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Lab Title: Simple Linux System Built On Raspberry Pi 3

Lab Purpose:

Raspberry Pi is one of the popular single-board computers today. In order to fully understand how the relevant components of the Linux system interact with the Raspberry Pi, we use open source package **"Buildroot"** to compile simple Linux components, ex: bootloader, kernel image, and root filesystem, etc. And then, we combined the components above to make a simple Linux system that can run on Raspberry Pi 3, for the purpose of learning more about both Raspberry Pi 3 and Linux system.

Lab Procedure:

1. Get the source code of buildroot
2. Make config (kernel image & bootloader)
    a. go into the configs folder to check if buildroot support Raspberry Pi 3
    b. If yes then make raspberrypi3_defconfig to config the kernel image and bootloader.
3. Download all the needed packages from the Makefile that buildroot provide: make source
4. Make Kconfig (root filesystem): setting up menuconfig, and save the setting
5. Compile buildroot
6. Partition the SD card
    a. Locate to **buildroot/output/images**
    b. Mount **sdcard.img** to partition SD card: before this, you need to check which device number is your SD card
7. Put the system just built up into the partitioned SD card
    a. Create two folders for mounting
    b. Mount the two folders to BOOT and FILESYSTEM respectively
    c. Put the Linux system (kernel image and bootloader) into BOOT
    d. Put the root filesystem into FILESYSTEM and decompress
8. Place the SD card back on the Raspberry Pi 3 and power on to test if the system you build is working

Problems and Discussions

- Questions
    1. What is the purpose of each file in the directory firmware?
        a. bootcode.bin: This is the bootloader, which is loaded by the SoC. This does some very basic setup, and then loads start.elf file.
        b. cmdline.txt: a plain text file used by the Raspberry Pi to pass parameters to the kernel during system boot. cmdline.txt contains a command line, and only the first line of the file is read, so parameters must be space-separated on the first line.

c. config.txt: This file contains many configuration parameters for setting up the Pi. Ex: If your HDMI display doesn’t work then you will need to modified the HDMI mode in this file via ssh into your Raspberry Pi.

d. fixup.dat: This is the linker file and is matched pairs with the start.elf file.

e. start.elf: This is the binary blob (firmware) that is loaded on to the VideoCore in the SoC, which is then take over the boot process, it is the basic firmware.

2. What is the content inside “cmdline.txt”, what is the meaning of all the parameters?
   a. root=/dev/mmcblk0p2 rootwait console=tty1 console=ttyAMA0,115200
   b. Parameters in cmdline.txt: root, console
      i. Root: defines the location of the root filesystem
      ii. Console: defines the serial console

- Discussions

  I have seen other people’s cmdline.txt online, most of them have **“rootfstype”** this parameter inside but I don’t have. I don’t know if there is anything wrong with it. But while testing the system works fine in the Raspberry Pi 3 and boot normally. Eventually, I just ignored it.

  I found it difficult to test on my laptop. I originally thought is to use my laptop display as my Raspberry Pi display but it is not working, nothing shows on the screen. So I find a monitor to test on it and it can display properly.