用户手册

A603 Carrier Board

安全警示及使用注意事项 Notice

请在使用本产品前仔细阅读本手册，未经授权的操作会导致错误或意外。制造商对因错误操作而导致设备出现的任何问题均不负责。

Please read manual carefully before install, operate, or transport Leetop device.

- 在给设备供电之前，确保使用正确的电源范围。

  Ensure that the correct power range is being used before powering the device.

- 避免热插拔设备接口。 Avoid hot plugging.

- 要正确关闭电源，请先关闭Ubuntu系统，然后再切断电源。由于Ubuntu系统的特殊性，在Nvidia的开发套件上，如启动未完成的时候强行断电，会有0.03%的概率出现异常，进而导致设备无法启动。

  To properly turn off the power, please shut down the Ubuntu system first, and then cut off the power. Due to the particularity of the Ubuntu system, on the Nvidia developer kit, if the power is turned off when the startup is not completed, there will be a 0.03% probability of abnormality, which will cause the device to fail to start. Due to the use of the Ubuntu system, the same problem also exists on the device.

- 请勿使用本手册提及以外的线缆。

  Do not use cables or connectors other than described in this manual.

- 避免在强磁场环境下使用本设备。

  Do not use device near strong magnetic fields.

- 长期不使用及运输前需要对数据进行备份。

  Backup your data before transportation or device is idle.

- 推荐使用原包装进行运输。

  Recommend to transport device in its original packaging.

- 警告！ 此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对干扰采取切实可行的措施。

ESD Warning

Electronic components and circuits are sensitive to ElectroStatic Discharge (ESD). When handling any circuit board assemblies including Leetop Tech COM Express carrier assemblies, it is recommended that ESD safety precautions be observed. ESD safe best practices include, but are not limited to: Leaving circuit boards in their antistatic packaging until they are ready to be installed. • Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static, charge that may be present on you. • Only handling circuit boards in ESD safe areas, which may include ESD floor and table mats, wrist strap stations and ESD safe lab coats. • Avoiding handling circuit boards in carpeted areas. • Try to handle the board by the edges, avoiding contact with components.

载板规格 Carrier Board specifications

Feature	A603 Carrier for NVIDIA Jetson Orin NX/Orin Nano
Module Compatibility	NVIDIA Jetson Orin NX/Orin Nano
PCB Size / Overall Size	87mm x 52mm
Display	1x HDMI
Ethernet	1x Gigabit Ethernet (10/100/1000)
USB	2x USB 3.0 Type A (Integrated USB 2.0) 1x USB 3.0 0.5mm pitch 20P ZIF 1x USB 2.0 Micro-AB
M.2 KEY M	M.2 KEY M (NVMe SSD) (2242)
Serial	1x CAN
Camera	1x CSI CAMERA
M.2 KEY E PCIE	1x PCIE 2230 SIZE
I2S	1x I2S(3.3V Level)
Misc.	2x I2C Link (+3.3V I/O) 6x GPIO 1x UART 2x SPI
Power Requirements	+9V to +20V DC Input @ 7A
Operating Temperature	-25℃ to +65°

接口位置 Interface Location

W8

W7

W9

W10

W11

W6

W5

W4

W1

W2

W3

W12

W13

W14
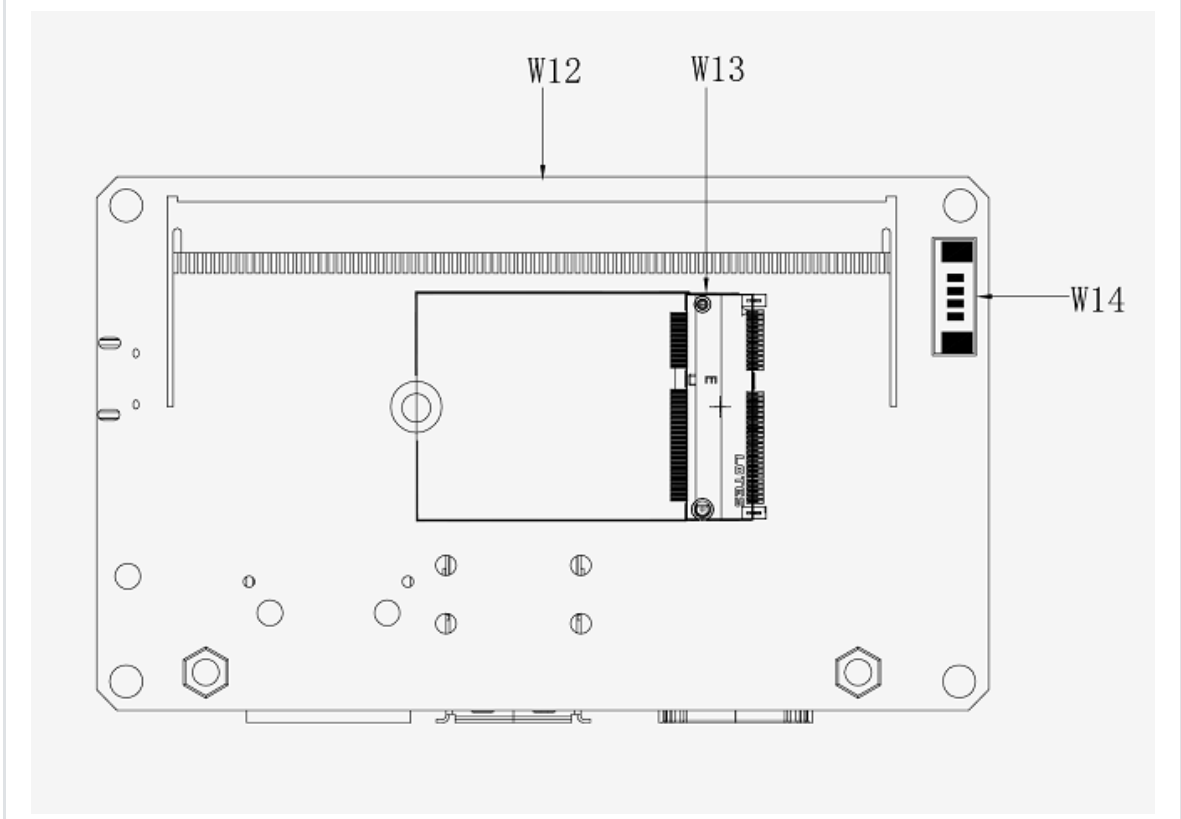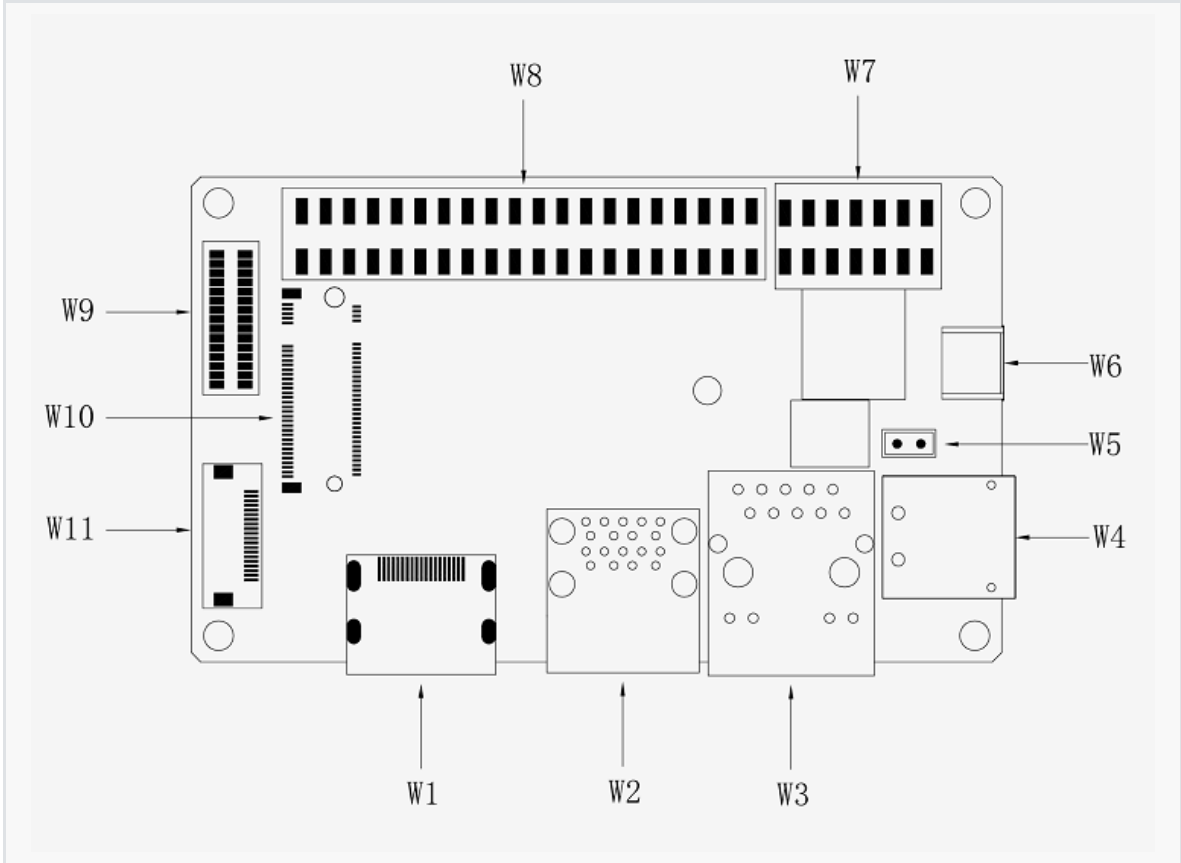
A603 V2.0 Carrier Board

对外接口 External Interface

Designator	Connector	Description
W1	HDMI Port	HDMI Right Angle Vertical Connector
W2	USB 3.0 Type A	USB 3.0 Link 1 Type A Connector
W3	NVIDIA Gigabit Ethernet	RJ45 Gigabit Ethernet Connector (10/100/1000)
W4	DC Power	DC Input Power TE Connector
W5	3V LITHIUM BATTERY	3V Lithium Battery Connector
W6	USB 2.0	USB 2.0 Link 0 Micro-AB Connector
W7	Multifunctional port 2.54 PITCH 14 PIN	2.54 PITCH 14 PIN
W8	Multifunctional port	2.54 PITCH 40 PIN
W9	CSI CAMERA0 CONNECT	15 pins CSI Camera connect
W10	M.2 KEY M Disk	Disk size 2242
W11	USB 3.0 ZIF connect	0.5 PITCH 20 PIN
W12	NVIDIA Jetson Orin Nono NX	Nano/NX 260 PIN Connector
W13	M.2 KEY E	PCIE 2230 SIZE
W14	FAN CONNECT	PicoBlade Header

接口详述 Interface details

HDMI (W1)

Pin	Signal Name	Pin	Signal Name
1	TMDS Data2+	2	TMDS Data2 GND
3	TMDS Data2-	4	TMDS Data1+
5	TMDS Data1 GND	6	TMDS Data1-
7	TMDS Data0+	8	TMDS Data0 GND
9	TMDS Data0-	10	TMDS Clock+
11	TMDS Clock GND	12	DS Clock-
13	CEC	14	NC
15	DDC clock	16	DDC data
17	DDC GND	18	+5V
19	Hot Plug Detect	20	

双层USB3.0 （W2）

Pin	Signal Name	Pin	Signal Name
1	VBUS	2	USB 2.0 D-
3	USB 2.0 D+	4	GND
5	SSRX-	6	SSRX+
7	GND	8	SSTX-
9	SSTX+	10	VBUS
11	USB 2.0 D-	12	USB 2.0 D+
13	GND	14	SSRX-
15	SSRX+	16	GND
17	SSTX-	18	SSTX+

网口 (W3)

Pin	Signal Name	Pin	Signal Name
1	TP0+	2	TP0-
3	TP1+	4	TP2+
5	TP2-	6	TP1-
7	TP3+	8	TP3-

DC电源接口 (W4)

Pin	Signal Name	Pin	Signal Name
1	电源正极	2.3.4	GND

注：电源输入范围：直流+9V—+20V（3A）

电源LED (LED) 插入电源正常开机后，电源LED灯亮

后备电池 (W5)

PIN	Signal Name	PIN	Signal Name
1	B+	2	GND

micro-USB (W6)

PIN	Signal Name	PIN	Signal Name
1	VBUS	2	USB 2.0 D-
3	USB 2.0 D+	4	USB ID
5	GND		

14PIN多功能接口（W7）

PIN	Signal Name	PIN#	Ball Name	PIN	Signal Name	PIN#	Ball Name
1	SYS_RST	239	SYS_RESET_IN	2	GND		
3	RECOVERY	214	FORCE_RECOVERY	4	GND		
5	PWR_BTN_	240	BUTTON_PWR_ON	6	GND		
7	LATCH_SET_BUT			8	LATCH_SET		
9	UART2_TXD_LS	236	UART1_TXD	10	UART2_RXD_LS	238	UART1_RXD
11	CAN_L			12	GND		
13	CAN_H			14	GND		

注："RESET"和"RECOVERY"按键 短路PIN 7和PIN 8脚关闭上电自动开机功能。

40PIN多功能接口 (W8)

PIN	Signal Name	PIN#	Ball Name	PIN	Signal Name	PIN#	Ball Name
1	VDD_3V3_SYS			2	5V		
3	I2C1_SDA	191	GEN2_I2C_SDA	4	5V		
5	I2C1_SCL	189	GEN2_I2C_SCL	6	GND		
7	GPIO9_(3.3V_LEVEL)	211	AUD_MCLK	8	UART1_TXD_3.3V	203	UART2_TXD
9	GND			10	UART1_RXD_3.3V	205	UART2_RXD
11	UART1_RTS_3.3V	207	UART2_RTS	12	I2S0_SCLK_3.3V	199	DAP4_SCLK
13	SPI1_SCLK_3.3V	106	SPI2_SCK	14	GND		
15	GPIO12_(3.3V_LEVEL)	218	LCD_TE	16	SPI1_CS1_3.3V	112	SPI2_CS1
17	VDD_3V3_SYS			18	SPI1_CS0_3.3V	110	SPI2_CS0
19	SPI0_MOSI_3.3V	89	SPI1_MOSI	20	GND		
21	SPI0_MISO_3.3V	93	SPI1_MISO	22	SPI1_MISO_3.3V	108	SPI2_MISO
23	SPI0_SCK_3.3V	91	SPI1_SCK	24	SPI0_CS0_3.3V	95	SPI1_CS0
25	GND			26	SPI0_CS1_3.3V	97	SPI1_CS1
27	ID_I2C_SDA_3.3V	187	GEN1_I2C_SDA	28	ID_I2C_SCL	185	GEN1_I2C_SCL
29	GPIO1_(3.3V_LEVEL)	118	CAM_AF_EN	30	GND		
31	GPIO11_(3.3V_LEVEL)	216	GPIO_PZ0	32	GPIO7_(3.3V_LEVEL)	206	LCD_BL_PWM
33	GPIO13_(3.3V_LEVEL)	228	GPIO_PE6	34	GND		
35	I2S0_LRCK_3.3V	197	DAP4_FS	36	UART1_CTS_3.3V	209	UART2_CTS
37	SPI1_MOSI_3.3V	104	SPI2_MOSI	38	I2S0_SDIN_3.3V	195	DAP4_DIN
39	GND			40	I2S0_SDOUT_3.3V	193	DAP4_DOUT

CSI Camera接口 (W9)

PIN	Signal Name	PIN	Signal Name
1	GND	2	GND
3	CSI0_D0_N	4	CSI0_D0_N
5	CSI0_D0_P	6	CSI0_D0_P
7	GND	8	GND
9	CSI0_D1_N	10	CSI0_D1_N
11	CSI0_D1_P	12	CSI0_D1_P
13	GND	14	GND
15	CSI0_CLK_N	16	CSI0_CLK_N
17	CSI0_CLK_P	18	CSI0_CLK_P
19	GND	20	GND
21	CAM0_PWDN	22	CAM0_PWDN
23	CAM0_MCLK	24	CAM0_MCLK
25	CAM0_I2C_SCL	26	CAM0_I2C_SCL
27	CAM0_I2C_SDA	28	CAM0_I2C_SDA
29	VDD_3V3	30	VDD_3V3

M.2 KEY M接口 (W10)

PIN	Signal Name	PIN	Signal Name
1	GND	2	3.3V
3	GND	4	3.3V
5	PCIE0_RX3_N	6	NC
7	PCIE0_RX3_P	8	NC
9	GND	10	NC
11	PCIE0_TX3_N	12	3.3V
13	PCIE0_TX3_P	14	3.3V
15	GND	16	3.3V
17	PCIE0_RX2_N	18	3.3V
19	PCIE0_RX2_P	20	NC
21	GND	22	NC
23	PCIE0_TX2_N	24	NC
25	PCIE0_TX2_P	26	NC
27	GND	28	NC
29	PCIE0_RX1_N	30	NC
31	PCIE0_RX1_P	32	NC
33	GND	34	NC
35	PCIE0_TX1_N	36	NC
37	PCIE0_TX1_P	38	NC
39	GND	40	I2C2_ CLK
41	PCIE0_RX0_N	42	I2C2_DAT
43	PCIE0_RX0_P	44	M2_KEYM_ALERT
45	GND	46	NC
47	PCIE0_TX0_N	48	NC
49	PCIE0_TX0_P	50	PCIE0_RST_N
51	GND	52	PCIE0_CLKREQ_N
53	PCIE0_CLK_N	54	M2_KEYM_PEWAKE
55	PCIE0_CLK_P	56	NC
57	GND	58	NC
59	NC	60	32.768KHz

PIN	Signal Name	PIN	Signal Name
61	NC	62	3.3V
63	GND	64	3.3V
65	GND	66	3.3V
67	GND	68	

20PIN多功能接口（W11）

PIN	Signal Name	PIN	Signal Name
1	5V	2	5V
3	5V	4	5V
5	5V	6	GND
7	USB2.0_DN	8	USB2.0_DP
9	GPIO_01	10	GND
11	USB3.0_SSTX_N	12	USB3.0_SSTX_P
13	GND	14	USB3.0_SSRX_N
15	USB3.0_SSRX_P	16	GND
17	GPIO_06	18	GND
19	GND	20	GND

NVIDIA Orin核心板接口（W12）

260PIN的连接器，主要功能是用于NVIDIA Jetson Orin Nx/Orin Nano核心板与A603载板之间的连接。

The main function of the 260PIN connector is to connect the NVIDIA Jetson Orin Nx/Orin Nano core board to the A603 carrier board.

M.2 KEY E接口 (W13)

Pin	Signal Name	Pin	Signal Name
1	GND	2	3V3
3	USB1_DP	4	3V3
5	USB1_DN	6	NC
7	GND	8	I2S1_SCLK
9	NC	10	I2S1_LRCK
11	NC	12	I2S1_SDIN
13	NC	14	I2S1_DOUT
15	NC	16	NC
17	NC	18	GND
19	NC	20	BT_M2_WAKE
21	NC	22	UART0_RXD
23	NC	24	UART0_TXD
25	GND	26	UART0_CTS
27	PCIE1_TX0_P	28	UART0_RTS
29	PCIE1_TX0_N	30	NC
29	PCIE1_TX0_N	30	NC
33	PCIE1_RX0_P	34	NC
35	PCIE1_RX0_N	36	NC
37	GND	38	NC
39	PCIE1_CLK_P	40	NC
41	PCIE1_CLK_N	42	CLK_32K
43	GND	44	PCIE1_RST
45	PCIE1_CLKREQ	46	W_DISABLE2
47	PCIE1_WAKE	48	W_DISABLE1
49	GND	50	I2C2_SDA
51	NC	52	I2C2_SCL
53	NC	54	M2_E_ALERT
55	GND	56	NC
57	NC	58	NC
59	NC	60	NC

Pin	Signal Name	Pin	Signal Name
61	GND	62	NC
63	NC	64	3V3
65	NC	66	3V3
67	GND	68	

风扇接口 (W14)

PIN	Signal Name	PIN	Signal Name
1	GND	2	+5V
3	FAN_TACH	4	FAN_PWM

模块的安装和拆卸 Module Installation and Removal

- 为了正确安装Jetson Orin NX/Orin Nano系列模块，请遵循以下顺序和安装硬件说明。

1. 插接时连接器应相互平行。
2. 在对接过程中使用平稳的动作（没有机械冲击，敲击，锤击）。
3. e PCB的操作人员。
4. 顶部和底部的PCB要用螺栓连接，以提高可靠性。
5. 用M3螺丝（2x）从模块的顶部固定。用2.5磅/英寸的扭矩拧紧螺钉。

- 如果使用夹具进行对接，那么该夹具应将对接的连接器保持在±2度以内。此外，夹具应允许连接器随着配接过程的进行而变得平行。 为了正确拆卸Jetson Orin NX/Orin Nano系列模块，请遵循以下顺序和安装硬件说明。

1. PCB设计需要有足够的手指可及性/空间要求，以握住板子进行解配。

2. 从模块的顶部卸下安装螺钉（2个）。

3. 摇晃顶板几次，不超过±3度，使连接器逐渐脱离。

连接器的针脚方向

载板上的260pin针连接器的符号引脚是镜像的，这样当模块和载板的连接器对接时，引脚号码是一致的（见下图3）。图中所示的方向与载板上的直立位置以及布局文件相匹配。
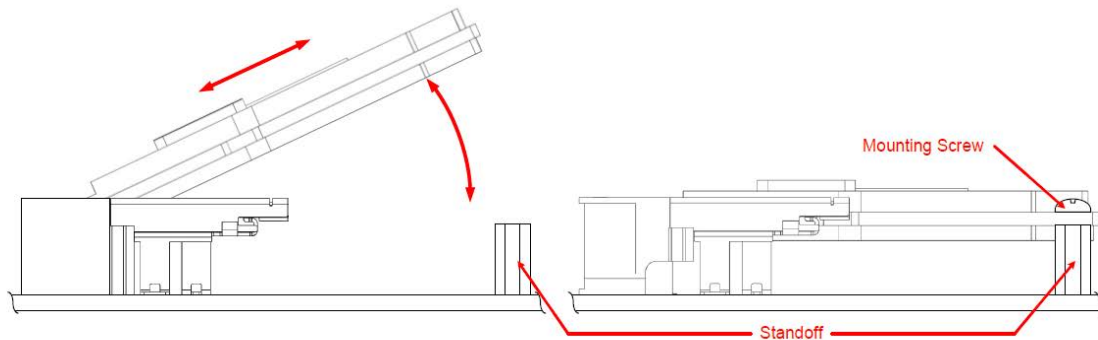
Figure3

To install the Jetson Orin NX/Orin Nano Series module correctly, follow the following sequence and mounting hardware instructions:

1. Connectors should be parallel with respect to each other during mating.
2. Use a smooth motion during mating (no mechanical shock, knocking, hammering).
3. e PCB for operators.
4. The top and bottom PCB are to be bolted to enhance reliability.
5. Secure with M3 screws (2x) from the top of the module. Torque the screws to 2.5 lbf-in.

If a fixture is used to do the mating, then that fixture should hold the mating connectors parallel to within ± 2 degrees. Also, the fixture should allow the connectors to become parallel as the mating process progresses. To remove the Jetson Orin NX/Orin Nano Series module correctly, follow the following sequence and mounting hardware instructions:

1. The PCB design needs to have enough finger reachability/space required to hold the board for un-mating.
2. Remove mounting screws (2x) from the top of the module.
3. Rock the top board a few times, no more than ± 3 degrees, to gradually disengage the connectors.

Connector Pin Orientations

The symbol pinout for the 260-pin connector on the carrier board is mirrored such that the pin numbers match when the module and carrier board connectors are mated (see Figure 3-2 below). The orientation shown matches the carrier board in the upright position as well as the layout file.

功能介绍 Function Introduction

系统安装 Operating system setup

1.硬件准备 Hardware preparation

- Ubuntu18.04系统的PC主机 1台

  Ubuntu 18.04 PC x1

  Micro-USB数据线 1条

  Micro-USB data cable x1

### 2.环境配置 Environment requirements

1. 将系统镜像包下载到Ubuntu18.04系统的PC主机上：

烧写步骤 Burn-in steps

1. 用USB线将Ubuntu18.04系统的PC电脑的USB Type-A与Leetop_A603 Development System 的 Micro-USB相连；

2. 给Leetop_A603 Development System上电，并进入Recovery模式；

3. PC电脑打开Nvidia-SDK-Manager，如下图所示，在界面中选择Jetson Orin NX/Orin Nano下载Jetpack5.xxx系统镜像包和开发工具，或者从https://developer.nvidia.com/embedded/downloads下载最新的Jetson Linux发布包和Jetson开发工具包的示例文件系统。(Jetson Linux Driver Package (L4T))

4. 下载配套驱动：

Link   https://pan.baidu.com/s/1YGUMyGtqtpzh9eoK_PGKAg

Extraction code   xnyb
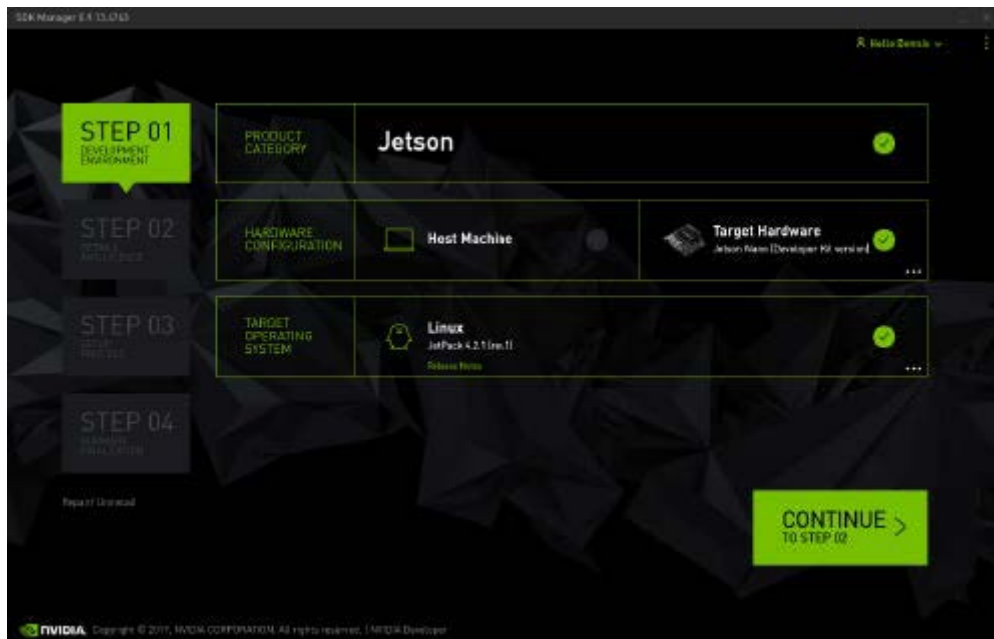

```
1  #使用最新版sdk查询不到对应版本时，可使用此指令获取
2  sdkmanager --archivedeversions
```

其余资料请联系我们索取：service@leetop.top

2. 解压下载下来的镜像包，并进入Linux for Tegra(L4T)目录

```
1   tar xf ${L4T_RELEASE_PACKAGE}
2   cd Linux_for_tegra/rootfs
3   sudo tar xpf ${SAMPLE_FS_PACKAGE}
4   cd ..
5   sudo ./apply_binaries.sh
6   sudo ./tools/l4t_flash_prerequisites.sh
7   #替换驱动包
8   sudo cp -r 603_xxx/Linux_for_tegra /Linux_for_tegra
```

3.进入Linux_for_tegra 目录使用刷机命令flash to NVMe

```
1   #flash to nvme
2   #orin nano
3   sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
    tools/kernel_flash/flash_l4t_external.xml -p "-c
    bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
    orin-nano-devkit internal
4   #orin nx
5   sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
    tools/kernel_flash/flash_l4t_external.xml -p "-c
    bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-
    a02+p3767-0000 internal
```

4.进入Linux_for_tegra 目录使用刷机命令flash to USB

```
1   #flash to USB:
2   #orin nano
3   sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c
    tools/kernel_flash/flash_l4t_external.xml -p "-c
    bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
    orin-nano-devkit internal
4   #orin nx
5   sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c
    tools/kernel_flash/flash_l4t_external.xml -p "-c
    bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-
    a02+p3767-0000 internal
```

5.进入Linux_for_tegra 目录使用刷机命令flash to SD

```
1   #flash to SD
2   #orin nano
3   sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device mmcblk1p1  -c
    tools/kernel_flash/flash_l4t_external.xml -p "-c
    bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
    orin-nano-devkit internal
```

1.Download the system image package to the PC host of the Ubuntu18.04 system:

Burn-in steps

1. Use a USB cable to connect the USB Type-A of the PC of the Ubuntu18.04 system to the Micro-USB of the Leetop_A603 Development System;

2. Power on the Leetop_A603 Development System and enter Recovery mode;

3. Open the Nvidia-SDK-Manager on the PC, as shown in the figure below, select Jetson Orin NX/Orin Nano in the interface to download the Jetpack5.xxx system image package and development tools, or download the latest from https://developer.nvidia.com/embedded/downloads Example filesystems for the Jetson Linux distribution and the Jetson Development Kit. (Jetson Linux Driver Package (L4T)).

4. Download the matching driver:

Link　https://pan.baidu.com/s/1YGUMyGtqtpzh9eoK_PGKAg
Extraction code　xnyb

```
1  #when using the latest version of SDK to find the corresponding version,
   you can use this command to get it
2  sdkmanager --archivedeversions
```

Please contact us for the rest of the information：service@leetop.top

2. Unzip the downloaded image package and enter the Linux for Tegra(L4T) directory

```
1  tar xf ${L4T_RELEASE_PACKAGE}
2  cd Linux_for_tegra/rootfs
3  sudo tar xpf ${SAMPLE_FS_PACKAGE}
4  cd ..
5  sudo ./apply_binaries.sh
6  sudo ./tools/l4t_flash_prerequisites.sh
7  #Replacement driver package
8  sudo cp -r 603_xxx/Linux_for_tegra /Linux_for_tegra
```

3. Enter the Linux_for_tegra directory and use the flash command: (flash to NVMe)

```
1  #flash to nvme
2  #orin nano
3  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1
   -c tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0
   jetson-orin-nano-devkit internal
4  #orin nx
5  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1
   -c tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0
   p3509-a02+p3767-0000 internal
```

4. Enter the Linux_for_tegra directory and use the command flash to USB

```
1  #flash to USB:
2  #orin nano
3  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
   orin-nano-devkit internal
4  #orin nx
5  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device sda1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-
   a02+p3767-0000 internal
```

5.Enter the Linux_for_tegra directory and use the command flash to SD

```
1  #flash to SD
2  #orin nano
3  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device mmcblk1p1  -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
   orin-nano-devkit internal
```

3.Recovery模式 Recovery mode

可以通过 USB 进行系统更新，更新需要进入 USB Recovery 模式。USB Recovery 模式下可以进行文件系统更新，内核更新，boot loader 更新，BCT 更新等操作。

请根据软件更新手册步骤进行系统更新操作

进入Recovery模式的步骤：

1. 关闭系统电源，请确保使电源关闭而不是进入待机状态。
2. 使用 Micro-USB到 USB Type A 的链接线链接载板和主机。
3. 对系统进行加电。
4. 使用跳线帽短接14pin处的rec 和gnd引脚，并接入micro-usb以及电源。

> **注**：在进入 USB Recovery 模式下，系统不会启动，串口不会有调试信息输出

The system can be updated via USB, and the update needs to enter the USB Recovery mode. In USB Recovery mode, you can perform file system update, kernel update, boot loader update, BCT update and other operations.

Please follow the steps in the software update manual to update the system

Steps to enter Recovery Mode:

1. Power down the system, make sure to power off and not into standby.
2. Use a Micro-USB to USB Type A link cable to link the carrier board and the host computer.
3. Apply power to the system.
4. Use a jumper cap to short-circuit the rec and gnd pins at 14pin, and connect to micro-usb and power supply.

> **Note:**
>
> Please follow the steps of the update manual for system update. when entering USB recovery mode, the system will not start, and the serial port will not have debugging information output`.

4.安装系统镜像 Install system image

a) 将Ubuntu18.04主机的USB Type-A与Leetop_A603的Micro-USB相连；

b) 给Leetop_A603上电，并进入Recovery模式；

c) PC主机进入L4T目录，执行刷机指令：(刷机到NVMe上)

```
1  cd Linux_for_tegra
2  #flash to nvme
3  #orin nano
4  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
   orin-nano-devkit internal
5  #orin nx
6  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-
   a02+p3767-0000 internal
```

d) 刷机完成后，给Leetop_A603重新上电登录系统。

a) Connect USB type-A of Ubuntu 18.04 Host to Micro-USB of Leetop_A603;

b) Power up Leetop_A603 and enter Recovery mode(RCM);

c) The PC Host enters the L4T directory and executes the flashing instruction：(Swipe to NVMe)

```
1  cd Linux_for_tegra
2  #flash to nvme
3  #orin nano
4  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 jetson-
   orin-nano-devkit internal
5  #orin nx
6  sudo ./tools/kernel_flash/l4t_initrd_flash.sh --external-device nvme0n1p1 -c
   tools/kernel_flash/flash_l4t_external.xml -p "-c
   bootloader/t186ref/cfg/flash_t234_qspi.xml" --showlogs --network usb0 p3509-
   a02+p3767-0000 internal
```

d) After flashing, power on Leetop_A603 again and log in to the system.

5.切换工作模式 Switching working modes

登录系统后，可在系统界面右上角点击操作修改，如图所示：

After logging in to the system, you can modify the operation by clicking on the top right corner of the system interface, as shown in the picture：

或者，在终端输入命令进行切换：

Alternatively, switch by entering the following command in the terminal：

```
1  # 切换到模式0,可用-q参数查看当前模式  Switch to mode 0, use the -q parameter to
   view the current mode
2  sudo nvpmodel -m 0
```

# Xshell 的使用 Use of xshell

Xshell 是一个强大的安全终端模拟软件，它支持SSH1, SSH2, 以及Microsoft Windows 平台的TELNET 协议。Xshell 通过互联网到远程主机的安全连接以及它创新性的设计和特色帮助用户在复杂的网络环境中享受他们的工作。Xshell 可以在Windows 界面下用来访问远端不同系统下的服务器，从而比较好的达到远程控制终端的目的。xshell 不是必需品，但是它能更好的辅助我们使用设备.他可以将你的 Windows 系统和你的Ubuntu 系统链接起来，让你在Windows 系统下，去操作你的Linux 系统。安装 xshell 可以在网上百度搜索下载安装即可.(当产品无法进入桌面系统的情况时,也可以通过xshell 来进行远程控制,修改配置上的错误).

Xshell is a powerful security terminal emulation software, it supports SSH1, SSH2, and TELNET protocol of Microsoft Windows platform. Xshell's secure connection to remote hosts through the Internet and its innovative design and features help users enjoy their work in complex network environments. Xshell can be used to access servers under different remote systems under the Windows interface, so as to better achieve the purpose of remote control of the terminal. xshell is not necessary, but it can better assist us in using equipment. It can link your Windows system with your Ubuntu system, allowing you to operate your Linux system under Windows system. To install xshell, you can download and install it by searching Baidu on the Internet. (When the product cannot enter the desktop system, you can also use xshell to perform remote control and modify configuration errors).

- 打开xshell Open xshell
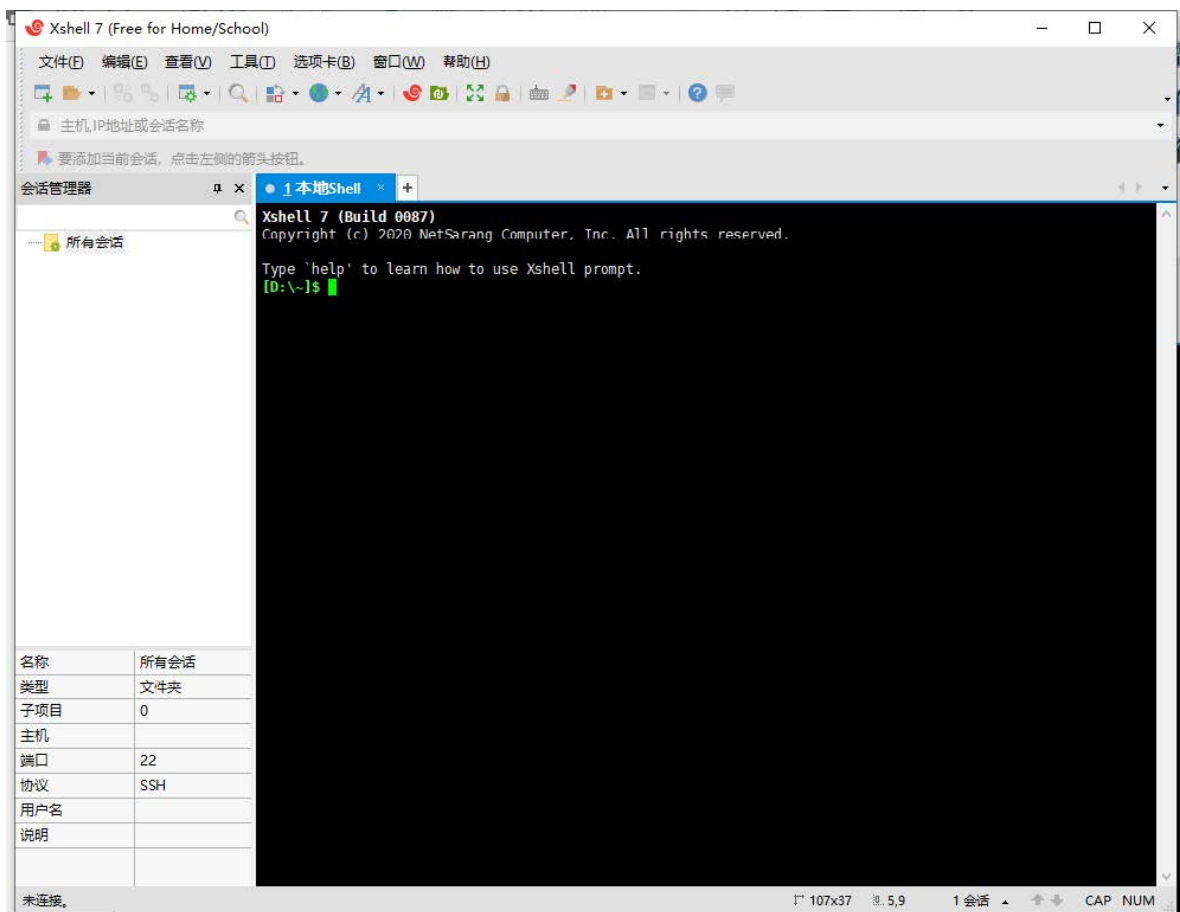


- 新建 Newly built
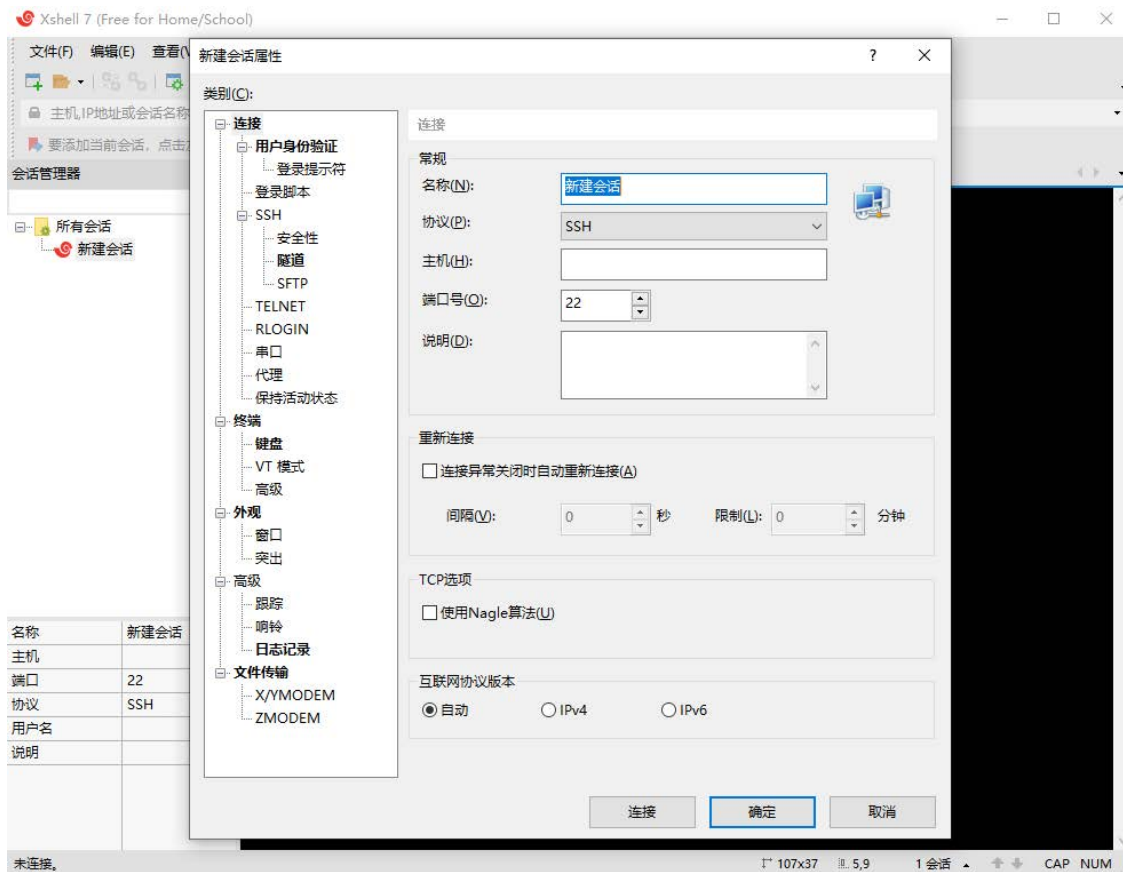
- 填写名称以及主机ip(正常情况下可以通过网络ip 来连接,若不知道ip 的情况下,可以通过usb 数据线连接电脑和设备OTG 口,填写固定ip来进行连接)

Fill in the name and host ip (under normal circumstances, you can connect through the network ip, if you don't know the ip, you can connect the computer and the OTG port of the device through the usb data cable, and fill in the fixed ip to connect)
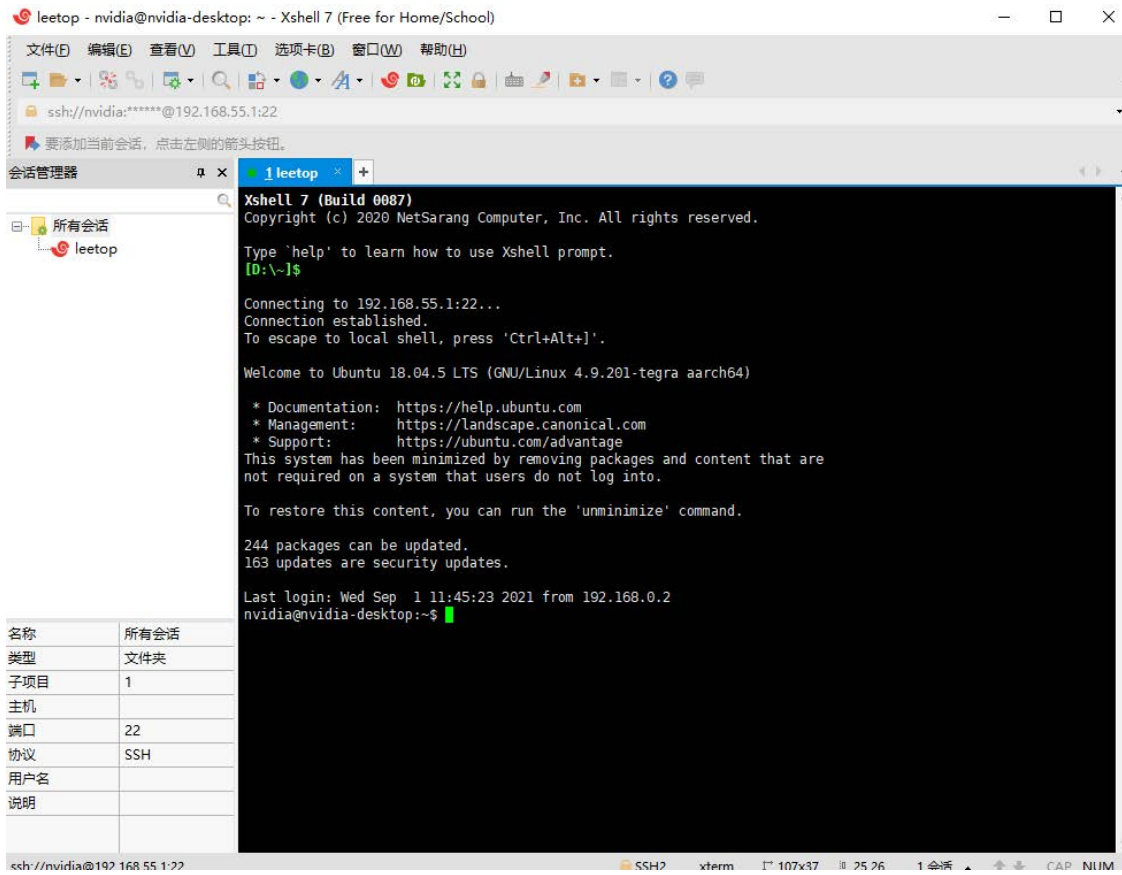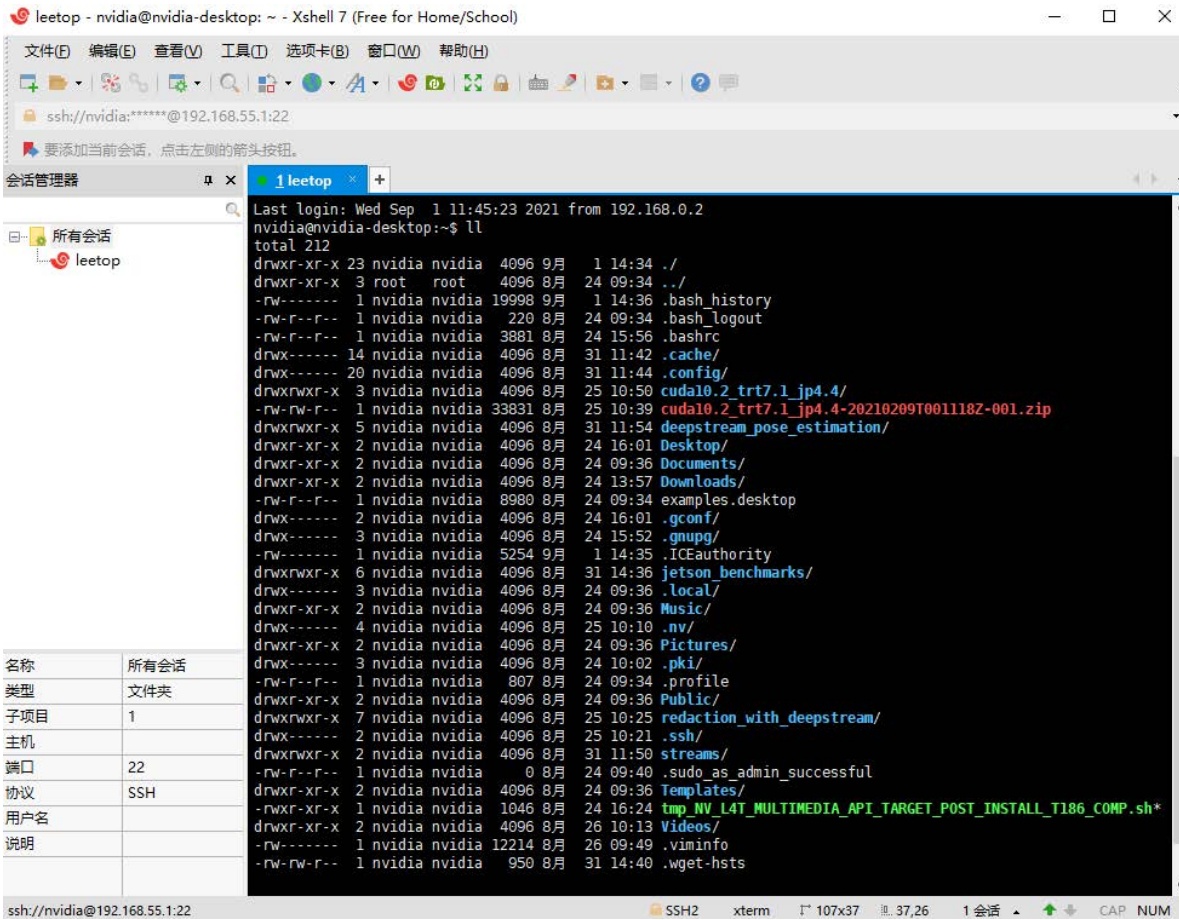
```
1 192.168.55.1
```
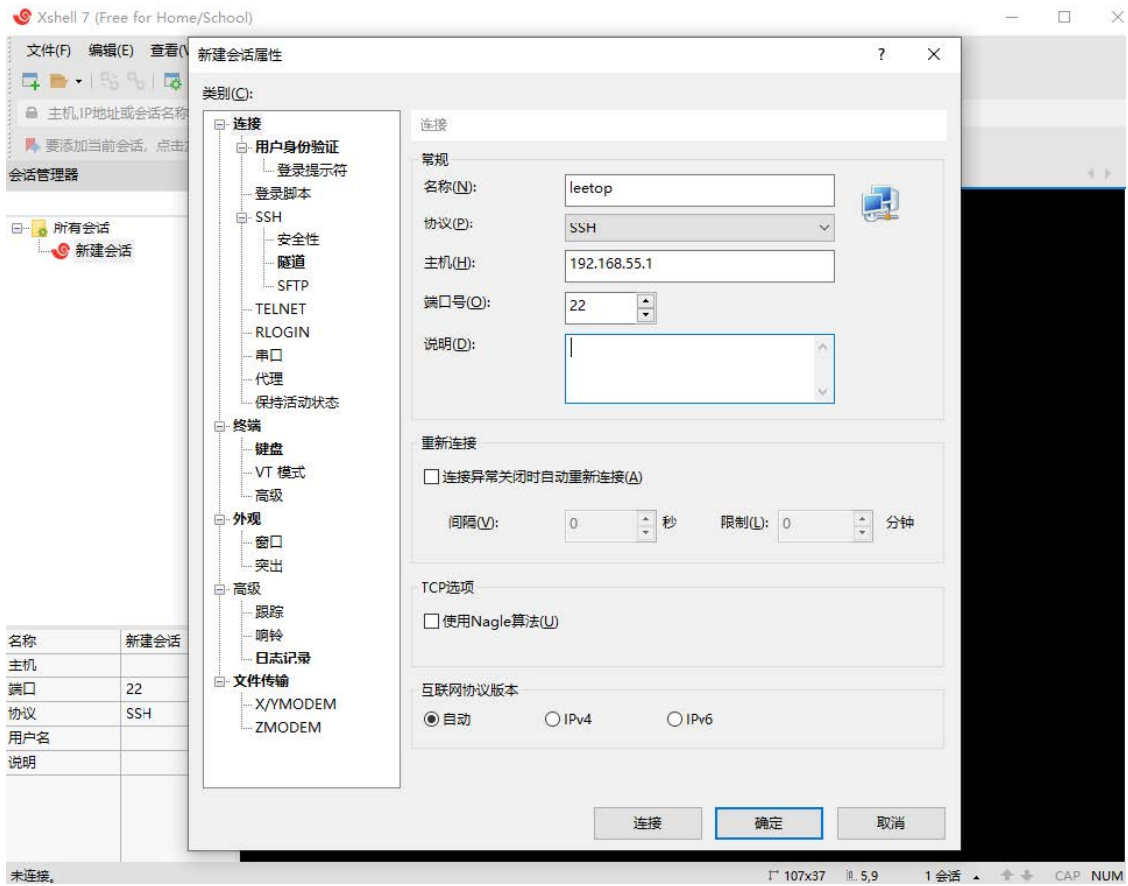
- 输入用户和密码 Enter user and password
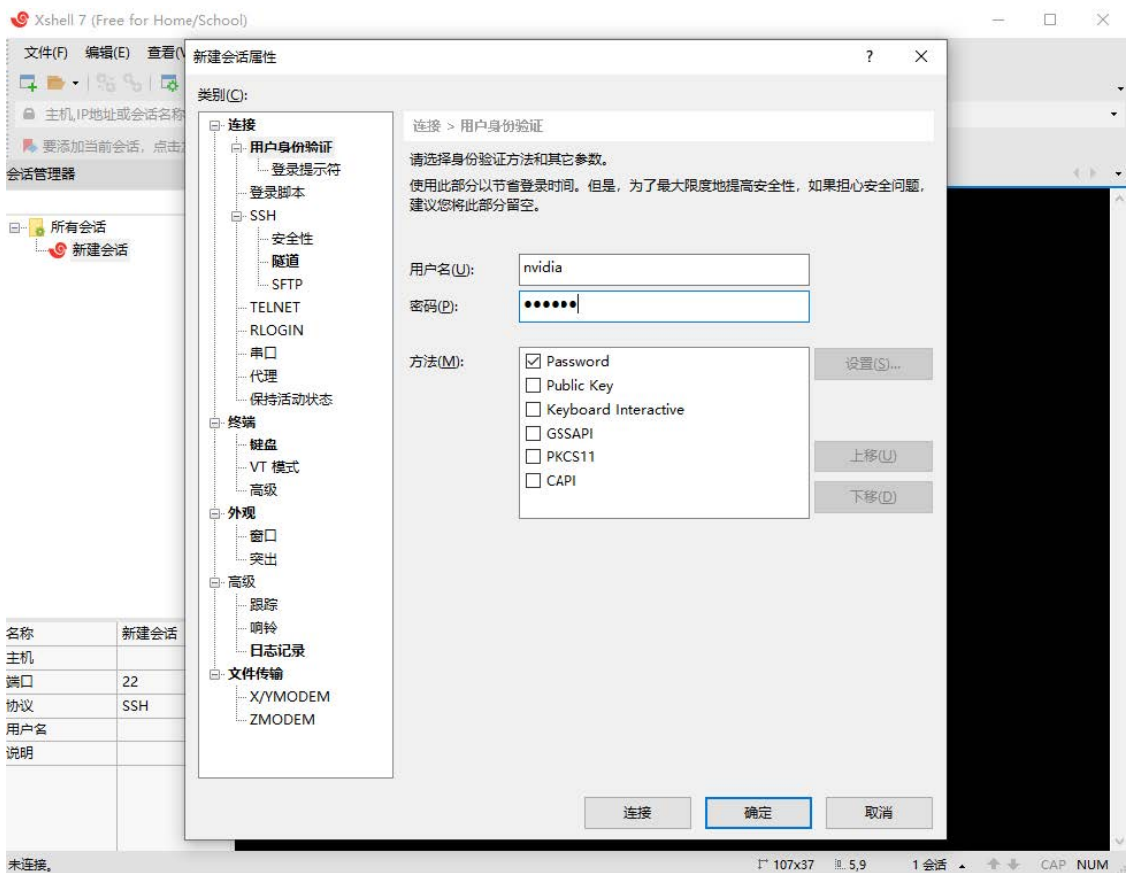


- 点击连接进入命令行界面 Click Connect to enter the command line interface

- 通过xshell 远程操作jetson 设备 Operate jetson devices remotely through xshell

# 系统配置 System Configuration

**默认用户名：** *nvidia* **密码：** *nvidia*

*Default username: nvidia Password: nvidia*

- **NVIDIA Linux For Tegra (L4T)**

  载板支持原生 NVIDIA Linux For Tegra（L4T）Builds。HDMI、千兆以太网、USB3.0、Micro-USB、串口、GPIO、I2C 总线均可得到支持。

  详细说明和工具下载链接：https://developer.nvidia.com/embedded/jetson-linux-r3531

  The board supports native NVIDIA Linux For Tegra (L4T) Builds. HDMI, Gigabit Ethernet, USB3.0, Micro-USB, serial port, GPIO, and I2C bus are all supported.

  Detailed instructions and tools download link：https://developer.nvidia.com/embedded/jetson-linux-r3531

- **NVIDIA Jetpack for L4T**

  Jetpack 使一个 NVIDIA 发布的软件包，包含了使用A603 进行 Orin NX/Orin Nano 开发所需要的各种软件工具，包含主机端和目标机端各种工具，包括 OS 镜像文件，中间件，示例程序，文档等内容。最新发布的 JetPack 运行在 Ubuntu 18.04 Linux 64 位主机上。

  可从下面链接进行下载：https://developer.nvidia.com/embedded/jetpack

  Jetpack is a software package released by NVIDIA that contains all of the software tools needed for Orin NX/Orin Nano development using the A603, including host and target tools, including OS image files, middleware, sample applications, documentation, and more. The newly released JetPack runs on Ubuntu 18.04 Linux 64-bit hosts.
  It can be downloaded from the link below：https://developer.nvidia.com/embedded/jetpack

- **默认配置系统** *Default configuration system*

  Leetop_A603 采用Ubuntu 20.04系统，默认用户名：nvidia 密码：nvidia

  Leetop_A603 uses Ubuntu 20.04 system, default username: nvidia password: nvidia

- **开发资料及论坛** *Development materials and forum*

  L4T开发资料：https://developer.nvidia.com/embedded/linux-tegra

  开发者论坛：https://forums.developer.nvidia.com/

  L4T development data：https://developer.nvidia.com/embedded/linux-tegra

  Developer Forum: https://forums.developer.nvidia.com/

# 查看系统版本 View System Version

查看安装的系统包版本 View the installed system package version

```
1  cat /etc/nv_tegra_release
```

查看安装的JetPack信息 View information about the installed JetPack

```
1  sudo apt show nvidia-jetpack
```

制作备份镜像 Make a backup image

制作备份镜像需在命令行刷机的环境下进行，只备份 `system.img` 文件

Making a backup image needs to be done in the environment of command line flashing, only the system.img file is backed up

1. 用USB线将Ubuntu18.04系统的PC电脑的USB Type-A与Leetop_A603的Micro-USB相连；

   Use a USB cable to connect the USB Type-A of the PC computer of the Ubuntu18.04 system to the Micro-USB of the Leetop_A603;

2. 给Leetop_A603上电，并进入Recovery模式；

   Power on the Leetop_A603 and enter Recovery mode;

3. 进入 Linux_for_tegra目录，参照backup_restore中README_backup_restore.txt进行备份.

   Enter the Linux_for_tegra directory, and refer to README_backup_restore.txt in backup_restore for backup.

   备份Jetson Orin Nano/Orin NX系统的指令:

   Instructions for backing up the Jetson Orin Nano/Orin NX system:

```
1  cd Linux_for_Tegra/tools/backup_restore
2  # 将以下文件中mmcblk0替换为nvme0n1 Replace mmcblk0 with nvme0n1 in the
   following files
3  sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.sh
4  sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.func
5  sudo sed -i 's/mmcblk0/nvme0n1/g' nvbackup_partitions.sh
6  sudo sed -i 's/mmcblk0/nvme0n1/g' nvrestore_partitions.sh
7  cd ../../
8  #须暂时禁用新外部存储设备的自动挂载备份恢复。Automount backup restore for new
   external storage devices must be temporarily disabled.
9  systemctl stop udisks2.service
10 sudo tools/l4t_flash_prerequisites.sh # For Debian-based Linux
11 sudo service nfs-kernel-server start
12 sudo ./tools/backup_restore/l4t_backup_restore.sh -b <board-name>
13 #备份镜像，备份成功后在Linux_for_Tegra/tools/backup_restore下生成image文件。
   Backup image, after the backup is successful, an image file will be
   generated under Linux_for_Tegra/tools/backup_restore.
14 sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
15 #备份镜像恢复。Backup image restoration.
```

4. 使用备份的镜像进行刷机： Use the backup image to flash:

```
1  sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
2  #备份镜像恢复。Backup image restoration
```

能正常刷机使用表示制作的备份镜像可用 。

If it can be flashed normally, it means that the created backup image is available.

安装Jtop工具 Installation of Jtop tools

Jtop是一个Jetson的系统监视实用程序，可在终端上运行，可实时查看和控制 NVIDIA Jetson的状态。

Jtop is a system monitoring utility for Jetson that can be run on a terminal to view and control the status of NVIDIA Jetson in real time.

安装步骤 Installation steps:

1. 安装pip3工具 Install pip3-tools

```
1  sudo apt-get install python3-pip
```

2. 用pip3安装jtop包 Install the jtop package with pip3

```
1  sudo -H pip3 install -U jetson-stats
```

3. 重启后可运行 Can run after reboot

```
1  jtop
```

运行后如下图所示 After running, as shown in the figure below:

接入固态硬盘 Access to Solid State Drives

A603载板有一个标准的M.2 KEY M接口，可以接标准的2242尺寸,PCIE接口的固态硬盘等标准的M.2 KEY M设备。连接固态硬盘后，将硬盘挂载到系统有两种方式，一种是使用 `Fdisk` 这些工具，另一种是使用命令行方式。

The A603 carrier board has a standard M.2 KEY M interface, which can be connected to standard M.2 KEY M devices such as standard 2242 size, SSD with PCIE interface. After connecting the SSD, there are two ways to mount the HDD to the system, one is to use tools such as Fdisk, and the other is to use the command line.

命令行挂载的操作步骤如下：

The operation steps of command line mounting are as follows:

1. 使用命令 `lspci` 查看是否识别成功 Use the command lspci to check whether the recognition is successful

2. 建立分区 Create partition

```
1  sudo su
2  fdisk /dev/nvme0n1
```

3. 创建ext4文件系统 Create an ext4 file system

```
1  mkfs.ext4  /dev/nvme0n1p1
2  # mkfs是文件系统类型
```

4. 挂载硬盘 Mounting hard disk

```
1  mount -t ext4 /dev/nvme0n1p1  nvme/
```

5. 设置自动挂载 Set automatic mounting

```
1  echo /dev/nvme0n1p1 /mnt ext4 defaults 0 0 >> /etc/fstab
```

Developer Tools

JetPack

NVIDIA JetPack SDK 是构建 AI 应用程序的最全面的解决方案。 它捆绑了 Jetson 平台软件，包括 TensorRT、cuDNN、CUDA Toolkit、VisionWorks、GStreamer 和 OpenCV，所有这些软件都构建在带有 LTS Linux 内核的 L4T 之上。

NVIDIA JetPack SDK is the most comprehensive solution for building AI applications. It bundles Jetson platform software including TensorRT, cuDNN, CUDA Toolkit, VisionWorks, GStreamer, and OpenCV, all built on top of L4T with LTS Linux kernel.

JetPack 包含 NVIDIA 容器运行时，可在边缘支持云原生技术和工作流。

JetPack includes NVIDIA container runtime, enabling cloud-native technologies and workflows at the edge.

JetPack SDK Cloud-Native on Jetson

L4T

英伟达L4T为Jetson平台提供了Linux内核、引导程序、驱动程序、闪光实用程序、样本文件系统等。

你可以对L4T软件进行定制，以适应你的项目的需要。通过遵循平台适应性和带入指南，你可以优化使用完整的Jetson产品功能集。遵循以下链接，了解最新的软件库、框架和源代码包的详细信息。

NVIDIA L4T provides the Linux kernel, bootloader, NVIDIA drivers, flashing utilities, sample filesystem, and more for the Jetson platform.

You can customize L4T software to fit the needs of your project. By following the platform adaptation and bring-up guide, you can optimize your use of the complete Jetson product feature set. Follow the links below for details about the latest software libraries, frameworks, and source packages.

DeepStream SDK on Jetson

NVIDIA 的 DeepStream SDK 为基于 AI 的多传感器处理、视频和图像理解提供了完整的流分析工具包。 DeepStream 是 NVIDIA Metropolis 的一个组成部分，该平台用于构建端到端服务和 将像素和传感器数据转化为可操作见解的解决方案。 在我们的 开发者新闻 中了解最新的 5.1开发者预览功能。

NVIDIA's DeepStream SDK delivers a complete streaming analytics toolkit for AI-based multi-sensor processing, video and image understanding. DeepStream is an integral part of NVIDIA Metropolis, the platform for building end-to-end services and solutions that transform pixel and sensor data to actionable insights. Learn about the latest 5.1developer preview features in our developer news article.

Isaac SDK

NVIDIA Isaac SDK 使开发人员可以轻松创建和部署 AI 驱动的机器人。 SDK 包括 Isaac Engine（应用程序框架）、Isaac GEM（具有高性能机器人算法的包）、Isaac Apps（参考应用程序）和 Isaac Sim for Navigation（一个强大的模拟平台）。 这些工具和 API 可以更轻松地将用于感知和导航的人工智能 (AI) 添加到机器人中，从而加速机器人的开发。

The NVIDIA Isaac SDK makes it easy for developers to create and deploy AI-powered robotics. The SDK includes the Isaac Engine (application framework), Isaac GEMs (packages with high-performance robotics algorithms), Isaac Apps (reference applications) and Isaac Sim for Navigation (a powerful simulation platform). These tools and APIs accelerate robot development by making it easier to add artificial intelligence (AI) for perception and navigation into robots.

Jetpack 的主要功能 KEY FEATURES IN JETPACK

OS	NVIDIA Jetson Linux 35.3.1 提供了 Linux Kernel 5.10、基于 UEFI 的引导加载程序、基于 Ubuntu 20.04 的根文件系统、NVIDIA 驱动程序、必要的固件、工具链等。JetPack 5.1.1 包括 Jetson Linux 35.3.1，它增加了以下亮点：（请 有关详细信息，请参阅发行说明）添加对 Jetson AGX Orin 64GB、Jetson Orin NX 8GB、Jetson Orin Nano 8GB 和 Jetson Orin Nano 4GB 生产模块的支持 安全性：无线更新：基于图像的 OTA 工具支持在现场升级运行 JetPack 5 的基于 Xavier 或 Orin 的模块1 相机：支持 Orin 上的多点镜头阴影校正 (LSC)。增强了 Argus 的弹性 SyncStereo 应用程序可保持立体相机对之间的同步。多媒体：支持 AV1 编码中的动态帧速率 新的 argus_camera_sw_encode 示例用于演示 CPU 内核上的软件编码 更新了 nvgstcapture-1.0 带有 CPU 内核软件编码选项 1以前的版本支持在运行 JetPack 4 的现场升级基于 Xavier 的模块。
TensorRT	TensorRT 是一种用于图像分类、分割和对象检测神经网络的高性能深度学习推理运行时。TensorRT 基于 NVIDIA 的并行编程模型 CUDA 构建，使您能够优化所有深度学习框架的推理。它包括一个深度学习推理优化器和运行时，可为深度学习推理应用程序提供低延迟和高吞吐量。**JetPack 5.1.1 includes TensorRT 8.5.2**
cuDNN	CUDA 深度神经网络库为深度学习框架提供高性能原语。它为标准例程提供高度调整的实现，例如前向和反向卷积、池化、归一化和激活层。**JetPack 5.1.1 includes cuDNN 8.6.0**
CUDA	CUDA 工具包为构建 GPU 加速应用程序的 C 和 C++ 开发人员提供了一个全面的开发环境。该工具包包括用于 NVIDIA GPU 的编译器、数学库以及用于调试和优化应用程序性能的工具。**JetPack 5.1.1 includes CUDA 11.4.19** 从 JetPack 5.0.2 开始，从 CUDA 11.8 升级到最新和最好的 CUDA 版本，而无需更新 Jetson Linux 的其他 JetPack 组件。请参阅 CUDA 文档中的说明，了解如何在 JetPack 上获取最新的 CUDA。
Multimedia API	Jetson 多媒体 API 包为灵活的应用程序开发提供低级 API。相机应用程序 API：libargus 为相机应用程序提供低级帧同步 API，具有每帧相机参数控制、多个（包括同步）相机支持和 EGL 流输出。需要 ISP 的 RAW 输出 CSI 相机可以与 libargus 或 GStreamer 插件一起使用。在任何一种情况下，都会使用 V4L2 媒体控制器传感器驱动程序 API。传感器驱动程序 API：V4L2 API 支持视频解码、编码、格式转换和缩放功能。用于编码的 V4L2 开放了许多功能，如比特率控制、质量预设、低延迟编码、时间权衡、运动向量图等。**JetPack 5.1.1 相机亮点包括**：支持 Orin 上的多点镜头阴影校正 (LSC)。增强了 Argus SyncStereo 应用程序的弹性，以保持立体相机对之间的同步。**JetPack 5.1.1 多媒体亮点包括**：支持 AV1 编码中的动态帧率 用于演示 CPU 内核上的软件编码的新 argus_camera_sw_encode 示例 使用 CPU 内核上的软件编码选项更新了 nvgstcapture-1.0
Computer Vision	VPI（视觉编程接口）是一个软件库，它提供在 Jetson 上的多个硬件加速器上实现的计算机视觉/图像处理算法，例如 PVA（可编程视觉加速器）、GPU、NVDEC（NVIDIA 解码器）、NVENC（NVIDIA 编码器）、VIC （视频图像合成器）等。OpenCV 是一个用于计算机视觉、图像处理和机器学习的开源库。**JetPack 5.1.1 包含对 VPI 2.2 的小更新，并修复了错误** JetPack 5.1.1 包含 OpenCV 4.5.4

Graphics	JetPack 5.1.1 包括以下图形库： Vulkan® 1.3（包括 Roadmap 2022 Profile）。 [Vulkan 1.3 公告](#) [Vulkan® SC 1.0](#) Vulkan SC 是一个低级的、确定性的、健壮的 API，它基于 Vulkan 1.2。 此 API 可实现最先进的 GPU 加速图形和计算，这些图形和计算可部署在安全关键型系统中，并经认证符合行业功能安全标准。 有关详细信息，请参阅 https://www.khronos.org/vulkansc/。 Vulkan SC 对于实时非安全关键型嵌入式应用程序也具有无可估量的价值。 Vulkan SC 通过尽可能多地将运行时应用程序环境的准备转移到离线或应用程序设置中来提高确定性并减小应用程序大小。 这包括定义 GPU 如何处理数据的图形管道的离线编译，以及静态内存分配，它们共同实现了可以严格指定和测试的详细 GPU 控制。 Vulkan SC 1.0 从 Vulkan 1.2 演变而来，包括： 删除安全关键市场不需要的运行时功能，更新设计以提供可预测的执行时间和结果，以及消除其操作中潜在歧义的说明。 有关详细信息，请参阅 https://www.khronos.org/blog/vulkan-sc-overview 注意：Jetson 对 Vulkan SC 的支持未经安全认证。 OpenWF™ 显示 1.0 OpenWF Display 是一种 Khronos API，用于与 Jetson 上的本机显示驱动程序进行低开销交互，并允许与 Vulkan SC 交互以显示图像。 注意：Jetson 对 OpenWF Display 的支持未经安全认证。
Developer Tools	CUDA 工具包为使用 CUDA 库构建高性能 GPU 加速应用程序的 C 和 C++ 开发人员提供了一个全面的开发环境。 该工具包括 [Nsight Visual Studio Code Edition](#)、[Nsight Eclipse](#) 插件、包括 [Nsight Compute](#) 在内的调试和分析工具，以及用于交叉编译应用程序的工具链[NVIDIA Nsight Systems](#) 是一种低开销的系统级分析工具，可为开发人员提供分析和优化软件性能所需的见解。 [NVIDIA Nsight Graphics](#) 是一个独立的应用程序，用于调试和分析图形应用程序。 [NVIDIA Nsight Deep Learning Designer](#) 是一个集成开发环境，可帮助开发人员高效地设计和开发用于应用内推理的深度神经网络。 Jetson Orin 模块支持 Nsight System、Nsight Graphics 和 Nsight Compute，以协助开发自主机器。 **JetPack 5.1.1 包括 NVIDIA Nsight Systems v2022.5 JetPack 5.1.1 包含 NVIDIA Nsight Graphics 2022.6 JetPack 5.1.1 包含 NVIDIA Nsight Deep Learning Designer 2022.2** 有关详细信息，请参阅发行[说明](#)。
Supported SDKs and Tools	[NVIDIA DeepStream SDK](#) 是一个完整的分析工具包，用于基于 AI 的多传感器处理以及视频和音频理解。 **DeepStream 6.2 版本支持 JetPack 5.1.1** [NVIDIA Triton™ 推理服务器](#)可大规模简化 AI 模型的部署。 Triton 推理服务器是开源的，支持在 Jetson 上部署来自 NVIDIA TensorRT、TensorFlow 和 ONNX Runtime 的经过训练的 AI 模型。在 Jetson 上，Triton 推理服务器作为共享库提供，用于与 C API 直接集成。 [PowerEstimator](#) 是一个网络应用程序，可简化自定义电源模式配置文件的创建并估算 Jetson 模块功耗。 **JetPack 5.1.1 支持 Jetson AGX Orin 和 Jetson Xavier NX 模块的 PowerEstimator** [NVIDIA Isaac™ ROS](#) 是硬件加速包的集合，使 ROS 开发人员可以更轻松地在包括 NVIDIA Jetson 在内的 NVIDIA 硬件上构建高性能解决方案。 **Isaac ROS DP3 发布支持 JetPack 5.1.1**
Cloud Native	Jetson 将 [Cloud-Native](#) 带到了边缘，并支持容器和容器编排等技术。 NVIDIA JetPack 包括带有 Docker 集成的 NVIDIA Container Runtime，可在 Jetson 平台上启用 GPU 加速的容器化应用程序。 NVIDIA 在 [NVIDIA NGC](#) 上为 Jetson 托管了多个容器镜像。有些适用于带有示例和文档的软件开发，有些适用于生产软件部署，仅包含运行时组件。在 Jetson 上的 [Cloud-Native 页面](#)上找到更多信息和所有容器镜像的列表。
Security	NVIDIA Jetson 模块包括各种安全功能，包括硬件信任根、安全启动、硬件加密加速、可信执行环境、磁盘和内存加密、物理攻击保护等。跳转到 Jetson Linux 开发人员指南的安全部分，了解安全功能。

Sample Applications

JetPack 包括几个演示 JetPack 组件使用的示例。 这些存储在参考文件系统中，可以在开发人员工具包上进行编译。

JetPack includes several samples which demonstrate the use of JetPack components. These are stored in the reference filesystem and can be compiled on the developer kit.

JetPack component	Sample locations on reference filesystem
TensorRT	/usr/src/tensorrt/samples/
cuDNN	/usr/src/cudnn_samples_/
CUDA	/usr/local/cuda-/samples/
Multimedia API	/usr/src/tegra_multimedia_api/
VisionWorks	/usr/share/visionworks/sources/samples/ /usr/share/visionworks-tracking/sources/samples/ /usr/share/visionworks-sfm/sources/samples/
OpenCV	/usr/share/OpenCV/samples/
VPI	/opt/nvidia/vpi/vpi-/samples

开发者工具

JetPack包括以下开发工具。有些直接在Jetson系统上使用，有些则在连接到Jetson系统的Linux主机上运行。

- 用于应用程序开发和调试的工具(支持所以Jetson产品):
  - NSight Eclipse版用于开发GPU加速的应用程序。在Linux主机上运行。
  - 用于应用程序调试的CUDA-GDB。在Jetson系统或Linux主机上运行。
  - CUDA-MEMCHECK用于调试应用程序的内存错误。在Jetson系统上运行。
- 用于应用分析和优化的工具：
  - NSight Systems用于应用多核CPU分析。在Linux主机上运行。通过识别代码的缓慢部分，帮助你提高应用程序的性能。支持所有Jetson产品。
  - NVIDIA® Nsight™ 计算内核剖析器。一个针对CUDA应用程序的互动式剖析工具。它通过一个用户界面和命令行工具提供详细的性能指标和API调试。
  - NSight Graphics用于图形应用程序的调试和分析。一个控制台级别的工具，用于调试和优化OpenGL和OpenGL ES程序。在Linux主机上运行。支持所有Jetson产品。

Developer Tools

JetPack includes the following developer tools. Some are used directly on a Jetson system, and others run on a Linux host computer connected to a Jetson system.

- Tools for application development and debugging:
  - NSight Eclipse Edition for development of GPU accelerated applications: Runs on Linux host computer. Supports all Jetson products.
  - CUDA-GDB for application debugging: Runs on the Jetson system or the Linux host computer. Supports all Jetson products.

- CUDA-MEMCHECK for debugging application memory errors: Runs on the Jetson system. Supports all Jetson products.
- Tools for application profiling and optimization:
  - NSight Systems for application multi-core CPU profiling: Runs on the Linux host computer. Helps you improve application performance by identifying slow parts of code. Supports all Jetson products.
  - NVIDIA® Nsight™ Compute kernel profiler: An interactive profiling tool for CUDA applications. It provides detailed performance metrics and API debugging via a user interface and command line tool.
  - NSight Graphics for graphics application debugging and profiling: A console-grade tool for debugging and optimizing OpenGL and OpenGL ES programs. Runs on the Linux host computer. Supports all Jetson products.

缩略语和定义Abbreviations and Definitions

Abbreviation	Definition
CEC	Consumer Electronic Control
CAN	Controller Area Network
DP	VESA® DisplayPort® (output)
eDP	Embedded DisplayPort
eMMC	Embedded MMC
HDMI	High Definition Multimedia Interface
I2C	Inter IC
I2S	Inter IC Sound Interface
LDO	Low Dropout (voltage regulator)
LPDDR4x	Low Power Double Data Rate DRAM, Fourth-generation
PCIe (PEX)	Peripheral Component Interconnect Express interface
PCM	Pulse Code Modulation
PHY	Physical Layer
PMIC	Power Management IC
RTC	Real Time Clock
SDIO	Secure Digital I/O Interface
SLVS	Scalable Low Voltage Signaling
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver-Transmitter
UFS	Universal Flash Storage
USB	Universal Serial Bus