Debian GNU/Linux Installation Guide

Debian 'Etch' (4.0R2)

2008

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This document is a condensed version (with additions) of the "Debian GNU/Linux Installation Guide". A full version of this manual is available on the USQ Debian GNU/Linux DVD.

This document was prepared with LaTeX, as implemented in Debian GNU/Linux.

The fonts used in this document are ITC Garamond, Computer Modern San Serif and Computer Modern Typewriter.

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Chapter 1

Introduction

1.1 About this guide

This installation guide is a shortened version of the official Debian/Linux installation manual. It also has many additions to help with the installation of Debian GNU/Linux from the USQ DVD.

The full Debian GNU/Linux installation manual can be found on the USQ Debian DVD in HTML form in the directory `doc/manual/en`

1.2 What is GNU/Linux?

The most important part of an operating system is the kernel. The kernel's primary purpose is to manage the computer's resources: manage the computer's memory; allocate CPU time and other resources to running programs; read and write data to hard disks, tapes, printers, the keyboard, the mouse, displays, network cards etc. In a GNU/Linux system, Linux is the kernel component. The rest of the operating system consists of all the other programs, many of which were written by or for the GNU Project[1]. Since the Linux kernel alone does not form a working operating system, the term "GNU/Linux" is a better way to refer to operating systems that many people casually refer to as "Linux".

1.3 What is Debian?

Debian is an all-volunteer organisation dedicated to developing free software. The Debian Project began in 1993, when Ian Murdock issued an open invita-

[1] `http://www.gnu.org`

tion to software developers to contribute to a complete and coherent software distribution based on the relatively new Linux kernel. That small band of enthusiasts, originally funded by the Free Software Foundation, has grown over the years into an organisation of over 1000 Debian Developers. An extremely large user base, combined with a bug tracking system ensures that problems are found and fixed relatively quickly.

Debian is especially popular among advanced users because of its technical excellence and its deep commitment to the needs and expectations of the Linux community. Debian also introduced many features to Linux that are now commonplace. For example, Debian was the first Linux distribution to include a package management system for easy installation and removal of software. It was also the first Linux distribution that could be upgraded without requiring re-installation.

The feature that most distinguishes Debian from other Linux distributions is its package management system. These tools give the administrator of a Debian system complete control over the packages installed on that system, including the ability to install a single package or automatically update the entire operating system. Individual packages can also be protected from being updated. You can even tell the package management system about software you have compiled yourself and what dependencies it fulfils.

The current stable Debian distribution provides over 18,700 packages.

There are a number of distributions based on Debian. Some well known distributions based on Debian are Ubuntu, Xandros, and Knoppix.

1.4 Why Debian at USQ?

The requirements for a teaching/learning platform is that:

- it is stable.
- it is freely available with source.
- it works on most hardware, especially new hardware,
- it has a large active user base.
- it conforms to Unix practices and standards with file structure and documentation.
- there are no radical variation between distributions.
- it has all the software required for USQ courses.
- it uses a robust package system.

- It does not hide the underlying operating system

There are a number of popular distributions that meet nearly all the requirements above even better than Debian.

The advantage Debian has over many more polished products is that it is a system designed by programmers/system administrators for programmers/system administrators—which makes it an ideal teaching/learning platform. More commercial products (even those based on Debian) hide the underlying operating system and protocols from the user—they are aiming at a MS-Windows market.

Debian is also an extensively documented operating system that has published a number of guidelines for developers:

- The *Debian Social Contract* (`http://www.debian.org/social_contract`) is a statement of Debian's commitments to the Free Software Community.
- The *Debian Free Software Guidelines* (`http://www.debian.org/social_contract#guidelines`) are a clear and concise statement of Debian's criteria for free software.
- The *Debian Policy Manual* (`http://www.debian.org/doc/debian-policy`) is an extensive specification of the Debian Project's standards of quality.

that ensures the stability of the operating system and the stability of the packages.

Chapter 2

System Requirements

2.1 CPU

Debian has been ported to more computer architectures than any other operating system. Though Debian supports 13 different architectures, the Department of Mathematics and Computing can only support one architecture—the Intel 386 32-bit instruction set (i386).

All Pentium and later 32-bit Intel and AMD CPUs can run the 386 instruction set. Most 64-bit Intel and AMD CPUs should also be able run the 386 instruction set. Despite its name—the Intel 386 and earlier CPUs cannot run the i386 kernels.

2.2 System I/O Bus

The system bus is the part of the motherboard which allows the CPU to communicate with peripherals such as storage devices. All personal computers sold in recent years use either ISA, EISA, PCI, MCA or VLB—the kernel supports all these.

2.3 Graphics Card Support

Debian's support for graphical interfaces is determined by the underlying support found in X.Org's X11 system. Most AGP, PCI and PCIe video cards work under X.Org. Details on supported graphics buses, cards, monitors, and pointing devices can be found at `http://www.x.org/`. Debian 4.0 ships with X.Org version 7.1.

Proprietary X11 drivers are available free from some graphics card manufacturers—

most notably NVidia and ATI. For some newer graphics cards these can improve the display considerably.

2.4 Laptops

Laptops are also supported. Laptops are often specialised or contain proprietary hardware. To see if your particular laptop works well with GNU/Linux, see the Linux Laptop pages at `http://www.linux-laptop.net`. This site has extremely useful information on installing Linux on Laptops.

2.5 Multiple Processors

Multiprocessor support — also called "symmetric multiprocessing" or SMP — is available for i386 architecture. The standard Debian 4.0 kernel image was compiled with SMP-alternatives support. This means that the kernel will detect the number of processors (or processor cores) and will automatically deactivate SMP on uniprocessor systems.

2.6 DVD Reader

The installation media supplied by the Department of Mathematics and Computing is one DVD-ROM. To install Debian on your computer you will need a DVD reader.

The Debian install kernel should be able to auto-detect your DVD reader— SCSI, SATA and IDE/ATAPI DVD readers are supported.

If you only have a CD-ROM reader Debian is also available on CDs — from the Debian Web site (`http://www.debian.org/`).

2.7 Network Cards

Almost any network interface card (NIC) is supported by the Linux kernel should also be supported by the installation system; modular drivers should normally be loaded automatically. This includes most PCI and PCMCIA cards. Many older ISA cards are supported as well.

2.8 Wireless Network Cards

Wireless NICs are generally supported as well, with one big proviso. A lot of wireless adapters require drivers that are either non-free or have not been accepted into the official Linux kernel. These NICs can generally be made to work under Debian GNU/Linux, but are not supported during the installation.

In some cases the driver you need may not be available as a Debian package. You will then have to look if there is source code available in the Internet and compile the driver yourself. How to do this is outside the scope of this manual. If no Linux driver is available, your last resort is to use the *ndiswrapper* package, which allows you to use a Windows driver.

Chapter 3

Before Installing Debian GNU/Linux

This chapter deals with the preparation for installing Debian before you even boot the installer. This includes backing up your data, gathering information about your hardware, and locating any necessary information.

Here is a road map for the steps you will take during the installation process.

1. Backup the documents or data that are on the hard disk where you plan to install Debian GNU/Linux.
2. Gather information about your computer and any needed documentation, before starting the installation
3. Create partition-able space for Debian on your hard disk. This means that you plan to install GNU/Linux on its own disk or in its own partition.
4. Set the BIOS of your computer to boot from the DVD Reader first.
5. Boot the installation system from the DVD.
6. Select the installation language and locale.
7. Create the partitions on which Debian will be installed.
8. Watch the automatic install/setup of the *base system*.
9. Select the tasks you wish your system to perform—*Desktop*, *Web Server* etc.
10. Watch the automatic install/setup of the *layered software*.

11. Install a *boot loader* onto the Master Boot Record (MBR) of the disk. The boot loader will be able to start Debian GNU/Linux or your existing system.

12. Boot into the newly installed system for the first time.

3.1 Back Up Your Existing Data!

Before you start, make sure to back up every important file that is now on your system. If this is the first time a non-native operating system has been installed on your computer, it's quite likely you will need to re-partition your disk to make room for Debian GNU/Linux. Anytime you partition your disk, you run a risk of losing everything on the disk, no matter what program you use to do it. The programs used in installation are quite reliable and most have seen years of use; but they are also quite powerful and a false move can cost you. Even after backing up, be careful and think about your answers and actions. Two minutes of thinking can save hours of unnecessary work.

If you are creating or restoring a multi-boot system, make sure that you have the distribution media of any other present operating systems on hand. Especially if you repartition your boot drive, you might find that you have to reinstall your operating system's boot loader, or in some cases the whole operating system itself and all files on the affected partitions.

3.2 Information You Will Need

Table 3.1 contains a list of the hardware information you *may* need. If you do not have all of this information—Don't Panic—the `debian-installer` is good at querying the hardware and finding out for itself what it needs to know. If the installer does require information from you and you don't know what it is talking about just hit the **Enter** key and move to the next part of the install. The installer will try and choose reasonable values.

3.2.1 Documentation

The document you are now reading in hard-copy format or on another computer not the one you are about to install GNU/Linux on.

The full Debian GNU/Linux installation manual may also be required. The full manual can be found on the installation disk.

3.2.2 Finding Sources of Hardware Information

In many cases, the installer will be able to automatically detect your hardware. But to be prepared, we do recommend familiarising yourself with your hardware before the install.

Hardware information can be gathered from:

- The manuals that come with each piece of hardware.
- The BIOS setup screens of your computer. You can view these screens when you start your computer by pressing a combination of keys. Check your manual for the combination. Often, it is the **Delete** key or a function key.
- The cases and boxes for each piece of hardware.
- The System window in the Windows Control Panel.
- System commands or tools in another operating system, including file manager displays. This source is especially useful for information about RAM and hard drive configuration.
- Your system administrator or Internet Service Provider. These sources can tell you the settings you need to set up your networking and e-mail.

Network Settings

If your computer is connected to a network via an Ethernet or equivalent connection you should ask your network's system administrator for the following information:

- Your host name (you may be able to decide this on your own).
- Your domain name.
- Your computer's IP address.
- The netmask to use with your network.
- The IP address of the default gateway system you should route to, if your network *has* a gateway.
- The system on your network that you should use as a DNS (Domain Name Service) server.

Table 3.1: Hardware Information that May be Required for an Install

Hardware	**Information you might need**
Hard Drives	– How many you have. – Their order on the system. – Whether IDE, SATA or SCSI (most older systems are IDE, newer systems are SATA) – Available free space. – Partitions and their sizes. – Partitions where other operating systems are installed.
Monitor	– Model and manufacturer. – Resolutions supported. – Horizontal refresh rate. – Vertical refresh rate. – Colour depth (number of colours) supported. – Screen size.
Video Card	– Model and manufacturer. – Video RAM available. – Resolutions and colour depths supported (these should be checked against your monitor's capabilities).
Mouse	– Type: serial, PS/2, USB, Bluetooth. – Port – Manufacturer – Number of Buttons
Network	– Model and manufacturer (If wireless also the chipset used - these can be different for the same model number). – Type of Adapter
Printer	– Model and manufacturer. – Printing resolutions supported.

On the other hand, if your administrator tells you that a DHCP server is available and is recommended, then you don't need this information because the DHCP server will provide it directly to your computer during the installation process.

If you use a wireless network, you should also find out:

- The ESSID of your wireless network.
- The WEP security key (if applicable).
- The WPA security key (if applicable).

3.3 Pre-Partitioning for Multi-Boot Systems

Partitioning your disk simply refers to the act of breaking up your disk into sections. Each section is then independent of the others (see Appendix B for a detailed discussion of disk partitions for a PC).

If you already have an operating system on your system (Windows 9x, Windows NT/2000/XP/Vista, OS/2, MacOS, Solaris, FreeBSD, ...) and want to install Linux on the same disk, you will need to repartition the disk. Debian requires its own hard disk partitions. It cannot be installed on Windows or MacOS partitions.

You can find information about your current partition setup by using a partitioning tool for your current operating system, such as fdisk, PartitionMagic, or GParted (See Appendix D). Partitioning tools always provide a way to show existing partitions without making changes.

In general, changing a partition with a file system already on it will destroy any information there. Thus you should always make backups before doing any repartitioning.

If your computer has more than one hard disk, you may want to dedicate one of the hard disks completely to GNU/Linux. If so, you don't need to partition that disk before booting the installation system; the Debian installer's included partitioning program can handle the job nicely.

If your machine already has multiple partitions, and enough space can be provided by deleting and replacing one or more of them, then you too can wait and use the Debian installer's partitioning program.

3.3.1 Re-install Windows

If you currently have one hard disk with one partition (a common setup for desktop computers), and you want to multi-boot the native operating system

and Debian, then the safest way is to reinstall Windows and during the install process leave enough space for GNU/Linux as either free space on the disk or as an empty partition.

Remember that you will have to install Windows on the *first* partition (the C-drive). Though later MS-Windows versions offer you a choice of which partition you wish to install on—MS-Windows still expects that key parts of the its boot loader and kernel be on the first partition. Installing GNU/Linux on the first partition will overwrite these key components and make MS-Windows unbootable.

GNU/Linux can be installed on any partition either "primary" or "logical".

You will need to:

- Back up everything on the computer.
- Boot from the native operating system installer media such as a CD-ROM.
- Use the native partitioning tools to create native system partition(s). Leave either a place holder partition or free space for Debian GNU/Linux.
- Install the native operating system on its new partition.
- Boot back into the native system to verify everything's OK.
- Boot the Debian installer to continue installing Debian

3.3.2 Resizing existing Partitions

There are a number of partitioning tools that can be used to resize existing partitions without destroying the file systems and files on the partitions. The commercial product PartitionMagic is one, the freeware GParted is another (see Appendix D).

Before using any partition tool you need to clean-up the file system on the partition you wish to resize. First delete or archive any files you do not need or want. Under MS-Windows you can use the system tool "disk clean".

Disk space is administered by the operating system in units of a *block*. The size of this unit varies across file systems and is also adjustable. Files come in any size. They do not come in multiples of blocks. Since the block is the smallest writable unit this means that there is some wastage at the end of every file. The size of the block can be adjusted to minimise this wastage, that is made small. Unfortunately data transfer is faster for large contiguous chunks of data. A compromise size is chosen.

When a file is written to disk the operating system tries to write the file on disk into contiguous blocks. Since files are often accessed in a sequential

manner noncontiguous placement of blocks is bad for performance. It forces the operating system to split a disk access and the disk to move the read head. This slows the data read considerably. When files become split over the disk this is known as *fragmentation*, this is a common problem with DOS file systems, but not with later generation file systems.

MS-Windows comes with a disk defragmenter (in "System Tools"). Defragment the partition you are planning to resize—even if the disk defragmenter says it is not required.

MS-Windows has a tendency to scatter files all over a partition not just at the start. Fragmented files will make it harder for the partitioning tool to move files to the front of the partition before chopping the end off the partition.

Before using any partitioning tool backup your disk and read the documentation for the particular tool.

> **Warning:** Irrespective of what software you use any attempt to modify a disk's partition table and preserve the contents of the partition is *Dangerous*—there is no guarantee that the data on the entire disk will not be lost. So before attempting to modify the partition table of any disk be sure to backup all the valuable data on the disk—not just the partition to be modified.

3.4 How much space for Debian?

The USQ Debian install will take 2.4 GBytes of space. Additional space will be needed for "swap", system log files and user files (see Appendix C).

We suggest a minimal install would be 5Gbytes—larger would be better and would allow for unexpected expansion (installation of extra software).

Before the install you should have this amount of space available for GNU/Linux. The space can be a free partition or just free disk space that does not belong to any partition. The final partitioning of the space will be done during the install by the *debian-installer*.

During the installation the free disk space available for Debian will have to be partitioned. We suggest one of two scenarios: 2 partitions or 3 partitions.

3.4.1 2 Partition Scenario

In this scenario one partition is reserved for "swap" and one partition for everything else.

First calculate the amount of swap space you will need—the "rule of thumb"

for machines with little memory is the swap space should be twice the amount of RAM. For machines with gigabytes of RAM the amount of swap should be the same size as the memory. In both cases the maximum swap should not exceed 2 GBytes and there is probably no need to exceed 1 GByte.

The space left over will all be allocated to the root file system.

3.4.2 3 Partition Scenario

As in the "2 Partition Scenario" first calculate the amount of swap space you will need. The remaining space should be split into two partitions: one for root and one for `/home`—that is the user files should be in a separate partition. The advantage of this is that GNU/Linux can be reinstalled without affecting the user's files. A reinstall is normally done if you are changing flavours of GNU/Linux or there is a major upgrade of the flavour you are using—GNU/Linux should never require a reinstall because it appears to be damaged. Most problems can be solved without reinstalling.

Assign about 1Gbyte to `/home` and the rest to `/` root. Root should have at least 3Gbytes of space and preferably more.

Chapter 4

Installation

4.1 How the Installer Works

The Debian Installer consists of a number of special-purpose components to perform each installation task. Each component performs its task, asking the user questions as necessary to do its job. The questions themselves are given priorities, and the priority of questions to be asked is set when the installer is started.

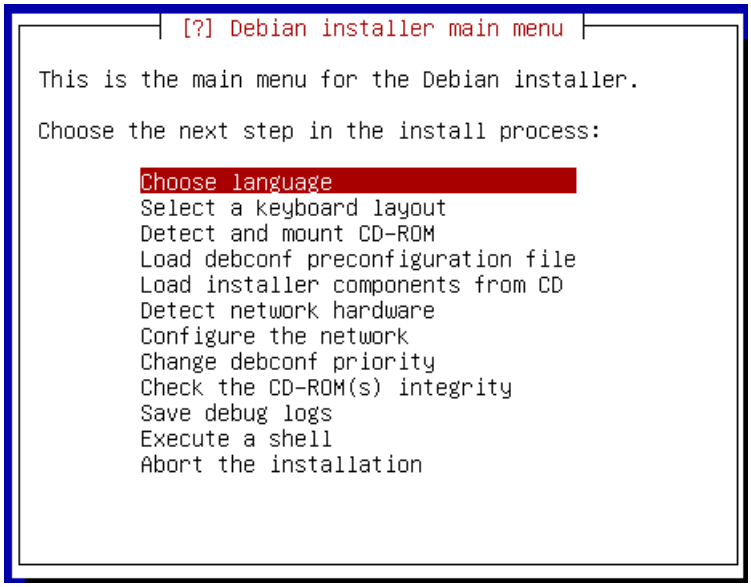
When a default installation is performed, only essential (high priority) questions will be asked. This results in a highly automated installation process with little user interaction. Components are automatically run in sequence; which components are run depends mainly on the installation method you use and on your hardware. The installer will use default values for questions that are not asked.

If there is a problem, the user will see an error screen, and the installer menu (see Figure 4.1) may be shown in order to select some alternative action. If there are no problems or the user never needs to go back, the user will never see the installer menu, but will simply answer questions for each component in turn.

The normal installer display is character-based (as opposed to the now more familiar graphical interface). The mouse is not operational in this environment. Here are the keys you can use to navigate within the various dialogs—

- The **Tab** or **right arrow** keys move "forward"
- The **Shift-Tab** or **left arrow** keys move "backward" between displayed buttons and selections.
- The **up arrow** and **down arrow** select different items within a scrollable list, and also scroll the list itself. In addition, in long lists, you can

Figure 4.1: The Installer Menu—normally never seen.



type a letter to cause the list to scroll directly to the section with items starting with the letter you typed and use **Pg-Up** and **Pg-Down** to scroll the list in sections.

- The **space bar** selects an item such as a checkbox.
- Use **Enter** to activate choices.

Error messages and logs are redirected to the fourth console. You can access this console by pressing **Left Alt-F4** (hold the left Alt key while pressing the F4 function key); you can return to the main installer process with **Left Alt-F1**.

These messages can also be found in `/var/log/syslog`. After installation, this log is copied to `/var/log/installer/syslog` on your new system. Other installation messages may be found in `/var/log/` during the installation, and `/var/log/installer/` after the computer has been booted into the installed system.

A limited shell console is available on console two. You can access this console by pressing **Left Alt-F2** and you then have root access to the installer's file system.

Figure 4.2: The Installer boot screen.

4.2 Installation — Step by Step

In this section we will describe each installer component in detail. The components have been grouped into stages that should be recognisable for users. They are presented in the order they appear during the install. Note that not all modules will be used for every installation; which modules are actually used depends on the installation method you use and on your hardware.

4.3 Setting up Debian Installer and Hardware Configuration

Let's assume the Debian Installer has booted and you are facing its first screen (see Figure 4.2). At this time, the capabilities of `debian-installer` are still quite limited. It doesn't know much about your hardware, preferred language, or even the task it should perform. Don't worry. Because `debian-installer` is quite clever, it can automatically probe your hardware, locate the rest of its components and upgrade itself to a capable installation system. However, you still need to help `debian-installer` with some information it can't determine automatically (like selecting your preferred language, keyboard layout or desired network mirror).

You will notice that `debian-installer` performs hardware detection several times during this stage. The first time is targeted specifically at the hardware needed to load installer components (e.g. your CD-ROM or network card). As

not all drivers may be available during this first run, hardware detection needs to be repeated later in the process.

4.4 Check available memory/low memory mode

One of the first things `debian-installer` does, is to check available memory. If the available memory is limited, this component will make some changes in the installation process which hopefully will allow you to install Debian GNU/Linux on your system.

4.5 Selecting Localisation Options

In most cases the first questions you will be asked concern the selection of localisation options to be used both for the installation and for the installed system. The localisation options consist of language, country and locales.

The language you choose will be used for the rest of the installation process, provided a translation of the different dialogs is available. If no valid translation is available for the selected language, the installer will default to English.

The selected country will be used later in the installation process to pick the default timezone. Language and country together will be used to set the default locale for your system and to help select your keyboard.

4.6 Choosing a Keyboard

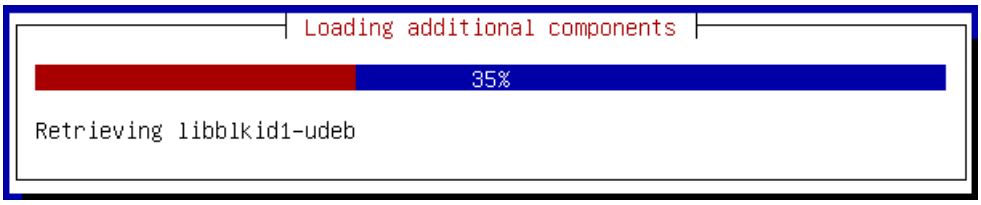
Keyboards are often tailored to the characters used in a language. Select a layout that conforms to the keyboard you are using, or select something close if the keyboard layout you want isn't represented. Once the system installation is complete, you'll be able to select a keyboard layout from a wider range of choices (run **kbdconfig** as root after you have completed the installation).

4.7 Scanning the DVD-ROM

The `debian-installer` will then attempt to auto-detect your hardware and load the appropriate hardware drivers.

If this step is successful the installer will scan the DVD-ROM in the DVD reader, ensure that it is a correct Debian archive and then load installer components from the DVD-ROM (see Figure 4.3). These components expand the capabilities of the installer—without them the installation will fail.

Figure 4.3: The Installer loading components from the DVD-ROM. Without them the install will fail.



4.8 Configuring the Network

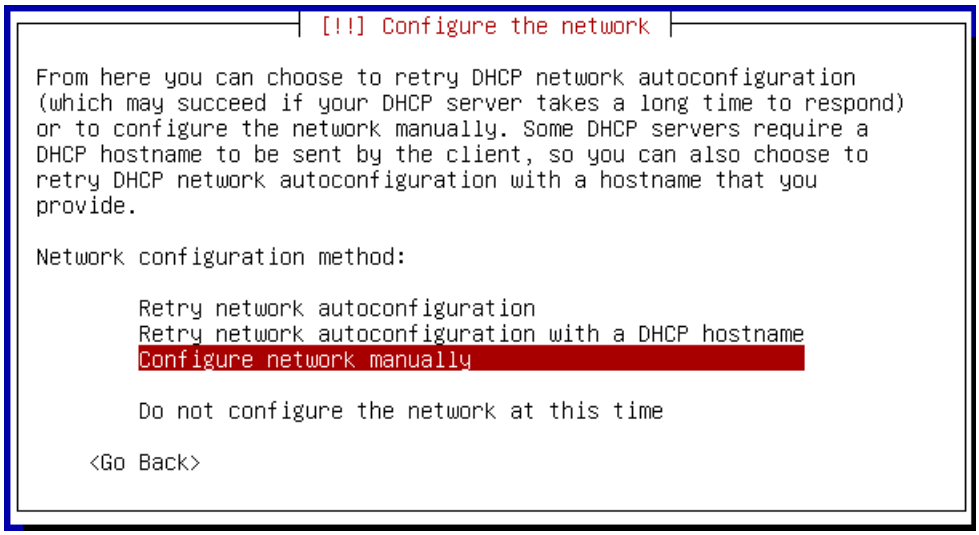
As you enter this step, if the system detects that you have more than one network device, you'll be asked to choose which device will be your *primary* network interface, i.e. the one which you want to use for installation. The other interfaces won't be configured at this time. You may configure additional interfaces after installation is complete; see the `interfaces(5)` man page.

By default, `debian-installer` tries to configure your computer's network automatically via DHCP. If the DHCP probe succeeds, you are done. If the probe fails, it may be caused by many factors ranging from unplugged network cable, to a misconfigured DHCP setup. Or maybe you don't have a DHCP server in your local network at all. For further explanation, check the error messages on the fourth console. In any case, you will be asked if you want to retry, or if you want to perform a manual setup. DHCP servers are sometimes really slow in their responses, so if you are sure everything is in place, try again.

As the USQ GNU/Linux installation will be from the DVD-ROM it is not necessary to configure the network at all. If you do not have the network information at the time of installation then it is perfectly safe to select the option "Do not configure the network at this time". Network configuration can be safely delayed until after the installation is complete (see Figure 4.4).

If you choose the manual network setup you will be asked a number of questions about your network, notably IP address, Netmask, Gateway, Name server addresses, and a Hostname. Moreover, if you have a wireless network interface, you will be asked to provide your Wireless ESSID and a WEP key. Fill in the answers from Section 3.2, "Information You Will Need".

Figure 4.4: Network configuration. Choosing not to configure the network will not effect a DVD-ROM install.



4.9 Partitioning and Mount Point Selection

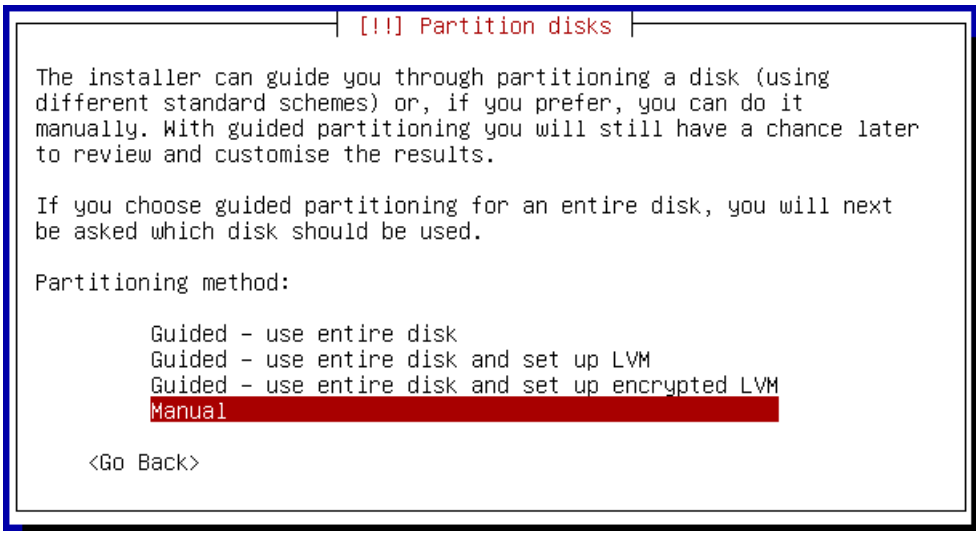
At this time, after hardware detection has been executed a final time, the installer should be at its full strength, customised for the user's needs and ready to do some real work. As the title of this section indicates, the main task of the next few components lies in partitioning your disks, creating file systems, assigning mount points and optionally configuring closely related issues like LVM or RAID devices.

4.9.1 Manually Partitioning Your Disks

Now it is time to partition your disks.

First you will be given the opportunity to automatically partition either an entire drive, or available free space on a drive. This is also called "guide" partitioning. We do not recommend auto-partitioning, but suggest choosing "Manual" from the menu (see Figure 4.5). (The official Debian Installation manual has more on auto-partitioning).

Figure 4.5: Select the "Manual" option for partitioning the disk.



Creating free space for use with GNU/Linux

Depending on how you partitioned your disk under Windows or with a third party partitioning tool—your disk should have either *free space* or an empty partition you wish to use for GNU/Linux.

If you have free space on the disk (see Figure 4.8) then you can skip this section.

If you have an empty partition on the disk you wish to use for GNU/Linux (see Figure 4.6) then the first step is to *delete* the partition. The partition has to be deleted to create "free space" on the disk so that we can re-partition the "free space" into two or three new partitions depending on the scenario (see Section 3.4 "How much space for Debian?") you have chosen to follow.

Select the partition to be deleted by highlighting it (using the arrow keys) and pressing the **Enter** key (see Figure 4.6). On the new screen—the edit screen for the partition you have selected (check this with the text at the top)—select the last option "Delete the partition" (see Figure 4.7).

When you return to the window with the lists of disks and partitions you should see that the space taken-up by the deleted partition is now free (see Figure 4.8).

Figure 4.6: The list if disks and partition for this system. Choose the Partition you wish to use for GNU/Linux.

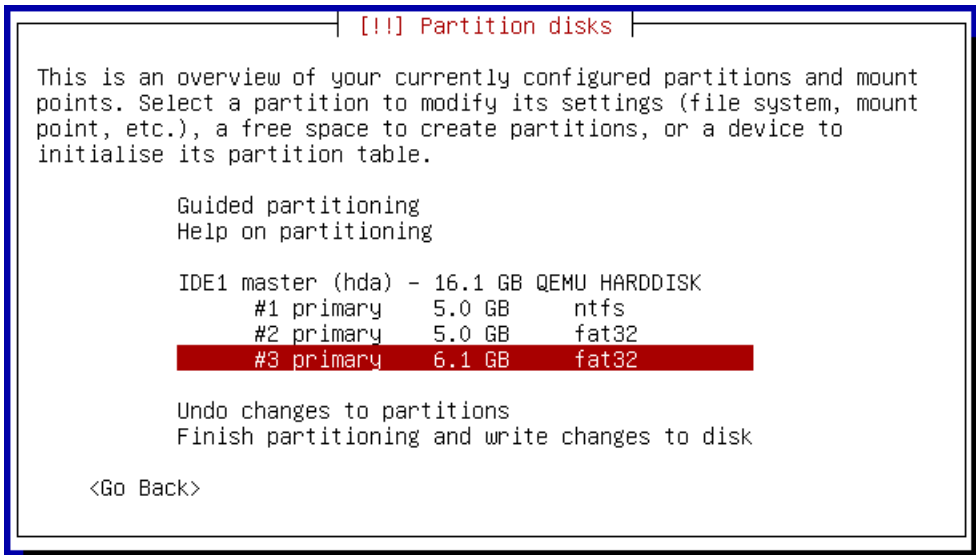


Figure 4.7: The “edit” window for Partition 3 on the IDE1 master disk. Delete the partition to create “free space” to be re-partitioned for GNU/Linux.

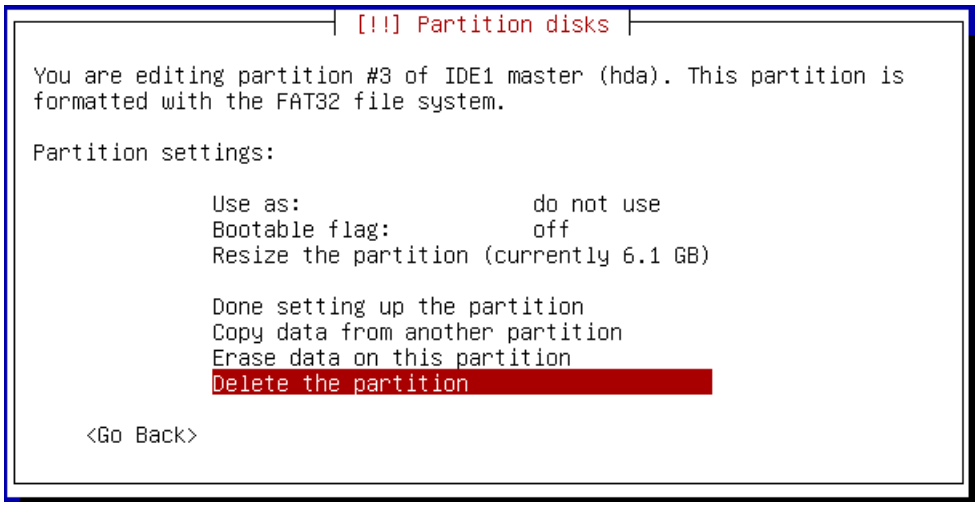
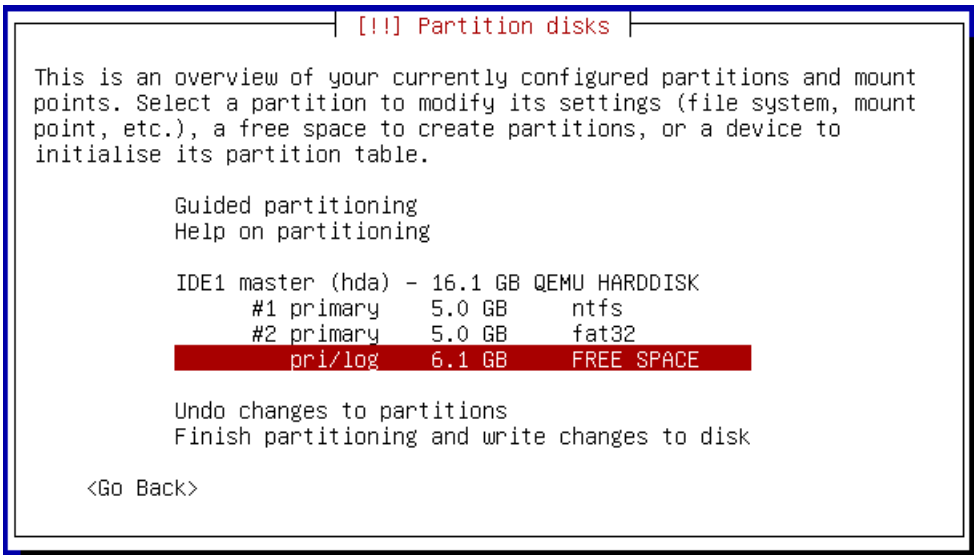


Figure 4.8: The list if disks and partition for this system. We now have "free space" on the disk that can be re-partitioned for GNU/Linux.



Creating a new partition from the free space

From the free space on the disk we will now create the partitions needed by GNU/Linux—either two new partitions or three.

The steps for creating each new partition are:

1. Select the "free space" from the disk/partition list.
2. Select the "create a new partition" option when asked how you wish to use the free space.
3. Choose the new partition's size (except for the last partition—let the partitioner choose the remaining free space).
4. Choose the type for the new partition "primary" or "logical" (see appendix B)
5. Choose which part of the free space the partition will use—either at the beginning of the free space or at the end.
6. Choose the file system that will be placed on the partition.
7. Choose the "mount point" for the partition (see Appendix A.3). That is how GNU/Linux will place the file system in its directory tree.

Figure 4.9: The root partition. The installer will install the GNU/Linux operating system onto the Root partition. The root partition has mount point "/".

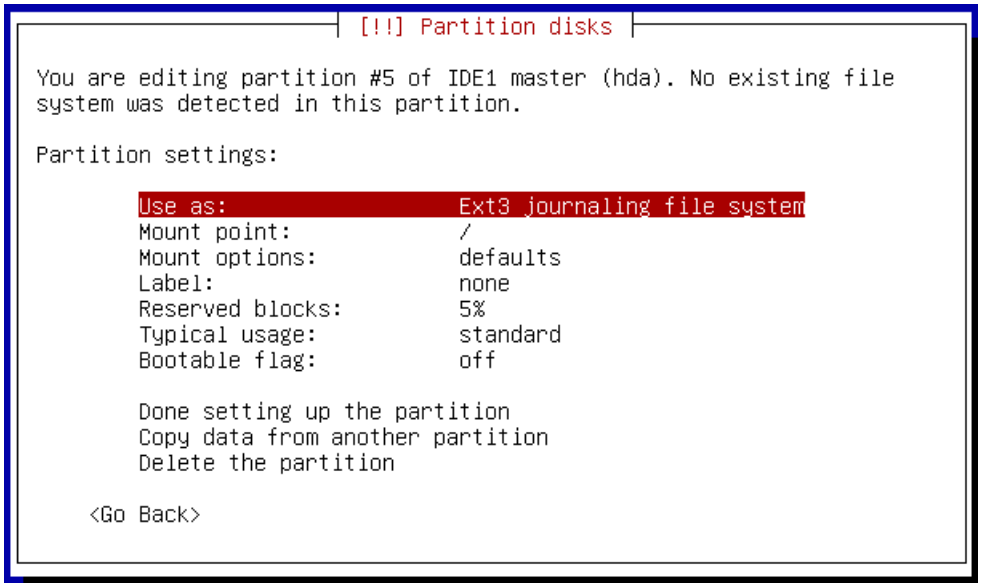
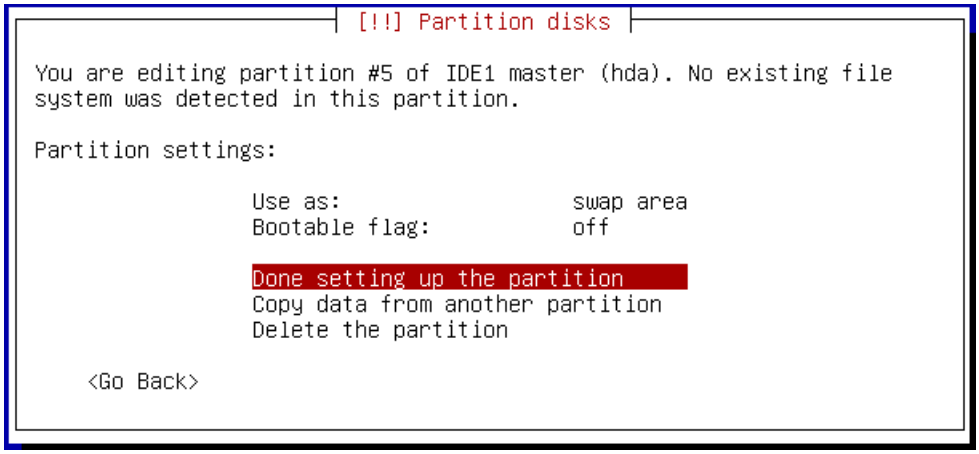


Figure 4.10: The swap partition. The installer knows how to deal with the swap partition so many options are missing



Some notes on the steps above:

- The choice of logical/primary partitions for the new partition is purely a matter of your choice and your disk's partition configuration. remember for a PC there can be only 4 primary partitions or if there are logical partitions only 3 primary partitions and 1 extended partition (see Appendix B).

  Where GNU/Linux resides is unimportant.

- When creating the last partition—do not change the preselected size for the partition—let the partitioner use all of the remaining space. Though the size may say 1.3GB (for example)—this number is rounded to two digits by the installer—for your convenience. If you erase this number and enter 1.3GB—you will find there will be a small amount of free space left over, since 1.3GB is not accurate enough.

- When choosing to use a partition as "swap" you will find that you will not be asked for a "mount point" since the installer knows how "swap" is to be used (see Figure 4.10).

- One of the new partitions **must** be mounted as root—that is the mount point must be "/" (see Figure 4.9).

- The preferred file system to use under GNU/Linux is the "Ext3" file system. This is the files system to use for the root partition and for the "home" partition if you are creating one.

  The "Ext3" uses a journal file on the disk to track disk changes. A journal file helps to maintain the file system integrity.

Writing the New partitions to Disk

When the new partitions have been created and you are happy with them the new partition structure can be written to the disk. Up until this point nothing has been written to disk—so you could safely abandon the install at this point.

After this point the disk will have been modified—and so there is no going back. Before writing the changes to disk be sure to study the disk/partition list screen (see Figure 4.11) and make certain that everything is as you expect.

There is one last chance to abandon the disk write (see Figure 4.12) accepting the changes before they are written to disk. Remember all data on the partitions to be formatted will be lost at this point.

Figure 4.11: Finished partitioning—the new partition table, can be written to the disk and the new partitions formatted. The “f” in front of swap and root show those partitions will be “formatted”.

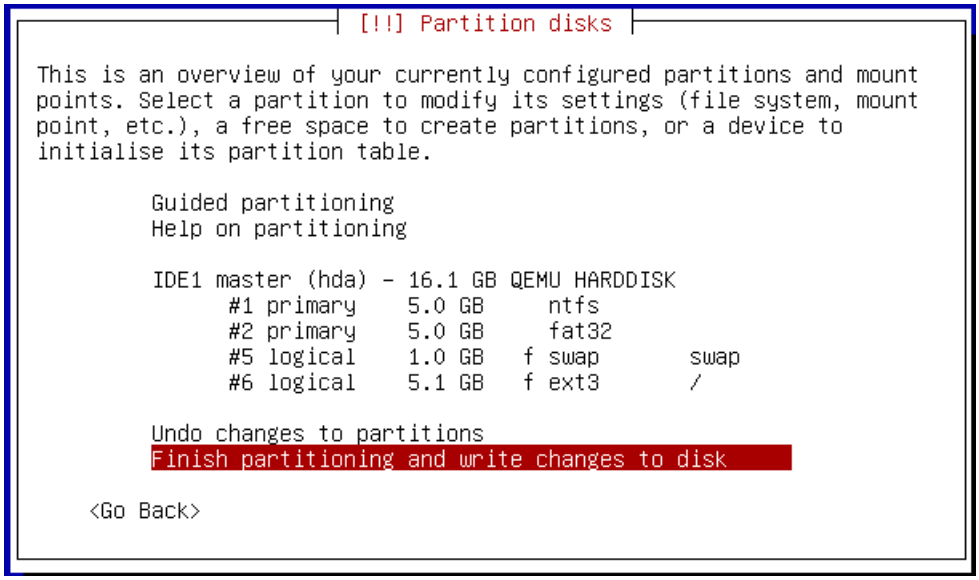
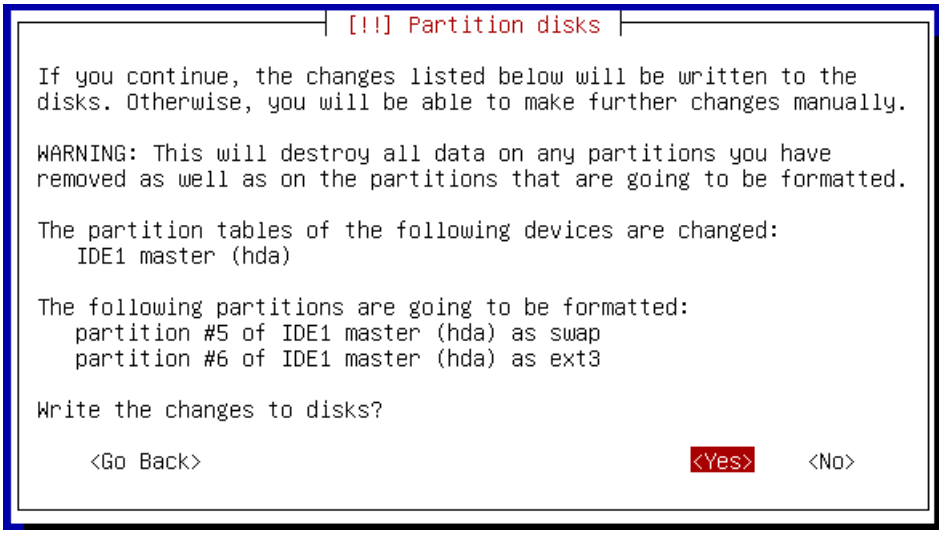


Figure 4.12: Final chance to back out from an irrevocable change to the disk structure.



4.10 Configure Time Zone

The choices available when configuring your time zone will be decided by your country choice at the start of the installation procedure.

4.11 Set up Users and Passwords

In this section you are asked to setup at least two accounts—the system administrator's account and a user's account.

4.11.1 The System Administrator

The Unix system administrator or "root" account or "superuser" account is the most privileged of GNU/Linux user accounts, and is capable of performing any task. It has no restrictions on the actions it can perform. It is used to install packages, upgrade packages, and perform all system maintenance. Logging in as root gives you complete control over your system. No file on your GNU/Linux system is denied access to the superuser. So choose the root password carefully—complex enough so that it is secure—simple enough so that you do not forget it!

The root account should **never** be used as your normal user account—it is far too dangerous for that.

4.11.2 User Accounts

You will be asked to set up at least one user account. This account should be viewed as your work account. This is the account you will use to login to GNU/Linux on a daily basis. The root account must never be used for anything other than administrative purposes—it is far to powerful and dangerous for a normal user account.

You will be asked for the full name of the user (normally your full name). From the full name the installer will suggest a username (login name) for the user, feel free to change this to whatever you want. You will also be asked for a password for the user. This password should be different from the root password.

4.12 Base System Installation

The first components installed onto the root partition is the "base" system. This is the minimum requirement of packages for a running GNU/Linux sys-

tem. After this step you would have a bootable GNU/Linux system on your root partition. It would not be of much use but it would be bootable.

> **Important**: From this point on if you do not understand a question posed by the *debian-installer*—Don't Panic—all questions have the default response highlighted—choose this response if in doubt.

Some of the questions posed in this section are:

- Allow the use of a "Network Mirror". That is, the installer will supplement its DVD-ROM package list from a Debian mirror. Unless you have networking working at this stage and know the URL of a mirror answer "no".
- A red screen may appear and warn you that the installer cannot access security updates. This will happen if you do not have network access at this time. Just continue.
- Debian sorts its over 18,000 packages onto the 4 DVDs or 23 CDs via a popularity contest. That is, you can allow your system to anonymously contact the Debian developers with information on which packages you have installed on your system. Feel free to answer "no" to whether you want to be part of the "popularity" contest.

4.13 Layered Software Installation

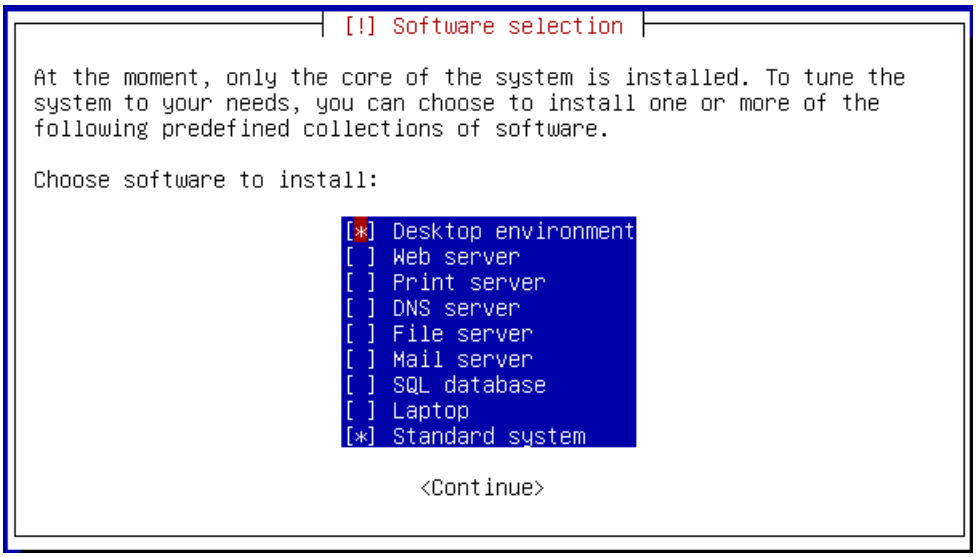
The majority of the software will now be installed. The software to be installed is categorised by tasks (see Figure 4.13). All computers should have "Desktop Environment" and "Standard System" selected. Laptops should also have "Laptop" selected. If the selections are not correct modify them and when they are correct continue.

Approximately 700 packages will now be installed. This includes the standard GNU software for a Unix like system, the X Windowing system with the Gnome Desktop as the default.

4.14 The X Server

The X server is part of the X11 windowing system. Unlike some other operating systems the graphical user interface under Unix is a program run by

Figure 4.13: Software selection based on tasks. “Desktop Environment” and “Standard System” should be selected for all computers—with “Laptop” and extra selection for laptops.



the kernel like any other. You can stop and start it at will. The program that controls your video card and monitor is the *X-server*. The X-server used by Debian is the Xorg X-server (see `http://www.x.org`). The configuration of the X-server is the most complex part of the GNU/Linux installation. Luckily for most video cards the configuration is mostly automatic.

One question that may be asked is the “video modes” that the X-server is to use (see Figure 4.14). The server can switch between video modes so you can select more than one.

If the installer can not auto detect your video card you may also be asked to specify which driver to use. If this happens then always select the “Vesa” driver. This driver should work for all modern video cards.

Important: If the X-server fails to start when you first boot into your new GNU/Linux installation “Don’t Panic”—it can be reconfigured from within GNU/Linux. See Section 5.1

Figure 4.14: The video modes to be used by the X-server.

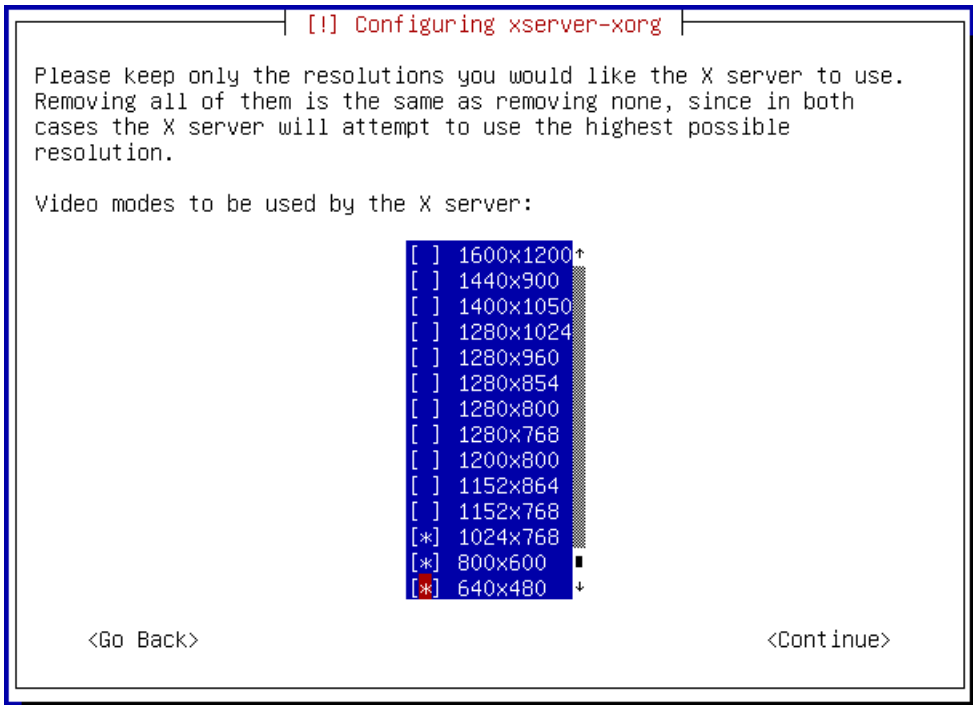
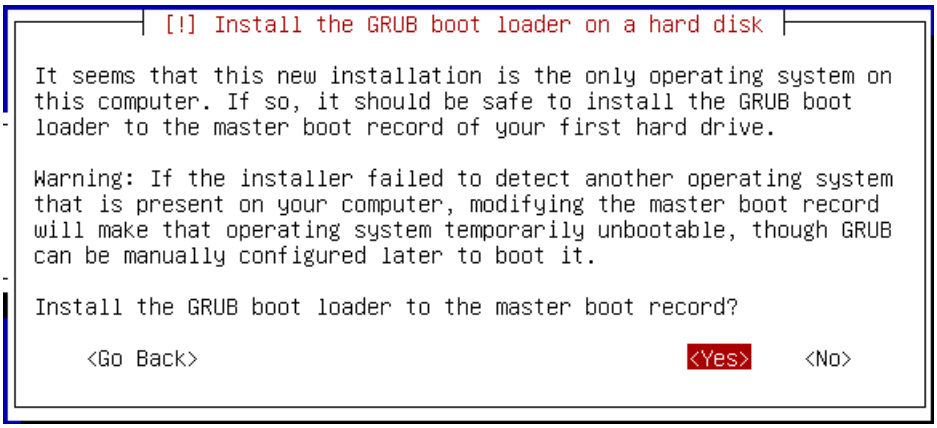


Figure 4.15: The GRUB installation should auto-detect other operating systems. But it may not.



4.15 The GRUB Boot Loader

A *boot loader* allows you to boot GNU/Linux, MS-Windows, or any other operating system from a text-based menu at boot time. If no selection is made at boot time then the boot loader will start the default operating system.

If you are planning to have a multi-boot system, and you already have MS-Windows installed, then a boot loader **must** be installed, and it **must** be installed in the Master Boot Record or MBR. By installing the boot loader in the MBR your PC will boot into the boot loader every time you turn on your machine. From the boot loader you can then select which operating system you would like to run MS-Windows or GNU/Linux.

If for any reason you have to reinstall MS-Windows, then the boot loader will also have to be reinstalled . This is because the MS-Windows installation overwrites the Master Boot Record (this can also happen with some MS-Windows' upgrades).

During the boot loader configuration all bootable partitions should be found on your system (see Figure 4.15). If they are not it will mean you will not have the choice of booting into that operating system at boot time. This can be fixed after installation (see Section 5.2).

The *debian-installer* will set the new GNU/Linux operating system as the default operating system. This default can be changed after installation (see Section 5.2).

4.16 Booting into GNU/Linux

The installation is essentially finished. The installer will clean-up, eject the installation disk and reboot the system.

The default system that GRUB will boot into is GNU/Linux.

Chapter 5

Post-Installation Problems

Sometimes the *debian-installer's* default choices were not correct and the system may need modifications after installation.

5.1 X server

If you are dissatisfied with the screen quality of the X-server it can be reconfigured after installation. Also if the X-server fails to start correctly when you boot into the new system it can be reconfigured from the command line.

From the command line run the command:

```
dpkg-reconfigure xserver-xorg
```

and attempt to answer the questions (many more of them than during the install—but remember "if in doubt accept the default value").

The X-server has many drivers available to it. The one driver that should work with all video cards is the "vesa" driver. If all else fails use the vesa driver.

From within X you can force the restart of the X-server by holding down the **Ctrl** and **Alt** keys and then hitting the **Backspace** key.

If you have an ATI or an NVidia graphics card you can download special GNU/Linux Xserver drivers for free that in many cases provide better quality than the freeware versions.

5.2 GRUB

At boot time GRUB reads a configuration file from the GNU/Linux partition. The configuration file `/boot/grub/menu.lst` is a simple text file that can be edited by root.

5.2.1 Default Operating System

The Debian installer defines the GNU/Linux system as the default operating system. If you want Windows to be the default operating system then you need to edit the GRUB configuration file `/boot/grub/menu.lst`.

After booting into Linux and logging in as `root` start the simple text editor `gedit`.

Near the top of the file you will find the line

```
default 0
```

This is the default Operating System block. Each Operating System block begins with the word "title" GRUB starts counting each OS block from 0.

Count down from the first OS block beginning with zero until you find the one you wish to be the default.

Edit the "default" line and replace zero. Save the file and reboot the machine.

5.2.2 Adding Windows to the Boot Loader

If the installer did not recognise Windows on one of your partitions then it will not have been added to the GRUB configuration file—that will have to be done manually.

After booting into Linux and logging in as `root` the GRUB configuration file `/boot/grub/menu.lst` needs to be edited and the device containing the Windows partition needs to be added.

Start the simple text editor `gedit`. Open the file `/boot/grub/menu.lst` and add the following lines at the bottom of the file

```
title Windows
root (hd0,0)
makeactive
chainloader +1
```

where we have assumed that Windows is on the first partition of the first disk.

Grub counts the drives and the partitions from 0. For example

`(hd0,2)` primary partition 3 of hard disk one
`(hd1,4)` first logical partition 5 of hard disk two
`(hd1,5)` second logical partition 6 of hard disk two

5.2.3 Reinstalling GRUB on the Master Boot Record

The simplest way to do this is to boot into the "rescue mode" of the Debian Installation disk. Reboot your computer with the installation disk in the drive. At the Debian installation prompt type "rescue" and Enter. This starts the Debian installer in "Rescue Mode"—visible in the top left of the screen.

After the normal installer questions you will be asked which partition you wish to mount as root. Choose your GNU/Linux root partition.

You will then be offered the chance to start a shell with the chosen partition as the root file system of the shell. Do so.

In the shell run the command "df" this will give you a list of mounted file systems. The root file system will be mounted on either a SCSI, SATA or IDE device file. For example: `/dev/sda8` or `/dev/hda3`—the disk device should be either `sda` or `hda`.

Now run the command (without a partition number):

```
grub-install /dev/sda
```

or

```
grub-install /dev/hda
```

depending on which disk your root file system is mounted.

Do not specify a partition number—you want GRUB installed on the Master Boot Record of the disk not the boot sector of the partition's file system.

5.3 Networking

Networking configuration under Debian GNU/Linux is to be found in the file `/etc/network/interfaces`, and with the DNS server's addresses in the file `/etc/resolv.conf`

Both files have man page entries in section 5 of the Unix man page system.

Appendix A

GNU/Linux Terminology

A.1 Directories

The term "directory" as used in Unix-like operating systems has exactly the same meaning as the term "folder" as used in MS-windows and MacOS.

A.2 Device Naming

Under Unix all devices are represented by *files*. MS-Windows on the other hand represents disks with a letter (C:; D: etc.). Under Unix **all** devices, such as the keyboard, the mouse, the video card, and disks are represented by a file in the device directory, `/dev`.

By convention device files have certain names and many system programs have knowledge about these names built in. They expect the EIDE disks device file names to begin with `hd`, and SCSI and SATA disk filenames to begin with `sd`. Disks are numbered `a`, `b`, `c` and so on. The first EIDE drive is `/dev/hda`, the second is `/dev/hdb`, and the first SCSI or SATA drive is `/dev/sda`. These device files represent the entire disk starting at block one. Writing to these device files with the wrong tool can render your disk unusable and your system unbootable.

Primary partitions on a disk are represented by the numbers 1, 2, 3 and 4. So `/dev/hda1` is the device file for the first primary partition on the first EIDE disk. Logical partitions have numbers beginning at 5. So `/dev/hdb5` is the first logical partition on the second EIDE disk.

A.3 Mount Points

As stated above, every aspect of the the Unix system exists as some aspect of it's hierarchical file system. A partition or disk has its own Unix file system (such as *Ext3*), to access this file system it must be attached to the operating system's file system hierarchy. The way this is done is through *mount points*. A mount point is an existing directory in the file system hierarchy. It is created like any directory. When a partition's file system is *mounted* or attached to the directory then a simple change directory command will give access to the partition. It should be noted that when a partition's file system is attached to a directory any files inside the directory mount point are hidden and inaccessible.

Partitions are normally attached to empty directories.

A.4 The Root Directory

Unix-like operating system expect everything it needs to run can be found within the **root** directory. As stated above—Unix also uses file naming conventions to locate devices, this means that devices are also children of the root directory. When you wish to specify where GNU/Linux is to be installed, then you simply name that partition as the root directory. Under MS-Windows the root partition is called `C:`, Under GNU/Linux the root partition is attached to the directory `/`. In other words, accessing the `/` directory becomes the same as accessing the partition it represents.

A.5 The Swap file

A swap file is simply an area set aside on the disk for the operating system to dump sections of the computer's memory when required. This is also known as `virtual memory`. MS-Windows uses a swap file as well, but it is normally created dynamically and stored on the same partition as the operating system. While this hides some complexity from the user, it is not as efficient as setting aside a partition strictly for the swap file as GNU/Linux does. GNU/Linux can also use large files within a partition but it is not as efficient.

With RAM now in the Gigabytes—swap files are losing their importance under GNU/Linux.

A.6 The Home Directory

The only partitions required by GNU/Linux are the root partition and the swap partition. This would be a minimalist partitioning for GNU/Linux. It is also not recommended. It is a good idea to create one more partition and attach it to the directory `/home`.

GNU/Linux, unlike MS-Windows and MacOS, was designed from the beginning to be a multi-user system. When multiple users are on a system then disk space can become a premium. Multiple users can use valuable disk space needed by the operating system. By placing users in their own partition separate from the operating system, disk space can be managed more easily

A more important reason for a separate partition for the users is that the operating system can be upgraded or reinstalled without touching the user data. An upgrade or re-installation of the operating system will only effect the the root partition not `/home`.

A.7 X-Window System

The X Windows system, or more correctly X11, is the windowing engine and software library that allows the graphical user interfaces under GNU/Linux to work. Unlike all other other windowing environments X Windows was designed at the outset to be network aware. This means that under X it is possible to start an application on a remote machine and have the application's graphical user interface to appear on the local machine.

As X is network aware it makes a distinction between X servers and X clients. An X client is any application that requires a window on a machine's monitor. The client can be local, that is on the same machine as the monitor, or remote, that is on a completely different networked machine.

An X server is the application running on your machine that controls the monitor and drives the video card. The X client tells the X server (using the X protocol) were it wants its windows and how it wants them drawn. The X server does the actual graphical display.

Normally each machine will have only one X server, but can have any number of X clients.

A.7.1 Desktop Environment

The desktop environment of a user is controlled by a suite of X clients. What clients run and how the environment behaves is dictated by the designers of the environment. There are four main desktop environments available under

GNU/Linux:

- The GNOME desktop environment; the default Debian environment (`http://www.gnome.org/`).
- The K Desktop Environment (KDE) (`http://www.kde.org/`).
- The XFCE desktop environment (`http://www.xfce.org/`).
- Build your own by choosing your own Window Manager and tools.

A.7.2 Window Manager

There is one special client in the X-window system—the Window Manager. There will only be one Window Manager running at any one time. The Window Manager is the program that adds the decoration around windows and is the interface between you and the windows. It allows you to move, resize, iconify and delete windows. It is the program that controls the desktop.

There are many Window Managers available for the X-Window system.

Appendix B

Partitions

Partitioning is a way of splitting a single physical disk into multiple virtual disks. A partition is a physical area on your disk, without gaps, that is treated like a completely separate disk by most operating systems.

Partitions are not allowed to overlap. Since virtual disks are treated exactly the same as physical disks it would be dangerous if writing to one disk modified files on another disk! Adjacent partitions should not have any gaps between them either. This is not dangerous as is overlapping partitions, but wasteful of disk space as the gap would be unusable!

Partitions are used as a means of organising data and constraining the growth of data on a disk (this is especially important on multi-user systems). Partitions are also used to separate operating systems from each other, thereby allowing them to coexist on the same hard drive.

As partitions are viewed as virtual hard drives they can have different file systems on them. It is important to be aware that a *partition* and a *file system* are different. The *partition* defines a section of your hard drive and is indistinguishable from a single, physical hard drive to your operating system. The *file system* on the other hand is how the data is stored in the partition. There are *many* ways of storing data within a partition, for example MS-Windows uses the FAT32 file system, NT, Windows 2000, XP and Vista use the NTFS file system (or FAT32), and GNU/Linux uses the Ext3 or Ext2 file system (and many others).

Partitions cannot be moved without *destroying* the file system contained within the partition. A Partition can be resized without destroying the file system but it must be done carefully otherwise the file system can be damaged and data lost. For this reason when re-partitioning your drive for GNU/Linux backup all critical files on the disk.

B.1 Primary Partitions

The number of partitions on an Intel based system is historically limited. The original partition table only held space for four partitions. When it became clear that people needed more partitions on their systems, a method was developed to work around the historical limitation.

The original four partitions are now called *primary partitions*. Most machines shipped with operating systems will use just one large primary partition that fills the entire physical disk.

B.2 Logical Partitions

To get around the limitation of only four primary partitions, *logical partitions* where invented. The number of logical partitions is not limited. Each logical partition contains a pointer to the next logical partition, so you can have, in theory, an unlimited chain of linked partitions.

Logical partitions are functionally equivalent to primary partitions. They need a file system to be created on them before they can be used. The only difference between a logical partition and a primary partition is that a logical partition exists in the *extended partition*

B.3 Extended Partition

For compatibility reasons, the space occupied by the logical partitions had to be accounted for. If logical partitions are needed then one primary partition is marked as the *extended partition*. This partition holds the start and the end of the space occupied by the logical partitions. This implies that the space occupied by the logical partitions must be contiguous.

There can only be one *extended partition* and if you use logical partitions then there are only three usable primary partitions.

B.4 Active Partition

The active partition is the partition your machine boots from. Only primary partitions can be marked *active* and only one can be active at any time. When there is only one operating system on your machine, that operating system resides on the first primary partition. To allow a machine to use multiple operating systems a special boot program is installed that allows you to choose between operating systems. GNU/Linux comes with just such a program.

Appendix C

Partitioning for Debian

C.1 Deciding on Debian Partitions and Sizes

At a bare minimum, GNU/Linux needs one partition for itself. You can have a single partition containing the entire operating system, applications, and your personal files. Most people feel that a separate swap partition is also a necessity, although it's not strictly true. "Swap" is scratch space for an operating system, which allows the system to use disk storage as "virtual memory". By putting swap on a separate partition, Linux can make much more efficient use of it. It is possible to force Linux to use a regular file as swap, but it is not recommended.

Most people choose to give GNU/Linux more than the minimum number of partitions, however. There are two reasons you might want to break up the file system into a number of smaller partitions. The first is for safety. If something happens to corrupt the file system, generally only one partition is affected. Thus, you only have to replace (from the backups you've been carefully keeping) a portion of your system. At a bare minimum, you should consider creating what is commonly called a "root partition". This contains the most essential components of the system. If any other partitions get corrupted, you can still boot into GNU/Linux to fix the system. This can save you the trouble of having to reinstall the system from scratch.

The second reason is generally more important in a business setting, but it really depends on your use of the machine. For example, a mail server getting spammed with e-mail can easily fill a partition. If you made /var/mail a separate partition on the mail server, most of the system will remain working even if you get spammed.

The only real drawback to using more partitions is that it is often difficult to know in advance what your needs will be. If you make a partition too small then you will either have to reinstall the system or you will be constantly

moving things around to make room in the undersized partition. On the other hand, if you make the partition too big, you will be wasting space that could be used elsewhere. Disk space is cheap nowadays, but why throw your money away?

C.2 The Directory Tree

Debian GNU/Linux adheres to the *Filesystem Hierarchy Standard* (`//http://www.pathname.com/fhs/`) for directory and file naming. This standard allows users and software programs to predict the location of files and directories. The root level directory is represented simply by the slash `/`. At the root level, all Debian systems include these directories—

Directory	Content
`bin`	Essential command binaries
`boot`	Static files required by the boot loader
`dev`	Device files
`etc`	Host-specific system configuration
`home`	User home directories
`lib`	Essential shared libraries and kernel module
`media`	Contains mount points for replaceable media
`mnt`	Mount point for mounting a file system temporarily
`proc`	Virtual directory for system information
`root`	Home directory for the root user
`sbin`	Essential system binaries
`sys`	Virtual directory for system information
`tmp`	Temporary files
`usr`	Secondary hierarchy containing user software
`var`	Variable data
`srv`	Data for services provided by the system
`opt`	Add-on application software packages

The following is a list of important considerations regarding directories and partitions. Note that disk usage varies widely given system configuration and specific usage patterns. The recommendations here are general guidelines and provide a starting point for partitioning.

- The root partition `/` must always physically contain `/etc`, `/bin`, `/sbin`, `/lib` and `/dev`, otherwise you won't be able to boot. Typically 150–250MB is needed for the root partition.
- `/usr`: contains all user programs (`/usr/bin`), libraries (`/usr/lib`), documentation (`/usr/share/doc`), etc. This is the part of the file system

that generally takes up most space. You should provide at least 500MB of disk space. This amount should be increased depending on the number and type of packages you plan to install. A generous workstation or server installation should allow 4–6GB.

- `/var`: variable data like news articles, e-mails, web sites, databases, the packaging system cache, etc. will be placed under this directory. The size of this directory depends greatly on the usage of your system, but for most people will be dictated by the package management tool's overhead. If you are going to do a full installation of just about everything Debian has to offer, all in one session, setting aside 2 or 3 GB of space for `/var` should be sufficient. If you are going to install in pieces (that is to say, install services and utilities, followed by text stuff, then X, ...), you can get away with 300–500 MB. If hard drive space is at a premium and you don't plan on doing major system updates, you can get by with as little as 30 or 40 MB.

- `/tmp`: temporary data created by programs will most likely go in this directory. 40–100MB should usually be enough. Some applications — including archive manipulators, CD/DVD authoring tools, and multimedia software — may use `/tmp` to temporarily store image files. If you plan to use such applications, you should adjust the space available in `/tmp` accordingly.

- `/home`: every user will put his personal data into a subdirectory of this directory. Its size depends on how many users will be using the system and what files are to be stored in their directories. Depending on your planned usage you should reserve about 100MB for each user, but adapt this value to your needs. Reserve a lot more space if you plan to save a lot of multimedia files (pictures, MP3, movies) in your home directory.

C.3 Swap Partition Size

With respect to the issue of swap partition size, there are many views. One rule of thumb which works well is to use as much swap as you have system memory. It also shouldn't be smaller than 16MB, in most cases. Of course, there are exceptions to these rules. If you are trying to solve 10000 simultaneous equations on a machine with 256MB of memory, you may need a gigabyte (or more) of swap.

On 32-bit architectures (i386, m68k, 32-bit SPARC, and PowerPC), the maximum size of a swap partition is 2GB. That should be enough for nearly any installation. However, if your swap requirements are this high, you should probably try to spread the swap across different disks and, if possible, dif-

ferent SCSI or IDE channels. The kernel will balance swap usage between multiple swap partitions, giving better performance.

C.4 Device Names in Linux

Linux disks and partition names may be different from other operating systems. You need to know the names that Linux uses when you create and mount partitions. Here's the basic naming scheme:

- The first floppy drive is named `/dev/fd0`.
- The second floppy drive is named `/dev/fd1`.
- The first SCSI or SATA disk is named `/dev/sda`.
- The second SCSI or SATA disk is named `/dev/sdb`, and so on.
- The first SCSI CD-ROM is named `/dev/scd0`.
- The master disk on IDE primary controller is named `/dev/hda`.
- The slave disk on IDE primary controller is named `/dev/hdb`.
- The master and slave disks of the secondary controller can be called `/dev/hdc` and `/dev/hdd`, respectively. Newer IDE controllers can actually have two channels, effectively acting like two controllers.

The partitions on each disk are represented by appending a decimal number to the disk name: `sda1` and `sda2` represent the first and second partitions of the first SCSI or SATA disk drive in your system.

Linux represents the primary partitions as the drive name, plus the numbers 1 through 4. For example, the first primary partition on the first IDE drive is `/dev/hda1`. The logical partitions are numbered starting at 5, so the first logical partition on that same drive is `/dev/hda5`. Remember that the extended partition, that is, the primary partition holding the logical partitions, is not usable by itself. This applies to SCSI and SATA disks as well as IDE disks.

Appendix D

Partitioning Tools

D.1 GParted

GParted is the Gnome Partition Editor application.

As stated before a disk is subdivided into one or more partitions. Partitions are normally not re-sizable (making one larger and the adjacent one smaller) without destroying the contents of the disk. The purpose of GParted is to allow the partitions to be modified while preserving the partition contents.

GParted is an industrial-strength package for creating, destroying, resizing, moving, checking and copying partitions, and the filesystems on them. This is useful for creating space for new operating systems, reorganizing disk usage, copying data residing on hard disks and mirroring one partition with another (disk imaging).

> **Warning:** Irrespective of what software you use any attempt to modify a disk's partition table and preserve the contents of the partition is *Dangerous*—there is no guarantee that the data on the entire disk will not be lost. So before attempting to modify the partition table of any disk be sure to backup all the valuable data on the disk—not just the partition to be modified.

The GParted program is part of the System Rescue Disk. The rescue disk image can be found on the Software DVD (White DVD). The ISO image has to be burnt to a CD-RW. Your computer can then boot from the CD — which will start the Rescue System. GParted can then be run.

Please read the GParted documentation before using it. The GParted documentation can be found on the DVD with the Rescue ISO image.

For more information on GParted go to the web site `http://gparted.sourceforge.net/`.

D.2 System Rescue CD

SystemRescueCd is a Linux system on a bootable CD-ROM for repairing your system and recovering your data after a crash. It aims to provide an easy way to carry out administration tasks on your computer, such as creating and editing the partitions of the hard disk. It contains a lot of system utilities (GParted, parted, partimage, fstools, ...) and basic administration tools (editors, midnight commander, network tools). The kernel supports most of the important file systems (ext2/ext3, reiserfs, reiser4, xfs, jfs, vfat, ntfs, iso9660), as well as network filesystems (samba and nfs).

The rescue disk image can be found on the Software DVD (White DVD).

For more information on the System Rescue CD go to the web site `http://www.sysresccd.org/`