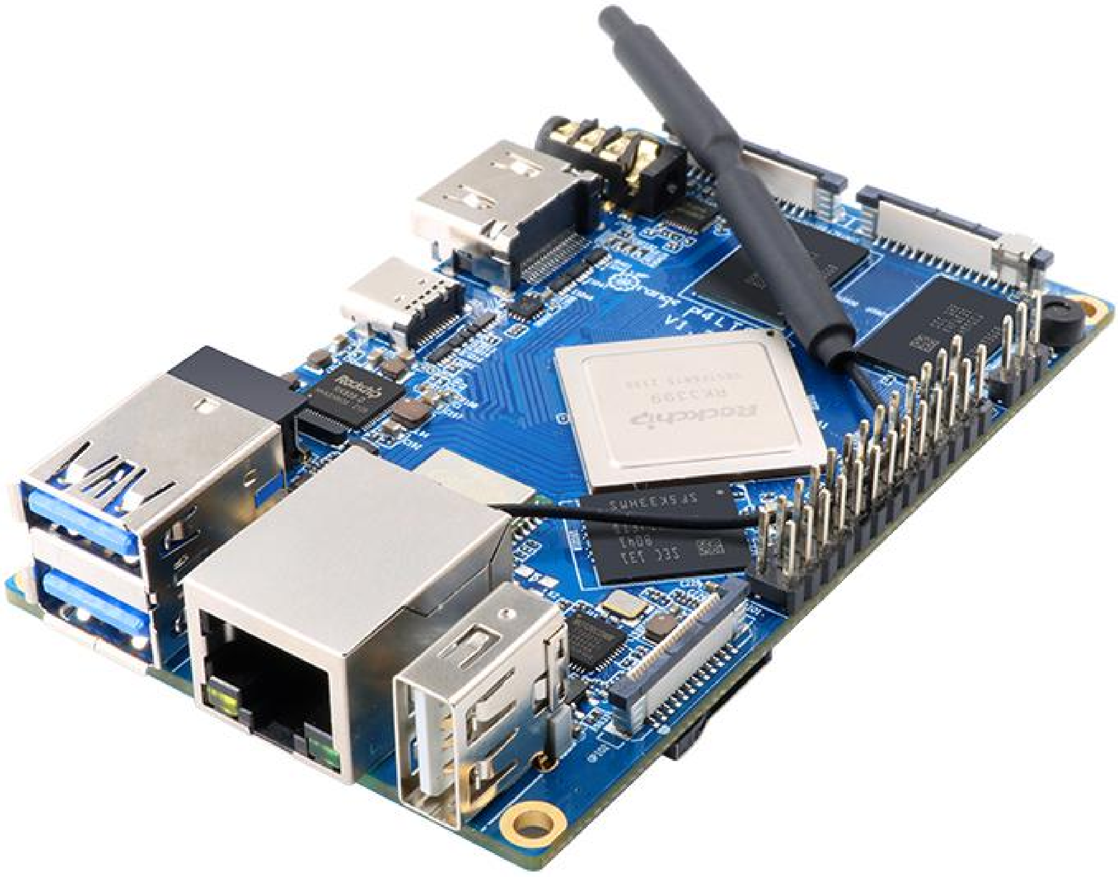
Orange Pi 4 LTS
User Manual



Contents

1. Basic Features of Orange Pi 4 LTS

1. 1. What is Orange Pi 4 LTS？

Orange Pi is an open source single-board card computer, a new generation of arm64 development boards, which can run operating systems such as Android 8.1, Ubuntu and Debian. Orange Pi development board (Orange Pi 4 LTS) uses Rockchip RK3399 or RK3399-T SoC, and has 3GB or 4GB LPDDR4 memory

1. 2. Purpose of Orange Pi 4 LTS

we can use it to build：

- A computer
- A wireless server
- Games
- Music and sounds
- HD video
- Android

Of course there are many more features as Orange Pi is open source

1. 3. Who is Orange Pi 4 LTS designed for?

The Orange Pi development board is not just a consumer product, it is designed for anyone who wants to use technology to create and innovate. It's a very simple, fun, and useful tool that you can use to shape the world around you

1. 4. Hardware specification

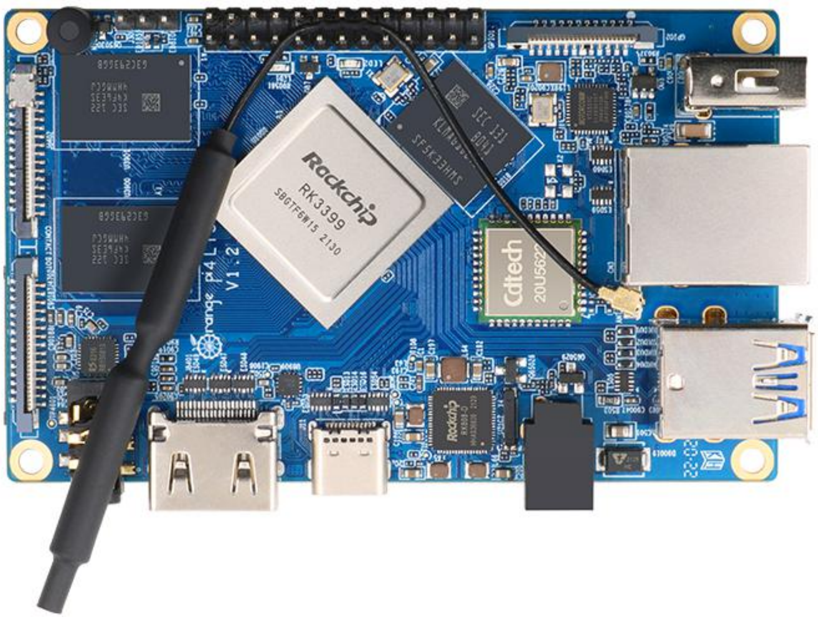
Hardware specification	
CPU	• Rockchip RK3399 or RK3399-T • 6-core ARM® 64-bit processor • The main frequency of RK3399 is up to 1.8GHz, and the main frequency of RK3399-T is up to 1.6GHz • Based on big.LITTLE large and small core architecture: Dual-core Cortex-A72 (large core) + quad-core Cortex-A53 (small core)
GPU	• High-performance multi-core GPU Mali T864 • OpenGL ES 1.1/2.0/3.0 • OpenCL 1.0/1.1/1.2 • DirectX 9/11.1
RAM	3GB or 4GB LPDDR4
Onboard storage	• 16GB EMMC or Default Empty • TF card slot
Network	10/100/1000Mbps Ethernet (YT8531C)
WIFI+Bluetooth	• UWE5622, IEEE 802.11 a/b/g/n/ac • BT5.0
video output	HDMI 2.0 x 1(Type-A), support 4K@60 frame output DP 1.2 x1 (DisplayPort) , support 4K@60 frame output Supports dual channel MIPI-DSI (4 wires per channel)
video input	MIPI-CSI x2 camera interface (MIPI_RX0, MIPI_TX1/RX1)
Audio output	• 3.5mm headphone jack • HDMI
audio input	• Onboard MIC

	• Headphone recording
power supply	• DC 5V/3A or DC 5V/4A • TYPE-C 5V/4A
USB port	• USB2.0 HOST x 2 • USB3.0 HOST x 1 • USB3.0 Type-C x 1
26 pins header	with I2Cx2, SPIx1 or UARTx1 and multiple GPIOs
Mini-PCIE	24pin mini-PCIE interface
Debug serial port	UART-TX、UART-RX and GND
LED	Power led & Status led
Button	Reset button x1, upgrade button x1
Supported OS	Android8.1、Ubuntu、Debian
Appearance Specifications	
Dimension	91mm×56mm
range Pi™ is a trademark of the Shenzhen Xunlong Software CO., Limited	

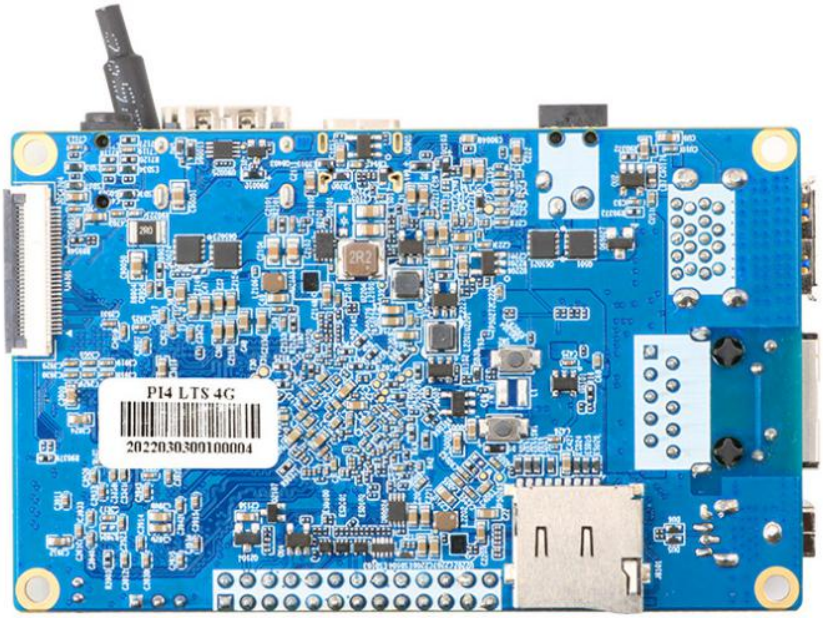
1. 5. Top view and bottom view of Orange Pi 4 LTS

1. 5. 1. RK3399+4GB LPDDR4 with 16GB eMMC version

Top view:

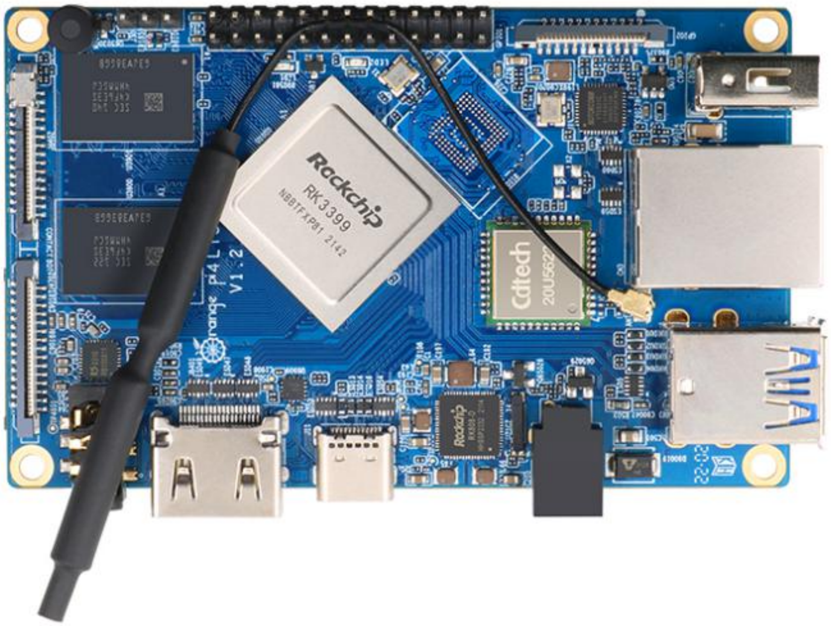


Buttom view:

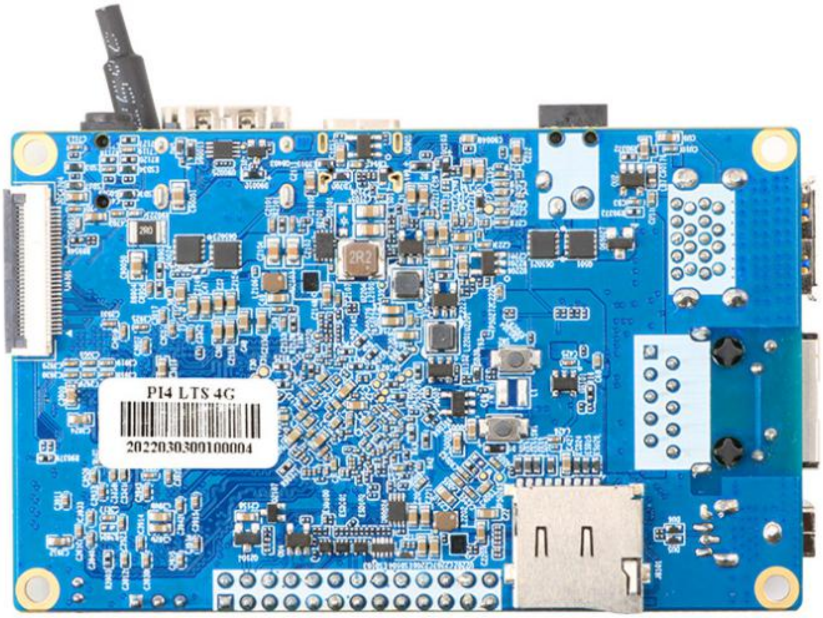


1.5.2. RK3399+4GB LPDDR4 without 16GB eMMC version

Top view:

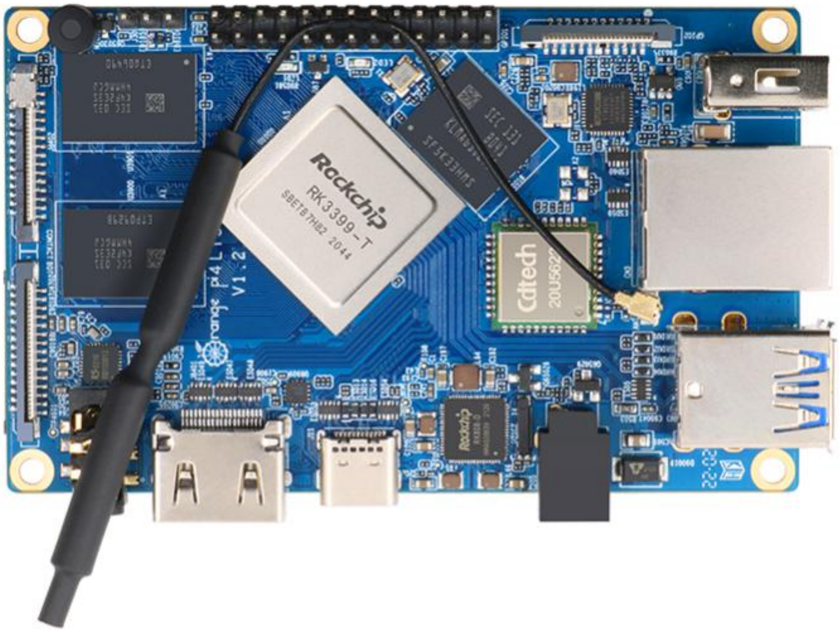


Buttom view:

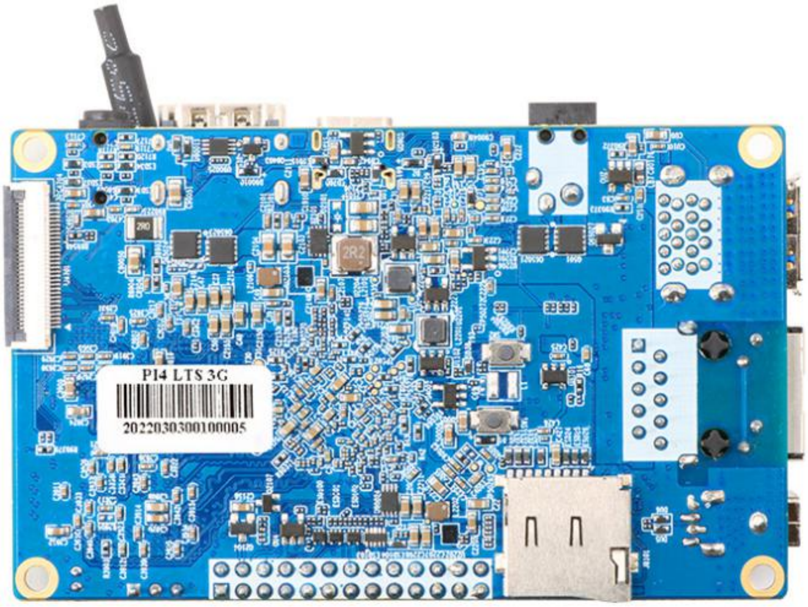


1.5.3. RK3399-T+3GB LPDDR4 with 16GB eMMC version

Top view:

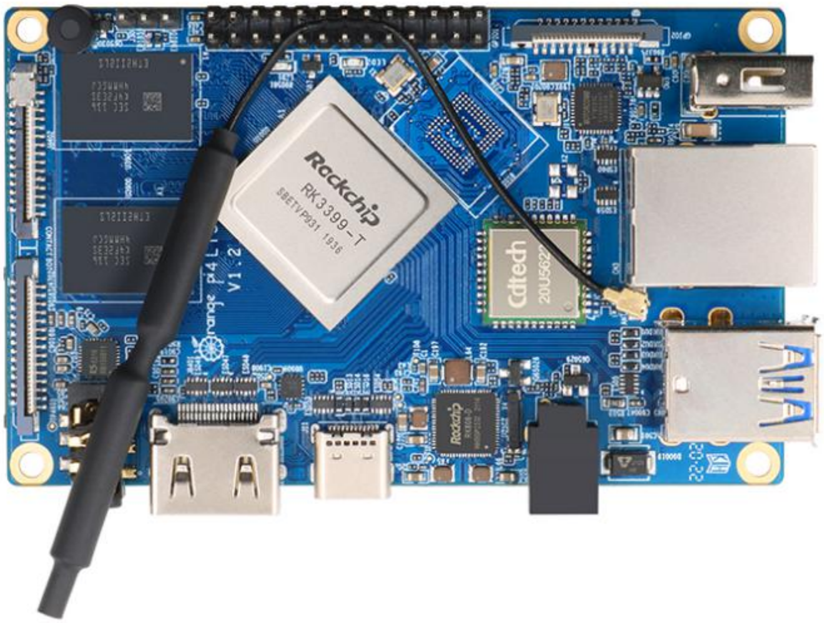


Buttom view:

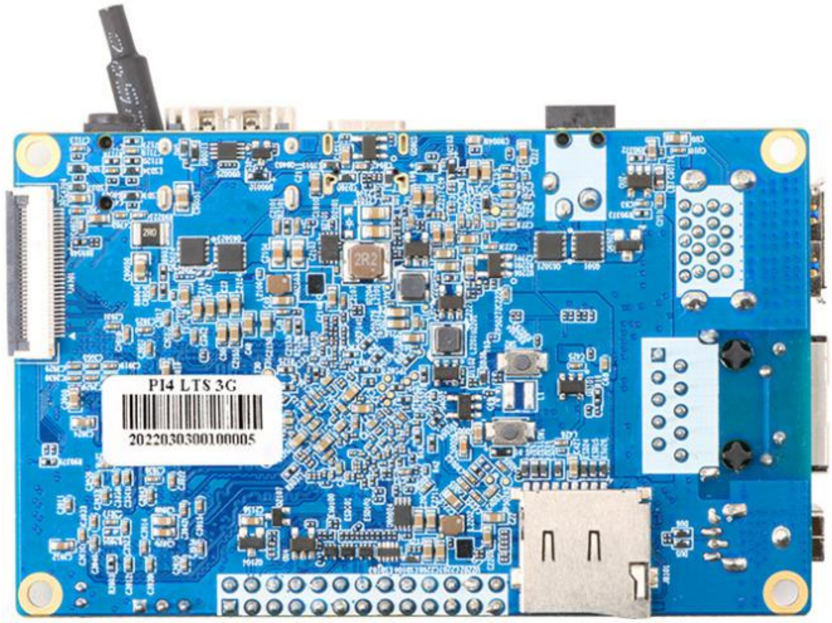


1.5.4. RK3399-T+3GB LPDDR4 without 16GB eMMC version

Top view:



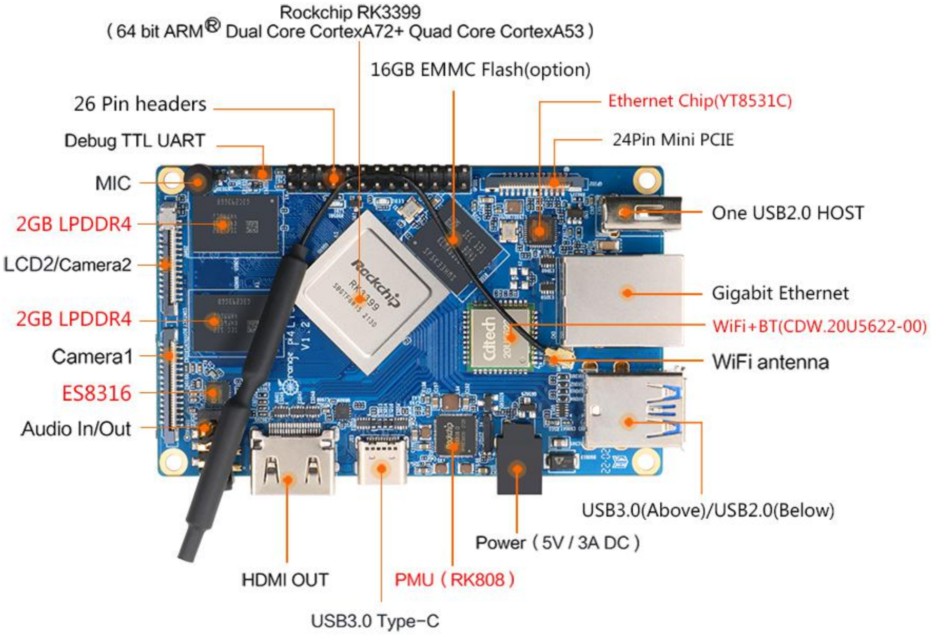
Buttom view:



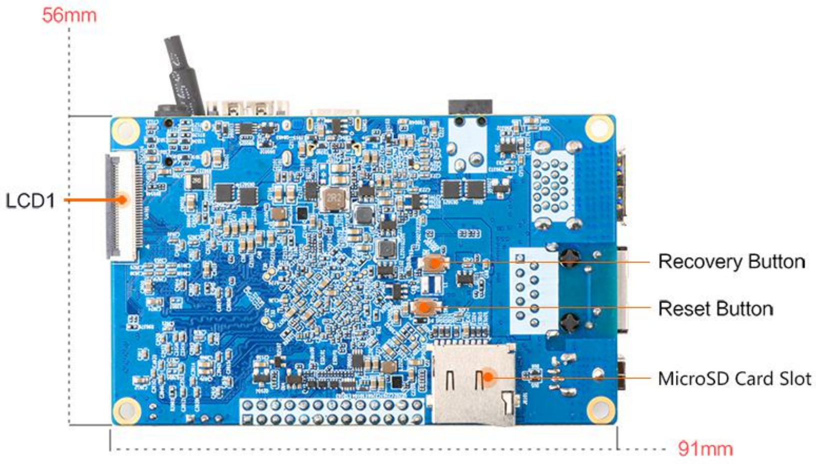
1.6. Interface details of Orange Pi 4 LTS

1.6.1. RK3399+4GB LPDDR4

Top view

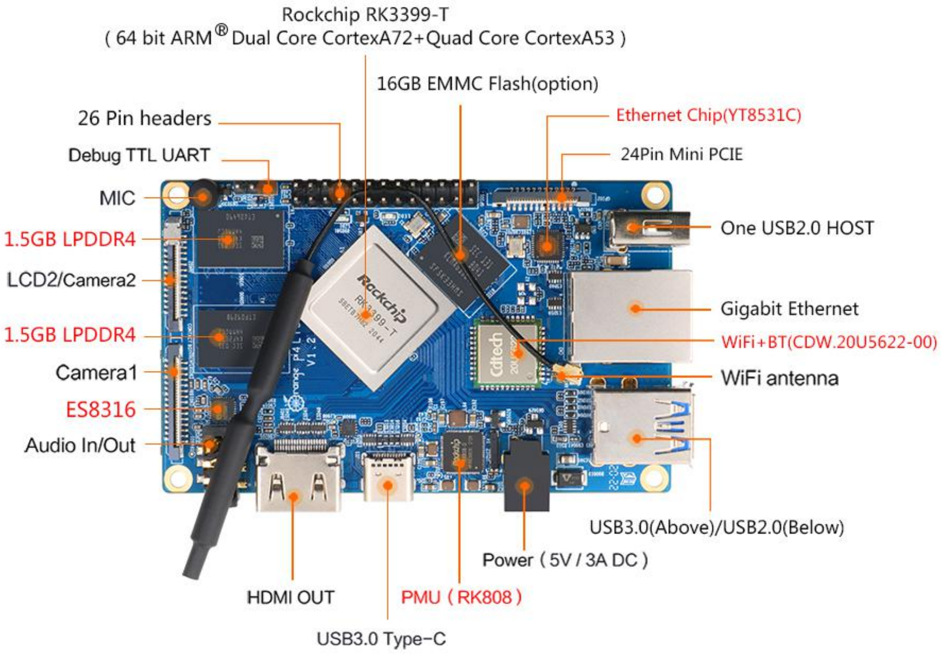


Bottom view

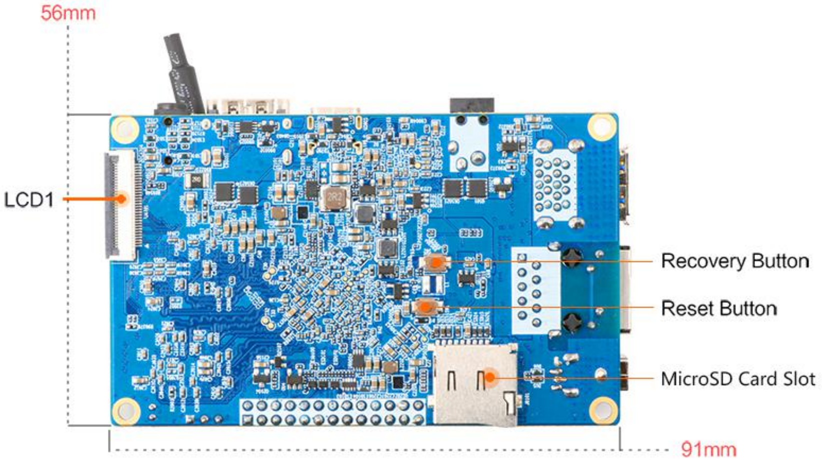


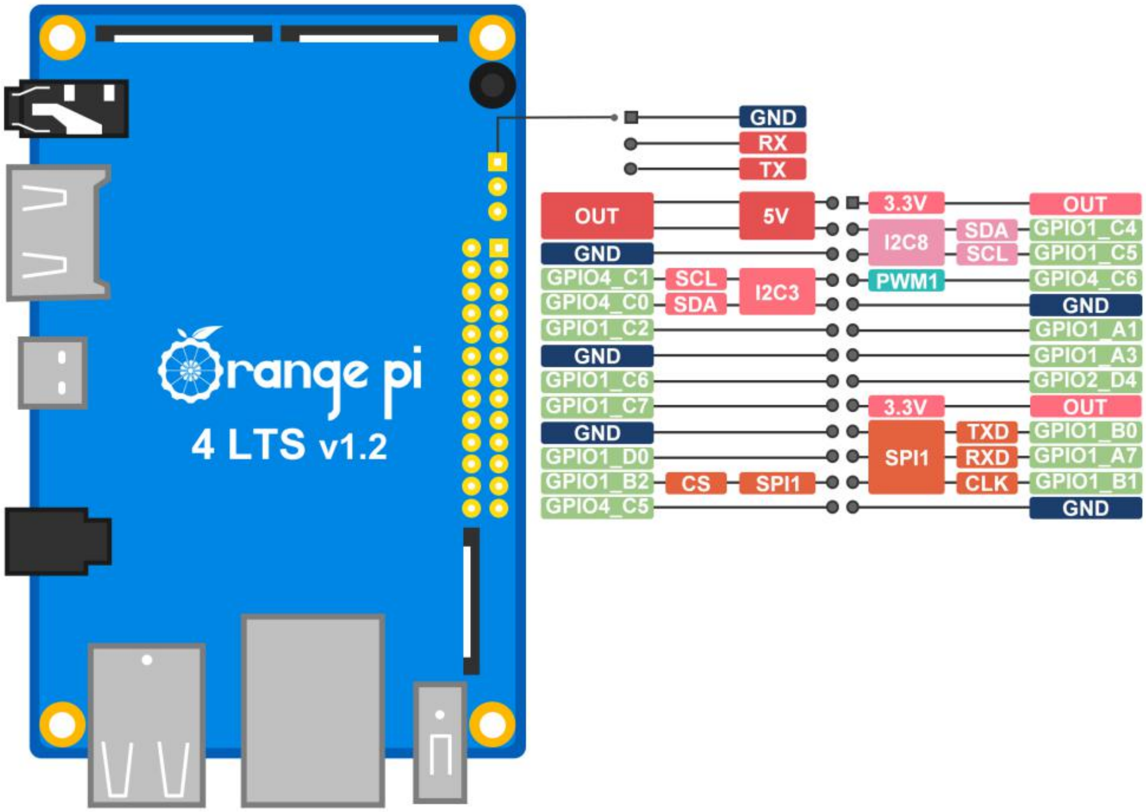
1.6.2. RK3399-T+3GB LPDDR4

Top view



Bottom view




GND
RX
TX
OUT
5V
3.3V
OUT
I2C8
SDA
GPIO1_C4
SCL
GPIO1_C5
GND
GPIO4_C1
SCL
I2C3
PWM1
GPIO4_C6
GPIO4_C0
SDA
GND
GPIO1_C2
GPIO1_A1
GND
GPIO1_A3
GPIO1_C6
GPIO2_D4
GPIO1_C7
3.3V
OUT
GND
SPI1
TXD
GPIO1_B0
GPIO1_D0
RXD
GPIO1_A7
GPIO1_B2
CS
SPI1
CLK
GPIO1_B1
GPIO4_C5
GND
Orange pi
4 LTS v1.2

2. Introduction to the use of the development board

2. 1. Prepare the necessary accessories

1) TF card, a high-speed card of class 10 or above with a minimum capacity of 8GB, it is recommended to use a SanDisk TF card, the Orange Pi test is to use a SanDisk TF card, other brands of TF cards may cause the system to fail to boot.

2) TF card reader, used to read and write TF card

3) HDMI to HDMI cable, used to connect the development board to an HDMI monitor or TV for display

4) Type-C to HDMI cable, connect the development board to HDMI display or TV through Type-C interface for display

5) Type-C to USB3.0 adapter, used to connect USB3.0 storage devices or USB devices such as mouse and keyboard

6) 10.1-inch MIPI screen, used to display the system interface of the development board

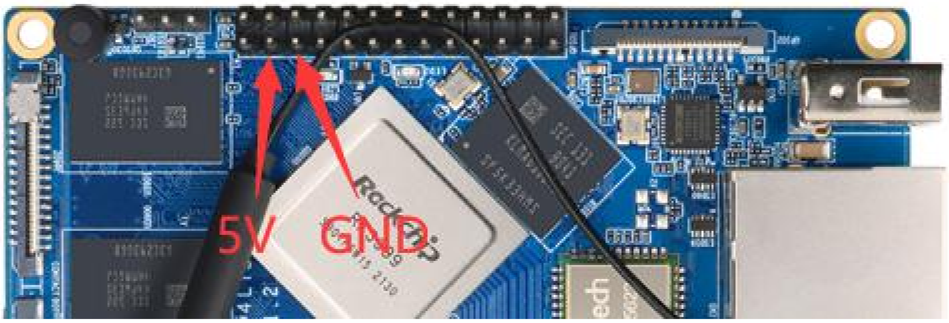
7) Power adapter, Orange Pi 4 LTS supports 5V/3A or 5V/4A DC power supply, and also supports 5V/4A Type-C power supply

It is not recommended to use 5V/3A Type-C power supply, because the system may be unstable due to insufficient power supply. In addition, the Orange Pi 4 LTS cannot be powered through the 5v pin on the 26pin interface

8) USB interface mouse and keyboard, as long as it is a standard USB interface mouse and keyboard, the mouse and keyboard can be used to control the Orange Pi development board

9) Metal heat dissipation shell, Orange Pi 4 LTS matching metal shell is shown in the figure below, because the RK3399/RK3399-T chip generates a relatively large amount of heat, it is necessary to have a metal shell

10) If you don't buy a metal cooling case, it is recommended to add a 5V cooling fan. As shown in the figure below, there are 5V and GND pins on the 26pin interface of the development board that can be connected to the cooling fan. The spacing between the 26pin pin headers is 2.54mm. The power interface of the cooling fan can be purchased from Taobao according to this specification (the development board is plugged into the power supply) After the 5V pin can be used directly, no other settings are required)



11) Fast or Gigabit Ethernet cable to connect the development board to the Internet

12) OV13850 13MP camera, dedicated camera for Orange Pi 4 LTS, compatible with MIPI interface

13) 3.3V USB to TTL module and DuPont cable, when using the serial port debugging function, USB to TTL module and DuPont cable are required to connect the development board and computer

14) A PC with Ubuntu and Windows operating systems installed

1	Ubuntu14.04 PC	Optional, used to compile Android source code
2	Ubuntu21.04 PC	Optional, used to compile Linux source code
3	Windows PC	For burning Android and Linux images

2. 2. Download the image of the development board and related files

1) The download URL of the Chinese version of the file is:

http://www.orangepi.cn/downloadresourcescn/

2) The download URL of the English version of the file is:

http://www.orangepi.org/downloadresources/

3) The information mainly includes

a. **Android source code**: saved on Baidu cloud disk and Google network disk

b. **Linux source code**: saved on github, the link address is

https://github.com/orangepi-xunlong/orangepi-build

c. **User manual and schematic diagram**: The data sheet related to the chip will also be placed here

d. **Official tools**: mainly include the software that needs to be used during the use of the development board

e.**Android image**: save on Baidu cloud disk and Google network disk

f.**Ubuntu image**: save on Baidu cloud disk and Google network disk

g.**Debian image**: save on Baidu cloud disk and Google network disk

2. 3. Use the Android image pre-installed in eMMC to test the function of the development board

Note that if you purchase the version without eMMC, you cannot pass the Android image test pre-installed in eMMC, you can only burn the image to the TF card, and then start the system in the TF card to test the function of the development board

If you purchased the Orange Pi 4 LTS development board with 16GB eMMC, after getting the development board, you can use the Android 8.1 image pre-installed in the eMMC to test the functions of the development board, and make sure that all hardware functions of the development board are OK. After that, burn the system you want to use.

2. 4. Method of burning Linux image to TF card based on Windows PC

Note that: the Linux image mentioned here refers specifically to the image of a Linux distribution such as Debian or Ubuntu downloaded from the Orange Pi data download page

2. 4. 1. How to use Win32Diskimager to burn Linux image

1) First prepare a TF card with a capacity of 8GB or more. The transmission speed of the TF card must be above class 10. It is recommended to use a TF card from a brand such as SanDisk

2) Then use the card reader to insert the TF card into the computer

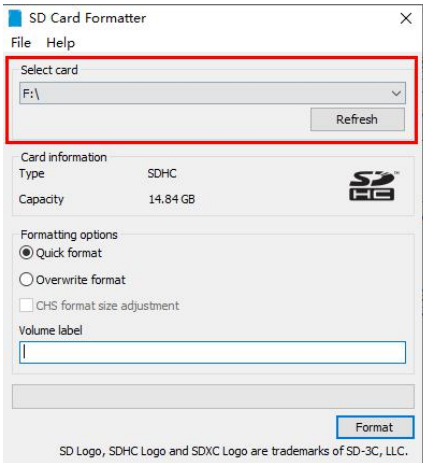
3) Then format the TF card

a. The SD Card Formatter software can be used to format the TF card, and its download address is

https://www.sdcard.org/downloads/formatter/eula_windows/SDCardFormatterv5_WinEN.zip

b. After downloading, unzip and install directly, and then open the software

c. If only the TF card is inserted into the computer, the "**Select card**" column will display the drive letter of the TF card. If multiple USB storage devices are inserted into the computer, you can select the drive letter corresponding to the TF card through the drop-down box.



Select card

F:\

Card information

Type SDHC

Capacity 14.84 GB

Formatting options

● Quick format

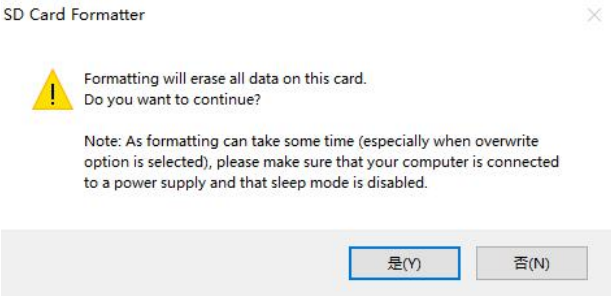
○ Overwrite format

□ CHS format size adjustment

Volume label

SD Logo, SDHC Logo and SDXC Logo are trademarks of SD-3C, LLC.

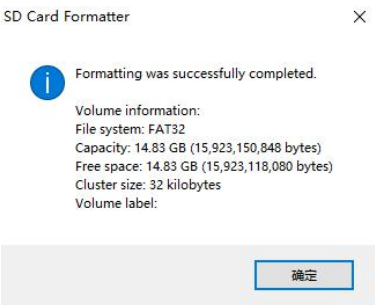
d. Then click "**Format**", a warning box will pop up before formatting, select "Yes (Y)" to start formatting



Formatting will erase all data on this card.
Do you want to continue?

Note: As formatting can take some time (especially when overwrite option is selected), please make sure that your computer is connected to a power supply and that sleep mode is disabled.

e. After formatting the TF card, the information shown in the figure below will pop up, click OK.



Formatting was successfully completed.

Volume information:
File system: FAT32
Capacity: 14.83 GB (15,923,150,848 bytes)
Free space: 14.83 GB (15,923,118,080 bytes)
Cluster size: 32 kilobytes
Volume label:

4) Download the compressed package of the Linux operating system image file you want to burn from the data download page of Orange Pi, and then use the decompression software to decompress it. In the decompressed file, the file ending with ".img" is the image file of the operating system. The size is generally more than 1GB

5) Use **Win32Diskimager** to burn the Linux image to the TF card

a. The download page of Win32Diskimager is

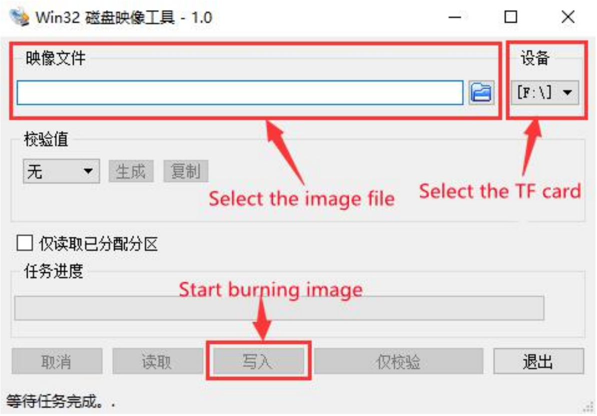
http://sourceforge.net/projects/win32diskimager/files/Archive/

b. After downloading, install it directly. The Win32Diskimager interface is as follows

a) First select the path of the image file

b) Then confirm that the drive letter of the TF card is consistent with the one displayed in the "Device" column

c) Finally click "Write" to start burning



c. After the image writing is completed, click the "**Exit**" button to exit, and then you can pull out the TF card and insert it into the development board to start

2. 4. 2. How to use balenaEtcher to burn a Linux image

1) First prepare a TF card with a capacity of 8GB or more. The transmission speed of the TF card must be above class 10. It is recommended to use a TF card from a brand such as SanDisk

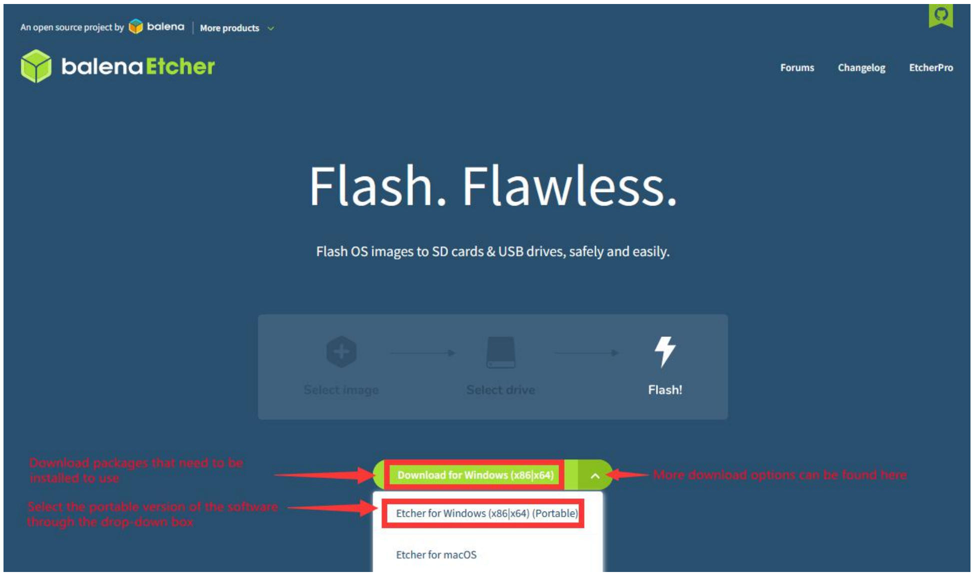
2) Then use the card reader to insert the TF card into the computer

3) Download the compressed package of the Linux operating system image file you want to burn from the data download page of Orange Pi, and then use the decompression software to decompress it. In the decompressed file, the file ending with ".img" is the image file of the operating system. The size is generally more than 1GB

4) Then download the burning software of the Linux image - **balenaEtcher**, the download address is

https://www.balena.io/etcher/

5) After entering the balenaEtcher download page, click the green download button to download the installation package of balenaEtcher. You can also select the Portable version of balenaEtcher through the drop-down box. The Portable version does not need to be installed. Double-click to open it and use it

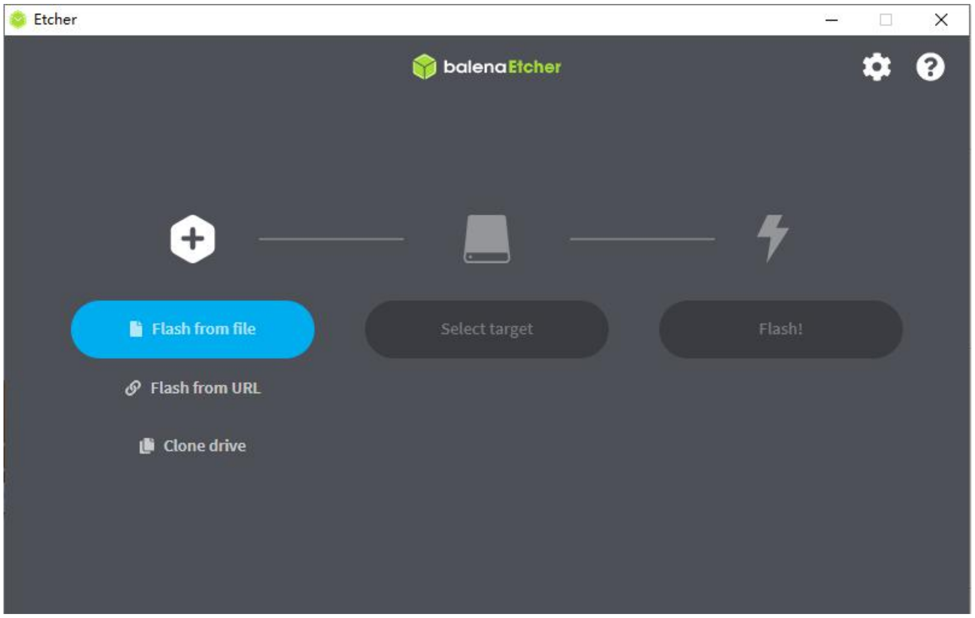

An open source project by balena
More products
balenaEtcher
Forums
Changelog
EtcherPro
Flash. Flawless.
Flash OS images to SD cards & USB drives, safely and easily.
Select image
Select drive
Flash!
Download for Windows (x86|x64)
Etcher for Windows (x86|x64) (Portable)
Etcher for macOS

Download packages that need to be installed to use

Select the portable version of the software through the drop-down box

More download options can be found here

6) If you download a version of balenaEtcher that needs to be installed, please install it before using it. If you download the Portable version of balenaEtcher, just double-click to open it. The opened balenaEtcher interface is shown in the figure below.

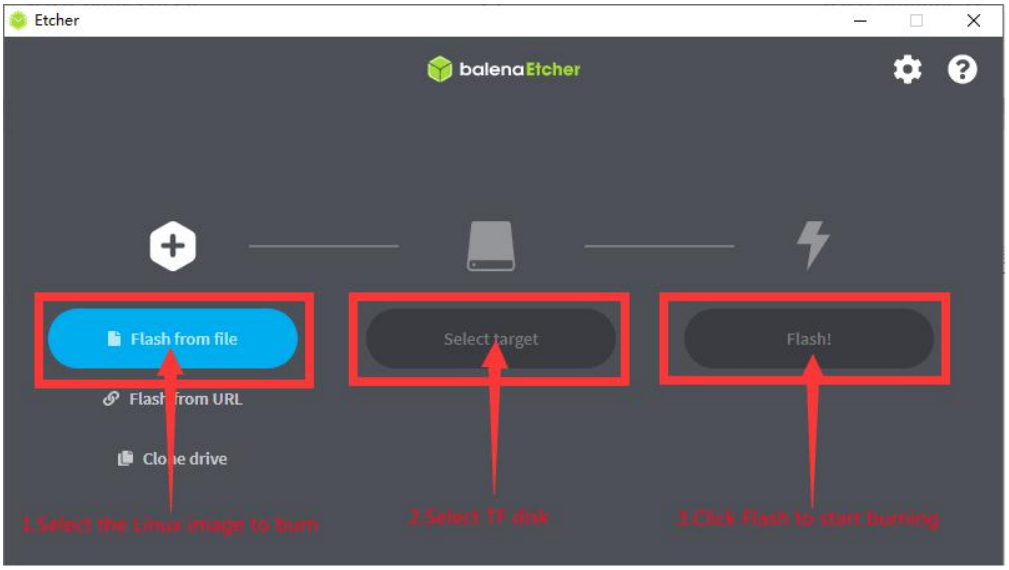


7) The specific steps to use balenaEtcher to burn a Linux image are as follows

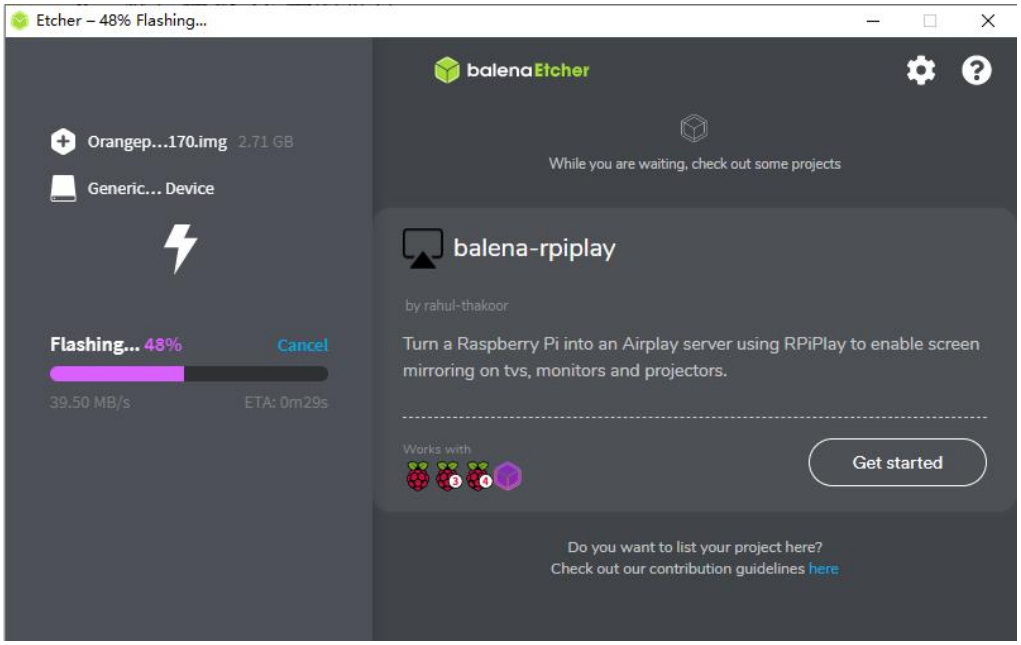
a. First select the path of the Linux image file to be burned

b. Then select the drive letter of the TF card

c. Finally, click Flash to start burning the Linux image to the TF card



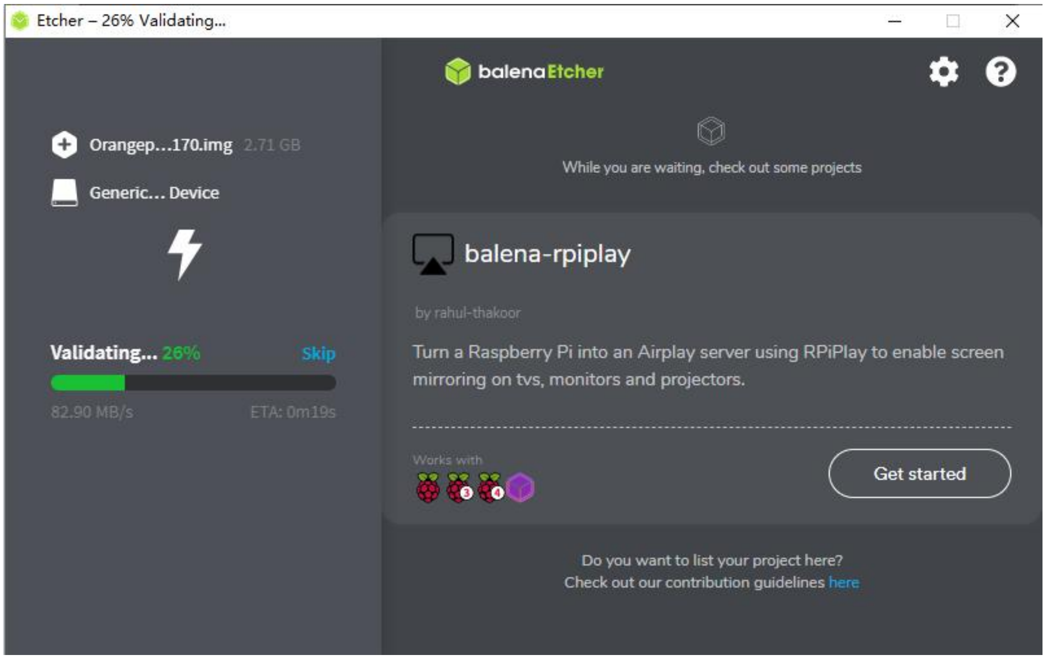
8) The interface displayed in the process of balenaEtcher burning the Linux image is shown in the figure below. In addition, the progress bar shows purple to indicate that the Linux image is being burned to the TF card.



Turn a Raspberry Pi into an Airplay server using RPiPlay to enable screen mirroring on tvs, monitors and projectors.

Do you want to list your project here?
Check out our contribution guidelines here

9) After the Linux image is burned, balenaEtcher will also verify the image burned to the TF card by default to ensure that there is no problem in the burning process. As shown in the figure below, a green progress bar indicates that the image has been burned, and balenaEtcher is verifying the burned image.



Etcher – 26% Validating...

Orangep...170.img 2.71 GB

Generic... Device

Validating... 26%

82.90 MB/s ETA: 0m19s

While you are waiting, check out some projects

balena-rpiplay

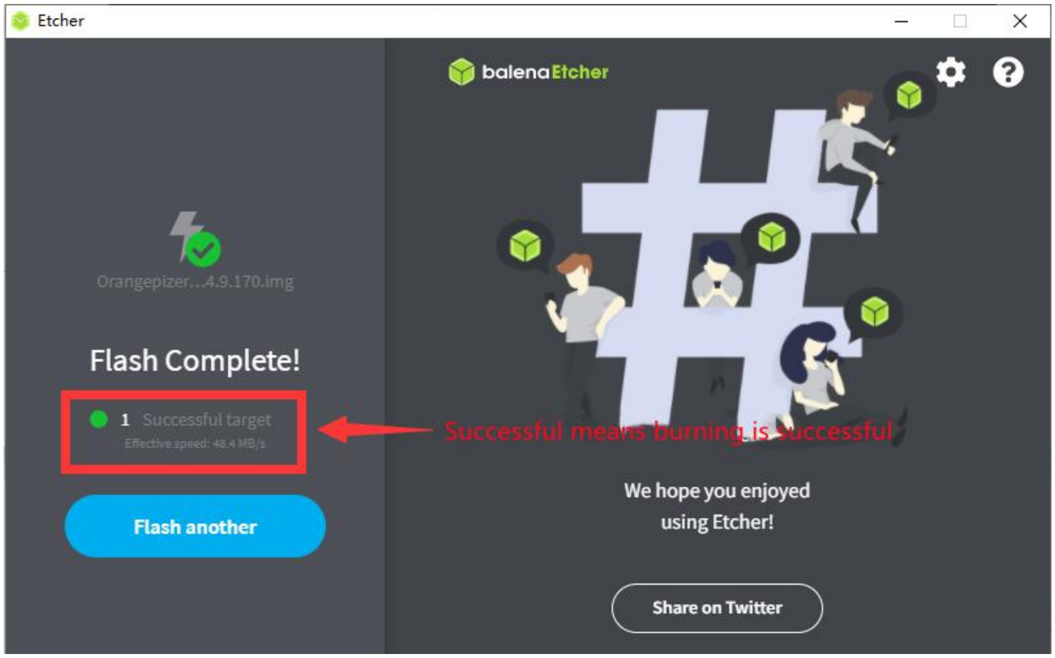
by rahul-thakoor

Turn a Raspberry Pi into an Airplay server using RPiPlay to enable screen mirroring on tvs, monitors and projectors.

Works with

Do you want to list your project here?
Check out our contribution guidelines here

10) After the successful burning is completed, the display interface of balenaEtcher is shown in the figure below. If a green indicator icon is displayed, it means that the image burning is successful. At this time, you can exit balenaEtcher, and then pull out the TF card and insert it into the TF card slot of the development board.



Orangepizer...4.9.170.img

Flash Complete!

1 Successful target

Effective speed: 48.4 MB/s

Successful means burning is successful

We hope you enjoyed using Etcher!

2. 5. The method of burning Linux image to TF card based on Ubuntu PC

Note that: the Linux image mentioned here specifically refers to a Linux distribution image such as Debian or Ubuntu downloaded from the Orange Pi data download page, and Ubuntu PC refers to a personal computer with Ubuntu installed.

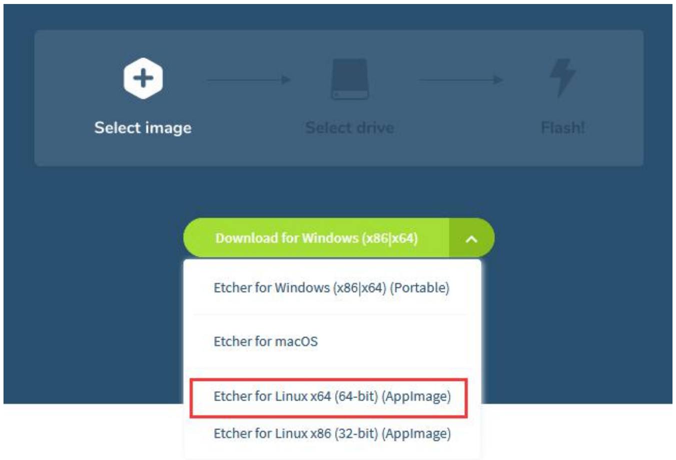
1) First prepare a TF card with a capacity of 8GB or more. The transmission speed of the TF card must be above class 10. It is recommended to use a TF card from a brand such as SanDisk

2) Then use the card reader to insert the TF card into the computer

3) Download balenaEtcher software, the download address is

https://www.balena.io/etcher/

4) After entering the balenaEtcher download page, please select the Linux version of the software through the drop-down box to download


Select image
Select drive
Flash!
Download for Windows (x86|x64)
Etcher for Windows (x86|x64) (Portable)
Etcher for macOS
Etcher for Linux x64 (64-bit) (AppImage)
Etcher for Linux x86 (32-bit) (AppImage)

5) After downloading, please use the **unzip** command to decompress the downloaded compressed package. The decompressed **balenaEtcher-1.5.109-x64.AppImage** is the software needed to burn the Linux image

```
test@test:~$ unzip balena-etcher-electron-1.5.109-linux-x64.zip
Archive:    balena-etcher-electron-1.5.109-linux-x64.zip
   inflating: balenaEtcher-1.5.109-x64.AppImage
test@test:~$ ls
balenaEtcher-1.5.109-x64.AppImage    balena-etcher-electron-1.5.109-linux-x64.zip
```

6) Download the compressed package of the Linux operating system image file you want to burn from the data download page of Orange Pi, and then use the decompression software to decompress it. In the decompressed file, the file ending with ".img" is the image file of the operating system. The size is generally more than 1GB

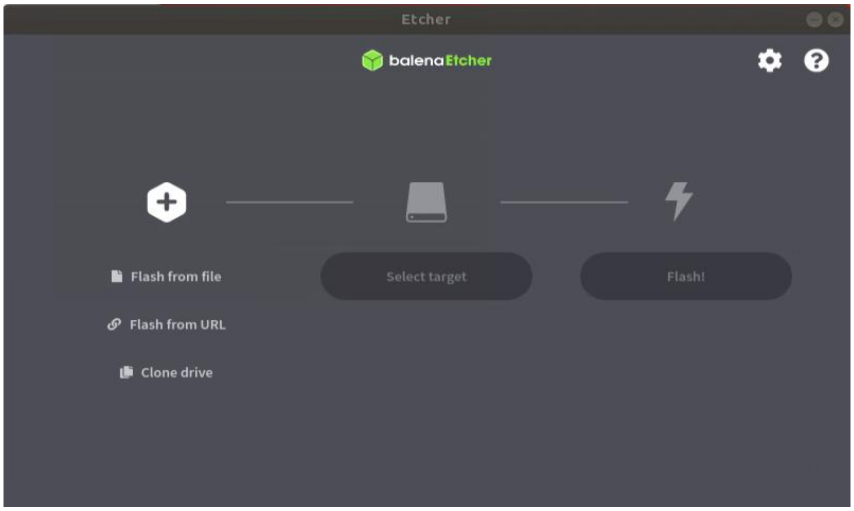
The decompression command for the compressed package ending in 7z is as follows

```
test@test:~$ 7z x Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.7z
test@test:~$ ls Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.*
Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.7z
Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.sha     #checksum file
Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.img     #image file
```

7) After decompressing the image, you can use the sha256sum -c *.sha command to calculate whether the checksum is correct. If the message is successful, it means that the downloaded image is correct, and you can safely burn it to the TF card. If the checksum does not match, it means that There is a problem with the downloaded image, please try to download again

```
test@test:~$ sha256sum -c *.sha
Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.img: success
```

8) Then double-click balenaEtcher-1.5.109-x64.AppImage on the graphical interface of Ubuntu PC to open balenaEtcher (no installation required), the interface after balenaEtcher is opened is shown in the following figure

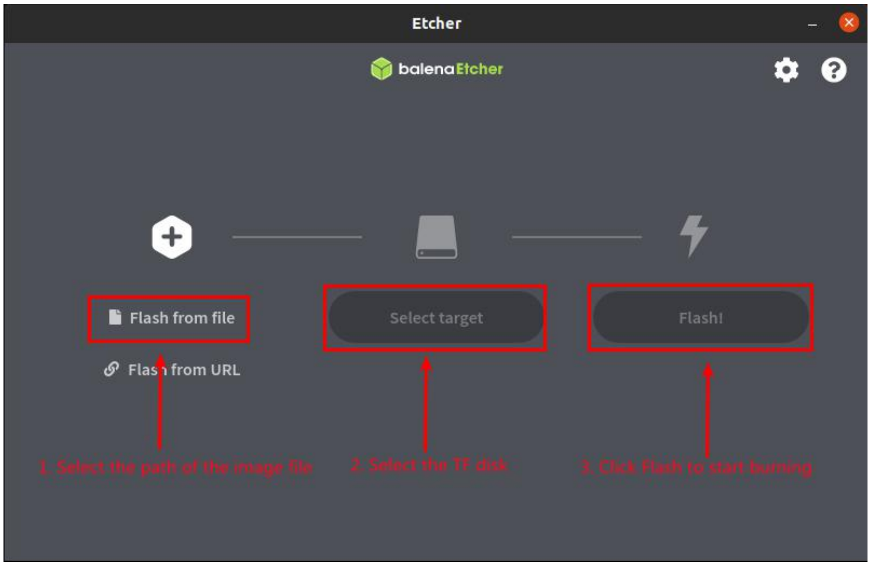


9) The specific steps to use balenaEtcher to burn a Linux image are as follows

a. First select the path of the Linux image file to be burned

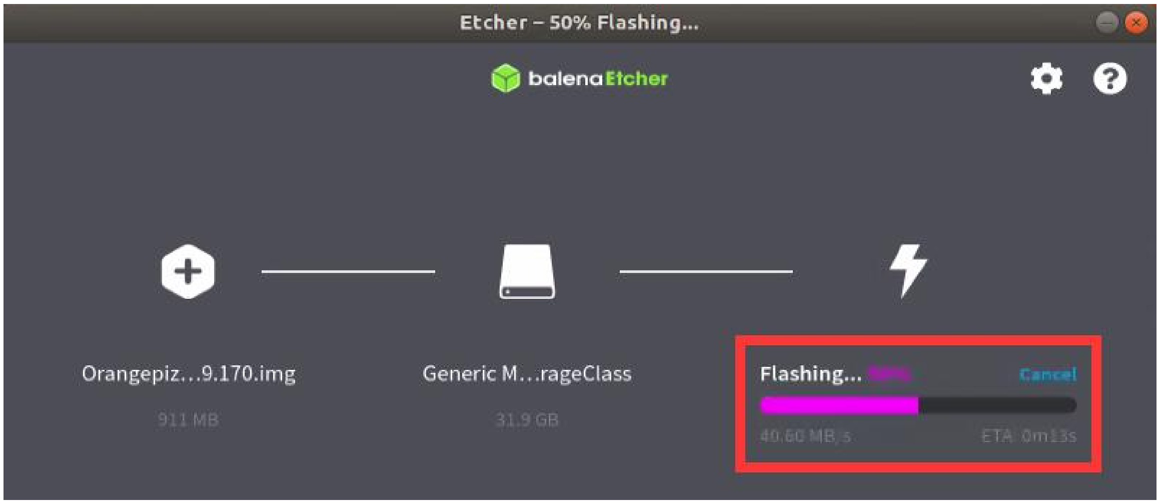
b. Then select the drive letter of the TF card

c. Finally, click Flash to start burning the Linux image to the TF card

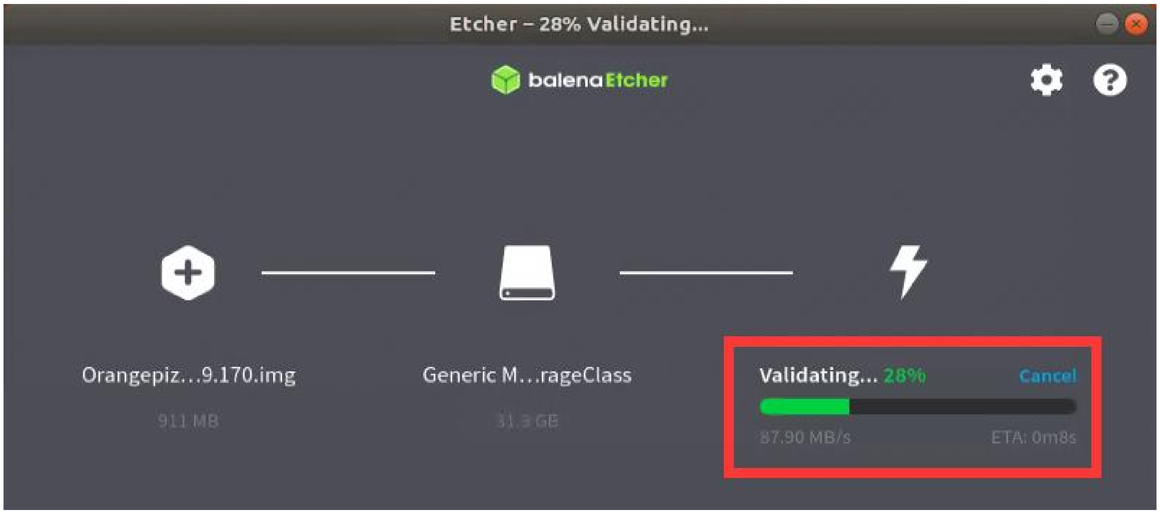


10) The interface displayed in the process of balenaEtcher burning the Linux image is

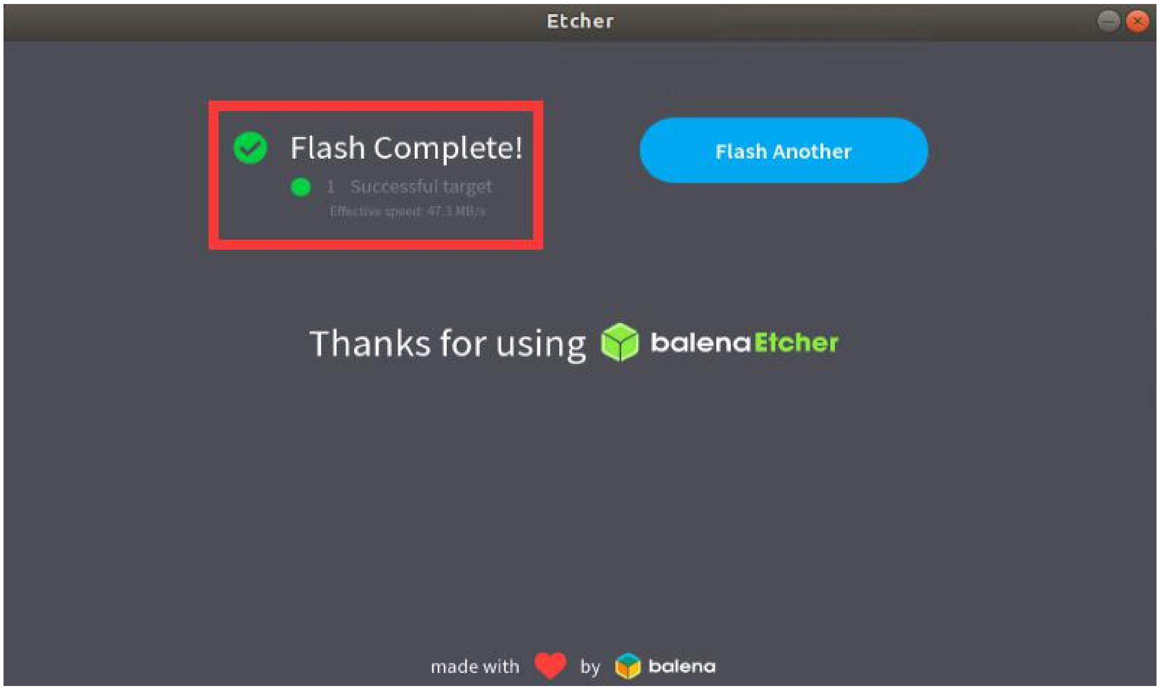
shown in the figure below. In addition, the progress bar shows purple to indicate that the Linux image is being burned to the TF card.



11) After the Linux image is burned, balenaEtcher will also verify the image burned to the TF card by default to ensure that there is no problem in the burning process. As shown in the figure below, a green progress bar indicates that the image has been burned, and balenaEtcher is verifying the burned image.



12) After the successful burning, the display interface of balenaEtcher is shown in the figure below. If the green indicator icon is displayed, it means that the image burning is successful. At this time, you can exit balenaEtcher, and then pull out the TF card and insert it into the TF card slot of the development board.



Flash Complete!

1 Successful target

Effective speed: 47.3 MB/s

2. 6. Method of programming Linux image to eMMC

See the method of burning linux image to EMMC

2. 7. How to burn Android firmware to TF card

The Android firmware of the development board can only be burned to the TF card using SDDiskTool software under the Windows platform. In addition, the SDDiskTool software does not have a Linux platform version, so it is impossible to burn the Android system to the TF card under the Linux platform.

1) First prepare a TF card with a capacity of 8GB or more. The transmission speed of the TF card must be above class 10. It is recommended to use a TF card from a brand such as SanDisk

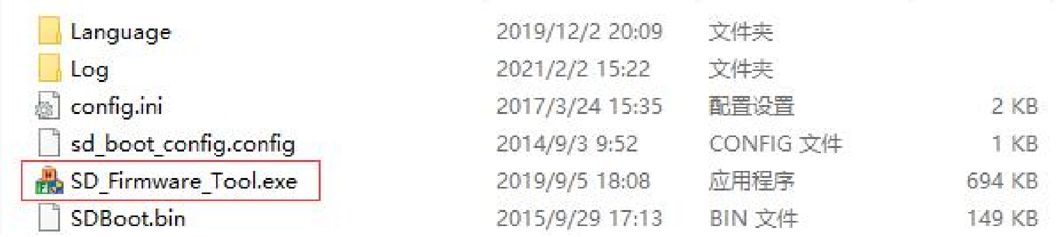
2) Then use the card reader to insert the TF card into the computer

3) Then download the SDDiskTool programming tool and Android firmware from the

data download page of Orange Pi. The Android firmware on the official website has two versions: eMMC boot and TF card boot. Here you need to select the TF card boot version, and pay attention to the TF card boot version. The name of the Android firmware contains the word "SD"

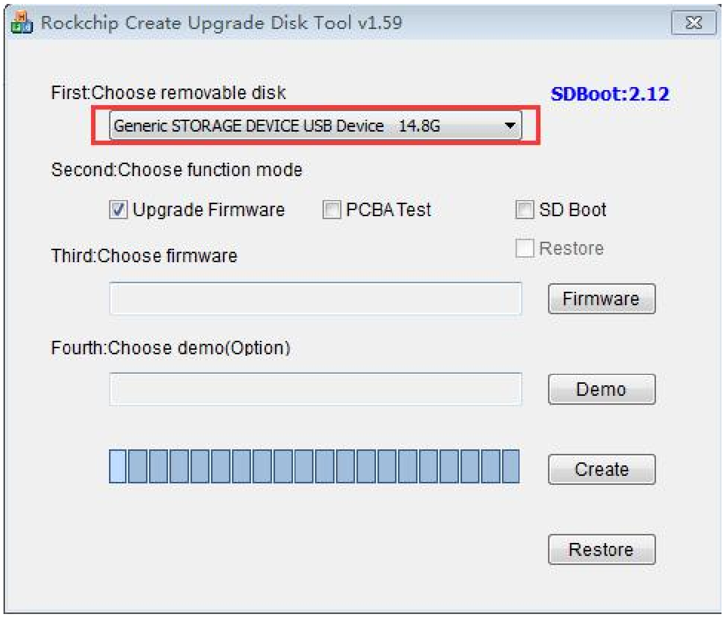
4) Then use the decompression software to decompress the downloaded Android firmware compressed package. In the decompressed file, the file ending with ".img" is the Android firmware

5) Then use the decompression software to decompress **SDDiskTool_v1.59.zip**, this software does not need to be installed, find **SD_Firmware_Tool.exe** in the decompressed folder and open it



Language	2019/12/2 20:09	文件夹	
Log	2021/2/2 15:22	文件夹	
config.ini	2017/3/24 15:35	配置设置	2 KB
sd_boot_config.config	2014/9/3 9:52	CONFIG 文件	1 KB
SD_Firmware_Tool.exe	2019/9/5 18:08	应用程序	694 KB
SDBoot.bin	2015/9/29 17:13	BIN 文件	149 KB

6) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "**Select Removable Disk Device**" column. **Please make sure that the displayed disk device is the same as the drive letter of the TF card you want to burn**. Yes, if there is no display, you can try to unplug the TF card



Rockchip Create Upgrade Disk Tool v1.59

First:Choose removable disk

SDBoot:2.12

Generic STORAGE DEVICE USB Device 14.8G

Second:Choose function mode

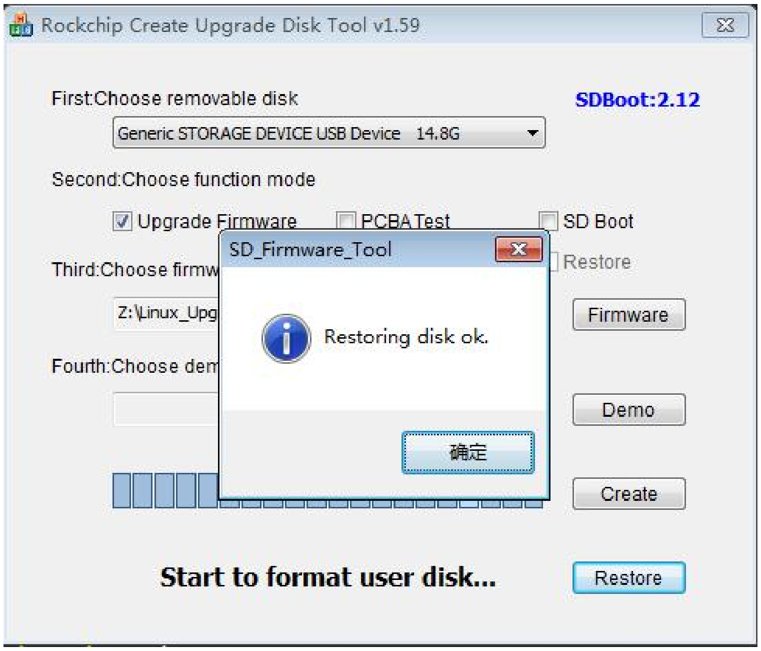
☑ Upgrade Firmware □ PCBA Test □ SD Boot

□ Restore

Third:Choose firmware

Fourth:Choose demo(Option)

7) After confirming the drive letter, format the TF card first, click the **restore disk** button in SDDiskTool, or use the SD Card Formatter mentioned above to format the TF card



Rockchip Create Upgrade Disk Tool v1.59

SDBoot:2.12

First:Choose removable disk: Generic STORAGE DEVICE USB Device 14.8G

Second:Choose function mode: ☑ Upgrade Firmware □ PCBA Test □ SD Boot □ Restore

Third:Choose firmw: Z:\Linux_Upg

Fourth:Choose dem

SD_Firmware_Tool

Restoring disk ok.

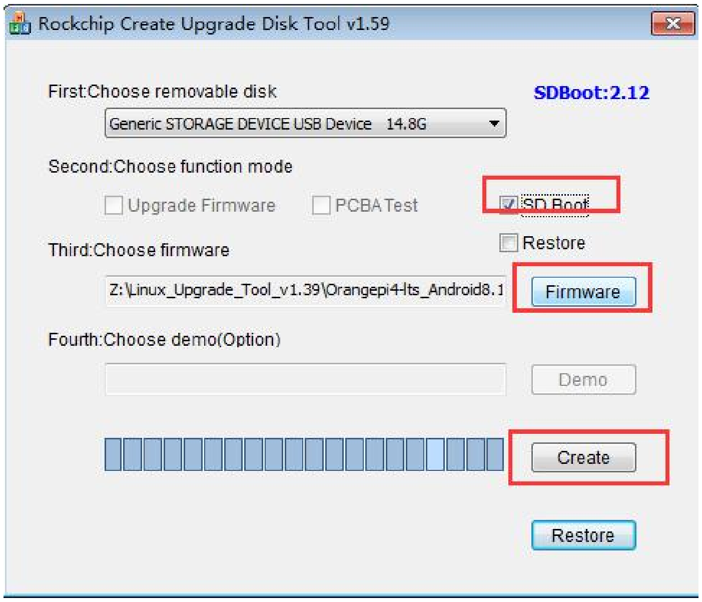
Start to format user disk...

8) Then start writing Android image to TF card

a. First check "SD Boot" in "Select Function Mode"

b. Then select the path of the Android image in the "Select firmware upgrade" column

c. Finally, click the "Start Creation" button to start burning the Android image to the TF card



Rockchip Create Upgrade Disk Tool v1.59

SDBoot:2.12

First:Choose removable disk: Generic STORAGE DEVICE USB Device 14.8G

Second:Choose function mode: □ Upgrade Firmware □ PCBA Test ☑ SD Boot □ Restore

Third:Choose firmware: Z:\Linux_Upgrade_Tool_v1.39\Orangepi4-lts_Android8.1

Fourth:Choose demo(Option)

9) After burning, you can exit SDDiskTool, and then you can pull out the TF card from the computer and insert it into the development board to start

2. 8. The method of burning Android firmware to eMMC based on Windows PC

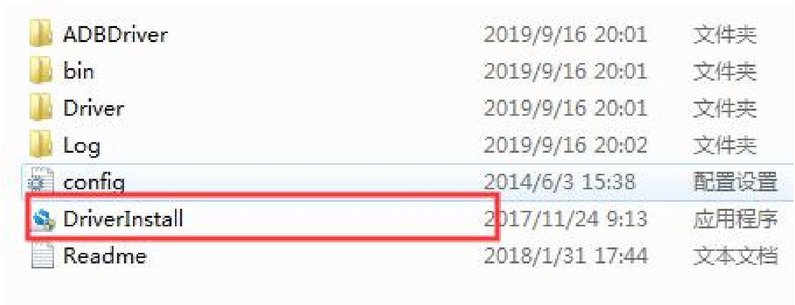
Orange Pi 4 LTS has three upgrade modes, namely MaskRom mode, Loader mode and SD upgrade mode. The first two modes need to be burned through the Type C cable, and the latter mode is burned through the TF card. For the way of programming through Type C cable, if there is no programming system in eMMC, it will enter MaskRom mode by default. If a bootable system has been programmed in eMMC, you can enter Loader mode for programming. It should be noted that if the system in eMMC is damaged due to an accident in programming or other reasons, it will not be able to enter the Loader mode for programming. You need to enter the MaskRom mode according to the method of entering the MaskRom mode, and then use the TypeC cable to connect. Computer and development board for programming

2. 8. 1. Directly burn Android firmware to eMMC through Type C interface

1) First prepare a good quality Type C data cable

2) Then download the Rockchip driver DriverAssitant_v4.6, the burning tool AndroidTool and the firmware of Android8.1 from the data download page of Orange Pi. The Android firmware on the official website has two versions: eMMC boot and TF card boot, here you need to choose eMMC The boot version, note that the name of the Android firmware that supports eMMC boot does not contain the word "SD", and please ensure that the version of the AndroidTool tool is v2.58, please do not use AndroidTool software lower than v2.58 to burn Android 8.1 firmware of Orange Pi 4 LTS, AndroidTool tools lower than this version may have problems to program Android 8.1 system

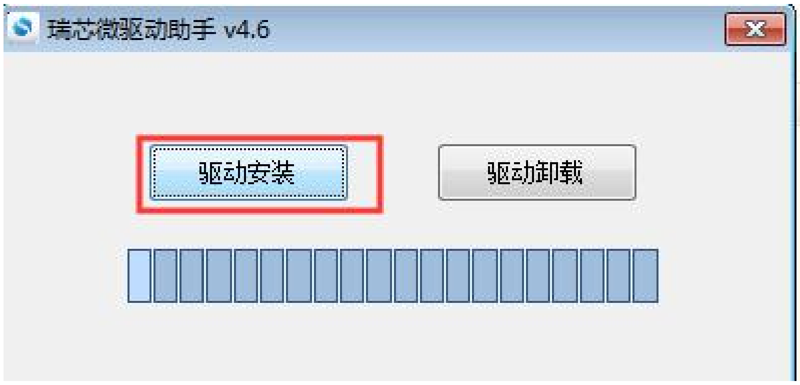
3) Decompress DriverAssitant_v4.6.zip with decompression software, find the DriverInstall.exe executable file in the decompressed folder and open it



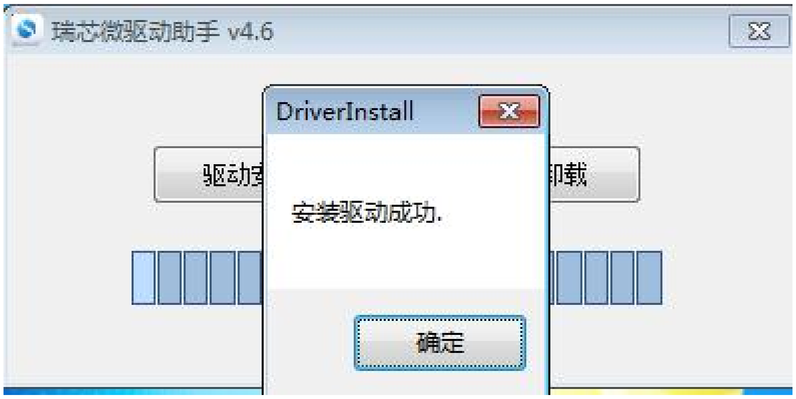
ADBDriver	2019/9/16 20:01	文件夹
bin	2019/9/16 20:01	文件夹
Driver	2019/9/16 20:01	文件夹
Log	2019/9/16 20:02	文件夹
config	2014/6/3 15:38	配置设置
DriverInstall	2017/11/24 9:13	应用程序
Readme	2018/1/31 17:44	文本文档

4) The steps to install Rockchip micro driver are as follows

a. Click the "Driver Installation" button

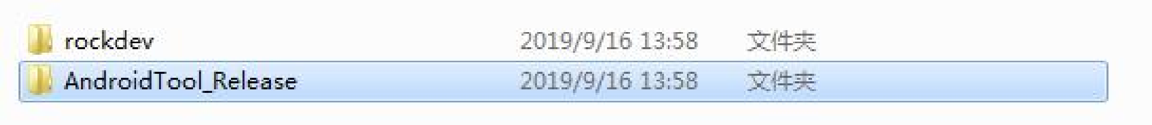


b. After waiting for a while, a pop-up window will prompt "Driver installed successfully"

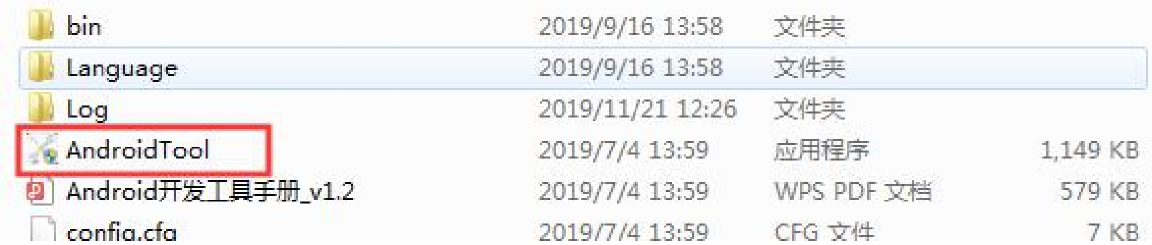


安装驱动成功.

5) Unzip AndroidTool_v2.58.zip, this software does not need to be installed, just find AndroidTool in the unzipped folder and open it

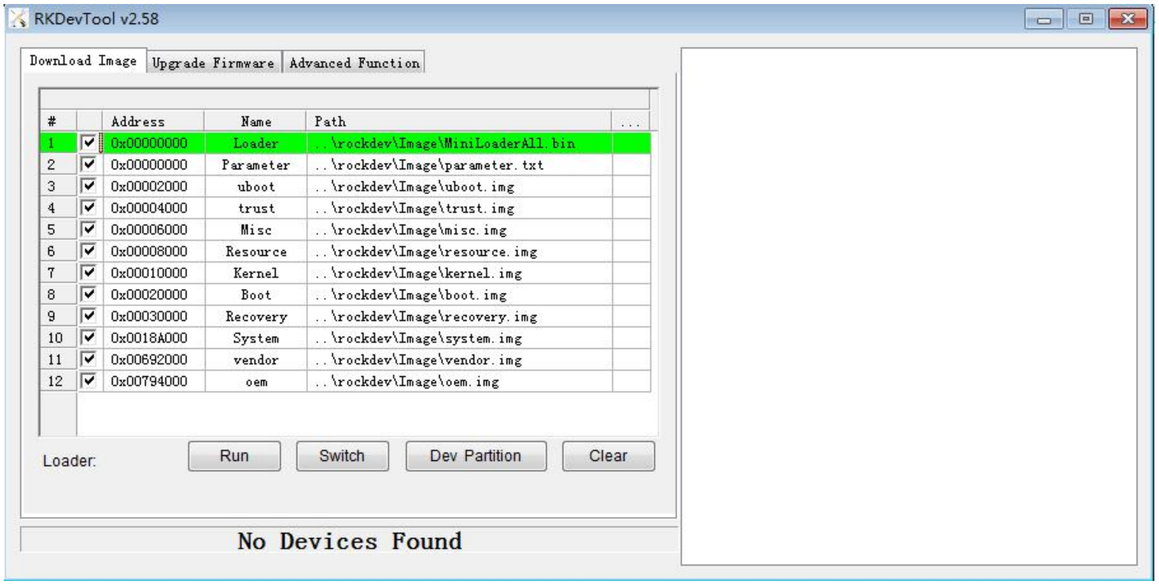


rockdev	2019/9/16 13:58	文件夹
AndroidTool_Release	2019/9/16 13:58	文件夹



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

6) After opening the AndroidTool tool, because the computer has not been connected to the Orange Pi 4 LTS development board through the Type-C cable at this time, the lower left corner will prompt "No Devices Found"



#		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	

Loader:

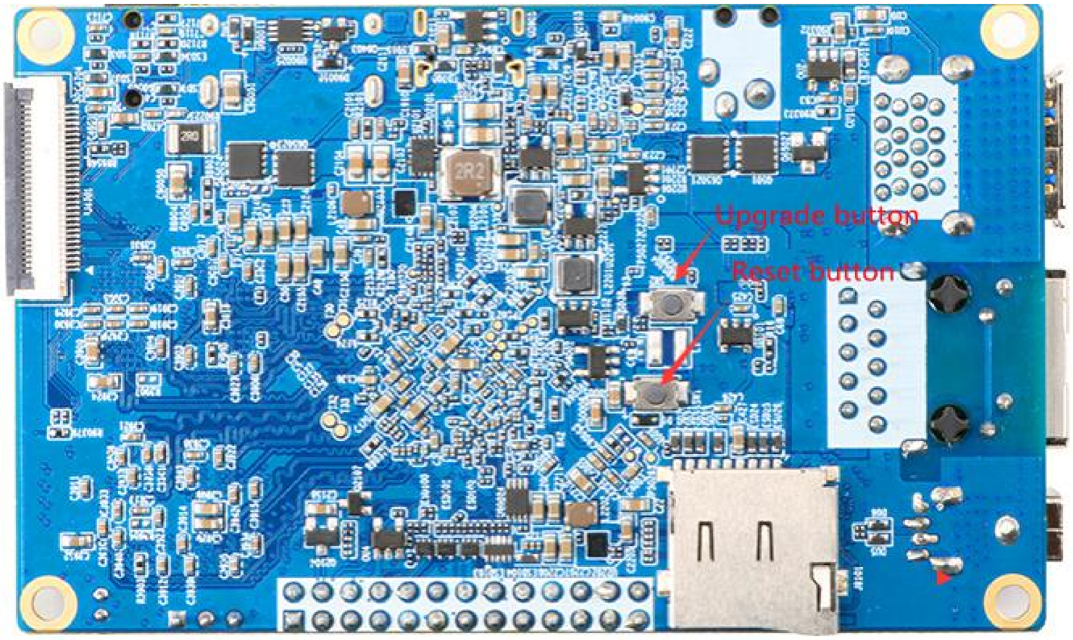
No Devices Found

7) Then start the burning of Android firmware

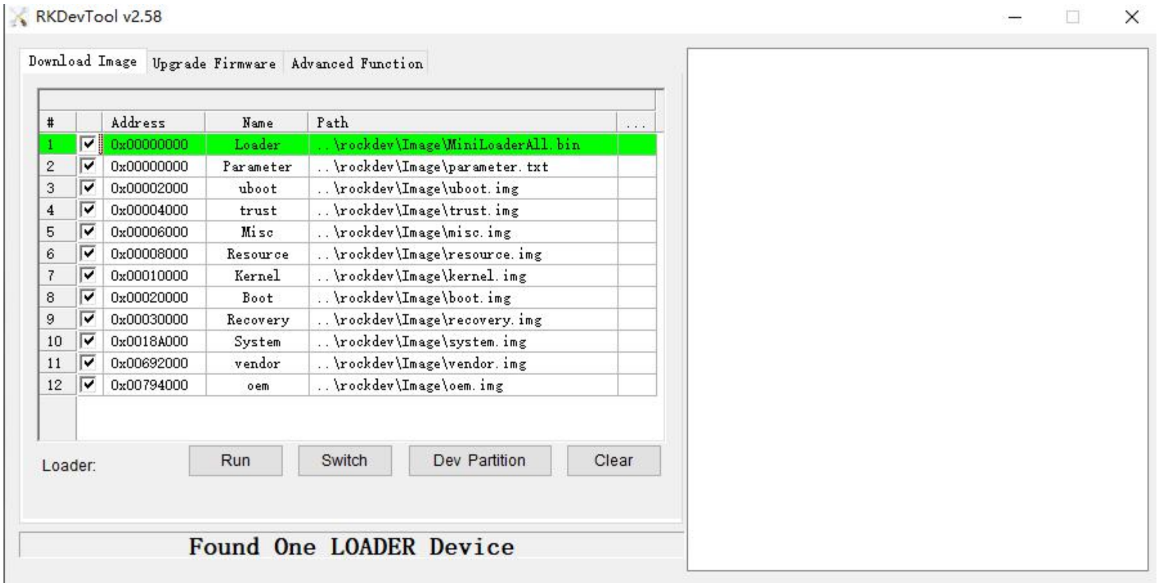
a. First connect the DC power adapter to the OrangePi 4 LTS development board, and make sure to unplug the TF card

b. Then connect OrangePi 4 LTS to Windows PC via Type-C cable

c. First press and hold the upgrade button of Orange Pi 4 LTS, then lightly press the reset button and release it immediately, wait for 3~5 seconds and then release the upgrade button. The position of the button on the development board is shown in the figure below.



a. If the previous steps are successful, the development board has entered the Loader mode, and "Found One LOADER Device" will be prompted on the interface of the AndroidTool tool

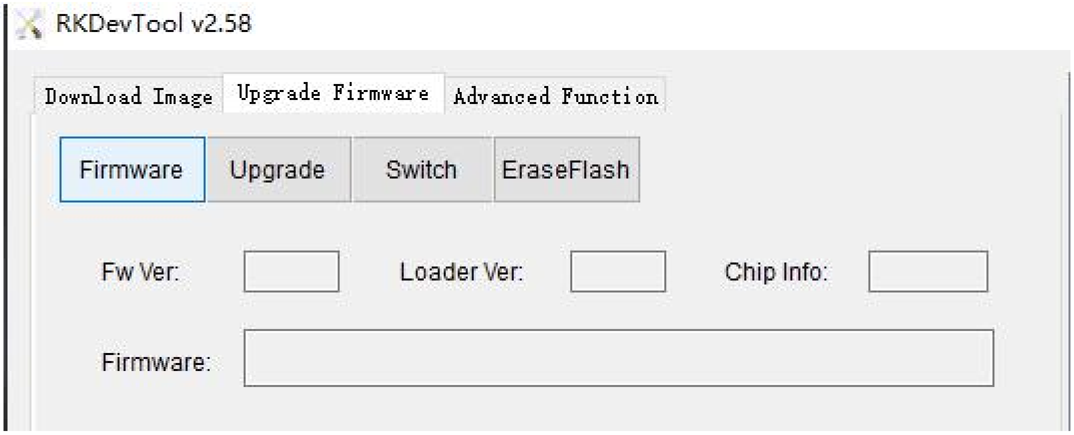


#		Address	Name	Path	...
1	☑	0x00000000	Loader	..\rockdev\Image\MiniLoaderAll.bin	
2	☑	0x00000000	Parameter	..\rockdev\Image\parameter.txt	
3	☑	0x00002000	uboot	..\rockdev\Image\uboot.img	
4	☑	0x00004000	trust	..\rockdev\Image\trust.img	
5	☑	0x00006000	Misc	..\rockdev\Image\misc.img	
6	☑	0x00008000	Resource	..\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	

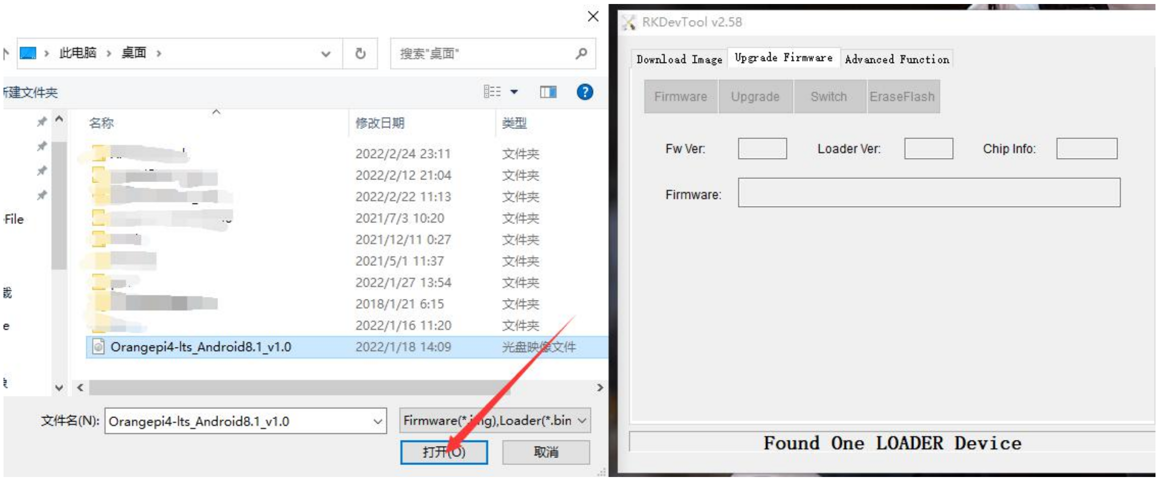
Found One LOADER Device

If no system is burned in eMMC, then AndroidTool will prompt "Found a MaskROM device"

b. Then click the "Upgrade Firmware" column of AndroidTool

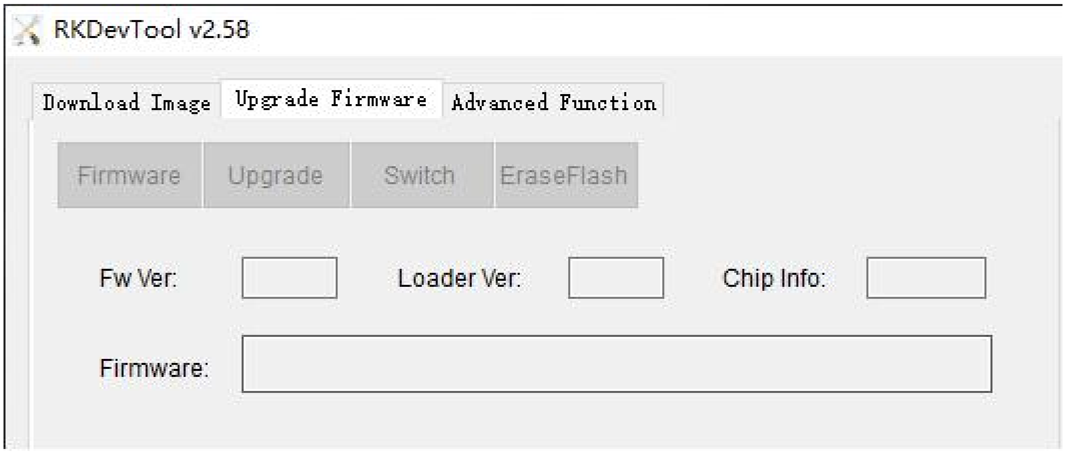


c. Then click the "Firmware" button to select the path of the Android firmware, and then click "Open", as shown in the following figure

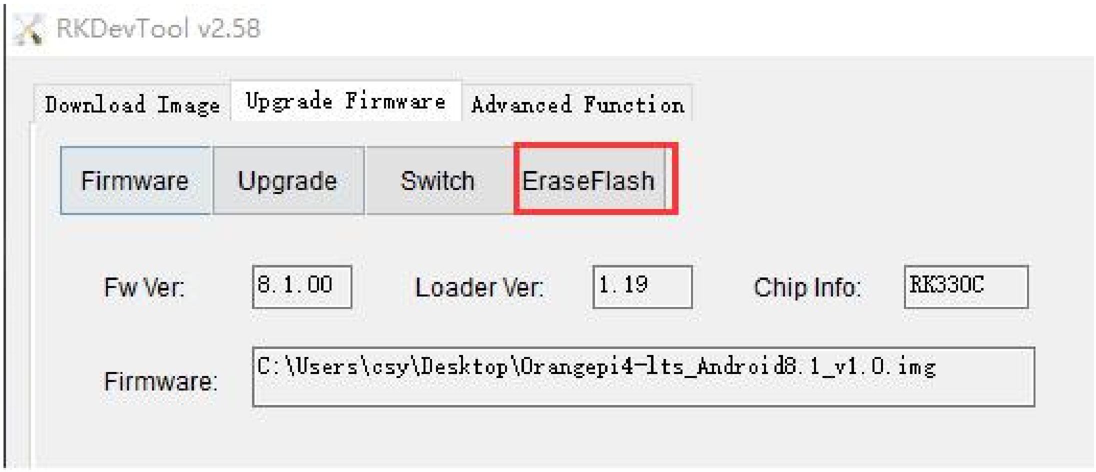


Found One LOADER Device

d. After the Android firmware path selection is completed, the firmware will start to be loaded, and the button will turn into a gray unselectable state.



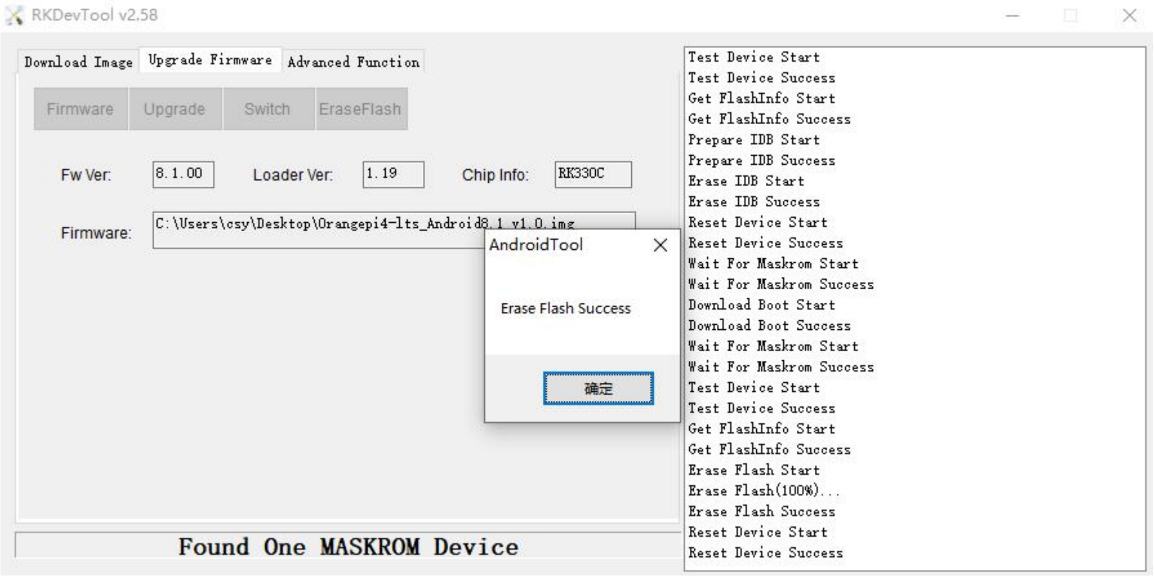
e. After the firmware is loaded, the button becomes selectable, and then click "Erase Flash" to start erasing eMMC



Fw Ver: 8.1.00 Loader Ver: 1.19 Chip Info: RK330C

Firmware: C:\Users\csy\Desktop\Orangepi4-lts_Android8.1_v1.0.img

f. The interface of the successful erasing is shown in the figure below, because the system in eMMC has been erased, so you can see the prompt "found a MASKROM device"



Fw Ver: 8.1.00 Loader Ver: 1.19 Chip Info: RK330C

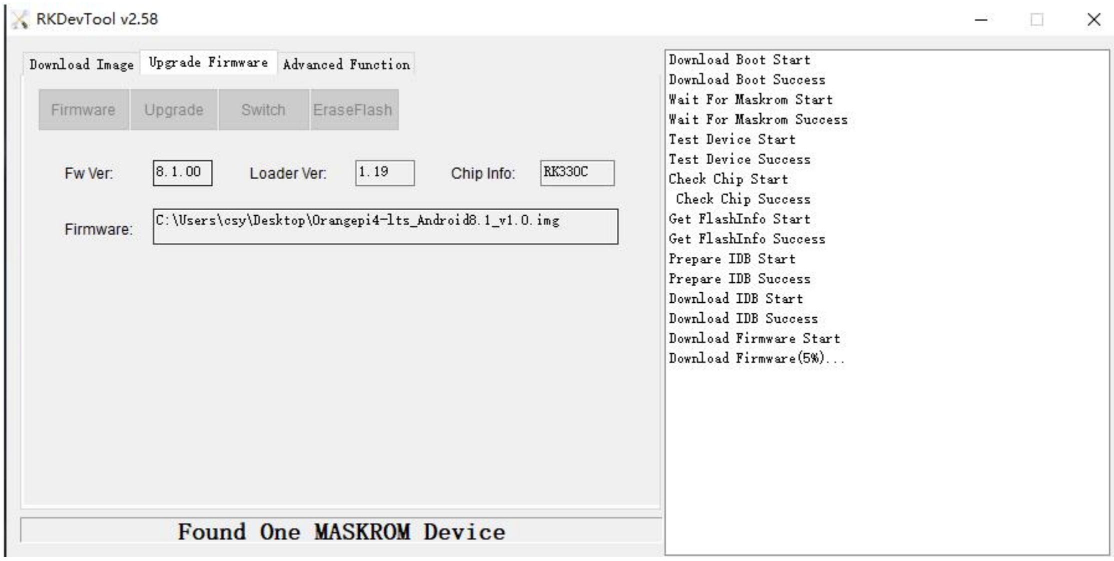
Firmware: C:\Users\csy\Desktop\Orangepi4-lts_Android8.1_v1.0.img

Erase Flash Success

Found One MASKROM Device

```
Test Device Start
Test Device Success
Get FlashInfo Start
Get FlashInfo Success
Prepare IDB Start
Prepare IDB Success
Erase IDB Start
Erase IDB Success
Reset Device Start
Reset Device Success
Wait For Maskrom Start
Wait For Maskrom Success
Download Boot Start
Download Boot Success
Wait For Maskrom Start
Wait For Maskrom Success
Test Device Start
Test Device Success
Get FlashInfo Start
Get FlashInfo Success
Erase Flash Start
Erase Flash(100%)...
Erase Flash Success
Reset Device Start
Reset Device Success
```

g. Finally, click the "Upgrade" button to burn. During the burning process, the AndroidTool is displayed as shown in the figure below, and the Android system will automatically start after the burning is completed.



Fw Ver: 8.1.00 Loader Ver: 1.19 Chip Info: RK330C

Firmware: C:\Users\csy\Desktop\Orangepi4-lts_Android8.1_v1.0.img

Found One MASKROM Device

```
Download Boot Start
Download Boot Success
Wait For Maskrom Start
Wait For Maskrom Success
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
Download Firmware Start
Download Firmware(5%)...
```

2.8.2. Burn Android image to eMMC via TF card

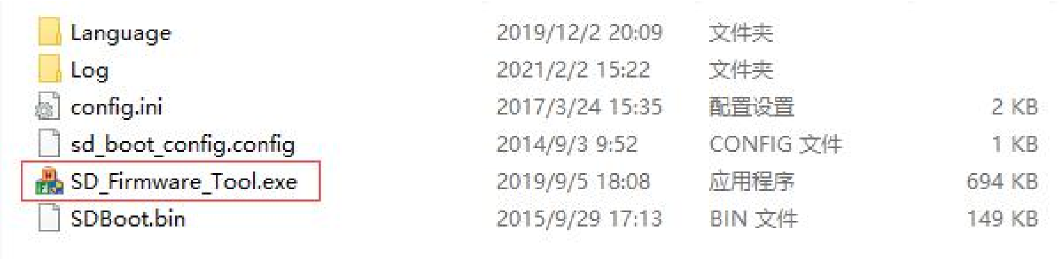
1) First prepare a TF card with a capacity of 8GB or more. The transmission speed of the TF card must be above class 10. It is recommended to use a TF card from a brand such as SanDisk

2) Then use the card reader to insert the TF card into the computer

3) Download the Android firmware and SDDiskTool programming tool from the data download page of Orange Pi. It should be noted that the firmware on the official website has two versions: eMMC boot and TF card boot. Here you need to select the eMMC boot version, and pay attention to support eMMC boot The firmware does not contain the word "SD", and please ensure that the version of SDDiskTool is v1.59

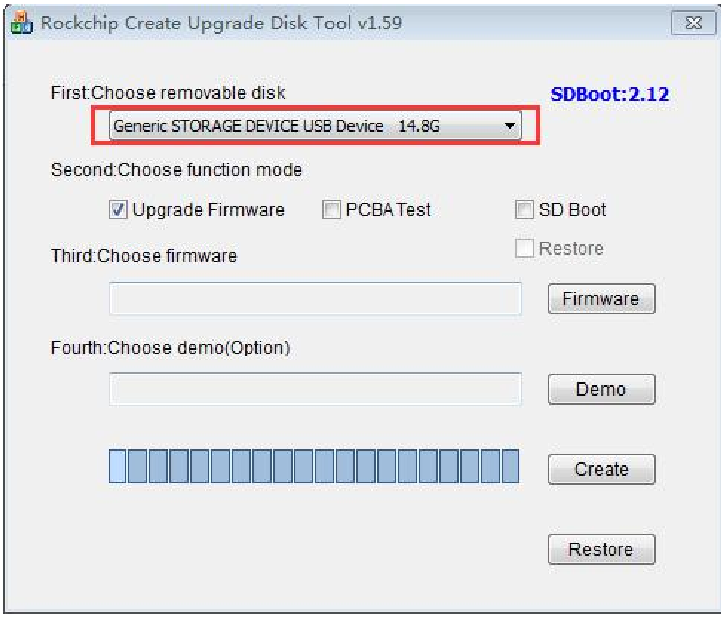
4) Then use the decompression software to decompress the downloaded Android firmware compressed package. In the decompressed file, the file ending with ".img" is the Android firmware

5) Use the decompression software to decompress **SDDiskTool_v1.59.zip**, this software does not need to be installed, just find **SD_Firmware_Tool.exe** in the decompressed folder and open it



Language	2019/12/2 20:09	文件夹	
Log	2021/2/2 15:22	文件夹	
config.ini	2017/3/24 15:35	配置设置	2 KB
sd_boot_config.config	2014/9/3 9:52	CONFIG 文件	1 KB
SD_Firmware_Tool.exe	2019/9/5 18:08	应用程序	694 KB
SDBoot.bin	2015/9/29 17:13	BIN 文件	149 KB

6) After opening SDDiskTool, if the TF card is recognized normally, the inserted disk device will be displayed in "Select Removable Disk Device". Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn. If there is no display, you can try to unplug the TF card



Rockchip Create Upgrade Disk Tool v1.59

First:Choose removable disk: Generic STORAGE DEVICE USB Device 14.8G

SDBoot:2.12

Second:Choose function mode: ☑ Upgrade Firmware □ PCBA Test □ SD Boot □ Restore

Third:Choose firmware

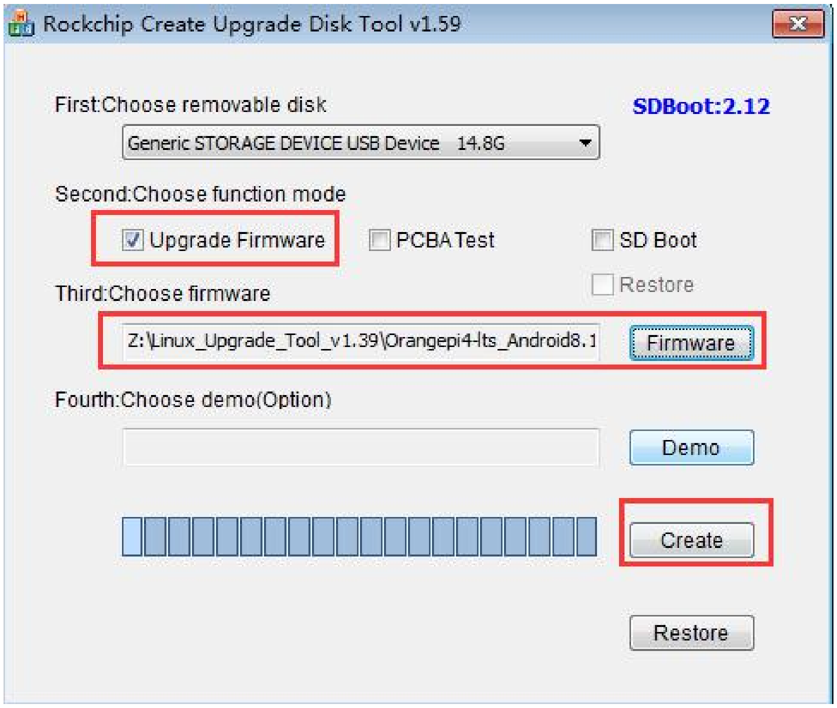
Fourth:Choose demo(Option)

7) Then start writing Android firmware to TF card

a. First select the path of the Android firmware in the "Choose firmware" column

b. Then select "Firmware Upgrade" in "Choose function mode"

c. Finally click the "Create" button to start burning



Rockchip Create Upgrade Disk Tool v1.59

First:Choose removable disk

Generic STORAGE DEVICE USB Device 14.8G

SDBoot:2.12

Second:Choose function mode

☑ Upgrade Firmware □ PCBA Test □ SD Boot □ Restore

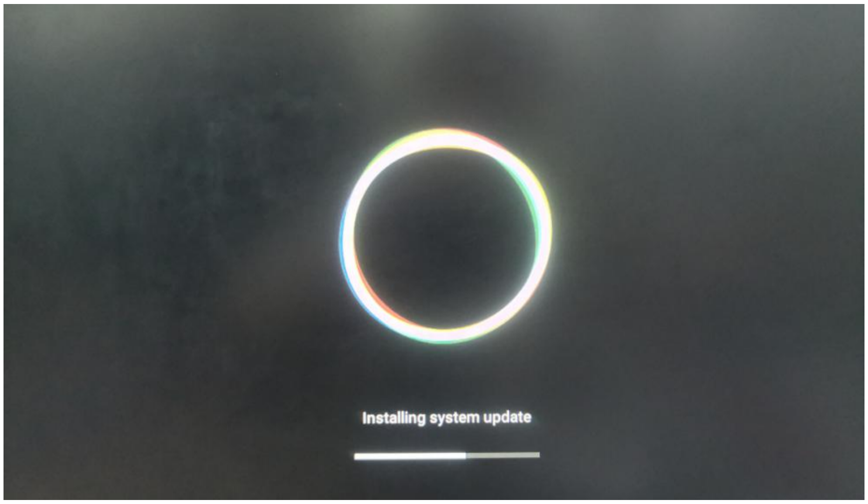
Third:Choose firmware

Z:\Linux_Upgrade_Tool_v1.39\Orangepi4-lts_Android8.1

Fourth:Choose demo(Option)

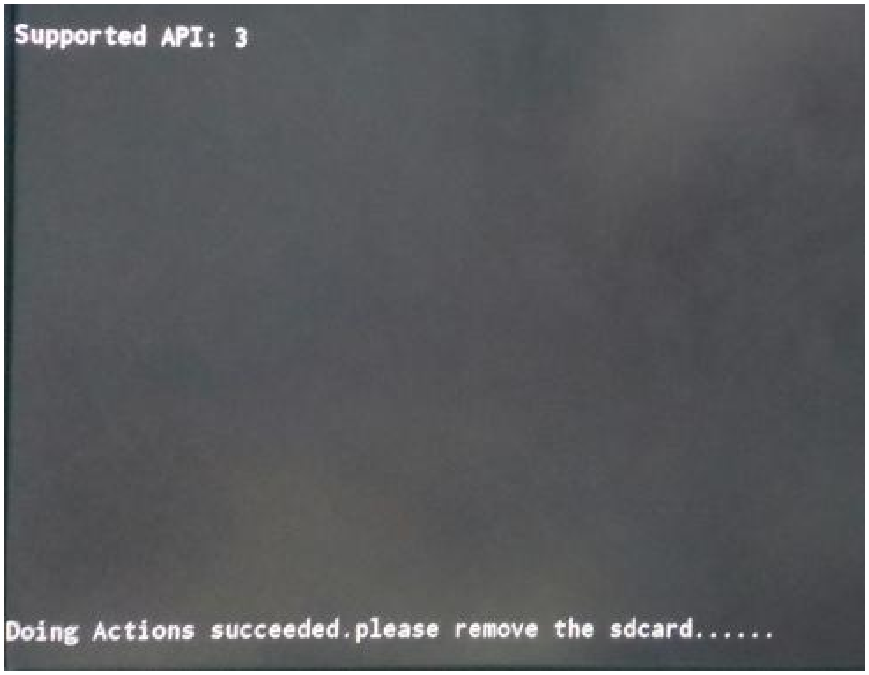
8) After burning, you can exit SDDiskTool, and then you can unplug the TF card from the computer and insert it into the development board. After the development board is powered on, it will start to burn the Android firmware in the TF to the eMMC.

9) If the development board is connected to an HDMI display, you can also see the progress bar of burning Android firmware to eMMC from the HDMI display



10) When the following information is displayed, it means that the Android firmware has been burned into the eMMC. At this time, the TF card can be pulled out, and then the

Android system in the eMMC will start to start.



```
Supported API: 3

Doing Actions succeeded.please remove the sdcard......
```

2. 9. Method of Burning Android Image to eMMC Based on Ubuntu PC

1) First prepare a good quality Type C data cable

2) Then download the upgrade_tool tool and Android 8.1 firmware from the data download page of Orange Pi. The firmware on the official website has two versions: eMMC boot and TF card boot. Here you need to select the eMMC boot version. Note that the firmware that supports eMMC boot does not contain "SD", please make sure the upgrade_tool version is v1.39, please do not use the upgrade_tool software lower than v1.39 to burn the Android 8.1 firmware of Orange Pi 4 LTS, the upgrade_tool tool lower than this version Burning Android 8.1 may be problematic

3) Then execute the command in the terminal to decompress upgrade_tool and add executable permissions

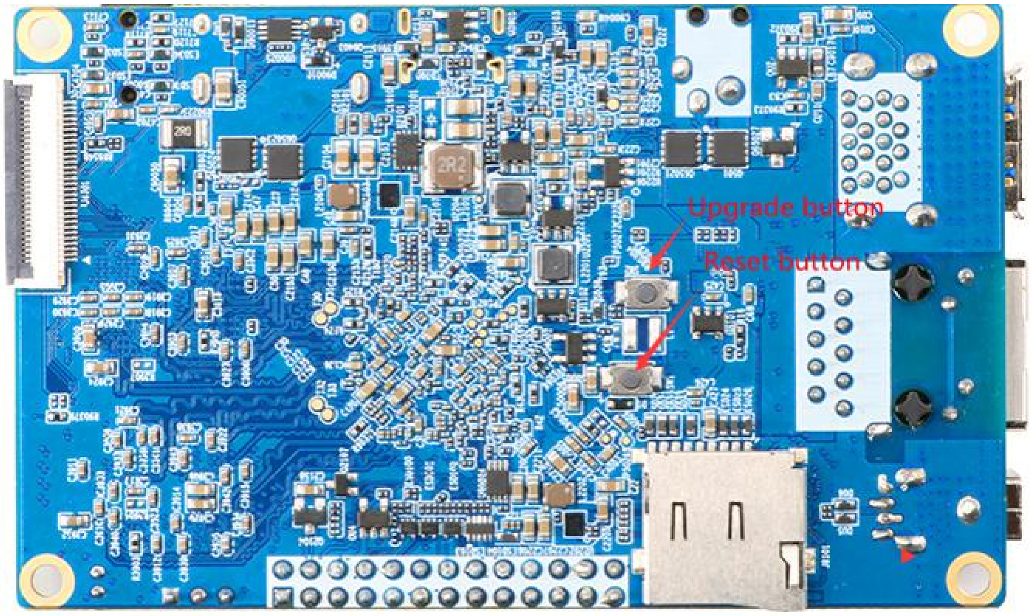
```
test@test:~$ unzip Linux_Upgrade_Tool_v1.39.zip
test@test:~$ cd Linux_Upgrade_Tool_v1.39
test@test:~/Linux_Upgrade_Tool_v1.39$ sudo chmod +x ./upgrade_tool
```

4) Then start the burning of Android firmware

a. First connect the DC power adapter to the OrangePi 4 LTS development board, and make sure to unplug the TF card

b. Then connect OrangePi 4 LTS with Ubuntu PC via Type-C data cable

c. First press and hold the upgrade button of Orange Pi 4 LTS, then lightly press the reset button and release it immediately, wait for 3~5 seconds and then release the upgrade button. The position of the button on the development board is shown in the figure below.



a. If the previous steps are successful, the development board has entered the Loader mode at this time, execute the following command and you will see Mode=Loader, indicating that the Loader device has been recognized

```
test@test:~/Linux_Upgrade_Tool_v1.39$ ./upgrade_tool LD
Program Data in /home/csy/.config/upgrade_tool
List of rockusb connected(1)
DevNo=1     Vid=0x2207,Pid=0x330c,LocationID=2010201 Mode=Loader
```

If no system is burned in eMMC, then the Maskrom device will be recognized, and the value of Mode will be Maskrom

b. Then copy the downloaded Android image to the Linux_Upgrade_Tool_v1.39 directory

c. Then enter the following command in the terminal of the Ubuntu PC to erase the eMMC

```
test@test:~$ sudo ./upgrade_tool ef Orangepi4-lts_Android8.1_v1.0.img
```

d. Finally execute the following command to start burning Android firmware to eMMC

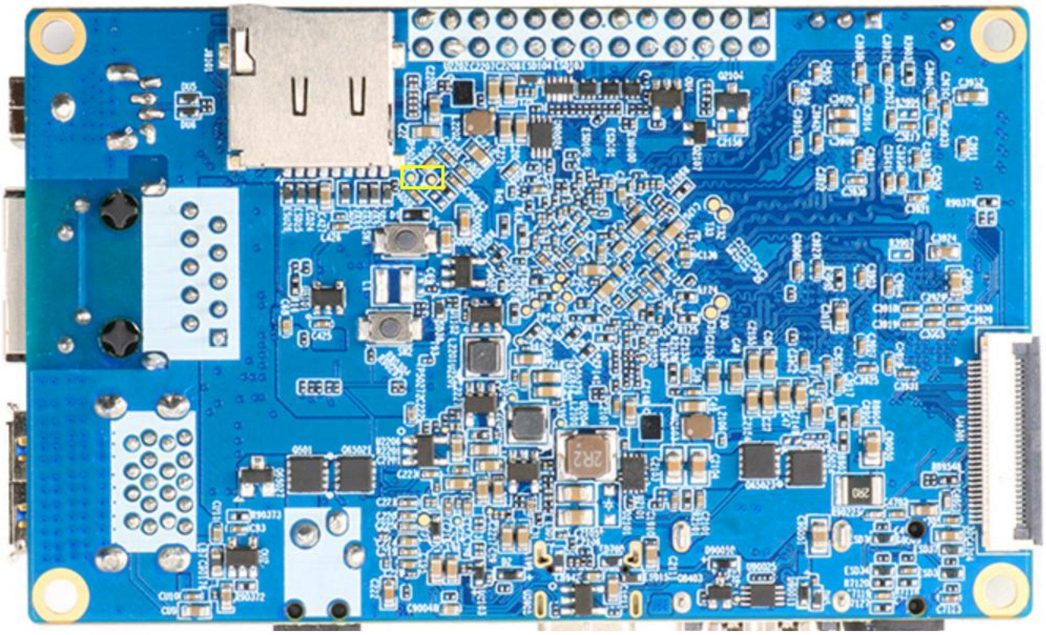
```
test@test:~$ sudo ./upgrade_tool uf Orangepi4-lts_Android8.1_v1.0.img
```

2. 10. How to enter MaskRom mode

Under normal circumstances, it is not necessary to enter MaskRom mode. Only when the bootloader is damaged and the system cannot be started, it is necessary to enter Maskrom mode for burning.

1) First make sure that the OrangePi 4 LTS development board is disconnected from all power sources, and the SD card is unplugged

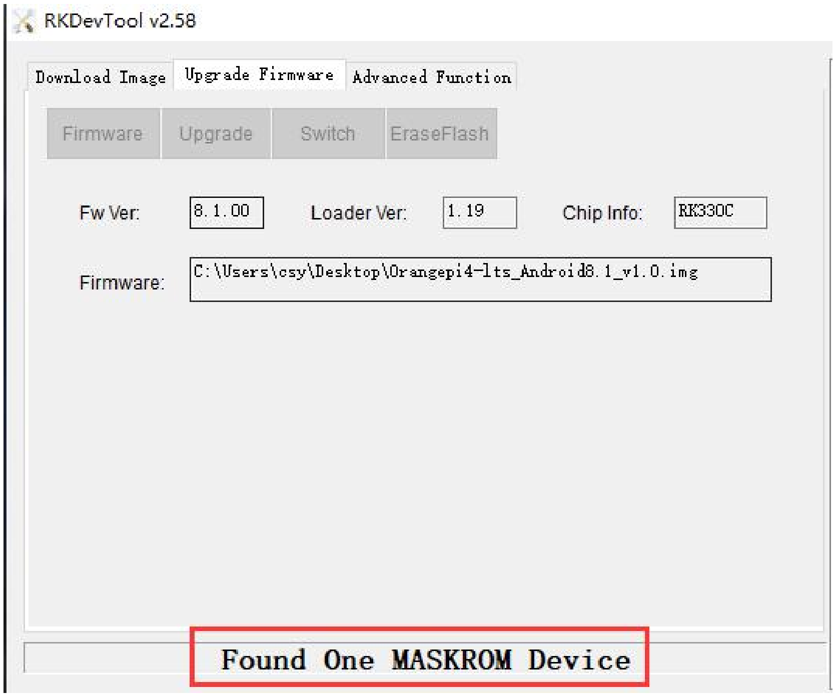
2) Then use metal tweezers to connect the two test points in the yellow box in the picture below reserved by the OrangePi 4 LTS development board, and keep it still (make sure that the two test points are short-circuited)



3) Then plug in the DC power supply to the Orange Pi 4 LTS development board, wait

for 2~3 seconds and then release the metal tweezers. At this point the OrangePi 4 LTS development board will enter maskrom mode

4）Then use the Type C cable to connect the OrangePi 4 LTS development board to the Windows PC, and then open the **AndroidTool** tool, if all goes well, you can see the AndroidTool interface prompts "**Found**
One MASKROM Device”



Fw Ver: 8.1.00 Loader Ver: 1.19 Chip Info: RK330C

Firmware: C:\Users\csy\Desktop\Orangepi4-lts_Android8.1_v1.0.img

Found One MASKROM Device

5）At this point, you can burn the Android firmware through the AndroidTool tool under Windows

2. 11. Start the orange pi development board

1) The development board has an onboard eMMC, and the Android 8.1 image is burned by default in it. When you get the development board, you can directly use the image in the eMMC for startup and full-function testing.
2) If you need to use the linux image, you can insert the TF card with the linux image burned into the TF card slot of the Orange Pi development board
3) The development board has an HDMI interface, and the development board can be connected to a TV or HDMI display through an HDMI to HDMI cable

4) Connect the USB mouse and keyboard to control the orange pi development board

5) The development board has an Ethernet port, which can be plugged into a network cable for Internet access

6) Connect a 5V/3A (5V/4A can also) high-quality power adapter

a.Orange Pi 4 LTS cannot be powered through the 5v pin on the 26pin interface

b. Remember not to plug in the 12V power adapter, if the 12V power adapter is plugged in, it will burn out the development board

c. Many unstable phenomena during system startup are basically caused by power supply problems, so a reliable power adapter is very important

1) Then turn on the switch of the power adapter. If everything is normal, the HDMI display can see the startup screen of the system.

2) If you want to view the output information of the system through the debugging serial port, please use the USB to TTL module and DuPont cable to connect the development board to the computer. For the connection method of the serial port, please refer to the section on how to use the debugging serial port.

How to judge whether the system has started normally:

1) If the HDMI display is connected, the judgment method is very simple. As long as the HDMI display normally displays the interface of the system, it means that the system has been started normally;

2) If there is no HDMI display, you can connect the development board to the computer through the serial cable, and check the startup status of the system by debugging the log information output by the serial port. If the serial port output stops at the login interface of the terminal, it means that the system has been started normally;

3) If there is no HDMI display and serial port cable, you can judge the startup status of the system through the two LED lights on the development board. If the red LED light is on and the green LED light is flashing, the system has generally started normally. , If after power-on and waiting for a period of time, only the red LED light is on, or the red and green LED lights are not on, it means that the system has not started normally.

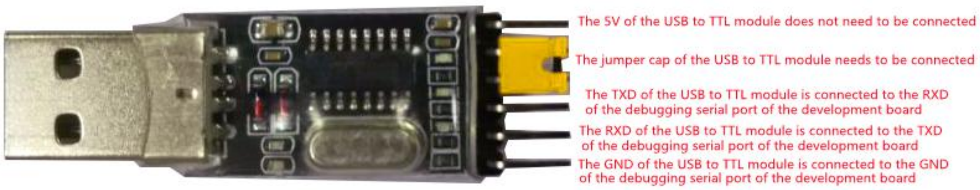
If the system fails to start or cannot enter the login interface normally, please check the following first:

1) Check whether the downloaded image is damaged, which can be judged by calculating the checksum attached to the image;
2) If there is any problem in the process of burning the image to the TF card, you can re-burn the image and test it again;
3) Make sure there is no problem with the power adapter, you can try another one;
4) Make sure that the TF card meets the requirements of the Orange Pi development board. If there is an extra TF card, you can try to change the TF card and then burn the image and test it again;
5) If all of the above are OK, please save the output log of the debugging serial port during the system startup process (preferably in the form of txt text instead of taking pictures), and then report the problem to the customer service.

2. 12. How to debug the serial port

2. 12. 1. Connection instructions for debugging serial port

1) First, you need to prepare a 3.3V USB to TTL module. For better platform compatibility, it is recommended to use the CH340 USB to TTL module. Then insert one end of the USB interface of the USB to TTL module into the USB interface of the computer



The 5V of the USB to TTL module does not need to be connected

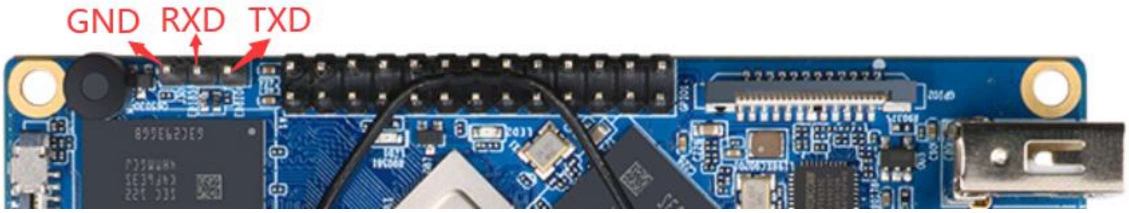
The jumper cap of the USB to TTL module needs to be connected

The TXD of the USB to TTL module is connected to the RXD of the debugging serial port of the development board

The RXD of the USB to TTL module is connected to the TXD of the debugging serial port of the development board

The GND of the USB to TTL module is connected to the GND of the debugging serial port of the development board

2) The corresponding relationship between the debug serial port GND, RXD and TXD pins of the development board is shown in the figure below



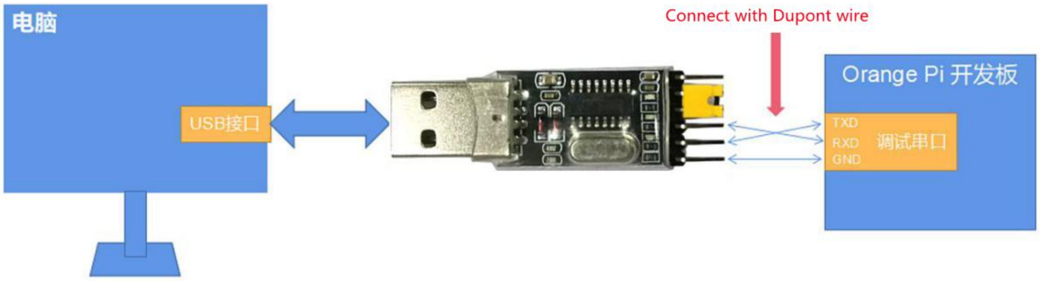
3) The GND, TXD and RXD pins of the USB to TTL module need to be connected to the debug serial port of the development board through a DuPont cable

a. Connect the GND of the USB to TTL module to the GND of the development board

b. The RX of the USB to TTL module is connected to the TX of the development board

c. The TX of the USB to TTL module is connected to the RX of the development board

4) The schematic diagram of connecting the USB to TTL module to the computer and the Orange Pi development board is shown below



Schematic diagram of connecting the USB to TTL module to the computer and the Orange Pi development board

The TX and RX of the serial port need to be cross-connected. If you don't want to carefully distinguish the order of TX and RX, you can connect the TX and RX of the serial port casually. If there is no output in the test, then exchange the order of TX and RX, so there is always a the order is correct

5) If the CP2102 USB to TTL module is used, in the case of a baud rate of 1500000, some systems may encounter garbled or unusable problems. The specific test situation is as follows

USB to TTL module model	Host system	Support situation
CH340	win7	OK
	win10	OK
	ubuntu14.04	OK
	ubuntu18.04	OK
	ubuntu20.04	OK
CP2102	win7	OK
	win10	NO
	ubuntu14.04	OK
	ubuntu18.04	NO

	ubuntu20.04	NO

2. 12. 2. How to use the debugging serial port on Ubuntu platform

There are many serial debugging software that can be used under Linux, such as putty, minicom, etc. The following demonstrates how to use putty

1) First, insert the USB to TTL module into the USB interface of the Ubuntu computer. If the connection and recognition of the USB to TTL module is normal, you can see the corresponding device node name under /dev of the Ubuntu PC, remember this node name, and set the serial port later software will be used

```
test@test:~$ ls /dev/ttyUSB*
/dev/ttyUSB0
```

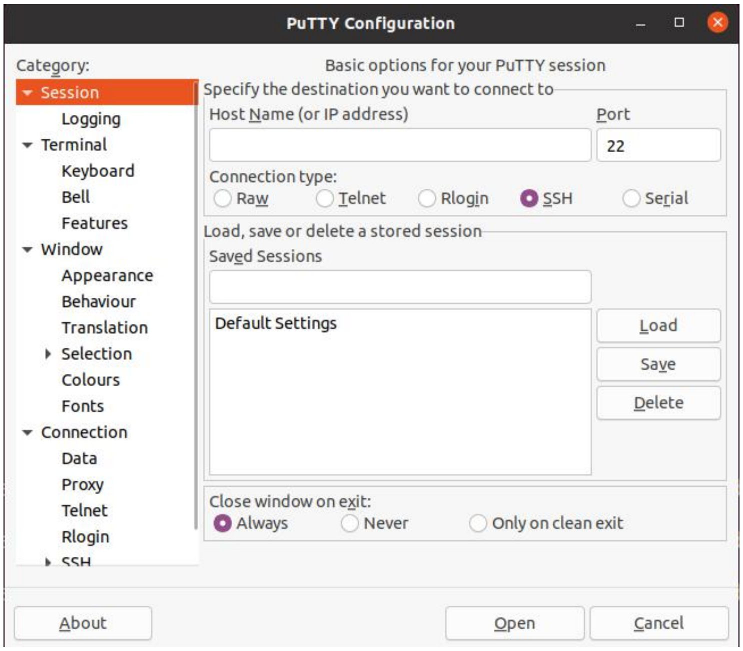
2) Then use the following command to install putty on Ubuntu PC

```
test@test:~$ sudo apt update
test@test:~$ sudo apt install putty
```

3) Then run putty, remember to add sudo permissions

```
test@test:~$ sudo putty
```

4) After executing the putty command, the following interface will pop up

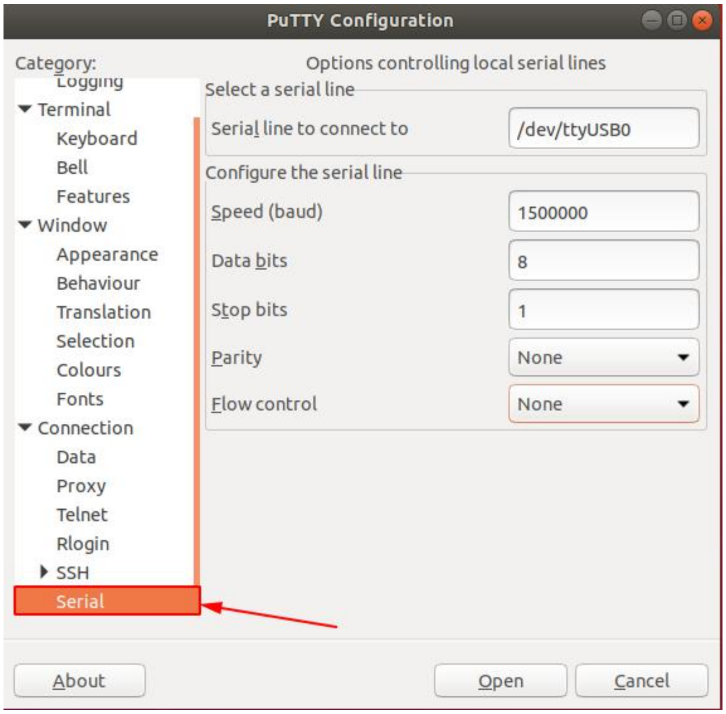


Port: 22

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

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

5) First select the setting interface of the serial port



Options controlling local serial lines

Select a serial line

Serial line to connect to /dev/ttyUSB0

Configure the serial line

Speed (baud) 1500000

Data bits 8

Stop bits 1

Parity None

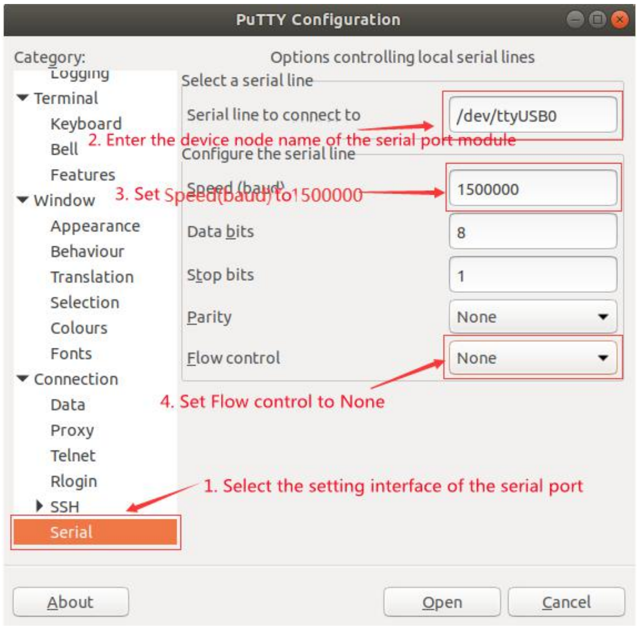
Flow control None

6) Then set the parameters of the serial port

a. Set Serial line to connect to to /dev/ttyUSB0 (modify to the corresponding node name, usually /dev/ttyUSB0)

b. Set Speed(baud) to 1500000 (the baud rate of the serial port)

c. Set Flow control to None



Options controlling local serial lines

Select a serial line

Serial line to connect to: /dev/ttyUSB0

Configure the serial line

Speed (baud): 1500000

Data bits: 8

Stop bits: 1

Parity: None

Flow control: None

1. Select the setting interface of the serial port

2. Enter the device node name of the serial port module

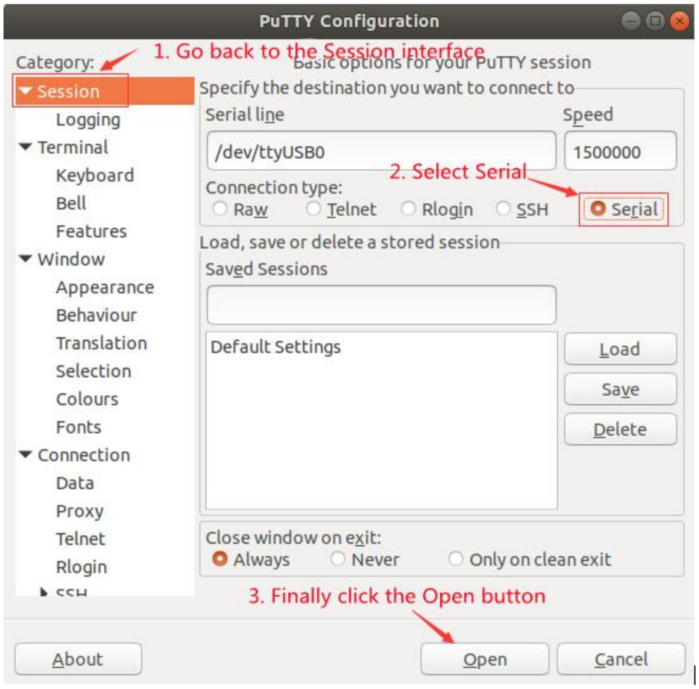
3. Set Speed(baud) to 1500000

4. Set Flow control to None

7) After setting the serial port setting interface, go back to the Session interface

a. First select the Connection type as Serial

b. Then click the Open button to connect the serial port



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

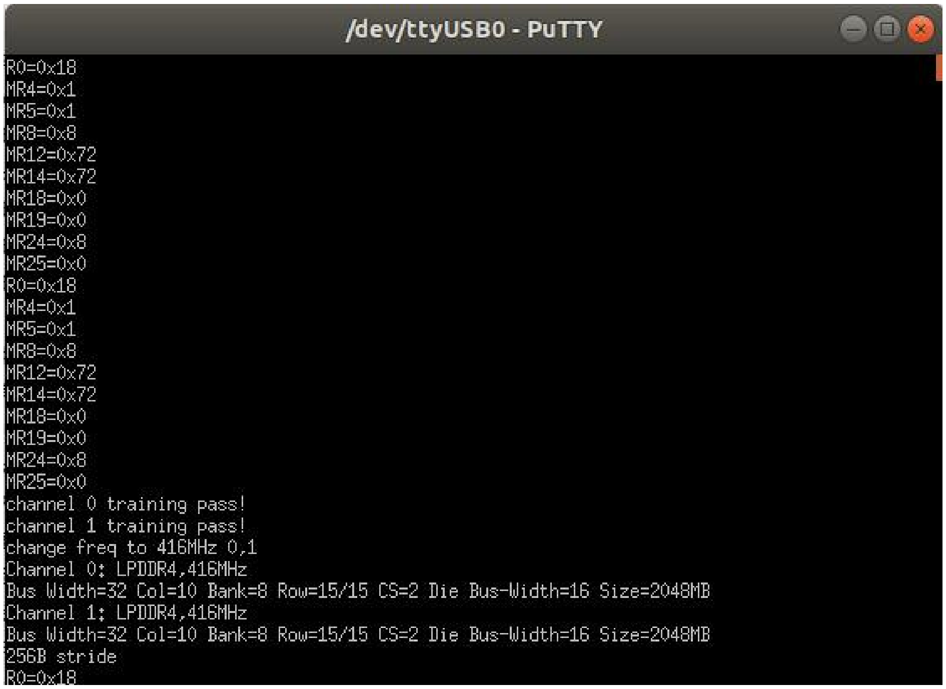
Close window on exit: ● Always ○ Never ○ Only on clean exit

1. Go back to the Session interface

2. Select Serial

3. Finally click the Open button

8) After starting the development board, you can see the Log information output by the system from the open serial terminal



```
R0=0x18
MR4=0x1
MR5=0x1
MR8=0x8
MR12=0x72
MR14=0x72
MR18=0x0
MR19=0x0
MR24=0x8
MR25=0x0
R0=0x18
MR4=0x1
MR5=0x1
MR8=0x8
MR12=0x72
MR14=0x72
MR18=0x0
MR19=0x0
MR24=0x8
MR25=0x0
channel 0 training pass!
channel 1 training pass!
change freq to 416MHz 0,1
Channel 0: LPDDR4,416MHz
Bus Width=32 Col=10 Bank=8 Row=15/15 CS=2 Die Bus-Width=16 Size=2048MB
Channel 1: LPDDR4,416MHz
Bus Width=32 Col=10 Bank=8 Row=15/15 CS=2 Die Bus-Width=16 Size=2048MB
256B stride
R0=0x18
```

2. 12. 3. How to use the debugging serial port on Windows platform

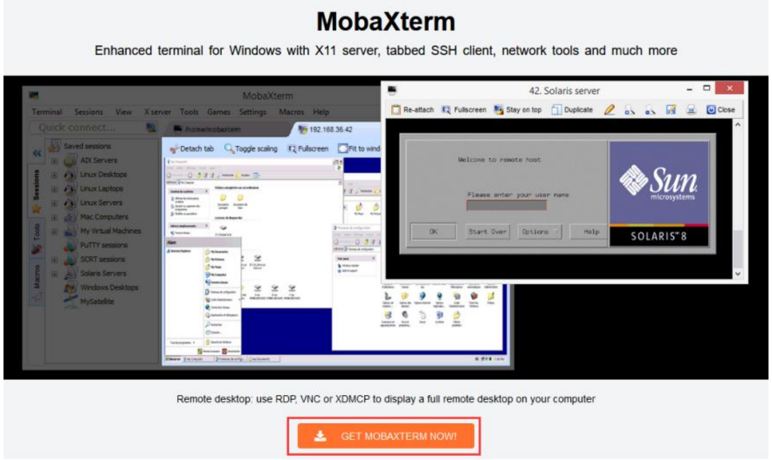
There are many serial port debugging software that can be used under Windows, such as SecureCRT, MobaXterm, etc. The following shows how to use MobaXterm. This software has a free version and can be used without purchasing a serial number.

1) Download MobaXterm

a. Download MobaXterm URL as follows

https://mobaxterm.mobatek.net/

b. After entering the MobaXterm download page, click GET XOBATERM NOW!



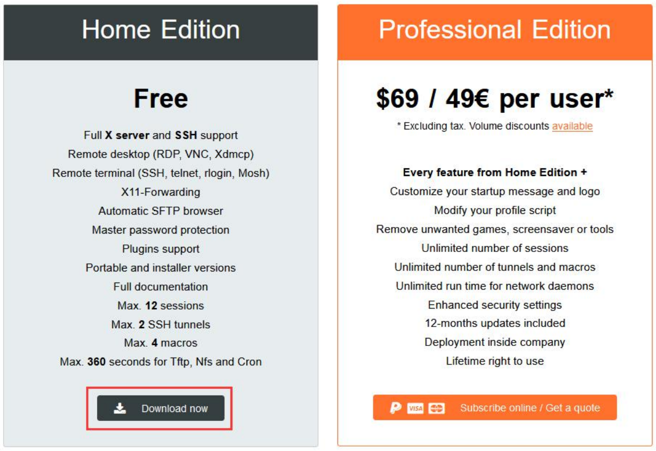
MobaXterm

Enhanced terminal for Windows with X11 server, tabbed SSH client, network tools and much more

Remote desktop: use RDP, VNC or XDMCP to display a full remote desktop on your computer

GET MOBAXTERM NOW!

c. Then choose to download the Home version



Home Edition

Free

Full **X server** and **SSH** support
Remote desktop (RDP, VNC, Xdmcp)
Remote terminal (SSH, telnet, rlogin, Mosh)
X11-Forwarding
Automatic SFTP browser
Master password protection
Plugins support
Portable and installer versions
Full documentation
Max. **12** sessions
Max. **2** SSH tunnels
Max. **4** macros
Max. **360** seconds for Tftp, Nfs and Cron

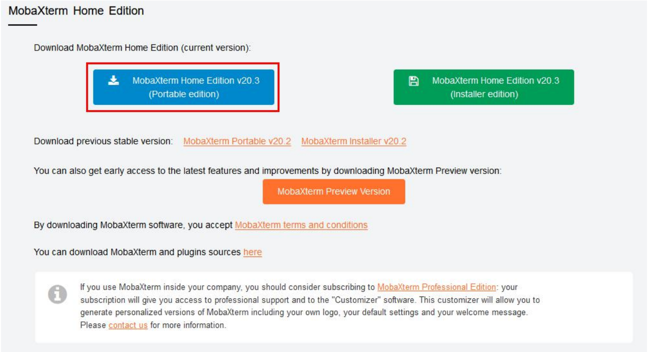
Professional Edition

$69 / 49€ per user*

* Excluding tax. Volume discounts available

Every feature from Home Edition +
Customize your startup message and logo
Modify your profile script
Remove unwanted games, screensaver or tools
Unlimited number of sessions
Unlimited number of tunnels and macros
Unlimited run time for network daemons
Enhanced security settings
12-months updates included
Deployment inside company
Lifetime right to use

d. Then select the Portable portable version. After downloading, there is no need to install it, just open it and use it



MobaXterm Home Edition

Download MobaXterm Home Edition (current version):

MobaXterm Home Edition v20.3 (Portable edition)
MobaXterm Home Edition v20.3 (Installer edition)

Download previous stable version: MobaXterm Portable v20.2 MobaXterm Installer v20.2

You can also get early access to the latest features and improvements by downloading MobaXterm Preview version:

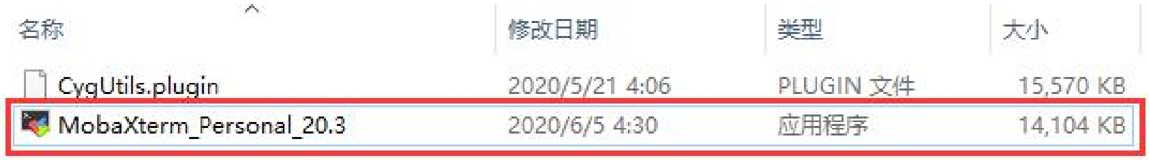
MobaXterm Preview Version

By downloading MobaXterm software, you accept MobaXterm terms and conditions

You can download MobaXterm and plugins sources here

If you use MobaXterm inside your company, you should consider subscribing to MobaXterm Professional Edition: your subscription will give you access to professional support and to the "Customizer" software. This customizer will allow you to generate personalized versions of MobaXterm including your own logo, your default settings and your welcome message. Please contact us for more information.

2) After downloading, use the decompression software to decompress the downloaded compressed package, you can get the executable software of MobaXterm, and then double-click to open it



名称	修改日期	类型	大小
CygUtils.plugin	2020/5/21 4:06	PLUGIN 文件	15,570 KB
MobaXterm_Personal_20.3	2020/6/5 4:30	应用程序	14,104 KB

3) After opening the software, the steps to set the serial port connection are as follows

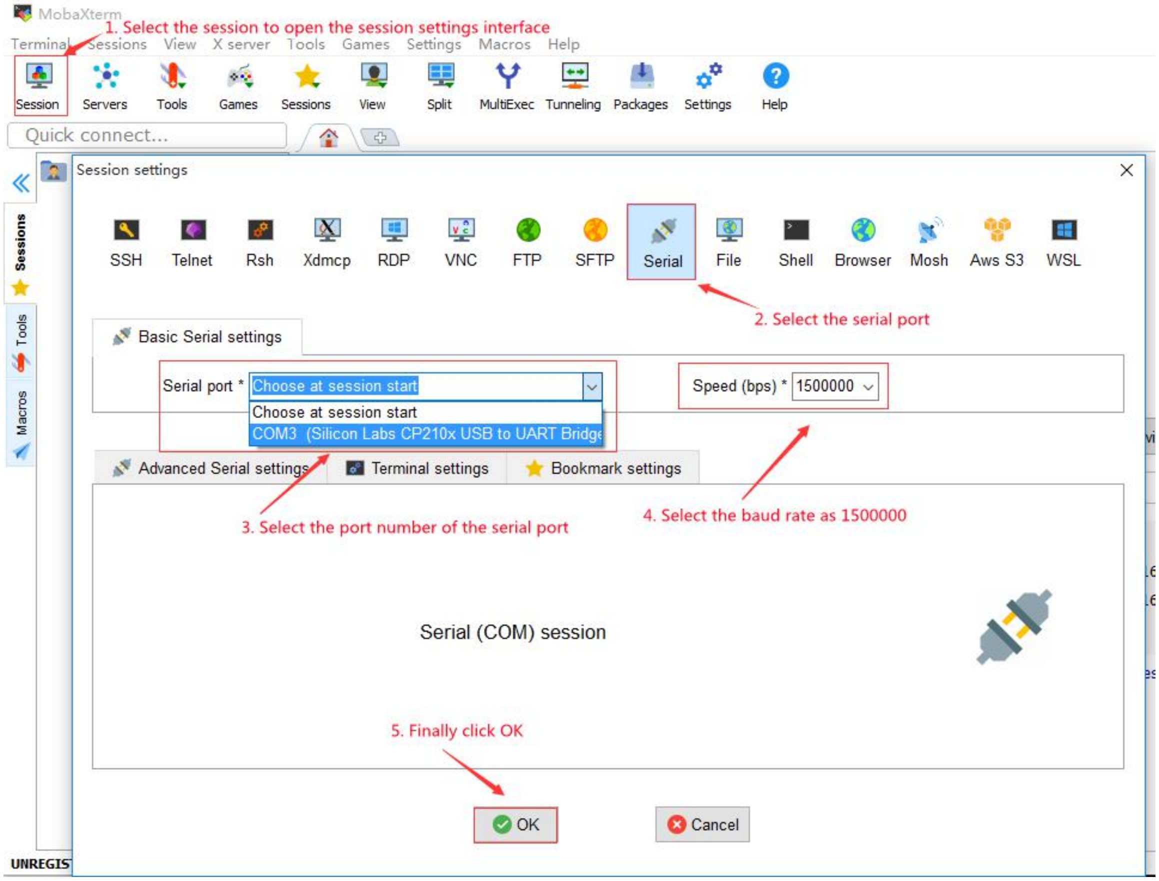
a. Open the session settings interface

b. Select serial port type

c. Select the port number of the serial port (select the corresponding port number according to the actual situation). If you cannot see the port number, please use the 360 driver master to scan and install the driver for the USB to TTL serial port chip.

d. Select the baud rate of the serial port to be 1500000

e. Finally, click the "OK" button to complete the setting



1. Select the session to open the session settings interface

2. Select the serial port

3. Select the port number of the serial port

4. Select the baud rate as 1500000

5. Finally click OK

Session settings

Basic Serial settings

Serial port * Choose at session start

Choose at session start

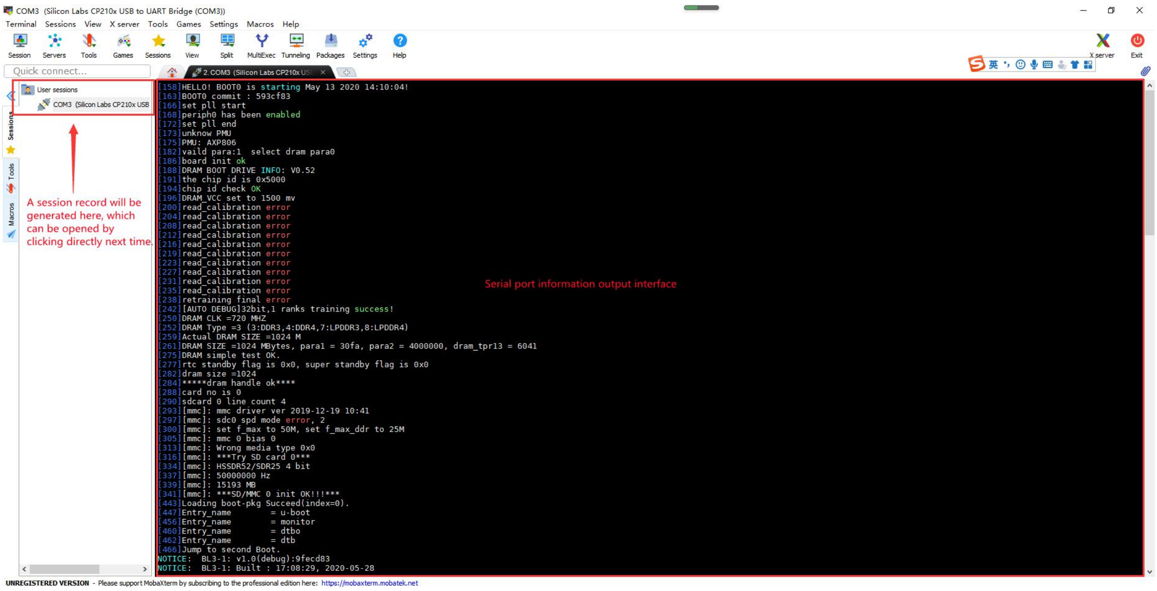
COM3 (Silicon Labs CP210x USB to UART Bridge

Speed (bps) * 1500000

Serial (COM) session

MobaXterm
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
SSH Telnet Rsh Xdmcp RDP VNC FTP SFTP Serial File Shell Browser Mosh Aws S3 WSL
Advanced Serial settings
Terminal settings
Bookmark settings
OK
Cancel
Sessions
Tools
Macros
UNREGIS

4) After clicking the "OK" button, it will enter the following interface. At this time, you can see the output information of the serial port when you start the development board.


COM3 (Silicon Labs CP210x USB to UART Bridge (COM3))
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
X server Exit
Quick connect...
2. COM3 (Silicon Labs CP210x USB
User sessions
COM3 (Silicon Labs CP210x USB
Sessions
Tools
Macros
A session record will be generated here, which can be opened by clicking directly next time.
Serial port information output interface
UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net

```
[158]HELLO! BOOT0 is starting May 13 2020 14:10:04!
[163]BOOT0 commit : 593cf83
[166]set pll start
[168]periph0 has been enabled
[172]set pll end
[173]unknow PMU
[175]PMU: AXP806
[182]vaild para:1  select dram para0
[186]board init ok
[188]DRAM BOOT DRIVE INFO: V0.52
[191]the chip id is 0x5000
[194]chip id check OK
[196]DRAM_VCC set to 1500 mv
[200]read_calibration error
[204]read_calibration error
[208]read_calibration error
[212]read_calibration error
[216]read_calibration error
[219]read_calibration error
[223]read_calibration error
[227]read_calibration error
[231]read_calibration error
[235]read_calibration error
[238]retraining final error
[242][AUTO DEBUG]32bit,1 ranks training success!
[250]DRAM CLK =720 MHZ
[252]DRAM Type =3 (3:DDR3,4:DDR4,7:LPDDR3,8:LPDDR4)
[259]Actual DRAM SIZE =1024 M
[261]DRAM SIZE =1024 MBytes, para1 = 30fa, para2 = 4000000, dram_tpr13 = 6041
[275]DRAM simple test OK.
[277]rtc standby flag is 0x0, super standby flag is 0x0
[282]dram size =1024
[284]*****dram handle ok****
[288]card no is 0
[290]sdcard 0 line count 4
[293][mmc]: mmc driver ver 2019-12-19 10:41
[297][mmc]: sdc0 spd mode error, 2
[300][mmc]: set f_max to 50M, set f_max_ddr to 25M
[305][mmc]: mmc 0 bias 0
[313][mmc]: Wrong media type 0x0
[316][mmc]: ***Try SD card 0***
[334][mmc]: HSSDR52/SDR25 4 bit
[337][mmc]: 50000000 Hz
[339][mmc]: 15193 MB
[341][mmc]: ***SD/MMC 0 init OK!!!***
[443]Loading boot-pkg Succeed(index=0).
[447]Entry_name        = u-boot
[456]Entry_name        = monitor
[460]Entry_name        = dtbo
[462]Entry_name        = dtb
[466]Jump to second Boot.
NOTICE:  BL3-1: v1.0(debug):9fecd83
NOTICE:  BL3-1: Built : 17:08:29, 2020-05-28
```

3. Instructions for use of Linux system

3. 1. Supported linux distribution types and kernel versions

Release type	Kernel version	Server version	Desktop version
Debian 10	Linux 4.4	support	support
Ubuntu 20.04	Linux5.10	support	support
Debian 11	Linux5.10	support	support

3. 2. Linux kernel driver adaptation

Function	Linux4.4	Linux5.10
USB2.0x2	OK	OK
USB3.0x1	OK	OK
USB Type-C 3.0	OK	NO
Type-C（Power supply）	OK	OK
MiniPCIE	OK	OK
gpio（26pin）	OK	OK
spi/uart4（26pin）	OK	OK
i2c8（26pin）	OK	OK
i2c3（26pin）	OK	OK
pwm（26pin）	OK	OK
Debug serial port	OK	OK
EMMC	OK	OK
TF card boot	OK	OK
HDMI video	OK	OK
HDMI audio	OK	OK
MIPI camera1	OK	NO
MIPI Camera2/Lcd2	OK	NO
Lcd1	OK	OK
Gigabit Ethernet port YT8531C	OK	OK
Network port status light	OK	OK
MIC	OK	OK

Headphone playback	OK	OK
Headphone recording	OK	OK
WIFI	OK	OK
Bluetooth	OK	OK
LED lights	OK	OK
Type-C to HDMI display	OK	OK
GPU	OK	OK
Hardware codec	OK	OK
Reset button	OK	OK
webGL hardware acceleration	OK	OK
Dual camera display at the same time	OK	NO
MIPI screen dual screen	OK	OK
simultaneous display	OK	OK
watchdog test	OK	OK

3. 3. Onboard LED light display description

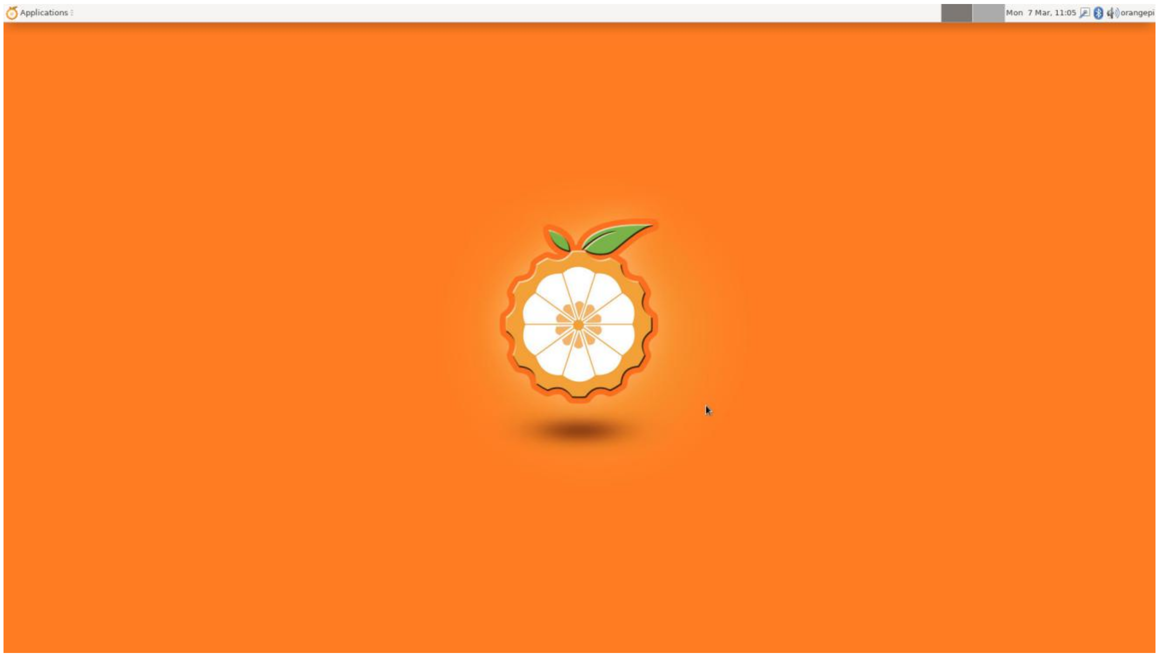
	green light	red light
u-boot startup phase	off	on
The kernel boots into the system	flashing	bright

3. 4. Linux system default login account and password

Account	Password
root	orangepi
orangepi	orangepi

3. 5. Instructions for automatic login of Linux desktop system

1) The desktop version of the system will automatically log in to the desktop after starting by default, no need to enter a password



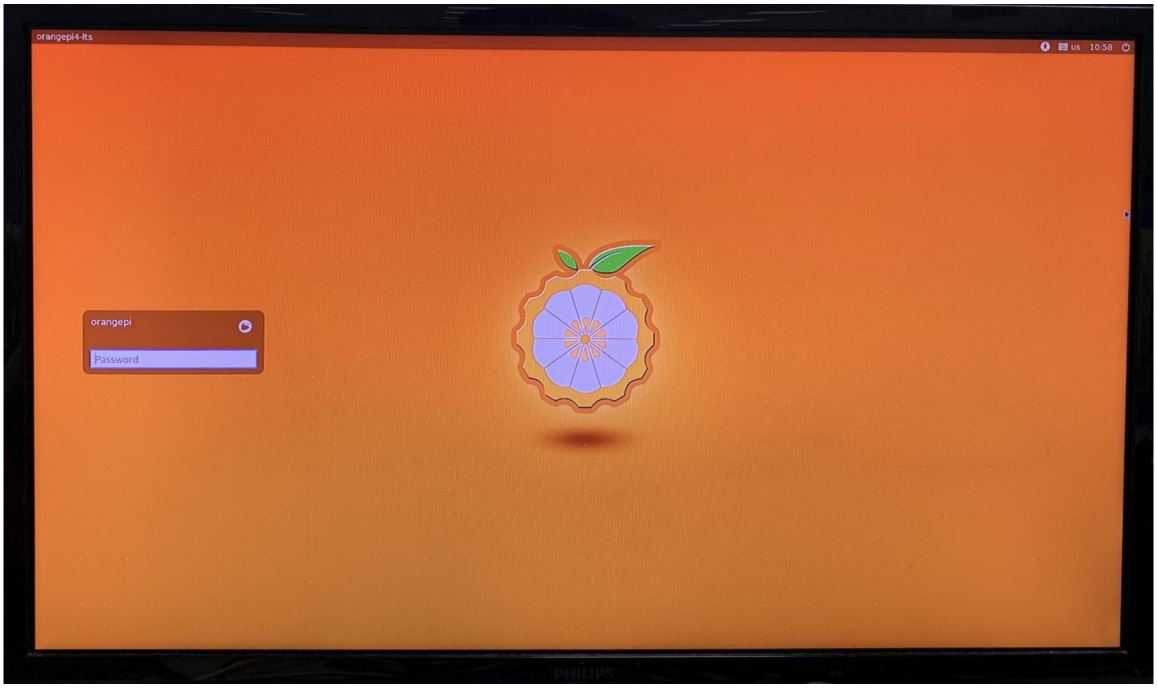
2) Modify the configuration in /etc/lightdm/lightdm.conf.d/22-orangepi-autologin.conf to prohibit the desktop version system from automatically logging in to the desktop. The modification command is as follows, or you can open the configuration file and modify it directly

```
root@orangepi4-lts:~# sed -i "s/autologin-user=orangepi/#autologin-user=orangepi/" /etc/lightdm/lightdm.conf.d/22-orangepi-autologin.conf
```

3) After modification, the configuration of /etc/lightdm/lightdm.conf.d/22-orangepi-autologin.conf is as follows

```
root@orangepi4-lts:~# cat /etc/lightdm/lightdm.conf.d/22-orangepi-autologin.conf
[Seat:*]
#autologin-user=orangepi
autologin-user-timeout=0
user-session=xfce
```

4) Then restart the system, the login dialog box will appear, at this time, you need to enter the password to enter the system



3. 6. Start the rootfs in the auto-expanding TF card for the first time

1) When the TF card starts the Linux system for the first time, it will call the orangepi-resize-filesystem script through the systemd service orangepi-resize-filesystem.service to automatically expand the rootfs, so there is no need to manually expand the capacity.

2) After logging in to the system, you can use the df -h command to check the size of the rootfs. If it is consistent with the actual capacity of the TF card, it means that the automatic expansion is running correctly.

```
root@orangepi4-lts:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            1.9G     0  1.9G   0% /dev
tmpfs           382M  5.6M  376M   2% /run
/dev/mmcblk0p1   15G  2.5G   12G  18% /
tmpfs           1.9G  140K  1.9G   1% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           1.9G     0  1.9G   0% /sys/fs/cgroup
tmpfs            1.9G   12K  1.9G   1% /tmp
/dev/zram0        49M  3.3M   42M   8% /var/log
cgmfs            100K     0  100K   0% /run/cgmanager/fs
tmpfs            382M  8.0K  382M   1% /run/user/1000
tmpfs            382M     0  382M   0% /run/user/0
```

3) It should be noted that the Linux system has only one partition in ext4 format, and a separate BOOT partition is not used to store files such as kernel images, so there is no problem of BOOT partition expansion.

4) In addition, if you do not need to automatically expand rootfs, you can use the following method to prohibit

a. First burn the linux image to the TF card

b. Then insert the TF card into the Ubuntu PC (Windows does not work), the Ubuntu PC will generally automatically mount the partition of the TF card. If the automatic mounting is normal, you can use the ls command to see the following output. The partition name of the TF card is shown in the following command. The name is not necessarily the same, please modify it according to the actual situation

```
test@test:~$ ls /media/test/27e62f92-8250-4ef1-83db-3d8f0c2e23db/
bin  boot  dev  etc  home  lib  lost+found  media  mnt  opt  proc  root  run
sbin  selinux  srv  sys  tmp  usr  var
```

c. Then switch the current user to the root user in the Ubuntu PC

```
test@test:~$ sudo -i
[sudo] test 的密码：
root@test:~#
```

d. Then enter the root directory of the Linux system in the TF card and create a new file named .no_rootfs_resize

```
root@test:~# cd /media/test/27e62f92-8250-4ef1-83db-3d8f0c2e23db
root@test:/media/test/27e62f92-8250-4ef1-83db-3d8f0c2e23db# cd root
root@test:/media/test/27e62f92-8250-4ef1-83db-3d8f0c2e23db/root# touch .no_rootfs_resize
root@test:/media/test/27e62f92-8250-4ef1-83db-3d8f0c2e23db/root# ls .no_rootfs*
.no_rootfs_resize
```

e. Then you can uninstall the TF card, then pull out the TF card and insert it into the development board to start. When the linux system starts, when it is detected that there is a .no_rootfs_resize file in the /root directory, the rootfs will no longer be automatically expanded.

f. After prohibiting the automatic expansion of rootfs, you can see that the available capacity of the TF card is only about 200M

```
root@orangepi4-lts:~# df -h
Filesystem          Size   Used Avail Use% Mounted on
udev                 1.9G      0  1.9G    0% /dev
tmpfs                382M   5.6M  376M    2% /run
/dev/mmcblk0p1       2.9G   2.3G  487M   83% /
tmpfs                1.9G   140K  1.9G    1% /dev/shm
tmpfs                5.0M   4.0K  5.0M    1% /run/lock
tmpfs                1.9G      0  1.9G    0% /sys/fs/cgroup
tmpfs                1.9G    12K  1.9G    1% /tmp
/dev/zram0            49M   2.6M   43M    6% /var/log
cgmfs                100K      0  100K    0% /run/cgmanager/fs
tmpfs                382M      0  382M    0% /run/user/0
tmpfs                382M    12K  382M    1% /run/user/1000
```

3. 7. How to modify the linux log level (loglevel)

1) The loglevel of the linux system is set to 1 by default. When using the serial port to view the startup information, the kernel output log is as follows, basically all shielded

```
Starting kernel ...

Uncompressing Linux... done, booting the kernel.

Orange Pi 2.2.0 Bionic ttyFIQ0

orangepi login:
```

2) When there is a problem with the startup of the Linux system, you can use the following method to modify the value of loglevel, so as to print more log information to the serial port display, which is convenient for debugging. If the Linux system fails to start and cannot enter the system, you can insert the TF card into the Ubuntu PC through the card reader, and then directly modify the configuration of the Linux system in the TF

card after mounting the TF card in the Ubuntu PC. Insert the TF card into the development board to start

```
root@orangepi4-lts:~# sed -i "s/verbosity=1/verbosity=7/" /boot/orangepiEnv.txt
root@orangepi4-lts:~# sed -i "s/console=both/console=serial/" /boot/orangepiEnv.txt
```

3) The above commands actually set the variables in /boot/orangepiEnv.txt. After setting, you can open /boot/orangepiEnv.txt to check.

```
root@orangepi4-lts:~# cat /boot/orangepiEnv.txt
verbosity=7
console=serial
```

4) Then restart the development board, the output information of the kernel will be printed to the serial port output

3. 8. Ethernet port test

1) First, insert the network cable into the Ethernet interface of the development board, and ensure that the network is unblocked

2) After the system starts, it will automatically assign an IP address to the Ethernet card through DHCP

3) The command to view the IP address is as follows

```
root@orangepi4-lts:~# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.122  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::4443:cee2:9b38:ff21  prefixlen 64  scopeid 0x20<link>
        ether 0a:b4:bd:10:02:90  txqueuelen 1000  (Ethernet)
        RX packets 14616  bytes 14141207 (14.1 MB)
        RX errors 0  dropped 1  overruns 0  frame 0
        TX packets 6845  bytes 725742 (725.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 24
```

There are three ways to check the IP address after the development board is

started:

1. Connect the HDMI display, then log in to the system and use the ifconfig command to check the IP address

2. Enter the ifconfig command in the debug serial terminal to view the IP address

3. If there is no debugging serial port and no HDMI display, you can also view the IP address of the network port of the development board through the management interface of the router. However, this method often fails to see the IP address of the development board. If you can't see it, the debug method looks like this:

A) First check whether the Linux system has been started normally. If the green light of the development board is flashing, it is generally started normally. If only the red light is on, it means that the system has not started normally.

B) Check whether the network cable is plugged in tightly, or try another network cable

C) Try another router (I have encountered many problems with the router, such as the router cannot assign an IP address normally, or the IP address has been assigned normally but cannot be seen in the router)

D) If there is no router to replace, you can only connect the HDMI display or use the debug serial port to view the IP address

In addition, it should be noted that the development board DHCP automatically assigns an IP address without any settings.

4) The command to test network connectivity is as follows

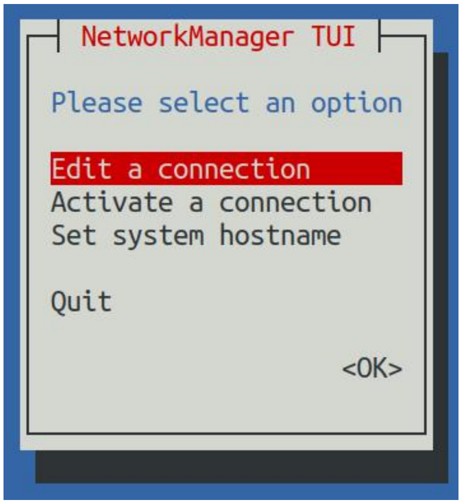
```
root@orangepi4-lts:~# ping www.baidu.com -I eth0
PING www.a.shifen.com (14.215.177.39) from 192.168.1.122 eth0: 56(84) bytes of data.
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=1 ttl=56 time=8.56 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=2 ttl=56 time=7.66 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=3 ttl=56 time=9.28 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=4 ttl=56 time=8.29 ms
^C
--- www.a.shifen.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 7.666/8.454/9.286/0.584 ms
```

3. 9. How to set a static IP address

1) First run the mutui command

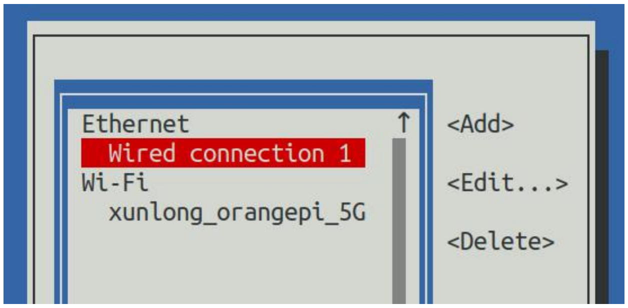
```
root@orangepi:~# nmtui
```

2) Then select Edit a connection and press enter



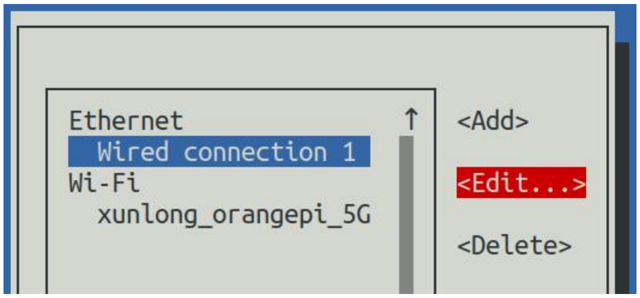
```
NetworkManager TUI

Please select an option

Edit a connection
Activate a connection
Set system hostname

Quit

                    <OK>
```

3) Then select the network interface that needs to set a static IP address, such as setting the static IP address of the Ethernet interface and select Wired connection 1.



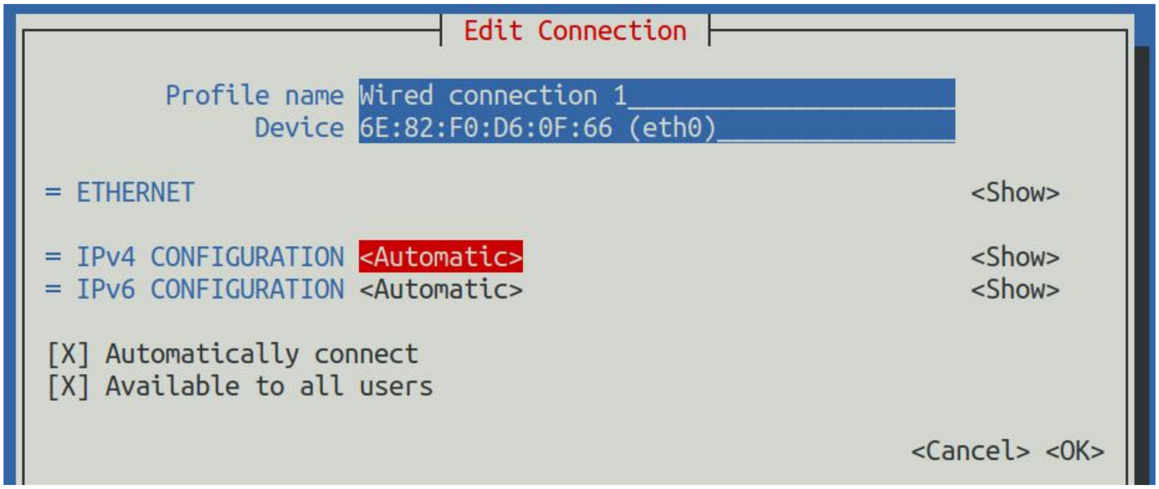
```
Ethernet                    ↑  <Add>
  Wired connection 1
Wi-Fi                          <Edit...>
  xunlong_orangepi_5G
                               <Delete>
```

4) Then select Edit by Tab key and press Enter



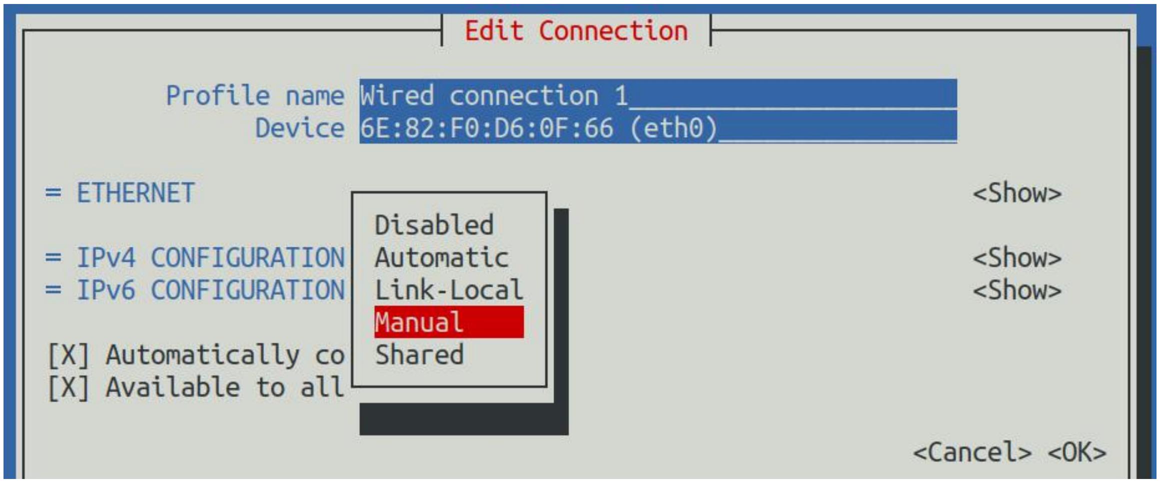
```
Ethernet                     ↑   <Add>
  Wired connection 1
Wi-Fi                            <Edit...>
  xunlong_orangepi_5G
                                 <Delete>
```

5) Then use the Tab key to move the cursor to the <Automatic> position shown in the figure below to configure IPv4



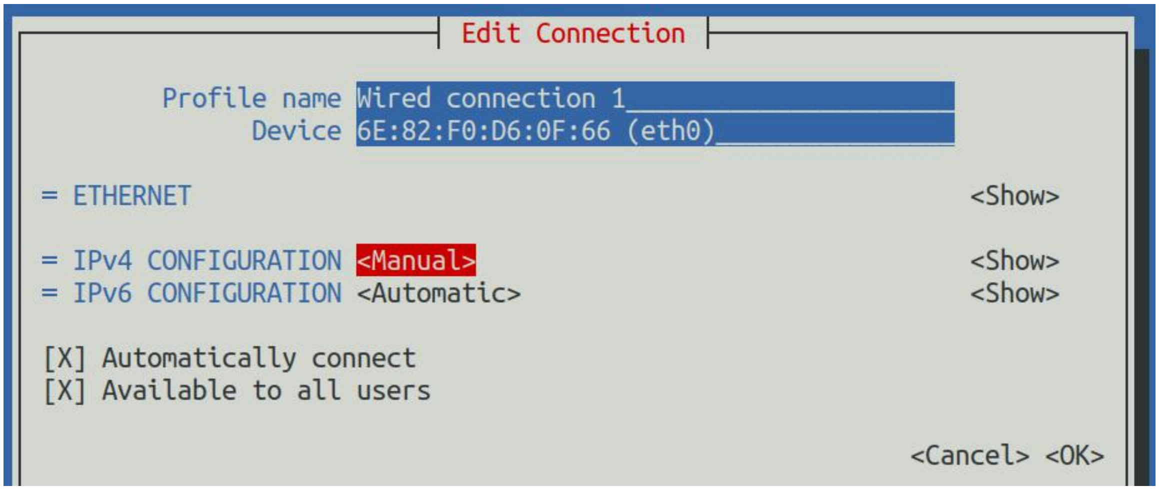
```
                        Edit Connection

        Profile name Wired connection 1_______________
              Device 6E:82:F0:D6:0F:66 (eth0)_________

 = ETHERNET                                              <Show>

 = IPv4 CONFIGURATION <Automatic>                        <Show>
 = IPv6 CONFIGURATION <Automatic>                        <Show>

 [X] Automatically connect
 [X] Available to all users

                                                    <Cancel> <OK>
```

6) Then press Enter, use the up and down arrow keys to select Manual, then press Enter to confirm



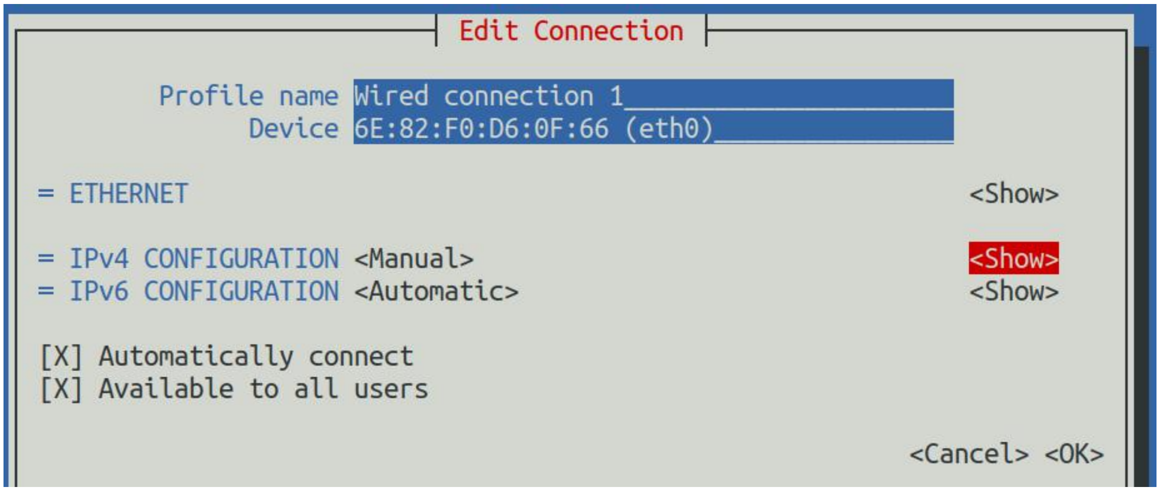
```
                        Edit Connection

        Profile name Wired connection 1_______________
              Device 6E:82:F0:D6:0F:66 (eth0)_________

 = ETHERNET                                              <Show>
                       Disabled
 = IPv4 CONFIGURATION  Automatic                         <Show>
 = IPv6 CONFIGURATION  Link-Local                        <Show>
                       Manual
 [X] Automatically co  Shared
 [X] Available to all

                                                    <Cancel> <OK>
```

7) The display after selection is as shown below



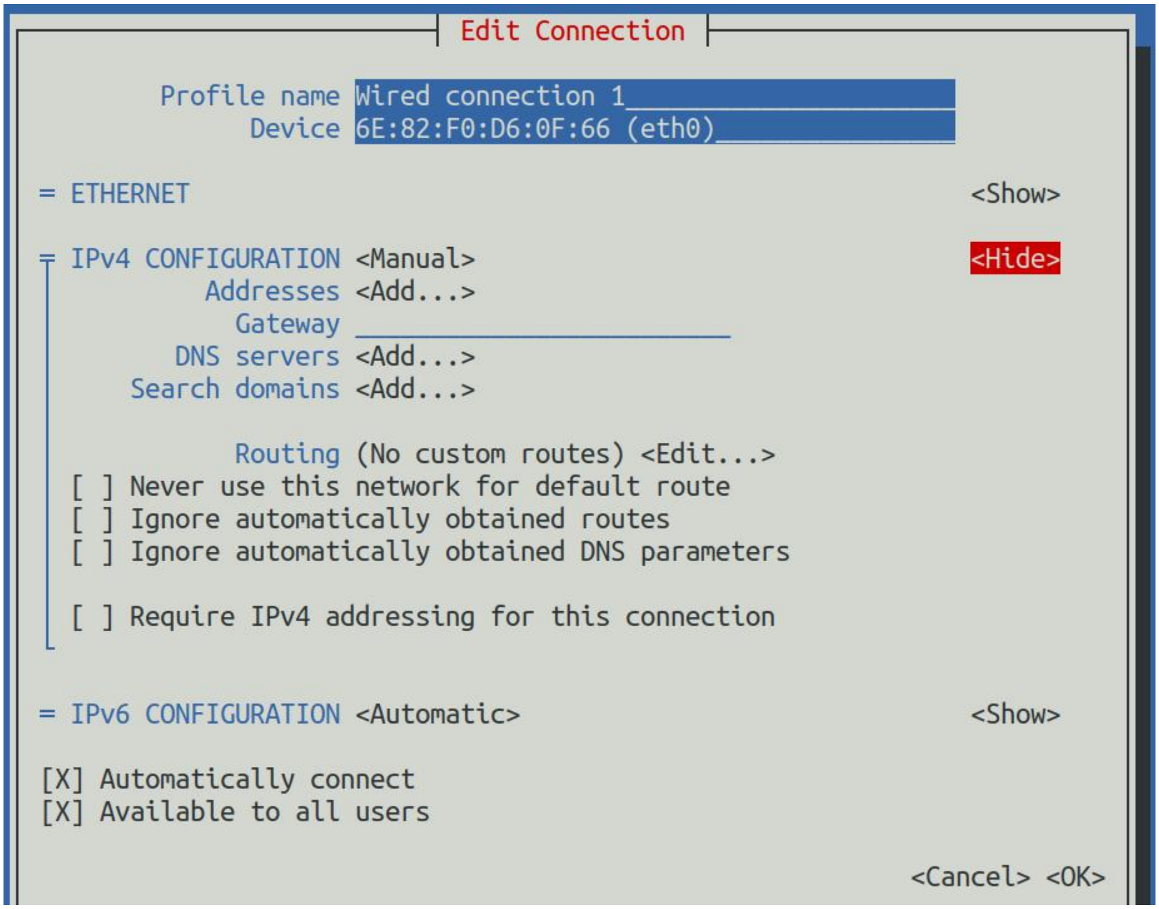
```
                    ┤ Edit Connection ├

        Profile name Wired connection 1________________
              Device 6E:82:F0:D6:0F:66 (eth0)__________

 = ETHERNET                                          <Show>

 = IPv4 CONFIGURATION <Manual>                       <Show>
 = IPv6 CONFIGURATION <Automatic>                    <Show>

 [X] Automatically connect
 [X] Available to all users

                                              <Cancel> <OK>
```

8) Then move the cursor to <Show> by Tab key



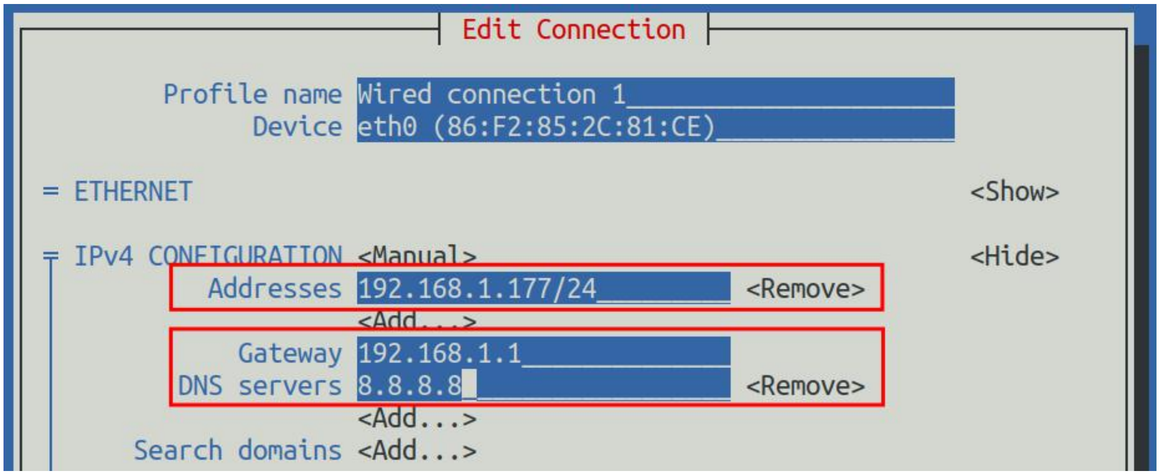
```
                    ┤ Edit Connection ├

        Profile name Wired connection 1________________
              Device 6E:82:F0:D6:0F:66 (eth0)__________

 = ETHERNET                                          <Show>

 = IPv4 CONFIGURATION <Manual>                       <Show>
 = IPv6 CONFIGURATION <Automatic>                    <Show>

 [X] Automatically connect
 [X] Available to all users

                                              <Cancel> <OK>
```

9) Then press Enter, the following setting interface will pop up after pressing Enter



```
                           Edit Connection

        Profile name Wired connection 1________________________
              Device 6E:82:F0:D6:0F:66 (eth0)__________________

= ETHERNET                                                  <Show>

╤ IPv4 CONFIGURATION <Manual>                               <Hide>
│          Addresses <Add...>
│            Gateway _________________________
│        DNS servers <Add...>
│     Search domains <Add...>
│
│            Routing (No custom routes) <Edit...>
│ [ ] Never use this network for default route
│ [ ] Ignore automatically obtained routes
│ [ ] Ignore automatically obtained DNS parameters
│
│ [ ] Require IPv4 addressing for this connection
└

= IPv6 CONFIGURATION <Automatic>                            <Show>

[X] Automatically connect
[X] Available to all users

                                                      <Cancel> <OK>
```

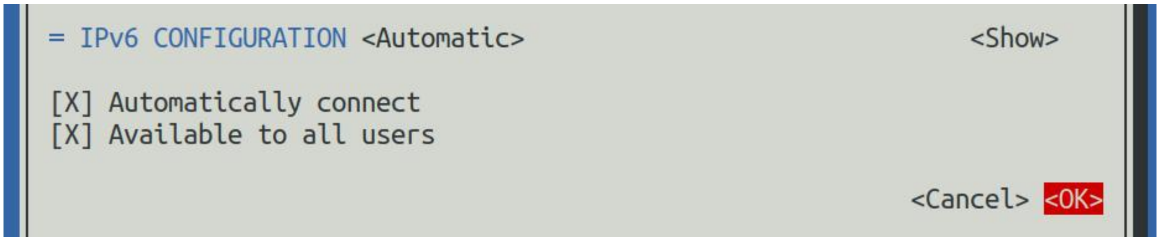
10) Then you can set the IP address (Addresses), gateway (Gateway) and DNS server address in the location shown in the figure below (there are many other setting options, please explore by yourself), please set according to your specific needs, The value set in the image below is just an example



```
                           Edit Connection

        Profile name Wired connection 1________________________
              Device eth0 (86:F2:85:2C:81:CE)__________________

= ETHERNET                                                  <Show>

╤ IPv4 CONFIGURATION <Manual>                               <Hide>
│          Addresses 192.168.1.177/24__________ <Remove>
│                    <Add...>
│            Gateway 192.168.1.1_______________
│        DNS servers 8.8.8.8___________________ <Remove>
│                    <Add...>
│     Search domains <Add...>
```

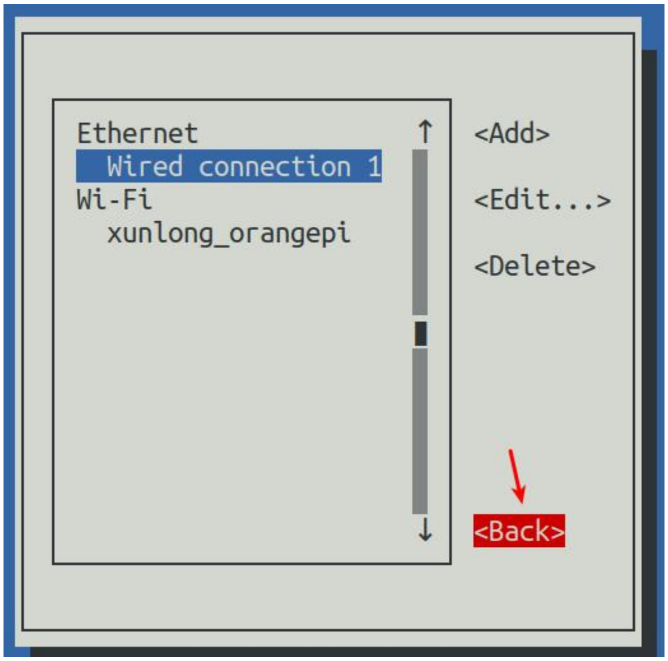
11) After setting, move the cursor to <OK> in the lower right corner, then press Enter to

confirm



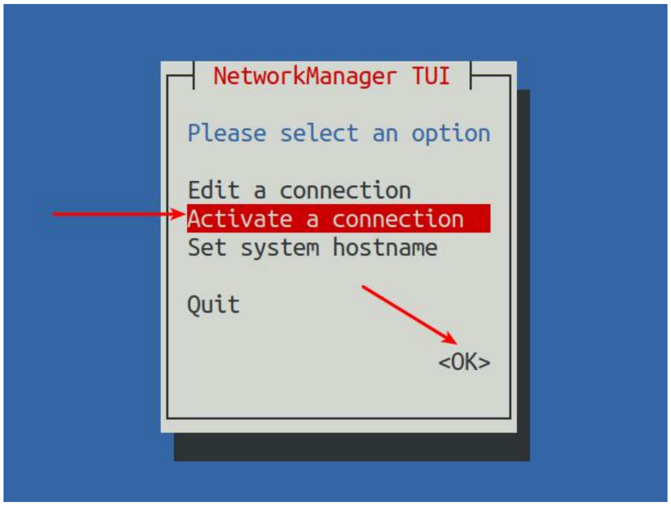
```
= IPv6 CONFIGURATION <Automatic>                          <Show>

[X] Automatically connect
[X] Available to all users

                                                  <Cancel> <OK>
```

12) Then click <Back> to return to the previous selection interface



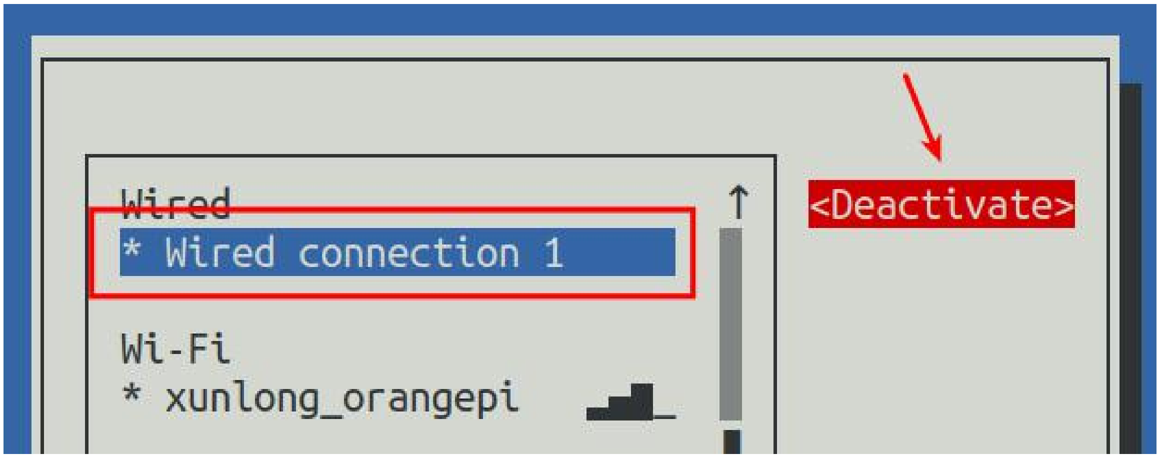
```
Ethernet                    ↑   <Add>
  Wired connection 1
Wi-Fi                           <Edit...>
  xunlong_orangepi
                                <Delete>



                            ↓   <Back>
```

13) Then select Activate a connection, move the cursor to <OK>, and finally click Enter



```
┤ NetworkManager TUI ├

Please select an option

Edit a connection
Activate a connection
Set system hostname

Quit

                  <OK>
```

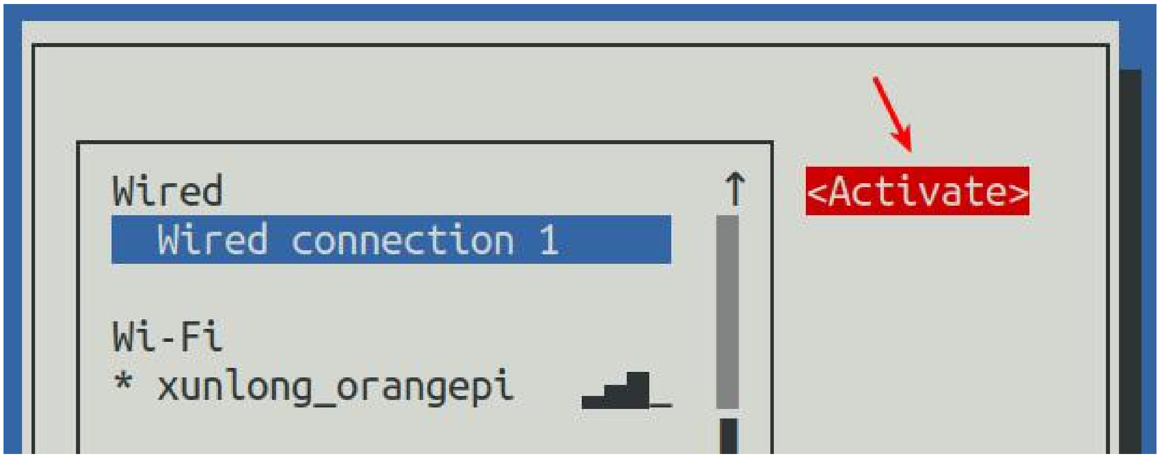
14) Then select the network interface to be set, such as Wired connection 1, then move the cursor to <Deactivate>, and press Enter to disable Wired connection 1



Wired
* Wired connection 1

Wi-Fi
* xunlong_orangepi

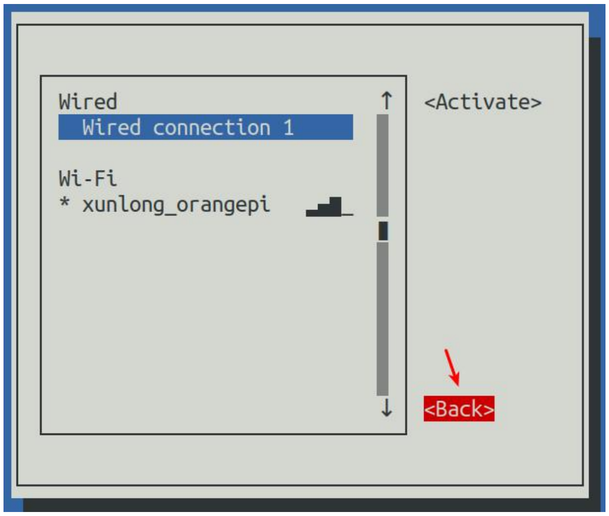
15) Then please do not move the cursor, and then press the Enter key to re-enable Wired connection 1, so that the static IP address set earlier will take effect

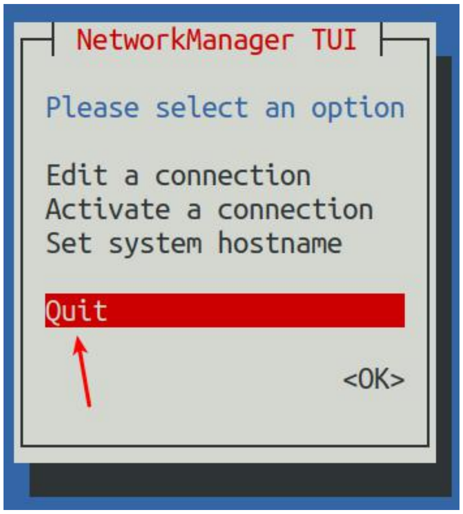


Wired
Wired connection 1

Wi-Fi
* xunlong_orangepi

16) Then exit nmtui through the <Back> and Quit buttons





17) Then through ifconfig, you can see that the IP address of the network port has become the static IP address set earlier

```
root@orangepi:~# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>   mtu 1500
        inet 192.168.1.177   netmask 255.255.255.0   broadcast 192.168.1.255
        inet6 fe80::69f6:23d3:a3f3:9772   prefixlen 64   scopeid 0x20<link>
        ether 86:f2:85:2c:81:ce   txqueuelen 1000   (Ethernet)
        RX packets 47817   bytes 4047732 (4.0 MB)
        RX errors 0   dropped 1563   overruns 0   frame 0
        TX packets 1815   bytes 295954 (295.9 KB)
        TX errors 0   dropped 0 overruns 0   carrier 0   collisions 0
        device interrupt 64
```

18) Then you can test the connectivity of the network to check whether the IP address is configured OK

```
root@orangepi:~# ping 192.168.1.47 -I eth0
PING 192.168.1.47 (192.168.1.47) from 192.168.1.188 eth0: 56(84) bytes of data.
64 bytes from 192.168.1.47: icmp_seq=1 ttl=64 time=0.233 ms
64 bytes from 192.168.1.47: icmp_seq=2 ttl=64 time=0.263 ms
64 bytes from 192.168.1.47: icmp_seq=3 ttl=64 time=0.273 ms
64 bytes from 192.168.1.47: icmp_seq=4 ttl=64 time=0.269 ms
64 bytes from 192.168.1.47: icmp_seq=5 ttl=64 time=0.275 ms
^C
--- 192.168.1.47 ping statistics ---
```

```
5 packets transmitted, 5 received, 0% packet loss, time 4042ms
rtt min/avg/max/mdev = 0.233/0.262/0.275/0.015 ms
```

3. 10. SSH remote login development board

By default, Linux systems enable ssh remote login and allow root users to log in to the system. Before ssh login, you need to ensure that the Ethernet or wifi network is connected, and then use the ifconfig command or obtain the IP address of the development board by viewing the router

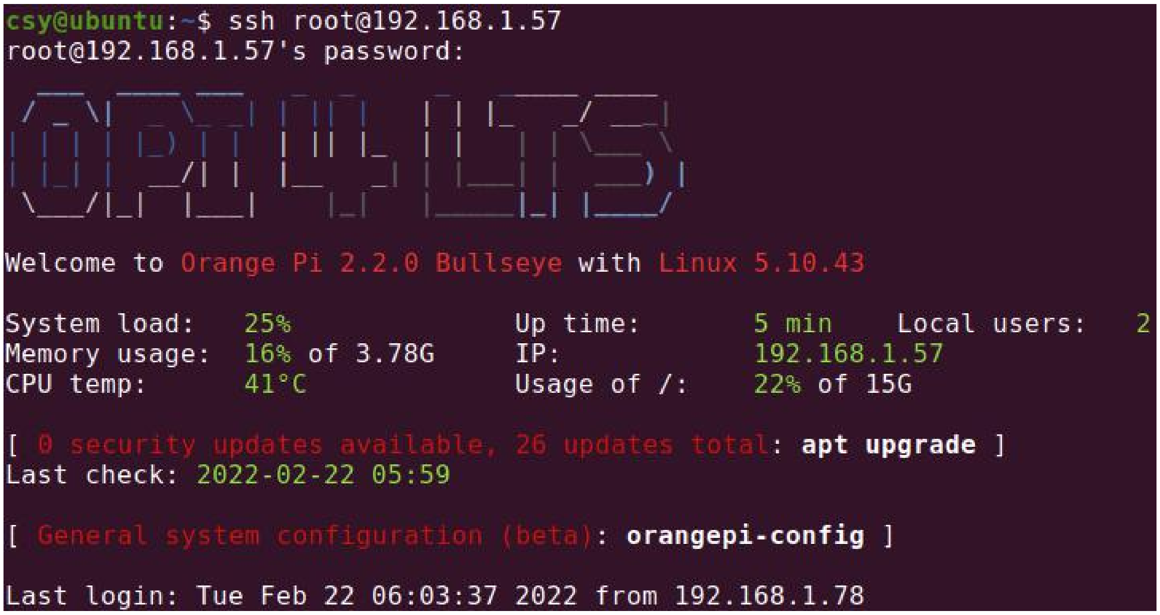
3. 10. 1. SSH remote login development board under Ubuntu

1) Obtain the IP address of the development board

2) Then you can log in to the Linux system remotely through the ssh command

```
test@test:~$ ssh root@192.168.1.57    (It needs to be replaced with the IP address of the development board)
root@192.168.1.57's password:        （Enter the password here, the default password is orangepi）
```

3) After successfully logging in to the system, the display is as shown below



```
csy@ubuntu:~$ ssh root@192.168.1.57
root@192.168.1.57's password:
  ___  ____ ___ _  _     _   _____ ____
 / _ \|  _ \_ _| || |   | | |_   _/ ___|
| | | | |_) | || || |_  | |   | | \___ \
| |_| |  __/| ||__   _| | |___| |  ___) |
 \___/|_|  |___|  |_|   |_____|_| |____/

Welcome to Orange Pi 2.2.0 Bullseye with Linux 5.10.43

System load:   25%              Up time:       5 min    Local users:   2
Memory usage:  16% of 3.78G     IP:            192.168.1.57
CPU temp:      41°C             Usage of /:    22% of 15G

[ 0 security updates available, 26 updates total: apt upgrade ]
Last check: 2022-02-22 05:59

[ General system configuration (beta): orangepi-config ]

Last login: Tue Feb 22 06:03:37 2022 from 192.168.1.78
```

If ssh cannot log in to the Linux system normally, you can enter the following

command on the development board and then try to connect:

```
root@orangepi:~# rm /etc/ssh/ssh_host_*
root@orangepi:~# dpkg-reconfigure openssh-server
```

3. 10. 2. SSH remote login development board under Windows

1) First get the IP address of the development board

2) Under Windows, you can use MobaXterm to remotely log in to the development board, first create a new ssh session

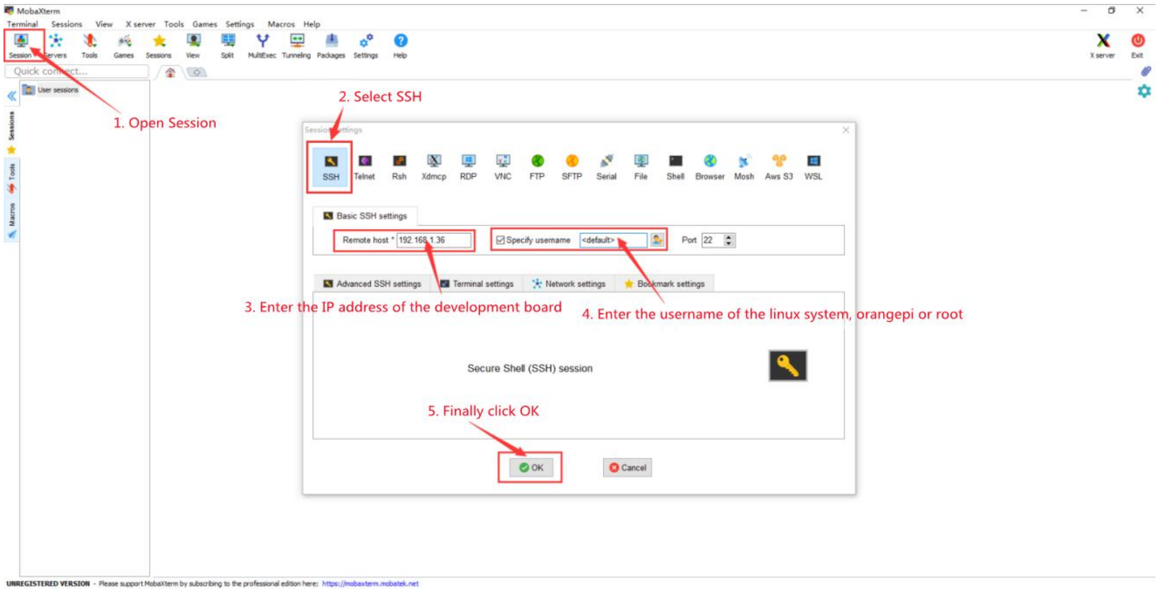
a. Open Session

b. Then select SSH in Session Setting

c. Then enter the IP address of the development board in Remote host

d. Then enter the username root or orangepi of the linux system in Specify username

e. Finally click OK



1. Open Session

2. Select SSH

Remote host * 192.168.1.36

☑ Specify username <default>

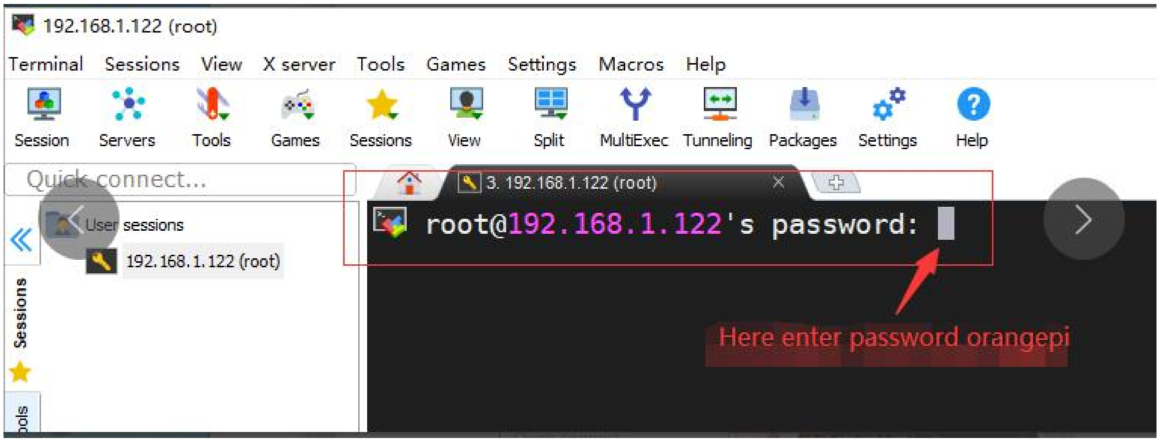
Port 22

3. Enter the IP address of the development board

4. Enter the username of the linux system, orangepi or root

5. Finally click OK

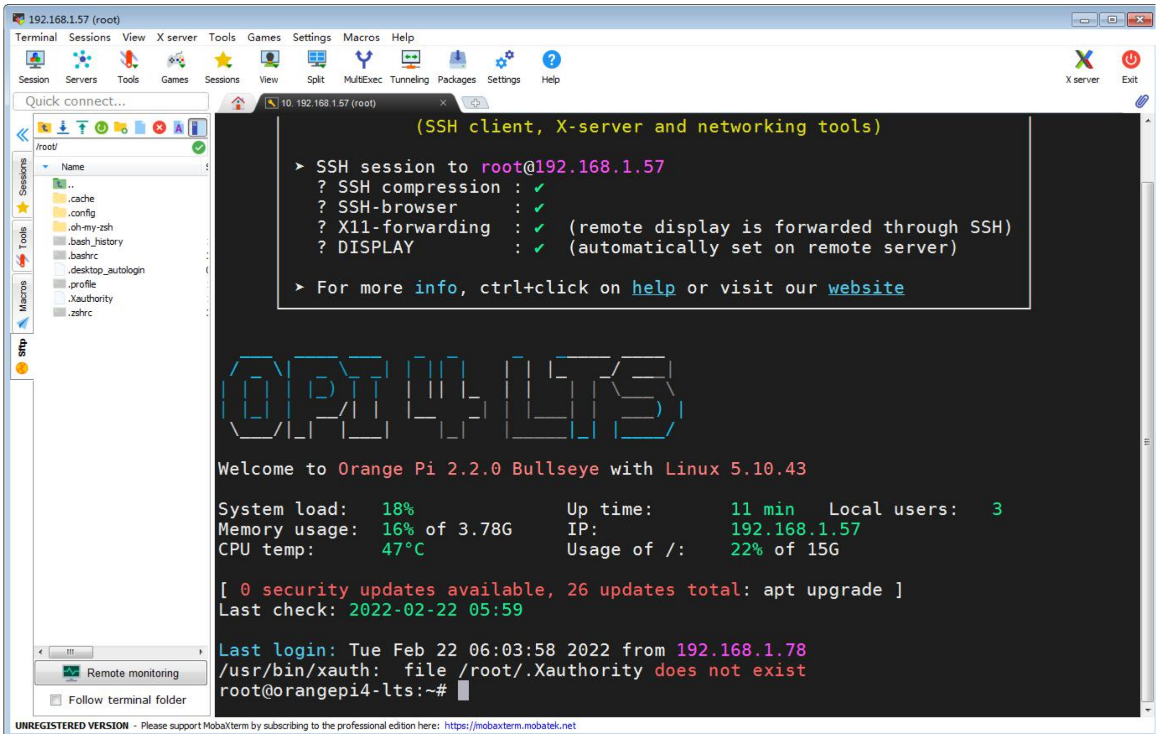
3) Then you will be prompted to enter a password. The default passwords for both root and orangepi users are orangepi


192.168.1.122 (root)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
User sessions
192.168.1.122 (root)
3. 192.168.1.122 (root)
Sessions
Tools

```
root@192.168.1.122's password:
```

Here enter password orangepi

4) After successfully logging in to the system, the display is as shown below


192.168.1.57 (root)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help X server Exit
Quick connect...
10. 192.168.1.57 (root)
/root/
Name
..
.cache
.config
.oh-my-zsh
.bash_history
.bashrc
.desktop_autologin
.profile
.Xauthority
.zshrc
Remote monitoring
Follow terminal folder
Sessions
Tools
Macros
Sftp
UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net

```
                 (SSH client, X-server and networking tools)

      ➤ SSH session to root@192.168.1.57
        ? SSH compression : ✔
        ? SSH-browser     : ✔
        ? X11-forwarding  : ✔  (remote display is forwarded through SSH)
        ? DISPLAY         : ✔  (automatically set on remote server)

      ➤ For more info, ctrl+click on help or visit our website

Welcome to Orange Pi 2.2.0 Bullseye with Linux 5.10.43

System load:   18%               Up time:       11 min   Local users:   3
Memory usage:  16% of 3.78G      IP:            192.168.1.57
CPU temp:      47°C              Usage of /:    22% of 15G

[ 0 security updates available, 26 updates total: apt upgrade ]
Last check: 2022-02-22 05:59

Last login: Tue Feb 22 06:03:58 2022 from 192.168.1.78
/usr/bin/xauth:  file /root/.Xauthority does not exist
root@orangepi4-lts:~#
```

3. 11. HDMI display test

1) Use HDMI to HDMI cable to connect Orange Pi development board and HDMI display

2) After starting the linux system, if the HDMI display has image output, it means that the HDMI interface is working normally

3. 12. Type C to HDMI display test

1) Use Type C to HDMI cable to connect Orange Pi development board and HDMI display

2) After starting the linux system, if the HDMI display has image output, it means that the Type C to HDMI display function is normal

3. 13. HDMI to VGA display test

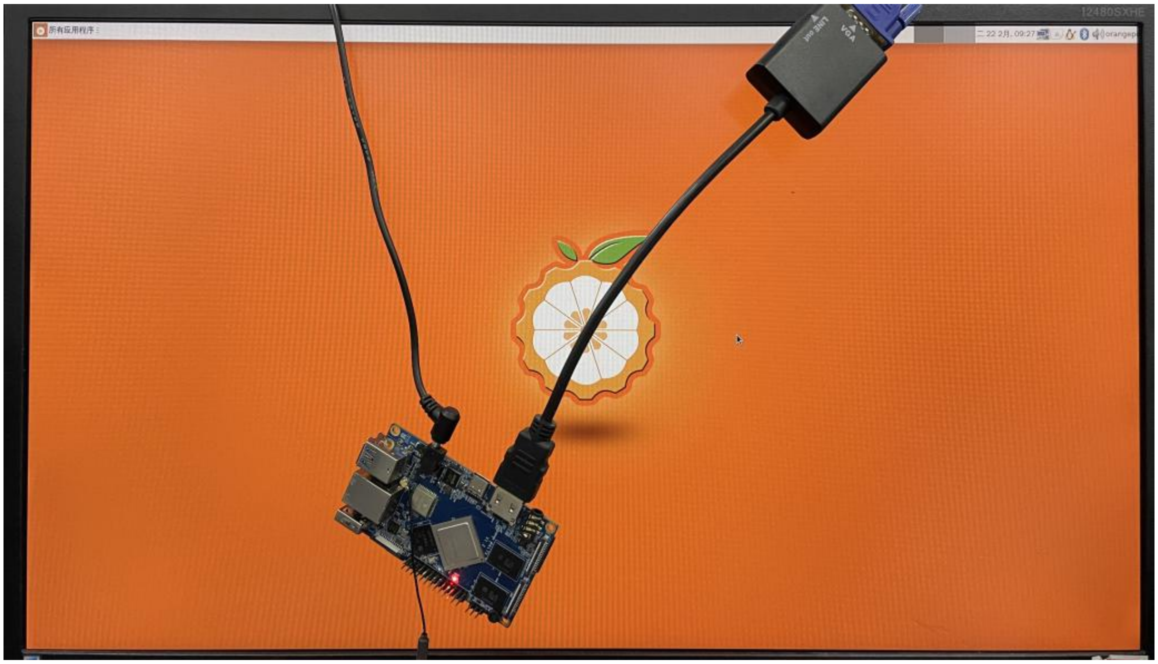
1) First you need to prepare the following accessories

a. HDMI to VGA converter

b. A VGA cable

c. A monitor or TV that supports VGA interface

2) HDMI to VGA display test as shown below



When using HDMI to VGA display, the development board and the Linux system of the development board do not need to do any settings, as long as the HDMI interface of the development board can display normally. So if there is a problem with the test, please check the HDMI to VGA converter, VGA cable and monitor if there is any problem

3. 14. WIFI connection test

Please do not connect to WIFI by modifying the /etc/network/interfaces configuration file. There will be problems with connecting to the WIFI network in this way.

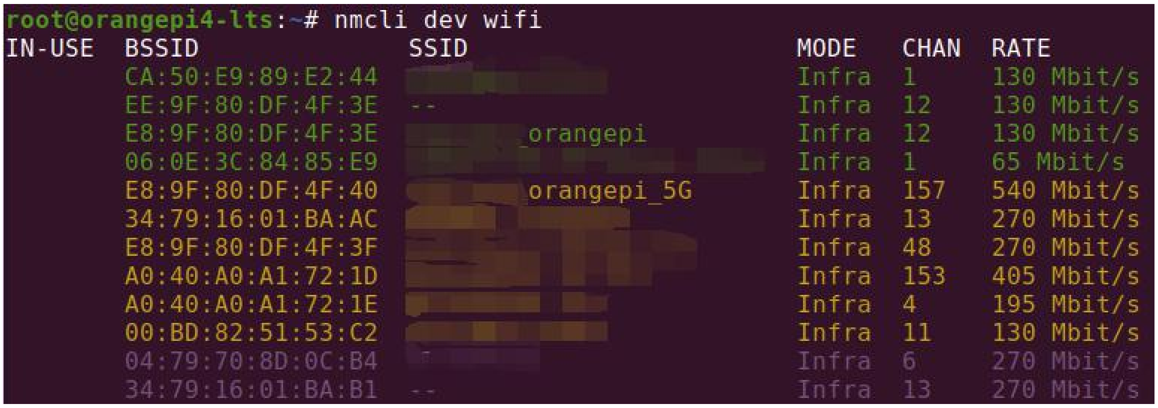
3. 14. 1. The server version image is connected to WIFI through the command

When the development board is not connected to the Ethernet, not connected to the HDMI display, and only connected to the serial port, it is recommended to use the commands demonstrated in this section to connect to the WIFI network. Because nmtui can only display characters in some serial port software (such as minicom), it cannot display the graphical interface normally. Of course, if the development board is connected to an Ethernet or HDMI display, you can also use the commands demonstrated in this section to connect to the WIFI network

1) First log in to the linux system, there are the following three ways
   a. If the development board is connected to the network cable, you can log in to the Linux system remotely through ssh
   b. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the linux system
   c. If the development board is connected to the HDMI display, you can log in to the linux system through the HDMI display terminal

1) First use the nmcli dev wifi command to scan the surrounding WIFI hotspots

```
root@orangepi4-lts:~# nmcli dev wifi
```



```
root@orangepi4-lts:~# nmcli dev wifi
IN-USE  BSSID              SSID                       MODE   CHAN  RATE
        CA:50:E9:89:E2:44  [redacted]                 Infra  1     130 Mbit/s
        EE:9F:80:DF:4F:3E  --                         Infra  12    130 Mbit/s
        E8:9F:80:DF:4F:3E  [redacted]_orangepi        Infra  12    130 Mbit/s
        06:0E:3C:84:85:E9  [redacted]                 Infra  1     65 Mbit/s
        E8:9F:80:DF:4F:40  [redacted] orangepi_5G     Infra  157   540 Mbit/s
        34:79:16:01:BA:AC  [redacted]                 Infra  13    270 Mbit/s
        E8:9F:80:DF:4F:3F  [redacted]                 Infra  48    270 Mbit/s
        A0:40:A0:A1:72:1D  [redacted]                 Infra  153   405 Mbit/s
        A0:40:A0:A1:72:1E  [redacted]                 Infra  4     195 Mbit/s
        00:BD:82:51:53:C2  [redacted]                 Infra  11    130 Mbit/s
        04:79:70:8D:0C:B4  [redacted]                 Infra  6     270 Mbit/s
        34:79:16:01:BA:B1  --                         Infra  13    270 Mbit/s
```

2) Then use the nmcli command to connect to the scanned WIFI hotspot, where:
   a. wifi_name needs to be replaced with the name of the WIFI hotspot you want to connect to
   b. wifi_passwd needs to be replaced with the password of the WIFI hotspot you want to connect to

```
root@orangepi4-lts:~# nmcli dev wifi connect wifi_name password wifi_passwd
```

```
Device 'wlan0' successfully activated with '36387224-f4ff-4021-85a1-eda7825ce09e'.
```

3) You can view the IP address of the wifi through the ifconfig command

```
root@orangepi4-lts:~# ifconfig wlan0
wlan0       Link encap:Ethernet   HWaddr b0:02:47:cf:28:77
            inet addr:192.168.1.187   Bcast:192.168.1.255   Mask:255.255.255.0
            inet6 addr: fe80::8008:703d:8f92:41c7/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST   MTU:1500   Metric:1
            RX packets:17 errors:0 dropped:0 overruns:0 frame:0
            TX packets:42 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:1837 (1.8 KB)   TX bytes:8320 (8.3 KB)
```

4) Use the ping command to test the connectivity of the wifi network

```
root@orangepi4-lts:~# ping www.baidu.com -I wlan0
PING www.a.shifen.com (14.215.177.39) from 192.168.1.187 wlan0: 56(84) bytes of
data.
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=3 ttl=56 time=15.0 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=4 ttl=56 time=12.8 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=5 ttl=56 time=13.7 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=6 ttl=56 time=14.9 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=7 ttl=56 time=13.6 ms
^C
```

3. 14. 2. Connect WIFI graphically in the command line

1) First log in to the linux system, there are the following three ways

a. If the development board is connected to the network cable, you can log in to the Linux system remotely through ssh

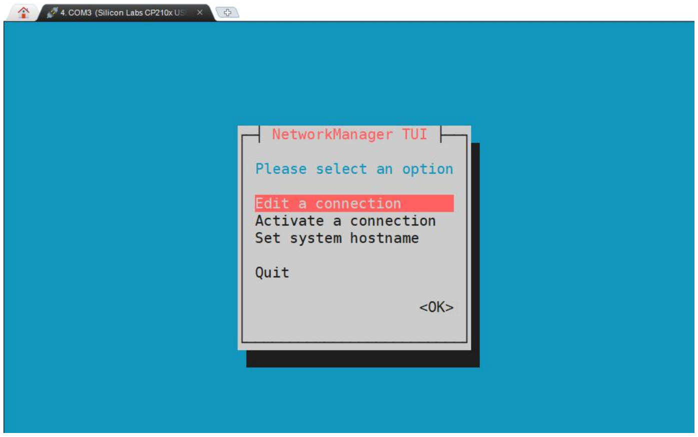
b. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the linux system (please use MobaXterm for serial port software, and the graphical interface cannot be displayed using minicom)

c. If the development board is connected to the HDMI display, you can log in to the linux system through the HDMI display terminal

2) Then enter the nmtui command in the command line to open the wifi connection interface

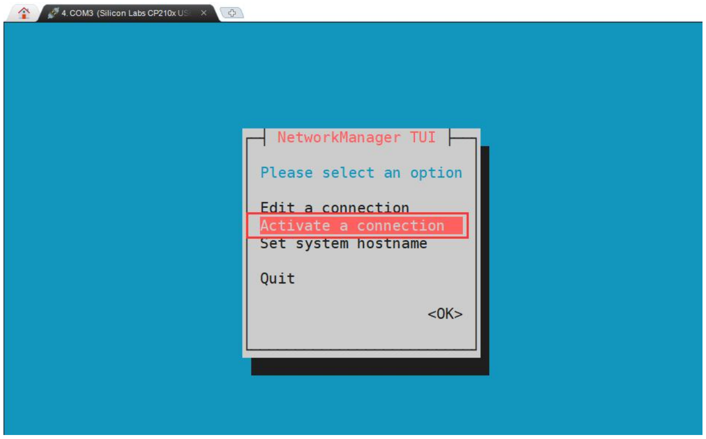
```
root@orangepi4-lts:~# nmtui
```

3) Enter the nmtui command to open the interface as shown below



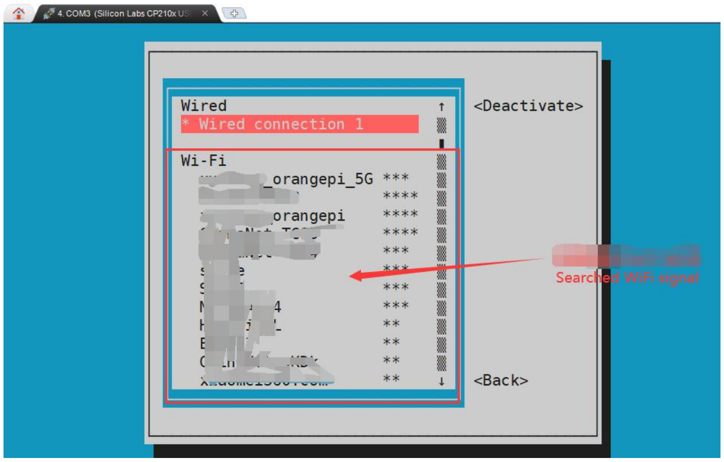
```
NetworkManager TUI

Please select an option

Edit a connection
Activate a connection
Set system hostname

Quit

<OK>
```

4) Select Activate a connect and press Enter



```
NetworkManager TUI

Please select an option

Edit a connection
Activate a connection
Set system hostname

Quit

<OK>
```

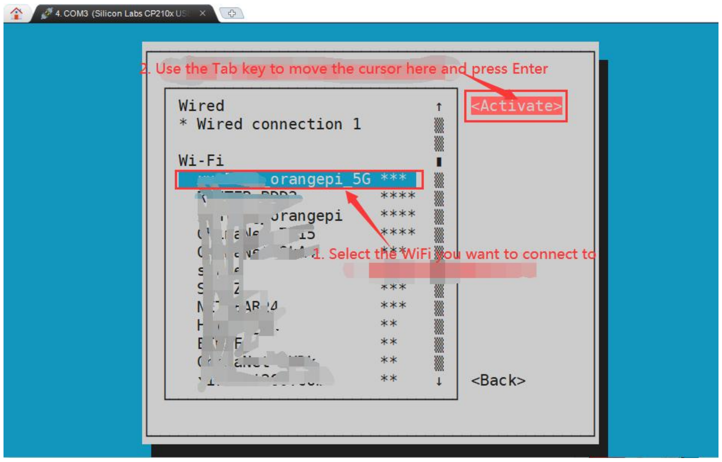
5) Then you can see all the searched WIFI hotspots



```
Wired                                ↑   <Deactivate>
* Wired connection 1
Wi-Fi
  [redacted]_orangepi_5G ***
  [redacted]             ****
  [redacted]orangepi     ****
  [redacted]             ****
  [redacted]             ***
  [redacted]             ***
  [redacted]             ***
  [redacted]             ***
  [redacted]             **
  [redacted]             **
  [redacted]             **
  [redacted]             **      ↓   <Back>
```

Searched WiFi signal

6) Select the WIFI hotspot you want to connect, then use the Tab key to position the cursor to Activate and press Enter

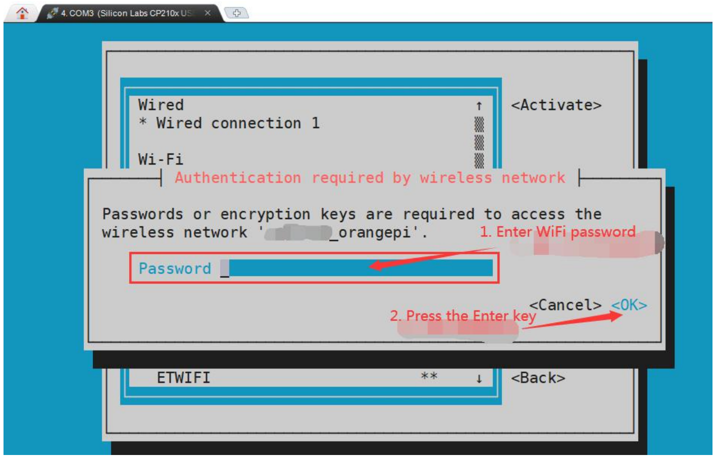


2. Use the Tab key to move the cursor here and press Enter

```
Wired                                ↑   <Activate>
* Wired connection 1
Wi-Fi
  [redacted]_orangepi_5G ***
  [redacted]             ****
  [redacted]orangepi     ****
  [redacted]             ****
  [redacted]             ***
  [redacted]             ***
  [redacted]             ***
  [redacted]             ***
  [redacted]             **
  [redacted]             **
  [redacted]             **
  [redacted]             **      ↓   <Back>
```

1. Select the WiFi you want to connect to

7) Then a dialog box for entering a password will pop up, enter the corresponding password in Pssword and press Enter to start connecting to WIFI

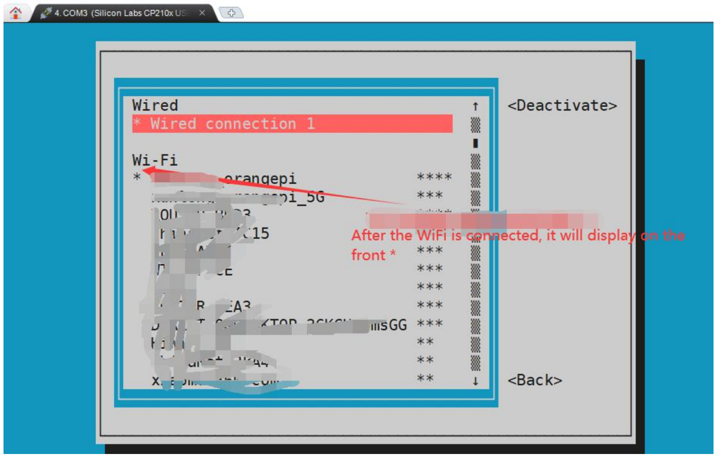


```
Wired                                ↑   <Activate>
* Wired connection 1
Wi-Fi
┤ Authentication required by wireless network ├

Passwords or encryption keys are required to access the
wireless network '[redacted]_orangepi'.

Password _

                                  <Cancel> <OK>

  ETWIFI                        **   ↓   <Back>
```

1. Enter WiFi password

2. Press the Enter key

8) After the WIFI connection is successful, a "*" will be displayed in front of the connected WIFI name



After the WiFi is connected, it will display on the front *

9) You can view the IP address of the wifi through the ifconfig command

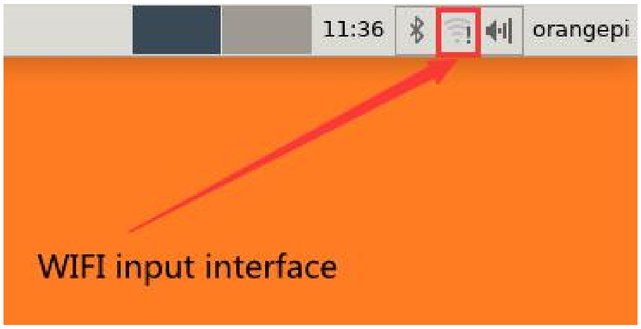
```
root@orangepi4-lts:~# ifconfig wlan0
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.187  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::76bb:f67d:ef98:2f9a  prefixlen 64  scopeid 0x20<link>
        ether 12:81:3e:a8:58:d8  txqueuelen 1000  (Ethernet)
        RX packets 185  bytes 109447 (109.4 KB)
        RX errors 0  dropped 61  overruns 0  frame 0
        TX packets 27  bytes 14783 (14.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

10) Use the ping command to test the connectivity of the wifi network

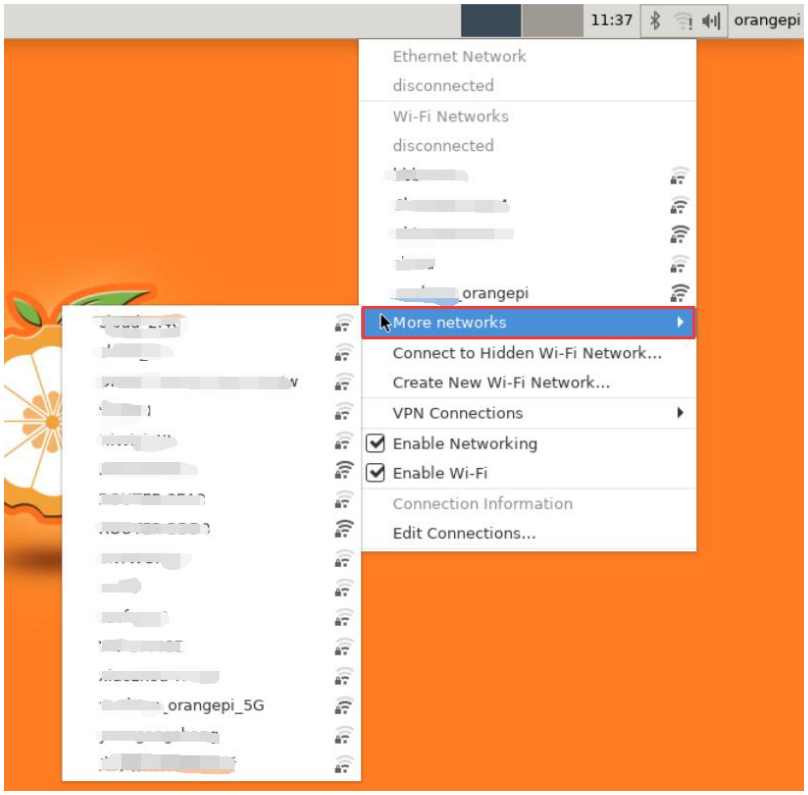
```
root@orangepi4-lts:~# ping www.baidu.com -I wlan0
PING www.a.shifen.com (14.215.177.39) from 192.168.1.187 wlan0: 56(84) bytes of data.
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=3 ttl=56 time=15.0 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=4 ttl=56 time=12.8 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=5 ttl=56 time=13.7 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=6 ttl=56 time=14.9 ms
64 bytes from 14.215.177.39 (14.215.177.39): icmp_seq=7 ttl=56 time=13.6 ms
^C
```

3. 14. 3. How to use the Linux desktop to connect to WIFI

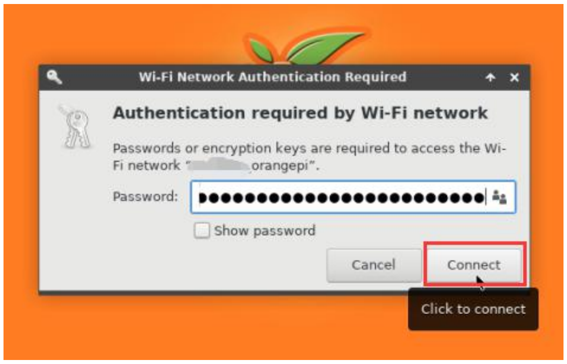
1) Click the network configuration icon in the upper right corner of the desktop (please do not connect the network cable when testing WIFI)



2) Click More networks in the pop-up drop-down box to see all scanned WIFI hotspots, and then select the WIFI hotspot you want to connect to



3) Then enter the password of the WIFI hotspot, and then click Connect to start connecting to the WIFI



Wi-Fi Network Authentication Required

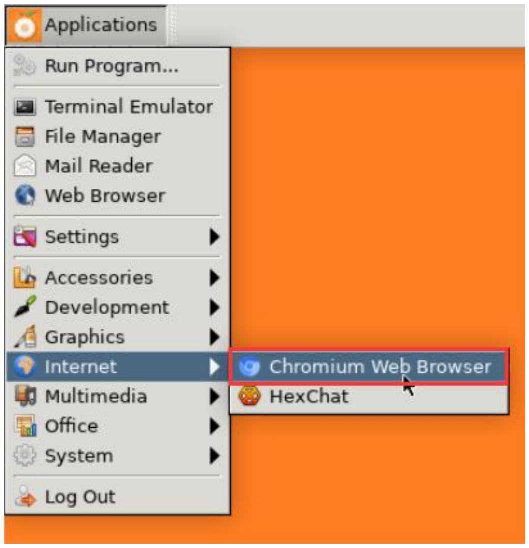
Authentication required by Wi-Fi network

Passwords or encryption keys are required to access the Wi-Fi network “[redacted]orangepi”.

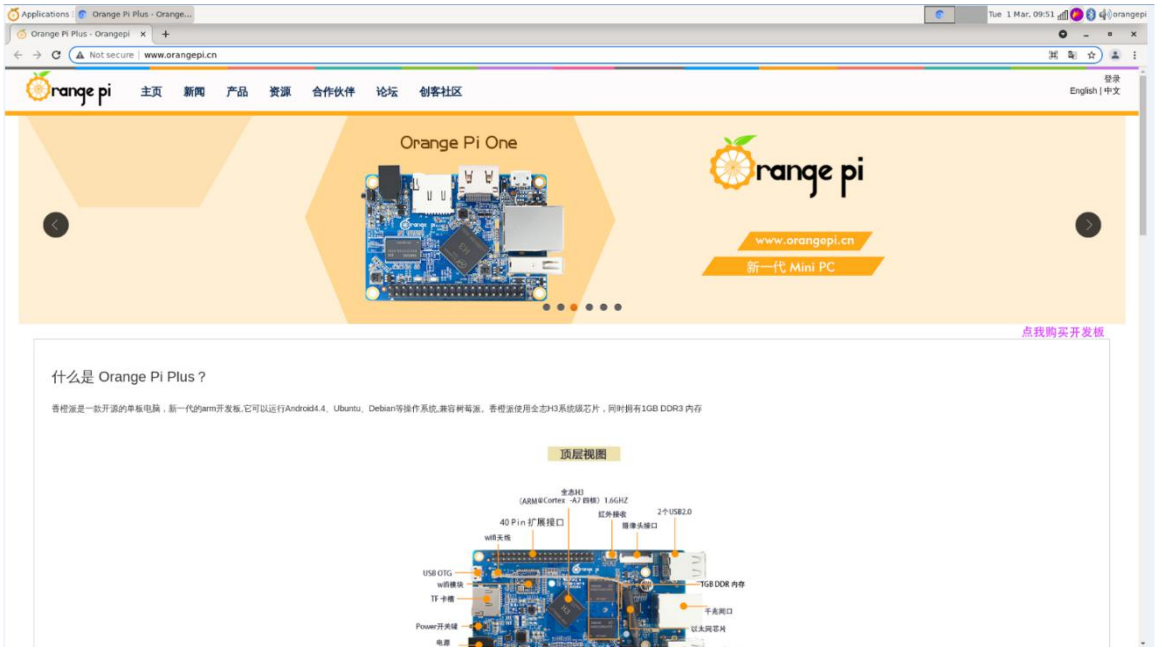
Password: ●●●●●●●●●●●●●●●●●●●●●●●●●

□ Show password

4) After connecting to WIFI, you can open the browser to check whether you can access the Internet. The entrance of the browser is shown in the figure below.



5) After opening the browser, if you can see the page of the Orange Pi website, or you can open other pages, it means the WIFI connection is normal



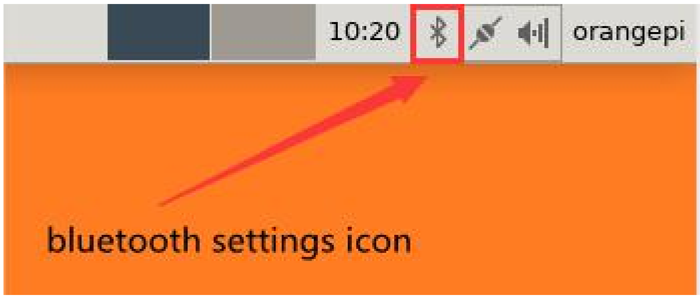
什么是 Orange Pi Plus？

香橙派是一款开源的单板电脑，新一代的arm开发板,它可以运行Android4.4、Ubuntu、Debian等操作系统,兼容树莓派。香橙派使用全志H3系统级芯片，同时拥有1GB DDR3 内存

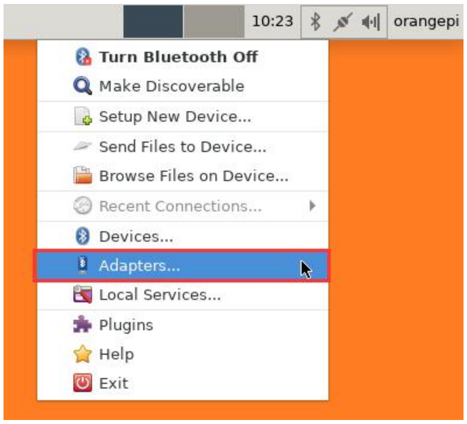
3. 15. How to use Bluetooth

3. 15. 1. Test method of desktop version image

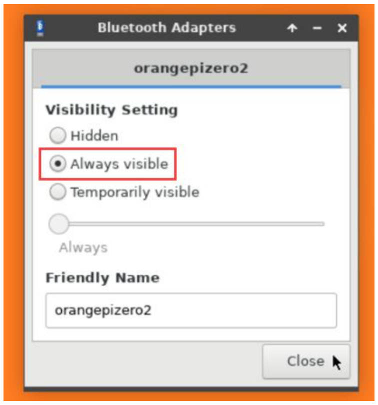
1) Click the Bluetooth icon in the upper right corner of the desktop



2) Then select adapter



3) In the Bluetooth adapter setting interface, set the Visibility Setting to Always visible, and then click the upper right corner to close the window


Bluetooth Adapters

orangepizero2

Visibility Setting

○ Hidden

● Always visible

○ Temporarily visible

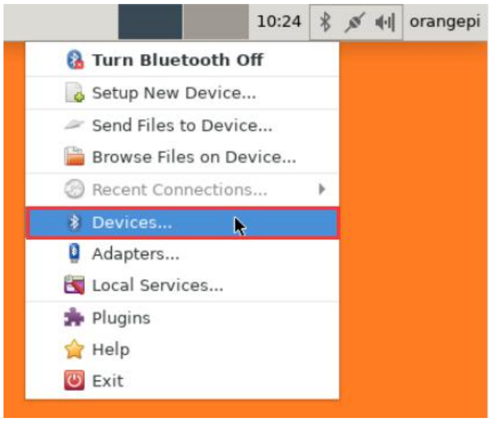
Always

Friendly Name

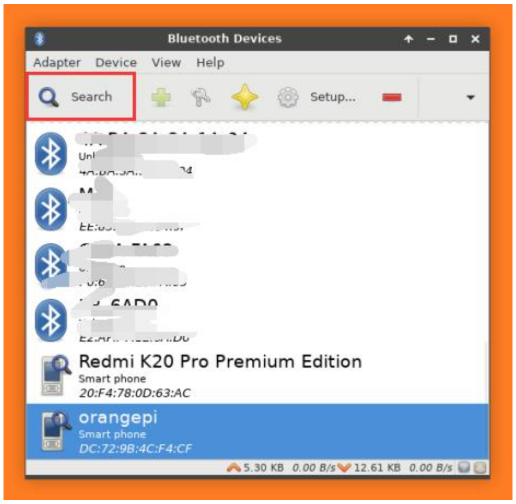
orangepizero2

Close

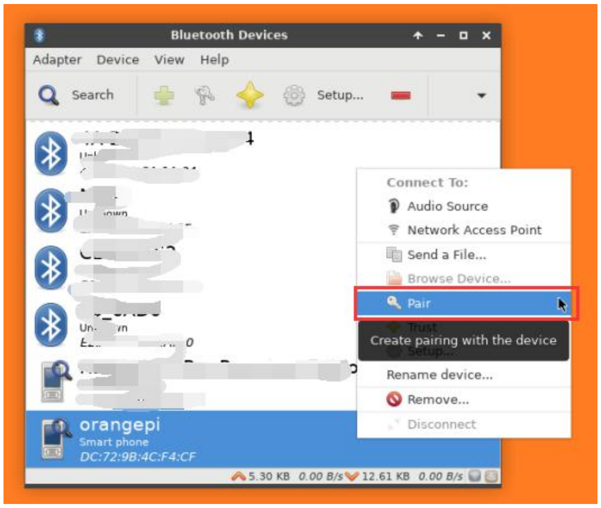
4) Then open the configuration interface of the Bluetooth device



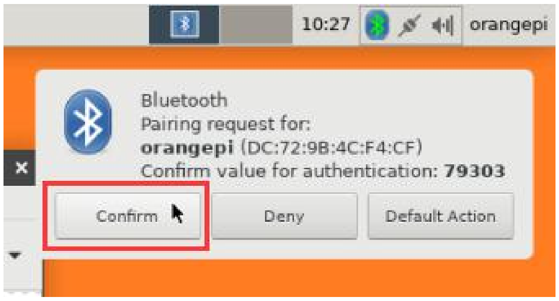
5) Click Search to start scanning for surrounding Bluetooth devices



6) Then select the Bluetooth device you want to connect, and then click the right mouse button to pop up the operation interface of the Bluetooth device. Select Pair to start pairing. The demonstration here is pairing with an Android phone.

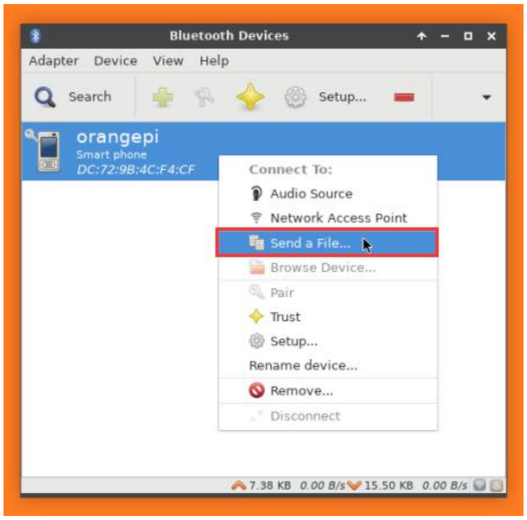


7) When pairing, a pairing confirmation box will pop up in the upper right corner of the desktop. Select Confirm to confirm. At this time, the mobile phone also needs to be confirmed.

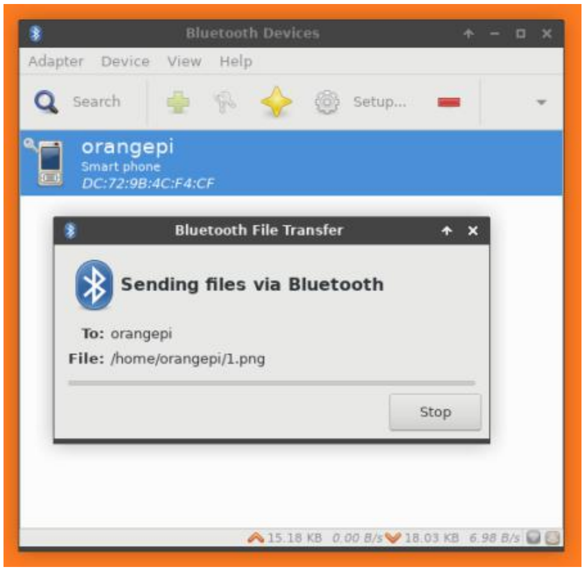


Bluetooth
Pairing request for:
orangepi (DC:72:9B:4C:F4:CF)
Confirm value for authentication: **79303**

8) After pairing with the mobile phone, you can select the paired Bluetooth device, then right-click and select Send a File to start sending a picture to the mobile phone



9) The interface for sending pictures is as follows



Sending files via Bluetooth

To: orangepi
File: /home/orangepi/1.png

3. 15. 2. How to use the server version image

1) After entering the system, you can first check whether there is a Bluetooth device node through the hciconfig command. If there is, it means that the Bluetooth initialization is normal.

```
root@orangepi4-lts:~# hciconfig -a
hci0:     Type: BR/EDR   Bus: UART
      BD Address: 43:45:C5:00:1F:AC   ACL MTU: 1021:8   SCO MTU: 64:1
      UP RUNNING PSCAN ISCAN
      RX bytes:897 acl:0 sco:0 events:65 errors:0
      TX bytes:4355 acl:0 sco:0 commands:65 errors:0
      Features: 0xbf 0xfe 0xcf 0xfe 0xdb 0xff 0x7b 0x87
      Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3
      Link policy: RSWITCH SNIFF
      Link mode: SLAVE ACCEPT
      Name: 'orangepi4-lts'
      Class: 0x1c0000
      Service Classes: Rendering, Capturing, Object Transfer
      Device Class: Miscellaneous,
      HCI Version:   (0x9)   Revision: 0x26
      LMP Version:   (0x9)   Subversion: 0x6606
      Manufacturer: Broadcom Corporation (15)
```

2) Scan for bluetooth devices using bluetoothctl

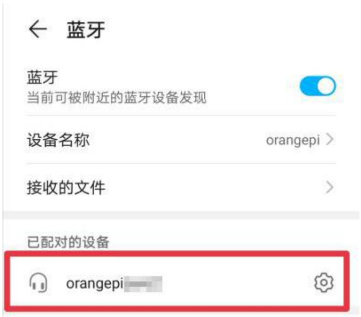
```
root@orangepi4-lts:~# bluetoothctl
[NEW] Controller 10:11:12:13:14:15 orangepi3 [default]
Agent registered
[bluetooth]# power on          #enable controller
Changing power on succeeded
[bluetooth]# discoverable on       #Make the controller discoverable
Changing discoverable on succeeded
[CHG] Controller 10:11:12:13:14:15 Discoverable: yes
[bluetooth]# pairable on      #Set the controller to be pairable
Changing pairable on succeeded
[bluetooth]# scan on           #Start scanning for surrounding bluetooth devices
Discovery started
[CHG] Controller 10:11:12:13:14:15 Discovering: yes
```

```
[NEW] Device 76:60:79:29:B9:31 76-60-79-29-B9-31
[NEW] Device 9C:2E:A1:42:71:11 Xiaomi phone
[NEW] Device DC:72:9B:4C:F4:CF orangepi
[bluetooth]# scan off          #After scanning the Bluetooth device you want to connect,
you can close the scan, and then write down the MAC address of the Bluetooth
device. The Bluetooth device tested here is an Android phone, the Bluetooth name is
orangepi, and the corresponding MAC address is DC:72:9B: 4C:F4:CF
Discovery stopped
[CHG] Controller 10:11:12:13:14:15 Discovering: no
[CHG] Device DC:72:9B:4C:F4:CF RSSI is nil
```

3) After scanning the device you want to pair, you can pair it. Pairing needs to use the MAC address of the device

```
[bluetooth]# pair DC:72:9B:4C:F4:CF        #Use the scanned MAC address of the
Bluetooth device for pairing
Attempting to pair with DC:72:9B:4C:F4:CF
[CHG] Device DC:72:9B:4C:F4:CF Connected: yes
Request confirmation
[leeb1m[agent] Confirm passkey 764475 (yes/no): yes    #Enter yes here, you also need
to confirm on the phone
[CHG] Device DC:72:9B:4C:F4:CF Modalias: bluetooth:v010Fp107Ed1436
[CHG] Device DC:72:9B:4C:F4:CF UUIDs: 0000046a-0000-1000-8000-00805f9b34fb
[CHG] Device DC:72:9B:4C:F4:CF ServicesResolved: yes
[CHG] Device DC:72:9B:4C:F4:CF Paired: yes
Pairing successful    #Prompt pairing is successful
[CHG] Device DC:72:9B:4C:F4:CF ServicesResolved: no
[CHG] Device DC:72:9B:4C:F4:CF Connected: no
```

4) After the pairing is successful, the display of the Bluetooth interface of the mobile phone is as follows



蓝牙

蓝牙
当前可被附近的蓝牙设备发现

设备名称 orangepi

接收的文件

已配对的设备

orangepi[redacted]

3. 16. USB interface test

3. 16. 1. Connect mouse or keyboard test

1) Insert the keyboard of the USB interface into the USB interface of the Orange Pi development board

2) Connect the Orange Pi development board to the HDMI display

3) If the mouse or keyboard can operate normally, the USB interface is in normal use (the mouse can only be used in the desktop version of the system)

3. 16. 2. Connect USB storage device test

1) First insert the U disk into the USB port of the Orange Pi development board

2) Execute the following command, if you can see the output of sdX, it means that the U disk is successfully recognized

```
root@orangepi4-lts:~# cat /proc/partitions | grep "sd*"
major minor   #blocks   name
   8        0      30044160 sda
   8        1      30043119 sda1
```

3) Use the mount command to mount the U disk to /mnt, and then you can view the files in the U disk

```
root@orangepi4-lts:~# mount /dev/sda1 /mnt/
root@orangepi4-lts:~# ls /mnt/
test.txt
```

4) After mounting, you can view the capacity usage and mount point of the U disk through the df -h command

```
root@orangepi4-lts:~# df -h | grep "sd"
/dev/sda1              29G   208K     29G      1% /mnt
```

3. 17. USB camera test

1) First insert the USB camera into the USB port of the Orange Pi development board

2) Through the v4l2-ctl (note that the l in v4l2 is a lowercase letter l, not the number 1) command, you can see that the device node information of the USB camera is /dev/video10

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt install v4l-utils
root@orangepi4-lts:~# v4l2-ctl   --list-devices
USB2.0 Camera RGB (usb-xhci-hcd.11.auto-1):
     /dev/video10
```

Note that the l in v4l2 is a lowercase l, not the number 1.

In addition, the serial number of the video is not necessarily video10, please modify it according to the actual situation.

3) Use fswebcam to test the USB camera

a. Install fswebcam

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt-get -y install fswebcam
```

b. After installing fswebcam, you can use the following command to take pictures

a) The -d option is used to specify the device node of the USB camera

b) --no-banner to remove watermark from photos

c) The -r option is used to specify the resolution of the photo

d) The -S option is set to skip previous frames

e) /image.jpg is used to set the name and path of the generated photo

```
root@orangepi4-lts:~# fswebcam -d /dev/video10 --no-banner -r 1280x720 -S
5 ./image.jpg
```

c. If there is no HDMI display or LCD screen connected, after taking the picture, you can use the scp command to transfer the taken picture to the Ubuntu PC for image viewing

```
root@orangepi4-lts:~# scp image.jpg test@192.168.1.55:/home/test (Modify the IP
address and path according to the actual situation)
```

d. If an HDMI display or LCD screen is connected, you can view the captured pictures directly through the HDMI display or LCD screen

4) Use motion to test the USB camera

a. Install the camera test software motion

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt -y install motion
```

b. Modify the configuration of /etc/default/motion and change start_motion_daemon=no to start_motion_daemon=yes

```
root@orangepi4-lts:~# sed -i
"s/start_motion_daemon=no/start_motion_daemon=yes/" \
/etc/default/motion        (this is a command)
```

c. Modify the configuration of /etc/motion/motion.conf

```
root@orangepi4-lts:~# sed -i "s/stream_localhost on/stream_localhost off/" \
/etc/motion/motion.conf        (this is a command)
```

d. Modify the configuration of /etc/motion/motion.conf and change videodevice /dev/video0 to videodevice /dev/video10

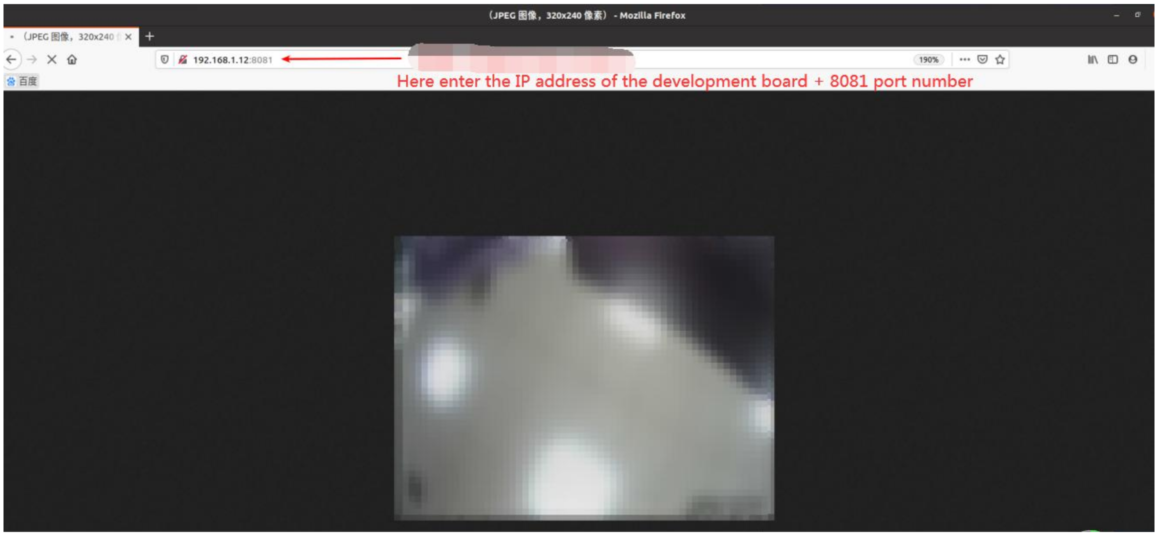
```
root@orangepi4-lts:~# sed -i "s/videodevice \/dev\/video0/videodevice \/dev\/video10/"
/etc/motion/motion.conf
```

e. Then restart the motion service

```
root@orangepi4-lts:~# /etc/init.d/motion restart
[ ok ] Restarting motion (via systemctl): motion.service.
```

f. Before using motion, please make sure that the Orange Pi development board can connect to the network normally, and then obtain the IP address of the development board through the ifconfig command

g. Then enter [IP address of the development board: 8081] in the Ubuntu PC or Windows PC or the Firefox browser of the mobile phone on the same LAN as the development board to see the video output by the camera


（JPEG 图像，320x240 像素） - Mozilla Firefox
（JPEG 图像，320x240
192.168.1.12:8081
190%
百度
Here enter the IP address of the development board + 8081 port number

5) Use mjpg-streamer to test the USB camera

a. Download mjpg-streamer

```
root@orangepi4-lts:~# git clone https://github.com/jacksonliam/mjpg-streamer
```

b. b. Install the dependent packages (under debian10, you need to replace libjpeg8-dev with libjpeg62-turbo-dev)

```
root@orangepi4-lts:~# apt-get -y install cmake libjpeg8-dev
```

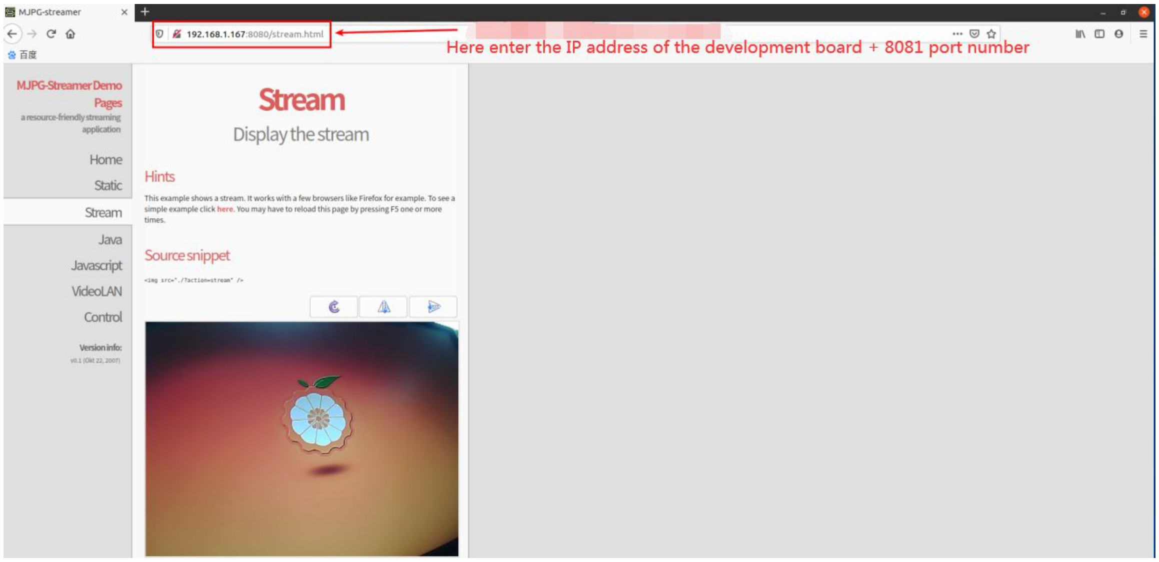
c. Compile and install mjpg-streamer

```
root@orangepi4-lts:~# cd mjpg-streamer/mjpg-streamer-experimental
root@orangepi4-lts:~/mjpg-streamer/mjpg-streamer-experimental# make
root@orangepi4-lts:~/mjpg-streamer/mjpg-streamer-experimental# make install
```

d. Then enter the following command to start mjpg_streamer

```
root@orangepi4-lts:~/mjpg-streamer/mjpg-streamer-experimental# export
LD_LIBRARY_PATH=.            (this is a command)
root@orangepi4-lts:~/mjpg-streamer/mjpg-streamer-experimental# ./mjpg_streamer -i
"./input_uvc.so -d /dev/video0 -u -f 30" -o "./output_http.so -w ./www"
```

e. Then enter [IP address of the development board: 8080] in the browser of the Ubuntu PC or Windows PC or mobile phone on the same LAN as the development board to see the video output by the camera



Here enter the IP address of the development board + 8081 port number

Stream

Display the stream

Hints

This example shows a stream. It works with a few browsers like Firefox for example. To see a simple example click here. You may have to reload this page by pressing F5 one or more times.

Source snippet

```
<img src="./?action=stream" />
```

f. It is recommended to use mjpg-streamer to test the USB camera, which is much smoother than motion, and you will not feel any lag when using mjpg-streamer

3. 18. Audio Test

3. 18. 1. Headphone jack audio playback test

1) First insert headphones into the audio interface

2) Through the aplay -l command, you can view the sound card devices supported by the linux system, among which rockchipes8316c is the sound card device required for headphone playback

```
root@orangepi4-lts:~# aplay -l
**** List of PLAYBACK Hardware Devices ****
xcb_connection_has_error() returned true
card 0: rockchipes8316c [rockchip-es8316c], device 0: ff890000.i2s-ES8316 HiFi ES8316 HiFi-0 []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 1: rkhdmidpsound [rk-hdmi-dp-sound], device 0: HDMI-DP multicodec-0 []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

3) Then use the aplay command to play the audio, and the headset can hear the sound

```
root@orangepi4-lts:~# aplay -D hw:0,0 /usr/share/sounds/alsa/audio.wav
Playing WAVE '/usr/share/sounds/alsa/audio.wav' : Signed 16 bit Little Endian, Rate
44100 Hz, Stereo
```

3. 18. 2. Onboard MIC recording test

1) First make sure the system has opened the following recording channel

```
root@orangepi4-lts:~# amixer cset name='Differential Mux' lin2-rin2
```

2) The recording command is as follows

```
root@orangepi4-lts:~# arecord -D hw:0,0 -d 5 -f cd -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

3) After the recording is completed, a recording file named test.wav will be generated in the current path. Use the aplay command to play test.wav to check whether there is sound output. If there is sound output, the recording is normal.

```
root@orangepi4-lts:~# ls -lh
total 862K
-rw-r--r-- 1 root root 862K Feb    5 04:24 test.wav
root@orangepi4-lts:~# aplay -D hw:0,0 test.wav
```

3. 18. 3. Headphone recording

1) First plug in the headphones with the recording function

2) Then use amixer to open the recording channel below

```
root@orangepi4-lts:~# amixer cset name='Differential Mux' lin1-rin1
```

3) The recording command is as follows

```
root@orangepi4-lts:~# arecord -D hw:0,0 -d 5 -f cd -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

4) After the recording is completed, a recording file named test.wav will be generated in the current path. Use the aplay command to play test.wav to check whether there is sound output. If there is sound output, the recording is normal.

```
root@orangepi4-lts:~# ls -lh
total 862K
```

```
-rw-r--r-- 1 root root 862K Feb   5 04:24 test.wav
root@orangepi4-lts:~# aplay -D hw:0,0 test.wav
```

3. 18. 4. HDMI audio playback test

1) First connect the Orange Pi development board to the TV with an HDMI cable (other HDMI monitors need to ensure that they can play audio)

2) Upload the audio files to be played to the /root folder of the linux system. In Ubuntu PC, you can use the scp command to upload (the IP address in the command is the IP address of the Orange Pi development board), or use a U disk to copy

```
test@test:~/AudioTest$ scp audio.wav    root@192.168.1.xx:/root (Modify the IP
address and path according to the actual situation)
```

3) HDMI audio playback does not require other settings, just use the aplay command to play

```
root@orangepi4-lts:~# aplay -D hw:1,0 audio.wav
```

3. 19. Temperature sensor

1) RK3399 has a total of 2 temperature sensors, the command to check the temperature is as follows

a. sensor0：CPU

```
root@orangepi4-lts:~# cat /sys/class/thermal/thermal_zone0/type
soc-thermal
root@orangepi4-lts:~# cat /sys/class/thermal/thermal_zone0/temp
48125
```

b. sensor1：GPU

```
root@orangepi4-lts:~# cat /sys/class/thermal/thermal_zone1/type
gpu-thermal
root@orangepi4-lts:~# cat /sys/class/thermal/thermal_zone1/temp
49375
```

3. 20. How to use Mini-PCIE

3. 20. 1. Connect SATA hard disk through mini PCIE interface

1) For the method of hardware wiring, please refer to the instructions for connecting the mini-PCIE to the hard disk.

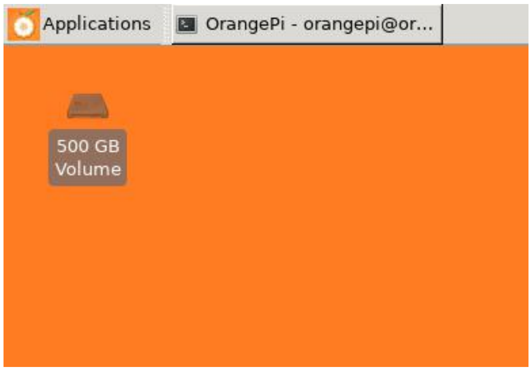
2) After completing the wiring, connect the DC power supply to the development board. After the system starts, execute the lspci command in the terminal to see the recognized pci device

```
root@orangepi4-lts:~# lspci
00:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd RK3399 PCI Express Root
Port
01:00.0 SATA controller: ASMedia Technology Inc. ASM1062 Serial ATA Controller (rev
02)
```

And the information about the hard disk can also be seen in the output information of the dmesg command

```
[    14.535120] scsi 0:0:0:0: Direct-Access     ATA      WDC WD5000LPCX-2
1A01 PQ: 0 ANSI: 5
[    14.536785] sd 0:0:0:0: [sda] 976773168 512-byte logical blocks: (500 GB/466 GiB)
[    14.536808] sd 0:0:0:0: [sda] 4096-byte physical blocks
[    14.537238] sd 0:0:0:0: [sda] Write Protect is off
[    14.537262] sd 0:0:0:0: [sda] Mode Sense: 00 3a 00 00
[    14.537411] sd 0:0:0:0: [sda] Write cache: enabled, read cache: enabled, doesn't
support DPO or FUA
[    14.590267]  sda: sda1
[    14.592221] sd 0:0:0:0: [sda] Attached SCSI disk
```

3) On the desktop of the Linux system, you can see that the hard disk has been mounted

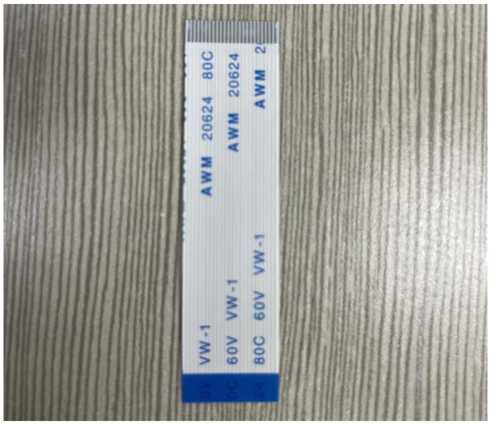


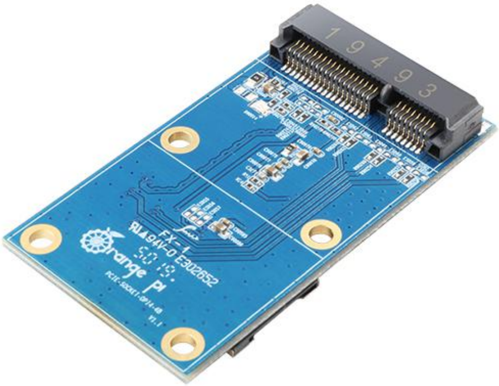
3. 20. 2. Connect the Gigabit LAN through the mini PCIE interface

1) First prepare the required accessories

a. Realtek 8111E mini PCIE to Gigabit Ethernet module

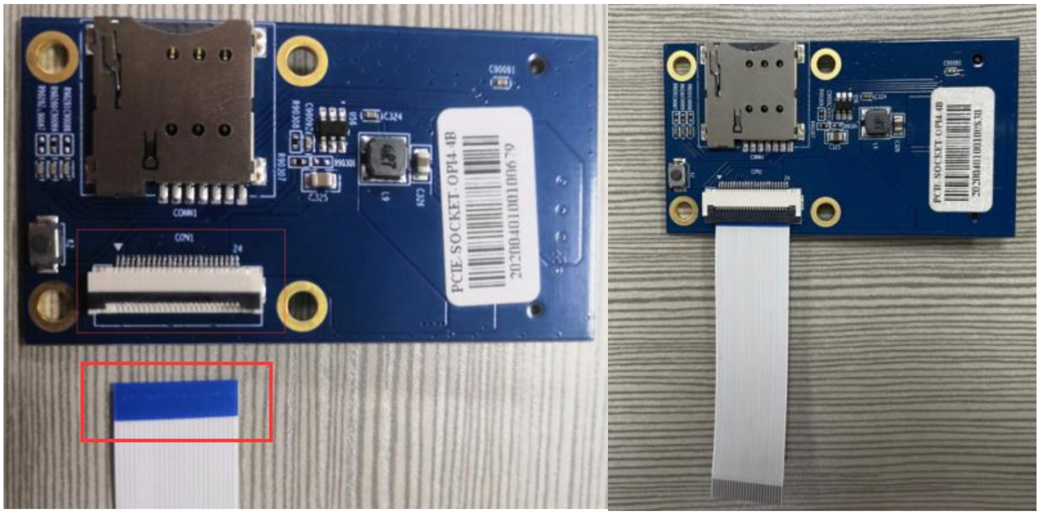
b. 24pin reverse cable and mini PCIE adapter board



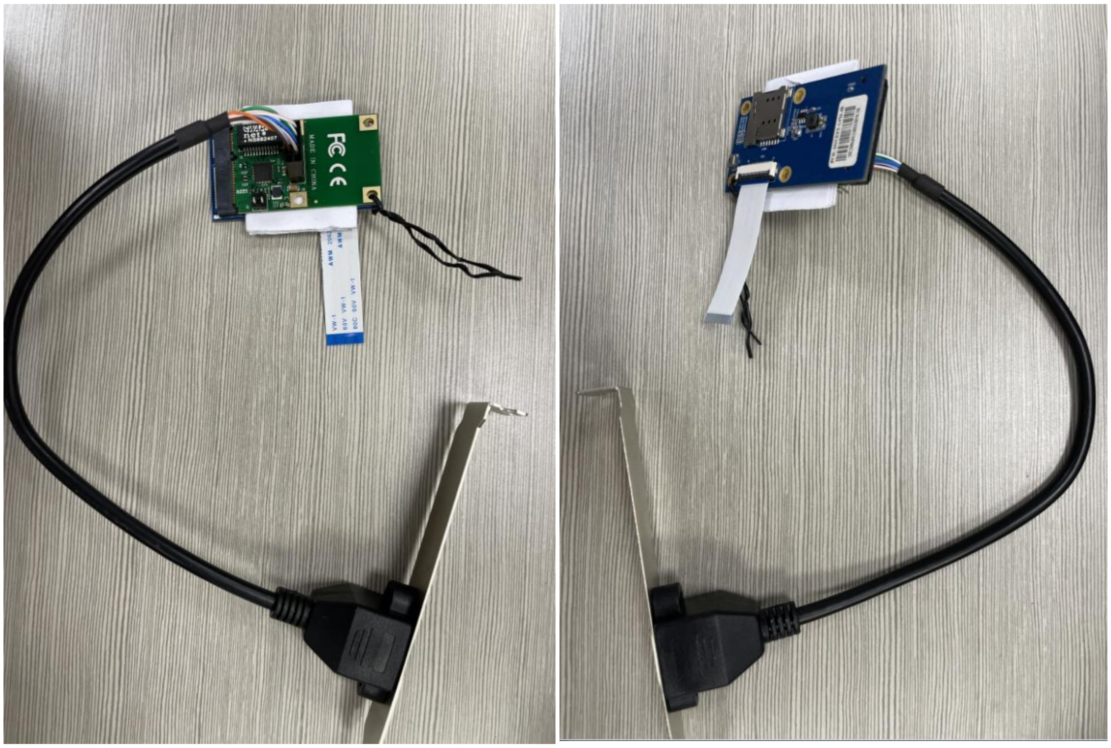


c. Fast or Gigabit Ethernet cable

2) Connect the 24pin reverse cable to the mini PCIE adapter board as shown in the figure below



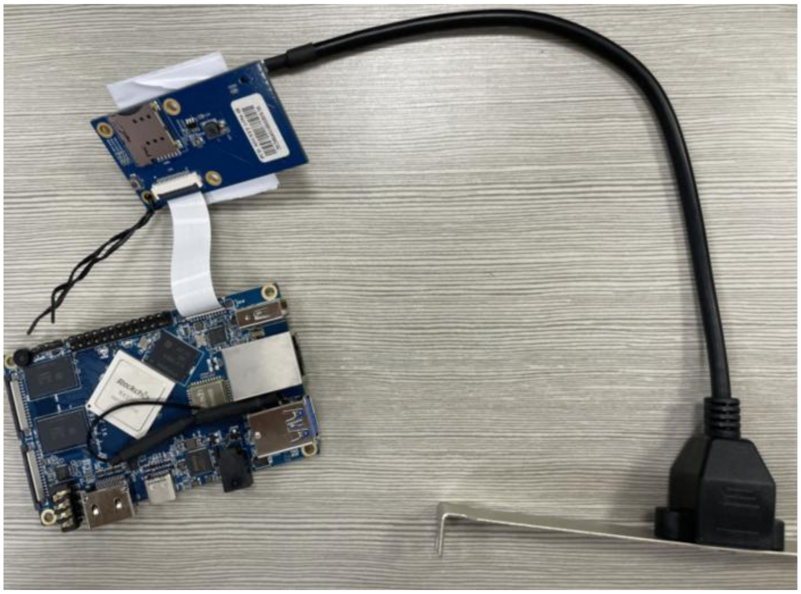
3) Then connect the mini PCIE to Gigabit LAN module to the mini PCIE adapter board



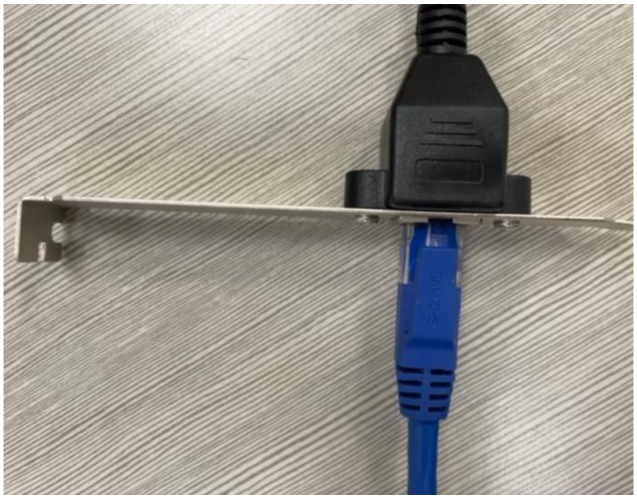
Put a piece of insulating white paper between the gigabit network card module and the mini PCIE adapter board to avoid short circuit caused by direct contact between the gigabit network card module and the mini PCIE adapter board, and

can be fixed with a rope after connection

4) Then connect the mini PCIE adapter board to the Orange Pi 4 LTS development board through the 24pin reverse cable



5) Finally, connect the network cable to the network port of the mini PCIE to Gigabit network card module



6) Power on the Orange Pi 4 LTS. After the system starts, enter the lspci command in the command line terminal. If there is the following output information, it means that the mini PCIE to Gigabit network card has been recognized.

```
root@orangepi4-lts:~# lspci
00:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd RK3399 PCI Express Root
Port
01:00.0 Ethernet controller: Realtek Semiconductor Co., Ltd. RTL8111/8168/8411 PCI
Express Gigabit Ethernet Controller (rev 06)
```

Use the ifconfig command to view the network device name and IP address corresponding to the mini PCIE to Gigabit network card

```
root@orangepi4-lts:~# ifconfig
enp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>   mtu 1500
        inet 192.168.1.63   netmask 255.255.255.0   broadcast 192.168.1.255
        inet6 fe80::bafe:2ff8:1a59:c3eb   prefixlen 64   scopeid 0x20<link>
        ether 00:e0:4c:68:0c:3c   txqueuelen 1000   (Ethernet)
        RX packets 98   bytes 7680 (7.5 KiB)
        RX errors 0   dropped 0   overruns 0   frame 0
        TX packets 31   bytes 3066 (2.9 KiB)
        TX errors 0   dropped 0 overruns 0   carrier 0   collisions 0
```

7) The command to test network connectivity is as follows

```
root@orangepi4-lts:~# ping www.baidu.com -I enp1s0
PING www.a.shifen.com (14.215.177.38) from 192.168.1.63 enp1s0: 56(84) bytes of
data.
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=1 ttl=56 time=8.49 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=2 ttl=56 time=8.81 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=3 ttl=56 time=7.99 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=56 time=8.87 ms
^C
--- www.a.shifen.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 8ms
rtt min/avg/max/mdev = 7.988/8.540/8.874/0.362 ms
```

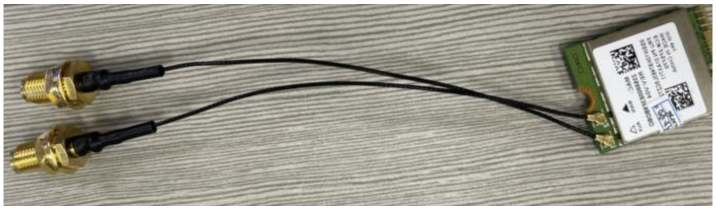
3. 20. 3. Connect the wireless network card through the mini PCIE interface

Note that only Linux4.4 Debian10 system supports this function

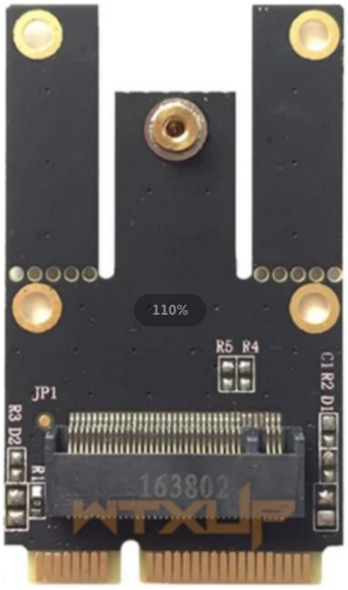
1) First prepare the required accessories

   a. Realtek RTL8822BE wireless network card, the size is 2230, the interface specification is NGFF M2

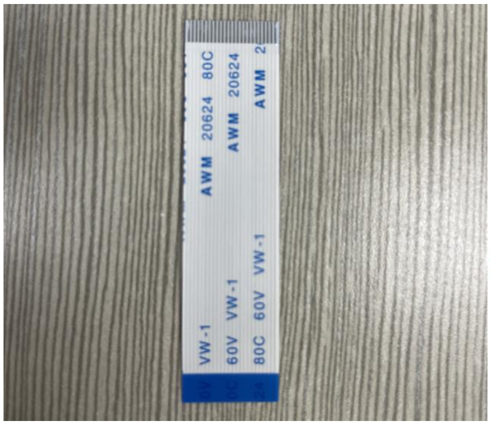
   b. Supporting antenna, IPX4 interface, there are two kinds of built-in and external, the picture below shows the external antenna

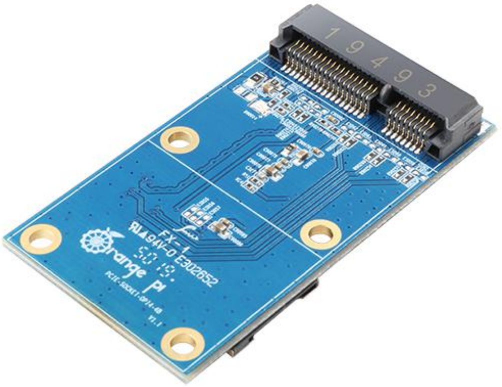


   c. NGFF to mini PCIE adapter card



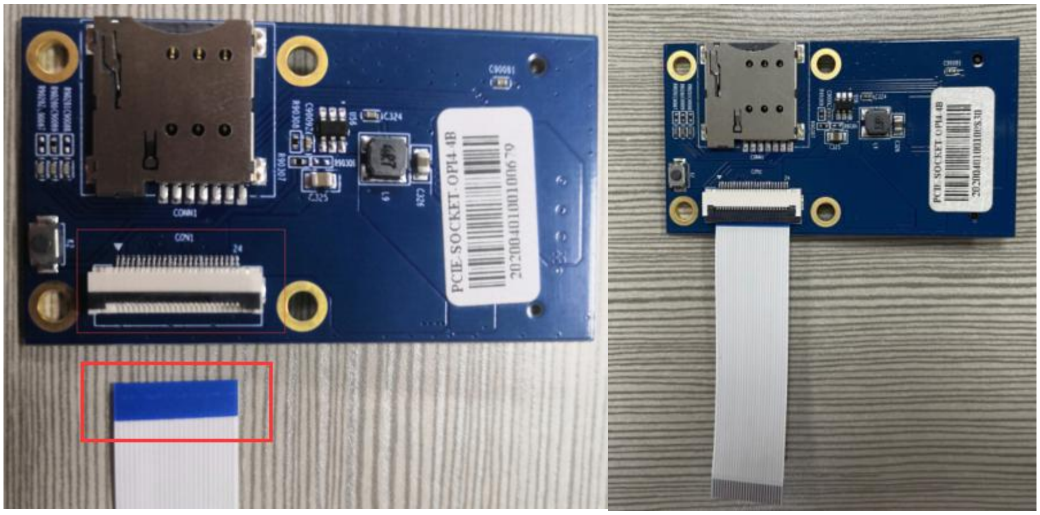
d. 24pin reverse cable and mini PCIE adapter board



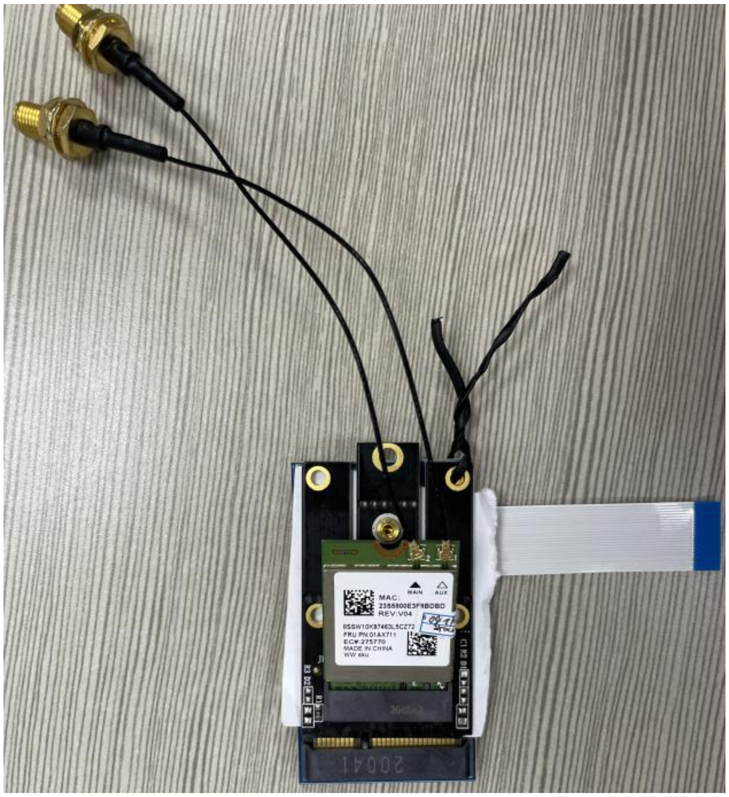


2) Connect the RTL8822BE wireless network card to the NGFF to mini PCIE adapter card as shown below

3) Then connect the 24pin reverse row wiring to the mini PCIE adapter board as shown below

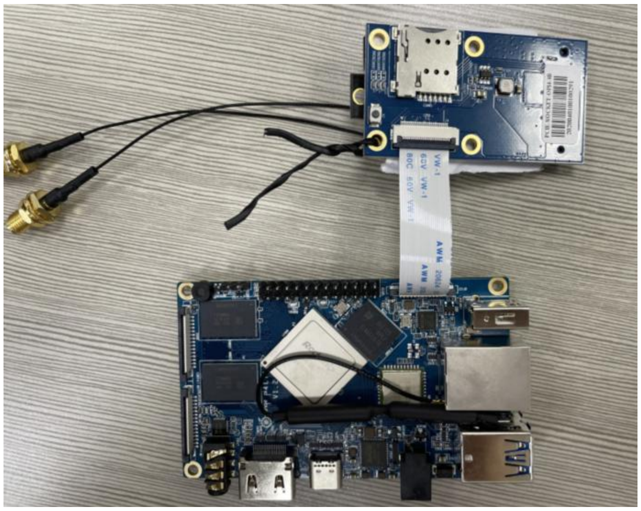


4) Then connect the NGFF to mini PCIE adapter card to the mini PCIE adapter board



Put a piece of insulating white paper between the wireless network card module and the mini PCIE adapter board to avoid short circuit caused by direct contact between the wireless network card module and the mini PCIE adapter board, and can be fixed with a rope after connection.

8) Finally, connect the mini PCIE adapter board to the Orange Pi 4 LTS development board through the 24pin reverse cable



9) Power on the Orange Pi 4 LTS development board. After the system starts, enter the lspci command in the command line terminal. If there is the following output information, it means that the RTL8822BE wireless network card is recognized

```
root@orangepi4-lts:~# lspci
00:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd RK3399 PCI Express Root Port
01:00.0 Unassigned class [ff00]: Realtek Semiconductor Co., Ltd. RTL8822BE 802.11a/b/g/n/ac WiFi adapter
```

Use the ifconfig command to view the network device name corresponding to the RTL8822BE wireless network card

```
root@orangepi4-lts:~# ifconfig wlp1s0
wlp1s0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 5a:00:e3:f9:bd:bd  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 18  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

10) In this case, you can connect WIFI according to the WIFI connection test

3. 20. 4. Connect SSD through mini PCIE interface

1) First prepare the required accessories

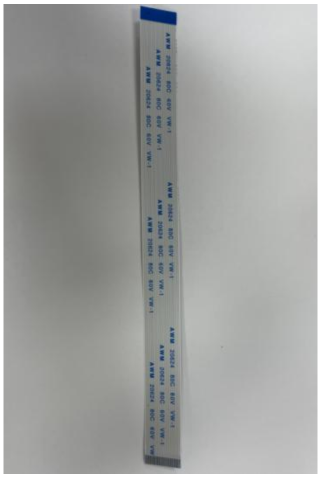
a. Kingston SSD, the size is 2280, the interface specification is NGFF M2, and the protocol is NvMe

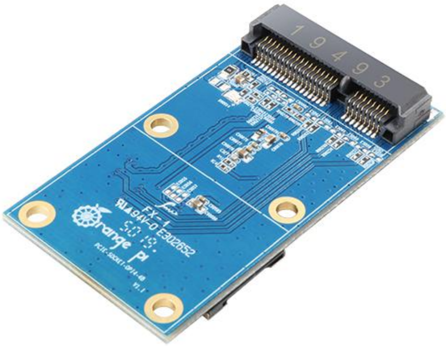
When purchasing, be sure to choose an M.2 NGFF SSD that supports the NVMe protocol. The corresponding M.2 interface is of the M key type. SSDs that meet this requirement should be able to support it. If it is an M.2 NGFF SSD of the SATA protocol, it is not supported. Yes, you can check this link for information on the M.2 interface

https://www.delock.de/infothek/M.2/M.2_e.html

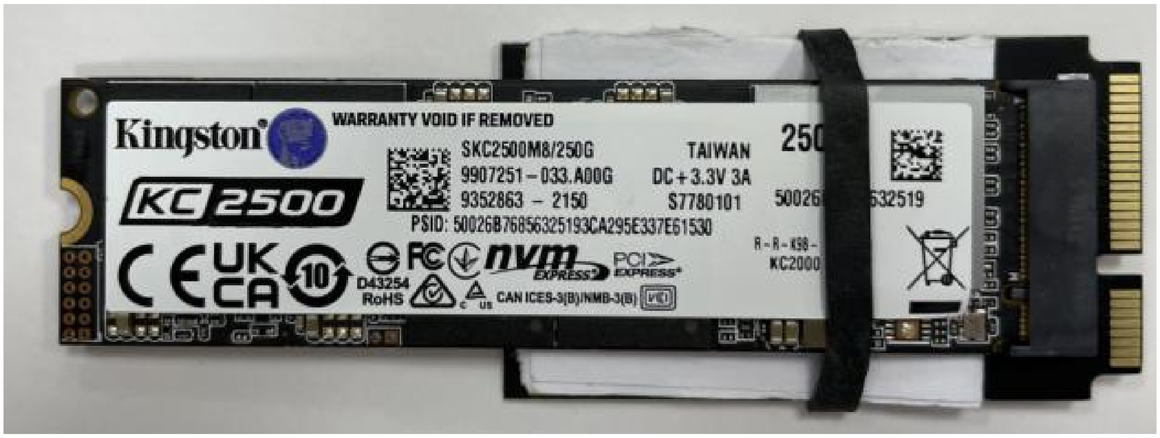
b. mini PCIE to NVMe M.2 NGFF riser card

e. 24pin reverse cable and mini PCIE adapter board

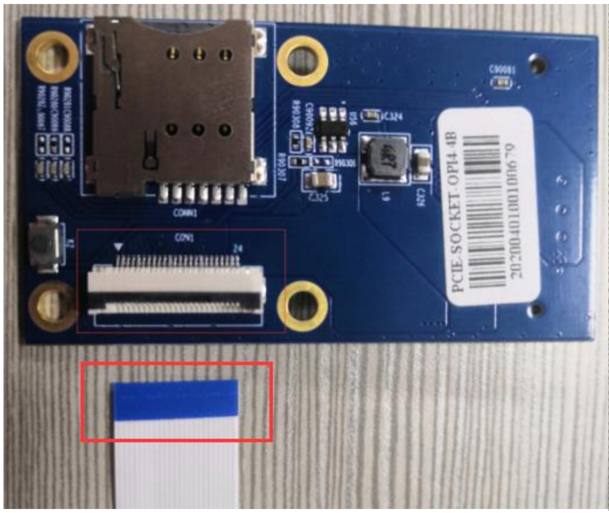


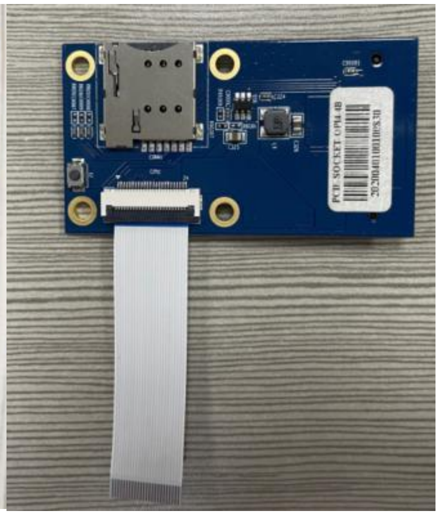


2) Then connect the SSD to the mini PCIE to NVMe M.2 NGFF riser card as shown in the figure below, put a piece of insulating white paper in the middle to avoid short circuit caused by direct contact between the SSD and the riser card, and fix it with a rubber band

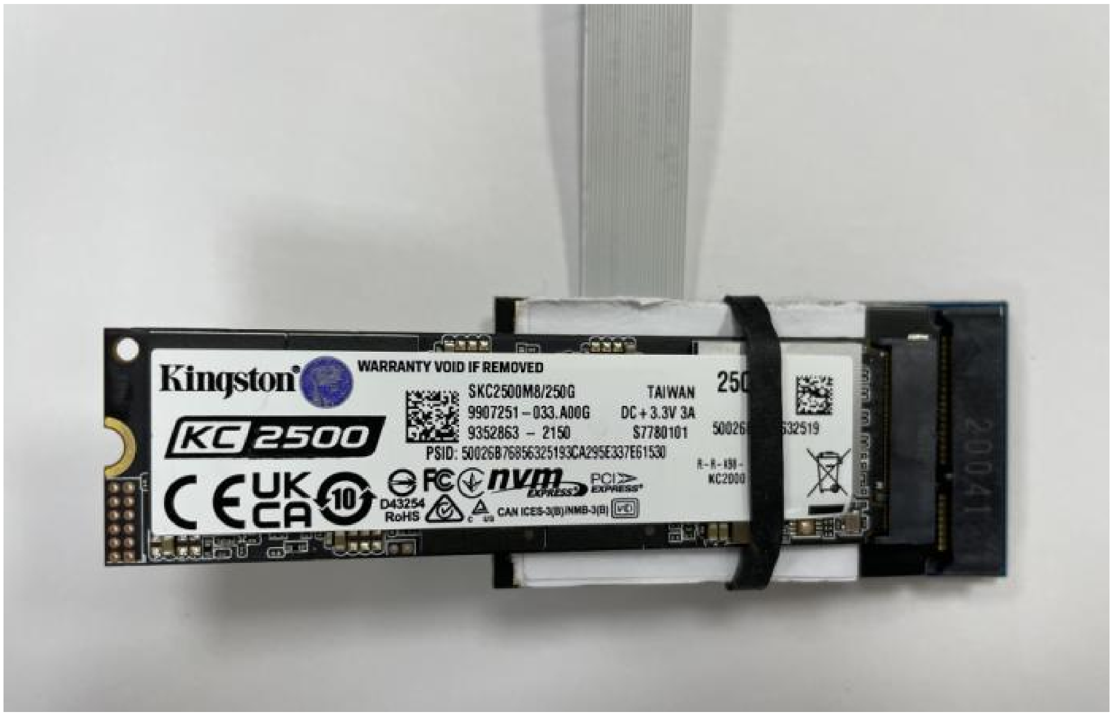


3) Then connect the 24pin reverse cable to the mini PCIE adapter board as shown below

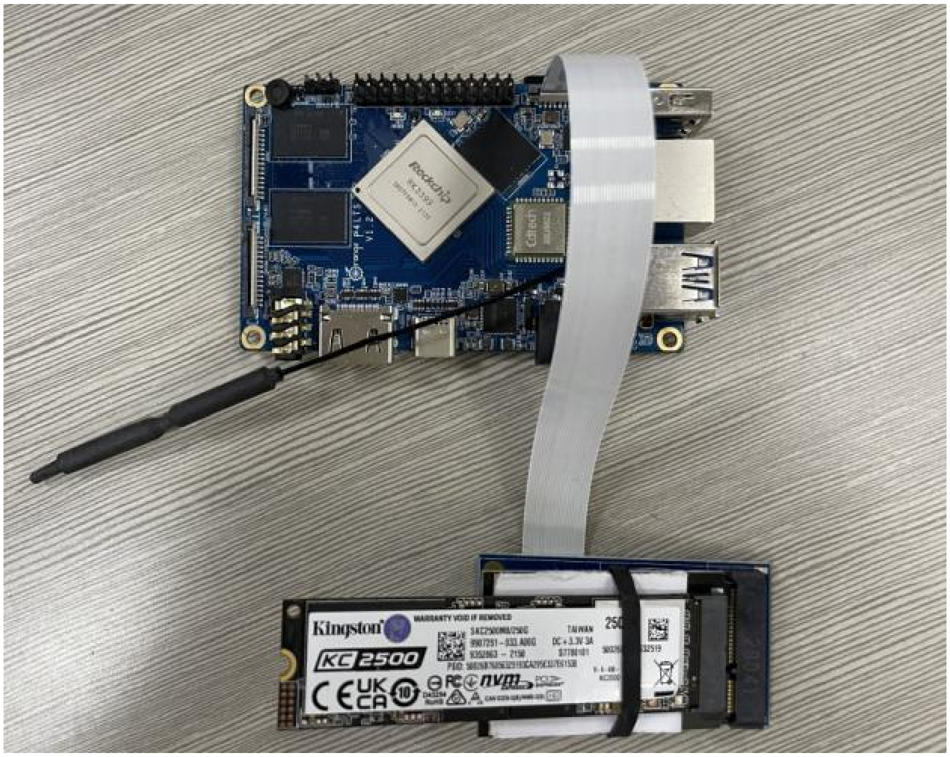




4) Then connect the mini PCIE to NVMe M.2 NGFF adapter card to the mini PCIE adapter board



5) Then connect the mini PCIE adapter board to the Orange Pi 4 LTS development board through a 24pin reverse cable



6) Power on the Orange Pi 4 LTS development board. After the system starts, enter the lspci command in the command line terminal. If the following output information is displayed, it means that the **Kingston SSD** has been recognized

```
root@orangepi4-lts:~# lspci
00:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd RK3399 PCI Express Root Port
01:00.0 Non-Volatile memory controller: Kingston Technology Company, Inc. Device 2262 (rev 03)
```

And the nvme device can also be seen in the output information of the dmesg command

```
root@orangepi4-lts:~# dmesg |grep nvme
[    2.922491] nvme nvme0: pci function 0000:01:00.0
[    2.922563] nvme 0000:01:00.0: enabling device (0000 -> 0002)
[    2.937629] nvme nvme0: missing or invalid SUBNQN field.
[    2.944972] nvme nvme0: 6/0/0 default/read/poll queues
```

Device node with Kingston SSD under /dev/

```
root@orangepi4-lts:~# ls /dev/nvme0*
```

```
/dev/nvme0    /dev/nvme0n1
```

7) Test the read and write rate of SSD

a. First format the SSD as ext4 format

```
root@orangepi4-lts:~# mkfs.ext4 /dev/nvme0n1
mke2fs 1.46.2 (28-Feb-2021)
/dev/nvme0n1 contains a ext4 file system
        created on Mon Mar 21 07:34:41 2022
Proceed anyway? (y,N) y
Discarding device blocks: done
Creating filesystem with 61049646 4k blocks and 15269888 inodes
Filesystem UUID: ef089041-afa0-4ec6-acba-d32282952f80
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Allocating group tables: done
Writing inode tables: done
Creating journal (262144 blocks): done
Writing superblocks and filesystem accounting information: done
```

b. Then mount the SSD to the /mnt directory

```
root@orangepi4-lts:~# mount /dev/nvme0n1 /mnt/
```

c. Test the write rate of 4k data blocks

```
root@orangepi4-lts:~# dd if=/dev/zero of=/mnt/test bs=4k count=1024k
1048576+0 records in
1048576+0 records out
4294967296 bytes (4.3 GB, 4.0 GiB) copied, 19.9681 s, 215 MB/s
```

d. Test the read rate of 4k data blocks

```
root@orangepi4-lts:~# dd if=/mnt/test of=/dev/null bs=4k
1048576+0 records in
1048576+0 records out
4294967296 bytes (4.3 GB, 4.0 GiB) copied, 20.4867 s, 210 MB/s
```

3. 21. GPU test method

Note that only Debian10 and Debian11 desktop systems support this feature,

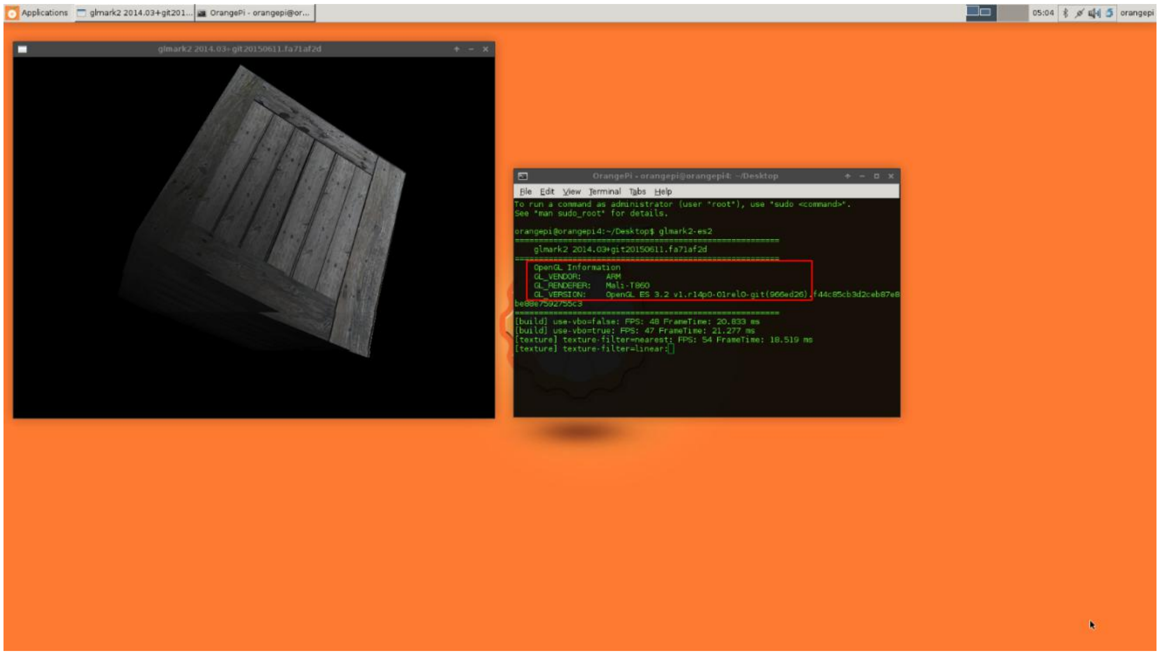
and Ubuntu20.04 does not currently support this feature

1) the GPU driver has been adapted to Debian10 and Debian11. Glmark2-es2 can be used for testing. **Glmark2-es2 is preinstalled on Debian10 and Debian11 by default**

2) Run glmark2-es2 in the terminal of the Ubuntu desktop

```
root@orangepi4-lts:~# glmark2-es2
```

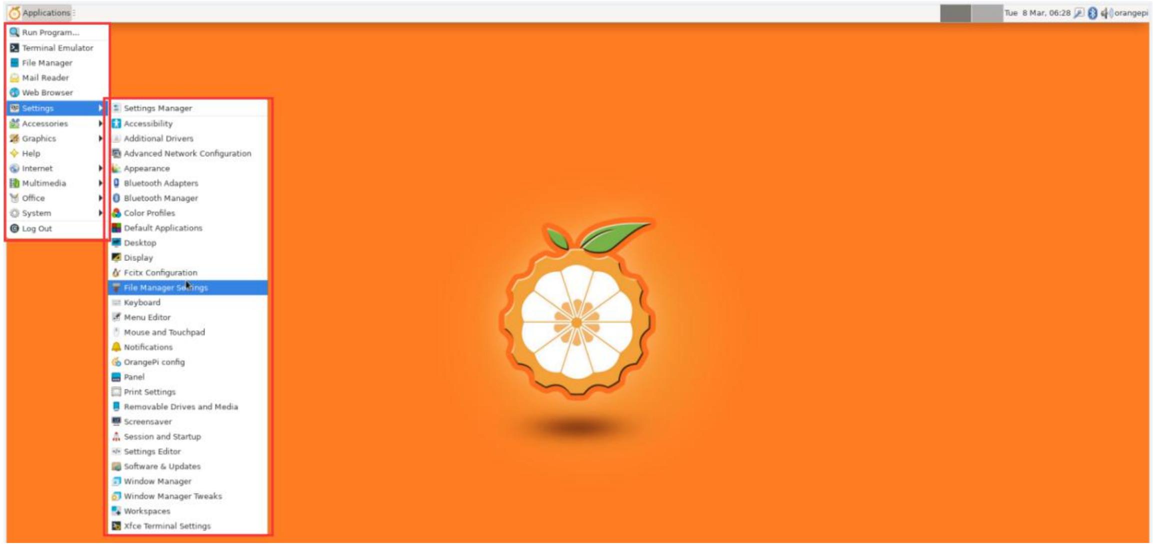
3) The effect of running glmark2-es2 is shown in the figure below. From the output log, you can see that the GPU used is Mali-T860



Applications
glmark2 2014.03+git201...
OrangePi - orangepi@or...
05:04
orangepi
glmark2 2014.03+git20150611.fa71af2d
OrangePi - orangepi@orangepi4: ~/Desktop
File Edit View Terminal Tabs Help

```
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

orangepi@orangepi4:~/Desktop$ glmark2-es2
=======================================================
    glmark2 2014.03+git20150611.fa71af2d
=======================================================
    OpenGL Information
    GL_VENDOR:     ARM
    GL_RENDERER:   Mali-T860
    GL_VERSION:    OpenGL ES 3.2 v1.r14p0-01rel0-git(966ed26).f44c85cb3d2ceb87e8
be88e7592755c3
=======================================================
[build] use-vbo=false: FPS: 48 FrameTime: 20.833 ms
[build] use-vbo=true: FPS: 47 FrameTime: 21.277 ms
[texture] texture-filter=nearest: FPS: 54 FrameTime: 18.519 ms
[texture] texture-filter=linear:
```

4) After Debian11 turns on GPU hardware acceleration, as shown in the figure below, when dragging with the mouse in the application list in the upper left corner, the speed will be slower than when GPU hardware acceleration is not turned on. This is a known issue



5) If you do not need GPU hardware acceleration, you can modify the following configuration file to turn off GPU hardware acceleration (after turning off GPU and VPU, both GPU and VPU cannot be used, including MPV hardware decoding and Chromium hardware acceleration), and then restart the system, it will not work I have the above carton problem.

```
root@orangepi4-lts:~# cat /etc/X11/xorg.conf.d/02-modesetting.conf
Section "Device"
        Identifier    "Rockchip Graphics"
        Driver            "modesetting"

### Use Rockchip RGA 2D HW accel
#        Option            "AccelMethod"        "exa"

### Use GPU HW accel
        Option              "AccelMethod"           "none"     #Set to none to turn off GPU
                                                                acceleration
```

3. 22. MPV hardware decoding test

1) The desktop version system has integrated MPV player, the player can call the rkmpp

decoding plug-in, the currently tested and supported decoding formats are H264, H265, VP9

2) The test video file can be downloaded by opening the link below

a. The video download link in H264 format is

```
https://test-videos.co.uk/vids/jellyfish/mp4/h264/1080/Jellyfish_1080_10s_30MB.mp4
http://bbb3d.renderfarming.net/download.html
```

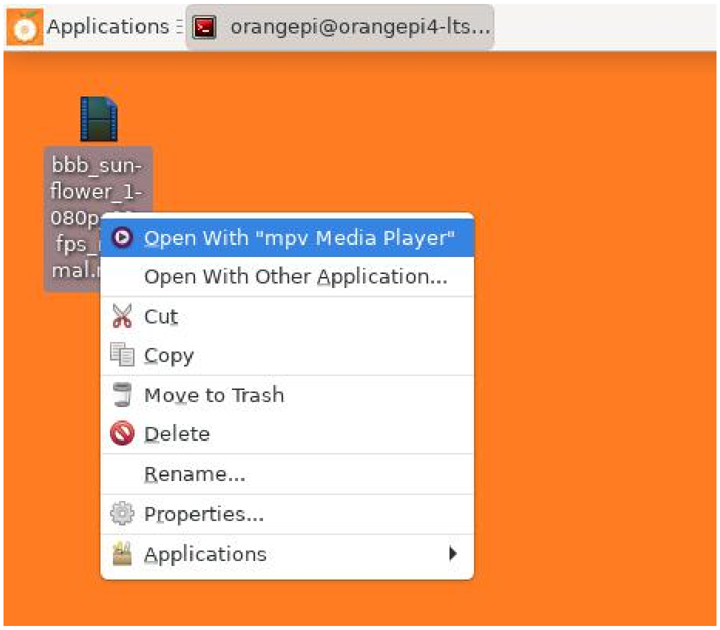
b. The video download link in H265 format is

```
https://test-videos.co.uk/vids/jellyfish/mp4/h265/1080/Jellyfish_1080_10s_30MB.mp4
```

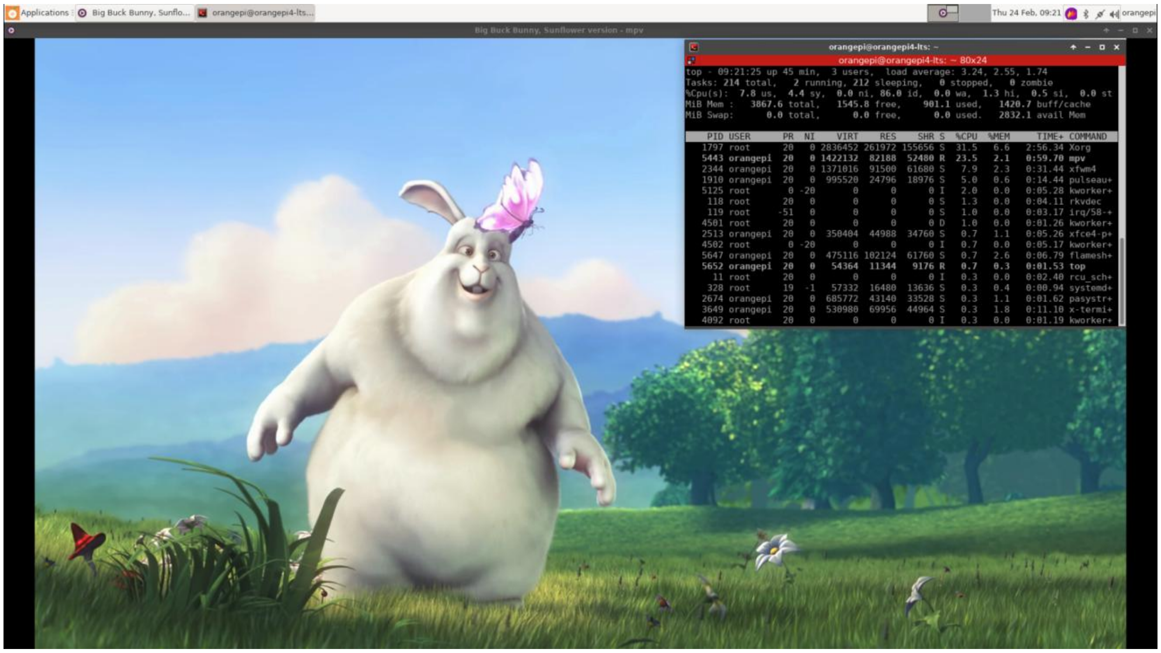
c. The video download link in VP9 format is

```
https://test-videos.co.uk/vids/jellyfish/webm/vp9/1080/Jellyfish_1080_10s_30MB.webm
```

3) Copy the video file to the desktop, right click and open it with MPV player



4) The video will start to play, then open the terminal and enter the top command, you can see the CPU usage


Applications
Big Buck Bunny, Sunflo...
orangepi@orangepi4-lts...
Thu 24 Feb, 09:21
orangepi
Big Buck Bunny, Sunflower version - mpv
orangepi@orangepi4-lts: ~
orangepi@orangepi4-lts: ~ 80x24

```
top - 09:21:25 up 45 min,  3 users,  load average: 3.24, 2.55, 1.74
Tasks: 214 total,   2 running, 212 sleeping,   0 stopped,   0 zombie
%Cpu(s):  7.8 us,  4.4 sy,  0.0 ni, 86.0 id,  0.0 wa,  1.3 hi,  0.5 si,  0.0 st
MiB Mem :   3867.6 total,   1545.8 free,    901.1 used,   1420.7 buff/cache
MiB Swap:      0.0 total,      0.0 free,      0.0 used.   2832.1 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1797 root      20   0 2836452 261972 155656 S  31.5   6.6   2:56.34 Xorg
 5443 orangepi  20   0 1422132  82188  52480 R  23.5   2.1   0:59.70 mpv
 2344 orangepi  20   0 1371016  91500  61680 S   7.9   2.3   0:31.44 xfwm4
 1910 orangepi  20   0  995520  24796  18976 S   5.0   0.6   0:14.44 pulseau+
 5125 root       0 -20       0      0      0 I   2.0   0.0   0:05.28 kworker+
  118 root      20   0       0      0      0 S   1.3   0.0   0:04.11 rkvdec
  119 root     -51   0       0      0      0 S   1.0   0.0   0:03.17 irq/58-+
 4501 root      20   0       0      0      0 D   1.0   0.0   0:01.26 kworker+
 2513 orangepi  20   0  350404  44988  34760 S   0.7   1.1   0:05.26 xfce4-p+
 4502 root       0 -20       0      0      0 I   0.7   0.0   0:05.17 kworker+
 5647 orangepi  20   0  475116 102124  61760 S   0.7   2.6   0:06.79 flamesh+
 5652 orangepi  20   0   54364  11344   9176 R   0.7   0.3   0:01.53 top
   11 root      20   0       0      0      0 I   0.3   0.0   0:02.40 rcu_sch+
  328 root      19  -1   57332  16480  13636 S   0.3   0.4   0:00.94 systemd+
 2674 orangepi  20   0  685772  43140  33528 S   0.3   1.1   0:01.62 pasystr+
 3649 orangepi  20   0  530980  69956  44964 S   0.3   1.8   0:11.10 x-termi+
 4092 root      20   0       0      0      0 I   0.3   0.0   0:01.19 kworker+
```

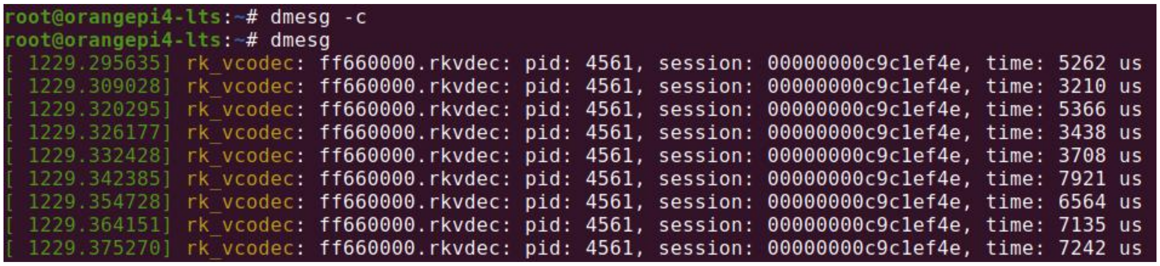
5) Then enter the following command in the terminal to turn on the debugging switch of the VPU driver, and you can see the output information of the VPU driver

a. The command for Linux4.4 is as follows

```
root@orangepi4-lts:~# echo 0x100 >   \
 /sys/module/rk_vcodec/parameters/debug
```

b. The command for Linux5.10 is as follows

```
root@orangepi4-lts:~# echo 0x100 >   \
 /sys/module/rk_vcodec/parameters/mpp_dev_debug
```



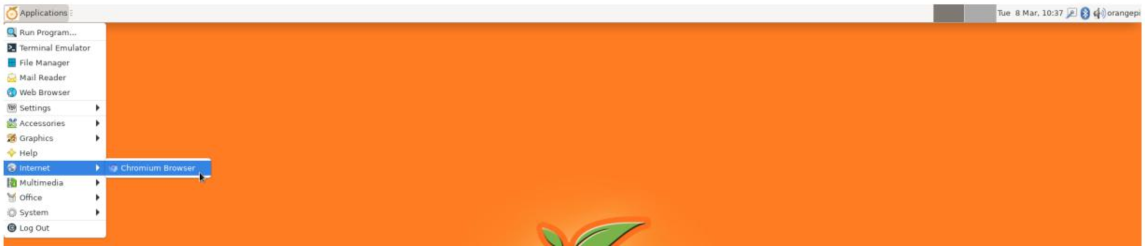
```
root@orangepi4-lts:~# dmesg -c
root@orangepi4-lts:~# dmesg
[ 1229.295635] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 5262 us
[ 1229.309028] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3210 us
[ 1229.320295] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 5366 us
[ 1229.326177] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3438 us
[ 1229.332428] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3708 us
[ 1229.342385] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7921 us
[ 1229.354728] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 6564 us
[ 1229.364151] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7135 us
[ 1229.375270] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7242 us
```

6) Use the left and right arrow keys to control the video playback progress

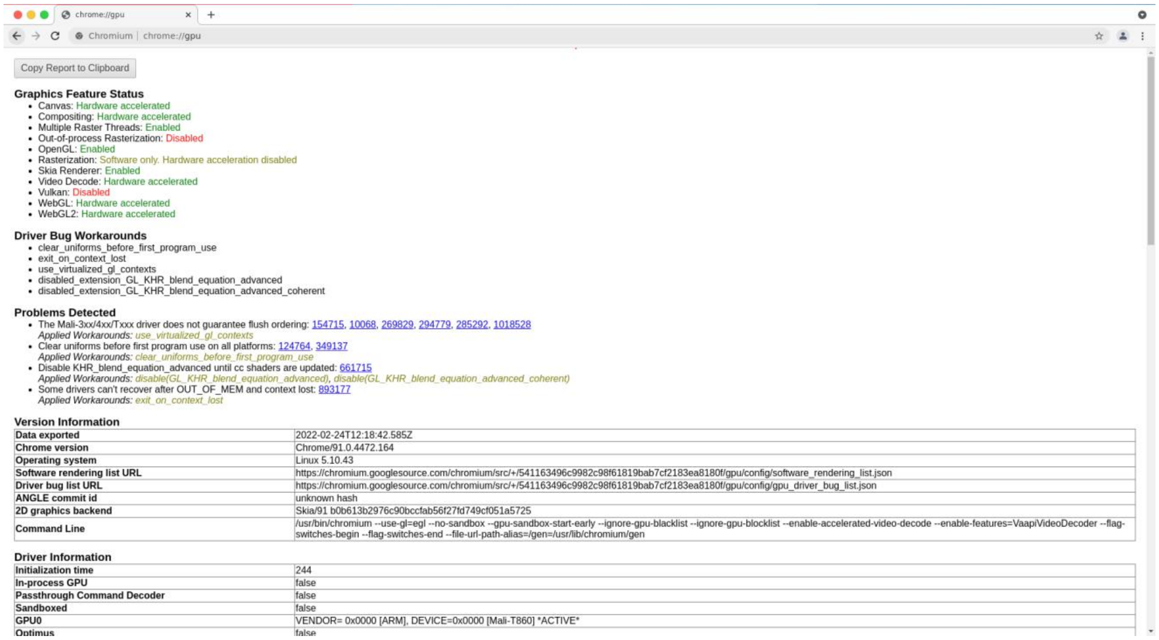
3. 23. Chromium hardware acceleration test

Note that the Ubuntu system does not support this function. Currently, the Debian11 desktop version system supports WebGL hardware acceleration and video decoding hardware acceleration. Debian10 only supports WebGL hardware acceleration, not video decoding hardware acceleration. This needs to be noted.

1) First open the chromium browser,



2) Then enter chrome://gpu in the address bar to view the hardware acceleration



Graphics Feature Status

- Canvas: Hardware accelerated
- Compositing: Hardware accelerated
- Multiple Raster Threads: Enabled
- Out-of-process Rasterization: Disabled
- OpenGL: Enabled
- Rasterization: Software only. Hardware acceleration disabled
- Skia Renderer: Enabled
- Video Decode: Hardware accelerated
- Vulkan: Disabled
- WebGL: Hardware accelerated
- WebGL2: Hardware accelerated

Driver Bug Workarounds

- clear_uniforms_before_first_program_use
- exit_on_context_lost
- use_virtualized_gl_contexts
- disabled_extension_GL_KHR_blend_equation_advanced
- disabled_extension_GL_KHR_blend_equation_advanced_coherent

Problems Detected

- The Mali-3xx/4xx/Txxx driver does not guarantee flush ordering: 154715, 10068, 269829, 294779, 285292, 1018528
  Applied Workarounds: use_virtualized_gl_contexts
- Clear uniforms before first program use on all platforms: 124764, 349137
  Applied Workarounds: clear_uniforms_before_first_program_use
- Disable KHR_blend_equation_advanced until cc shaders are updated: 661715
  Applied Workarounds: disable(GL_KHR_blend_equation_advanced), disable(GL_KHR_blend_equation_advanced_coherent)
- Some drivers can't recover after OUT_OF_MEM and context lost: 893177
  Applied Workarounds: exit_on_context_lost

Version Information

Data exported	2022-02-24T12:18:42.585Z
Chrome version	Chrome/91.0.4472.164
Operating system	Linux 5.10.43
Software rendering list URL	https://chromium.googlesource.com/chromium/src/+/541163496c9982c98f61819bab7cf2183ea8180f/gpu/config/software_rendering_list.json
Driver bug list URL	https://chromium.googlesource.com/chromium/src/+/541163496c9982c98f61819bab7cf2183ea8180f/gpu/config/gpu_driver_bug_list.json
ANGLE commit id	unknown hash
2D graphics backend	Skia/91 b0b613b2976c90bccfab56f27fd749cf051a5725
Command Line	/usr/bin/chromium --use-gl=egl --no-sandbox --gpu-sandbox-start-early --ignore-gpu-blacklist --ignore-gpu-blocklist --enable-accelerated-video-decode --enable-features=VaapiVideoDecoder --flag-switches-begin --flag-switches-end --file-url-path-alias=/gen=/usr/lib/chromium/gen

Driver Information

Initialization time	244
In-process GPU	false
Passthrough Command Decoder	false
Sandboxed	false
GPU0	VENDOR= 0x0000 [ARM], DEVICE=0x0000 [Mali-T860] *ACTIVE*
Optimus	false

3) Use chromium to play local video or play video online

4) Then enter the following command in the terminal to turn on the debugging switch of

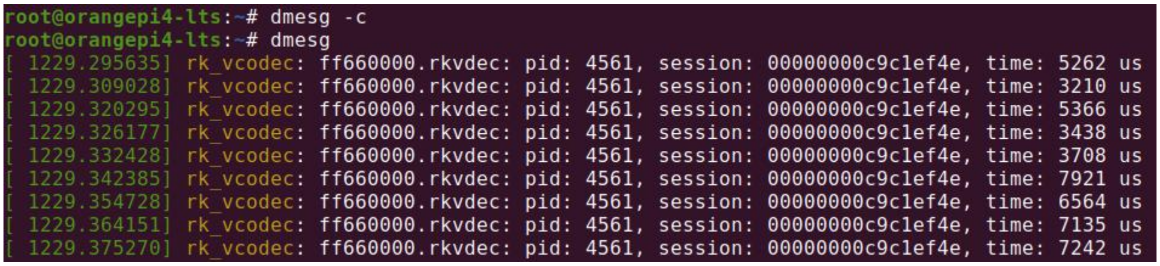
the VPU driver, and you can see the printout of the VPU driver

a. The command for Linux4.4 is as follows

```
root@orangepi4-lts:~# echo 0x100 >   \
 /sys/module/rk_vcodec/parameters/debug
```

b. The command for Linux5.10 is as follows

```
root@orangepi4-lts:~# echo 0x100 >   \
 /sys/module/rk_vcodec/parameters/mpp_dev_debug
```



```
root@orangepi4-lts:~# dmesg -c
root@orangepi4-lts:~# dmesg
[ 1229.295635] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 5262 us
[ 1229.309028] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3210 us
[ 1229.320295] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 5366 us
[ 1229.326177] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3438 us
[ 1229.332428] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 3708 us
[ 1229.342385] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7921 us
[ 1229.354728] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 6564 us
[ 1229.364151] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7135 us
[ 1229.375270] rk_vcodec: ff660000.rkvdec: pid: 4561, session: 00000000c9c1ef4e, time: 7242 us
```

3. 24. How to install Docker

1) First install the following packages

```
root@orangepi:~# apt update
root@orangepi:~# apt install -y apt-transport-https ca-certificates curl   \
software-properties-common
```

2) Add the key of Alibaba Cloud docker

a. Ubuntu OS

```
root@orangepi:~# curl -fsSL http://mirrors.aliyun.com/docker-ce/linux/ubuntu/gpg \
  | sudo apt-key add   -
```

b. Debian OS

```
root@orangepi:~# curl -fsSL http://mirrors.aliyun.com/docker-ce/linux/debian/gpg \
  | sudo apt-key add   -
```

3) Add the corresponding docker source to the system source

a. Ubuntu OS

```
root@orangepi:~# add-apt-repository "deb [arch=arm64]   \
 https://mirrors.aliyun.com/docker-ce/linux/ubuntu $(lsb_release -cs) stable"
```

b. Debian OS

```
 root@orangepi:~# add-apt-repository "deb [arch=arm64]   \
https://mirrors.aliyun.com/docker-ce/linux/debian $(lsb_release -cs) stable"
```

4) Install the latest version of docker-ce

```
root@orangepi:~# apt update
root@orangepi:~# apt install -y docker-ce
```

5) Verify the status of docker

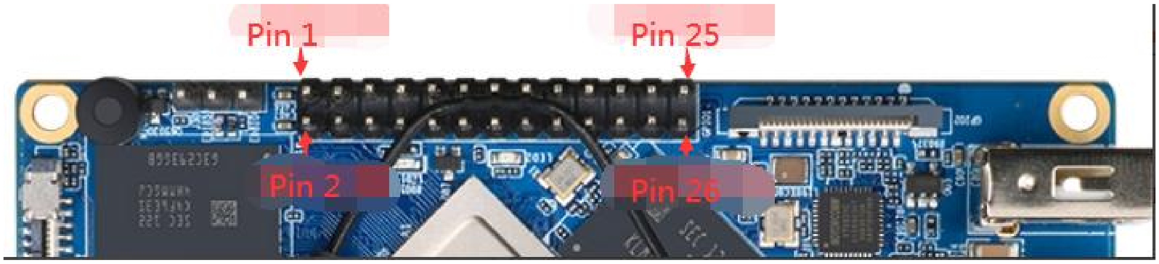
```
root@orangepi:~# systemctl status docker
● docker.service - Docker Application Container Engine
     Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
     Active: active (running) since Mon 2020-08-24 10:29:22 UTC; 26min ago
        Docs: https://docs.docker.com
  Main PID: 3145 (dockerd)
       Tasks: 15
     CGroup: /system.slice/docker.service
                   └─3145 /usr/bin/dockerd -H fd://
--containerd=/run/containerd/containerd.sock
```

6) Test docker

```
root@orangepi:~# docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
256ab8fe8778: Pull complete
Digest:
sha256:7f0a9f93b4aa3022c3a4c147a449ef11e0941a1fd0bf4a8e6c9408b2600777c5
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.
```

3. 25. 26pin interface pin description

1) Please refer to the figure below for the order of the 26 pin interface pins of the Orange Pi 4 LTS development board



2) The functions of the 40 pin interface pins of the Orange Pi 4 LTS development board are shown in the table below

GPIO	GPIO	Function	Pin
		3.3V	1
52	GPIO1_C4	I2C8_SDA	3
53	GPIO1_C5	I2C8_SCL	5
150	GPIO4_C6	PWM1	7
		GND	9
33	GPIO1_A1	GPIO1_A1	11
35	GPIO1_A3	GPIO1_A3	13
92	GPIO2_D4	GPIO2_D4	15
		3.3V	17
40	GPIO1_B0	SPI1_TXD	19
39	GPIO1_A7	SPI1_RXD	21
41	GPIO1_B1	SPI1_CLK	23
		GND	25

Pin	Function	GPIO	GPIO
2	5V		
4	5V		
6	GND		
8	I2C3_SCL	GPIO4_C1	145
10	I2C3_SDA	GPIO4_C0	144
12	GPIO1_C2	GPIO1_C2	50
14	GND		
16	GPIO1_C6	GPIO1_C6	54
18	GPIO1_C7	GPIO1_C7	55
20	GND		
22	GPIO1_D0	GPIO1_D0	56
24	SPI1_CS	GPIO1_B2	42
26	GPIO4_C5	GPIO4_C5	149

3. 26. How to install wiringOP

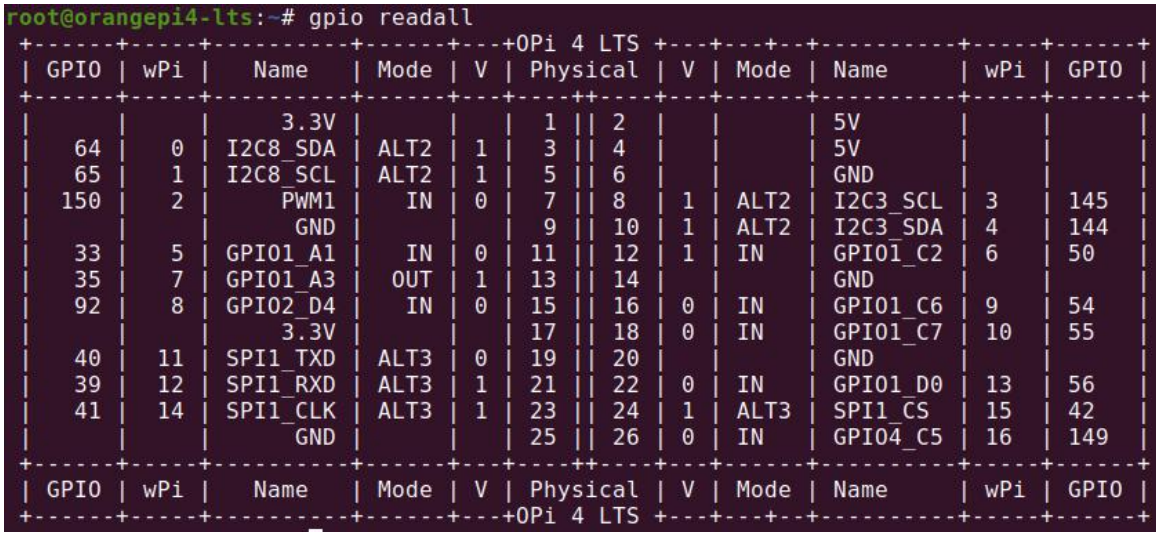
1) Download the code of wiringOP

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt -y install git
root@orangepi4-lts:~# git clone https://github.com/orangepi-xunlong/wiringOP
```

2) Compile wiringOP

```
root@orangepi4-lts:~# cd wiringOP
root@orangepi4-lts:~/wiringOP# ./build clean
root@orangepi4-lts:~/wiringOP# ./build
```

3) The output of the test gpio readall command is as follows, in which the physical pins 1 to 26 are in one-to-one correspondence with the 26Pin pins on the development board



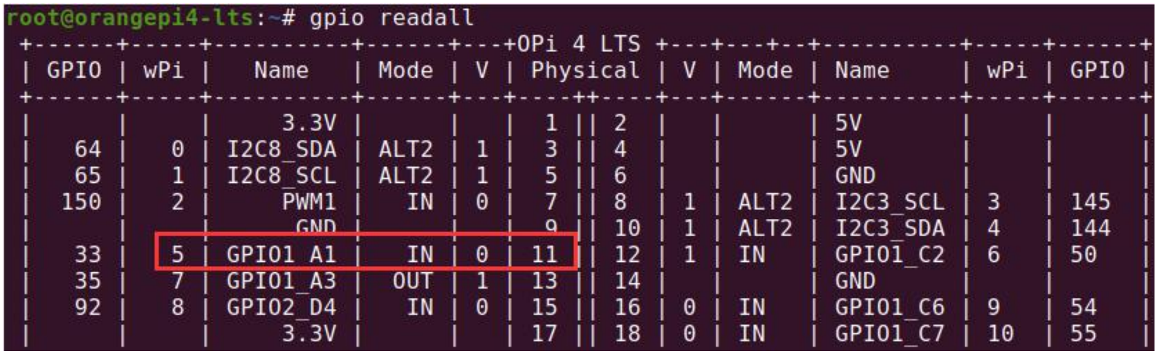
```
root@orangepi4-lts:~# gpio readall
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   64 |   0 | I2C8_SDA | ALT2 | 1 |  3 || 4  |   |      | 5V       |     |      |
 |   65 |   1 | I2C8_SCL | ALT2 | 1 |  5 || 6  |   |      | GND      |     |      |
 |  150 |   2 |     PWM1 |   IN | 0 |  7 || 8  | 1 | ALT2 | I2C3_SCL | 3   | 145  |
 |      |     |      GND |      |   |  9 || 10 | 1 | ALT2 | I2C3_SDA | 4   | 144  |
 |   33 |   5 | GPIO1_A1 |   IN | 0 | 11 || 12 | 1 | IN   | GPIO1_C2 | 6   | 50   |
 |   35 |   7 | GPIO1_A3 |  OUT | 1 | 13 || 14 |   |      | GND      |     |      |
 |   92 |   8 | GPIO2_D4 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO1_C6 | 9   | 54   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | IN   | GPIO1_C7 | 10  | 55   |
 |   40 |  11 | SPI1_TXD | ALT3 | 0 | 19 || 20 |   |      | GND      |     |      |
 |   39 |  12 | SPI1_RXD | ALT3 | 1 | 21 || 22 | 0 | IN   | GPIO1_D0 | 13  | 56   |
 |   41 |  14 | SPI1_CLK | ALT3 | 1 | 23 || 24 | 1 | ALT3 | SPI1_CS  | 15  | 42   |
 |      |     |      GND |      |   | 25 || 26 | 0 | IN   | GPIO4_C5 | 16  | 149  |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
```

3. 27. 26pin interface GPIO, I2C, UART, SPI, PWM test

wiringOP has been adapted to the Orange Pi 4 LTS development board. Using wiringOP can test the functions of GPIO, I2C, UART, and SPI

3. 27. 1. 26pin GPIO port test

1) The following uses pin No. 11—the corresponding GPIO is GPIO1_A1—the corresponding wPi serial number is 5—as an example to demonstrate how to set the high and low levels of the GPIO port

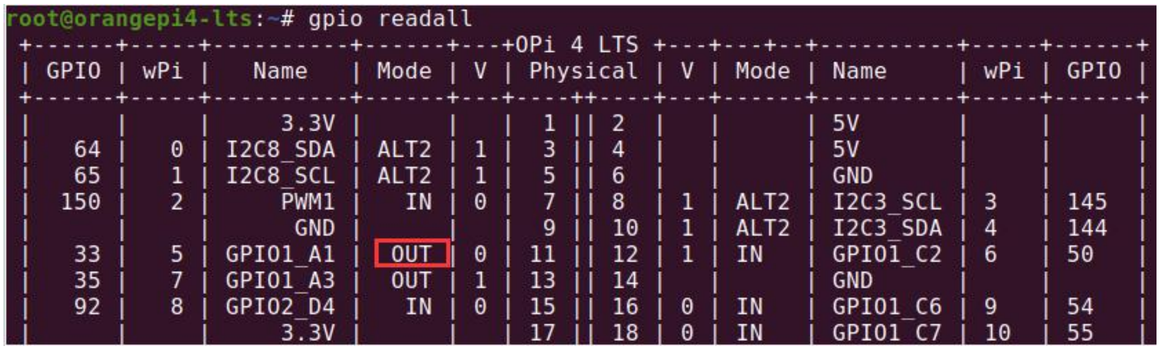


```
root@orangepi4-lts:~# gpio readall
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   64 |   0 | I2C8_SDA | ALT2 | 1 |  3 || 4  |   |      | 5V       |     |      |
 |   65 |   1 | I2C8_SCL | ALT2 | 1 |  5 || 6  |   |      | GND      |     |      |
 |  150 |   2 |     PWM1 |   IN | 0 |  7 || 8  | 1 | ALT2 | I2C3_SCL | 3   | 145  |
 |      |     |      GND |      |   |  9 || 10 | 1 | ALT2 | I2C3_SDA | 4   | 144  |
 |   33 |   5 | GPIO1_A1 |   IN | 0 | 11 || 12 | 1 | IN   | GPIO1_C2 | 6   | 50   |
 |   35 |   7 | GPIO1_A3 |  OUT | 1 | 13 || 14 |   |      | GND      |     |      |
 |   92 |   8 | GPIO2_D4 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO1_C6 | 9   | 54   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | IN   | GPIO1_C7 | 10  | 55   |
```

2) First set the GPIO port as output mode, where the third parameter requires the serial number of the wPi corresponding to the input pin

```
root@orangepi4-lts:~/wiringOP# gpio mode 5 out
```

Use gpio readall to see that the mode of pin 11 has changed to out

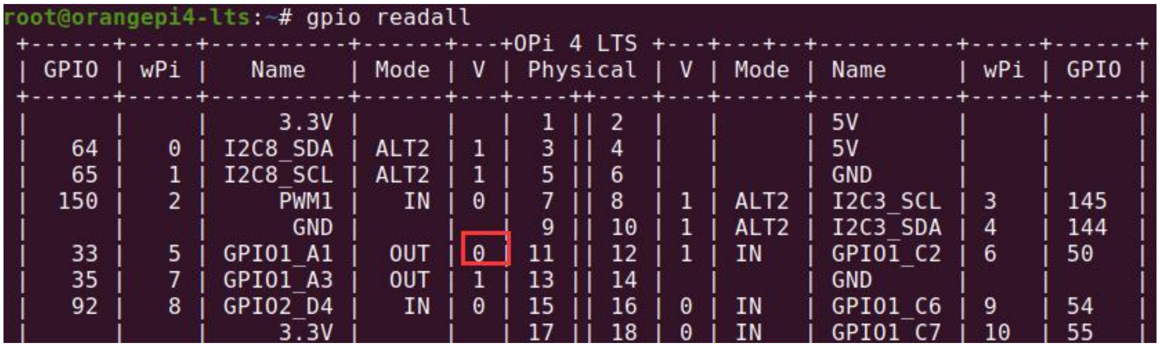


```
root@orangepi4-lts:~# gpio readall
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   64 |   0 | I2C8_SDA | ALT2 | 1 |  3 || 4  |   |      | 5V       |     |      |
 |   65 |   1 | I2C8_SCL | ALT2 | 1 |  5 || 6  |   |      | GND      |     |      |
 |  150 |   2 |     PWM1 |   IN | 0 |  7 || 8  | 1 | ALT2 | I2C3_SCL | 3   | 145  |
 |      |     |      GND |      |   |  9 || 10 | 1 | ALT2 | I2C3_SDA | 4   | 144  |
 |   33 |   5 | GPIO1_A1 |  OUT | 0 | 11 || 12 | 1 | IN   | GPIO1_C2 | 6   | 50   |
 |   35 |   7 | GPIO1_A3 |  OUT | 1 | 13 || 14 |   |      | GND      |     |      |
 |   92 |   8 | GPIO2_D4 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO1_C6 | 9   | 54   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | IN   | GPIO1_C7 | 10  | 55   |
```

3) Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means that the low level is successfully set.

```
root@orangepi4-lts:~/wiringOP# gpio write 5 0
```

Use gpio readall to see that the value of pin 11 (V) has become 0

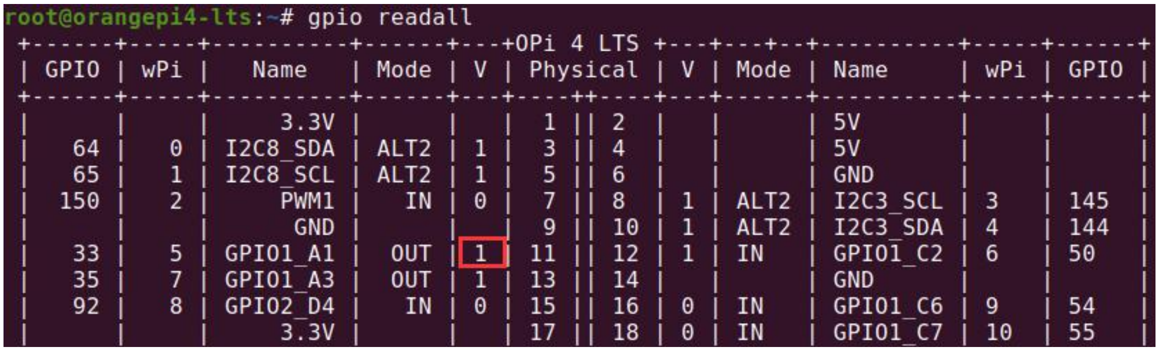


```
root@orangepi4-lts:~# gpio readall
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   64 |   0 | I2C8_SDA | ALT2 | 1 |  3 || 4  |   |      | 5V       |     |      |
 |   65 |   1 | I2C8_SCL | ALT2 | 1 |  5 || 6  |   |      | GND      |     |      |
 |  150 |   2 |     PWM1 |   IN | 0 |  7 || 8  | 1 | ALT2 | I2C3_SCL | 3   | 145  |
 |      |     |      GND |      |   |  9 || 10 | 1 | ALT2 | I2C3_SDA | 4   | 144  |
 |   33 |   5 | GPIO1_A1 |  OUT | 0 | 11 || 12 | 1 | IN   | GPIO1_C2 | 6   | 50   |
 |   35 |   7 | GPIO1_A3 |  OUT | 1 | 13 || 14 |   |      | GND      |     |      |
 |   92 |   8 | GPIO2_D4 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO1_C6 | 9   | 54   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | IN   | GPIO1_C7 | 10  | 55   |
```

4) Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means that the high level is successfully set.

```
root@orangepi4-lts:~/wiringOP# gpio write 5 1
```

Use gpio readall to see that the value (V) of pin 11 has changed to 1

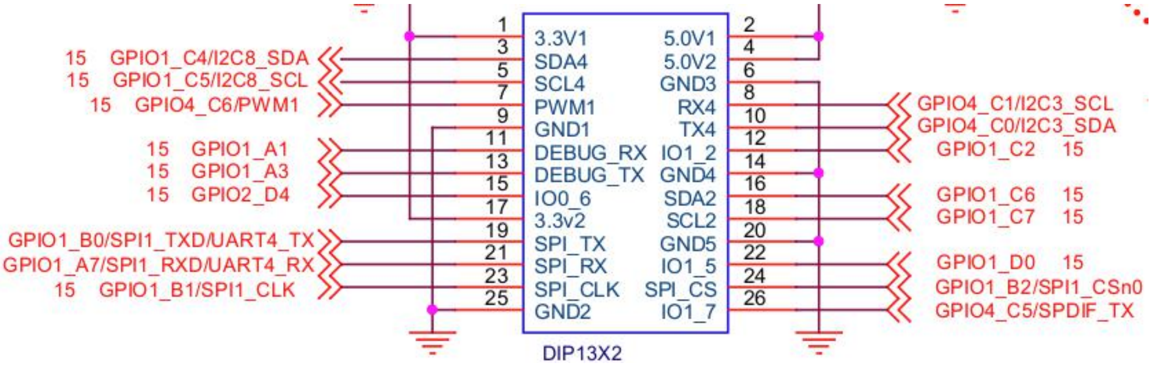


```
root@orangepi4-lts:~# gpio readall
 +------+-----+----------+------+---+OPi 4 LTS +---+---+--+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   64 |   0 | I2C8_SDA | ALT2 | 1 |  3 || 4  |   |      | 5V       |     |      |
 |   65 |   1 | I2C8_SCL | ALT2 | 1 |  5 || 6  |   |      | GND      |     |      |
 |  150 |   2 |     PWM1 |   IN | 0 |  7 || 8  | 1 | ALT2 | I2C3_SCL | 3   | 145  |
 |      |     |      GND |      |   |  9 || 10 | 1 | ALT2 | I2C3_SDA | 4   | 144  |
 |   33 |   5 | GPIO1_A1 |  OUT | 1 | 11 || 12 | 1 | IN   | GPIO1_C2 | 6   | 50   |
 |   35 |   7 | GPIO1_A3 |  OUT | 1 | 13 || 14 |   |      | GND      |     |      |
 |   92 |   8 | GPIO2_D4 |   IN | 0 | 15 || 16 | 0 | IN   | GPIO1_C6 | 9   | 54   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | IN   | GPIO1_C7 | 10  | 55   |
```

5) The setting method of other pins is similar, just modify the serial number of wPi to the corresponding serial number of the pin.

3. 27. 2. 26pin SPI test

1) It can be seen from the schematic diagram of 26pin that the spi available for the development board is spi1



2) First check whether there is a device node of spidev1.x (x may be 0 or 1) in the linux system. If it exists, it means that SPI1 has been set and can be used directly

```
root@orangepi4-lts:~# ls /dev/spi*
/dev/spidev1.0
```

3) Then compile the spidev_test test program in the examples of wiringOP

```
root@orangepi4-lts:~/wiringOP/examples# make spidev_test
[CC] spidev_test.c
[link]
```

4) Do not short the txd and rxd pins of SPI1 first, the output result of running spidev_test is as follows, you can see that the data of TX and RX are inconsistent

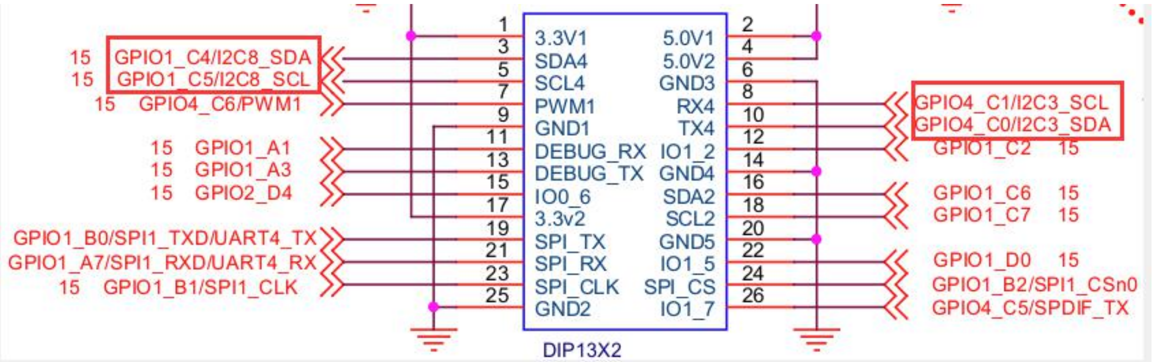
```
root@orangepi4-lts:~/wiringOP/examples# ./spidev_test -v -D /dev/spidev1.0
spi mode: 0x0
bits per word: 8
max speed: 500000 Hz (500 KHz)
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF F0 0D  | ......@...▒.................▒.
RX | FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  | ................................
```

5) Then short-circuit the two pins of SPI1's txd (pin 19 in the 40pin interface) and rxd (pin 21 in the 40pin interface) and then run the output of spidev_test as follows, you can see the sent and received the same data

```
root@orangepi4-lts:~/wiringOP/examples# ./spidev_test -v -D /dev/spidev1.0
spi mode: 0x0
bits per word: 8
max speed: 500000 Hz (500 KHz)
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF F0 0D  | ......@...▒.................▒.
RX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF F0 0D  | ......@...▒.................▒.
```

3. 27. 3. 26pin I2C test

1) It can be seen from the schematic diagram of 26pin that the available i2c for the development board are i2c3 and i2c8



2) After the system starts, you can see the following multiple i2c device nodes under /dev

a. i2c3 in 26pin corresponds to /dev/i2c-3

b. i2c8 in 26pin corresponds to /dev/i2c-8

```
root@orangepi4-lts:~# ls /dev/i2c*
/dev/i2c-0    /dev/i2c-1    /dev/i2c-2    /dev/i2c-3    /dev/i2c-4    /dev/i2c-7    /dev/i2c-8
/dev/i2c-9
```

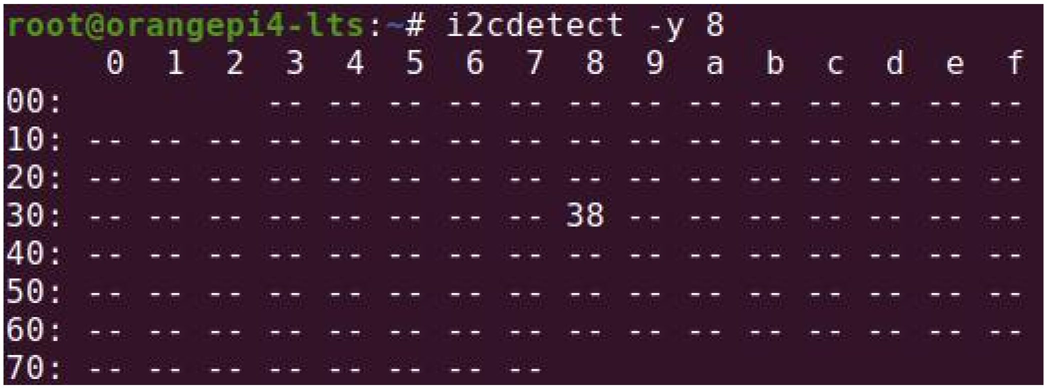
3) Then start testing i2c, first install i2c-tools

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt -y install i2c-tools
```

4) Then connect an i2c device to the i2c8 pin of the 26pin connector (the i2c3 test is the same as the i2c8, just connect the device to the i2c3 pin, the following takes i2c8 as an example)

	i2c8	i2c3
sda pin	Corresponds to pin 3	Corresponds to pin 10
sck pin	Corresponds to pin 5	Corresponds to pin 8
vcc pin	Corresponds to pin 1	Corresponds to pin 1
gnd pin	Corresponds to pin 6	Corresponds to pin 6

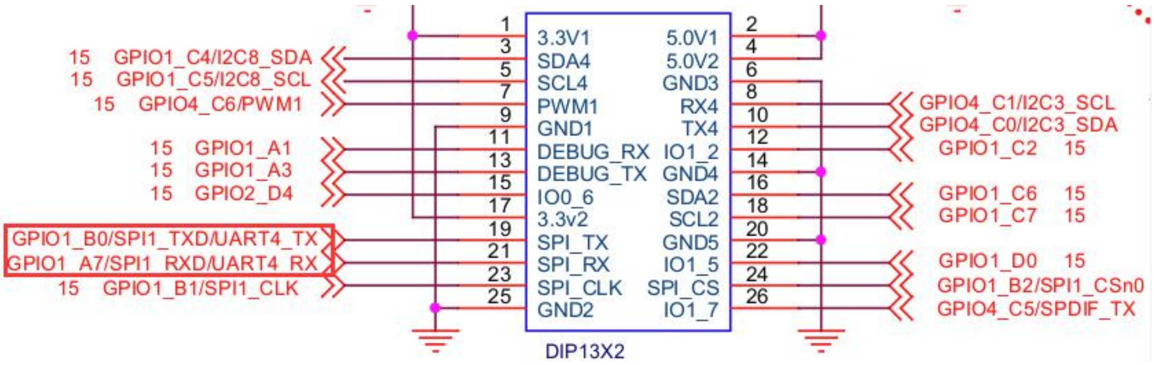
5) Then use the i2cdetect -y 8 command. If the address of the connected i2c device can be detected, it means that the i2c can be used normally



```
root@orangepi4-lts:~# i2cdetect -y 8
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- 38 -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

3. 27. 4. 26pin UART test

1) It can be seen from the schematic diagram of 26pin that the uart available for the development board is uart4



2) The SPI and UART4 of OragnePi 4 LTS multiplex the same pins. In dts, UART4 is turned off and SPI1 is turned on by default. In Linux system, DT overlay can be used to open the configuration of uart4

a. For Linux4.4 system, the method is as follows

a) A script named **orangepi-add-overlay** is pre-installed in the linux system. Through this script, we can use DT overlay to dynamically modify the configuration in dts. First write the rockchip-uart4.dts file, the content is as follows

```
/dts-v1/;
/plugin/;

/ {
        compatible = "rockchip,rk3399";

        fragment@0 {
                target = <&spi1>;
                __overlay__ {
                        status = "disabled";
                };
        };

        fragment@1 {
                target = <&uart4>;
                __overlay__ {
                        status = "okay";
                };
        };
};
```

b) Then you can use **orangepi-add-overlay** to compile rockchip-uart4.dts into rockchip-uart4.dtbo

```
root@orangepi:~# orangepi-add-overlay rockchip-uart4.dts
Compiling the overlay
Copying the compiled overlay file to /boot/overlay-user/
Reboot is required to apply the changes
```

c) Then restart the Linux system, you can see the following printing information in the log output from the serial port, indicating that rockchip-uart4.dtbo is loaded successfully

```
384 bytes read in 6 ms (62.5 KiB/s)
Applying user provided DT overlay rockchip-uart4.dtbo
```

d) After entering the Linux system, you can see the device node ttyS4 under /dev

```
root@orangepi4-lts:~# ls /dev/ttyS*
/dev/ttyS0    /dev/ttyS4
```

b. For Linux5.10 system, the method is as follows

a) First set the overlays variable in /boot/orangepiEnv.txt to open the uart4 configuration

```
root@orangepi4-lts:~# cat /boot/orangepiEnv.txt
verbosity=1
bootlogo=true
overlay_prefix=rockchip
fdtfile=rockchip/rk3399-orangepi-4-lts.dtb
rootdev=UUID=c51e6614-42cf-473c-9134-46a72667eb9c
rootfstype=ext4
overlays=uart4
```

b) Then restart the system. When starting, you can see the following print information in the startup log of u-boot, indicating that the configuration of uart4 is loaded successfully

```
Applying kernel provided DT overlay rockchip-uart4.dtbo
2698 bytes read in 8 ms (329.1 KiB/s)
```

c) After entering the Linux system, you can see the device node ttyS4 under /dev

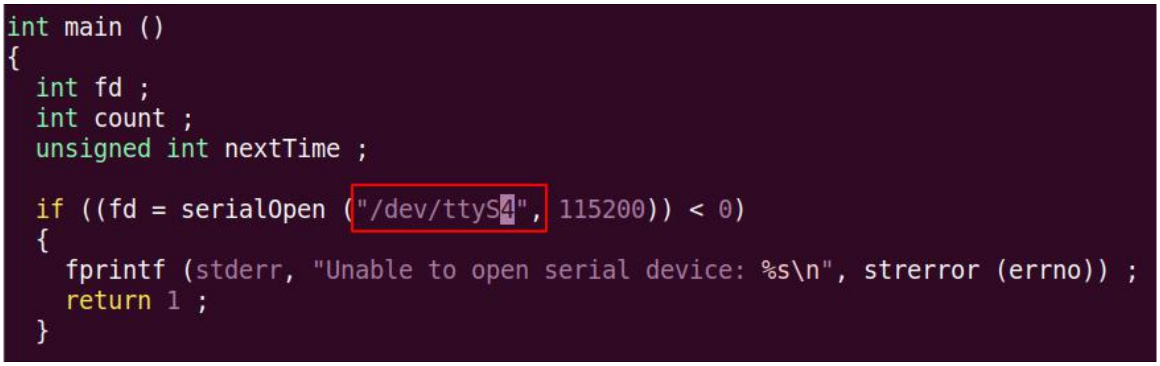
```
root@orangepi4-lts:~# ls /dev/ttyS*
/dev/ttyS2    /dev/ttyS4
```

3) Then start to test the uart interface, first use the DuPont line to short-circuit the rx and tx of the uart4 interface to be tested

	Uart4
tx pin	Corresponds to pin 19
rx pin	Corresponds to pin 21

4) Then modify the serial device node name opened by the serial test program serialTest in wiringOP to **/dev/ttyS4**

```
root@orangepi4-lts:~/wiringOP/examples# vim serialTest.c
```



```
int main ()
{
  int fd ;
  int count ;
  unsigned int nextTime ;

  if ((fd = serialOpen ("/dev/ttyS4", 115200)) < 0)
  {
    fprintf (stderr, "Unable to open serial device: %s\n", strerror (errno)) ;
    return 1 ;
  }
```

5) Recompile the serial test program serialTest in wiringOP

```
root@orangepi4-lts:~/wiringOP/examples# make serialTest
[CC] serialTest.c
[link]
root@orangepi4-lts:~/wiringOP/examples#
```

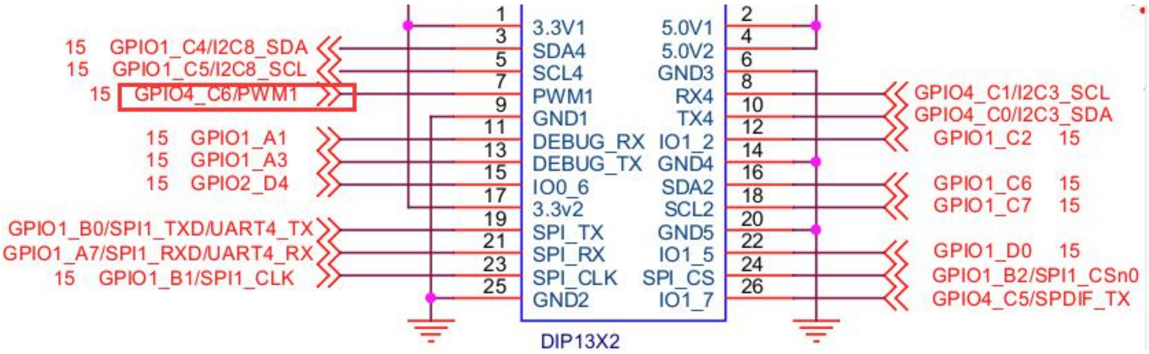
6) Finally run serialTest, if you can see the following print, it means the serial communication is normal

```
root@orangepi4-lts:~/wiringOP/examples# ./serialTest
Out:    0:   ->    0
Out:    1:   ->    1
Out:    2:   ->    2
Out:    3:   ->    3
Out:    4:   ->    4
```

```
Out:    5:   ->    5
Out:    6:   ->    6
Out:    7:   ->    7
Out:    8:   ->    8^C
```

3. 27. 5. 26pin PWM test

1) The 7th pin of 26pin is PWM1, the official image has turned on PWM1 by default, and PWM1 can be used without other configuration



2) After the pwm driver is loaded successfully, the pwmchip1 directory will be generated under /sys/class/pwm/, write 0 to the export file, the pwm timer will be opened, and a pwm0 directory will be generated. On the contrary, writing 0 to the unexport file will turn off the pwm timer, and the pwm0 directory will be deleted. This directory has the following files:

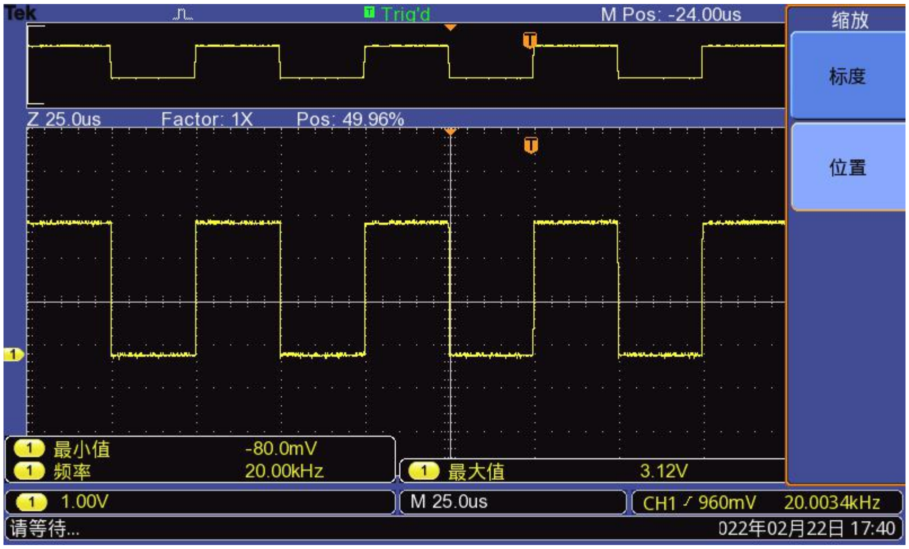
```
enable :      pwmWrite 1 to enable pwm, write 0 to disable pwm
polarity :    There are two parameter options, normal and inversed, indicating that the
output pin level is inverted.
duty_cycle : The unit is nanoseconds. In normal mode, it means the duration of high level.
In inversed mode, it means the duration of low level.
period :      The unit is nanoseconds, indicating the duration of the pwm wave
```

3) Example of use: let pwm1 output a square wave with a duty cycle of 50% and a period of 50 microseconds

```
root@orangepi4-lts:~#cd /sys/class/pwm/pwmchip1
root@orangepi4-lts:/sys/class/pwm/pwmchip1#echo 0 > export
root@orangepi4-lts:/sys/class/pwm/pwmchip1#
echo 50000 > pwm0/period
```

```
root@orangepi4-lts:/sys/class/pwm/pwmchip1#
echo 25000 > pwm0/duty_cycle
root@orangepi4-lts:/sys/class/pwm/pwmchip1#
echo 1 > pwm0/enable
```

4) On the oscilloscope, you can see that pwm1 outputs the following waveforms



3. 28. How to use 0.96-inch OLED module with I2C interface

1) The 0.96-inch OLED module of Orange Pi is shown in the figure below, and its 7-bit i2c slave address is 0x3c

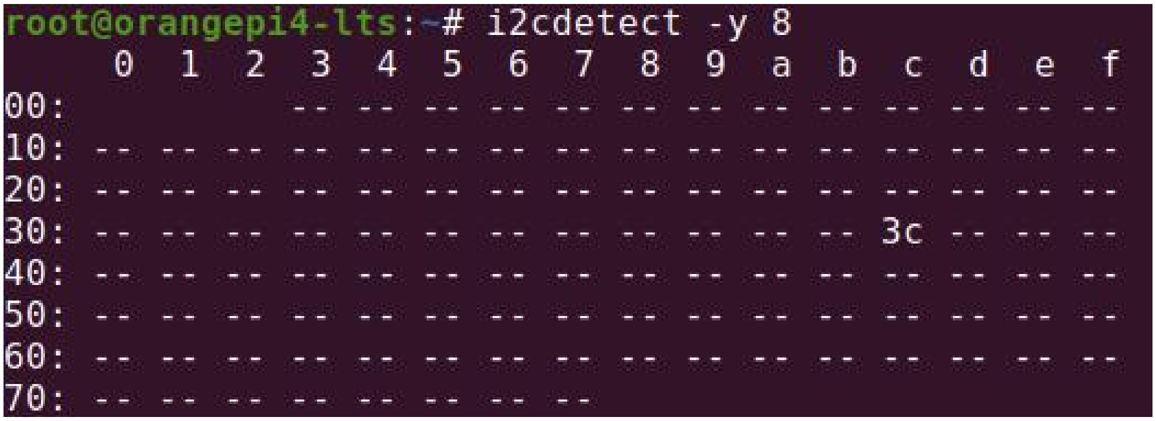
2) First, connect the 0.96-inch OLED module to the 26pin interface of the Orange Pi

development board through the DuPont cable. The wiring method is as follows (the following takes i2c8 as an example, i2c3 only needs to change the scl to pin 8, and the sda to the 8th pin. to pin 10)

OLED module pins	description	Development board 26pin interface i2c8 pin	Development board 26pin interface i2c3 pin
GND	power ground	pin 6	pin 6
VCC	5V	pin 4	pin 4
SCL	I2C clock line	pin 5	pin 8
SDA	I2C data line	pin 3	pin 10
RST	Connect to 3.3V	pin 1	pin 1
DC	Connect to GND	pin 9	pin 9
CS	Connect to GND	pin 25	pin 25

3) After connecting the OLED module to the development board, first use the i2c-tools tool to check whether the address of the OLED module can be scanned

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt install i2c-tools
root@orangepi4-lts:~# i2cdetect -y 8
```

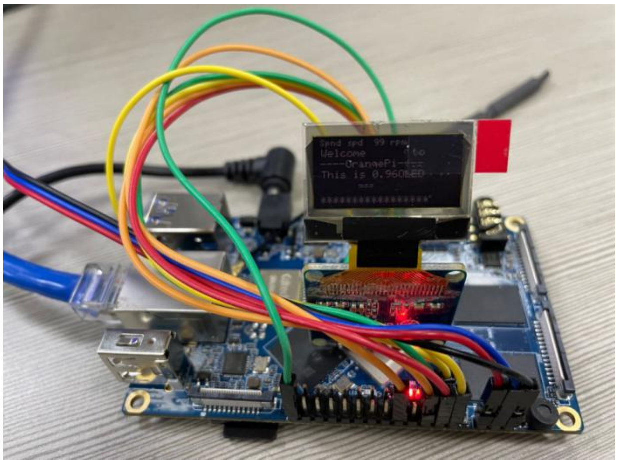


```
root@orangepi4-lts:~# i2cdetect -y 8
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- 3c -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

4) Then you can use the oled_demo in wiringOP to test the OLED module. The test steps are as follows

```
root@orangepi4-lts:~# git clone https://github.com/orangepi-xunlong/wiringOP
root@orangepi4-lts:~# cd wiringOP
root@orangepi4-lts:~/wiringOP# ./build clean && ./build
root@orangepi4-lts:~/wiringOP# cd examples
root@orangepi4-lts:~/wiringOP/examples# make oled_demo
root@orangepi4-lts:~/wiringOP/examples# ./oled_demo /dev/i2c-8
---------start--------
----------end---------
```

5) After running oled_demo, you can see the following output on the OLED screen



3. 29. Hardware watchdog test

1) Download the code of wiringOP

```
root@orangepi4-lts:~# apt update
root@orangepi4-lts:~# apt -y install git
root@orangepi4-lts:~# git clone https://github.com/orangepi-xunlong/wiringOP
```

2) Compile the watchdog test program

```
root@orangepi4-lts:~# cd wiringOP/examples/
root@orangepi4-lts:~/wiringOP/examples# gcc watchdog.c -o watchdog
```

3) Run the watchdog test program

a. The second parameter 10 represents the counting time of the watchdog. If the dog is not fed within this time, the system will restart

b. We can feed the dog by pressing any key on the keyboard (except ESC), after feeding the dog, the program will print a line of keep alive to indicate that the dog was fed successfully

```
root@orangepi4-lts:~/wiringOP/examples# ./watchdog 10
open success
options is 33152,identity is Synopsys DesignWare Watchdog
put_usr return,if 0,success:0
The old reset time is: 21
return ENOTTY,if -1,success:-1
return ENOTTY,if -1,success:-1
put_user return,if 0,success:0
put_usr return,if 0,success:0
keep alive
keep alive
```

3. 30. Check the serial number of the rk3399 chip

1) The command to view the serial number of the RK3399 chip is as follows, the serial number of each chip is different and unique, so the serial number can be used to distinguish multiple development boards

```
root@orangepi4-lts:~# cat /proc/cpuinfo
processor             : 5
BogoMIPS                  : 48.00
Features              : fp asimd evtstrm aes pmull sha1 sha2 crc32
CPU implementer : 0x41
CPU architecture: 8
CPU variant        : 0x0
CPU part               : 0xd08
CPU revision       : 2

Serial                  : a64e6031a34aa990
```

3. 31. How to program linux image to eMMC

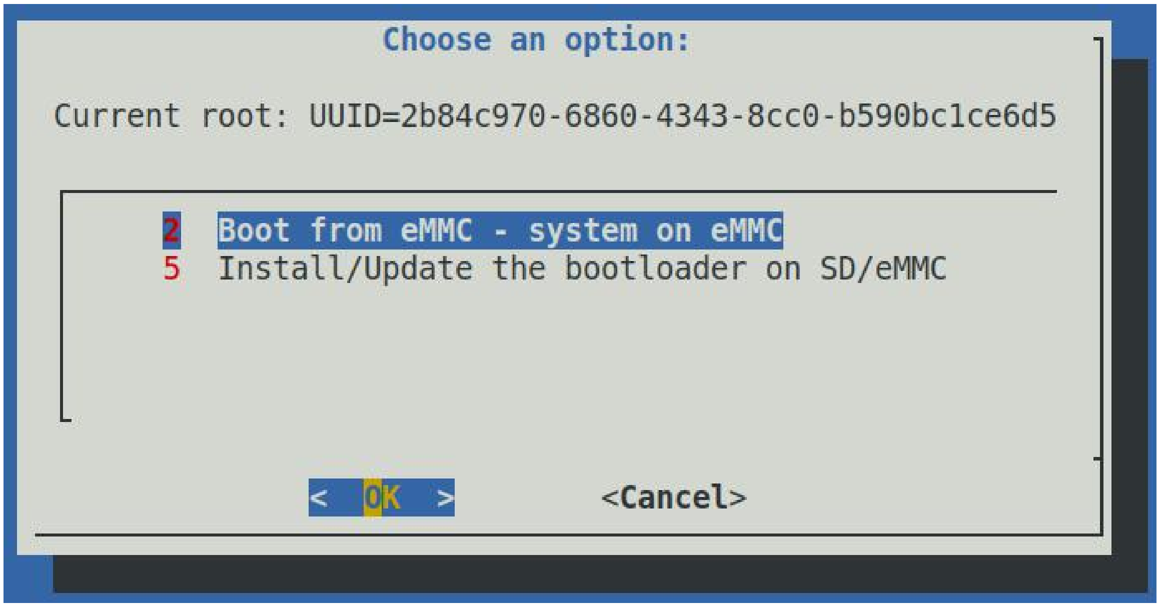
Note that only the Orange Pi 4 LTS development board with the eMMC chip model can burn the image into the eMMC. If the Orange Pi 4 LTS development board without the eMMC chip is purchased, the image cannot be burned into the eMMC.

1) Burning the linux image to eMMC needs to be done with the help of a TF card, first burn the linux image to the TF card, and then start the development board to enter the linux system

2) Then run the nand-sata-install script

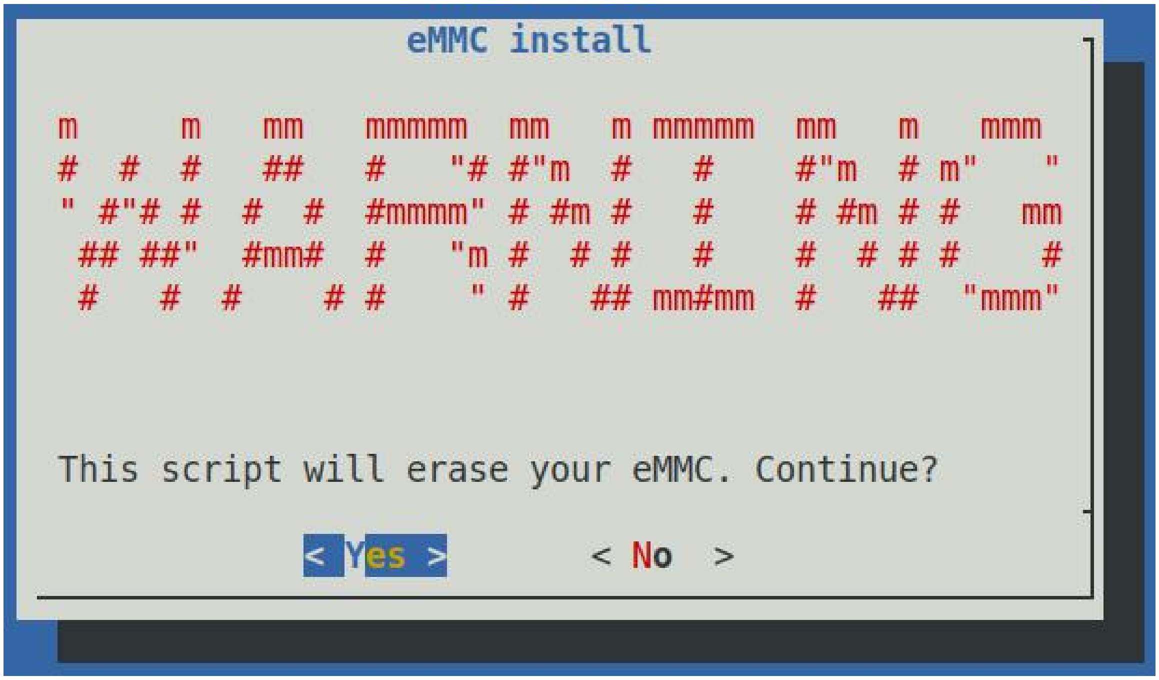
```
root@orangepi4-lts:~# nand-sata-install
```

3) then select **2 Boot from eMMC - sysytem on eMMC**



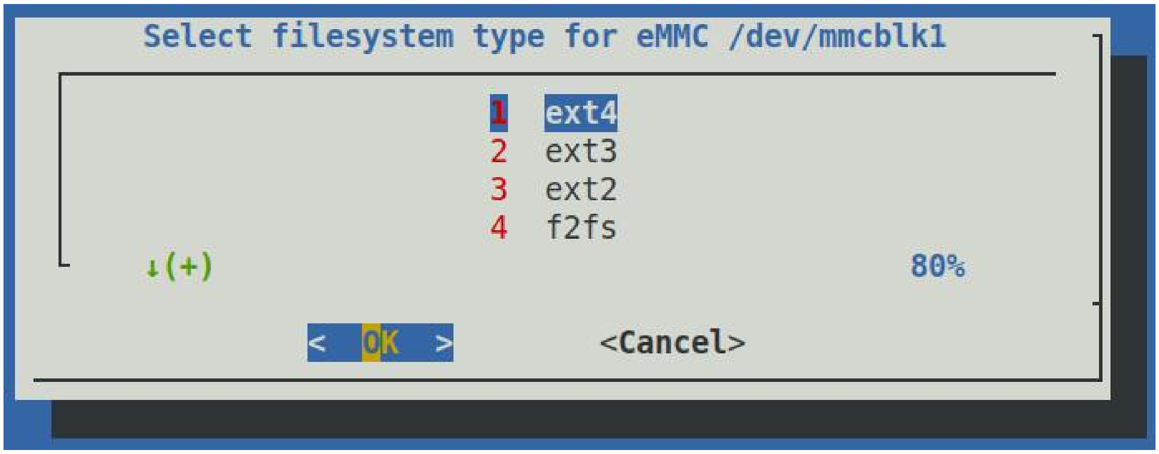
```
Choose an option:

Current root: UUID=2b84c970-6860-4343-8cc0-b590bc1ce6d5

2  Boot from eMMC - system on eMMC
5  Install/Update the bootloader on SD/eMMC
```

4) Then a warning will pop up, the script will erase all data on the eMMC, select **<Yes>** to continue

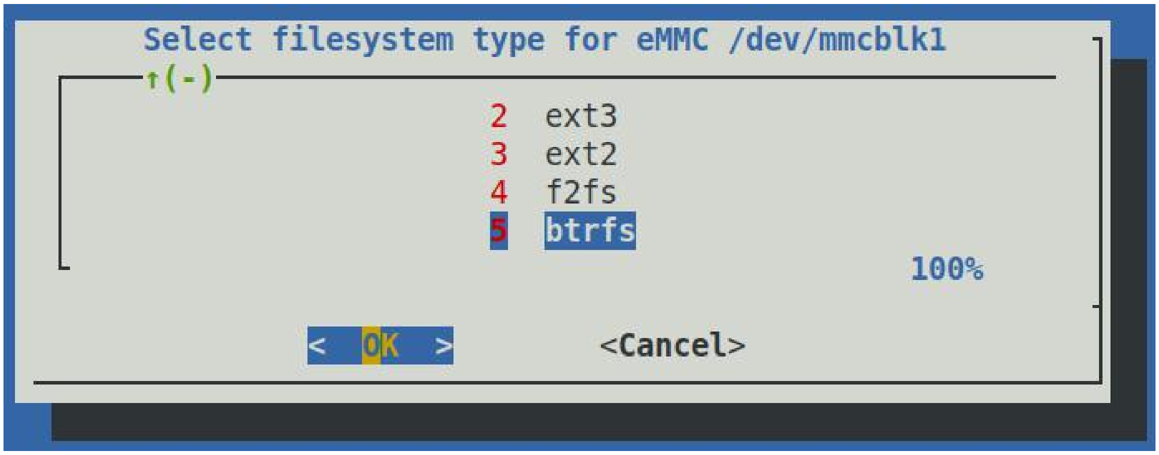


```
eMMC install

m     m   mm   mmmmm  mm   m mmmmm  mm   m   mmm
#  #  #   ##   #   "# #"m  #   #    #"m  # m"   "
" #"# #  #  #  #mmmm" # #m #   #    # #m # #   mm
 ## ##"  #mm#  #   "m #  # #   #    #  # # #    #
 #   #  #    # #    " #  ## mm#mm  #  ##   "mmm"

This script will erase your eMMC. Continue?
```

5) Then you will be prompted to select the type of file system, which supports ext2/3/4, f2fs and btrfs five file systems

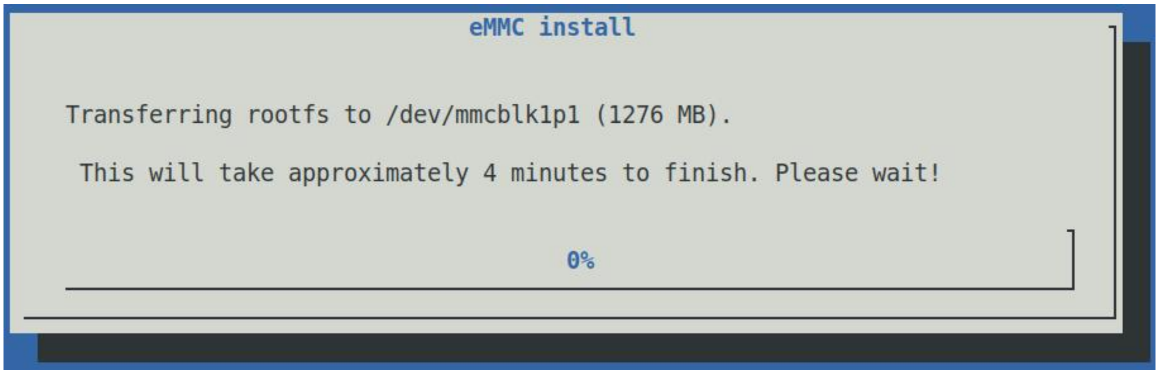


```
Select filesystem type for eMMC /dev/mmcblk1

                    1  ext4
                    2  ext3
                    3  ext2
                    4  f2fs
  ↓(+)                                   80%

          <  OK  >        <Cancel>
```



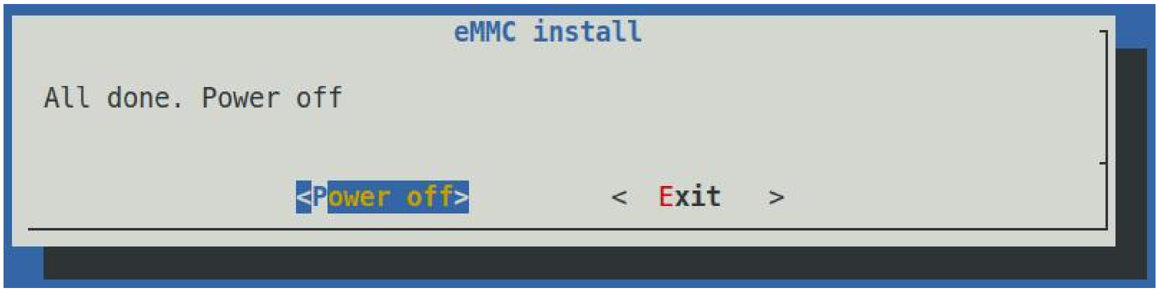
```
Select filesystem type for eMMC /dev/mmcblk1
  ↑(-)
                    2  ext3
                    3  ext2
                    4  f2fs
                    5  btrfs
                                         100%

          <  OK  >        <Cancel>
```

6) Then it will start to format eMMC. After formatting eMMC, it will start to burn the linux image into eMMC.



```
                    eMMC install

 Transferring rootfs to /dev/mmcblk1p1 (1276 MB).

  This will take approximately 4 minutes to finish. Please wait!

                         0%
```

7) After burning, the following options will be prompted, you can select <Power off> to directly shut down



```
eMMC install

All done. Power off

<Power off>          <  Exit  >
```

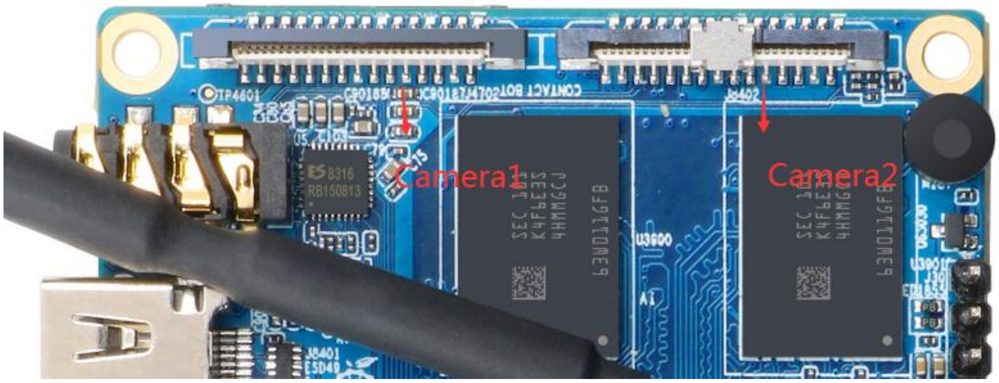
8) Then pull out the TF card, and then power on again, it will start the linux system in eMMC

3. 32. How to use Linux 4.4 OV13850 camera

> Note that only Debian10 supports this function, other systems do not support it temporarily

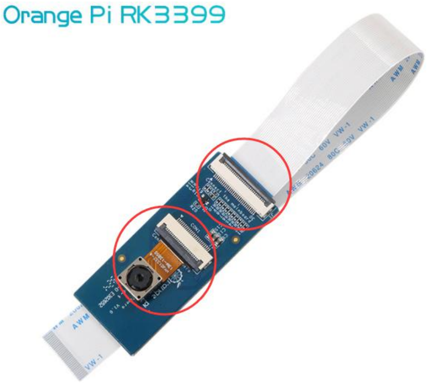
3. 32. 1. Camera connection instructions

1) OrangePi 4 LTS has two Camera ports, both ports only support OV13850 camera by default. The two Canera interfaces can use one of the interfaces alone, or you can use the two Camera interfaces to connect two cameras at the same time

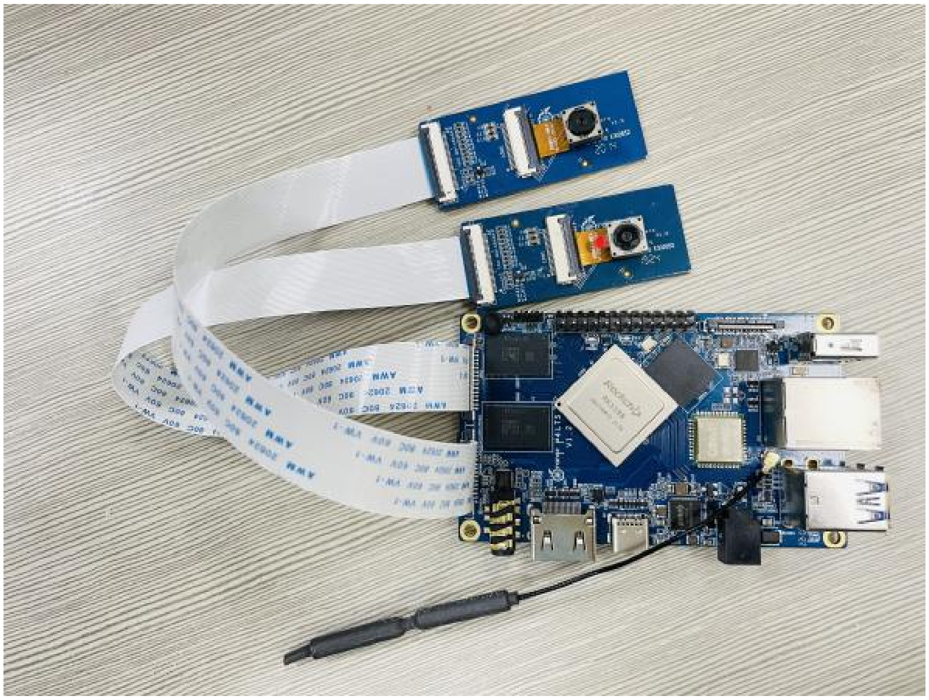


2) The OV13850 camera kit includes an OV13850 camera, an adapter board and a cable

3) First insert the OV13850 camera into the adapter board, and then insert the cable into another card slot of the adapter board



4) Then insert the other end of the cable into the Camera camera interface of the development board. The interface can be connected to two cameras at the same time, or one camera can be connected separately. After connecting the camera, start the Linux system (do not plug in the camera after powering on)



5) After starting the system, execute the following commands. If the following information appears, the camera is working normally. If there is no such information, please check whether the camera is connected correctly.

```
root@orangepi4-lts:~# dmesg | grep Async
```

```
[    1.623685] rkisp1: Async subdev notifier completed
```

3. 32. 2. Using a single camera

1) The system calls the camera through the test_camera-gst.sh script, the parameters are as follows

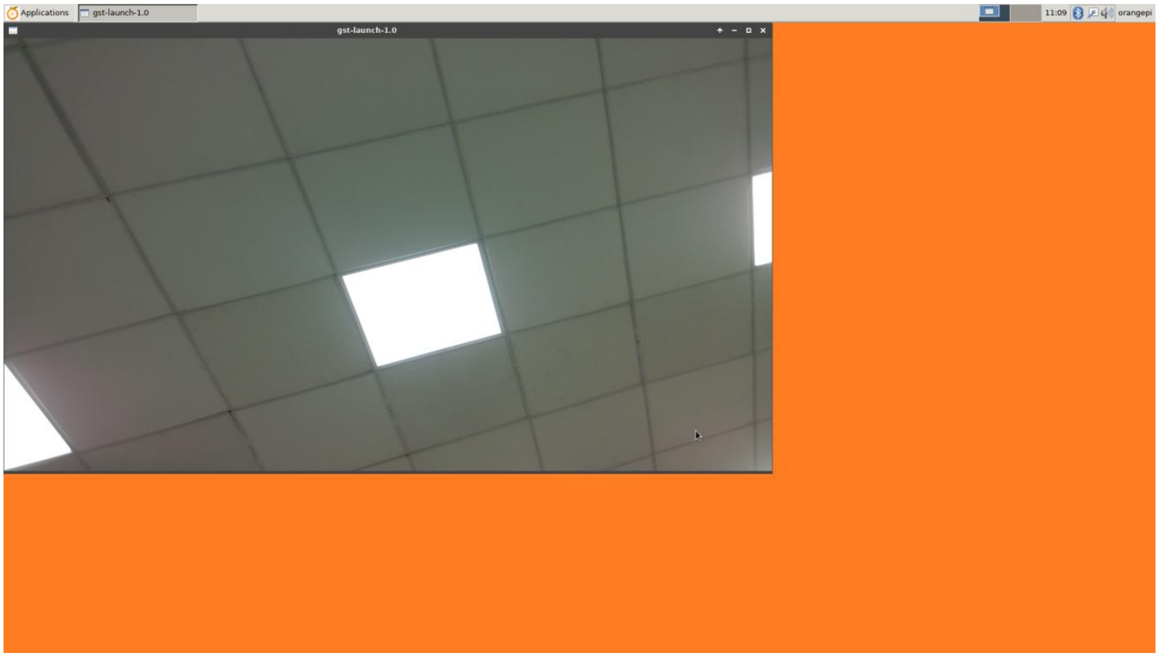
Parameter	**Function**
--index or -i	**Select the serial number of the camera to be used. The optional values are 0 and 1. When connecting two cameras at the same time, specify 1 to operate the second camera.**
--action or -a	**Specifies the action to be executed by the command. The optional parameters are: preview, photo and video, corresponding to preview, photo and video respectively**
--output or -o	**Specify the output file name, which is used to specify the output file name when taking pictures and videos**
--verbose or -v	**When specified as yes, the full command line that invokes the gst-launch-1.0 command will be output**

2) Then the way to preview the image is as follows

a. First run the test_camera-gst.sh script

```
root@orangepi4-lts:~# test_camera-gst.sh
Setting pipeline to PAUSED ...
media get entity by name: lens is null
Pipeline is live and does not need PREROLL ...
```

b. The effect is as shown in the figure below, a real-time camera window will be opened on the desktop



c. If no parameters are specified for this command, the default action is to preview, which will open the camera recognized by the system. If two OV13850 cameras are connected, camera1 (the camera interface near the headphone holder) will be opened first.

d. Take a picture with the camera, take a picture with the command, and save it as the file test.jpg

```
root@orangepi4-lts-lts:~# test_camera-gst.sh -a photo -o test.jpg
gst-launch-1.0: no process found
Setting pipeline to PAUSED ...
media get entity by name: lens is null
Pipeline is live and does not need PREROLL ...

root@orangepi4-lts:~# ls
test.jpg
```

3) Use the camera to record, after running the script, it will start to record a 17s video.

```
root@orangepi4-lts-lts:~# test_camera-gst.sh --action video --output test.ts
gst-launch-1.0: no process found
Setting pipeline to PAUSED ...
mpi: mpp version: Without VCS info
mpp_rt: NOT found ion allocator
```

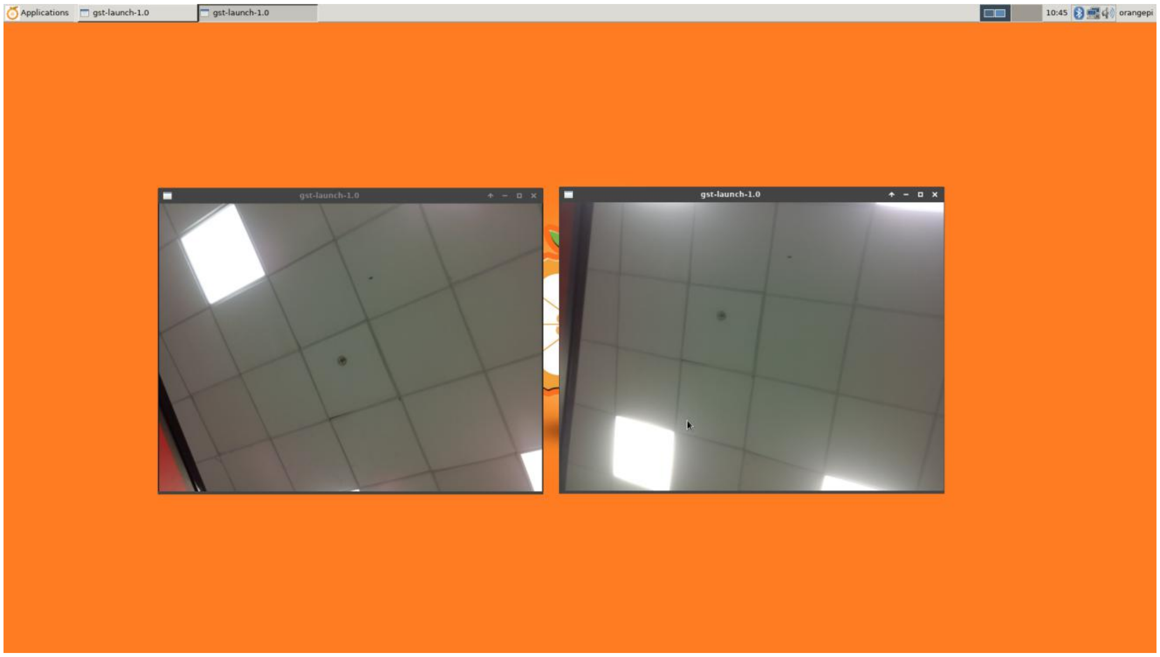
```
...
root@orangepi4-lts:~# ls
test.ts
```

3. 32. 3. Dual camera usage

1) Run test_camera-dual.sh to open the dual camera

```
root@orangepi4-lts:~# test_camera-dual.sh
Start MIPI CSI Camera Preview!
Setting pipeline to PAUSED ...
Setting pipeline to PAUSED ...
```

2) The effect is as shown in the figure below, the real-time windows of the two cameras will be opened on the desktop respectively



3. 33. 10.1 inch MIPI screen usage

The Linux image on the official website supports two video outputs by default, namely HDMI video output and TypeC-DP video output. MIPI LCD output is disabled by default. Orange Pi 4 LTS has two MIPI interfaces, and MIPI LCD1 only has the function of video output. MIPI LCD2 and Camera 2 are multiplexed

3. 33. 1. LCD1 interface instructions

1) In the dts of the Linux system, LCD1 is turned off by default. First, you need to open the configuration of LCD1 in the dts.

a. For Linux 4.4 kernel, the method is as follows

a) A script named orangepi-add-overlay is pre-installed in the linux system. Through this script, we can use DT overlay to dynamically modify the configuration in dts. First write the rockchip-lcd1.dts file, the content is as follows

```
root@orangepi4-lts:~# cat rockchip-lcd1.dts
/dts-v1/;
/plugin/;

/ {
        compatible = "rockchip,rk3399";

        fragment@0 {
                target = <&dsi>;
                __overlay__ {
                        status = "okay";
                };
        };

        fragment@1 {
                target = <&gt9xx>;
                __overlay__ {
                        status = "okay";
                };
        };
};
```

b) Then you can use orangepi-add-overlay to compile rockchip-lcd1.dts into rockchip-lcd1.dtbo

```
root@orangepi:~# orangepi-add-overlay rockchip-lcd1.dts
Compiling the overlay
Copying the compiled overlay file to /boot/overlay-user/
Reboot is required to apply the changes
```

c) Then restart the Linux system, you can see the following printing information in the log output from the serial port, indicating that rockchip-lcd1.dtbo is loaded successfully

```
379 bytes read in 6 ms (61.5 KiB/s)
Applying user provided DT overlay rockchip-lcd1.dtbo
```

d) After entering the Linux system, enter the following command to see the relevant information of the kernel output

```
root@orangepi4-lts:~# dmesg |grep mipi
[    1.478148] dw-mipi-dsi ff960000.dsi: final DSI-Link bandwidth: 444 x 4 Mbps
```

b. For Linux 5.10 kernel, the method is as follows

a) First set the overlays variable in /boot/orangepiEnv.txt to open the LCD1 interface configuration

```
root@orangepi4-lts:~# cat /boot/orangepiEnv.txt
verbosity=1
bootlogo=true
overlay_prefix=rockchip
fdtfile=rockchip/rk3399-orangepi-4-lts.dtb
rootdev=UUID=c51e6614-42cf-473c-9134-46a72667eb9c
rootfstype=ext4
overlays=lcd1
```

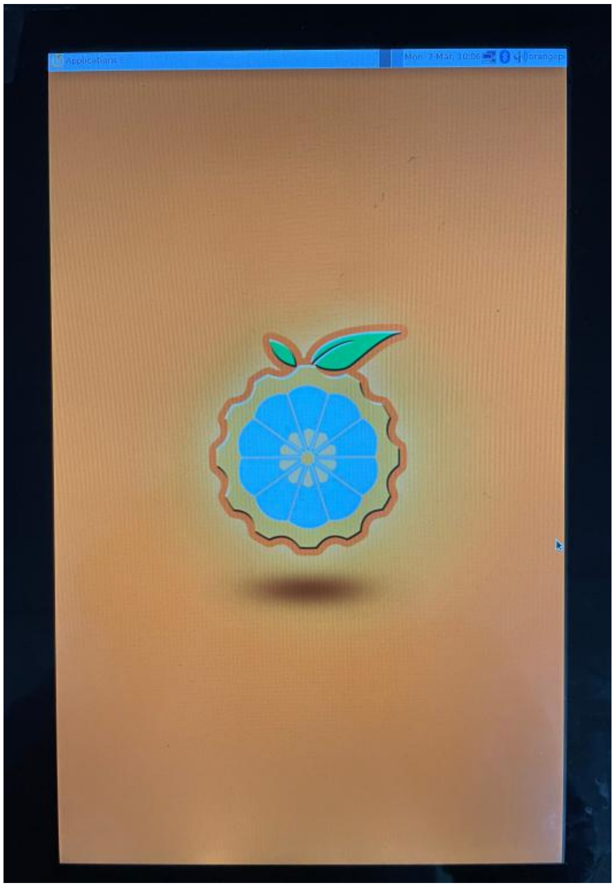
b) Then restart the system. When starting, you can see the following printing information in the startup log of u-boot, indicating that the configuration of lcd1 is loaded successfully

```
379 bytes read in 9 ms (41 KiB/s)
Applying kernel provided DT overlay rockchip-lcd1.dtbo
```

c) After entering the Linux system, enter the following command to see the relevant information of the kernel output

```
root@orangepi4-lts:~# dmesg |grep mipi
[                         8.622148]      dw-mipi-dsi-rockchip      ff960000.dsi:
[drm:dw_mipi_dsi_bridge_mode_set] final DSI-Link bandwidth: 444 x 4 Mbps
```

2) Then disconnect the power supply of the development board, and then connect the MIPI screen by referring to the usage of the 10.1-inch MIPI screen, plug in the power supply to start the system, and you can see the system interface on the screen



3. 33. 2. LCD2 interface instructions

1) In the dts of the Linux system, LCD2 is turned off by default. First, you need to open the configuration of LCD2 in dts.

a. For Linux 4.4 kernel, the method is as follows

a) A script named **orangepi-add-overlay** is pre-installed in the linux system. Through this script, we can use DT overlay to dynamically modify the configuration in dts. First write the rockchip-lcd2.dts file, the content is as follows

```
root@orangepi4-lts:~# cat rockchip-lcd2.dts
/dts-v1/;
/plugin/;

/ {
        compatible = "rockchip,rk3399";
        fragment@0 {
                target = <&dsi1>;
                __overlay__ {
                        status = "okay";
                };
        };
        fragment@1 {
                target = <&gt9xx_1>;
                __overlay__ {
                        status = "okay";
                };
        };
        fragment@2 {
                target = <&rkisp1_1>;
                __overlay__ {
                        status = "disabled";
                };
        };
        fragment@3 {
                target = <&isp1_mmu>;
                __overlay__ {
                        status = "disabled";
                };
        };
        fragment@4 {
                target = <&mipi_dphy_tx1rx1>;
                __overlay__ {
                        status = "disabled";
                };
        };
        fragment@5 {
                target = <&ov13850_1>;
                __overlay__ {
                        status = "disabled";
                };
        };
        fragment@6 {
                target = <&cdn_dp>;
                __overlay__ {
                        status = "disabled";
                };
        };
        fragment@7 {
                target = <&hdmi>;
                __overlay__ {
                        status = "disabled";
                };
        };
};
```

b) Then you can use **orangepi-add-overlay** to compile rockchip-lcd2.dts into rockchip-lcd2.dtbo

```
root@orangepi:~# orangepi-add-overlay rockchip-lcd2.dts
Compiling the overlay
Copying the compiled overlay file to /boot/overlay-user/
Reboot is required to apply the changes
```

c) Then restart the Linux system, you can see the following printing information in the log output by the serial port, indicating that rockchip-lcd2.dtbo is loaded successfully

```
1135 bytes read in 6 ms (184.6 KiB/s)
Applying user provided DT overlay rockchip-lcd2.dtbo
```

d) After entering the Linux system, enter the following command to see the relevant information of the kernel output

```
root@orangepi4-lts:~# dmesg |grep mipi
root@orangepi4-lts:~#    dmesg |grep mipi
[       2.714240] dw-mipi-dsi ff960000.dsi: final DSI-Link bandwidth: 444 x 4 Mbps
[       3.104433] dw-mipi-dsi ff968000.dsi: final DSI-Link bandwidth: 444 x 4 Mbps
```

b. For Linux5.10 system, the method is as follows

a) You can set overlays variable in /boot/orangepiEnv.txt to open LCD2 configuration

```
root@orangepi4-lts:~# cat /boot/orangepiEnv.txt
verbosity=1
bootlogo=true
```

```
overlay_prefix=rockchip
fdtfile=rockchip/rk3399-orangepi-4-lts.dtb
rootdev=UUID=c51e6614-42cf-473c-9134-46a72667eb9c
rootfstype=ext4
overlays=lcd1 lcd2
```

b) Then restart the system. When starting up, you can see the following printing information in the startup log of u-boot, indicating that the configurations of lcd1 and lcd2 are loaded successfully

```
379 bytes read in 9 ms (41 KiB/s)
Applying kernel provided DT overlay rockchip-lcd1.dtbo
626 bytes read in 9 ms (67.4 KiB/s)
Applying kernel provided DT overlay rockchip-lcd2.dtbo
```

c) After entering the Linux system, enter the following command to see the relevant information of the kernel output

```
root@orangepi4-lts:~# dmesg |grep mipi
[                8.124926]    dw-mipi-dsi-rockchip    ff960000.dsi:
[drm:dw_mipi_dsi_bridge_mode_set] final DSI-Link bandwidth: 444 x 4 Mbps
[                8.168243]    dw-mipi-dsi-rockchip    ff968000.dsi:
[drm:dw_mipi_dsi_bridge_mode_set] final DSI-Link bandwidth: 444 x 4 Mbps
```

2) Then disconnect the power supply of the development board, and then connect the MIPI screen by referring to the usage of the 10.1-inch MIPI screen, plug in the power supply to start the system, if two 10.1-inch screens are connected at the same time, you can see the system on the two 10.1-inch screens interface

3. 34. How to set up dual screen display

1) The Linux image on the official website supports HDMI output and TypeC-DP output by default. You can use the following commands to set dual-screen simultaneous display

```
root@orangepi4-lts:~#
su orangepi -c "DISPLAY=:0 xrandr --output HDMI-1 --same-as DP-1"
```

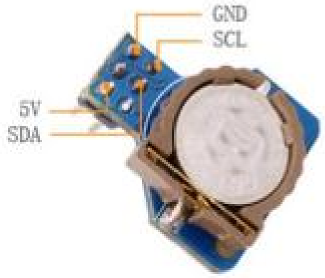
2) If you use MIPI LCD output and connect two 10.1-inch MIPI screens, you can use the following commands to set up, **if the system restarts after setting, please confirm whether the power supply is sufficient**

```
root@orangepi4-lts:~#
su orangepi -c "DISPLAY=:0 xrandr --output DSI-1 --same-as DSI-2"
```

3. 35. How to use the orange pi DS1307 RTC clock module

1) The orange pi DS1307 RTC clock module is shown in the figure below. It uses the

i2c interface to communicate with the development board, and the i2c device address is 0x68. The RTC module is not equipped with a battery by default, and a button battery needs to be prepared before use

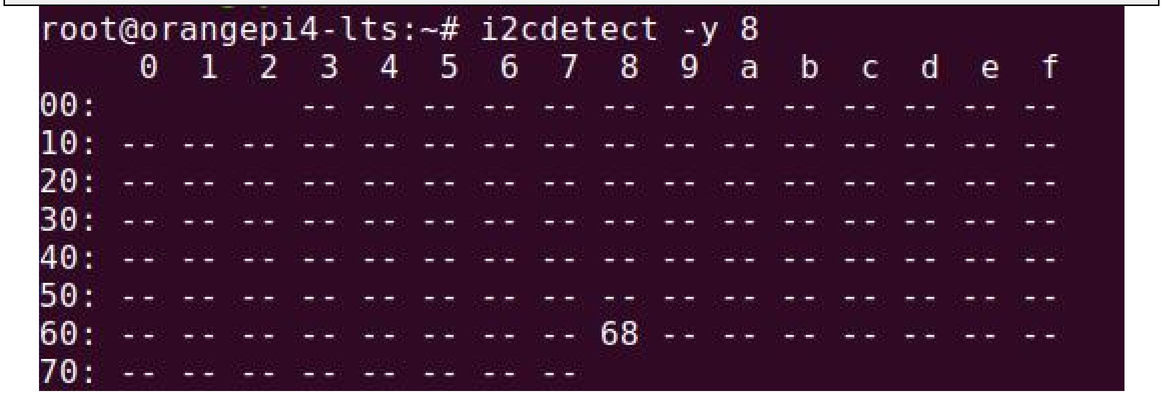


2) First, connect the RTC module to the 40pin of the development board. The wiring method is as follows

Pins of the RTC module	The corresponding pin of the development board 26pin
5V	pin 2
GND	Pin 6
SDA	Pin 3
SCL	Pin 5

3) After connecting the RTC module, first use the i2cdetect command to check whether the device address of the RTC module can be detected

```
root@orangepi:~# apt update
root@orangepi:~# apt -y install i2c-tools
root@orangepi:~# i2cdetect -y 8
```



```
root@orangepi4-lts:~# i2cdetect -y 8
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- 68 -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

4) Because the kernel has opened the ds1037 driver by default, the function can be

tested directly. Execute the following command to add an rtc device and view the generated rtc device, where rtc0 is the onboard rtc and rtc1 is the newly added external rtc

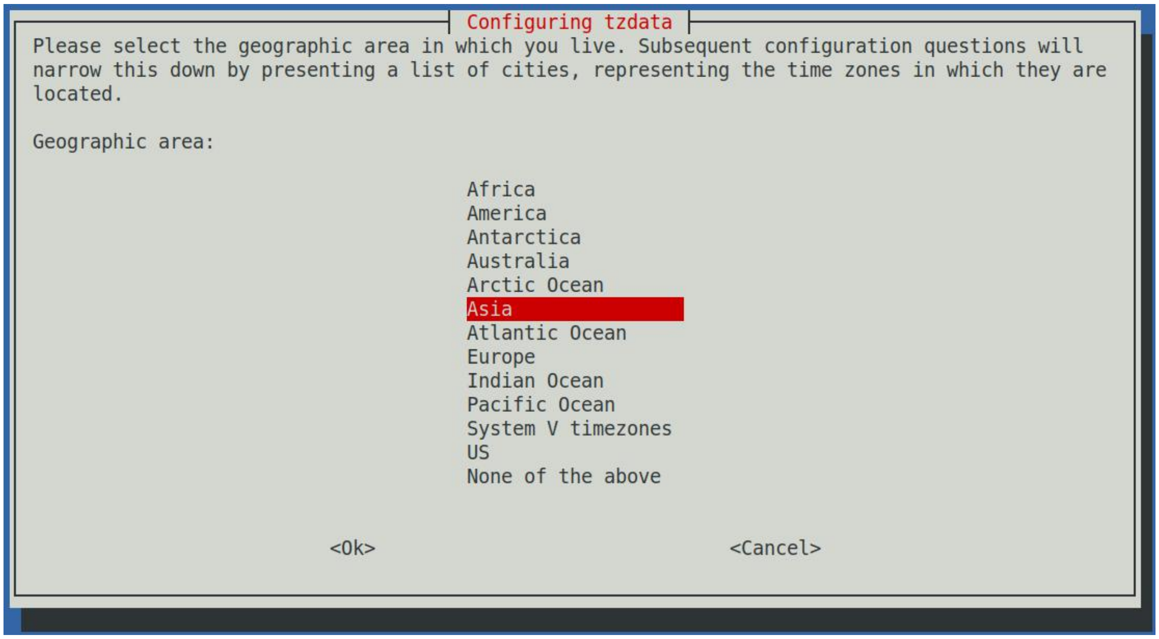
```
root@orangepi:~# echo "ds1307 0x68" > /sys/class/i2c-adapter/i2c-8/new_device
root@orangepi:~# ls /dev/rtc*
/dev/rtc    /dev/rtc0    /dev/rtc1
```

5) When the linux system starts, if the development board is connected to the network, the linux system will automatically synchronize the system time to the correct time through the network. The default time of the linux system is UTC. In China, the time zone needs to be changed to **Asia/Shanghai**. The time obtained by using the data command is correct, the method is as follows

a. Execute the following command

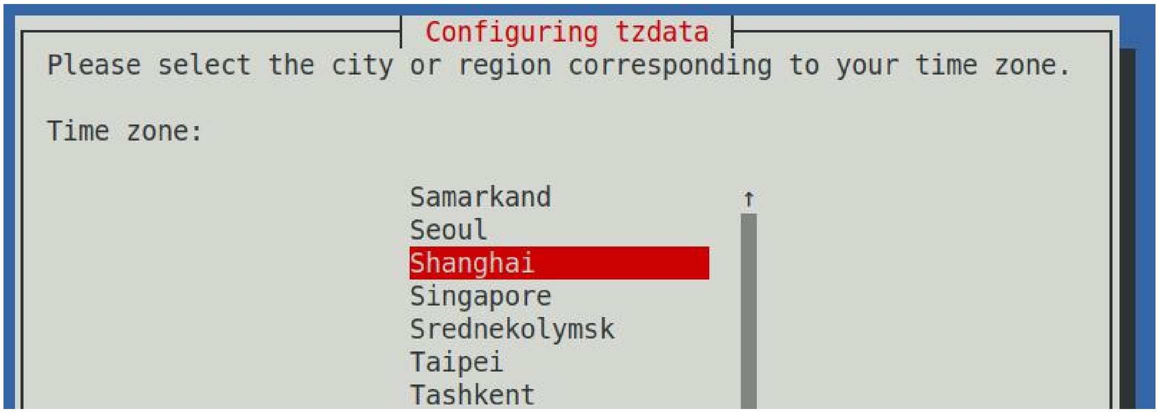
```
root@orangepi:~# dpkg-reconfigure tzdata
```

b. Then select the geographic area as **Asia**



```
Configuring tzdata
Please select the geographic area in which you live. Subsequent configuration questions will
narrow this down by presenting a list of cities, representing the time zones in which they are
located.

Geographic area:

                                        Africa
                                        America
                                        Antarctica
                                        Australia
                                        Arctic Ocean
                                        Asia
                                        Atlantic Ocean
                                        Europe
                                        Indian Ocean
                                        Pacific Ocean
                                        System V timezones
                                        US
                                        None of the above

                          <Ok>                                 <Cancel>
```

c. Then select the time zone as **Shanghai**



```
Configuring tzdata
Please select the city or region corresponding to your time zone.

Time zone:

                    Samarkand
                    Seoul
                    Shanghai
                    Singapore
                    Srednekolymsk
                    Taipei
                    Tashkent
```

d. After the configuration is completed, use the date command to view the time and it will be normal

```
root@orangepi:~# date
```

6) If the current time of the system is incorrect, please connect to the network first, and then use the following command to synchronize the time. The reason why the system time is set correctly is to prepare for the synchronization of the time of the RTC module later.

```
root@orangepi:~# apt -y update
root@orangepi:~# apt install ntpdate
root@orangepi:~# ntpdate 0.cn.pool.ntp.org
```

7) The command to view the current time of the RTC module is as follows, because the rtc specified by hwclock by default is the rtc0 device, so you need to use the -f option to specify the rtc1 device

```
root@orangepi:~# hwclock -r -f /dev/rtc1
```

8) The time read by the RTC module for the first time is definitely wrong. The current time of the system can be synchronized to the RTC module through the following command. Before synchronization, it is necessary to ensure that the current time of the system is correct

```
root@orangepi:~# date                          #First make sure the current system time is
correct
root@orangepi:~# hwclock -w -f /dev/rtc1   #Then write the system time to the RTC
module
root@orangepi:~# hwclock -r -f /dev/rtc1   #Finally read the time of the RTC module to
```

```
                                                confirm that the settings are correct
```

9) If it is confirmed that the time in the RTC module is correct, then you can unplug the power supply, then power it on, and execute the following command to synchronize the time in the RTC module to the system

```
root@orangepi:~#
echo "ds1307 0x68" > /sys/class/i2c-adapter/i2c-8/new_device    #add rtc device
root@orangepi:~# hwclock -s -f /dev/rtc1    #Then synchronize the RTC module
                                              time to the system
root@orangepi:~# date                       #Finally, use the date command to check
                                            whether the system time is correct
```

10) The above operation is to manually synchronize the time of the RTC module to the system. If you need to automatically synchronize the system time at startup, you need to set the startup script as follows to automatically synchronize the system time

a. Create the rc-local.service file

```
root@orangepi:~# sudo vi /etc/systemd/system/rc-local.service
```

Copy the following content into the rc-local.service file

```
[Unit]
Description=/etc/rc.local Compatibility
ConditionPathExists=/etc/rc.local

[Service]
Type=forking
ExecStart=/etc/rc.local start
TimeoutSec=0
StandardOutput=tty
RemainAfterExit=yes
SysVStartPriority=99

[Install]
WantedBy=multi-user.target
```

b. Create the rc.local file

```
root@orangepi:~# sudo vi /etc/rc.local
```

Copy the following content into the rc-local.service file

```
#!/bin/sh -e
#
# rc.local
#
# This script is executed at the end of each multiuser runlevel.
# Make sure that the script will "exit 0" on success or any other
# value on error.
#
# In order to enable or disable this script just change the execution
# bits.
#
# By default this script does nothing.

echo "ds1307 0x68" > /sys/class/i2c-adapter/i2c-8/new_device
hwclock -s -f /dev/rtc1

exit 0
```

c. Add permissions to rc.local

```
root@orangepi:~# sudo chmod +x /etc/rc.local
```

d. Enable service

```
root@orangepi:~# sudo systemctl enable rc-local
```

e. Start the service and check the status

```
root@orangepi:~# sudo systemctl start rc-local.service
root@orangepi:~# sudo systemctl status rc-local.service
```

11) At this point, you can disconnect all network connections of the development board, wait for a few minutes, restart the system, and then check the system time to find that even if there is no network, the system time is correct

3. 36. Reset and shutdown methods

1) During the operation of the Linux system, if the power is directly unplugged, some data may be lost in the file system. It is recommended to use the poweroff command to shut down the Linux system of the development board before power off, and then unplug the power.

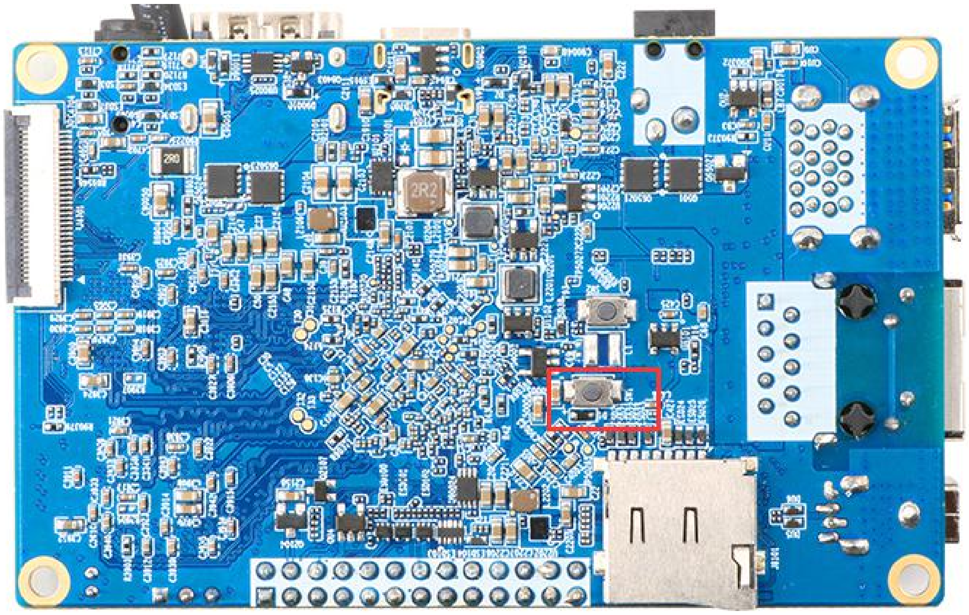
```
root@orangepi:~# poweroff
```

2) **After turning off the development board, you need to re-plug the power supply to turn it on**

3) Use the reboot command to restart the Linux system on the development board

```
root@orangepi:~# reboot
```

4) You can also short press the power button on the development board to reset



3. 37. Partial programming language test supported by Linux system

1) The full name of the image tested is as follows

```
Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop..7z
```

2) Debian Bullseye is installed with gcc compilation toolchain by default, which can directly compile C language programs in the Linux system of the development board

a. The version of a.gcc is shown below

```
root@orangepi:~# gcc --version
gcc (Debian 10.2.1-6) 10.2.1 20210110
Copyright (C) 2020 Free Software Foundation, Inc.
```

```
This is free software; see the source for copying conditions.   There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR
PURPOSE..
```

b. Write the **hello_world.c** program in C language

```
root@orangepi:~# cat hello_world.c
#include <stdio.h>

int main(void)
{
        printf("Hello World!\n");

        return 0;
}
```

c. Then compile and run **hello_world.c**

```
root@orangepi:~# gcc -o hello_world hello_world.c
root@orangepi:~# ./hello_world
Hello World!
```

3) Debian Bullseye has Python3 installed by default

a. The specific version of Python is as follows

```
root@orangepi4-lts:~# python3
Python 3.9.2 (default, Feb 28 2021, 17:03:44)
[GCC 10.2.1 20210110] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

b. Write the **hello_world.py** program in the Python language

```
root@orangepi:~# cat hello_world.py
print('Hello World!')
```

c. The result of running **hello_world.py** is as follows

```
root@orangepi:~# python3 hello_world.py
Hello World!
```

4) Debian Bullseye does not install Java compilation tools and runtime environment by default

a. You can install openjdk with the following command, the default version in

Debian Bullseye is openjdk-11

```
root@orangepi:~# apt -y install openjdk-11-jdk
```

b. After installation, you can check the version of Java

```
root@orangepi:~# java --version
openjdk 11.0.12 2021-07-20
OpenJDK Runtime Environment (build 11.0.12+7-post-Debian-2)
OpenJDK 64-Bit Server VM (build 11.0.12+7-post-Debian-2, mixed mode)
```

c. Write the Java version of **hello_world.java**

```
root@orangepi:~# vim hello_world.java
public class hello_world
{
        public static void main(String[] args)
        {
                System.out.println("Hello World!");
        }
}
```

d. Then compile and run **hello_world.java**

```
root@orangepi:~# javac hello_world.java
root@orangepi:~# java hello_world
Hello World!
```

4. Instructions for use of Android system

4. 1. Supported Android Versions

Android version	kernel version
Android 8.1	linux4.4

4. 2. Android 8.1 function adaptation

Function	status
HDMI video	OK
HDMI audio	OK
USB2.0 x 2	OK
USB3.0 x 1	OK
TypeC USB3.0	OK
TF card boot	OK
EMMC start	OK
network card	OK
WIFI	OK
Bluetooth	OK
Bluetooth earphone	OK
headphone recording	OK
Headphone playback	OK
microphone recording	OK
LED lights	OK
Temperature Sensor	OK
USB camera	OK
GPU	OK
Video codec	OK
Reset button	OK
upgrade key	OK
ADB debugging	OK
OV13850 camera	OK

10.1 inch MIPI screen	OK
mini-PCIE	OK
TypeC to HDMI	OK

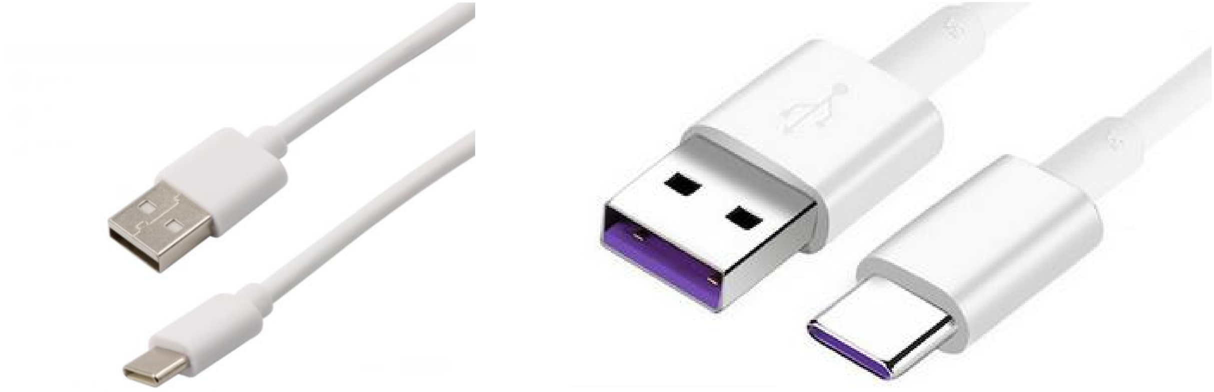
4. 3. On-board LED light display description

	green light	red light
u-boot startup phase	Light off	light on
The kernel boots into the system	flicker	light on

4. 4. How to use ADB

4. 4. 1. Use data cable to connect adb debugging

1) First prepare a good quality Type-C data cable. It is recommended to use the white port Type-C 2.0 data cable shown on the left. The purple port quick charging cable shown on the right does not work properly on the OrangePi 4 LTS development board



2) First, you need to use the Type-C data cable to connect the development board to the USB interface of the computer (please use the DC power supply to power the development board at the same time)

3) Install adb tool on Ubuntu PC

```
test@test:~$ sudo apt update
test@test:~$ sudo apt -y install adb
```

4) Check to identify the ADB device

```
test@test:~$ adb devices
List of devices attached
S63QCF54CJ      device
test@test:~$ lsusb
Bus 003 Device 006: ID 2207:0006
```

5) Then you can log in to the android system through adb shell on the Ubuntu PC

```
test@test:~$ adb shell
rk3399_mid:/ $
```

6) If you need to change the Android system files, you need to close the security verification, execute the following command

```
test@test:~$ adb root
test@test:~$ adb disable-verity
```

7) Then execute the command to restart the system

```
test@test:~$ adb reboot
```

8) Remount the Android system

```
test@test:~$ adb root
test@test:~$ adb remount
```

9) Then you can transfer files to the Android system

```
test@test:~$ adb push example.txt /system/
```

4. 4. 2. Using network connection adb debugging

Using network adb does not require the USB Typc C interface data cable to connect the computer and the development board, but communicates through the network, so first make sure that the wired or wireless network of the development board has been connected, and then obtain the IP address of the development board, and then to use

1) Make sure that the **service.adb.tcp.port** of the Android system is set to the port number 5555

```
rk3399_mid:/ # getprop | grep "adb.tcp"
[service.adb.tcp.port]: [5555]
```

2) If **service.adb.tcp.port** is not set, you can use the following command to set the port number of network adb

```
rk3399_mid:/ # setprop service.adb.tcp.port 5555
rk3399_mid:/ # stop adbd
rk3399_mid:/ # start adbd
```

3) Install adb tool on Ubuntu PC

```
test@test:~$ sudo apt update
test@test:~$ sudo apt install -y adb
```

4) Then connect network adb on Ubuntu PC

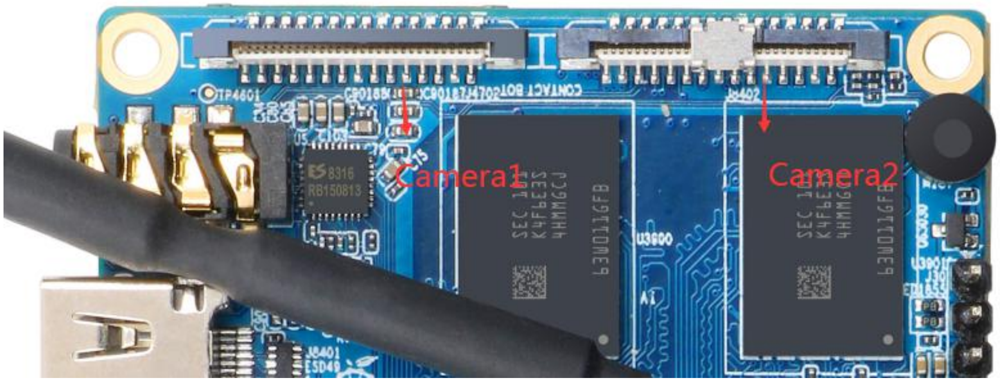
```
test@test:~$ adb connect 192.168.1.xxx      (The IP address needs to be changed to the IP address of the development board)
* daemon not running; starting now at tcp:5037
* daemon started successfully
connected to 192.168.1.xxx:5555

test@test:~$ adb devices
List of devices attached
192.168.1.xxx:5555          device
```

5) Then you can log in to the android system through adb shell on the Ubuntu PC

```
test@test:~$ adb shell
rk3399_mid:/ #
```

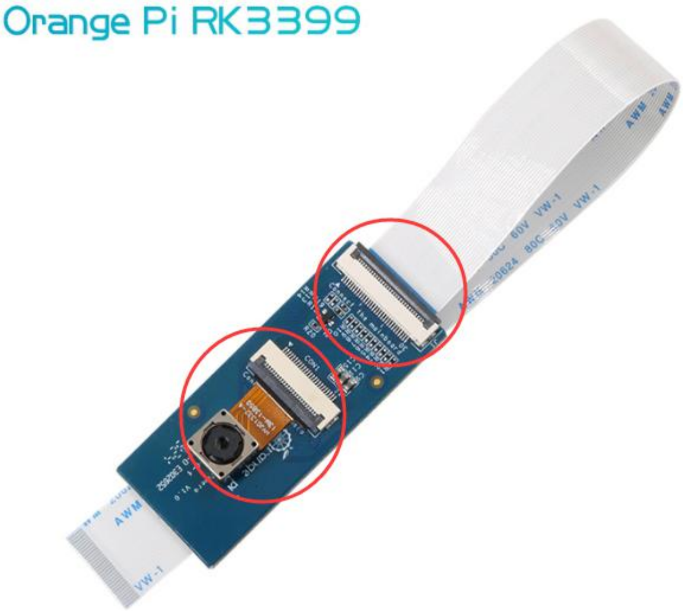
4. 5. How to use OV13850 camera

1) OrangePi 4 LTS has two Camera ports and both support OV13850 camera. The two Canera interfaces can use one of the interfaces alone, or you can use the two Camera interfaces to connect two cameras at the same time. After connecting two cameras, one is front and one is rear

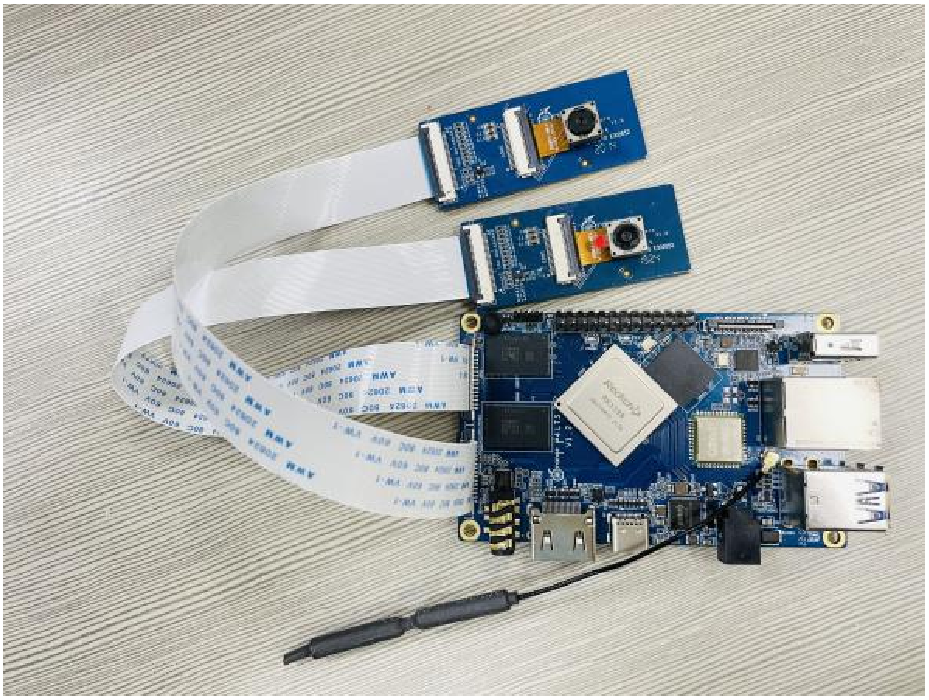


2) The OV13850 camera kit includes an OV13850 camera, an adapter board, and a ribbon cable

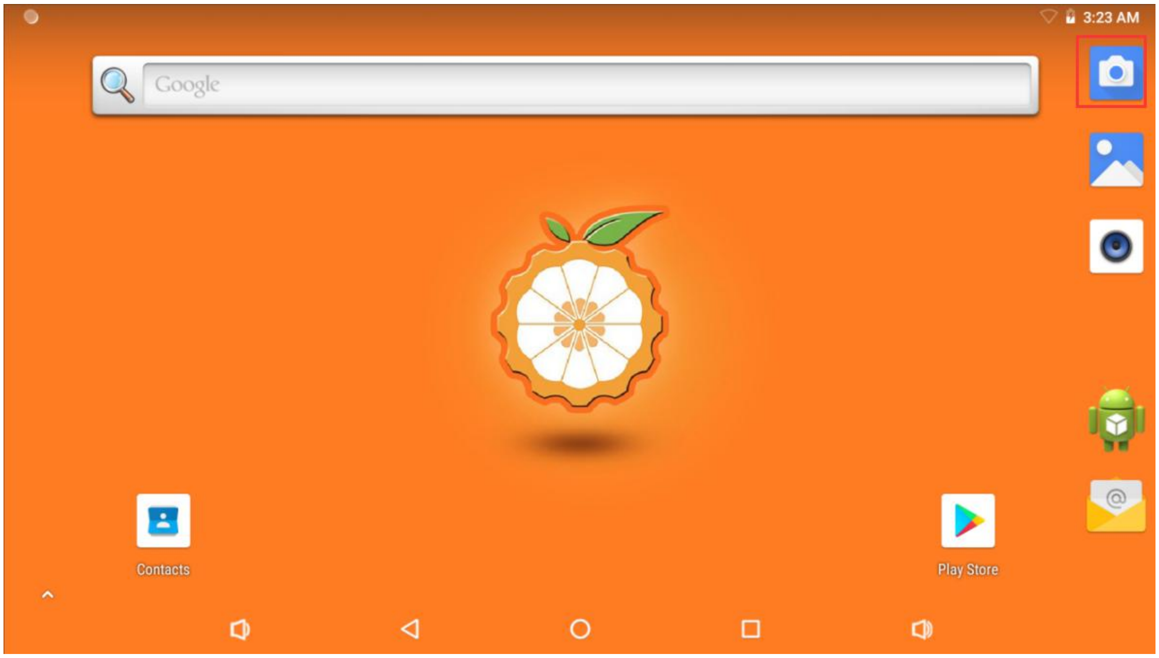
3) First insert the OV13850 camera into the adapter board, and then insert the cable into another slot on the adapter board



4) Then insert the other end of the cable into the Camera camera interface of the development board. The interface can be connected to two cameras at the same time, or one camera can be connected separately. After connecting the camera, start the Android system (**do not plug in the camera after power on**)

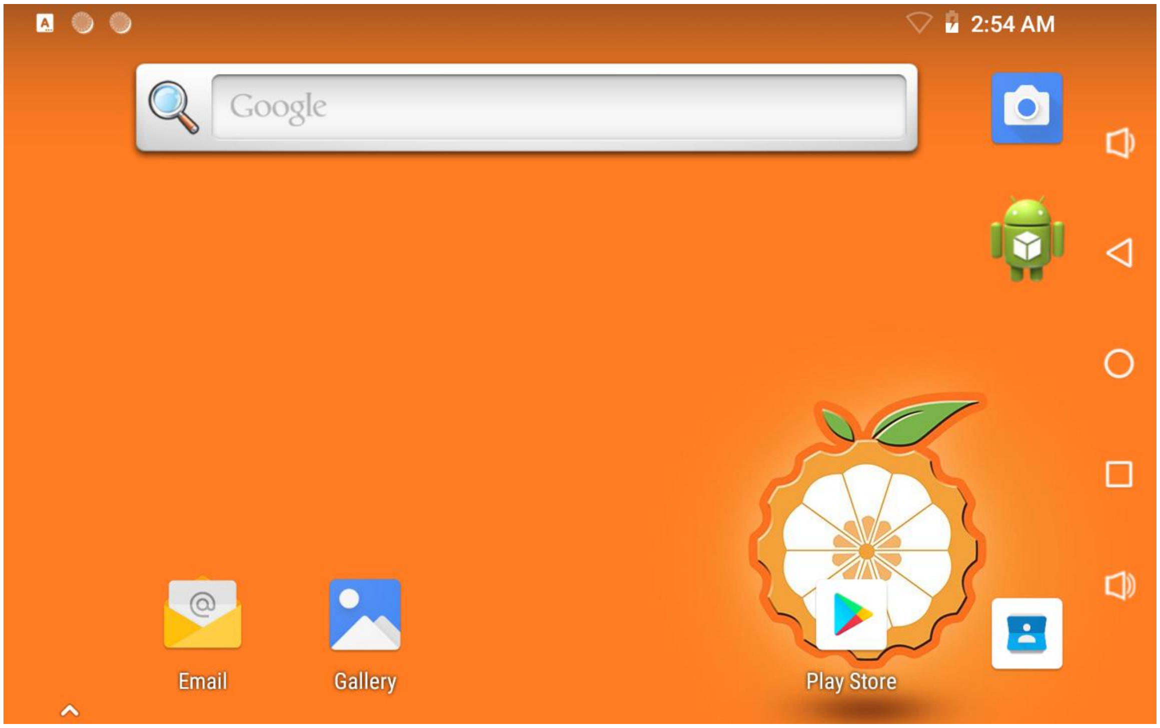


5) After the Android system is started, open the camera APP and you can see the output of the OV13850 camera. The location of the camera APP is shown in the following figure:

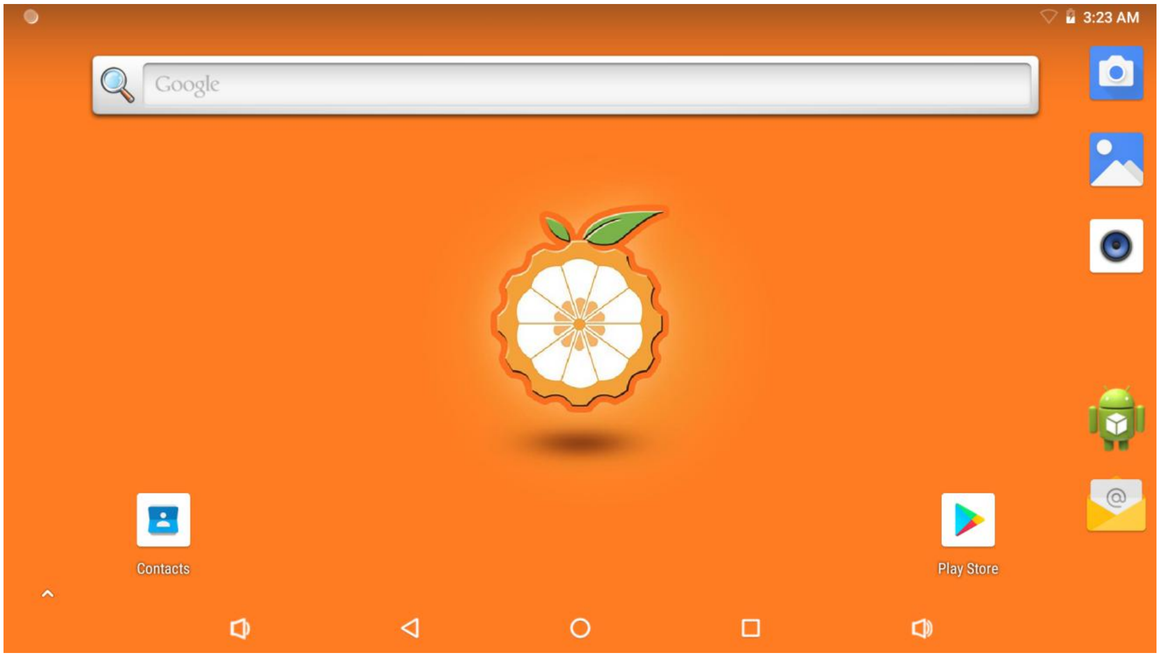


4. 6. How to use the HDMI interface

1) The factory-installed Android of the Orange Pi 4 LTS development board supports HDMI display. Since it also supports a 10.1-inch MIPI screen, its UI resolution is only 1280x800. After connecting the development board to an HDMI display or TV through an HDMI to HDMI cable, the interface after the system starts is as shown in the figure below



2) After testing all functions with the pre-installed system and confirming that there is no problem, if the 10.1-inch MIPI screen is not connected, in order to obtain a better display effect, it is recommended to re-burn the image without the word "LCD" and wait for the system to start up. After that, the display interface is as shown in the figure below, and the UI resolution is 1920*1080



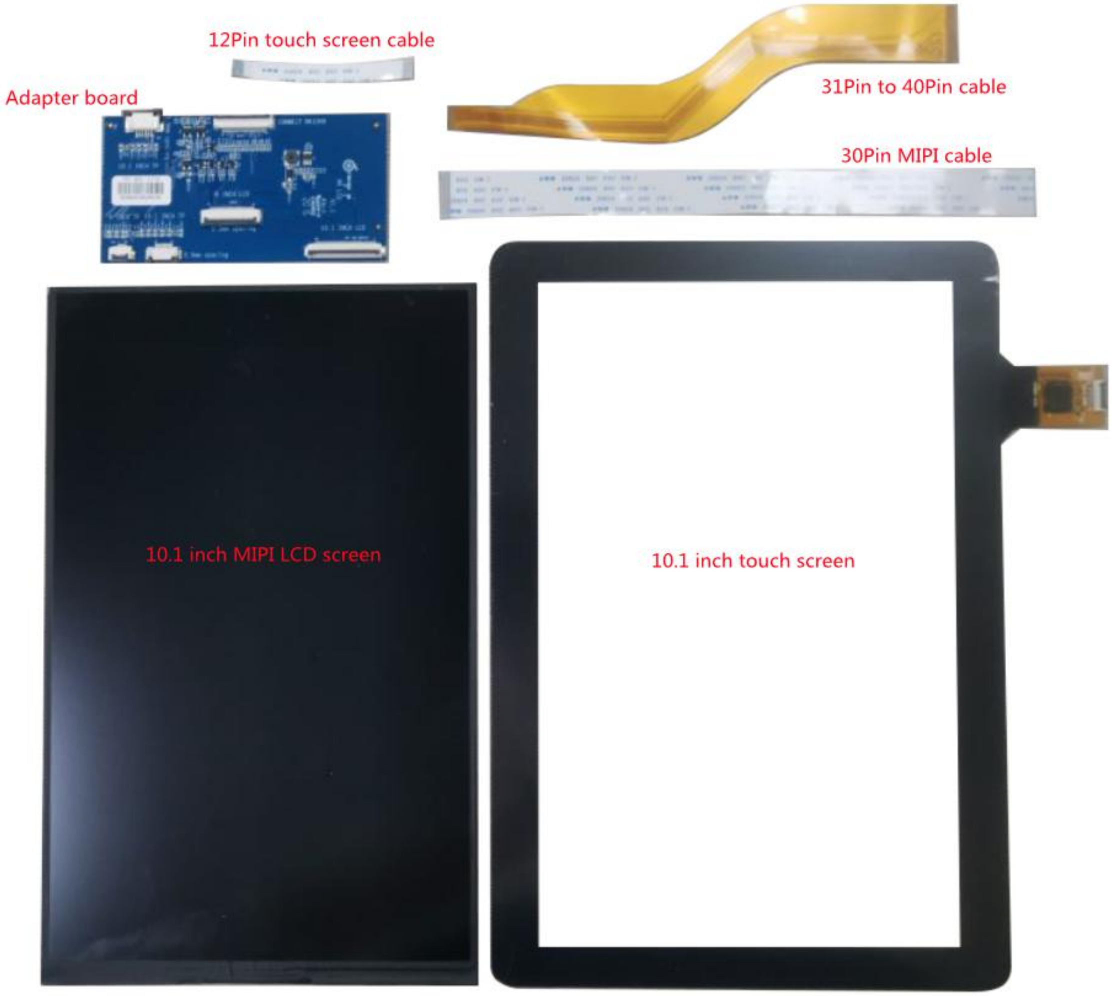
4. 7. The method of displaying the system interface through the TypeC interface

1）The factory-installed Android of the Orange Pi 4 LTS development board supports Type-C to HDMI display. You need to prepare a Type-C to HDMI cable, and connect the development board to an HDMI display or TV through the Type-C interface for display

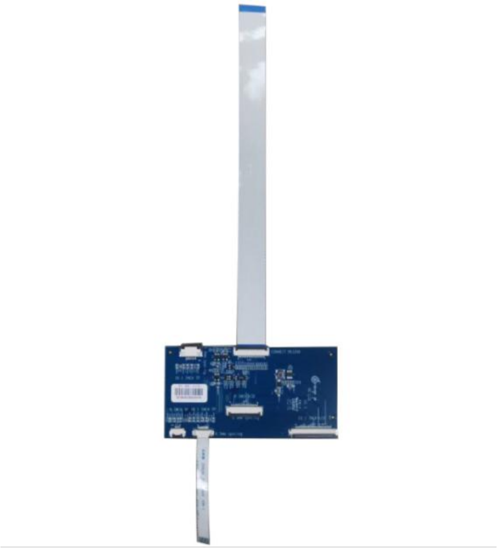
4. 8. 10.1 inch MIPI screen usage

The pre-installed Android system of the Orange Pi 4 LTS development board already supports MIPI screen. If it is not the pre-installed Android system, please re-burn the Android firmware with the word "LCD" on the official website that supports 10.1-inch MIPI screen.

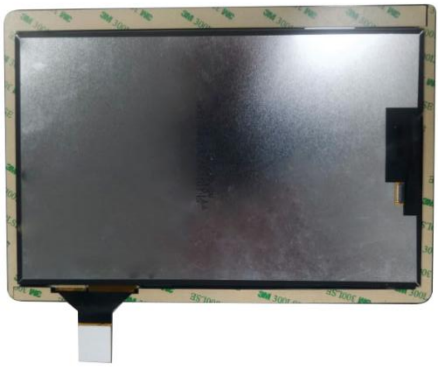
1) 10.1 inch MIPI screen delivery list, including a touch screen, a MIPI LCD screen, a 31pin to 40pin cable, a 12pin touch screen cable, a 30pin MIPI cable, and a transfer board



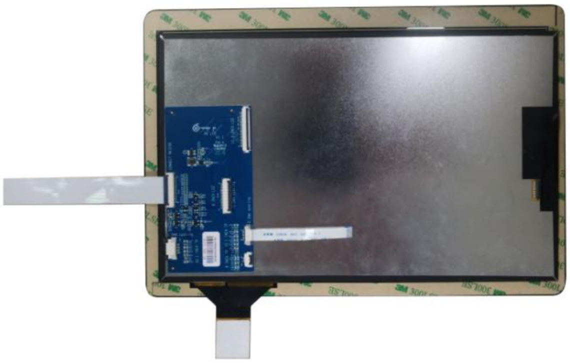
2) Connect the 12pin touch screen cable and 30pin MIPI cable to the adapter board as shown in the figure below. Note that the 12pin touch screen cable direction is the blue bar facing down.



3) With the touch screen facing down, stack the MIPI LCD screen on the touch screen as shown below

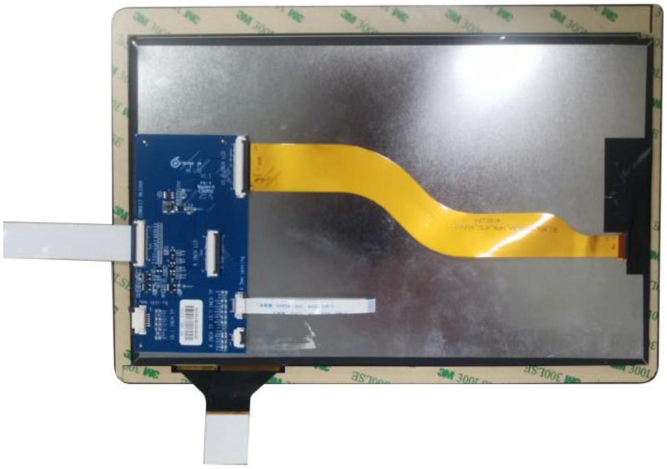


4) Place the connected adapter board on the MIPI LCD screen as shown in the figure below

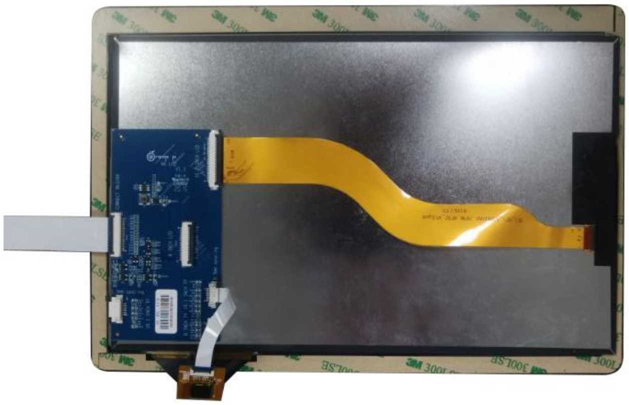


5) Then connect the MIPI LCD screen and the adapter board through the 31pin to 40pin

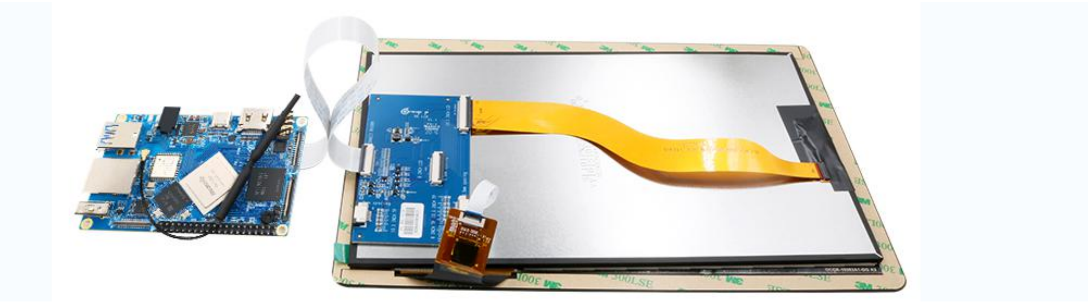
cable



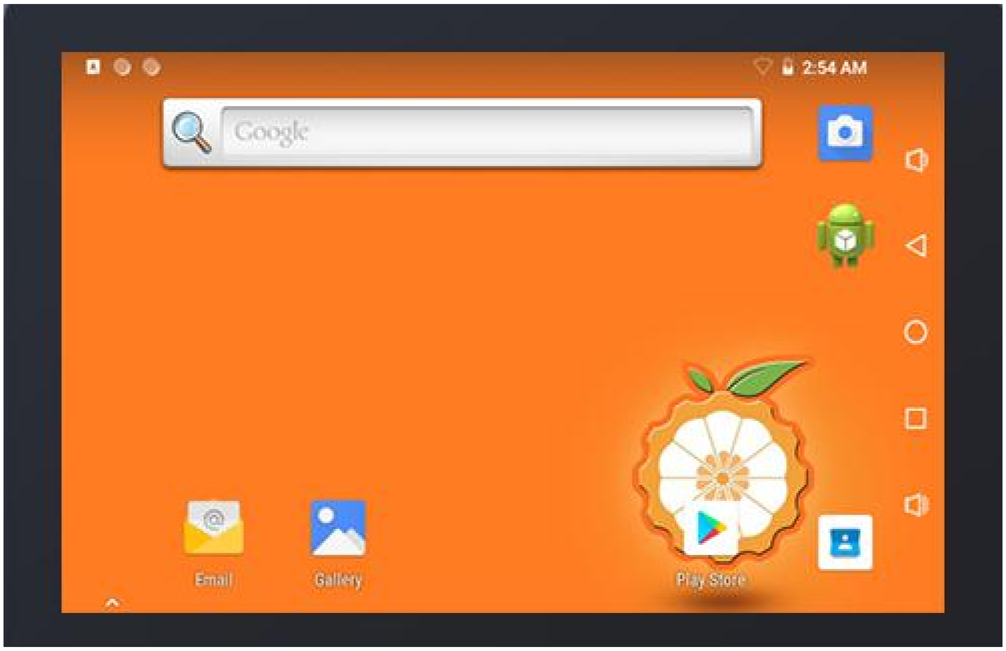
6) Then connect the touch screen and the adapter board through the 12pin touch screen cable



7) Connect the adapter board to the LCD1 interface of the Orange Pi 4 LTS through a 30pin MIPI cable



8) Then insert the DC power supply into the development board. After the system is started, the interface is as shown in the figure below.



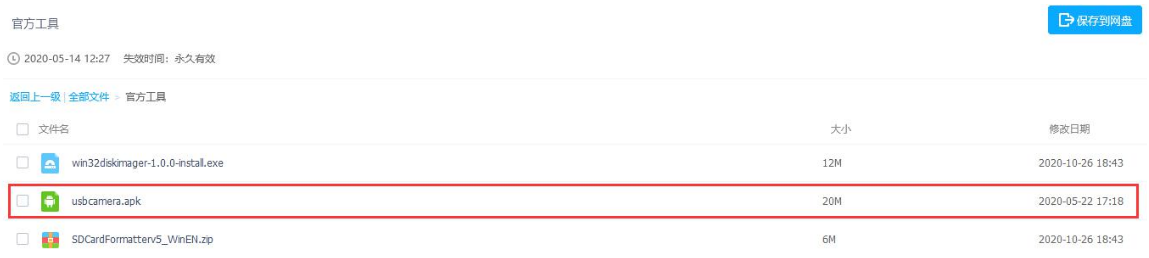
4. 9. How to use the USB camera

1) First insert the USB camera into the USB interface of the development board. If the USB camera is recognized normally, the corresponding video device node will be generated under /dev

```
rk3399_mid:/ $ ls /dev/video*
/dev/video0
rk3399_mid:/ $ ls /sys/class/video4linux/ -lh
total 0
lrwxrwxrwx 1 root root 0 2020-09-30 03:29 video0 \
-> ../../devices/platform/usb@fe900000/fe900000.d0
```

2) Then make sure the adb connection between the Ubuntu PC and the development board is normal

3) Download the USB camera test APP in the official tool on the data download page of Orange Pi 4 LTS



官方工具

保存到网盘

2020-05-14 12:27 失效时间：永久有效

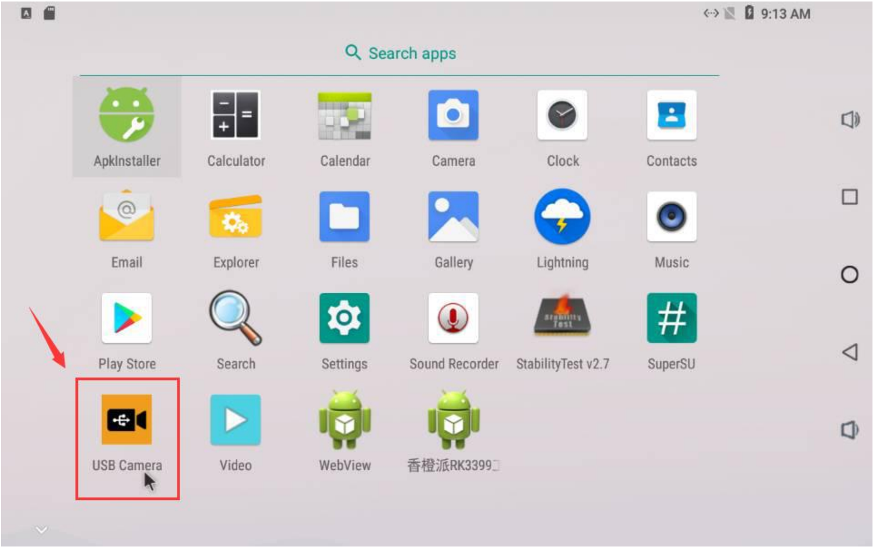
返回上一级 | 全部文件 > 官方工具

□ 文件名	大小	修改日期
□ win32diskimager-1.0.0-install.exe	12M	2020-10-26 18:43
□ usbcamera.apk	20M	2020-05-22 17:18
□ SDCardFormatterv5_WinEN.zip	6M	2020-10-26 18:43

4) Then use the adb command to install the USB camera test APP to the Android system, of course, you can also use the U disk copy method to install

```
test@test:~$ adb install usbcamera.apk
```

5) After installation, you can see the startup icon of the USB camera in the Android App list

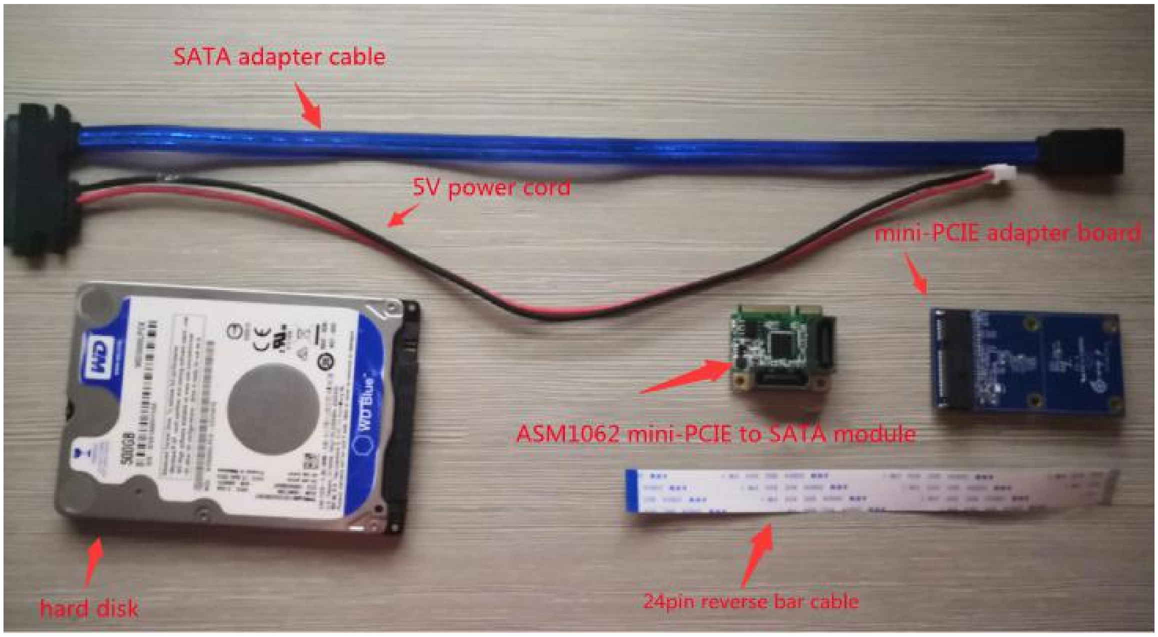


6) Then double-click to open the USB camera APP to see the output video of the USB camera

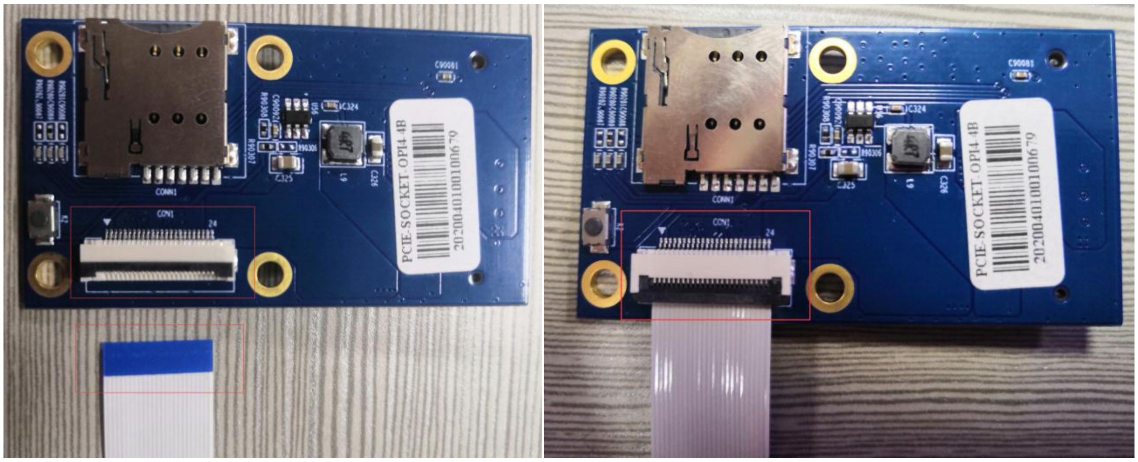
4. 10. Instructions for use of Mini-PCIE

4. 10. 1. Instructions for connecting mini-PCIE to hard disk

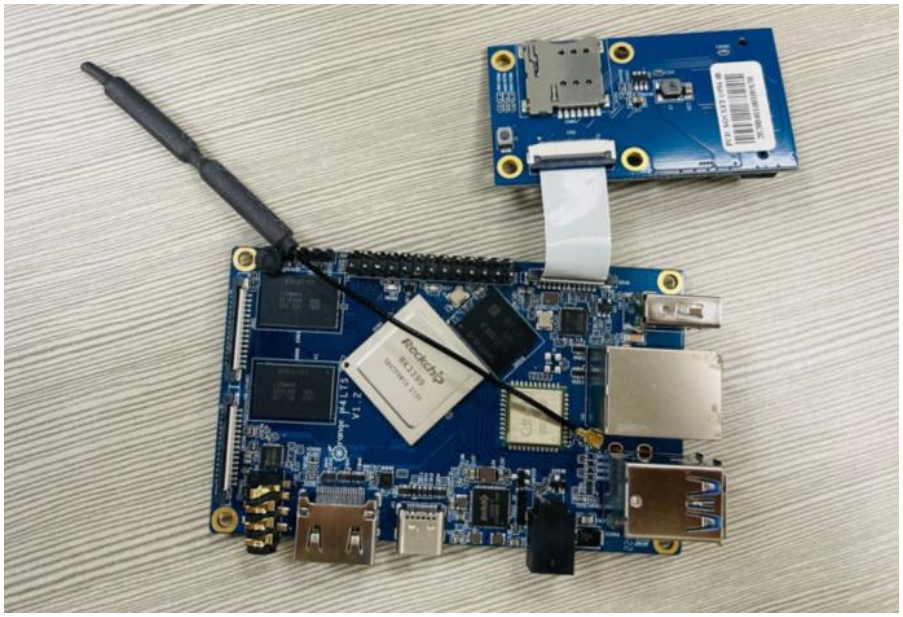
1) Prepare the required accessories, 24pin reverse cable, mini-PCIE adapter board, ASM1062 mini-PCIE to SATA module, hard disk, SATA adapter cable, 5V power cable, accessories picture as shown below



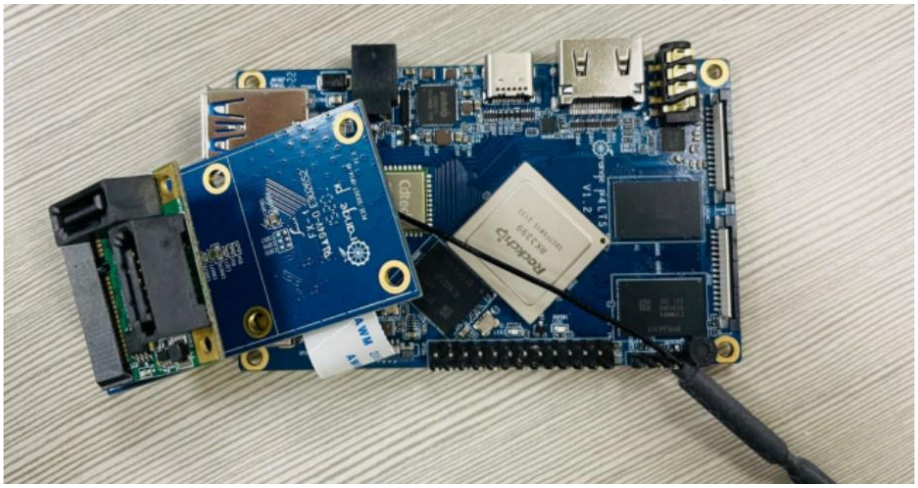
2) Connect the 24pin reverse cable to the mini-PCIE adapter board as shown in the figure below. Note that the blue bar of the cable is facing outward.



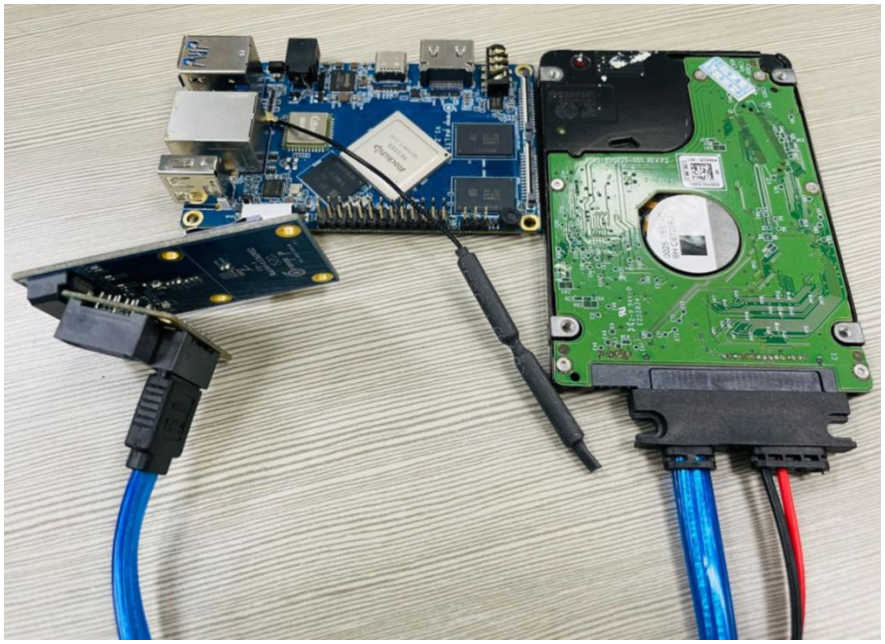
3) Connect the mini-PCIE adapter board to the 24pin interface of the Orange Pi 4 LTS development board



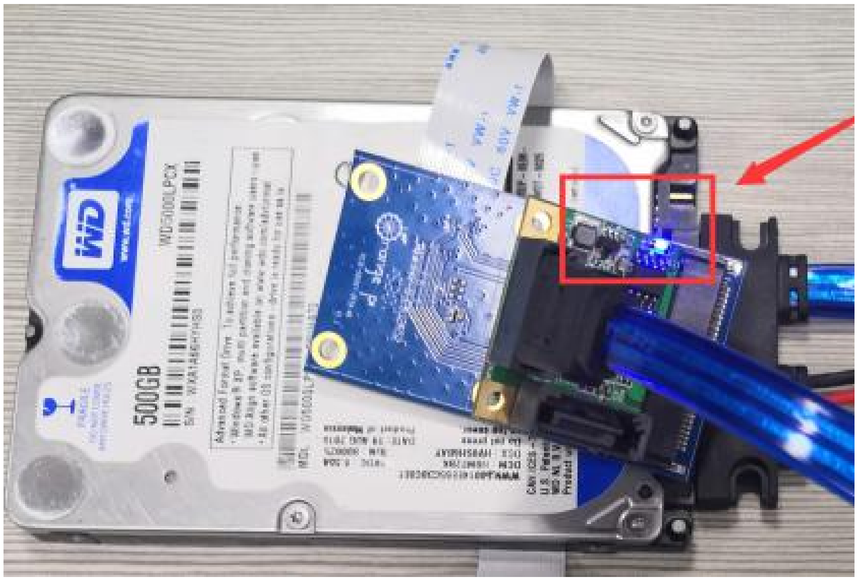
4) Connect the ASM1062 mini-PCIE to SATA module to the mini-PCIE adapter board



5) Connect the hard disk to the interface of the mini-PCIE to SATA module through a SATA cable

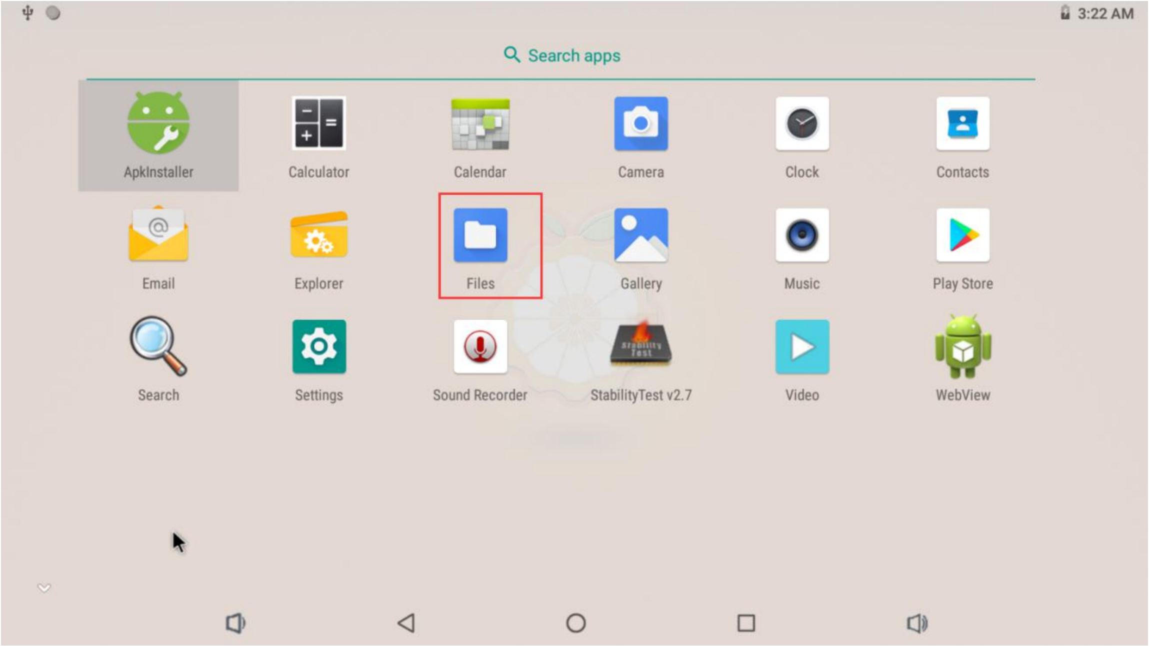


6) Connect the power cable of the SATA adapter cable to the 5V power supply. After the connection is completed, the development board is connected to the DC power supply and powered on. ASM1062 mini-PCIE to SATA module LED light flashes, indicating that the connection is successful

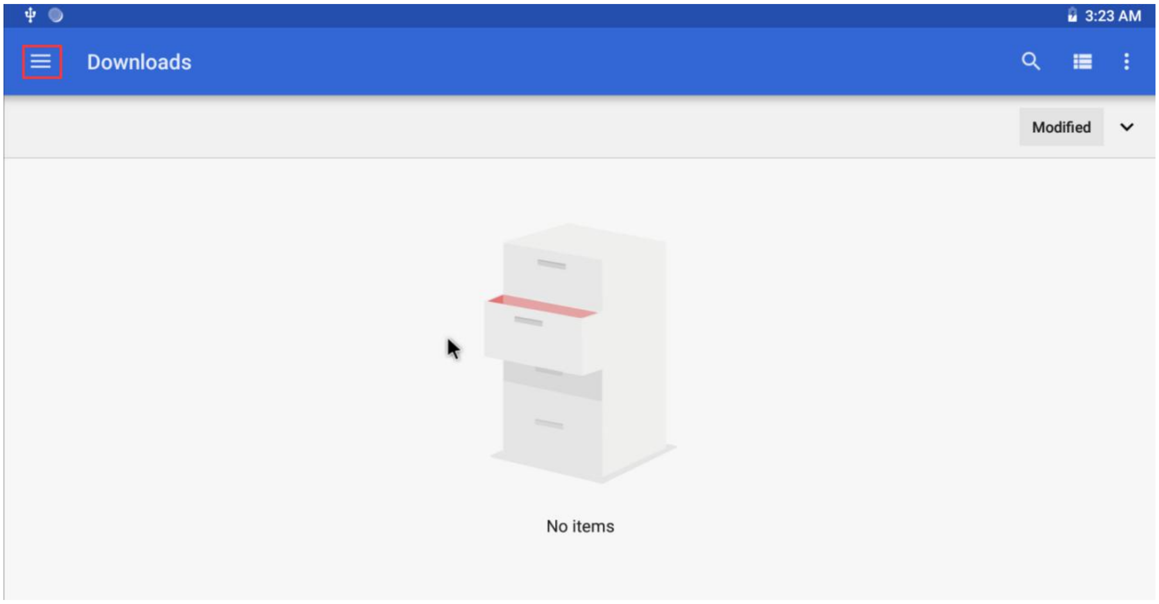


This function does not support hot swapping and must be connected before powering on

7) Power on and start the development board. After the system is started, open the file manager app

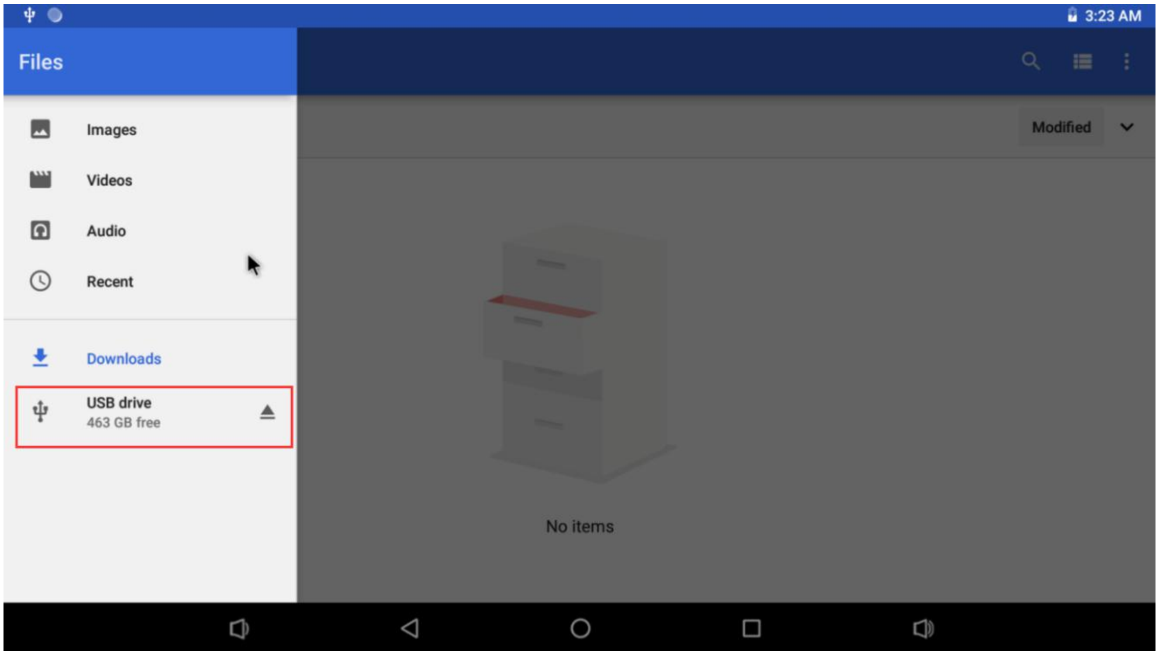


8) After opening, the file manager interface is as shown below, and then click the position of the red box in the upper left corner



No items

9) At this point, you can see that the 500G hard disk is recognized



3:23 AM
Files
Images
Videos
Audio
Recent
Downloads
USB drive
463 GB free
Modified
No items

5. Instructions for using the Linux SDK

5. 1. Compilation system requirements

1) The Linux SDK, the Ubuntu_21.04 branch of orangepi-build, only supports running on a computer with **Ubuntu21.04** installed, so before downloading orangepi-build, please make sure that the Ubuntu version installed on your computer is Ubuntu21.04. The command to check the Ubuntu version installed on the computer is as follows. If the Release field shows other than **21.04**, it means that the current Ubuntu version does not meet the requirements. Please change the system before performing the following operations.

```
test@test:~$ lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 21.04
Release:        21.04
Codename:       hirsute
test@test:~$
```

2) If the Windows system is installed on the computer and there is no computer with Ubuntu 21.04 installed, you can consider using VirtualBox or VMware to install an Ubuntu21.04 virtual machine in the Windows system. But please note, do not compile orangepi-build on the WSL virtual machine, because orangepi-build has not been tested in the WSL virtual machine, so it cannot be guaranteed that orangepi-build can be used normally in WSL, and please do not use the Linux system of the development board. using orangepi-build in

5. 2. Get the source code of linux sdk

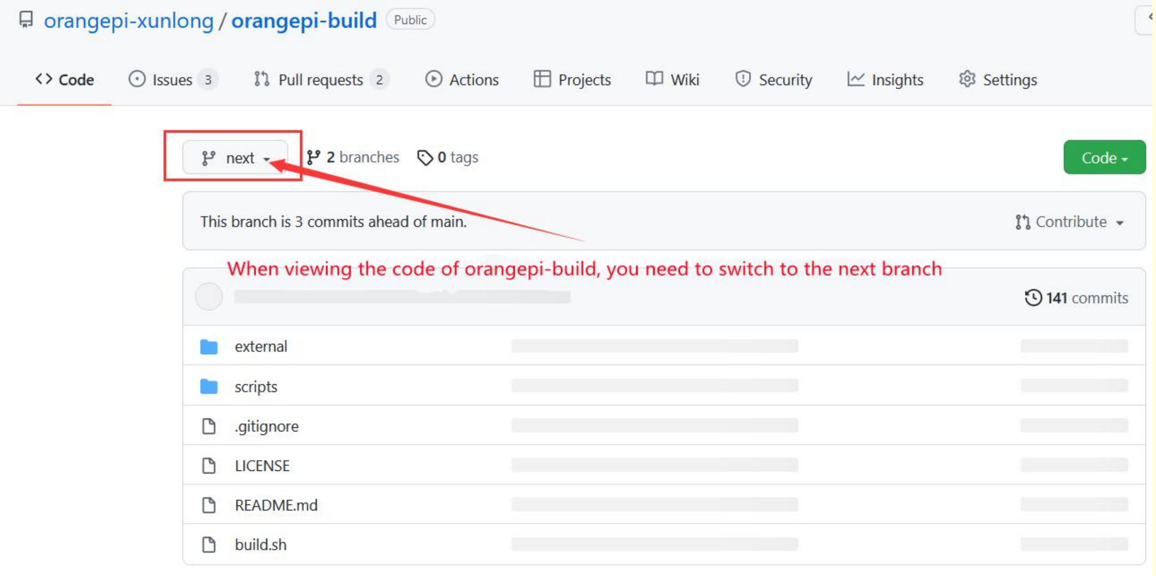
Note that Orange Pi 4 LTS must use the source code of the next branch of orangepi-build, and the source code of the main branch is not adapted to Orange Pi 4 LTS.

5. 2. 1. Download orangepi-build from github

1) The linux sdk actually refers to the code of orangepi-build. Orangepi-build is modified based on the armbian build compilation system. Using orangepi-build, multiple versions of linux images can be compiled. First download the code of orangepi-build. Currently, the RK3399 series development boards in the Linux SDK already support the legacy branch and the current branch.

```
test@test:~$ sudo apt update
test@test:~$ sudo apt install git
test@test:~$ git clone https://github.com/orangepi-xunlong/orangepi-build.git -b
Ubuntu21.04
```

Note that Orange Pi 4 LTS must use the source code of the next branch of orangepi-build. The above git clone command specifies that the branch of the orangepi-build source code is next. The source code of the main branch is not adapted to Orange Pi 4 LTS.



When viewing the code of orangepi-build, you need to switch to the next branch

Downloading the code of orangepi-build through the git clone command does not require entering the username and password of the github account (the same is true for downloading other codes in this manual). If the Ubuntu PC prompts the user who needs to enter the github account after entering the git clone command The name and password are usually the wrong address of the orangepi-build

repository behind git clone. Please check the spelling of the command carefully, instead of thinking that we forgot to provide the username and password of the github account here.

2) The u-boot and linux kernel versions currently used by the RK3399 series development boards are as follows

branch	u-boot version	linux kernel version
legacy	u-boot 2020.10	linux4.4
current	u-boot 2020.10	linux5.10

3) Orangepi-build will contain the following files and folders after downloading

a. **build.sh**: Compile startup script

b. **external**: Contains configuration files, specific scripts and source code of some programs needed to compile the image, etc.

c. **LICENSE**: GPL 2 license file

d. **README.md**: orangepi-build documentation

e. **scripts**: Generic script for compiling linux images

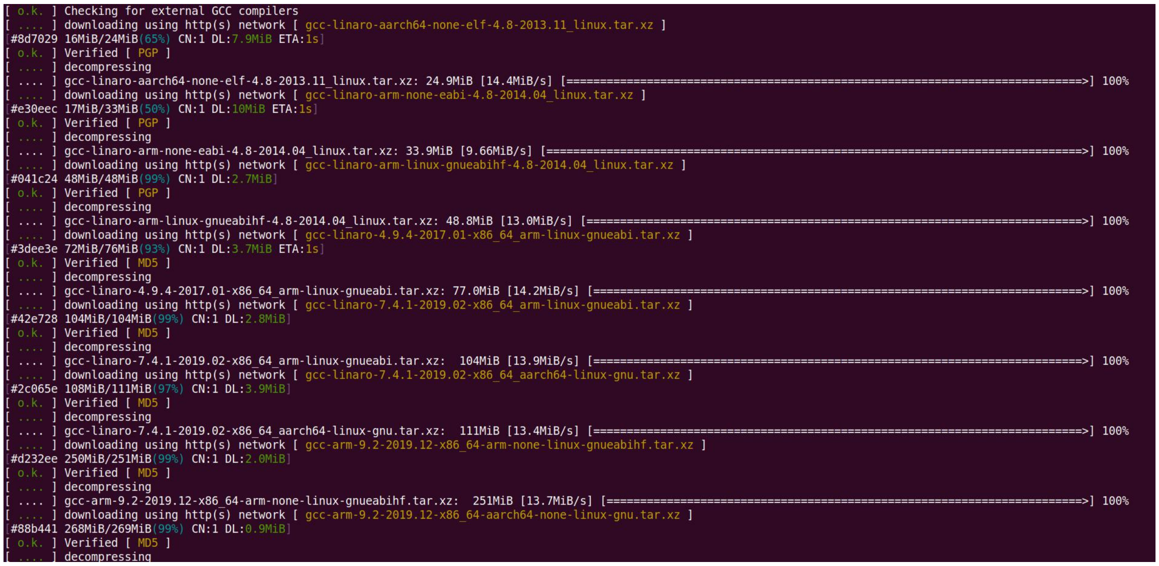
```
test@test:~/orangepi-build$ ls
build.sh   external   LICENSE   README.md   scripts
```

If you downloaded the code of orangepi-build from github, after downloading, you may find that orangepi-build does not contain the source code of u-boot and linux kernel, nor does it require cross-compilation to compile u-boot and linux kernel Toolchain, this is normal, because these things are stored in other separate github repositories or some servers (the addresses will be detailed below). orangepi-build will specify the address of u-boot, linux kernel and cross-compilation toolchain in the script and configuration file. When running orangepi-build, when it finds that these things are not available locally, it will automatically go to the corresponding place to download.

5. 2. 2. Download the cross-compilation toolchain

1) When orangepi-build runs for the first time, it will automatically download the cross-compilation toolchain and put it in the toolchains folder. After running the build.sh script of orangepi-build, it will check whether the cross-compilation toolchain in toolchains exists. , if it does not exist, it will restart the download, if it exists, it will be

used directly, and the download will not be repeated



```
[ o.k. ] Checking for external GCC compilers
[ .... ] downloading using http(s) network [ gcc-linaro-aarch64-none-elf-4.8-2013.11_linux.tar.xz ]
[#8d7029 16MiB/24MiB(65%) CN:1 DL:7.9MiB ETA:1s]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-aarch64-none-elf-4.8-2013.11_linux.tar.xz: 24.9MiB [14.4MiB/s] [=============================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-arm-none-eabi-4.8-2014.04_linux.tar.xz ]
[#e30eec 17MiB/33MiB(50%) CN:1 DL:10MiB ETA:1s]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-arm-none-eabi-4.8-2014.04_linux.tar.xz: 33.9MiB [9.66MiB/s] [================================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux.tar.xz ]
[#041c24 48MiB/48MiB(99%) CN:1 DL:2.7MiB]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux.tar.xz: 48.8MiB [13.0MiB/s] [==========================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi.tar.xz ]
[#3dee3e 72MiB/76MiB(93%) CN:1 DL:3.7MiB ETA:1s]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi.tar.xz: 77.0MiB [14.2MiB/s] [=========================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi.tar.xz ]
[#42e728 104MiB/104MiB(99%) CN:1 DL:2.8MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi.tar.xz:  104MiB [13.9MiB/s] [=========================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu.tar.xz ]
[#2c065e 108MiB/111MiB(97%) CN:1 DL:3.9MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu.tar.xz:  111MiB [13.4MiB/s] [=========================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf.tar.xz ]
[#d232ee 250MiB/251MiB(99%) CN:1 DL:2.0MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf.tar.xz:  251MiB [13.7MiB/s] [=======================================================================>] 100%
[ .... ] downloading using http(s) network [ gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu.tar.xz ]
[#88b441 268MiB/269MiB(99%) CN:1 DL:0.9MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
```

2) The image website of the cross-compilation tool chain in China is the open source software mirror site of Tsinghua University

```
https://mirrors.tuna.tsinghua.edu.cn/armbian-releases/_toolchain/
```

3) After the toolchains is downloaded, it will contain multiple versions of the cross-compilation toolchain

```
test@test:~/orangepi-build$ ls toolchains/
gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu
gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf
gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi
gcc-linaro-5.5.0-2017.10-x86_64_arm-linux-gnueabihf
gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu
gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi
gcc-linaro-aarch64-none-elf-4.8-2013.11_linux
gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux
gcc-linaro-arm-none-eabi-4.8-2014.04_linux
```

4) The cross-compilation toolchain used to compile the RK3399 Linux kernel source code is

a. linux4.4

```
gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu
```

b. linux5.10

```
gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu
```

5) The cross-compilation toolchain used to compile RK3399 u-boot source code is

   a. v2020.10

```
gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu
```

5. 2. 3. Orangepi-build complete directory structure description

1) After the orangepi-build repository is downloaded, it does not contain the source code of the linux kernel, u-boot and the cross-compilation tool chain. The source code of the linux kernel and u-boot are stored in a separate git repository

   a. The git repository where the linux kernel source code is stored is as follows, pay attention to switch the branch of the linux-orangepi repository to

      a) linux4.4

```
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-4.4-rockchip64
```

      b) Linx5.10

```
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.10-rk3399
```

   b. The git repository where the u-boot source code is stored is as follows. Note that the branch of the u-boot-orangepi repository is switched to

v2020.10-rockchip64

```
https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2020.10-rockchip64
```

If you are not familiar with orangepi-build and do not know the detailed process of compiling the linux kernel and u-boot, please do not download and use the above linux kernel and u-boot source code for compilation operation, because the compilation script and configuration file of orangepi-build Some adjustments and optimizations will be made to u-boot and linux. If you do not use orangepi-build to compile u-boot and linux, you may encounter problems of compilation failure or failure to start.

2) When orangepi-build runs for the first time, it will download the cross-compilation toolchain, u-boot and linux kernel source code. After successfully compiling a linux image, the files and folders that can be seen in orangepi-build are:

   c. **build.sh**: Compile startup script

   d. **external**: Contains configuration files, scripts for specific functions and source code of some programs needed to compile the image. The rootfs compressed package cached in the process of compiling the image is also stored in external

e. **kernel**: Store the source code of the linux kernel, the folder named orange-pi-4.4-rockchip64 stores the kernel source code of the legacy branch of the RK3399 series development board, and the folder named orange-pi-5.10-rk3399 stores the The kernel source code of the current branch of the RK3399 series development board (if only the linux image of the legacy branch is compiled, then only the kernel source code of the legacy branch can be seen; if only the linux image of the current branch is compiled, then only the current branch can be seen. Kernel source code), please do not manually modify the name of the folder of the kernel source code. If modified, the compilation system will re-download the kernel source code when running.

f. **LICENSE**: GPL 2 license file

g. **README.md**: orangepi-build documentation

h. **output**: Store the compiled u-boot, linux and other deb packages, compilation logs, and compiled images and other files

i. **scripts**: Generic script for compiling linux images

j. **toolchains**: Store the cross-compilation toolchain

k. **u-boot**: The source code of u-boot is stored. The folder named v2020.10-rockchip64 stores the u-boot source code of the current branch and legacy branch of the RK3399 series development board. Please do not manually modify the name of the folder of the u-boot source code. If it is modified, the u-boot source code will be re-downloaded when the compilation system is running.

l. **userpatches**: Store the configuration files needed to compile the script

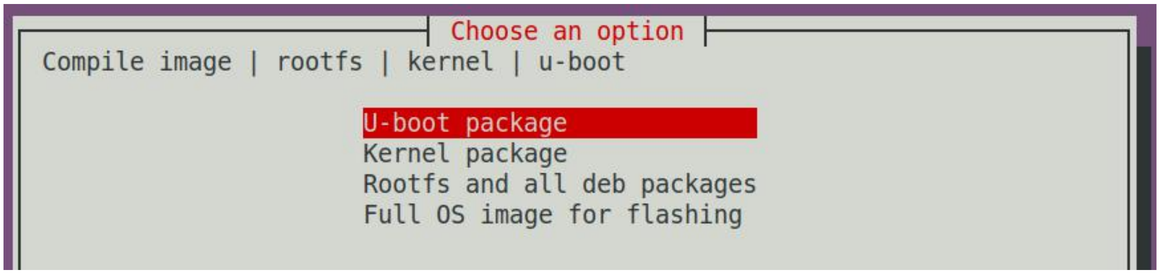
```
test@test:~/orangepi-build$ ls
build.sh    external    kernel    LICENSE    output    README.md    scripts
toolchains   u-boot   userpatches
```

5. 3. Compile u-boot

1) Run the build.sh script, remember to add sudo permissions

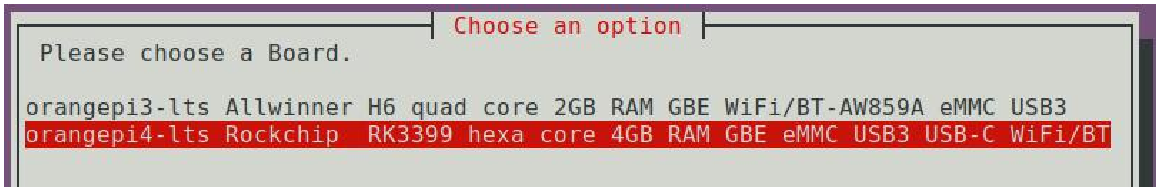
```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **U-boot package** and press Enter



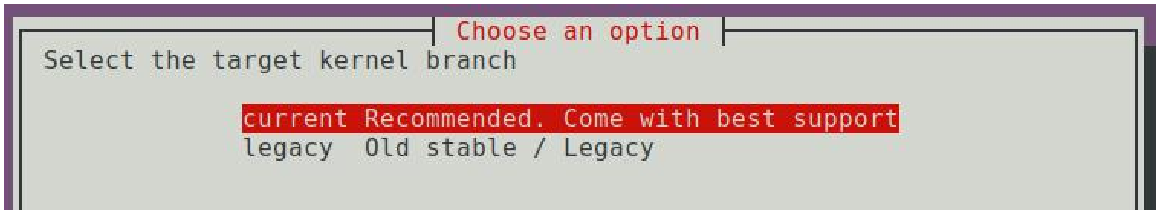
```
Choose an option
Compile image | rootfs | kernel | u-boot

U-boot package
Kernel package
Rootfs and all deb packages
Full OS image for flashing
```

3) Then select the model of the development board



```
Choose an option
Please choose a Board.

orangepi3-lts Allwinner H6 quad core 2GB RAM GBE WiFi/BT-AW859A eMMC USB3
orangepi4-lts Rockchip  RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
```

4) Then select branch



```
Choose an option
Select the target kernel branch

current Recommended. Come with best support
legacy  Old stable / Legacy
```

5) Then it will start to compile u-boot, and some of the information prompted during compilation are as follows

a. u-boot source code version

```
[ o.k. ] Compiling u-boot [ v2020.10 ]
```

b. The version of the cross-compile toolchain

```
[ o.k. ] Compiler version [ aarch64-none-linux-gnu-gcc 9.2.1 ]
```

c. The path to the generated u-boot deb package

```
[ o.k. ] Target directory [ orangepi-build/output/debs/u-boot ]
```

d. The package name of the u-boot deb package generated by compilation

```
[ o.k. ] File name [ linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb ]
```

e. Compilation time used

```
[ o.k. ] Runtime [ 1 min ]
```

f. Repeat the command to compile u-boot, use the following command to start compiling u-boot directly without selecting through the graphical interface

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh    BOARD=orangepi4-lts
BRANCH=current BUILD_OPT=u-boot KERNEL_CONFIGURE=yes ]
```

6) View the compiled u-boot deb package

```
test@test:~/orangepi-build$ ls output/debs/u-boot/
linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb
```

7) The files contained in the generated u-boot deb package are as follows

a. Use the following command to decompress the deb package

```
test@test:~/orangepi-build$ cd output/debs/u-boot
test@test:~/orangepi_build/output/debs/u-boot$ $ dpkg -x \
linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb .     (Note that there is a "." at
the end of the command)
test@test:~/orangepi_build/output/debs/u-boot$ ls
linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb    usr
```

b. The decompressed file is as follows

```
test@test:~/orangepi-build/output/debs/u-boot$ tree usr
usr
└── lib
    ├── linux-u-boot-current-orangepi4-lts_2.2.0_arm64
    │   ├── idbloader.bin
    │   ├── trust.bin
    │   └── uboot.img
    └── u-boot
        ├── LICENSE
        ├── orangepi-4-rk3399_defconfig
        └── platform_install.sh

3 directories, 6 files
```

8) When the orangepi-bulid compilation system compiles the u-boot source code, it first synchronizes the u-boot source code with the u-boot source code of the github server, so if you want to modify the u-boot source code, you need to turn off the download and update function of the source code (**required This function can only be turned off after u-boot is fully compiled once, otherwise it will prompt that the source code of u-boot cannot be found**), otherwise the modifications will be restored, the method is as follows

Set the IGNORE_UPDATES variable in userpatches/config-default.conf to "yes"

```
test@test:~/orangepi-build$ vim userpatches/config-default.conf
IGNORE_UPDATES="yes"
```

9) When debugging the u-boot code, you can use the following method to update the u-boot in the linux image for testing

a. Upload the compiled u-boot deb package to the linux system of the development board

```
test@test:~/orangepi-build$ cd output/debs/u-boot
test@test:~/orangepi_build/output/debs/u-boot$ scp \
linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb root@192.168.1.xxx:/root
```

b. Then log in to the development board and uninstall the installed deb package of u-boot

```
root@orangepi:~# apt purge -y linux-u-boot-orangepi4-lts-current
```

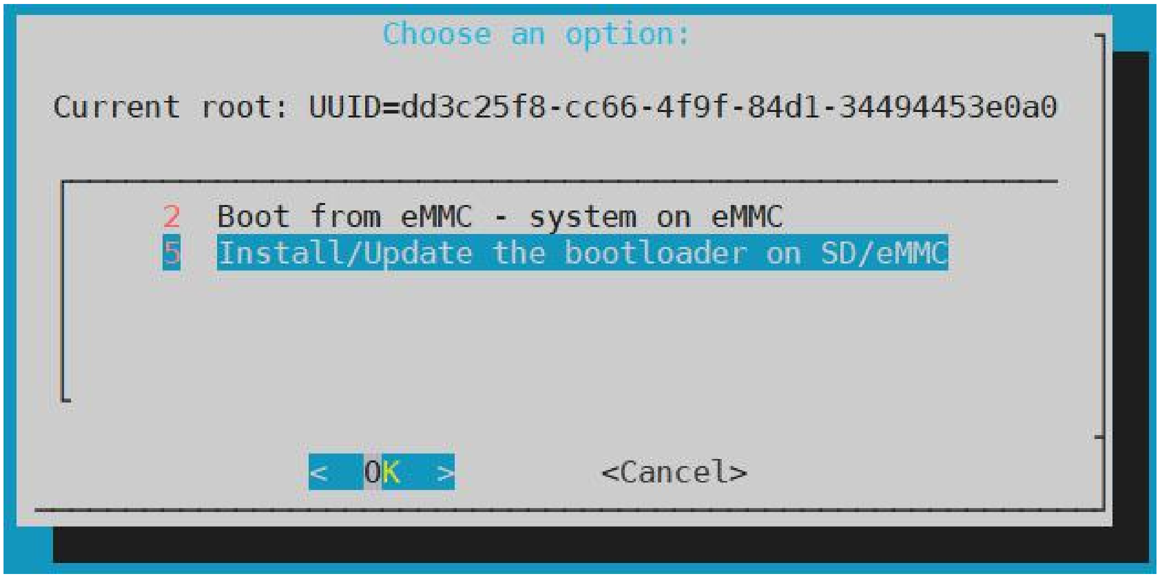
c. Install the new u-boot deb package just uploaded

```
root@orangepi:~# dpkg -i linux-u-boot-current-orangepi4-lts_2.2.0_arm64.deb
```

d. Then run the nand-sata-install script

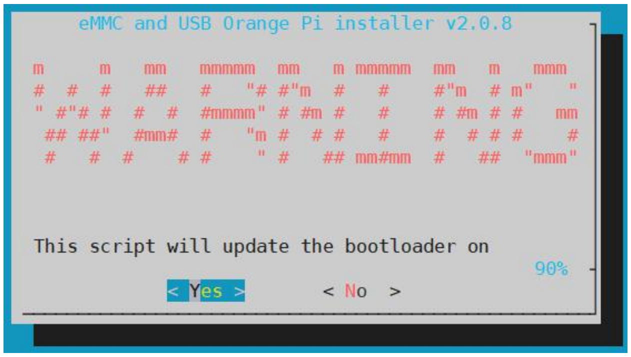
```
root@orangepi:~# nand-sata-install
```

e. then select **5 Install/Update the bootloader on SD/eMMC**



```
Choose an option:

Current root: UUID=dd3c25f8-cc66-4f9f-84d1-34494453e0a0

      2  Boot from eMMC - system on eMMC
      5  Install/Update the bootloader on SD/eMMC

        <  OK  >          <Cancel>
```

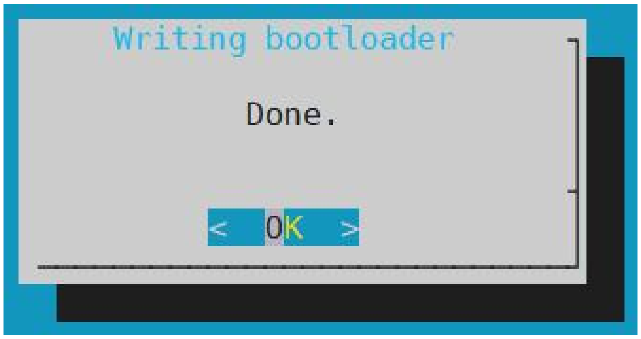
f. After pressing the Enter key, a Warring will pop up first



eMMC and USB Orange Pi installer v2.0.8

This script will update the bootloader on

g. Press the Enter key again to start updating u-boot. After the update, the following information will be displayed



Writing bootloader

Done.

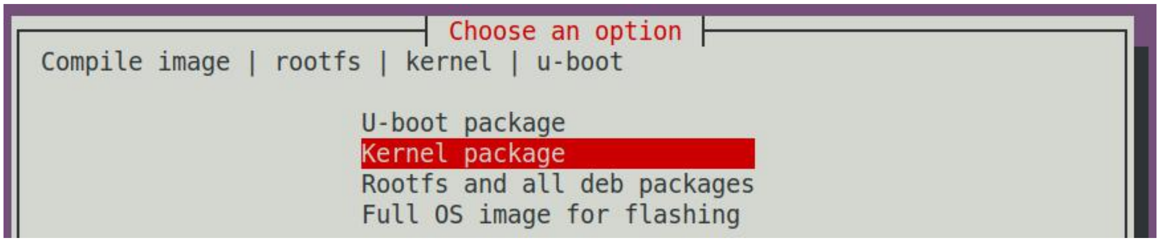
h. Then you can restart the development board to test whether the modification of u-boot takes effect

5. 4. Compile the linux kernel

1) Run the build.sh script, remember to add sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

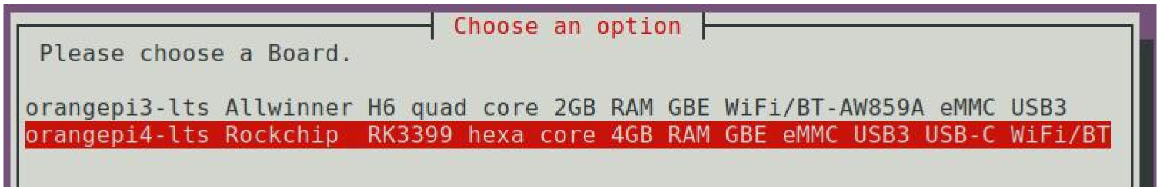
2) Select **Kernel package**, then press Enter



Choose an option

Compile image | rootfs | kernel | u-boot

3) Then select the model of the development board

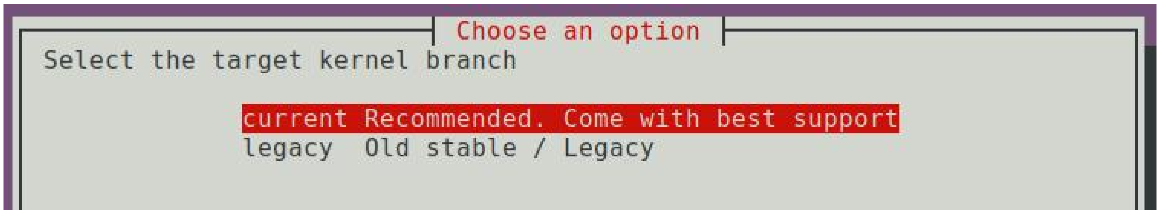


```
Choose an option
Please choose a Board.

orangepi3-lts Allwinner H6 quad core 2GB RAM GBE WiFi/BT-AW859A eMMC USB3
orangepi4-lts Rockchip  RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
```

4) Then select branch

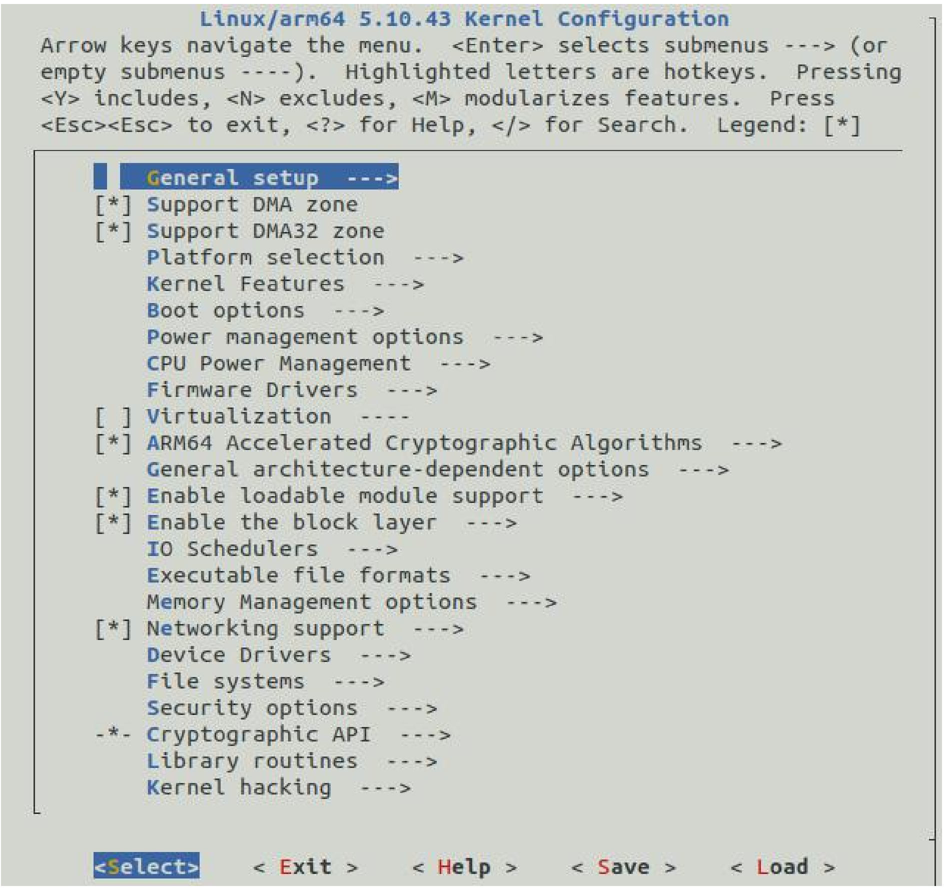
a. current will compile linux 5.10

b. legacy will compile linux4.4



```
Choose an option
Select the target kernel branch

             current Recommended. Come with best support
             legacy  Old stable / Legacy
```

5) Then the kernel configuration interface opened by **make menuconfig** will pop up. At this time, you can directly modify the kernel configuration. If you do not need to modify the kernel configuration, you can simply exit. After exiting, the kernel source code will be compiled.



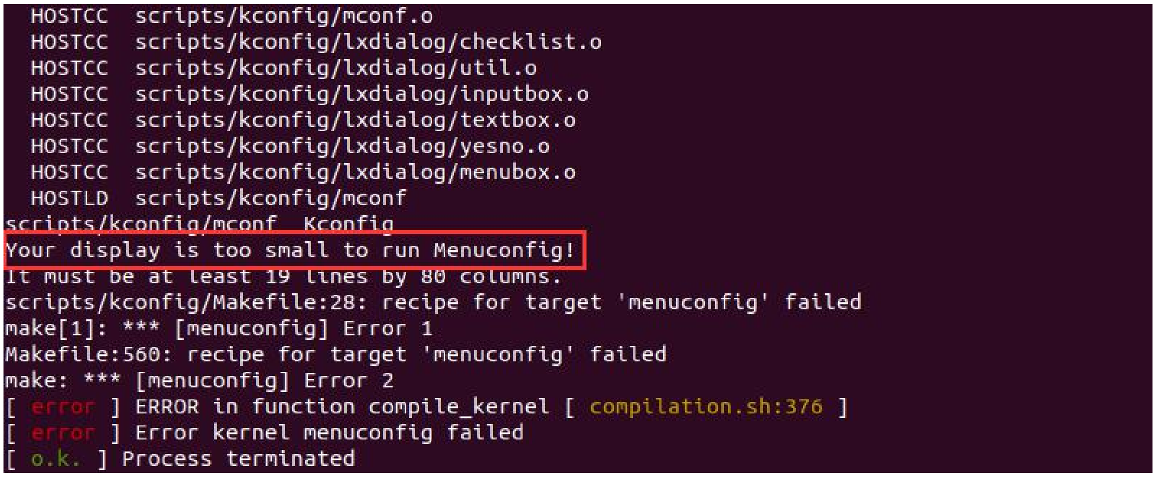
```
                  Linux/arm64 5.10.43 Kernel Configuration
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or
  empty submenus ----).  Highlighted letters are hotkeys.  Pressing
  <Y> includes, <N> excludes, <M> modularizes features.  Press
  <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*]

        General setup  --->
    [*] Support DMA zone
    [*] Support DMA32 zone
        Platform selection  --->
        Kernel Features  --->
        Boot options  --->
        Power management options  --->
        CPU Power Management  --->
        Firmware Drivers  --->
    [ ] Virtualization  ----
    [*] ARM64 Accelerated Cryptographic Algorithms  --->
        General architecture-dependent options  --->
    [*] Enable loadable module support  --->
    [*] Enable the block layer  --->
        IO Schedulers  --->
        Executable file formats  --->
        Memory Management options  --->
    [*] Networking support  --->
        Device Drivers  --->
        File systems  --->
        Security options  --->
    -*- Cryptographic API  --->
        Library routines  --->
        Kernel hacking  --->

    <Select>    < Exit >    < Help >    < Save >    < Load >
```

a. If you do not need to modify the configuration options of the kernel, when running the build.sh script, pass in **KERNEL_CONFIGURE=no** to temporarily shield the configuration interface of the pop-up kernel

```
test@test:~/orangepi-build$ sudo ./build.sh KERNEL_CONFIGURE=no
```

b. You can also set **KERNEL_CONFIGURE=no** in the orangepi-build/userpatches/config-default.conf configuration file to permanently disable this feature

c. If the following error is displayed when compiling the kernel, this is because the terminal interface of the Ubuntu PC is too small, so the interface of make menuconfig cannot be displayed. Please adjust the terminal of the Ubuntu PC to the maximum, and then re-run the build.sh script



```
  HOSTCC  scripts/kconfig/mconf.o
  HOSTCC  scripts/kconfig/lxdialog/checklist.o
  HOSTCC  scripts/kconfig/lxdialog/util.o
  HOSTCC  scripts/kconfig/lxdialog/inputbox.o
  HOSTCC  scripts/kconfig/lxdialog/textbox.o
  HOSTCC  scripts/kconfig/lxdialog/yesno.o
  HOSTCC  scripts/kconfig/lxdialog/menubox.o
  HOSTLD  scripts/kconfig/mconf
scripts/kconfig/mconf  Kconfig
Your display is too small to run Menuconfig!
It must be at least 19 lines by 80 columns.
scripts/kconfig/Makefile:28: recipe for target 'menuconfig' failed
make[1]: *** [menuconfig] Error 1
Makefile:560: recipe for target 'menuconfig' failed
make: *** [menuconfig] Error 2
[ error ] ERROR in function compile_kernel [ compilation.sh:376 ]
[ error ] Error kernel menuconfig failed
[ o.k. ] Process terminated
```

6) Part of the information prompted when compiling the kernel source code is explained as follows

a. The version of the linux kernel source code

[o.k.] Compiling current kernel [**5.10.43**]

b. The version of the cross-compilation toolchain used

[o.k.] Compiler version [**aarch64-none-linux-gnu-gcc 9.2.1**]

c. The configuration file used by the kernel by default and the path where it is stored

[o.k.] Using kernel config file [**config/kernel/linux-5.10-rk3399.config**]

d. If KERNEL_CONFIGURE=yes, the final configuration file .config used by the kernel will be copied to **output/config**. If the kernel configuration is not modified, the final configuration file is the same as the default configuration file

[o.k.] Exporting new kernel config [**output/config/linux-5.10-rk3399.config**]

e. The path to the generated kernel-related deb package

[o.k.] Target directory [**output/debs/**]

f. The package name of the kernel image deb package generated by compilation

[o.k.] File name [**linux-image-current-rk3399_2.2.0_arm64.deb**]

g. Compilation time used

[o.k.] Runtime [**5 min**]

h. Finally, the compilation command to repeat the compilation of the last selected kernel will be displayed. Use the following command to directly start compiling the kernel source code without selecting through the graphical interface.

[o.k.] Repeat Build Options [**sudo ./build.sh BOARD=orangepi4-lts BRANCH=current BUILD_OPT=kernel KERNEL_CONFIGURE=yes**]

7) View the compiled and generated kernel-related deb packages

   a. **linux-dtb-current-rk3399_2.2.0_arm64.deb** Not used yet, don't worry about it

   b. **linux-headers-current-rk3399_2.2.0_arm64.deb** Include kernel header files

   c. **linux-image-current-rk3399_2.2.0_arm64.deb** Contains kernel images and kernel modules

```
test@test:~/orangepi-build$ ls output/debs/linux-*
output/debs/linux-dtb-current-rk3399_2.2.0_arm64.deb
output/debs/linux-image-current-rk3399_2.2.0_arm64.deb
output/debs/linux-headers-current-rk3399_2.2.0_arm64.deb
```

8) The files contained in the generated linux-image deb package are as follows

   a. Use the following command to decompress the deb package

```
test@test:~/orangepi-build$ cd output/debs
test@test:~/orangepi_build/output/debs$ mkdir test
test@test:~/orangepi_build/output/debs$ cp \
linux-image-current-rk3399_2.2.0_arm64.deb test/
test@test:~/orangepi_build/output/debs$ cd test
test@test:~/orangepi_build/output/debs/test$ dpkg -x \
linux-image-current-rk3399_2.2.0_arm64.deb .
test@test:~/orangepi_build/output/debs/test$ ls
boot    etc    lib    linux-image-current-rk3399_2.2.0_arm64.deb    usr
```

   b. The decompressed file is as follows

```
test@test:~/orangepi-build/output/debs/test$ tree -L 2
.
├── boot
│   ├── config-5.10.43                  //The configuration file used to
                                          compile the kernel source code
│   ├── System.map-5.10.43
│   └── vmlinuz-5.10.43                 //Compile the generated kernel image file
├── etc
│   └── kernel
├── lib
│   └── modules                         //Compile the generated kernel module
├── linux-image-current-rk3399_2.2.0_arm64.deb
```

```
└── usr
    ├── lib
    └── share

8 directories, 4 files
```

9) The orangepi-bulid compilation system will first synchronize the linux kernel source code with the linux kernel source code of the github server when compiling the linux kernel source code, so if you want to modify the linux kernel source code, you first need to turn off the update function of the source code (**you need to compile it once This function can only be turned off after the linux kernel source code, otherwise it will prompt that the source code of the linux kernel cannot be found**), otherwise the modification will be restored, the method is as follows:

Set the IGNORE_UPDATES variable in userpatches/config-default.conf to "yes"

```
test@test:~/orangepi-build$ vim userpatches/config-default.conf
IGNORE_UPDATES="yes"
```

10) If the kernel is modified, the following methods can be used to update the kernel and kernel modules of the development board linux system

a. Upload the compiled deb package of the linux kernel to the linux system of the development board

```
test@test:~/orangepi-build$ cd output/debs
test@test:~/orangepi-build/output/debs$ scp \
linux-image-current-rk3399_2.2.0_arm64.deb root@192.168.1.207:/root
```

b. Then log in to the development board and uninstall the deb package of the installed linux kernel

```
root@orangepi:~# apt purge -y linux-image-current-rk3399
```

c. Install the deb package of the new linux kernel just uploaded

```
root@orangepi:~# dpkg -i linux-image-current-rk3399_2.2.0_arm64.deb
```

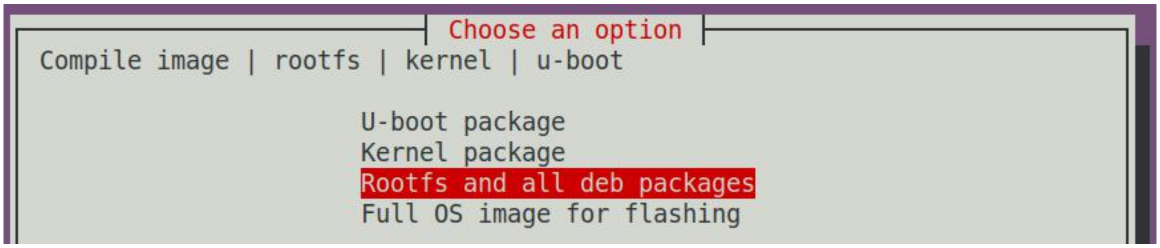
d. Then restart the development board, and then check whether the kernel-related modifications have taken effect

5. 5. Compile rootfs

1) Run the build.sh script, remember to add sudo permissions

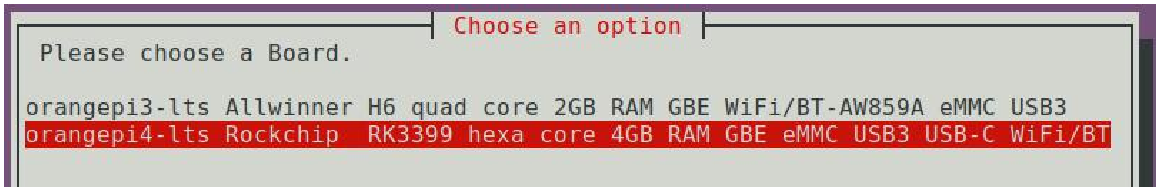
```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **Rootfs and all deb packages**, then press Enter



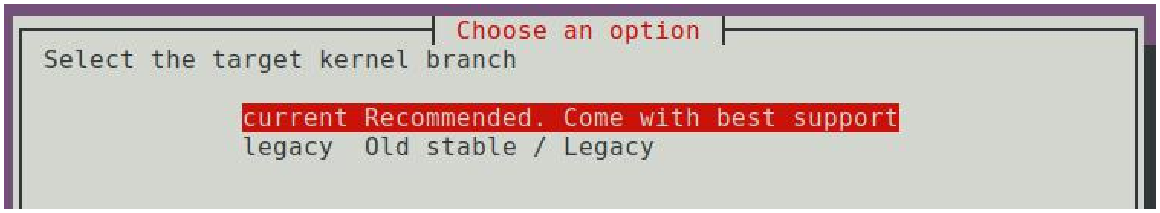
```
Choose an option
Compile image | rootfs | kernel | u-boot

          U-boot package
          Kernel package
          Rootfs and all deb packages
          Full OS image for flashing
```

3) Then select the model of the development board



```
Choose an option
Please choose a Board.

orangepi3-lts Allwinner H6 quad core 2GB RAM GBE WiFi/BT-AW859A eMMC USB3
orangepi4-lts Rockchip  RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
```

4) Then select branch

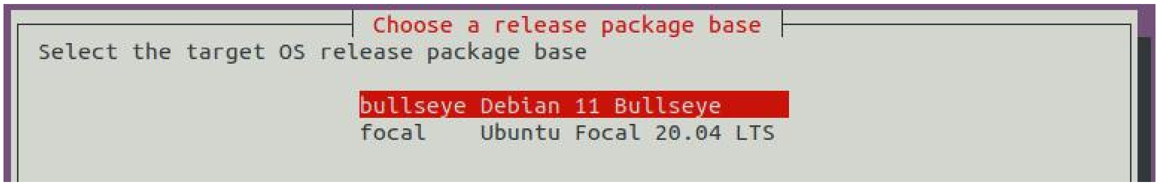


```
Choose an option
Select the target kernel branch

          current Recommended. Come with best support
          legacy  Old stable / Legacy
```

5) Then select the type of rootfs

a. bullseye means Debian 11

b. **Focal** means Ubuntu 20.04

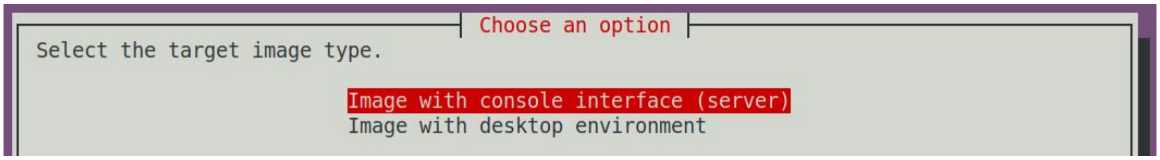


```
Choose a release package base
Select the target OS release package base

          bullseye Debian 11 Bullseye
          focal    Ubuntu Focal 20.04 LTS
```

6) Then select the type of image

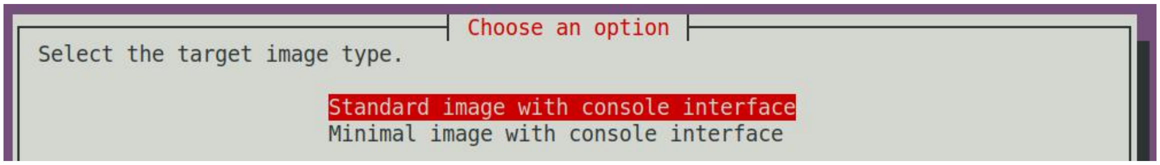
a. **Image with console interface (server)** Indicates the image of the server version, which is relatively small in size

b. **Image with desktop environment** Indicates a image with a desktop, which is relatively large in size



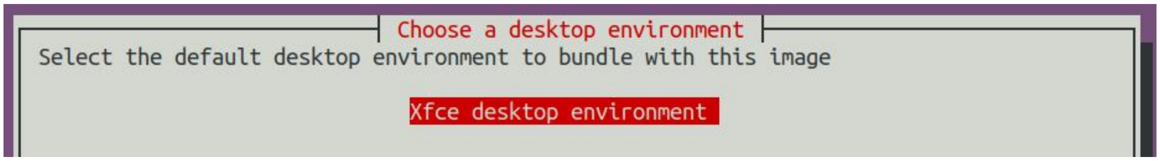
```
Choose an option
Select the target image type.

Image with console interface (server)
Image with desktop environment
```

7) If you are compiling the image of the server version, you can also choose to compile the Standard version or the Minimal version. The software pre-installed in the Minimal version will be much less than the Standard version.

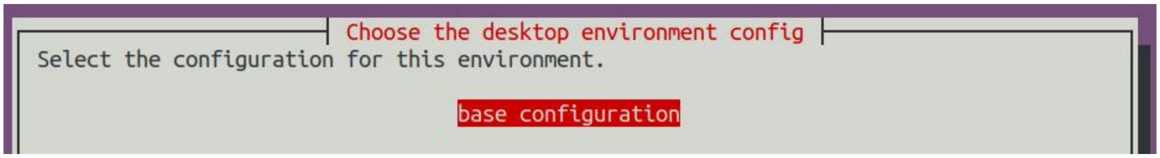


```
Choose an option
Select the target image type.

Standard image with console interface
Minimal image with console interface
```

8) If you are compiling the desktop version of the image, you also need to select the type of desktop environment, but only XFCE is currently supported, so just press Enter.



```
Choose a desktop environment
Select the default desktop environment to bundle with this image

Xfce desktop environment
```



```
Choose the desktop environment config
Select the configuration for this environment.

base configuration
```

9) You can then select additional packages that need to be installed. For example, if you need to install a browser, you can choose browsers. Which packages are included in each selection can be seen in the code of orangepi-build, you can also modify these configurations to add the packages you want to install

1. First enter **external/config/desktop** to see the desktop configuration folders of different linux distributions. Note that not all the Orange Pi development boards that can be seen in the code are supported and tested.

```
test@test:~/orangepi-build$ cd external/config/desktop
test@test:~/orangepi-build/external/config/desktop$ ls
bionic   bookworm   bullseye   buster   focal   jammy   README.md   sid
```

2. Then select the type of distribution you want to view or modify, and enter the

corresponding directory, such as **bullseys**

```
test@test:~/orangepi-build/external/config/desktop$ cd bullseye
test@test:~/orangepi-build/external/config/desktop/bullseye$ ls
appgroups   environments
```

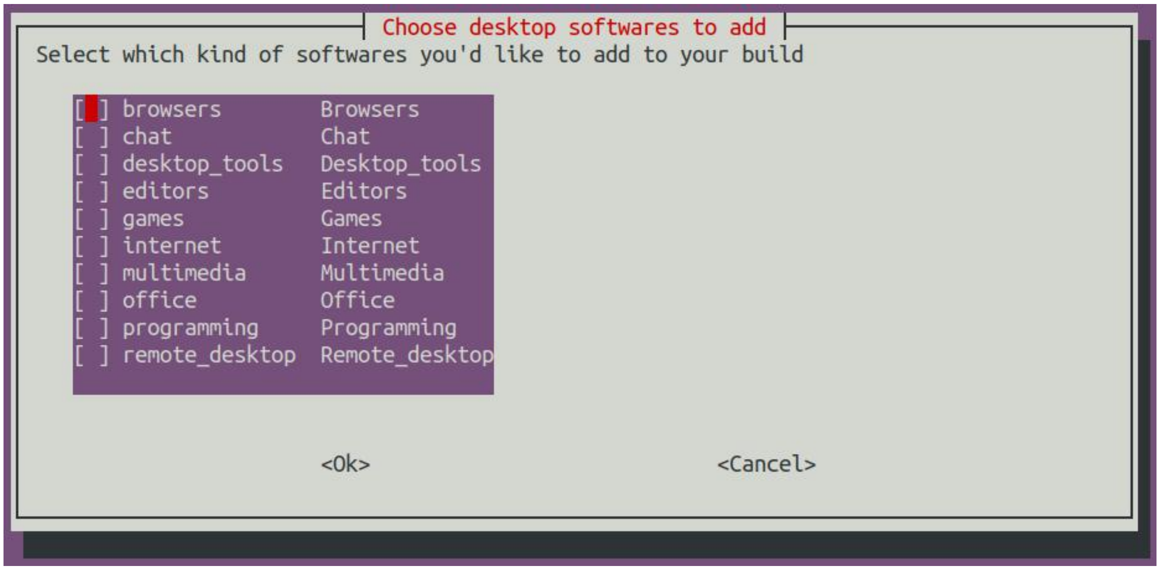
3. Then enter the **appgroups** directory to see all app groups

```
test@test:~/orangepi-build/external/config/desktop/bullseye$ cd appgroups
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ ls
browsers   chat   desktop_tools   editors   games   internet   multimedia   office
programming   remote_desktop
```

4. Open the **packages** file under different groups to view the software contained in the group

```
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ cat
programming/packages
geany
thonny
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ cat
office/packages
ibreoffice
```

5. Except for the browser, the Linux image released by Orange Pi does not choose to install other software packages here. This is mainly to reduce the size of the Linux image.



```
Choose desktop softwares to add
Select which kind of softwares you'd like to add to your build

[ ] browsers         Browsers
[ ] chat             Chat
[ ] desktop_tools    Desktop_tools
[ ] editors          Editors
[ ] games            Games
[ ] internet         Internet
[ ] multimedia       Multimedia
[ ] office           Office
[ ] programming      Programming
[ ] remote_desktop   Remote_desktop

            <Ok>                    <Cancel>
```

10) Then the rootfs will be compiled, and some of the information prompted during compilation are as follows

a. type of rootfs

```
[ o.k. ] local not found [ Creating new rootfs cache for bullseye ]
```

b. The storage path of the rootfs compressed package generated by compilation

```
[ o.k. ] Target directory [ external/cache/rootfs ]
```

c. The name of the rootfs compressed package generated by compilation

```
[ o.k. ] File name
 [ bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4 ]
```

d. Compilation time

```
[ o.k. ] Runtime [ 13 min ]
```

e. Repeat the command to compile rootfs, use the following command to start compiling rootfs directly without selecting through the graphical interface

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh    BOARD=orangepi4-lts
BRANCH=current BUILD_OPT=rootfs RELEASE=bullseye
BUILD_MINIMAL=no    BUILD_DESKTOP=no
KERNEL_CONFIGURE=yes    ]
```

11) View the rootfs compressed package generated by compilation

a. bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4 is the compressed package of rootfs, the meaning of each field of the name is

a) **bullseye** indicates the type of linux distribution of rootfs

b) **xfce** indicates that the rootfs is of the desktop version, and if it is cli, it indicates the server version

c) **arm64** represents the architecture type of rootfs

d) **25250ec7002de9e81a41de169f1f89721** is the MD5 hash value generated by the package names of all packages installed by rootfs. As long as the list of packages installed by rootfs is not modified, this value will not change, and the compilation script will use this MD5 hash value to Determine if you need to recompile rootfs

b. bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4.list lists the package names of all packages installed by rootfs

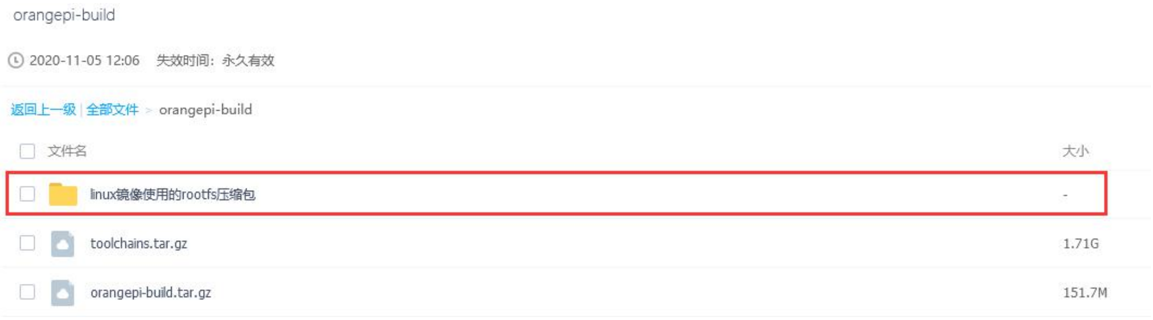
```
test@test:~/orangepi-build$ ls external/cache/rootfs/
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4
```

```
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4.current
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4.list
```

12) If the required rootfs already exists under **external/cache/rootfs**, then compiling the rootfs again will skip the compilation process and will not restart the compilation. When compiling the image, it will also go to **external/cache/rootfs** to find out whether it has There is a rootfs available for cache, if there is one, use it directly, which can save a lot of download and compilation time

13) Since it takes a long time to compile rootfs, if you do not want to compile rootfs from scratch, or there is a problem with the process of compiling rootfs, you can directly download the rootfs compressed package cached by Orange Pi. The download link of the rootfs compressed package Baidu cloud disk is as follows, download A good rootfs compressed package needs to be placed in the **external/cache/rootfs** directory of orangepi-build to be used normally by the compiled script

```
Link：https://pan.baidu.com/s/1vWQmCmSYdH7iCDFyKpJtVw
password：zero
```



orangepi-build

2020-11-05 12:06 失效时间：永久有效

返回上一级 | 全部文件 > orangepi-build

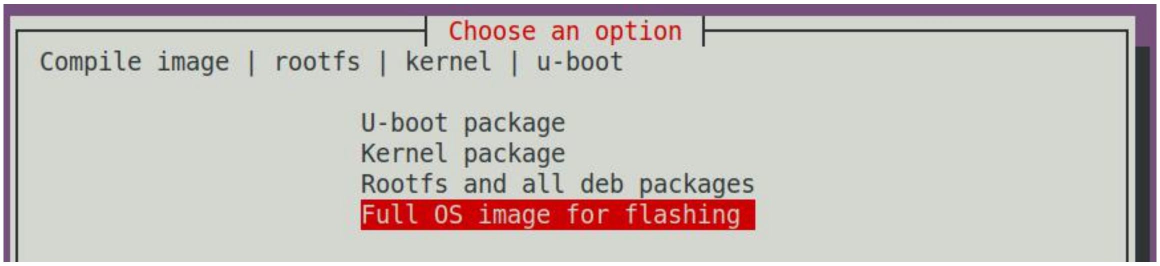
□ 文件名	大小
□ linux镜像使用的rootfs压缩包	-
□ toolchains.tar.gz	1.71G
□ orangepi-build.tar.gz	151.7M

5. 6. Compile the linux image

1) Run the build.sh script, remember to add sudo permissions

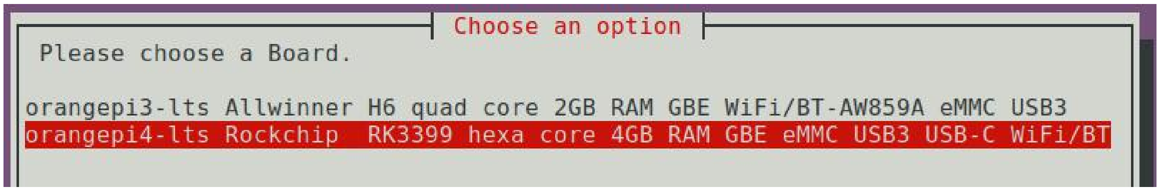
```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **Full OS image for flashing** and press Enter



```
Choose an option
Compile image | rootfs | kernel | u-boot

                        U-boot package
                        Kernel package
                        Rootfs and all deb packages
                        Full OS image for flashing
```

3) Then select the model of the development board

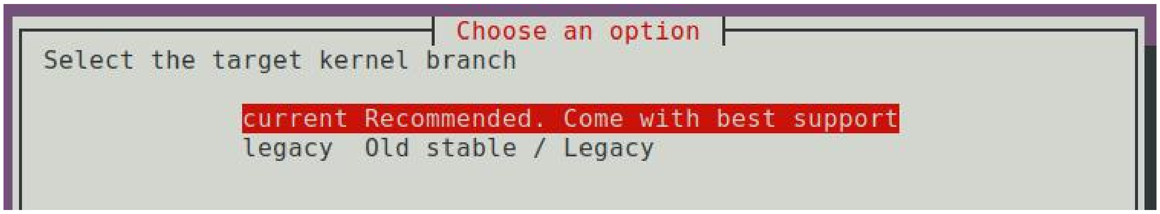


```
Choose an option
 Please choose a Board.

orangepi3-lts Allwinner H6 quad core 2GB RAM GBE WiFi/BT-AW859A eMMC USB3
orangepi4-lts Rockchip  RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
```

4) Then select branch

   a. current will compile linux 5.10

   b. legacy will compile linux4.4

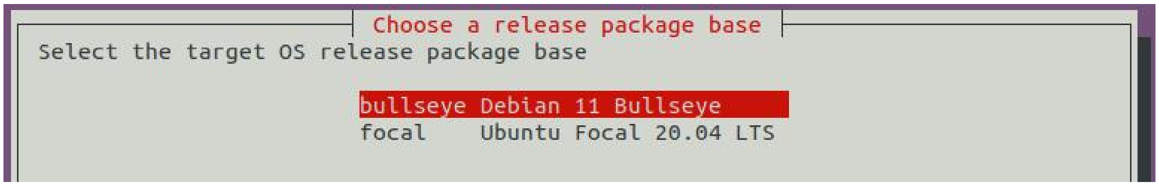


```
Choose an option
 Select the target kernel branch

                current Recommended. Come with best support
                legacy  Old stable / Legacy
```

5) Then select the type of rootfs

   a. **Bullseye** means Debian 11

   b. **Focal** means Ubuntu 20.04

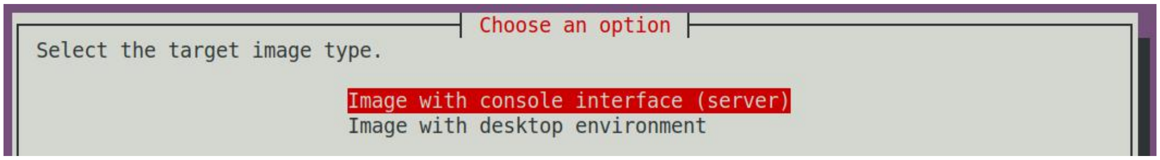


```
Choose a release package base
 Select the target OS release package base

                    bullseye Debian 11 Bullseye
                    focal    Ubuntu Focal 20.04 LTS
```

6) Then select the type of image

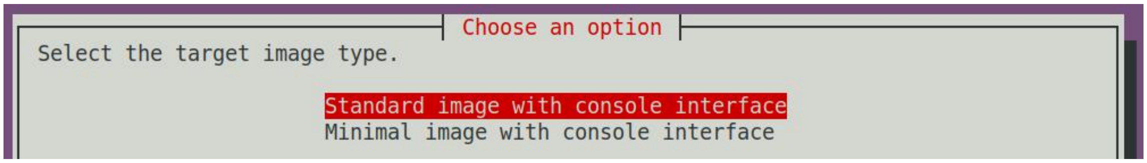
   a. **Image with console interface (server)** Indicates the image of the server version, which is relatively small in size

   b. **Image with desktop environment** Indicates a image with a desktop, which is relatively large in size



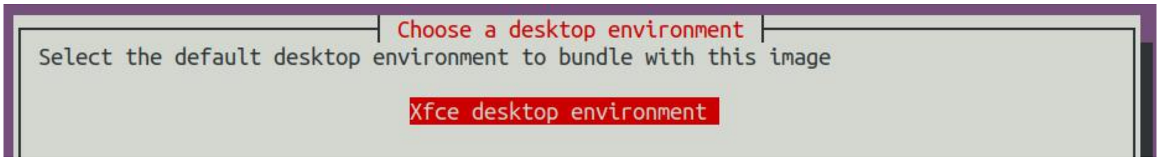
```
Choose an option
Select the target image type.

Image with console interface (server)
Image with desktop environment
```

7) If you are compiling the image of the server version, you can also choose to compile the Standard version or the Minimal version. The software pre-installed in the Minimal version will be much less than the Standard version.

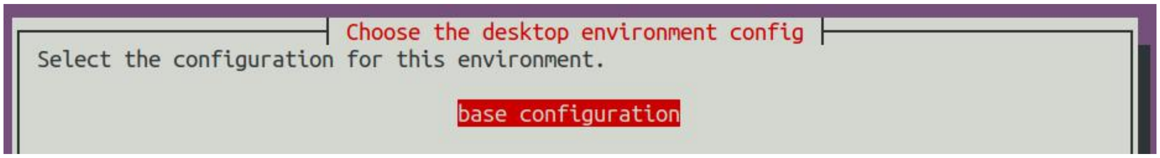


```
Choose an option
Select the target image type.

Standard image with console interface
Minimal image with console interface
```

8) If you are compiling the desktop version of the image, you also need to select the type of desktop environment, but only XFCE is currently supported, so just press Enter.



```
Choose a desktop environment
Select the default desktop environment to bundle with this image

Xfce desktop environment
```



```
Choose the desktop environment config
Select the configuration for this environment.

base configuration
```

9) You can then select additional packages that need to be installed. For example, if you need to install a browser, you can choose browsers. Which packages are included in each selection can be seen in the code of orangepi-build, you can also modify these configurations to add the packages you want to install

1. First enter **external/config/desktop** to see the desktop configuration folders of different linux distributions. Note that not all the Orange Pi development boards that can be seen in the code are supported and tested.

```
test@test:~/orangepi-build$ cd external/config/desktop
test@test:~/orangepi-build/external/config/desktop$ ls
bionic    bookworm    bullseye    buster    focal    jammy    README.md    sid
```

2. Then select the type of distribution you want to view or modify, and enter the corresponding directory, such as **bullseys**

```
test@test:~/orangepi-build/external/config/desktop$ cd bullseye
test@test:~/orangepi-build/external/config/desktop/bullseye$ ls
appgroups    environments
```

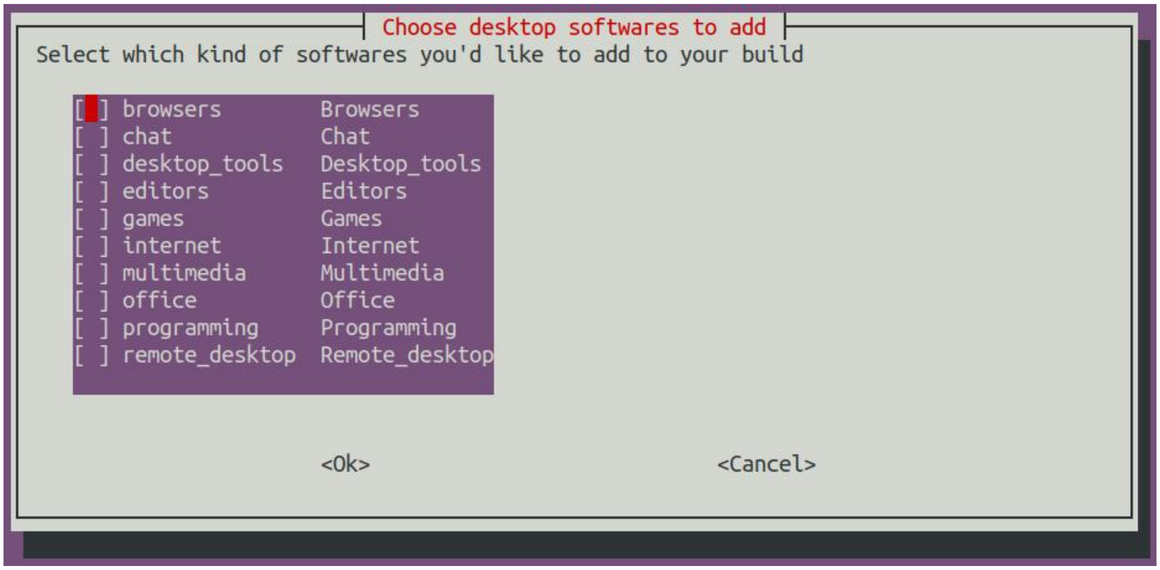
3. Then enter the **appgroups** directory to see all app groups

```
test@test:~/orangepi-build/external/config/desktop/bullseye$ cd appgroups
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ ls
browsers   chat   desktop_tools   editors   games   internet   multimedia   office
programming   remote_desktop
```

4. Open the **packages** file under different groups to view the software contained in the group

```
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ cat
programming/packages
geany
thonny
test@test:~/orangepi-build/external/config/desktop/bullseye/appgroups$ cat
office/packages
ibreoffice
```

5. Except for the browser, the Linux image released by Orange Pi does not choose to install other software packages here. This is mainly to reduce the size of the Linux image.



```
Choose desktop softwares to add
Select which kind of softwares you'd like to add to your build

    [ ] browsers        Browsers
    [ ] chat            Chat
    [ ] desktop_tools   Desktop_tools
    [ ] editors         Editors
    [ ] games           Games
    [ ] internet        Internet
    [ ] multimedia      Multimedia
    [ ] office          Office
    [ ] programming     Programming
    [ ] remote_desktop  Remote_desktop

                <Ok>                  <Cancel>
```

10) Then the linux image will be compiled. The general process of compilation is as follows

a. Initialize the compilation environment of the Ubuntu PC and install the software packages required for the compilation process
b. Download the source code of u-boot and linux kernel (if cached, only update the code)
c. Compile u-boot source code and generate u-boot deb package
d. Compile the linux source code to generate linux-related deb packages
e. Make a deb package of linux firmware
f. Make the deb package of the orangepi-config tool
g. Make board-level supported deb packages
h. If you are compiling the desktop version of the image, you will also create a desktop-related deb package
i. Check whether the rootfs has been cached, if there is no cache, then recreate the rootfs, if it has been cached, directly decompress and use
j. Install the deb package generated earlier into rootfs
k. Make some specific settings for different development boards and different types of images, such as pre-installing additional software packages, modifying system configuration, etc.
l. Then make an image file and format the partition, the default type is ext4
m. Copy the configured rootfs to the mirrored partition
n. then update initramfs
o. Finally, write the bin file of u-boot into the image through the dd command

11) After compiling the image, the following information will be prompted

a. The storage path of the compiled image

```
[ o.k. ] Done building
[ output/images/Orangepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop/Or
angepi4-lts_2.2.0_debian_bullseye_linux5.10.43_xfce_desktop.img ]
```

b. Compilation time used

```
[ o.k. ] Runtime [ 19 min ]
```

c. Repeat the command to compile the image, use the following command to start compiling the image directly without selecting through the graphical interface

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh    BOARD=orangepi4-lts
BRANCH=current BUILD_OPT=image RELEASE=bullseye
BUILD_MINIMAL=no BUILD_DESKTOP=no KERNEL_CONFIGURE=yes ]
```

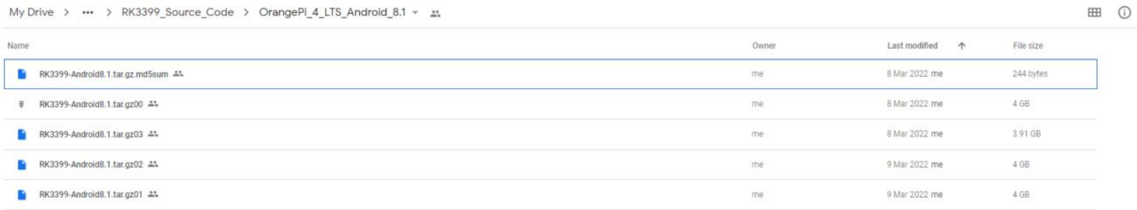
6. Instructions for using Android SDK

The compilation of Android SDK is carried out on a PC with Ubuntu 14.04 installed. Other versions of Ubuntu systems may have some differences. The image download address of Ubuntu14.04 amd64 version is as follows

https://repo.huaweicloud.com/ubuntu-releases/14.04/ubuntu-14.04.6-desktop-amd64.iso

6. 1. Download the source code of Android SDK

1) First download the Android SDK's sub-volume compressed package from the Google disk



My Drive > ••• > RK3399_Source_Code > OrangePi_4_LTS_Android_8.1

Name	Owner	Last modified	File size
RK3399-Android8.1.tar.gz.md5sum	me	8 Mar 2022 me	244 bytes
RK3399-Android8.1.tar.gz00	me	8 Mar 2022 me	4 GB
RK3399-Android8.1.tar.gz03	me	8 Mar 2022 me	3.91 GB
RK3399-Android8.1.tar.gz02	me	9 Mar 2022 me	4 GB
RK3399-Android8.1.tar.gz01	me	9 Mar 2022 me	4 GB

2) After downloading the compressed package of Android SDK, please check whether the MD5 checksum is correct. If it is not correct, please download the source code again.

```
test@test:~$ md5sum -c RK3399-Android8.1.tar.gz.md5sum
RK3399-Android8.1.tar.gz00: OK
RK3399-Android8.1.tar.gz01: OK
RK3399-Android8.1.tar.gz02: OK
RK3399-Android8.1.tar.gz03: OK
```

3) Then you need to combine multiple compressed files into one, and then decompress

```
test@test:~$ cat RK3399-Android8.1.tar.gz* > RK3399-Android8.1.tar.gz
test@test:~$ tar xvf RK3399-Android8.1.tar.gz
```

6. 2. Build Android Compilation Environment

1) Install JDK

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

2) Configure JAVA environment variables

a. First determine the installation path of java, generally

```
test@test:~$ ls /usr/lib/jvm/java-8-openjdk-amd64
ASSEMBLY_EXCEPTION   bin   docs   include   jre   lib   man   src.zip
THIRD_PARTY_README
```

b. Then use the following command to export java environment variables

```
test@test:~$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
test@test:~$ export PATH=$JAVA_HOME/bin:$PATH
test@test:~$ export CLASSPATH=.:$JAVA_HOME/lib:$JAVA_HOME/lib/tools.jar
```

3) Install platform support software

```
test@test:~$ sudo apt-get update
test@test:~$ 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

test@test:~$ sudo apt-get install u-boot-tools
```

6. 3. Compile Android image

6. 3. 1. Compiling u-boot

1) The compilation method of u-boot is as follows

```
test@test:~$ cd RK3399-Android8.1
test@test:~/RK3399-Android8.1$ ./make.sh -B
```

2) After the compilation is successful, the output content is as follows

```
out:trust.img
merge success(trust.img)
load addr is 0x200000!
pack input u-boot.bin
pack file size: 682652
crc = 0xc21153c6
pack uboot.img success!
```

6. 3. 2. Compile the kernel

1) The compilation method of the kernel is as follows

```
test@test:~/RK3399-Android8.1$ ./make.sh -K
```

2) After the compilation is successful, the output content is as follows

```
scripts/kconfig/conf    --silentoldconfig Kconfig
   CHK         include/config/kernel.release
   CHK         include/generated/uapi/linux/version.h
......
make[2]: “include/generated/vdso-offsets.h” is the latest.
   Building modules, stage 2.
   MODPOST 13 modules
Pack to resource.img successed!
   Image:    resource.img (with rk3399-orangepi-4-lts.dtb logo.bmp logo_kernel.bmp) is
ready
   Image:    boot.img (with Image resource.img) is ready
```

6. 3. 3. Compile android

1) The compilation method of android is as follows

```
test@test:~/RK3399-Android8.1$ ./make.sh -A
```

2) After the compilation is successful, the output content is as follows

```
Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done
......
```

```
[100% 129/129] Install system fs image: out/target/product/rk3399_mid/system.img
out/target/product/rk3399_mid/system.img+out/target/product/rk3399_mid/obj/PACKAG
ING/recovery_patch_intermediates/recovery_from_boot.p            maxsize=2740531200
blocksize=135168 total=1198447603 reserve=27709440

#### build completed successfully (03:53 (mm:ss)) ####
```

6. 3. 4. Packaging the full image

1) The android image packaging method is as follows

```
test@test:~/RK3399-Android8.1$ ./make.sh -M -u
```

2) After the compilation is successful, the output content is as follows

```
create uboot.img...done.
create trust.img...done.
create loader...done.
......
Make firmware OK!
------ OK ------
********RKImageMaker ver 1.63********
Generating new image, please wait...
Writing head info...
Writing boot file...
Writing firmware...
Generating MD5 data...
MD5 data generated successfully!
New image generated successfully!
Making update.img OK.
```

3) After the compilation is completed, the generated image file will be placed under **rockdev/Image-rk3399_mid/**. Where update.img is the Android firmware that can be burned and run

```
test@test:~/RK3399-Android8.1$ cd rockdev/Image-rk3399_mid/
test@test:~/RK3399-Android8.1$ ls update*
update.img
```