User Guide
T536 Evaluation Board



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Overview

The Linux Software Evaluation Guide is used to introduce the test steps and evaluation methods of the core resources and peripheral resources under the open source Linux system running on Ebyte's evaluation board. This article can be used as a preliminary evaluation guide, and can also be used as a test guide for general system development.

1.1. Software Resources

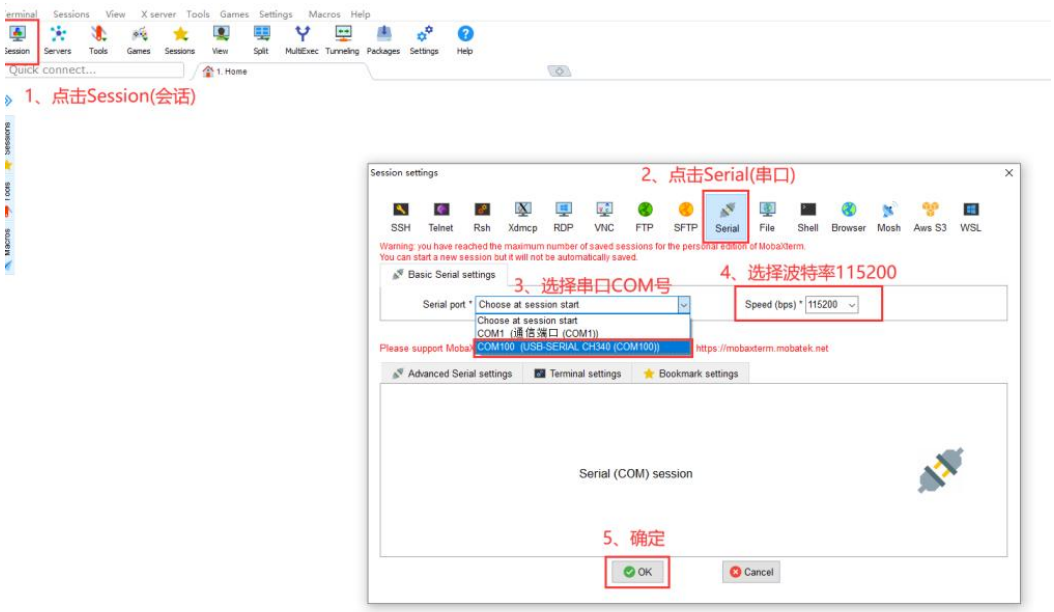
The ECB33 is equipped with an operating system based on the Linux 5.10 version kernel. The evaluation board comes with the cross-compilation toolchain required for the development of the embedded Linux system, the U-boot source code, the source code of the Linux kernel and each driver module at the factory. As well as various development and debugging tools suitable for Windows desktop environments and Linux desktop environments, application development samples, etc.

2. Preparation before use

2.1. Serial port software installation

Before using the serial port, you need to install the CH340 serial port driver and Moba Xterm serial port terminal. For specific installation methods, see the core board development guide.

After connecting the serial port, install MobaXterm and configure it, and open the serial port as follows.



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2.2. Quick Start

The evaluation board produced by EBIT does not come with a boot firmware by default. Users need to burn a firmware by themselves. Users can choose to burn the firmware based on the model of the evaluation board. Here, we mainly help users quickly start the evaluation board and only explain the method of burning the firmware to emmc using the official tool. The same applies to nand. For more burning methods and problems during burning, please refer to Development_Guide.

2.2.1. Burn the evaluation board Flash

Use the official Allwinner tool PhoenixSuit to achieve rapid USB burning.



Click on the "One-Click Flashing" option at the top to enter the image selection. After choosing ECB33, there is no need to click the "Upgrade Now" button.

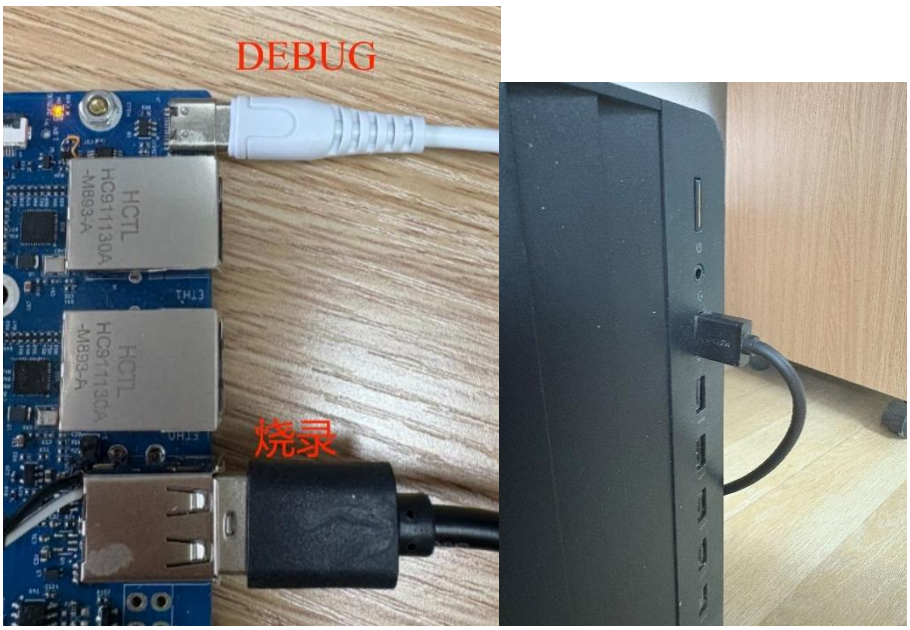
For ECB33, select ebyte_t536_uart0_linux-5.10-origin.img



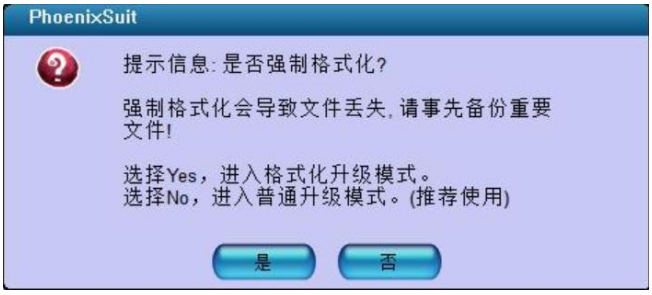
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Next, we connect two type-a and type-c data cables. One is used to observe the burning log, and the other is used to burn the flash on the board. After the connection is completed, we need to enter the burning mode. The type-a evaluation board must be connected to the upper port on this side, and only then is the OTG on the upper side.



The ECB33 has introduced the FEL button. Users can press FEL and hold it, then press the reset button or power on the board to enter the burning mode, and a burning inquiry box will pop up.



Users can choose whether to format and upgrade as needed and wait for the burning process to complete.

It should be noted that the T536 starts from the SD card first. After burning to the flash on the board, the sd card must be removed before it can boot from the flash on the board.

2.2.2. Using the serial port to interact with the single board computer

T After the burning is completed, we can connect to the serial port to check the startup of the evaluation board. The debugging serial port of the evaluation board needs to be connected using a usb data cable. Then, use the above serial port software mobaXterm to select the correct serial port

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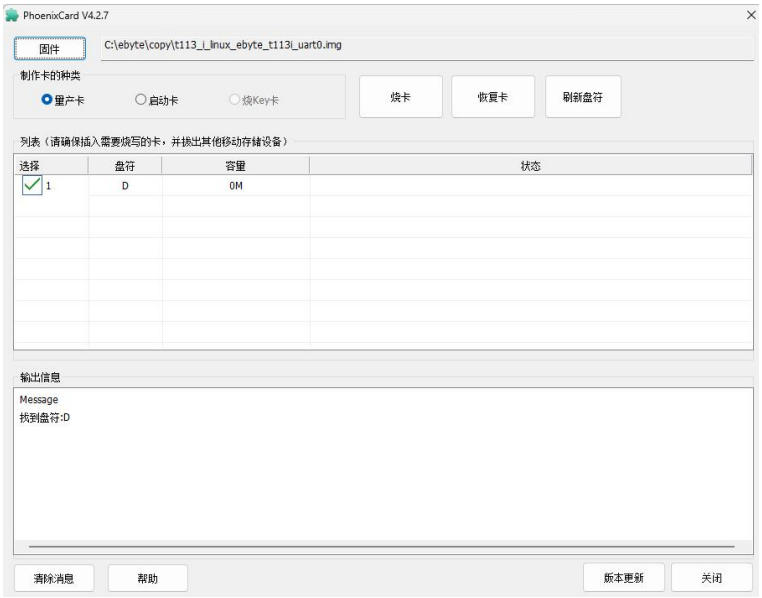
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number and baud rate 115200. Next, we can move on to the functional test content of Chapter Three.

The username and password for logging into the ECB33 evaluation board are both root.

2.2.3. Burn SD card

This section is a supplement to the burning function. Users can burn to the SD card to start the evaluation board. Here we need to use PhoenixCard to burn the SD card.



Users are requested to select the firmware to be burned in sequence and choose the same firmware as that burned to emmc. Select the type of card as "Boot Card", and then choose the SD card device to be burned. The software will automatically scan for available mobile storage devices. Please note not to select the wrong device. Finally, click the "Burn Card" button. During the process of burning the card, the current progress will be displayed in real time.

3. Functional testing

3.1. Core Resources

In Linux system, the proc virtual file system is provided to query the parameters of various core resources and some general tools are provided to evaluate the performance of resources. The following will specifically read and test the parameters of core resources such as CPU, memory, eMMC, RTC, etc.

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3.1.1. CPU

3.1.1.1. View CPU information

Use cat /proc/cpuinfo to view CPU information. The ECB33 is equipped with an Arm® Cortex®-A55*4 processor, with a maximum clock speed of up to 1.5GHz.

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```
root@ebyte:~# cat /proc/cpuinfo
processor       : 0
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid
asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x2
CPU part        : 0xd05
CPU revision    : 0

processor       : 1
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid
asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x2
CPU part        : 0xd05
CPU revision    : 0

processor       : 2
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid
asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x2
CPU part        : 0xd05
CPU revision    : 0

processor       : 3
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid
asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x2
CPU part        : 0xd05
CPU revision    : 0
```

processor: The number of the logical processing core in the system. For a multi-core processor, it can be a physical core or a virtualized logical core using hyperthreading technology.

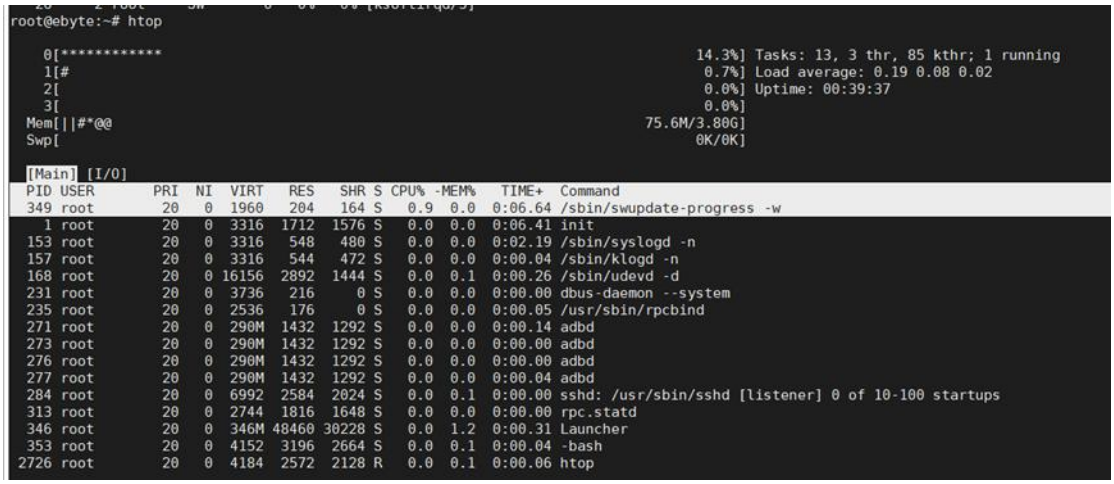
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model name: the name and number of the CPU

BogoMIPS : A rough estimate of the number of instructions executed by the CPU per second when the system kernel is booted (MillionInstructions Per Second)

3.1.1.2. Check CPU usage



3.1.1.3. View CPU temperature information

Check the internal temperature of the CPU via cat /sys/class/thermal/thermal_zone0/temp .

```
#cat /sys/class/thermal/thermal_zone0/temp
39061
```

The above value divided by 1000 is the correct temperature value in degrees Celsius.

3.1.2. Memory

3.1.2.1. View memory information

You can view memory information through cat /proc/meminfo .

```
root@ebyte:~# cat /proc/meminfo
MemTotal:        3988940 kB
MemFree:         3843356 kB
MemAvailable:    3865152 kB
Buffers:            2928 kB
Cached:            55312 kB
SwapCached:            0 kB
Active:            13084 kB
```

MemTotal : Total memory . The value shown here is 449616 kB, which means that the system has a total of about 449 MB of physical memory available.

MemFree : The amount of free memory. The value displayed here is 370472 kB, which

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means that there are about 370 MB of free memory in the current system and it is not being used.

MemAvailable : The amount of available memory. The value shown here is 407640 kB, which represents the total amount of memory currently available to the system, including cached memory and available memory.

Buffers: Buffer usage. The value shown here is 0 kB, which means that the system is not currently using any memory as a buffer.

Cached: The amount of cached memory. The value shown here is 39208 kB, which indicates the amount of memory currently used by the system for caching.

SwapCached : The amount of memory that is swap cached. The value shown here is 0 kB, indicating that there is currently no memory cached in the swap space.

Active: The amount of active memory. The value shown here is 13408 kB, which indicates the amount of memory currently in use.

3.1.2.2. Memory stress test

By specifying the size and number of test memory, the system's existing memory can be stress tested. You can use the system tool memtester to test, such as specifying a memory size of 10MB , a test number of 1, and a test command of " memtester 1 0M 10".

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```
#memtester 10M 1
memtester version 4.3.0 (32-bit)
Copyright (C) 2001-2012 Charles Cazabon.
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pagesize is 4096
pagesizemask is 0xfffff000
want 10MB (10485760 bytes)
got  10MB (10485760 bytes), trying mlock ...locked.
Loop 1/1:
  Stuck Address       : ok
  Random Value        : ok
  Compare XOR         : ok
  Compare SUB         : ok
  Compare MUL         : ok
  Compare DIV         : ok
  Compare OR          : ok
  Compare AND         : ok
  Sequential Increment: ok
  Solid Bits          : ok
  Block Sequential    : ok
  Checkerboard        : ok
  Bit Spread          : ok
  Bit Flip            : ok
  Walking Ones        : ok
  Walking Zeroes      : ok
  8-bit Writes        : ok
  16-bit Writes       : ok

Done.
```

3.1.3. eMMC Test

View eMMC capacity

The eMMC partition information and capacity can be queried through the fdisk -l command.

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```
root@ebyte:~# fdisk -l
Found valid GPT with protective MBR; using GPT

Disk /dev/mmcblk0: 60620800 sectors,    928M
Logical sector size: 512
Disk identifier (GUID): ab6f3888-569a-4926-9668-80941dcb40bc
Partition table holds up to 6 entries
First usable sector is 73728, last usable sector is 60620766

Number    Start (sector)       End (sector)    Size Name
       1             73728             139263 32.0M boot-resource
       2            139264             172031 16.0M env
       3            172032             368639 96.0M boot
       4            368640             401407 16.0M private
       5            401408            2498559 1024M rootfs
       6           2498560           60620766 27.7G UDISK
```

View emmc partition

The df command can be used to query eMMC partition information, usage, mount directory and other information.

```
root@ebyte:~# df -h
Filesystem                Size    Used Avail Use% Mounted on
/dev/root                 991M    297M    679M   31% /
devtmpfs                  1.9G       0    1.9G    0% /dev
tmpfs                     2.0G    244K    2.0G    1% /tmp
tmpfs                     2.0G    292K    2.0G    1% /run
/dev/by-name/UDISK         28G     16K      28G    1% /mnt/UDISK
```

3.1.4. NPU

Some models of the ECB33 are equipped with an NPU independently developed by

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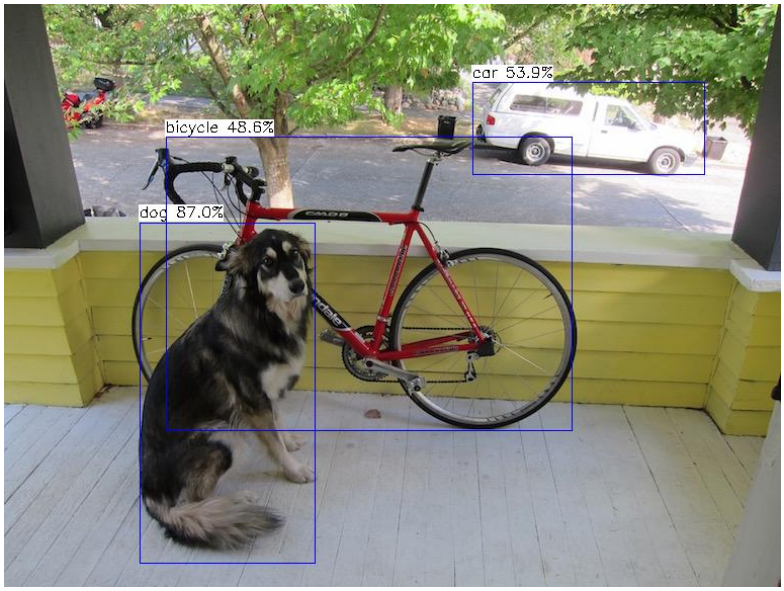
Allwinner, which provides a solution for lightweight edge-side AI computing. This NPU adopts an outstanding VPU (Visual Processing Unit) architecture to provide high-performance computing speed and can meet the requirements of tasks such as image recognition and speech recognition.

Here we run a model demo of npu for object detection and recognition.

```
root@ebyte:/etc/npu/yolov5# pwd
/etc/npu/yolov5
root@ebyte:/etc/npu/yolov5# ./yolov5 model/yolov5.nb input_data/dog.jpg
```

```
  tensor to fp: 95.64 ms.
awnn_run total: 125.69 ms.
yolov5_postprocess.cpp run.
detection num: 3
16:  87%, [ 134,  216,  308,  552], dog
 2:  54%, [ 463,   77,  693,  170], car
 1:  49%, [ 160,  131,  562,  423], bicycle
awnn_destroy total: 8.04 ms.
awnn_uninit total: 8.30 ms.
root@ebyte:/etc/npu/yolov5# ls
input_data  model  result.png  yolov5
```

After the operation is completed, generate a result.png and copy it to the virtual machine for viewing. It can be seen that dog,bicycle and car have been recognized.



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3.1.5. Nand Flash Test

3.1.5.1. Check Nand capacity and size

```
#cat /proc/mtd
dev:        size     erasesize    name
mtd0: 00100000 00040000 "boot0"
mtd1: 00300000 00040000 "uboot"
mtd2: 00100000 00040000 "secure_storage"
mtd3: 0fb00000 00040000 "sys"
```

3.1.6. RTC

The Linux system is divided into system clock (software clock) and RTC clock (hardware clock). The system clock will disappear when the power is off, and the RTC clock will run for a long time if a battery is installed. If you need to use an external RTC clock, please install the ML2032 (3V rechargeable) or CR2032 (3V non-rechargeable) battery into the RTC button battery holder .

Setting the system time

Set the system time to 2 024.07.12 16:35:15

```
# date 071216352024.15
Fri Jul 12 16:35:15 UTC 2024
```

Write system time to R TC

```
# hwclock -w
```

```
# hwclock -r
2000-01-01 07:07:15.965766+0000
```

Keep RTC time when power off

Turn off the evaluation board and disconnect the power supply. After a while, turn it back on. Check the RTC time and system time:

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```
# hwclock -r
2024-07-12 16:52:42.648561+0000
```

3.1.7. Watch Dog

Use the test routine to test the watchdog. The file has been compiled and placed in the tool directory. After copying it to the evaluation board, run the watchdog application , with a timeout of 4s and feed the dog every 1s:

```
# ./watchdog 4 1 0
Starting wdt_driver (timeout: 4, sleep: 1, test: ioctl)
Trying to set timeout value=4 seconds
The actual timeout was set to 4 seconds
Now reading back -- The timeout is 4 seconds
```

If the above 1s is changed to greater than 4s, the required 4s dog feeding time will be exceeded and the evaluation board will restart.

3.1.8. Power Management

This chapter demonstrates the Suspend function of Linux power management, which allows the evaluation board to sleep and be awakened by external events. The Linux kernel generally provides three types of Suspend: Freeze and STR (Suspend to RAM). They can be triggered by writing " freeze " and " mem " to the " /sys/power/state " file in user space .

View currently supported modes

```
# cat /sys/power/state
freeze mem
```

Hibernate to RAM

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```
root@ebyte-ubuntu:~# echo "mem" > /sys/power/state
```

3.2. Peripheral Interface

3.2.1. GPIO

View all GPIOs and list all registered pins.

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```
root@ebyte:~# mount -t debugfs none /sys/kernel/debug
root@ebyte:~# cat /sys/kernel/debug/pinctrl/3604000.pinctrl/pinmux-pins
Pinmux settings per pin
Format: pin (name): mux_owner|gpio_owner (strict) hog?
pin 0 (PA0): UNCLAIMED
pin 1 (PA1): UNCLAIMED
pin 2 (PA2): UNCLAIMED
pin 3 (PA3): UNCLAIMED
pin 4 (PA4): UNCLAIMED
pin 5 (PA5): UNCLAIMED
pin 6 (PA6): UNCLAIMED
pin 7 (PA7): UNCLAIMED
pin 8 (PA8): UNCLAIMED
pin 9 (PA9): GPIO 3604000.pinctrl:9
pin 32 (PB0): device 2602000.uart function uart2 group PB0
pin 33 (PB1): device 2602000.uart function uart2 group PB1
pin 34 (PB2): UNCLAIMED
pin 35 (PB3): UNCLAIMED
pin 36 (PB4): device 2608000.uart function uart8 group PB4
pin 37 (PB5): device 2608000.uart function uart8 group PB5
pin 38 (PB6): UNCLAIMED
pin 39 (PB7): device 4541800.can function can1 group PB7
pin 40 (PB8): device 4541800.can function can1 group PB8
pin 41 (PB9): device 2600000.uart function uart0 group PB9
pin 42 (PB10): device 2600000.uart function uart0 group PB10
******
```

Export GPIO

Here, we take ECB33 as an example. From the schematic diagram, it can be seen that the 13th pin of the connecting pin J16 on the base plate is PB2. From the above pins, it can be

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known that the GPIO sequence number is 34. We export gpio34 via gpiofs as follows.

```
#cd /sys/class/gpio/
#ls
export          gpiochip0    unexport
#echo 34 > export
#ls
export          gpio34          gpiochip0    unexport
```

Set GPIO direction

Input

```
#cd gpio34
#ls
active_low                  edge                        uevent
device                      power                       value
direction                   subsystem                   waiting_for_supplier
#echo in > direction
```

Output

```
#echo out > direction
```

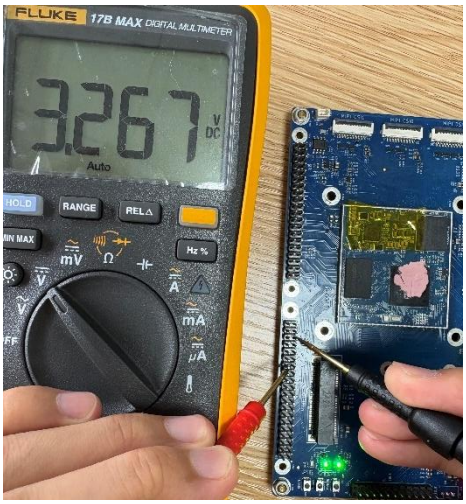
setting the G PIO value to 1, you can use a multimeter to measure and find that the 13st pin of J16 is 3.3V .

The actual measurement error range is ±5 % .

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```
#echo 1 > value
```



Unregister G PIO

```
#echo 34 > unexport
]#ls
export          gpiochip0    unexport
```

3.2.2. LED Light

The Linux system provides an independent subsystem to facilitate the operation of LED devices from user space. This subsystem provides operation interfaces for LED devices in the form of files. These interfaces are located in the /sys/class/ leds directory. In the hardware resource list, we have listed all the LEDs on the evaluation board. Next, we test the LED by reading and writing sysfs commands . The following commands are all general commands and are also general methods for operating LEDs.

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```
root@ebyte:/sys/class/leds# ls
led-Run    led-User
```

LEDs on and off

```
# echo 0 > brightness
# echo 1 > brightness
```



View LED Trigger Mode

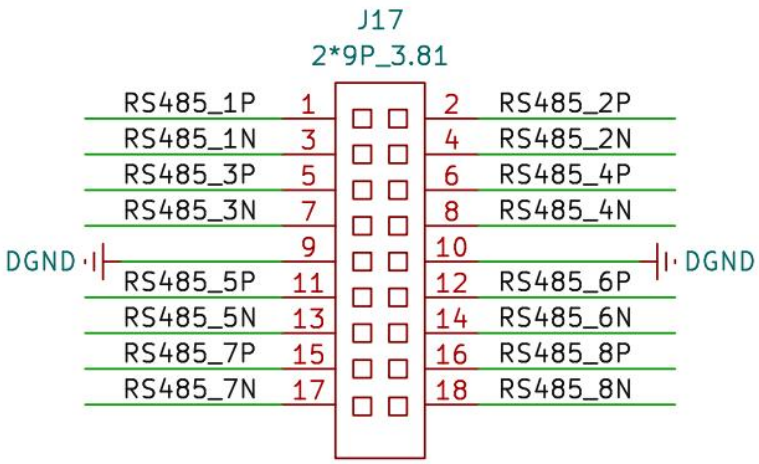
```
root@ebyte-ubuntu:/sys/class/leds/green:heartbeat# cat trigger
[none] rfkill-any rfkill-none kbd-scrolllock kbd-numlock kbd-capslock kbd-kanalock kbd-shiftlock kbd-altgrlock kbd-ctrllock kbd-altlock kbd-shiftllock kbd-shiftrlock kbd-ctrllock kbd-ctrlrlock timer oneshot heartbeat backlight gpio cpu cpu0 default-on transient flash torch mmc0 mmc1
```

3.2.3. Serial Port

The evaluation board leads out eight 485 serial ports for use. The schematic diagram is as follows.

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The device names mapped to linux are shown in the following table respectively.

RS485_1	/dev/ttyAS16
RS485_2	/dev/ttyAS15
RS485_3	/dev/ttyAS2
RS485_4	/dev/ttyAS1
RS485_5	/dev/ttyAS4
RS485_6	/dev/ttyAS9
RS485_7	/dev/ttyAS11
RS485_8	/dev/ttyAS12

Here we test RS485_1. First, we connect a USB RS485 automatic transceiver to the PC. A+ connects to RS485_1P, and B- connects to RS485_1N.

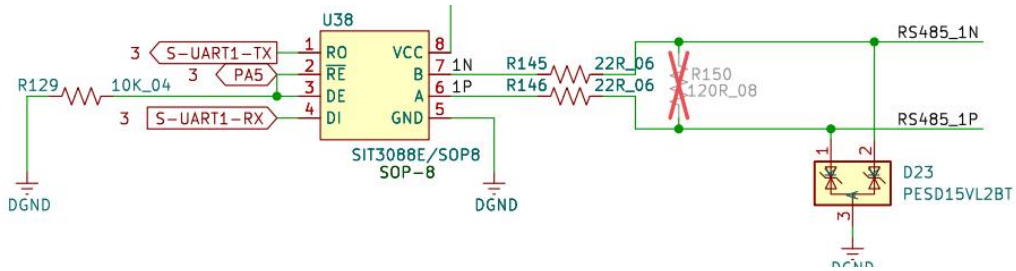


Receive messages

It can be seen that the direction enable pin corresponding to the 485 controller RS485_1P in the schematic diagram is PA5, and it is pulled down. By default, it is for receiving information.

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Use minicom -s to enter the serial port configuration seria port setup. Press A to enter the serial port device /dev/ttyAS16, press F to turn off the hardware flow control, and press Enter to confirm. Finally, press esc to select exit to enter the serial port transceiver interface.

minicom -s

Press A to set the serial port number, and press Enter to end

Press F to set and turn off the hardware flow control. Press Enter to end

Select "exit" to enter the communication interface.

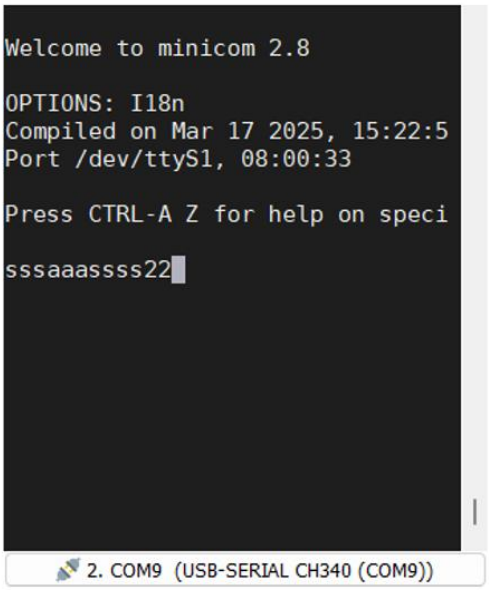
```
A -    Serial Device      : /dev/ttyAS16
B - Lockfile Location     : /var/lock
C -   Callin Program      :
D -  Callout Program      :
E -    Bps/Par/Bits       : 115200 8N1
F - Hardware Flow Control : No
G - Software Flow Control : No
H -     RS485 Enable      : No
I -   RS485 Rts On Send   : No
J -  RS485 Rts After Send : No
K -  RS485 Rx During Tx   : No
L -  RS485 Terminate Bus  : No
M - RS485 Delay Rts Before: 0
N - RS485 Delay Rts After : 0

   Change which setting?
```

Use a PC to open our USB to RS485 serial port, send information, and our evaluation board can receive the information.

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Send message

We press ctrl + A, then press X to exit minicom, and the above direction enables the PA5 pin to be raised.

```
root@ebyte:/# cd /sys/class/gpio/
root@ebyte:/sys/class/gpio# echo 5 > export
root@ebyte:/sys/class/gpio# cd gpio5
root@ebyte:/sys/class/gpio/gpio5# echo out > direction
root@ebyte:/sys/class/gpio/gpio5# echo 1 > value
root@ebyte:/sys/class/gpio/gpio5# cat value
1
```

Then repeat the above operation of opening minicom. We input information on the terminal of the evaluation board and can see that the 485 controller of the PC has received the information

3.2.4. USB

This section verifies the feasibility of the USB Host driver through related commands or hot plugging and USB HUB, and realizes the functions of reading and writing U disk and USB enumeration.

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3.2.4.1. 1. Insert the USB drive

According to the silk-screen printing, the type-a below is USB. Insert the USB flash drive into the opening below.

Mount /dev/sda to /mnt/usb, and then use df-h to find the storage device.

```
root@ebyte:/# mkdir /mnt/usb/ -p
root@ebyte:/# mount /dev/sda1 /mnt/usb/
[   322.468359] FAT-fs (sda1): Volume was not properly unmounted. Some data may be corrupt.
Please run fsck.
root@ebyte:/# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/root                 991M  297M  679M  31% /
devtmpfs                  973M     0  973M   0% /dev
tmpfs                     976M  176K  976M   1% /tmp
tmpfs                     976M  312K  976M   1% /run
/dev/by-name/UDISK         14G  248M   14G   2% /mnt/UDISK
/dev/sda1                  29G  4.8G   24G  17% /mnt/usb
```

3.2.4.2. U disk mount read and write

After testing, it can read and write files normally.

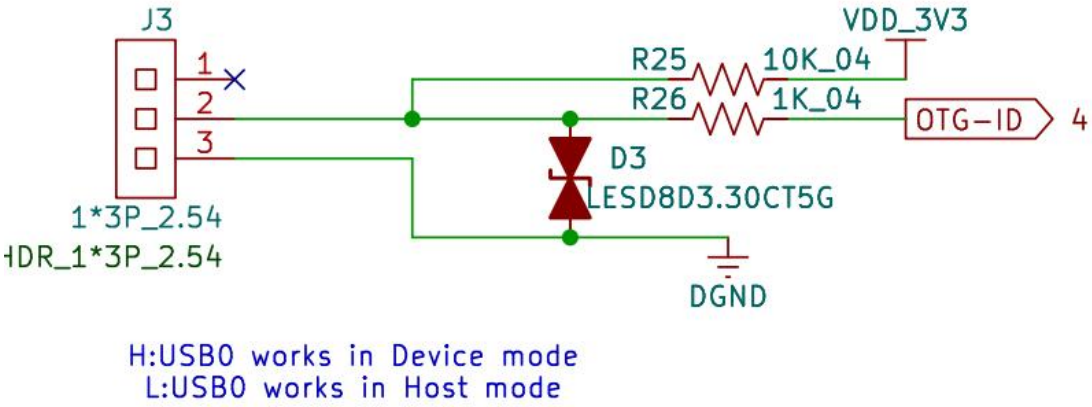
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```
root@ebyte:/# dd if=/dev/random of=/mnt/usb/testfile count=1 bs=500M
1+0 records in
1+0 records out
524288000 bytes (524 MB, 500 MiB) copied, 17.2115 s, 30.5 MB/s
root@ebyte:/# echo 3 > /proc/sys/vm/drop_caches
[    563.506938] bash (353): drop_caches: 3
root@ebyte:/# dd if=/mnt/usb/testfile of=/dev/null count=10 bs=50M
10+0 records in
10+0 records out
524288000 bytes (524 MB, 500 MiB) copied, 30.0336 s, 17.5 MB/s
```

3.2.5. OTG

3.2.5.1. USB HOST mode test



Short the jumper at pins 2 and 3, and then insert the USB flash drive into the otg port

Execute the following command to view that the current mode is HOST.

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```
#cat /sys/bus/platform/drivers/otg\ manager/soc\@3000000\:usbc0\@0/otg_role
usb_host
```

3.2.5.2. USB DEVICE mode test

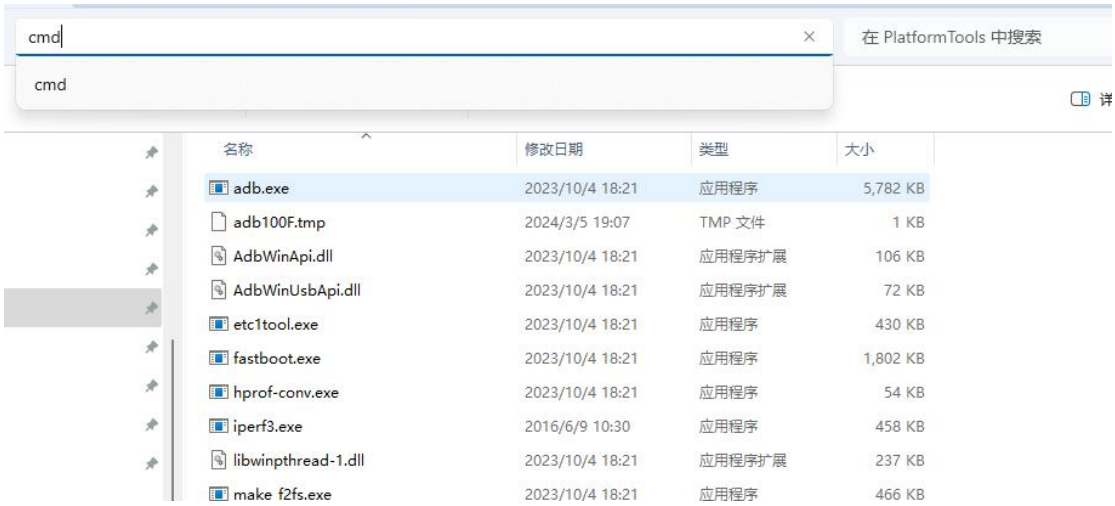
Short-circuit pins 1 and 2 of the jumper and set it to device mode. When the system is powered on and started, the default configuration of the OTG interface is DEVICE mode.

```
#cat /sys/bus/platform/drivers/otg\ manager/soc\@3000000\:usbc0\@0/otg_role
usb_device
```

After connecting to the PC using type-A to typa-A, log in to the evaluation board using the adb tool.

Before logging in, turn off the burning tool phoneix suit first. Open the "PlatformTools" folder under the "tools" directory, then type "cmd" at the top and press Enter.

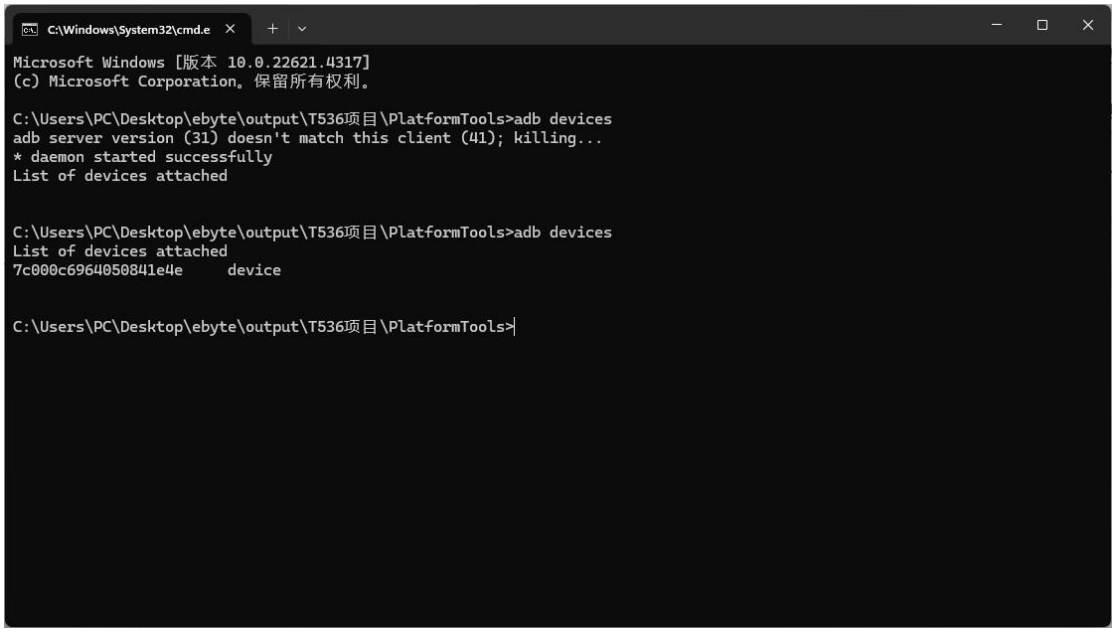
```
#mv /etc/init.d/S50adb_start /root/
```



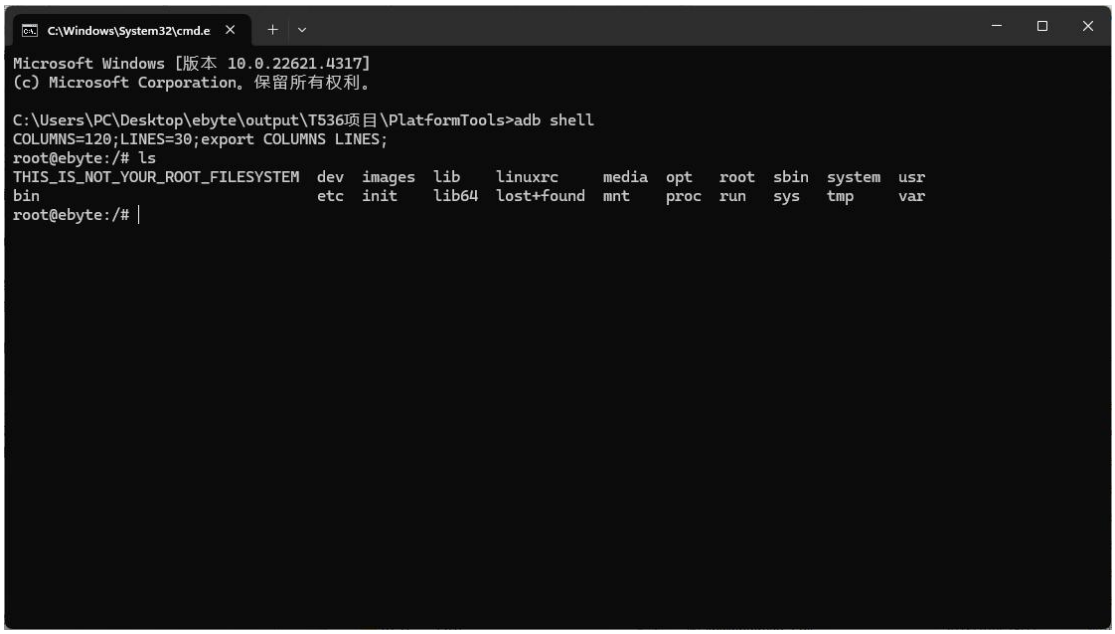
Enter "adb devices" in the terminal to view the listed devices

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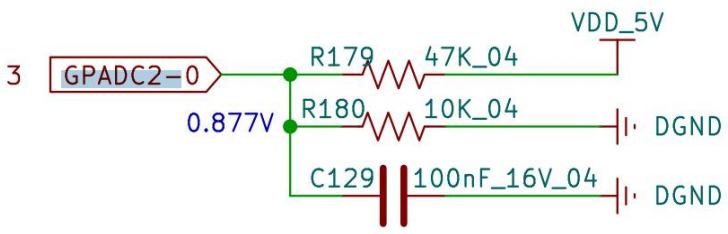


Log in to the evaluation board again using the adb shell



3.2.6. GPADC

GPADC is an analog-to-digital conversion module with 12-bit sampling accuracy. We tested channel 0 of gpadc2. Here, 5V has been divided, and the measured value of gpadc2 should be 0.877. Let's use the software to measure and read the values.



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```
root@ebyte:~# cd /sys/class/gpadc/gpadc_chip2
root@ebyte:/sys/class/gpadc/gpadc_chip2# echo 0 > data
root@ebyte:/sys/class/gpadc/gpadc_chip2# cat data
gpadc2-channel0 voltage data is 877
```

After actual reading, the voltage of GPADC2 channel 0 is indeed 877mA.

3.2.7. LocalBus

The ECB33 provides one 16-bit LocalBus interface. The lbc offers test and configuration nodes. The paths where the nodes are located are as follows:

```
/sys/devices/platform/soc@3000000/2810000.lbc-controller/lbc/lbc
```

clk_freq: View/set the current lbc frequency

transfer_mode: View/Set the transfer mode:

0: Direct access mode

Interrupt mode

2. : DMA mode

transfer_width: View/Set the transfer width

0:8 bit width

1:16-bit bit width

2:32-bit bit width

message: View the current lbc information

```
cd /sys/devices/platform/soc\@3000000/2810000.lbc-controller/lbc/lbc/
echo 10000000 > clk_freq
echo 2 > transfer_mode
echo 0 > transfer_width
echo 7 > burst_mode
lbc_dma_memtester
```

Here we use 10M, DMA mode, with a bit width of 8 bits, and set to address increment mode. The signal lines are connected to the FPGA for testing.

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```
lbc_dma_memtester s/platform/soc@3000000/2810000.lbc-controller/lbc/lbc]#
local dma loop 0 :  ok
local dma loop 1 :  ok
local dma loop 2 :  ok
local dma loop 3 :  ok
local dma loop 4 :  ok
local dma loop 5 :  ok
local dma loop 6 :  ok
local dma loop 7 :  ok
local dma loop 8 :  ok
local dma loop 9 :  ok
local dma loop 10 :  ok
local dma loop 11 :  ok
local dma loop 12 :  ok
local dma loop 13 :  ok
local dma loop 14 :  ok
local dma loop 15 :  ok
local dma loop 16 :  ok
```

4. Mini PCIE

The ECB33 has one MiniPCIe socket that supports PCIex1 GEN2. We inserted an SSD for testing.



After insertion, the system automatically recognizes /dev/nvme0n1. All we need to do is create a partition for this disk, then format it, and finally mount it to the directory to be ready for use.

First, open the fdisk tool and select the device to perform the partitioning operation

```
#fdisk /dev/nvme0n1
```

View the existing partitions:

Input "p" to display the existing partition table.

2. Delete the existing partition (if necessary) :

If /dev/nvme0n1p1 already has a partition and you want to delete and recreate it, you can enter d to delete the existing partition.

3. Create a new partition:

Input n to create a new partition. Then select:

Partition type: Generally, primary is selected (which is usually the default option).

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Partition number: Select the partition number (if it is the first partition, usually choose 1).

Starting sector: Press Enter to use the default value (usually the first available sector).

End sector: Press Enter to use the default value, or set the size (for example, +20G to create a 20GB partition).

4. Save and exit:

Enter "w" to save the partition table and exit fdisk.

5. Format the partition, create the mount point and mount it

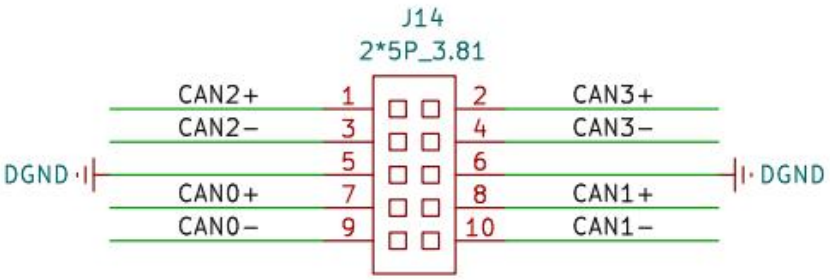
```
# mkfs.ext4 /dev/nvme0n1p1
# mkdir -p /mnt/nvme
# mount /dev/nvme0n1p1 /mnt/nvme
```

Finally, check the partition and you can see that a 117G nvme hard drive is mounted.

```
root@ebyte:/# df -h
Filesystem          Size  Used Avail Use% Mounted on
/dev/root           991M  291M  685M  30% /
devtmpfs            973M     0  973M   0% /dev
tmpfs               976M  248K  976M   1% /tmp
tmpfs               976M  312K  976M   1% /run
/dev/by-name/UDISK   14G  8.0K   14G   1% /mnt/UDISK
/dev/nvme0n1p1      117G   24K  111G   1% /mnt/nvme
```

4.1.1. CAN

The ECB33 has four CAN channels. We CAN use the CAN box to connect to the PC for transmitting and receiving tests, or short-circuit the CAN-H and CAN-L of the two CAN channels respectively for testing. This test uses EBITt's ECAN-U01S to test CAN0. Connect can H to pin 7 of J14 and CAN L to pin 9 of J14.



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We can see can0, can1, can2 and can3 by using ifconfig -a.

```
root@ebyte:/# ifconfig -a
can0      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:56

can1      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:59

can2      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:62

can3      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:65
```

Turn on can0 and set the communication baud rate of can0's can device to 1,000,000, which means the communication baud rate is 1MBit/s.

```
ip link set can0 up type can bitrate 1000000
```

Open the CAN transceiver software ECAN-Tools that comes with ECAN-U01S on the PC, as shown below.

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The evaluation board sends can data:

```
cansend can0 123#01.02.03.04.05.06.07.08
```

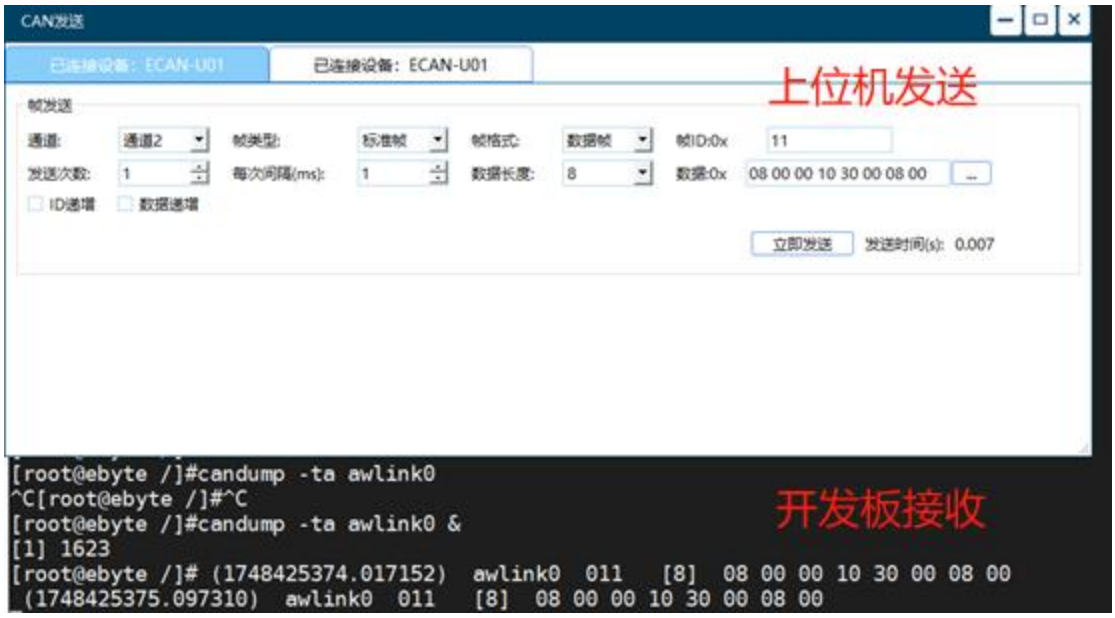


The evaluation board receives can data:

```
candump -ta can0 &
```

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4.1.2. SD Card

32GB Micro SD card from SanDisk to test the performance of the evaluation board's Micro SD interface. Please refer to the document "Linux System Boot Card Production and System Hardening" to make it into a Linux system boot card before testing. Different Micro SD cards and different test methods will cause certain differences in the Micro SD interface test results.

insert the Linux system boot card into the Micro SD card slot of the evaluation board, power on the evaluation board, enter the evaluation board file system and execute the following command to view the Linux system boot card information.

4.1.2.1. Check TF card capacity

The TF card partition information and capacity can be queried through the fdisk -l command:

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```
#fdisk -l
Found valid GPT with protective MBR; using GPT
Disk /dev/mmcblk0: 62333952 sectors, 1764M
Logical sector size: 512
Disk identifier (GUID): ab6f3888-569a-4926-9668-80941dcb40bc
Partition table holds up to 12 entries
First usable sector is 73728, last usable sector is 62333947
Number  Start (sector)    End (sector)  Size Name
     1           73728          108165 16.8M boot-resource
     2          108166          110213 1024K env
     3          110214          112261 1024K env-redund
     4          112262          147461 17.1M boot
     5          147462         2244613 1024M rootfs
     6         2244614         2246661 1024K dsp0
     7         2246662         2248709 1024K riscv0
     8         2248710         2281477 16.0M private
     9         2281478        62331903 28.6G UDISK
```

4.1.2.2. TF card performance test

The performance test mainly tests the reading and writing speed of eMMC files under the Linux system, and is generally tested by combining the time and dd commands . Mount the TF card partition to be tested. Here, the last partition /dev/mmcblk0p 9 is taken as an example, and the mounting directory is /run / meida /mmcblk0p9 .

Run the following commands to create a directory and mount the partition.

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```
mkdir -p /run/media/mmcblk0p9
mount /dev/mmcblk0p9 /run/media/mmcblk0p9
```

Micro SD interface write speed test

Enter the evaluation board system and execute the following command to test the Micro SD interface write speed

```
echo 3 > /proc/sys/vm/drop_caches
time dd if=/dev/zero of=/run/media/mmcblk0p9/test bs=1024K count=100 conv=fsync


100+0 records in
100+0 records out


real    0m6.473s
user    0m0.000s
sys     0m1.633s
```

The time command is used for timing, dd is used for copying, reading from the if (input file) file and writing to the file specified by of (output file), bs is the size of each write block, and count is the number of read and write blocks.

"if=/dev/zero" does not generate IO, that is, it continuously outputs data and can be used to test the pure write speed.

Here, a total of 100MByte of test data is written to the test file of the Linux system boot card . It can be seen that the write speed of the Micro SD interface in this test is approximately: 100MByte / 6.47 s ≈ 15.45 MB/s.

Micro SD interface read speed test

Execute the following command to test the Micro SD interface read speed .

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```
echo 3 > /proc/sys/vm/drop_caches
time dd if=/run/media/mmcblk0p9/test of=/dev/null bs=1024K count=100
```

"of=/dev/null" does not generate IO, that is, it continuously receives data and can be used to test the pure read speed .

interface reading speed of this test can be seen.

The speed is approximately: 100MByte / 4.4 7 s ≈ 22.40MB/s.

After the test is completed, execute the following command to unmount the mounted partition.

```
umount /run/media/mmcblk0p9/
rm -r /run/media/mmcblk0p9
```

4.1.3. show

This module consists of a display engine (DE) and various types of controllers (tcon). After the input layers (layers) undergo display-related processing in the DE, they are output to the display device for display through one or more interfaces, so as to achieve the effect of combining the layers rendered by numerous applications and presenting them to users on the monitor for viewing. DE has two independent units (which can be abbreviated as de0 and de1), which can respectively accept the layers input by the user for synthesis and output to different displays to achieve dual display. Each independent unit of DE has 1 to 4 channels (typically, de0 has 4 and de1 has 2), and each channel can simultaneously process and receive 4 layers of the same format. The sunxi platform is divided into video channels and UI channels. The video channel is powerful and can support YUV format and RGB layers. The UI channel only supports RGB layers.

4.1.3.1. 5.5 -inch MIPI display

Please connect the 5.5-inch MIPI display screen (model: EBITt ECA11-5P5LCDMIPI1019CT-C, resolution: 1080x1920) correctly to the DSI (display) interface of the evaluation board.

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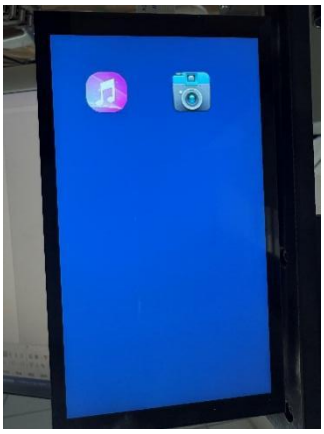


Please be sure to use the 7-inch MIPI display screen and FFC flexible flat cable provided by our company, and connect the hardware as follows. If third-party accessories are used, the wiring sequence of the evaluation board interface, FFC flexible flat cable and MIPI display screen must be carefully checked; otherwise, the MIPI LCD screen may be burned out.

Please connect the 26-pin FFC flexible flat cable to the MIPI LCD screen to the MIPI LCD interface of the evaluation board.

After the evaluation board is restarted, the startup logo can be observed on the MIPI display.

After entering the system, the QT interface will appear on the screen. Clicking on the two ICONS will respectively display different print information.



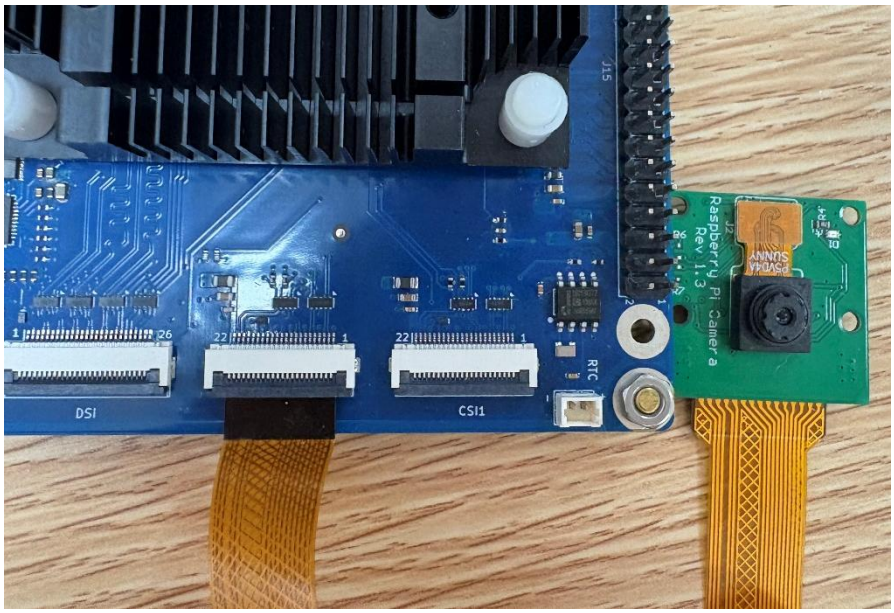
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```
root@ebyte:~# menu:on_camera_home_btn_clicked
sh: line 1: /sys/class/disp/disp/attr/fb2ui: No such file or directory
sh: line 1: /sys/inputFocus/write: No such file or directory
menu:on_camera_home_btn_clicked
sh: line 1: /sys/class/disp/disp/attr/fb2ui: No such file or directory
sh: line 1: /sys/inputFocus/write: No such file or directory
menu:on_media_btn_clicked
sh: line 1: /sys/class/disp/disp/attr/fb2ui: No such file or directory
sh: line 1: /sys/inputFocus/write: No such file or directory
menu:on_media_btn_clicked
sh: line 1: /sys/class/disp/disp/attr/fb2ui: No such file or directory
sh: line 1: /sys/inputFocus/write: No such file or directory
```

4.1.4. Camera

The ECB33 supports the MIPI-CSI interface. Our company takes the Raspberry PI P5V04A camera as an example. The chip used in this camera is ov5647. We used the CSI0 interface to connect the camera for testing.



After entering the system, execute the following command to mount the driver, and then use the official test program to test the image acquisition.

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```
root@ebyte:~# modprobe vin_v4l2
root@ebyte:~# ls /dev/video*
/dev/video0    /dev/video4
root@ebyte:~# ./csi_test_mplane 0 0 1280 720 /root/ 1 60 20
open /dev/video0 fd = 3
resolution got from sensor = 1280*720 num_planes = 3
VIDIOC_STREAMON ok
VIDIOC_STREAMOFF ok
mode 1 test done at the 0 time!!
time cost 2.094031(s)
```

The above command is stored in the directory of 'bsp/drivers/vin/vin_test/mplane_image' and needs to be manually copied to the evaluation board. The meanings of the above command are as follows:

Test the program

2. /dev/video0

3. The index parameter of set_input can be set to 0 by default

4. The configured image width is 1280 here

5. The configured image height is 720 here

6. Storage path of the collected image

7. The format of the collected image, 1 indicates YUV420M. For more formats, please refer to the source code of the path where the command is located.

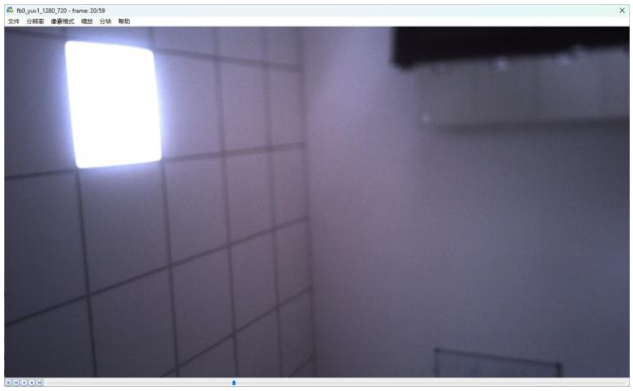
8. The number of frames collected

9. Collected frame rate

After the collection is completed, a bin file will be generated in the corresponding path. Essentially, it is a video image of yuv420m. After directly changing the suffix name to yuv, you can use the included tool yuvplayer.exe to play and view it. Note that the size and color need to be configured to correspond to the image format.

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4.2. Network Interface

4.2.1. Ethernet

Use ifconfig in the net-tools toolkit to manually configure the network. First, view the network device information through the ifconfig command as follows. The ECB33 has two network ports, namely eth0 and eth1. Let's connect eth0 for the test first.

```
eth0      Link encap:Ethernet  HWaddr 66:7D:3B:66:D2:26
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:142

eth1      Link encap:Ethernet  HWaddr 1E:33:99:53:81:CB
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:143 Base address:0x8000
```



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After configuring the Ethernet connection, you can use PING to conduct a simple test on the network connection, such as ping virtual machines in the same network segment for testing.

```
root@ebyte:~# ifconfig eth0 192.168.20.76 up
root@ebyte:~# ifconfig eth1 192.168.20.77 up
root@ebyte:~# ping 192.168.20.66 -I eth0
PING 192.168.20.66 (192.168.20.66): 56 data bytes
64 bytes from 192.168.20.66: seq=0 ttl=64 time=11.756 ms
64 bytes from 192.168.20.66: seq=1 ttl=64 time=2.860 ms
^C
--- 192.168.20.66 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 2.860/7.308/11.756 ms
```

Connect the network cable to eth1

```
root@ebyte:~# ping 192.168.20.66 -I eth1
PING 192.168.20.66 (192.168.20.66): 56 data bytes
64 bytes from 192.168.20.66: seq=0 ttl=64 time=11.756 ms
64 bytes from 192.168.20.66: seq=1 ttl=64 time=2.860 ms
^C
--- 192.168.20.66 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 2.860/7.308/11.756 ms
```

4.2.1.1. Iperf3

iperf3 is a tool for actively measuring the maximum achievable bandwidth on IP networks. It supports adjusting the test time, buffering zone size and protocol (TCP, UDP, SCTP under IPV4 and IPV6). iperf3 can be divided into server mode or client mode according to its role. We can use it to test and view the network bandwidth, TCP window value, retransmission probability, etc. under TCP mode, and we can also test the packet loss rate, delay and jitter under the specified UDP bandwidth.

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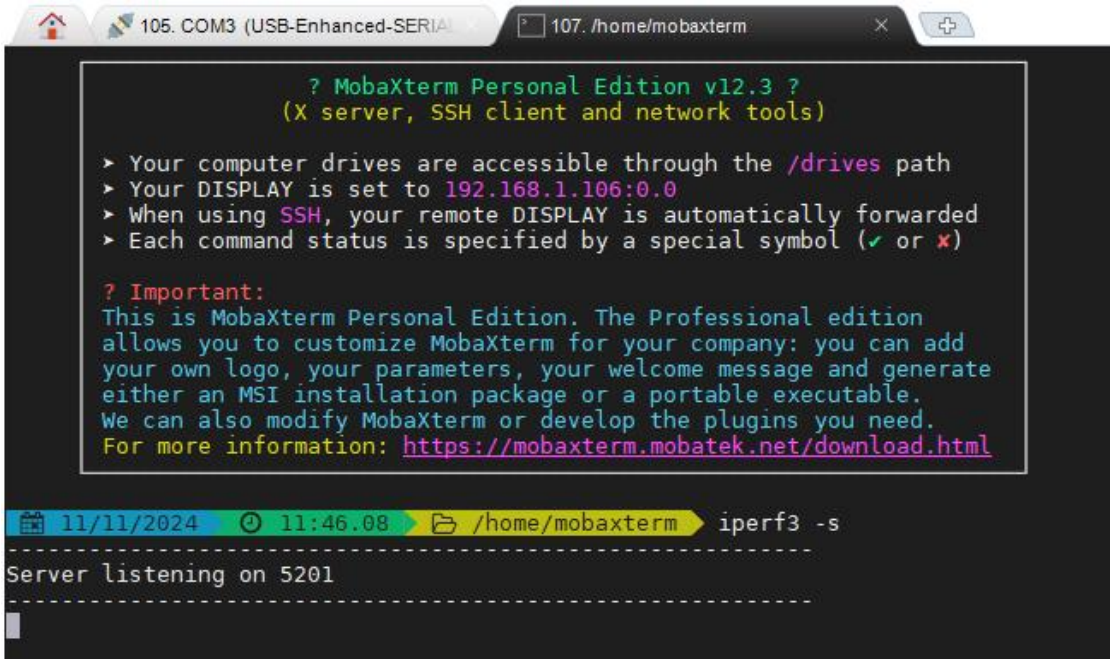
MobaXterm on the development host , use the host with a Gigabit network card as the iperf3 server, and use the tested evaluation board as the client to test the TCP and UDP performance of the evaluation board network card.

the server and evaluation board directly via CAT6 network cable and configure their respective IP addresses. For example, we set the server IP to 192.168.1.106 and the evaluation board IP to 192.168.1.250 , and use the ping command to test to ensure that they are connected.

Note: Try not to connect a router or switch to prevent the test results from being affected by the transmission forwarding of intermediate devices.

Testing TCP Performance

On the server, iperf3 uses the -s parameter to indicate that it works in server mode.



The iperf3 program running on the evaluation board works in client, TCP mode, where the parameters are described as follows:

➢ -c 192.168.0.102: works on the client side, connecting to the server side 192.168.1.106

➢ - i 2: The test result report interval is 2 seconds

➢ -t 10: total test duration is 10 seconds

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```
#iperf3 -c 192.168.1.106 -i 2 -t 10
Connecting to host 192.168.1.106, port 5201
[  5] local 192.168.1.250 port 58936 connected to 192.168.1.106 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-2.00   sec   215 MBytes   900 Mbits/sec    0    754 KBytes
[  5]   2.00-4.00   sec   216 MBytes   906 Mbits/sec    0    754 KBytes
[  5]   4.00-6.00   sec   202 MBytes   851 Mbits/sec    0    847 KBytes
[  5]   6.00-8.00   sec   198 MBytes   828 Mbits/sec    0    936 KBytes
[  5]   8.00-10.00  sec   216 MBytes   907 Mbits/sec    0    936 KBytes
- - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  1.02 GBytes   878 Mbits/sec    0             sender
[  5]   0.00-10.00  sec  1.02 GBytes   876 Mbits/sec                  receiver

iperf Done.
```

seconds, the client ends the test and displays the above test results, indicating that the TCP bandwidth is 900 Mbits or so.

Testing UDP performance

Continue to run iperf3 on the server and use the -s parameter to indicate that it works in server mode.

On the device, iperf3 works in client mode, UDP mode, and the parameters are as follows:

➢ -u : Work in UDP mode

➢ -c 192.168.1.106: works on the client side, connecting to the server side 192.168.0.106

➢ - i 2: The test result report interval is 2 seconds

➢ -t 10: total test duration is 10 seconds

➢ -b 100M: Set the UDP transmission bandwidth to 100Mbps.

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```
#iperf3 -c 192.168.1.106 -u -i 2 -t 10 -b 100M
Connecting to host 192.168.1.106, port 5201
[  5] local 192.168.1.250 port 58311 connected to 192.168.1.106 port 5201
[ ID] Interval           Transfer     Bitrate         Total Datagrams
[  5]   0.00-2.00   sec  1.50 MBytes  6.28 Mbits/sec  1085
[  5]   2.00-4.00   sec  80.6 KBytes   330 Kbits/sec  57
[  5]   4.00-6.00   sec   322 KBytes  1.32 Mbits/sec  228
[  5]   6.00-8.00   sec   161 KBytes   660 Kbits/sec  114
[  5]   8.00-10.00  sec   242 KBytes   990 Kbits/sec  171
- - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec  2.29 MBytes  1.92 Mbits/sec  0.000 ms  0/1655 (0%)  sender
[  5]   0.00-10.00  sec  2.29 MBytes  1.92 Mbits/sec  0.099 ms  0/1655 (0%)  receiver
```

after 10 seconds on the client and the above test result is displayed, indicating that UDP has no packet loss when the specified bandwidth is 100Mbps.

4.2.1.2. Access the external net

After connecting the network cable, you can manually configure the DNS and gateway to access the external network. Or you can automatically configure the network through DHCP to access the external network.

The network segment assigned by our router is 1 92.168.20.* , so we manually configure the network as follows.

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```
#ifconfig eth0 192.168.20.7 up

#echo "nameserver 114.114.114.114" > /etc/resolv.conf #Add dns

#ip route add default via 192.168.20.1 #Add gateway
```

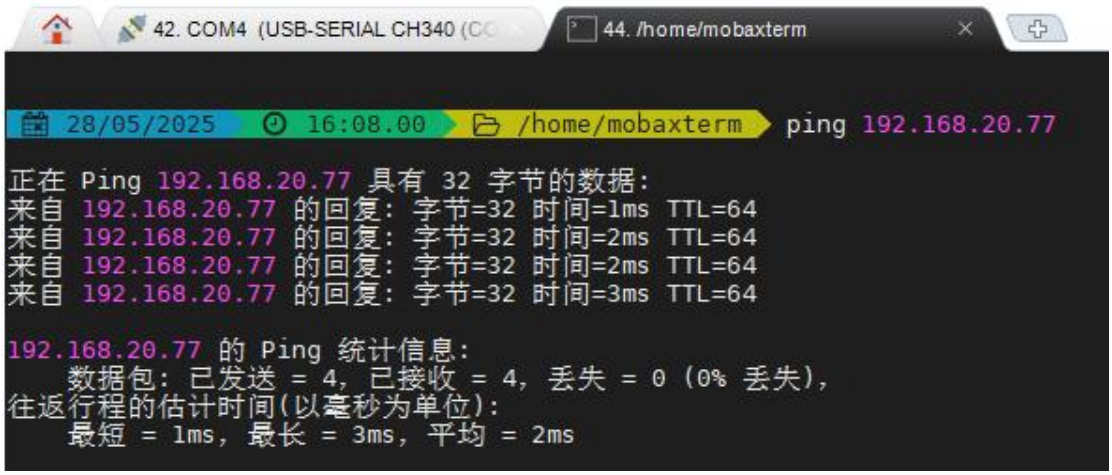
The only command needed to automatically configure the network is the udhcpc command.

```
# udhcpc
```

4.2.1.3. Log in to the evaluation board via SSH

You can log in to the evaluation board via SSH, provided that the machine you need to log in to and the evaluation board are in the same network segment and can PING each other. You can use the SSH service provided by mobaExterm or the built-in SSH of the cmd command line. mobaExterm is more convenient for file transfer. Let's take mobaExterm as an example.

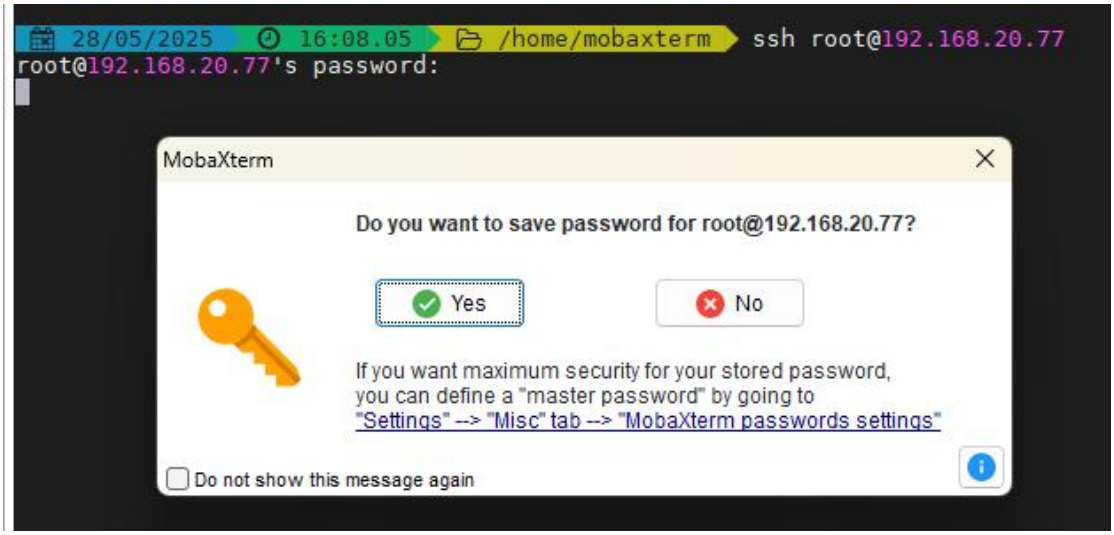
First, ensure that the host can ping the evaluation board. 192.168.20.77 is the IP address set by the evaluation board.

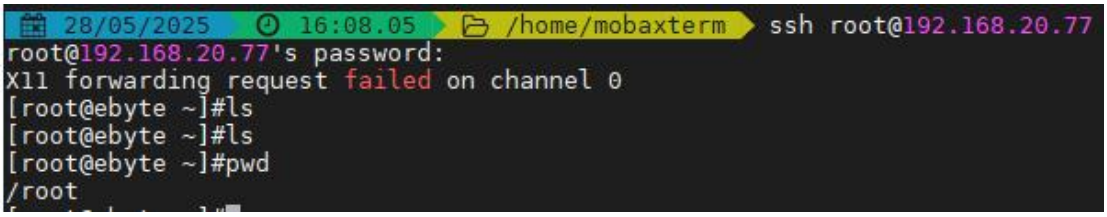


For SSH login, the default username and password for the evaluation board are both root.

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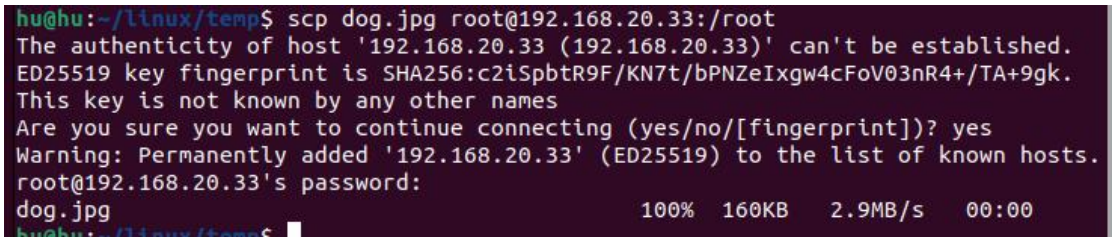
If you need to transfer files, simply drag the files you want to transfer to the sftp service bar on the left.

4.2.1.4. SCP transfer file

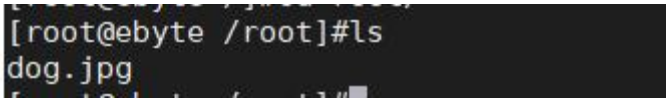
If you want to transfer files between the virtual machine and the evaluation version, simply use scp to copy the files.

The prerequisite is that both the virtual machine and the evaluation board have enabled ssh services and can ping each other.

The virtual machine copies files to the evaluation board



The file can be seen in the root directory of the evaluation board



If you need to copy the folder, just add the -r parameter after "scp", for example:

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```
#scp -r test-dir root@192.168.20.33:/root
```

The evaluation board copies files to the virtual machine

```
[root@ebyte /root]#echo helloworld > a.file
[root@ebyte /root]#scp a.file hu@192.168.20.140:/home/hu/linux/temp
The authenticity of host '192.168.20.140 (192.168.20.140)' can't be established.
ECDSA key fingerprint is SHA256:FcbovPE9fo9FD1LVzqRHVpNAtfDeLaSK/a6NmQwyIOQ.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.20.140' (ECDSA) to the list of known hosts.
hu@192.168.20.140's password:
```

Files can be seen in the corresponding directory of the virtual machine

```
hu@hu:~/linux/temp$ ls a.file
a.file
```

4.2.1.5. NFS Shared Directory

If you want the evaluation version to directly access the directory of the virtual machine, you can use the NFS shared directory. This makes it more convenient for the evaluation version to use large files or for development.

First, the NFS server of the virtual machine needs to be set up. After installing the NFS service, configure the folder location and finally restart the NFS service.

```
#sudo apt-get install nfs-kernel-server rpcbind
#sudo vi /etc/exports     #文件最后一行添加配置内容


/home/hu/linux/nfs *(rw,sync,no_root_squash)
```

Finally, restart the NFS service.

```
#sudo /etc/init.d/nfs-kernel-server restart
```

It is necessary to ensure that the evaluation version can ping the virtual machine successfully. Then create a directory to mount the NFS server.

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```
#mkdir /mnt/nfs

#mount -t nfs 192.168.20.140:/home/hu/linux/nfs /mnt/nfs
```



4.3. Audio Interface

Prepare a headphone jack, connect the left and right channels to LINEOUTLP and LINEOUTLN respectively, and then connect a GND.

Prepare a pair of headphones and connect the headphone plug.

PLAY

```
# aplay /etc/44100.wav
```

5. References

- Linux kernel open source community:

https://www.kernel.org/

- Allwinner S DK Module Development Guide

6. Revision Notes

Revision Notes Table

Version	Modifications	Modification time	prepared by	Proofreading	Approval
V1.0	First Draft	25-06-25	HSL	WYQ	WFX

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