Implementing Linux on the

Zynq™-7000 SoC

Lab 2.3

Booting ZedBoard to a Linux Command Prompt

September 2012
Version 05

Table of Contents

Lab 2.3 Overview

This lab builds upon the skills covered in the previous labs.

Using the boot image binary file created in Lab 1.3, the Linux Kernel binary from Lab 2.1, and the RAM disk root file system image from Lab 2.2, we will setup an SD card to boot ZedBoard to a Linux command prompt.

Lab 2.3 Objectives

When you have completed Lab 2.3, you will know how to do the following:

- Setup an SD card with essential Linux files
- Boot ZedBoard to Linux command prompt

Experiment 1: Setup SD Card

This experiment shows how to setup an SD card with the necessary files to boot ZedBoard to a Linux command prompt.

Experiment 1 General Instruction:

Copy the files needed to boot Linux on ZedBoard to the SD card.

Experiment 1 Step-by-Step Instructions:

1. Insert the SD card into the PC or SD card reader and wait for it to enumerate as a Windows drive. If prompted by Windows when inserting the SD card, select the **Continue without scanning** option.

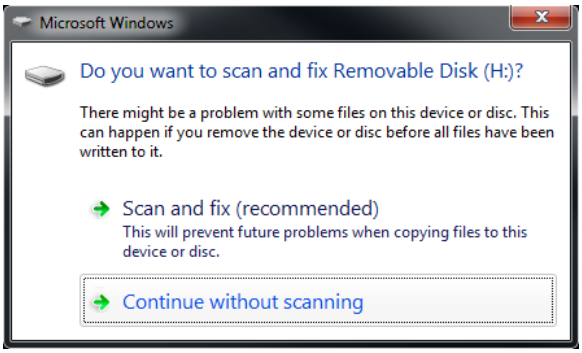

Figure 1 – Windows Prompt for Scanning and Fixing an SD Card

The Zynq BootROM is capable of interpreting the FAT32 file system for SD card boot mode. If the SD card used is not already formatted for FAT32 file system, right click on the drive in Windows Explorer and select the **Format** option. Select the options shown in Figure 2 and click the **Start** button.

When the format process is complete, click the **Close** button.

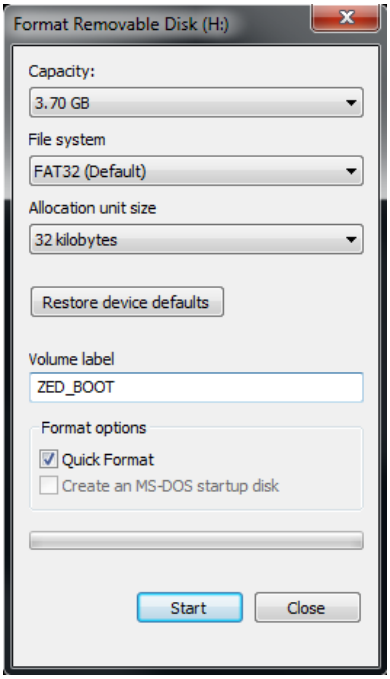

Figure 2 – Formatting the SD Card with FAT32 File System

2. Copy the **boot.bin** file from the Lab 1.3 folder to the top level of the SD card. Replace any existing versions of the **boot.bin** file that may be on the SD card.

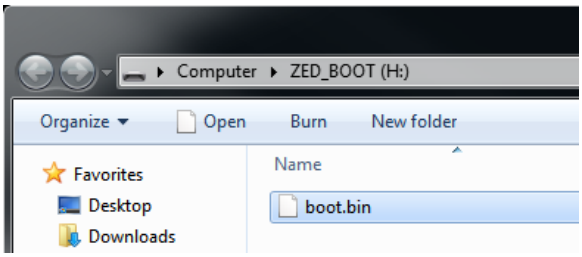

Figure 3 – The Boot Image File Copied to the SD Card

3. Copy the Linux **zImage**, **devicetree.dtb**, and **ramdisk32M.image.gz** files from the Lab 2.3 folder to the top level of the SD card. Replace any existing versions of these files that may be on the SD card.

   You may have noticed the **devicetree.dtb** file which was not built from a source file in the labs leading up to this point. This file serves as the platform description used by the kernel to initialize the hardware and related drivers. We will discuss this file in further detail later in Part 3 and Lab 3.3.

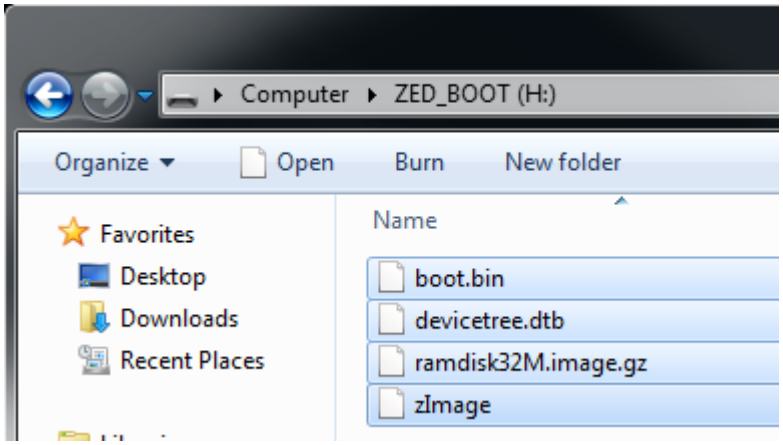

Figure 4 – The Linux Files Copied to the SD Card

Questions:

Answer the following questions:

- *What are the 4 required files needed to boot into a basic Zynq Linux system?*

_____

_____

_____

_____

Experiment 2: Boot ZedBoard Using New Boot Image

ZedBoard can now be booted to the Linux command prompt using the files that were copied to the SD card in the previous exercise.

Experiment 2 General Instruction:

Boot ZedBoard using the SD card with the created Zynq boot image and observe the terminal output.

Experiment 2 Step-by-Step Instructions:

1. Connect 12 V power supply to ZedBoard barrel jack (J20).

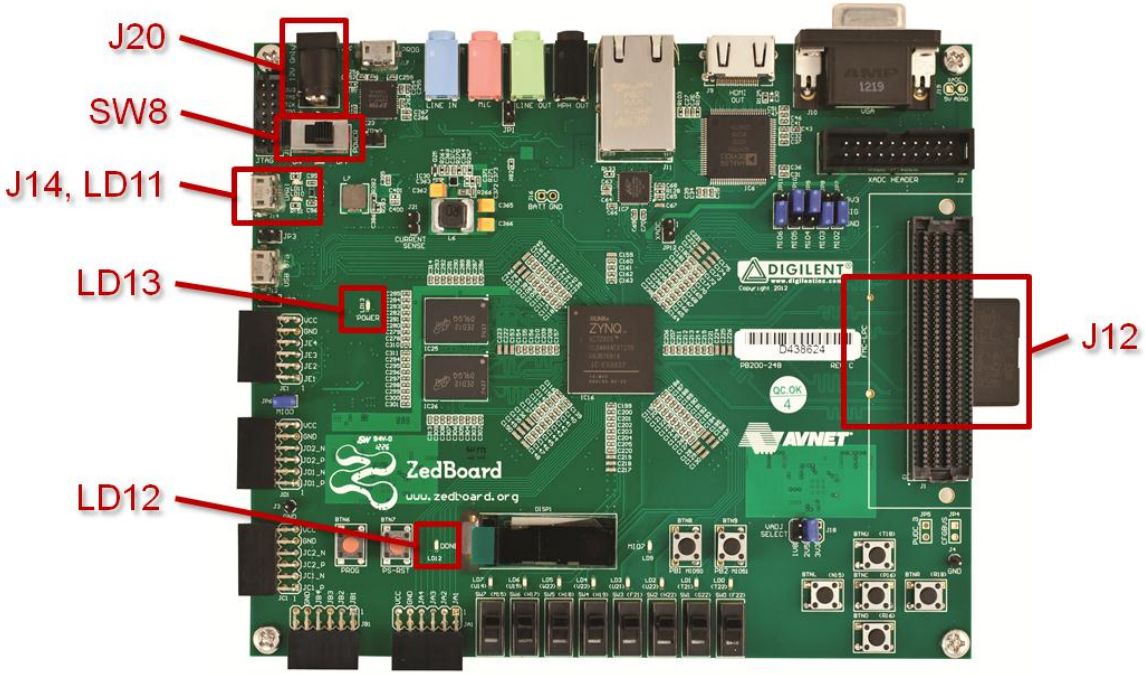

Figure 5 – ZedBoard Hardware Reference

2. Connect the USB-UART port of ZedBoard (J14) which is labeled UART to a PC using the MicroUSB cable.

3. Insert the 4GB SD card included with ZedBoard into the SD card slot (J12) located on the underside of ZedBoard PCB.

4. Verify the ZedBoard boot mode (JP7-JP11) and MIO0 (JP6) jumpers are set to SD card mode as described in the Hardware Users Guide:

   http://www.zedboard.org/sites/default/files/ZedBoard_HW_UG_v1_6.pdf

   A copy of the Hardware Users Guide is also located in the SpeedWay **C:\Speedway\Fall_12\Zynq_Linux\support_documents** folder for your convenience.

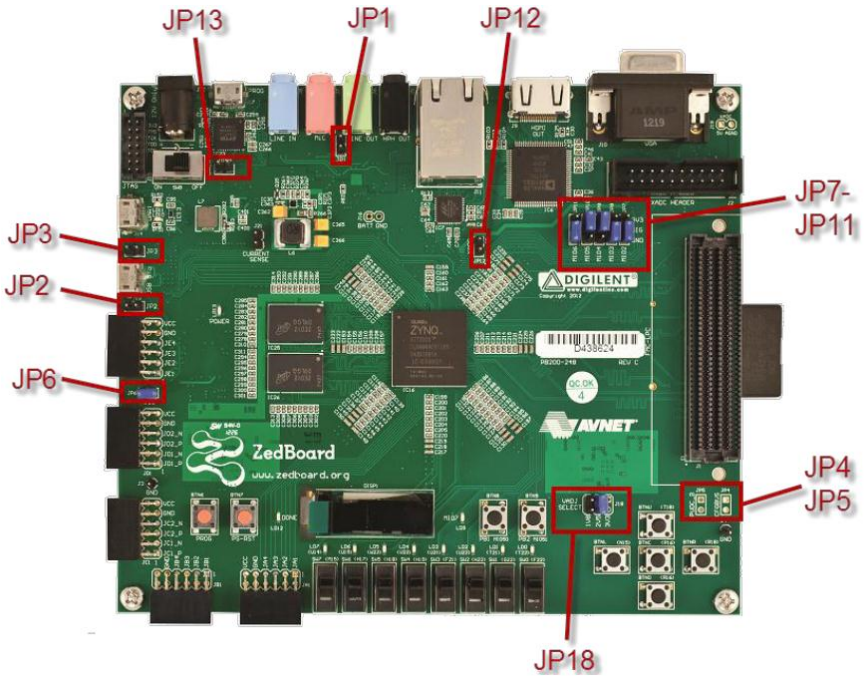

Figure 6 – ZedBoard Jumper Settings

5. Turn power switch (SW8) to the ON position. ZedBoard will power on and the Green Power Good LED (LD13) should illuminate.

6. Wait approximately 15 seconds. The blue Done LED (LD12) should illuminate.

7. On the PC, if a serial terminal session is not already open, open a serial terminal program. Tera Term was used to show the example output for this lab document.

Figure 7 – Tera Term Icon

8. If the amber USB-Link Status (LD11) does not flicker during boot to indicate activity, check the driver installation to determine if the device driver is recognized and enumerated successfully and that there are no errors reported by Windows.

9. Power cycle the ZedBoard and monitor the Tera Term window. When the terminal output from U-Boot and a countdown is observed, allow the countdown to expire.

Figure 8 – ZedBoard U-Boot Booting Linux

10. When the Linux command prompt is reached, experiment by looking through the root file system using the **ls** command.

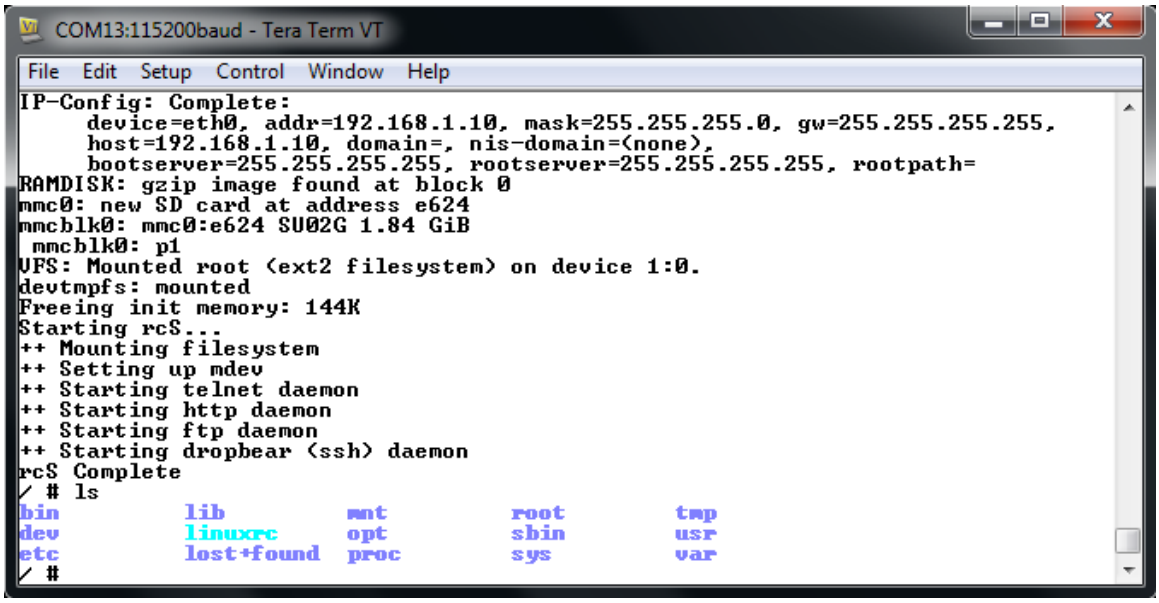

Figure 9 – Exploring the Linux Root File System

Questions:

Answer the following questions:

- *Why does it take almost 45 seconds to boot to the Linux command prompt?*

_____

_____

Exploring Further

If you have additional time and would like to investigate more…

- Experiment with the Linux environment using the Linux command reference in the appendix section of the course slides.
- Determine how much space is already used on the RAM disk. How much space remains available to add applications to this platform?

This concludes Lab 2.3.

Revision History

Date	Version	Revision
12 Sep 12	00	Initial Draft
27 Sep 12	01	Revised Draft
18 Oct 12	02	Course Release
14 Jan 13	05	ZedBoard.org Training Course Release

Resources

http://www.zedboard.org

http://www.xilinx.com/zynq

http://www.xilinx.com/planahead

http://www.xilinx.com/sdk

Answers

Experiment 1

- *What are the 3 required files needed to create a Zynq boot image?*

1. Boot image binary file: boot.bin
2. Linux Kernel: zImage
3. Device Tree: devicetree.dtb
4. Root File System: ramdisk32M.image.gz

Experiment 2

- *Why does it take almost 45 seconds to boot to the Linux command prompt?*

The duration of this boot process is mostly due to the amount of time required to load each boot component from the SD card. Booting Zynq from a Flash memory device such as QSPI can improve boot time by up to 4x that of SD card times.