

EMBEDDED LINUX

Firmware deployment onto the SD card

Brief

From the first chapter, we built a full Debian distribution that is now ready to be sent to the SD card. From the second chapter, we formatted the SD card so it's now ready to host a filesystem. You got it: this chapter's about copy-pasting our Debian files onto the SD card. That's what the deployment is all about.

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Source

[Debian: Getting started with the BeagleBone Black.](#)

by Robert C. Nelson

Reminder

/!\ Understand all commands before running them! /!\

RUN THE START-UP SCRIPT

Run the `elinux/tp/disco/script/start_elinux.sh` script that moves you to your working directory

```
source script/start_elinux.sh
```

DEPLOY ALL IMAGES ON MMC SD CARD

BOOTLOADER

You have already built the 2nd-stage and 3rd-stage bootloaders in the first chapter. They are stored in the `${DISCOPATH}/deploy/` directory.

```
cd ${DISCOPATH}
```

Install MLO - Texas Instrument 2nd boot level

Copy the MLO (2nd-stage bootloader) onto the SD card.

```
sudo dd if=./deploy/MLO of=${DISK} count=1 seek=1 bs=128k
```

Let's analyse what has been written onto the card.

```
sudo dd if=${DISK} of=./mass/sdcard_dump_step2_mlo bs=1 count=1M
xxd mass/sdcard_dump_step2_mlo > mass/sdcard_dump_step2_mlo.txt
gedit mass/sdcard_dump_step2_mlo.txt &
```

- What is the start address of the MLO on the SD device? Does it match the first `dd` command?

- How does the 1st-stage bootloader (i.e. Boot Rom, the TI firmware) know where the MLO is stored? Does the start address really matter? See [here](#)

Install U-Boot - 3rd boot level

Copy the U-Boot (3rd-stage bootloader) onto the SD card.

```
sudo dd if=./deploy/u-boot.img of=${DISK} count=2 seek=1 bs=384k
```

Let's analyse what has been written onto the card.

```
sudo dd if=${DISK} of=./mass/sdcard_dump_step3_uboot bs=1 count=1M
xxd mass/sdcard_dump_step3_uboot > mass/sdcard_dump_step3_uboot.txt
gedit mass/sdcard_dump_step3_uboot.txt &
```

- What is the start address of the U-boot on the SD device? Does it match the first `dd` command?

KERNEL

Install kernel and dtb on microSD card

You have already built the kernel image and the device tree binary in the first chapter. They are stored in the `${DISCOPATH}/deploy/` directory. Also, check if your partition is correctly mounted. If not, mount it.

```
cd ${DISCOPATH}/deploy
lsblk -f
```

Copy the files onto the mounted partition.

```
sudo mkdir -p ${MEDIA}/rootfs/boot/

export kernel_version=4.14.198-bone-rt-r40
sudo sh -c "echo 'uname_r=${kernel_version}' >> ${MEDIA}/rootfs/boot/uEnv.txt"

sudo cp -v ./zImage ${MEDIA}/rootfs/boot/vmlinuz-${kernel_version}
sudo cp -v ./am335x-boneblack.dtb ${MEDIA}/rootfs/boot/
```

- What files have been written onto the SD card partition?

ROOTFS

Install Debian rootfs on microSD card

You have already downloaded an archive of the Debian filesystem in the first chapter. It is stored in the `${DISCOPATH}/rootfs/debian/` directory.

```
cd ${DISCOPATH}/rootfs/debian
sudo tar xfvp ./*-*-*-armhf-*/armhf-rootfs-*.tar -C ${MEDIA}/rootfs/

sudo chown root:root ${MEDIA}/rootfs/
sudo chmod 755 ${MEDIA}/rootfs/
```

- Check at the content of your SD card partition. What is there now?

SYNC THE PARTITION

Sync, but wait for the operation to be complete (approx 1-2 min).

```
sync
sudo umount ${MEDIA}/rootfs
```

Verify that your mounting point `${MEDIA}/rootfs/` is correctly unmounted.

```
lsblk -f
```

VERIFY BBB BOOT SEQUENCE

Now that a full distribution is on the SD card, we will check if the BeagleBone Black would start with your SD card.

Prepare Minicom

1. Plug the USB/Serial TTL cable into your computer
2. Check for the corresponding device (`ls /dev`)
3. Open minicom (`sudo minicom -D /dev/*your_device*`)
4. Configure Minicom (`Ctrl+A`, then `Z`, then `0`)
 - 115200 bauds, 8 bit, 1 stop bit, no parity, no flux control

Prepare the BeagleBoneBlack

5. Plug the SD card into the BBB
6. Connect the USB/Serial TTL cable to the BBB
 - the black wire of the USB/Serial TTL cable is the ground connection
 - connector J1 on BBB, the dot next to the connector indicates the ground

Start the BeagleBone Black and see

7. Hold down the USER/BOOT button (marked S2)
8. Apply power
9. When all blue lights will turn on, you can release the USER/BOOT button

In the meantime, you should have seen many messages on the Minicom interface. We will analyse them later on.

UPDATE THE `start_elinux.sh` SCRIPT

Update the `elinux/tp/disco/script/start_elinux.sh` script by adding the definition of the variable `kernel_version`.

CREATE A SCRIPT FOR SETTING UP THE SD CARD

Create a new script `elinux/tp/disco/script/sdcard_deploy.sh`. It should contain only the necessary commands to deploy the Bootload / Kernel-image / Device-tree / Debian-fs onto the SD Card.

- Copy here the content of your script.

