# NPCM7xx Evaluation Board (EVB) BootBlock, u-boot and OpenBMC Programming Guide

November 2018
Revision 1.1

# REVISION RECORD

| REVISION | RELEASE DATE | SUMMARY OF CHANGES |
|---|---|---|
| 1.0 | June 2018 | First revision |
| 1.1 | November 2018 | Use python scripts instead of batch files<br>Openbmc programming via FTP |

# PREFACE

This Evaluation Board Programming Guide is intended for board designers using the Nuvoton NCTM750x.

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# Chapter 1 Overview

This guide describes how to program the BootBlock + u-boot and/or The entire OpenBMC image on the NPCM7xx Evaluation Board (EVB).

## 1.1 Requirements

- For BootBlock and u-boot programming:
  - Image generation and programming scripts package (**IGPS)**, the latest version is available in https://github.com/Nuvoton-Israel/igps
  - Installed python 2.7+. If it is not installed, download it from https://www.python.org/ftp/python/3.7.1/python-3.7.1.exe and run the installation

- For OpenBMC programming:
  - Linux files: "**image-bmc**"
  - Environment file: "**uboot_env_parameters.txt**"

**Note:** Check with Nuvoton support for the most recent versions of the BootBlock, u-boot and OpenBMC.

# Chapter 2 Programming BootBlock and u-boot

**Note: if u-boot is already running on your EVB you can skip to OpenBMC Programming**

## 2.1 Conectors, Switches and Jumpers on the EVB Board

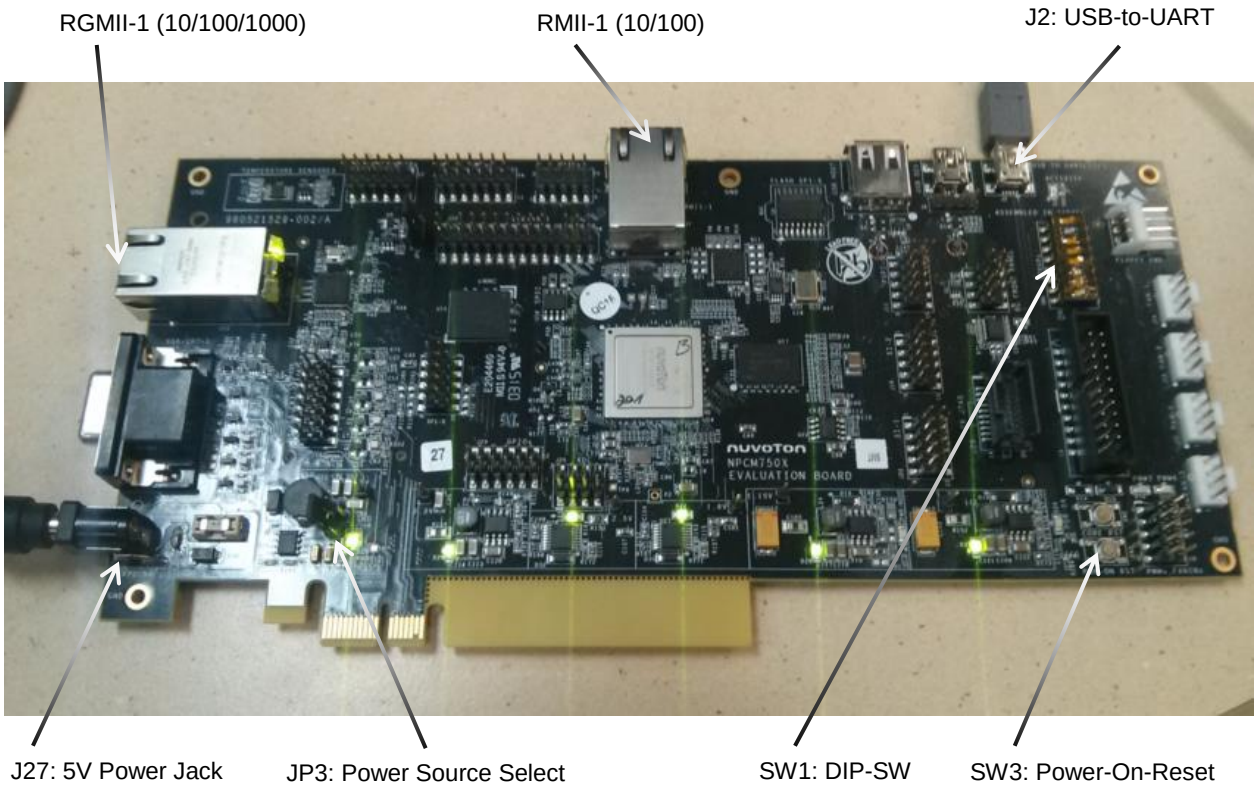


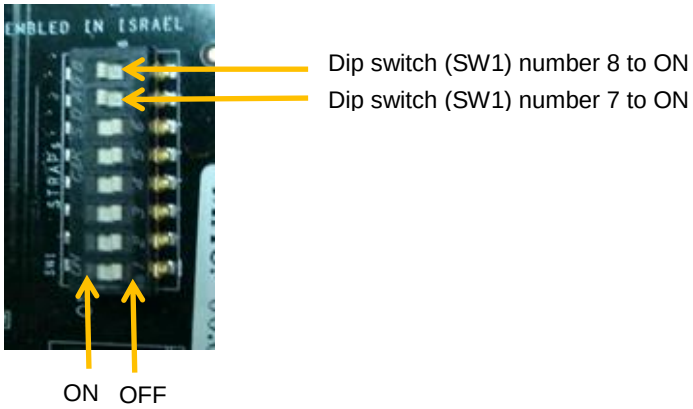

**Figure 1 - Connectors, Switches and Jumpers on the EVB Board**

## 2.2 Programming Procedure

This procedure refers to Figure 1, above.

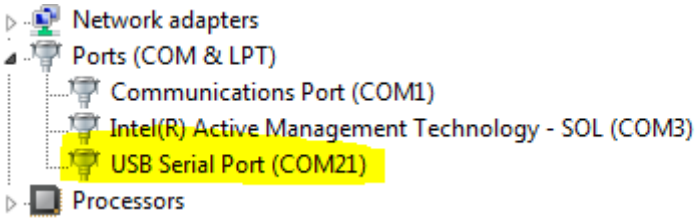
1. Hardware Setup:
   a. Verify that jumper JP3 (power source selector) is in the 1-2 position (to select the 5V power jack).
   b. Connect the 5V power supply to power jack J27. The power supply should be 5V with at least 2.5A; the jack should be 2.5 mm in diameter (with '+' in the center core).

c. Set dip switch (SW1) number 7 and 8 to the ON position and all other switches to the OFF position. This places the NPCM7xx into Flash UART Programming (FUP) mode using Serial Interface 2 (SI2) on the next Power-Up reset. In the NPCM7xx EVB, SI2 is connected, via the FTDI USB-to-UART IC, to mini-USB connector J2.




d. Connect a mini-USB cable between the PC host and J2. J2 is connected to a USB-to-UART device, which is itself connected to SI2.

e. Wait for the FTDI driver to be installed automatically. The COM port number is assigned automatically. If the FTDI driver does not get installed automatically, download and install the USB-to-UART driver from: http://www.ftdichip.com/Drivers/VCP.htm .




f. Press and release the PWR-ON-RST (SW3) button to issue a Power-Up reset.

2. Programming:

**Note:** Steps **a** and **b** may be skipped if they were already performed for the correct platform and firmware version.

a. The programming tool supports several different platforms. To set the EVB platform, open command line in the root directory and run:

**python UpdateInputsBinaries_EB.py**

b. To genearte all images for the Nuvoton's EB, run:

**python GenerateAll.py**

Verify that there are no errors.

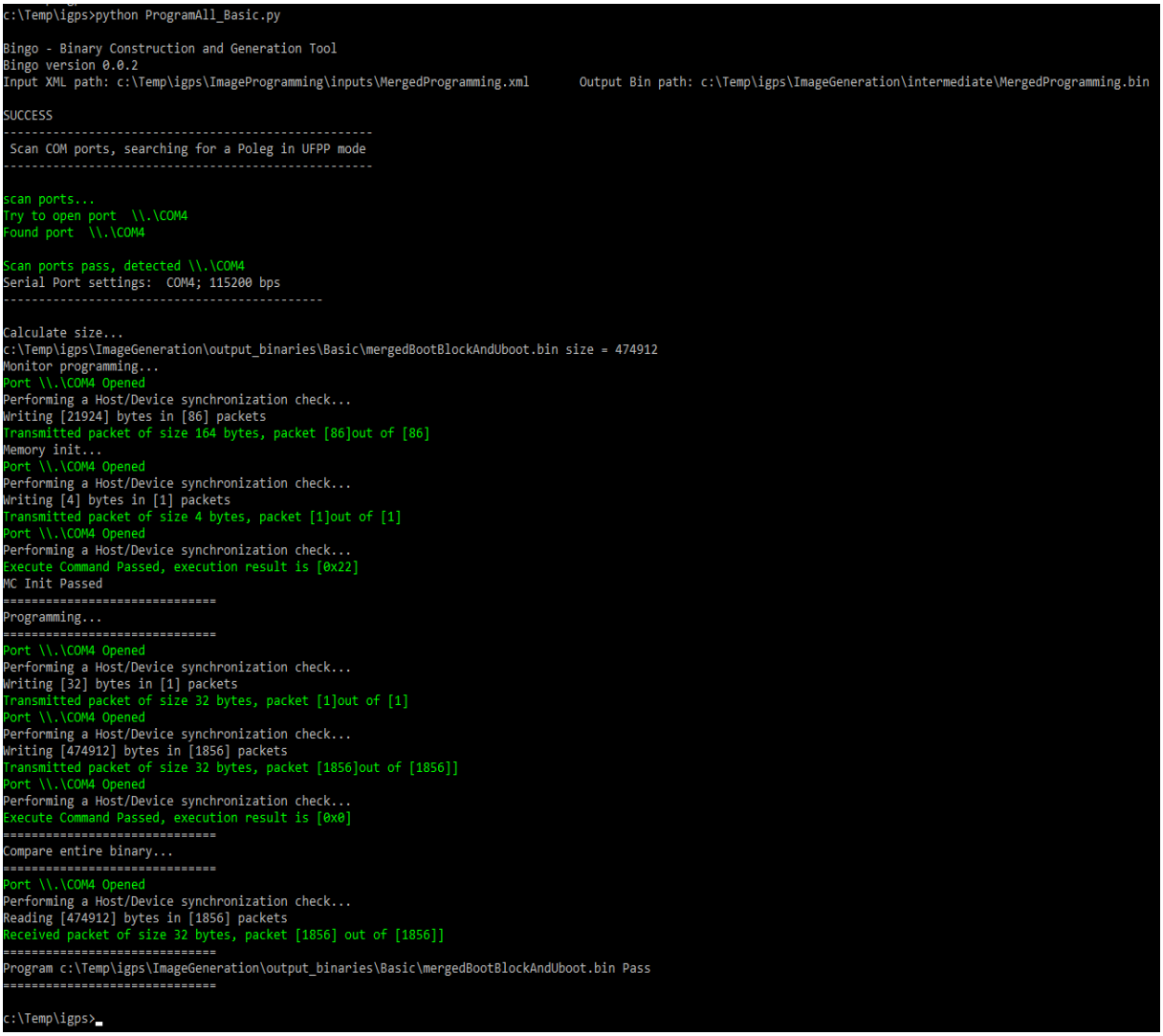
c. Close all terminals and programs associated with the COM port number assigned by the FTDI driver for SI2.

d. To start programming BootBlock and u-boot, run:

**Python ProgramAll_Basic.py**

The utlity auto-detects the COM port number and starts the programming.

e. Verify that the programming completes with no errors.




Testing:

f. Open a terminal (e.g., Tera Term version 4.9) and set the correct COM port number assigned by the FTDI driver (in Step 1.e).

   The COM port should be configured as follows:
   115 Kbps, 8 bit, 1 stop-bit, no parity no flow control.

g. Verify that all first 7 dip switches (SW1) are set to the OFF and dip switch number 8 is set to ON, position for normal operation (800 MHz CPU and 800 MHz DDR4).

h. Press and release the PWR-ON-RST (SW3) button to issue a Power-Up-reset.

i. Verify that boot-block and u-boot are running and that the versions are up-to-date.

**Notes:**

- If, after Power-Up reset, the terminal displays only a '**Z**', dip switch (SW1) number 7 is probably at ON position. Set it to OFF position for normal operation and try again.
- Further information can be found in the 'How_to_generate_and_program_images.html' file (under igps/docs folder).

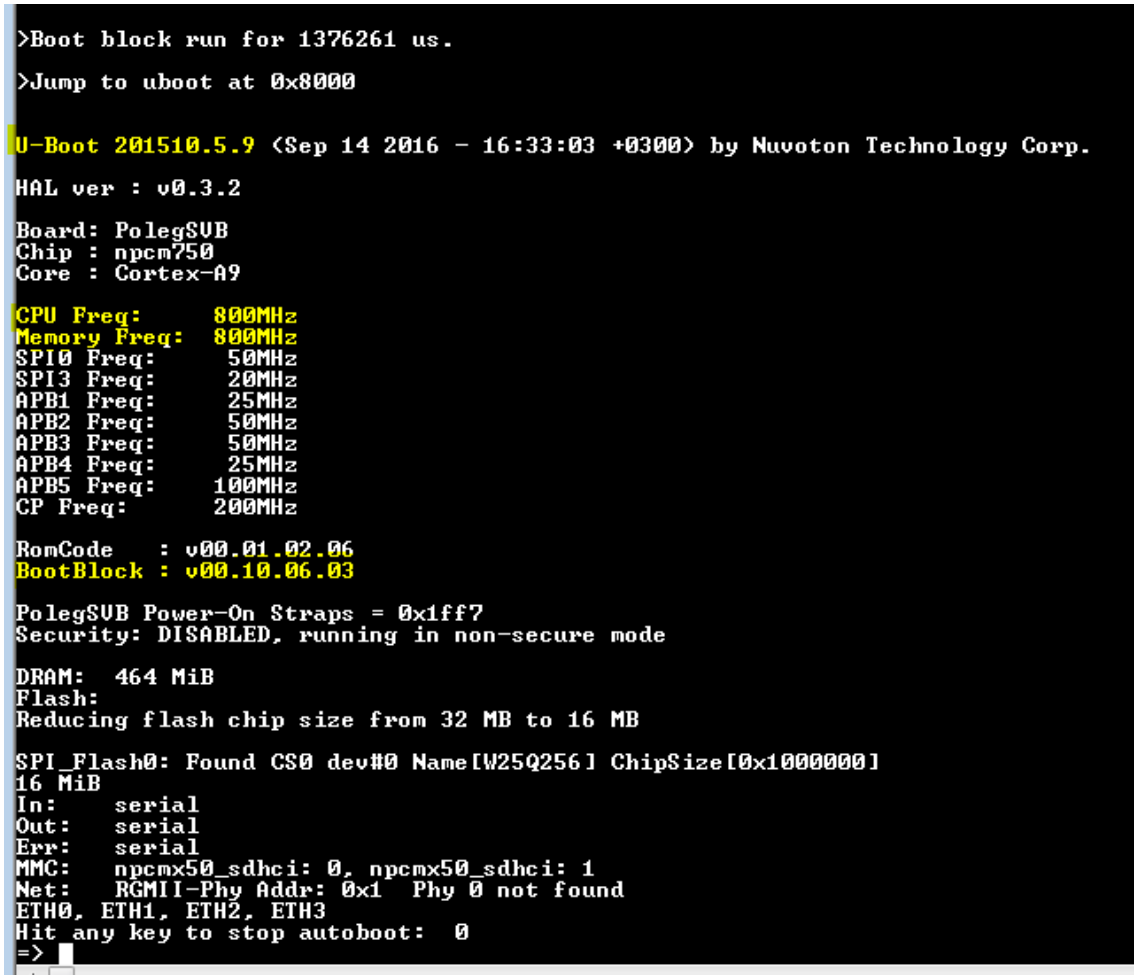



**Figure 2: Sample Terminal Log File**

# Chapter 3 OpenBMC Programming

## 3.1 OpenBMC Programming From SD card or USB key to SPI Flash Device

This section desribes how to program the entire OpenBMC image to the flash from eitheran SD card or a USB storage device.

Prepare the SD card or USB storage device with a FAT file system (FAT16 or FAT32) and verify that there is at least 32 MB of free space available for the OpenBMC files.

1. Copy the "**image-bmc**" file into the root directory of either the SD card or USB storage device.
2. Plug the SD card or USB storage device into the EVB (see Figure 2 and Figure 3 below).
3. Power up the EVB and hit any key to stop at the u-boot shell.
4. On u-boot shell type those commands (the commands might already exist in your u-boot environment):
   ```
   setenv sd_prog 'fatload mmc 0 10000000 image-bmc; cp.b 10000000 80000000 ${filesize}'
   setenv usb_prog 'usb start; fatload usb 0 10000000 image-bmc; cp.b 10000000 80000000 ${filesize}'
   ```
5. If you whish to save those comands type:
   ```
   saveenv
   ```
6. Type either "**run sd_prog**" (for an SD card) or "**run usb_prog**" (for USB storage) and press **<ENTER>**. This loads Linux kernel files to SDRAM and from SDRAM to SPI flash.
7. Reset the EVB to run Linux.

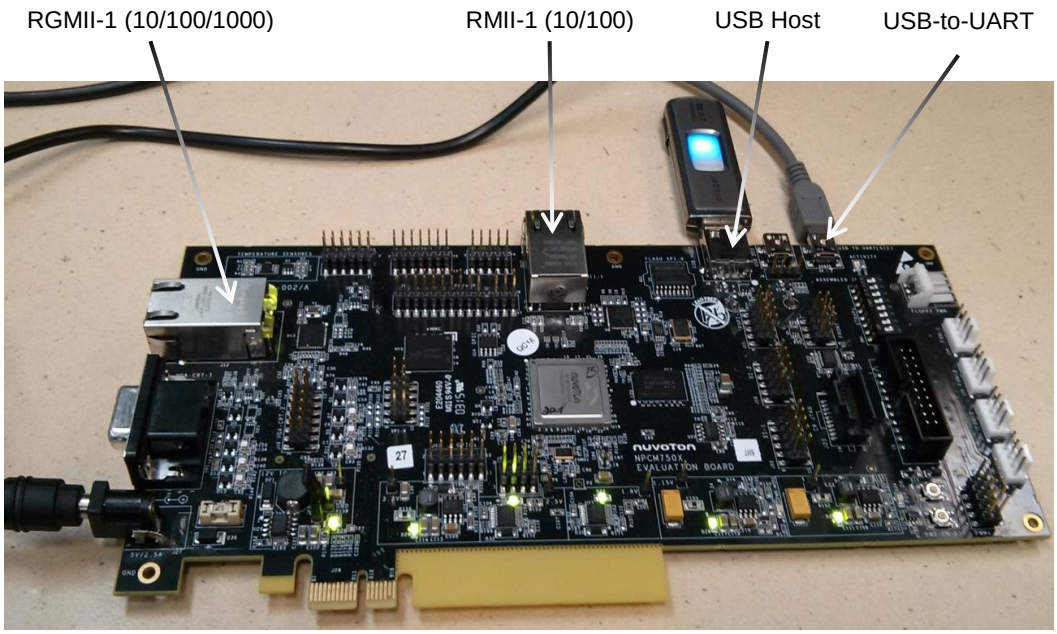



**Figure 2: NPCM7xx EVB with USB Storage Device Plugged In**

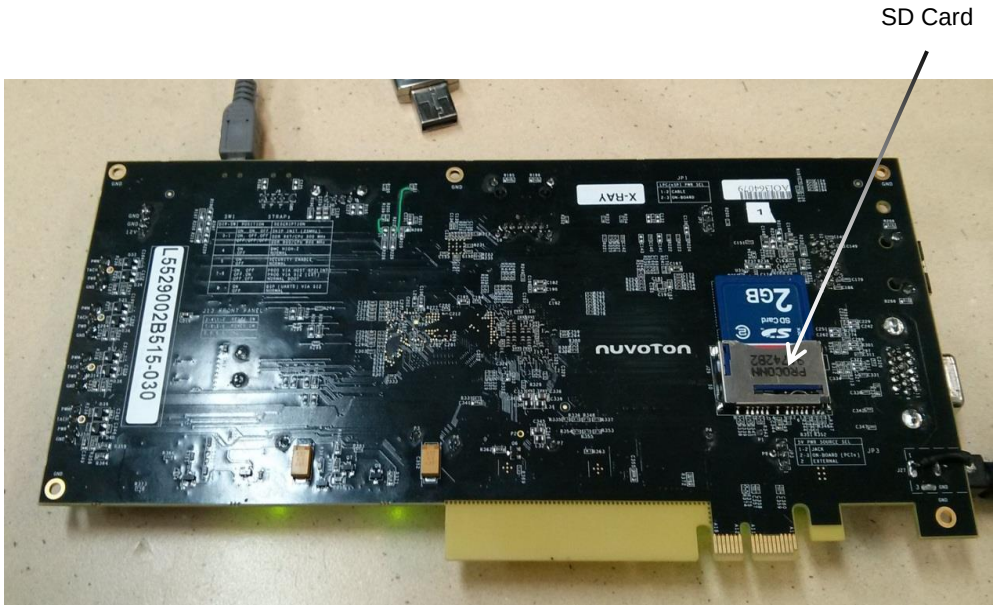



**Figure 3: NPCM7xx EVB with SD Card Plugged In**

### 3.1.1 USB Example Log

An example USB log is shown on the following page. U-Boot 2015.10.7.0-00003-gb95e424a80 (Jun 08 2018 - 17:21:14 +0300)

```
Nuvoton Technology Corp.



HAL ver : v0.3.2

Board: PolegSVB
Chip : npcm750
Core : Cortex-A9

CPU Freq:     800MHz
Memory Freq:  800MHz
SPI0 Freq:     50MHz
SPI3 Freq:     20MHz
APB1 Freq:     25MHz
APB2 Freq:     50MHz
APB3 Freq:     50MHz
APB4 Freq:     25MHz
APB5 Freq:    100MHz
CP Freq:      200MHz

RomCode   : v00.01.02.06
BootBlock : v00.10.08.07

PolegSVB Power-On Straps = 0x1bf7
Security: DISABLED, running in non-secure mode
Model: Nuvoton npcm750 Development Board (Device Tree)

DRAM:  464 MiB
Flash:
SPI_Flash0: Found CS0 dev#0 Name[MX66L512] ChipSize[0x4000000]
64 MiB
In:    serial
Out:   serial
Err:   serial
MMC:   npcmx50_sdhci: 0, npcmx50_sdhci: 1
Net:   RGMII-Phy Addr: 0x1  Phy 0 not found
ETH0, ETH1, ETH2, ETH3
Hit any key to stop autoboot:  0
=> run usb_prog
starting USB...
USB0:   USB EHCI 1.00
scanning bus 0 for devices... 2 USB Device(s) found
       scanning usb for storage devices... 1 Storage Device(s) found
reading image-bmc
33554432 bytes read in 1912 ms (16.7 MiB/s)
Copy to Flash...
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         ################################################################
         done
=>
```

## 3.2 Load the openBMC image from the Host machine via TFTP server

This section describes how to load and boot the OpenBMC image from the TFTP server. This is very useful in the development stage when doing frequent builds.

These steps below should be performed one time per EVB.

After performing these steps, on each EVB reset, OpenBMC image is downloaded automatically from the TFPT to EVB SDRAM and then is booted.

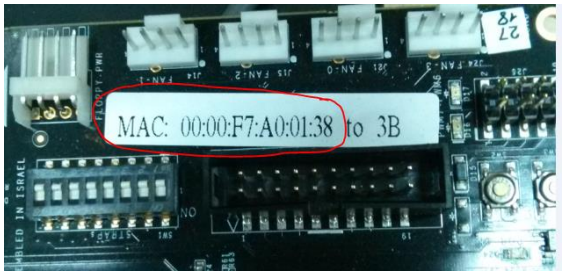
1. Install and set up the TFTP server on your host machine
   - For Windows, use 'Tftpd32' or 'Tftpd64' from http://tftpd32.jounin.net
   - For Linux, set up the tftp server environment.
2. Copy the "deliverables" folder, which contains the "**image-bmc**" file, into the TFTP server root folder on the host machine.
3. Power up the EVB and hit any key to stop at the u-boot shell.
4. Open the "**uboot_env_parameters.txt**" file for editing and update the u-boot environment according to your network settings and working method. Pay attention to the following environment settings:
   - Update the MAC address (**mac_base** and **mac_offset**) as printed on your board.
   - Change the Host IP address (**gatewayip** and **serverip**) according to your network parameters
   - Change the EVB static IP address (**ipaddr**) in case the EVB uses static IP rather than dynamic IP.
   - Change the Linux file location in the FTP (**tftp_dir**).
   - Change the Ethernet connection (**eth_num**). The EVB supports an RMII-1 or RGMII-1 Ethernet connection.
5. Change the **bootcmd** environment to boot from the TFTP, as follows:
   `setenv bootcmd 'run ftp_run'`
6. Copy and paste the contents of "**uboot_env_parameters.txt**" to the u-boot shell and press **<ENTER>**. This saves the u-boot environment to the flash.
7. Connect an Ethernet cable between the EVB (RMII-1 or RGMII-1, according to the **eth_num** configuration) and the host machine (the connection can be through your work network).
8. Type "**run bootcmd**" or reset the EVB, This loads the OpenBMC image file from the host machine through the TFTP server to EVB SDRAM, and performs the boot.

**Note:** To program the **OpenBMC** to the flash, type "**run usb_prog**" and press **<ENTER>**. This loads the OpenBMC image file from the TFTP to SDRAM and programs them into the flash device. Remember to update the **bootcmd** environment back to 'run romboot' and save the environment to the SPI flash device in order to be able to boot from the flash device after an EVB reset.

### 3.2.1 FTP Example Log

In this example log, we set up the TFTP server on host IP 10.191.10.155. The network supports DHCP. The following environments were changed:

- **mac_base** - changed to 00:00:F7:A0; **mac_offset** changed to 0138 as printed on the EVB (see picture below).




- **gatewayip** - changed to 10.191.20.254
- **serverip** - changed to 10.191.10.155
- **tftp_dir** - changed to “poleg/deliverables”

```
U-Boot 2015.10.7.0-00003-gb95e424a80 (Jun 08 2018 - 17:21:14 +0300)
Nuvoton Technology Corp.


HAL ver : v0.3.2

Board: PolegSVB
Chip : npcm750
Core : Cortex-A9

CPU Freq:     800MHz
Memory Freq:  800MHz
SPI0 Freq:     50MHz
SPI3 Freq:     20MHz
APB1 Freq:     25MHz
APB2 Freq:     50MHz
APB3 Freq:     50MHz
APB4 Freq:     25MHz
APB5 Freq:    100MHz
CP Freq:      200MHz

RomCode   : v00.01.02.06
BootBlock : v00.10.08.07

PolegSVB Power-On Straps = 0x1bf7
Security: DISABLED, running in non-secure mode
Model: Nuvoton npcm750 Development Board (Device Tree)

DRAM:  464 MiB
Flash:
SPI_Flash0: Found CS0 dev#0 Name[MX66L512] ChipSize[0x4000000]
64 MiB
In:    serial
Out:   serial
Err:   serial
MMC:   npcmx50_sdhci: 0, npcmx50_sdhci: 1
Net:   RGMII-Phy Addr: 0x1  Phy 0 not found
ETH0, ETH1, ETH2, ETH3
Hit any key to stop autoboot:  0
=> run ftp_run
Speed: 1000, full duplex
```

```
BOOTP broadcast 1
DHCP client bound to address 10.191.20.94 (2 ms)
Speed: 1000, full duplex
Using ETH2 device
TFTP from server 10.191.10.146; our IP address is 10.191.20.94; sending through gateway 10.191.20.254
Filename './image-bmc'.
Load address: 0x10000000
Loading: #################################################################
         #################################################################
         #################################################################
         #################################################################
         #################################################################
         #################################################################
         ###########
         3.4 MiB/s
done
Bytes transferred = 33554432 (2000000 hex)
## Loading kernel from FIT Image at 10200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Verifying Hash Integrity ... OK
   Trying 'kernel@1' kernel subimage
     Description:  Linux kernel
     Type:         Kernel Image
     Compression:  uncompressed
     Data Start:   0x1020012c
     Data Size:    3773448 Bytes = 3.6 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: 0x00008000
     Entry Point:  0x00008000
     Hash algo:    sha1
     Hash value:   ddccaccf733880d122a976e235229ccd6fb24d4d
   Verifying Hash Integrity ... sha1 calc hash addr 0x1020012c size 0x399408
 =>UBOOT last command run for 76648 us.
+ OK
## Loading ramdisk from FIT Image at 10200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Trying 'ramdisk@1' ramdisk subimage
     Description:  obmc-phosphor-initramfs
     Type:         RAMDisk Image
     Compression:  lzma compressed
     Data Start:   0x105a67d8
     Data Size:    1844883 Bytes = 1.8 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: unavailable
     Entry Point:  unavailable
     Hash algo:    sha1
     Hash value:   11c9a7c95faa5afca5cceae1d318999a2091e1ac
   Verifying Hash Integrity ... sha1 calc hash addr 0x105a67d8 size 0x1c2693
 =>UBOOT last command run for 39692 us.
+ OK
## Loading fdt from FIT Image at 10200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Trying 'fdt@nuvoton-npcm750-evb.dtb' fdt subimage
     Description:  Flattened Device Tree blob
     Type:         Flat Device Tree
     Compression:  uncompressed
     Data Start:   0x1059963c
     Data Size:    53468 Bytes = 52.2 KiB
     Architecture: ARM
     Hash algo:    sha1
     Hash value:   b356e69630b97b8e209344c206df4dfb65e5c0a6
   Verifying Hash Integrity ... sha1 calc hash addr 0x1059963c size 0xd0dc
 =>UBOOT last command run for 4551 us.
+ OK
   Booting using the fdt blob at 0x1059963c
   Loading Kernel Image ... OK
   Loading Ramdisk to 1cc14000, end 1cdd6693 ... OK
   Loading Device Tree to 1cc03000, end 1cc130db ... OK

Starting kernel ...
```

## 3.3 Program the openBMC image from the Host machine via TFTP server to the SPI flash

This section is a combination of the two previous sections. You can get download the entire openbmc image (image-bmc) which includs the bootblock and uboot via TFTP server, and program it to the flash.

After performing these steps, on each EVB reset, OpenBMC image is loaded aoutomatically from the spi flash to the EVB SDRAM and then will be bootedownloaded automatically from the TFPT to EVB SDRAM and is booted.

1. Follow steps 1-4 of the previous section ('Load the openBMC image from the Host machine via TFTP server') to install the TFTP, prepare the image-bmc file and set u-boot environments to load from TFTP.
2. Copy and paste the contents of "**uboot_env_parameters.txt**" to the u-boot shell and press **<ENTER>**. This saves the u-boot environment to the flash
3. Power up the EVB and hit any key to stop at the u-boot shell.
4. Type either "**run ftp_prog**" and press **<ENTER>**. This loads Linux kernel files to SDRAM and from SDRAM to SPI flash.
5. Reset the EVB to run Linux

### 3.3.1 FTP and Programming Example Log

```
=> run ftp_prog
Speed: 1000, full duplex
Using ETH2 device
TFTP from server 10.0.0.2; our IP address is 10.0.0.1
Filename 'images/evb-npcm750/image-bmc'.
Load address: 0x10000000
Loading: ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ############
         10.6 MiB/s
done

=> run ftp_prog
Speed: 1000, full duplex
Using ETH2 device
TFTP from server 10.0.0.2; our IP address is 10.0.0.1
Filename 'images/evb-npcm750/image-bmc'.
Load address: 0x10000000
Loading: ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ############
         10.6 MiB/s
Done
```

Power-up reset…

### 3.3.2 Boot Example Log

```
RomCode   : v00.01.02.06
BootBlock : v00.10.08.07

PolegSVB Power-On Straps = 0x1bf7
Security: DISABLED, running in non-secure mode
Model: Nuvoton npcm750 Development Board (Device Tree)

DRAM:  464 MiB
Flash:
SPI_Flash0: Found CS0 dev#0 Name[W25Q256] ChipSize[0x2000000]
32 MiB
In:    serial
Out:   serial
Err:   serial
MMC:   npcmx50_sdhci: 0, npcmx50_sdhci: 1
Net:   RGMII-Phy Addr: 0x1  Phy 0 not found
ETH0, ETH1, ETH2, ETH3
Hit any key to stop autoboot:  0
Booting Kernel from flash
+++ uimage at 0x80200000
Using bootargs: earlycon=uart8250,mmio32,0xf0001000 root=/dev/ram0 console=ttyS0,115200n8 mem=464M
ramdisk_size=48000 ip=10.0.0.1:10.0.0.2:192.168.200.40:255.255.255.0::eth2
## Loading kernel from FIT Image at 80200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Verifying Hash Integrity ... OK
   Trying 'kernel@1' kernel subimage
     Description:  Linux kernel
     Type:         Kernel Image
     Compression:  uncompressed
     Data Start:   0x8020012c
     Data Size:    2759552 Bytes = 2.6 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: 0x00008000
     Entry Point:  0x00008000
     Hash algo:    sha1
     Hash value:   3fd279ed7865b6973ffa4d78f0b86c47a7e63230
   Verifying Hash Integrity ... sha1 calc hash addr 0x8020012c size 0x2a1b80
 =>UBOOT last command run for 2372366 us.
+ OK
## Loading ramdisk from FIT Image at 80200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Trying 'ramdisk@1' ramdisk subimage
     Description:  obmc-phosphor-initramfs
     Type:         RAMDisk Image
     Compression:  lzma compressed
     Data Start:   0x804b0a30
     Data Size:    1849777 Bytes = 1.8 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: unavailable
     Entry Point:  unavailable
     Hash algo:    sha1
     Hash value:   17f0eb3b1da3cb266fd13a950d400acccee290ac
   Verifying Hash Integrity ... sha1 calc hash addr 0x804b0a30 size 0x1c39b1
 =>UBOOT last command run for 1591354 us.
+ OK
## Loading fdt from FIT Image at 80200000 ...
   Using 'conf@nuvoton-npcm750-evb.dtb' configuration
   Trying 'fdt@nuvoton-npcm750-evb.dtb' fdt subimage
     Description:  Flattened Device Tree blob
     Type:         Flat Device Tree
     Compression:  uncompressed
     Data Start:   0x804a1db4
```

```
     Data Size:    60348 Bytes = 58.9 KiB
     Architecture: ARM
     Hash algo:    sha1
     Hash value:   c60c6eeee976d03014701290bd86a008de2cbae3
   Verifying Hash Integrity ... sha1 calc hash addr 0x804a1db4 size 0xebbc
 =>UBOOT last command run for 55078 us.
+ OK
   Booting using the fdt blob at 0x804a1db4
   Loading Kernel Image ... OK
   Loading Ramdisk to 1cc12000, end 1cdd59b1 ... OK
   Loading Device Tree to 1cc00000, end 1cc11bbb ... OK

Starting kernel ...
```

In this example log, we set up the TFTP server on host IP 10.191.10.155. The network supports DHCP. The

*Nuvoton provides comprehensive service and support.*

*For product information and technical assistance, contact the nearest Nuvoton center.*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