

Installation Guide

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Linux Installation and Configuration Guide for AlphaServer DS10 and AlphaServer DS20

Abstract: The purpose of this guide is to provide the basic installation and configuration guidelines for the Linux operating system on AlphaServer DS10 and AlphaServer DS20 computers.

This guide limits its testing to two prominent Linux distributions, Red Hat and SuSE. Much of the information contained in this document should be applicable to most other Linux distributions for AlphaServer computers too.

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Linux Installation and Configuration Guide for AlphaServer DS10 and AlphaServer DS20
Installation Guide prepared by Internet and E-Commerce Solutions Business Unit

Enterprise Solutions Division

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Introduction

The purpose of this guide is to discuss the basics of installation and configuration of the Linux operating system on the Compaq AlphaServer DS10 and DS20 platforms. The intention of the guide is to provide step-by-step instructions showing how to install the Linux operating system on the equipment listed above. Numerous references to external sources and materials are used in this guide, and Compaq recommends that you refer to these sources where additional detail is needed.

The following is a partial list of references to learn more about the software:

- <http://compaq.com/alphaserver/Linux> : Compaq's AlphaServer information page.
- <http://www.alphalinux.org> : A web site dedicated to information about Linux and Alpha Processor-based computer systems.
- <http://www.linux.org> : The web site of Linux Online.
- <http://www.li.org> : The web site of Linux International.
- <http://www.gnu.org> and <http://www.fsf.org> : The web site of the GNU project and the Free Software Foundation.
- <http://metalab.unc.edu/LDP> : The web site of the Linux Documentation Project.
- <http://www.tux.org> : Site of several east coast (U.S.) Linux Users Groups.
- <http://www.RedHat.com> : The web site of the Red Hat Linux distribution.
- <http://www.suse.com> : The web site of the SuSE Linux distribution.

Many of these sites are also mirrored at other sites, and some of these sites (or portions of these) are published in languages other than English. As an exercise, Compaq recommends that you peruse these sites, along with others, to learn the basics of using Linux.

Management Summary

Each distribution vendor includes operating system and application management tools that form a common base across one or more distributions. Red Hat's Package Management (RPM) format, for instance, is a commonly used software distribution mechanism. Other tools, such as each vendor's setup program, are specific to a particular distribution. This guide does not provide discussion of the Operating System Management (OSM). For detailed information on the OSM, you should refer to the particular distribution vendor.

Distributions Overview

The discussion in this document focuses on the following two Linux distributions:

- Red Hat Software, Inc.
- SuSE, Inc.

All of these distributions include large amounts of software that can run in conjunction with Linux. This guide will not analyze the available software by distribution nor give a comparison of the software from one distribution to another. The focus of the guide is exclusively on the base Linux operating system and the process required configuring and installing the software.

Red Hat

Red Hat is one of the most popular distributions of Linux in the United States. It is created by Red Hat Software, Inc. and is available through its website located at [http://www.Red Hat.com](http://www.RedHat.com). The distributions used in the creation of this document include 5.2 and 6.0.

SuSE

SuSE is one of the most popular distributions of Linux in Europe and is gaining in popularity in the United States. It is maintained by SuSE, Inc. and is available through its website located at <http://www.suse.com>. The distributions used in the creation of this document include 6.1.

Overview of Installation

Hardware Overview

The two different models included in the testing for this guide were the Compaq AlphaServer DS10 and DS20.

Compaq Hardware Basics

Configuration for the systems is outlined in Table 1. All of the systems used in the come equipped with standard bus-interface devices for which drivers already exist for Linux. All bus-interface devices detailed use the PCI bus. Detailed information on each particular bus-interface device can be found in a subsection of the appropriate software. Only the installation and configuration details that are necessary to clarify the hardware explanation are provided in this section. Unless otherwise specified, the Linux kernel version used in qualifying each component was version 2.2.x. Detailed setup and configuration instructions for a particular Linux vendor's distribution can be found in the section "Installation Briefs".

Table 1. Qualified System Components

Compaq PN	Vendor PN	Description	Underlying Technology	DS 10	DS 20	Comments
DE500-AA	CbleTrn DE500-AA	PCI network adapter 10/100	DEC Tulip chip (21140)	OK @ 10MB	OK @ 10MB	Driver V9.0 fairly stable. Tulip.c & de5x4.c need 100 MB autosense patches integrated – use tulip.c driver (0.89H) in 2.2.0 kernel sources
DE500-BA	CbleTrn DE500-BA	Same as above	DEC Tulip Chip (21143)	Same as AA	Same as AA	Red Hat - Use DE4*5 or Tulip driver
DE504-BA	ITI	PCI 10/100 quad channel Ethernet	DEC Tulip chip PC	Same as 500-AA	Same as 500-AA	Red Hat - Use DE4*5 or Tulip driver
RZ1CF -CF	Fuj IBM	4.3 GB UltraSCSI drive, SCA-2	Fuj MAB3045SC	OK	OK	
-CB	Qntm Trid	80 pin connector	IBM 59H6992 Bluefin			
DS-RZ1DF -CF	Fuj	9.1 GB UltraSCSI	Fuj MAB3091SC	OK	OK	

RZ1DF-CB	IBM Qntm Trid	Drive SCA-2 80 Pin connector 7200 RPM	IBM 59H6594 Sailfin	OK	OK	
DS-RZ1EF CF	Fuj CG01000 -436901	18 GB SE UltraSCSI Disk drive SCA-2	Fuj MAA3182SC			Not qual'd except as OEM part
-CB	IBM Qntm Trid	80 pin connector 7200 RPM	IBM 59H6595 Marlin			
RZ2EA-LA						
BA610-AD	SYM8951 U-IA	single channel ultra2 (LVD) controller	Symbios 895	N/A	N/A	SCSI controller card – requires Alpha patches Gatekeeper.dec.com
KZPCM- DA	IntraServ er ITI 4280 UE	PCI 2 port UltraSCSI SE adapter + Ethernet	Symbios NCR (875) +Dec Tulip	OK ¹	OK	Use the ncr53c8xx driver instead of the 53c7,8xx. In kernel 2.2.0,
KZPBA-CA		PCI 1 port SCSI SE adapter	Qlogic 1040B	OK ¹	OK	Stable Driver available – Qlogic ISP driver in 2.2.0 kernel sources
KZPBA-CB		PCI 1 port SCSI Diff adapter -	Qlogic 1040B	OK ¹	OK	
KZPAC-AA		PCI 1 port UltraS Raid controller	Mylex DAC960-DB	N/A	N/A	Product going eol
KZPAC-CA		PCI 3 port UltraS Raid controller	Mylex DAC960-DB	N/A	N/A	Product going eol
SWXA3- BB	Adaptec 2940W	PCI wide SCSI Adapter		OK	OK	RH51 Tier 1
BA610-AD	Sym8951 U	LVD SCSI adapter		OK	OK	
	PwrStorm 3D10		S3	OK		
SN- PBXGK- AA	CPQ PwrStorm 4D10T	Comet 4M Graphics controller	Permedia 2 3DLabs		Needs build	Needs Xserver built from Xfree86 3.3.3 w patches to support DP264. See gatekeeper.dec.com
SN- PBXGK- AB	CPQ PwrStorm 4D10T	Comet 8M Graphics controller	Permedia 2 3DLabs	N/A	N/A	Needs Xserver built from Xfree86 3.3.3 w patches to support DP264. See gatekeeper.dec.com
SN- PBXGK- BB	Elsa Gloria Synergy	Synergy 8M video controller	Permedia 2 3D Labs	OK	OK	use XF86_3DLabs See gatekeeper.dec.com
SN- PBXGI-AD	PwrStorm 4D51T	Oclet w/16MB texture	Intergraph Panther graphic	N/A	N/A	
PwrStrm30 0	E+S		Intergraph Realizm 2100	N/A	N/A	

SN-VRQV5-xx	CPQ V55	15" color monitor, .24mm pitch hoz, 1024x768 max @60 & 75hz		OK	OK	Vendor supplied parameters set in distributions: XFree86 docs for reference
SN-VRQP7-xx	CPQ P75	17" color monitor, .25mm stripe pitch, <u>1024x768@60, 75 & 85hz</u> , 1280x1024 max	Sony Trinitron	OK	OK	Vendor supplied parameters set in distributions: XFree86 docs for reference
SN-VRQP1-xx	CPQ P110 284757-003	21" color monitor, .25-.27 pitch, 1600x1200 @ 60, 75 . & 85hz	Sony Trinitron	OK	OK	Vendor supplied parameters set in distributions: XFree86 docs for reference
KN310-AD	CPQ	DS 20 SMP CPU	DEC 21264		OK	Requires 2.2.0 base level

Video Cards and Monitors

When setting up the appropriate driver for The X Window System, it is important to note that at this time there are no specific X-servers for the DS 10 and DS 20 AlphaServer video cards. Regardless of which distribution is selected, the generic SVGA server should be selected for servers set up with an SVGA monitor; lesser monitors – such as VGA or monochrome should use an X-server appropriate for the particular monitor type. When you are setting up X, whether through the `xf86config` script or through a distribution vendor's setup program, select a monitor from the monitors list, or enter the video parameters included in the monitor documentation. The specifications for several Compaq monitors are included above. Since the instructions for the outlined video cards tell you not to autoprobe, it is best to enter the information manually.

Of special note, the ELSA Gloria Synergy-8-Compaq graphics adapter (Compaq PN 298693-001) can be used with the AlphaServer DS10 and DS20 systems, though you will need to perform some manual configuration. First, if you are using an AlphaServer DS10 system, make sure that the card is installed in either slot 14 or 15 on bus 00. It will fail if it is in slots 16 or 17 on bus 00. The AlphaServer DS20 does not have this problem. Then, follow these steps after the operating system has been installed and booted. The boot process will fail to start the X11 server, until this procedure is completed.

1. Login as root
2. Change directory to `/usr/X11R6/bin` (`cd /usr/X11R6/bin`)
3. Copy the X server program from the Internet using ftp:
 - `ftp ftp.digital.com`
 - `cd /pub/DEC/Linux-Alpha/X11`
 - `bin`
 - `get XF86_3Dlabs`
 - `quit`
4. Make the new server program the default (`ln -sf ../usr/X11R6/bin/XF86_3Dlabs /etc/X11/X`)
5. Make the new server program executable (`chmod 4751 XF86_3Dlabs`)

6. Check to be certain that `/etc/X11/XF86config` is setup appropriately for your monitor and graphic adapter card.
7. Test the configuration (`/usr/X11R6/bin/startx`)

The depths and resolutions supported for the ELSA on Red Hat 5.2 are:

```
8 bit depth @230 MHz 640x480, 800x600, 1024x768, 1280x1024
16 bit depth @230 MHz 640x480, 800x600, 1024x768, 1280x1024
32 bit depth @110 MHz 640x480, 800x600, 1024x768, 1280x1024
```

For SuSE 6.1, they are:

```
8 bit depth @230 MHz 640x480, 800x600, 1024x768, 1152x864,
1280x960, 1280x1024, 1600x1000, 1600x1200
16 bit depth @230 MHz 640x480, 800x600, 1024x768, 1152x864,
1280x960, 1280x1024, 1600x1000, 1600x1200
32 bit depth @110 MHz 640x480, 800x600, 1024x768, 1152x864,
1280x960, 1280x1024, 1600x1000
```

If the tests in step 6 above worked, you may want to configure your system to automatically start up X11 when it boots. This can be done several ways. One way is to use the `init(8)` run levels. The file `/etc/inittab` provides the configuration for this, and usually comes with a pre-configured statement for starting `xdm` as part of the run level 5 configuration. For trouble shooting purposes, if you need to explicitly boot to a specific level, you can do so by adjusting the SRM "boot_osflags" parameter. Examples include:

To boot to single user level:

```
P00>>>set boot_osflags "/root=/dev/sda1 bootdevice=sr0 single"
```

To boot to run level 3:

```
P00>>>set boot_osflags "/root=/dev/sda1 bootdevice=sr0 3"
```

Software Overview

Compaq has tested and verified the following software distributions on the DS10 and DS20 systems:

- Red Hat Linux versions 5.2 and 6.0.
- SuSE Linux versions 6.1.

Compaq is aware of other distributions being prepared by other vendors than those listed above, but were unavailable for testing at the time this document was written. The testing process selected a default software configuration so that a minimum amount of software was included in the installation.

Installation Briefs

Creating BOOT and RAMDISK Floppies

Before you can begin to install the Linux software on your AlphaServer, you will need to create a BOOT floppy and RAMDISK. These floppies contain the information required to initiate the installation of Linux. The process varies depending upon what software distribution you are using.

Red Hat Distribution

To create the BOOT and RAMDISK floppies, you will need to make use of a PC which has Internet access. The instructions below detail the process:

1. Create a directory on the PC into which you will copy files for Linux, for example \Linux.
2. Connect to the URL "<ftp://ftp.digital.com/pub/DEC/Linux-Alpha/Images/>" which is a directory containing the latest boot floppy images.
3. If you are installing to a single-CPU AlphaServer, copy the file "generic-up-223.img" to the local system, calling it "genu223.img".
4. If you are installing to a multi-CPU AlphaServer, copy the file "generic-smp-223.img" to the local system, calling it "gens223.img".
5. Insert the Linux CD-ROM into the PC.
6. Copy the file "\dosutils\rawrite.exe" from the CD-ROM to the \Linux directory on the PC.
7. Copy the file "\images\ramdisk.img" from the CD-ROM to the \Linux directory on the PC.
8. Insert a blank, formatted floppy into the PC.
9. Run the command "rawrite -f genu223.img -d a -n" to create the single-CPU floppy, or for the multi-CPU configuration, run "rawrite -f gens223.img -d a -n". Label this floppy "AlphaServer Linux Boot Floppy".
10. Run the command "rawrite -f ramdisk.img -d a -n". Label this floppy "AlphaServer Linux RAMDISK".

With those two floppies in hand, and the CD-ROM removed from the PC, you are now prepared to begin the installation process on your AlphaServer.

SuSE Distribution

To create the BOOT and RAMDISK floppies, you will need to make use of a PC which has Internet access. The instructions below detail the process:

1. Create a directory on the PC into which you will copy files for Linux, for example \Linux.
2. Insert the Linux CD-ROM into the PC.
3. Copy the file ftp://tsx-11.mit.edu/pub/linux/dos_utils/rawrite.exe to "\Linux\rawrite.exe" on the PC. This utility is required to build the floppies.
4. Copy the file "\disks\aboot" from the CD-ROM to the \Linux directory on the PC.
5. Copy the file "\disks\install" from the CD-ROM to the \Linux directory on the PC.
6. Insert a blank, formatted floppy into the PC.

7. Run the command "rawrite -f about -d a -n" to create the floppy. Label this floppy "AlphaServer Linux Boot Floppy".
8. Run the command "rawrite -f install -d a -n". Label this floppy "AlphaServer Linux RAMDISK".

With those two floppies in hand, and the CD-ROM removed from the PC, you are now prepared to begin the installation process on your AlphaServer.

AlphaServer System Resource Manager (SRM)

Since the two Compaq servers discussed in this guide are all based on industry standard components, installation of Linux for all distributions is straightforward.

There are several steps common to all distributions:

1. Power up your system. After several diagnostics are completed, you will be presented an SRM prompt "P00>>>", as shown here:

```

Initializing...
512 Meg of system memory
probing hose 1, PCI
bus 0, slot 7 -- pka -- QLogic ISP1020
probing hose 0, PCI
probing PCI-to-ISA bridge, bus 1
bus 0, slot 5, function 1 -- dqa -- Cypress 82C693 IDE
bus 0, slot 5, function 2 -- dqb -- Cypress 82C693 IDE
bus 0, slot 5, function 3 -- usba -- Cypress 82C693 USB
Testing the System
Testing the Memory
Testing the Disks (read only)
System Temperature is 24 degrees C

AlphaServer DS 20 500 MHz Console T5.4-3, Dec  9 1998 11:49:01
P00>>>

```

2. Determine what devices your system has installed. In particular you will need to note your installation device (a floppy and/or CD-ROM), and your target disk drive. Entering the command "show devices" as shown below will print out the information about your system:

```

P00>>>show device
dka300.3.0.7.1          DKA300          RZ1CF-CF  1614
dka500.5.0.7.1          DKA500          TOSHIBA CD-ROM XM-5701TA  0557
dva0.0.0.0.0           DVA0
pka0.7.0.7.1           PKA0            SCSI Bus ID 7  5.57

```

In the output above, the first line shows that DKA300 is a hard disk, DKA500 is a CD-ROM, and DVA0 is a floppy drive.

3. Configure the system SRM parameters to boot from your installation device. The commands for configuring to boot from the floppy device are shown here:

```

P00>>>set bootdef_dev dva0
P00>>>set boot_file vmlinux.gz
P00>>>set boot_osflags "root=/dev/fd0 load_ramdisk=1 bootdevice=/dev/fd0"
P00>>>show boot*
boot_dev          dva0.0.0.0.0
boot_file         vmlinux.gz
boot_osflags      root=/dev/fd0 load_ramdisk=1 bootdevice=/dev/fd0
boot_reset        OFF
bootdef_dev       dva0.0.0.0.0
booted_dev
booted_file
booted_osflags

```

4. Insert the boot media for the Linux distribution of your choice into the floppy .
5. Boot the system using the "boot" command. The result should be that the system boots from the floppy. You will eventually be prompted to replace the BOOT floppy with the RAMDISK floppy.

If during this process you encounter a problem, such as due to a typographic error in the setting of the SRM parameters, you will probably be stopped with a "aboot>" prompt. The best way to deal with this situation is to reset the system using the reset button on the front panel. Then using the SRM commands, correct the mistake, and repeat the "boot" process.

At this stage, you should now refer to the documentation provided with the vendor software.

NOTES:

There are known problems with SRM version T5.4-4. If your system has this version installed, you must upgrade. In general, it is recommended that you use the most recent version of the SRM. You can find more information about the SRM in the AlphaServer User's Guide Chapter 3.10, document order number EK-AS140-UG.A01.

Disk Partitioning

The process of partitioning your boot disk for Linux on your AlphaServer can be somewhat involved. This sections provides an example of how to calculate and perform the partitioning process. The disk used for this example has 1500 cylinders. The total size in MB divided by number of cylinders gives you MB/cylinder. In this case a 64MB root partition, four 128MB swap partitions and the remaining for the /usr partition is used. It helps to do the math before doing this step.

```

Disk /dev/sda:      128  heads, 32  sectors, 1500  cylinders
Units =           cylinders of 4096  * 512  bytes

```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1		3	33	67568	83	Linux native
/dev/sda2		34	1246	2484224	83	Linux native
/dev/sda3		1247	1309	129024	82	Linux swap
/dev/sda4		1310	1500	391168	5	Extended
/dev/sda5		1310	1372	129008	82	Linux swap
/dev/sda6		1373	1435	129008	82	Linux swap
/dev/sda7		1436	1498	129008	82	Linux swap

You may question why the swap partition is so small. The reason for this is that Linux kernel prior to version 2.2.x cannot deal with a single swap partition larger than 128MB. To get around this you could configure additional 128MB swap partitions. As a general rule of thumb, the total amount of swap allocated on all swap partitions should be about twice that of the amount of RAM in the system. Therefore, if you have 64MB of RAM, 128MB of swap space is generally a reasonable amount to allocate. Systems with a kernel version 2.2.x or newer can allocate up to 2GB swap partitions.

To perform the partitioning operation on the disk, when prompted, follow these steps:

1. Arrow to the drive you will be installing the software to and press the ENTER key. You will now be in the fdisk command line
2. Type "m" for help.

3. Type “p” to print the partition table.
4. If there is partition information already configured for the disk, you will need to delete it using the “d” option. Please be sure that you want to zero out this drive. All data will be lost on the drive doing this.
- 5. Type “b” to edit the BSD disklabel.**
6. If you completed the last step correctly, you should see the following: “/tmp/sdb contains no disklabel. Do you want to create a disklabel? (y/n)” – Answer Y.
7. Type “m” for more help.
8. Type “p” to print the partition table. You should see a “c” partition that takes up the whole disk. This will have to be removed to install Linux correctly
9. Type “d” to delete a BSD partition
10. Type “c” to delete the c partition
11. Type “p” to print the partition table and verify no partitions exist
12. Type “n” to add a new BSD partition – the root partition in this case
13. Never start at the 1st cylinder. By default and to be safe, you should start at the 3rd cylinder. The reason for this is when you are all done you would want to be able to boot off the hard drive and not be forced to boot off floppies. By reserving the first two cylinders for the boot blocks, you will be able to configure the drive to be bootable. More details about this are provided in the next section (Booting from the installed drive).
14. Type “a” for partition a.
15. First cylinder: Type “3”.
16. Last cylinder: Type “50”.
17. Type “n” to add a new BSD partition – the swap partition in this case.
18. Type “b” for partition b.
19. First cylinder: Type “51”.
20. Last cylinder: Type “67”.
21. Type “n” to add a new BSD partition – the usr partition in this case.
22. Type “c” for partition c. Notice that partition “c” here is not the same as the UNIX partition c; it does not take up the whole disk; it is simply the next partition to be created.
23. First cylinder: Type “68”.
24. Last cylinder: Type “256”.
25. Type “p” to print the partition table. You should notice that the fstype is set to unused for each of the partitions. This will have to be changed via “toggle” – see next step.
26. Type “t” to change the partitions filesystem id.
27. Type “a” for partition a – root partitions use a “ext2” code.
28. Type “L” to list the codes you can use.
29. Enter “8” for ext2 type.
30. Type “t” to change the partitions filesystem id.
31. Type “b” for partition b – swap partitions use a “swap” code.

32. Type “L” to list the codes you can use.
33. Enter “1” for swap type.
34. Type “t” to change the partitions file system id.
35. Type “c” for partition c – usr partitions use a “ext2” code.
36. Type “L” to list the codes you can use.
37. Enter “8” for ext2 type.
38. Type “p” to print the partition table – Please verify all your settings.
39. Type “w” to write the disklabel to the disk.
40. Type “q” to quit.
41. Tab to DONE and press ENTER.

Booting from the installed drive

After the software has been loaded to the disk, the system will attempt to reboot. Before it begins the bootup process, press the front panel reset button. This will stop the bootup process, and allow you to make the final configuration changes to be able to boot directly from the disk, instead of the floppy or CD-ROM. You should now be at the SRM prompt, "P00>>>". Enter the following commands to finalize the configuration.

If you have installed SuSE then you need to enter this command:

```
P00>>>set boot_file boot/vmlinuz
```

On all systems, regardless of the distribution you have installed, you need to enter these commands:

```
P00>>>set bootdef_dev dka300
P00>>>set boot_osflags "root=/dev/sda1 bootdevice=sr0"
P00>>>boot dva0
```

Once the system is up, login and do the following:

1. Type: `swriteboot /dev/sdZ /boot/bootlx` (where Z is the letter of the drive you are booting; ex: dka0=sda, dka100=sdb)
2. Type: `"pico /etc/inittab"` – change the initdefault line to this:
id:5:initdefault:

If the "pico" command is not found, then you can use one of the other editor programs on the system, such as "vi". This will automatically run the X Window System when you reboot.

3. Type: `shutdown -h now`

The system may or may not hang here. This is a known issue and is being worked on.

At the SRM prompt, you can now boot directly from the hard drive:

```
P00>>>boot
```

Red Hat

The Red Hat version used in the testing for this guide has a simple installation program. Most of the devices available with the AlphaServer DS10 and AlphaServer DS20 can be correctly

autodetected by Red Hat. Testing for this Solutions Guide was performed using Red Hat Linux versions 5.2 and 6.0.

During the boot process, you may see messages about "IDE STO" errors. These can be safely ignored.

When configuring "Timezones", do not select "Hardware clock set to GMT", nor "Startup through ARC console". Instead select "EST" for the timezone, or the value that is appropriate for your location.

SuSE

SuSE's installation program is flexible. While it allows for autodetection of devices and autoload of device drivers, it allows you to override the automatically configured parameters. Compaq's testing this Solutions Guide was performed using SuSE Version 6.1.

NOTE: During installation, to perform the fdisk operation, you will need to press "ALT+F2" to get to the "# " prompt, followed by typing "fdisk". The instructions for creating partitions earlier in this document should then be followed. Once you have completed the fdisk operation, you can return to the installation screen by pressing "ALT+F1".

To be able to boot directly from the disk drive, be certain to install the "aboot.rpm", which includes the "swriteboot" executable. Without this package, you will only be able to boot from the floppy device.

Building an SMP kernel

This guide is not intended to cover the specifics of building a Linux kernel. Newer Linux distributions will be shipping with a Linux V2.2.x kernel. This information is provided for people using a pre-V2.2.x kernel. For background information on how to build a new Linux kernel, Caldera Systems (<http://www.calderasystems.com/support/techguide/COL12-Kernel-Rebuild.html>) provides excellent documentation. The /usr/src/linux/README file, distributed with all Linux kernel sources, also provides good background for kernel compilation.

They're two basic stages to building an SMP kernel and getting it to run on a Compaq AlphaServer DS20. The first stage is to build the kernel itself. You should refer to <http://www.phy.duke.edu/brahma/smp-faq/smp-faq-3.html>, which is the source for the documentation on building an SMP kernel. The information discussed here is derived from the referenced document, with some commentary and additions for clarification.

To build an SMP kernel, it is necessary to install the sources for the Linux kernel. All of the distributions covered in this document include the kernel sources as an install package. A good place to install the kernel sources is in /usr/src/<kernel-source-identifier> where <kernel-source-identifier> is a directory name which identifies the source, e.g. linux-2.0.36 or linux-2.1.121. Once the kernel sources are installed, it is necessary to create a soft link from /usr/src/linux to /usr/src/<kernel-source-identifier>. This allows /usr/src/linux to indirectly refer to the particular source distribution you choose to use. Assuming that kernel Version 2.0.36 is used, do the following:

```
# su # switches user context to root
Password:
# cd /usr/src
# rm -f linux
# ln -s linux-2.0.36
# exit
```

These steps are useful since they allow you to always compile from `/usr/src/linux`, and are necessary since compilation scripts refer to `/usr/src/linux` explicitly.

In Compaq's testing for this guide, both `SMP` and `SMP_PROF` were uncommented.

Once the *Makefile* is edited and saved, run `make menuconfig` (from a command prompt) or `make xconfig` (from a *xterm*) from `/usr/src/linux`. It is necessary to make the following kernel modifications:

- Be sure that other kernel configuration options are properly set. Some distributions install the kernel sources with a default configuration identical to the kernel that is shipped with the distribution, others do not. It is necessary to build a kernel with proper support for Compaq AlphaServer hardware in order for these guidelines to work. See section, Hardware Overview, for documentation on which device drivers need to be built in to the kernel or configured to be loadable as modules.

After the kernel, modules, and `initrd` pieces (see `initrd` in section below) are rebuilt for `SMP`, shutdown the server and reboot into the System Configuration Utility.

Note: Keep an intact copy of the `initrd` file used as a basis to build an `SMP`-compliant `initrd`, and a non-`SMP` kernel can still reference it for booting in case the `SMP` kernel fails to boot properly.

Appendix A

Linux Links

This is a partial list of available links. If you would like to submit additional sites, please e-mail to the author at chris.stewart@compaq.com. Every attempt will be made to include pertinent sites in future document revisions.

- <http://compaq.com/alphaserver/Linux> : Compaq's AlphaServer information page.
- <http://www.alphalinux.org> : A web site dedicated to information about Linux and Alpha-based computer systems.
- <http://www.linux.org> : The web site of Linux Online.
- <http://www.li.org> : The web site of Linux International.
- <http://www.gnu.org> and <http://www.fsf.org> : The web site of the GNU project and the Free Software Foundation.
- <http://metalab.unc.edu/LDP> : The web site of the Linux Documentation Project.
- [http://www.Red Hat.com](http://www.RedHat.com) : The web site of the Red Hat Linux distribution.
- <http://www.suse.com> : The web site of the SuSE Linux distribution.
- <http://www.insync.net/~frantz/cpqarray.html> : The Compaq SMART/2 Array Controller device driver site.
- <http://www.slashdot.org/> : A useful site for Linux news.
- <http://www.linux.org.uk/SMP/title.html> : Link to useful information on Symmetric Multi-Processing under Linux.
- <http://www.phy.duke.edu/brahma/smp-faq> : Linux SMP FAQ (mirrored from <http://www.irisa.fr/prive/dmentre/smp-faq>).
- <http://www.cs.cmu.edu/People/AUIS/ftp/web/andrew-home.html> : The Andrew Consortium site. You can obtain the Andrew EZ program for viewing Andrew EZ format documents (such as the SMP document posted on the <http://www.linux.org.uk> site).
- <http://www.xfree86.org> : The Xfree86 Project. Most Linux distributions (including Caldera, SuSE and Red Hat) include the free X server developed by this organization.
- <http://www.freshmeat.net> : A large index of ports of software for Linux and other platforms. If you are looking for a particular utility or program, try looking here first.

Appendix B

Kernel Version 2.2

At this time, only some of the distributions covered in this Solutions Guide include the 2.2 version of the Linux kernel. However, Appendix B attempts to direct you to the location of detailed information on this kernel. This guide further outlines a successful installation of the 2.2 kernel to AlphaServer DS10 and AlphaServer DS20 computers, and to validate the new kernel on these systems.

The most important area to address is the location of information regarding the new 2.2 kernel version. Several links outline this below:

- <ftp://ftp.us.kernel.org/pub/linux/kernel/v2.2> – Location of the Linux kernel 2.2 archives. This location is a U.S. mirror.
- <http://www.kernel.org/mirrors> – Listing of kernel.org mirrors throughout the world.
- <http://www-stu.calvin.edu/~clug/users/jnieho38/goto22.html> – Jon Niehof's 2.2 kernel upgrade HOWTO.
- <http://metalab.unc.edu/LDP/HOWTO/Kernel-HOWTO.html> – A basic Linux kernel HOWTO guide from the Linux Documentation Project.
- <http://roadrunner.swansea.linux.org.uk/clue.html> – Alan Cox's Clue-Point-Two site with helpful information on building the 2.2 kernel.
- <http://linxtoday.com/stories/296.html> – Linux Today's guide to the 2.2 kernel.

The upgrade is currently non-trivial. This section does not include detailed information and refers you to the above-mentioned links to cover the basic 2.2 kernel details. The www-stu.calvin.edu site in particular provides very good information for building the 2.2 kernel, as well as a few warnings about necessary upgrades of supporting pieces of the operating system. The other mentioned sites, as well as the `/usr/src/linux/Documentation/Changes` file, also provide the necessary information for advanced users who wish to build the new kernel into their distribution. These documents provide pertinent well-written information for the necessary procedures to incorporate the new kernel.

Glossary

A

Availability - Refers to the amount of time that an application is available to perform work, typically measured in percentage of uptime.

B

Bootstrap – The act of passing control over a computer to an operating system following system power-up.

C

CPU – Central Processing Unit

D

E

F

G

GB – Gigabytes

H

I

IDE – Integrated Development Environment

IP – Internet Protocol – The part of TCP/IP Protocol set that provides the routing mechanism.

J

K

L

M

Man pages - Manual pages

MIB – Management Information Base – Set of monitored items that management application and management agents use to monitor, analyze, and control the operation of managed devices.

MB - Megabytes

N

NIC – Network Interface Card

O

P

Q

R

RAID – Redundant Array of Independent Disks

S

SRM – System Resource Manager, used to configure the bootup parameters of Compaq AlphaServers.

System Partition – The name of the bootable partition used to configure Compaq AlphaServers.

Switch – A switch is a network device that selects a path or circuit for sending a unit of data to its next destination.

T

TCP/IP – Protocol that manages the transmission of packets on a network and checks for errors.

U

URL – Universal Resource Locator – the name of a specific resource on the Internet.

V

W

XYZ

YaST – The setup and configuration utility provided by SuSE for their Linux distribution.