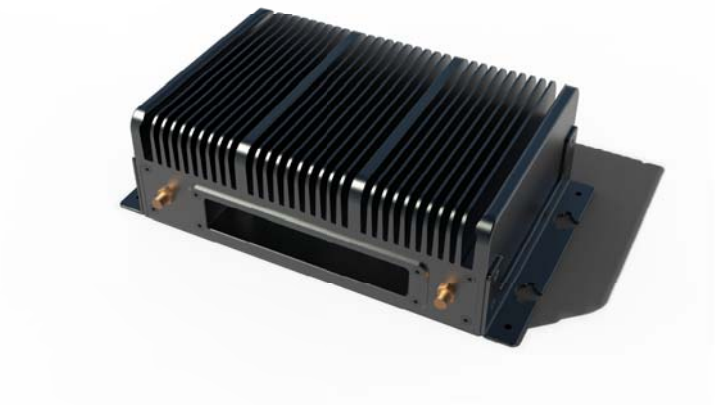
沥拓科技
— LEETOP —

# User Manual



## Leetop-ALP_607
## _User_Guide_V1.0

NVIDIA ELITE PARTNER

Leetop Technology (Shenzhen) Co., Ltd.
http://www.leetop.top

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# Notice

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

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

Avoid hot plugging.

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 Leetop device.

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

Do not use Leetop device near strong magnetic fields.

Backup your data before transportation or Leetop device is idle.

Recommend to transport Leetop device in its original packaging.

## Service and Support

**Technical Support**

Leetop is glad to help you with any questions you may have about our product, or about the use of the technology for your application. The fastest way is sending us an email: service@leetop.top

## Warranties

Warranty period: One year from the date of delivery.

Warranty content: Leetop warrants the product manufactured by us to be free from defects in material and workmanship during warranty period. Please contact service@leetop.top for return material authorization (RMA) prior to returning any items for repair or exchange. The product must be returned in its original packaging to prevent damage during shipping. Before returning any product for repair, it is recommended to back up your data and delete any confidential or personal data.

## Packing List

- Leetop-ALP607 x 1

  **Non-standard equipment:**
- Power adapter x 1
- Power cord x 1

# DOCUMENT CHANGE HISTORY

| Document | Version | date |
| --- | --- | --- |
| ALP607 | V1.0 | 20230314 |

# Leetop-ALP607

## Brief

Leetop-ALP607 is an embedded artificial intelligence computer capable of delivering up to 70/100 TOPS of computing power to numerous end devices. Leetop-ALP607 provides fast passive heat dissipation design, which can meet industrial standards such as seismic and anti-static. At the same time, Leetop-ALP607 interface rich, high cost performance.

# Specifications

## Processor

| Processor | Jetson Orin NX 8GB | Jetson Orin NX 16GB |
|---|---|---|
| **AI Performance** | 70 TOPS | 100 TOPS |
| **GPU** | 1024-core NVIDIA Ampere GPU with 32 Tensor Cores | 1024-core NVIDIA Ampere GPU with32 Tensor Cores |
| **CPU** | 6-core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3 | 8-core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU2MB L2 + 4MB L3 |
| **Memory** | 8 GB 128-bit LPDDR5 102.4 GB/s | 16 GB 128-bit LPDDR5102.4 GB/s |
| **Storage** | (Supports external NVMe) | (Supports external NVMe) |
| **Power** | 10W - 20W | 10W - 25W |
| **PCIe** | 1 x4 + 3 x1 (PCIe Gen4, Root Port & Endpoint) | 1 x4 + 3 x1 (PCIe Gen4, Root Port & Endpoint) |
| **CSI Camera** | Up to 4 cameras (8 via virtual channels***) 8 lanes MIPI CSI-2 D-PHY 2.1 (up to 20Gbps) | Up to 4 cameras(8 via virtual channels***) 8 lanes MIPI CSI-2D-PHY 2.1 (up to 20Gbps) |
| **Video Encode** | 1x4K60 \| 3X4K30\| 6X1080p60 \| 12x1080p30(H.265)\| 1x4K60 \|2x 4K30 \| 5x 1080p60 \| 11x 1080p30 (H.264) | 1x 4K60 \| 3x 4K30 \| 6x 1080p60 \| 12x 1080p30 (H.265) 1x 4K60 \| 2x 4K30 \| 5x 1080p60 \| 11x 1080p30 (H.264) |
| **Video Decode** | 1x 8K30 \|2x 4K60 \| 4x 4K30 \|9x 1080p60 \| 18x 1080p30 (H.265) \| 1x 4K60 \| 2x 4K30 \| 5x 1080p60 \| 11x 1080p30 (H.264) | 1x 8K30 \| 2x 4K60 \| 4x 4K30 \| 9x 1080p60\| 18x 1080p30 (H.265) 1x 4K60 \| 2x 4K30 \| 5x 1080p60 \| 11x 1080p30 (H.264) |
| **Display** | 1x 8K60 multi-mode DP 1.4a (+MST)/eDP1.4a/HDMI 2.1 | 1x 8K60 multi-mode DP 1.4a (+MST)/eDP1.4a/HDMI 2.1 |
| **Networking** | 10/100/1000 BASE-T Ethernet | 10/100/1000 BASE-T Ethernet |
| **Mechanical** | 69.6mm x 45mm 260-pin SO-DIMM connector | 69.6mm x 45mm260-pin SO-DIMM connector |

## I/O

| Interface | Specification |
|---|---|
| **PCB Size / Overall Size** | 115mm x 105mm |
| **Display** | 1x HDMI |
| **Ethernet** | 2x Gigabit Ethernet (10/100/1000) |
| **USB** | 4x USB 3.0 Type A (Integrated USB 2.0)<br>1x USB 2.0+3.0 Type C |
| **M.2 KEY M** | 1x M.2 KEY M Interface |
| **Camera** | 120P |
| **CAN** | 1x CAN, 1CAN |
| **USB 2.0+3.0** | ZIF 20P 0.5mm pitch |
| **Misc.** | 2x I2C Link (+3.3V I/O)<br>1xSPI Bus(+3.3V Level)<br>4xLED STATE |
| **Power Requirements** | +12 (7A)--+36V(3A) DC Input |

## Power Supply

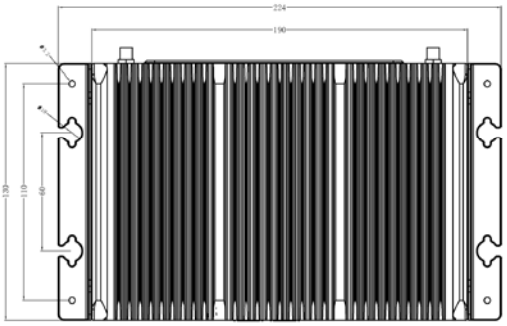
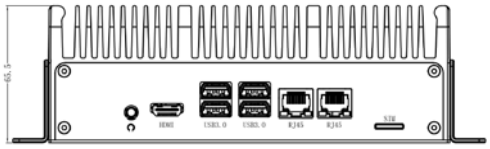
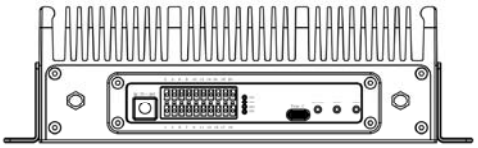
| Power Supply | Specification |
|---|---|
| **Input Type** | DC |
| **Input Voltage** | +12 (7A)--+36V(3A) DC Input |

## Environmental

| Environmental | Specification |
|---|---|
| **Operating Temperature** | -25 ℃ to +75℃ |
| **Storage Humidity** | 10%-90% non-condensing |

## Install Dimension

Leetop-ALP607 Dimensions as below:

| *Up view (Unit:mm)* | *Front view (Unit:mm)* |
| --- | --- |
|  |  |
| ***Left view (Unit:mm)*** | ***Back view (Unit:mm)*** |
| |  |

# Leetop-ALP607  Interfaces

## Interface description

### Front interface

***Leetop-ALP607* front interface**

| interface | Interface name | Interface description |
| --- | --- | --- |
| HDMI | HDMI | 1*HDMI |
| USB 3.0 | USB 3.0 | 4*USB3.0 Type-A |
| RJ45 | RJ45 | 2*RJ45 |
| Audio | Audio | 3.5mm audio interface |

## Rear interface

***Leetop-ALP607* back interface**

| interface | Interface name | Interface description |
|---|---|---|
| DC | DC | +12 (7A)--+36V(3A) DC Input |
| LNB | LNB | Antenna HF head |
| RESET | RESET | Reset button |
| RECOVERY | Recovery BUTTON | For Recovery mode |
| POWER | Power switch | Power switch |
| 20Pin | 20pin | Series-mode |

| PIN | Signal Name | PIN | Ball Name | PIN | Signal Name | PIN | Ball Name |
|---|---|---|---|---|---|---|---|
| 1 | CAN_L | | | 2 | CAN_H | | |
| 3 | RS232_TX | | | 4 | RS232_RX | | |
| 5 | RS485_A | | | 6 | RS485_B | | |
| 7 | I2C1_SDA (3.3V) | 191 | GEN2_I2C_SDA | 8 | I2C1_SCL(3.3V) | 189 | GEN2_I2C_SCL |
| 9 | GND | | | 10 | 3.3V | | |
| 11 | UART2_TXD_3V3 | 236 | UART1_TXD | 12 | UART2_RXD_3V3 | 238 | UART1_RXD |
| 13 | SPI0_MOSI_3V3 | 89 | SPI1_MOSI | 14 | SPI0_SCK_3V3 | 91 | SPI1_SCK |
| 15 | SPI0_MISO_3V3 | 93 | SPI1_MISO | 16 | SPI0_CS0_3V3 | 95 | SPI1_CS0 |
| 17 | SPI0_SC1_3V3 | 97 | SPI1_CS1 | 18 | GPIO2_3V3 | 124 | GPIO_PH6 |
| 19 | GND | | | 20 | 5V | | |

> Note: UART2 is converted to 3.3V logic level by the on-board level switching circuit;
>
> SPI0 is converted to 3.3V logic level by the on-board level switching circuit;
>
> GPIO2_3V3 is 3.3V logic level;

# Funtion introduct

## Operating system setup

### 1. Hardware preparation

- Ubuntu 18.04 PC x1

  Type-C data cable x1

  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 Type-C of the ALP607;
  2. Power on the ALP607 and enter Recovery mode;
  3. Open the Nvidia-SDK-Manager on the PC, as shown in the figure below, select Jetson Orin NX in the interface to download the Jetpack5.1 system image package and development tools。 From https://developer.nvidia.com/embedded/downloads or download the latest Jetson Linux distribution package and Jetson development kit sample file system. (Jetson Linux Driver Package (L4T) )
  4. Download the accompanying driver：

     Link: https://pan.baidu.com/s/1YwEhYBj6aiZqABXGYL-IXA

     Extraction code: 9ihb

```
#If you can't find the version using the latest sdk, you can use this command to get it
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

```
tar xf ${L4T_RELEASE_PACKAGE}
cd Linux_for_tegra/rootfs
sudo tar xpf ${SAMPLE_FS_PACKAGE}
cd ..
sudo ./tools/l4t_flash_prerequisites.sh
sudo ./apply_binaries.sh
#Replace driver packages
sudo cp -r 607_onx_jp5.1_R35.2.1/Linux_for_tegra /Linux_for_tegra
```

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

```
# flash to nvme
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. flash to USB

```
# flash to USB:
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
```

## 3.Recovery mode

Leetop-ALP607 can use USB to update the system. You need to enter USB Recovery mode to update the system. In USB Recovery mode, you can update the file system, kernel, boot loader, and BCT. Steps to enter recovery mode:

1. Turn off the system power, make sure that the power is turned off instead of in standby mode.
2. Use the USB Type-C to USB Type A cable to connect the carrier board to the host.
3. Power on the device.
4. Hold down the RECOVERY button and press and release the reset button. Wait 2 seconds for the RECOVERY button to be released.

> 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.Install system image

a) Connect USB type-A of Ubuntu 18.04 Host to Type-c of Leetop- ALP607;

b) Power up Leetop- ALP607 and enter Recovery mode(RCM);

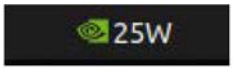
c) The PC Host enters the L4T directory and executes the flashing instruction:

```
cd Linux_for_tegra
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- ALP607 again and log in to the system.

## 5. Switching working modes

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:



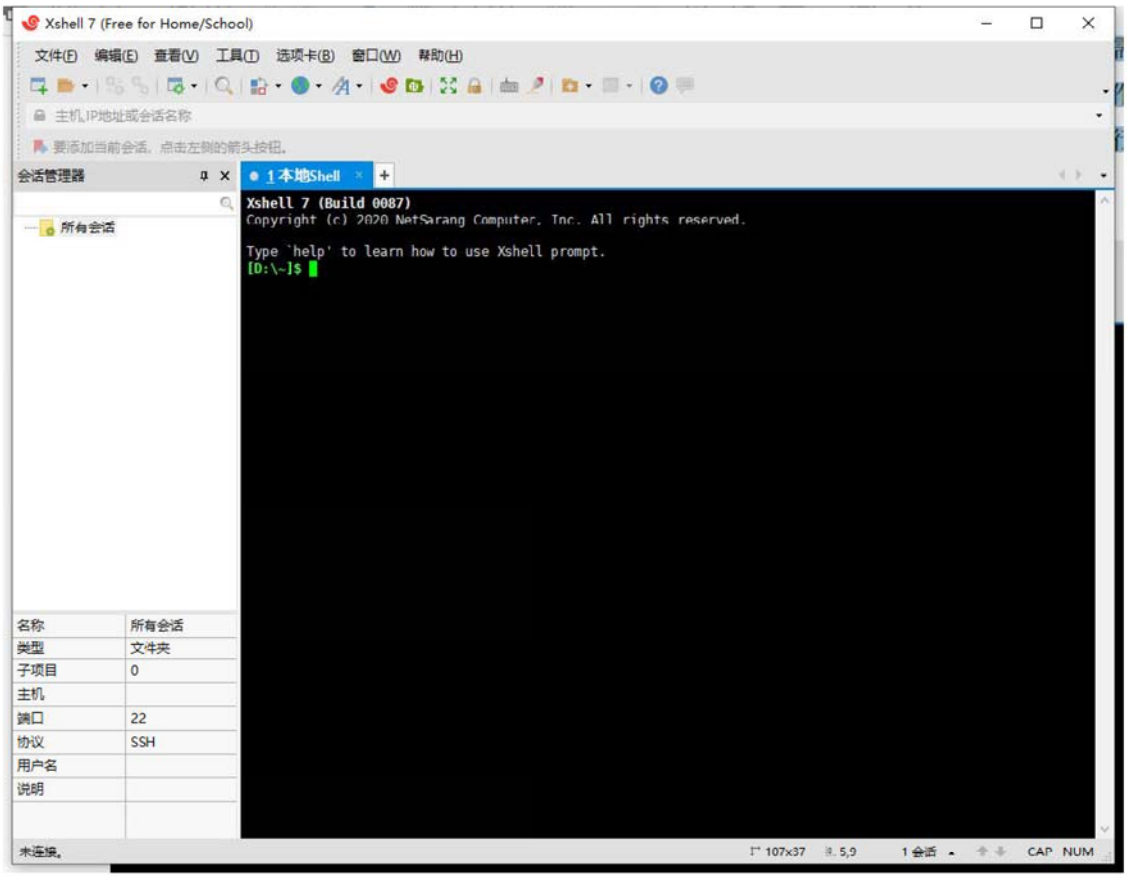

Alternatively, switch by entering the following command in the terminal:

```
# 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
sudo nvpmodel -m 0
```

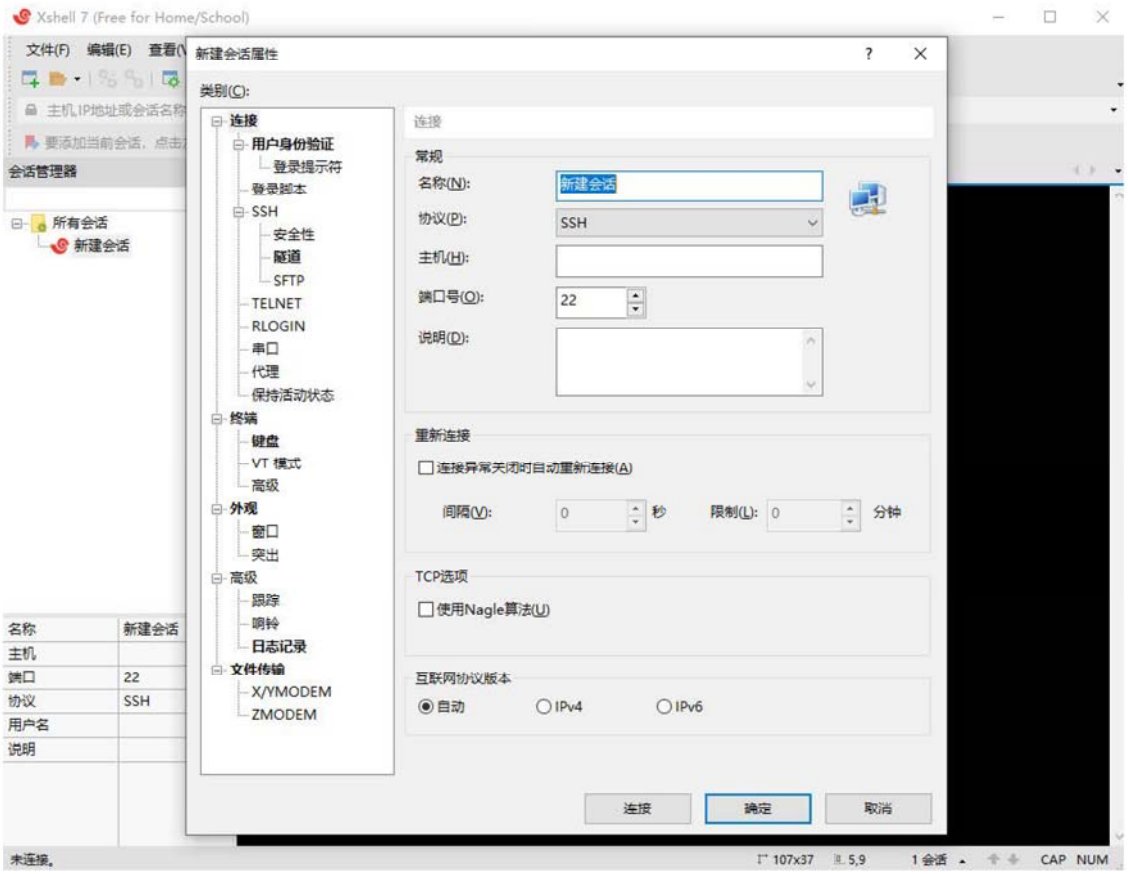
# Xshell

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).

- open xshell

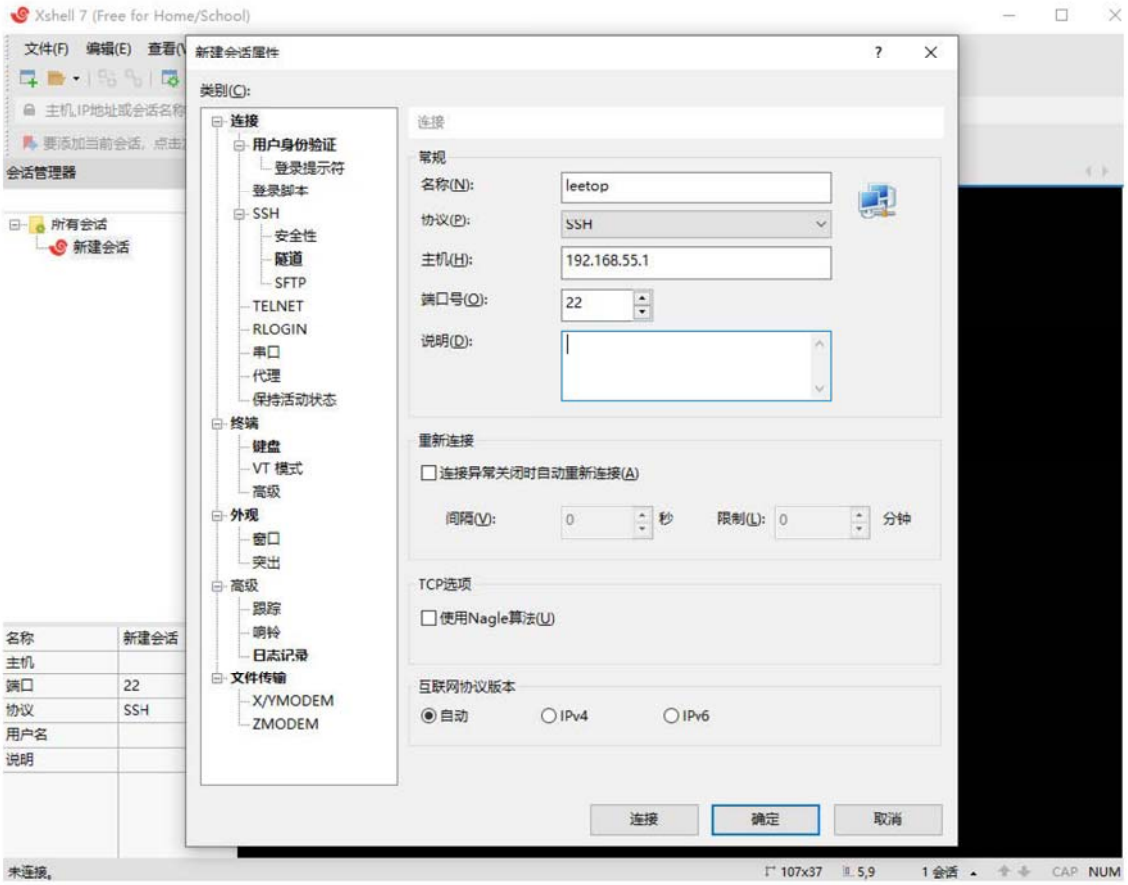



- Newly bulit

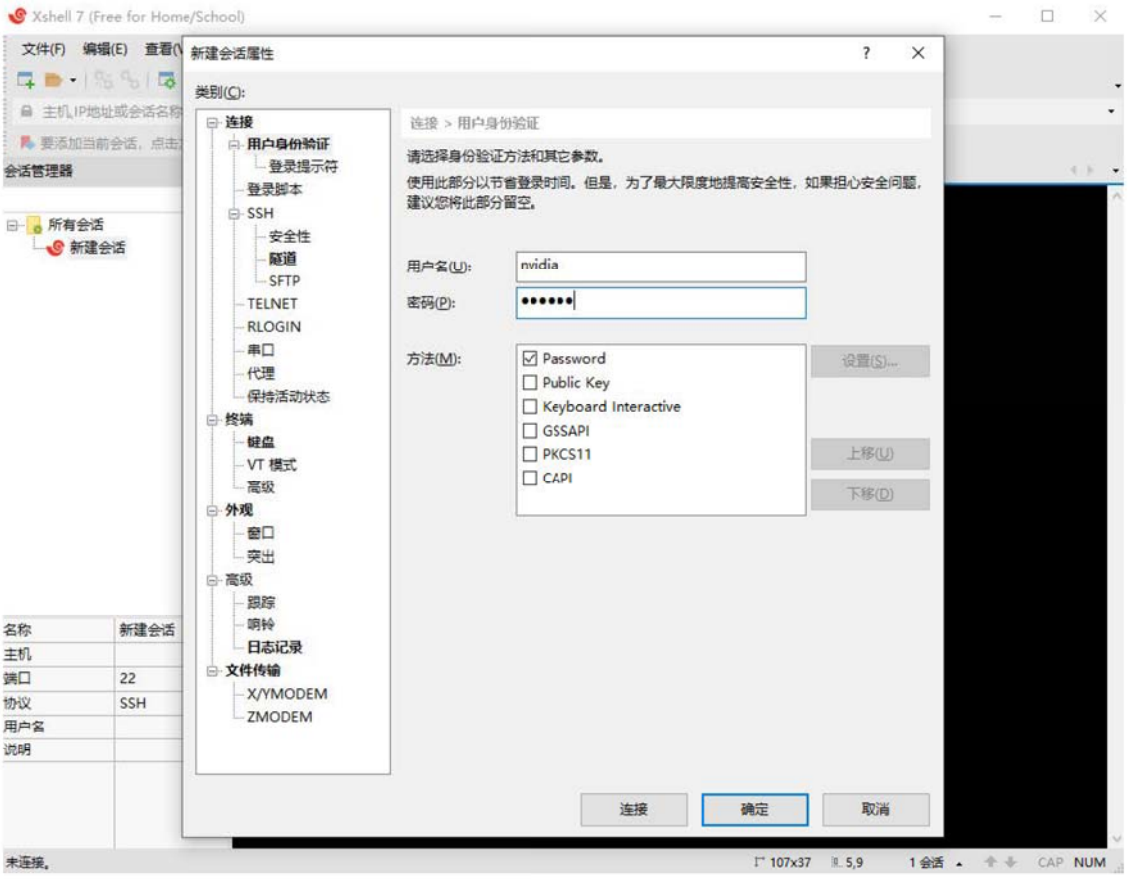



- Fill in the name and host ip(normally you can connect through the network ip, if you do not know the ip, you can connect the computer and the OTG port of the device through the usb data cable, fill in the fixed ip to connect)

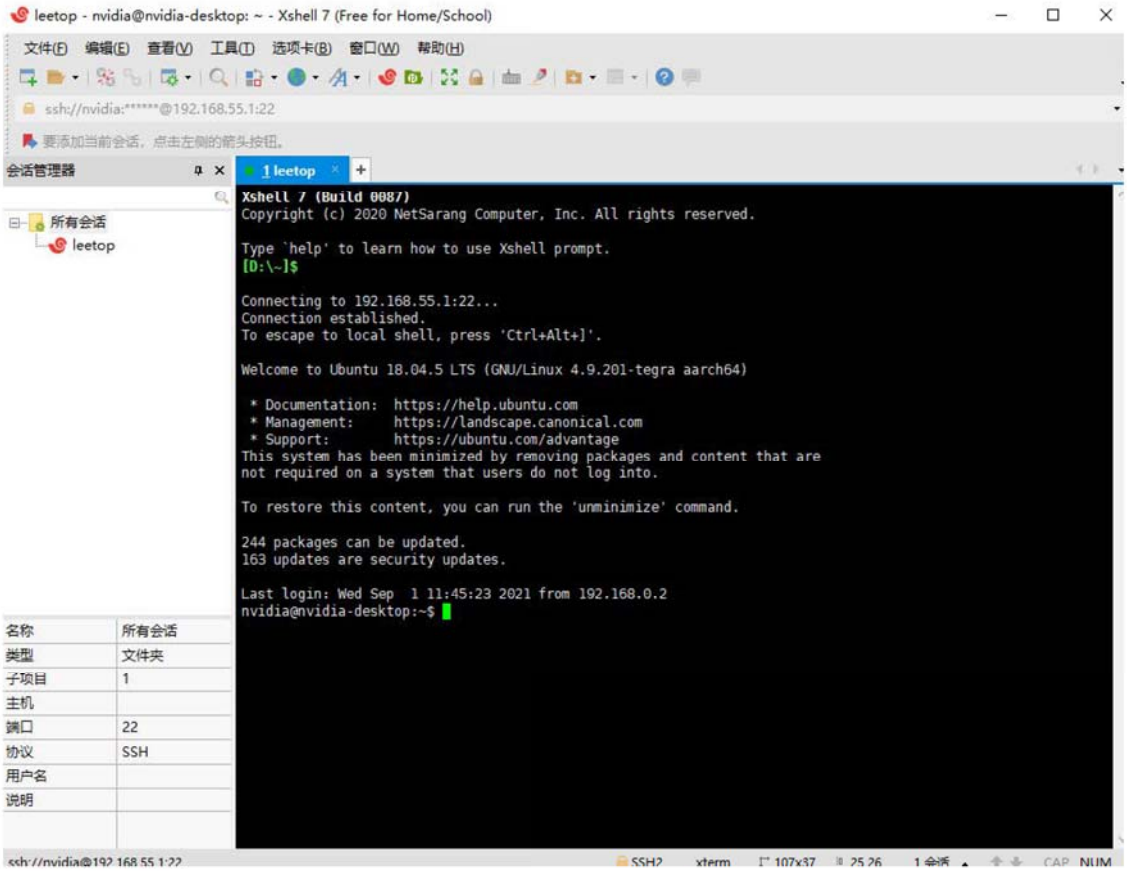
```
192.168.55.1
```



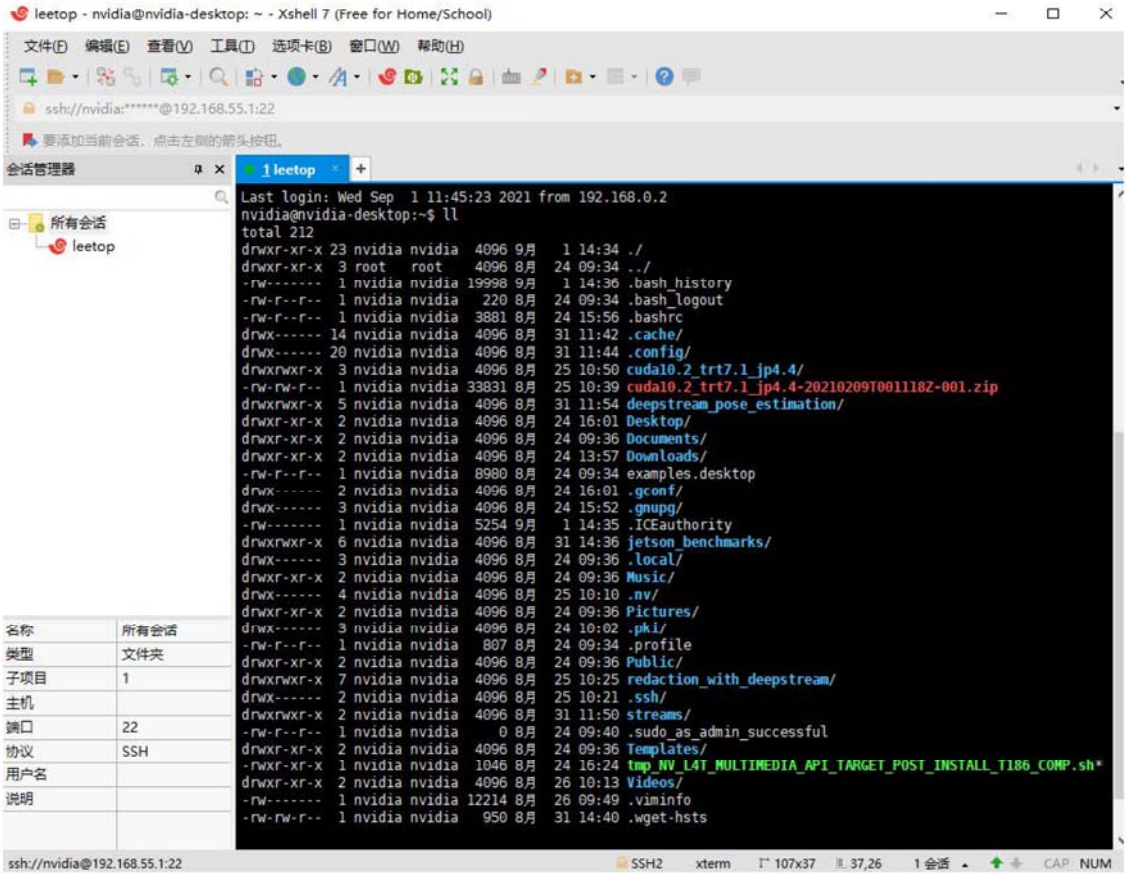

- 输入用户和密码 Enter the user and password




- Click Connect to enter the command line interface




- Operate jetson devices remotely through xshell



## System setting

**User：*nvidia* Password：*nvidia***

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

  The board supports native NVIDIA Linux For Tegra (L4T) Builds. HDMI, Gigabit Ethernet, USB3.0, USB OTG, serial port, GPIO, I2C bus are all supported and can run directly on the A607 without modification.

  Detailed instructions and tools download links: https://developer.nvidia.com/embedded/jetson-linux-r3521

  > Note: The native system does not support PWM fan control. If the native system is used, IPCall-BSP must be deployed

- ***NVIDIA Jetpack for L4T***

  Jetpack is a software package released by NVIDIA that contains all of the software tools needed for Orin NX development using ALP607. It includes both host and target tools, including OS images, middleware, sample applications, documentation, and more. The newly released JetPack runs on Ubuntu 20.04 Linux 64-bit hosts.
  It can be downloaded from the following link:

  https://developer.nvidia.com/embedded/jetpack

  **System setting**

- The Leetop-ALP607 runs Ubuntu 20.04. The default user name is nvidia and the password is nvidia

  **Development data and forum**

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

## View System Version

View the installed system package version

```
cat /etc/nv_tegra_release
```

View information about the installed JetPack

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

# Make a backup image

Backup images need to be created in the CLI environment. Only the system.img file is backed up

1. Use A USB cable to connect USB Type-A of the Ubuntu18.04 PC to Type-C of the ALP607.
2. Power on the ALP607 and enter the Recovery mode;
3. Go to the Linux_for_tegra directory and backup data by referring to README_backup_restore.txt in backup_restore.

   Instructions for backing up the Jetson Orin NX core module

```
cd Linux_for_Tegra/tools/backup_restore
# 将以下文件中mmcblk0替换为nvme0n1 Replace mmcblk0 with nvme0n1 in the following file
sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.sh
sudo sed -i 's/mmcblk0/nvme0n1/g' l4t_backup_restore.func
sudo sed -i 's/mmcblk0/nvme0n1/g' nvbackup_partitions.sh
sudo sed -i 's/mmcblk0/nvme0n1/g' nvrestore_partitions.sh
cd ../../
#须暂时禁用新外部存储设备的自动挂载备份恢复。Automount of new external storage devices must be temporarily disabled during backing up and restoring
systemctl stop udisks2.service
sudo tools/l4t_flash_prerequisites.sh # For Debian-based Linux
sudo service nfs-kernel-server start
sudo ./tools/backup_restore/l4t_backup_restore.sh -b <board-name>
#备份镜像，备份成功后在Linux_for_Tegra/tools/backup_restore下生成image文件。Back up the image and generate an image file under Linux_for_Tegra/tools/backup_restore.
sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
#备份镜像恢复。Restore the backup image.
```

4. Use the backup image for brushing

```
sudo ./tools/backup_restore/l4t_backup_restore.sh -r <board-name>
#Restore the backup image.
```

If the backup image can be used normally, it indicates that the backup image is available.

# Installation of Jtop tools

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.

nstallation steps:

1. Installing the pip3 tool

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

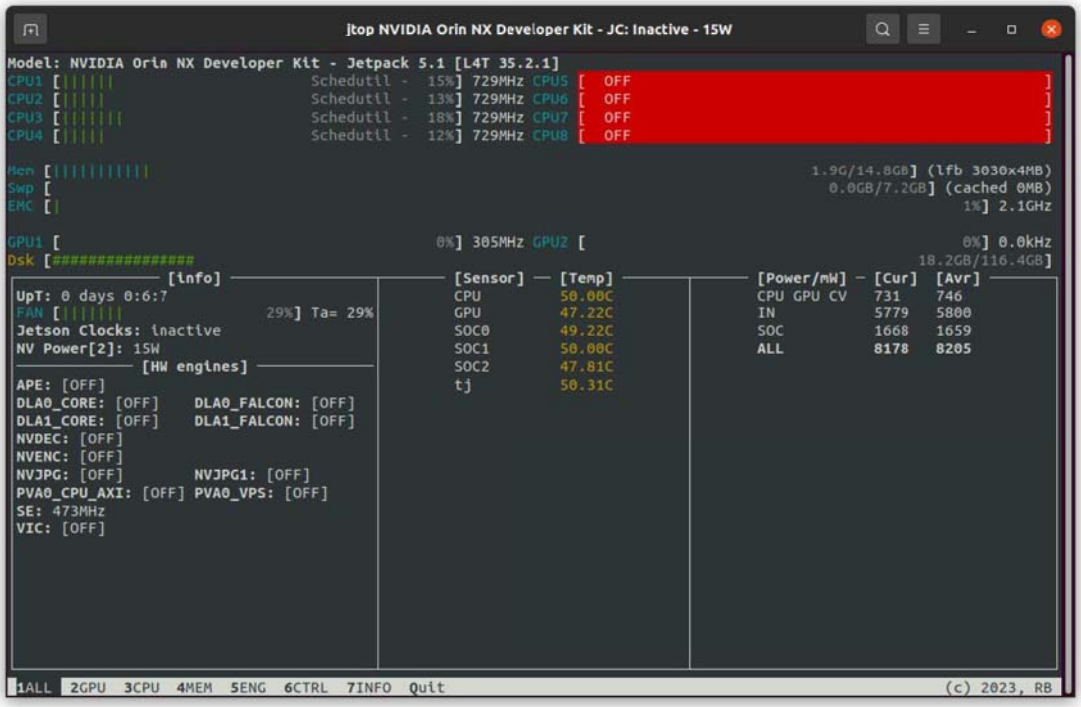
2. Installing jtop packages with pip3 1 sudo -H pip3

```
install -U jetson-stats
```

3. jtop Restart to run jtop

```
jtop
```

When run, the image below shows:



# Developer Tools

## JetPack

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

JetPack SDK Cloud-Native on Jetson

## L4T

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'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

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) . These tools and APIs accelerate robot development by making it easier to add artificial intelligence (AI) for perception and navigation into robots.

## Sample Applications

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/<br>/usr/share/visionworks-tracking/sources/samples/<br>/usr/share/visionworks-sfm/sources/samples/ |
| OpenCV | /usr/share/OpenCV/samples/ |
| VPI | /opt/nvidia/vpi/vpi-/samples |

# Development tool

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.

FCC Warnning:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection againstharmful interference in a residential installation. This equipment generates, uses and can radiateradio frequency energy and, if not installed and used in accordance with the instructions, maycause harmful interference to radio communications. However, there is no guarantee thatinterference will not occur in a particular installation. If this equipment does cause harmfulinterference to radio or television reception, which can be determined by turning the equipmentoff and on, the user is encouraged to try to correct the interference by one or more of thefollowing measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1)This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.