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OpenSTLinux : Starter package_handson

Johnson Zhang

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Agenda

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3 STM32CubeProgrammer
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Starter Package Installation

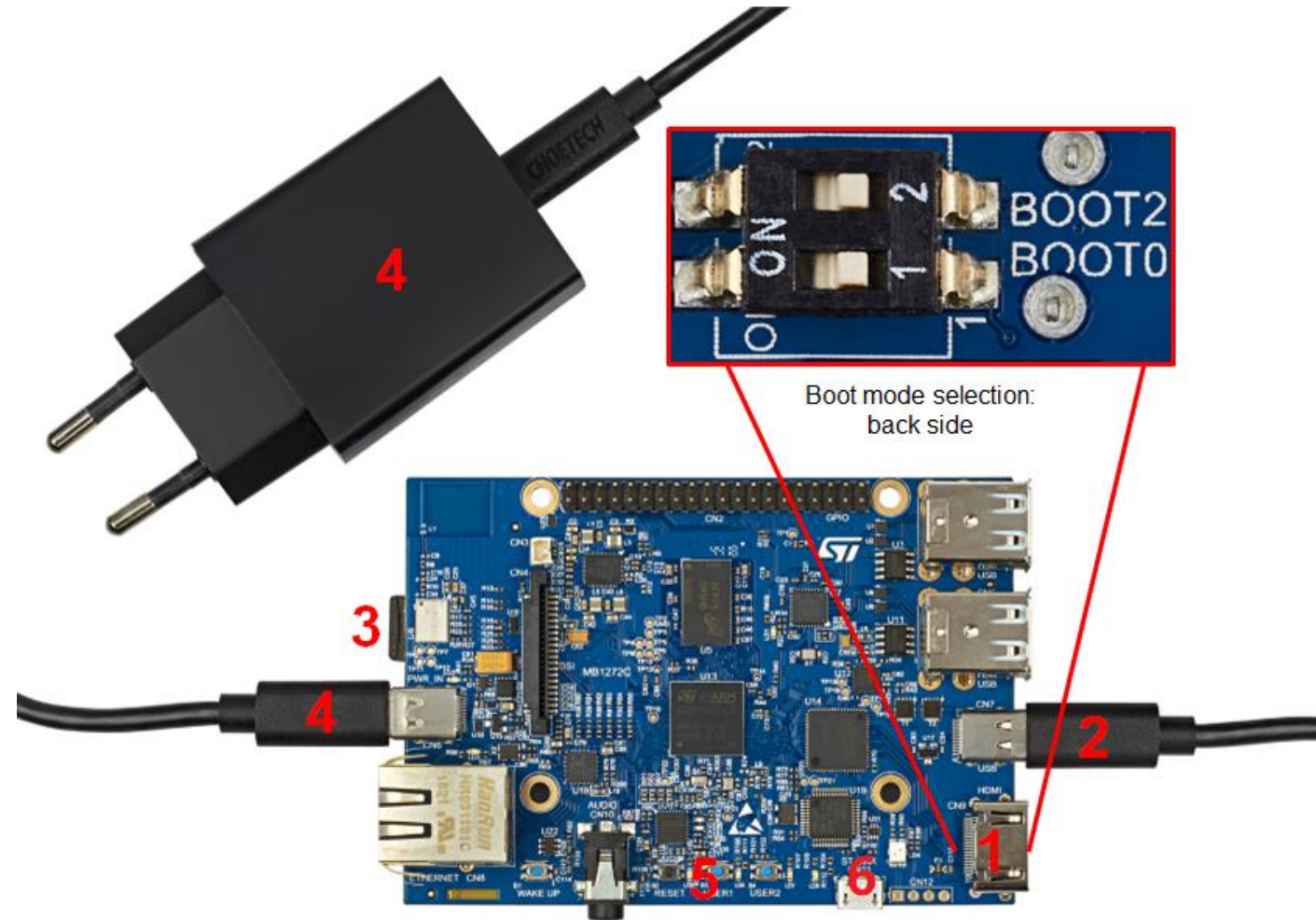


Checking the material

PC	Linux or Windows operating systems. See PC prerequisites for more details on the required configurations.
<u>STM32MP157x-DKx Discovery kit</u>	•Flexible and complete development platform for the STM32MP15 microprocessor device including:a MB1272 motherboard •a MB1407 daughterboard (480x800 pixels DSI display): only for the STM32MP157C-DK2 and STM32MP157F-DK2 Discovery kits
Power supply	•Including:a USB Type-C™ cable (delivered in the packages) •a USB Type-C™ charger (5 V, 3 A) (not delivered in the packages)
MicroSD card	Populated with OpenSTLinux distribution (Linux software), and providing extra storage capacity. A 2-Gbyte minimum microSD card is needed.
USB micro-B cable	In order to connect the STM32MP157x-DKx Discovery kit to the PC through the USB micro-B (ST-LINK/V2-1) connector
USB Type-C™ cable	In order to connect the STM32MP157x-DKx Discovery kit to an USB OTG device through the USB Type-C™ connector

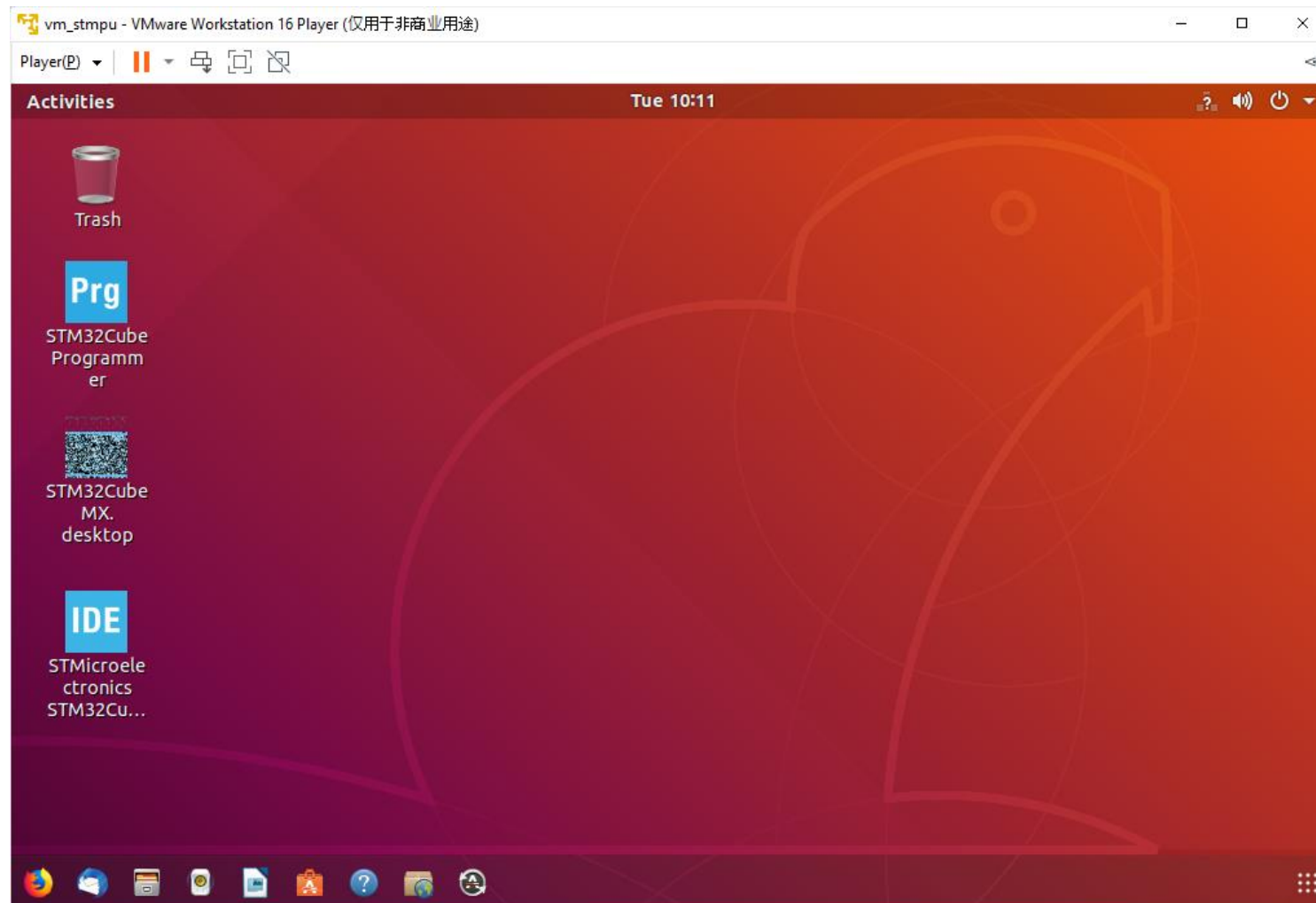
Board connection

- Set the board to flashing mode:
 - 1) Set the boot switches to the off position
 - 2) Connect the USB Type-C™ (OTG) port to the host PC that contains the downloaded image
 - 3) Insert the delivered microSD card into the dedicated slot
 - 4) Connect the delivered power supply to the USB Type-C™ port
 - 5) Press the reset button to reset the board
 - 6) Connect the Micro USB port to the host PC to capture UART log.



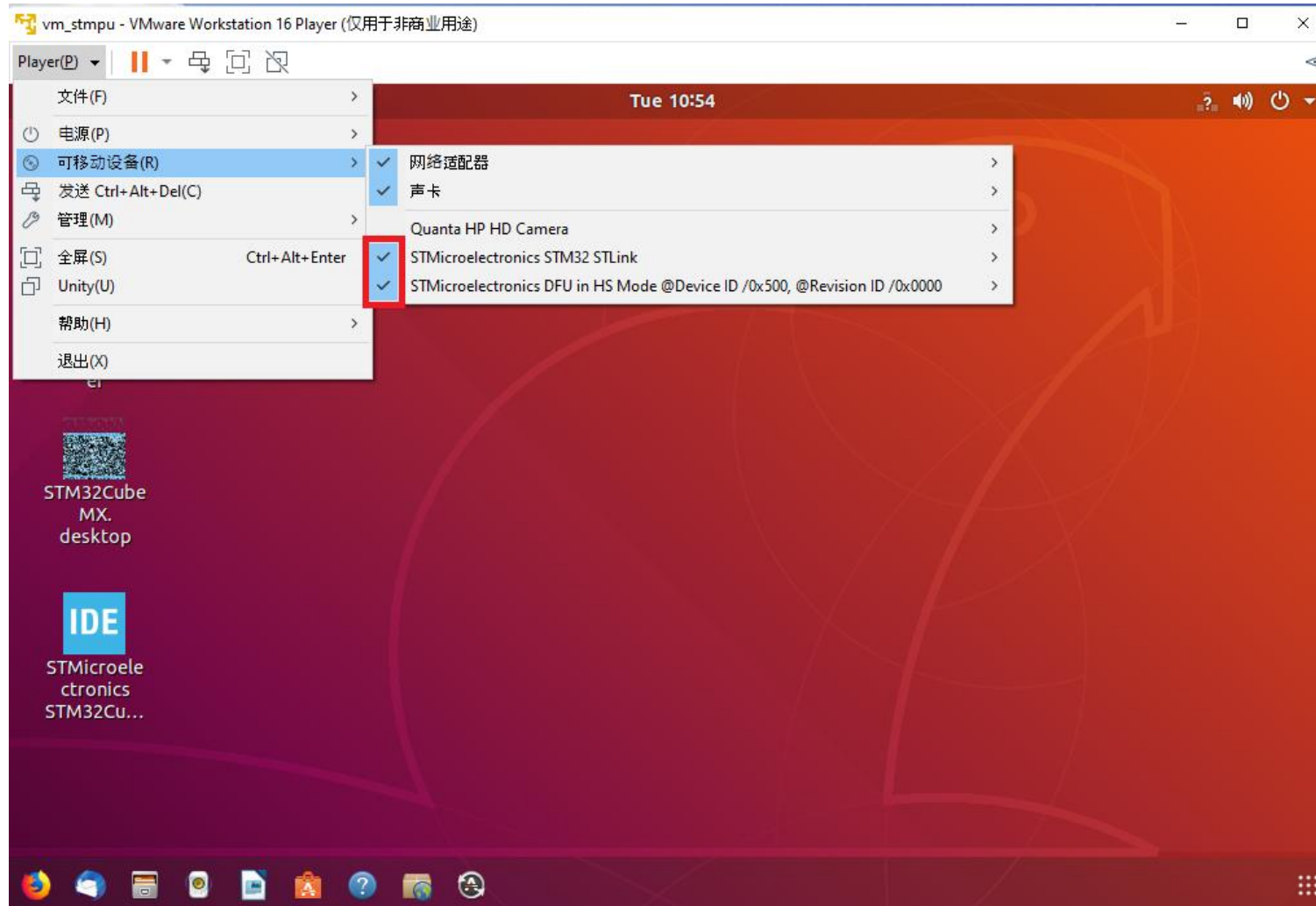
Start the virtual machine

- Start the Ubuntu 18.04 virtual machine described in training environment installation presentation:



Virtual machine connection

- Ensure the two ST devices is connected to virtual machine through “Player=>Mobile device”:

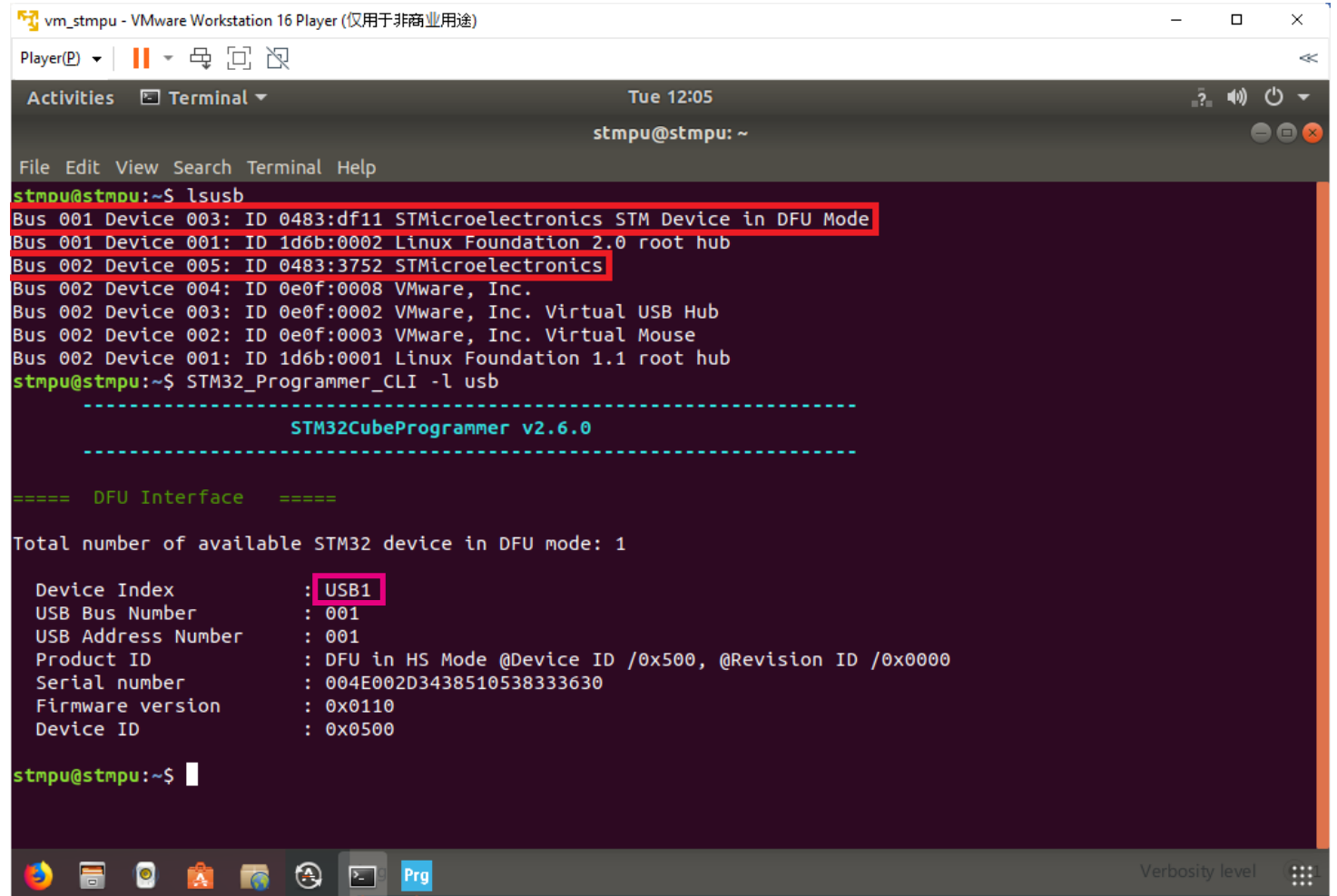


Check ST devices

- Press “CTRL”+“ALT”+“T” simultaneously to open the Terminal, run below command to check if the ST devices is ready:

~\$ lsusb

~\$ STM32_Programmer_CLI -l usb



```
vm_stmpu - VMware Workstation 16 Player (仅用于非商业用途)
Player(P) | [Icons]
Activities Terminal Tue 12:05 stmpu@stmpu: ~
File Edit View Search Terminal Help
stmpu@stmpu:~$ lsusb
Bus 001 Device 003: ID 0483:df11 STMicroelectronics STM Device in DFU Mode
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 005: ID 0483:3752 STMicroelectronics
Bus 002 Device 004: ID 0e0f:0008 VMware, Inc.
Bus 002 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 002 Device 002: ID 0e0f:0003 VMware, Inc. Virtual Mouse
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
stmpu@stmpu:~$ STM32_Programmer_CLI -l usb
-----
STM32CubeProgrammer v2.6.0
-----

==== DFU Interface ====

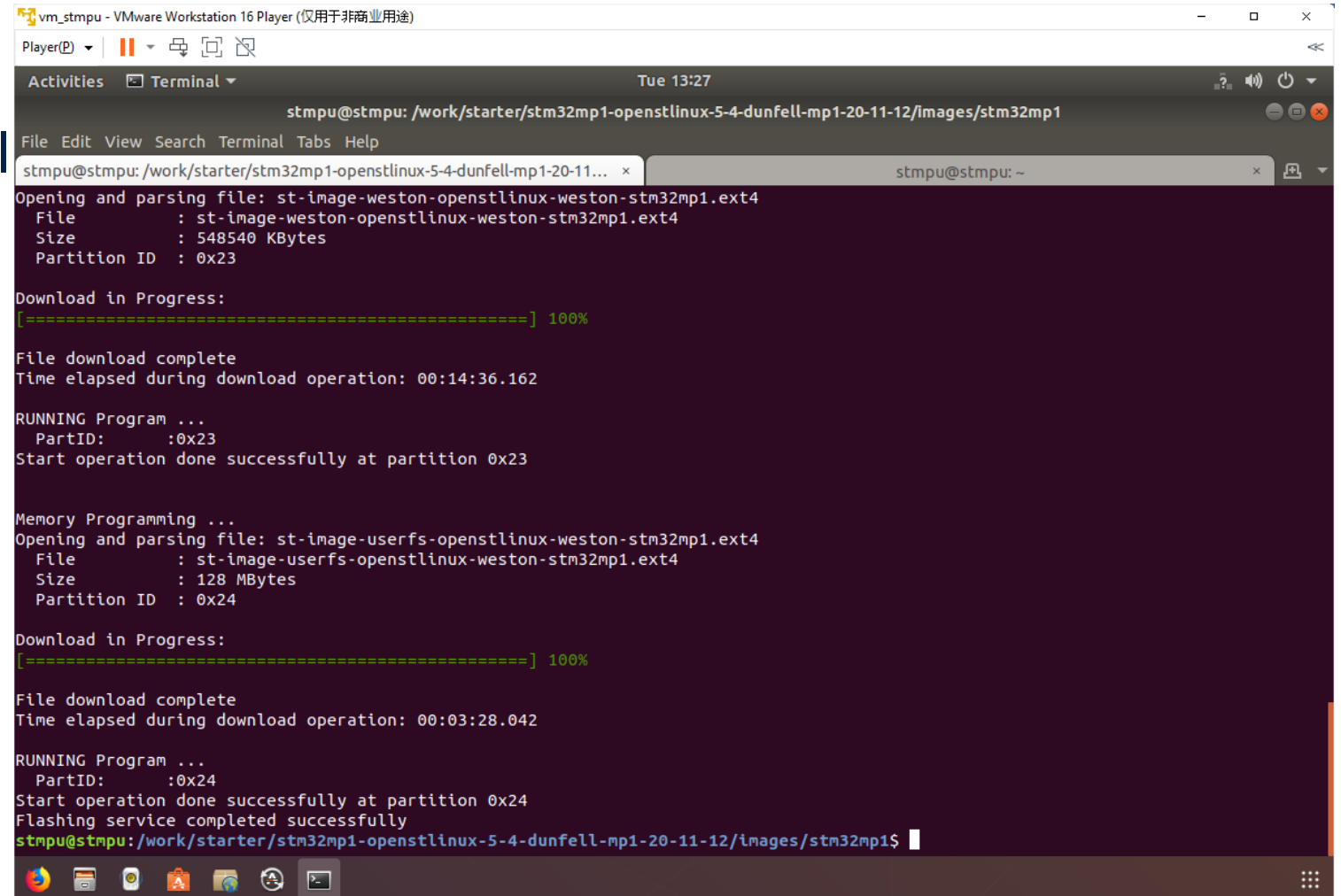
Total number of available STM32 device in DFU mode: 1

Device Index      : USB1
USB Bus Number    : 001
USB Address Number : 001
Product ID        : DFU in HS Mode @Device ID /0x500, @Revision ID /0x0000
Serial number     : 004E002D3438510538333630
Firmware version  : 0x0110
Device ID         : 0x0500

stmpu@stmpu:~$
```

Image flashing

- In the Terminal, run below command to flash the starter package image to the sdcard on the DK2 board:
~\$ burnsdcard
- Check the alias to see the detail
~\$ alias burnsdcard



```
vm_stmpu - VMware Workstation 16 Player (仅用于非商业用途)
Player(P) [Icons]
Activities Terminal Tue 13:27
stmpu@stmpu: /work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1
File Edit View Search Terminal Tabs Help
stmpu@stmpu: /work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1 x stmpu@stmpu: ~
Opening and parsing file: st-image-weston-openstlinux-weston-stm32mp1.ext4
File      : st-image-weston-openstlinux-weston-stm32mp1.ext4
Size     : 548540 KBytes
Partition ID : 0x23

Download in Progress:
[=====] 100%

File download complete
Time elapsed during download operation: 00:14:36.162

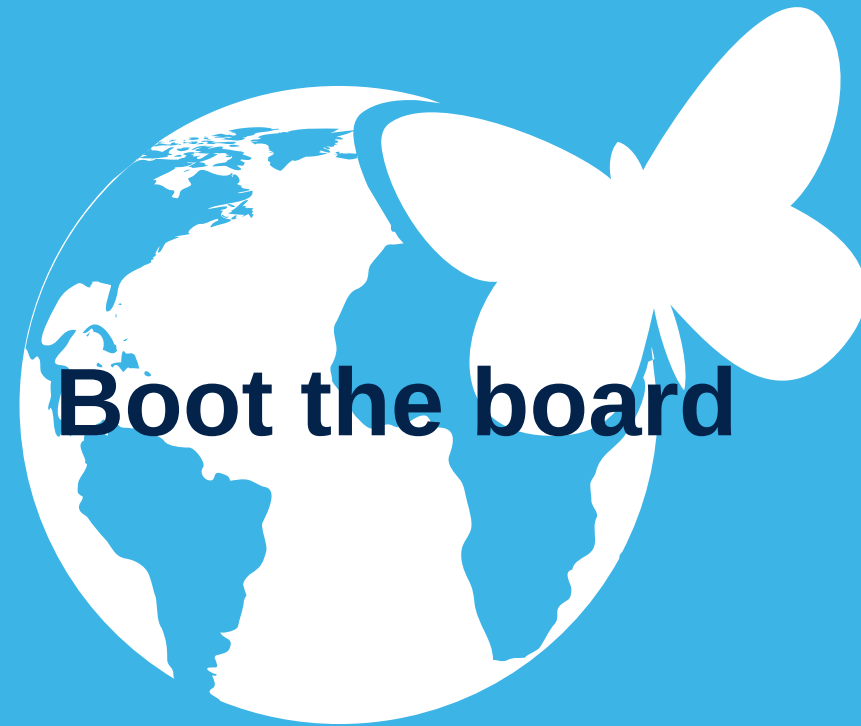
RUNNING Program ...
PartID:      :0x23
Start operation done successfully at partition 0x23

Memory Programming ...
Opening and parsing file: st-image-userfs-openstlinux-weston-stm32mp1.ext4
File      : st-image-userfs-openstlinux-weston-stm32mp1.ext4
Size     : 128 MBytes
Partition ID : 0x24

Download in Progress:
[=====] 100%

File download complete
Time elapsed during download operation: 00:03:28.042

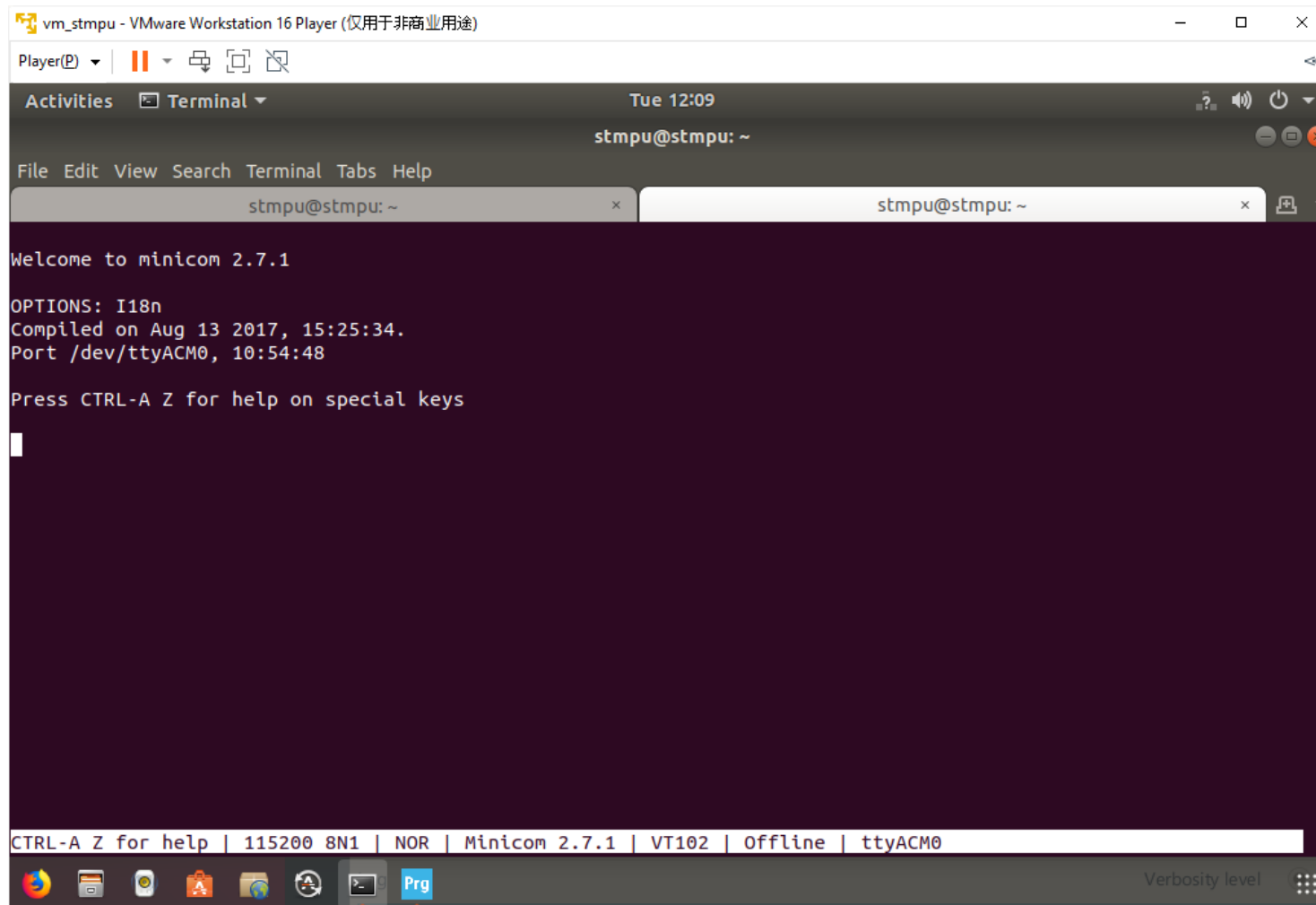
RUNNING Program ...
PartID:      :0x24
Start operation done successfully at partition 0x24
Flashing service completed successfully
stmpu@stmpu: /work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1$
```



Console

- Press “CTRL”+“ALT”+“T” simultaneously to open the Terminal, run below command to open minicom for tracing log and communicating with the board:

`~$ sudo minicom`



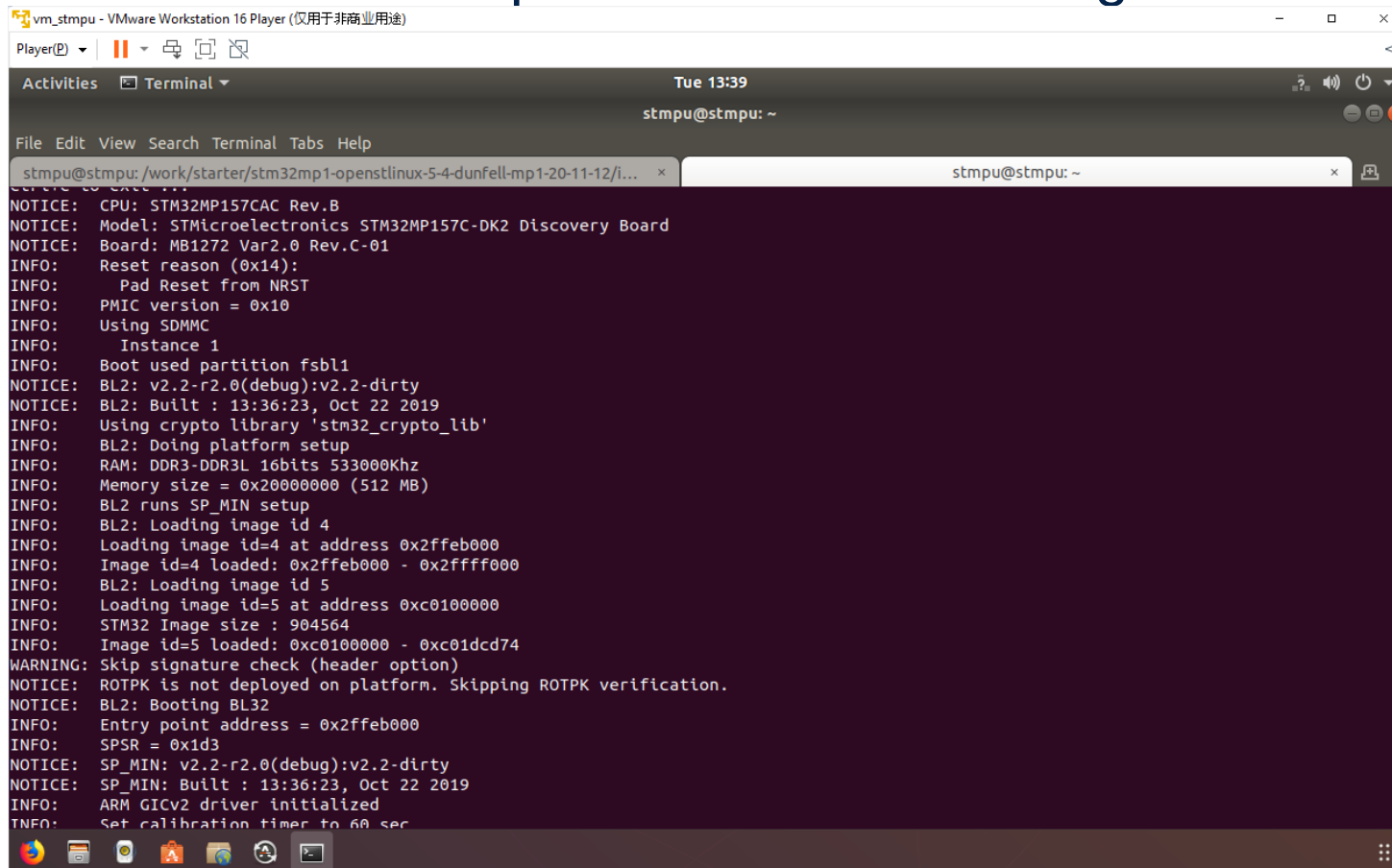
The screenshot shows a terminal window titled "vm_stmpu - VMware Workstation 16 Player (仅用于非商业用途)". The terminal displays the output of the `sudo minicom` command. The text in the terminal is as follows:

```
stmpu@stmpu: ~  
Welcome to minicom 2.7.1  
  
OPTIONS: I18n  
Compiled on Aug 13 2017, 15:25:34.  
Port /dev/ttyACM0, 10:54:48  
  
Press CTRL-A Z for help on special keys  
  
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | ttyACM0
```

The terminal window has a menu bar with "File", "Edit", "View", "Search", "Terminal", "Tabs", and "Help". The status bar at the bottom shows "Verbosity level" and a grid icon.

Board booting

- Set the boot switches to the on position
- Press reset button
- Shift to the minicom terminal tap to check the boot log

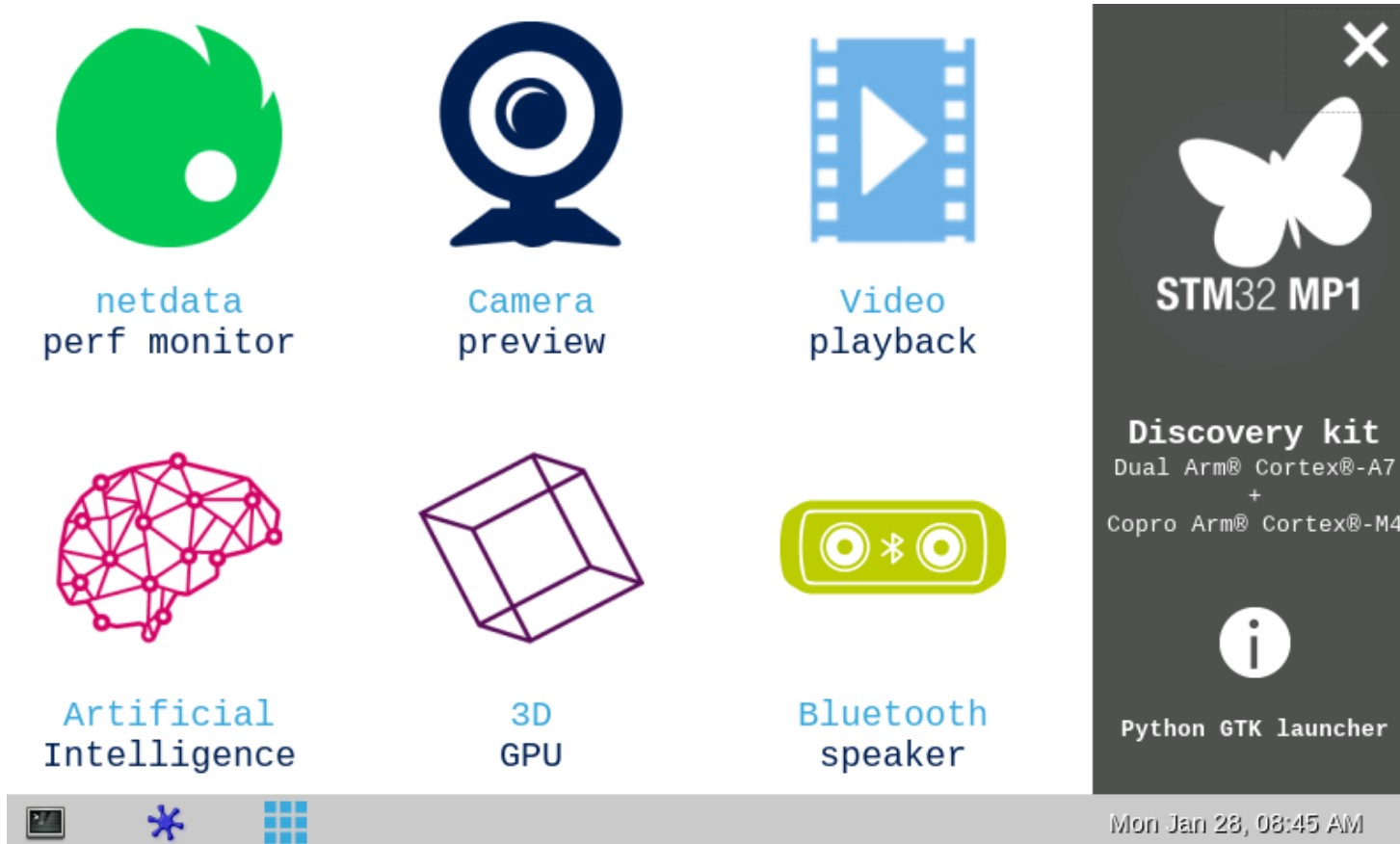


The screenshot shows a VMware Workstation 16 Player window titled 'vm_stmpu - VMware Workstation 16 Player (仅用于非商业用途)'. Inside the player, a terminal window is open, displaying the boot log for an STM32MP157C Discovery Board. The log includes the following information:

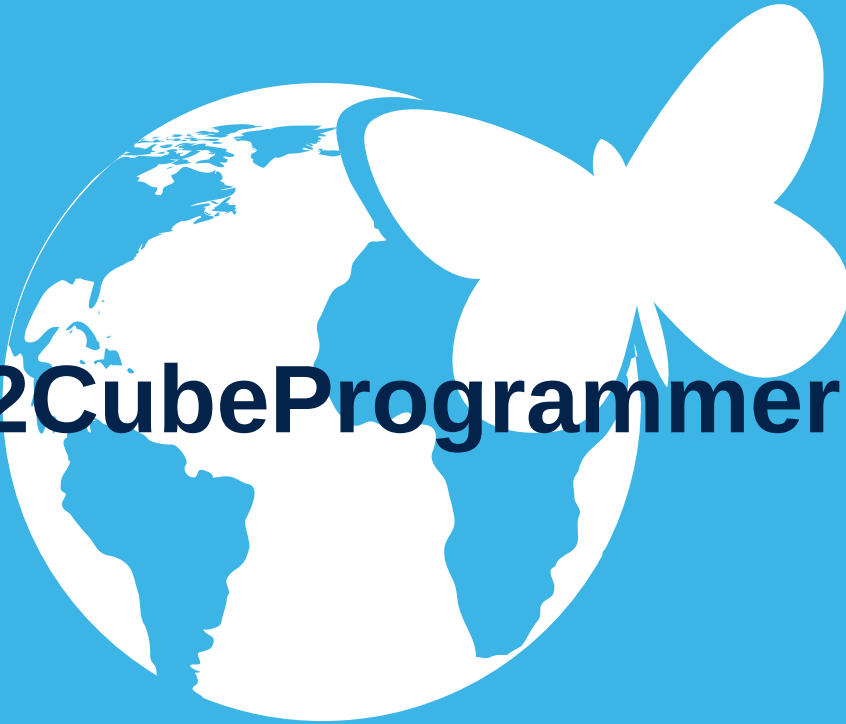
```
NOTICE: CPU: STM32MP157CAC Rev.B
NOTICE: Model: STMicroelectronics STM32MP157C-DK2 Discovery Board
NOTICE: Board: MB1272 Var2.0 Rev.C-01
INFO: Reset reason (0x14):
INFO:   Pad Reset from NRST
INFO: PMIC version = 0x10
INFO: Using SMMMC
INFO:   Instance 1
INFO: Boot used partition fsbl1
NOTICE: BL2: v2.2-r2.0(debug):v2.2-dirty
NOTICE: BL2: Built : 13:36:23, Oct 22 2019
INFO: Using crypto library 'stm32_crypto_lib'
INFO: BL2: Doing platform setup
INFO: RAM: DDR3-DDR3L 16bits 533000KHz
INFO: Memory size = 0x20000000 (512 MB)
INFO: BL2 runs SP_MIN setup
INFO: BL2: Loading image id 4
INFO: Loading image id=4 at address 0x2ffeb000
INFO: Image id=4 loaded: 0x2ffeb000 - 0x2ffff000
INFO: BL2: Loading image id 5
INFO: Loading image id=5 at address 0xc0100000
INFO: STM32 Image size : 904564
INFO: Image id=5 loaded: 0xc0100000 - 0xc01dcd74
WARNING: Skip signature check (header option)
NOTICE: ROTPK is not deployed on platform. Skipping ROTPK verification.
NOTICE: BL2: Booting BL32
INFO: Entry point address = 0x2ffeb000
INFO: SPSR = 0x1d3
NOTICE: SP_MIN: v2.2-r2.0(debug):v2.2-dirty
NOTICE: SP_MIN: Built : 13:36:23, Oct 22 2019
INFO: ARM GICv2 driver initialized
INFO: Set calibration timer to 60 sec
```

GUI demos

- When the boot process is complete, the launcher application is shown on the DSI display(only for DK2).
- Touch one of the icons to start the demo.



STM32CubeProgrammer GUI



STM32CubeProgrammer GUI

- Using STM32CubeProgrammer GUI to flash image:
 - 1) Double click “STM32Cube Programmer” icon on the Desktop to open CubeProgrammer GUI;
 - 2) Click “+”=>“Open file” to load your TSV file, the file should be in:
`/work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1/flashlayout_st-image-Weston/`
 - 3) Click “Browse” to choose the binaries path, the path should be:
`/work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1`
 - 4) Choose “USB” port as the interface;
 - 5) Refresh the port, the ST USB device “USB1” will be showed in the listbox automatically;
 - 6) Click “Connect” to connect the board;
 - 7) Click “Download” to program sdcard;
 - 8) Click “x” in the bottom to cancel the program process.

STM32CubeProgrammer GUI

The screenshot displays the STM32CubeProgrammer GUI with the following components and annotations:

- 1**: STM32CubeProgrammer logo in the top left corner.
- 2**: A '+' button in the 'Device memory' tab header.
- 3**: A 'Browse' button next to the 'Binaries path' field.
- 4**: A 'USB' dropdown menu in the 'USB configuration' panel.
- 5**: A 'Connect' button in the 'USB configuration' panel.
- 6**: A 'Not connected' status indicator in the top right corner.
- 7**: A 'Download' button in the 'Device memory' tab.
- 8**: A progress bar at the bottom of the interface.

Device memory table:

Select	Opt	Id	Name	Type	IP	Offset	Binary
☒	-	0x1	fsbl1-boot	Binary	none	0x00000000	arm-trusted-firmware/tf-a-stm32mp157c-dk2-s...
☒	-	0x3	ssbl-boot	Binary	none	0x00000000	bootloader/u-boot-stm32mp157c-dk2-trusted.stm
☒	-	0x4	fsbl1	Binary	mmc0	0x00004400	arm-trusted-firmware/tf-a-stm32mp157c-dk2-t..
☒	-	0x5	fsbl2	Binary	mmc0	0x00044400	arm-trusted-firmware/tf-a-stm32mp157c-dk2-t..
☒	DPE	0x6	ssbl	Binary	mmc0	0x00084400	bootloader/u-boot-stm32mp157c-dk2-trusted.stm
☒	-	0x21	boot	System	mmc0	0x00284400	st-image-bootfs-openstlinux-weston-stm32mp1..
☒	-	0x22	vendorfs	FileSystem	mmc0	0x04284400	st-image-vendorfs-openstlinux-weston-stm32m..
☒	-	0x23	rootfs	FileSystem	mmc0	0x05284400	st-image-weston-openstlinux-weston-stm32mp1..

Log:

```
15:12:34 : USB speed : High Speed (480MBit/s)
15:12:34 : Manuf. ID : STMicrelectronics
15:12:34 : Product ID : USB download gadget@Device ID /0x500, @Revision ID /0x2000, @Name /STM32MP157CAC Rev.B,
15:12:34 : SN : 004E002D3438510538333630
15:12:34 : FW version : 0x0110
15:12:34 : Device ID : 0x0500
15:12:34 : Start operation done successfully at partition 0x03
15:12:34 : Flashing service completed successfully
15:19:51 : Read TSV File: /work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1/flashlayout_st-image-weston/trusted/FlashLayout_sdca
15:19:51 : Number of partitions: 9
15:25:42 : Disconnected from device.
```



Scripts Usage

- One script is available to generate a full SDcard image (raw image):

```
/work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1/scripts/create_sdcard_from_flashlayout.sh
```

- Create a Raw image for DK2 board:

```
~$ ./ create_sdcard_from_flashlayout.sh ../flashlayout_st-image-Weston/trusted/FlashLayout_sdcard_stm32mp157c-dk2-trusted.tsv
```

- Create a TSV that program the raw generated by the script:

Opt	Part	Name	Type	Device	Offset	Binary
-	0x01	fsbl	Binary	none	0x0	tf-a.stm32
-	0x03	ssbl	Binary	none	0x0	u-boot.stm32
PD	0x20	sdcard	RawImage	mmc0	0x0	FlashLayout_sdcard_stm32mp157c-dk2-trusted.bin

Transfer files to the board

- The starter package is made up of several raw/ext4 partitions.
- We can add a file into one of the ext4 partition and update it on your board thanks to the programmer.
- Mount an ext4 file system in your laptop thanks to the mount command:
~\$ cd /work/starter/stm32mp1-openstlinux-5-4-dunfell-mp1-20-11-12/images/stm32mp1
~\$ mkdir bootfs
~\$ mount ./st-image-bootfs-openstlinux-weston-stm32mp1.ext4 bootfs
- Copy the files you want to transfer to the board to the bootfs directory:
~\$ cp -a /work/developer/build/install_artifact/boot/* /bootfs/
- Umount the ext4 partition file.
~\$ sudo umount bootfs
- Use CubeProgrammer to update the ext4 partition to the sdcard.
- Reboot the board and check if your new file is on the board.

Basic commands



Version checking

Software	How to get its version	Output example
TF-A	See the version displayed in the console	NOTICE: BL2: v2.2-r2.0(debug): v2.2-dirty
U-Boot	See the version displayed in the console	2020.01-stm32mp-r2 [...]
Linux kernel	Board \$> cat /proc/version	Linux version 5.4.56 (xxxx@yyyy) (gcc version 9.3.0 (GCC)) [...]
GCC	Board \$> cat /proc/version	Linux version 5.4.56 (xxxx@yyyy) (gcc version 9.3.0 (GCC)) [...]
Yocto Project	Board \$> grep DISTRO_CODENAME /etc/build	DISTRO_CODENAME = dunfell
Weston	Board \$> weston --version	weston 8.0.0
GStreamer	Board \$> gst-play-1.0 --version	GStreamer 1.16.2
GPU	Board \$> cat /sys/kernel/debug/gc/version	6.4.3.279124 built [...]

System information

- Use below command to print the linux system information:
~# uname -a
- For ecosystem release v2.1.0, the output meaning is:

Linux	Kernel name
stm32mp1	Network node hostname
5.4.56	Kernel release
#1 SMP PREEMPT Wed Aug 5 07:59:52 UTC 2020	Kernel version
armv7l	Machine hardware name
GNU/Linux	Operating system

Disk information

- Printing the amount of disk space available on all mounted file systems:

~# df -h

```
root@stm32mp1:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        148M   0    148M   0% /dev
/dev/mmcblk0p6  690M  418M  231M  65% /
tmpfs           214M   64K  214M   1% /dev/shm
tmpfs           214M  8.8M  205M   5% /run
tmpfs           214M   0    214M   0% /sys/fs/cgroup
tmpfs           214M  4.0K  214M   1% /tmp
/dev/mmcblk0p4   58M   14M   40M  26% /boot
/dev/mmcblk0p5   15M   6.8M   6.7M  51% /vendor
tmpfs           214M  148K  214M   1% /var/volatile
/dev/mmcblk0p7  14G   39M   13G   1% /usr/local
tmpfs           43M    0    43M   0% /run/user/0
```

GPIO hands on

- Use the libgpiod to control the LED on GPIOA13 and GPIOA14 in your board:
 - List all gpiochips present on the system:
~# gpiodetect
 - Print gpiochip0 lines:
~# gpioinfo gpiochip0
 - Get value of GPIO PA14:
~# gpioget gpiochip0 14
 - Set GPIO PA14 low(green led on):
~# gpioset gpiochip0 14=0

Exercises

- Create an TSV file to update only u-boot on your board. (Point:4)
- Create an TSV to delete TF-A (FSBL1 only). Are you still booting? why? (Point:4)
- Modify the TSV of your board increasing the rootfs partition size. (Point:4)
- Write one command line that set the GPIOA14 depending of GPIOA13 input state. (Point:3)

Thank you