# Getting Started With Linux on HP Servers

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Executive Summary

Identifying supported Linux solutions or getting started building Linux on a new platform can be challenging. This paper provides information on where to find information on supported Linux solutions from HP. Information on starting the Linux installation process, including the use of the remote consoles to manage your server is also included. Additional online resources for building and configuring Linux solutions are also identified.

Introduction

HP offers supported Linux solutions with HP Integrity and ProLiant industry standard servers. This document identifies these solutions and provides information to assist in an installation of Linux from scratch.

Intended Audience

This document is intended for System Administrators moving to Linux on HP Integrity or ProLiant servers. It is assumed that the reader has an understanding of UNIX System Administration and operating system installation.

Goals

This document provides:

- A means to identify HP supported Linux system configurations.
- Information needed to start installing Linux on HP servers.

Because of the various Linux distributions available and the unique differences among them, it is not a goal to provide installation or system administration information for specific Linux distributions. It is also not a goal to provide exhaustive information on the console options available.

Linux and HP

HP has been involved with Linux since the beginning, and today has a dedicated R&D lab with over 20 years experience developing libraries and device drivers for UNIX platforms. These R&D teams are dedicated to enabling, testing, and supporting Linux on HP workstations and servers.

HP hardware offerings provide industry standard solutions for servers, desktops, laptops, and storage. ProLiant servers, based on Intel® and AMD® processor technology, are separated into three categories:

- The DL line focused on high density rack servers (www.hp.com/go/proliant)
- the ML line focused on maximum expansion within the server (www.hp.com/go/proliant)
- the BL blade servers for scalable, adaptive solutions (www.hp.com/go/blades)

HP Integrity servers, based on the industry standard Intel® Itanium® processor family, range from a 1U 2-way server to the 64-way Superdome (www.hp.com/go/integrity). Extensive testing and integration are done to create Linux solutions that work right the first time. The website www.hp.com/go/linux has support information, and support matrices for HP hardware and the supported Linux distributions.

HP delivers industry-leading hardware and software Linux solutions and maintains close partnerships with major application software suppliers. As a Linux partner, HP provides state-of-the-art management and clustering technologies for Linux, as well as broad service and support expertise for customers and ISVs. Working with HP and Linux allows you to get both your hardware and software
support from a single organization. For more information on HP and Linux visit www.hp.com/go/Linux.

In addition to its Linux involvement HP is also highly active in the open source community. HP has a history of pioneering open computing and has been involved in the open source community longer than any other major hardware vendor. HP’s labs contribute to numerous high-profile open source applications, some of which are available from www.opensource.hp.com. HP also provides development environment tools as part of the Linux Programmers Toolkit, to download the toolkit or get more information see www.hp.com/go/linuxtools.

HP hardware running Linux holds many high ranked benchmarks, including the first TPC-H 3TB benchmark result of under $100/QphH. For the latest benchmark data for Linux solutions on HP hardware see, www.hp.com/wwsolutions/linux/about_linux_hp/benchmarks.html. HP solutions are classified as some of the largest super-computers in the world1. Information on these and other Linux clustering solutions from HP is available at: www.hp.com/techsevers/clusters.

HP is committed to the success of its enterprise customers and to driving Linux into the enterprise. On October 1, 2003, HP introduces a program where qualified customers can obtain indemnification from HP against legal action from SCO. HP is making this offer to protect you, the customer, and to allow you to continue your Linux deployment plans without unnecessary risk or distraction. For more information see the Linux indemnification program at www.hp.com/go/linuxprotection.

Why Linux?

Linux has become a popular operating system, appearing everywhere from PDAs (see www.handhelds.org) to enterprise level servers. Its open nature allows components to be easily added or removed to achieve any goal. Linux is the fastest-growing server operating system in the world today. Much of Linux’s popularity has been attributed to the familiarity of its interface and features. The command line offers a familiar interface to UNIX users while the graphical interfaces provide Microsoft Windows users with a familiar interface. By offering interfaces and system services, such as file sharing, Linux provides a low-cost industry-standard alternative to both Windows and UNIX environments.

While Solaris runs best on relatively expensive proprietary hardware, Linux is optimized to run on industry-standard hardware such as HP’s ProLiant and Integrity servers. Linux’s ability to run on industry-standard servers means a low cost of entry and its low total cost of ownership makes it attractive for both edge and enterprise servers. For example, moving from Sun to Linux servers for deployments of Reuters Market Data System (RMDS) can yield significant changes in infrastructure costs2. See the savings for yourself with the Linux TCO calculator at www.hp.com/wwsolutions/linux/download/tco/hp-linux-value/HPLinuxTCOCalculator.html.

Most importantly, Linux’s availability on numerous hardware platforms allows you the flexibility to choose your hardware vendor without worrying about the availability of the operating system. It also allows you to move based on performance and application availability. In a recent benchmark, HP Integrity servers running Oracle in a Linux cluster set a new TPC-C record with over one million TPC-C, the highest TPC-C numbers in the industry at only $5.52/tpmC3. HP ProLiant Servers running Linux have the lowest TCO in the industry for Oracle Application server, 53% below Solaris while achieving a 31% increase in performance4. For the latest benchmarks with HP and Linux, see www.hp.com/wwsolutions/linux/about_linux_hp/benchmarks.html.

Linux Certified and Supported Matrices

Our certified and supported matrices provide easy access to information on HP’s Linux solutions. The matrices provide one-stop shopping for support information, an overview of supported distributions, sources:

1 Source: Top 500 supercomputer list - www.top500.org
2 www.rmds-linux.com
3 Source: Transaction Processing Council (TPC), www.tpc.org
and certified hardware solutions. Links to additional information pertaining to software downloads, detailed product information, “How To Buy”, documentation, and other resources are easily accessible.

To find the current HP supported Linux systems go to: www.hp.com/go/linux then navigate to the ‘Certified and supported matrices’ from there select the server or client type of interest. See Figure 1 and Figure 2 for an example of the matrices.

Figure 1: Integrity Server Certification Matrix - An Example of Supported HP Integrity Solutions (Please check the web for current information)

<table>
<thead>
<tr>
<th></th>
<th>Red Hat</th>
<th>SuSE Linux</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Servers</strong></td>
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<td>nx2600</td>
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<td>nx6070</td>
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<td>nx8620</td>
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<td></td>
</tr>
<tr>
<td><strong>Superdome</strong></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

- ✓ vendor certified and HP supported
- ✓ HP supported
- $ buy direct
- 🛠️ pre-installed
- 🙇 Planned support/certification pending
Figure 2: ProLiant Server Certification Matrix - Example of Supported ProLiant Solutions (Please check the web for current information)

<table>
<thead>
<tr>
<th>DL series</th>
<th>Red Hat Linux</th>
<th>UnitedLinux</th>
<th>SUSE Linux</th>
<th>SLES 9 / UL 1.0</th>
<th>SLES 7</th>
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<tr>
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<tr>
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<table>
<thead>
<tr>
<th>DL series</th>
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<th>UnitedLinux</th>
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<tr>
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<tr>
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</tbody>
</table>

### Locating Linux Kits

Linux kits can be ordered through HP, by calling HP at 1-800-282-6672 or online from a certified vendor.
Linux Documentation

Detailed documentation for the various Linux platforms covering full installation and system specific feature information is available from HP. Start at www.hp.com/go/linux, then navigate to the ‘Certified and supported matrices’. At this point select the type of system (i.e. ProLiant servers, HP Integrity servers, etc.), then select the system, (example DL360 G3).

Additional sources of information available on Linux are provided by the community at large and the vendors themselves. The Linux Documentation Project, www.tldp.org, provides detailed information on Linux and Linux solution implementation. Linux vendors provide detailed documentation on installation and management for their product.

Integrity Servers

The HP Integrity server family brings you a winning combination of HP expertise in system design and the industry-leading Intel® Itanium® processor. This results in unprecedented performance, multi-OS flexibility, high availability, and unmatched investment protection based on industry-standards for enabling business agility and better return on IT. The HP Integrity family is a key member of the broad portfolio of industry-leading HP servers for building your adaptive enterprise.

Management Processor

HP Integrity servers that have the Management Processor (MP) included allow the execution of control commands remotely through a serial line or LAN connection. The MP is an independent support processor for the system console that provides services that facilitate the management of the host system, including power control and system resets.

To enter the MP enter <Ctrl-B> on the console and login to the MP using the login information provided on the screen. See Figure 3 and Figure 4.

Figure 3: Management Processor - Login example

```
MP password:

MP login:
MP password:

MP login:
MP password:

******************************************************************************
Only default users are configured.
Use one of the following user/password pairs to login:

Admin/Admin
Oper/Oper

MP login: 
```
NOTE: The following example is for a non-cell based HP Integrity server such as an rx4640, a cell-based system will use a similar concept but the commands will be slightly different, allowing for control of the cells and related hardware.

The system may have been powered off at the Management Console and therefore may not appear to power on as expected. To turn the power on from the Management Console,

- enter cm (Command Menu) at the MP> prompt. (Figure 5)
- type pc (Power Control), the current state of the system power will be displayed along with the power management choices.
- Enter on and the power will go to an on state.

To return to the console prompt

- return to the main menu by typing ma (main)
- then enter co (console)
Configuring the Console on Integrity Systems

The environment for booting an operating system and handling pre-boot applications on the Integrity system is through the EFI, Extensible Firmware Interface. For detailed information on the EFI go to: www.intel.com/technology/efi/index.htm

The first step is to be able to communicate with the console. When the system is powered on it will go through a power up test. At the end of the test the system will be at the EFI Boot Manager and will attempt to boot the first device listed (Figure 6) after a brief period. For extended terminals the arrow keys will allow you to select various options and configure the boot manager. For terminals without extended support the ^, <Shift-6>, or <v> can be used in place of the arrow keys. The ^, <Shift-6>, will scroll the selection up and <v> will scroll the selection down.
EFI Shell - extensible firmware interface

The Extensible Firmware Interface (EFI) is an interface that allows you to configure the Itanium Processor Family firmware. The EFI menu includes the following options:

- The EFI Shell is a command line interface that allows you to operate the EFI commands or create and run automated scripts.
- Boot Option Maintenance Menu allows you to select the order of the devices from which you want the firmware to attempt to boot the OS. You can also configure the system to boot from a configuration file.
- On systems with EFI firmware version 2.0 or higher, the System Configuration Menu lets you view the system configuration and change or delete administrator and user passwords.
- On systems with EFI firmware version 1.9 or lower, the Security/Password Menu lets you add, change and delete system administrator and user passwords. (not shown)

Using the EFI shell

To access the EFI shell (Figure 7), select EFI Shell from the boot option menu.
The system may contain several bootable disks. The following is an example of selecting `fs0`.

1. A list of file systems (drives and partitions), and block devices on hard drives is displayed.
2. You can now enter commands.

To switch to a different file system, execute the following, where `fsX` is the selected file system, as listed on the screen.

```
Shell> fs0:
```

To list EFI command classes, enter `help` at the EFI shell prompt.

**Selecting Active Console Input / Output devices**

The console on an HP Integrity server is capable of being configured for several different input/output devices, including serial and graphics (if equipped). The following examples show how to make changes for the console configuration. Choose the correct device and deselect others for the console output, input and standard error. Please see the documentation for the specific system for more information.

**NOTE:** If the console does not appear to be working when the operating system is booted check for proper configuration of the console. Specific information would be in the manual for the system, or for general information see the following example.

**Configuring Serial Console**

This example illustrates changing the Console Output device. In a similar fashion, the Input and Standard Error should also be configured properly for the installation needs. HP Enablement Kit for Linux ([www.software.hp.com](http://www.software.hp.com)) contains detailed information on how to configure the serial console.

Before Linux boots, all console interaction is through firmware. To modify the default local graphics display to a serial console path, configure a single serial port (UART) for both **Console In** and **Console Out** in the boot manager interface. When the Linux kernel boots, it interprets the UART as `ttyS0` and sends the computer output to the chosen display screen.

**To begin:**
1. When your system boots, select the **Boot option maintenance menu** from the **EFI Boot Manager** screen and press `<Enter>.

2. From the menu, highlight **Select Active Console Output Devices** and press `<Enter>`.

Figure 8: Selecting Console Devices

![EFI Boot Maintenance Manager](image)

3. The resulting screen displays a list of UARTs and PCI devices available for console input/output.
   - UART identifiers of PNP0501 describe modes available for the "Serial A" or "Serial 1" built-in UART.
   - UART identifiers of HWP0002 describe modes available for the "Console" UART on the management processor.
   - Highlight a UART and press `<Enter>` On the same screen, highlight **Save Settings to NVRAM** and press `<Enter>`. The system prompts you to save NVRAM if you omit this step.
4. Highlight Select Active Console Input Devices from the main menu and press <Enter>
5. From the list on the resulting screen, highlight the same UART you selected as your output device and press <Enter>. Next highlight Save Settings to NVRAM and press <Enter>
6. To apply the changes you have selected, highlight Cold Reset from the main menu and press <Enter>
7. Select Reboot the System and OK. The firmware and serial console are configured after reboot.

Booting the CD

Boot Option 1

1. Insert a bootable Operating System installation CD in the drive and reboot the machine. The EFI boot manager loads.
2. At the Please Select a Boot Option prompt, use your arrow keys to highlight Boot Option Maintenance Menu and press <Enter>.  
3. At the Select an operation prompt, Boot from a file is highlighted. Press <Enter>
4. Under Boot From a File. Select a Volume, use your arrow keys to highlight Removable Media Boot and press <Enter>.
5. If Removable Media Boot is not listed as an option in Step 4, follow the directions for Boot Option 2 below.

Boot Option 2:

If the preceding instructions did not list Removable Media Boot as an option in the EFI boot manager, follow these directions to use the bootloader to boot the CD.

Note: select the EFI Shell [Built-in] boot option within five seconds to avoid booting a default option.

1. Turn on your system and install a bootable system installation CD in your CD drive.
Note: To use a serial console as your display screen, configure it prior to booting a Linux installation CD.
See Configuring the Console on Integrity Systems in this whitepaper for more information.

2. Within five seconds, use your arrow keys to select **EFI Shell [Built-in]** from the list of boot options presented and press `<Enter>`.

3. A list of mapping table choices is displayed which may not fit on one screen if many disks are attached to the system. If necessary, type `map -b` at the EFI shell prompt to see the list screen by screen.

   - Locate the list entry with the `fs` prefix that contains the text, **CDROM**.
   - At the shell prompt, input this list entry followed by a colon.
     
     For example, if `fs0` contains the text **CDROM**:
     
     
     Type `fs0:`
     
     Press `<Enter>`.

4. To execute the elilo bootloader type `elilo` at the `fs0:` prompt

   Press `<Enter>` and proceed with the installation from the CD. If there is no elilo bootloader in the current directory, you should use the `ls` and `cd` commands to find the file `bootia64.efi`. A typical location for the file is `efi\boot`. At the `fs0:` prompt type `cd efi\boot` then press `<Enter>` then type `bootia64` then press `<Enter>`.

---

**HP enablement kit for Linux**

One resource on setting up an Integrity system is the ‘HP enablement kit for Linux’. This kit contains both documentation and a CD.

The documentation for HP enablement kit for Linux is available online from: [www.docs.hp.com/linux/](http://www.docs.hp.com/linux/) From this page, scroll to the section titled **Linux for Itanium 2-based Servers and Workstations** then select installing Linux on HP Itanium 2-based servers and workstations

The enablement kit documentation provides:

- Instructions for configuring your console and getting started with the enablement kit
- An explanation of the enablement kit’s menu options
- HP Enablement Kit for Linux CD content list
- An appendix with directions for using Smart Array with Linux on Itanium 2-based servers
- Answers to frequently asked questions
- Web resources for Linux

The HP enablement kit for Linux is available from: [www.software.hp.com](http://www.software.hp.com). Under product category select Linux then select the appropriate enablement kit.

While not required for installation the enablement kit CD automates the following processes:

- Hardware discovery
- Disk partitioning
- Configuration of storage controllers
- Linux installation from distributor media (e.g., CD-ROM)
- Recovery of a pre-installed operating system

---

**ProLiant Servers**

HP ProLiant servers are based upon x86 and the new x86-64 architectures from Intel® and AMD® delivering industry standard solutions for Linux. Depending on the server configuration, different configuration options may be presented during the boot sequence. Detailed information on the Proliant family of servers is available at [www.hp.com/go/proliant](http://www.hp.com/go/proliant).
iLO – integrated Lights Out

HP has incorporated the integrated Lights Out (iLO) feature in the BL (Blade) servers, DL360 series and higher, and the ML370 and higher ML servers. The iLO device is a separate management processor that resides on the system board and contains its own processor, memory, and network interface that allow it to operate independently from the host server. The iLO feature allows system administrators to manage a ProLiant server remotely, independent of the state of the operating system.

The iLO device uses a network connection for communications. The network can be configured manually or automatically via DHCP provided there is an appropriately configured DHCP server. The default is DHCP.

On servers equipped with iLO press the designated key (typically `<F8>`) to configure.

---

**Figure 10: ProLiant boot showing iLO prompt**

---

If iLO has been configured and connected to the network, access to the console can be gained through a web browser going to the network address of the iLO port.

For additional information about iLO please see: [www.hp.com/servers/ilo](http://www.hp.com/servers/ilo)

**HP Smart Array**

After the HP Smart Array is initialized, it can be configured. The configuration mode can be entered by pressing the key indicated (typically `<F8>`) during initialization as shown in Figure 11. The actual RAID configuration will vary based on the intended use of the system and available resources. The Smart Array controller is standard on all DL360 and higher servers, and can be ordered in most other DL and ML servers.
Figure 11: ProLiant boot showing Smart Array prompt

6144 MB Initialized / 6144 MB Detected

Copyright 1992, 2003 Hewlett-Packard Development Group, L.P.

Processor 1 initialized at 3.00 GHz (612 Mbyte L2, 4 Mbyte L3)
Processor 2 initialized at 3.00 GHz (612 Mbyte L2, 4 Mbyte L3)
Processor 3 initialized at 3.00 GHz (612 Mbyte L2, 4 Mbyte L3)
Processor 4 initialized at 3.00 GHz (612 Mbyte L2, 4 Mbyte L3)

Advanced Memory Protection Mode: Advanced ECC Support
Redundant ROM Detected - This system contains a valid backup system ROM.

Integrated Lights-Out 1.30 Dec 17 2003

Slot 0 HP Smart Array 514 Controller (64MB, v2.53) 1 Logical Drive

Press <F8> to run the Option ROM Configuration for Arrays Utility
Press <ESC> to skip configuration and continue

Figure 12 and Figure 13 show the process for creating a logical drive. Note that in Figure 13 there is only one drive available on this system, as a result there can only be one logical drive created.

Figure 12: Smart Array Configuration Menu

Option Rom Configuration for Arrays, version 2.16
Copyright 2003 Hewlett-Packard Development Company, L.P.

Controller: HP Smart Array 51, slot 0
Direct-Attached Storage

Main Menu:
Create Logical Drive
View Logical Drive
Delete Logical Drive

<Enter> to create a new logical drive
<UP/DOWN ARROW> to select main menu option; <ESC> to exit
BIOS - ROM Based Install Utility

Various system configuration and control information is accessible through the system ROM. When prompted (Figure 14), press the <F9> key.

Figure 14: ROM-Based Setup Utility
The Date and Time should be verified before you start the installation process. To install Linux, the OS Selection should be set to Linux. The OS Selection (Figure 16) is set under the System Options (Figure 15) submenu.

**Figure 15: Selecting the System Options**

![System Options Menu](image)

- System Options:
  - PCI Devices
  - Standard Boot Order (IPL)
  - Boot Controller Order
  - Date and Time
  - Automatic Server Recovery
  - Server Passwords
  - Server Asset Tag
  - Advanced Options
  - BIOS Serial Console & EMS
  - Utility Language

- HD Proliant DL650 C1
- S/N: EA06M9532F
- HD EIOS P30 12/11/2003
- Backup Version 12/11/2003
- 5144MB Memory Installed
- Advanced ECC Support

- Proc 1: Intel 3.00GHz, 1MB Cache
- Proc 2: Intel 3.00GHz, 1MB Cache
- Proc 3: Intel 3.00GHz, 1MB Cache
- Proc 4: Intel 3.00GHz, 1MB Cache

- MAC address for NIC 1: 000EC99BCC9F
- MAC address for NIC 2: 000EC99BCC94

*<Enter>* to View/Modify System Specific Options
*<z>/<z>* for Different Selection; <ESC> to Exit Utility

**Figure 16: Selecting the OS Specification**

![OS Specification Menu](image)

- OS Selection
- Serial Number
- Embedded COM Port
- Integrated Diskette Controller
- NUMLOCK Power-On Share
- Embedded NIC Port 1 PXE Support
- Embedded NIC Port 2 PXE Support
- Diskette Write Control
- Diskette Boot Control
- Advanced Memory Protection

- HD Proliant DL650 C1
- S/N: EA06M9532F
- HD EIOS P30 12/11/2003
- Backup Version 12/11/2003
- 5144MB Memory Installed
- Advanced ECC Support

- Proc 1: Intel 3.00GHz, 1MB Cache
- Proc 2: Intel 3.00GHz, 1MB Cache
- Proc 3: Intel 3.00GHz, 1MB Cache
- Proc 4: Intel 3.00GHz, 1MB Cache

- MAC address for NIC 1: 000EC99BCC9F
- MAC address for NIC 2: 000EC99BCC94

*<Enter>* to Modify OS Setting; <F1> for More Help
*<z>/<z>* for Different Configuration Options; <ESC> to Close Menu
Figure 17 illustrates some of the options available under the OS Selection list.

Figure 17: Choosing Linux

Installing Linux

This section introduces generic concepts that may be useful during installation. Linux distribution vendors provide detailed installation guides. HP also provides additional documentation on specific hardware platform installations. Both documentation sets can generally be found [www.hp.com/go/linux](http://www.hp.com/go/linux).

The ‘Certified and supported matrices’ provide links to detailed documentation for installations on both HP ProLiant and HP Integrity servers.

During the installation process you will need the following system configuration information:

- **node name**
- **ip address & network mask**
- **domain name**
- **default gateway address and other routing information**
- **DNS server (BIND) configuration**
- **NIS or LDAP information**
- **Graphics card model**
- **Monitor**

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5 Most graphic cards are pre-defined by manufacturer and model

6 Most monitors are pre-defined, if not, then the supported refresh frequencies from the owners manual are required
**Partitions**

The default is typically to create a small `/boot` partition, a swap partition and place the operating system in a single, large partition. However, depending on the system configuration, it may be advantageous to create several partitions on the disk. One reason for partitioning into several separate partitions is to restrict the growth of certain file systems (directories). Any file system that could be subject to frequent change or is used to create temporary files should be considered. If the root file system (`/`) were to fill up, the system may experience performance or other problems when it attempts to create files and fails. In order to reduce the risk of these problems, file systems can be separated on different partitions.

Examples of file systems that could/should be separate:

- `/var`
  This file system contains spool directories for mail and printing. It also contains the system logs. If there is a chronic error, those messages could fill the partition.

- `/usr`
  This is where most executable binaries go. The kernel source tree is here and much of the documentation is here.

- `/tmp`
  Some programs write temporary data files here. Some applications require several megabytes of `/tmp` space for installation or operation. Depending on requirements, keep `/tmp` on a separate partition. Users have full access to `/tmp`.

- `/home`
  This is where user home directories typically go. Depending on the number of users on the system or if quotas are enabled, this could grow quite large. This should be on its own partition.

- `/boot`
  This is where kernel images go, it may be required to be a separate partition.

- `/swap`
  The size of swap space is very dependant on the size of the system physical memory and the applications running on the system. A general rule of thumb is to configure the same amount of swap as physical memory.

**Driver updates**

HP provides updates to drivers on supported systems. To locate these drivers, start at [www.hp.com/go/linux](http://www.hp.com/go/linux) then navigate to the ‘Certified and supported matrices’ from there select the server or client type of interest, ProLiant or Integrity Server. At this point select the appropriate hardware platform, then go to drivers and select the correct operating system.
Resources

www.hp.com/go/linux
www.hp.com/go/eclipse
www.hp.com/dspp
www.docs.hp.com/linux
www.tldp.org