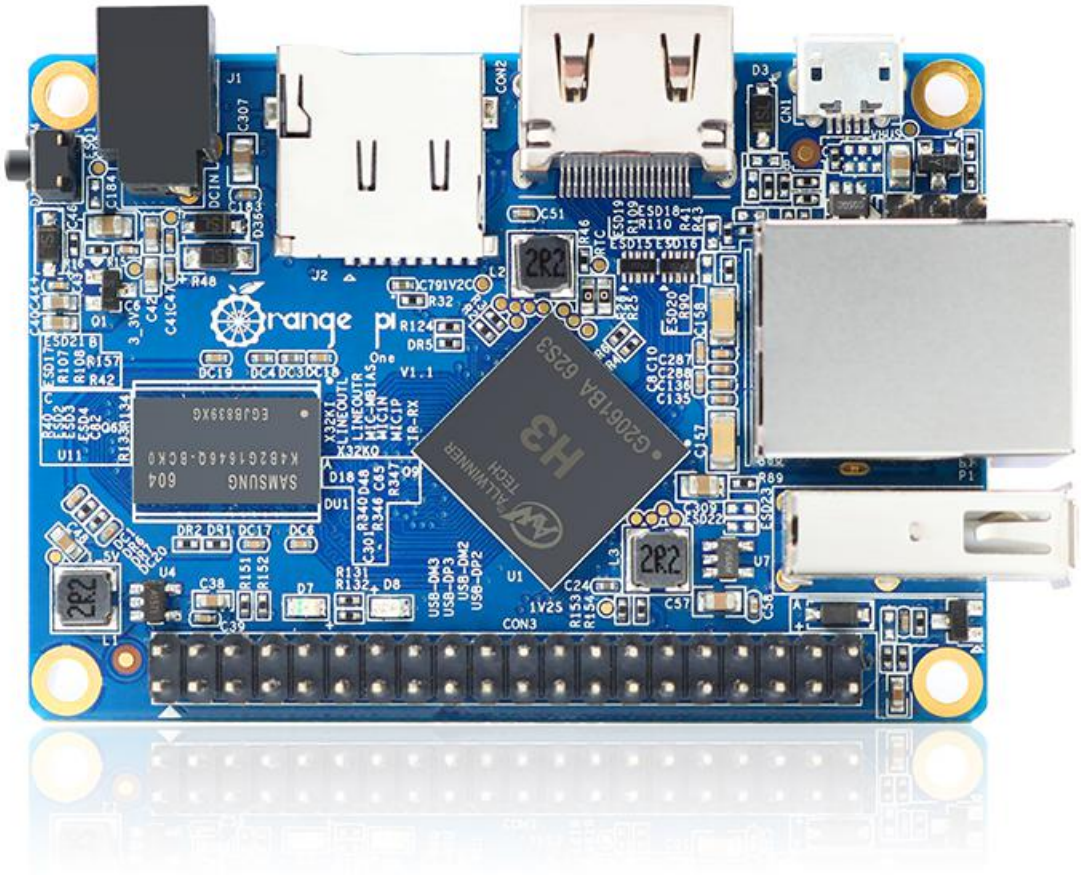
Orange Pi One

User Manual



Content

1. Basic features of Orange Pi One

1.1. What is Orange Pi One?

Orange Pi is an open source single-board card computer, a new generation of arm development board, it can run Android 4.4, Android 7.0, Ubuntu and Debian and other operating systems. Orange Pi One development board uses Allwinner H3 system-on-chip and has 512MB DDR3 memory

1.2. Purpose of Orange Pi One

We can use it to build:

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

Pretty much anything else, because Orange Pi is open source

1.3. Who's it for?

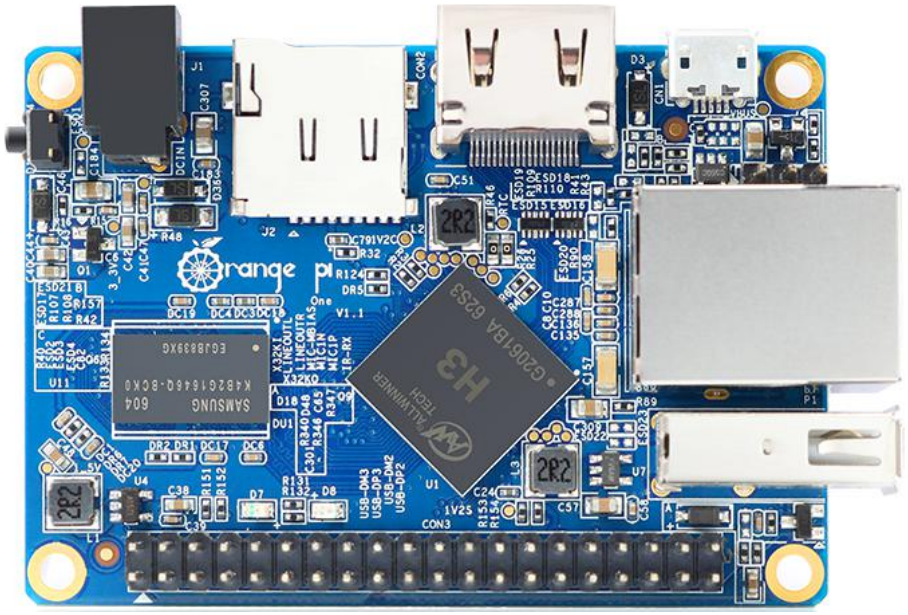
Orange Pi development board is for anyone who wants to start creating with technology – not just consuming it. It's a simple, fun, useful tool that you can use to start taking control of the world around you.

1. 4. Hardware features of Orange Pi One

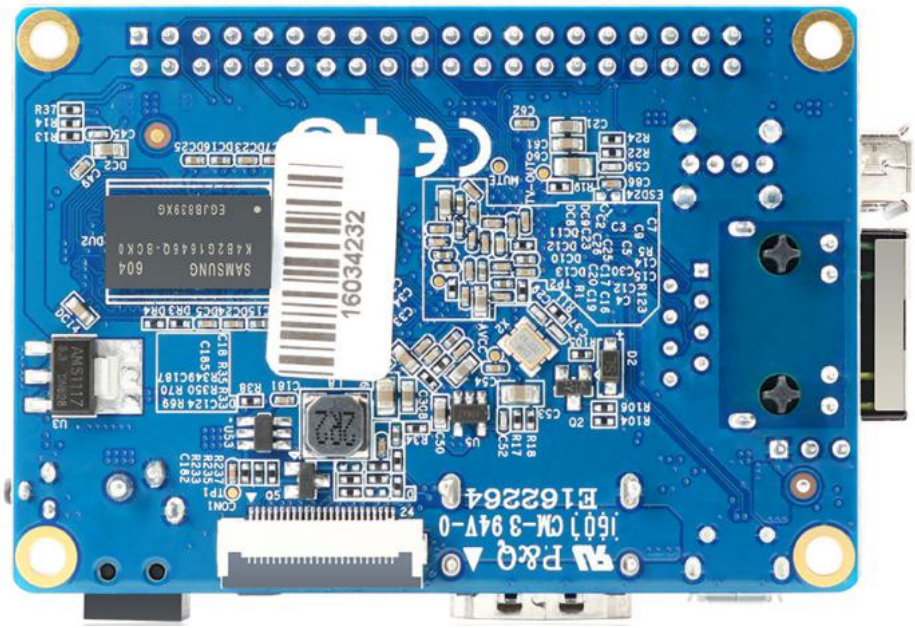
Hardware specification	
CPU	Allwinner H3 ARM Cortex-A7 Quad Core
GPU	Mali400MP2 GPU @600MHz Supports OpenGL ES 2.0
Memory (SDRAM)	512MB DDR3 (Shared with GPU)
Onboard Storage	TF card (Max. 32GB) / MMC card slot）
Onboard Network	10/100M Ethernet RJ45
Video Input	A CSI input connector Camera
Video Outputs	HDMI
Audio Outputs	HDMI
Power Source	DC input, MicroUSB (OTG) cannot be used as power input
USB 2.0 Port	1*USB 2.0 HOST, 1*USB 2.0 OTG
Low-level peripherals	40 pin connector, compatible with Raspberry Pi
Debug serial port	UART-TX,UART-RX,GND
LED	Power led & Status led
Key	Power（SW4）
Supported OS	Android,Ubuntu,Debian
Interface definition	
dimension	69mm×48mm
Weight	27g
range Pi™ is a trademark of the Shenzhen Xunlong Software CO., Limited	

1.5. The top and bottom views of Orange Pi One

Top View：

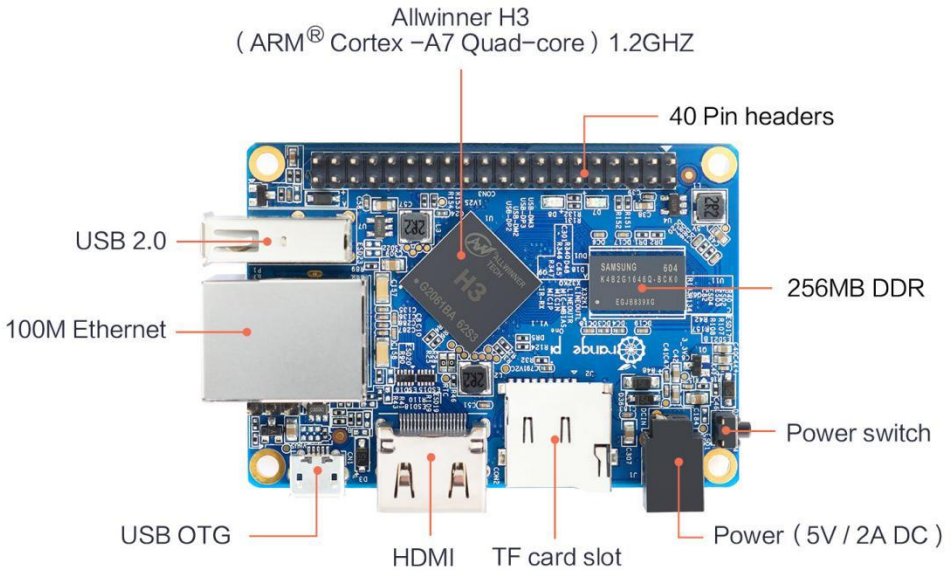


Bottom View：

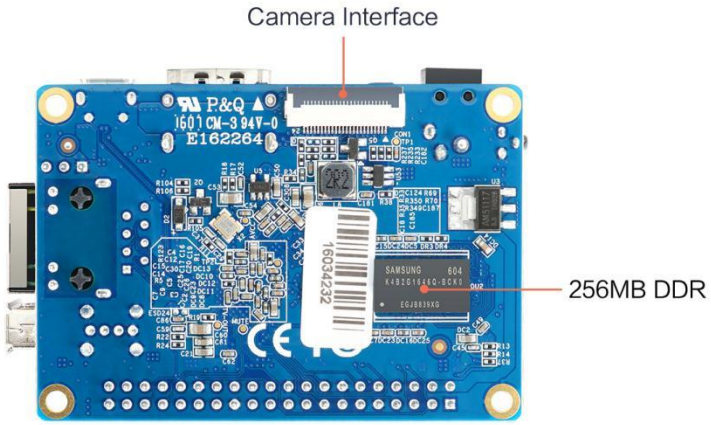


1. 6. Orange Pi One interface details

Top view



Bottom view



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 higher with a minimum capacity of 8GB, it is recommended to use SanDisk TF card, Orange Pi test is to use SanDisk TF card, other brands of TF card may have the problem of system failure

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

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

4) Power adapter, at least 5V/2A high-quality power adapter, note that the OTG interface of the development board cannot be used as a power input

5) 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

6) GC2035 or OV5640 camera kit, which can be connected to the CSI interface of the development board to display video images

7) 100M or Gigabit network cable, used to connect the development board to the Internet

8) Micro USB interface data cable, when using the ADB debugging function of the Android system, you need to connect the development board to the computer through the Micro USB interface data cable

9) USB to TTL module and DuPont cable, when using the serial port debugging function, you need USB to TTL module and DuPont cable to connect the development board and the computer

10) A personal computer with Ubuntu and Windows operating systems

1	Ubuntu14.04 PC	Optional, used to compile Android source code
2	Ubuntu18.04 PC	Optional, used to compile Linux source code
3	Windows PC	Used to burn Android and Linux images

2.2. Download the image and related information of the development board

1) The download URL of the Chinese version is

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

2) The download URL of the English version is

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

3) The information mainly contains

a. Android source code: saved on Baidu Cloud Disk and Google Cloud Disk

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

https://github.com/orangepi-xunlong

c. User manuals and schematic diagrams: chip-related data manuals will also be placed here

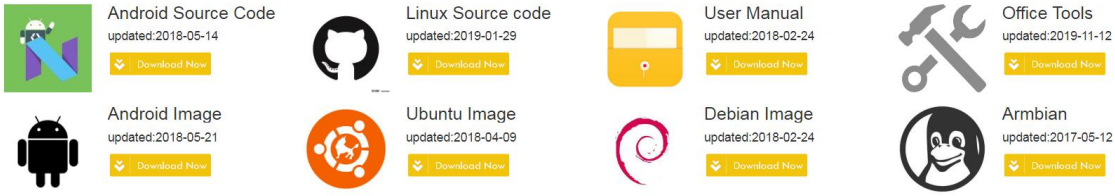
d. Official tools: mainly include the software that needs to be used during the use of the development board

e. Android image: saved on Baidu Cloud Disk and Google Cloud Disk

f. Ubuntu image: saved on Baidu Cloud Disk and Google Cloud Disk

g. Debian image: saved on Baidu Cloud Disk and Google Cloud Disk

h. Armbian image, a image developed by the Armbian community. If you encounter any problems during use, please report to the armbian forum first. The maintainer of the Armbian image and other people who use the Armbian image will assist in solving various problems. This is also a fastest way to solve the problem. Orange Pi is not responsible for maintaining this image.



2.3. Method of flashing Linux image to TF card based on Windows PC

1) First, prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be above class10. It is recommended to use a TF card of SanDisk and other brands

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

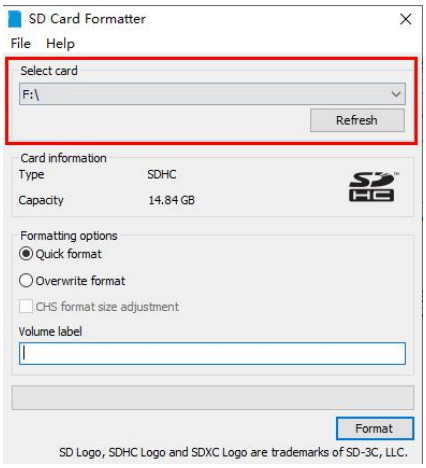
3) Then format the TF card

a. You can use the SD Card Formatter software to format the TF card, the download address is

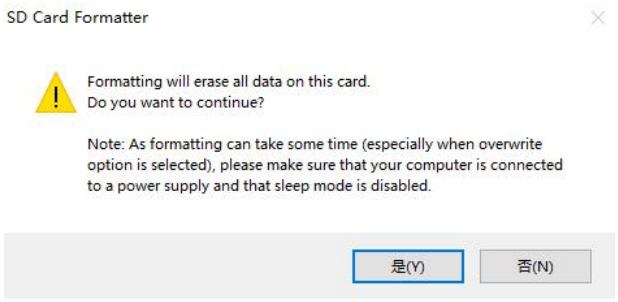
https://www.sdcard.org/downloads/formatter/eula_windows/SDCardFormatterv5_WinEN.zip

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

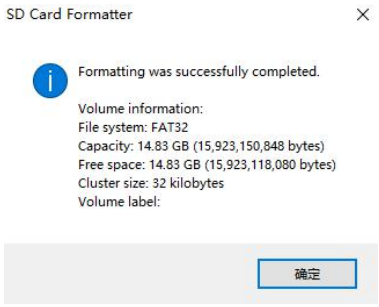
c. If the computer only has a TF card inserted, the TF card's drive letter will be displayed in the Select card column. If the computer has multiple USB storage devices inserted, you can select the drive letter corresponding to the TF card through the drop-down box



d. Then click Format, a warning box will pop up before formatting, and formatting will start after selecting "Yes (Y)"



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



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

5) Use Win32Diskimager to burn Linux image to TF card

a. The download page of Win32Diskimager is

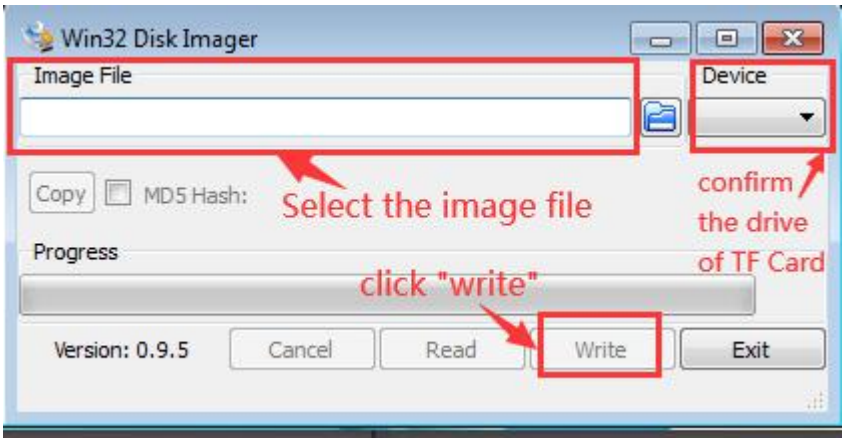
http://sourceforge.net/projects/win32diskimager/files/Archive/

b. Install directly after downloading, the interface of Win32Diskimager is shown below

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 is written, 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. Method of flashing Linux image to TF card based on Ubuntu PC

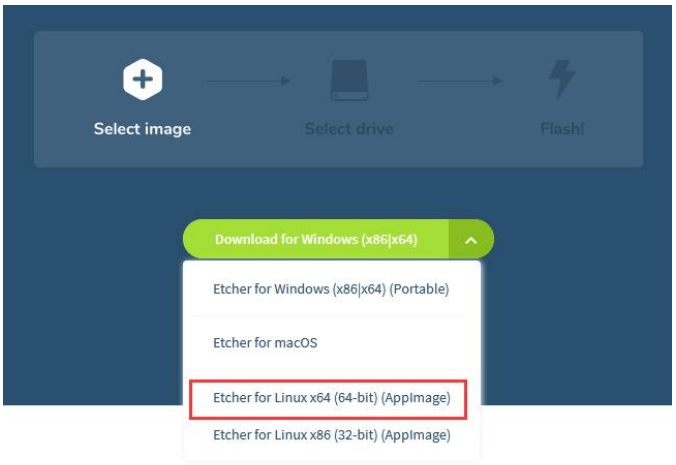
1) First, prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be above class10. It is recommended to use a TF card of SanDisk and other brands

2) Then use a 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



5) After downloading, use unzip to decompress, the decompressed balenaEtcher-1.5.109-x64.AppImage is the software needed for burning

```
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 Linux operating system image file compression package you want to burn from the Orange Pi data download page, and then use the decompression software to decompress it. In the decompressed file, the file ending with ".img" is the operating system image file,the size is generally above 1GB.

a. The decompression command of the compressed package at the end of 7z is as follows

```
test@test:~$ 7z x    image_filename.7z
```

b. The decompression command for the compressed package at the end of tar.gz is as follows

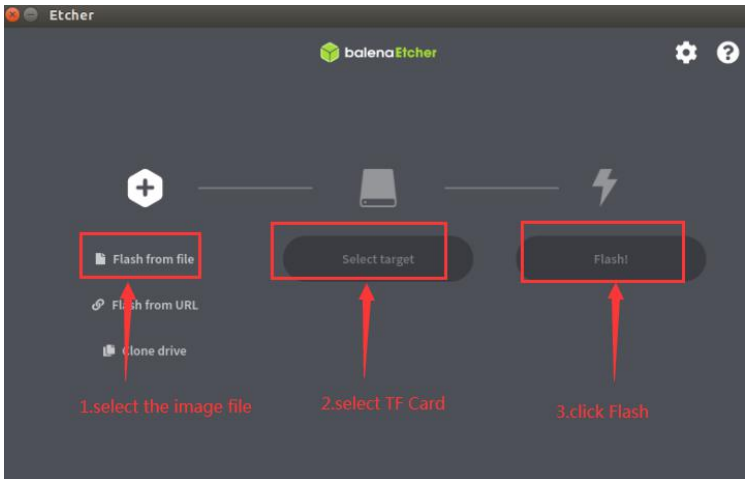
```
test@test:~$ tar -zxf    image_filename.tar.gz
```

7) Double-click balenaEtcher-1.5.109-x64.AppImage on the graphical interface of Ubuntu PC to open balenaEtcher. The opened interface is shown in the figure below

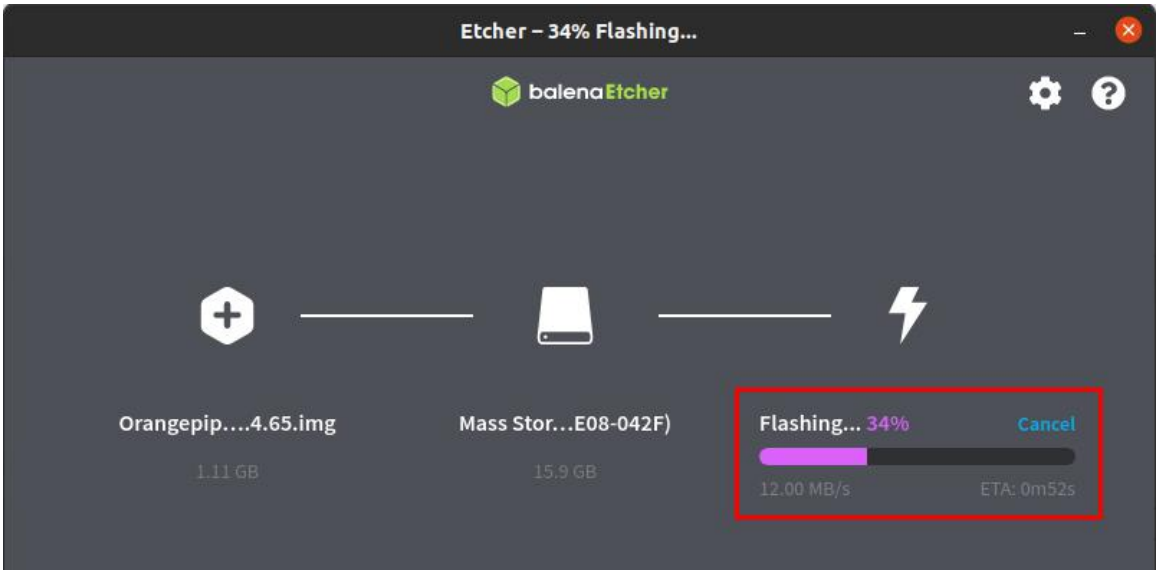
a. First select the path of the image file

b. Then select the device number of the TF card

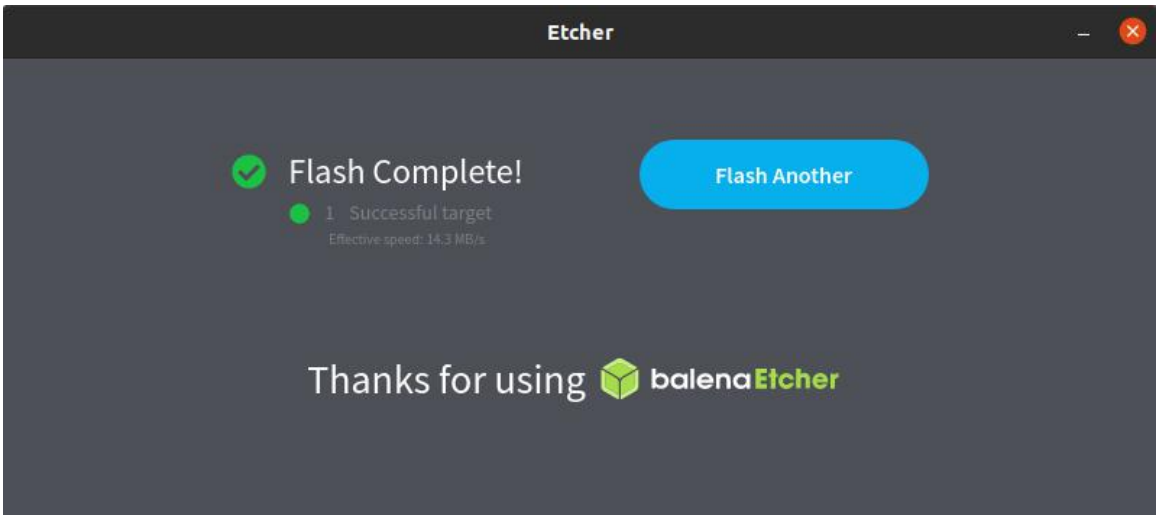
c. Finally click Flash to start burning

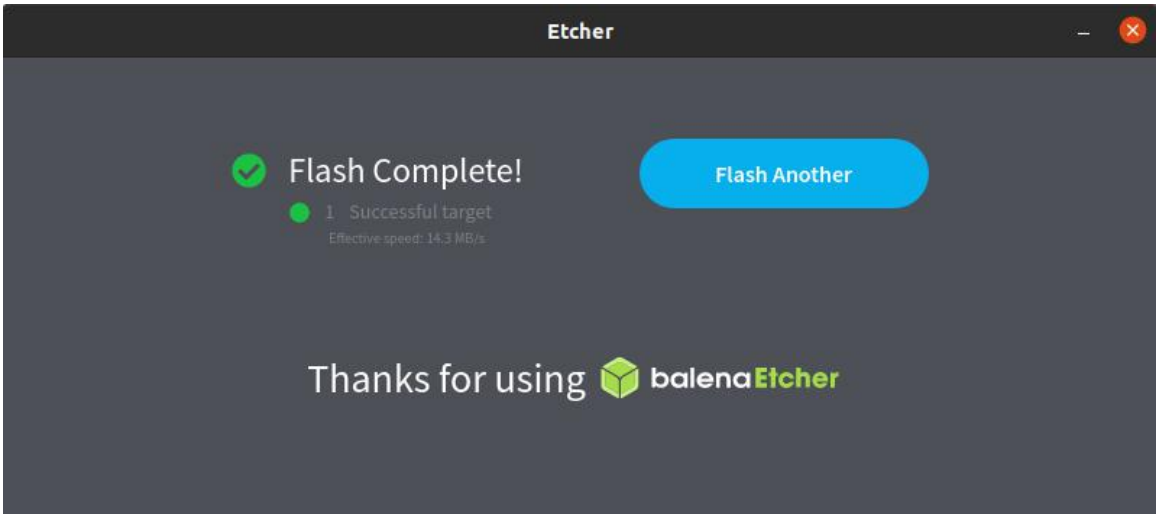


8) The writing speed and remaining time will be prompted during the burning process



9) After burning, the following interface will be displayed. At this time, you can unplug the TF card from the computer and insert it into the development board to start.





2. 5. Method of flashing Android firmware to TF card

Android image can only be burned to TF card using PhoenixCard software under Windows platform, but cannot be burned under Linux platform

1) First, prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be above class10. It is recommended to use a TF card of SanDisk and other brands

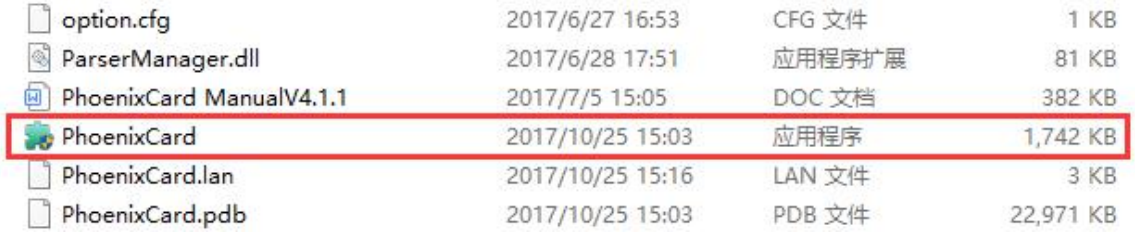
2) Then use a card reader to insert the TF card into the computer

3) Download Android 4.4 or Android 7.0 firmware and PhoenixCard burning tool from

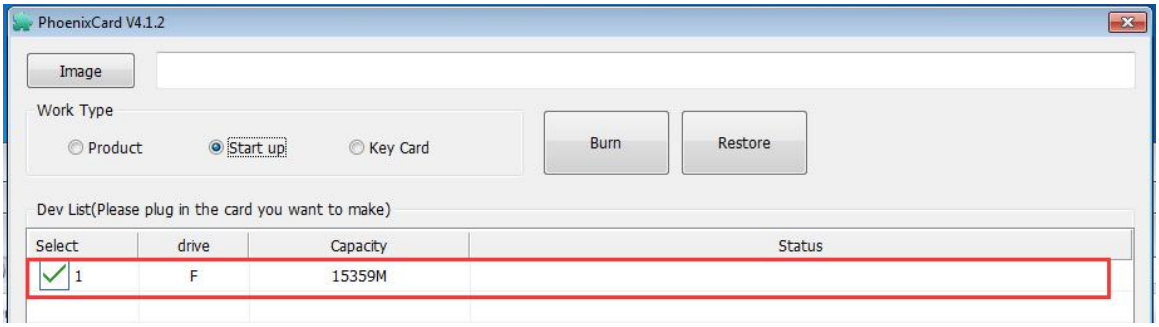
Orange Pi's data download page. Please make sure that the version of PhonenixCrad tool is PhoenixCard v4.1.2

4) 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

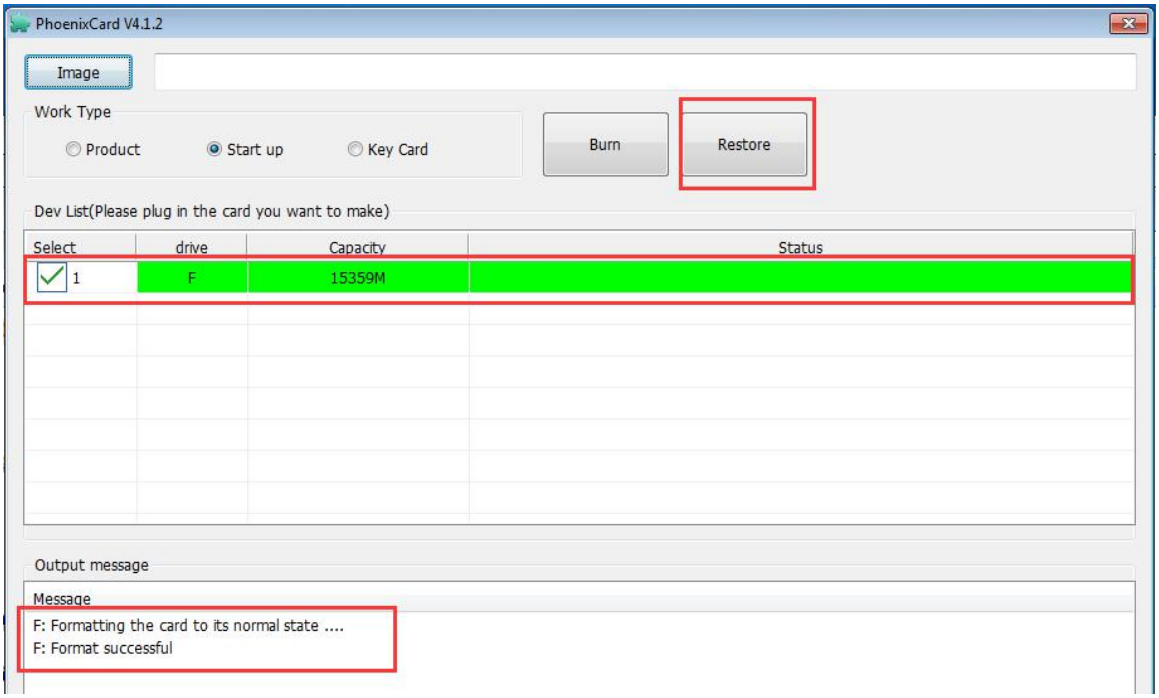
5) Use decompression software to decompress PhoenixCard v4.1.2.rar, this software does not need to be installed, you can find PhoenixCard in the decompressed folder and open it



6) After opening PhoenixCard, if the TF card is recognized normally, the drive letter and capacity of the TF card will be displayed in the middle list. Please make sure that the displayed drive letter is consistent with the drive letter of the TF card you want to burn. There is no display, you can try to unplug and insert the TF card



7) After confirming the drive letter, format the TF card first, click the **restore card** button in PhoenixCard, or use the aforementioned SD Card Formatter to format the TF card

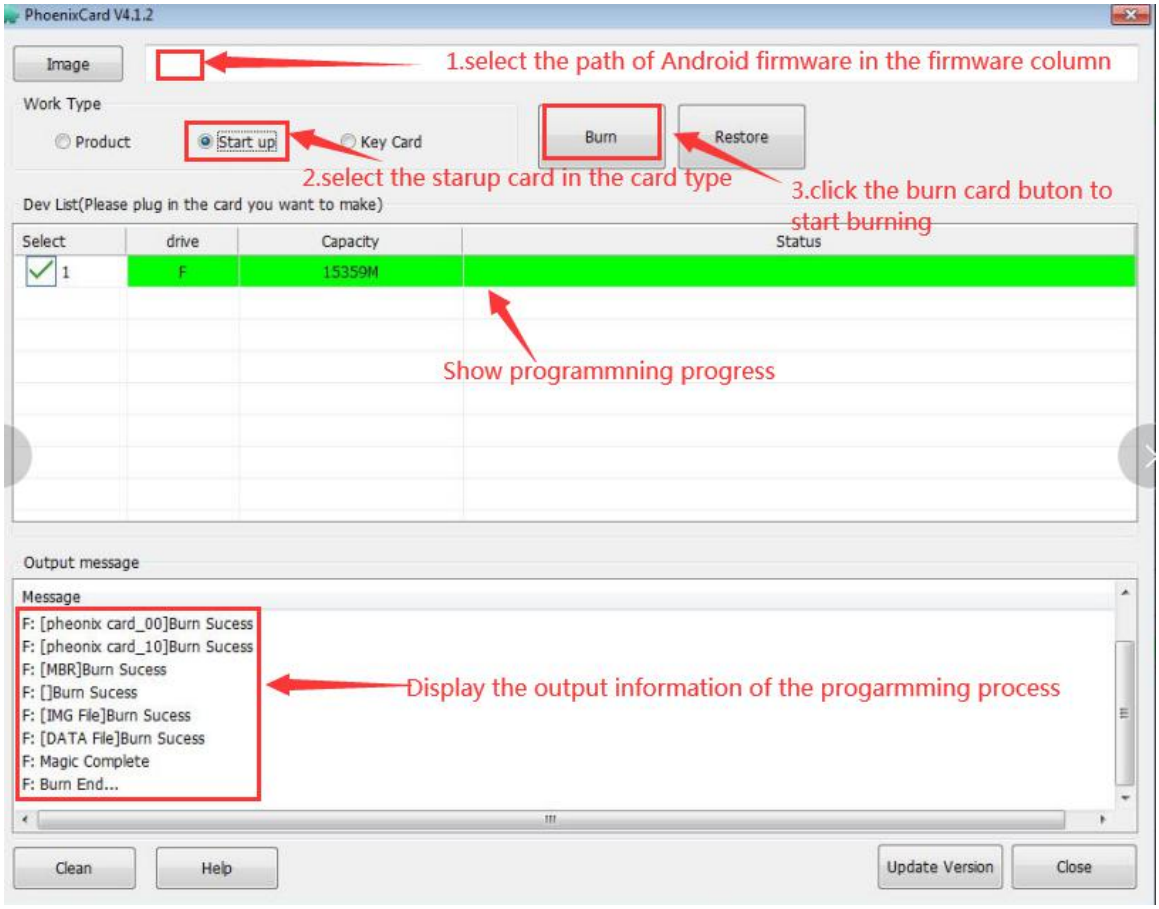


8) Then start to write the Android firmware to the TF card

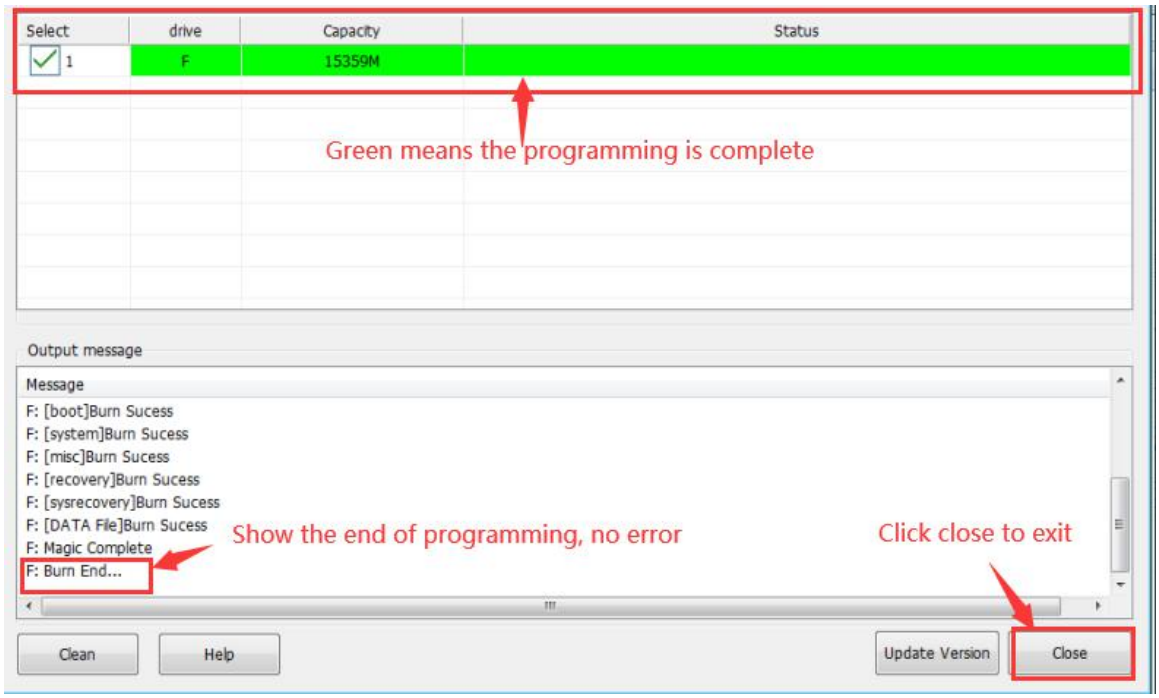
a. First select the path of Android firmware in the firmware column

b. Select the startup card in the card type

c. Then click the burn card button to start burning



9) After burning, the PhoenixCard will be displayed as shown in the figure below. At this time, click the close button to exit PhoenixCard, and then you can unplug the TF card from the computer and insert it into the development board to start.



2. 6. Start the Orange Pi development board

1) Insert the burned image TF card into the TF card slot of the Orange Pi development board

2) The development board has an HDMI interface, you can connect the development board to a TV or other HDMI monitors through an HDMI cable

3) Connect the USB mouse and keyboard to control the Orange Pi development board

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

5) Connect a 5V and at least 2A power adapter (3A is also possible)

a. Remember not to plug in the 12V power adapter, if you plug in the 12V power adapter, the development board will be burned out

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

6) Then turn on the switch of the power adapter, if everything is normal, the HDMI display will be able to see the startup screen of the system at this time

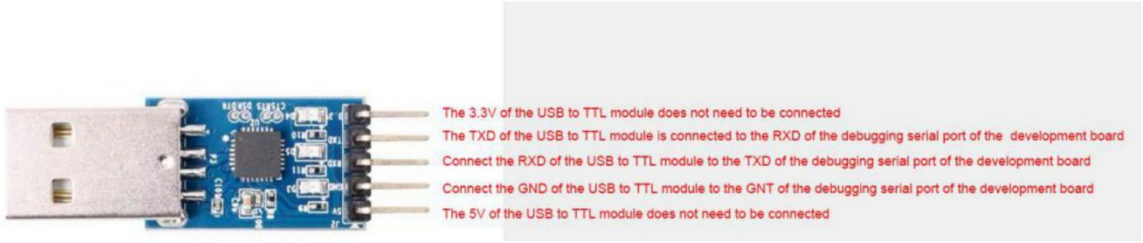
7) If you want to view the output information of the system through the debug serial port, please use the serial cable to connect the development board to the computer. For the connection method of the serial port, please refer to the section on the use of the debug

serial port

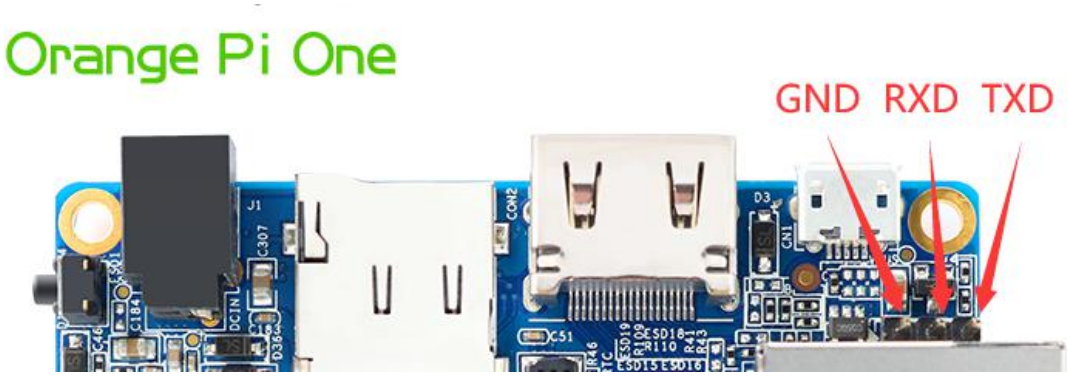
2. 7. How to use the debug serial port

2. 7. 1. Debug serial port connection instructions

1) First, you need to prepare a USB to TTL module. This module can be bought in Orange Pi stores. If there are other similar USB to TTL modules, you can also insert the USB end of the USB to TTL module into the USB port of the computer



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



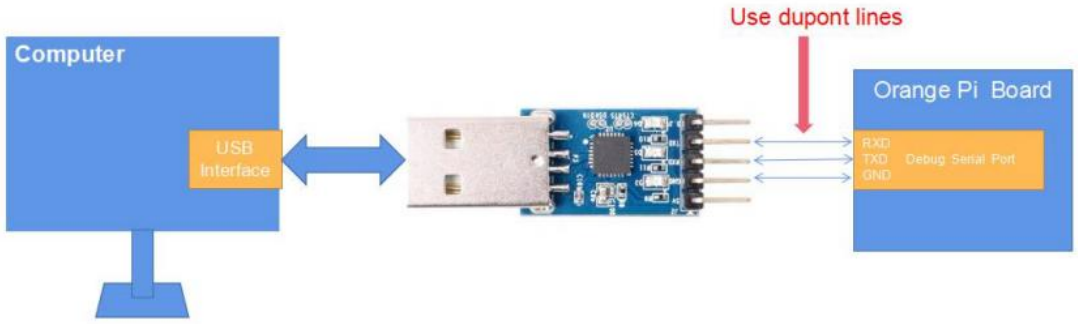
3) The GND, TXD and RXD pins of the USB to TTL module need to be connected to the debug serial port of the development board through a DuPont cable

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

b. Connect the RXD of the USB to TTL module to the TXD of the development board

c. Connect the TXD of the USB to TTL module to the RXD 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 USB to TTL module to computer and Orange Pi development board

2.7.2. How to use the debug serial port on the Ubuntu platform

1) If the USB to TTL module is connected normally, you can see the corresponding device node name under /dev of Ubuntu PC, remember this node name, you will use it when setting up the serial port software later

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

2) There are many serial debugging tools that can be used under linux, such as putty, minicom, etc. The following shows how to use putty

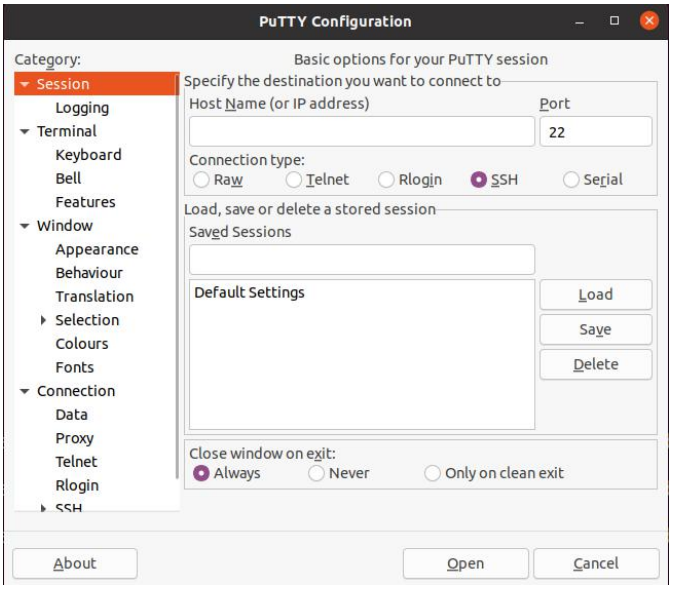
3) First install putty on the Ubuntu PC

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

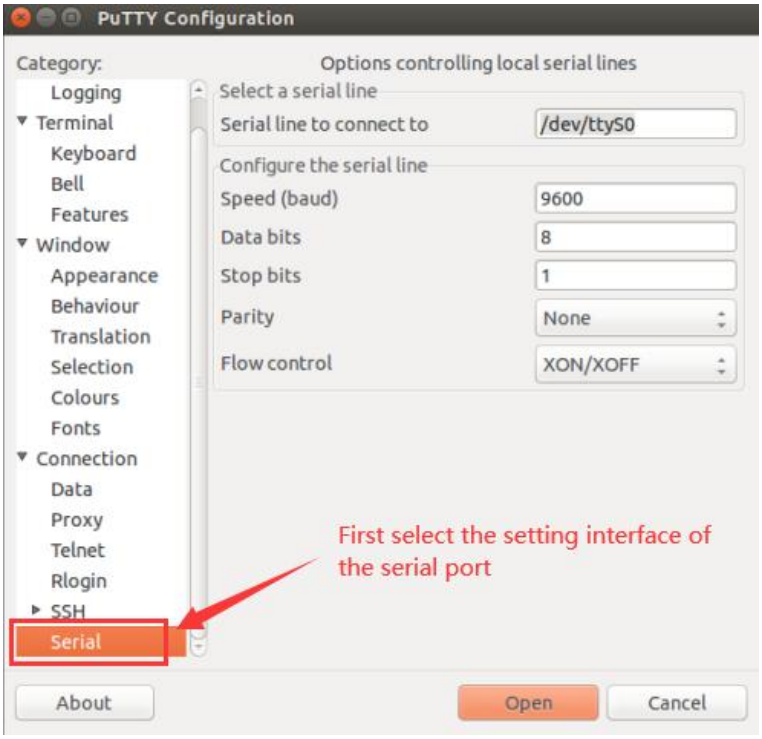
4) Then run putty, remember to add sudo permissions

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

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



6) First select the setting interface of the serial port

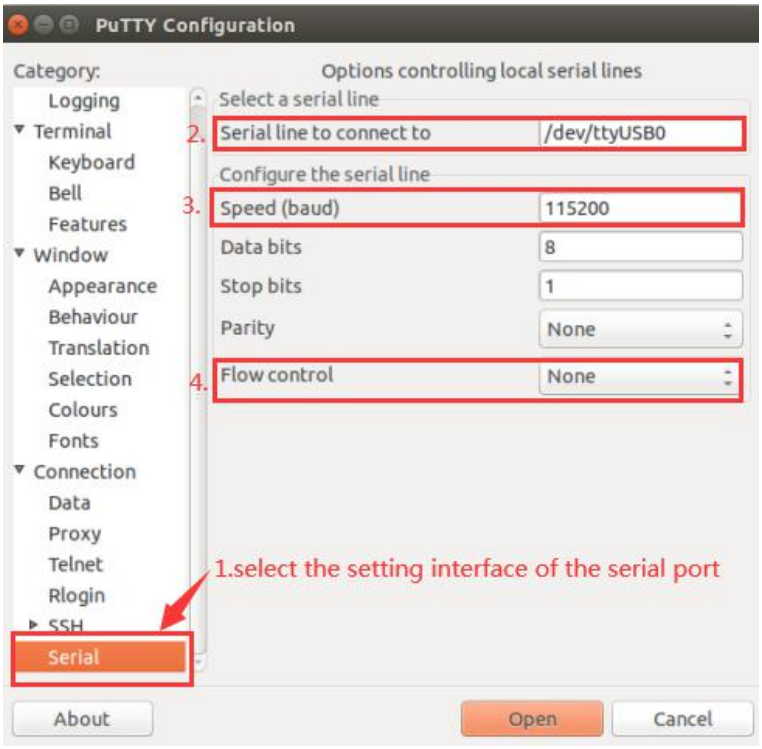


7) Then set the parameters of the serial port

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

b. Set Speed(baud) to 115200

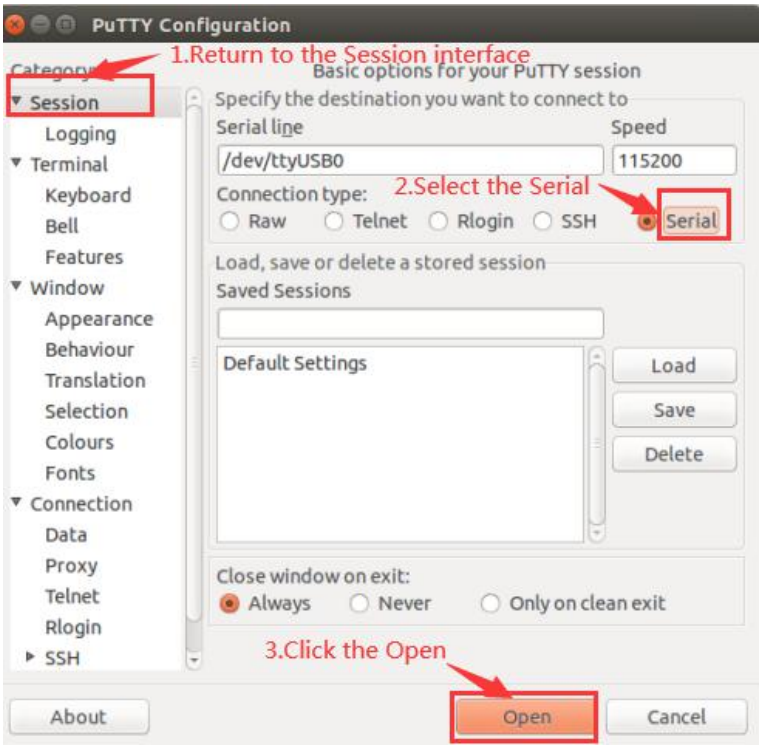
c. Set Flow control to None



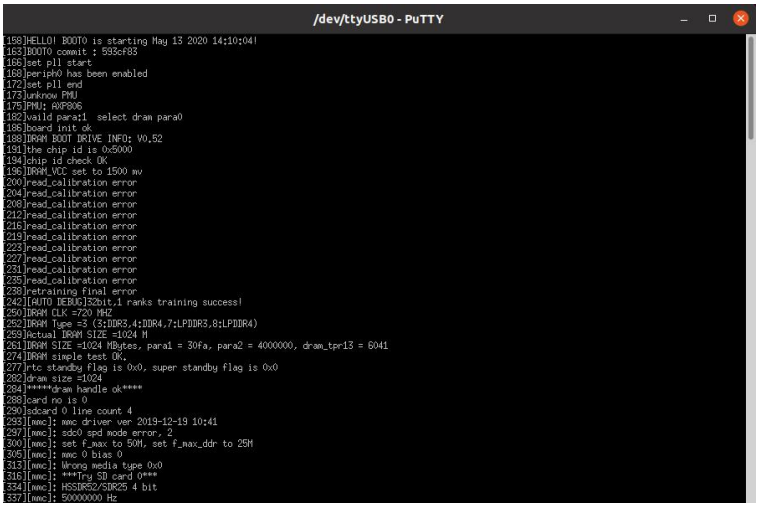
8) After setting the serial port setting interface, return to the Session interface

a. First select the Connection type as Serial

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



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



2. 7. 3. How to use the debug serial port on Windows platform

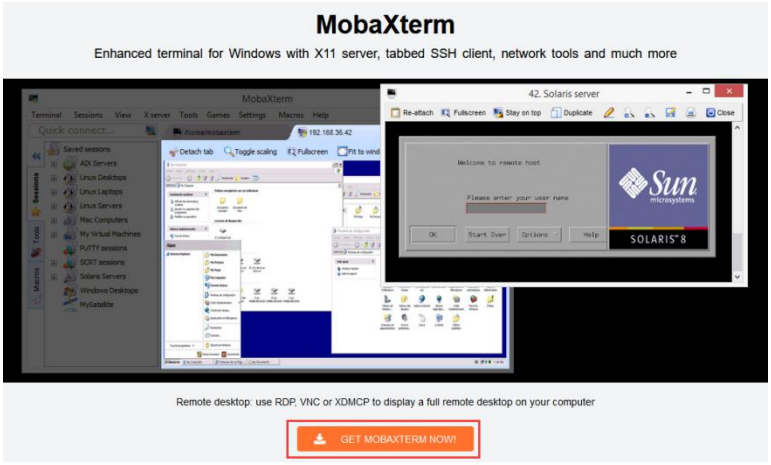
1) There are many serial debugging tools that can be used under Windows, such as SecureCRT, MobaXterm, etc. The following demonstrates how to use MobaXterm. This software is free and can be used without purchasing a serial number.

2) Download MobaXterm

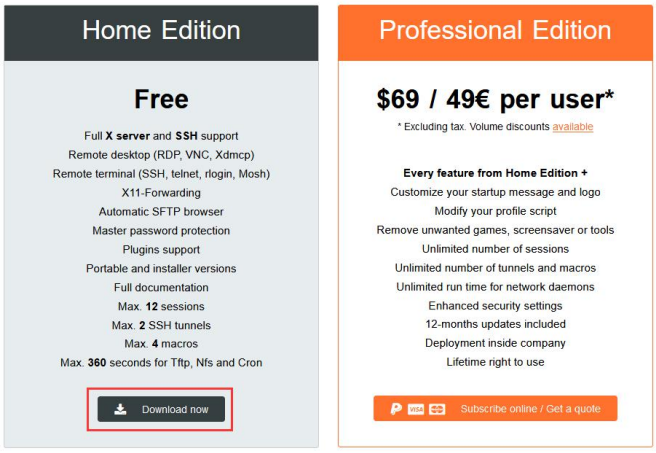
a. Download MobaXterm URL as follows

https://mobaxterm.mobatek.net/

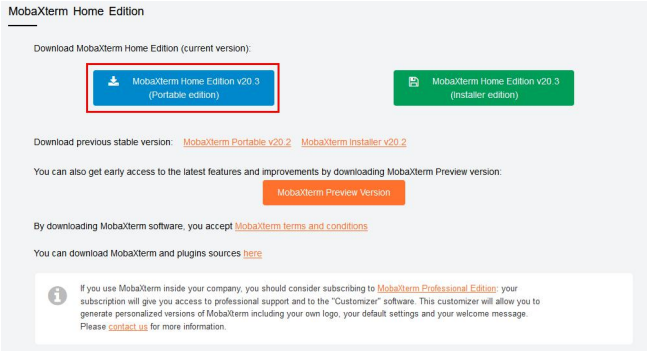
b. After entering the MobaXterm download page, click **GET XOBATERM NOW!**



c. Then choose to download the Home version



d. Then select the Portable version, after downloading, you don't need to install it, just open it and you can use it



3) 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

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

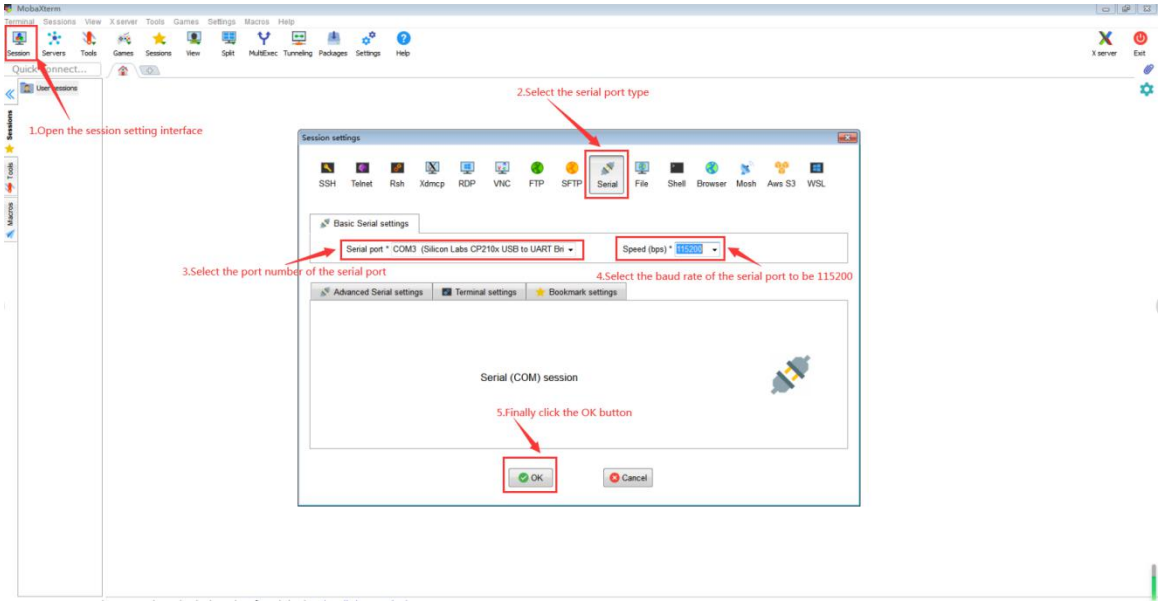
a. Open the session setting interface

b. Select the serial port type

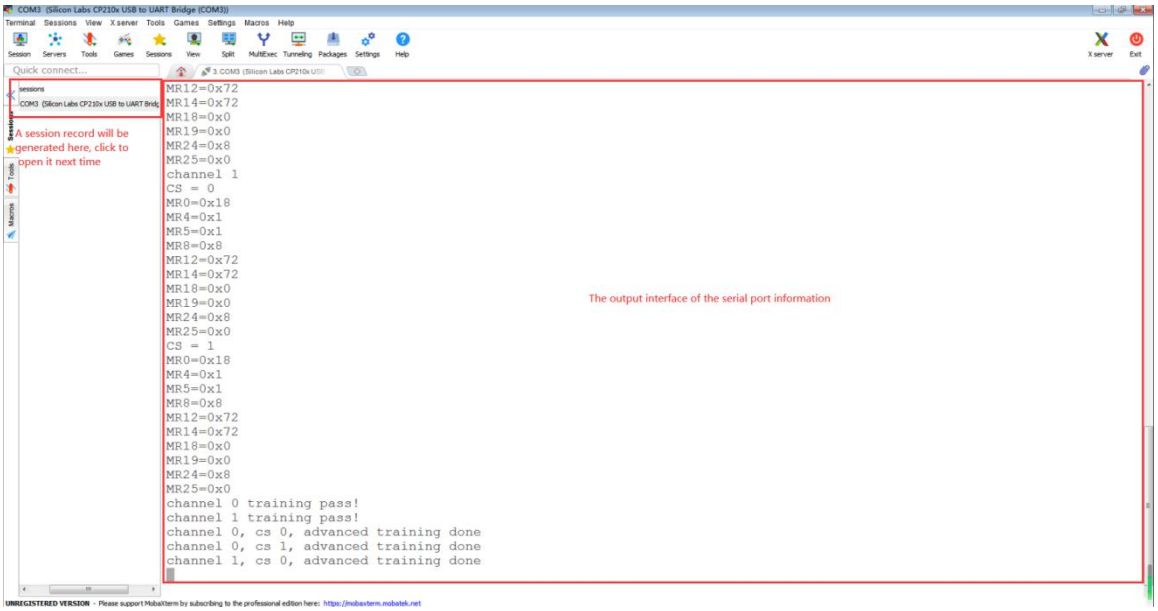
c. Select the port number of the serial port (choose the corresponding port number according to the specific situation), if you can't see the port number, please use the 360 driver master to scan and install the USB to TTL serial chip driver

d. Select the baud rate of the serial port to be 115200

e. Finally click the OK button to complete the setting



5) After clicking OK, you will enter the following interface, and you can see the output information of the serial port when you start the development board.



3. Linux system instructions

3. 1. Supported Linux distribution types and kernel versions

Release version	Kernel version	Server version	Desktop version
Ubuntu 20.04	linux5.4	Support	Support
Ubuntu 18.04	linux5.4	Support	Support
Debian 10	linux5.4	Support	Support
Ubuntu 16.04	linux3.4	Support	Support

3. 2. Linux5.4 kernel image driver adaptation situation

Functions	Status
HDMI Video	OK
HDMI Audio	OK
USB2.0	OK
TF card boot	OK
Network card	OK
USB camera	OK
LED	OK
40pin GPIO	OK
I2C	OK
SPI	OK
UART	OK
Temperature Sensor	OK
Hardware Watchdog	OK
OV5640 camera	OK
GC2035 camera	NO

3. 3. Linux3.4 kernel image driver adaptation situation

Functions	Status
HDMI Video	OK
HDMI Audio	OK
USB2.0	OK
TF card boot	OK
USB camera	OK
LED	OK
40pin GPIO	OK
I2C	OK
SPI	OK
UART	OK
Temperature Sensor	OK

Hardware Watchdog	OK
OV5640 camera	OK
GC2035 camera	OK
Mali GPU	OK

3. 4. Login account and password

Account	Password
root	orangepi
orangepi	orangepi

3. 5. Onboard LED light display control instructions

1) There are two LED lights on the development board, one green light and one red light. The default display of the LED lights when the system starts is as follows

	Green Light	Red Light
u-boot startup phase	Turn off	Bright
Kernel boot to enter the system	Bright	Turn off or Flashing
GPIO Port	PL10	PA15

2) The method of setting the green light on and off and flashing is as follows (take the linux3.4 system as an example)

a. First enter the green light setting directory

```
root@orangepi:~# cd /sys/class/leds/green_led
```

b. The command to set the green light off is as follows

```
root@orangepi:/sys/class/leds/green_led# echo 0 > brightness
```

c. The command to set the green light to be steady is as follows

```
root@orangepi:/sys/class/leds/green_led# echo 1 > brightness
```

d. The command to set the green light to flash is as follows

```
root@orangepi:/sys/class/leds/green_led# echo heartbeat > trigger
```

e. The command to set the green light to stop flashing is as follows

```
root@orangepi:/sys/class/leds/green_led# echo none > trigger
```

3) The method of setting the red light on and off and flashing is as follows (take the linux3.4 system as an example)

a. First enter the red light setting directory

```
root@orangepi:~# cd /sys/class/leds/red_led
```

b. The command to set the red light off is as follows

```
root@orangepi:/sys/class/leds/red_led# echo 0 > brightness
```

c. The command to set the red light to be always on is as follows

```
root@orangepi:/sys/class/leds/red_led# echo 1 > brightness
```

d. The command to set the red light to flash is as follows

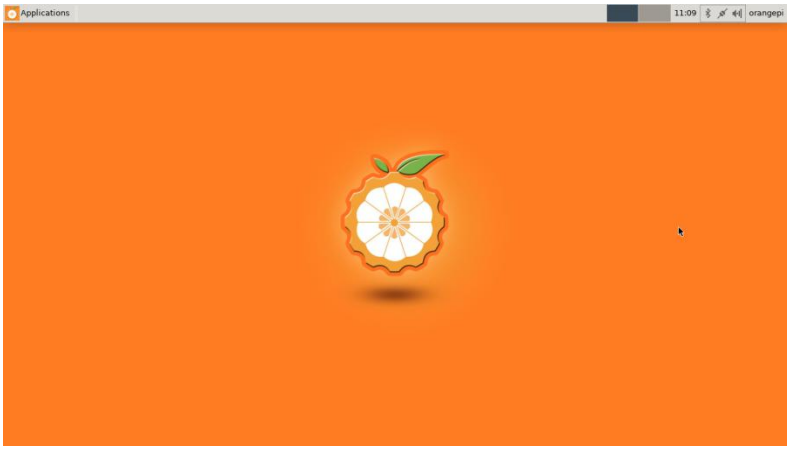
```
root@orangepi:/sys/class/leds/red_led# echo heartbeat > trigger
```

e. The command to set the red light to stop flashing is as follows

```
root@orangepi:/sys/class/leds/red_led# echo none > trigger
```

3. 6. Linux5.4 desktop version system automatic login instructions

1) The linux5.4 desktop version system will automatically log in to the desktop after it is started by default, without entering a password



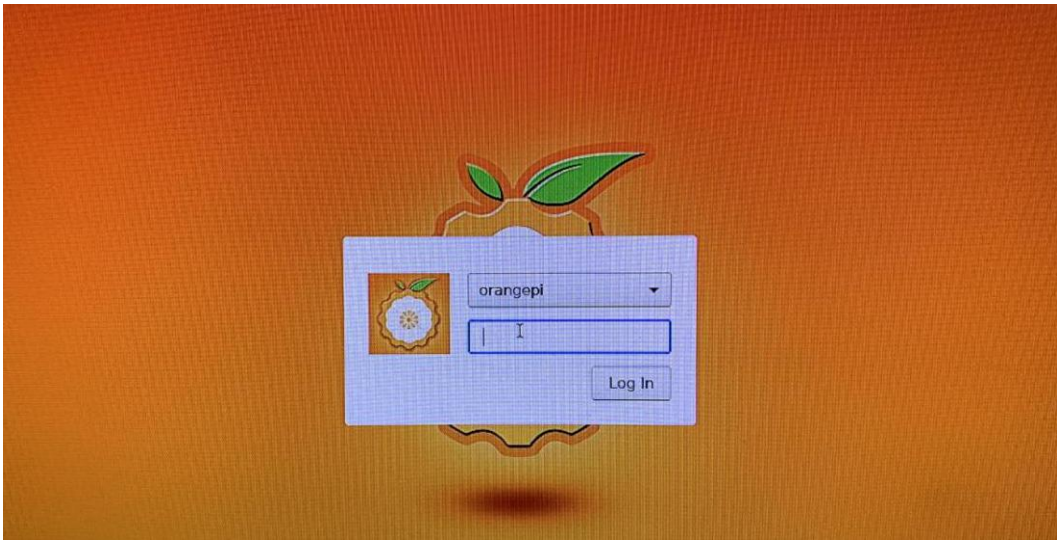
2) Modify the configuration in **/etc/lightdm/lightdm.conf.d/22-orangepi-autologin.conf** to prevent the desktop version system from automatically logging in to the desktop. The modification command is as follows, or you can open the configuration file to modify it directly

```
root@orangepis:~# 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@orangepis:~# 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 and a login dialog box will appear, at this time you need to enter a password to enter the system



3. 7. The first time the Linux5.4 system starts to automatically expand rootfs

1) When the linux5.4 system is started for the first time through the TF card, the orangepi-resize-filesystem script will be called through the orangepi-resize-filesystem.service systemd service to automatically expand the rootfs

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

```
root@orangepi:~# df -h
```

```
Filesystem      Size  Used Avail Use% Mounted on
udev            430M     0  430M   0% /dev
tmpfs           100M  5.6M   95M   6% /run
/dev/mmcblk0p1   15G   915M   14G   7% /
tmpfs           500M     0  500M   0% /dev/shm
```

3) It should be noted that the Linux system has only one partition in ext4 format, and does not use a separate BOOT partition 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 usually automatically mount the TF card partition. If the automatic mounting is normal, use the ls command to see the following output, the TF card partition name and the following command The names shown are not necessarily the same, please modify 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 root user in 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 unmount the TF card, then unplug the TF and plug it into the development board to start up. When the linux system starts, when the file .no_rootfs_resize in the /root directory is detected, the rootfs will no longer be

automatically expanded

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

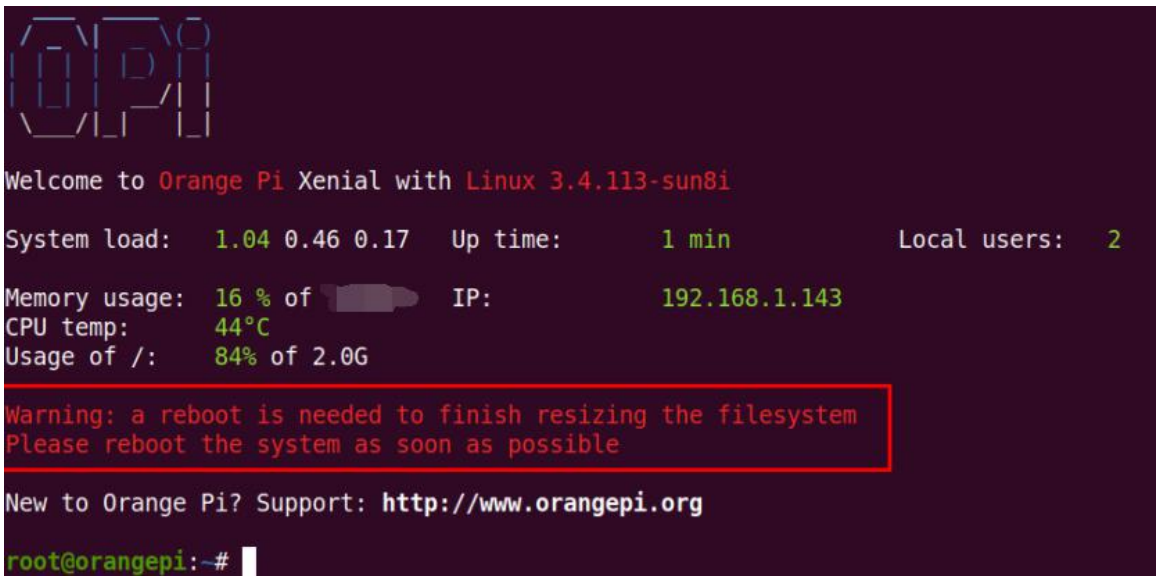
```
root@orangepi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            927M     0  927M   0% /dev
tmpfs           200M  5.6M  194M   3% /run
/dev/mmcblk0p1  1.5G  1.3G  196M  87% /
tmpfs           997M     0  997M   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           997M     0  997M   0% /sys/fs/cgroup
tmpfs           997M  4.0K  997M   1% /tmp
/dev/zram0       49M  1.5M   44M   4% /var/log
tmpfs           200M     0  200M   0% /run/user/0
```

3.8. Linux3.4 system automatic expansion rootfs instructions

1) When the linux3.4 system is started for the first time through the TF card, the **orangepi-resize-filesystem** script will be called through the **orangepi-resize-filesystem.service** systemd service to automatically expand the rootfs, but it is different from the linux5.4 system. After the first boot is completed, the automatic expansion has not been completed, and the system needs to be restarted to finally complete the automatic expansion of rootfs

2) When you start the linux3.4 system for the first time, you will see a warning when you log in to the system through ssh or serial port: a restart is required to complete the expansion of the file system, please restart as soon as possible

a. If you see this warning, please restart as soon as possible, and perform other operations after the automatic expansion is completed

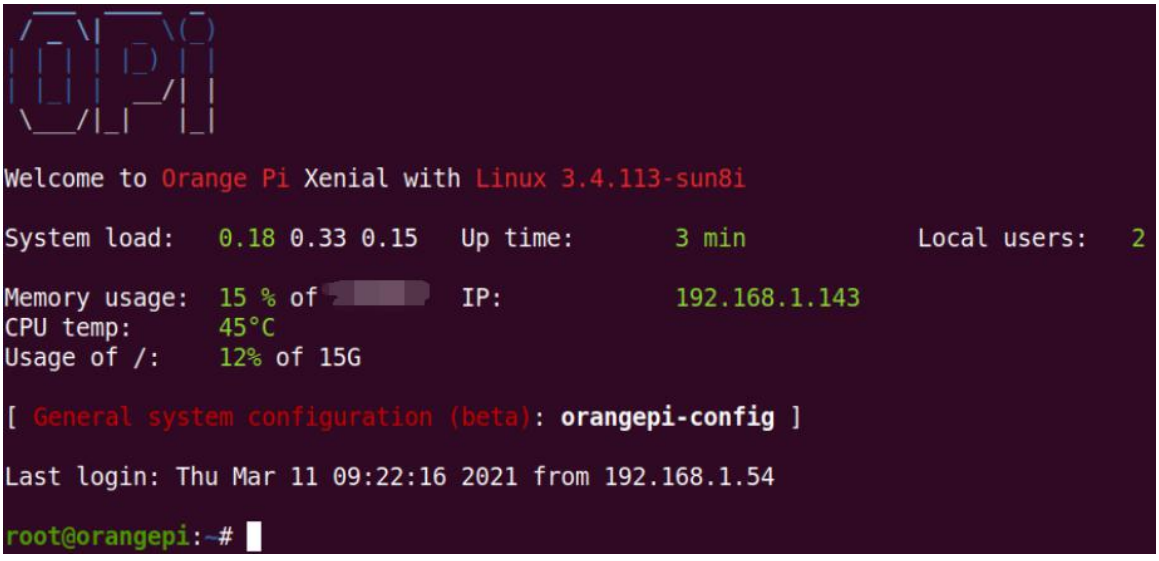


b. After starting the linux system for the first time, you can see the size of rootfs as shown below before restarting, only a few hundred megabytes of free space

```
root@orangepi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            370M     0  370M   0% /dev
tmpfs           101M  2.1M   99M   3% /run
/dev/mmcblk0p1  2.0G  1.6G  335M  84% /
tmpfs           501M  140K  501M   1% /dev/shm
```

3) After restarting, you can log in to the system through ssh or serial port to see

a. The warning that needs to restart to complete the expansion has disappeared



b. Use the df -h command to check the size of the rootfs. If the automatic

expansion is running correctly, you can see that the size of the rootfs is basically the same as the actual capacity of the TF card

```
root@orangepi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            430M     0  430M   0% /dev
tmpfs           100M  5.6M   95M   6% /run
/dev/mmcblk0p1   15G   915M   14G   7% /
tmpfs           500M     0  500M   0% /dev/shm
```

4) It should be noted that the linux3.4 system has only one partition in ext4 format, and does not use a separate BOOT partition to store files such as kernel images, so there is no problem of BOOT partition expansion

5) 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 usually automatically mount the TF card partition. If the automatic mounting is normal, use the ls command to see the following output, the TF card partition name and the following command The names shown are not necessarily the same, please modify according to the actual situation

```
test@test:~$ ls /media/test/49cc0cc0-8cb2-435d-bd35-4bbc6b7cd975/
bin   dev  home  lost+found  mnt  proc  run   selinux  sys  usr
boot  etc  lib   media       opt  root  sbin  srv      tmp  var
```

c. Then switch the current user to root user in 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/49cc0cc0-8cb2-435d-bd35-4bbc6b7cd975
root@test:/media/test/49cc0cc0-8cb2-435d-bd35-4bbc6b7cd975# cd root
root@test:/media/test/49cc0cc0-8cb2-435d-bd35-4bbc6b7cd975/root# touch .no_rootfs_resize
root@test:/media/test/49cc0cc0-8cb2-435d-bd35-4bbc6b7cd975/root# ls .no_rootfs*
.no_rootfs_resize
```

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

f. After disabling rootfs automatic expansion, after the first startup, you will no longer see the warning that you need to restart to complete expansion after logging in to the system through ssh or serial port. Even after restarting, you can see that the available capacity of the TF card is only about 300M

```
root@orangepi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            370M     0  370M   0% /dev
tmpfs           101M  2.0M   99M   2% /run
/dev/mmcblk0p1  2.0G  1.6G  335M  84% /
tmpfs           501M  140K  501M   1% /dev/shm
```

3.9. 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 2.1.0 Bionic ttyS0

orangepi login:
```

2) When there is a problem with the system startup, 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

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

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

```
root@orangepi:~# cat /boot/orangepiEnv.txt
verbosity=7
bootlogo=false
console=serial
```

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

```
[  OK  ] Started Dispatcher daemon for systemd-networkd.
[  OK  ] Reached target Multi-User System.
[  OK  ] Reached target Graphical Interface.
         Starting Update UTMP about System Runlevel Changes...
[  OK  ] Started Update UTMP about System Runlevel Changes.
[  OK  ] Started Authorization Manager.

Orange Pi 2.1.0 Bionic ttyS0

orangepi login:
```

3. 10. SSH remote login to the development board

Linux systems have SSH remote login enabled by default, and allow root users to log in to the system. Before ssh login, you need to make sure that the Ethernet is connected, and then use the ifconfig command or check the router to obtain the IP address of the development board

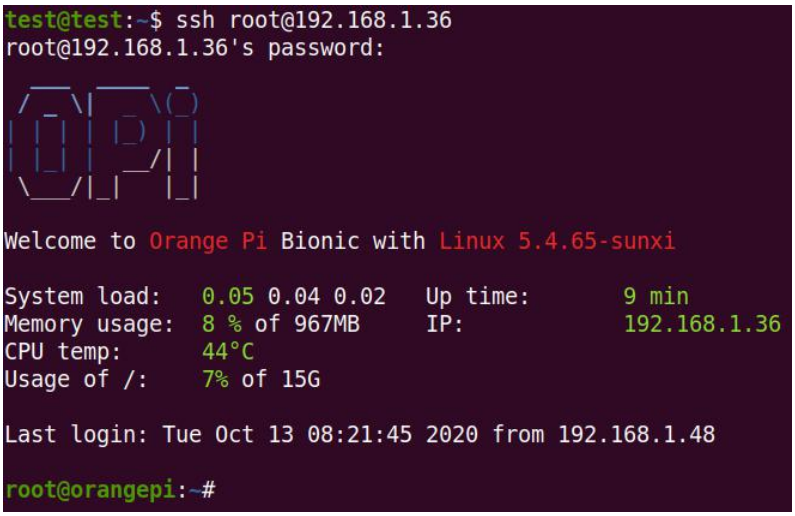
3. 10. 1. SSH remote login development board under Ubuntu

1) First get 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@192.168.1.36          // Need to be replaced with the IP address of the development board
root@192.168.1.36's password:               // Enter the password here, the default password is orangepi
```

3) The display after successfully logging in to the system is as shown in the figure below



4) If the following error is prompted when ssh login

```
test@test:~$ ssh root@192.168.1.36
Connection reset by 192.168.1.149 port 22
lost connection
```

You can enter the following command on the development board and 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) In windows, you can use MobaXterm to remotely log in to the development board, first create a new ssh session

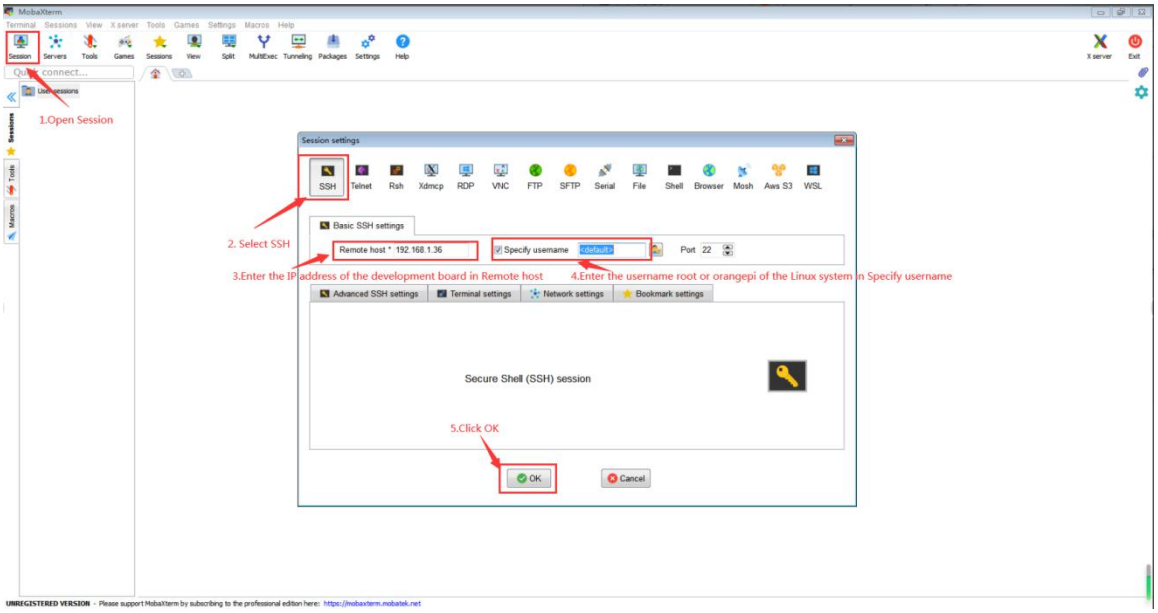
a. Open Session

b. Then select SSH in Session Setting

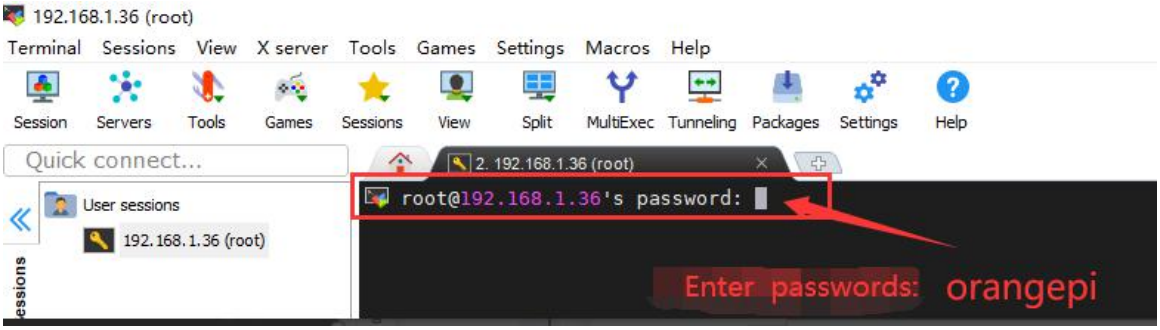
c. Then enter the IP address of the development board in Remote host

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

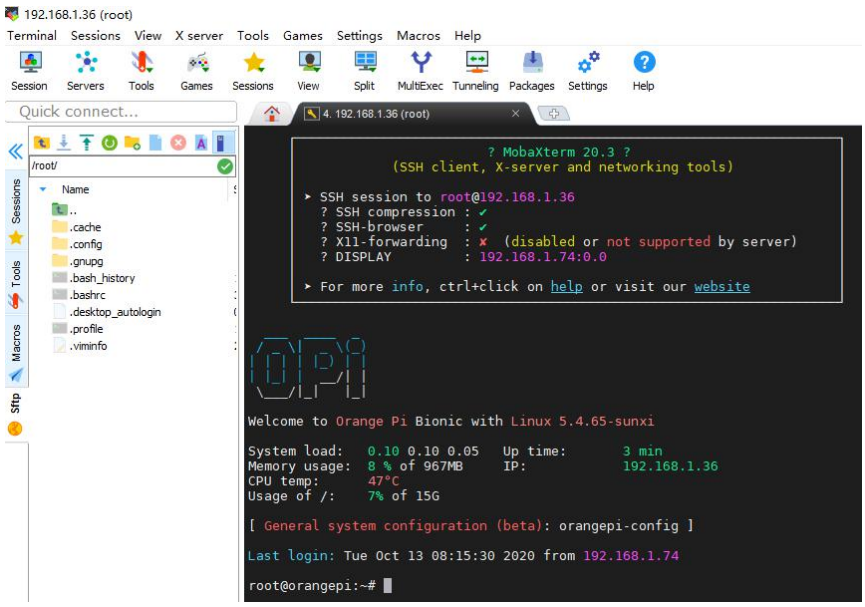
e. Finally click OK



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



4) The display after successfully logging in to the system is as shown in the figure below



3. 11. 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@orangepi:~# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.47  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::e56:c34d:62f0:8d6e  prefixlen 64  scopeid 0x20<link>
        ether 02:81:3e:a8:58:d8  txqueuelen 1000  (Ethernet)
        RX packets 2165  bytes 177198 (177.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 312  bytes 40435 (40.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 39
```

4) The command to test network connectivity is as follows

```
root@orangepi:~# ping www.orangepi.org -I eth0
PING www.orangepi.org (182.92.236.130) from 192.168.1.47 eth0: 56(84) bytes of data.
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=1 ttl=52 time=39.3 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=2 ttl=52 time=39.3 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=3 ttl=52 time=39.9 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=4 ttl=52 time=39.7 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=39.7 ms
^C
--- www.orangepi.org ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 39.323/39.617/39.922/0.274 ms
```

3.12. HDMI display test

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

2) If the HDMI display has image output after starting the linux system, it means that the HDMI interface is in normal use

3) In the absence of network and serial port, you can use HDMI display, and then connect the mouse and keyboard to control the development board

3.13. USB interface test

3.13.1. 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 used normally (the mouse can only be used in the image of the desktop version)

3. 13. 2. Connect USB storage device test

1) Format the U disk first, and then put some files in the U disk

2) Then insert the U disk into the USB interface of the development board

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

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

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

```
root@orangepi:~# mount /dev/sda1 /mnt/
root@orangepi:~# ls /mnt/
test.txt
```

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

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

3. 14. USB Ethernet card test

1) The USB Ethernet cards that have been tested and can be used are as follows. Among them, the RTL8153 USB Gigabit network card is inserted into the USB 2.0 Host interface of the development board. The test can be used normally, but the speed is not up to

Gigabit. Please pay attention to this point.

Serial number	model
1	RTL8152B USB 100M network card
2	RTL8153 USB Gigabit Ethernet

2) First insert the USB network card into the USB interface of the development board, and then insert the network cable into the USB network card to ensure that the network cable can normally access the Internet. If you can see the following log information through the dmesg command, it means that the USB network card is recognized normally

```
root@orangepi:~# dmesg | tail
[    121.985016] usb 3-1: USB disconnect, device number 2
[    126.873772] sunxi-ehci 5311000.ehci3-controller: ehci_irq: highspeed device connect
[    127.094054] usb 3-1: new high-speed USB device number 3 using sunxi-ehci
[    127.357472] usb 3-1: reset high-speed USB device number 3 using sunxi-ehci
[    127.557960] r8152 3-1:1.0 eth1: v1.08.9
[    127.602642] r8152 3-1:1.0 enx00e04c362017: renamed from eth1
[    127.731874] IPv6: ADDRCONF(NETDEV_UP): enx00e04c362017: link is not ready
[    127.763031] IPv6: ADDRCONF(NETDEV_UP): enx00e04c362017: link is not ready
[    129.892465] r8152 3-1:1.0 enx00e04c362017: carrier on
[    129.892583] IPv6: ADDRCONF(NETDEV_CHANGE): enx00e04c362017: link becomes ready
```

3) Then you can see the device node of the USB network card and the automatically assigned IP address through the ifconfig command

```
root@orangepi:~# ifconfig
enx00e04c362017: 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::681f:d293:4bc5:e9fd  prefixlen 64  scopeid 0x20<link>
        ether 00:e0:4c:36:20:17  txqueuelen 1000  (Ethernet)
        RX packets 1849  bytes 134590 (134.5 KB)
        RX errors 0  dropped 125  overruns 0  frame 0
        TX packets 33  bytes 2834 (2.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

4) The command to test network connectivity is as follows

```
root@orangepi:~# ping www.baidu.com -I enx00e04c362017
PING www.a.shifen.com (14.215.177.38) from 192.168.1.12 eth0: 56(84) bytes of data.
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=1 ttl=56 time=6.74 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=2 ttl=56 time=6.80 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=3 ttl=56 time=6.26 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=56 time=7.27 ms
^C
--- www.a.shifen.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3002ms
rtt min/avg/max/mdev = 6.260/6.770/7.275/0.373 ms
```

3.15. USB camera test

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

2) Use lsmod to check whether the system has automatically loaded the uvcvideo kernel module

```
root@orangepi:~# lsmod
Module                  Size  Used by
uvcvideo              106496  0
```

3) Then use v4l2-ctl (note that l in v4l2 is a lowercase letter l, not a number 1) command to view the device node of the USB camera. From the output below, you can see that the device node corresponding to the USB camera is /dev/video2. If you look The USB-related video node is not found, indicating that the USB camera cannot be recognized

```
root@orangepi:~# apt update
root@orangepi:~# apt install v4l-utils
root@orangepi:~# v4l2-ctl    --list-devices
sun6i-csi (platform:camera):
        /dev/video1

cedrus (platform:cedrus):
        /dev/video0
```

```
USB 2.0 Camera: HD USB Camera (usb-1c1c000.usb-1):
        /dev/video2
        /dev/video3
```

4) Install fswebcam

```
root@orangepi:~# apt update
root@orangepi:~# apt-get install fswebcam
```

5) 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 is used to remove watermark from photos

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

d. -S option is used to skip the previous frame number

```
root@orangepi:~# fswebcam -d /dev/video2 --no-banner -r 1280x720 -S 5 ./image.jpg
```

6) In the server version of the Linux system, you can use the scp command to transfer the taken pictures to the Ubuntu PC for image after taking pictures.

```
root@orangepi:~# scp image.jpg test@192.168.1.55:/home/test // Need to be modified to the corresponding path
```

3. 16. Audio test

3. 16. 1. HDMI audio playback test

1) First use the aplay -l command to ensure that you can see the HDMI sound card device, where card 0 is the HDMI sound card device

```
root@orangepi:~# aplay -l
card 0: allwinnerhdmi [allwinner-hdmi], device 0: 1c22800.i2s-i2s-hifi i2s-hifi-0 [1c22800.i2s-i2s-hifi i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

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

```
root@orangepi:~# aplay -D hw:0,0 audio.wav
```

3. 17. Hardware watchdog test

1) Download the code of wiringOP

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

2) Compile wiringOP

```
root@orangepi:~# cd wiringOP
root@orangepi:~/wiringOP# ./build clean
root@orangepi:~/wiringOP# ./build
```

3) Compile the watchdog test program

```
root@orangepi:~/wiringOP# cd examples/
root@orangepi:~/wiringOP/examples# make watchdog
[CC] watchdog.c
[link]
```

4) 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 the success of feeding the dog

```
root@orangepi:~/wiringOP/examples# ./watchdog 10
open success
options is 33152,identity is sunxi-wdt
put_usr return,if 0,success:0
The old reset time is: 16
return ENOTTY,if -1,success:0
return ENOTTY,if -1,success:0
put_user return,if 0,success:0
put_usr return,if 0,success:0
keep alive
keep alive
```

3. 18. CSI camera test

3. 18. 1. CSI camera interface specifications

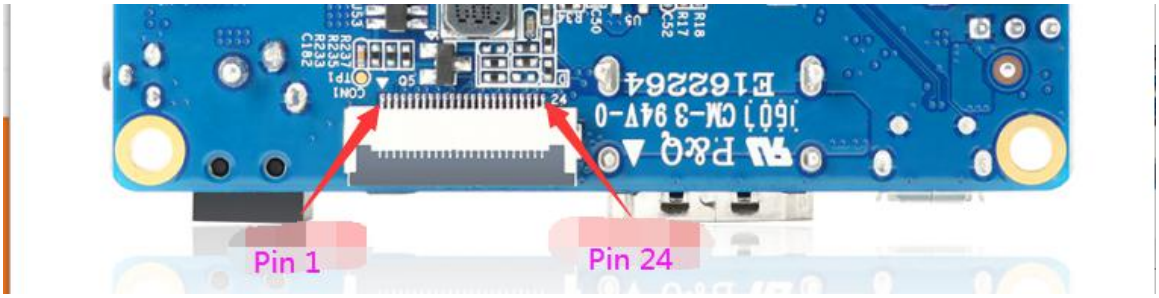
1) The CSI interface of Orange Pi One supports two cameras, gc2035 and ov5640. The support for cameras in different systems is explained as follows

	GC2035	OV5640
Linux3.4	Support	Support
Linux5.4	**Not Support**	Support

2) The serial number of the CSI interface pins is shown in the figure below

a. The No. 1 pin of the CSI interface is connected to the No. 24 pin of the camera adapter board

b. The 24th pin of the CSI interface is connected to the 1st pin of the camera adapter board



3) CSI interface pins are defined as follows

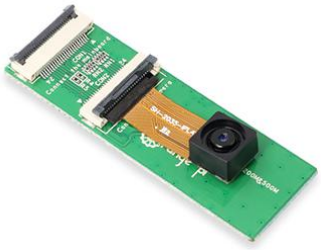
Pin	Functions	GPIO Port
CON1-P01	DCIN-5V	
CON1-P02	GND	
CON1-P03	TWI2-SDA	PE13
CON1-P04	CSI-PWR-EN	PA17
CON1-P05	TWI2-SCK	PE12
CON1-P06	CSI-RESET	PE15
CON1-P07	CSI-VSYNC	PE3
CON1-P08	CSI-STBY-EN	PE15
CON1-P09	CSI-HSYNC	PE2
CON1-P10	VDD1V8-CSI	PG11

CON1-P11	AFCC_EN	PG13
CON1-P12	CSI-D7	PE11
CON1-P13	CSI-MCLK	PE1
CON1-P14	CSI-D6	PE10
CON1-P15	GND	
CON1-P16	CSI-D5	PE9
CON1-P17	CSI-PCLK	PE0
CON1-P18	CSI-D4	PE8
CON1-P19	CSI-D0	PE4
CON1-P20	CSI-D3	PE7
CON1-P21	CSI-D1	PE5
CON1-P22	CSI-D2	PE6
CON1-P23	GND	
CON1-P24	DCIN-5V	

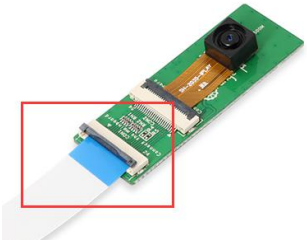
3. 18. 2. Linux3.4 system gc2035 camera test

1) The Gc2035 camera kit includes a gc2035 camera, an adapter board and a cable

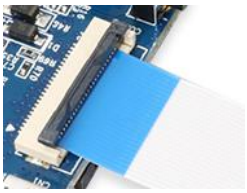
2) First insert the gc2035 camera into the adapter board



3) Then insert the ribbon cable into another card slot of the adapter board



4) Then insert the other end of the cable into the CIS camera interface of the development board. Start the linux system after connecting the camera (**don't plug in the camera after power-on**)



5) Then use the setsystem gc2035 command to initialize the configuration of gc2035

```
root@orangepi:~# setsystem gc2035
Set the csi camera used by the orangepione as: gc2035
```

The setsystem gc2035 command mainly does：

a. Configure the kernel modules that need to be loaded for gc2035

```
root@orangepi:~# cat /etc/modules-load.d/modules.conf
gc2035
vfe_v4l2
```

b. Configure vip_dev0_mname in /boot/script.bin as gc2035

6) After restarting and entering the system, first confirm whether the kernel module related to the gc2035 camera is automatically loaded

```
root@orangepi:~# lsmod
Module                  Size  Used by
vfe_v4l2              1018545  0
videobuf_dma_contig      3513  1 vfe_v4l2
videobuf_core           14871  2 vfe_v4l2,videobuf_dma_contig
```

```
gc2035                 19692  0
vfe_subdev              4531  2 vfe_v4l2,gc2035
cci                    22869  2 vfe_v4l2,gc2035
vfe_os                  4269  3 cci,vfe_v4l2,vfe_subdev
```

7) Then use v4l2-ctl (**note that l in v4l2 is a lowercase letter l, not a number 1**) command to view the device node of the CSI camera. From the output below, we can see that the device node corresponding to the camera is /dev/video0

```
root@orangepi:~# apt update
root@orangepi:~# apt install v4l-utils
root@orangepi:~# v4l2-ctl    --list-devices
sunxi-vfe (sunxi_vfe sunxi_vfe.0):
     /dev/video0
```

8) Then start to install the camera test software motion

```
root@orangepi:~# apt update
root@orangepi:~# apt install motion
```

9) Modify the configuration of /etc/default/motion, change start_motion_daemon=no to start_motion_daemon=yes

```
root@orangepi:~# sed -i "s/start_motion_daemon=no/start_motion_daemon=yes/" \
/etc/default/motion
```

10) Modify the configuration of /etc/motion/motion.conf

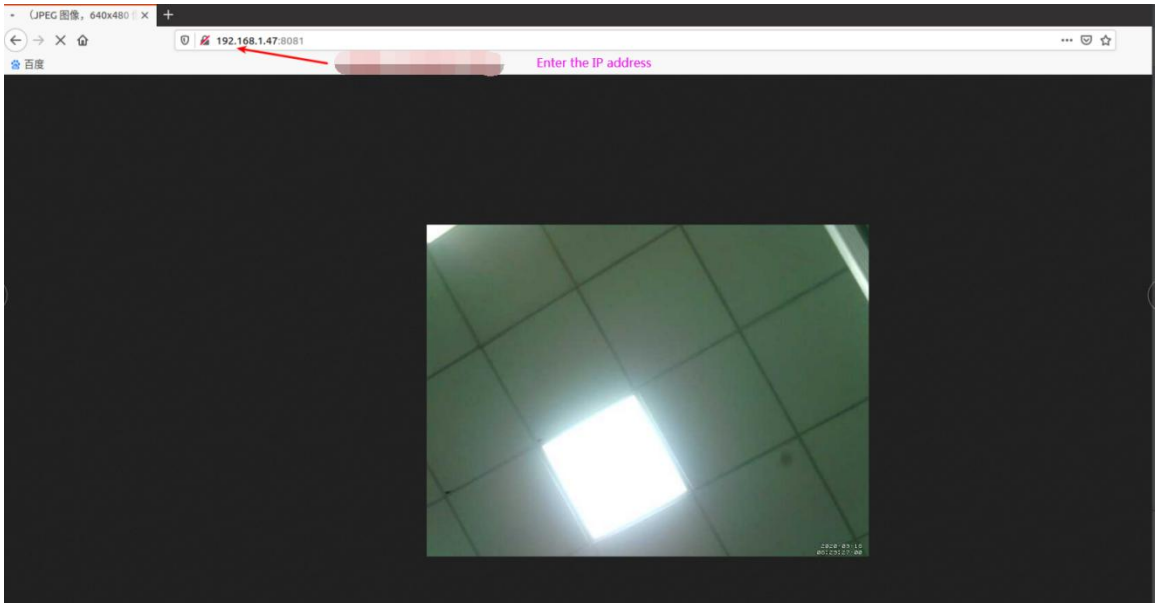
```
 root@orangepi:~# sed -i "s/stream_localhost on/stream_localhost off/" \
/etc/motion/motion.conf
```

11) Then restart the motion service

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

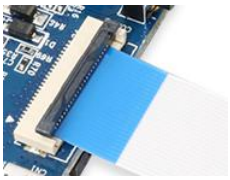
12) Before using motion, please make sure that the Orange Pi development board can be connected to the network normally, and then obtain the IP address of the development board through the ifconfig command

13) Then enter [development board IP address: 8081] in the Firefox browser to see the image output by gc2035



3. 18. 3. Linux3.4 system ov5640 camera test

1) First connect the Ov5640 camera adapter board to the CIS camera interface of the development board through a cable, and then start the linux system after connecting the camera (**don't plug in the camera after powering on**)



2) Then use the setsystem ov5640 command to initialize the configuration of ov5640

```
root@orangepi:~# setsystem ov5640
Set the csi camera used by the orangepione as: ov5640
```

The setsystem ov5640 command mainly does：

a. Configure the kernel modules that need to be loaded for ov5640

```
root@orangepi:~# cat /etc/modules-load.d/modules.conf
ov5640
```

```
vfe_v4l2
```

b. Configure vip_dev0_mname in /boot/script.bin as ov5640

3) After restarting and entering the system, first confirm whether the kernel module related to the ov5640 camera is automatically loaded

```
root@orangepi:~# lsmod
Module                  Size  Used by
vfe_v4l2              1018545  1
videobuf_dma_contig      3513  1 vfe_v4l2
videobuf_core           14871  2 vfe_v4l2,videobuf_dma_contig
ov5640                  42317  0
vfe_subdev               4531  2 vfe_v4l2,ov5640
cci                     22869  2 vfe_v4l2,ov5640
vfe_os                   4269  3 cci,vfe_v4l2,vfe_subdev
```

4) Then use the v4l2-ctl (**note that the l in v4l2 is a lowercase letter l, not a number 1**) command to view the device node of the CSI camera. From the output below, we can see that the device node corresponding to the camera is /dev/video0

```
root@orangepi:~# apt update
root@orangepi:~# apt install -y   v4l-utils
root@orangepi:~# v4l2-ctl   --list-devices
sunxi-vfe (sunxi_vfe sunxi_vfe.0):
    /dev/video0
```

5) Then start to install the camera test software motion

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

6) Modify the configuration of /etc/default/motion, change start_motion_daemon=no to start_motion_daemon=yes

```
root@orangepi:~# sed -i "s/start_motion_daemon=no/start_motion_daemon=yes/" \
/etc/default/motion
```

7) Modify the configuration of /etc/motion/motion.conf

```
root@orangepi:~# sed -i "s/stream_localhost on/stream_localhost off/" \
```

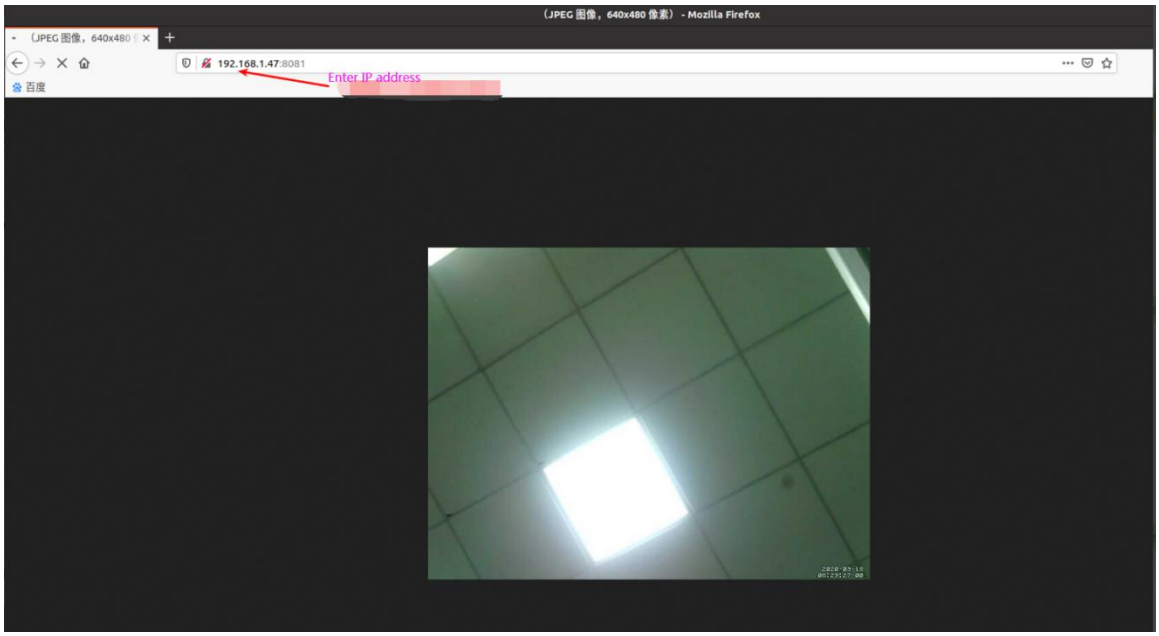
/etc/motion/motion.conf

8) Then restart the motion service

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

9) 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

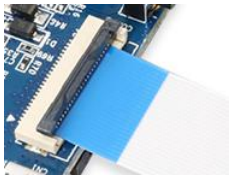
10) Then enter the [IP address of the development board: 8081] in the Firefox browser to see the image output by the ov5640



3. 18. 4. Linux5.4 system ov5640 camera test

1) linux5.4 system currently only supports ov5640 camera, not gc2035

2) First connect the Ov5640 camera adapter board to the CIS camera interface of the development board through a cable, and then start the linux system after connecting the camera (**don't plug in the camera after powering on**)



3) After entering the system, check the loading status of the ov5640 kernel module

```
root@orangepi:~# lsmod | grep "ov5640"
ov5640                 28672  1
v4l2_fwnode            24576  2 ov5640,sun6i_csi
videodev              151552  7
ov5640,v4l2_fwnode,sunxi_cedrus,videobuf2_common,sun6i_csi,v4l2_mem2mem,video
buf2_v4l2
mc                     36864  7
ov5640,sunxi_cedrus,videobuf2_common,videodev,sun6i_csi,v4l2_mem2mem,videobuf
2_v4l2
```

4) Then use v4l2-ctl (**note that l in v4l2 is a lowercase letter l, not a number 1**) command to view the device node of the CSI camera. From the output below, we can see that the device node corresponding to the USB camera is /dev/video0

```
root@orangepi:~# apt update
root@orangepi:~# apt install v4l-utils
root@orangepi:~# v4l2-ctl    --list-devices
sun6i-csi (platform:camera):
        /dev/video0

cedrus (platform:cedrus):
        /dev/video1
```

5) Then start to install the camera test software motion

```
root@orangepi:~# apt update
root@orangepi:~# apt install motion
```

6) Modify the configuration of /etc/default/motion, change start_motion_daemon=no to

start_motion_daemon=yes

```
root@orangepi:~# sed -i "s/start_motion_daemon=no/start_motion_daemon=yes/" \
/etc/default/motion
```

7) Modify the configuration of /etc/motion/motion.conf and set the resolution to 640x480 (other resolutions are not currently supported)

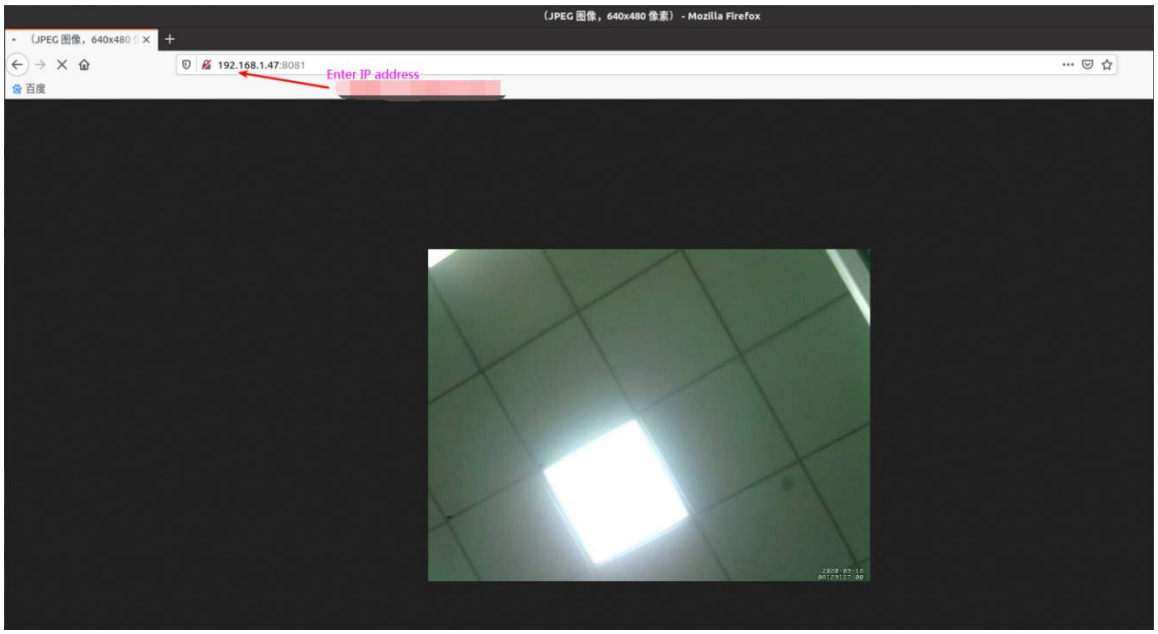
```
root@orangepi:~# sed -i "s/width 320/width 640/" /etc/motion/motion.conf
root@orangepi:~# sed -i "s/height 240/height 480/" /etc/motion/motion.conf
root@orangepi:~# sed -i "s/stream_localhost on/stream_localhost off/" \
/etc/motion/motion.conf
```

8) Then restart the motion service

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

9) 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

10) Then enter the [IP address of the development board: 8081] in the Firefox browser to see the image output by the ov5640



3. 19. 40 Pin interface pin description

1) Please refer to the figure below for the sequence of the 40 pins on the Orange Pi One development board

2) The functions of the 40 pins of the Orange Pi One development board are shown in the table below

GPIO serial number	GPIO	Functions	Pin	Pin	Functions	GPIO	GPIO serial number
		3.3v	1	2	5v		
12	PA12	SDA.0	3	4	5v		
11	PA11	SCL.0	5	6	GND		
6	PA6	PA6	7	8	TXD.3	PA13	13
		GND	9	10	RXD.3	PA14	14
1	PA1	RXD.2	11	12	PD14	PD14	110
0	PA0	TXD.2	13	14	GND		
3	PA3	CTS.2	15	16	PC4	PC4	68
		3.3v	17	18	PC7	PC7	71
64	PC0	MOSI.0	19	20	GND		
65	PC1	MISO.0	21	22	RTS.2	PA2	2
66	PC2	SCLK.0	23	24	CE.0	PC3	67
		GND	25	26	PA21	PA21	21
19	PA19	SDA.1	27	28	SCL.1	PA18	18
7	PA7	PA7	29	30	GND		
8	PA8	PA8	31	32	RTS.1	PG8	200
9	PA9	PA9	33	34	GND		

10	**PA10**	**PA10**	**35**	**36**	**CTS.1**	**PG9**	**201**
20	**PA20**	**PA20**	**37**	**38**	**TXD.1**	**PG6**	**198**
		GND	**39**	**40**	**RXD.1**	**PG7**	**199**

3. 20. Install wiringOP

1) Download the code of wiringOP

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

2) Compile and install wiringOP

```
root@orangepi:~# cd wiringOP
root@orangepi:~/wiringOP# ./build clean
root@orangepi:~/wiringOP# ./build
```

3) The output of the test gpio readall command is as follows

```
root@orangepi:~# gpio readall
 +------+-----+----------+------+---+OrangePiH3+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   12 |   0 |    SDA.0 | ALT2 | 0 |  3 || 4  |   |      | 5V       |     |      |
 |   11 |   1 |    SCL.0 | ALT2 | 0 |  5 || 6  |   |      | GND      |     |      |
 |    6 |   2 |      PA6 |  OFF | 0 |  7 || 8  | 0 | ALT3 | TXD.3    | 3   | 13   |
 |      |     |      GND |      |   |  9 || 10 | 0 | ALT3 | RXD.3    | 4   | 14   |
 |    1 |   5 |    RXD.2 | ALT2 | 0 | 11 || 12 | 0 | OFF  | PD14     | 6   | 110  |
 |    0 |   7 |    TXD.2 | ALT2 | 0 | 13 || 14 |   |      | GND      |     |      |
 |    3 |   8 |    CTS.2 |  OFF | 0 | 15 || 16 | 0 | OFF  | PC04     | 9   | 68   |
 |      |     |     3.3V |      |   | 17 || 18 | 0 | OFF  | PC07     | 10  | 71   |
 |   64 |  11 |   MOSI.0 | ALT3 | 0 | 19 || 20 |   |      | GND      |     |      |
 |   65 |  12 |   MISO.0 | ALT3 | 0 | 21 || 22 | 0 | OFF  | RTS.2    | 13  | 2    |
 |   66 |  14 |   SCLK.0 | ALT3 | 0 | 23 || 24 | 0 | ALT3 | CE.0     | 15  | 67   |
 |      |     |      GND |      |   | 25 || 26 | 0 | OFF  | PA21     | 16  | 21   |
 |   19 |  17 |    SDA.1 | ALT3 | 0 | 27 || 28 | 0 | ALT3 | SCL.1    | 18  | 18   |
 |    7 |  19 |     PA07 |  OFF | 0 | 29 || 30 |   |      | GND      |     |      |
 |    8 |  20 |     PA08 |  OFF | 0 | 31 || 32 | 0 | OFF  | RTS.1    | 21  | 200  |
 |    9 |  22 |     PA09 |  OFF | 0 | 33 || 34 |   |      | GND      |     |      |
 |   10 |  23 |     PA10 |  OFF | 0 | 35 || 36 | 0 | OFF  | CTS.1    | 24  | 201  |
 |   20 |  25 |     PA20 |  OFF | 0 | 37 || 38 | 0 | ALT2 | TXD.1    | 26  | 198  |
 |      |     |      GND |      |   | 39 || 40 | 0 | ALT2 | RXD.1    | 27  | 199  |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+OrangePiH3+---+------+----------+-----+------+
```

3. 21. 40Pin GPIO, I2C, UART, SPI test

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

Before starting the test, please make sure that wiringOP has been compiled and installed by referring to the section Installing wiringOP

3. 21. 1. Common GPIO port test

1) Below, take pin 7-corresponding to GPIO as PA6-corresponding to wPi serial number as 2-as an example to demonstrate how to set the high and low levels of GPIO

```
root@orangepi:~# gpio readall
 +------+-----+----------+------+---+OrangePiH3+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   12 |   0 |    SDA.0 | ALT2 | 0 |  3 || 4  |   |      | 5V       |     |      |
 |   11 |   1 |    SCL.0 | ALT2 | 0 |  5 || 6  |   |      | GND      |     |      |
 |    6 |   2 |      PA6 |  OFF | 0 |  7 || 8  | 0 | ALT3 | TXD.3    | 3   | 13   |
 |      |     |      GND |      |   |  9 || 10 | 0 | ALT3 | RXD.3    | 4   | 14   |
 |    1 |   5 |    RXD.2 | ALT2 | 0 | 11 || 12 | 0 | OFF  | PD14     | 6   | 110  |
```

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

```
root@orangepi:~# gpio mode 2 out
```

Use gpio readall to see that the Mode of pin 7 is displayed as OUT

```
root@orangepi:~# gpio mode 2 out
root@orangepi:~# gpio readall
 +------+-----+----------+------+---+OrangePiH3+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   12 |   0 |    SDA.0 | ALT2 | 0 |  3 || 4  |   |      | 5V       |     |      |
 |   11 |   1 |    SCL.0 | ALT2 | 0 |  5 || 6  |   |      | GND      |     |      |
 |    6 |   2 |      PA6 |  OUT | 0 |  7 || 8  | 0 | ALT3 | TXD.3    | 3   | 13   |
 |      |     |      GND |      |   |  9 || 10 | 0 | ALT3 | RXD.3    | 4   | 14   |
```

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

```
root@orangepi:~# gpio write 2 0
```

Use gpio readall to see that the value (V) of pin 7 has become 0

```
root@orangepi:~# gpio write 2 0
root@orangepi:~# gpio readall
 +------+-----+----------+------+---+---OrangePiH3---+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   12 |   0 |    SDA.0 | ALT2 | 0 |  3 || 4  |   |      | 5V       |     |      |
 |   11 |   1 |    SCL.0 | ALT2 | 0 |  5 || 6  |   |      | GND      |     |      |
 |    6 |   2 |      PA6 |  OUT | 0 |  7 || 8  | 0 | ALT3 | TXD.3    | 3   | 13   |
 |      |     |      GND |      |   |  9 || 10 | 0 | ALT3 | RXD.3    | 4   | 14   |
```

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

```
root@orangepi:~# gpio write 2 1
```

Use gpio readall to see that the value (V) of pin 7 has become 1

```
root@orangepi:~# gpio write 2 1
root@orangepi:~# gpio readall
 +------+-----+----------+------+---+---OrangePiH3---+---+------+----------+-----+------+
 | GPIO | wPi |   Name   | Mode | V | Physical | V | Mode | Name     | wPi | GPIO |
 +------+-----+----------+------+---+----++----+---+------+----------+-----+------+
 |      |     |     3.3V |      |   |  1 || 2  |   |      | 5V       |     |      |
 |   12 |   0 |    SDA.0 | ALT2 | 0 |  3 || 4  |   |      | 5V       |     |      |
 |   11 |   1 |    SCL.0 | ALT2 | 0 |  5 || 6  |   |      | GND      |     |      |
 |    6 |   2 |      PA6 |  OUT | 1 |  7 || 8  | 0 | ALT3 | TXD.3    | 3   | 13   |
 |      |     |      GND |      |   |  9 || 10 | 0 | ALT3 | RXD.3    | 4   | 14   |
```

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

3. 21. 2. SPI interface test

1) The linux5.4 system turns off the spi controller in the 40pin by default in the dts. If you need to use the spi, you first need to turn on the spi configuration. The linux3.4 system is turned on by default and no additional configuration is required. linux5. 4 The opening method of system spi is as follows

a. According to the 40pin schematic diagram, the available spi for Orange Pi One is spi0

b. Then set overlays=spi-spidev in /boot/orangepiEnv.txt, set param_spidev_spi_bus=0, where 0 represents spi0

```
overlays=spi-spidev
param_spidev_spi_bus=0        # Modified to the corresponding spi bus number supported by the development board
```

c. Then restart the system. When booting, you can see the configuration output of SPI DT overlays in the boot log of u-boot

```
788 bytes read in 8 ms (95.7 KiB/s)
Applying kernel provided DT overlay sun8i-h3-spi-spidev.dtbo
4185 bytes read in 8 ms (510.7 KiB/s)
Applying kernel provided DT fixup script (sun8i-h3-fixup.scr)
```

d. After the system is started, if you can see the SPI device node under /dev, it means the configuration is correct

```
root@orangepi:~# ls /dev/spi*
/dev/spidev0.0
```

2) Then compile the spidev_test test program

a. The compilation command for linux5.4 system is

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

b. The compilation command for linux3.4 system is

```
root@orangepi:~/wiringOP/examples# make spidev_test_linux3_4
[CC] spidev_test.c
[link]
```

3) Do not short-circuit the mosi and miso pins of spi first, and the output result of running spidev_test is as follows, you can see that the data sent and received are inconsistent

a. The test commands and results of the linux5.4 system are

```
root@orangepi:~/wiringOP/examples# ./spidev_test -v -D /dev/spidev0.0
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 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
FF FF FF FF FF FF FF FF   | ................................
```

b. The test commands and results of the linux3.4 system are

```
root@orangepi:~/wiringOP/examples# ./spidev_test_linux3_4 -D /dev/spidev0.0
spi mode: 0
bits per word: 8
max speed: 500000 Hz (500 KHz)

00 00 00 00 00 00
00 00 00 00 00 00
00 00 00 00 00 00
00 00 00 00 00 00
00 00 00 00 00 00
00 00 00 00 00 00
00 00
```

4) Then use the Dupont wire to short-circuit the two pins of spi's mosi (corresponding to pin 19) and miso (corresponding to pin 21). The output of the retest is as follows. You can see that the data sent and received are the same, indicating the spi Can be used normally

a. The test commands and results of the linux5.4 system are

```
root@orangepi:~/wiringOP/examples# ./spidev_test -v -D /dev/spidev0.0
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 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 FF FF
FF FF FF FF FF F0 0D   | ......@....▒.....................▒.
```

b. The test commands and results of the linux3.4 system are

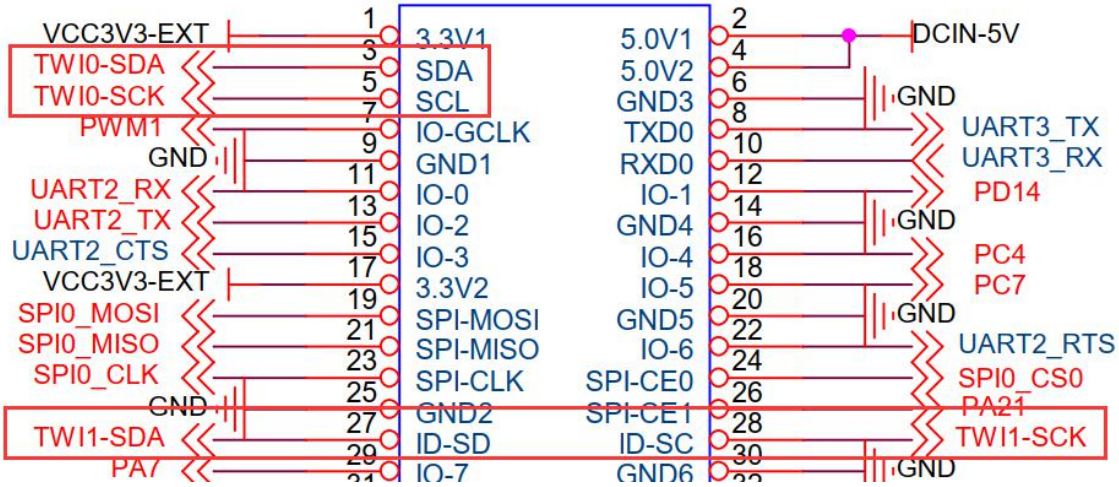
```
root@orangepi:~/wiringOP/examples# ./spidev_test_linux3_4 -D /dev/spidev0.0
spi mode: 0
bits per word: 8
max speed: 500000 Hz (500 KHz)
```

```
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
DE AD BE EF BA AD
F0 0D
```

3. 21. 3. I2C test

1) The linux5.4 system turns off the i2c controller in 40pin by default in the dts. If you need to use i2c, you need to turn on the i2c configuration first. The linux3.4 system is turned on by default and no additional configuration is required. linux5. 4 The opening method of system i2c is as follows

a. According to the 40pin schematic diagram, the i2c available for Orange Pi One are i2c0 and i2c1



b. Then set overlays=i2c0 i2c1 in /boot/orangepiEnv.txt to open the configuration of i2c0 and i2c1 at the same time

```
overlays=i2c0 i2c1
```

c. Then restart the system. When booting, you can see the configuration output of I2C DT overlays in the boot log of u-boot

```
Found mainline kernel configuration
29940 bytes read in 6 ms (4.8 MiB/s)
374 bytes read in 8 ms (44.9 KiB/s)
Applying kernel provided DT overlay sun8i-h3-i2c0.dtbo
```

```
374 bytes read in 8 ms (44.9 KiB/s)
Applying kernel provided DT overlay sun8i-h3-i2c1.dtbo
```

d. After the system starts, if there are two more i2c device nodes under /dev, the configuration is correct

```
root@orangepi:~# ls /dev/i2c*
/dev/i2c-0  /dev/i2c-1  /dev/i2c-2  /dev/i2c-3  /dev/i2c-4
```

e. The corresponding relationship of different i2c device nodes is shown below, where

a) i2c0 in 40pin corresponds to /dev/i2c-0

b) i2c1 in 40pin corresponds to /dev/i2c-1

```
root@orangepipcplus:~# ls /sys/class/i2c-adapter/ -lh
total 0
lrwxrwxrwx 1 root root 0 Oct 13 10:46 i2c-0 -> ../../devices/platform/soc/1c2ac00.i2c/i2c-0
lrwxrwxrwx 1 root root 0 Oct 13 10:46 i2c-1 -> ../../devices/platform/soc/1c2b000.i2c/i2c-1
lrwxrwxrwx 1 root root 0 Oct 13 10:46 i2c-2 -> ../../devices/platform/soc/1c2b400.i2c/i2c-2
lrwxrwxrwx 1 root root 0 Oct 13 10:46 i2c-3 -> ../../devices/platform/soc/1f02400.i2c/i2c-3
lrwxrwxrwx 1 root root 0 Oct 13 10:46 i2c-4 -> ../../devices/platform/soc/1ee0000.hdmi/i2c-4
```

2) Then start to test i2c, first install i2c-tools

```
root@orangepi:~# apt update
root@orangepi:~# apt install i2c-tools
```

3) Then connect an i2c device to the 40pin i2c0 or i2c1

	i2c0	i2c1
Sda pin	Corresponding to pin 3	Corresponding to pin 27
sck pin	Corresponding to pin 5	Corresponding to pin 28
vcc pin	Corresponding to pin 1	Corresponding to pin 17
gnd pin	Corresponding to pin 6	Corresponding to pin 25

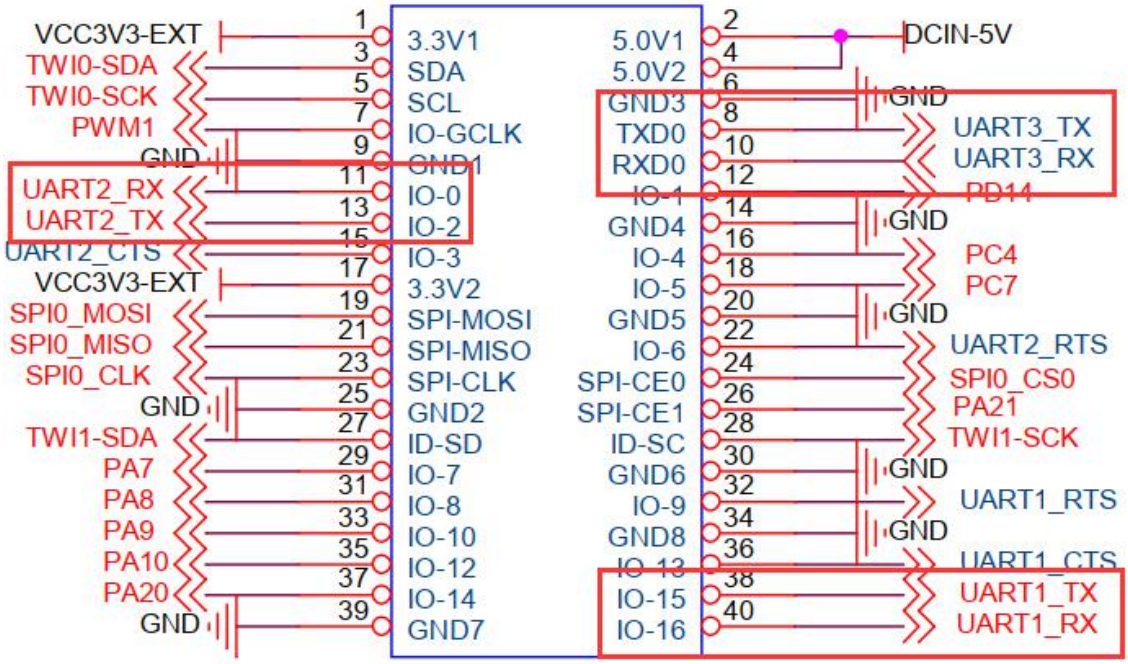
4) Then use i2cdetect -y 0 (where 0 means i2c0, i2c1 needs to be modified to i2cdetect -y 1) if the command can detect the address of the connected i2c device, it means that i2c can be used normally

```
root@orangepi:~# i2cdetect -y 0
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- 57 -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- 68 -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
root@orangepi:~#
```

3. 21. 4. UART test

1) The linux5.4 system turns off the uart controller in 40pin by default in the dts. If you need to use uart, you first need to turn on the uart configuration. The linux3.4 system is enabled by default and no additional configuration is required. linux5. 4 The opening method of system uart is as follows

a. According to the 40pin schematic diagram, the uart available for Orange Pi One are uart1, uart2 and uart3



b. Then set overlays=uart1 uart2 uart3 in /boot/orangepiEnv.txt to open the configuration of uart1, uart2 and uart3 at the same time

```
overlays=uart1 uart2 uart3
```

c. Then restart the system. When booting, you can see the configuration output of UART DT overlays in the boot log of u-boot

```
Applying kernel provided DT overlay sun8i-h3-uart1.dtbo
502 bytes read in 10 ms (48.8 KiB/s)
Applying kernel provided DT overlay sun8i-h3-uart2.dtbo
502 bytes read in 5 ms (97.7 KiB/s)
Applying kernel provided DT overlay sun8i-h3-uart3.dtbo
4155 bytes read in 4 ms (1013.7 KiB/s)
Applying kernel provided DT fixup script (sun8i-h3-fixup.scr)
```

d. After the system is started, you can see the information of ttyS1, ttyS2 and ttyS3 under /sys/class/tty, where

a) uart1 in 40pin corresponds to /dev/ttyS1

b) uart2 in 40pin corresponds to /dev/ttyS2

a) uart3 in 40pin corresponds to /dev/ttyS3

```
root@orangepi:~# ls /sys/class/tty/ttyS* -lh
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS0 -> ../../devices/platform/soc/1c28000.serial/tty/ttyS0
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS1 -> ../../devices/platform/soc/1c28400.serial/tty/ttyS1
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS2 -> ../../devices/platform/soc/1c28800.serial/tty/ttyS2
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS3 -> ../../devices/platform/soc/1c28c00.serial/tty/ttyS3
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS4 -> ../../devices/platform/serial8250/tty/ttyS4
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS5 -> ../../devices/platform/serial8250/tty/ttyS5
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS6 -> ../../devices/platform/serial8250/tty/ttyS6
lrwxrwxrwx 1 root root 0 Oct 13 11:47 /sys/class/tty/ttyS7 -> ../../devices/platform/serial8250/tty/ttyS7
root@orangepi:~#
```

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

	uart1	uart2	uart3
Tx Pin	Corresponding to pin 38	Corresponding to pin 13	Corresponding to pin 8
Rx Pin	Corresponding to pin 40	Corresponding to pin 11	Corresponding to pin 10

3) Then modify the serial test program serialTest in wiringOP

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

  if ((fd = serialOpen ("/dev/ttyS2", 115200)) < 0)
  {
    fprintf (stderr, "Unable to open serial device: %s\n", strerror (errno)) ;
    return 1 ;
```

Modify the device node name corresponding to the serial port to be tested

4) Recompile the serial test program serialTest in wiringOP

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

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

```
root@orangepi:~/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. 22. 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 40pin interface of the Orange Pi development board through the DuPont cable. The wiring method is as follows

Pins of OLED module	Description	Development board 40pin interface corresponding pin
GND	Power ground	6 Pin
VCC	5V	2 Pin
SCL	I2C clock line	5 Pin
SDA	I2C data cable	3 Pin
RST	Connect to 3.3V	1 Pin
DC	Connect to GND	9 Pin
CS	Connect to GND	25 Pin

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@orangepi:~# apt update
root@orangepi:~# apt install i2c-tools
root@orangepi:~# i2cdetect -y 0
```

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

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

```
root@orangepi:~# git clone https://github.com/orangepi-xunlong/wiringOP
root@orangepi:~# cd wiringOP
root@orangepi:~/wiringOP# ./build clean && ./build
root@orangepi:~/wiringOP# cd examples
root@orangepi:~/wiringOP/examples# make oled_demo
root@orangepi:~/wiringOP/examples# ./oled_demo /dev/i2c-0
---------start--------
----------end---------
```

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

3. 23. How to use SPI LCD display

Note: This method is only applicable to linux3.4 kernel systems, and linux5.4 kernel systems cannot be used

3. 23. 1. 2.4 inch SPI LCD display

1) The link to the tested LCD display details page is as follows

http://www.lcdwiki.com/2.4inch_SPI_Module_ILI9341_SKU:MSP2402

2) The wiring method of the LCD display and the development board is as follows

TFT SPI module pins	The corresponding pins of development board 40pin	GPIO -- GPIO num
VCC-5V	2 Pin	
GND	6 Pin	
CS	24 Pin	
RESET	12 Pin	PD14 -- 110
D/C	16 Pin	PC4 -- 68
SDI(MOSI)	19 Pin	
SCK	23 Pin	
LED	1 Pin	
SDO(MISO)	21 Pin	

3) After connecting the display to the development board, use the following command to

```
root@orangepi:~# modprobe fbtft_device custom name=fb_ili9341  busnum=0 cs=0 gpios=reset:110,dc:68 rotate=90 speed=65000000 bgr=1 txbuflen=65536
```

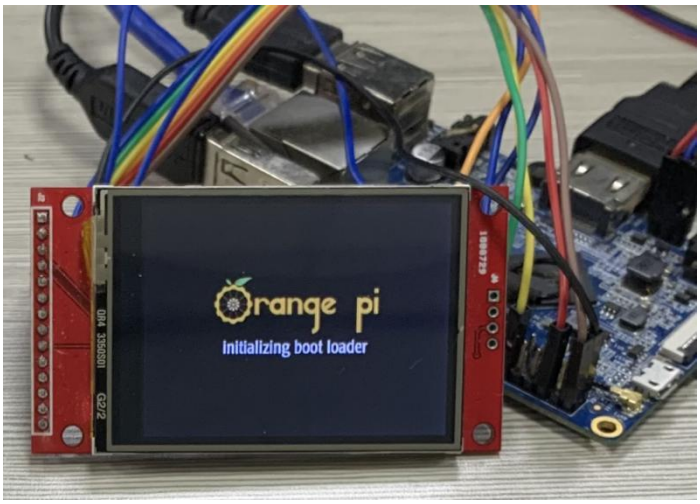
4) When the **fbtft_device** kernel module is loaded, the correct output log of the dmesg command is shown below, and the log can know that the framebuffer used by the LCD display is **fb8**

```
root@orangepi:~# dmesg | tail
root@orangepione:~# dmesg | tail
[    82.034708] fbtft_device:   SPI devices registered:
[    82.034751] fbtft_device:         spidev spi0.0 33000kHz 8 bits mode=0x00
[    82.034779] fbtft_device:   'fb' Platform devices registered:
```

```
[     82.034931] fbtft_device: Deleting spi0.0
[     82.036030] fbtft_device:    GPIOS used by 'fb_ili9341':
[     82.036054] fbtft_device:       'reset' = GPIO110
[     82.036072] fbtft_device:       'dc' = GPIO68
[     82.036088] fbtft_device:    SPI devices registered:
[     82.036117] fbtft_device:          fb_ili9341 spi0.0 65000kHz 8 bits mode=0x00
[     82.365862] graphics fb8: fb_ili9341 frame buffer, 320x240, 150 KiB video memory,
64 KiB buffer memory, fps=20, spi0.0 at 65 MHz
```

5) Then use the following command to display the Orange Pi logo picture on the LCD display

```
root@orangepi:~# apt update
root@orangepi:~# apt -y install fbi
root@orangepi:~# fbi -vt 1 -noverbose -d /dev/fb8 /boot/boot.bmp
```



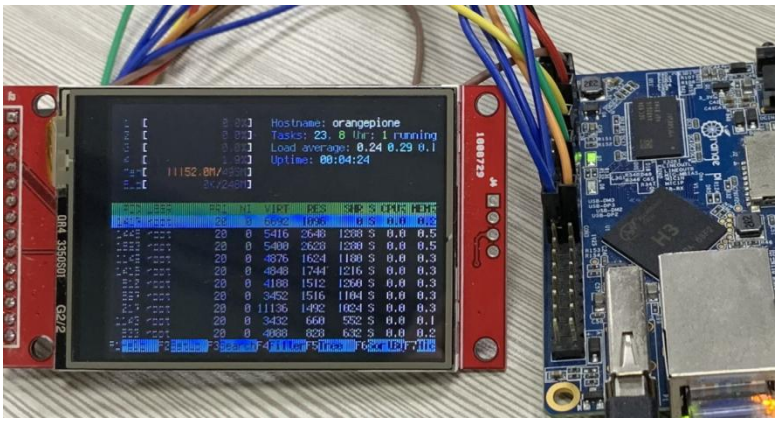
6) You can also map the output of tty1 to the fb device of the LCD display-**fb8**. After the mapping is completed, HDMI will no longer have image output.

```
root@orangepi:~# con2fbmap 1 8
```

If you want to switch back to HDMI display, please use the following command

```
root@orangepi:~# con2fbmap 1 0
```

Below is the output of running the htop command

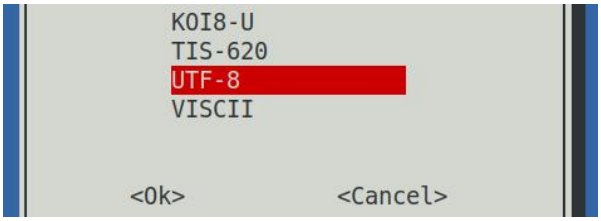


7) Because the default terminal font is too large, the screen cannot display too much content, you can use the following method to reduce the terminal font

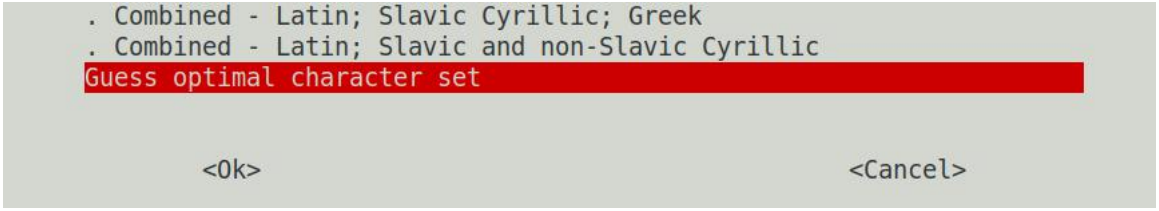
a. Run first **dpkg-reconfigure console-setup**

```
root@orangepi:~# apt-get update
root@orangepi:~# apt-get install kbd
root@orangepi:~# dpkg-reconfigure console-setup
```

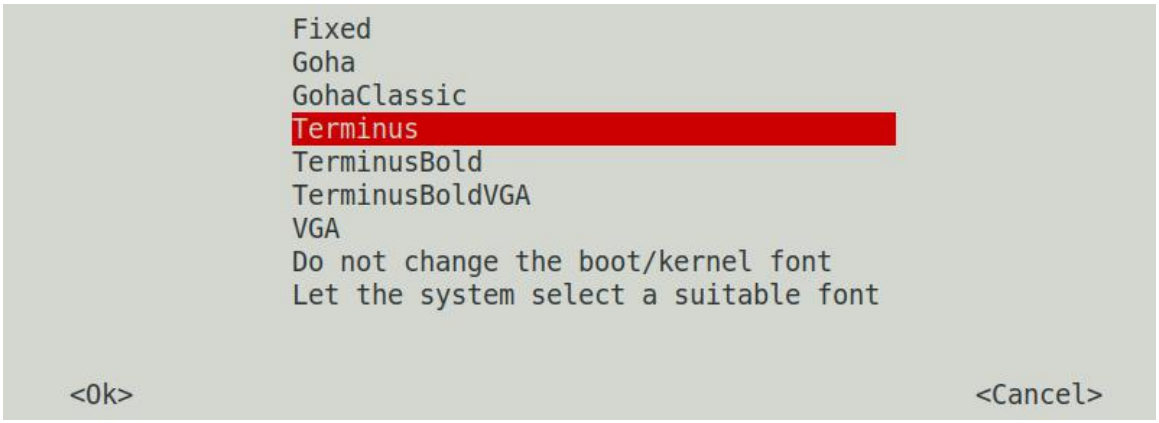
b. Terminal coding selection **UTF-8**



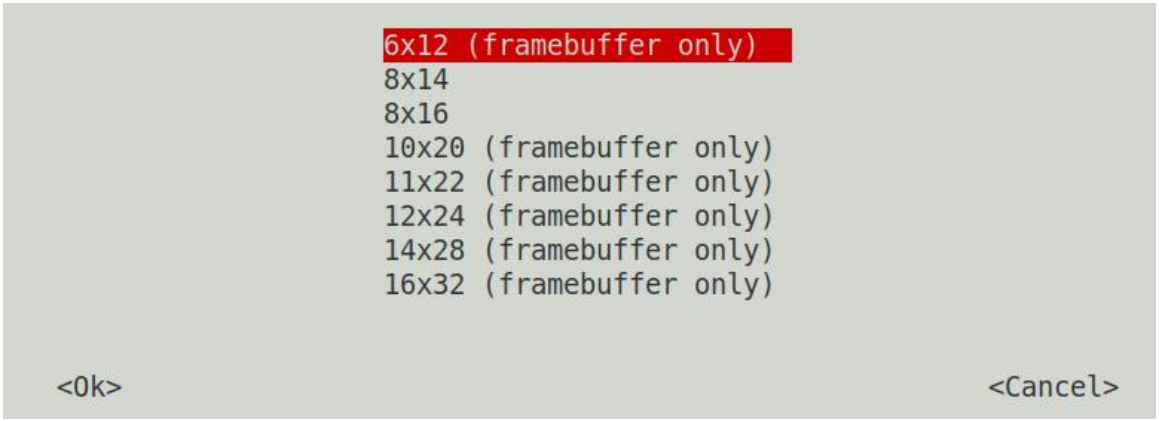
c. Then choose **Guess optimal character set**



d. Then choose **Terminus**



e. Finally select the font size as 6x12



f. After setting, you can see that the font on the LCD display becomes smaller

8) Method for setting system startup to automatically load fbtft_device module

a. Create a new **/etc/modules-load.d/fbtft.con** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modules-load.d/fbtft.conf
fbtft_device
```

b. Create a new **/etc/modprobe.d/fbtft.conf** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modprobe.d/fbtft.conf
options    fbtft_device custom name=fb_ili9341    busnum=0 cs=0
gpios=reset:110,dc:68 rotate=90 speed=65000000 bgr=1 txbuflen=65536
```

c. Then restart the linux system and you can see that the kernel modules related to fbtft_device have been automatically loaded

9) If you want the linux system to automatically map the console to the LCD display after booting, please add the following configuration to **/boot/orangepiEnv.txt,** and then restart the system to see the LCD display output

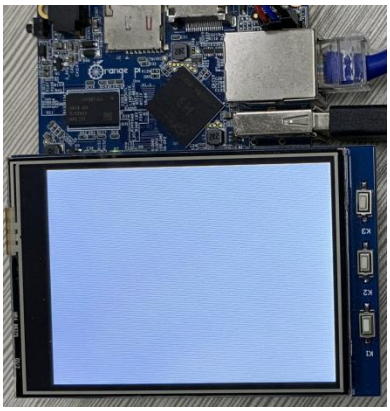
```
root@orangepi:~# cat /boot/orangepiEnv.txt | grep "fbcon"
extraargs=fbcon=map:8
```

3. 23. 2. 3.2 inch RPi SPI LCD display

1) The link to the tested LCD display details page is as follows

```
http://www.lcdwiki.com/3.2inch_RPi_Display
```

2) The wiring method of the LCD display and the development board is as follows



3) After connecting the LCD display to the development board, use the following command to load the **fbtft_device** kernel module

```
root@orangepi:~# modprobe fbtft_device custom name=fb_ili9341    busnum=0 cs=0
gpios=reset:0,dc:3 rotate=90 speed=65000000 bgr=1 txbuflen=65536
```

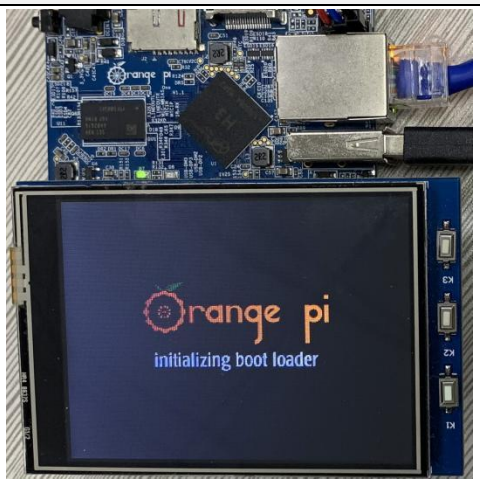
4) When the **fbtft_device** kernel module is loaded, the correct output log of the dmesg command is shown below, and the log can know that the framebuffer used by the LCD screen is **fb8**

```
root@orangepione:~# dmesg | tail
[    99.471345] fbtft_device:    SPI devices registered:
[    99.471383] fbtft_device:          spidev spi0.0 33000kHz 8 bits mode=0x00
[    99.471405] fbtft_device:    'fb' Platform devices registered:
[    99.471554] fbtft_device: Deleting spi0.0
[    99.472469] fbtft_device:    GPIOS used by 'fb_ili9341':
```

```
[     99.472493] fbtft_device:       'reset' = GPIO0
[     99.472510] fbtft_device:       'dc' = GPIO3
[     99.472525] fbtft_device:    SPI devices registered:
[     99.472554] fbtft_device:          fb_ili9341 spi0.0 65000kHz 8 bits mode=0x00
[     99.796157] graphics fb8: fb_ili9341 frame buffer, 320x240, 150 KiB video memory,
64 KiB buffer memory, fps=20, spi0.0 at 65 MHz
```

5) Then use the following command to display the Orange Pi logo picture on the LCD screen

```
root@orangepi:~# apt update
root@orangepi:~# apt -y install fbi
root@orangepi:~# fbi -vt 1 -noverbose -d /dev/fb8 /boot/boot.bmp
```



6) You can also map the output of tty1 to the fb device of the LCD screen-**fb8**. After the mapping is completed, HDMI will no longer have image output.

```
root@orangepi:~# con2fbmap 1 8
```

If you want to switch back to HDMI display, please use the following command

```
root@orangepi:~# con2fbmap 1 0
```

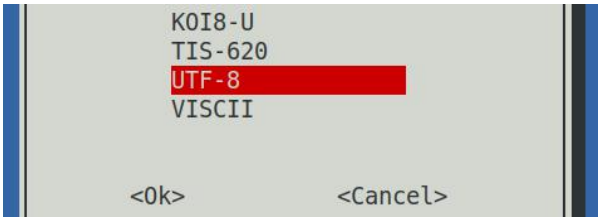
Below is the output of running the htop command

7) Because the default terminal font is too large, the screen cannot display too much content, you can use the following method to reduce the terminal font

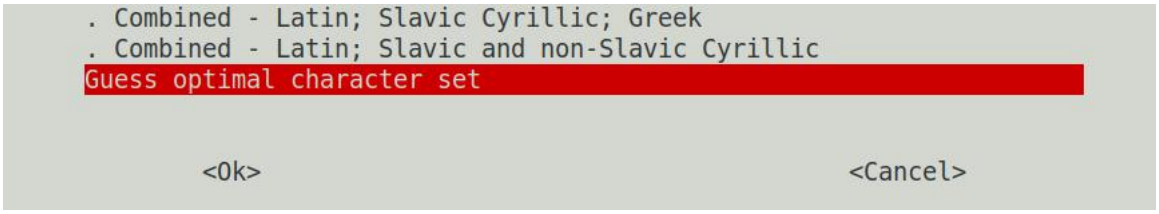
a. Run first **dpkg-reconfigure console-setup**

```
root@orangepi:~# apt-get update
root@orangepi:~# apt-get install kbd
root@orangepi:~# dpkg-reconfigure console-setup
```

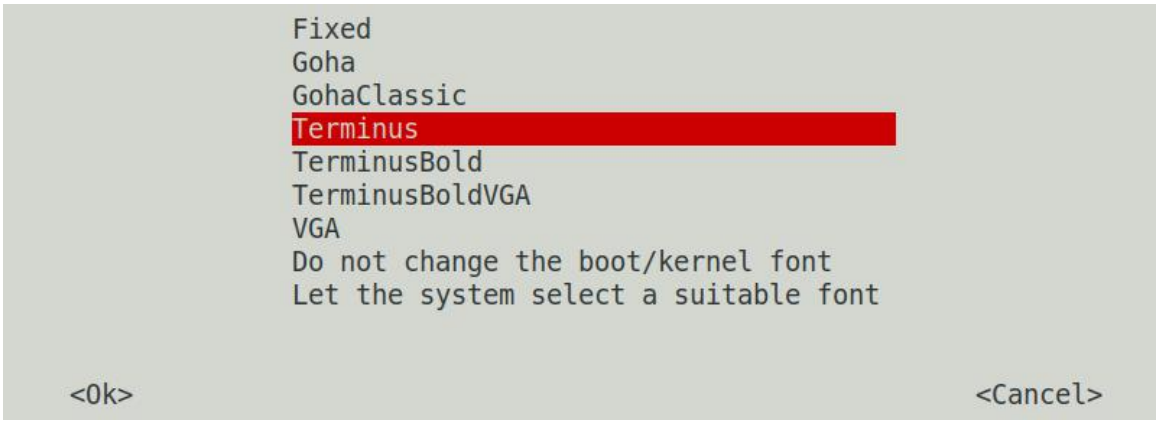
b. Terminal coding selection **UTF-8**



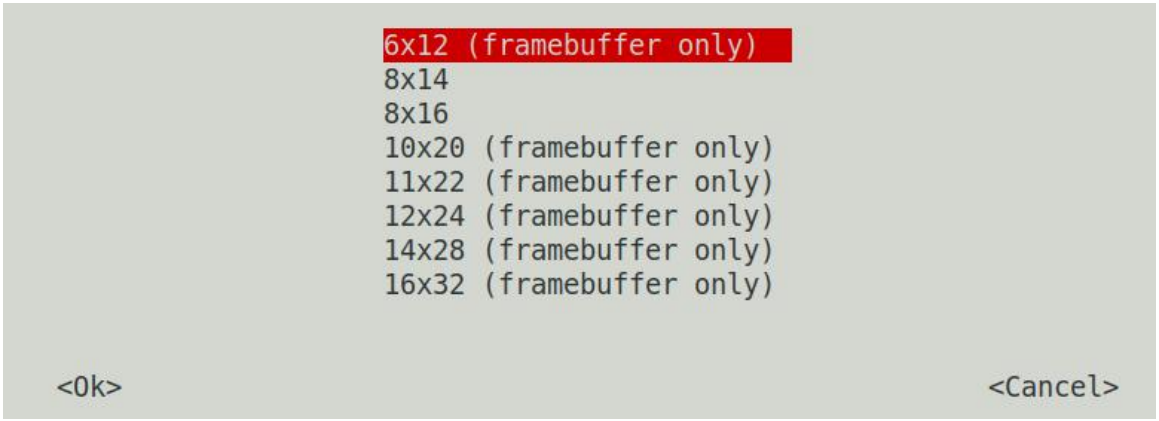
c. Then choose **Guess optimal character set**



d. Then choose **Terminus**



e. Finally select the font size as 6x12



f. After setting, you can see that the font on the LCD screen becomes smaller

8) Method for setting system startup to automatically load fbtft_device module

a. Create a new **/etc/modules-load.d/fbtft.con** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modules-load.d/fbtft.conf
fbtft_device
```

b. Create a new **/etc/modprobe.d/fbtft.conf** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modprobe.d/fbtft.conf
options fbtft_device custom name=fb_ili9341    busnum=0 cs=0    gpios=reset:0,dc:3
rotate=90 speed=65000000 bgr=1 txbuflen=65536
```

c. Then restart the linux system and you can see that the kernel modules related to fbtft_device have been automatically loaded

9) If you want the linux system to automatically map the console to the LCD screen after booting, please add the following configuration in **/boot/orangepiEnv.txt,** and then restart the system to see the LCD screen output

```
root@orangepi:~# cat /boot/orangepiEnv.txt | grep "fbcon"
extraargs=fbcon=map:8
```

3. 23. 3. 3.5 inch SPI LCD display

1) The link to the details page of the tested LCD display is as follows

```
http://www.lcdwiki.com/3.5inch_SPI_Module_ILI9488_SKU:MSP3520
```

2) The wiring method of the LCD display and the development board is as follows

TFT SPI module pins	The corresponding pins of development board 40pin	GPIO -- GPIO num
VCC	1 Pin	
GND	6 Pin	
CS	24 Pin	
RESET	12 Pin	PD14 -- 110
DC/RS	16 Pin	PC04 -- 68
SDI(MOSI)	19 Pin	
SCK	23 Pin	
LED	18 Pin	PC7 -- 71
SDO(MISO)	21 Pin	

3) After connecting the display to the development board, use the following command to load the fbtft_device kernel module

```
root@orangepi:~# modprobe fbtft_device custom name=fb_ili9488    busnum=0 cs=0
gpios=reset:110,dc:68,led:71 rotate=270 speed=65000000 bgr=1 txbuflen=65536
```

4) When the **fbtft_device** kernel module is loaded, the correct output log of the dmesg command is shown below, and the log can know that the framebuffer used by the LCD display is **fb8**

```
root@orangepione:~# dmesg | tail
[   273.581459] fbtft_device:          spidev spi0.0 33000kHz 8 bits mode=0x00
[   273.581483] fbtft_device:    'fb' Platform devices registered:
```

```
[    273.581628] fbtft_device: Deleting spi0.0
[    273.582486] fbtft_device:    GPIOS used by 'fb_ili9488':
[    273.582509] fbtft_device:        'reset' = GPIO110
[    273.582526] fbtft_device:        'dc' = GPIO68
[    273.582543] fbtft_device:        'led' = GPIO71
[    273.582563] fbtft_device:    SPI devices registered:
[    273.582598] fbtft_device:          fb_ili9488 spi0.0 65000kHz 8 bits mode=0x00
[    273.955952] graphics fb8: fb_ili9488 frame buffer, 480x320, 300 KiB video memory,
64 KiB buffer memory, fps=100, spi0.0 at 65 MHz
```

5) Then use the following command to display the Orange Pi logo picture on the LCD display

```
root@orangepi:~# apt update
root@orangepi:~# apt -y install fbi
root@orangepi:~# fbi -vt 1 -noverbose -d /dev/fb8 /boot/boot.bmp
```

6) You can also map the output of tty1 to the fb device of the LCD display-**fb8**. After the mapping is completed, the LCD screen will display the output of the terminal, and HDMI will no longer have image output.

```
root@orangepi:~# con2fbmap 1 8
```

If you want to switch back to HDMI display, please use the following command

```
root@orangepi:~# con2fbmap 1 0
```

7) Set the method to automatically load the fbtft_device module at system startup

a. Create a new **/etc/modules-load.d/fbtft.con** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modules-load.d/fbtft.conf
fbtft_device
```

b. Create a new **/etc/modprobe.d/fbtft.conf** configuration file, the content of the file is as follows

```
root@orangepi:~# cat /etc/modprobe.d/fbtft.conf
options fbtft_device custom name=fb_ili9488    busnum=0 cs=0
gpios=reset:110,dc:68,led:71 rotate=270 speed=65000000 bgr=1 txbuflen=65536
```

c. Then restart the linux system and you can see that the kernel modules related to fbtft_device have been automatically loaded

8) If you want the linux system to automatically map the console to the LCD display after booting, please add the following configuration to **/boot/orangepiEnv.txt,** and then restart the system to see the LCD display output

```
root@orangepi:~# cat /boot/orangepiEnv.txt | grep "fbcon"
extraargs=fbcon=map:8                    //Server version system needs to add configuration
```

```
extraargs=cma=96M fbcon=map:8        //Configurations that need to be added to the desktop version
```

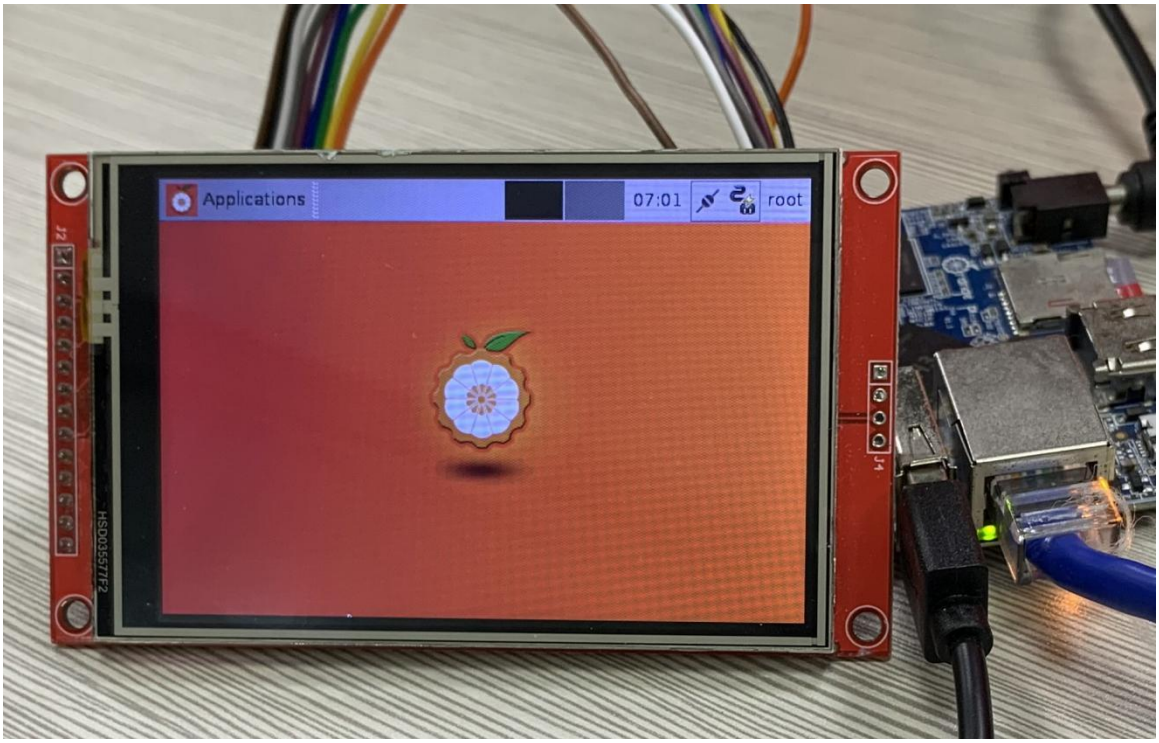
9) If you need to display the desktop version of the system to the LCD screen, first modify the following configuration file, change fb0 to **fb8**, and you can see the desktop displayed on the LCD screen after restarting

```
root@orangepione:~# cat /etc/X11/xorg.conf.d/50-fbturbo.conf
Section "Device"
        Identifier      "Allwinner A10/A13 FBDEV"
        Driver          "fbturbo"
        Option          "fbdev" "/dev/fb8"

        Option          "SwapbuffersWait" "true"
EndSection
```

10) If you do not restart the system, you can execute the following command, after a few seconds, the LCD screen can also see the desktop of the linux system

```
root@orangepi:~# FRAMEBUFFER=/dev/fb8 startx
```



3. 24. linux3.4 desktop version system GPU driver test method

1) First install **glmark2-es2**

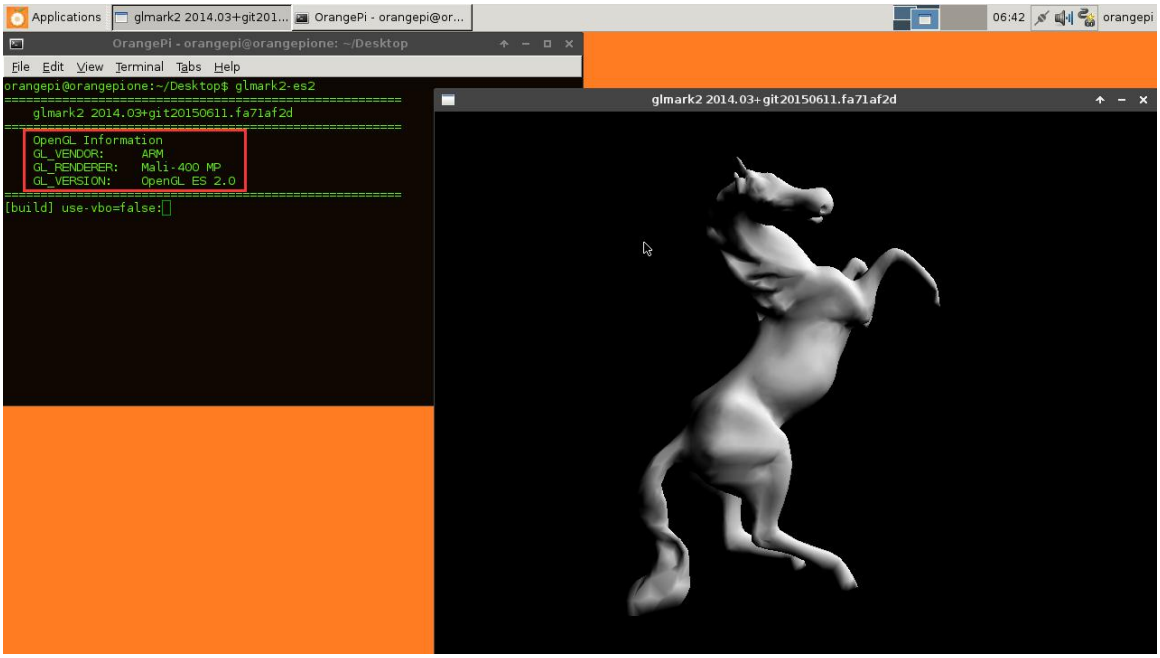
```
root@orangepi:~# apt update
root@orangepi:~# apt install glmark2-es2
```

2) Then enter the desktop of the linux system through the HDMI display, **do not use ssh to log in remotely or serial port to log in to the linux system**

3) Run glmark2-es2

```
root@orangepi:~# glmark2-es2
```

4) It can be seen that OpenGL uses Mali-400 MP, indicating that the GPU can be used normally



3. 25. View the chipid of the H3 chip

Note: This method is only suitable for linux3.4 system, linux5.4 system cannot read

1) The command to view the chipid of the h3 chip is as follows, the chipid of each chip

is different, so you can use chipid to distinguish multiple development boards

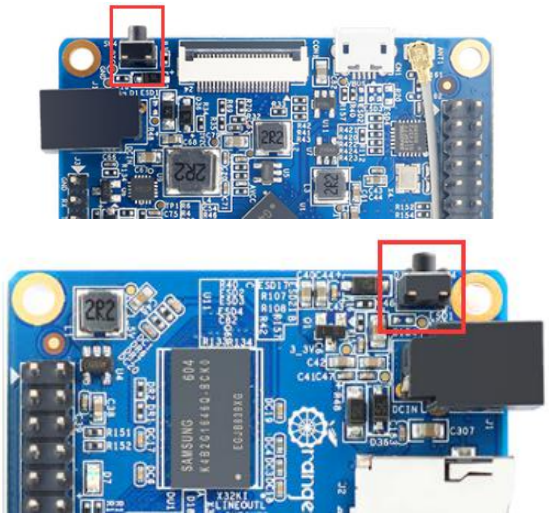
```
root@orangepi:~# cat /sys/class/sunxi_info/sys_info | grep "chipid"
sunxi_chipid            : 541c035348a0471c0000115000000000
```

3. 26. Boot and shutdown method

1) Shut down using the poweroff command

```
root@orangepi:~# poweroff
```

2) You can also short press the power button on the development board to shut down （**The linux3.4 server version is temporarily unavailable**）



3) After shutting down, you need to unplug and plug the power again to boot up

4) The command to restart the linux system is

```
root@orangepi:~# reboot
```

4. Android system instructions

4.1. Supported Android version

Android version	Kernel version
Android 4.4	linux3.4
Android 7.0	linux4.4

4.2. Android 4.4 function adaptation situation

Function	Status
HDMI video	OK
HDMI audio	OK
USB2.0	OK
TF card boot	OK
Network card	OK
USB camera	OK
OV5640 camera	OK
GC2035 camera	OK
button	OK

LED lights	OK
Temperature Sensor	OK
ADB debugging	OK
Mali GPU	OK
Video codec	OK

4. 3. Android 7.0 function adaptation situation

Function	Status
HDMI video	OK
HDMI audio	OK
USB2.0	OK
TF card boot	OK
USB camera	OK
OV5640 camera	NO
GC2035 camera	NO
Button	OK
LED lights	OK
Temperature Sensor	OK
ADB debugging	OK
Mali GPU	OK
Video codec	OK

4. 4. Onboard LED light display description

1) LED light display

	Green light	Red light
u-boot startup phase	off	on
Kernel boot to enter the system	on	off

2) GPIO port corresponding to LED light

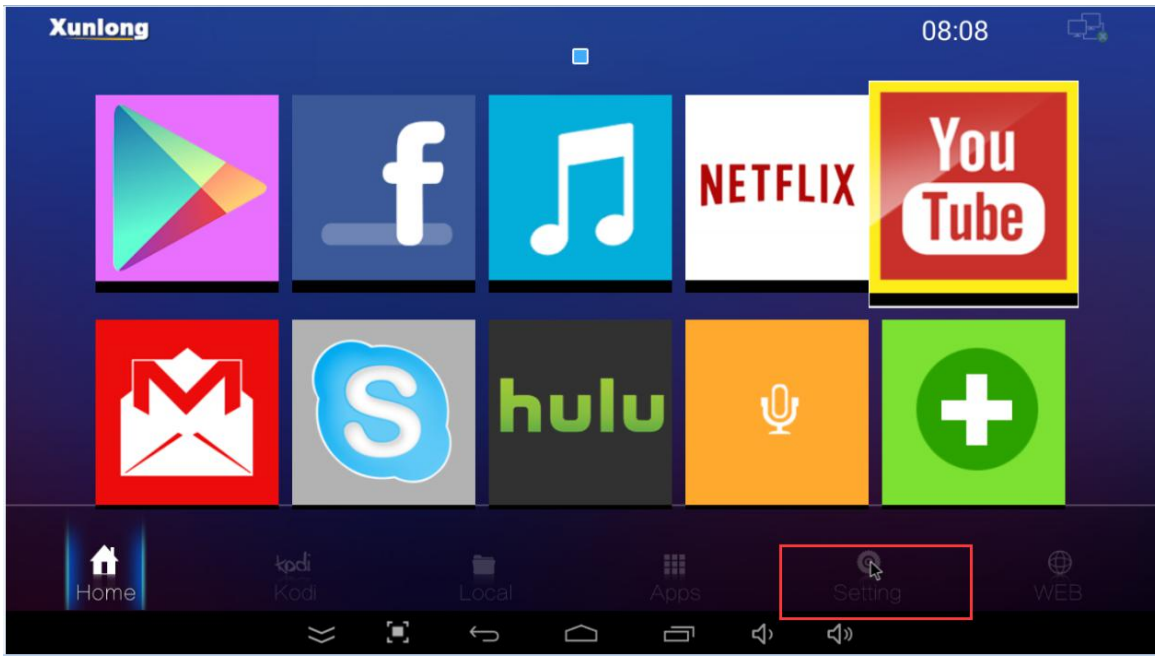
	GPIO port
Green light	PL10

Red light	PA15

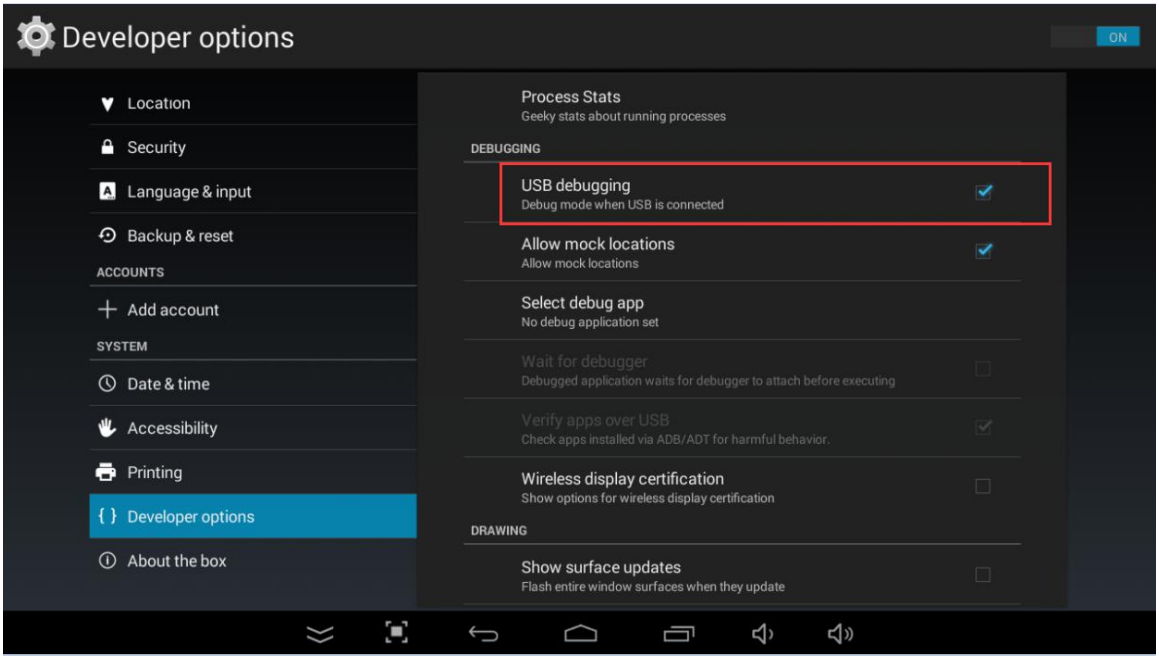
4. 5. How to use ADB

4. 5. 1. Android4.4 method to open the USB debugging option

1) Choose settings



2) Then find the developer option and make sure that USB debugging is turned on

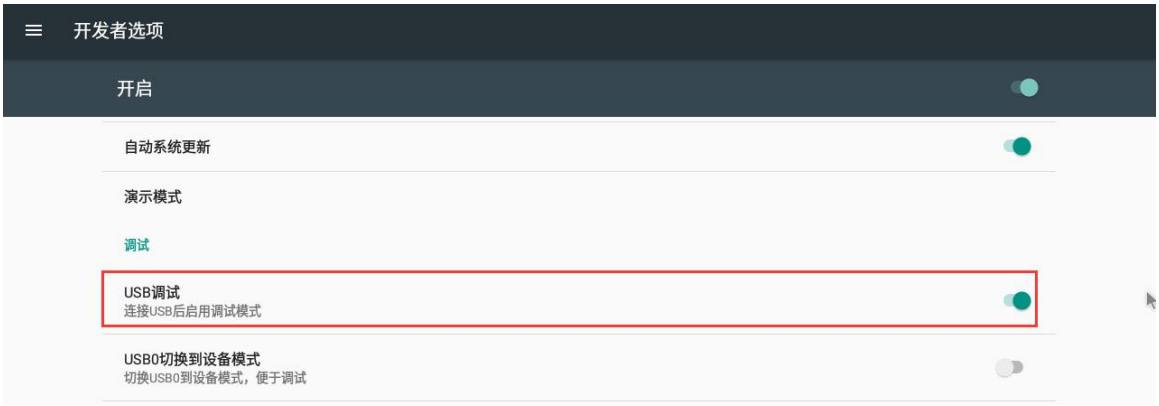


4. 5. 2. How to enable the USB debugging option in Android7.0

1) Choose settings

2) Then open the developer options

3) Then make sure that USB debugging is turned on



4. 5. 3. Use data cable to connect adb for debugging

1) First make sure that the **USB debugging option has been turned on**

2) Prepare a USB-to-Micro USB cable, insert the USB interface into the USB interface of the computer, and insert one end of the Micro USB interface into the USB OTG interface of the development board

3) Install adb tool on Ubuntu PC

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

```
test@test:~$ sudo apt install adb
```

4) Then check if the adb device can be recognized

```
test@test:~$ adb devices
List of devices attached
20080411    device
```

5) Then you can log in to the android system through the adb shell on the Ubuntu PC

```
test@test:~$ adb shell
root@dolphin-fvd-p1:/ #
```

4. 5. 4. Use network connection adb debugging

1) The use of network adb does not require a USB to microphones USB cable to connect the computer and the development board, but communicates through the network, so first make sure that the network of the development board is connected

2) Then turn on the **USB debugging option**

3) Make sure that the **service.adb.tcp.port** of the Android system is set to port number 5555

```
root@dolphin-fvd-p1:/ # getprop | grep "adb.tcp"
[service.adb.tcp.port]: [5555]
```

4) If **service.adb.tcp.port** is not set, you can use the following command to set the port number of the network adb

```
root@dolphin-fvd-p1:/ # setprop service.adb.tcp.port 5555
root@dolphin-fvd-p1:/ # stop adbd
root@dolphin-fvd-p1:/ # start adbd
```

5) Install adb tool on Ubuntu PC

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

6) Then connect to the network adb on the Ubuntu PC

```
test@test:~$ adb connect 192.168.1.xxx      (The IP address needs to be modified to
```

```
the IP address of the development board)
connected to 192.168.1.149:5555
test@test:~$ adb devices
List of devices attached
192.168.1.xxx:5555          device
```

7) Finally, you can log in to the android system through the adb shell on the Ubuntu PC

```
test@test:~$ adb shell
root@dolphin-fvd-p1:/ #
```

4. 6. How to use USB camera

1) Insert the USB camera into the USB interface of the development board to ensure that the device node of the usb camera can be seen under /sys/class/videov4linux

```
root@dolphin-fvd-p1:/ # ls /sys/class/video4linux -l
lrwxrwxrwx root     root              2020-10-16 10:04 video0 -> ../../devices/platform/sunxi_vfe.0/video4linux/video0
lrwxrwxrwx root     root              2020-10-16 10:04 video1 -> ../../devices/platform/sunxi-ehci.4/usb4/4-1/4-1:1.0/video4linux/video1
```

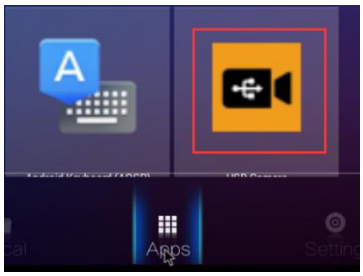
2) Download the USB camera test APP in Baidu cloud disk

3) Then install usbcamera.apk to the Android system, you can use U disk copy and install, you can also use adb to install, use adb to install usbcamera.apk command is

```
test@test:~$ adb devices
List of devices attached
192.168.1.xxx:5555   device      //First make sure that adb is properly connected

test@test:~$ adb install usbcamera.apk
```

4) After installation, you can see the startup icon of the USB camera in all applications



5) Then open the USB camera APP and you can see the video output of the USB camera

4. 7. How to use CSI camera

4. 7. 1. CSI camera interface specifications

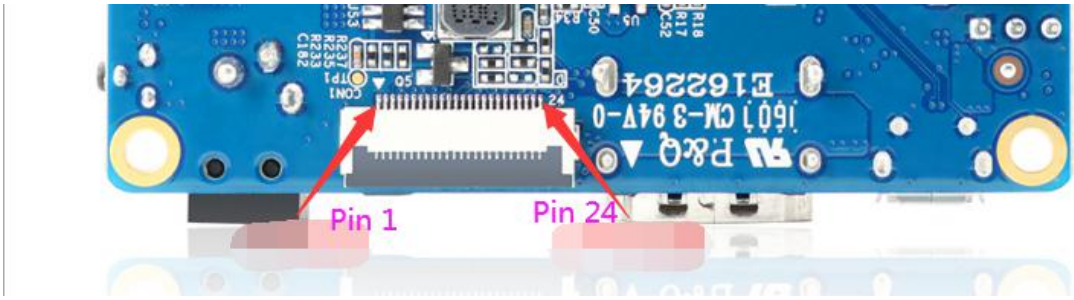
1) The CSI interface of Orange Pi PC Plus supports two cameras, gc2035 and ov5640. The support for cameras in different systems is explained as follows

	GC2035	OV5640
Android 4.4	Support	Support
Android 7.0	No support	No support

2) The serial number of the CSI interface pins is shown in the figure below

a. The No. 1 pin of the CSI interface is connected to the No. 24 pin of the camera adapter board

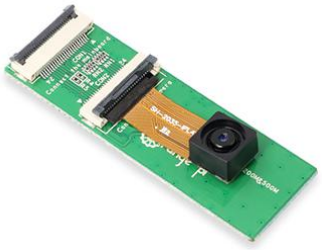
b. The 24th pin of the CSI interface is connected to the 1st pin of the camera adapter board



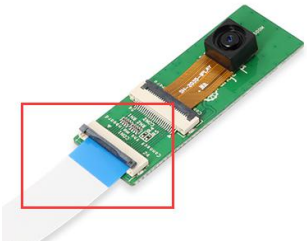
4. 7. 2. How to use gc2035 camera in Android4.4 system

1) The Gc2035 camera kit includes a gc2035 camera, an adapter board and a cable

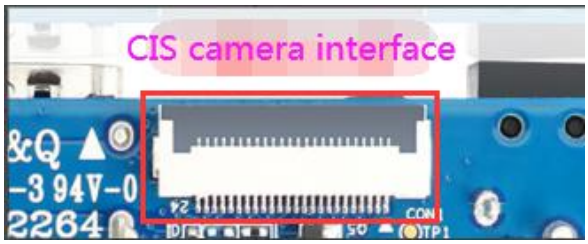
2) First insert the gc2035 camera into the adapter board

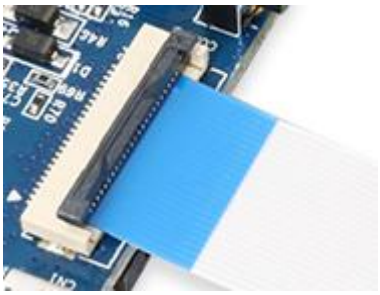


3) Then insert the ribbon cable into another card slot of the adapter board



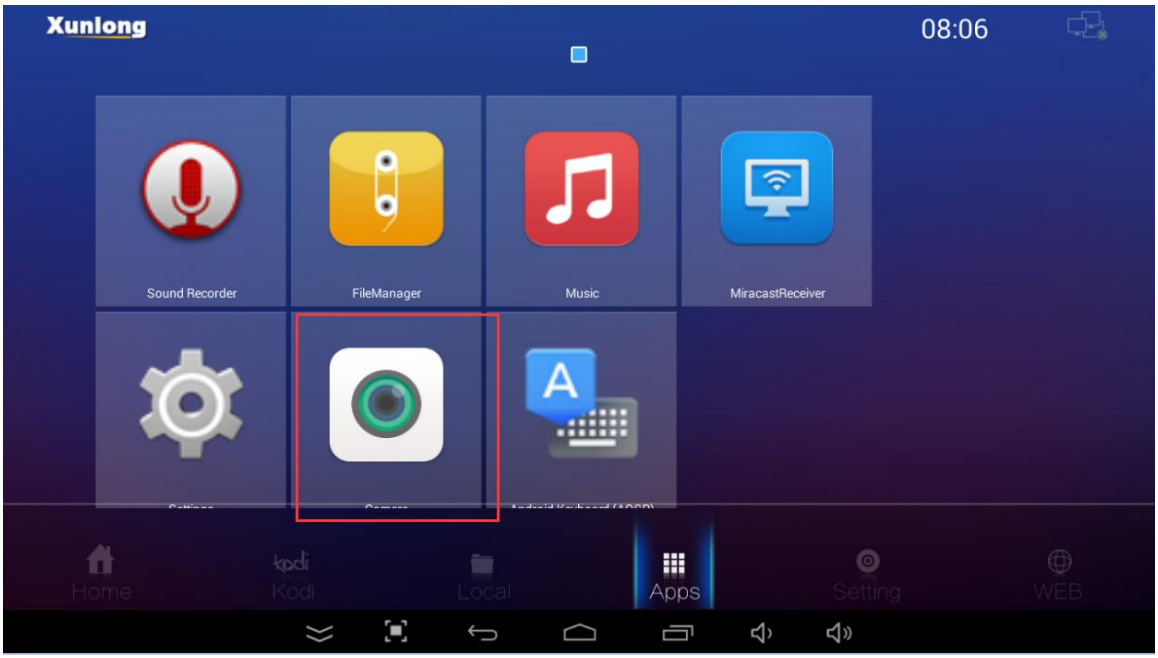
4) Then insert the other end of the cable into the CIS camera interface of the development board. Start the Android system after connecting the camera **(do not insert the camera after power-on)**





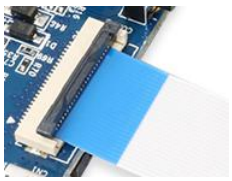
5) Android 4.4 system test gc2035 camera requires the following Android image

6) After the Android system is started, open the camera APP and you can see the output of the gc2035 camera. The location of the camera APP is shown in the figure below



4. 7. 3. How to use the ov5640 camera in Android4.4 system

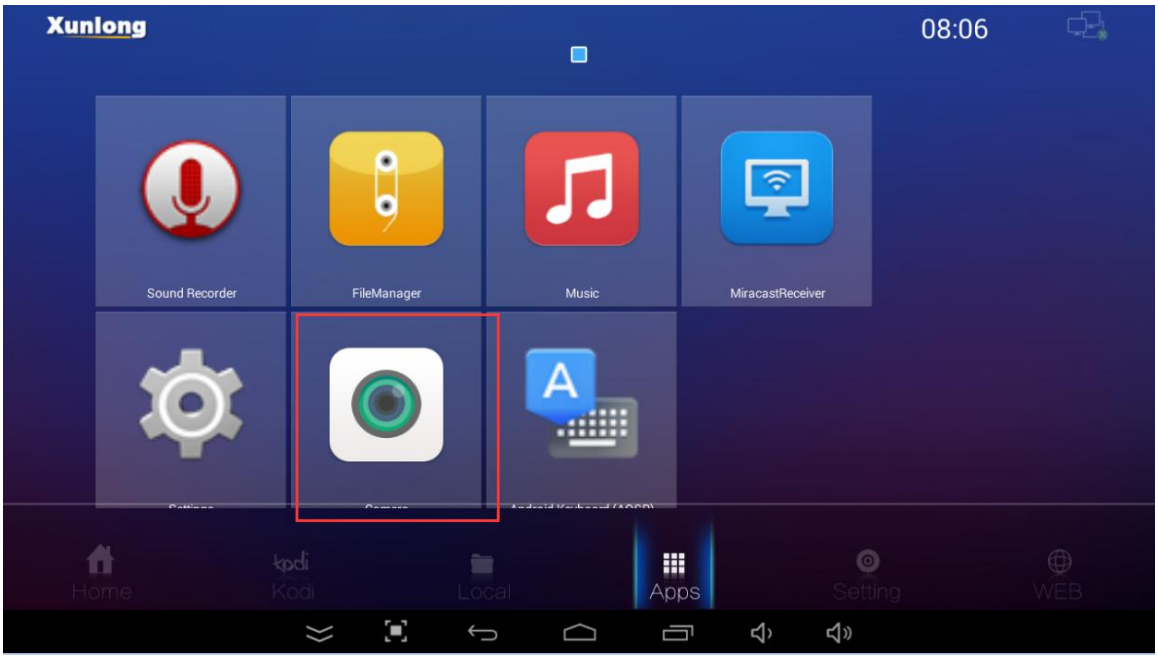
1) First connect the Ov5640 camera adapter board to the CIS camera interface of the development board through a cable, and then start the Android system after connecting the camera **(don't plug in the camera after powering on)**



2) Android 4.4 system test ov5640 camera requires the following Android image

3) After the Android system is started, open the camera APP and you can see the output

of the ov5640 camera. The location of the camera APP is shown in the figure below



5. Linux SDK instructions

Linux SDK The compilation of the Linux SDK is performed on a **PC or virtual machine (VirtualBox or VMware)** with Ubuntu 18.04 installed. Please do not use other versions of the Ubuntu system or compile the Linux SDK on WSL

5.1. Get the source code of linux sdk

5.1.1. Download orangepi-build from github

1) First download the code of orangepi-build. The code of orangepi-build is modified based on the armbian build system. At present, the H3 series development boards 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
```

To download the code of orangepi-build through the git clone command, you do not need to enter the username and password of the github account (the other codes in this manual are also the same), if you enter the git clone command, the Ubuntu PC prompts the user who needs to enter the github account Name and password, usually the address of the orangepi-build warehouse behind git clone is entered incorrectly. First of all, please check the spelling of the command carefully, instead of thinking that we forgot to provide the username and password of the github account.

2) The legacy branch uses the BSP version of the kernel. The current branch generally uses the u-boot and kernel close to the mainline version. The u-boot and linux kernel currently used by the H3 series development boards are as follows

Branch	u-boot version	linux kernel version
legacy	u-boot 2018.05	linux3.4.113
current	u-boot 2020.04	linux5.4.65

3) After orangepi-build is downloaded, it will contain the following files and folders

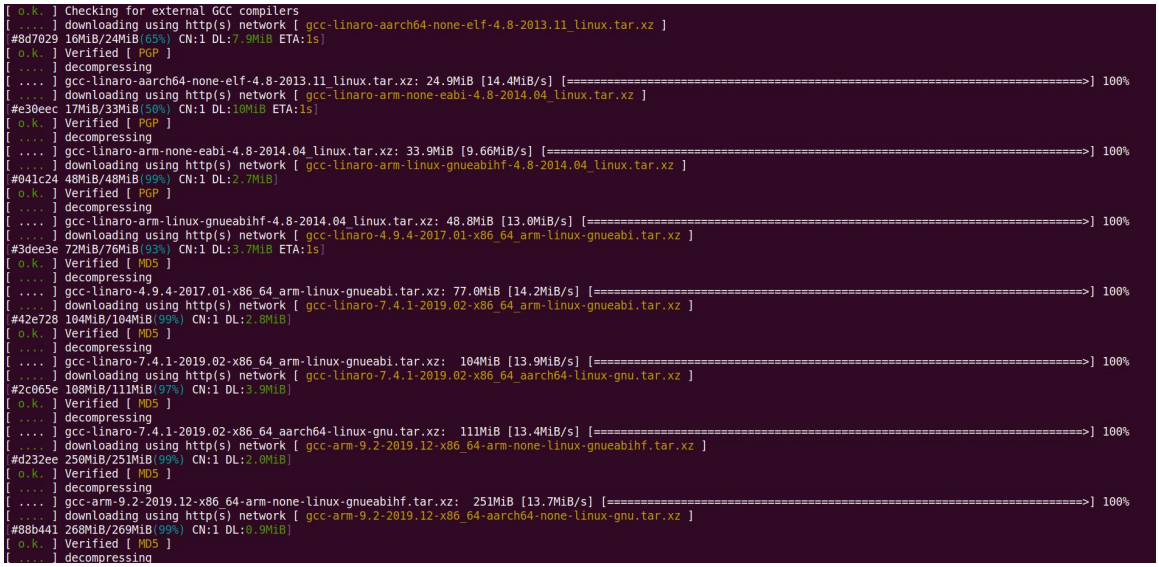
a. **build.sh**: Compile the startup script

b. **external**: Contains the configuration files needed to compile the image, specific scripts, and the source code of some programs, etc.
c. **LICENSE**: GPL 2 license file
d. **README.md**: d.orangepi-build documentation
e. **scripts**: General script for compiling linux image

```
test@test:~/orangepi-build$ ls
build.sh  external  LICENSE  README.md  scripts
```

5.1.2. Download the cross-compilation toolchain

1) When orangepi-build is run for the first time, it will automatically download the cross-compilation toolchain and place it in the toolchains folder. Every time the orangepi-build build.sh script is run, 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



2) The image URL of the cross-compilation tool chain in China is the open source software imager site of Tsinghua University

```
https://mirrors.tuna.tsinghua.edu.cn/armbian-releases/_toolchain/
```

3) After **Toolchains** is downloaded, it will contain multiple versions of cross-compilation toolchains

```
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 tool chain used to compile the H3 linux kernel source code is

a. linux3.4

```
gcc-linaro-5.5.0-2017.10-x86_64_arm-linux-gnueabihf
```

b. linux5.4

```
gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf
```

5) The cross-compilation tool chain used to compile the H3 u-boot source code is

a. u-boot 2018.05

```
gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf
```

b. u-boot 2020.04

```
gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf
```

5.1.3. Description of the complete directory structure of orangepi-build

1) After the orangepi-build repository is downloaded, it does not contain the linux kernel, u-boot source code and cross-compilation tool chain. The source code of the linux kernel and u-boot are stored in a separate git repository **(please do not download and use the kernel and u separately -boot source code to compile, unless you know how to use it)**

a. The git repository stored in the linux kernel source code is as follows

a) linux3.4

```
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-3.4-sun8i
```

b) linux5.4

```
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.4
```

b. The git repository where u-boot source code is stored is as follows

a) u-boot 2018.05

```
https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2018.05-sun8i-linux3.4
```

b) u-boot 2020.04

https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2020.04

2) When orangepi-build runs for the first time, it will download the cross-compilation tool chain, 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:

a. **build.sh**: Compile the startup script
b. **external**: Contains the configuration files needed to compile the image, scripts for specific functions, and the source code of some programs. The rootfs compressed package cached during the compiling of the image is also stored in external
c. **kernel**: Store the source code of the Linux kernel. The folder named orange-pi-3.4-sun8i stores the kernel source code of the legacy branch of the H3 development board, and the folder named orange-pi-5.4 stores the current branch of the H3 development board. The kernel source code (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 kernel source code of the current branch can be seen), the kernel Please do not modify the name of the source code folder manually. If the build system is modified, the kernel source code will be downloaded again when the system is running.
d. **LICENSE**: GPL 2 license file
e. **README.md**: orangepi-build documentation
f. **output**: Store the compiled u-boot, linux and other deb packages, compilation logs, and compiled images and other files
g. **scripts**: General script for compiling linux image
h. **toolchains**: Store the cross-compilation tool chain
i. **u-boot**: Store the source code of u-boot, the folder named v2018.05-sun8i-linux3.4 inside stores the u-boot source code of the legacy branch of the H3 development board, and the folder named v2020.04 inside stores the H3 development U-boot source code of the current branch of the board (if only the linux image of the legacy branch is compiled, then you can only see the u-boot source code of the legacy branch; if you only compile the linux image of the current branch, then you can only see the current Branch u-boot source code), please do not modify the name of the u-boot source code folder manually. If the compilation system is modified, the u-boot source code will be re-downloaded when the system is running.

j. **userpatches**: Store configuration files needed to compile scripts

```
test@test:~/orangepi-build$ ls
build.sh  external  kernel  LICENSE  output  README.md  scripts
toolchains  u-boot  userpatches
```

5.1.4. Download from Google Cloud

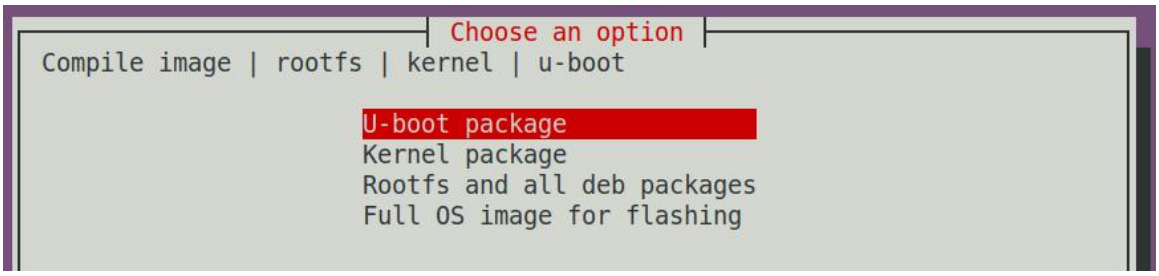
Link:
http://www.orangepi.org/downloadresources/PCPlus/2019-11-12/pcplus_57fbd8b253d28fd1c1026579e5068.html

5.2. Compile u-boot

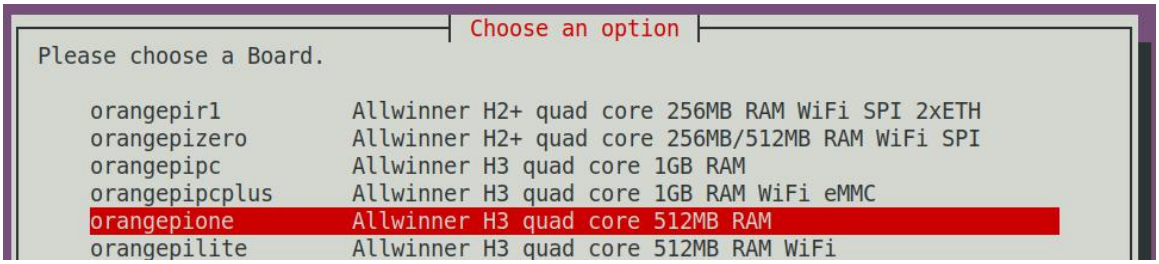
1) Run the build.sh script, remember to add sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **U-boot package,** then press Enter



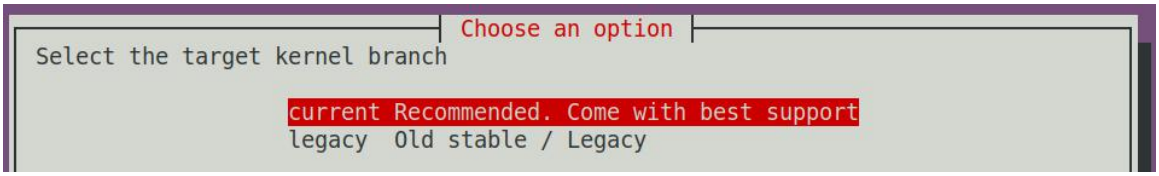
3) Then select the model of the development board



4) Then select the branch

a. current will compile u-boot v2020.04

b. legacy will compile u-boot v2018.05



5) Then it will start to compile u-boot, some of the information prompted during compilation are explained as follows

a. u-boot source version

[o.k.] Compiling u-boot [**v2020.04**]

b. The version of the cross-compilation toolchain

[o.k.] Compiler version [**arm-none-linux-gnueabihf-gcc 9.2.1**]

c. Compile the generated u-boot deb package path

[o.k.] Target directory [**output/debs/u-boot**]

d. The package name of the compiled u-boot deb package

[o.k.] File name [**linux-u-boot-current-orangepipcplus_2.1.0_armhf.deb**]

e. Compile time

[o.k.] Runtime [**1 min**]

f. Repeat the command to compile u-boot, use the following command without selecting through the graphical interface, you can directly start compiling u-boot

[o.k.] Repeat Build Options [**sudo ./build.sh BOARD=orangepipcplus 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-orangepipcplus_2.1.0_armhf.deb
```

7) The files contained in the generated u-boot deb package are as follows

a. Use the following command to unzip 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-orangepipcplus_2.1.0_armhf.deb .
test@test:~/orangepi_build/output/debs/u-boot$ ls
linux-u-boot-current-orangepipcplus_2.1.0_armhf.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-orangepipcplus_2.1.0_armhf
    │   └── u-boot-sunxi-with-spl.bin      //u-boot binary file
    └── u-boot
        ├── LICENSE
        ├── orangepi_pc_plus_defconfig     //Compile the configuration file used by
u-boot source code
        └── platform_install.sh            //Burning script of u-boot

3 directories, 4 files
```

8) When the orangepi-bulid compilation system compiles the u-boot source code, it will first synchronize 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 first need to turn off the download and update function of the source code **(You need to compile u-boot once to turn off this function, otherwise you will be prompted that u-boot's source code cannot be found),** otherwise the changes made 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 u-boot code, you can use the following method to update 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-orangepipcplus_2.1.0_armhf.deb root@192.168.1.207:/root
```

b. Then log in to the development board and uninstall the installed deb package of u-boot

```
root@orangepi:~# apt remove -y linux-u-boot-orangepipcplus-current
```

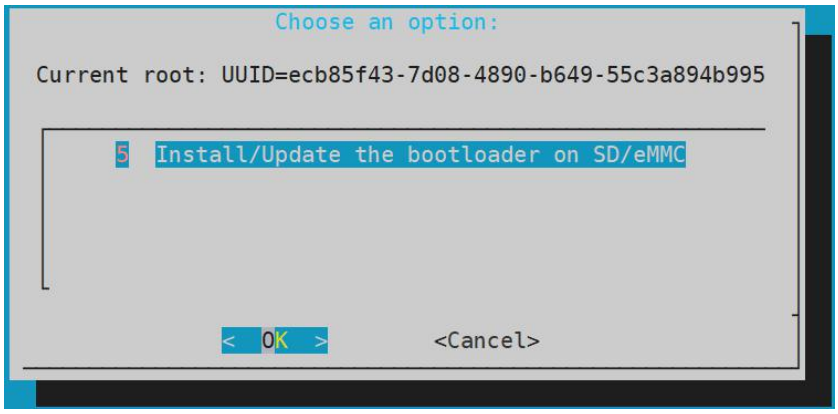
c. Install the new u-boot deb package just uploaded

```
root@orangepi:~# dpkg -i linux-u-boot-current-orangepipcplus_2.1.0_armhf.deb
```

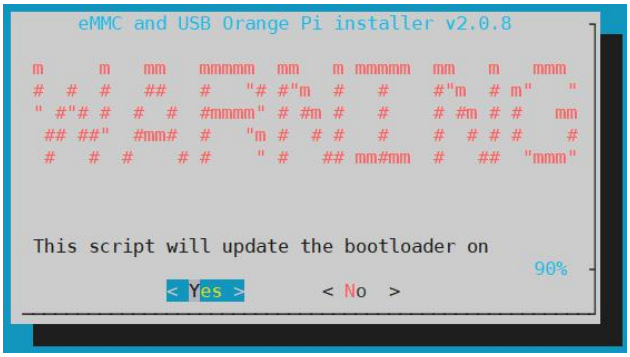
d. Then run the nand-sata-install script

```
root@orangepi:~# nand-sata-install
```

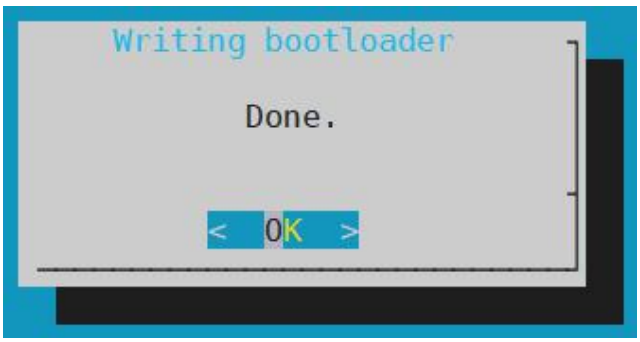
e. Then choose **5 Install/Update the bootloader on SD/eMMC**



f. After pressing the enter key, a Warring will pop up first



g. Press Enter again to start updating u-boot, and the following information will be displayed after the update is complete



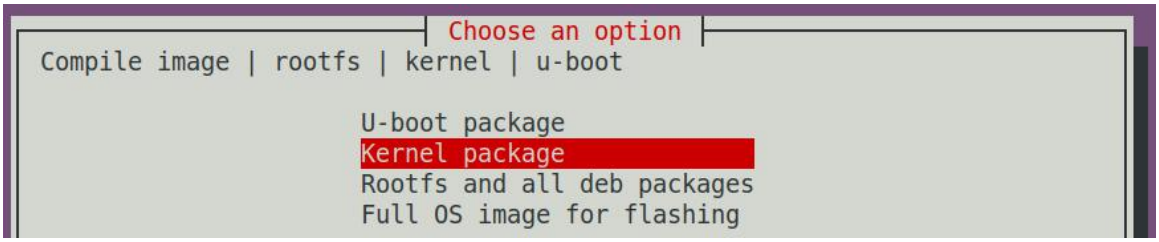
h. Then you can restart to test that the u-boot modification is effective

5. 3. Compile the linux kernel

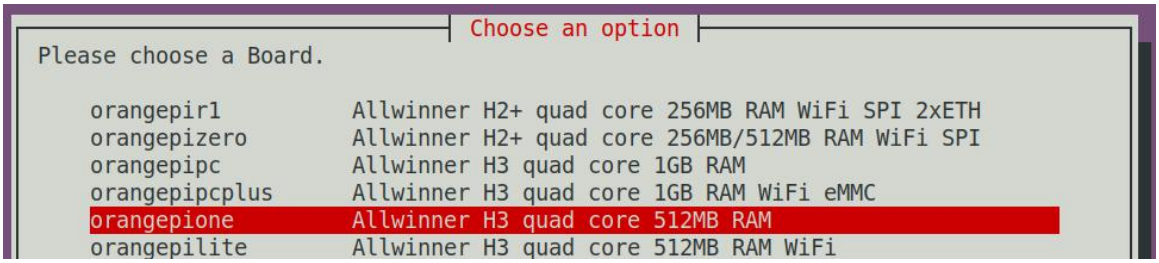
1) Run the build.sh script, remember to add sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **Kernel package**, and then press Enter



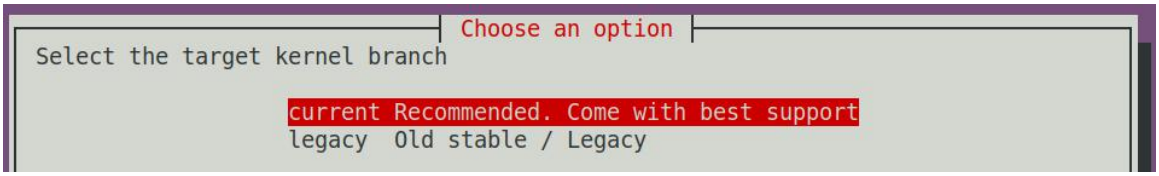
3) Then select the model of the development board



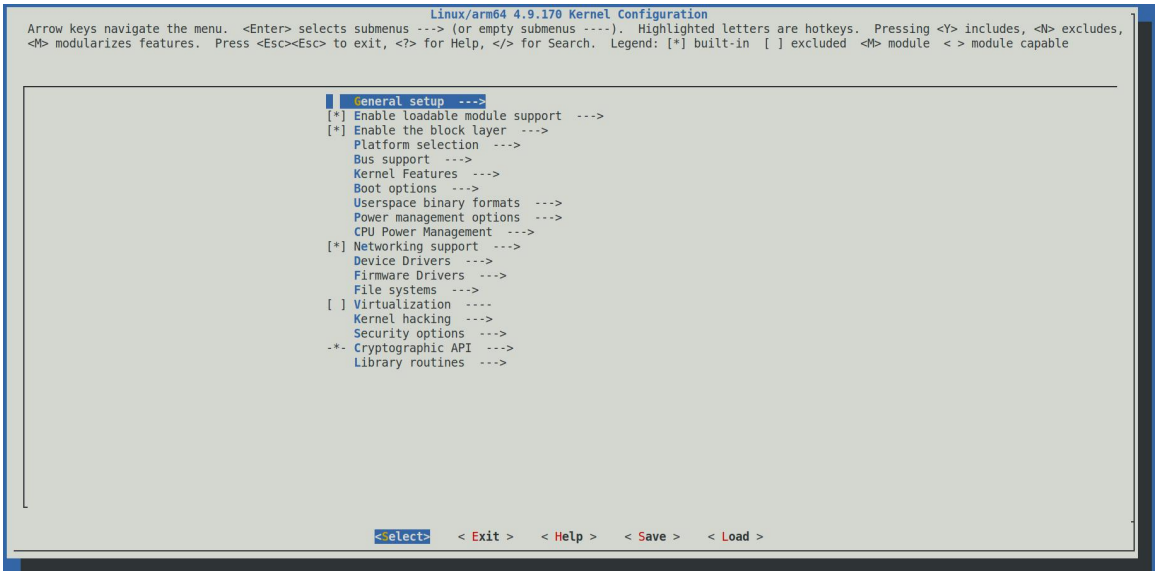
4) Then select the branch

a. current will compile linux5.4

b. legacy will compile linux3.4



5) Then the kernel configuration interface opened through **make menuconfig** will pop up. At this time, you can directly modify the kernel configuration. If you don't need to modify the kernel configuration, just exit directly. After exiting, the kernel source code will be compiled.



a. If you do not need to modify the configuration options of the kernel, when you run the build.sh script, pass in **KERNEL_CONFIGURE=no** to temporarily block the pop-up kernel configuration interface.

```
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 disable this feature permanently

c. If the following error is prompted when compiling the kernel, this is because the terminal interface of the Ubuntu PC is too small, and the make menuconfig interface 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) When compiling the kernel source code, the following information will be prompted (take the current branch as an example)

a. The version of the kernel source code

[o.k.] Compiling legacy kernel [**5.4.65**]

b. The version of the cross-compilation tool chain used to compile the kernel source code

[o.k.] Compiler version [**aarch64-none-linux-gnu-gcc 9.2.1**]

i. 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-sunxi-current.config**]

j. The final configuration file .config used by the kernel (modified the default kernel configuration file through make menuconfig) will be copied to **output/config.** If the kernel configuration is not modified, the final configuration file and the default configuration file are Consistent

[o.k.] Exporting new kernel config [**output/config/linux-sunxi-current.config**]

k. The path of the deb package related to the kernel generated by the compilation

[o.k.] Target directory [**output/debs/**]

l. The package name of the deb package containing the kernel image and kernel module generated by the compilation

```
[ o.k. ] File name [ linux-image-current-sunxi_2.1.0_armhf.deb ]
```

m. Compile time

```
[ o.k. ] Runtime [ 4 min ]
```

n. At the end, it will display the compiling command to recompile the kernel selected last time. Use the following command without selecting through the graphical interface, you can directly start compiling the kernel source code

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh  BOARD=orangepipcplus
BRANCH=current BUILD_OPT=kernel KERNEL_CONFIGURE=yes ]
```

10) View the deb package related to the kernel image generated by the compilation

a. **linux-dtb-current-sunxi_2.1.0_armhf.deb** contains dtb files used by the kernel

b. **linux-headers-current-sunxi_2.1.0_armhf.deb** contains the header files used by the kernel

c. **linux-image-current-sunxi_2.1.0_armhf.deb** contains kernel images and kernel modules

```
test@test:~/orangepi-build$ ls output/debs/linux-*
output/debs/linux-dtb-current-sunxi_2.1.0_armhf.deb
output/debs/linux-image-current-sunxi_2.1.0_armhf.deb
output/debs/linux-headers-current-sunxi_2.1.0_armhf.deb
```

11) The files contained in the generated linux-image deb package are as follows

a. Use the following command to unzip 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-sunxi_2.1.0_armhf.deb test/
test@test:~/orangepi_build/output/debs$ cd test
test@test:~/orangepi_build/output/debs/test$ dpkg -x \
linux-image-current-sunxi_2.1.0_armhf.deb .
test@test:~/orangepi_build/output/debs/test$ ls
boot  etc  lib  linux-image-current-sunxi_2.1.0_armhf.deb  usr
```

b. The decompressed file is as follows

```
test@test:~/orangepi_build/output/debs/test$ tree -L 2
.
├── boot
│   ├── config-5.4.65-sunxi          //Configuration file used to compile the kernel source code
│   ├── System.map-5.4.65-sunxi
│   └── vmlinuz-5.4.65-sunxi         //Compile the generated kernel image file
├── etc
│   └── kernel
├── lib
│   └── modules                      //Compile the generated kernel module
├── linux-image-current-sunxi_2.1.0_armhf.deb
└── usr
    ├── lib
    └── share

8 directories, 4 files
```

12) The files contained in the generated linux-dtb deb package are as follows

a. Use the following command to unzip 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-dtb-current-sunxi_2.1.0_armhf.deb test/
test@test:~/orangepi_build/output/debs$ cd test
test@test:~/orangepi_build/output/debs/test$ dpkg -x \
linux-dtb-current-sunxi_2.1.0_armhf.deb .
test@test:~/orangepi_build/output/debs/test$ ls
boot    linux-image-current-sunxi_2.1.0_armhf.deb    usr
```

b. Use the following command to unzip the deb package

```
test@test:~/orangepi_build/output/debs/test$ tree -L 2
```

```
.
├── boot
│   └── dtb-5.4.65-sunxi                //Store dtb files used by the kernel
├── linux-dtb-current-sunxi_2.1.0_armhf.deb
└── usr
    └── share

4 directories, 1 file
```

13) When the orangepi-bulid compilation system compiles the linux kernel source code, it first synchronizes the linux kernel source code with the linux kernel source code of the github server, so if you want to modify the linux kernel source code, you need to turn off the source code update function first **(you need to compile the linux kernel once. This function can only be turned off after the source code, otherwise it will be prompted that the source code of the linux kernel cannot be found),** otherwise the changes made 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"
```

14) If you modify the kernel, you can use the following method to update the kernel and kernel modules of the Linux system on the development board

a. Upload the compiled linux deb package 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-sunxi_2.1.0_armhf.deb root@192.168.1.207:/root
```

b. Then log in to the development board and uninstall the installed deb package of u-boot

```
root@orangepi:~# apt purge -y linux-image-current-sunxi
```

c. Install the new u-boot deb package just uploaded

```
root@orangepi:~# dpkg -i linux-image-current-sunxi_2.1.0_armhf.deb
```

d. Then restart the development board, and then check whether the kernel-related changes have taken effect

15) The method of installing the kernel header file into the linux system is as follows

a. Upload the deb package of the compiled linux header file to the linux system of the development board

```
test@test:~/orangepi-build$ cd output/debs
test@test:~/orangepi-build/output/debs$ scp \
linux-headers-current-sunxi_2.1.0_armhf.deb root@192.168.1.207:/root
```

b. Then log in to the development board and install the deb package of the linux header file just uploaded

```
root@orangepi:~# dpkg -i linux-headers-current-sunxi_2.1.0_armhf.deb
```

c. After installation, you can see the contents of the kernel header file just installed in /usr/src

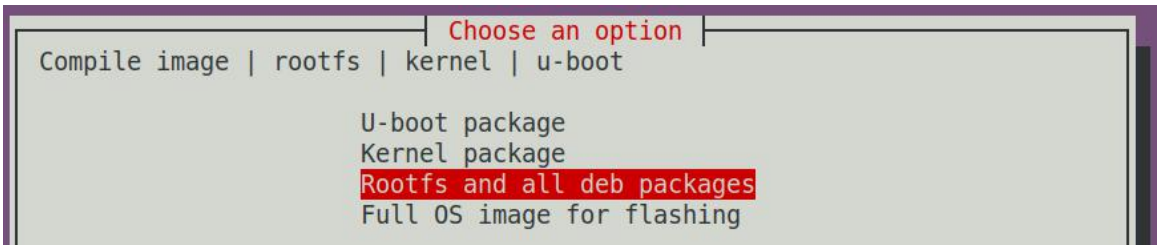
```
root@orangepi:~# ls /usr/src
linux-headers-current-sunxi
root@orangepi:~# ls /usr/src/linux-headers-current-sunxi
Documentation Module.symvers certs firmware init lib net security usr
Kconfig arch crypto fs ipc mm samples sound virt Makefile block
drivers include kernel modules scripts tools
```

5. 4. Compile rootfs

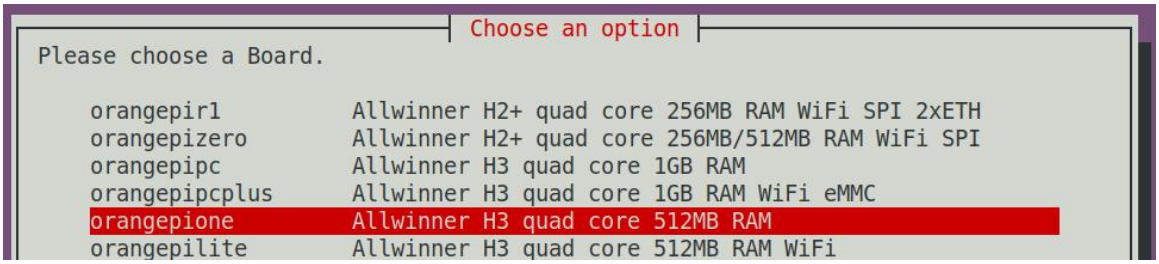
1) Run the build.sh script, remember to add sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **Rootfs and all deb packages**, and then press Enter



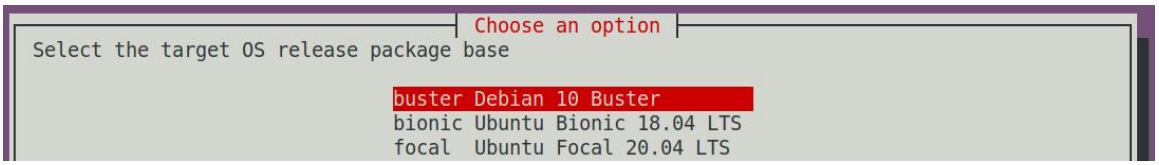
3) Then select the model of the development board



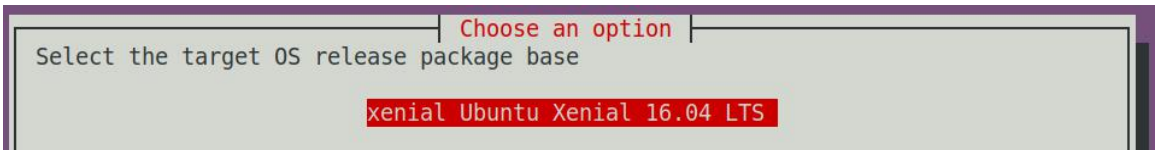
4) Then select the type of rootfs

buster	Debian 10
bionic	Ubuntu 18.04
focal	Ubuntu 20.04
xenial	Ubuntu16.04

a. Linux distributions supported by linux5.4 are as follows



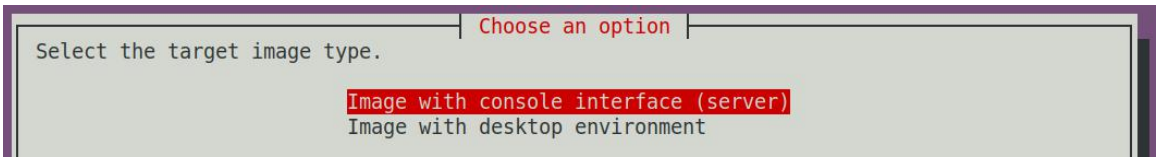
b. The Linux distributions supported by linxu3.4 are as follows



5) Then select the type of image

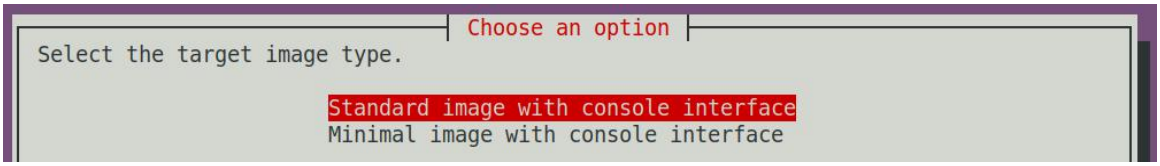
a. **Image with console interface** represents the image of the server version, which is relatively small

b. **Image with desktop environment** means that the image of desktop version, and the volume is relatively large



6) If it is to compile the image of the server version, you can also choose to compile the

Standard version or the Minimal version. The pre-installed software of the Minimal version will be much less than the Standard version.



7) After selecting the type of image, rootfs will be compiled, and the following information will be prompted during compilation

a. Type of rootfs

[o.k.] local not found [Creating new rootfs cache for **bionic**]

b. The storage path of the compiled rootfs compressed package

[o.k.] Target directory [**external/cache/rootfs**]

a. The name of the rootfs compressed package generated by the compilation

[o.k.] File name [**bionic-cli-armhf.153618961f14c28107ca023429aa0eb9.tar.lz4**]

b. Compilation time

[o.k.] Runtime [**13 min**]

c. Repeat the command to compile rootfs, use the following command without selecting through the graphical interface, you can start compiling rootfs directly

[o.k.] Repeat Build Options [**sudo ./build.sh BOARD=orangepione BRANCH=current BUILD_OPT=rootfs RELEASE=bionic BUILD_MINIMAL=no BUILD_DESKTOP=no KERNEL_CONFIGURE=yes**]

8) View the compiled rootfs compressed package

a. bionic-cli-armhf.153618961f14c28107ca023429aa0eb9.tar.lz4 is a compressed package of rootfs, the meaning of each field of the name is

a) **Bionic** represents the type of linux distribution of rootfs

b) **Cli** indicates that rootfs is the server version type, if it is dekstop, it indicates the desktop version type

c) **Armhf** indicates the architecture type of rootfs

d) 153618961f14c28107ca023429aa0eb9 is the MD5 hash value generated by

the package names of all software packages installed by rootfs. As long as the list of software packages installed by rootfs is not modified, this value will not change. The compilation script will judge by this MD5 hash value Do you need to recompile rootfs

b. bionic-cli-armhf.153618961f14c28107ca023429aa0eb9.tar.lz4.list lists the package names of all packages installed by rootfs

```
test@test:~/orangepi_build$ ls external/cache/rootfs/
bionic-cli-armhf.153618961f14c28107ca023429aa0eb9.tar.lz4
bionic-cli-armhf.153618961f14c28107ca023429aa0eb9.tar.lz4.list
```

9) 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 is already Rootfs with cache available, if available, use it directly, which can save a lot of downloading and compiling time

10) Since it takes a long time to compile rootfs, if you don't want to compile rootfs from scratch, or if there is a problem with compiling rootfs, you can directly download the rootfs compressed package cached by Orange Pi. The download link of rootfs compressed package Baidu cloud disk is shown below, download A good rootfs compressed package (don't decompress it) needs to be placed in the **external/cache/rootfs** directory of orangepi-build before it can be used normally by the compiled script

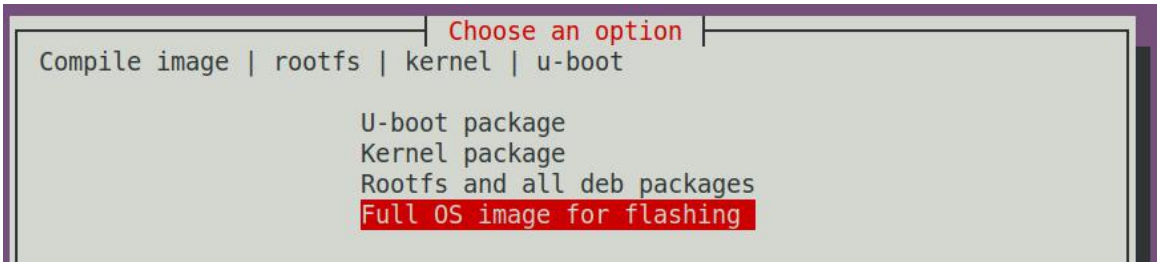
Link：https://pan.baidu.com/s/1vWQmCmSYdH7iCDFyKpJtVw
Code：zero

5. 5. Compile linux image

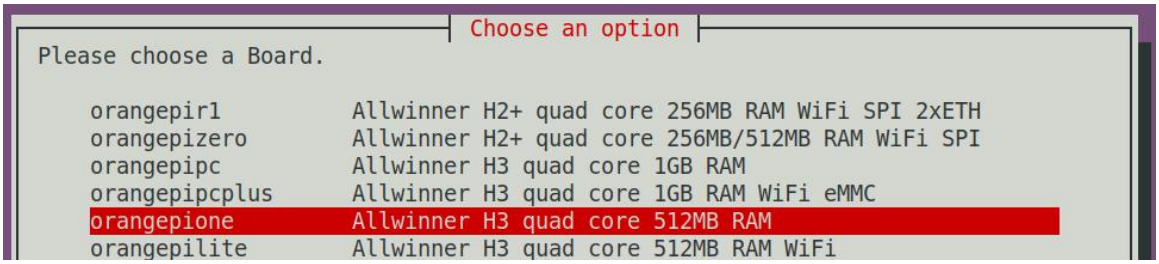
1) Run the build.sh script, remember to add sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select Full OS image for flashing, and then press Enter



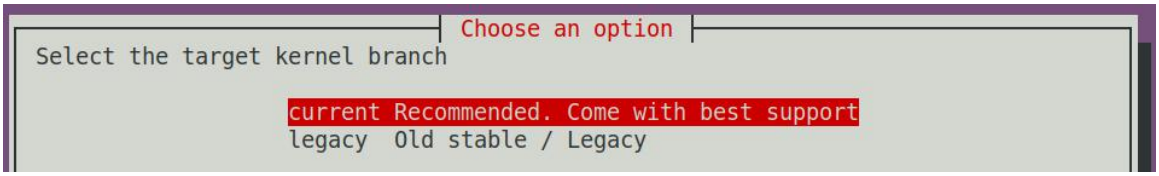
3) Then select the model of the development board



4) Then select the branch

a. Current will compile u-boot v2020.04、linux5.4

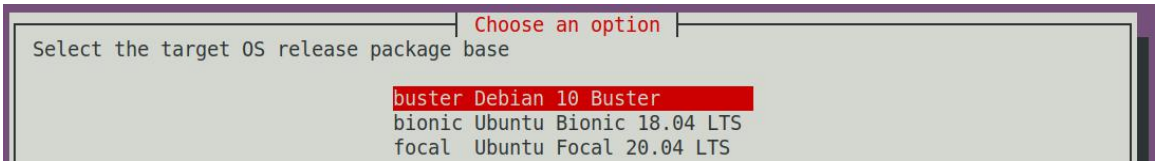
b. legacy will compile u-boot v2018.05、linux3.4



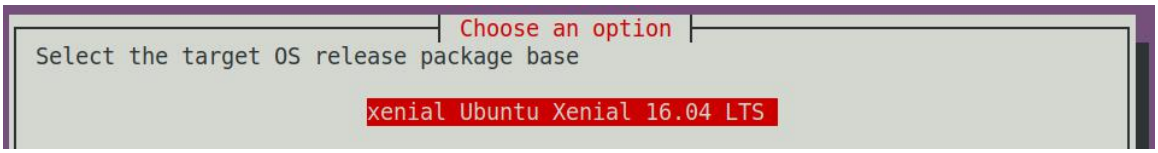
5) Then select the type of rootfs

buster	Debian 10
bionic	Ubuntu 18.04
focal	Ubuntu 20.04
xenial	Ubuntu16.04

a. Linux distributions supported by linux5.4 are as follows



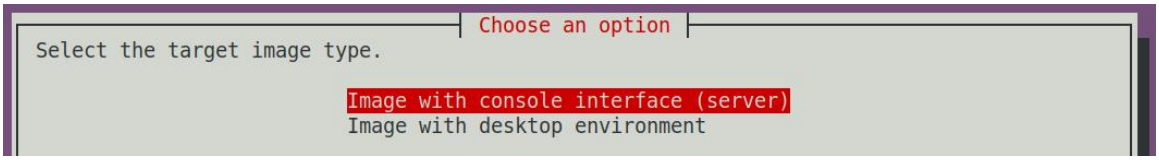
b. The Linux distributions supported by linxu3.4 are as follows



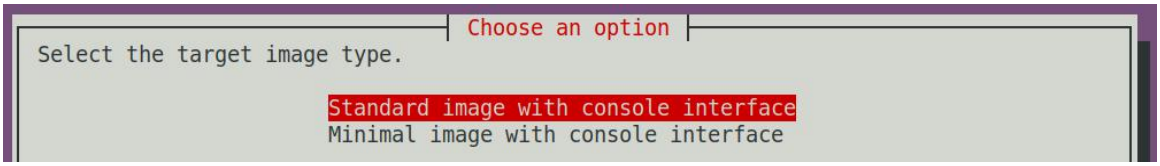
6) Then select the type of image

a. **Image with console interface** represents the image of the server version, which is relatively small

b. **Image with desktop environment** indicates that the image of desktop version and the volume is relatively large



7) If it is to compile the image of the server version, you can also choose to compile the Standard version or the Minimal version. The pre-installed software of the Minimal version will be much less than the Standard version.



8) After selecting the type of image, it will start to compile the Linux image. The general process of compiling the image is as follows

a. Compile u-boot source code and generate u-boot deb package

b. Compile linux source code, generate linux related deb package

c. Make deb package of linux firmware

d. Make deb package of orangepi-config tool

e. Make board-level support deb package

f. If it is to compile the desktop version image, the desktop related deb package

will also be made

g. Check whether the rootfs has been cached, if there is no cache, re-create the rootfs, if it has been cached, just unzip and use
h. Install the previously generated deb package into rootfs
i. Make some specific settings for different development boards and different types of images, such as pre-installing additional software packages and modifying configuration files
j. Then make an image file and format the partition, the default type is ext4
k. Then copy the configured rootfs to the image partition
l. Then update the initramfs
m. Finally, write the bin file of u-boot to the image through the dd command

9) After compiling the image, the following information will be prompted

a. The storage path of the compiled linux image

```
[ o.k. ] Done building
[ output/images/orangepione_2.1.0_ubuntu_bionic_server_linux5.4.65/orangepione_2.1.0_ubuntu_bionic_server_linux5.4.65.img ]
```

b. The time used to compile the image

```
[ o.k. ] Runtime [ 9 min ]
```

c. Repeat the command to compile the image, use the following command without selecting through the graphical interface, you can directly start to compile the image

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh  BOARD=orangepione BRANCH=current BUILD_OPT=image RELEASE=bionic BUILD_MINIMAL=no BUILD_DESKTOP=no KERNEL_CONFIGURE=yes ]
```

6. Android SDK instructions

1) The Android SDK supported by Allwinner H3 SOC is as follows

Android version	Kernel version
Android 4.4	linux 3.4
Android 7.0	linux 4.4

2) The compilation of the Android SDK is performed on a PC with **Ubuntu 14.04** installed, and there may be some differences in other versions of Ubuntu systems

3) Android 4.4 has more complete drivers than Android 7.0. Both versions of the SDK are the original SDK released by the chip manufacturer. If you want to use the Android images compiled by these SDKs on the Orange Pi development board, you need to target different boards. Adaptation can ensure the normal use of all functions

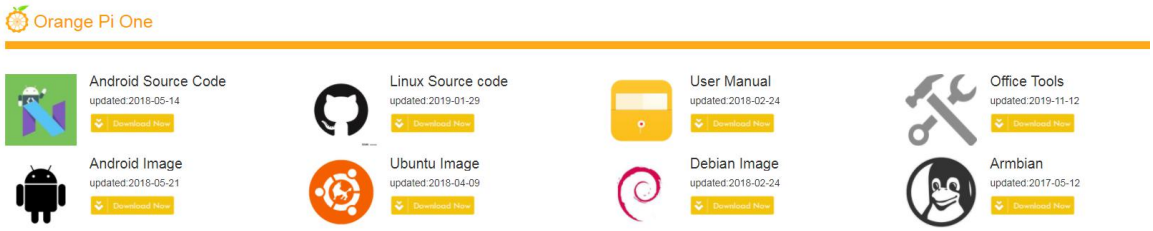
6. 1. Android 4.4 SDK instructions

6. 1. 1. Download the source code of android 4.4 sdk

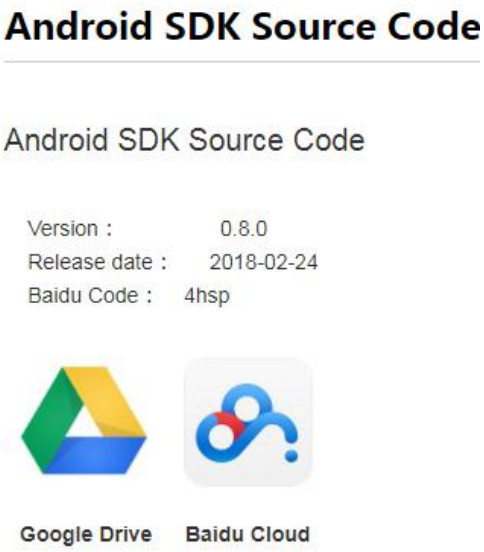
1) The download address of the Android source code is

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

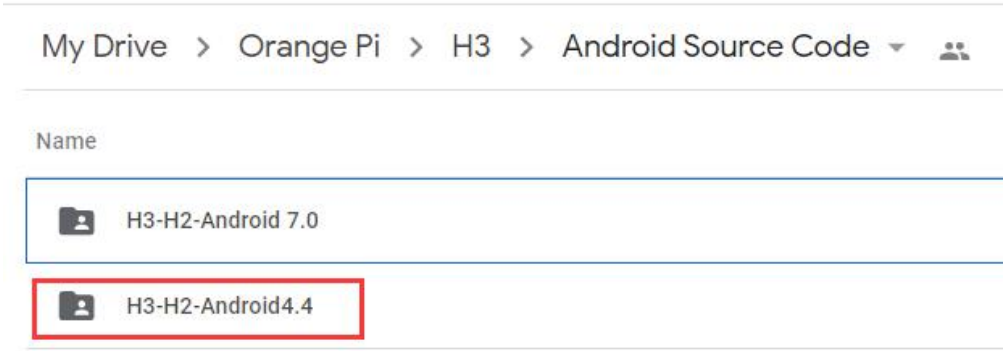
2) After entering the data page, find the data download link corresponding to the development board, and select the Android source code option



3) Then select Google Cloud



4) Then download the source code of H3-Android4.4



5) H3 android 4.4 source code contains the following 2 files

a. **OrangepiH3.tar**：android source code

b. **OrangepiH3.tar.md5sum**：The MD5 checksum file of OrangepiH3.tar

6) After downloading the android source code, first check whether the MD5 checksum is correct, if not, please download the source code again

```
test@test:~$ md5sum -c    OrangepiH3.tar.md5sum
OrangepiH3.tar: 确定
```

7) Then decompress the source code of android sdk, after decompressing the sdk, two folders of android and lichee will be generated

a. android: Store android-related code

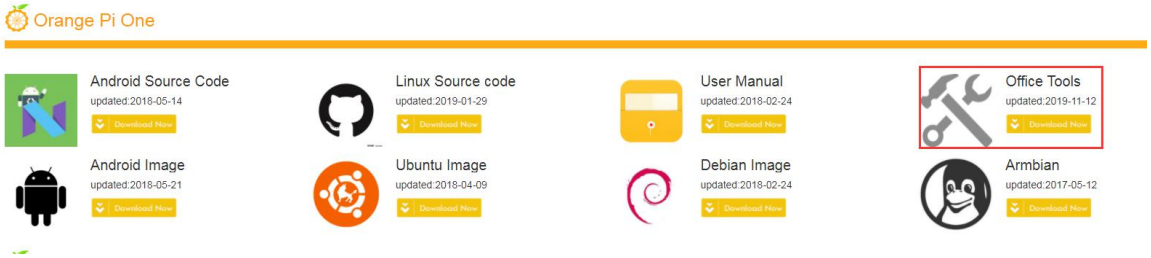
b. linchee: Store the linux kernel and u-boot code

```
test@test:~$ mkdir OrangePiH3
test@test:~$ tar -xf OrangePiH3.tar -C OrangePiH3
test@test:~$ cd OrangePiH3
test@test:~/OrangePiH3$ ls
android    lichee
```

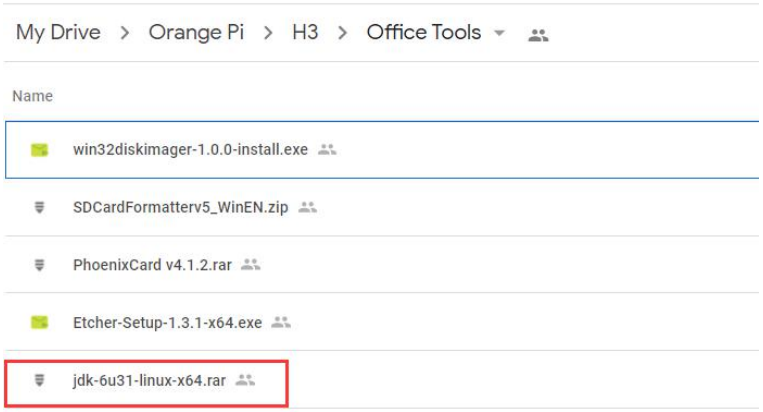
6. 1. 2. Build android compilation environment

1) Download the jdk installation package

a. Select the official tool on the data download page



b. Then select jdk-6u31-linux-x64.rar in the opened Baidu cloud disk



2) Install jdk, execute the following command, a folder named jdk1.6.0_31 will be generated under /usr/lib/jvm/ b. Then select jdk-6u31-linux-x64.rar in the opened Baidu cloud disk

```
test@test:~$ sudo cp jdk-6u31-linux-x64.bin /usr/lib/jvm/
test@test:~$ cd /usr/lib/jvm/
test@test:~ /usr/lib/jvm$ sudo chmod a+x ./jdk-6u31-linux-x64.bin
test@test:~ /usr/lib/jvm$ sudo ./jdk-6u31-linux-x64.bin
```

```
test@test:~ /usr/lib/jvm$ ls
jdk1.6.0_31   jdk-6u31-linux-x64.bin
```

3) Export java environment variables

```
test@test:~$ export JAVA_HOME=/usr/lib/jvm/jdk1.6.0_31
test@test:~$ export JRE_HOME=/usr/lib/jvm/jdk1.6.0_31/jre
test@test:~$ export CLASSPATH=.:$JAVA_HOME/lib:$JRE_HOME/lib:$CLASSPATH
test@test:~$ export PATH=$JAVA_HOME/bin:$JRE_HOME/bin:$JAVA_HOME:$PATH
```

4) 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 libc6-dev libncurses5-dev:i386 x11proto-core-dev \
libx11-dev:i386 libreadline6-dev:i386 libgl1-mesa-glx:i386 \
libgl1-mesa-dev g++-multilib mingw32 tofrodos \
python-markdown libxml2-utils xsltproc zlib1g-dev:i386
```

5) The location where the cross-compilation tool chain used in the compilation process is stored is

```
test@test:~$ cd OrangePiH3/lichee/brandy/gcc-linaro
test@test:~/OrangePiH3/lichee/brandy/gcc-linaro$ ls
arm-linux-gnueabi    bin    lib    libexec
```

6.1.3. Compile android image

6.1.3.1. Compile the Linux kernel source code

1) The compilation environment needs to be configured when compiling the kernel for the first time. After the configuration, the kernel code will be compiled automatically

```
test@test:~/OrangePiH3$ cd lichee
test@test:~/OrangePiH3/lichee$ ./build.sh config

Welcome to mkscript setup progress
All available chips:
    0. sun8iw6p1
```

```
    1. sun8iw7p1
    2. sun8iw8p1
    3. sun9iw1p1
Choice: 1
All available platforms:
    0. android
    1. dragonboard
    2. linux
Choice: 0
All available business:
    0. dolphin
    1. secure
    2. karaok
Choice: 0
```

2) After compiling, the following information will be output

```
sun8iw7p1 compile Kernel successful


INFO: build kernel OK.
INFO: build rootfs ...
INFO: skip make rootfs for android
INFO: build rootfs OK.
----------------------------------------
build sun8iw7p1 android dolphin lichee OK
----------------------------------------
```

3) If you recompile the kernel code later, you only need to enter the **./build.sh** command to start compiling

```
test@test:~/OrangePiH3/lichee$ ./build.sh
```

6.1.3.2. Compile android source code

1) The command to compile android is as follows

```
test@test:~$ cd android
```

```
test@test:~/OrangePiH3/android$ source build/envsetup.sh
test@test:~/OrangePiH3/android$ lunch dolphin_fvd_p2-eng
test@test:~/OrangePiH3/android$ extract-bsp
test@test:~/OrangePiH3/android$ make -j8 && pack
```

2) The final output log of the packaged and generated android image is as follows

```
test@test:~/OrangePiH3/android$ pack
......

----------image is at----------

lichee/tools/pack/sun8iw7p1_android_dolphin-p2_uart0.img

pack finish
```

3) The path where the generated Android image is stored is

lichee/tools/pack/sun8iw7p1_android_dolphin-p2_uart0.img

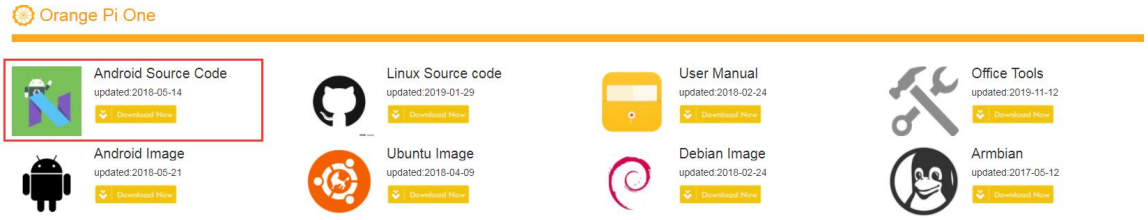
6. 2. Android 7.0 SDK instructions

6. 2. 1. Download the source code of android 7.0 sdk

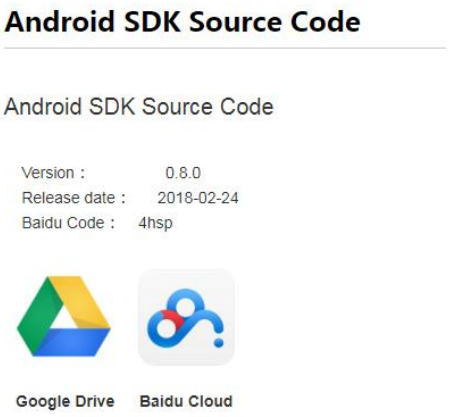
1) The download address of the Android source code is

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

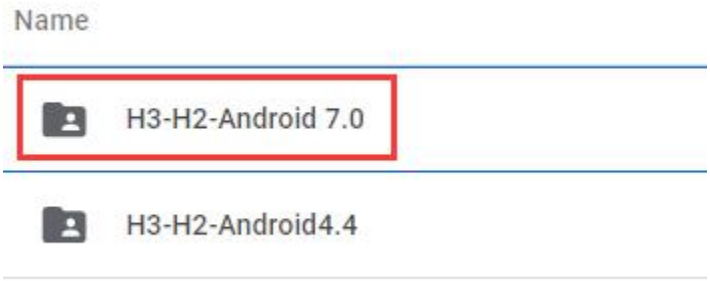
2) After entering the data page, find the data download link corresponding to the development board, and select the Android source code option



3) Then select Google Cloud



4) Then download the source code of H3-Android7.0



5) H3's android 7.0 source code includes file descriptions as follows

c. **H3-sdk7.0-2017-11-03.tar.gza*：** Sub-volume compressed package of android sdk source code

d. **md5sum.txt：** H3-sdk7.0-2017-11-03.tar.gza* of H3-sdk7.0-2017-11-03.tar.gza*

6) After downloading the android source code, first check whether the MD5 checksum is correct, if not, please download the source code again

```
test@test:~$ cd H3-Android7.0
test@test:~/H3-Android7.0$ md5sum -c md5sum.txt
H3-sdk7.0-2017-11-03.tar.gzaa: 确定
H3-sdk7.0-2017-11-03.tar.gzab: 确定
H3-sdk7.0-2017-11-03.tar.gzac: 确定
H3-sdk7.0-2017-11-03.tar.gzad: 确定
H3-sdk7.0-2017-11-03.tar.gzae: 确定
H3-sdk7.0-2017-11-03.tar.gzaf: 确定
H3-sdk7.0-2017-11-03.tar.gzag: 确定
```

```
H3-sdk7.0-2017-11-03.tar.gzah: 确定
H3-sdk7.0-2017-11-03.tar.gzai: 确定
H3-sdk7.0-2017-11-03.tar.gzaj: 确定
H3-sdk7.0-2017-11-03.tar.gzak: 确定
H3-sdk7.0-2017-11-03.tar.gzal: 确定
H3-sdk7.0-2017-11-03.tar.gzam: 确定
H3-sdk7.0-2017-11-03.tar.gzan: 确定
```

7) Then add multiple compressed packages and merge them into one compressed file

```
test@test:~/H3-Android7.0$ cat H3-sdk7.0-2017-11-03.tar.gza* > OrangePiH3.tar
```

8) Then decompress the source code of android sdk, after decompressing the sdk, two folders of android and lichee will be generated

a. android: Store android-related code

b. lichee: Store the linux kernel and u-boot code

```
test@test:~$ mkdir OrangePiH3
test@test:~$ tar -xf OrangePiH3.tar -C OrangePiH3
test@test:~$ cd OrangePiH3
test@test:~/OrangePiH3$ ls
android  lichee
```

6. 2. 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
```

6.2.3. Compile android image

6.2.3.1. Compile the kernel

1) First configure the compilation environment, after the configuration, the kernel source code will be compiled

```
test@test:~/H3-Android7.0 /OrangePiH3$ cd  lichee
test@test:~/H3-Android7.0 /OrangePiH3/lichee$ ./build.sh  config

./build.sh config

Welcome to mkscript setup progress
All available chips:
    0. sun50iw1p1
    1. sun50iw2p1
    2. sun50iw6p1
    3. sun8iw11p1
    4. sun8iw12p1
    5. sun8iw6p1
    6. sun8iw7p1
    7. sun8iw8p1
    8. sun9iw1p1
Choice: 6
```

```
All available platforms:
    0. android
    1. dragonboard
    2. linux
    3. camdroid
Choice: 0
All available business:
    0. dolphin
    1. secure
    2. karaok
Choice: 0
```

2) After compiling, the following information will be output

```
sun8iw7p1 compile Kernel successful


INFO: build kernel OK.
INFO: build rootfs ...
INFO: skip make rootfs for android
INFO: build rootfs OK.
----------------------------------------
build sun8iw7p1 android dolphin lichee OK
----------------------------------------
```

3) If you recompile the kernel code later, you only need to enter the **./build.sh** command to start compiling

```
test@test:~/OrangePiH3/lichee$ ./build.sh
```

6.2.3.2. Compile android source code

1) The command to compile android is as follows

```
test@test:~/H3-Android7.0 /OrangePiH3$ cd android
test@test:~/H3-Android7.0 /OrangePiH3/android$ source build/envsetup.sh
test@test:~/H3-Android7.0 /OrangePiH3/android$ lunch dolphin_fvd_p1-eng
test@test:~/H3-Android7.0 /OrangePiH3/android$ extract-bsp
```

```
test@test:~/H3-Android7.0 /OrangePiH3/android$ make -j8 && pack
```

2) The final output log of the packaged and generated android image is as follows

```
----------image is at----------

lichee/tools/pack/sun8iw7p1_android_dolphin-p1_uart0.img

pack finish
```

4) The path where the generated Android image is stored is

```
lichee/tools/pack/sun8iw7p1_android_dolphin-p1_uart0.img
```