Part 1 Preparing for Linux

Before you can get Linux up and running, you need to prepare your PC for the transition. *Jarrod Spiga* explains.

Bonus DVD software

Fedora Core 2 ISO images • SiSoft Sandra 2004 SP2b

Skill level

Beginner

Requirements

None

Time to complete

Varies

Linux has gone mainstream since its first appearance in 1991. Nowadays, anyone familiar with a PC can use Linux. You no longer need to be on a first-name basis with Linus Torvalds in order to install it, and most distributions have so many bundled software packages that you don't need to look anywhere else for a complete Windows alternative.

Best of all, Linux and the vast majority of applications that run on it are free, thanks to the popular GNU GPL (GNU's Not Unix General Public License) scheme that is often used by the open source development community.

This is the first part of a comprehensive guide to Linux. If you have little or no experience with Linux, you'll be a pro by the end of this series — even to the stage where Linux may well replace your Windows system.

DISTRIBUTIONS

Specifically, the kernel is all a Linux operating system is. All you need to do is install it. However, without other applications and utilities, your Linux system won't do much more than waste CPU cycles.

While it's possible to piece together your own Linux system from scratch, it can be incredibly tedious and labour-intensive. Most users start out with a distribution of Linux — a version of the kernel and suite of tools, applications and programs that give you the complete Linux experience.

There are hundreds of Linux distributions to choose from and each has its own niche. Some distributions mimic Windows and are intended for users new to Linux. Some distros aren't updated frequently with the idea that system stability won't compromise any mission-critical applications. Others include few packages and are designed for underpowered or embedded systems, while some ship with every package and line of source code imaginable.

When choosing a distro, you should ideally choose the one that best suits your needs. The table below provides a brief description of the aims of each distribution. Several Web sites are also dedicated to helping you choose the distro that suits your needs.

Most of the information provided here is non-distro specific. However, in order to give additional assistance to readers who are new to Linux, the Fedora Core 3 distribution of Linux is used to demonstrate each aspect of the operating system.

WHY FEDORA?

There are a number of reasons why Fedora is used in this guide. For starters, it's one of the most popular distributions and it has a wealth of online support.

Popular Linux distros

The following table lists the 10 most popular Linux or "Unix clone" distributions, along with a short description of each. Note that the distributions in italics are either not freely available, or are other Unix clones (don't specifically use a Linux kernel).

Distro	Description	Distro	Description
Mandrake	The main goal of the Mandrake project is to make Linux easier to use and thus bring Linux to the masses. This has seen Mandrake become the most frequently-used distribution (at the time of writing). Mandrake is updated often, giving users the latest software as soon as each package is stable.	**Fedora**	The Fedora project is assisted by Red Hat in order to develop and maintain a mainstream Linux operating system for general purpose use. Updates are available every three months, giving users reasonably new versions of most packages. This OS is also used as a long-term stability testing ground for Red Hat's server product, Red Hat Enterprise Linux.
Debian	The distribution for power users, Debian has a reputation for being a little less user-friendly, but incredibly stable. Part of the reason for this is the thorough testing process all packages must go through before becoming a part of the distribution — stability is often favoured over having the latest version of each package available.	**Knoppix**	Knoppix is a version of Linux that doesn't need to be installed on a hard disk in order to run, it boots directly from CD. It's ideal for demonstration or rescue purposes, and allows for up to 2GB of (compressed) software to be installed on the CD.
SUSE	SUSE, now owned by Novell, has a very large development team dedicated to the project. As a result, this distribution is good if you must have the latest of everything. In particular, SUSE was one of the first distributions to offer x64 support.	**Slackware**	Focusing on both ease of use and stability, Slackware was one of the first Linux distributions to achieve wide acceptance. It's refreshed every few months.
Gentoo	Aimed more towards developer and network professional users, Gentoo mixes elements of BSD-style operating systems with Linux. The "Portage" package management application is based on the tradition of BSD ports. Speed and efficiency are the paramounts of this distribution.	*FreeBSD*	A free version of University of California's BSD Unix, *FreeBSD* isn't technically a Linux distribution. However, the philosophy of the GNU movement is preserved, giving students, researchers and professionals an environment that closely matches BSD at no cost.
RHEL	*Red Hat's Enterprise Linux (RHEL)* is an enterprise-level Linux operating system. While not freely distributed, the licence fee goes towards Red Hat's support plans. Providing such avenues for support is unique in the Linux market, and helps shift the onus from the user to Red Hat if there are problems with the OS itself.	**Xandros**	Formerly Corel-Linux, Xandros is more of a desktop operating system that emphasises compatibility with Windows systems. In addition to the free unsupported downloads, a number of supported versions are available after paying a fee.

Fedora is a feature-rich distribution aimed at general purpose use, and new packages aren't included in the project until they've been thoroughly tested. As a result, it's not as bleeding-edge as some, but offers more stability.

PREPARING TO INSTALL

As with the installation of any operating system, a number of preparatory steps should be taken first. In recent years, distribution developers have greatly improved the installation interface. While the days of awkward text-based interfaces are long gone, you can still get stuck if you aren't properly prepared.

IDENTIFYING YOUR HARDWARE

Before installing any operating system (including Windows), it's a good idea to make a note of the hardware installed on your system.

Most Linux installers correctly identify hardware, but occasionally you may have to give specific configuration details to the installer. This is where a detailed inventory comes in handy.

If your list of hardware goes into great depth, you'll be more likely to correctly answer any questions the installer throws at you. At bare minimum, you should complete the following list:
■ Memory Capacity (in MB)
■ CPU model; clock rate (in MHz); supported architecture (Athlon, i386, i586, i686, ia32e, ia64, ppc64, s390 or x86_64); and whether you use SMP or Hyper-Threading
■ Graphics card chipset and memory (in MB)
■ Hard drive capacities (in MB) and interface channel each drive is connected to
■ Network devices and communications hardware (including chipsets).

If you're familiar with your system, you should be able to compile this list without looking inside your system. If not, you can get most of the information by opening up your system, or by using SiSoft Sandra (included on this month's cover DVD). Install the application to your system, launch it, and go to File > Create a Report Wizard. Proceed through the wizard and ensure that all of the information modules are selected. Save the report to the hard disk as a text file and keep a printout handy.

EVALUATING YOUR HARDWARE AND ANTICIPATING PROBLEMS IN ADVANCE

Hardware compatibility is a problem that Linux has recently (for the most part)
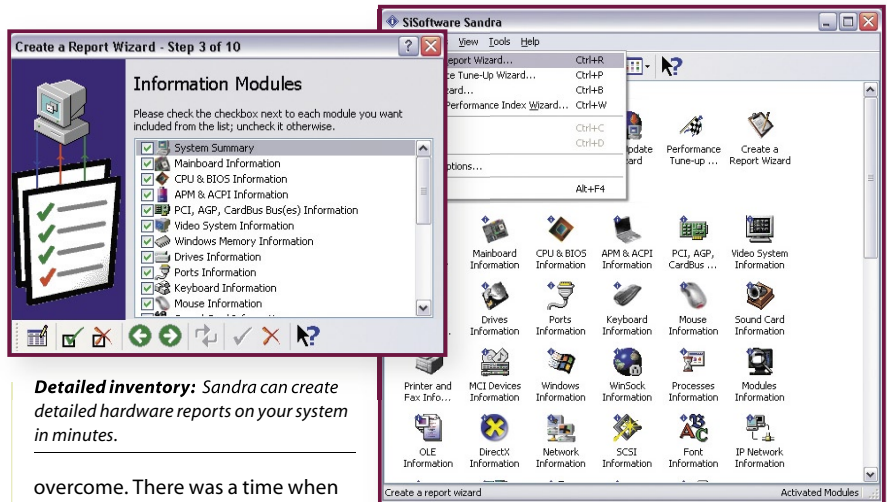
Detailed inventory: *Sandra can create detailed hardware reports on your system in minutes.*

overcome. There was a time when you had to go through every component in your system and double-check that it would work under Linux. But fgenerally, unless you have hardware that is rare or unique, it will work with Linux.

However, there are cases where it's prudent to perform some checks — that way you won't get into Linux and find out that a modem or soundcard won't work as intended.

The most common piece of hardware that won't work is the WinModem — an internal dial-up modem that relies on the Windows driver model to operate (as opposed to using a serial port). Many internal modems are WinModems, and since Linux uses a different driver model to Windows it has a hard time communicating with them. It's best to check whether your device is compatible with Linux by going to the modem manufacturer's Web site.

You should also check the Web site of your printer's manufacturer. A number of printer makers can supply native Linux drivers for their hardware, while others may be
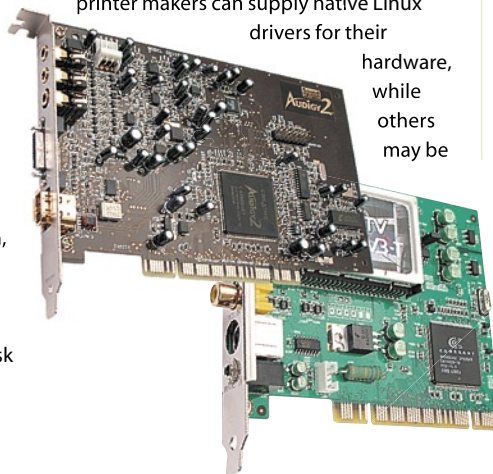
Hardware: *check the compatibility of your hardware before installing Linux. That way, you can anticipate problems later.*

able to point you toward another driver that your printer can emulate. If your printer software had special functionality under Windows (such as the ability to tell you when your printer cartridge is running low), be prepared to lose some of these features.

It's also a good idea to check the compatibility of soundcards, TV tuners and video capture devices. Manufacturers of a lot of these devices use sound or video processors that are supplied by other chip makers. To determine whether your card is Linux friendly, search for the compatibility status of the sound or video processor.

Although Fedora has no problems detecting, installing on and booting to Linux from Serial ATA drives, a number of other distributions (such as the current stable release of Debian) have trouble with it.

Red Hat has a database of hardware (**http://hardware.redhat.com/hcl**) that is either certified for use with, or is known to work with Red Hat Linux versions. While the hardware detailed in this database has only been tested with various Red Hat versions, it can be used as a general guide for Linux — if it works with Red Hat, it should work with other distributions.

DETERMINING MINIMUM SYSTEM SPECS

A main advantage of becoming familiar with Linux is that it runs remarkably well — even on dated hardware. In general, it's how you plan to use Linux that determines your minimum specification, rather than Linux itself.

Fedora has the following suggested minimum system requirements:
■ Pentium, Celeron, Athlon or Duron processor running at 400MHz or greater
■ 128MB of system memory
■ 3GB of available hard disk space ▶

▶ If your system doesn't meet these specifications, Fedora can still be installed. However, a system that doesn't meet this specification may run a lot slower than one that does meet it.

In fact, advanced Linux users often keep systems below this spec for certain purposes. For example, if a user wanted a Linux PC to only act as a firewall, they could install a minimum package on a considerably slower PC and get acceptable performance. However, the video editing performance of this PC would be dismal.

If you're new to Linux, try to exceed the minimum specification by as much as possible. In particular, the more RAM and hard disk space you can allocate, the better.

One last note: you need 128MB of available system memory if you want to run Linux Desktop (a graphical user interface similar to Windows) on a Fedora PC, otherwise the Linux Desktop won't load.

MAKING SPACE ON YOUR SYSTEM
Before Linux can be installed, there must be suitable and sufficient free space on the hard disk. Sadly, it's not as simple as opening Windows Explorer to find out how much room is available on your C:\ drive.

Linux uses a different file system structure to Windows, which means you must have separate hard disk partitions for your Windows and Linux installations.

In order to make room for Linux, you have a couple of choices available.

■ Linux enthusiasts will say that you don't really need to use Windows at all, since Linux lets you do everything that you ever need to do on a PC. As a result, you should wipe your existing hard disk, get rid of the Windows partitions and install Linux.

However, most people know that a number of applications only run under Windows with no open source equivalents (such as accounting applications).

Completely wiping your hard disk is an option, but if you're new to Linux you'll probably want to be able to occasionally jump back into Windows.

Whatever your viewpoint, backup all your data before diving into Linux (and certainly before wiping your hard drive).

Option summary

✔	Very simple; free.
✖	Windows is gone!

■ A more sensible option for users new to Linux is dual booting. This is where you break up each hard disk into a number of partitions, and install an operating system on a number of these partitions. A boot manager (installed in the boot sector of the hard disk) then allows you to select the partition you want to boot to.

This means you can have Windows and Linux on the same hard disk. However, Windows won't be able to read the Linux partitions and in some cases, Linux will blissfully ignore the Windows partitions. Therefore, each operating system can only use the space you reserve for its own partition.

Setting up a dual boot system is pretty involved and time consuming. Most people who adopt this approach already have Windows taking up their entire hard disk. These users have two options: backup everything, remove all partitions on the drive, then repartition and reinstall/install everything; or use a partition editing tool to shrink the Windows partition, freeing up the space to create Linux partitions.

The latter option generally sounds better to many users, but any software that messes with your partitions can easily render them inoperable. Whichever method you choose, make sure you've backed up your data.

The process of setting up your system using both approaches is detailed a little later.

Option summary

✔	Elegant solution; costs nothing.
✖	Partition editing is messy; reinstalling is time consuming.

■ The third option is to purchase an additional hard drive to install Linux on. This solution is by far the easiest, but also the most expensive — and your PC's configuration might not be able to handle an additional drive.

This solution allows you to keep your existing Windows installation. When it comes to using a boot manger, you have the most flexible options available: you can either install a boot manager on the boot
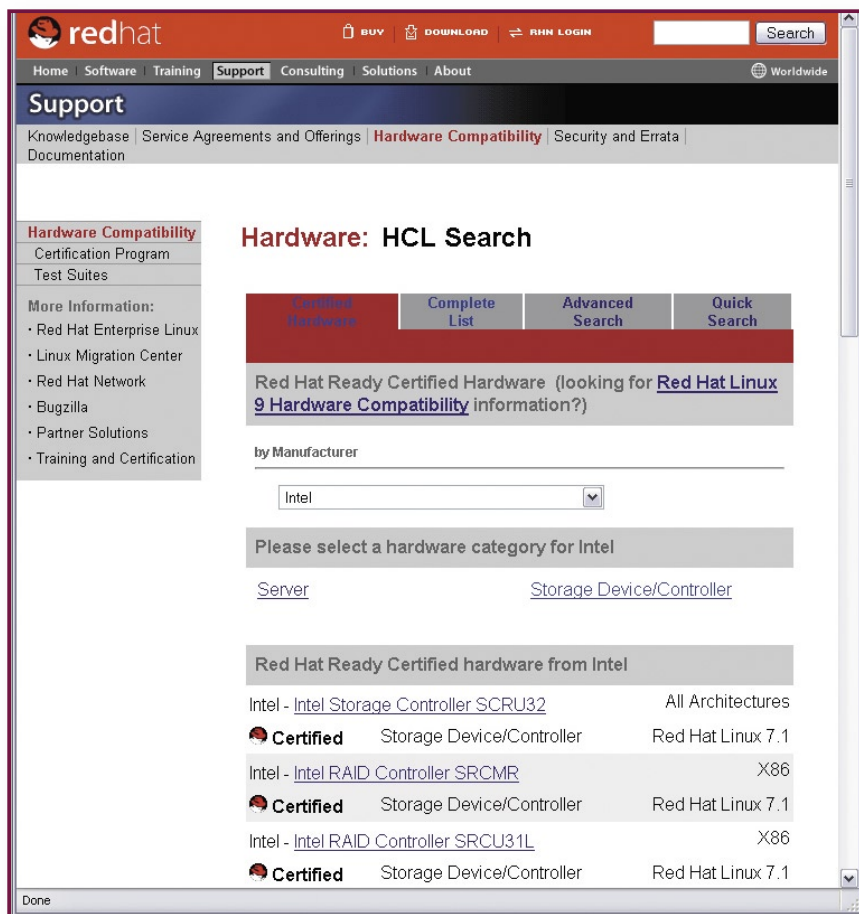
Certified: *Red Hat's Certified Hardware Compatibility database lets you know if your gear works with Linux.*

sector of the hard drive that you boot to, or you can change your hard disk boot order in the BIOS, eliminating a boot manager altogether.

Best of all, you have a large and fast disk reserve for your Linux installation.

Option summary

✔	Flexible and easy.
✖	Cost.

THE TWO-SHOE SHUFFLE

If you haven't got the money to invest in a new hard disk for Linux, and you're not totally convinced you can do everything that you're used to in Windows on your new Linux installation, the only solution is to set up a dual booting system.

There are two distinct things that must be done; make appropriate space and then fill it. The latter task is usually the simple one and involves the installation of your operating systems. However, there are still traps you can fall into. The majority of this task will be covered next month, when we install Linux.

In the meantime, ensure you have enough free space for your installation. Before you even think about starting, back up all your data. Even if you plan on only modifying your Windows partitions, this activity is fraught with danger.

As mentioned earlier, there are two different ways to divide up your hard disk. You can delete everything from the hard disk and install Windows and Linux afresh, or you can keep your existing Windows installation and try to free up some space for the Linux installation.

THE RULES OF PARTITIONING

Before tinkering with the partition tables on any hard disk, decide which partitions will be created, where they'll be physically located, what format of partition is required and how much space each partition should take up. When considering this, remember the following:

■ The 1,024 cylinder boundary: the BIOS in some systems (particularly in older systems) aren't able to boot to partitions that start after the 1,024th cylinder on the hard disk. Consider installing a small Linux boot partition at the beginning of the hard disk.
■ Windows 95, 98, Me and NT generally need to be installed on primary partitions (Windows NT can be installed on logical partitions, but the boot program must be

installed on a primary partition). The Linux boot partition (or root partition, if you aren't creating a dedicated boot partition) must also be installed on a primary partition.
■ You can create a maximum of four primary partitions on a drive, or three primary partitions with an extended partition. An extended partition can't be formatted. Instead, it's used to house one or more logical partitions.
■ Partitions located towards the beginning of the hard disk generally perform the best. Using partitions towards the beginning of the hard disk for swap space can produce improved paging performance and better system performance.
■ Most versions of Windows 95, 98 and Me can be installed on FAT (sometimes known as FAT16) and FAT32 formatted partitions. Windows NT can only be installed on FAT and NTFS4 partitions. Windows 2000, XP and 2003 can be installed on FAT32 and NTFS5 partitions. Most versions of Linux can only be installed on Linux Native partitions.

Linux requires at least two partitions: the root (/) partition and the swap partition. The root partition could be considered the equivalent to the C:\ drive under Windows (it's where all the data on your system is stored). The swap partition fulfills the same purpose as the Windows Page File; it swaps pages of memory to and from the hard disk. While Windows can store its page file on any drive in your system, Linux will only use partitions assigned as swap space.

While you only need two partitions to use Linux, it's a good idea to set up a /boot partition at the very beginning of your drive. This will almost always prevent any problems caused by the 1,024 cylinder BIOS limitation. Doing this also allows you to install Linux on a logical partition. The /boot partition only needs to be a minimum of 75MB.

Advanced users can also create a number of other partitions. For instance, if a Linux PC was to be used as a file server, setting up a dedicated /home partition prevents the system from crashing if that partition fills up. Once you've decided on the Linux partitioning structure, plan out your Windows partitions.

TRASH IT ALL

Deleting everything from your hard disk gives you a nice clean slate to work with. Best of all, it gives you a lot of flexibility in where you situate different partitions. If you set your partitions up in the correct manner, you can achieve slightly better disk performance.

Software RAID

If your system has multiple hard disks of similar capacity available for the Linux installation, consider using a RAID setup. The lower RAID levels allow you to either increase the fault tolerance of your disk subsystem (via mirroring), or increase the disk subsystems performance (via striping). Higher levels usually let you to do both.

If there is a hardware RAID controller in your system, set up the RAID array there — hardware RAID solutions are the most reliable and generally perform better. If you don't have a hardware RAID controller, you can still get some of the advantages of a RAID configuration via software. Software RAID gives you the ability to work with higher RAID levels, which most desktop controllers won't allow you to do.

The process of setting up a software RAID array will be explained in part two of this series, so if you're familiar with RAID and would like to give it a go, consider this when planning your partitioning scheme.

Before trashing everything on your drive, think about how you're going to create your new partitions. It's a little more difficult to do if you're installing Windows 95, 98 or Me. These three don't give you the ability to tailor your partition sizes from within the installer, they simply install themselves on the hard disk's active partition. In the event that no partitions exist, the installation processes of these versions of Windows create a single partition that's the size of your entire hard disk, and installs Windows to that.

If you're going to use one of these three operating systems, partition your system *before* installing them. To do this, format a bootable floppy disk from within Windows and copy the fdisk.exe utility to it. Reboot your system with this floppy in your drive and create the partition structure using fdisk.

Ensure the Windows 95, 98 or Me partition is a primary partition, and that it's marked as the active partition before you exit fdisk.

If you're installing Windows 2000, XP or Server 2003, you can add or remove partitions from within the installer (this is the same for Linux). As a result, all Linux and Windows partitions can be created from within the installer.

The Windows 2000, XP, Server 2003 installer and the fdisk application won't ▶

▶ let you create native Linux partitions. To "reserve" space for Linux partitions at the beginning of your drive (for /boot and swap partitions, for instance), create partitions from within the installer/fdisk that cover that space. You can then delete these partitions from within the Linux installer and recreate them.

As you make changes to the partition table on the hard disk, keep a record of them on paper; doing this reduces the chances of accidentally modifying a partition.

It's always a good idea to install Windows before Linux, as Linux's boot loaders are a lot more configurable than Windows'. Windows 95, 98 and Me don't even have boot loaders. The installation processes of these operating systems overwrite any boot loader on your system without asking, forcing you to boot to the OS that was installed last.

MODIFYING PARTITIONS

If you don't like the idea of completely wiping your hard disk, you might be able to modify existing partitions to make enough space for Linux. But you'll need some additional software, such as PowerQuest's PartitionMagic.

Partitioning tools are far from perfect, and it doesn't take much modification to make a partition unusable. And back up all of your data before proceeding.

While most partition management software allows for the creation of Linux partitions from within the application, this is unwise. It has been reported that some Linux installers aren't able to properly read partitions created using these tools, and as a result, the installer can't proceed.

To make the necessary space for Linux, you need to:
■ Defragment the hard disk from within Windows (Start > Control Panel > Administrative Tools > Computer Management > Disk Defragmenter from within Windows 2000/XP/Server 2003)

1 Load the disk management software.
2 Resize the Windows partition, making sufficient space for Linux.
3 Move your Windows partition so there's enough space before it to squeeze in your Linux /boot and swap partitions.
4 Apply the changes. This usually means rebooting the system.
Once your partition management software has done its stuff, you should be ready to install Linux.
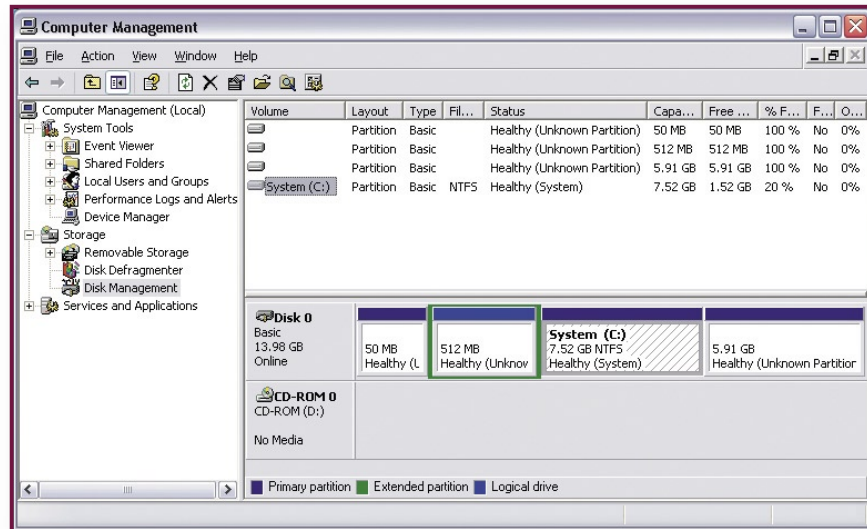
Partition magic: *a typical dual-booting partition scheme with 50MB /boot, 512MB swap, 7.52GB Windows and 5.91GB Linux / partitions.*

GETTING A COPY OF FEDORA

At the time of writing, the latest version of Fedora was Core 2. However, Core 3 is scheduled for release on 1 November, 2004. The next few instalments of this guide are based around Fedora Core 3. Regardless, Fedora can be obtained in a number of ways and in a number of formats.

If you're ready to jump into the thick of things now, and you have a CD or DVD burner, you can create a Fedora Core 2 installation disc using this month's cover DVD. Simply place the DVD in your drive and copy the four ISO images to your hard disk. You can then burn these images to CD using the following instructions.

(Alternatively, if you want to download Fedora Core 3 now, head to **http://fedora.redhat.com/download** and download the appropriate images.)

To install Fedora Core 3, you only need the four main ISO images — the other images are only useful for advanced users (such as the SRPMS images which contain installers for all of the source code inside the Fedora project).

If you have a DVD writer, download the DVD image. This is larger than 4GB, so make sure your current hard disk format supports files of this size (NTFS-formatted drives will, FAT16 and FAT32 partitioned drives won't). Ensure your HTTP or FTP client also supports the transfer of files this size.

Fedora Core 3 will be on next month's cover DVD. Best of all, the DVD is bootable.

BURNING THE CD/DVD

If you've downloaded ISO image files (or

copied them from the cover DVD), burn them to a CD/DVD. ISO files are complete disk images, not single files that can be burned directly to CD.

Most CD writing applications should be able to write ISO images to CD or DVD, including Nero's Burning ROM and Adaptec's Easy CD Creator. The following steps should work for the majority of burning apps:
■ Open the CD/DVD burning application and cancel any wizard screens that pop up
■ Select File > Open, and select the first ISO image. A write media window should appear
■ Insert blank media into your drive and hit the button that starts the burn
■ Repeat the process for the remaining ISO files.

Most importantly, test the burnt media by putting the disc containing the first image into the drive and restarting your computer.
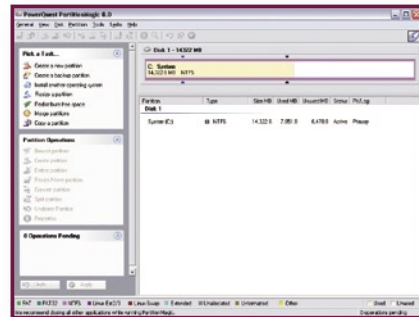
1 *Load your disk management software (in this case, PartitionMagic) after defragging the drive.*

With any luck, your system will boot from the optical media. If not, go to the drive booting priorities within BIOS and ensure that your optical drive is set with a higher boot priority than your hard drive. If the drive is already set to a higher boot priority, or you don't have the ability to set it so, you need to create boot floppies (as outlined in the next section).

Once you've successfully booted to the media, enter the following at the prompt:

```
linux mediacheck
```

This command performs a scan of your CD or DVD media in order to verify its integrity. Embedded into each ISO image is an MD5 checksum. The scan simply goes through the process of calculating an MD5 sum based on the contents of the CD/DVD, and compares the result to the value embedded in the image. If the values match, you have a good burn.

CREATING BOOT FLOPPIES
If you can't boot directly to your CD or DVD drive, you need to make a bootable floppy disk to get your installation started. Creating the boot floppy isn't as simple as copying files to a disk — you need to prepare the disk in order for it to function properly.

First, grab a high-density (1.44MB) 3.5in floppy disk. If this disk holds data you want to keep, back it up. Bring up a command prompt by going to Start > Run > cmd (or command under Windows 95/98/Me). At the prompt, enter:

```
format a:
```

where a: is the drive letter corresponding to the floppy drive your disk is in. You should be asked to confirm that you want to reformat this disk. When this is complete, you'll be prompted to enter a volume label. Leave the label blank. Once the floppy disk is freshly formatted, it's time to get the boot image onto the disk.
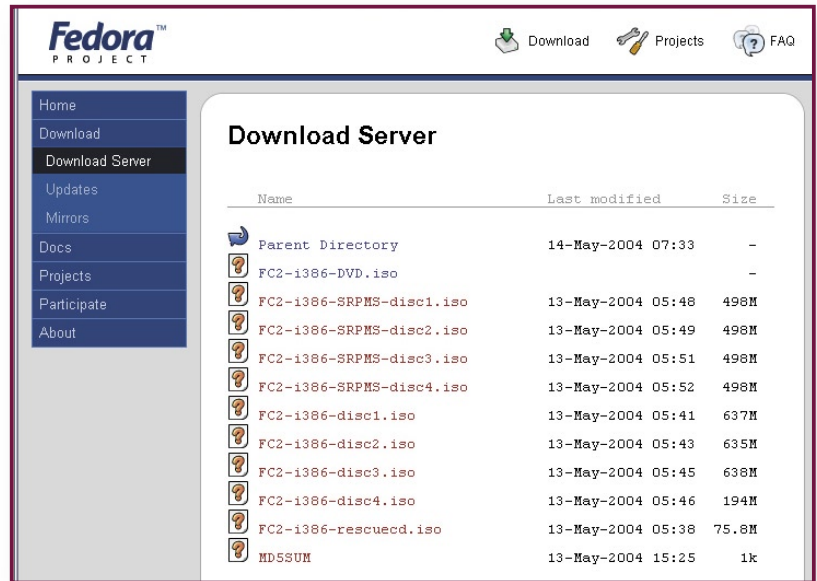
ISO metric: most users only need to download the non-SRPMS ISO images.

Insert the first Fedora installation CD or the DVD into your optical drive and enter the following commands (assuming that D:\ is the drive your installation media is in):

```
c:\> d:
d:\> cd \dosutils
d:\dosutils> rawrite
Enter disk image source file
name: ..\images\bootdisk.img
Enter target diskette drive: a:
Please insert a formatted dis-
kette into drive A: and
press --ENTER-- : [Enter]
```

The rawrite utility on the first installation CD will copy the floppy boot image to your freshly formatted floppy disk. Once the copy has completed, you should be able to boot to this floppy disk, which will detect and initialise the installation CD.
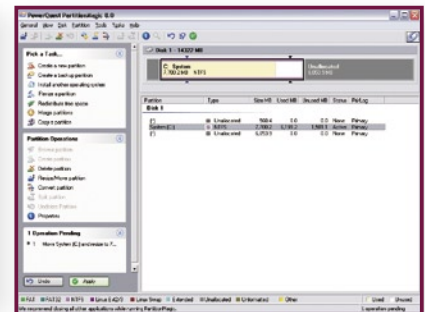
Next month . . .
The next installment of *Mastering Linux* will include a step-by-step installation guide for Fedora Core 3. Accompanying the distribution on the cover DVD will be a large image gallery, so you know what to expect when going through your installation — from when you first put CD/DVD into drive, until you boot to the Linux desktop. We'll also show you how to set up printers, scanners, cameras and other peripherals, then finish off with automating the process of updating your system.
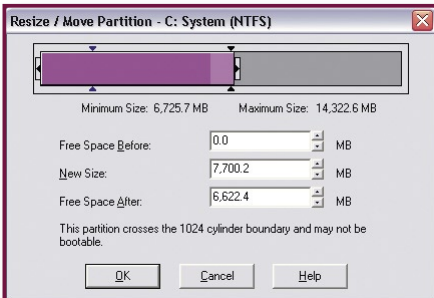
2 *Shrink the Windows partition to make room for Linux.*
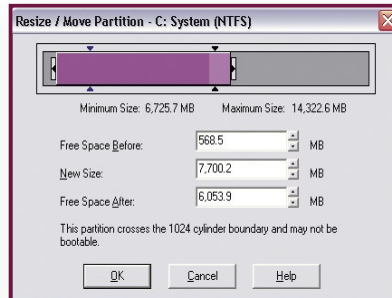
3 *Move the Windows partition to make room for the /boot partition.*

4 *Apply the changes and reboot.*