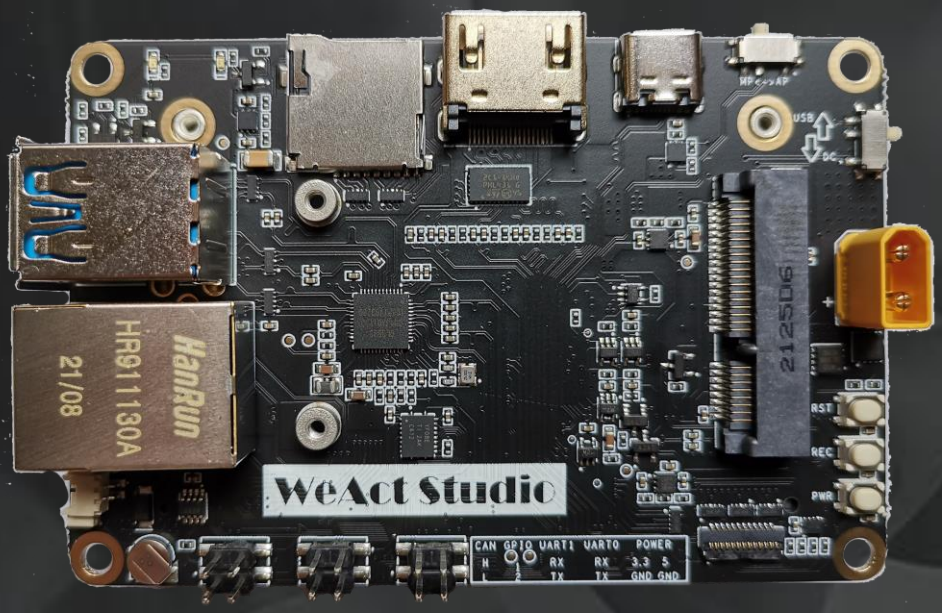


WeAct Studio

NANO&XAVIER TX2 NX 底板

使用教程

WeAct Studio

目录

REVISION HISTORY

Draft Date	Revision	Description
2021.9.20	V1.0	1. 初始版本
2021.12.26	V1.1	1. 增加系统备份 2. 增加系统迁移至 NVME 固态
2022.1.22	V1.2	1. 增加系统迁移至 SD 卡

1. 搭建烧写环境

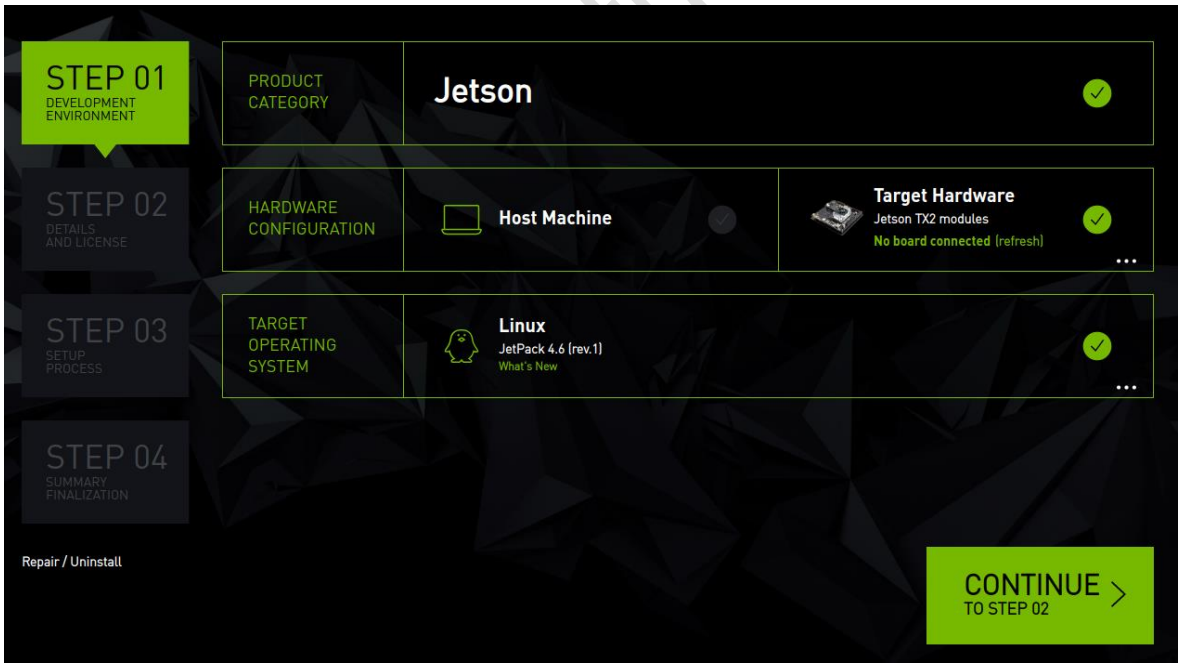
a) 首先，需要一台装有 **Ubuntu16.04** 以上的电脑作为 HOST 端给 Nano/NX 烧写，或者可以在 Windows 上安装 VMware 来实现。

- VMware 上如何安装 Ubuntu18.04：
  https://blog.csdn.net/u012556114/article/details/82751089

b) 在 NVIDIA 下载最新的 **SDK-Manager** 并在 ubuntu18.04 中安装（需要注册一个 NVIDIA 账号，后面也需要用到）

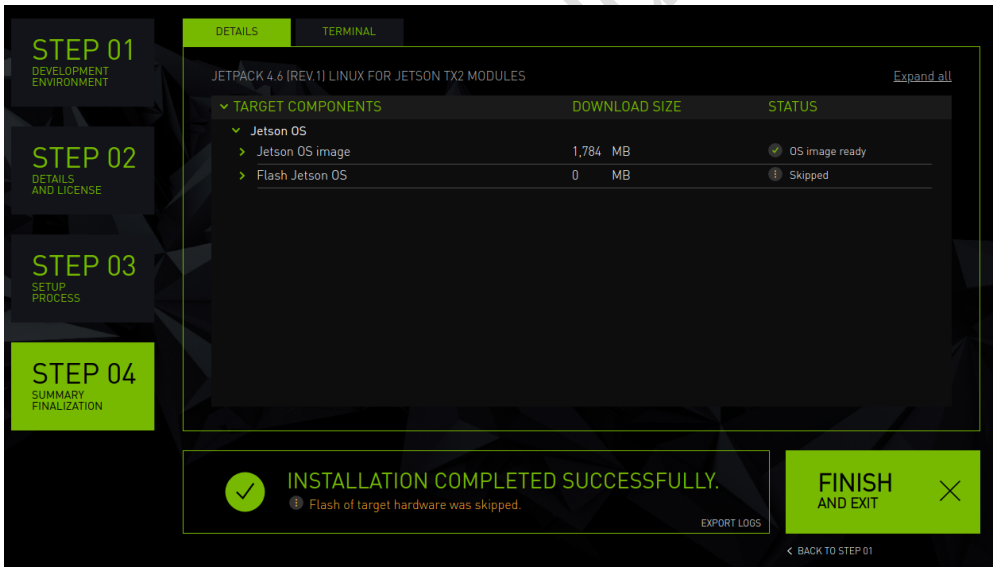
- SDK-Manager 下载地址：https://developer.nvidia.com/nvidia-sdk-manager

c) 选择需要 **Target Hardware** 以及 **JetPack** 版本，**不勾选 HostMachine**，这里以 **TX2NX 为例**选择，点击 **Continue**

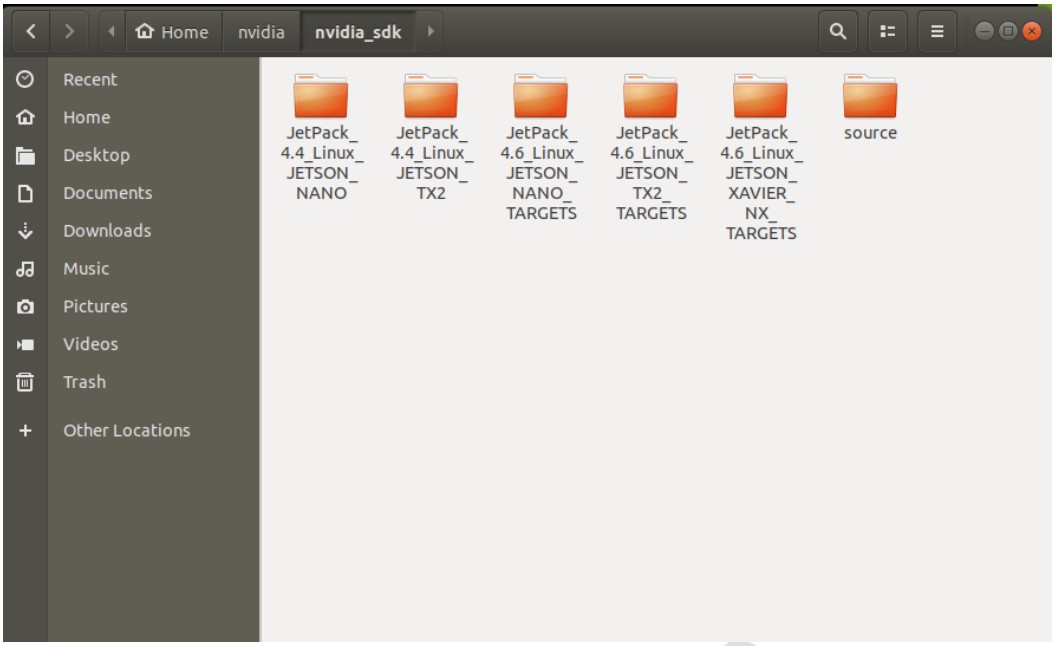


d) 这里需要勾选 **I accept the terms and conditions of the license agreements**，**取消勾选 Jetson SDK Components**，点击 CONTINUE 进行下一步。

e) P.S：请在畅通的网络环境下进行下载以及安装，下载或安装失败时，可点击 **Retry** 继续，直至**全部状态为 Installed 并且显示绿色**，安装过程中会弹出联网烧写的信息，选择**Skip。**



f) 安装成功后，会在**~/nvidia/nvidia_sdk/** 下有相应版本烧写所需的文件



g) 在终端通过 **sudo apt-get install python** 安装 python 支持以便后续烧写环境。

2. 为 NANO/NX 更新设备树或刷机

P.S: WeAct 设备树与官方设备树区别（**其他功能相同**），如果无需求，可以不更新设备树。
！！！ 注意，更新设备树不影响系统任何文件，请放心更新

NVIDIA 与 WeAct 设备树差异

	NVIDIA	WeAct Studio
Nano-SD	相同	相同
Nano-EMMC	无法使用 SD 卡	可以使用 SD 卡
TX2NX	无法使用 **SD 卡&UART1**	可以使用 **SD 卡&UART1**
XavierNX	无法使用 **SD 卡**	可以使用 **SD 卡**

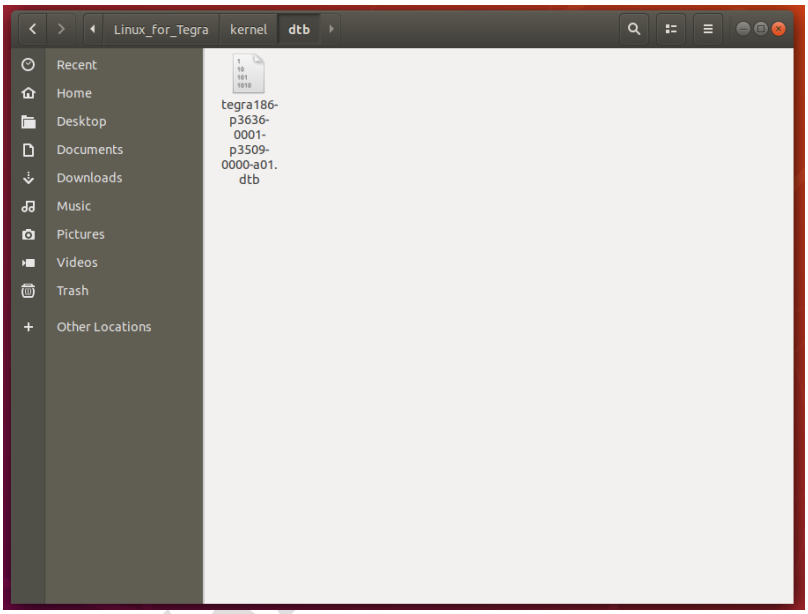
a) 这里**以 TX2NX 为例**，在 WeAct Studio 的 **github** 或者**码云**上下载相应的设备树文件。
- Github：https://github.com/WeActTC/Nano_TX2-Xavier_NX-CB
- 码云：https://gitee.com/WeAct-TC/Nano_TX2-Xavier_NX-CB

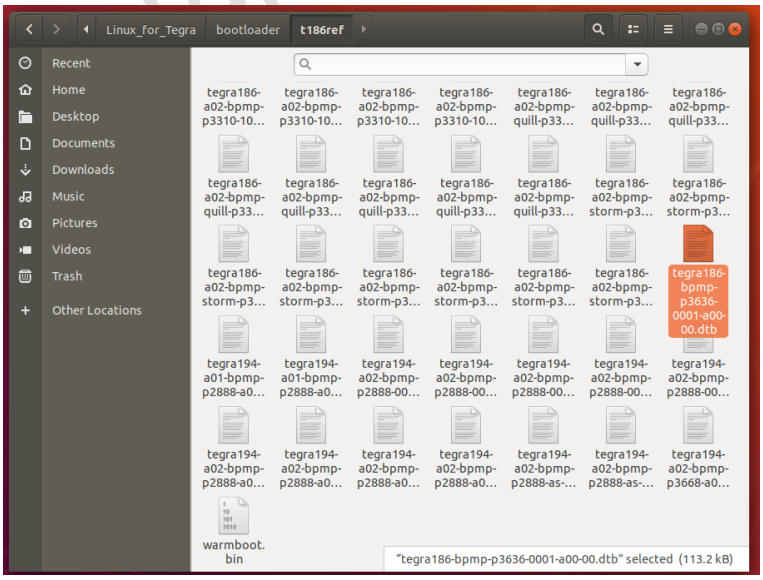
各设备设备树更新路径及设备树名称

	Linux_for_Tegra/kernel/dtb	**Linux_for_Tegra/bootloader/t186ref(t210f)**
Nano-EMMC	**tegra210-p3448-0002-p3449-0000-b00**	**无**
TX2NX	**tegra186-p3636-0001-p3509-0000-a01**	**tegra186-bpmp-p3636-0001-a00-00**
XavierNX	**tegra194-p3668-all-p3509-0000**	**无**

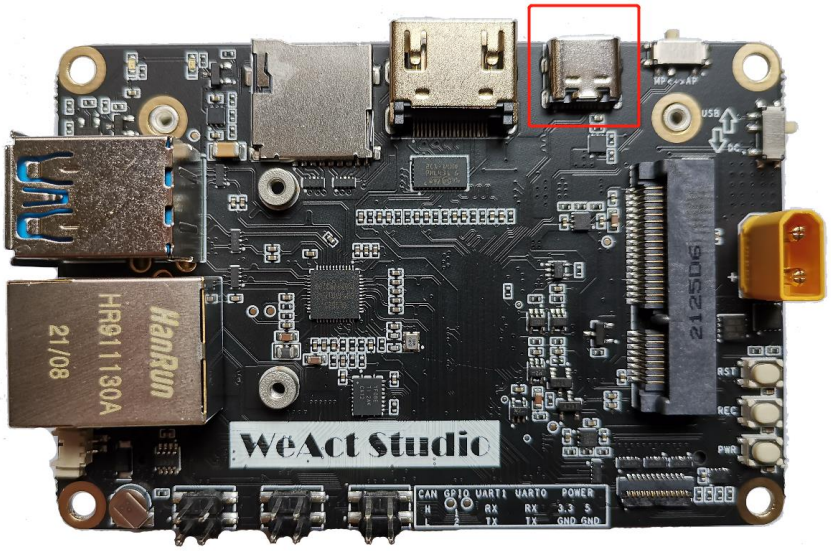
b) 找到相应版本的设备树

1. 进入**~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra/kernel/dtb**，复制提供的设备树 **tegra186-p3636-0001-p3509-0000-a01.dtb** 至该目录
2. 进入**~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra/bootloader/t186ref**，复制提供的设备树 **tegra186-bpmp-p3636-0001-a00-00.dtb** 至该目录【**仅 TX2NX 需要更新**】

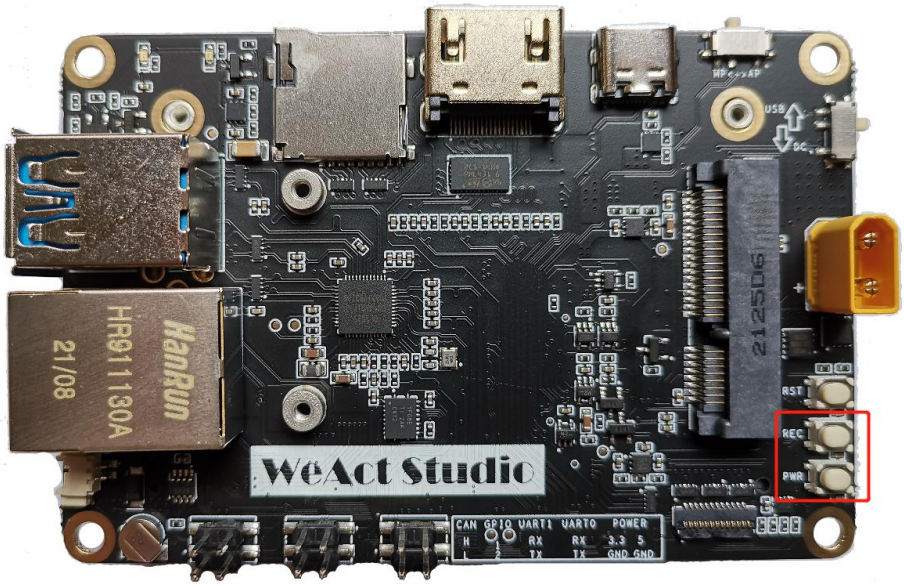




3. 使用 **USB Type-C** 线连接载板上的 **USB OTG** 接口 。



4. 将开机键**拨至 MP（手动开机）**，摁住 **REC** 键，再摁 **PWR** 键开机，松开 **REC** 键进入 Recovery 模式，此时 VMWare 右下角会出现 **NVIDIA 的 USB 驱动标志**，或者打开终端，输入 **lsusb** 命令，会发现 **Nvidia Corp**。



5. 进入**~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra**，打开终端：
   a) **如果你没有系统，需要刷机**，请使用刷机命令 **sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx mmcblk0p1**
   b) **如果你有系统，只需要更新设备树**，请使用更新设备树命令 **sudo ./flash.sh -r -k kernel-dtb jetson-xavier-nx-devkit-tx2-nx mmcblk0p1**

   等更新成功就可以使用了，其他设备命令请参考下面表格。

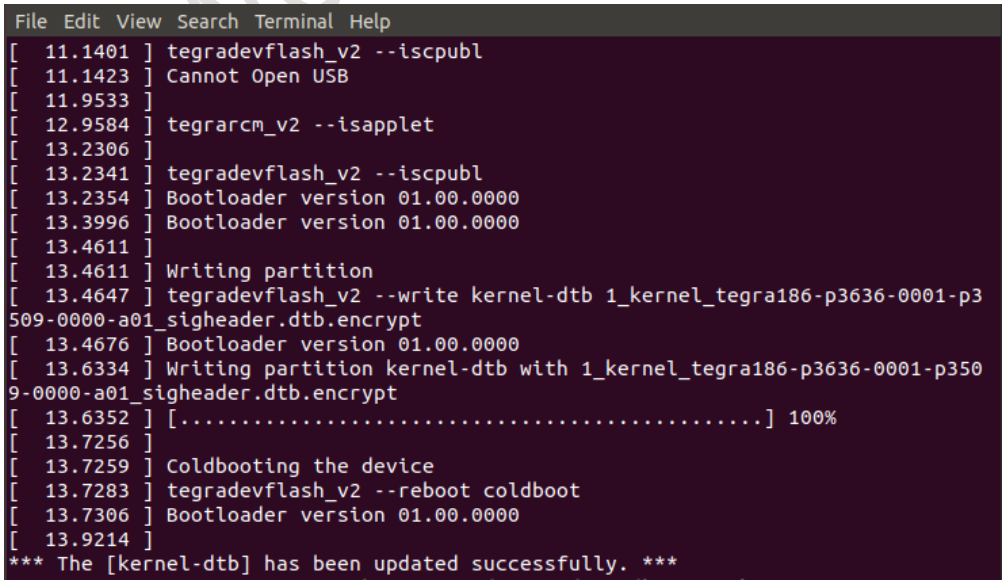
各设备更新设备树命令

设备	设备树更新命令
Nano-SD	sudo ./flash.sh -r -k DTB jetson-nano-qspi-sd mmcblk0p1
Nano-EMMC	sudo ./flash.sh -r -k DTB jetson-nano-emmc mmcblk0p1
TX2-NX	sudo ./flash.sh -r -k kernel-dtb jetson-xavier-nx-devkit-tx2-nx mmcblk0p1
Xavier-SD	sudo ./flash.sh -r -k kernel-dtb jetson-xavier-nx-devkit-qspi mmcblk0p1
Xavier-EMMC	sudo ./flash.sh -r -k kernel-dtb jetson-xavier-nx-devkit-emmc mmcblk0p1

各设备刷机命令

设备	设备树更新命令
Nano-SD	sudo ./flash.sh jetson-nano-qspi-sd mmcblk0p1
Nano-EMMC	sudo ./flash.sh jetson-nano-emmc mmcblk0p1
TX2-NX	sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx mmcblk0p1
Xavier-SD	sudo ./flash.sh jetson-xavier-nx-devkit-qspi mmcblk0p1
Xavier-EMMC	sudo ./flash.sh jetson-xavier-nx-devkit-emmc mmcblk0p1

更新设备树/刷机后，会有 Successfully!显示，如下图所示。



3. 环境备份及镜像烧写

a) 参考**第 2 章**，无论备份还是镜像烧写，进入 Recovery 模式，注意镜像较大，请保证 Ubuntu 有充足的空间（>40G）。

b) **备份**：这里以 TX2NX 为例（其他设备参考上章内容修改 jetson 名称），对核心板现有环境进行备份。进入~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra，打开终端：

使用镜像备份命令：**sudo ./flash.sh -r -k APP -G backup.img jetson-xavier-nx-devkit-tx2-nx mmcblk0p1**，等待备份完成即可，此时目录下会有 backup.img 的镜像（建议复制一份至其他位置备份），此时**备份已经成功**。

```
greetrix@greetrix-virtual-machine:~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra$ sudo ./flash.sh -r -k APP -G backup.img jetson-xavier-nx-devkit-tx2-nx mmcblk0p1
```

```
[    9.1920 ] tegrarcm_v2 --boot recovery
[    9.1966 ] Applet version 01.00.0000
[    9.3692 ]
[   10.3763 ] tegrarcm_v2 --isapplet
[   10.3793 ] USB communication failed.Check if device is in recovery
[   10.5068 ]
[   10.8536 ] tegradevflash_v2 --iscpubl
[   10.8565 ] Cannot Open USB
[   11.3572 ]
[   12.3617 ] tegrarcm_v2 --isapplet
[   12.5109 ]
[   12.5142 ] tegradevflash_v2 --iscpubl
[   12.5163 ] Bootloader version 01.00.0000
[   12.6843 ] Bootloader version 01.00.0000
[   12.7463 ]
[   12.7464 ] Reading partition
[   12.7492 ] tegradevflash_v2 --read APP /home/greetrix/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra/backup.img
[   12.7511 ] Bootloader version 01.00.0000
[   12.9183 ] [.............................................] 100%
[ 2216.5426 ]
*** The [APP] has been read successfully. ***
        Converting RAW image to Sparse image... greetrix@greetrix-virtual-machin
X2_TARGETS/Linux_for_Tegra$ k 4.6_Linux_JETSON_TX
```

c) **镜像烧写**：进入~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra，将备份好的 backup.img 拷入 Liunx_for_Tegra/bootloader/下，并重命名为 system.img，回到 Linux_for_Tegra 目录下，打开终端：

使用已有镜像烧写命令：**sudo ./flash.sh -r jetson-xavier-nx-devkit-tx2-nx mmcblk0p1**，等待烧写完成即可。

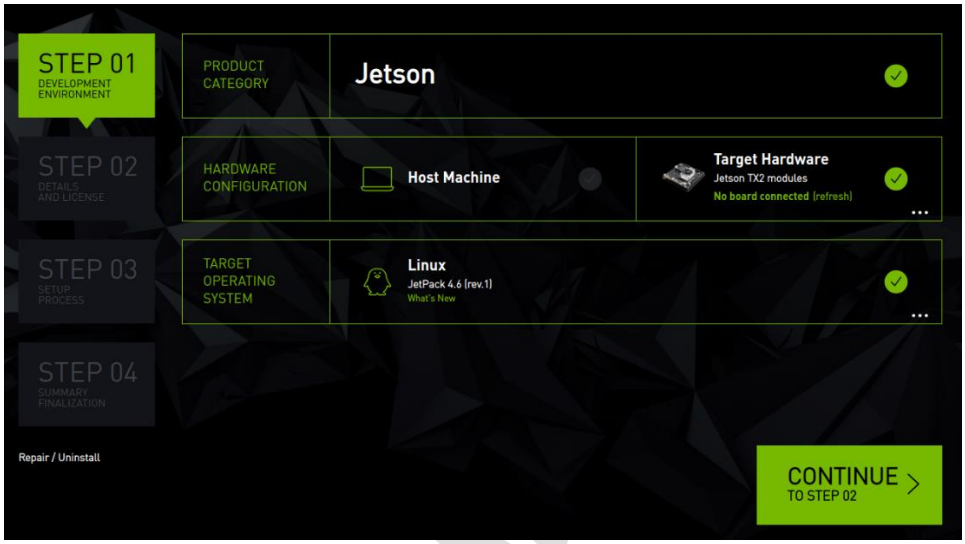
```
[   18.0000 ] Writing partition spe-fw_b with spe_sigheader.bin.encrypt
[   18.0298 ] [.................................................] 100%
[   18.0790 ] Writing partition mb2 with nvtboot_sigheader.bin.encrypt
[   18.1057 ] [.................................................] 100%
[   18.1596 ] Writing partition mb2_b with nvtboot_sigheader.bin.encrypt
[   18.1895 ] [.................................................] 100%
[   18.2416 ] Writing partition mts-preboot with preboot_d15_prod_cr_sigheader.bi
n.encrypt
[   18.2710 ] [.................................................] 100%
[   18.6760 ] Writing partition mts-preboot_b with preboot_d15_prod_cr_sigheader.
bin.encrypt
[   18.7053 ] [.................................................] 100%
[   18.7467 ] Writing partition SMD with slot_metadata.bin
[   18.7744 ] [.................................................] 100%
[   18.9037 ] Writing partition SMD_b with slot_metadata.bin
[   18.9302 ] [.................................................] 100%
[   18.9658 ] Writing partition VER_b with emmc_bootblob_ver.txt
[   18.9922 ] [.................................................] 100%
[   19.0322 ] Writing partition VER with emmc_bootblob_ver.txt
[   19.0592 ] [.................................................] 100%
[   19.0966 ] Writing partition master_boot_record with mbr_1_3.bin
[   19.1194 ] [.................................................] 100%
[   19.1525 ] Writing partition APP with system.img
[   19.1800 ] [........                                        ] 016%
```

```
t.encrypt
[ 1888.6372 ] Bootloader version 01.00.0000
[ 1888.8013 ] Writing partition MB1_BCT with mb1_cold_boot_bct_MB1_sigheader.b
.encrypt
[ 1888.8019 ] [.................................................] 100%
[ 1888.8706 ]
[ 1888.8837 ] tegradevflash_v2 --write MB1_BCT_b mb1_cold_boot_bct_MB1_sigheade
.bct.encrypt
[ 1888.8849 ] Bootloader version 01.00.0000
[ 1889.0452 ] Writing partition MB1_BCT_b with mb1_cold_boot_bct_MB1_sigheader
t.encrypt
[ 1889.0468 ] [.................................................] 100%
[ 1889.1180 ]
[ 1889.1181 ] Flashing completed

[ 1889.1181 ] Coldbooting the device
[ 1889.1436 ] tegradevflash_v2 --reboot coldboot
[ 1889.1449 ] Bootloader version 01.00.0000
[ 1889.3379 ]
*** The target t186ref has been flashed successfully. ***
Reset the board to boot from internal eMMC.
```

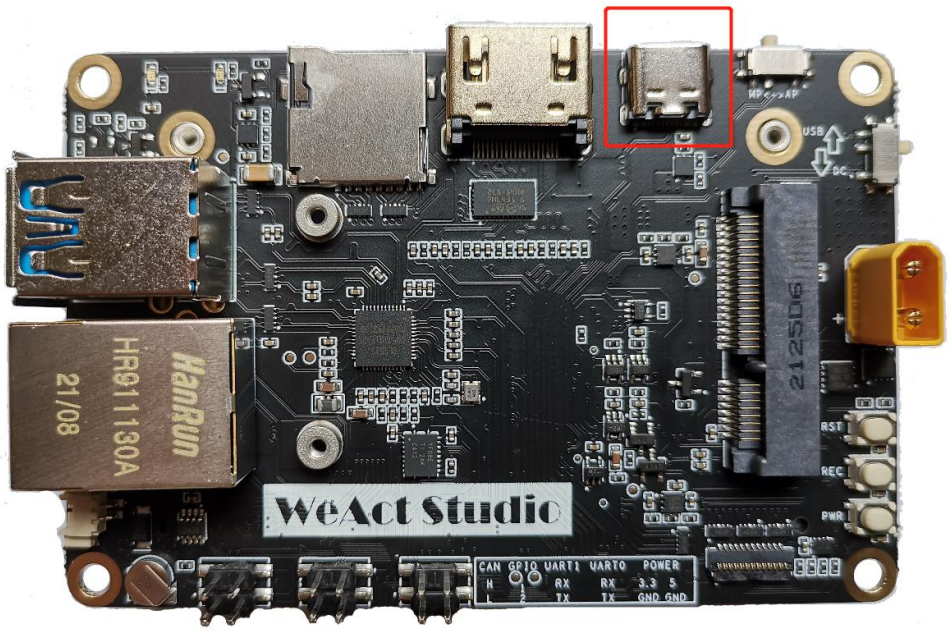
4. 安装 NVIDIA 组件

d) 选择需要 **Target Hardware** 以及 **JetPack** 版本，**不勾选 HostMachine**，这里以 **TX2NX 为例**选择，点击 **Continue**



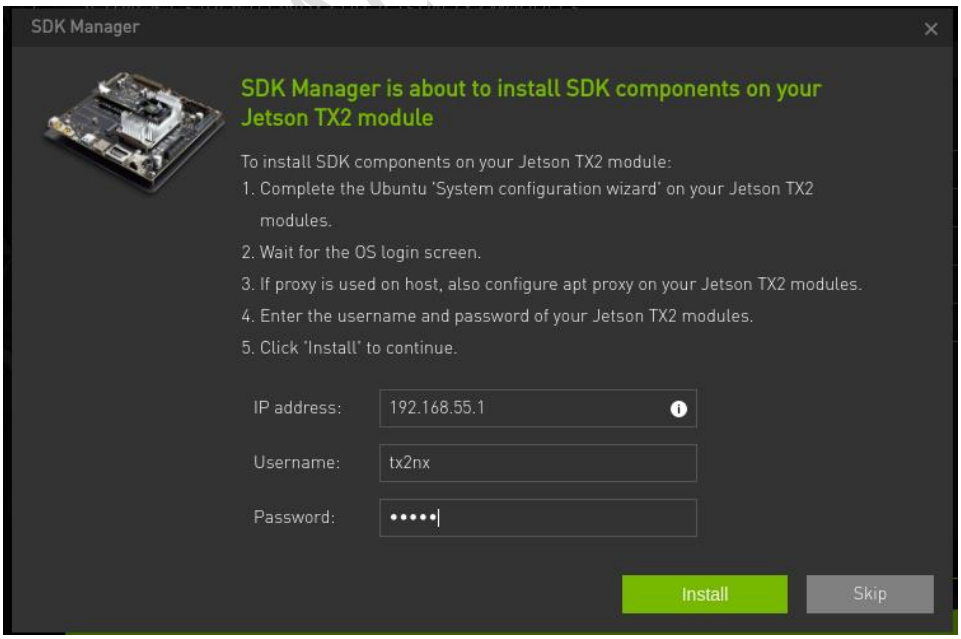
e) 勾选所需要 **SDK 组件**，勾选 **I accept the terms and conditions of the license agreements**，点击 **CONTINUE** 进行下一步。

f) 使用 **USB Type-C** 线连接载板上的 **USB OTG** 接口 。



g) 将开机键**拨至 MP（手动开机）**，摁 **PWR** 键开机，此时 VMWare 右下角会出现 **NVIDIA 的 USB 驱动标志**，或者打开终端，输入 **lsusb** 命令，会发现 **Nvidia Corp**。

h) 输入 **TX2NX** 账号密码，**TX2NX** 端请**保持联网状态**



i) 等待安装完成即可。

5. 使用 CAN 进行通信

a) Tx2-NX/XavierNX 上集成了 2 个 CAN 控制器（CAN0/CAN1），另外 WeAct Studio 的载板上设计了 1 个 CAN 收发器（CAN0），可直接挂载 CAN 物理总线使用。

b) Tx2-NX/XavierNX 自带 canbus 的驱动并集成到了镜像中，已经支持 canbus 无需多做处理。我们需要安装 canbus 模块。（在终端输入下面命令或者放入 rc.local 里面开启自启）

```
modprobe can        // 插入 can 总线子系统
modprobe can-raw    //插入 can 协议模块
modprobe can-bcm
modprobe can-gw
modprobe can_dev
modprobe mttcan     //真正的 can 口支持
```

c) 通过 **lsmod** 检查是否安装成功。

```
nvidia@localhost:~$ lsmod
Module                  Size  Used by
fuse                  103841  2
mttcan                 66251  0
can_dev                13306  1 mttcan
can_gw                 10919  0
can_bcm                16471  0
can_raw                10388  0
can                    46600  3 can_raw,can_bcm,can_gw
zram                   26166  6
overlay                48691  0
bcmdhd                934274  0
cfg80211              589351  1 bcmdhd
spidev                 13282  0
nvgpu                1575721  20
bluedroid_pm           13912  0
ip_tables              19441  0
x_tables               28951  1 ip_tables
```

d) 配置 canbus 属性，和串口的波特率设置类似。

sudo ip link set can0 type can bitrate 500000
sudo ip link set up can0

e) 通过 ifconfig 查看是否配置成功。

```
nvidia@localhost:~$ ifconfig
can0: flags=193<UP,RUNNING,NOARP>  mtu 16
        unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00  txqueuelen 10  (UNSPEC)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 131
```

f) 在一个终端通过 cansend can0(can1) ×××命令来发送数据, 另一个终端通过 candump can1(can0)完成实际信号收发测试

```
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$ cansend can0 555#112233445566
nvidia@localhost:~$
```

```
nvidia@linux:~$ candump can1
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
  can1  555   [6]  11 22 33 44 55 66
```

6. GPIO 在 SHELL 中使用

a) Nano/TX2-NX/Xavier-NX 可直接通过 shell 命令控制 GPIO 输入输出

	GPIO1	GPIO2
Nano	194	38
TX2-NX	338	269
Xavier-NX	196	105

b) 以 TX2-NX GPIO1 为例

- 先激活 IO: sudo echo 338 > /sys/class/gpio/export
- 设置 IO 方向: echo out > /sys/class/gpio/gpio338/direction
- 设置输出: echo 1 > /sys/class/gpio/gpio338/value

7. 系统迁移至 NVME 固态硬盘

a) WeAct-Nano&Xavier-TX2_NX-CB 搭配 WeAct-MiniPCIE2M2 转板，支持 2242/2230 NVME SSD 固态硬盘，最大可达 300M/s 读写速度。

```
tx2nx@tx2nx:/mnt/ssd$ dd if=/dev/zero of=./largefile bs=1M count=1024
dd: failed to open './largefile': Permission denied
tx2nx@tx2nx:/mnt/ssd$ sudo dd if=/dev/zero of=./largefile bs=1M count=1024
1024+0 records in
1024+0 records out
1073741824 bytes (1.1 GB, 1.0 GiB) copied, 3.14822 s, 341 MB/s
tx2nx@tx2nx:/mnt/ssd$ sudo sh -c "sync && echo 3 > /proc/sys/vm/drop_caches"
tx2nx@tx2nx:/mnt/ssd$ dd if=./largefile of=/dev/null bs=4k
262144+0 records in
262144+0 records out
1073741824 bytes (1.1 GB, 1.0 GiB) copied, 3.08641 s, 348 MB/s
tx2nx@tx2nx:/mnt/ssd$
```

b) NVME 固态硬盘配置：

- 1. 配置前确保系统能识别到 NVME 固态硬盘，终端命令：**sudo fdisk -lu**

```
Disk /dev/nvme0n1: 119.2 GiB, 128035676160 bytes, 250069680 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
```

- 2. 将 NVME 设置成 GPT 格式：

i. 终端命令：**sudo parted /dev/nvme0n1** 进入 parted

```
tx2nx@tx2nx:~$ sudo parted /dev/nvme0n1
[sudo] password for tx2nx:
GNU Parted 3.2
Using /dev/nvme0n1
Welcome to GNU Parted! Type 'help' to view a list of commands.

(parted)
```

ii. 终端命令：**mklabel gpt** 将磁盘 label 设置为 gpt 格式

```
(parted) mklabel gpt
Warning: The existing disk label on /dev/nvme0n1 will be destroyed and all data on this disk will be lost. Do you want to
Yes/No? Yes
```

iii. 终端命令：**mkpart logical 0 -1** 将磁盘 part 设置为 gpt 格式

```
(parted) mkpart logic 0 -1
Warning: The resulting partition is not properly aligned for best performance.
Ignore/Cancel? Ignore
```

iv. 终端命令：**print** 查看分区结果

```
(parted) print
Model: KBG40ZNS128G NVMe TOSHIBA 128GB (nvme)
Disk /dev/nvme0n1: 128GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start   End    Size   File system  Name   Flags
 1      17.4kB  128GB  128GB               logic
```

v. 终端命令：**quit** 退出

vi. 终端命令：**sudo fdisk /dev/nvme0n1**

```
(parted) quit
Information: You may need to update /etc/fstab.

tx2nx@tx2nx:~$ sudo fdisk /dev/nvme0n1

Welcome to fdisk (util-linux 2.31.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.


Command (m for help):
```

vii. Command（m for help): 输入 **N**，选择增加新分区，后面回车默认即可

```
Command (m for help): n
Partition number (2-128, default 2): 2
First sector (250067728-250069646, default 250068992):
Last sector, +sectors or +size{K,M,G,T,P} (250068992-250069646, default 250069646):

Created a new partition 2 of type 'Linux filesystem' and of size 327.5 KiB.
```

viii. Command（m for help)：输入 **P**，查看分区结果

```
Device             Start       End   Sectors   Size Type
/dev/nvme0n1p1        34 250067727 250067694 119.2G Linux filesystem
/dev/nvme0n1p2 250068992 250069646       655 327.5K Linux filesystem
```

ix. 终端命令：**quit** 退出

x. 终端命令：**sudo mke2fs -t ext4 /dev/nvme0n1p1**，格式化分区

```
tx2nx@tx2nx:~$ sudo mke2fs -t ext4 /dev/nvme0n1p1
mke2fs 1.44.1 (24-Mar-2018)
/dev/nvme0n1p1 contains a ext4 file system
        last mounted on / on Sun Dec 26 11:04:07 2021
Proceed anyway? (y,N)
```

xi. 终端命令：**sudo mount /dev/nvme0n1p1 /mnt**，成功 mount 则 NVME 配置成功

```
tx2nx@tx2nx:~$ sudo mount /dev/nvme0n1p1 /mnt
tx2nx@tx2nx:~$
```

c) **NVIDIA Jetson 系统迁移 (!!!迁移前建议参考第 3 章进行系统备份)：**

- ✓ **下面以 TX2NX 为例，其他设备替换命令中间的设备名称即可，设备名称可参考上面命令**
- ➢ 1. 终端命令： **git clone https://github.com/jetsonhacks/rootOnNVMe** 或者 https://github.com/jetsonhacks/rootOnNVMe 下载脚本
- ➢ 2. 进入 **rootOnNVMe** 文件夹，终端命令：**./copy-rootfs-ssd.sh**，复制系统文件至 NVME SSD

```
tx2nx@tx2nx:/home/script/rootOnNVMe-master$ ./copy-rootfs-ssd.sh
mount: /mnt: /dev/nvme0n1p1 already mounted on /mnt.
     17,380,838   0%    2.40MB/s    0:00:06 (xfr#39, ir-chk=1015/44887)
```

- ➢ 3. 终端命令：**./setup-service.sh** 配置启动项

```
tx2nx@tx2nx:/home/script/rootOnNVMe-master$ ./setup-service.sh
==== AUTHENTICATING FOR org.freedesktop.systemd1.reload-daemon ===
Authentication is required to reload the systemd state.
Authenticating as: tx2nx,,, (tx2nx)
Password: Failed to reload daemon: Method call timed out
polkit-agent-helper-1: pam_authenticate failed: Authentication failure
Created symlink /etc/systemd/system/default.target.wants/setssdroot.service → /etc/systemd/system/setssdroot.service.
Service to set the rootfs to the SSD installed.
Make sure that you have copied the rootfs to SSD.
Reboot for changes to take effect.
```

- ➢ 4. 参考第 2 章，进入 **Recovery 模式。**
- ➢ 5. （**烧录环境的 Ubuntu**，参考**前面章节**）进入**~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra**，打开终端：**sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx nvme0n1p1** 更新 EMMC 内部引导

```
greetrix@greetrix-virtual-machine:~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra$ sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx nvme0n1p1
```

```
[   37.3739 ] Coldbooting the device
[   37.3775 ] tegradevflash_v2 --reboot coldboot
[   37.3788 ] Bootloader version 01.00.0000
[   37.5711 ]
*** The target t186ref has been flashed successfully. ***
Make the target filesystem available to the device and reset the board to boot from external nvme0n1p1.
```

- 6. 重启 TX2NX，终端命令：**df -l**， 此时系统盘已经变为 NVME SSD，并且原有 EMMC 上系统已经成功迁移。

```
tx2nx@tx2nx:~$ df -l
Filesystem     1K-blocks     Used Available Use% Mounted on
/dev/nvme0n1p1 122547172 11949920 104329176  11% /
none             1578060        0   1578060   0% /dev
tmpfs            1962748       52   1962696   1% /dev/shm
tmpfs            1962748    20764   1941984   2% /run
tmpfs               5120        4      5116   1% /run/lock
tmpfs            1962748        0   1962748   0% /sys/fs/cgroup
tmpfs             392548       12    392536   1% /run/user/120
tmpfs             392548        0    392548   0% /run/user/1000
```

8. 系统迁移至 SD 卡

a) SD 卡配置：

1. 配置前确保系统能识别到 SD 卡，终端命令：**sudo fdisk -lu**

```
Disk /dev/mmcblk1: 59.5 GiB, 63864569856 bytes, 124735488 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

2. 将 SD 卡设置成 GPT 格式：

i. 终端命令：**sudo fdisk /dev/mmcblk1** ，进入 sd 卡配置

```
tx2nx@tx2nx:~/Desktop$ sudo fdisk /dev/mmcblk1

Welcome to fdisk (util-linux 2.31.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.
```

ii. 终端命令：**g**，新建 gpt 分区表

```
Command (m for help): g
Created a new GPT disklabel (GUID: E39DF30E-48FE-B041-A6FA-5EFAEC223CEA).
```

iii. 终端命令：**n**，新建分区

```
Command (m for help): n
Partition number (1-128, default 1):
First sector (2048-124735454, default 2048):
Last sector, +sectors or +size{K,M,G,T,P} (2048-124735454, default 124735454):
```

iv. 终端命令：**w**， 保存分区信息

```
Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.
```

v. 终端命令：**sudo mke2fs -t ext4 /dev/mmcblk1p1，格式化分区**

```
tx2nx@tx2nx:~/Desktop$ sudo mke2fs -t ext4 /dev/mmcblk1p1
mke2fs 1.44.1 (24-Mar-2018)
Discarding device blocks: done
Creating filesystem with 15591675 4k blocks and 3899392 inodes
Filesystem UUID: 3c6ce310-2a86-4385-8dd0-86ab0089767e
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424

Allocating group tables: done
Writing inode tables: done
Creating journal (65536 blocks): done
Writing superblocks and filesystem accounting information: done
```

vi. 终端命令：**sudo mount /dev/mmcblk1p1/mnt**，成功 mount 则 SD 卡配置成功

```
tx2nx@tx2nx:~/Desktop$ sudo mount /dev/mmcblk1p1 /mnt
```

b) NVIDIA Jetson 系统迁移 (!!!迁移前建议参考第 3 章进行系统备份)：

✓ **下面以 TX2NX 为例，其他设备替换命令中间的设备名称即可，设备名称可参考上面命令**

➢ 1. 终端命令： **git clone https://github.com/jetsonhacks/rootOnNVMe** 或者 https://github.com/jetsonhacks/rootOnNVMe 下载脚本

➢ 2. 修改 **copy-rootfs-ssd.sh** 文件，注释掉 mount 命令

```
#!/bin/bash
# Mount the SSD as /mnt
# sudo mount /dev/nvme0n1p1 /mnt
# Copy over the rootfs from the SD card to the SSD
sudo rsync -axHAWX --numeric-ids --info=progress2 --exclude={"/dev/","/proc/","/sys/","/tmp/"
,"/run/","/mnt/","/media/*","/lost+found"} / /mnt
# We want to keep the SSD mounted for further operations
# So we do not unmount the SSD
```

➢ 3. 进入 **rootOnNVMe** 文件夹，终端命令：**./copy-rootfs-ssd.sh**，复制系统文件至 SD 卡

```
tx2nx@tx2nx:~/Desktop/rootOnNVMe$ sudo ./copy-rootfs-ssd.sh
  1,149,753,593  71%   23.18MB/s    0:00:19  xfr#6703, ir-chk=2715/12064)
```

➢ 4. 参考第 2 章，进入 **Recovery 模式。**

➢ 5. （**烧录环境的 Ubuntu**，参考**前面章节**）进入**~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra**，打开终端：**sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx mmcblk1p1** 更新 EMMC 内部引导

```
greetrix@greetrix-virtual-machine:~/nvidia/nvidia_sdk/JetPack_4.6_Linux_JETSON_TX2_TARGETS/Linux_for_Tegra$ sudo ./flash.sh jetson-xavier-nx-devkit-tx2-nx mmcblk1p1
```

```
[   30.4511 ] Coldbooting the device
[   30.4521 ] tegradevflash_v2 --reboot coldboot
[   30.4531 ] Bootloader version 01.00.0000
[   30.6253 ]
*** The target t186ref has been flashed successfully. ***
Make the target filesystem available to the device and reset the board to boot f
rom external mmcblk1p1.
```

- 6. 重启 TX2NX，终端命令：**df -l**， 此时系统盘已经变为 SD 卡，并且原有 EMMC 上系统已经成功迁移。

```
tx2nx@tx2nx:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/mmcblk1p1   59G   12G   44G  21% /
devtmpfs        1.6G     0  1.6G   0% /dev
tmpfs           1.9G   52K  1.9G   1% /dev/shm
tmpfs           1.9G   21M  1.9G   2% /run
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           1.9G     0  1.9G   0% /sys/fs/cgroup
tmpfs           384M   12K  384M   1% /run/user/120
tmpfs           384M     0  384M   0% /run/user/1000
```

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