



# Zoom™ CDK Linux Evaluation Guide

## Software Documentation

Sam Siciliano

Logic Product Development

Published: August, 2005

### Abstract

This document describes how to load and test drive a sample Linux binary image on a Zoom™ ColdFire Development Kit.

This file contains source code, ideas, techniques, and information (the Information) which are Proprietary and Confidential Information of Logic Product Development, Inc. This information may not be used by or disclosed to any third party except under written license, and shall be subject to the limitations prescribed under license.

No warranties of any nature are extended by this document. Any product and related material disclosed herein are only furnished pursuant and subject to the terms and conditions of a duly executed license or agreement to purchase or lease equipments. The only warranties made by Logic Product Development, if any, with respect to the products described in this document are set forth in such license or agreement. Logic Product Development cannot accept any financial or other responsibility that may be the result of your use of the information in this document or software material, including direct, indirect, special or consequential damages.

Logic Product Development may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering the subject matter in this document. Except as expressly provided in any written agreement from Logic Product Development, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

The information contained herein is subject to change without notice. Revisions may be issued to advise of such changes and/or additions.

© Copyright 2005, Logic Product Development, Inc. All Rights Reserved.

### REVISION HISTORY

REV	EDITOR	DESCRIPTION	APPROVAL	DATE
A	James Wicks	Release	SJS	9/1/2005
B	Jed Anderson	Removed 'lspci' command from Section 5.3; Added step 3 to Section 3; Fixed incorrect step numbering in Section 2.2.2; Added additional information to Section 5.6; General document editing	SJS	10/26/2005

# 1 Introduction

The purpose of this document is to describe how to load a Linux image onto a Zoom ColdFire Development Kit (CDK), burn it to flash, mount and execute the image, and then test drive it.

**Important Note:** The Linux image described in this document does not include PCI drivers, and it is recommended to keep the PCI slot(s) empty while going through this document.

## 1.1 Requirements

1. A PC workstation with a serial port terminal emulator installed, such as TeraTerm or Hyper Terminal.
2. A CompactFlash® card with at least 16 MB of memory and formatted as FAT, or a workstation with TFTP support and on the same LAN as the CDK.
3. One of the following ColdFire Fire Engines sold by Logic Product Development, with either a Standard or LITE application board/baseboard configuration:
  - Fire Engine M5475, PN M5475BFE
  - Fire Engine M5475, PN M5475CFE
  - Fire Engine M5485, PN M5485BFE
  - Fire Engine M5485, PN M5485CFE
4. LogicLoader™ version 2.0.3 or higher loaded on the Fire Engine. Refer to support section of Logic's website for instructions on how to login, download, and update your kit with the latest version of LogicLoader.

**Warning: If dBug™ is loaded in the first NOR flash block and LogicLoader is in the second, LogicLoader will be corrupted when following these steps. Avoid this by updating your kit with LogicLoader-only bootloader update images. Do not use bootloader update images that contain both dBug and LogicLoader.**

## 1.2 Assumptions

It is assumed that the user is familiar with the *Zoom ColdFire Development Kit QuickStart Guide*. It is also assumed that the user is familiar with LogicLoader. LogicLoader is a bootloader/monitor which provides the capability for loading operating systems and applications into memory.

## 1.3 Scope

While this guide describes how to load and test drive a Linux image, this guide does not describe how to perform supplementary tasks such as TFTP server configuration and Ethernet port configuration. It is the user's responsibility to become fluent in tasks outside the scope of this document.

### 1.3.1 TFTP Server Configuration

Information on how to install and configure a TFTP server is beyond the scope of this document.

There are many shareware TFTP servers available, one available can be found via this link: <http://support.solarwinds.net/updates/New-customerFree.cfm>

### 1.3.2 Ethernet Port Configuration

Instructions for setting up the workstation's Ethernet interface are beyond the scope of this document.

### 1.3.3 DHCP Server Configuration

Information on how to configure a DHCP server is beyond the scope of this document.

## 2 Loading the Linux Image File

This section describes how to copy the Linux image file from the workstation to the card engine's SDRAM. This step must be completed before burning it to NOR flash (see **Section 3**).

There are two ways to load the Linux image file. Chose instructions applicable to your Fire Engine:

- If the CPLD code is not programmed on the Fire Engine, the Linux image file must be transferred via Ethernet. See **Section 2.1** for these instructions.
- If the CPLD is programmed on the Fire Engine, then optionally the Linux image file can be transferred to the Zoom CDK via a CompactFlash card and loaded on the kit using LogicLoader commands. See **Section 2.2** for these instructions.

If you are unsure if the CPLD is programmed, follow the instructions in **Section 2.2**.

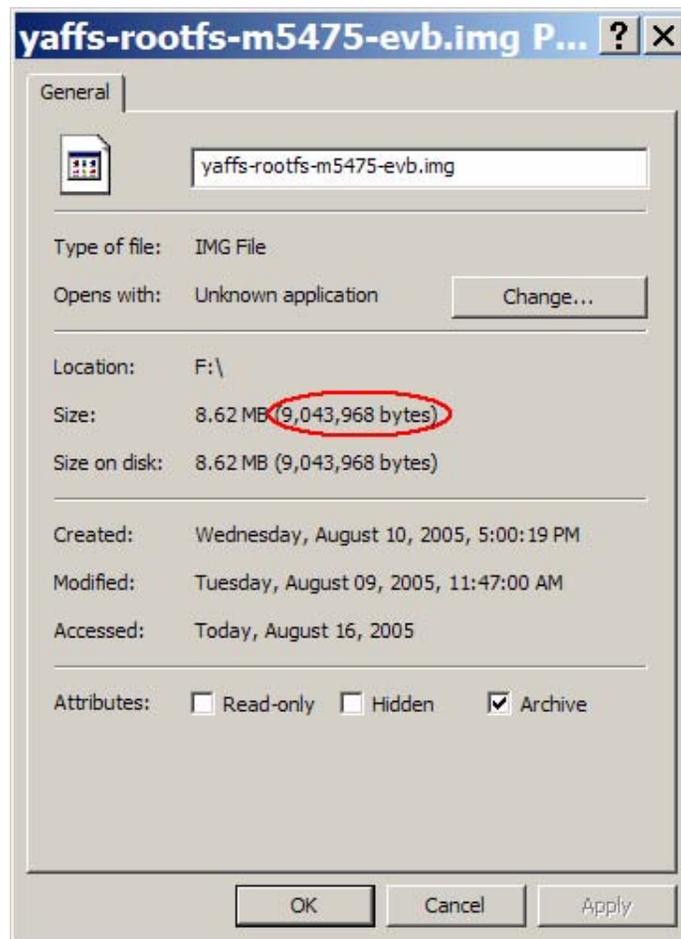
## 2.1 Loading the Linux Image on a CDK without a Programmed CPLD

This section describes how to load the Linux image via Ethernet. Use this method if the Fire Engine CPLD is not programmed. Otherwise, see Section 2.2.

Note: in the examples below, the Linux file is stored in the root folder. Also, 'xx' in the example file name denotes either '75' or '85,' depending on your Fire Engine.

### 2.1.1 Download the Linux Image File

1. Download the Linux Sample Evaluation Zip file to the workstation from Logic Product Development's downloads site, located at <http://www.logicpd.com/auth/login.php>. Click on the link, enter your username and password, and then download the Linux Sample Evaluation Zip file. (If you have not registered your product, or do not have your registration information, you will need to register first. You will receive an e-mail with your new username and password.)
2. Extract the files and copy the file named `yaffs-rootfs-m54xx.img` into a folder on your workstation shared by a TFTP server.
3. Obtain the size of the Linux image file. In Windows®, this can be done by right clicking on the file name in Windows Explorer, and selecting "Properties." The size of the Linux image file will be used in a later step. See figure, below.



**Figure 2.1: Obtain the size of the Linux image file**

If a Linux operating system is on the workstation, obtain the size of the Linux image file by navigating to the directory that the Linux image file is extracted to, and typing **ls -al**.

```
[sams@lpdlnx07 tftp]$ ls -al
total 8856
drwxrwxr-x    2 sams    sams      4096 Aug 16 19:14 .
drwxrwxr-x   17 sams    sams      4096 Aug 16 19:13 ..
-rw-r--r--    1 sams    sams     9043968 Aug 16 19:14 yaffs-rootfs-m5475.img
[sams@lpdlnx07 tftp]$
```

4. Connect the cross-over Ethernet cable, included with the CDK, from the RJ-45 port (PCB silk-screen label P3 on the EVB or J1 on the LITE application board) to your workstation.
5. Ensure that the workstation Ethernet interface is enabled and is either configured to automatically assign IP addresses via DHCP server or set to a static IP address.

### 2.1.2 Copy the Linux Image File from the Workstation to the CDK SDRAM via TFTP

1. Start a terminal emulator program on the workstation and connect the serial cable (provided with the development kit) from the development kit to your workstation. For more information, please refer to the *Zoom ColdFire Development Kit QuickStart Guide*.
2. Apply power to the CDK and verify that the LogicLoader prompt appears in the terminal emulator window.

```
*****
                          LogicLoader
(c) Copyright 2002-2005, Logic Product Development, Inc.
All Rights Reserved.
Version pre2.0.3-MCF5475 10 0001
*****

losh>
```

3. To bring up the Fire Engine's Ethernet interface, type **ifconfig sm0 dhcp** if the workstation is configured with a DHCP server or **ifconfig sm0 192.168.0.100 255.255.255.0 0.0.0.0** if the network requires a statically assigned IP address (this includes the IP address that will be assigned to the kit, the netmask, and the network gateway). For more information about the 'ifconfig' command, refer to the *LogicLoader Command Description Manual*.

```
losh> ifconfig sm0 dhcp
WARNING -- valid config block not found - using default MAC
address
Starting DHCP on sm0
```

4. Wait 5 seconds, and then type **ifconfig** to ensure the interface is up and a valid IP has been assigned to the CDK.

```
losh> ifconfig

sm0: up    100M full-duplex  (425)
sm0:      mac: 00:11:22:33:44:55 ip: 192.168.0.127
          mask: 255.255.255.0   gw: 192.168.0.1
```

5. To copy the Linux image file to the CDK SDRAM, type **load raw 0xe0000000 <size> /tftp/<workstation IP>:< filename>**, where <size> is the size of the Linux image file (see section 2.2.1 step #3, above), <workstation IP> is the IP address of the workstation running the TFTP server, and the <filename> is the name of the Linux image file.

```
losh> load raw 0xe0000000 9043968 /tftp/192.168.0.1:yaffs-rootfs-m5475.img
loading from /tftp/192.168.0.1:yaffs-rootfs-m5475.img:
loading raw binary to 0xe0000000 (flash) len 00880000:
.....
.....
md5sum of _loaded_ portion of the file:
cf695ea4482d5396de66f8384f0b4598 - addr: 000c0000 len: 00880000
file loaded
losh>
```

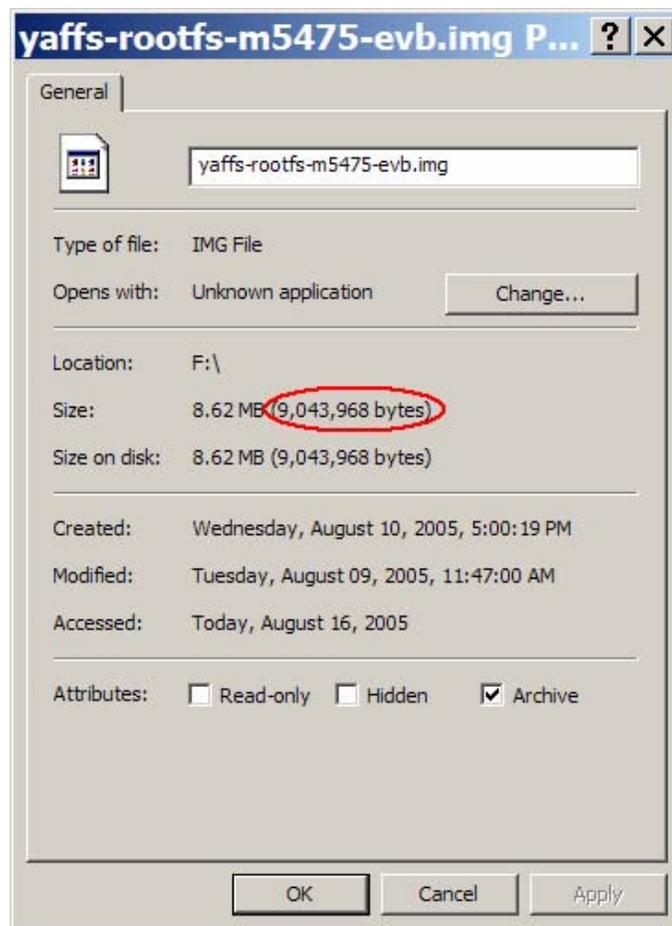
## 2.2 Loading the Linux Image on a CDK with a Programmed CPLD (optional)

This section describes how to load the Linux image via CompactFlash card. Use this method if the Fire Engine CPLD is programmed. Otherwise, see Section 2.1.

Note: in the examples below, the Linux file is stored in the root folder. Also, 'xx' in the example file name denotes either '75' or '85,' depending on your Fire Engine.

### 2.2.1 Download the Linux Image File

1. Download the Linux Sample Evaluation Zip file to the workstation from Logic Product Development's downloads site, located at <http://www.logicpd.com/auth/login.php>. Click on the link, enter your username and password, and then download the Linux Sample Evaluation Zip file. (If you have not registered your product, or do not have your registration information, you will need to register first. You will receive an e-mail with your new username and password.)
2. Extract the files and copy the file named `yaffs-rootfs-m54xx.img` onto a CompactFlash card.
3. Obtain the size of the Linux image file. In Windows, this can be done by right clicking on the file name in Windows Explorer, and selecting "Properties." The size of the Linux image file will be used in a later step. See figure below.



**Figure 2.2: Obtain the size of the Linux image file**

If a Linux operating system is on the workstation, obtain the size of the Linux image file by navigating to the directory that the Linux image file is extracted to, and typing **ls -al**.

```
[sams@lpdlnx07 tftp]$ ls -al
total 8856
drwxrwxr-x    2 sams    sams          4096 Aug 16 19:14 .
drwxrwxr-x   17 sams    sams          4096 Aug 16 19:13 ..
-rw-r--r--    1 sams    sams      9043968 Aug 16 19:14 yaffs-rootfs-m5475.img
[sams@lpdlnx07 tftp]$
```

## 2.2.2 Copy the Linux Image File from the CompactFlash Card to the CDK SDRAM

1. Disconnect power from the CDK, remove the CompactFlash card from the workstation, and then insert the card into the CDK's CompactFlash slot, located on the top of the System on Module.
2. Start a terminal emulator program on the workstation, and connect the serial cable (provided with the development kit) from the development kit to your workstation. For more information refer to the *Zoom ColdFire Development Kit QuickStart Guide*.
3. Apply power to the CDK and verify that the LogicLoader prompt appears in the terminal emulator window.

```
*****
                          LogicLoader
(c) Copyright 2002-2005, Logic Product Development, Inc.
All Rights Reserved.
Version pre2.0.3-MCF5475_10 0001
*****

losh>
```

4. Type **mount fatfs /cf** to mount the CompactFlash card in LogicLoader.

```
losh> mount fatfs /cf
losh>
```

5. Type **cd /cf** to change the directory to the CompactFlash card, and then type **ls** to view the directory content in order to confirm that the Linux image file is present on the card.

```
losh> cd /cf
losh> ls
r:      yaffs-rootfs-m5475.img  9043968
losh>
```

6. To load the Linux image file into RAM, type **load raw 0xe0000000 <size> <image filename>**, where <size> is the size of the Linux image file (Section 2.2.1 step #3, above), and <image filename> is the Linux image filename.

```
losh> load raw 0xe0000000 9043968 yaffs-rootfs-m5475.img
.....
.md5sum of loaded portion of the file:
545d196f1e0b6788d73ab67c68373166 - addr: 000c0000 len: 008a0000
file loaded
losh>
```

For more information on the 'load' command, please reference the *LogicLoader User's Manual* and the *LogicLoader Command Description Manual*.

### 3 Burning the Linux Image to the CDK NOR Flash

1. To format the area of flash that the Linux image will be burned to, type the erase command: **erase 0xe0000000 0x01000000**. The image will be mounted as a YAFFS partition; this ensures any previous data stored in YAFFS format will be cleared out. The first parameter, 0xe0000000 specifies the starting address, and the next parameter, 0x01000000, specifies the length. For more information on the 'erase' command, please reference the *LogicLoader User's Manual* and the *LogicLoader Command Description Manual*.

```
losh> erase 0xe0000000 0x01000000
erasing flash: 100%
erased '/dev/flash1' start=0x0: len=0x1000000 bytes
losh>
```

**Warning:** Misuse of the erase command can remove LogicLoader and prevent the system from booting.

2. The Linux image is now loaded in SDRAM. Next, type **burn** to burn it to NOR flash.

```
losh> burn
burning 9043968 bytes from 000c0000 to /dev/flash1
erasing flash: 100%
burning flash: 100%
burn good (9043968 bytes)
losh>
```

3. To format boot flash (which Linux can use), type the erase command: **erase 0xff8c0000 0x140000**. For more information on the 'erase' command, please reference the *LogicLoader User's Manual* and the *LogicLoader Command Description Manual*.

```
losh> erase 0xff8c0000 0x140000
erasing flash: 100%
erased '/dev/flash0' start=0xc0000: len=0x140000 bytes
losh>
```

**Warning:** Misuse of the erase command can remove LogicLoader and prevent the system from booting. This will clear out everything (except for LogicLoader) previously stored in boot flash.

## 4 Mounting and Executing the Image

Now that the image is in non-volatile memory, the instructions described in Section 2, above, are no longer necessary between power sequences, and the CompactFlash card does not need to be loaded on the SOM.

The next step is to mount the image as a YAFFS partition and then execute the image.

1. Type **add-yaffs flash nor 0xe0000000 0x01000000** to set the mount type, location, and length of the Linux image burned to flash as described in Section 3, above.

```
losh> add-yaffs flash nor 0xE0000000 0x01000000
add-yaffs: inserted: start 0xe0000000 - len 0x1000000
```

2. Type **mount yaffs /flash** to mount the image. This creates the directory “/flash” which exposes the entire contents of the Linux image in flash.

```
losh> mount yaffs /flash
-----
Starting YAFFS file system:
Current YAFFS partition table:
    0:          flash 00000000 - 0000007f (          0)
    1:          <NULL>
    2:          <NULL>
    3:          <NULL>
YAFFS initialized.
-----
```

3. Load the Linux kernel into RAM using the ‘load’ command. Type **load elf /flash/boot/vmlinux**.

```
losh> load elf /flash/boot/vmlinux
loading from /flash/boot/vmlinux:
.....
.....
warning: guessing combined program header size as 71600
loaded 1252944 @ 0x000c0000 Ram
md5sum of loaded portion of the file:
c0bf4c531797e0a7882d3367ca537901 - addr: 000c0000 len: 00131e50
file loaded
```

4. Next, execute the kernel by typing **exec**.

```
losh> exec

Linux version 2.4.26 (sams@lpdlx07) (gcc version 3.4.3) #1 Mon
Aug 8 19:13:01 CDT 2005
starting up linux rev 0.2: startmem 0xc022e000, size 61MB
...
```



## 5.5 Mounting the CompactFlash Card

Command	Description
<code>mount -t vfat /dev/hd/1 /mnt</code>	Mounts first partition of CompactFlash card.

Note that when using a CompactFlash card, the CPLD must be programmed and the CompactFlash card must be in the slot on bootup. **The CompactFlash slot is not hot-swappable.**

## 5.6 Using the Web Server

The built-in Boa web server is already running, the kit just needs to be connected to a Local Area Network (LAN). If the Linux image file was downloaded via TFTP, as described in Section 2, obtain the kit's IP address by typing **ifconfig eth0**.

```
[root@localhost root]# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:11:22:33:44:50
          inet addr:192.168.0.81  Bcast:192.168.0.255
Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:117 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:31542 (30.8 KiB)  TX bytes:2970 (2.9 KiB)
          Interrupt:103 Base address:0x9000

[root@localhost root]#
```

If the kit is not plugged into a LAN, connect the cross-over Ethernet cable, included with the CDK, from the RJ-45 port (PCB silk-screen label P3 on the EVB or J1 on the LITE application board) to your workstation. If DHCP is enabled on the network, bring up the interface and obtain the IP address by typing **ifup eth0**.

```
[root@localhost root]# ifup eth0
udhcpc (v0.9.9-pre) started
Sending discover...
Sending select for 192.168.0.81...
Lease of 192.168.0.81 obtained, lease time 604800
[root@localhost root]#
```

If DHCP fails to find an IP address on startup (such as in the case of the network cable being unplugged during first attempt), you can make a second attempt by typing **ifdown eth0** and then **ifup eth0**.

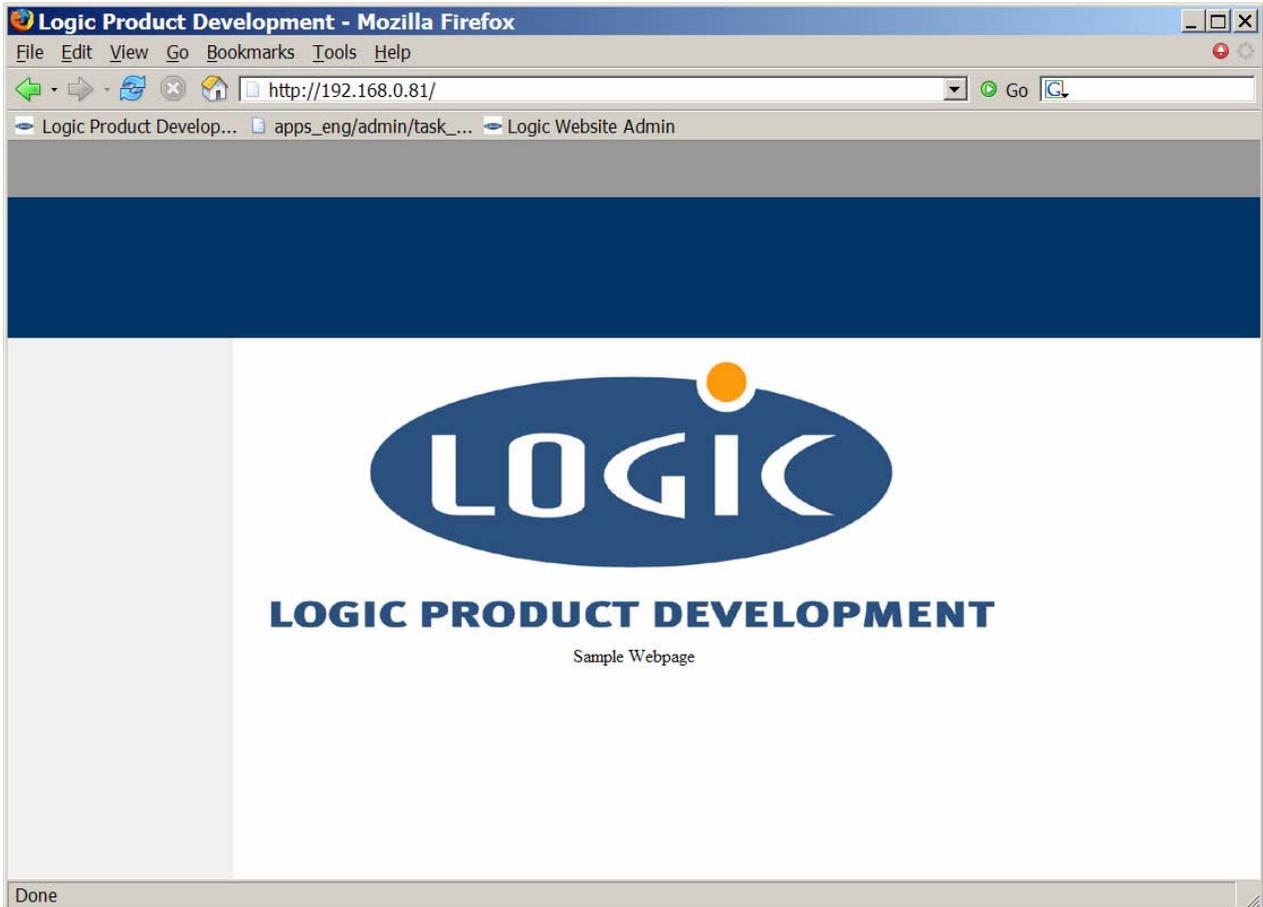
```
[root@localhost root]# ifdown eth0
cat: /var/run/udhcpc.eth0.pid: No such file or directory
cat: /var/run/udhcpc.eth0.pid: No such file or directory

[root@localhost root]# ifup eth0
udhcpc (v0.9.9-pre) started
Sending discover...
Sending select for 192.168.3.104...
Lease of 192.168.3.104 obtained, lease time 259200
[root@localhost root]#
```

If DHCP is not enabled on the network, assign a static IP address by typing **ifconfig eth0 <ipaddress>**, where <ipaddress> is the static IP to assign the kit.

```
[root@localhost bin]# ifconfig eth0 192.168.0.81
[root@localhost bin]#
```

Once the Ethernet interface is up and an IP address is obtained, open a web browser on a workstation on the same Local Area Network, and visit the url "http://<ip address>", where <ip address> is the IP address obtained.



**Figure 5.1: Logic Product Development Sample Webpage**

## 5.7 Halting the System

Command	Description
/sbin/halt	Use the halt command to ensure any file system changes made are synchronized to non-volatile memory before the system shuts down

## 6 (Optional) Running Linux Automatically

To program the EEPROM in LogicLoader for Linux to boot automatically, type **echo "VLOadd-yaffs flash nor 0xE0000000 0x01000000;mount yaffs /flash;load elf /flash/boot/vmlinux;exec;exit;" /dev/serial\_eeprom** in LogicLoader.

```
*****
                        LogicLoader
(c) Copyright 2002-2005, Logic Product Development, Inc.
All Rights Reserved.
Version pre2.0.3-MCF5475 10 0001
*****

losh>echo "VLOadd-yaffs flash nor 0xE0000000 0x01000000;mount yaffs
/flash;load elf /flash/boot/vmlinux;exec;exit;" /dev/serial eeprom
losh>
```

To prevent the system from automatically booting Linux, hold down **q** in the serial terminal immediately after applying power. Then type **echo " " /dev/serial\_eeprom**.

```
*****
                        LogicLoader
(c) Copyright 2002-2005, Logic Product Development, Inc.
All Rights Reserved.
Version pre2.0.3-MCF5475 10 0001
*****

losh>echo " " /dev/serial eeprom
losh>
```

For more information on using LogicLoader to program the serial\_eeprom to launch scripts at startup, refer to the *Logic Loader User's Manual* and the *Logic Loader Command Description Manual*.