockdev\Image\kernel.img	
8	☑	0x00020000	Boot	..\rockdev\Image\boot.img	
9	☑	0x00030000	Recovery	..\rockdev\Image\recovery.img	
10	☑	0x0018A000	System	..\rockdev\Image\system.img	
11	☑	0x00692000	vendor	..\rockdev\Image\vendor.img	
12	☑	0x00794000	oem	..\rockdev\Image\oem.img	

Found One LOADER Device

(5) Click Upgrade Firmware. After selecting the firmware path, first erase the Flash,

and then click Upgrade to burn.

Note the order of the red marked sections in the figure below.

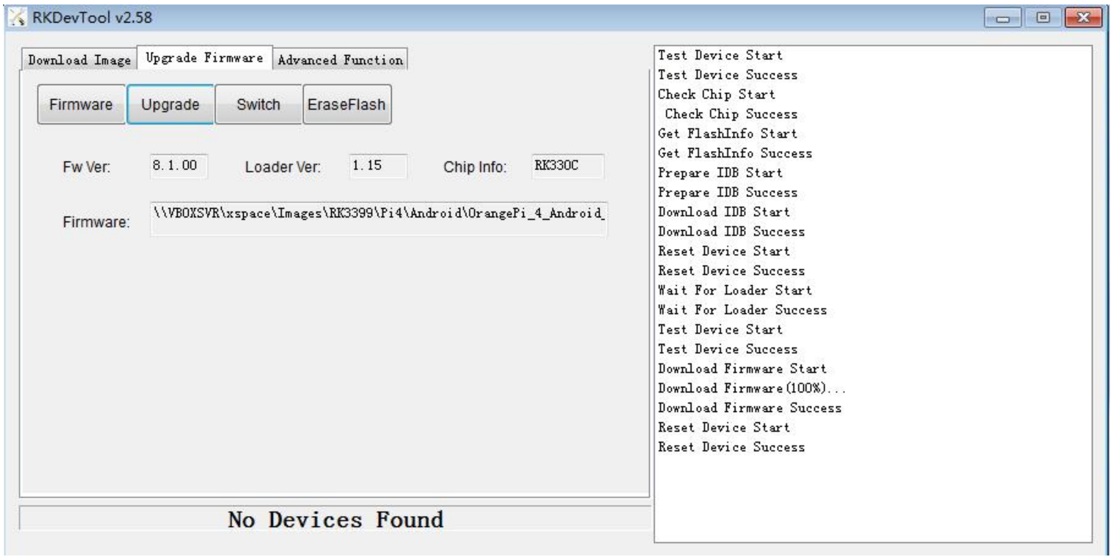


Fw Ver: 8.1.00 Loader Ver: 1.15 Chip Info: RK330C

Firmware: \\VBOXSVR\xspace\Images\RK3399\Pi4\Android\OrangePi_4_Android_

Found One LOADER Device

Burning completed



Fw Ver: 8.1.00 Loader Ver: 1.15 Chip Info: RK330C

Firmware: \\VBOXSVR\xspace\Images\RK3399\Pi4\Android\OrangePi_4_Android_

No Devices Found

```
Test Device Start
Test Device Success
Check Chip Start
 Check Chip Success
Get FlashInfo Start
Get FlashInfo Success
Prepare IDB Start
Prepare IDB Success
Download IDB Start
Download IDB Success
Reset Device Start
Reset Device Success
Wait For Loader Start
Wait For Loader Success
Test Device Start
Test Device Success
Download Firmware Start
Download Firmware(100%)...
Download Firmware Success
Reset Device Start
Reset Device Success
```

- **The host is a linux system**

(1) Prepare the upgrade_tool tool

```
$ unzip  Linux_Upgrade_Tool_v1.39.zip
$ cd  Linux_Upgrade_Tool_v1.39
$ sudo chmod +x ./upgrade_tool
```

(2) Connect the OrangePi 4B to the power adapter, and connect the Type-C data cable to the OrangePi 4B and the PC.

(3) Press and hold the rescover key, and press the reset key lightly. At this time, the OrangePi 4B enters the loader mode.

(4) Burn Android firmware

```
sudo ./upgrade_tool ef OrangePi_4_Android8.1_v1.0.img  Erase EMMC
sudo ./upgrade_tool uf OrangePi_4_Android8.1_v1.0.img  Burn to EMMC
```

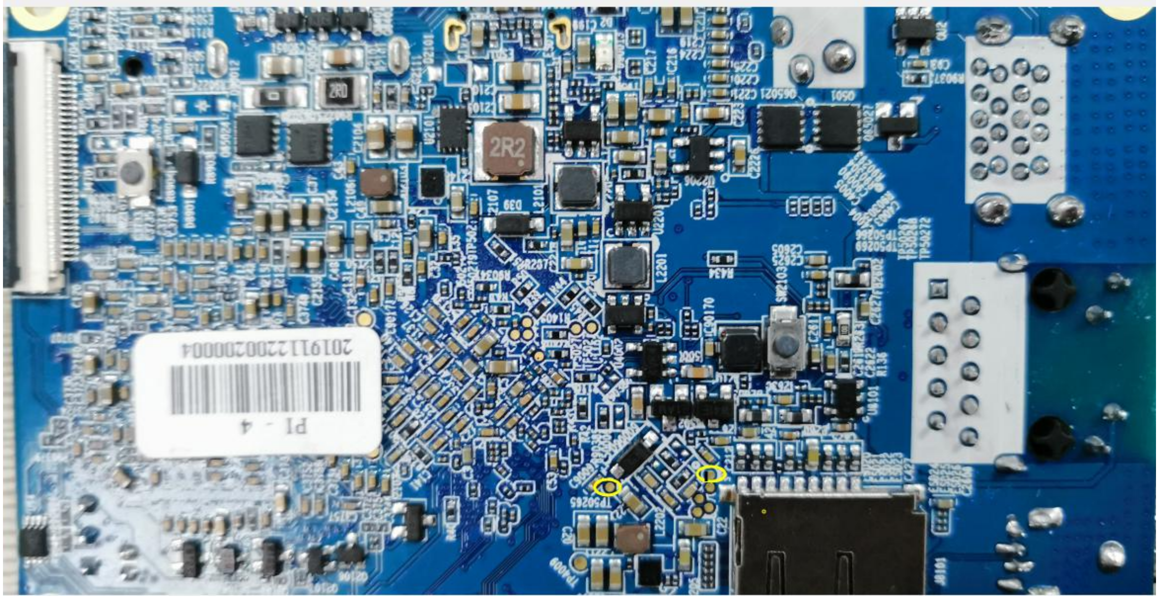
Note: If you can't enter the loader mode, you can try the MaskRom mode programming. Methods as below:

1.The device disconnects all power

2.Remove the SD card

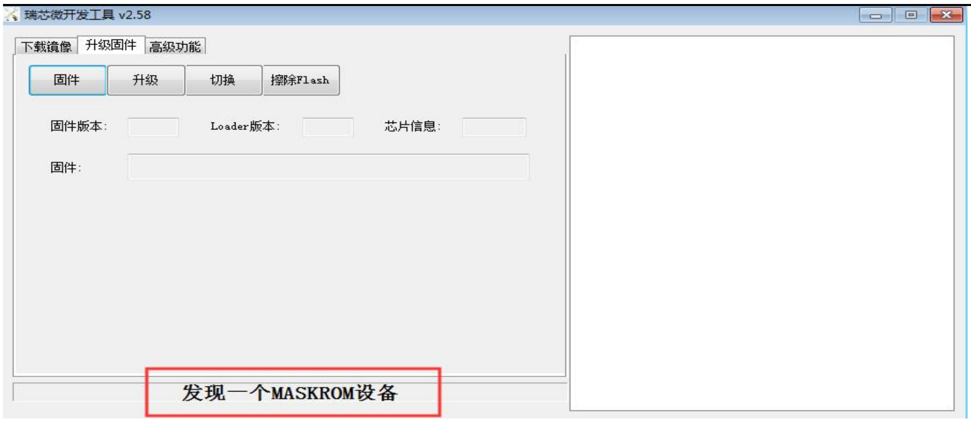
3.Connect the device and the host with a USB Type-C cable

4. Use metal tweezers to connect the solder joints reserved by OrangePi 4 (note the yellow circle in the figure below) and keep it.



5. Plug the device into a power source.

6. Wait for a while, then release the tweezers, the device should enter MaskRom mode.



固件版本:

Loader版本:

芯片信息:

固件:

发现一个MASKROM设备

2. Flash to EMMC using SD upgrade card

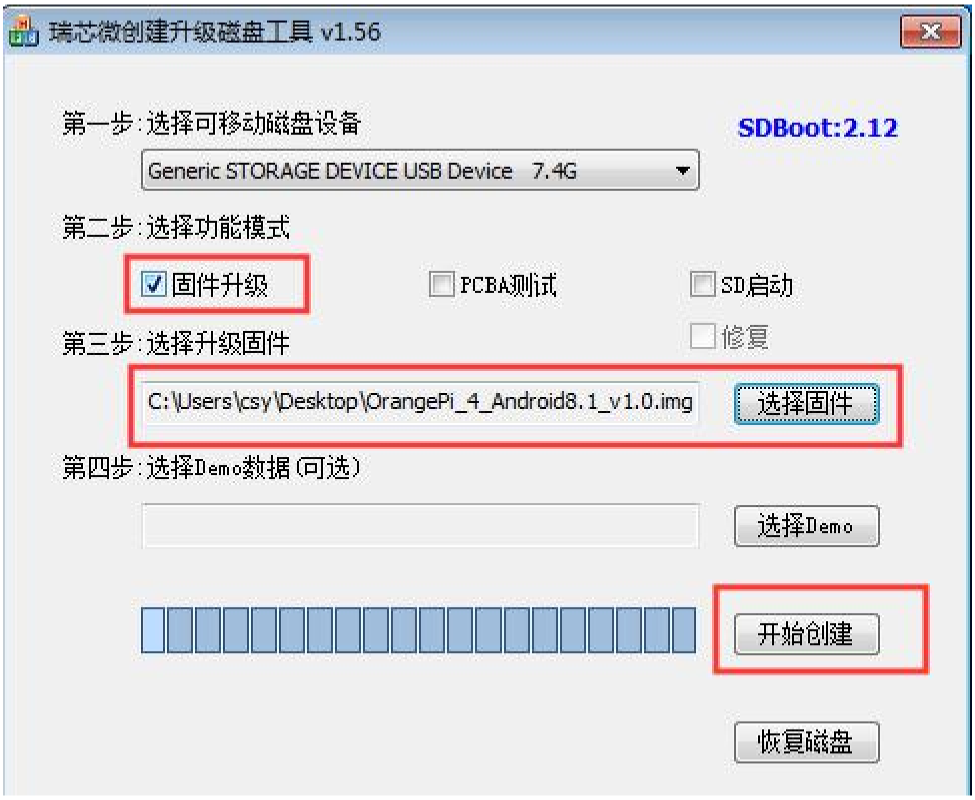
Preparation: android firmware, a tf card, card reader

This method can only be used in windows systems.

Insert the card reader into the host, download SDDiskTool_v1.56 in the official tool section of OrangePi 4, and open the software.

Tick Firmware Upgrade, select the firmware, and finally click Create.

Please note the red marks in the figure below.



第一步:选择可移动磁盘设备

Generic STORAGE DEVICE USB Device 7.4G

第二步:选择功能模式

☑ 固件升级 □ PCBA测试 □ SD启动 □ 修复

第三步:选择升级固件

C:\Users\csy\Desktop\OrangePi_4_Android8.1_v1.0.img

第四步:选择Demo数据(可选)

After finishing, insert the TF card into the slot of OrangePi 4B, power on and start up, and the startup code will burn the firmware into EMMC. If you want to see the programming progress, you can prepare an HDMI cable to connect the board and the monitor. The programming process is about 3 ~ 4 minutes.

VI. Linux firmware burning

We can flash the Linux firmware of Orange Pi 4B to the TF card through Etcher. If you purchased the Orange Pi 4 development board without EMMC Flash chip, you can only start the system through the TF card. Etcher supports the following operating systems:

- Linux (most distributions, such as Ubuntu)
- MacOS 10.9 and later
- Windows 7 and later

The Etcher software installation package can be downloaded from its official website https://etcher.io/, or it can be downloaded from the official tool of the Orange Pi 3 official website download page

1. How to install Etcher

- The installation method of Etcher in Windows is the same as that of ordinary software, so I won't go into details here.
- Etcher is installed on Ubuntu and Debian systems as follows

1. Add Etcher Debian repository：

```
$ echo ″deb https://dl.bintray.com/resin-io/debian stable etcher″ | sudo
tee /etc/apt/sources.list.d/etcher.list
```

2. Download key

```
$ sudo apt-key adv --keyserver hkp://pgp.mit.edu:80 --recv-keys
379CE192D401AB61
```

3. Update and install

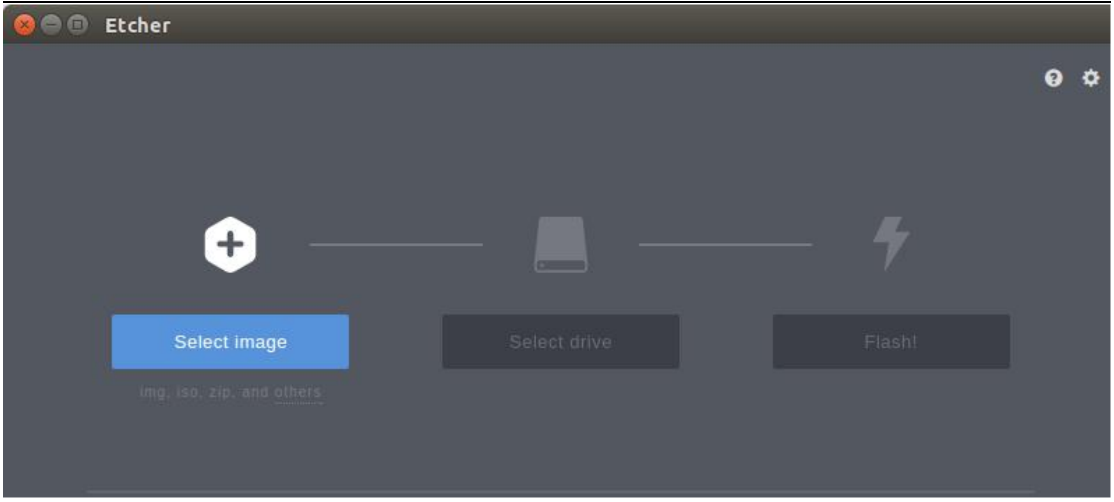
```
$ sudo apt-get update && sudo apt-get install etcher-electron
```

4. Uninstallation method

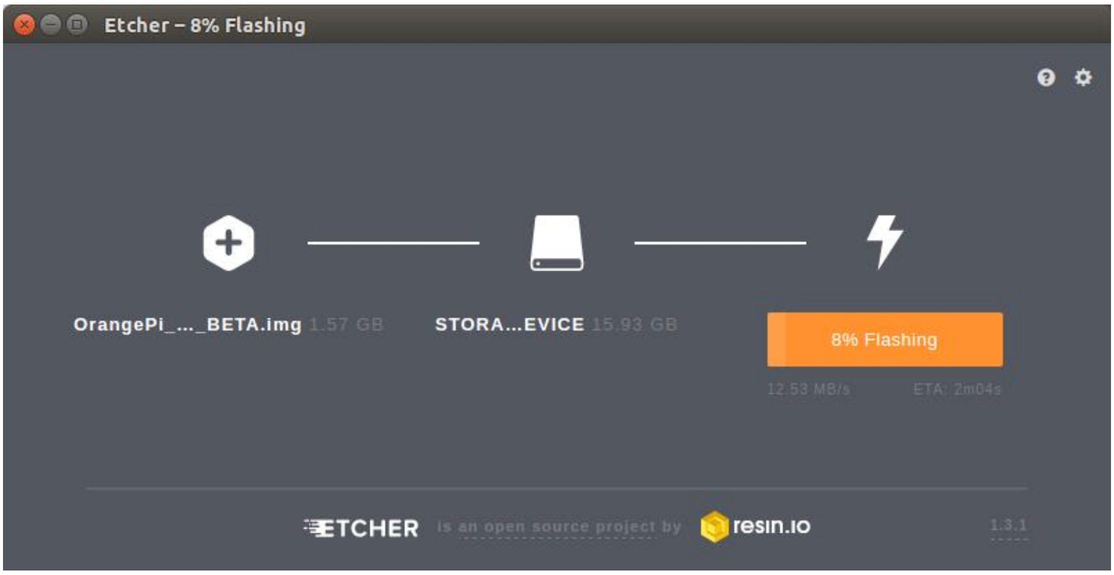
```
$ sudo apt-get remove etcher-electron
$ sudo rm /etc/apt/sources.list.d/etcher.list && sudo apt-get update
```

2. How to flash Linux firmware through Etcher

- First open Etcher, its interface is shown below



- Then select the Linux firmware to be burned with “Select image”
- Then insert the TF card, Etcher will automatically identify the corresponding drive
- Finally, click “Flash!” To start burning. After burning, you can insert the development board to start the system.



3. Burn Linux system into EMMC Flash chip by script

If you purchased the Orange Pi 4 development board with EMMC Flash chip, you can also burn the Linux system into EMMC Flash through the install_to_emmc script after starting the Linux system through the TF card.
Enter the install_to_emmc command in the Linux terminal, and then enter y according to the prompt. The Linux system will automatically be burned into the EMMC Flash. After the programming is complete, turn off the power, remove the TF card, and then power on the Linux system in EMMC Flash automatically.

```
root@OrangePi:~# install_to_emmc

WARNING: EMMC WILL BE ERASED !, Continue (y/N)?  y
Erasing EMMC ...
Creating new filesystem on EMMC ...
  New filesystem created on /dev/mmcblk0.
Partitioning EMMC ...
  Creating boot & linux partitions
  OK.
Formating fat partition ...
  fat partition formated.
Formating linux partition (ext4), please wait ...
  linux partition formated.

Instaling u-boot to EMMC ...

Mounting EMMC partitions...
FAT partitions mounted to /tmp/_fatdir
linux partition mounted to /tmp/_extdir

Copying file system to EMMC ...

  Creating "fstab"

*******************************
Linux system installed to EMMC.
*******************************
```

VII. Android build environment to build

The compilation environment recommends Ubuntu 14.04 or Ubuntu 18.04. It is not recommended to use a virtual machine.

1. Get SDK source zip

After downloading the Android source package, first you need to combine multiple compressed files into one and then decompress them.

```
$ mkdir OrangePi_4
$ cat rk3399-android-8.1.tar.gz* > rk3399-android-8.1.tar.gz
$ tar xvf rk3399-android-8.1.tar.gz -C OrangePi_4
```

2. Build a compilation environment

- **Install JDK**

Android 8.1 development can only use the version of openjdk8, higher or lower than this version and Oracle's JDK will cause the compilation to fail. Openjdk-8 installation commands are as follows:

```
$ sudo add-apt-repository ppa:openjdk-r/ppa
$ sudo apt-get update
$ sudo apt-get install openjdk-8-jdk
```

- **Install platform support software**

For Ubuntu14.04:

```
$ sudo apt-get update
$ sudo apt-get install git gnupg flex bison gperf build-essential \
zip curl zlib1g-dev gcc-multilib g++-multilib libc6-dev-i386 \
lib32ncurses5-dev x11proto-core-dev libx11-dev lib32z1-dev ccache \
libgl1-mesa-dev libxml2-utils xsltproc unzip
$ sudo apt-get install u-boot-tools
```

- **Compile SDK source code**

Compile with

```
cd rk3399-android-8.1
./make.sh -F -M -u
```

After compilation is complete, generate the image file in the following directory.

```
cd rockdev/Image-rk3399_mid/
```

```
tree -L 2
├──── boot.img
├──── kernel.img
├──── MiniLoaderAll.bin
├──── misc.img
├──── oem.img
├──── parameter.txt
├──── pcba_small_misc.img
├──── pcba_whole_misc.img
├──── recovery.img
├──── resource.img
├──── system.img
├──── trust.img
├──── uboot.img
├──── update.img
└──── vendor.img

0 directories, 15 files
```

Update.img is the complete firmware, which can be burned to EMMC by referring to the "Android Firmware Burning" chapter.

VIII. Build a Linux compilation environment

The recommended host environment is 64-bit Ubuntu 18.04. OrangePi 4 development board ubuntu 18.04 image requires host environment is ubuntu18.04 to compile successfully, debian9 and ubuntu16.04 can be compiled on ubuntu 14.04.

1. Get SDK source zip

- **Orange Pi Linux Source Downloader**

Orange Pi 4's Linux source code has been uploaded to GitHub, and the kernel version is Linux 4.4. We can use the OrangePi Linux source-specific downloader to download. The way to obtain the downloader source code is as follows:

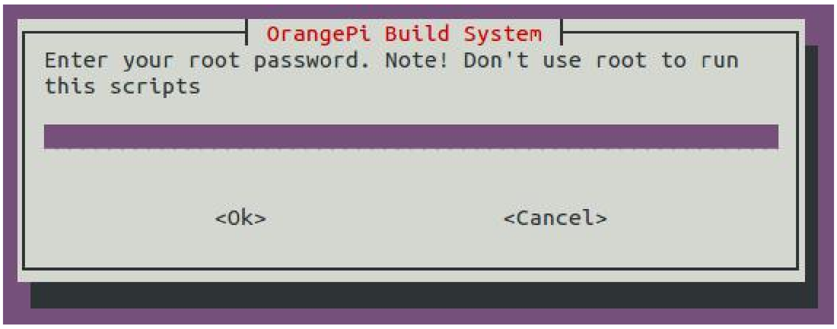
```
$ sudo apt-get install git
$ git clone https://github.com/orangepi-xunlong/OrangePi_Build.git
$ cd OrangePi_Build
$ ls
Build_OrangePi.sh  lib  README.md
```

Note: The source code should be placed on the local hard disk. Do not use a shared directory or mount the hard disk. Otherwise, it will affect normal compilation.

- **Run the downloader**

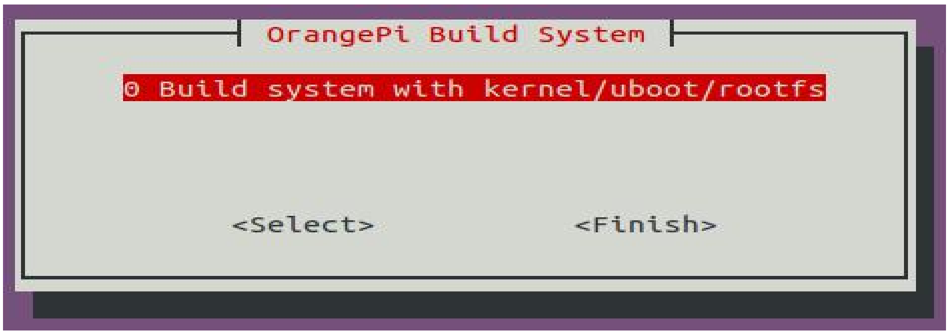
```
$ ./Build_OrangePi.sh
```

Enter the root password and press enter



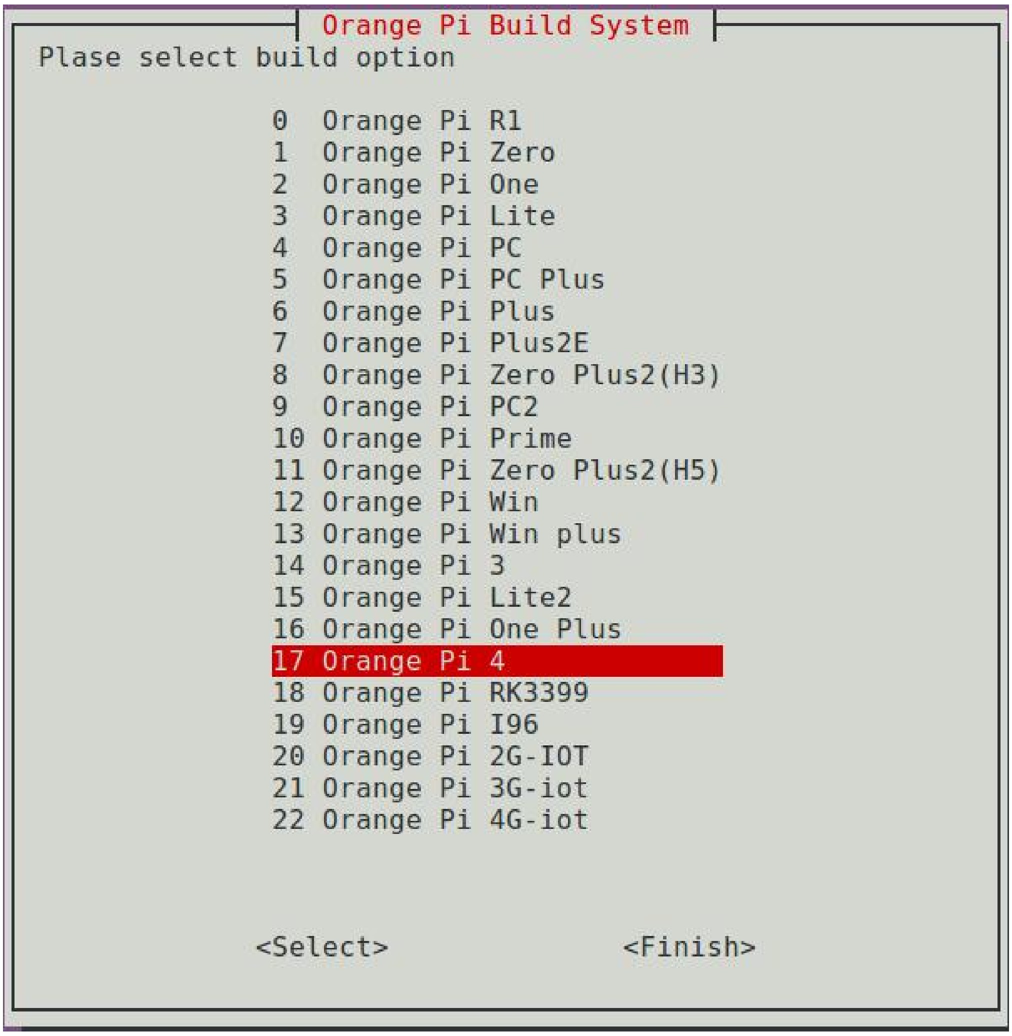
```
OrangePi Build System
Enter your root password. Note! Don't use root to run
this scripts
```

Select 0 Build system with kernel / uboot / rootfs to enter the interface of development board model selection



Select 17 orangepi 4 and after downloading, you will start downloading the Linux

SDK source code for Orange Pi 4.



```
Orange Pi Build System
Plase select build option

 0  Orange Pi R1
 1  Orange Pi Zero
 2  Orange Pi One
 3  Orange Pi Lite
 4  Orange Pi PC
 5  Orange Pi PC Plus
 6  Orange Pi Plus
 7  Orange Pi Plus2E
 8  Orange Pi Zero Plus2(H3)
 9  Orange Pi PC2
10  Orange Pi Prime
11  Orange Pi Zero Plus2(H5)
12  Orange Pi Win
13  Orange Pi Win plus
14  Orange Pi 3
15  Orange Pi Lite2
16  Orange Pi One Plus
17  Orange Pi 4
18  Orange Pi RK3399
19  Orange Pi I96
20  Orange Pi 2G-IOT
21  Orange Pi 3G-iot
22  Orange Pi 4G-iot

<Select>            <Finish>
```

The downloaded source code will be stored in the same directory of OrangePi_Build

```
$ ls ../OrangePi_Build
 OrangePi_Build OrangePiRK3399_Pi4
```

2. Build a compilation environment

The Linux source directory structure of OrangePi 4B is shown below

```
$ cd OrangePiRK3399_Pi4
$ tree -L 1.
├── build.sh -> scripts/build.s     Compile startup script
├── external                        Store additional configuration files
├── kernel                          Linux kernel source
├── output   Store output files, only generated after compiling source code
├── scripts                         Script files used during compilation
├── toolchai   Cross-compilation toolchain used by the kernel and u-boot
└── uboot                           u-boot source
```

```
6 directories, 1 file
```

The directory structure of the cross-compilation toolchain is shown below. If the downloaded file directory is different from it, or the toolchain directory is empty, there is a problem with the download process. Please try to download again using OrangePi_Build downloader.

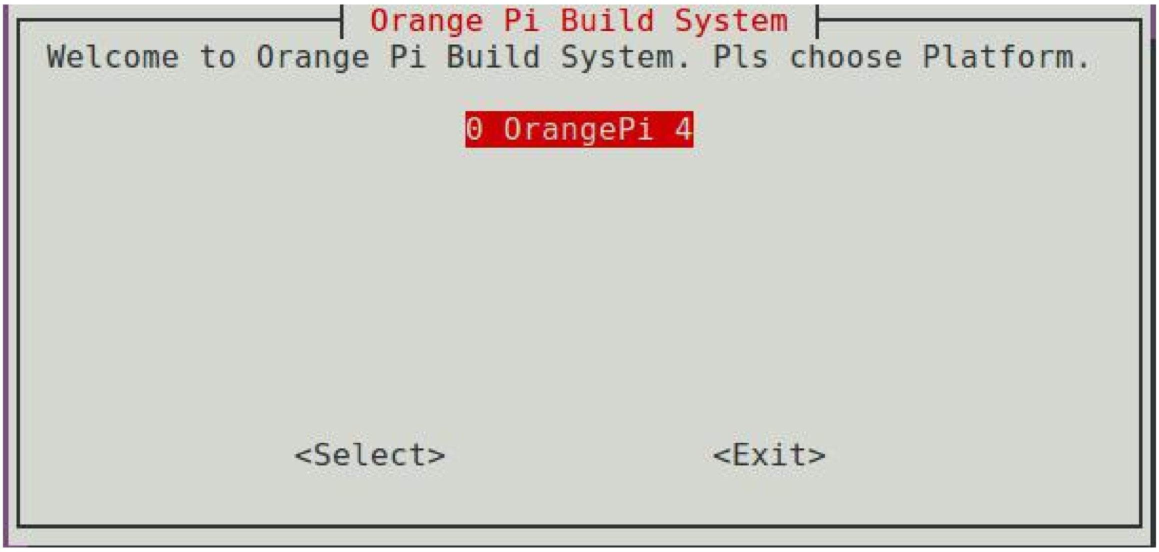
```
$ cd toolchain
$ tree -L 2
├─── gcc-linaro-6.3.1-2017.05-x86_64_aarch64-linux-gnu
|      ├─── aarch64-linux-gnu
|      ├─── bin
|      ├─── gcc-linaro-6.3.1-2017.05-linux-manifest.txt
|      ├─── include
|      ├─── lib
|      ├─── libexec
|      └─── share
└─── README.md

7 directories, 2 files
```

3. Compile Linux and U-boot source code

- **Execute compile start up script**

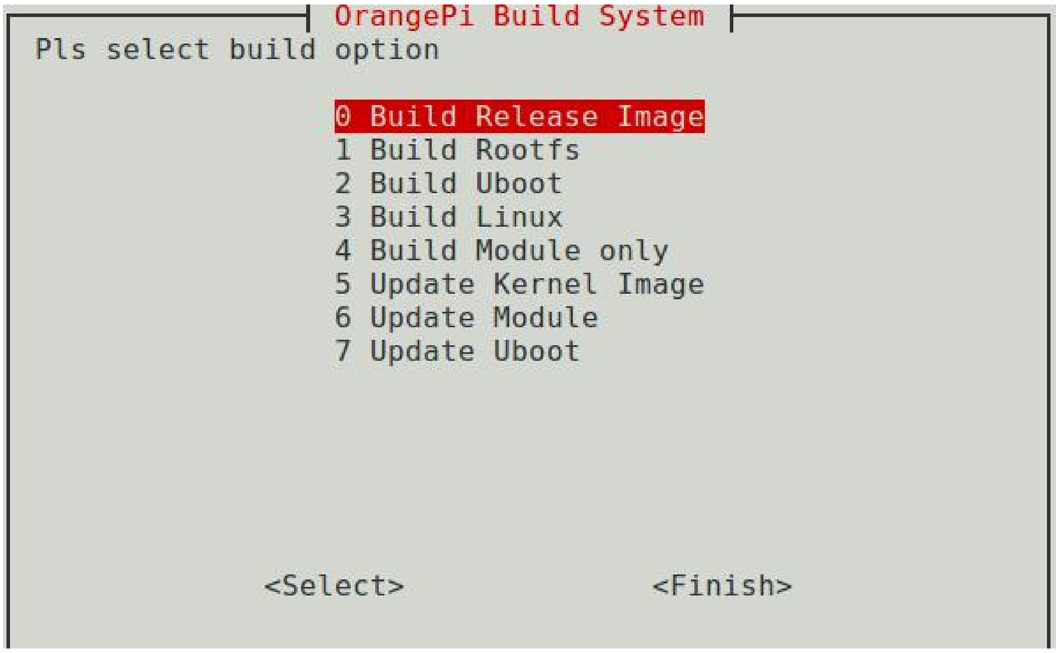
```
$ cd OrangePiRK3399_Pi4
$ ./build.sh
```

Select 0 OrangePi 4 and press enter



```
Orange Pi Build System
Welcome to Orange Pi Build System. Pls choose Platform.

0 OrangePi 4
```

Then select the function you want to perform.



```
OrangePi Build System
Pls select build option

        0 Build Release Image
        1 Build Rootfs
        2 Build Uboot
        3 Build Linux
        4 Build Module only
        5 Update Kernel Image
        6 Update Module
        7 Update Uboot

    <Select>            <Finish>
```

The functions of each option are as follows:

- Build Release Image-build Ubuntu or Debian release images
- Build Rootfs ------ Compile Rootfs
- Build Uboot-compile u-boot source code
- Build Linux-compile the Linux kernel source code
- Build Module only ----- only build kernel modules
- Update kernel Image-Update the kernel boot.img in SD card Linux system
- Update Module-Update the kernel module in the SD card Linux system
- Update Uboot-Update u-boot of SD card Linux system

The final file generated after compiling u-boot and kernel source code will be saved in the output directory

```
$ cd output
$ tree -L 2
.
├── kernel
│    └── boot.img
├── lib
│    └── modules
└── uboot
     ├── idbloader.img
     ├── rk3399_loader_v1.22.119.bin
     ├── trust.img
     └── uboot.img

4 directories, 5 files
```

After compiling the distribution image, the generated image is saved in the output / images directory

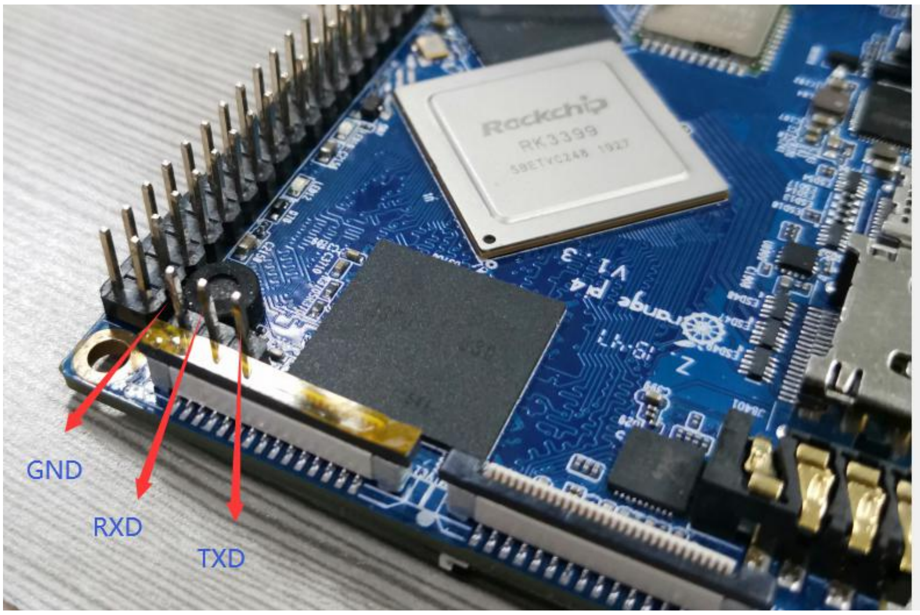
```
$ tree -L 2 output/images/
output/images/
├── OrangePi_4_ubuntu_bionic_desktop_linux4.4.179_v1.0.img
├── OrangePi_4_ubuntu_bionic_desktop_linux4.4.179_v1.0.tar.gz
├── OrangePi_4_ubuntu_xenial_desktop_linux4.4.179_v1.0.img
└── OrangePi_4_ubuntu_xenial_desktop_linux4.4.179_v1.0.tar.gz

0 directories, 4 files
```

IX. Introduction to serial debugging tools

First you need to prepare a USB to TTL serial cable similar to the following figure:

Connect the serial cable as shown in the figure below. The functions of the cables of different colors are as follows:

- Black——GND
- Green-RX
- White-TX



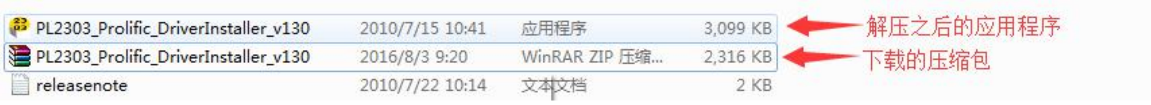
Note: The board's RXD is connected to the USB to TTL serial TXD
TXD of the board is connected to RXD of USB to TTL serial port

1. Use on Windows platform

In the process of using OrangePi for project development, in order to obtain more debugging information, OrangePi supports serial port information debugging by default. For developers, they only need to prepare the materials mentioned above to get serial debugging information. The serial debugging tools used by different host computers are similar. Basically, you can refer to the methods below to deploy. There are many tools for serial debugging on the Windows platform. The commonly used tool is putty. This section uses putty as an example to explain deployment.

- **Install USB driver**

Download the latest driver PL2303_Prolific_DriverInstaller_v130.zip, download and unzip.

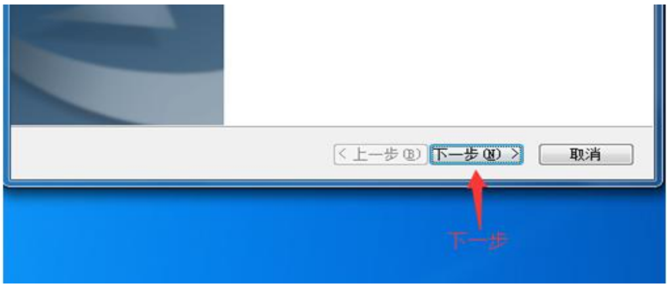


PL2303_Prolific_DriverInstaller_v130	2010/7/15 10:41	应用程序	3,099 KB
PL2303_Prolific_DriverInstaller_v130	2016/8/3 9:20	WinRAR ZIP 压缩...	2,316 KB
releasenote	2010/7/22 10:14	文本文档	2 KB

解压之后的应用程序

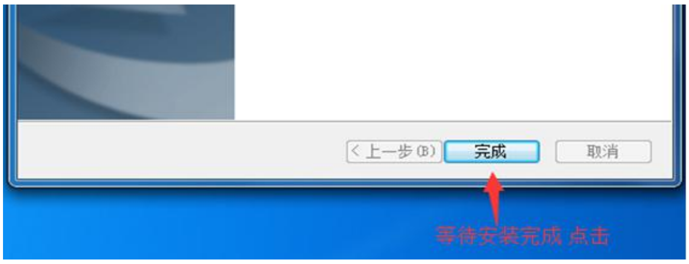
下载的压缩包

Select application installation as administrator



下一步

Wait for the installation to complete



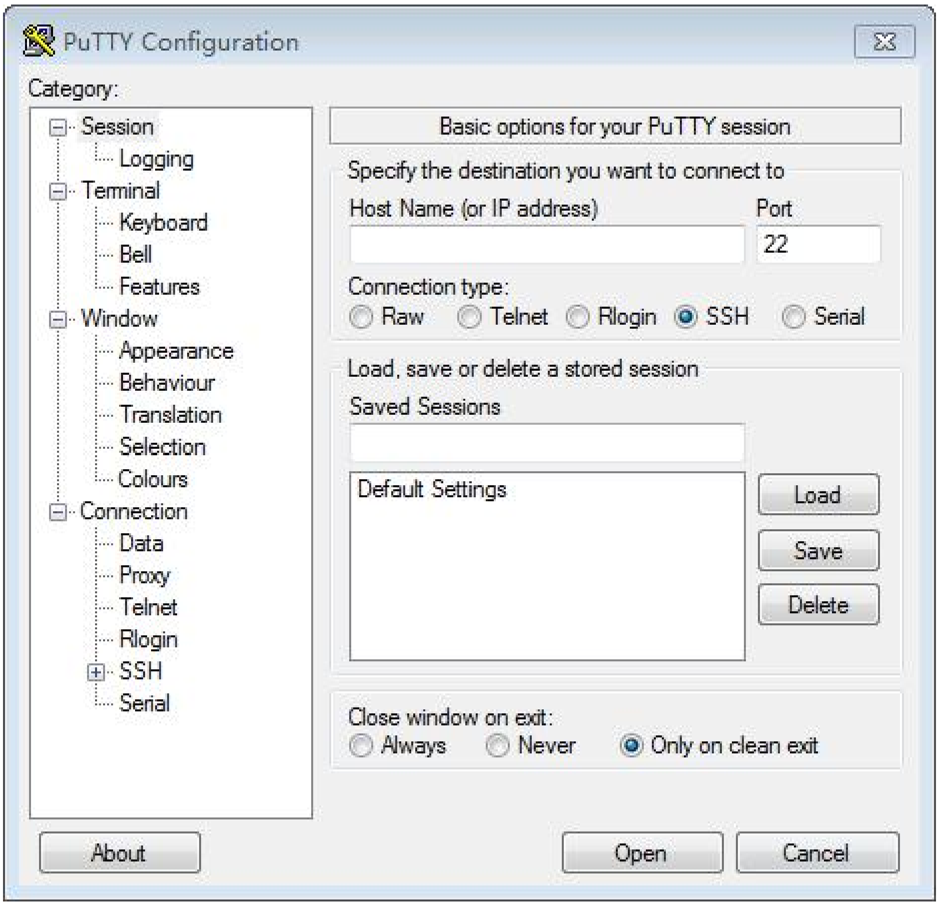
等待安装完成 点击

- **Download and install Putty**

Putty can be downloaded from the following address, please choose the version suitable for your development environment.

```
https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html
```

Double-click the downloaded putty.exe directly to open putty. The software interface is shown in the figure below.



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address)

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

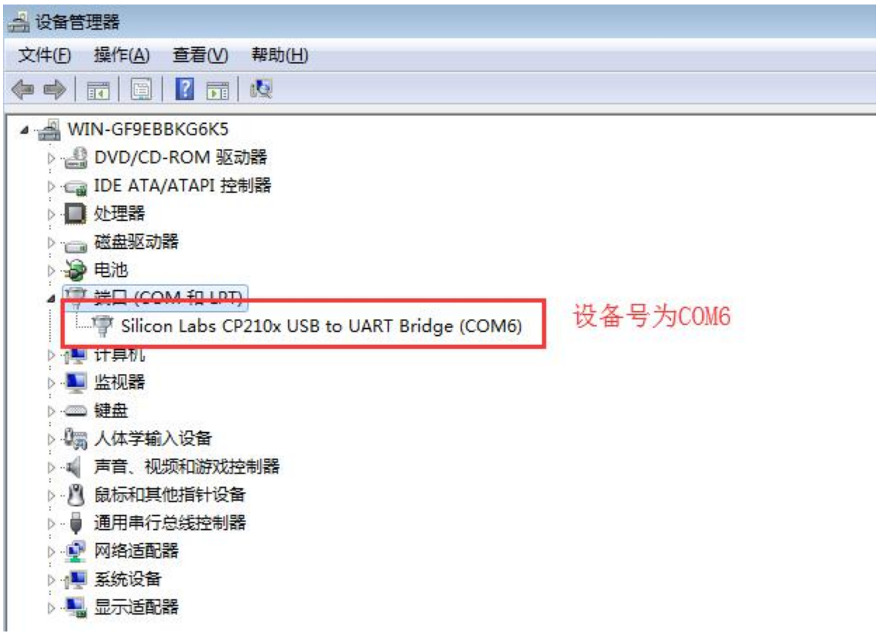
Saved Sessions

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

- **Acquisition of equipment information**

In Windows 7, we can check whether the serial port connection is normal and the device number of the serial port through the device manager. If the device is not recognized normally, please check whether the driver is successfully installed. If there is a problem with the driver installation, you can try to use 360 Driver Master to scan and install the driver.



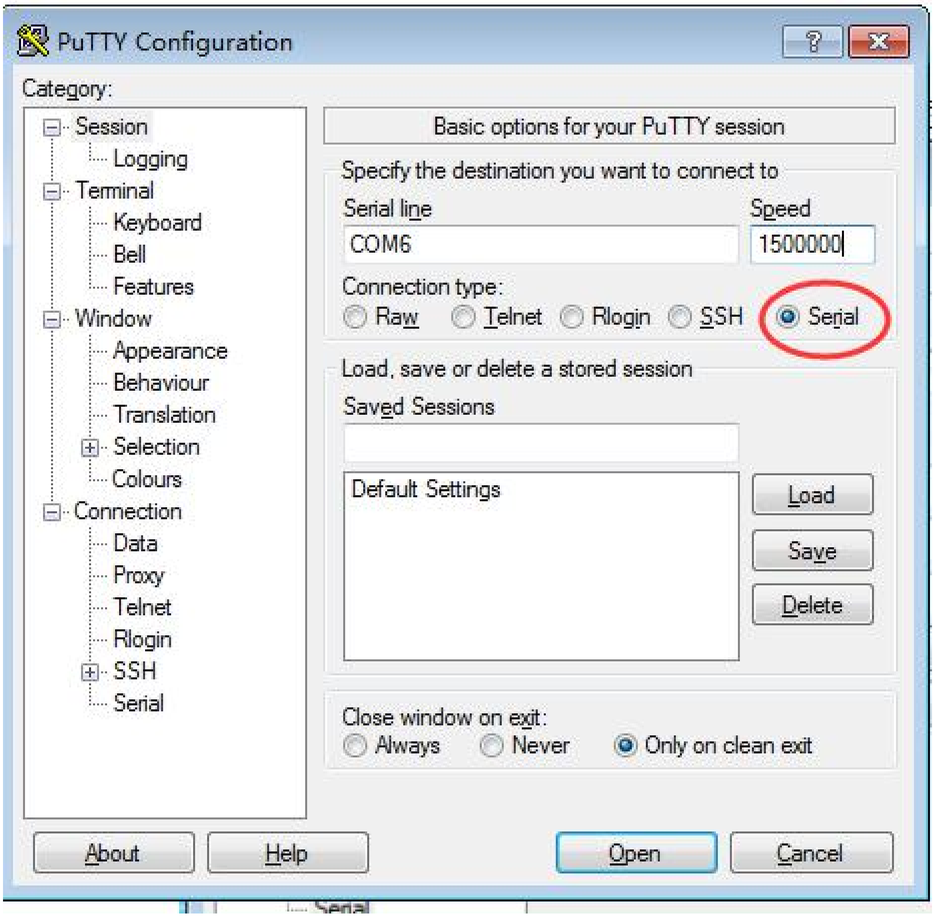
设备管理器

- WIN-GF9EBBKG6K5
  - DVD/CD-ROM 驱动器
  - IDE ATA/ATAPI 控制器
  - 处理器
  - 磁盘驱动器
  - 电池
  - 端口 (COM 和 LPT)
    - Silicon Labs CP210x USB to UART Bridge (COM6)
  - 计算机
  - 监视器
  - 键盘
  - 人体学输入设备
  - 声音、视频和游戏控制器
  - 鼠标和其他指针设备
  - 通用串行总线控制器
  - 网络适配器
  - 系统设备
  - 显示适配器

设备号为COM6

- **Putty configuration**

Set the serial port to the corresponding port number (COM6), turn off flow control, and set the speed to 1500000



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Serial line: COM6

Speed: 1500000

Connection type: ○ Raw ○ Telnet ○ Rlogin ○ SSH ● Serial

Load, save or delete a stored session

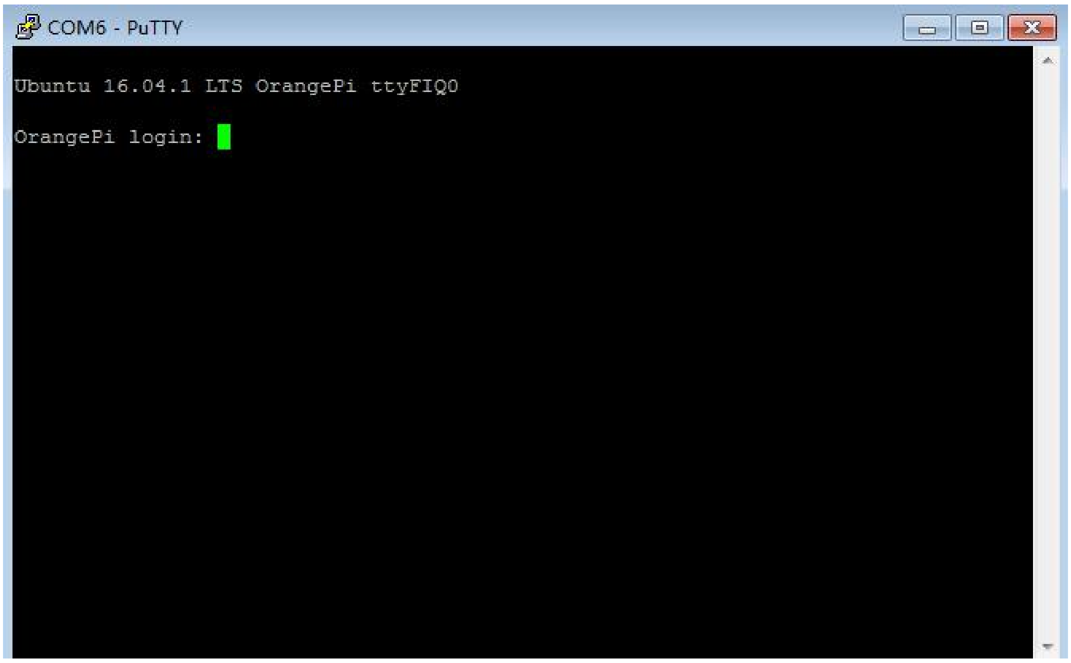
Saved Sessions

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

- **Start debugging serial output**

OrangePi is powered on and putty will automatically print serial port log information



```
Ubuntu 16.04.1 LTS OrangePi ttyFIQ0

OrangePi login:
```

2. Use on Linux platforms

There is not much difference between using putty on the Linux platform and the Windows platform. The following mainly describes the operation steps where there are differences. All operations are based on Ubuntu 14.04 system.

- **Install and launch Putty**

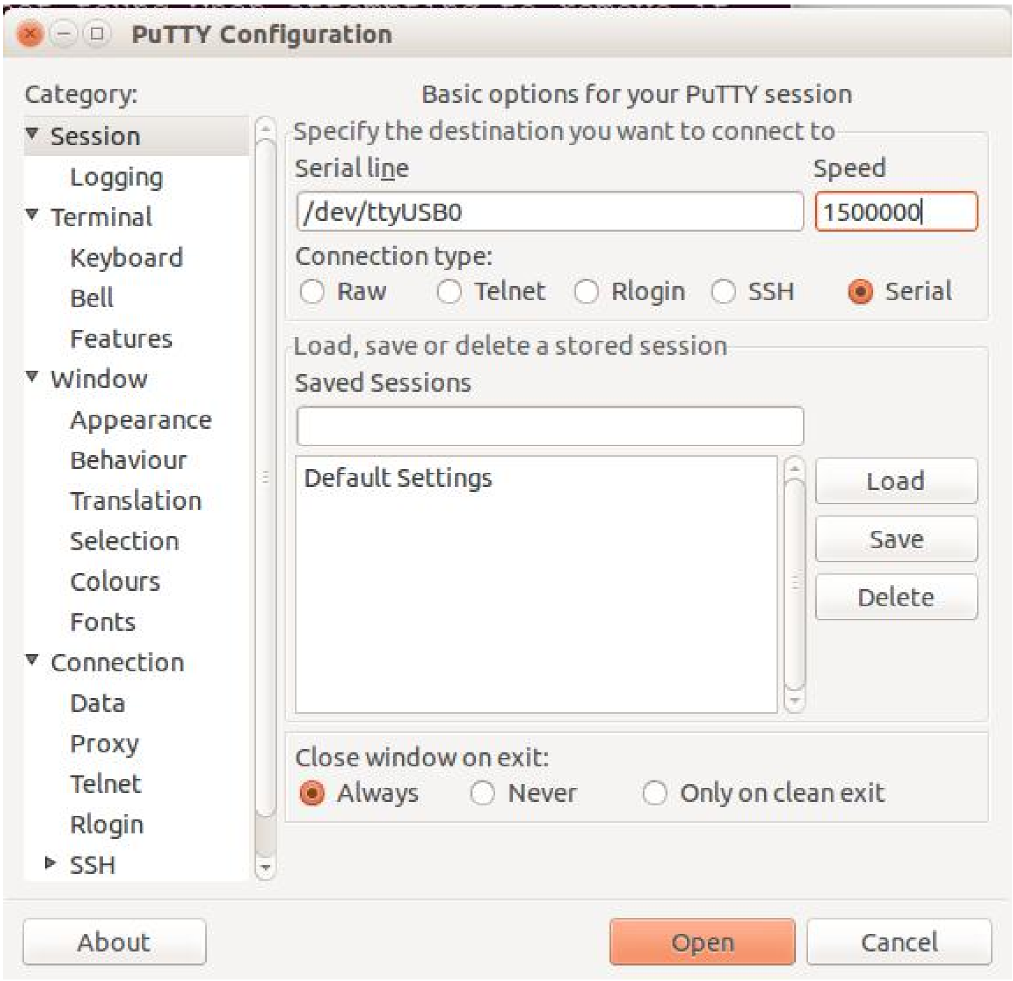
```
$ sudo apt-get install putty
$ sudo putty
```

- **Configure Putty**

The serial number can be viewed through ls / dev / ttyUSB *

Baud rate needs to be set to 1500000

And turn off flow control



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Serial line: /dev/ttyUSB0

Speed: 1500000

Connection type: ○ Raw ○ Telnet ○ Rlogin ○ SSH ● Serial

Load, save or delete a stored session

Saved Sessions

Default Settings

Close window on exit: ● Always ○ Never ○ Only on clean exit