

# SMARC-iMX8M

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## Build and Install Linux System for *SMARC-iMX8M* (Dual, Quad Lite and Quad Core)

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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-iMX8M* 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 recommended host environment is Ubuntu 14.04 or Ubuntu 16.04.

## Availability

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SMARC-iMX8M from Embedian

## Carrier Board

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

## Basic Resources

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- AArch64 Cross Compiler
  - Linaro: <https://launchpad.net/linaro-toolchain-binaries>
- 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>
  - Freescale Linux source tree: [git://git.freescale.com/imx/linux-imx.git](http://git.freescale.com/imx/linux-imx.git)
  - Freescale BSP meta layer: [git://git.freescale.com/imx/meta-fsl-bsp-release](http://git.freescale.com/imx/meta-fsl-bsp-release)

- OpenEmbedded/Yocto BSP layer for Freescale's ARM platform [git://git.yoctoproject.org/meta-fsl-arm](https://git.yoctoproject.org/meta-fsl-arm)
- Embedian SMARC-iMX8M kernel source tree for linux smarc-imx\_4.9.51\_imx8m\_ga: [git@git.embedian.com:developer/smarc-fsl-linux-kernel.git](https://git.embedian.com:developer/smarc-fsl-linux-kernel.git)
- ARM based rootfs
  - Debian Squeeze: <http://www.debian.org/>

## ARM Cross Compiler: GCC

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To build Embedian's *SMARC-iMX8M* u-boot and linux kernel, you will need to install the following Linaro aarch64 compiler first:

For **u-boot 2017.03** and **Linux 4.9.51**, you need to use the following Linaro aarch64 coss compiler.

```
$ wget -c https://releases.linaro.org/components/toolchain/binaries/6.4-2017.11/aarch64-linux-gnu/gcc-linaro-6.4.1-2017.11-x86_64_aarch64-linux-gnu.tar.xz

$ sudo tar -C /opt -xJf gcc-linaro-6.4.1-2017.11-x86_64_aarch64-linux-gnu.tar.xz

$ export CC=/opt/gcc-linaro-6.4.1-2017.11-x86_64_aarch64-linux-gnu/bin/aarch64-linux-gnu-
```

Test:

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

```
$ ${CC}gcc --version

aarch64-linux-gnu-gcc (Linaro GCC 6.4-2017.11) 6.4.1 20171012
Copyright (C) 2017 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

## 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 rsa -C "your_email@example.com"
# Creates a new ssh key, using the provided email as a label
# Generating public/private rsa key pair.
# Enter file in which to save the key (/c/Users/you/.ssh/id_rsa): [Press enter]
$ ssh-add id_rsa
```

Now you need to enter a passphrase.

```
Enter passphrase (empty for no passphrase): [Type a passphrase]
Enter same passphrase again: [Type passphrase again]
```

Which should give you something like this:

```
Your identification has been saved in /c/Users/you/.ssh/id_rsa.
Your public key has been saved in /c/Users/you/.ssh/id_rsa.pub.
The key fingerprint is:
01:0f:f4:3b:ca:85:d6:17:a1:7d:f0:68:9d:f0:a2:db your_email@example.com
```

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

Copy the key to your clipboard.

```
$ cat ~/.ssh/id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQDQUEnh8uGpfxaZVU6+uE4bsDrs/tEE5/BPW7jMAxak
6qgOh6nUrQGBWS+VxMM2un3KzwwLRJSj8G4TnTK2CSmlBvR+X8ZeXNTyAdaDxULs/StVhH+QRtFEGy4o
iMIzvIlTyORY89jzhIsgZzwr0lnqoSeWWASd+59JWtFjVY0nwVNVtbek7NfuIGGAPaijO5Wnshr2uChB
Pk8ScGjQ3z4VqNXP6CWhCXTqIk7EQ17yX2Gkd6FgEFrzae+5Jf63Xm8g6abbE3ytCrMT/jYy500j2XSg
6jlxSFnKcONAcfMTWkTXeG/OgeGeG5kZdtqryRtO1GmOeuQe1dd3I+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 instructs 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://source.codeaurora.org/external/imx/imx-mkimage -b imx_4.9.51_imx8m_ga
$ cd imx-mkimage
$ wget -c ftp://ftp.embedian.com/public/smarcimx8m/0001-change-uboot-device-tree-name.patch
$ patch -p1 <0001-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://source.codeaurora.org/external/imx/imx-atf -b imx_4.9.51_imx8m_ga
$ cd imx-atf
$ make CROSS_COMPILE=${CC} PLAT=imx8mq bl31
$ cp build/imx8mq/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-7.8.bin
$ chmod a+x firmware-imx-7.8.bin
$ ./firmware-imx-7.8
enter "y" to accept EULA
$ cd firmware-imx-7.8
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_ld_dmem.bin ../imx-mkimage/IMX8M/
$ cp firmware/ddr/synopsys/lpddr4_pmu_train_ld_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/
$ cp firmware/hdmi/cadence/signed_hdmi_imx8m.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 v2017.03:**

```
$ git clone git@git.embedian.com:developer/smarc-t335x-uboot.git u-boot_v2017.03 -b
smarc-imx_v2017.03_4.9.88_2.0.0_ga
$ cd u-boot_v2017.03
```

Configure and Build:

```
$ make ARCH=arm CROSS_COMPILE=${CC} distclean
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimx8mq_2g_ser3_defconfig
$ make ARCH=arm CROSS_COMPILE=${CC}
```

#### **Note 1:**

If the board is SMARC-iMX8M-D-2G, SMARC-iMX8M-L-2G, SMARC-iMX8M-Q-2G (2GB LPDDR4, normal temperature), use

```
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimx8mq_2g_ser3_defconfig
```

If the board is SMARC-iMX8M-D-2G-I, SMARC-iMX8M-L-2G-I or SMARC-iMX8M-Q-2G-I (2GB LPDDR4, industrial temperature), use

```
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimxmq_2g_ser3_ind_defconfig
```

If the board is SMARC-iMX8M-Q-4G or SMARC-iMX8M-Q-4G-I (4GB LPDDR4), use

```
$ make ARCH=arm CROSS_COMPILE=${CC} smarcimxmq_4g_ser3_defconfig
```

#### **Note 2:**

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

#### **Note 3:**

The *SMARC-iMX8M* module always boot 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 shunt crossed the *TEST#* to ground. In this way, the *SMARC-iMX8M* module will boot up to carrier SD card, if *TEST#* pin is shunt crossed. The *flash.bin* image are the same, the difference is how 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/fsl-smarcimx8mq.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/fsl-smarcimx8mq.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=iMX8M flash_spl_uboot
```

If your device has HDMI port use the following command instead.

```
$ make CROSS_COMPILE=${CC} SOC=iMX8M flash_hdmi_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 4.9.51 \(Based on Freescale imx\\_4.9.51\\_imx8m\\_ga official release\):](#)**

```
$ git clone git@git.embedian.com:developer/smarc-fsl-linux-kernel.git linux_v4.9.51 -b
smarc-imx_4.9.51_imx8m_ga
$ cd linux_v4.9.51
```

Configure and Build:

```
$ make ARCH=arm64 CROSS_COMPILE=${CC} distclean
$ make ARCH=arm64 CROSS_COMPILE=${CC} smarcimx8m_defconfig
$ make ARCH=arm64 CROSS_COMPILE=${CC} Image modules dtbs
```

### **DCSS vs LCDIF**

i.MX8M comes with 2 display controllers: DCSS and LCDIF.

DCSS can be connected to either HDMI or MIPI-DSI (to LVDS bridge) and supports resolutions up to 4K.

LCDIF can be connected only to MIPI-DSI and supports resolutions up to 1080p.

Selecting display configuration is a matter of selecting an appropriate DTB file under `arch/arm64/boot/dts/embedian`. All available DTB files are listed in the table below.

DTB File Name	Description
<code>fsl-smarcimx8mq.dtb</code>	Device tree blob for no display configuration.
<code>fsl-smarcimx8mq-hdmi.dtb</code>	Device tree blob for HDMI display configuration (DCSS).
<code>fsl-smarcimx8mq-hdmi-4k.dtb</code>	Device tree blob for HDMI 4k display configuration (DCSS).
<code>fsl-smarcimx8mq-lcdif-lvds.dtb</code>	Device tree blob for LCDIF LVDS display configuration.
<code>fsl-smarcimx8mq-dcss-lvds.dtb</code>	Device tree blob for DCSS LVDS display configuration.

`fsl-smarcimx8mq-dual-display.dtb`

Device tree blob for dual LVDS+HDMI display configuration.

## Root File System

### Ubuntu ARM64 16.04.03:

User	Password
root	root
ubuntu	temppwd

Ubuntu 16.04 Download:

```
$ wget -c
ftp://ftp.embedian.com/public/dev/minfs/ubuntu/xenial/arm64/ubuntu-minimal-imx8m-16.04.5-arm64.tar.gz
```

Verify:

```
$ md5sum ubuntu-minimal-imx8m-16.04.5-arm64.tar.gz
64ff8dfe67051363209235511dfac746  ubuntu-minimal-imx8m-16.04.5-arm64.tar.gz
```

### Yocto 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.

## 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=16
```

Create Partition Layout: Leave 2MB offset for flash.bin.

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

```
sfdisk
$ sudo sfdisk --version
sfdisk from util-linux 2.27.1
```

Create Partitions:

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

```
__EOF__
```

```
i sfdisk <=2.25  
$ sudo sfdisk --in-order --Linux --unit M ${DISK} <<__EOF__  
2,48,0x83,*  
,,-  
__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 not empty

The *flash.bin* is pre-installed in on-module eMMC flash at factory default. SMARC-iMX8M 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-iMX8M)

### home directory

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

### 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-iMX8M* 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
```



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-iMX8M 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
```

```
optargs="video=HDMI-A-1:1920x1080-32@60 consoleblank=0"
#optargs="video=HDMI-A-1:3840x2160-32@30 consoleblank=0"
#optargs="video=HDMI-A-1:3840x2160-32@60 consoleblank=0"
#console port SER3
console=ttyMXC0,115200 earlycon=ec_imx6q,0x30860000,115200
#console port SER2
#console=ttyMXC1,115200 earlycon=ec_imx6q,0x30890000,115200
#console port SER1
#console=ttyMXC2,115200 earlycon=ec_imx6q,0x30880000,115200
#console port SER0
#console=ttyMXC3,115200 earlycon=ec_imx6q,0x30A60000,115200
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 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:

```
~/linux_v4.9.51
```

```
$ sudo cp -v arch/arm64/boot/Image /media/boot
```

## Install Kernel Device Tree Binary



```
$ sudo mkdir -p /media/boot/dtbs
$ sudo cp -v arch/arm64/boot/dts/embedian/<device tree name> /media/boot/dtbs/fsl-smarcimx8mq.dtb
```

The device tree name in your SD card has be to fsl-smarcimx8mq.dtb

## 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.gz> -C /media/rootfs
```

#### Ubuntu 16.04:

directory where your root file system is

```
$ sudo tar xvfz ubuntu-minimal-imx8m-16.04.5-arm64.tar.gz -C /media/rootfs
```

### Copy Kernel Modules:

~/linux\_v4.9.51

```
$ 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. No need to copy again.

#### 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-iMX8M*, 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 16.04, 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`)

```
optargs="video=HDMI-A-1:1920x1080-32@60 consoleblank=0"
#optargs="video=HDMI-A-1:3840x2160-32@30 consoleblank=0"
#optargs="video=HDMI-A-1:3840x2160-32@60 consoleblank=0"
#console port SER3
console=ttyMXC0,115200 earlycon=ec_imx6q,0x30860000,115200
#console port SER2
#console=ttyMXC1,115200 earlycon=ec_imx6q,0x30890000,115200
#console port SER1
#console=ttyMXC2,115200 earlycon=ec_imx6q,0x30880000,115200
#console port SER0
#console=ttyMXC3,115200 earlycon=ec_imx6q,0x30A60000,115200
mmcdev=0
mmcpart=1
image=image
```

```
loadaddr=0x40480000
fdt_addr=0x43000000
mmcroot=/dev/mmcblk0p2 rw
usbroot=/dev/sda2 rw
mmcrootfstype=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 console=${console} root=${mmcroot} rootfstype=${mmcrootfstype} ${optargs}
uenvcmd=run loadimage; run loadfdt; run mmcboot
# USB Boot
#usbargs=setenv bootargs console=${console} root=${usbroot} rootfstype=${mmcrootfstype} ${optargs}
#uenvcmd=run loadusbimage; run loadusbfdt; run usbboot
```

### Copy device tree blob to rootfs partition:

```
$ sudo cp -v /media/boot/dtbs/fsl-smarcimx8mq.dtb /media/rootfs/home/root/fsl-smarcimx8mq.dtb
```

### Copy real rootfs to rootfs partition:

#### Yocto Built Root File Systems

```
$ pushd /media/rootfs
$ sudo tar cvfz ~/smarcimx8mq-emmc-rootfs.tar.gz .
$ sudo mv ~/smarcimx8mq-emmc-rootfs.tar.gz /media/rootfs/home/root
$ popd
```

#### Ubuntu 16.04 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 ~/smarcimx8mq-emmc-rootfs.tar.gz .
$ sudo mv ~/smarcimx8mq-emmc-rootfs.tar.gz /media/rootfs/home/ubuntu
$ popd
```

Remove SD card:

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

## Copy Binaries to eMMC from SD card:

Insert this SD card into your SMARC-iMX8M 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 eMMC:

```
$ sudo dd if=/dev/zero of=${DISK} bs=2M count=16
```

## 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 -v fsl-smarcimx8mq.dtb /media/boot/dtbs/
```

## Install Root File System

```
$ sudo tar -zxvf smarcimx8mq-emmc-rootfs.tar.gz -C /media/rootfs
```

## Unmount eMMC:

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

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

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