

# SMARC-iMX8M-ANDROID-P9.0.0\_2.0.0-ga

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## Building Freescale/Embedian's Android P9.0.0\_2.0.0-ga BSP Distribution

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## Introduction

This document describes how to build and deploy Android Oreo on the SMARC-iMX8M. It is based on NXP's IMX8M\_P9.0.0\_2.0.0-GA ANDROID release.

## Generating SSH Keys

In order to download u-boot and kernel from Embedian. 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

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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

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Copy the key to your clipboard.

```
$ cat ~/.ssh/id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQDQUEnh8uGpfxaZVU6+uE4bsDrs/tEE5/BPW7jMAXak
6qg0h6nUrQGBWS+VxMM2un3KzwlLRJSj8G4TnTK2CSm1BvR+X8ZeXNTyAdaDxULs/StVhH+QRtFEgy4o
iMIzvIlTyORY89jzhIsgZzwr01nqoSeWwASd+59JWtFjVy0nwVNVtbek7NfuIGGAPaij05Wnshr2uChB
Pk8ScGjQ3z4VqNXP6CWhCXTqIk7EQ17yX2GKd6FgEFrzae+5Jf63Xm8g6abbE3ytCrMT/jYy500j2XSg
6jlxSFnKcONAcfMTWkTXeG/OgeGeG5kZdtqryRt0lGmOeuQe1dd3I+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.

## Overview of this document

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The objective of this document is to guide SMARC-iMX8M Android developers to obtain Android P9.0.0\_2.0.0-ga Pie sources, setting up host environment, compilation and deployment.

This document contains instructions for:

- Hardware and software requirements.
- Setup the hardware.
- Setup the toolchain.
- Download & build the sources.
- Install the binaries on the SMARC-iMX8M SOM.

## Hardware Requirement

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EVK-STD-CARRIER-S20 and SMARC-iMX8M.

## Host (PC) setup requirements

The host development environment for Android is based on Ubuntu and Debian, please install Ubuntu version 16.04 64bit LTS <http://www.ubuntu.com/download/desktop> or Debian 9.6 64bit <https://www.debian.org/releases>



Do not use other Ubuntu or Debian releases, than recommended above.

## Install required packages on host PC

```
$ sudo apt-get -y install git-core gnupg flex bison gperf build-essential zip curl  
zlib1g-dev gcc-multilib g++-multilib  
$ sudo apt-get -y install libc6-dev-i386 lib32ncurses5-dev x11proto-core-dev  
libx11-dev lib32z-dev ccache libgl1-mesa-dev libxml2-utils  
$ sudo apt-get -y install xsltproc unzip mtd-utils u-boot-tools lzop liblzo2-2  
liblzo2-dev zlib1g-dev liblz-dev uuid uuid-dev android-tools-fsutils
```

## Install the OpenJDK

```
$ sudo apt-get update  
$ sudo apt-get install openjdk-8-jdk
```

Update the default Java version by running:

```
$ sudo update-alternatives --config java  
$ sudo update-alternatives --config javac
```



The build machine should have at least 50GB of free space to complete the build process.

## Obtain Source Code

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### Get NXP's Android Release Package

Go to NXP's website, download IMX8MQ\_P9.0.0\_2.0.0\_ANDROID\_SOURCE\_BSP (filename: imx-p9.0.0\_2.0.0-ga.tar.gz and put into your

~/downloads directory.

```
$ cd ~/downloads
$ tar xvfz imx-p9.0.0_2.0.0-ga.tar.gz
```

## Obtain Google Android Pie P9.0.0\_2.0.0-ga source code and Apply NXP's patch

```
$ mkdir -p ~/android/smarc8m/p_900_200
$ cd ~/android/smarc8m/p_900_200
$ mkdir ~/bin
$ curl http://comdatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
$ chmod a+x ~/bin/repo
$ export PATH=~/bin:$PATH
$ mv ~/download/imx-p9.0.0_2.0.0-ga .
$ source imx-p9.0.0_2.0.0-ga/imx_android_setup.sh
```

After done, it will create an android\_build directory. Go to this directory.

## Clone Embedian's U-Boot and Linux kernel sources

```
$ cd ~/android/smarc8m/p_900_200/android_build
$ mkdir -p vendor/embedian
$ cd vendor/embedian
$ git clone git@git.embedian.com:developer/smarc-t335x-uboot.git uboot-imx -b
smarc-8m-p9.0.0_2.0.0_ga
$ git clone git@git.embedian.com:developer/smarc-fsl-linux-kernel.git kernel_imx -b
smarc-8m-p9.0.0_2.0.0_ga
```

## Apply Embedian's patches for i.MX8M platforms

```
$ cd ~/android/smarc8m/p_900_200/android_build/device
$ git clone git@git.embedian.com:developer/smarc-imx8m-android.git embedian -b
smarc-8m-p9.0.0_2.0.0_ga
$ embedian/scripts/install.sh
```

## Build Android Images

Change to Android top level directory.

```

$ export MY_ANDROIDID=~/.android/smarcimx8m/p_900_200/android_build
$ cd ${MY_ANDROIDID}
$ source build/envsetup.sh
$ export JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-amd64
$ export PATH=$JAVA_HOME/bin/:$PATH
$ lunch smarc_mx8mq-eng
or
$ lunch smarc_mx8mq-userdebug
$ make -j4 2>&1 | tee build1-1.log

```



userdebug build creates a debuggable version of Android. eng build creates an engineering version of Android. Development mode enable and development tools are available on target.

## Images created by the Android build for SMARC-iMX8M system

The images created are located at out/target/product/smarc\_mx8m/ directory.

| Image                        | Description                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| u-boot-smarcim8mq_2g.img     | Bootloader for eMMC/SD card boot for SMARC-iMX8M-D/Q-2G(-I)<br><br>Other SMARC variants could be defined at device/embedian/smarc_mx8m/BoardConfig.mk             |
| u-boot-smarcim8mq_2g_uuu.img | Bootloader used by uuu for eMMC/SD card boot for SMARC-iMX8M-D/Q-2G(-I)<br><br>Other SMARC variants could be defined at device/embedian/smarc_mx8m/BoardConfig.mk |
| boot-<name>.img              | Boot image for SMARC-iMX8M                                                                                                                                        |
| partition-table.img          | GPT table image for 16GB SD card and eMMC.                                                                                                                        |
| partition-table-7GB.img      | GPT table image for 8GB SD card and eMMC.                                                                                                                         |
| partition-table-28GB.img     | GPT table image for 28GB SD card and eMMC.                                                                                                                        |
| system.img                   | System Boot image                                                                                                                                                 |
| vbmeta-<name>.img            | Android Verified Boot metadata Image for SMARC-iMX8M to support different display output                                                                          |
| vendor.img                   | Vendor image                                                                                                                                                      |
| dtbo-<name>.img              | Device Tree image for SMARC-iMX8M to support different display output                                                                                             |

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <name> | <p><i>smarcimx8mq</i> Support no display configuration.</p> <p><i>smarcimx8mq-hdmi</i> Support HDMI display configuration (DCSS).</p> <p><i>smarcimx8mq-dp</i> Support Display Port (DP) display configuration (DCSS).</p> <p><i>smarcimx8mq-edp</i> Support Embedded Display Port (eDP) display configuration (DCSS).</p> <p><i>smarcimx8mq-lcdif-lvds</i> Support LCDIF LVDS display configuration.</p> <p><i>smarcimx8mq-dcss-lvds</i> Support DCSS LVDS display configuration.</p> <p><i>smarcimx8mq-dual-display</i> Support dual LVDS+HDMI display configuration.</p> |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 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.

The default configuration for SMARC-iMX8M variant is SMARC-iMX8M-D-2G. If users used other variant, make changes at device/embedian/smarc\_mx8m/BoardConfig.mk. Find "TARGET\_BOOTLOADER\_CONFIG" and change the u-boot defconfig file.

### U-Boot defconfig file

If your LPDDR4 is 2GB commercial or industrial temperature, use *smarcima8mq\_2g:smarcimx8mq\_2g\_ser3\_android\_defconfig*

If your LPDDR4 is 4GB commercial or industrial temperature, use *smarcima8mq\_4g:smarcimx8mq\_4g\_ser3\_android\_defconfig*.

"ser3" stands for the debug output port that is defined in SMARC specification.

## UUU Scripts

The table below describes the UUU scripts in android\_p9.0.0\_2.0.0-ga. They are used with the UUU binary file to download the images above into SMARC-iMX8M SMARC modules.

| UUU Script name                         | Function                                                            |
|-----------------------------------------|---------------------------------------------------------------------|
| <i>uuu-android-smarc-mx8mq-emmc.lst</i> | Used with the UUU binary file to download image files into eMMC.    |
| <i>uuu-android-smarc-mx8mq-sd.lst</i>   | Used with the UUU binary file to download image files into SD card. |

## Setup SD card

Prepare for an SD card and insert into your Linux host PC

```
$ cp smarc-mksdcard.sh out/target/product/smarc_mx8mq/
$ cd out/target/product/smarc_mx8mq/
$ chmod a+x smarc-mksdcard.sh
$ sudo ./smarc-mksdcard.sh -f <name> /dev/sdX; sync
```

<name>

***smarcimx8mq*** Support no display configuration.

***smarcimx8mq-hdmi*** Support HDMI display configuration (DCSS).

***smarcimx8mq-dp*** Support Display Port (DP) display configuration (DCSS).

***smarcimx8mq-edp*** Support Embedded Display Port (eDP) display configuration (DCSS).

***smarcimx8mq-lcdif-lvds*** Support LCDIF LVDS display configuration.

***smarcimx8mq-dcss-lvds*** Support DCSS LVDS display configuration.

***smarcimx8mq-dual-display*** Support dual LVDS+HDMI display configuration.



1. The minimum size of the SD card is 8 GB.
2. /dev/sdX, the X is the disk index from 'a' to 'z'. That may be different on each computer running Linux OS.
3. If the SD card is 16 GB, use "sudo ./smarc-mksdcard.sh -f <name> /dev/sdX" to flash images.
4. If the SD card is 8 GB, use "sudo ./smarc-mksdcard.sh -f <name> -c 7 /dev/sdX" to flash images.
5. If the SD card is 32 GB, use "sudo ./smarc-mksdcard.sh -f <name> -c 28 /dev/sdX" to flash images.
6. The default SMARC variant is SMARC-iMX8M-2G. If using other SMARC variants, make sure to change *bootloader\_file* in *smarc-mksdcard.sh* before setting up SD card.

Insert the SD card into your device, set the *BOOT\_SEL* to "ON OFF OFF" and shut cross the *TEST#* pin to Ground. You will be able to see Android booting up. For eMMC boot, leave the *TEST#* floating and the *BOOT\_SEL* should be set as "OFF ON ON". The next section will instruct you to flash eMMC.

## Setup eMMC

Setup eMMC for Android is a bit complex, but trivial. There are a couple of ways to achieve it.

## Use UUU

UUU can be used to download all images into a target device. It is a quick and easy tool for downloading images. See the *AndroidTM Quick Start Guide (AQSUG)* for detailed description of UUU.

Make sure that the *FORCE\_RECOV#* pin has to be shunt to Ground to enter into CPU serial download mode when using this tool. Connect USB0 min-B port of the device to your host computer.

Copy uuu.exe, u-boot-smarcimx8mq-2g.imx, u-boot-smarcimx8mq-2g\_uuu.imx, partition-table.img, boot.img, vbmeta-<name>.img, system.img, vendor.img, dtbo-<name> and uuu-android-smarc-mx8mq-emmc.lst into the same folder.

```
$ uuu uuu-android-smarc-mx8mq-emmc.lst
```

After done, make sure that *FORCE\_RECOV#* and *TEST#* pins are floating. Change the *BOOT\_SEL* to OFF ON ON and the module will boot up from eMMC.

## Use a Ubuntu 18.04 Bootable SD card

The second way that we also recommend is to make a bootable Ubuntu 16.04 SD card for SMARC-iMX8M. User go to our [Linux Development Site](#) to learn how to make a bootable Ubuntu 16.04 SD card. An pre-built images can be downloaded from our [ftp site](#). Users can download those images and follow the "Setup SD card" section from our Linux development site. Once it done, you can copy the `smarc-mksdcard.sh` script and all Android images (`u-boot-smarcimx8mq-2g.imx`, `partition-table.img`, `boot.img`, `vbmata-<name>.img`, `system_raw.img`, `vendor_raw.img`, `dtbo-<name>`, `smarc-mkemmmccard.sh`) into your home directory. Follow exactly what you did for SD card, but now, eMMC device will be emulated as `/dev/mmcblk0`.

```
$ sudo ./smarc-mkemmmccard.sh -f <name> /dev/mmcblk0; sync
```

<name>

**`smarcimx8mq`** Support no display configuration.

**`smarcimx8mq-hdmi`** Support HDMI display configuration (DCSS).

**`smarcimx8mq-dp`** Support Display Port (DP) display configuration (DCSS).

**`smarcimx8mq-edp`** Support Embedded Display Port (eDP) display configuration (DCSS).

**`smarcimx8mq-lcdif-lvds`** Support LCDIF LVDS display configuration.

**`smarcimx8mq-dcss-lvds`** Support DCSS LVDS display configuration.

**`smarcimx8mq-dual-display`** Support dual LVDS+HDMI display configuration.

Power off and set `BOOT_SEL` to "OFF ON ON", leave the `TEST#` pin floating and you will be able to boot up your Android from on-module eMMC.

## Android Recovery Mode

### Enter board in Android Recovery mode

Shunt `LID#` pin to ground will enter Android Recovery mode.

### Update Android Firmware

#### Generate OTA Packages

For generating "OTA" packages, use the following commands:

```
$ cd ${MY_ANDROID}
$ make PRODUCT=smarc_mx8mq-eng -j4 otapackage 2>&1 | tee build1-1.log
```

#### Install OTA Packages to device

1. Enter to Android Recovery mode
2. Select menu item "apply update from ADB"
3. To the host system, perform the following command:

```
$ out/host/linux-x86/bin/adb sideload
out/target/product/smarc_mx8mq/smarc_mx8mq-ota-<data>-<name>.zip
```

smarc\_mx8mq-ota- $\{date\}$ .zip includes payload.bin and payload\_properties.txt . The two files are used for full update.

Reboot the device.



Real example name for OTA package: `out/target/product/smarc_mx8mq/smarc_mx8mq-ota-20180416-smarcimx8mq-hdmi.zip`

## Manual Operations

### Build boot.img

When you perform changes to the kernel, you may build boot.img solely instead of building the whole Android.

```
$ cd ${MY_ANDROID}
$ source build/envsetup.sh
$ export JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-amd64
$ export PATH=$JAVA_HOME/bin/:$PATH
$ lunch smarc_mx8m-eng
or
$ lunch smarc_mx8m-userdebug
$ make bootimage
```

### Toolchain setup for manual build kernel and U-Boot

Setup the toolchain path to point to arm-eabi- tools in prebuilts/gcc/linux-x86/arm/arm-eabi-4.8/bin

```
$ export ARCH=arm64
$ export
CROSS_COMPILE=${MY_ANDROID}/prebuilts/gcc/linux-x86/aarch64/aarch64-linux-android-4.9/
bin/aarch64-linux-android-
```

### Manual build Bootloader

Change directory to U-Boot

```
$ cd ${MY_ANDROID}/vendor/embedian/u-boot-imx
```

Execute following commands:

```
$ make distclean
$ make smarcimx8mq_2g_ser3_android_defconfig
$ make -j4
```

#### **U-Boot defconfig file**

If your LPDDR4 is 2GB commercial or industrial temperature, use `smarcimx8mq_2g:smarcimx8mq_2g_ser3_android_defconfig`

If your LPDDR4 is 4GB commercial or industrial temperature, use `smarcimx8mq_4g:smarcimx8mq_4g_ser3_android_defconfig`.

"ser3" stands for the debug output port that is defined in SMARC specification.

It will generate u-boot.imx file.

## Manual build Android Linux Kernel and modules

---

```
$ cd ${MY_ANDROID}/vendor/embedian/kernel_imx
$ make distclean
$ make smarcimx8m_android_defconfig
$ make KCFLAGS=-mno-android
```

The kernel images are found in \${MY\_ANDROID}/vendor/embedian/kernel\_imx/arch/arm64/boot/Image

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