Booting Linux from SD card using U-Boot

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Introduction

Often I hear from people that it'd be nice to have U-Boot running on 96Boards at full pace. Even though U-Boot is supported for couple of our 96Boards, we of it. One of which is extracting boot environment from uEnv.txt. This blog addresses this pitfall and also explains about how to boot Linux from SD card usi

U-Boot

Das U-Boot (Universal Bootloader) is the the popular Open source bootloader for Embedded devices. It offers wide range of flexibility in terms of booting f put up as a secondary or later stage bootloader for the SBC's. The reason behind that is, in most of the SoC's there will a ROM bootloader which gets execut

1. SPL - MLO
2. U-Boot - u-boot.img

SPL is the stripped version of the full fledged U-Boot binary. It is often used in cases where the memory available for second stage bootloader is scarce or th RAM/Flash. In those cases, SPL will initialize some externally connected peripherals like eMMC,SRAM etc.., and then it loads the final U-Boot onto external

But for Dragonboard, SPL is not needed as the U-Boot finds its place in third stage of the booting process and by the time ample amount of external RAM ar process involved in Dragonboard410c for U-Boot:

```
ROM bootloader---->LK bootloader---->U-Boot---->Linux Kernel
```

Boot Environment

U-Boot supports two types of boot environment. One is the hard coded environment which is available as a part of the binary and another is the extracted e internal environment variables are available in **include/configs/dragonboard410c.h** and external environment would be extracted from **uEnv.txt** available fr

Once the boot environment is extracted from **uEnv.txt** it will get imported into the environment table of U-Boot. Later those environment variables could b the commands under one variable and execute it using **run** command.

For instance, below is the environment variable contains command to load and import env from SD card.

```
"loadbootenv=if ext4load mmc 1:1 ${scriptaddr} ${bootenv}; then " \
                "echo Loaded environment from ${bootenv}; " \
                "run importbootenv; "\
            "fi;\0" \
```

The above variable could be executed by the following command:

```
=>dragonboard410c: run loadbootenv
```

Booting Linux from SD card

Now, lets get into the detail of booting Linux from SD card using U-Boot. The complete guide containing the instructions is avaialbe in 96Boards Document

First, SD card needs to be formatted in such as way that the first partition should be of **ext4** type. This is the place, we will store the RFS (Root File System), would be placed in **FAT** partition and RFS would be in **ext4** partition. But, we are going to place the Kernel image under RFS itself.

After formatting SD card, download the OpenEmbedded RFS from 96Boards build, extract it and flash onto SD card's first partition. By the end of this step, File System populated.

Now, build the Linux Kernel along with device tree using the instructions available in release notes. Then, convert the generated Kernel image to the format

```
$ sudo apt-get install u-boot-tools
$ mkimage -A arm64 -O linux -C none -T kernel -a 0x80080000 -e 0x80080000 -n Dragonboard -d arch/arm64/boot/Ir
```

> *Note: arch/arm64/boot/Image is inside the kernel directory*

Once the image has been created successfully, you should get something similar to following output

```
Image Name:   Dragonboard
Created:      Sat Jul 29 15:15:27 2017
Image Type:   AArch64 Linux Kernel Image (uncompressed)
Data Size:    17349120 Bytes = 16942.50 kB = 16.55 MB
Load Address: 80080000
Entry Point:  80080000
```

After getting **uImage** copy it along with device tree blob **apq8016-sbc.dtb** to */boot* directory in SD card's ext4 filesystem. Final step is to place the **uEnv.txt** f create a file uEnv.txt in */boot* driectory of SD and paste the following contents to it.

```
bootargs=root=/dev/mmcblk1p1 rw rootwait console=tty0 console=ttyMSM0,115200n8 rootfs=ext4 noinitrd selinux=0
bootcmd=ext4load mmc 1:1 ${kernel_addr_r} /boot/uImage; ext4load mmc 1:1 ${fdt_addr_r} /boot/apq8016-sbc.dtb;
uenvcmd=run bootcmd
```

Above environment variables instructs U-Boot to fetch Kernel image and device tree blob from */boot/* directory in SD card's first partition. It also specifies to Linux kernel. When U-Boot imports environment from **uEnv.txt** it scans for the **uenvcmd** and executes it.

Finally, eject SD card from host and insert it onto Dragonboard410c and boot it. U-Boot will automatically fetch the environment and loads Kernel image ar the step fails, appropriate error message will be shown in the U-Boot console.

> *Note: By default, U-Boot console is available through on board UART in Dragonboard410c.*

Conclusion

I hope this blog has provided much information to boot Linux using U-Boot from SD card. More detailed steps are availabe in the Documentation repo.

As we always say, if you encounter any issues or have any suggestion please report it in comments/forum. We are glad to help you :-)