

Chapter 1

Booting HP Integrity Servers

Introduction

This chapter covers booting an HP Integrity (Itanium-based) server booting. Booting an Integrity server requires that you become familiar with two levels of firmware. The first level is HP's implementation of Intel's EFI (Extensible Firmware Interface), *POSSE* (Pre-OS System Environment). The second is HP's independent support processor for the system console, the *Management Processor* (MP), which is covered along with Node Partitions, nPartitions, in Chapter 4. The MP is also called Integrated Lights Out (iLO) but I'll call it MP. The MP is integral to booting both HP Integrity and HP 9000 servers. Although functionality varies from one platform to another, the topics in this chapter apply to all HP Integrity servers at the time of this writing. The systems used throughout this chapter include a variety of two- and four-way Integrity servers.

This chapter covers the following topics:

- High-level boot process overview on HP Integrity servers
- EFI and POSSE

In addition to providing background on these topics, this chapter also provides many examples of running commands and analyzing output for both POSSE and MP.

The trifold included with this book is a quick reference for many boot-related commands.

High-Level Boot Process Overview on HP Integrity Servers

The boot process on HP Integrity Servers is much different than that on HP 9000 servers. Figure 1-1 summarizes the Integrity boot process.

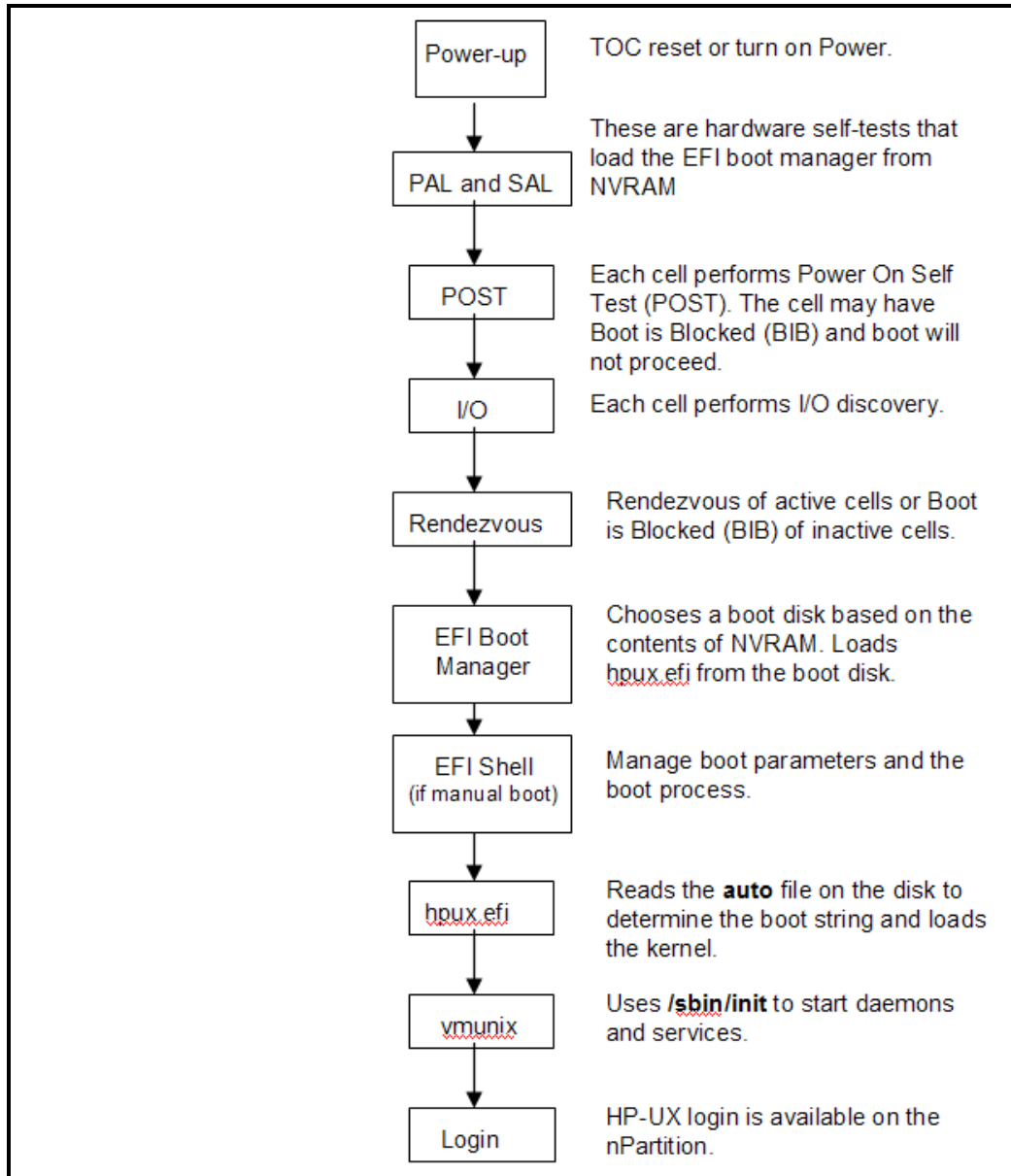


Figure 1-1 Boot Steps on HP Integrity Servers

The first few steps of this boot process are related to hardware. Chapter 4 on Node Partitions (nPartitions) or hard partitions covers resetting an nPartition, so you'll see such steps in the flowchart as I/O discovery of each nPartition. Because most of the interaction you'll have with a system is related to EFI, I'll cover it in some detail in the next section.

EFI and POSSE

EFI is an interface between your operating system and platform firmware. POSSE is the HP implementation of EFI that contains additional commands beyond the ones available through EFI alone. The EFI acronym is used in this chapter, but be aware that some HP documentation may use POSSE.

EFI is a component that is independent of the operating system and provides a shell for interfacing to multiple operating systems. The interface consists of data tables that contain platform-related information along with boot and runtime service calls that are available to the operating system and its loader. These components work together to provide a standard environment for booting multiple operating systems.

If you are interested in finding out more about EFI than what's documented here, take a look Intel's EFI Web site. At the time of this writing, EFI information can be found at <http://www.intel.com/technology/efi>.

As you can see in Figure 1-2, EFI on HP Integrity servers contains several layers. The hardware layer contains disk with an EFI partition, which in turn has in it an operating system loader. This layer also contains one or more operating system partitions.

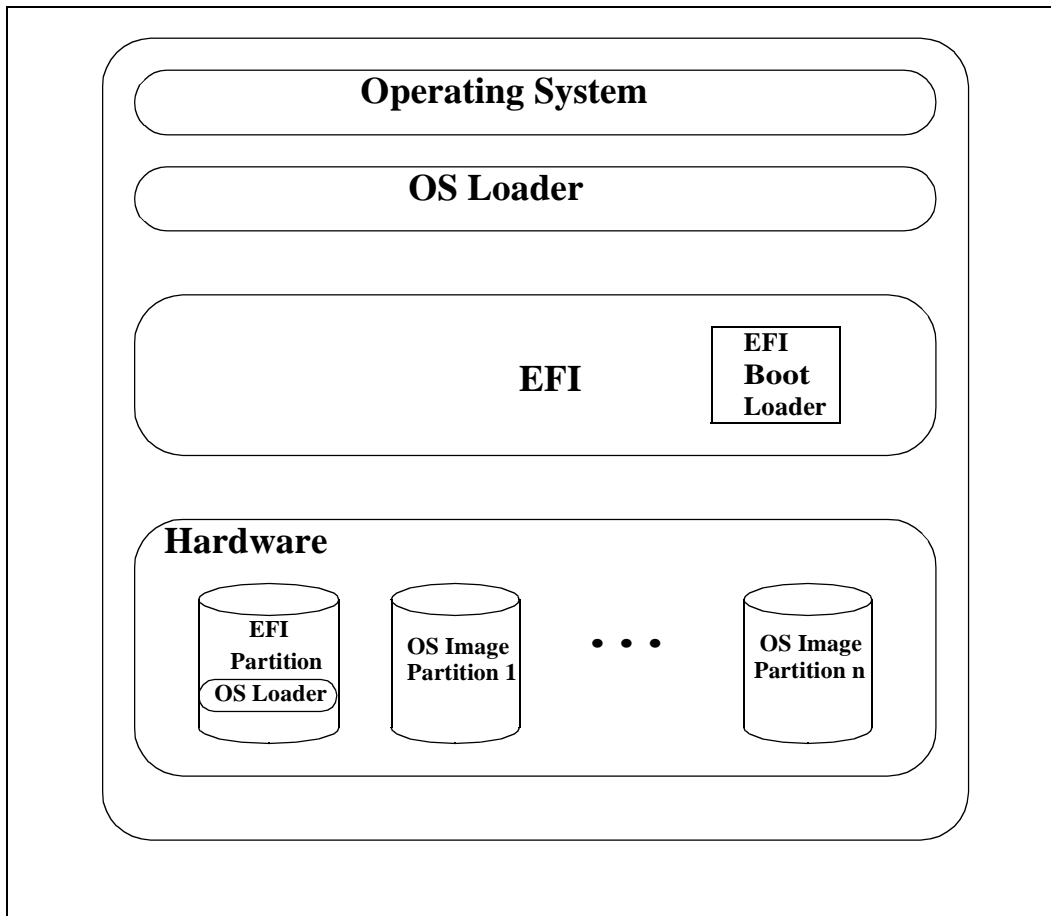


Figure 1-2 EFI on HP Integrity Servers

In addition, the EFI system partition itself consists of several different components, as shown in Figure 1-3.

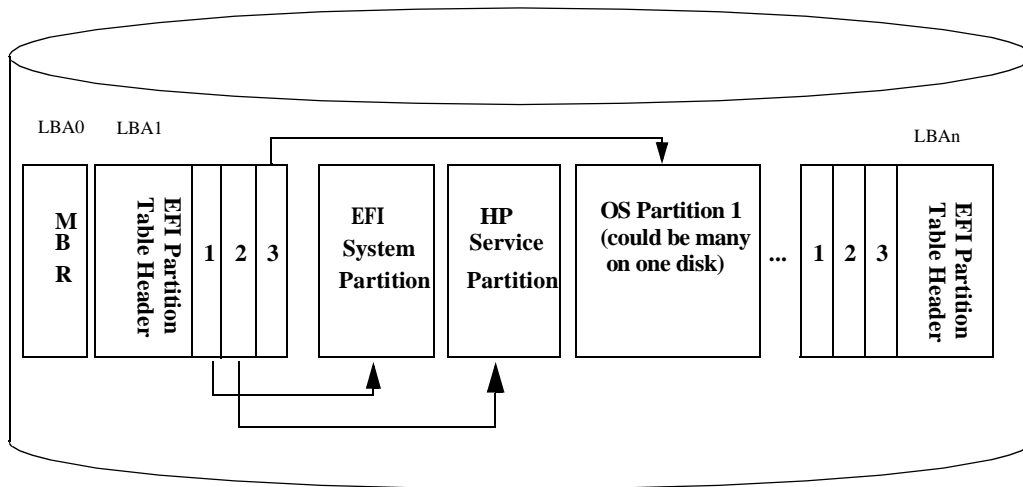


Figure 1-3 EFI System Partition

The Logical Block Addresses (LBAs) are shown across the top of Figure 1-3. The Master Boot Record (MBR) is the first LBA. There is then a partition table. Three partitions are shown on this disk. Note that multiple operating system partitions can be loaded on the same disk. At the time of this writing, Windows Server 2003 and Linux can be loaded on the same disk. The EFI partition table on the right is a backup partition table.

Booting an operating system with EFI on an Integrity server involves several steps. Figure 1-4 depicts the high-level steps.

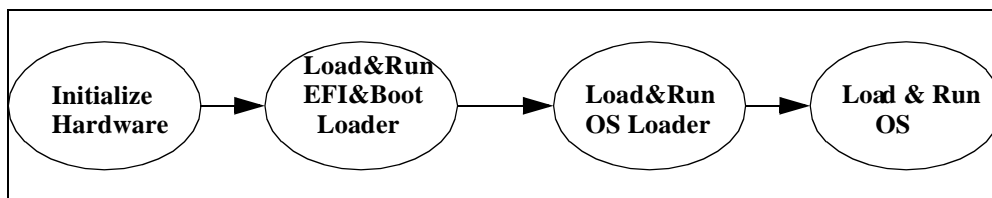


Figure 1-4 Load and Run an Operating System

The first step is to initialize the hardware. This takes place at the lowest level (BIOS) before EFI or the operating systems play any part in the pro-

cess. Next, the EFI and boot loader are loaded and run. After an operating system is chosen, the operating system loader is loaded and run for the specific operating system being booted. Finally, the operating system itself is loaded and run. There are no specific operating systems cited in Figure 1-4 because the process is the same regardless of the operating system being loaded. In the examples in this book, Linux, HP-UX, and Windows are used and all these operating systems would load in the same manner.

EFI and MP: Where am I?

Before I show examples of EFI I want to cover one of the most confusing aspects of it. When the system is shut down and you connect to the MP you get the MP menu as shown in the first bullet below. At this point you can issue a command such as **pc -on** from *CM* and begin the boot process and select the console to see the boot take place or interrupt it. If you interrupt the boot you work with EFI various menus without the operating system loaded as shown in the second bullet below. If you select an operating system to boot from EFI, or an operating system autoboots, you can follow the boot process from the console. After the system boots you can issue **^b** to connect to the MP and work through its menu structure.

1. The system is shutdown and you connect to the MP to get access to the following menu.

```
MP MAIN MENU:
  CO: Console
  VFP: Virtual Front Panel
  CM: Command Menu
  CL: Console Log
  SL: Show Event Logs
  HE: Main Help Menu
  X: Exit Connection

[rx2600m] MP>
```

You can select *CM* and **pc -on** and then go to the console to see the boot take place or interrupt it.

2. If you interrupt the boot process, from the console, to prevent an operating system from loading you get the EFI Boot Manager and you're working with EFI as indicated by the *EFI Boot Manager*. This is accessible to you only before booting an operating system.

```
EFI Boot Manager ver 1.10 [14.61] Firmware ver 2.31 [4411]
```

```
Please select a boot option
```

```
HP-UX Primary Boot: 0/1/1/1.2.0
Red Hat Enterprise Linux WS
Windows Server 2003, Enterprise
EFI Shell [Built-in]
Drive Explorer
Boot Option Maintenance Menu
System Configuration Menu
```

```
Use ^ and v to change option(s). Use Enter to select an option
```

You can go back to the MP with `^b` or boot the system by selecting the desired boot device.

3. Booting an HP VM guest and interrupting it (this is done by issuing **hpvmconsole -P hpvm1 -fi**) gives you access to the same EFI boot manager, however, the commands you can issue are scaled down. The **info** command that you would issue from the *Shell*> prompt, for instance, is not available. The EFI boot manager from an HP VM guest is shown in the following listing:

```
EFI Boot Manager ver 1.10 [14.62] [Build: Wed Aug 10 07:36:12 2005]
```

```
Please select a boot option
```

```
HP-UX Primary Boot: 0/0/1/0.0.0
EFI Shell [Built-in]
Boot option maintenance menu
```

```
Use ^ and v to change option(s). Use Enter to select an option
```

4. If an operating system is running and you enter `^b` from an MP connection, you get the *MP MAIN MENU*: which is covered in Chapter 4. The `^b` works only if you're connected to the MP.

Table 1-1 gives a description of MP menu picks:

Table 1-1 MP Menu Picks

Example MP Top Menu Picks	
Detail on some of these menu picks appear in this table	<pre> MP MAIN MENU: CO: Console VFP: Virtual Front Panel CM: Command Menu CL: Console Log SL: Show Event Logs HE: Main Help Menu X: Exit Connection [rx2600m] MP> </pre>
VFP	To see status of power, system state, and so on.
CM commands	<pre> BP : Reset BMC Passwords MS : Modem Status CA : Configure asynch/serial ports PC : Remote Power Control DATE: Display Date PG : PaGing parameters setup DC : Default Configuration PR : Power Restore Policy Config. DF : Display FRU Information PS : Power management module Status DI : DIscconnect users RB : Reset BMC DNS : Configure DHCP and DNS RS : Reset System through RST signal FW : Upgrade MP firmware SA : Set MP Access HE : Display Help SO : Security Options ID : System Information SS : System processors Status IT : Modify MP inactivity timeouts SYSREV: Display System firmware Revs. LC : Configure LAN, SSH and Web ports TC : Reset system via INIT LDAP: Configure LDAP parameters TE : TELL- send a msg. to other users LM : License Management UC : User Configuration LOC : Locator LED display WHO : Display connected MP users LS : LAN Status XD : Diagnostics and reset of MP MR : Modem Reset </pre>
CL	To see console log.
SL	To see event log.

Example MP Top Menu Picks	
Detail on some of these menu picks appear in this table	<pre> MP MAIN MENU: CO: Console VFP: Virtual Front Panel CM: Command Menu CL: Console Log SL: Show Event Logs HE: Main Help Menu X: Exit Connection [rx2600m] MP> </pre>
HE	<pre> MP Help System Enter a command at the help prompt: OVerview : Launch the help overview LIst : Show the list of MP Main Menu commands <COMMAND> : Enter the command name for help on individual command TOPics : Show all MP Help topics and commands HElp : Display this screen Q : Quit help </pre>

Table 1-2 shows the EFI menu structure and provides sub-commands for some of the menu selections.

Table 1-2 EFI Menu Structure

Example EFI Top Menu Picks	
Top Level Menu Picks Showing Three Operating System Selections and Menu Picks	<pre> EFI Boot Manager ver 1.10 [14.61] Firmware ver 2.31 [4411] Please select a boot option HP-UX Primary Boot: 0/1/1/1.2.0 Red Hat Enterprise Linux WS Windows Server 2003, Enterprise EFI Shell [Built-in] Drive Explorer Boot Option Maintenance Menu System Configuration Menu Use ^ and v to change option(s). Use Enter to select an option </pre>
Shell> Commands	

<p>Shell> Boot Commands</p>	<pre> autoboot -- View or set autoboot timeout variable bcfg -- Displays/modifies the driver/boot configuration boottest -- Set/View BootTest bits clearlogs -- Clears FPL and SEL logs dblk -- Displays the contents of blocks from a block device lanboot -- Performs boot over lan from EFI Shell mount -- Mounts a file system on a block device reset -- Resets the system tftp -- Tftp to a bootp/dhcp enabled unix boot server vol -- Displays volume information of the file system </pre>
<p>Shell> Configuration Commands</p>	<pre> cpuconfig -- Deconfigure or reconfigure cpus date -- Displays the current date or sets the systemdate err -- Displays or changes the error level esiproc -- Make an ESI call errdump -- View/Clear logs info -- Display hardware information monarch -- View or set the monarch processor palproc -- Make a PAL call salproc -- Make a SAL call time -- Displays the current time or sets the system time ver -- Displays the version information </pre>
<p>Shell> Device Commands</p>	<pre> baud -- Set serial port com settings connect -- Binds an EFI driver to a device and starts the driver devices -- Displays the devices being managed by EFI drivers devtree -- Displays the tree of devices of the EFI Driver Model disconnect -- Disconnects one or more drivers from a device dh -- Displays the handles in the EFI environment drivers -- Displays the list of drivers of the EFI Driver Model drvcfg -- Invokes the Driver Configuration Protocol drvdiag -- Invokes the Driver Diagnostics Protocol guid -- Displays all the GUIDs in the EFI environment lanaddress -- Display LAN MAC addresses load -- Loads and optionally connected EFI drivers loadpcirom -- Loads a PCI Option ROM map -- Displays or defines mappings openinfo -- Displays the protocols on a handle and the agents optload -- Lists all optional ROM-based efi drivers and apps pci -- Displays PCI devices or PCI function config space reconnect -- Reconnects one or more drivers from a device unload -- Unloads a protocol image </pre>
<p>Shell> Memory Commands</p>	<pre> default -- Sets, Resets, or Clears default NVM values dmpstore -- Displays all NVRAM variables dmem -- Displays the contents of memory memmap -- Displays the memory map mm -- Displays or modifies MEM/IO/PCI pdt -- View or set page deallocation table </pre>

<p>Shell> Shell Commands</p>	<pre>alias -- Displays, creates, or deletes aliases in the EFI shell attrib -- Displays or changes the attributes of files or directories cd -- Displays or changes the current directory cls -- Clears the standard output with an optional background color comp -- Compares the contents of two files cp -- Copies one or more files/directories to another location edit -- Edits an ASCII or UNICODE file in full screen eficompress -- Compress a file efidecompress -- Compress a file exit -- Exits the EFI Shell help -- Displays help menus, command list, or verbose help of a command hexedit -- Edits with hex mode in full screen ls -- Displays a list of files and subdirectories in a directory mkdir -- Creates one or more directories mode -- Displays or changes the mode of the console output device mv -- Moves one or more files/directories to destination rm -- Deletes one or more files or directories set -- Displays, creates, changes or deletes EFI environment variables setsize -- Sets the size of the file touch -- Updates time with current time type -- Displays the contents of a file xchar -- Turn on/off extended character features</pre>
<p>Shell> Script Commands</p>	<pre>echo -- Displays messages or turns command echoing on or off for/endifor -- Executes commands for each item in a set of items goto -- Makes batch file execution jump to another location if/endif -- Executes commands in specified conditions pause -- Prints a message and suspends for keyboard input stall -- Stalls the processor for some microseconds</pre>
<p>Boot Option Maintenance Menu</p>	
<p>There are sub- menus in each of these areas</p>	<pre>EFI Boot Maintenance Manager ver 1.10 [14.61] Main Menu. Select an Operation Boot from a File Add a Boot Option Delete Boot Option(s) Change Boot Order Manage BootNext setting Set Auto Boot TimeOut Select Active Console Output Devices Select Active Console Input Devices Select Active Standard Error Devices Cold Reset Exit Timeout-->[10] sec SystemGuid-->[7B8CA118-DA48-11D8-B39D- 28E83DA9F617] SerialNumber-->[US42578894]</pre>

System Configuration Menu	
There are sub-menus in each of these areas	System Configuration Menu. Select an Option Security/Password Menu Advanced System Information Menu Set System Date Set System Time Reset Configuration to Default Help Exit

An interesting aspect of the EFI commands is that you can accomplish many of the same functions running BCH commands on HP 9000 (PA-RISC) systems. To those of you who have PA-RISC system experience, you'll see many of the same functions performed in EFI.

Using EFI, you can control the boot-related setup on your Integrity server. Because of the number of operating systems you can run on Integrity servers, you use this interface often to coordinate and manage them.

I connect to the MP using the MP LAN as opposed to the MP console. If you were to connect using the console you would also see the menu pick *CSP:Connect to Service Processor* and *SE:Enter OS Session* menu picks.

The next sections cover working with EFI.

EFI Top Level Menu

When you get access to the EFI menu structure you can issue commands. You make your desired selections and then traverse a menu hierarchy. To start EFI, when the system self-test is complete, press any key to stop the countdown timer. The main EFI screen appears. The following output shows the EFI Boot Administration main screen, which is where you can make various boot-related selections:

```

EFI Boot Manager ver 1.10 [14.61] Firmware ver 2.31 [4411]

Please select a boot option

  HP-UX Primary Boot: 0/1/1/1.2.0
  Red Hat Enterprise Linux WS
  Windows Server 2003, Enterprise
  EFI Shell [Built-in]
  Drive Explorer
  Boot Option Maintenance Menu

```

```
System Configuration Menu
```

```
Use ^ and v to change option(s). Use Enter to select an option
```

This output shows the primary HP-UX boot device and other selections.

From the main screen, you can also choose *EFI Shell [Built-in]*, *Boot option maintenance menu*, and a variety of other selections. The first item shown in the EFI main screen is the default. Use the arrow keys to scroll and highlight a selection. After the item you need is highlighted, press *Enter* to select it. For example, if you were to select *Boot option maintenance menu*, you would see a screen resembling the one shown in the following output:

```
EFI Boot Maintenance Manager ver 1.10 [14.61]
Main Menu. Select an Operation

    Boot from a File
    Add a Boot Option
    Delete Boot Option(s)
    Change Boot Order

    Manage BootNext setting
    Set Auto Boot TimeOut

    Select Active Console Output Devices
    Select Active Console Input Devices
    Select Active Standard Error Devices

    Cold Reset
    Exit

Timeout-->[10] sec SystemGuid-->[7B8CA118-DA48-11D8-B39D-28E83DA9F617]
SerialNumber-->[US42578894      ]
```

EFI Command Examples

As previously mentioned, traversing the EFI menu structure and issuing commands is straightforward. When the system boots, you are given the option to interrupt the autoboot. (If you don't interrupt it, the autoboot loads the first operating system listed, which, in our case, is *HP-UX Primary Boot*). At system startup, the EFI Boot Manager presents the boot option menu (as shown in the following output). Here, you have 10 seconds to enter a selection before *HP-UX Primary Boot* is selected:

```
EFI Boot Manager ver 1.10 [14.61] Firmware ver 2.31 [4411]

Please select a boot option

  HP-UX Primary Boot: 0/1/1/1.2.0
  Red Hat Enterprise Linux WS
  Windows Server 2003, Enterprise
  EFI Shell [Built-in]
  Drive Explorer
  Boot Option Maintenance Menu
  System Configuration Menu

Use ^ and v to change option(s). Use Enter to select an option
```

You can use the arrow keys to move up and down the menu structure.

EFI Shell> Help

I used the ↓ key (down arrow) to select *EFI Shell [Built-in]*. This brought me to the *Shell>* prompt. From there, you can issue EFI commands. Similarly, once you're at the *Shell>* prompt, help is always available. To get a listing of the classes of commands available in *Shell>*, simply enter **help** and press Enter as shown in the following output:

```
Shell> help
List of classes of commands:

boot          -- Booting options and disk-related commands
configuration -- Changing and retrieving system information
device        -- Getting device, driver and handle information
memory        -- Memory related commands
shell         -- Basic shell navigation and customization
scripts       -- EFI shell-script commands

Use 'help <class>' for a list of commands in that class
Use 'help <command>' for full documentation of a command
Use 'help -a' to display list of all commands

Shell>
```

When using a network connection from another system, you may have to use the ^ and v to move up and down the menu structure respectively. The main help commands are the same for both bus and cell-based systems.

You can also issue *help* requests for any EFI commands at any level. For example, if you want to know more about your current CPU configuration, you would start with **help configuration** to determine the help command for CPU configuration, and then use the **help cpuconfig** command:

Cell-based example:

```
Shell> help configuration
Configuration commands:

acpiconfig -- Set/View ACPI configuration mode
cellconfig -- Deconfigure/Reconfigure cells
cpuconfig  -- Deconfigure/Reconfigure cpus
date       -- Display the current date or set the date of the system
dimmmconfig -- Deconfigure/Reconfigure dimms
err        -- Display/Change the error level
errdump   -- View/Clear logs
fru       -- View Fru data
info      -- Display hardware information
monarch   -- Set/View a monarch processor
palproc   -- Make a PAL call.
romdrivers -- Enable/Disable PCI expansion ROM drivers
rootcell  -- Set/View preferred root cells
salproc   -- Make a SAL call
tftp      -- Performs tftp operation to a bootp/dhcp enabled unix boot server
time      -- Display the current time or set the time of the system
variable  -- Save/Restore specific EFI variables
ver       -- Display the version information

Type 'help' followed by a command name for full documentation.

Shell>
```

Bus-based example:

```
Shell> help configuration
Configuration commands:

cpuconfig  -- Deconfigure or reconfigure cpus
date       -- Displays the current date or sets the date in the system
err        -- Displays or changes the error level
esiproc    -- Make an ESI call
errdump   -- View/Clear logs
info      -- Display hardware information
monarch    -- View or set the monarch processor
palproc    -- Make a PAL call
salproc    -- Make a SAL call
time      -- Displays the current time or sets the time of the system
ver       -- Displays the version information

Use 'help <command>' for full documentation of a command
Use 'help -a' to display list of all commands

Shell>
```

I give both a cell-based and bus-based example because the cell-based system has some additional commands.

As a result of having issued **help cpuconfig**, you now know how to manipulate the CPUs in your system.