

# SMARC-iMX8MM-Standalone

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## Build and Install Linux System for *SMARC-iMX8MM* (Solo, Solo Lite, Dual, Dual Lie, Quad and Quad Lite Core)

This document provides instructions for advanced users how Embedian offers patches and builds a customized version of u-boot and linux kernel for Embedian's *SMARC-iMX8MM* product platform and how to install the images to bring the evaluation board up and running.

Our aim is to fully support our hardware through device drivers. We also provide unit tests so that testing a board is easy and custom development can start precisely.

The host Linux machine is recommended Ubuntu 20.04 or 22.04.

Once you have Ubuntu 20.04 or 22.04 LTS running, install the additional required support packages using the following console command:

```
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib build-essential chrpath socat cpio python python3 python3-pip python3-pexpect xz-utils debianutils iputils-ping python3-git python3-jinja2 libegl1-mesa libsdl1.2-dev pylint xterm rsync curl zstd lz4 libssl-dev pv device-tree-compiler libghc-gnutls-dev
```

## Availability

SMARC-iMX8MM at Embedian

## Carrier Board

SBC-SMART-BEE (module and carrier board) at Embedian

SBC-SMART-MEN (module and carrier board) at Embedian

EVK-STD-CARRIER-S20 (universal carrier board for all SMARC 1.1 and 2.0 modules) at Embedian

## Basic Resources

- ARM Cross Compiler
  - ARM: <https://developer.arm.com/downloads/-/gnu-a>
- Bootloader
  - Das U-Boot – the Universal Boot Loader <http://www.denx.de/wiki/U-Boot>
  - Source – <http://git.denx.de/?p=u-boot.git;a=summary>
- Linux Kernel
  - Linus's Mainline tree: <http://git.kernel.org/?p=linux/kernel/git/torvalds/linux.git;a=summary>
  - NXP Linux source tree: [git://github.com/nxp-imx/linux-imx.git](https://github.com/nxp-imx/linux-imx.git)
  - NXP Yocto BSP meta layer: <https://github.com/nxp-imx/meta-imx/meta-bsp>
  - Freescale community BSP release: <https://github.com/Freescale/meta-freescale-distro>
  - Embedian SMARC-iMX8MM Linux kernel source tree: [git@git.embedian.com:developer/smarc-fsl-linux-kernel.git](https://git@git.embedian.com:developer/smarc-fsl-linux-kernel.git) or [git@github.com:embedian/smarc-fsl-linux-kernel.git](https://github.com/embedian/smarc-fsl-linux-kernel.git)
- ARM based rootfs
  - Debian Squeeze: <http://www.debian.org/>

## ARM Cross Compiler: GCC

This is a pre-built (32bit) version of Linaro GCC that runs on generic linux, so 64bit users need to make sure they have installed the 32bit libraries for their distribution.

| debian based          | extra                             | pkgs: (sudo apt-get update ; sudo apt-get install xyz)   |
|-----------------------|-----------------------------------|--|
| Ubuntu 20.04          |                                   | ia32-libs  |
| Debian 11 (Bullseye)  | sudo dpkg --add-architecture i386 | libc6:i386 libstdc++6:i386 libncurses5:i386 zli b1g:i386 |
| Ubuntu 20.10 -> 22.04 |                                   | libc6:i386 libstdc++6:i386 libncurses5:i386 zli b1g:i386 |
| Red Hat/Centos/Fedora |                                   | libstdc++.i686 ncurses-devel.i686 zlib.i686              |
| Red Hat based (rpm)   | extra                             | pkgs: (yum install xyz)                                  |
| Red Hat/Centos/Fedora |                                   | libstdc++.i686 ncurses-devel.i686 zlib.i686              |
| Ubuntu 22.04          |                                   | ia32-libs  |
| Ubuntu 20.10 -> 22.04 |                                   | libc6:i386 libstdc++6:i386 libncurses5:i386 zli b1g:i386 |

To build Embedian's *SMARC-iMX8MM* u-boot and linux kernel, you will need to install the following ARM compiler:

For **u-boot 2022.04**, you need to use the following Arm compiler.

```
$ wget -c https://developer.arm.com/-/media/Files/downloads/gnu-a/9.2-2019.12/binrel/gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu.tar.xz

$ sudo tar -Jxvf gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu.tar.xz -C /opt

$ export CC=/opt/gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu/bin/aarch64-none-linux-gnu-
```

Test:

If this test fails, verify that you have the 32bit libraries installed on your development system.

```
$ ${CC}gcc --version
arm-none-linux-gnueabi-hf-gcc (GNU Toolchain for the A-profile Architecture 9.2-2019.12 (arm-9.10)) 9.2.1
20191025
```

## Generating SSH Keys

We recommend you use SSH keys to establish a secure connection between your computer and Embedian Gitlab server. The steps below will walk you through generating an SSH key and then adding the public key to our Gitlab account.

### Step 1. Check for SSH keys

First, we need to check for existing ssh keys on your computer. Open up Git Bash and run:

```
$ cd ~/.ssh
$ ls
# Lists the files in your .ssh directory
```

Check the directory listing to see if you have a file named either `id_rsa.pub` or `id_dsa.pub`. If you don't have either of those files go to **step 2**. Otherwise, you already have an existing keypair, and you can skip to **step 3**.

### Step 2. Generate a new SSH key

To generate a new SSH key, enter the code below. We want the default settings so when asked to enter a file in which to save the key, just press enter.

```
$ ssh-keygen -t ed25519 -C "your_email@example.com"
Generating public/private ed25519 key pair.
Enter file in which to save the key (/home/eric/.ssh/id_ed25519):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/eric/.ssh/id_ed25519
Your public key has been saved in /home/eric/.ssh/id_ed25519.pub
The key fingerprint is:
SHA256:SS9opo/QHxT2cCwLX+ulhn3ZUVdhdG88vvliOVHJ/6c your_email@example.com
The key's randomart image is:
+--[ED25519 256]--+
|      . . . .+B|
|      = . . .O+|
|      = = . . O.=|
|      . O * O O.=O|
|      = S * O .O.|
|      . = O . . +|
|      . O .      =.|
|      . + .      = +|
|      . O      .E+O|
+-----[SHA256]-----+
```

### Step 3. Add your SSH key to Embedian Gitlab Server

Copy the key to your clipboard.

```
$ cat ~/.ssh/id_ed25519
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQDQUEnh8uGpfxaZVU6+uE4bsDrs/tEE5/BPW7jMAxak
6qgOh6nUrQGBWS+VxMM2un3KzwwLRJSj8G4TnTK2CSm1BvR+X8ZeXNTyAdaDxULs/StVhH+QRtFEGy4o
iMIzvIlTyORY89jzhIsgZzwr0lnqoSeWWASd+59JWtFjVY0nwVNVtbek7NfuIGGAPaijO5Wnshr2uChB
Pk8ScGjQ3z4VqNXP6CWhCXTqIk7EQl7yX2Gkd6FgEFrzae+5Jf63Xm8g6abbE3ytCrMT/jYy500j2XSg
6jlxSFnKcONAcfMTWkTXeG/OgeGeG5kZdtqryRtOlGmOeuQe1dd3I+Zz3JyT your_email@example.c
om
```

Go to [Embedian Git Server](#). At **Profile Setting --> SSH Keys --> Add SSH Key**

Paste your public key and press "Add Key" and you are done.

## Boot File: flash.bin

The boot file is called **flash.bin**. It is made up of some pieces of programs. This section instruct you how to generate flash.bin.

1. Download the imx-mkimage tool and apply Embedian's patch to accept Embedian's device tree blob.

```
$ git clone https://github.com/nxp-imx/imx-mkimage -b lf-5.15.71_2.2.0
$ cd imx-mkimage
$ wget -c ftp://ftp.embedian.com/public/smarcimx8mm/0005-imx8mm-change-uboot-device-tree-name.patch
$ patch -p1 <0005-imx8mm-change-uboot-device-tree-name.patch
$ cd ../
```

2. Get and Build the ARM Trusted firmware and copy bl31.bin to imx-mkimage/iMX8M directory.

```
$ git clone https://github.com/nxp-imx/imx-atf -b lf_v2.6
$ cd imx-atf
$ wget -c ftp://ftp.embedian.com/public/smarcimx8mm/0007-imx8mm-atf-uart4.patch
$ patch -p1 <0007-imx8mm-atf-uart4.patch
$ make CROSS_COMPILE=${CC} PLAT=imx8mm bl31
$ cp build/imx8mm/release/bl31.bin ../imx-mkimage/iMX8M/
$ cd ../
```

3. Get the DDR firmware and copy to imx-mkimage/iMX8M/ directory.

```
$ wget https://www.nxp.com/lgfiles/NMG/MAD/YOCTO/firmware-imx-8.18.bin
$ chmod a+x firmware-imx-8.18.bin
$ ./firmware-imx-8.18
enter "y" to accept EULA
$ cd firmware-imx-8.18
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_1d_dmem.bin ../imx-mkimage/iMX8M/
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_1d_imem.bin ../imx-mkimage/iMX8M/
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_2d_dmem.bin ../imx-mkimage/iMX8M/
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_2d_imem.bin ../imx-mkimage/iMX8M/
$ cd ../
```

4. Clone the U-Boot source code from [Embedian Git Server](#) and copy related files to imx-mkimage/iMX8M/ directory.

Download:

**For u-boot v2022.04:**

```
$ git clone git@git.embedian.com:developer/smarc-t335x-uboot.git v2022.04 -b emb_1f_v2022.04
```

Configure and Build:

```
$ make ARCH=arm CROSS_COMPILE=${CC} distclean
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimx8mm_2g_ser3_defconfig
$ make ARCH=arm CROSS_COMPILE=${CC}
```

**Note1:**

If the board is 2GB LPDDR4 in commercial or industrial temperature, use

```
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimx8mm_2g_ser3_defconfig
```

If the board is 4GB LPDDR4, use

```
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimx8mm_4g_ser3_defconfig
```

**Note 2:**

"ser3" stands for console debug port in SMARC definition. In this example, we use SER3 as debug port. If user uses SER0 as your debug port, make change to "ser0" instead. Same as SER1 and SER2.

**Note 3:**

To change the debug port, in addition to u-boot defconfig and uEnv.txt files, you also need to modify *plat/imx/imx8m/imx8mm/include/platform\_def.h* in the imx-atf. Find "*#define IMX\_BOOT\_UART\_BASE U(0x30890000)*" and change to the correct address that is defined in uEnv.txt file.

**Note 4:**

The *SMARC-iMX8MM* module always boots up from the on-module *eMMC* flash. The factory default will be *flash.bin* pre-installed with SER3 as console output. In some cases when the *eMMC* flash is empty or needs to be upgraded. Users can short-circuit the *TEST#* to ground. In this way, the *SMARC-iMX8MM* module will boot up to carrier SD card. The *flash.bin* images are the same, the difference is where you flash *flash.bin*. This will be explained in the "Setup SD card" section.

Copy *u-boot-nodtb.bin* *spl/u-boot-spl.bin* *arch/arm/dts/imx8mm-smarc.dtb* to *imx-mkimage/imx8M* directory and copy *tools/mkimage* to *imx-mkimage/imx8M/mkimage\_uboot*

```
$ cp u-boot-nodtb.bin spl/u-boot-spl.bin arch/arm/dts/imx8mm-smarc.dtb ../imx-mkimage/imx8M/
$ cp tools/mkimage ../imx-mkimage/imx8M/mkimage_uboot
```

5. Generate *flash.bin* file.

```
$ cd ../imx-mkimage
$ make CROSS_COMPILE=${CC} SOC=IMX8MM flash_spl_uboot
```

The *flash.bin* file will be located at *imx-mkimage/imx8M* directory. Go to "Setup SD Card" section to instruct you how to flash this file into SD card.

## Linux Kernel

Download:

**For 5.15.71 (Based on NXP imx\_1f-5.15.y official release):**

```
$ git clone git@git.embedian.com:developer/smarc-fsl-linux-kernel.git v5.15.71 -b emb_imx_1f-5.15.y
```

Configure and Build:

```
$ make ARCH=arm CROSS_COMPILE=${CC} distclean
$ make ARCH=arm CROSS_COMPILE=${CC} emb_imx_v8_defconfig
$ make ARCH=arm CROSS_COMPILE=${CC} Image modules dtbs
```

All available DTB files are listed in the table below.

| DTB Name                | Description                       |
|-------------------------|-----------------------------------|
| <i>imx8mm-smarc.dtb</i> | Device tree blob for SMARC-iMX8MM |

## Root File System

### Ubuntu ARM64 18.04:

| User | Password |
|------|----------|
| root | N/A      |

Ubuntu 18.04 Download:

```
$ wget -c ftp://ftp.embedian.com/public/dev/minfs/ubuntu/bionic/ubuntu-minimal-imx8mm-18.04-arm64.tar.gz
```

Verify:

```
$ md5sum ubuntu-minimal-imx8mm-18.04-arm64.tar.gz
78b861b57259b37bdf5efd60836ffa56  ubuntu-minimal-imx8mm-18.04-arm64.tar.gz
```

### Yocto Kirkstone Build Root File System:

| User | Password |
|------|----------|
| root | N/A      |

Find the yocto pre-built root file systems here at [Embedian's ftp site](#) based on your module CPU variants.

```
$ wget -c ftp://ftp.embedian.com/public/test/fsl-image-qt6-validation-imx-smarcimx8mm4g.tar.bz2
$ md5sum fsl-image-qt6-validation-imx-smarcimx8mm4g.tar.bz2
ea4832d04d8729ac54d470fcb10ba2ee  fsl-image-qt6-validation-imx-smarcimx8mm4g.tar.bz2
```

## Setup SD Card

For these instruction, we are assuming: DISK=/dev/mmcblk0, "lsblk" is very useful for determining the device id.

```
$ export DISK=/dev/mmcblk0
```

Erase SD card:

```
$ sudo dd if=/dev/zero of=${DISK} bs=1M count=160
```

Create Partition Layout:

With util-linux v2.26, sfdisk was rewritten and is now based on libfdisk.

#### sfdisk

```
$ sudo sfdisk --version
sfdisk from util-linux 2.34
```

Create Partitions:

```
i sfdisk >=2.26.x
$ sudo sfdisk ${DISK} <<--__EOF__
2M,48M,0x83,*
50M,,,
__EOF__
```

Format Partitions:

```
for: DISK=/dev/mmcblk0
$ sudo mkfs.vfat -F 16 ${DISK}p1 -n boot
$ sudo mkfs.ext4 ${DISK}p2 -L rootfs

for: DISK=/dev/sdX
$ sudo mkfs.vfat -F 16 ${DISK}1 -n boot
$ sudo mkfs.ext4 ${DISK}2 -L rootfs
```

Mount Partitions:

On some systems, these partitions may be auto-mounted...

```
$ sudo mkdir -p /media/boot/
$ sudo mkdir -p /media/rootfs/

for: DISK=/dev/mmcblk0
$ sudo mount ${DISK}p1 /media/boot/
$ sudo mount ${DISK}p2 /media/rootfs/

for: DISK=/dev/sdX
$ sudo mount ${DISK}1 /media/boot/
$ sudo mount ${DISK}2 /media/rootfs/
```

## Install Boot File

### If on-module eMMC Flash is empty

In some cases, when eMMC flash is erased or the u-boot is under development, we need a way to boot from SD card first. Users need to shunt cross the **TEST#** pin to ground. In this way, *SMARC-iMX8MM* will always boot up from SD card.

Fuse flash.bin to the SD card.

#### ~/imx-mkimage

```
$ sudo dd if=iMX8M/flash.bin of=${DISK} bs=1024 seek=33
```

### If on-module eMMC Flash is not empty

The *flash.bin* is pre-installed in on-module eMMC flash at factory default. *SMARC-iMX8MM* is designed to always boot up from on-module eMMC flash and to load Image, device tree blob and root file systems based on the setting of *BOOT\_SEL*. If users need to fuse your own flash.bin or perform u-boot upgrade. This section will instruct you how to do that.

Copy flash.bin to the second partition home directory of your SD card and boot into SD card. Go to home directory and you should see flash.bin file (The flash.bin file is located at imx-mkimage/iMX8M/ directory).

```
$ sudo cp -v imx-mkimage/iMX8M/flash.bin /media/rootfs/home/root/
```

Fuse flash.bin to the on-module eMMC flash. (The eMMC flash is emulated as /dev/mmcblk0 in SMARC-iMX8MM)

#### home directory

```
$ sudo dd if=flash.bin of=/dev/mmcblk0 bs=1024 seek=33
```



1. If your u-boot hasn't been finalized and still under development, it is recommended to shunt cross the test pin and boot directly from SD card first. Once your u-boot is fully tested and finalized, you can fuse your flash.bin to eMMC flash.
2. When *TEST#* pin of SMARC-iMX8MM is not shunt crossed, it will always boot up from on-module eMMC flash. U-boot will read the *BOOT\_SEL* configuration and determine where it should load Image and device tree blob. When *TEST#* is shunt crossed (pull low), it will always boot up from SD card.

## uEnv.txt based bootscript

Create "uEnv.txt" boot script: (\$ vim uEnv.txt)

#### ~/uEnv.txt

```
#console port SER3
console=ttyMX1,115200 earlycon=ec_imx6q,0x30890000,115200
#console port SER2
#console=ttyMX2,115200 earlycon=ec_imx6q,0x30880000,115200
#console port SER1
#console=ttyMX3,115200 earlycon=ec_imx6q,0x30a60000,115200
#console port SER0
#console=ttyMX0,115200 earlycon=ec_imx6q,0x30860000,115200
mmcdev=1
mmcpart=1
image=Image
loadaddr=0x40480000
fdt_addr=0x43000000
mmccroot=/dev/mmcblk1p2 rw
usbroot=/dev/sda2 rw
mmccrootfstype=ext4 rootwait fixrtc
netdev=eth0
ethact=FEC0
ipaddr=192.168.1.150
serverip=192.168.1.53
gatewayip=192.168.1.254
mmccargs=setenv bootargs ${mcore_clk} console=${console} root=${mmccroot} rootfstype=${mmccrootfstype}
${optargs}
uenvcmd=run loadimage; run loadfdt; run mmccboot
# USB Boot
#usbargs=setenv bootargs console=${console} root=${usbroot} rootfstype=${mmccrootfstype} ${optargs}
#uenvcmd=run loadusbimage; run loadusbfdt; run usbboot
```

Copy uEnv.txt to the boot partition:

#### ~/

```
$ sudo cp -v ~/uEnv.txt /media/boot/
```

## Install Kernel Image



Copy Image to the boot partition:

~/v5.15.71

```
$ sudo cp -v arch/arm/boot/Image /media/boot
```

## Install Kernel Device Tree Binary

```
$ sudo mkdir -p /media/boot/dtbs
```

```
$ sudo cp -v arch/arm/boot/dts/imx8mm-smarc.dtb /media/boot/dtbs
```

All available DTB files are listed in the table below.

| DTB Name                | Description                       |
|-------------------------|-----------------------------------|
| <i>imx8mm-smarc.dtb</i> | Device tree blob for SMARC-iMX8MM |

## Install Root File System and Kernel Modules

### Copy Root File System:

#### Yocto Pre-Built Rootfs:

directory where your root file system is

```
$ sudo tar jxvf <filename.tar.bz2> -C /media/rootfs
```

#### Ubuntu 18.04:

directory where your root file system is

```
$ sudo tar xvfz ubuntu-minimal-imx8mm-18.04-arm64.tar.gz -C /media/rootfs
```

### Copy Kernel Modules:

~/smarc-fsl-linux-kernel

```
$ sudo make ARCH=arm64 CROSS_COMPILE=${CC} INSTALL_MOD_PATH=/media/rootfs modules_install
```



#### Note

1. MAC address is factory pre-installed at on board I2C EEPROM at offset 60 bytes. It starts with Embedian's vendor code *10:0D:32*. u-boot will read it and pass this parameter to kernel.
2. If your rootfs is yocto built, the kernel modules will be included in the rootfs.

#### Networking:

Edit: /etc/network/interfaces

```
$ sudo vim /media/rootfs/etc/network/interfaces
```

Add:

### **/media/rootfs/etc/network/interfaces**

```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet dhcp
```

Remove SD card:

```
$ sync
$ sudo umount /media/boot
$ sudo umount /media/rootfs
```

## Setup eMMC

Setting up eMMC usually is the last step at development stage after the development work is done at your SD card or NFS environments. From software point of view, eMMC is nothing but a non-removable SD card on board. For *SMARC-iMX8MM*, the SD card is always emulated as /dev/mmcblk1 and on-module eMMC is always emulated as /dev/mmcblk0. Setting up eMMC now is nothing but changing the device descriptor.

This section gives a step-by-step procedure to setup eMMC flash. Users can write a shell script your own at production to simplify the steps.

First, we need to backup the final firmware from your SD card or NFS.

### Prepare for eMMC binaries from SD card (or NFS):

Insert SD card into your Linux PC. For these instructions, we are assuming: DISK=/dev/mmcblk0, "lsblk" is very useful for determining the device id.

For these instruction, we are assuming: DISK=/dev/mmcblk0, "lsblk" is very useful for determining the device id.

```
$ export DISK=/dev/mmcblk0
```

Mount Partitions:

**On some systems, these partitions may be auto-mounted...**

```
$ sudo mkdir -p /media/boot/
$ sudo mkdir -p /media/rootfs/

for: DISK=/dev/mmcblk0
$ sudo mount ${DISK}p1 /media/boot/
$ sudo mount ${DISK}p2 /media/rootfs/

for: DISK=/dev/sdX
$ sudo mount ${DISK}1 /media/boot/
$ sudo mount ${DISK}2 /media/rootfs/
```

### Copy Image to rootfs partition:

```
$ sudo cp -v /media/boot/Image /media/rootfs/home/root
```



#### **Note**

1. If your rootfs is Ubuntu 18.04, copy to `/media/rootfs/home/ubuntu` instead of `/media/rootfs/home/root`

### Copy uEnv.txt to rootfs partition:

Copy and paste the following contents to /media/rootfs/home/root (\$ sudo vim /media/rootfs/home/root/uEnv.txt)

```
#console port SER3
console=ttymxcl,115200 earlycon=ec_imx6q,0x30890000,115200
#console port SER2
#console=ttymx2,115200 earlycon=ec_imx6q,0x30880000,115200
#console port SER1
#console=ttymx3,115200 earlycon=ec_imx6q,0x30a60000,115200
#console port SER0
#console=ttymx0,115200 earlycon=ec_imx6q,0x30860000,115200
mmcdev=0
mmcpart=1
image=Image
loadaddr=0x40480000
fdt_addr=0x43000000
mmccroot=/dev/mmcblk0p2 rw
usbroot=/dev/sda2 rw
mmccrootfstype=ext4 rootwait fixrtc
netdev=eth0
ethact=FEC0
ipaddr=192.168.1.150
serverip=192.168.1.53
gatewayip=192.168.1.254
mmccargs=setenv bootargs ${mcore_clk} console=${console} root=${mmccroot} rootfstype=${mmccrootfstype}
${optargs} cma=400M
uenvcmd=run loadimage; run loadfdt; run mmccboot
# USB Boot
#usbargs=setenv bootargs console=${console} root=${usbroot} rootfstype=${mmccrootfstype} ${optargs}
#uenvcmd=run loadusbimage; run loadusbfdt; run usbboot
```

#### Copy device tree blob to rootfs partition:

```
$ sudo cp -v /media/boot/dtbs/imx8mm-smarc.dtb /media/rootfs/home/root/imx8mm-smarc.dtb
```

#### Copy boot file to rootfs partition:

```
~/imx-mkimage
$ sudo cp -v iMX8M/flash.bin /media/rootfs/home/root/flash.bin
```

#### Copy real rootfs to rootfs partition:

##### Yocto Built Root File Systems

```
$ pushd /media/rootfs
$ sudo tar cvfz ~/smarcimx8mm-emmc-rootfs.tar.gz .
$ sudo mv ~/smarcimx8mm-emmc-rootfs.tar.gz /media/rootfs/home/root
$ popd
```

##### Ubuntu 18.04 Root File Systems

```
$ sudo vim /media/rootfs/etc/udev/rules.d/70-persistent-net.rules

Delete all contents starting with "SUBSYSTEM=="

$ pushd /media/rootfs
$ sudo tar cvfz ~/smarcimx8mm-emmc-rootfs.tar.gz .
```

```
$ sudo mv ~/smarcimx8mm-emmc-rootfs.tar.gz /media/rootfs/home/root
$ popd
```

Unmount SD card.

```
$ sync
$ sudo umount /media/boot
$ sudo umount /media/rootfs
```

It is safe to remove SD card now.

## Copy Binaries to eMMC from SD card:

Insert this SD card into your SMARC-iMX8MM device and boot into SD card.

Now it will be almost the same as you did when setup your SD card, but the eMMC device descriptor is `/dev/mmcblk0` now.

```
$ export DISK=/dev/mmcblk0
```

Erase SD card:

```
$ sudo dd if=/dev/zero of=${DISK} bs=1M count=160
```

Create Partition Layout:

```
$ sudo sfdisk ${DISK} <<-__EOF__
2M,48M,0x83,*
50M,,,
__EOF__
```

Format Partitions:

```
$ sudo mkfs.vfat -F 16 ${DISK}p1 -n boot
$ sudo mkfs.ext4 ${DISK}p2 -L rootfs
```

Mount Partitions:

```
$ sudo mkdir -p /media/boot/
$ sudo mkdir -p /media/rootfs/
$ sudo mount ${DISK}p1 /media/boot/
$ sudo mount ${DISK}p2 /media/rootfs/
```

## Install binaries for partition 1

Copy uEnv.txt/Image/\*.dtb to the boot partition

```
$ sudo cp -v Image uEnv.txt /media/boot/
```

## Install Kernel Device Tree Binary

```
$ sudo mkdir -p /media/boot/dtbs
$ sudo cp imx8mm-smarc.dtb /media/boot/dtbs
```

# Install Root File System

---

```
$ sudo tar -zxvf smarcimx8mm-emmc-rootfs.tar.gz -C /media/rootfs
```

Unmount eMMC:

```
$ sync  
$ sudo umount /media/boot  
$ sudo umount /media/rootfs
```

Flash boot file

```
$ sudo dd if=flash.bin of=${DISK} bs=1024 seek=32
```

Switch your Boot Select to eMMC (OFF ON ON) and you will be able to boot up from eMMC now.

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