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How to Flash the EMAC PPC-E7

This document covers the basic steps to program the on-board NOR flash of a PPC-E7 with the Redboot bootloader and Linux. Note that this procedure will erase all data on the flash.

Materials
1. PPC-E7 board
2. PC with Linux or Windows
3. NULL modem serial cable
4. Ethernet connection
5. TFTP server accessible on the local network

Procedure
1. Begin by downloading the necessary software images and tools to the PC that will be used for control of the programming process.
   a. The download application is an application provided by Cirrus to interface with the EP93xx series processors. The Linux binary is available here:
      ftp://ftp.emacinc.com/Controllers/Development_Kits/GNU_Tools/Linux/ep93xx/download
      The Windows binary is available here:
      ftp://ftp.emacinc.com/Controllers/Development_Kits/GNU_Tools/Windows/ep93xx/download.exe
   b. Redboot is the bootloader used on the PPC-E7 boards. A different binary image is required depending on the flash size of the board to be programmed. The redboot images are located here:
      ftp://ftp.emacinc.com/PPC/PPC-E7/Linux/Software/Redboot/
   c. The Linux kernel for the PPC-E7 is available in zImage format. There is a different version depending on the flash size as well. Download the appropriate version from:
      ftp://ftp.emacinc.com/PPC/PPC-E7/Linux/Software/Linux-Kernel/images
   d. The JFFS2 image is the root filesystem for the PPC-E7. It is available on the EMAC FTP site at this location:
      ftp://ftp.emacinc.com/PPC/PPC-E7/Linux/Software/Rootfs

   The Linux kernel image and JFFS2 image both need to be placed on the TFTP server in an accessible location. The download utility and Redboot image both need to be placed on the development machine that will be connected through the serial port to the PPC.
2. Setup the PPC-E7 by:
   a. Connect the NULL modem serial cable to CN1 on the PPC-E7 and the development PC.
   b. Connect the Ethernet port of the PPC-E7 to the local network.

Programming Redboot (If Redboot does not need to be reprogrammed this section may be skipped)
3. Set the boot mode jumper JP2 (BOOT) to SER to configure the processor for serial boot mode.
4. Program the Redboot image into the flash using the download utility by running `download` with the filename of the Redboot image as the argument. If you need to specify a different serial port to use rather than ttyS0/COM1, use the P switch. Consult the usage message for the download application for examples.
5. Once the application has started it will wait for the board to wake up. Apply power to the PPC and download should begin to transfer the image to the flash. Progress will be displayed as it continues. Note: EMAC has found that the Cirrus download application will fail to complete programming under Linux under certain environments. If this occurs, run download under valgrind and the issue should be resolved.
6. Change the boot jumper from SER back to NRML mode to allow the processor to boot from the flash.

Configuring Redboot
7. Start a terminal application on the development PC with settings 57600 baud, 8 data bits, 1 stop bit, no parity, and no flow control. Make sure that this is running on the serial port that the PPC is connected to.

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8. Apply power to the board and press Ctrl+C several times on the terminal to interrupt the boot process. You may or may not see anything printed on the screen when Redboot loads depending on the current Redboot configuration. If the Linux kernel begins to boot, the timeout was exceeded -- press the reset button and try again. If the boot process is successfully interrupted a `Redboot>` prompt will be displayed.
9. Initialize the flash on the board with the following command:
    ```
    fis init -f
    ```
    This will take several minutes to complete.
10. The next step is to configure the network settings for the local network. Although Redboot can be set to use a BOOTP or DHCP server for this, EMAC recommends the use of static network settings as DHCP can cause unnecessary delays in the boot process if Redboot attempts to connect to a server and it is not available. Acquire valid static network settings (IP address, subnetwork mask, gateway, and IP of the TFTP server).
11. Redboot is configured using the `fconfig` command. Although fconfig can be run interactively with no arguments, it is sometimes easier to set each necessary parameter individually. Run the following commands to configure the network settings (replace 10.0.2.1 with the gateway IP address, 10.0.2.14 with the PPC's IP address, 255.255.255.0 with the subnetwork mask, and 10.0.2.60 with the TFTP server's IP address):
    ```
    fconfig bootp false
    fconfig bootp_my_gateway_ip 10.0.2.1
    fconfig bootp_my_ip 10.0.2.14
    fconfig bootp_my_ip_mask 255.255.255.0
    fconfig bootp_server_ip 10.0.2.60
    ```
    When asked to commit the settings to non-volatile memory, answer 'y'.
12. Redboot uses a bootscript that is run automatically on boot to load and execute Linux. Run the commands below:
    ```
    fconfig no_debug_prompt false
    fconfig boot_script true
    fconfig boot_script_timeout 1
    fconfig boot_script_data
    ```
    After entering the last command, a prompt will appear to `Enter script, terminate with empty line`. Enter the following lines one at a time, pressing enter after each line. Each new line will have a prompt of '>>'. Press enter again after the last line to return to the Redboot> prompt:
    ```
    fis unlock -f 0x60000000 -l 0x1fdffff
    fis load zImage
    exec -c "root=/dev/mtdblock2 rootfstype=jffs2 console=ttyAM"
    ```
13. After configuring Redboot, reset the board and interrupt the boot process again to return to the Redboot> prompt.

Loading the Linux kernel and JFFS2 filesystem

14. Use the following commands to load the Linux kernel and JFFS2 to RAM and program them to the NOR flash. Note that the <zImage-name> parameter below should be replaced by the name of the zImage file on the TFTP server and that the <JFFS2-name> should be replaced by the name of the JFFS2 file on the TFTP server. Theses commands will take several minutes to complete.
    ```
    fis unlock -f 0x60000000 -l 0x1fdffff
    load -r -v -b 0x80000 <zImage-name>
    fis create -b 0x80000 -l 0x200000 zImage
    fis unlock -f 0x60000000 -l 0x1fdffff
    load -r -v -b 0x300000 <JFFS2-name>
    fis create -b 0x300000 -l 0x1c00000 jffs2
    ```
15. After loading the kernel and filesystem, reset the board and make sure that everything boots properly.

Note that Redboot also supports scripting, easing the process if many boards need to be programmed with the same image. Write the Redboot commands to be run in a text file separated by newlines and place the file on a TFTP server. After the network is configured, load the script to RAM (i.e. `load -r -v -b 0x50000 flash-script`), and execute the script to run the commands in succession (i.e. `script -b 0x50000`).

If you experience any difficulties or have any questions regarding this procedure, contact EMAC technical support at support@emacinc.com.