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Beginning Ubuntu Linux

The complete guide to Ubuntu—includes everything you need to take advantage of the world's favorite Linux operating system.

FOURTH EDITION

ubuntu

Keir Thomas and Andy Channelle
with Jaime Sicam

Accompanying DVD includes full versions of Ubuntu 9.04, as well as Kubuntu, Edubuntu, Xubuntu, and PPC releases!

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Beginning Ubuntu Linux

From Novice to Professional, Fourth Edition

Keir Thomas and
Andy Channelle
with Jaime Sicam

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Despite the names that appear on their covers, these books are actually the product of a large team of editors, proofreaders, designers, and project managers, so I'd like to thank all those involved in making this book the thing of beauty that you hold in your hands. And before the book is even begun, there needs to be compelling software to write about—the developers, testers, and managers at Canonical, and all those other free software projects that feed into the Ubuntu family, deserve our appreciation, as do the families that occasionally have to put up with cranky authors tapping away late into the night to hit their deadlines.

For some authors, silence is part of the writing process, but I'd like to thank the developers of Facebook, Drupal, WordPress, Slashdot, Lifehacker, io9, and Spotify for providing welcome distractions and displacement opportunities when inspiration wasn't available.

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Andy Channelle

Introduction

Linux applies an alternative philosophy to computing that revolves around the sharing of not only software but also knowledge. To use Linux is to become part of a huge global community of people who have caught on to a phenomenon that is changing the world.

Ubuntu (`www.ubuntulinux.org`) is the natural continuation of these goals. It's a project founded by entrepreneur businessman Mark Shuttleworth with the intention of bringing a freely available, high-quality operating system to the world. To this end, Shuttleworth invested $10 million of his own money to guarantee that this will be the case for many years to come. In 2009, the project has moved closer to becoming self-sustaining as Ubuntu becomes part of the mainstream for desktop, netbook, mobile, and server users.

The fundamental concept is that Ubuntu is available for use by anyone in the world, no matter who they are or where they are. As such, many different languages are supported, and the operating system can also be accessed by those with disabilities, such as partial sight or hearing. Ubuntu might just as easily be found on a Wall Street banker's laptop as on a battered old computer in a Brazilian favela.

Ubuntu is built around one of the most established versions of Linux: Debian (`www.debian.org`). The Debian Project was started back in 1993, shortly after the very first version of the Linux software was released, and has become one of the pioneering varieties of Linux. Ubuntu and Debian Linux both share common goals and are closely allied, but Ubuntu focuses largely on the desktop. For exmple, it provides a powerful office suite by default, as well as some excellent pieces of Internet software. It is only recently that a dedicated server version has become available.

It's also very easy to use. Ubuntu works straight out of the box. As soon as it's installed, you should be ready to start using it without any further work. In addition, tasks such as updating your software are as easy—and in most cases easier—under Ubuntu as they are under Windows. Above all, however, Ubuntu is designed to be shared. You can take the DVD-ROM included with this book and install Ubuntu on as many computers as you want. You can also copy it as many times as you want and give those copies to your friends. We're serious! This isn't some kind of trick, either—Ubuntu isn't a trial version that will quit running in a month. You will *never* find yourself having to pay a fee further down the line, even if you want to install additional software. Ubuntu, and much of the software that runs on top of it, will always be free of charge.

Since its inception in 2004, Ubuntu has literally taken the world of Linux by storm and has even broken out of the technically demanding world of open source software. It's consistently voted the most popular desktop Linux and has even garnered a handful of celebrity users along the way: Jamie Hyneman of the popular TV show *MythBusters* is a fan, as is novelist and blogger Cory Doctorow. Within some Internet communities, such as Digg.com and Reddit, you'll struggle to find individuals who don't use Ubuntu.

Ubuntu's popularity has risen as the software appears on desktop and laptop computers from the likes of Dell and HP, and it is finding its way into many users' hands through netbooks.

What You'll Find in This Book

Beginning Ubuntu Linux, Fourth Edition is divided into seven parts, each of which contains chapters about a certain aspect of Ubuntu use. These parts can be read in sequence, or you can dip in and out of them at will. Whenever a technical term is mentioned, a reference is made to the chapter where that term is explained.

Part 1 examines the history and philosophy behind the Linux operating system. We aim to answer many of the common questions about Linux. Such knowledge is considered to be as important, if not more so, than understanding the technical details on how Linux works. But although these chapters should be read sooner rather than later, they don't contain any technical information that you absolutely require to get started with Ubuntu.

Part 2 covers installing Ubuntu on your computer. An illustrated guide is provided, and all installation choices are explained in depth. Additionally, you'll find a problem-solving chapter to help, just in case anything goes wrong.

Part 3 focuses on getting started with Ubuntu. It covers setting up the Linux system so that it's ready to use. One chapter is dedicated to setting up common hardware devices, such as printers, and another explains how you can secure your system. Other chapters in this part explore the desktop, explaining what you need to know to begin using Ubuntu on a daily basis.

In Part 4, we take a look at how the underlying technology behind Linux functions. You're introduced to the command-line prompt, and you learn how the file system works. It's in these chapters that you'll really master controlling Linux!

Part 5 covers multimedia functions available for Ubuntu users, which let you watch movies and play back music. We also take a look at the image-editing software built into Ubuntu.

Part 6 moves on to explain how typical office tasks can be accomplished under Ubuntu. We investigate OpenOffice.org, the complete office suite built into Ubuntu. After an introduction to OpenOffice.org, separate chapters explore its word processor, spreadsheet, database, and presentation package. You will also learn how to use the Evolution e-mail and personal information manager program.

Part 7 carries on from Part 4 and takes an even more in-depth look at the underlying technology behind Ubuntu. This time, the emphasis is on giving you the skills you need to keep your system running smoothly. You learn how to install software, manage users, optimize your system, back up essential data, schedule tasks, and access computers remotely.

Finally, Part 8 contains four appendixes. The first is a glossary of Linux terms used not only in this book but also in the Linux and Unix worlds. The second appendix is a quick reference to commands typically used at the command-line prompt under Linux. The third appendix explains how to get further help when using Ubuntu, and the fourth explains how to use the DVD-ROM and the differences between the various versions of Ubuntu.

What's New in the Fourth Edition

The original edition of *Beginning Ubuntu Linux* was the first English-language book to provide a guide to using Ubuntu, and it remains one of the best. Successive editions of the book have tracked the changes within the Ubuntu project and have improved each time.

This edition of *Beginning Ubuntu Linux* has been thoroughly updated and revised to take into account improvements introduced with the 9.04 release of the software, code-named Jaunty Jackalope. The previous edition covered the 8.04 release. This version of Ubuntu has refined its multimedia support considerably, so much so that support for many file types you'll encounter on the Internet and elsewhere are supported through an automated system. Desktop visual effects that were introduced in the preceding edition—and are covered in Chapters 8 and 10—have been allied to options that make the desktop more accessible to disabled users. Improvements in the Linux kernel itself have resulted in better support for wireless networking, and proprietary drivers for many common graphics cards can bring unmatched visual sophistication to even entry-level machines.

About the DVD-ROM Supplied with This Book

The DVD-ROM attached to the book is completely new, compared to that offered with previous editions. This edition offers a double-sided DVD-ROM that contains virtually every official release of Ubuntu 9.04, including not only the main Ubuntu release, but also Kubuntu, Edubuntu, Xubuntu, and some releases for alternative hardware platforms, such as older PowerPC-based Macintosh computers.

By booting from the DVD-ROM, you can opt to install Ubuntu or run in "live" mode, which means that the entire operating system boots from the disc and doesn't touch your hard disk. This can be useful for those who wish to "try out" Ubuntu, but there are a handful of caveats, which we explain in Chapter 5.

The contents of the DVD-ROM are explained in detail in Appendix D.

Conventions Used in This Book

The goal when writing *Beginning Ubuntu Linux* was to make it as readable as possible while providing the facility for readers to learn at their own pace.

Throughout the book, you'll find various types of notes and sidebars complementing the regular text. These are designed to provide handy information to help further your knowledge. They also make reading the book a bit easier.

■**Note** A note is designed to provide an important piece of information that you should know and that will help your understanding of the topic being discussed.

■**Tip** A tip is something that will help when you need to perform the task being described. Alternatively, it might be something that can make your life easier when using Ubuntu.

■**Caution** A caution is something you should certainly pay attention to, because it warns of a hidden danger or particular caveat that applies to the topic being discussed.

In the sidebars, we take a moment to explain something that you should know, but that isn't vital to an understanding of the main topic being discussed. You don't need to read the sidebars there and then; you can return to them later if you wish.

PART 1

Introducing the World of Linux

CHAPTER 1

Welcome!

If you're an avid computer user, there's a good chance that you've heard of Linux. You might have read about it or perhaps heard about it in the media.

One of the odd things about Linux is that the more you learn about it, the more questions you have. For instance, it's generally thought that Linux is free of charge, but this then raises the question of how, in our modern world, something like an entire computer operating system can cost nothing. Who pays the programmers?

Over the following introductory chapters, we answer some of these questions. In this chapter, we explain what Linux is and its benefits compared to Windows.

What Is Linux?

There are two ways of looking at a PC. The first is to see it as a magical box, which lets you do cool stuff like browse the Internet or play games. Seen in this way, it's like a DVD movie player—put in a disc, press a button, and a picture appears on your TV. On your PC, you click the Internet Explorer icon, type a web address, and a web site somehow appears. The astonishing technical complexity behind these simple procedures isn't important to most people.

The other way of looking at a PC is as a collection of components that are made by various manufacturers. You might be familiar with this way of thinking if you've ever tried to upgrade your PC's hardware. In that case, you'll know that your PC consists of a CPU, a hard disk, a graphics card, and so on. You can swap any of these out to put in newer and better components that upgrade your PC's performance or allow more data storage.

What almost no one realizes is that the operating system—the fundamental software that runs your computer—is just another component of your PC. It, too, can be swapped out for a better replacement. Windows doesn't come free of charge, and Microsoft isn't performing a public service by providing it. Around $50 to $100 of the price you pay for a PC goes straight into Microsoft's pocket. Bearing in mind that hundreds of millions of PCs are made each year, it's not hard to see why Microsoft is one of the world's richest corporations.

It would be difficult to question this state of affairs if Microsoft gave us our money's worth. But it often falls far short. Microsoft's most recent operating system, Windows

Vista, has met with almost universal derision, even from many who considered themselves fans of Microsoft products.

Microsoft became rich, and maintains its wealth, by a virtual monopoly over PC manufacturers. While the intelligent computer buyer can choose between components to put together a better PC—deciding between an AMD or Intel processor, for example—you usually have little choice but to buy Windows with a new PC. Try it now. Phone your favorite big-name computer retailer. Say that you want a PC but you *don't* want Windows installed. Then listen as the salesperson on the other end of the phone struggles to understand.

■ **Note** Actually, this isn't quite true. One or two PC manufacturers will sell you a PC without Windows installed on it. Dell offers a line of desktop PCs and laptops that come with Ubuntu preinstalled—for more information, see `www.ubuntu.com/dell`. Hewlett-Packard produces a range of desktop PCs with Linux preinstalled, but these are business workstations and not intended for home users. Some smaller manufacturers may offer a Linux option too. But these are exceptions to the rule—in most cases, you will not be able to order a computer without Windows on it from a major PC manufacturer.

Wouldn't it be terrific if you could get rid of Windows? Would you like to finally say goodbye to worrying about viruses and security issues? Or weird slowdowns and crashes? Yet not lose out on any features or need to make sacrifices or compromises?

There is an alternative. Welcome to the world of Linux.

Linux is an operating system, which is to say that it's a bit like Windows. It's the core software that runs your computer and lets you do stuff on it. As mentioned earlier, by the strictest definition of the term, an *operating system* is the fundamental software that's needed to make your PC work. Without an operating system installed on your PC, it would merely be an expensive doorstop. When you turned it on, it would beep in annoyance—its way of telling you that it can't do much without a whole set of programs to tell it what to do next.

An operating system allows your PC's hardware to communicate with the software you run on it. It's hundreds of programs, system libraries, drivers, and more, all tightly integrated into a whole. In addition, an operating system lets programs talk to other programs and, of course, communicate with you, the user. In other words, the operating system runs everything and allows everything to work.

■ **Note** Some companies and individuals, including Microsoft, define an operating system as much more than this fundamental software. They add in the basic tools you run on an operating system, such as web browsers and file management programs.

Linux consists of a central set of programs that run the PC on a low level, referred to as the *kernel*, and hundreds (if not thousands) of additional programs provided by other people and various companies. Technically speaking, the word *Linux* refers explicitly to the core kernel program. However, most people generally refer to the entire bundle of programs that make up the operating system as *Linux*.

GNU/LINUX

Although most of us refer to Linux as a complete operating system, the title *Linux* hides a lot of confusing but rather important details. Technically speaking, the word *Linux* refers merely to the kernel file: the central set of programs that lie at the heart of the operating system. Everything else that comes with a typical version of Linux, such as programs to display graphics on the screen or let the user input data, is supplied courtesy of work done by other people, organizations, or companies. The Linux operating system is the combination of many disparate projects. (We explain how this works in the next chapter.)

The GNU organization (`www.gnu.org`), in particular, supplies a lot of vital programs and also system library files, without which Linux wouldn't run. These programs and files were vital to the acceptance of Linux as an operating system in its early days. Because of this, and the fact that Linux completed a long-running goal of the GNU project to create a Unix-like operating system, some people choose to refer to Linux as *GNU/ Linux*.

A fierce debate rages over the correct way to refer to the Linux operating system and whether the GNU prefix should be used. For what it's worth, an equally fierce debate rages over how we should define an operating system. It can all get very confusing. It's also easy to accidentally offend someone by not using the correct terminology!

It's not the purpose of this book to get involved in this debate. Suffice it to say that we acknowledge the vital input of the GNU project into the operating system many people refer to simply as Linux, as well as that of other vital projects. However, readers should note that when we refer to Linux throughout this book, we mean the entire operating system. If we intend to refer simply to the kernel programs, we will make that clear.

The Age of Linux

At the time of writing this book, Linux is a little over 18 years old. It has gone from a hobbyist project maintained by just one man to a professional and corporate-sponsored solution for virtually every level of computer user.

Linux has also gone from being a server operating system, designed for central computers that hand out files and other computer resources to other computers, to becoming a full-fledged graphical desktop operating system like Windows. In fact, it's gone even further. Today, it's very likely that you'll find Linux running your digital video recorder and other computerized household gadgets.

Note I bought a digital photo-frame for my mother last Christmas. Checking the documentation, I found that it ran Linux. Not that she was aware, of course!

Getting technical for a moment, Linux is a 32-bit and 64-bit, multitasking, multiuser operating system. This is a complicated way of saying that it's pretty darn powerful. Linux is as capable of running supercomputers as it is of running a desktop PC. Linux builds on the foundation laid by Unix, which itself was based on Multics, which was one of the first modern computer operating systems. It's not an exaggeration to say that Linux can trace its family tree all the way back to the pioneering days of computing.

CORRECT PRONUNCIATION

What most people refer to as the Linux operating system takes its name from the kernel program, one of its most important system components. This, in turn, was named after its creator, Linus Torvalds.

The name Linus is commonly pronounced *Lie-nus* in many English-speaking countries, but Torvalds speaks Swedish. He pronounces his name *Leen-us* (imagine this spoken with a gentle Scandinavian lilt, and you've got it about right).

Because of this, he pronounces Linux not as *Lie-nux*, but as *Lin-ux*, and most people copy this pronunciation. You can hear this spoken by Torvalds himself by visiting `www.paul.sladen.org/pronunciation/`.

Some people refer to the Linux operating system by its full title of GNU/Linux. In this case, GNU is pronounced with a hard *G*, unlike the name of the animal, as *G-noo*. The full pronunciation is therefore *G-noo Lin-ux*.

Finally, the DVD that comes with this book contains a version of Linux called Ubuntu. This is an African word that, in its country of origin, is pronounced in three separate short syllables: *oo-bu-ntoo*. However, most western English speakers pronounce the word *oo-bunt-oo*, which is perfectly acceptable!

The Problems with Windows

The world's most popular operating system is Windows, which is made by the Microsoft Corporation. Linux has no links with Windows at all. Microsoft doesn't contribute anything to Linux and, in fact, is rather hostile toward it, because it threatens Microsoft's market dominance. This means that installing Linux can give you an entirely Microsoft-free PC. How enticing does that sound?

Although it's impossible to get an accurate measure, by some estimates Windows is used on 89 percent of the world's desktop computers. In other words, it must be doing a good job for it to be so popular, right?

On the one hand, Windows does some things pretty well. Its software is reasonably easy to use, and since the release of Windows XP, has been largely stable and reliable. But it gets other things so very, very wrong. Chief among them is security. At the time of this writing, yet another Windows worm is all over the news headlines. This isn't a unique occurrence, and few commentators are surprised. Worms and viruses have plagued Windows users for time immemorial. What makes it particularly galling is that Microsoft sat idly by for many years, all but pretending the issue was nothing they could prevent, even though knowledgeable commentators pointed out that it was design flaws in Microsoft's software that allowed the problems to arise.

With the release of the Windows XP service packs, the problem was eased a little, although with its next release—Windows Vista—Microsoft took a massive step backward by implanting a draconian security policy. This nags the user for confirmation of even trivial actions, to the extent that most users simply switch it off and thereby deactivate the first line of defense.

Remember that Windows isn't produced by a back-street operation. It's produced by one of the richest corporations in the world. Things should be better than they are. With every new release of Windows, Microsoft makes exactly the same promises of faster and more-secure operating systems, but it never delivers.

■ **Note** Unlike many Linux books, *Beginning Ubuntu Linux* doesn't ignore Windows or pretend it doesn't exist. Throughout these pages, you'll find frequent references to Windows and the software that runs under it. You'll find direct comparisons with actual Windows programs, and you'll learn how to work with Windows files. The intention is that anyone with prior experience will be able to get started with Ubuntu much more quickly.

So is Linux the solution to these problems? Most would agree that it's a step in the right direction, at the very least. Linux users don't install antivirus programs, because there are virtually no Linux-specific viruses (although some Linux server computers run antivirus programs, to protect any Windows computers that connect from viruses!). As with all software, security holes are occasionally discovered in Linux, but the way it is designed means exploiting those holes is much more difficult. (We talk more about this in Chapter 9.)

Note There have been a couple of viruses for Linux, but they're no longer "in the wild" (that is, they are no longer infecting PCs). This is because the security holes they exploited were quickly patched, causing the viruses to die out. This happened because the majority of Linux users update their systems regularly, so any security holes that viruses might exploit are patched promptly. Compare that to Windows, where most users aren't even aware they can update their systems, even when Microsoft gets around to issuing a patch (which has been known to take months).

There's also the fact that Linux encourages you to take control of your computer, as opposed to treating it like a magical box. As soon as you install Linux, you become a power user. Every aspect of your PC is under your control, unlike with Windows. This means fixing problems is a lot easier, and optimizing your system becomes part and parcel of the user experience.

Tip There's no reason why Linux and Windows can't live side by side on the same computer. This can be done by dual-booting, and we explain how in Chapter 5.

WINDOWS COMPATIBLE?

One of the biggest questions asked by most newcomers to Linux is whether it can run Windows software. The answer is yes…and no.

Linux is completely different from Windows on a fundamental technical level. Its creators based it on Unix, an industrial-strength operating system. This means that Linux isn't a swap-in replacement for Windows. You cannot take the installation CD of a Windows program and use it to install that program on Linux, just as you cannot install an Apple Mac program on Windows.

However, several current projects let you run some Windows programs on Linux. Wine (`www.winehq.com`) is an example of such a project, and you can download a commercial and easy-to-use variation of it from `www.codeweavers.com`. You can also use programs such as VirtualBox (`www.virtualbox.org`) or VMware (`www.vmware.com`) to create a "virtual computer" running on Linux—effectively, an entire PC emulated in software. Then you can install the Windows operating system on the virtual computer and, therefore, any Windows software you like.

In most cases, however, you'll find that there's a Linux equivalent of your favorite Windows software. Frequently, you'll find that this Linux version is actually superior to the Windows program you've been using. We discuss many of these in Chapter 11.

The Benefits of Linux

People have been known to exaggerate about Linux when singing its praises, and there's certainly some hyperbole around. But there are a couple of cast-iron facts about its benefits.

Fewer Crashes

The experiences of different people vary but, in our extensive experience, Linux very rarely crashes. Our mouse cursors have never frozen on screen. A strange error box has never appeared and remained until we've rebooted. Program windows don't freeze and leave trails as we drag them around. It's possible to leave a Linux system running for years without ever needing to reboot (although most desktop Ubuntu users shut down their PCs when they won't be using them for a while, just like the rest of us).

Of course, programs that run on top of Linux sometimes crash, but they don't take the rest of the system down with them. Instead, you can clean up after a crash and just carry on.

Security

The next benefit is that Linux is very secure. It's built from the ground up to be secure, in fact, and Linux is based on years of proven computer science research. It works on the principle of users who have permissions to undertake various tasks on the system. If you don't have the correct permission, you cannot, for example, access a particular piece of hardware. Additionally, privacy can be ensured, because the files on the PC are "owned" by individual users, who can permit or deny others access to those files. There are other aspects to Linux security that we discuss in Chapter 9.

Free and Shareable

Another big benefit is that Linux can be obtained free of charge. After it's installed, the latest updates for all your programs are also free of charge. Not only that, but if you want any new software, it will also usually be free of charge (and normally just a download away). Is this starting to sound attractive yet?

The software is also released under a license that indicates you can share it with anybody you want. Suppose that you find a really great image editor. You mention it to a friend, and he asks for a copy. Under Windows, copying the program will probably be strictly illegal—to do so turns you into a software pirate! Unless that image editor is freeware, your friend will need to buy the software himself. Under Linux, sharing software is normally entirely legal. In fact, it's encouraged! We explain why in Chapter 2.

This philosophy of sharing applies to the entire operating system. You can install the software contained on the DVD that comes with this book on the computer of your friends, relatives, or neighbors. You can even give them copies of the DVD. All this can be done entirely legally!

In fact, this redistribution is what the makers of Ubuntu want. They created Ubuntu so that it would be shared and used by anybody, anywhere in the world. They'll even send you or somebody you know free copies of the installation CD if you want; see the ShipIt page of the Ubuntu web site: `https://shipit.ubuntu.com`.

No Annoying Copy Protection or Usage Restrictions

A happy side effect of the sharing culture that surrounds Linux is that you'll never need a software registration code to install it. There's no scheme like Windows Product Activation (WPA) or Windows Genuine Advantage (WGA), whereby the software must "phone home" over the Internet to be "activated."

This kind of approach to software, whereby the creators attempt to fundamentally limit what users can do with the software they've bought, is anathema to all those involved in Linux. The spirit of Linux users is freedom, rather than restrictions.

The Linux Community

We've established that Linux is powerful, secure, and flexible. It doesn't nag you to register or ask you to type in lengthy registration codes.

But we've saved the best for last. Linux is more than a computer operating system. It's an entire community of users spread across the globe. When you start to use Linux, you become part of this community (whether you like it or not!).

One of the benefits of membership is that you're never far from finding a solution to a problem. The community likes to congregate online around forums and newsgroups, which you can join in order to find help.

Your placement in the ranks of the community is *newbie*. This is a popular way of describing someone who is new to Linux. Although this sounds derisory, it will actually help when you talk to others. Advertising your newbie status will encourage people to take the time to help you. After all, they were newbies once upon a time!

There's another reason not to be disheartened by your newbie tag: you'll outgrow it very quickly. By the time you reach the end of this book, you'll have advanced to the other end of the spectrum: *guru*. You'll be one of those giving out the advice to those poor, clueless newbies, and you'll be 100 percent confident in your skills.

Tip One of the best ways to learn about Linux is under the auspices of a knowledgeable friend. It's very beneficial to have your own guru to help you along when you get stuck—someone who is just an e-mail message or a phone call away. If you have a friend who uses Linux, consider taking that friend out for a drink and getting more friendly! You might also consider joining a Linux user group (LUG); see `www.linux.org/groups/`.

But being part of a community is not just about getting free technical support. It's about sharing knowledge. Linux is as much about an ideal as it is about software. It was created to be shared among those who want to use it. There are no restrictions, apart from one: any software changes you make and distribute must also be made available to others.

The spirit of sharing and collaboration has been there since day one. One of the first things Torvalds did when he produced an early version of the Linux kernel program was to ask for help from others. And he got it. Complete strangers e-mailed him and said they would contribute their time, skills, and effort to help his project. This has been the way Linux has been developed ever since. Thousands of people around the world contribute their own small pieces, rather than there being one overall company in charge. And the same concept applies to knowledge of Linux. When you learn something, don't be afraid to share this knowledge with others. "Giving something back" is an important part of the Linux community, and that doesn't mean just creating programs—people contribute artwork, documentation, or just time to help others.

To understand why Linux is shared, you need to understand its history, as well as the history of what came before it. This is the topic of Chapter 2.

Summary

This chapter provided an introduction to Linux. It explained what Linux can be used for and its many advantages when compared to Microsoft Windows. It also introduced the community surrounding Linux, which adds to its benefits. You should be starting to realize what makes millions of people around the world use Linux as the operating system of choice.

The next chapter covers the history of Linux. It also discusses another curious aspect: the political scene that drives the operating system forward.

CHAPTER 2

A History and Politics Lesson

Linux is more than just software. It's an entire community of users, and as such, there's a detailed social history behind it. In this chapter, you'll look at the origins of Linux, both in terms of where it came from and the people who make it.

You might be tempted to skip this chapter and move on to the information about installing Ubuntu. To be fair, nothing of vital technical importance is mentioned here. But it's important that you read this chapter at some stage, because Linux is more than simply the sum of its parts. It should be considered as far more than a set of computer programs that run your computer. If nothing else, this chapter explains the fundamental philosophies behind Linux and attempts to answer some of the often baffling questions that arise when Linux is considered as a whole.

In the Beginning

It is difficult to categorically state when Linux was born. Linux can trace its origins back to the birth of the Unix operating system in 1969. However, some would argue that when viewed as an operating system, the project started in 1983, when a talented computer scientist named Richard Stallman decided to create his own version of an operating system called Unix.

We'll come back to him later in our story, but for now we'd like to suggest that the true story of Linux began just 18 years ago, in 1991.

That was the year that a Finnish national named Linus Torvalds announced to the world his personal project to develop an operating system. At the time, Torvalds was studying in Helsinki, Finland, and had recently got himself a desktop PC. His new computer needed an operating system, and Torvalds's choices were limited: there were various versions of Microsoft DOS and something called Minix. Minix was a clone of the popular Unix operating system. Unix was used on huge computers in businesses and universities, including those at Torvalds's university. It was created in 1969 and would evolve into what many considered the cutting edge of computing. Unix brought to fruition a large number of computing concepts in use today and, many agree, got almost everything just right in terms of features and usability.

Versions of Unix were available for smaller computers like Torvalds's PC, but they were considered professional tools and were very expensive. This was in the early days of the IBM PC craze, and the only people who used such computers were businesspeople and hobbyists.

■ **Note** Linux is a pretty faithful clone of Unix. If you were to travel back in time 20 or 30 years, you would find that using Unix on those old mainframe computers, complete with their teletype interfaces, would be similar to using Linux on your home PC. Many of the fundamental concepts of Linux, such as the file system hierarchy and user permissions, are taken directly from Unix.

Torvalds liked Unix because of its power, and he liked Minix because it ran on his computer. Minix was created by Andrew Tanenbaum, a professor of computing, to demonstrate the principles of operating system design to his students. Crucially, because Minix was also a learning tool, people could view the *source code* of the program—the original listings that Tanenbaum had entered to create the software. This was very attractive to programmers like Torvalds.

But Torvalds had a number of issues with Minix. Although it's now available free of charge, at the time Minix was available only for a fee (although in many universities, it was possible to obtain copies free of charge from professors who paid a group licensing fee). Nevertheless, the copyright issue meant that using Minix in the wider world was difficult, and this, along with a handful of technical issues, inspired Torvalds to create from scratch his own version of Unix, just as Tanenbaum had done with Minix.

"I'm doing a (free) operating system (just a hobby, won't be big and professional)," he wrote when he announced his project in a Usenet posting in 1991.

He couldn't have been more wrong.

■ **Note** Most clones or implementations of Unix are named so that they end in an *x*. One story has it that Torvalds wanted to call his creation *Freax*, but a containing directory was accidentally renamed *Linux* on an Internet server. The name stuck.

From day one, Torvalds intended his creation to be shared among everyone who wanted to use it. He encouraged people to copy it and give it to friends. He didn't charge any money for it, and he also made the source code freely available. The idea was that people could take the code and improve it.

This was a master stroke. Many people contacted Torvalds, offering to help out. Because they could see the program code, they realized he was onto a good thing. Soon, Torvalds wasn't the only person developing Linux. He became the leader of a loosely organized team that used the fledgling Internet to communicate and share improvements.

Note Perhaps because of its humble origins, a popular conception of Linux is that it was created by a few hobbyists who worked on it in their spare time. This might have been true in the very early days. Nowadays, in addition to these “bedroom programmers,” Linux is programmed by hundreds of professionals around the world, many of whom are employed specifically for the task. Torvalds adds to the effort himself and also coordinates the work as part of his full-time position at the Linux Foundation.

It’s important to note that when we talk here about Linux, we’re talking about the kernel—the central program that runs the PC hardware and keeps the computer ticking. This is all that Torvalds initially produced back in 1991. It was an impressive achievement but needed a lot of extra software to take care of even the most basic tasks. Torvalds’s kernel needed additional software so that users could enter data, for example. It needed a way for users to be able to enter commands so they could manipulate files, such as deleting or copying them. And that’s before you even consider more complicated stuff like displaying graphics on the screen or printing documents.

Linux itself didn’t offer these functions. It simply ran the computer’s hardware. After it booted up, it expected to find other programs. If they weren’t present, all you saw was a blank screen.

LINUS TORVALDS

Linus Benedict Torvalds was born in Helsinki, Finland, in 1969. A member of the minority Swedish-speaking population, he attended the University of Helsinki from 1988 to 1996, graduating with a master’s degree in computer science.

He started Linux not through a desire to give the world a first-class operating system but with other goals in mind. Its inspiration is in part due to Helsinki winters being so cold. Rather than leave his warm flat and trudge through the snow to the university’s campus in order to use its powerful mini-computer, he wanted to be able to connect to it from home! He also wanted to have a platform to use to experiment with the properties of the Intel 386 microprocessor, but that’s another story. Torvalds needed an operating system capable of such tasks. Linux was born.

It took Torvalds the better part of a year to come up with the very first version of Linux, during which he worked alone in a darkened room. In 1991, he announced his creation to the world, describing Linux as “just a hobby,” and saying it would never be big. It wouldn’t be until 1994 that it reached version 1.0.

In the early days, Torvalds's creation was fairly primitive. He was passionate that it should be free for everyone to use, and so he released it under a software license that said that no one could ever sell it. However, he quickly changed his mind, adopting the GNU Public License.

Torvalds was made wealthy by his creation, courtesy of the dot-com boom of the late 1990s, even though this was never his intention; he was driven by altruism. Nowadays, he lives in Portland, Oregon, with his wife and children, having moved to the United States from Finland in the late 1990s.

Initially, Torvalds worked for Transmeta, developing CPU architectures as well as overseeing kernel development, although this wasn't part of his official work. He still programs the kernel, and currently manages the project as an employee of the Linux Foundation, an organization created to encourage open source adoption in industry. The Linux Foundation is also referred to as the official home of Linux.

The GNU Project

Around the time Torvalds created Linux, another project, called GNU, also existed. This project team also hoped to create an operating system that used Unix as its inspiration, while avoiding some of the pitfalls that had blighted that operating system, both technically and in terms of its licensing. *GNU* is a so-called recursive acronym that stands for *GNU's Not Unix*, a play on words favored by computer programmers.

GNU's parent organization, the Free Software Foundation (FSF), had been formed eight years prior to Torvalds's effort, and since that time had produced the majority of the core software that Linux needed to be a bona fide operating system. However, as luck would have it, FSF lacked the essential functionality of a kernel. The developers were in the process of creating their own kernel, but it had not come to fruition.

The GNU software was distributed for free to anyone who wanted it. The source code was also made available, so users could adapt and change the programs to meet their own needs (in fact, Torvalds had used the GNU model when deciding how to distribute Linux).

Richard Stallman is the man behind GNU and, along with Torvalds, is the second hero in our story. Stallman had been around since the Dark Ages of computing, back when wardrobe-sized computers were "time-shared" among users who used small desktop terminals to access them. Like Torvalds, Stallman started GNU as a personal project, but then found others who were more than willing to join his cause.

■ **Note** Stallman created the Emacs text editor and the GNU C Compiler (GCC, nowadays known as the GNU Compiler Collection). Together they allow the creation of yet more software, so it's no surprise that one of the very first programs Torvalds used in the early days to create Linux was Stallman's GCC.

Back in Stallman's day at the legendary Massachusetts Institute of Technology (MIT), computer software was shared. If you created a program to perform a particular task, you offered it to practically anyone who wanted it. Alternatively, if you found that an existing program wasn't adequate or had a bug, you improved it yourself and then made the resulting program available to others. People might use your improved version, or they might not; it was up to them.

This way of sharing software was disorganized and done on an ad hoc basis, but came about of its own accord. Nobody questioned it, and it seemed the best way of doing things. There certainly wasn't any money involved, any more than there would be money involved in one friend explaining an idea to another.

RICHARD STALLMAN

Richard Matthew Stallman, usually referred to as RMS, was born in 1953 in Manhattan. He comes from the old school of computing forged during the 1970s and was a member of MIT's legendary Artificial Intelligence Lab.

Seemingly destined for a life in academia, Stallman left MIT in 1984 to found the GNU Project. This was a reaction to the increasing commercialization of computer software. Whereas once all hackers (that is, programmers) had shared ideas and program code, the trend in the 1980s was toward proprietary, nonshared code, as well as legal nondisclosure contracts, which forced programmers to keep secrets from one another.

"I cannot in good conscience sign a nondisclosure agreement or a software license agreement," wrote Stallman in his announcement of GNU in 1984. "[In order] that I can continue to use computers without violating my principles, I have decided to put together a sufficient body of free software so that I will be able to get along without any software that is not free."

Stallman is a very talented programmer and is considered a genius by many observers. He single-handedly created many essential programming tools in his initial efforts to get GNU off the ground. Many of these find a home in Linux.

Together with Eben Moglen, a professor of law at Columbia University, Stallman is also widely applauded for the creation of the GNU Public License. This is a legal document that lets people share software. It introduces the concept of *copyleft* and is opposed to the legal concept of copyright, which attempts to limit the freedom of individuals when using a piece of software (or any other creative work). Nowadays, the concept of copyleft has been applied to literature, music, and other arts in an attempt to avoid restricting who can and cannot access various items, as well as to encourage a collaborative working environment.

Proprietary Software and the GPL

In the 1980s, everything changed. The world became more corporate, and with the rise of the desktop PC, the concept of proprietary software became prevalent. More and more companies started to sell software. They reasoned that this was impossible to do if they shared it with everybody else, so they kept it secret. Microsoft led this charge and did very well with its proprietary software approach.

To Stallman, this "trade secrets" approach to software was anathema. He had nothing against software being sold for a profit, but he hated the fundamental ideas behind software being kept secret. He felt passionately that sharing software and being able to understand how it worked was akin to free speech—necessary and vital for the furthering of technology, and therefore society itself. How could the new generation of programmers improve on the previous generation's work if they were unable to see how it worked? It was absurd to need to create software from scratch each time, rather than taking something that already existed and making it better.

Because of his beliefs, Stallman resigned from his job in the MIT Artificial Intelligence Lab and founded GNU. His aim initially was to produce a complete Unix-compatible operating system that would be shared in the ways he knew from the early days of computing. This software would be available for everyone to use, to study, and to adapt. It would be free, in the same sense as free speech—shared and unrestricted. This gave rise to the vital concept of *free software*, and soon GNU, and the FSF, became not just a programming venture, but also a political movement.

■ **Note** A common misconception of *free software* is that it is always free of charge. This isn't correct. The word *free* is used here in its political sense, as in *free speech*. There's no rule that forbids the sale of free software, although in the majority of cases it is available entirely free of charge. To help avoid confusion like this, some people prefer to use the term *libre* instead of free software. Often the term *free, libre, or open source software (FLOSS)* is used too.

To protect the rights of people to share and adapt the GNU software, Stallman came up with the GNU Public License (GPL). Various drafts of this license were produced over time, until it became a completely watertight legal contract, which furthered the concept of free software. You can read the text of the license at `www.gnu.org/licenses/gpl.html`.

Most software you buy comes with a license agreement—that big chunk of text you must agree to when installing software (in the case of Windows desktop software, it's frequently referred to as the End-User License Agreement, or EULA). The license agreement usually says that you cannot copy the software or share it with friends. If others want to use the software, they must buy their own version.

The GPL turns this on its head. Rather than restricting what people can do with the software, it gives them permission to share the software with whomever they wish. However, if they modify the program in any way and then distribute it to others, the program they come up with must also be licensed under the GPL. In other words, people cannot make changes to a program that has a GPL and then sell the modified program, keeping their improvements secret.

■ **Note** An interesting side note is that the actual wording of the GPL says that any changes you make should be shared with others *only if the software is redistributed*. This means that if you modify some GPL software and don't give it to anyone else, there's no need for you to publish your changes or make others aware of those changes.

GNU and Linux Together

The Linux kernel project, initiated by Torvalds, and the GNU project, initiated by Stallman, were a perfect match for the majority of people who needed a powerful and capable clone of Unix. It's important to note that this doesn't mean the two projects joined forces. It simply means that the Linux project took some of the GNU software and gave it a good home. This was done with Stallman's blessing, but there wasn't any official union between the two groups. Remember that Stallman intended everyone to freely share and use the GNU tools. Linux represented a set of people doing just that. GNU has its own kernel project, called Hurd. This provides an alternative to using the Linux kernel, but it isn't very popular, perhaps because it lacks the broad hardware support that Linux has.

However, GNU and Linux together formed a complete and capable operating system, which mimicked the way Unix operated. Other projects and individuals spotted the success of Linux and emulated its approach in making software freely available. Eventually, hundreds of items of vital software would be provided by individuals and organizations, all using the same "share and share alike" example set by Stallman with the GNU tools, and by Torvalds with his kernel.

As noted in Chapter 1, many people refer to Linux as GNU/Linux. This gives credit to the GNU Project that provided the majority of tools vital to making Linux into a usable operating system. However, like the majority of people in the computing world, we use the term *Linux* throughout this book to avoid confusion.

Different Flavors of Linux

All the pieces of GNU software, along with the Linux kernel, were available for free download and were therefore free of charge. But this brought its own problems. Not everyone had the know-how to put all the bits and pieces together into a complete operating system. Those who could do this didn't necessarily have the time.

Because of this, a number of companies stepped in to do the hard work. They put together versions of Linux, complete with all the software from the GNU Project, which they then sold for a fee on floppy disks, CDs, or DVDs. They also added in bits of their own software, which made it possible to easily install the operating system onto a computer's hard disk, for example. They produced their own manuals and documentation, too, and did other things such as bug testing to ensure it all worked well.

What they came up with became known as *distributions* of Linux, or *distros* for short. Examples of these companies include Red Hat, SUSE, Mandriva, and many others around the world. Additionally, a number of enthusiasts got together and formed organizations to create their own distros, such as Debian and Slackware.

Modern distros are very advanced. They make it easy to install Linux on your PC, and they usually come with everything you need so you can get started immediately. Additionally, they have their own look and feel, as well as unique ways of working and operating. This means that Ubuntu is not the same as Red Hat Linux, for example, although they share a lot of common features and, of course, they all share the core GNU software and Linux kernel.

Linux Today

Nowadays, Linux is a thoroughly modern and capable operating system that is at the forefront of computer science.

The traditional home of Linux, as defined by the people who typically use it, has always been on servers—computers that offer resources to other computers. The Internet is effectively a large network of servers, for example, and a lot of Linux's early success came from providing an efficient and stable operating system for these computers.

In more recent times, Linux has come to be favored on computers at either end of the size spectrum—very large and very small! It's not unusual to find Linux running supercomputers, the types of computer that are so powerful that they heat the building they're installed in and work out global weather patterns or the physics behind nuclear detonations.

Yet Linux is also found on ultraportable computing devices, such as mobile phones. Google recently utilized Linux in its Android operating system for mobile devices, for example. Linux can even be found on computing devices smaller than this; some people have had Linux running on digital watches! Often it really is the case that if it looks even remotely like a computing device, Linux will run on it.

Linux is invading your home too: digital video recorders, car navigation systems… look under the hood and you may well find they run some version of Linux. All of this is possible because Linux is free software, and therefore freely available to adapt and modify however manufacturers wish.

All of Linux's success on wide-ranging hardware is in addition to its "traditional" home, which is the ubiquitous PC that utilizes Intel, AMD, or other x86-compatible processors—just as Torvalds had envisioned back in 1991.

Ubuntu: African Philosophy

The story of Linux is an ongoing one, and each year brings new victories and surprises. Linux is frequently taken in new and exciting directions by individuals and organizations. Each new direction brings its own personal history, and the story of Ubuntu is an increasingly important entry on that list.

The Ubuntu project was started in 2004 by Mark Shuttleworth, a South African entrepreneur. A longtime advocate and developer of free software, Shuttleworth had many reasons for creating an entirely new distribution of Linux. Like Linux itself, many of these reasons are ethical and philosophical in origin, as well as practical.

The name *Ubuntu*, which has African origins, began to receive international attention during the post-apartheid years in South Africa, when eminences such as Archbishop Desmond Tutu and Nelson Mandela spoke of it frequently. The word has no clear translation from the African Bantu language, but the closest approximation is *humanity to others* and *a person is a person through other persons*.

"A person with Ubuntu is open and available to others," Desmond Tutu said in 1999, "[he or she is] affirming of others, does not feel threatened that others are able and good, for he or she has a proper self-assurance that comes from knowing that he or she belongs in a greater whole and is diminished when others are humiliated or diminished, when others are tortured or oppressed."

Shuttleworth's goal was to combine the spirit of Ubuntu with the spirit of free software, as laid down by Richard Stallman. Shuttleworth was interested in making an operating system that was universally accessible by everybody in the world, no matter where they lived or who they were. As stated on the Ubuntu web site (`www.ubuntu.com/community/ubuntustory/philosophy`), there are three key elements to the Ubuntu philosophy and approach:

- Every computer user should have the freedom to download, run, copy, distribute, study, share, change, and improve their software for any purpose, without paying licensing fees.
- Every computer user should be able to use their software in the language of their choice.
- Every computer user should be given every opportunity to use software, even if they work under a disability.

On a more practical level, Shuttleworth wanted to make a "Linux for human beings." Indeed, this is the catchphrase of the Ubuntu organization. With this statement, Shuttleworth was rallying against the prevailing mindset of that time, which was that Linux was "for techies only." Shuttleworth saw the potential of Ubuntu to be an operating system for all kinds of users, whatever their level of knowledge or expectations.

In addition to encouraging the creation of such things as user-friendly configuration and installation software, Shuttleworth also wanted to create a Linux that was fine-tuned for desktop users. Prior to the arrival of Ubuntu, most versions of Linux ran well on desktop computers, but the experience wasn't always a good one. Many distributions of Linux were primarily aimed at server computers, and often catering to more humble desktop users was an afterthought.

Although only 5 years old and a mere youngster compared to some distributions of Linux, Ubuntu continues to achieve unprecedented success, both in the world of Linux and beyond. It's widely considered the very best alternative to Windows for those who have become tired of Microsoft's products or its business practices.

Although driven by altruism, Shuttleworth sees Ubuntu as a business too. In fact, Ubuntu sits astride two stools when it comes to its origins. On the one hand, it is a community-driven distribution that prides itself on a democratic approach. The community makes most key decisions, and community members carry out much of the programming and development work.

However, Ubuntu is also commercially sponsored by Canonical, a private company owned and run by Shuttleworth. This provides funding for key projects within Ubuntu and pays for much of the infrastructure. It makes money by offering paid support services to the corporations that adopt Ubuntu.

■ **Note** Shuttleworth donated $10 million of his own money to create the Ubuntu Foundation, which provides the official (and noncommercial) home of Ubuntu. If ever Canonical should withdraw from sponsoring Ubuntu, it is envisioned that this organization will take over the day-to-day running of the distribution.

DEBIAN

Ubuntu isn't entirely original, which is to say it wasn't created from scratch. It is in fact an adaptation of the Debian distribution of Linux. Debian has been around almost as long as Linux itself, being founded in 1993, just two years after Torvalds made his initial announcement of the Linux kernel. Debian is widely respected and revered within the Linux community, and has some claim to be the definitive Linux distribution.

The project was started by a computer scientist named Ian Murdock, and the name comes from a combination of his Christian name along with that of his girlfriend, Deborah—hence Deb-Ian. Murdock was driven to action because of perceived deficiencies in the then-popular distribution Softlanding Linux System, plus a desire to make concrete the community spirit that was arising around Linux.

As always with Linux, the new distribution was as much a political ideal as a technological one. It wasn't long before the Debian Constitution was drawn up, which lays down rules on governance of the decentralized worldwide community that is Debian, and also the Debian Social Contract, which is an effective and pure distillation of the spirit of free software. You can read both by visiting the Debian web site: `www.debian.org`.

Ubuntu and Debian are closely intertwined, on a practical and philosophical level. Ubuntu uses many Debian developers and supports the same fundamental principles. On a technical level it is almost identical, and Ubuntu wouldn't be possible if it wasn't for certain technical breakthroughs made by the Debian project across the years, particularly when it comes to software management.

The two distributions differ in their uses and approaches, however. Although supremely flexible and malleable, Debian finds most use on server computers. Ubuntu is primarily a desktop distribution, although it also has a server edition. In terms of approach to new software, Debian is extremely cautious and makes a release only after a thorough bug-testing procedure This can be arguably detrimental: there was a gap of around three years between the Woody and Sarge releases (all Debian releases are named after characters in the movie *Toy Story*), during which time the fast-evolving world of computing had changed almost out of all recognition. In contrast, Ubuntu is extremely aggressive when incorporating new versions of software, to the point sometimes of including prerelease beta software, and makes new releases on a six-month schedule.

Summary

This chapter has detailed the history of Linux and explained its origins. It also explained *why* Linux came into being. It showed how Linux formed one of the building blocks of a political movement geared toward producing software that can be shared.

We discussed the creator of Linux, Linus Torvalds. You've also looked at the massive input the GNU Project has made and, in particular, that of its philosopher king, Richard Stallman.

In the next chapter, we move on to look at what you can expect from day-to-day use of Linux.

CHAPTER 3

The Realities of Running Linux

So now that you've learned about the politics, history, and personalities behind Linux and Ubuntu, only one question remains: what's Linux actually like when used day to day? What should the average user expect from the experience?

These are the questions we answer in this brief chapter.

Learning to Use Linux

What should you expect from Linux after you've installed it? Well, it's a little like running Windows, except there are no viruses, fewer crashes, and no inexplicable slowdowns.

In addition, you have complete control over the system. This doesn't mean Linux is necessarily complicated. It's just that you have the control if you wish to make use of it. You'll look into this further in the later chapters of this book.

Most software you use under Windows has at least one equivalent under Ubuntu, installed by default. It's unlikely that you'll need to download or install any additional software and, even if you do, you'll probably find it's available for free.

Does this sound too good to be true? There is just one caveat. Linux isn't a clone of Windows and doesn't aim to be. It has its own way of doing certain things and sometimes works differently from Windows. This means that many people experience a learning curve when they first begin using Linux.

Note Several Linux distributions aim to mimic Windows pretty faithfully. For example, Xandros and Linspire copy the look and feel of Windows to the extent that (allegedly) some people are unable to tell the difference.

But in just a few weeks after your move to Linux, everything will start to seem entirely normal. Most of the time, you won't even be aware you're running Linux. Of course, some patience is required during those initial few weeks. Linux can be illogical and frustrating; on the other hand, so can Windows. We simply got used to it.

Who Uses Linux?

Who uses Linux? Modern distributions make Linux accessible to all. It's no exaggeration to say that you could install Linux on a computer Luddite's PC and have that person use it in preference to Windows.

Up until quite recently, Linux was largely seen as a programmer's tool and a server operating system. It was geared toward programmers or was destined for a life running backroom computers, serving data, and making other computer resources available to users.

To this end, Linux continues to run a sizable proportion of the computers that make the Internet work, largely because it provides an ideal platform for the Apache web server, as well as various databases and web-based programming languages. This has lead to the LAMP acronym, which stands for Linux, Apache (a web server), MySQL (a database), and PHP, Python, or Perl (three programming languages that can be used in an online environment).

Despite its technical origins, recent years have seen a strong push for Linux on desktop computers. Linux has stepped out of the dark backrooms, with the goal of pushing aside Microsoft Windows and Mac OS in order to dominate the corporate workstation and home-user market.

Running Linux on the desktop has always been possible, but the level of knowledge required was often prohibitively high, putting Linux out of the reach of most ordinary users. It's only comparatively recently that the companies behind the distributions of Linux have taken a long, hard look at Windows and attempted to mirror its user-friendly approach (with Ubuntu arguably looking longest and hardest). In addition, the configuration software in distributions such as Ubuntu has progressed in leaps and bounds. Now, it's no longer necessary to know arcane commands in order to do something as simple as switch the screen resolution. The situation has also been helped by the development of extremely powerful office software, such as OpenOffice.org.

More recently, Linux has invaded the portable computer market, where it is arguably achieving its highest degree of success. Netbooks—ultrasmall computers modeled on notebooks—are nearly always offered with a Linux option, and Ubuntu is becoming a particularly popular choice. There's even a version of Ubuntu designed specifically for netbooks called Ubuntu Netbook Remix. See `www.canonical.com/projects/ubuntu/unr`.

Is Linux for you? There's only one way of finding out, and that's to give it a go. Linux doesn't require much of you except an open mind and the will to learn new ways of doing things. You shouldn't see learning to use Linux as a chore. Instead, you should see it as an adventure—a way of finally getting the most from your PC and not having to worry about things going wrong for reasons outside your control.

Linux puts you in charge. You're the mechanic of the car as well as its driver, and you'll be expected to get your hands dirty every now and then. Unlike Windows, Linux doesn't hide any of its settings or stop you from doing things for your own protection; everything is available to tweak.

Using Linux requires commitment and the realization that there are probably going to be problems, and they're going to need to be overcome.

However, using Linux should be enjoyable. Always remember that in his initial newsgroup posting announcing Linux back in 1991, Linus Torvalds said that he was creating Linux "just for fun." This is what it should be for you.

Getting Hold of Linux

Getting hold of Linux is easy. You'll already have spotted the version of Ubuntu packaged with this book. Ubuntu is the main focus of this book, and we consider it to be the very best version of Linux out there for desktop users. It's ideal for both beginners and power users, and it really does match the functionality offered in Windows. It includes several easy-to-use configuration tools, which makes changing your system settings a breeze. For example, a tool known as the Synaptic Package Manager can automate the download and installation of new software with just a few clicks.

Ubuntu is also a very good-looking distribution. You'll find your friends and colleagues "wowing" when they happen to pass by and glance at your PC!

Quite a number of Linux distributions are available. If you want to explore other Linux distributions as well as Ubuntu, by far the most fuss-free method of getting hold of Linux is to pop over to your local computer store (or online retailer) and buy a boxed copy. You can choose from Red Hat, SUSE, Mandriva, and several others. Although some distributions come on CD, most commercially sold distributions come on one or two DVDs.

■ **Caution** Bearing in mind what we've said about the sharing nature of Linux, you might think it possible to buy a boxed copy of Linux and run off copies for friends, or even sell them for a profit. However, you shouldn't assume this is the case. A minority of distribution companies, such as Red Hat, incorporate copyrighted corporate logos into their distributions that place restrictions on redistribution. Sometimes they include proprietary software along with the Linux tools, which you cannot copy without prior permission. However, in many cases, reproducing the CDs in small volumes for friends or for use on workstations in a company environment is permitted.

Many of the Linux distributions are also available to download free of charge. In fact, many community-run distributions—such as Slackware, Debian, Fedora, and Gentoo—are *only* available this way (although you can often buy "homemade" CDs from small retailers, who effectively burn the CDs for you and produce makeshift packaging). If your PC has a CD-R/RW drive and you have some CD-burning software under Windows (such as Nero), you can download an ISO image and make your own installation CD from it.

Note An *ISO image* is a very large file (typically 700MB for a CD or 4.3GB for a DVD), which you can burn to CD or DVD. This CD or DVD is then used to install Linux. We discuss how to burn CDs/DVDs in Appendix D.

Understanding How Linux Differs from Windows

It's worth spending just a few minutes discussing specific practical areas in which Linux differs from Windows. This can help cushion the landing for many new Linux users and avoid any surprises. Some of these areas are, of course, discussed in depth throughout this book.

Modular Structure

Although we talk of the Linux operating system as a singular entity, in actual fact it comprises many separate components that are taken from many different projects. As discussed in the preceding chapter, the chief among these is the Linux kernel, the heart of the operating system. In addition, many crucial system files and user tools are taken from the GNU Project (`www.gnu.org`). The desktop of Ubuntu comes from the GNOME project (`www.gnome.org`), while the web browser comes from the Mozilla Project (`www.mozilla.org`). All of these projects operate independently of each other.

This list of components could continue practically indefinitely, but the key point is that—unlike Windows or Mac OS X—it isn't the case that all the software you use on a daily basis is originated and developed by one organization. Linux is a composite of the work of many projects and people.

The nature of open source software, which enables the source code to be shared and appropriated by any interested parties, is what makes this possible.

Because a modular approach is taken, anybody with enough know-how can swap in and out what appear to be crucial system components. For example, the GNOME desktop of Ubuntu can be swapped for KDE (`www.kde.org`) or Xfce (`www.xfce.org`). In fact, often there's not even any need to swap one for another; GNOME, KDE, and Xfce can all be installed alongside each other, leaving the user to choose which one to use.

Software Installation

Software installation under Windows or Mac OS X can be something of a Wild West experience. You need to find the software you're interested in, download it (or purchase the CD/DVD), and then install it. Under Ubuntu, software installation is much more organized, and it's very likely that any Linux software you need, or have even heard about, will be offered for free download under the auspices of the main Ubuntu project. Ubuntu uses the Synaptic Package Manager program to manage access to this software.

As stated earlier, this approach to software availability is possible because of the nature of open source software, which encourages people to take the source code for a project and appropriate it for use however they wish. We explain more about software installation in Chapter 28.

File System

Most versions of Linux (Ubuntu included) feature the same approach to files and folders as Windows or Mac OS X. There are a couple of differences, however. Linux doesn't use drive letters, for example, to identify individual storage devices. Instead, the contents of any attached storage device, such as a USB memory stick, are "automagically" made available via a process known as mounting. This is explained in depth in Chapter 12.

In addition, Linux offers a more comprehensive method of protecting files from access by others, compared to most versions of Windows. This is also explained in Chapter 12.

Using Ubuntu

As mentioned in Chapter 2, the goal of the Ubuntu project is to give anyone in the world access to an easy-to-use version of Linux, regardless of geographical location or physical abilities. Ubuntu supports a large number of languages, so it can be used in most countries around the world. In addition, it includes optional accessibility tools, so it can be used by partially sighted, deaf, or disabled people.

From the very start, Mark Shuttleworth, Ubuntu's creator, decided it would always be free of charge and would always be freely available. Unlike many versions of Linux, no commercial version of Ubuntu exists (although it is possible to pay for various services such as support, if you wish).

Ubuntu also is designed to be easy to use. Anyone who has used Windows or Mac OS will feel right at home. It features every piece of software you could wish for or would find within a well-equipped modern operating system. It includes a web browser, an e-mail client, instant messaging software, an office suite, a graphics editor, and much more. And don't think that these are cut-down versions designed to lure you into purchasing the full version later on. In every case, they're full-featured pieces of software that give proprietary programs a run for their money. Perhaps more important, system administration tasks are also made as easy as possible: updating the system can be done with just a few clicks of the mouse, as can downloading and installing new software.

But Ubuntu's greatest strength is its community, which extends across the world. If you have a question about Ubuntu, you'll find hundreds of people willing to help. Just as the software is designed to be shared, a strong belief within the Ubuntu community is that knowledge should be shared too. We talk more about this in Appendix C.

Summary

This chapter explained what you can realistically expect when using Linux every day. It also discussed the kind of company you'll be keeping in terms of fellow users.

You learned how people usually get hold of Linux. Of course, with this book, you already have a version of Linux—Ubuntu—which was introduced in this chapter.

This completes the general overview of the world of Linux. In the next part of the book, you'll move on to installing Linux on your hard disk. This sounds more daunting than it is. The next chapter gets you started by explaining a few basic preinstallation steps.

PART 2

Installing Ubuntu

CHAPTER 4

Preinstallation Steps

The first part of this book discussed using Linux as part of your day-to-day life. It was intended to help you evaluate Linux and understand what you're buying into should you decide to make it your operating system of choice. Now we move on to actually installing Linux and, specifically, Ubuntu, which is included with this book on a DVD-ROM.

Installing any kind of operating system is a big move. However, Ubuntu makes this complicated maneuver as easy as it's possible to be. Its installation routines are very advanced compared to previous versions of Linux and even compared to other current distributions.

What does saying that you're going to install Ubuntu actually mean? This effectively implies three things:

- Somehow, all the files necessary to run Ubuntu are going to be put onto your hard disk.
- The PC will be configured so that it knows where to find these files when it first boots up.
- The Ubuntu operating system will be set up so that you can use it.

However, in order to do all this and get Ubuntu onto your PC, you must undertake some preparatory work, which is the focus of this chapter.

Understanding Partitioning

Chances are your PC already has Windows installed on it. This won't present a problem. In most cases, Ubuntu can live happily alongside Windows in what's called a *dual-boot setup*, which enables you to choose which operating system to run at your computer's startup. However, installing Ubuntu means that Windows must make certain compromises. Windows is forced to cohabit on your hard disk with another operating system—something it isn't designed to do.

■**Note** Even if you intend to install Ubuntu on a completely blank hard disk, it's still important that you understand partitioning.

The main issue with such a situation is that Windows needs to shrink and make some space available for Ubuntu (unless you install a second hard disk, which is discussed later in this chapter). In an ideal world, Ubuntu needs its own separately defined part of the disk, which is referred to as a *partition*. All of this can be handled automatically by the Ubuntu installation routine, but it's important that you know what happens so that you will know what to do in the unlikely event of anything going wrong.

■**Note** It's possible to install Ubuntu within the Windows file system too, as an alternative to dual-booting. This is explained in the next chapter.

All hard disks are split into partitions, which are large chunks of the disk created to hold operating systems (just as a large farm is partitioned into separate fields). A partition is usually multiple gigabytes in size, although it can be smaller.

■**Note** If you use a Macintosh, don't feel left out! The next chapter includes a sidebar explaining the options for installing Ubuntu on your computer.

You can view your disk's partitions by using the Disk Management tool in Windows XP, 2000, and Vista, as shown in Figure 4-1. You can access this tool by opening the Control Panel, switching to Classic View, clicking the Administrative Tools icon, selecting Computer Management, selecting Storage, and then choosing Disk Management.

Most desktop PC systems have just one partition, unless the user has specifically created additional partitions. As mentioned, Ubuntu needs a partition of its own. During installation, Ubuntu needs to shrink the main Windows partition and create two partitions: one for the operating system itself, and an extra one to hold the swap file.

In addition, the Ubuntu installation routine writes a new boot sector (also known as a *boot loader*). The boot sector is located at the very beginning of the disk and contains a small program that then runs another program that lets you choose between operating systems (and therefore partitions) when you first boot up.

Figure 4-1. *You can view your disk's partitions by using Windows' Disk Management tool.*

Note Not all Linux distributions have the ability to repartition the hard disk. Quite a few expect to simply take over the entire hard disk, wiping out Windows in the process (although they'll always ask the user to confirm this beforehand). The ability to repartition a disk is just one of the reasons that Ubuntu is among the best Linux distributions currently available.

Of course, Ubuntu cannot shrink a Windows partition that is packed full of data, because no space is available for it to reclaim. Therefore, one of the first preparatory steps is to ensure that enough space is free.

Freeing Up Space

The first step before installing Ubuntu alongside Windows is to check how much free space you have in your Windows partition. To see the amount of free space you have under Windows Vista, click the Start button, click Computer, and look at the bar graph next to your hard disk drive, as shown in Figure 4-2. With older versions of Windows, you should double-click My Computer, right-click your boot drive, and select Properties. The free space is usually indicated in purple on a pie chart.

In both cases, look for how much free space you have. In Windows Vista, this is the first figure underneath the bar graph.

You need to have at least 3GB of free space in your Windows partition for Ubuntu to use, but this really is a bare minimum and should be considered only if you have no other choice (that is, your computer lacks free disk space). You'll need more space if you wish to install a lot of programs. If you don't have enough free space, you have several options: reclaim space, remove Windows, or use a second hard disk.

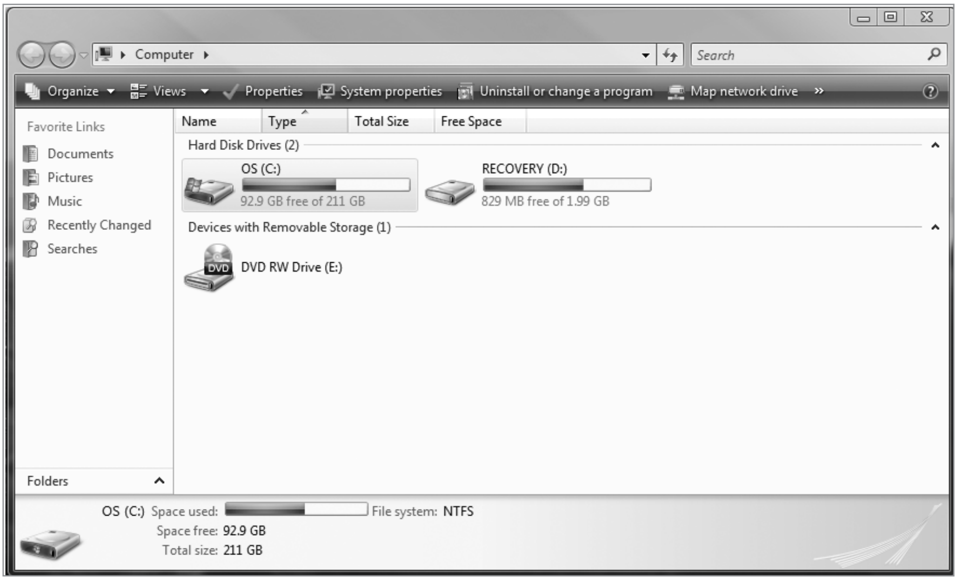

Figure 4-2. *Ubuntu needs free disk space in which to install, so you might need to clean up your Windows partition.*

Reclaiming Space

In Windows Vista and XP, you can run the Disk Cleanup tool to free some space on your hard disk. Under Windows Vista, click Start ➤ Computer, and right-click the icon representing your hard disk. Select Properties from the menu that appears and then click the Disk Cleanup button. On Windows XP, click the Disk Cleanup button beneath the pie chart showing the free disk space. Disk Cleanup is also accessible by clicking Start ➤ All Programs ➤ Accessories ➤ System Tools ➤ Disk Cleanup.

You might also consider turning off System Restore. This consumes a lot of disk space, which you can therefore reclaim. However, deactivating System Restore will mean that you lose the possibility of returning your system to a previous state should anything go wrong (although you can always manually back up your data, of course). To access

System Restore under Vista, click the Start button and then right-click Computer in the menu. Select Properties, and click the System Protection link on the left of the window that appears. Next, remove the check alongside the drives under the Available Disk list, confirm that you want to turn off System Restore, and click the OK button on the System Properties dialog box. Under Windows XP, right-click My Computer, click Properties, and then click the System Restore tab. Next, put a check alongside Turn Off System Restore on All Drives, and click OK.

If you still cannot free up enough disk space, consider uninstalling unused software via the Add/Remove Programs applet within Control Panel. If you have any large games installed, consider removing them first, because they usually take up substantial amounts of hard disk space. You might also consider deleting movie and MP3 music files, which are renowned for eating up hard disk space. The average MP3 is around 4MB, for example, and one minute of video typically takes up 1MB of disk space!

Removing Windows

Some users might prefer a second, more radical option: getting rid of Windows completely and letting Ubuntu take over the entire hard disk. If you feel confident that Ubuntu will fulfill your needs, this is undoubtedly the most straightforward solution. You'll be able to do this during installation. However, this will also mean that any personal data you have will be lost, so you should first back up your data (as described shortly).

■ **Caution** You should be aware that installing Windows back onto a hard disk that has Ubuntu on it is troublesome. Windows has a Darwinian desire to wipe out the competition. If you attempt to install Windows on an Ubuntu hard disk, it will overwrite Linux.

Using Another Hard Disk

A third option for making room for Ubuntu is attractive and somewhat safer in terms of avoiding the potential for data loss, but also potentially expensive: fitting a second hard disk to your PC. You can then install Ubuntu on this other hard disk, letting it take up the entire disk. Unlike some versions of Windows, Ubuntu doesn't need to be installed on the primary hard disk and is happy on a secondary drive.

A second hard disk is perhaps the best solution if you're low on disk space and want to retain Windows on your system. However, you'll need to know how to install the new drive or find someone to do it for you (although step-by-step guides can be found on the Web—just search using Google or another search engine). In addition, if your PC is less than 12 months old, you could invalidate your warranty by opening up your PC.

If you have an old PC lying around, you might also consider installing Ubuntu on it, at least until you're sure that you want to run it on your main PC.

VIRTUALIZATION

If you don't want to repartition your disk or add another disk drive, there's another way you can run Ubuntu under Windows: using virtualization software.

Put simply, virtualization software lets you run a "computer within a computer" (or, in fact, several computers within a computer!). It does this by cleverly sharing system resources between the real computer and the one that's being virtualized in software.

When the virtualization software is run, the virtual computer appears in a program window. A BIOS-like startup screen appears, just as on a real computer, and then the virtual hard disk (usually a file on the main hard disk) is booted. An operating system may then be installed onto the virtual hard disk or, alternatively, it's possible to download entire virtual machines from various sites, for which the hard work of installing the operating system has been done for you!

There are a wide variety of virtualization software packages available, both proprietary and freely available open source. Undoubtedly the best open source rendition is VirtualBox (`www.virtualbox.org`), which is sponsored by computing giant Sun Microsystems. Perhaps the best proprietary packages are those offered by VMware, including VMware Server and VMware Player. Both products are entirely free of charge and can be downloaded from `www.vmware.com`. Another version of VMware, called Workstation, which is available for a charge, is also highly praised by many.

Also popular with many is QEMU (`www.nongnu.org/qemu/`), although it doesn't quite offer the performance of the software already mentioned. However, should you decide to give it a try, also worth downloading is QEMU Manager, which provides a GUI-based configuration front end for QEMU: see `www.davereyn.co.uk/download.htm`.

Using a virtualized computer is useful for testing software but, obviously, the experience isn't seamless. Operating systems running within virtual computers tend to operate more slowly compared to running natively on a computer, and the virtualized hardware is often very simple (you are usually unable to access your computer's 3D graphics hardware, for example). Setting up a virtual computer can also be difficult for those who are new to it, and you'll require a powerful PC with at least 2GB of memory (and more like 3–4GB for optimum results).

One final note: virtualization software doesn't run just on Windows. You can download several virtualization software packages for Ubuntu, which means you could install and run Windows within a virtual machine running on Ubuntu! QEMU, mentioned previously, runs on Ubuntu, as does VirtualBox and the various VMware products.

Backing Up Your Data

Whichever route you decide to take when installing Ubuntu, you should back up the data currently on your computer beforehand. Possibly the easiest way of doing this is to burn the data to CD-R/RW discs by using a program such as Nero and a CD-R/RW or DVD-R/RW drive.

If you take the coexistence route, installing Ubuntu alongside Windows, backing up your data should be done for insurance purposes. Although the people behind Ubuntu test all their software thoroughly and rely on community reporting of bugs, there's always the chance that something out of your control will go wrong. Repartitioning a hard disk is a major operation and carries with it the potential for data loss.

If you intend to erase the hard disk when installing Ubuntu (thereby removing Windows), you can back up your data and then import it into Ubuntu.

Table 4-1 shows a list of common personal data file types, their file extensions, where they can be typically found on a Windows system, and notes on importing the data into Ubuntu. Note that earlier versions of Windows (95, 98, and Me) may differ when it comes to data storage locations.

Table 4-1. *Data That Should Be Backed Up*

Type of File	File Extensions	Typical Location (Vista)	Typical Location (XP)	Notes
Office files	.doc, .xls, .ppt, .pdf, etc.	/Users/<username>/Documents	/Documents and Settings/<username>/My Documents	Microsoft Office files can be opened, edited, and saved under Ubuntu by using the OpenOffice.org suite. PDF documents can be viewed with the Evince program. Unfortunately, most recent versions of Office have brought with them differing file formats and therefore differing file extensions. You might want to search for the file extensions mentioned here, or others in addition; see http://en.wikipedia.org/wiki/Microsoft_Office_2007_file_extensions for more information.

Continued

Table 4-1. *Continued*

Type of File	File Extensions	Typical Location (Vista)	Typical Location (XP)	Notes
E-mail files	N/A	N/A	N/A	The Evolution mail client used by Ubuntu cannot import data directly from Microsoft Outlook or Outlook Express. However, there is a convoluted but effective workaround, which is described in the next section.
Digital images	`.jpg`, `.bmp`, `.tif`, `.png`, `.gif`, etc.	`/Users/<username>/Documents/Pictures`	`/Documents and Settings/<username>/My Pictures`	Ubuntu includes a variety of programs to catalog, view, and edit image files.
Multimedia files	`.mp3`, `.mpg`, `.avi`, `.wma`, etc.	Various within `Documents`	Various within `/My Documents`	With some additional downloads, discussed in Chapter 18, programs under Ubuntu can play most audio and movie file formats.
Internet Explorer Favorites	None	`/Users/<username>/Favorites`	`/Documents and Settings/<username>/Favorites`	Your Favorites list cannot be imported into Ubuntu, but the individual files can be opened in a text editor in order to view their URLs, which can then be opened in the Ubuntu web browser.
Mozilla Firefox Bookmarks	`.html`	N/A	N/A	If you use Mozilla Firefox under Windows, you can manually export your bookmarks for import under Firefox when Ubuntu is installed. Click Bookmarks ➤ Organize Bookmarks, click the Import and Backup button on the toolbar of the window that appears, and then select the Backup option from the menu that appears. To import the bookmarks into Ubuntu's version of Firefox, repeat the steps, but click the Restore ➤ Choose File option on the menu instead, and then locate the `.html` file you saved.

Type of File	File Extensions	Typical Location (Vista)	Typical Location (XP)	Notes
Miscellaneous Internet files	Various	Various	Various	You might also want to back up web site archives or instant messenger chat logs, although hidden data such as cookies cannot be imported.

Backing Up E-Mail Files

Microsoft e-mail cannot be easily imported into Ubuntu. Most e-mail programs use the MBOX format, and this is true of Ubuntu as well as programs created by the Mozilla Foundation (the organization behind the Firefox web browser). However, Microsoft uses its own DBX file format for Outlook Express and PST format for Outlook.

As a workaround, you can download and install the free Mozilla Thunderbird e-mail client (available from `www.mozillamessaging.com/en-US/thunderbird/`) on your Windows system. In Thunderbird, choose Tools ➤ Import to import your messages from Outlook, Outlook Express, or even the popular Eudora mail client. You will then be able to back up Thunderbird's mail files and import them into Evolution under Ubuntu, as described in Chapter 27.

To find where the mail files are stored, in Thunderbird choose Tools ➤ Account Settings, and then look in the Local Directory box. Back up each file that corresponds to a folder within your mail program (for example, Inbox, Sent, and so on). Note that you need to back up only the files without file extensions. You can ignore the `.sdb` folders as well as the `.msf` files.

■ **Tip** To quickly go to the location of the Thunderbird e-mail files under Windows, copy the address in the Local Directory text box. Then, under Windows XP, click Start ➤ Run, paste the address straight into the Open box, and click OK. Under Windows Vista, paste the address into the Start Search text box and press Enter. Bear in mind that some of the folders are classified as system folders and are therefore hidden. You will need to activate the View Hidden Files option within My Computer.

Making Notes

When you're backing up data, a pencil and paper come in handy too. You should write down any important usernames and passwords, such as those for your e-mail account and other online services. You might want to write down the phone number of your dial-up connection, for example, or your DSL/cable modem technical settings. Figure 4-3 shows an example of some information you might want to record.

In addition, don't forget to jot down essential technical details, such as your IP address if you are part of a network of computers using static addresses (this will usually be relevant only if you work in an office environment).

■ **Tip** If you've forgotten any passwords, several freeware/shareware applications are able to "decode" the asterisks that obscure Windows passwords and show what's beneath them. A good example is Asterisk Password Reveal, which you can download from `www.paqtool.com/product/pass/pass_001.htm`. Shareware sites like `www.download.com` offer similar applications.

Note that you don't need to write down information such as hardware interrupt (IRQ) or memory addresses, because hardware is configured automatically by Ubuntu. However, it might be worth making a note of the make and model of some items of internal hardware, such as your graphics card, modem (dial-up, DSL, or cable), and sound card. This will help if Ubuntu is unable to automatically detect your hardware, although such a situation is fairly unlikely to arise. Under Windows Vista, you can find out this information by clicking the Start button and right-clicking Computer. Click Properties in the menu that appears, and click the Device Manager link on the left of the window that appears. Under Windows XP, right-click My Computer on the desktop (or on your Start menu), select Properties, and click the Hardware tab. Then click the Device Manager button.

Instead of writing everything down, you might consider taking a screenshot by pressing the Print Screen key and using your favorite image editor to print it.

■ **Tip** Ubuntu works with a wide variety of hardware, and in most cases, it will automatically detect your system components. If you're in any doubt, you can consult the forums at `http://ubuntuforums.org`, in particular, the Hardware Help forums under the Main Support Categories heading. You might also consider subscribing to one or more of the Ubuntu mailing lists at `https://lists.ubuntu.com`. Remember that an important element of Ubuntu is its community of users, many of whom will be very willing to answer any questions you might have!

When you're certain that all your data is backed up, you can move on to the next chapter, which provides a step-by-step guide to installing the operating system.

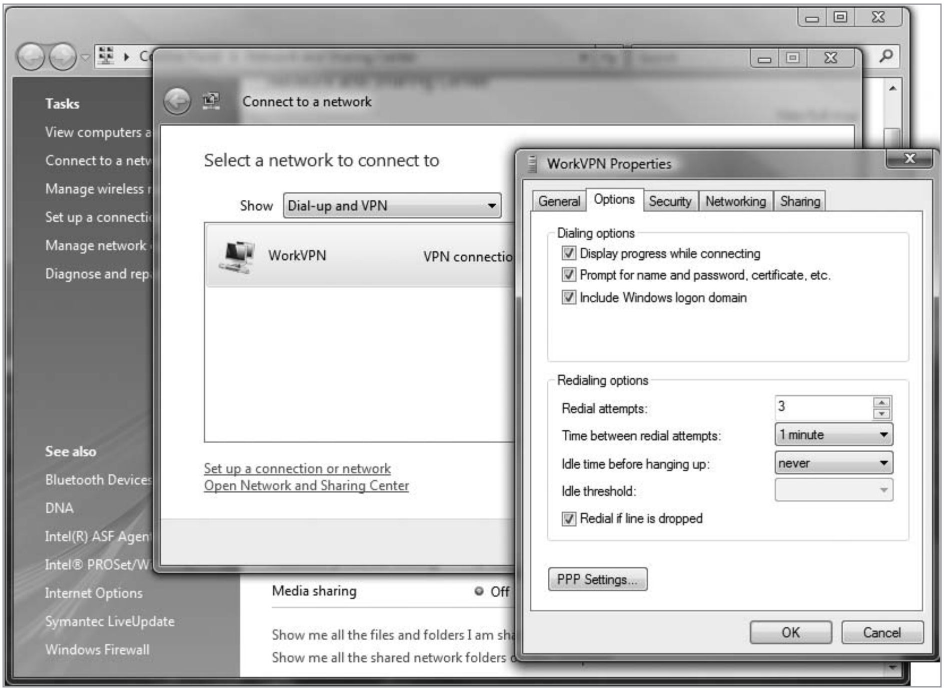

Figure 4-3. *Don't forget to back up "hidden" data, such as ISP dial-up phone numbers.*

Summary

The aim of this chapter has been to prepare both you and your computer for the installation of Ubuntu. You've looked at how your hard disk will be partitioned prior to installation and the preparations you should make to ensure that your hard disk has sufficient free space. You also learned about the types of files you might choose to back up, in addition to vital details you should record, such as usernames and passwords for your online accounts.

In the next chapter, we move on to a full description of the Ubuntu installation procedure. The chapter guides you through getting Ubuntu onto your computer.

CHAPTER 5

Installing Ubuntu

It's now time to install Ubuntu. In the dim and distant past, installation was sometimes difficult, but the developers now have it down to a fine art, so it should take only 30 minutes or so on a modern PC. It's also relatively simple, with very few decisions to make throughout, and lots of hand-holding.

However, you should examine all the options you're offered to make sure they're correct. Installing an operating system involves a couple of serious processes that have the potential for data loss. Read and consider every warning message you see, and be sure to keep your wits about you. Above all, make a backup of your data, as described in the previous chapter.

An Overview of the Installation Process

The DVD-ROM disc supplied with this book is double-sided. This means it's like a vinyl LP record. To play Side A, simply insert the disc with the Side A label topmost. To play Side B, insert the disc with the Side B label topmost.

Side A contains the complete DVD-ROM release of Ubuntu 9.04, code-named Jaunty Jackalope. This is the most recent version of Ubuntu at the time of this writing and contains most of the officially supported software released by the Ubuntu project. Side B contains the following:

- An ISO image file of the CD release of Ubuntu 9.04, which you can burn to a blank CD-R/RW disc by following the instructions in Appendix D. This is included in case you wish to give copies of Ubuntu to your friends, or if you wish to try the Wubi Windows installer (see the "Installing Ubuntu Inside Windows" sidebar), which isn't included with the DVD version of Ubuntu 9.04 for technical reasons.

Note You can also freely duplicate the DVD supplied with this book and give copies to friends if you wish. In fact, this is encouraged.

- The 9.04 (Jaunty Jackalope) releases of Kubuntu and Xubuntu, which provide alternate desktop environments if Ubuntu's default desktop environment, GNOME, does not suit your taste, and Edubuntu, which provides a layer of educational content on top of the standard Ubuntu installation. For more details on these versions of Ubuntu, see Appendix D.

- A version of Ubuntu for PowerPC-based computer users, such as those with an older G3-, G4-, or G5-based Macintosh computer. You should bear in mind that this version of Ubuntu is community supported. This means there isn't a 100 percent guarantee of updates or security fixes in the future, as with the officially supported releases. This is discussed in more detail in Appendix D.

If you want to use any of these installers on Side B of the DVD, you will first need to burn it onto a CD. This procedure is discussed in Appendix D.

However, most readers will want to install the default version of Ubuntu. So to start things rolling, insert Side A of the DVD-ROM drive and boot your computer. You might have to set your BIOS to boot from DVD, as explained in stage 2 of the installation guide in this chapter.

If you've ever installed Windows from scratch on a computer, you might be used to working with the Windows installation program. This appears when you boot from a Windows CD or DVD or run the `setup.exe` program from the desktop, and it guides you through installing Windows onto your hard disk.

Ubuntu is a little different. After you've booted from the DVD-ROM, a menu will appear. You can choose the Install Ubuntu option, and the DVD will continue booting to a graphical installer. Alternatively, you can choose the Try Ubuntu Without Any Change to Your Computer option. This allows you to run Ubuntu from the DVD-ROM, effectively trying it out without making any changes to your computer.

Using Ubuntu without installing it to the hard disk is referred to as running in *live distro mode*. Although this is a great way to take a sneak peak at what Ubuntu offers, there are a handful of practical drawbacks, as discussed in the sidebar titled "Running in Live Distro Mode."

To install Ubuntu on your computer, simply select the Install Ubuntu option from the boot menu. This will run the dedicated installation program, which will work through a few stages to get Linux on your computer's hard disk. During the installation stages, you'll be asked a handful of essential questions and will be taken through the process of creating space on your computer for the new operating system. After this, Ubuntu is installed onto your hard disk.

At the end of the procedure, your PC will boot straight into the Ubuntu login screen, and you're set to go. There's no need to mess around configuring hardware, because for almost everything, that's done automatically. Neat, eh?

In most cases, the installation process will run smoothly without a hitch. But if you do run into problems, head over to Chapter 6, which addresses many of the most common issues and provides solutions.

RUNNING IN LIVE DISTRO MODE

If you don't want to install Ubuntu just yet, you can try it out by booting the operating system straight from the DVD supplied with this book. You might want to do this, for instance, to highlight any potential hardware issues or if you're visiting friends and want to boot up into a familiar desktop on their PC. To do this, simply insert the DVD-ROM and then reboot your computer. Make sure the computer is set to boot from DVD (see stage 2 of the installation guide in this chapter to learn how), and select the Try Ubuntu Without Any Change to Your Computer option. After a few moments, the Ubuntu desktop will appear. Depending on the speed and memory capacity of your computer, this process can take some time, so be patient. You can follow most of the chapters in this book when running in live distro mode, and you can even save data (documents, downloads, and so forth) to a USB drive. However, you should be aware of the following issues:

- **Settings**: Any changes you make to the system will be forgotten as soon as you shut down your PC or reboot. In other words, each time you run in live distro mode, it will be as if Ubuntu has been freshly installed. For example, if you've configured a network card or rearranged the desktop, those changes will be lost. There are ways around losing settings on each reboot, but they require partitioning your hard disk, which, frankly, is as much effort as installing Ubuntu from scratch. So there's little to be gained by doing so.

- **Performance**: Because the data must be read from DVD-ROM, running Ubuntu in live distro mode is a slow and, therefore, frustrating experience. It can also be noisy if your DVD-ROM is a model that makes a whirring noise as it spins.

- **System**: As strange as it sounds, Ubuntu is largely unaware of when it's running in live distro mode. For example, if you were to follow the instructions in Chapter 9, which discuss how to update your system, Ubuntu will attempt to update, even though it's running in live distro mode! Of course, it can't do this, because, as far as it is concerned, the DVD-ROM is the hard disk, and it's therefore impossible to write data to it. This can create confusing error messages.

- **Root**: When running in live distro mode, you're automatically given root-user powers. We explain the significance of this in Chapter 7, but for the moment, it's enough to know that the root user, with enough knowledge of how Ubuntu works, has unlimited power over the system. This means that you could potentially repartition the hard disk, for example, or even wipe the hard disk entirely, all without any password prompt or warning This can be useful in certain circumstances—you can attempt to "rescue" a hard disk that's having problems using the live distro mode of the Ubuntu disc. But using it for everyday tasks is a huge risk, and the potential for accidental damage is high.

In short, we recommend that you use live distro mode sparingly and only to get a taste of what Ubuntu is like. If you intend to use Ubuntu for any significant period of time, you should install it to your hard disk.

A Step-by-Step Guide

As outlined in Chapter 4, you shouldn't start the installation process until you've made sure there is enough space for Ubuntu on your hard disk and you have backed up all the data. With those preparations complete, you're ready to install Ubuntu. The remainder of this chapter guides you through the process.

Stage 1: Prepare the Windows Partition for Resizing

If you're installing Ubuntu on a computer that already contains Windows, it's a good idea to perform three additional steps before actually installing Ubuntu. These steps will ensure that Ubuntu will be able to resize the Windows partition successfully.

If your computer doesn't contain Windows, or if you're installing Ubuntu onto a second hard disk, you can skip straight to stage 2.

The following are the steps for preparing the Windows partition for resizing:

1. Scan the disk for errors.
2. Defragment the hard disk.
3. Ensure that Windows is shut down correctly.

To scan the disk, open My Computer (or Computer if you're running Windows Vista), right-click your Windows drive (usually `C:\`), and select Properties. In the window that appears, click the Tools tab, and then click the Check Now button under the Error Checking heading. Ensure that there's a check alongside Automatically Fix File System Errors, and click the Start button. You will then be prompted to schedule the disk check the next time your computer restarts. Select to do so and reboot your computer, so the disk check can take place.

When the computer has rebooted, repeat the previous steps to view the Tools tab of the drive's Properties dialog box, and click the Defragment Now button. Then work through the defragmentation program's options in order to defragment the Windows disk (shown in Figure 5-1); usually this involves simply clicking the Defragment button (labeled Defragment Now under Windows Vista).

After that has completed—it may take several hours if your computer has not been defragmented before—shut down the computer as usual and proceed to stage 2 of the installation process.

It's vital that the computer shuts itself down properly. If the computer doesn't cleanly shut down, Ubuntu's installation program might stop with an error message about not being able to resize the partition.

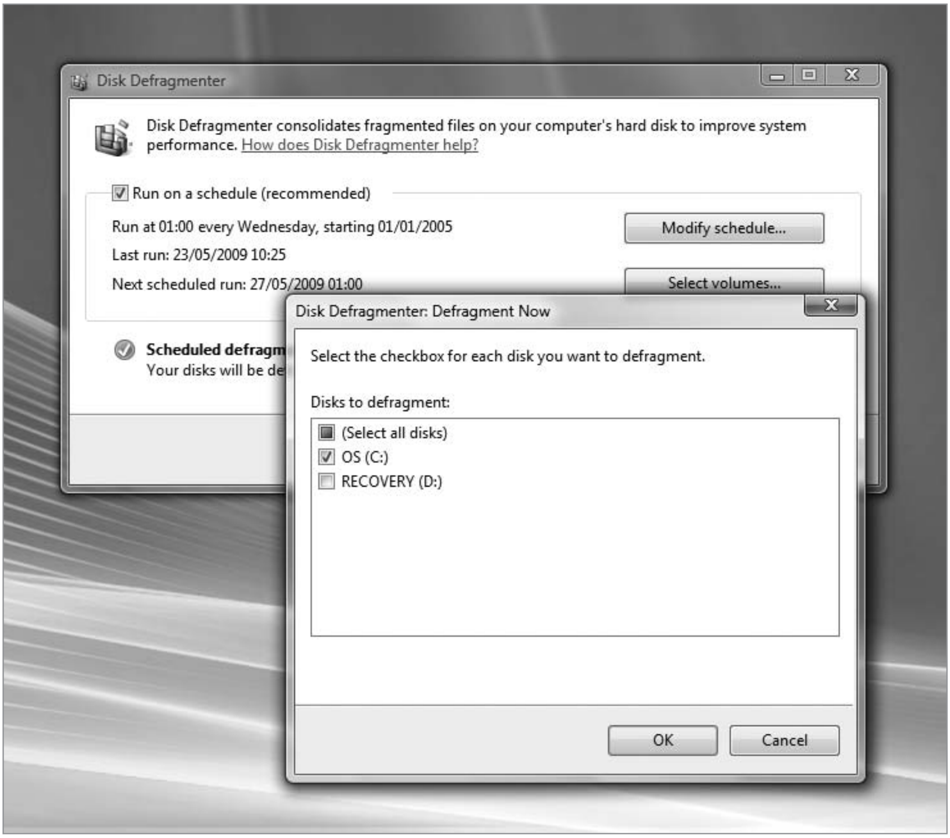

Figure 5-1. *Before installing Ubuntu, it's essential to scan the Windows partition for errors and to defragment it.*

INSTALLING UBUNTU INSIDE WINDOWS

Ubuntu includes a clever piece of software called Wubi that lets you install Ubuntu within the Windows file system. In other words, there is no need to repartition your hard disk. Aside from this, there is no major difference between a partitioned installation and a Wubi installation.

Wubi works by creating a loopback file system—that is, it creates a single large file within the Windows file system, and that file is then used as the Ubuntu file system.

Wubi is a nice way to try out Ubuntu on a more permanent basis than using the live distro mode. The biggest issue is that Wubi requires at least 256MB of memory and 5GB of hard disk space, although this shouldn't present any problems for relatively modern computers. However, users have reported performance degradation compared to a dedicated Ubuntu installation in its own partition, and you'll also find that Ubuntu's useful Hibernate power-saving mode (what Windows refers to as Suspend to Disk) isn't supported.

Unfortunately, Wubi isn't included on the DVD release of Ubuntu, as supplied on Side A of the DVD-ROM disc that comes with this book. To use it, you'll need to burn your own CD-R/RW disc from the installation ISO image of Ubuntu provided on Side B of the disc. To learn how to do this, follow the instructions in Appendix D.

To use Wubi, insert the CD while Windows is up and running. In the dialog box that appears, click the Install Inside Windows button. If the dialog box doesn't appear, navigate to the contents of the CD and double-click `wubi.exe`. In the next dialog box, you are presented with a series of drop-down lists. Using these, you can choose on which drive to create the Ubuntu file system, if you have more than one hard disk or partition, and you can choose the size of the loopback file system you want to create. In most cases, the default options are fine. You will need to enter a username and password in the boxes provided. These will form your Ubuntu login details. When you're finished, click the Next button.

Wubi will then create the loopback file system. When it has finished, you'll be invited to reboot your computer. After the computer is up and running again, you'll be presented with a boot menu from which you can choose either Windows or Ubuntu. Choosing Ubuntu will then start the installation routine, which will complete automatically. Following this, you'll be prompted to reboot. From then on, selecting the Ubuntu option from the boot menu will start Ubuntu. To start Windows, simply choose the Windows option from the menu.

To remove the Ubuntu file system from your Windows hard disk, navigate to `C:\ubuntu` from within Windows and double-click `Uninstall-Ubuntu.exe`. Don't be tempted to just delete the Ubuntu folder, because doing so will not remove the boot menu component.

Stage 2: Boot from the DVD-ROM

With your computer booted up, insert the Ubuntu disc into the DVD-ROM drive, with Side A topmost. Close the tray and reboot your computer. The disc might automatically run under Windows, opening a menu where you can click to find out more about Ubuntu, but you can ignore this.

Because you need to boot from the DVD-ROM disc in order to run the Ubuntu installer, the first step is to make sure your computer's BIOS is set correctly.

Many modern computers let you press a particular key during the initial boot phase of your computer, during the memory testing and drive identification period, to make a boot menu appear. Often this is F8, Delete, or Esc, but you should keep an eye on the boot messages to identify the correct key. On the boot menu, you can choose to boot from the CD or DVD drive from the list.

If you do not have an option to boot from the CD/DVD drive, you'll need to enter the BIOS setup program and change the boot priority of your computer. To do this, press the Delete key just after the computer is first activated. Again, some computers use another key or key combination, and your boot screen should indicate which key to press.

When the BIOS menu appears, look for a menu option such as Boot and select it (you can usually navigate around the screen of the BIOS menu by using the cursor keys and select options by pressing Enter). On the new menu, look for a separate entry such as Boot Device Priority or perhaps Boot Sequence. Make sure that the entry for the CD/DVD-ROM is at the top of the list. Arrange the list so that CD/ DVD-ROM is followed by the floppy drive and then your main hard disk. You can usually press the F1 key for help on how the menu selection system works.

After you've made the changes, be sure to select the Save and Exit option. Your PC will then reset and boot from the Ubuntu DVD-ROM, and you'll be greeted by the Ubuntu DVD boot menu.

■ **Note** After Ubuntu has been installed on your computer, you might choose to repeat this step and rearrange the boot order once more to make the hard disk appear at the top of the list. Then your computer won't waste time checking the DVD-ROM drive for a boot disc every time it starts.

Stage 3: Choose Language Settings

After the Ubuntu disc has booted, but prior to the Ubuntu boot menu appearing, you'll be prompted to choose the language in which you want the boot menu to appear. Use the cursor keys to make your choice and then press Enter.

Stage 4: Select from the Boot Menu

When the DVD-ROM boot menu appears, you'll be offered several options, as shown in Figure 5-2. You can use the up and down arrow keys to move between the menu options. Press the Enter key to select an option.

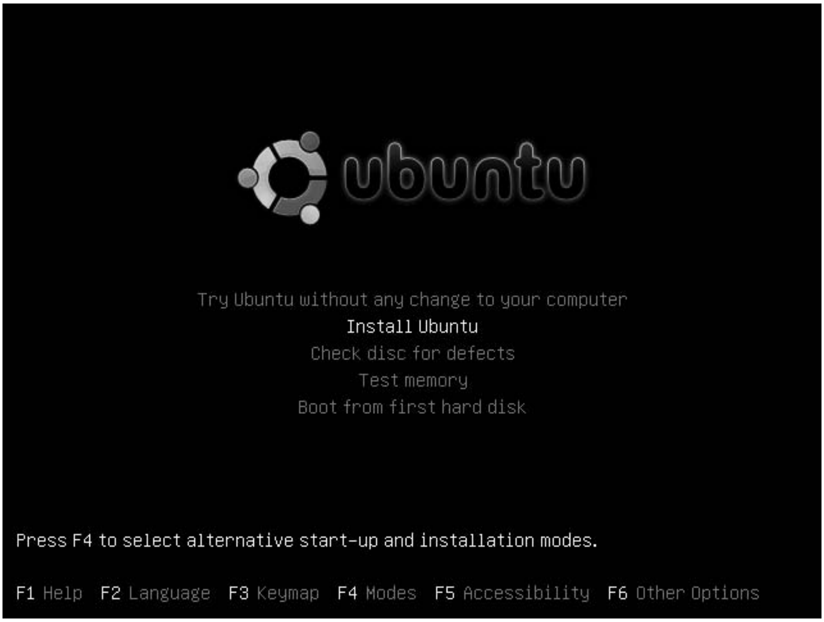

Figure 5-2. *Select Install Ubuntu and press Enter.*

The options are as follows:

Try Ubuntu Without Any Change to Your Computer: This option lets you run Ubuntu from the DVD-ROM disc, so you can try out its features, albeit in a slightly limited state (see the "Running in Live Distro Mode" sidebar). If you select this, you can install from an icon on the desktop and still use the computer while the installation happens.

Install Ubuntu: This will start Ubuntu's installation routine and is the option you should choose.

Check Disc for Defects: This will check the DVD and make sure that the contents are correct. A defective or damaged DVD will cause errors at some point during the installation process. After the DVD has been validated, you can press any key to reboot. Note that you don't need to use this option unless you run into problems during installation and are trying to locate the cause.

Test Memory: This will start a simple but thorough memory-testing program called Memtest86. This is useful if you think your computer's memory might have a fault that will prevent you from installing Ubuntu. For more details about how to use Memtest86, see `www.memtest86.com`. To quit Memtest86 and reboot your computer, press Esc.

Boot from First Hard Disk: This will cause the computer to boot from the default hard disk, thereby bypassing Ubuntu. If your computer has Windows installed on it, this will start Windows.

If you encounter problems with the installation, you can press F4 to find alternative installation methods, including a text-only installer, which is useful if you're having problems with the graphical installer. You can also change the language by pressing F2.

Stage 5: Choose a Language for Ubuntu

After some time, the Ubuntu installation program will start, as shown in Figure 5-3. From the list on the left, choose the language you wish to use when Ubuntu is up and running on your computer (not just during the installation), and then click the Forward button.

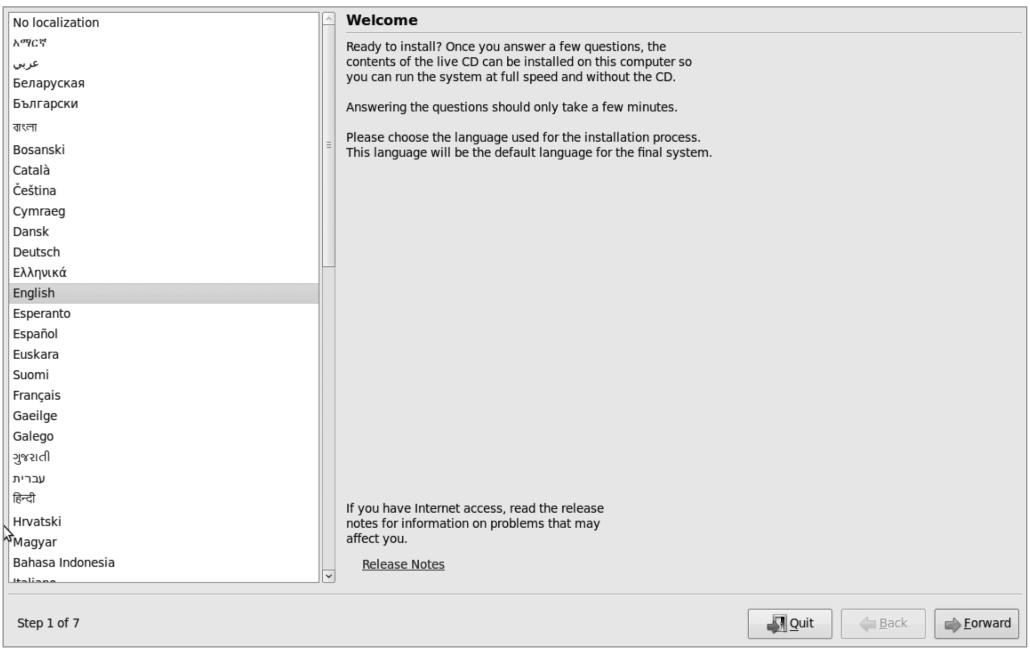

Figure 5-3. *Select the language you want to be the default when Ubuntu is installed, and then click the Forward button.*

Stage 6: Select Your Country and Time Zone

Ubuntu will next ask you to choose your time zone. Choices include American time zones, such as Eastern Standard Time (EST), and European time zones, such as Greenwich Mean Time (GMT). The selection can be made either by clicking your location on the world map that's displayed or by selecting the nearest city from the drop-down lists at the base of the page.

When you click the map, you'll see that the time zone is highlighted in green, and you can click near your location within this band. You'll also see a live clock showing the time in that location. See Figure 5-4 for an example.

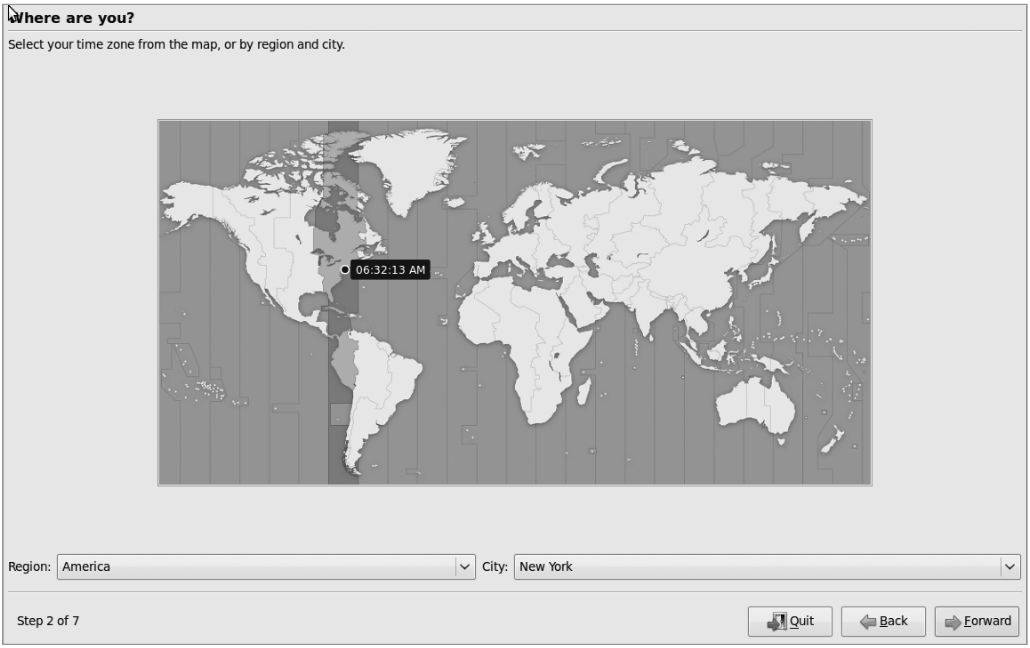

Figure 5-4. *Select the time zone from the map and then you can refine your options by using the drop-down lists at the bottom of the page.*

The city you choose doesn't matter a great deal—the purpose of this step is to ensure that Ubuntu selects the correct time zone for your location, which it does by looking up the city in a database of time zones.

After you've made your selection, click the Forward button.

Stage 7: Confirm Your Keyboard Layout

Next you'll be asked to confirm the keyboard layout you'll be using, as shown in Figure 5-5. This should correspond to your language and locale settings, and will be automatically selected, so you can just click the Forward button. If you're unsure whether Ubuntu has guessed the correct keyboard layout, you can click the test text field and type in some characters before continuing.

Note Keyboard layouts can differ from country to country even if they speak the same language. This is to allow for local necessities. The UK keyboard layout has the pound sterling symbol (£) above the number 3, for example, and swaps around the locations of a handful of other symbols too.

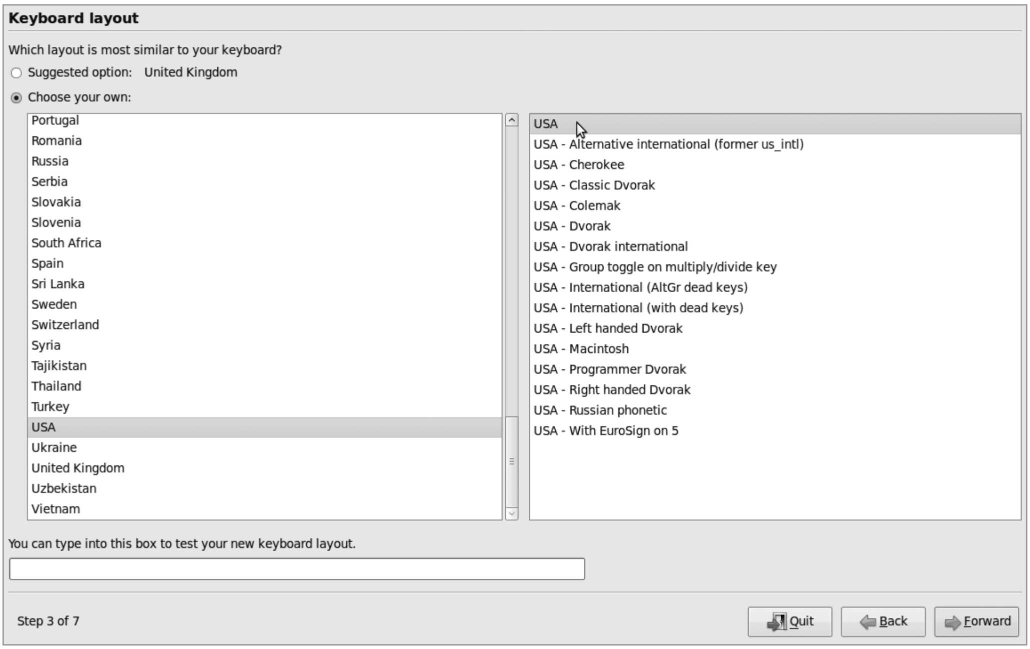

Figure 5-5. *Ubuntu will guess your keyboard layout, but you can test it to make sure by typing in the test text field at the bottom of the dialog box.*

Stage 8: Repartition Your Hard Disk

Partitioning the disk is one of the most important steps during installation, although, unfortunately, it's one that can be couched in difficult terminology. Partitioning is the process of dividing up a hard disk into sections so that different operating systems or one operating system and some data can exist on the same computer and convince the computer that more than one disk exists. Though it's a complex subject, Ubuntu does its best to make partitioning easy.

The Ubuntu installation routine offers four options for disk partitioning:

- Resize the existing partition on the hard disk and install Ubuntu alongside it in the newly created free space.
- Use the entire disk, whether it already has some contents or not (that is, if the computer or hard disk is new or if you want to overwrite your Windows installation).
- Use the largest free space that might already exist on the hard disk (perhaps if you've already manually repartitioned the disk).
- Manually edit the partition table—that is, resize/delete any existing partitions by hand and create the Ubuntu partitions. This is suitable only for expert users.

Most people who are installing Ubuntu on a computer that already has Windows on it will want to resize the main partition, as described next.

If you're installing Ubuntu on a computer that has no operating system installed or one that you would like to completely erase from the computer, follow the instructions under the upcoming "Use Entire Disk" section. However, be aware that this will completely wipe any data from that disk.

Resize the Main Partition

This is the default partitioning option if your computer already has Windows installed on it. Ubuntu will detect the main Windows partition and suggest the amount of resizing.

■ **Caution** If there's not enough free space within the Windows partition, you won't be able to resize it to make space for Ubuntu. If this is the case, the Ubuntu installer will tell you. See Chapter 4 for suggestions for freeing up space.

By default, Ubuntu attempts to grab as much space for itself as possible, without shrinking the existing partition too much. In our example in Figure 5-6, the installation program has decided to split the disk roughly 50/50, giving both operating systems a decent amount of space. This is shown in the bar display: the right part of the bar represents Windows, and the left part represents the new Ubuntu partition.

Ubuntu's default choice is normally fine, but you can also click and drag the grab bar in the middle of the partitioning display bar to increase or decrease the sizes of the Windows and Ubuntu partitions. You may want to give Windows a little more space if you plan to divide your time between Windows and Ubuntu.

The Ubuntu installer is intelligent enough not to let you set an impossible value for shrinking the existing partition. The Ubuntu installer is also clever enough to know that Windows needs some free space within its partition to operate effectively—to write temporary and system files and user-created files such as Word documents, for example. So you shouldn't be able to make changes that are too extreme. On a test system, we couldn't set a size for the existing partition lower than 10 percent of the entire disk, because the existing data on the partition occupied about 10 percent of the space. You can override this protection by manually partitioning, as described in the "Manually Edit the Partition Table" section of this chapter. Similarly, the installer shouldn't let you create an inadequate amount of free space for Ubuntu when dragging the slider to the right.

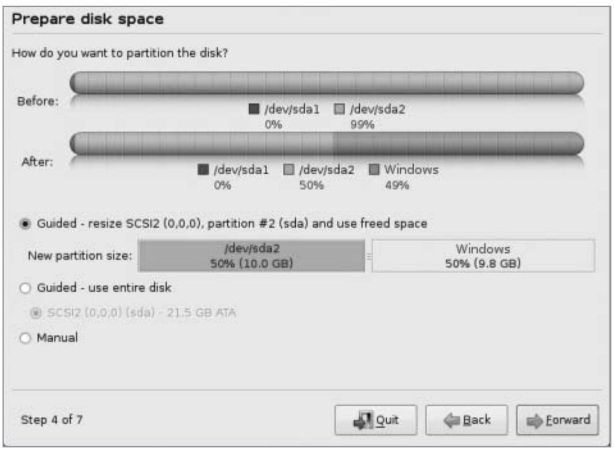

Figure 5-6. *The installer will take as much space as Ubuntu needs, without shrinking the existing partition too much.*

After you've made your selection, click the Forward button. The installer will resize the partition, which might take a few moments.

■ **Caution** If you're resizing a partition on a notebook computer, ensure that you have the main power connected. If the power goes off during the resizing procedure because of a failing battery, there's a very good chance your Windows partition will be destroyed.

Use Entire Disk

If the hard disk is empty, or if you've decided to eradicate Windows and use only Ubuntu on your computer, you can choose the Use the Entire Disk option, as shown in Figure 5-7.

If the disk does have contents, this option will remove them and then use the entire disk to install Ubuntu. As mentioned in Chapter 4, before undertaking this move, you should back up essential data on the Windows partition (or any others on the hard disk). There is no way of undoing the partition erasure, so you should proceed with caution.

After you've made the choice, click the Forward button. The deletion should take place quickly, after which you can proceed straight to the next stage in this guide.

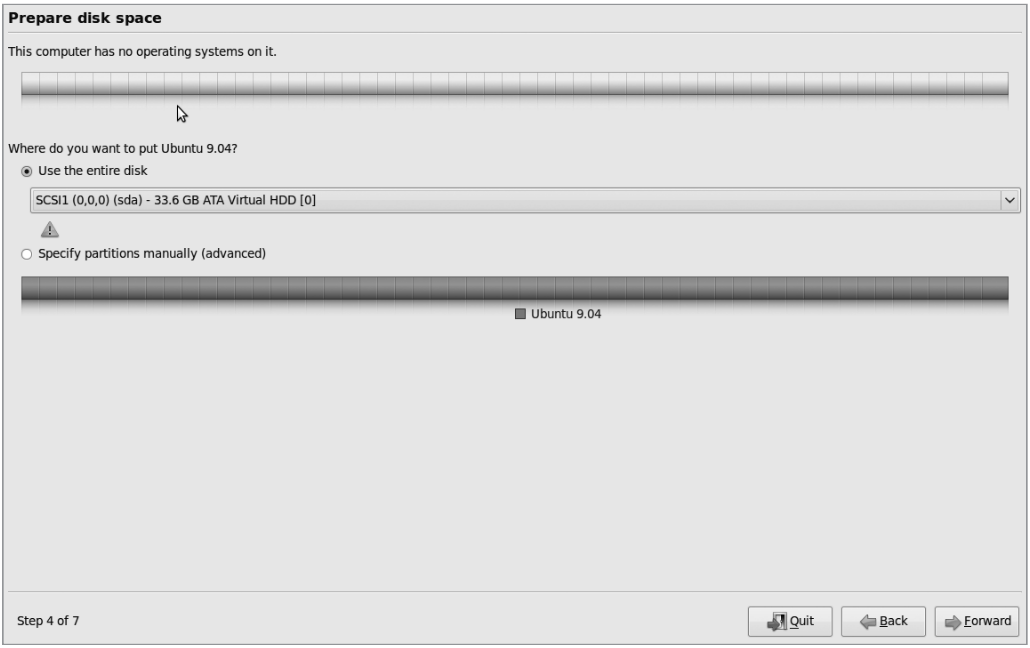

Figure 5-7. *If you have an unused disk or are getting rid of Windows entirely, choose the Use the Entire Disk option.*

Use the Largest Contiguous Free Space

If you've already repartitioned your hard disk by using a third-party utility, or if you deliberately created a smaller Windows partition in order to leave free space for another operating system, you can select the Guided – Use the Largest Continuous Free Space option (note that this option won't appear unless there is free space on the hard disk). Then the Ubuntu installation program will use the *largest amount of free space* for the Ubuntu partitions. This is an important point: if you have more than one area of free space, the largest will be used.

If you do have more than one amount of free space, the Ubuntu installation routine is unable to automatically use any smaller amounts of free space. If you wish this to be the case, the only option is to manually partition, as described under “Manually Edit the Partition Table.” However, only advanced users will need to do this.

After you’ve made your choice, click the Forward button and proceed to the next stage in this guide.

Use a Second Hard Disk

If your computer has more than one hard disk—a new hard disk you’ve added for Ubuntu, as described in Chapter 4, or a second hard disk already installed in your computer—you should select it under the Use the Entire Disk option. The way Ubuntu identifies your hard disks might seem a little complicated at first, but is actually straightforward.

If your computer is relatively new, chances are it has a SATA-based hard disk. If so, the first hard disk will be identified as `sda`, the second as `sdb`, the third as `sdc`. All that changes in each case is the last letter: `a`, `b`, `c`, and so on.

If your computer uses IDE-based hard disks, the drives will also be identified as `sda`, `sdb`, and so on. The primary master drive in the system is identified as `sda`, the primary slave as `sdb`, the secondary master as `sdc`, and so on. The drive will also be identified by make and model, which may help you identify it.

Assuming the second hard disk is installed as a slave on the primary channel, as is the standard configuration for an additional hard disk, it will be identified as `sdb`, so make that selection. If the disk is installed as the slave on the secondary channel (that is, the same channel as the DVD-ROM drive), it will be identified as `sdd`.

After you’ve selected the disk, click the Forward button.

Manually Edit the Partition Table

If, for any reason, you find that Ubuntu’s default partitioning choices are not for you, you can opt to manually edit the partition table. For example, you may want to separate the operating system installation from your `/home` folder. This separation makes doing a fresh installation of Ubuntu or another Linux OS easy, because the data is left untouched. There are essentially two stages to work through if you choose this option:

- You’re given the chance to repartition the disk manually. You can resize or delete any existing partitions and create the partitions Ubuntu needs.
- While creating/editing the partitions, you’ll be asked to assign *mount points*. You’ll be prompted to tell Ubuntu which of the partitions on the disk it should use for the *root file system* (that is, the main partition for Ubuntu’s use) and which should be used for the *swap partition*.

Manually partitioning offers ultimate flexibility but requires a relatively high level of knowledge of how Ubuntu works. Therefore, we recommend that only experts undertake this step, unless you have no other choice because the default Ubuntu partitioning choices do not offer what you need or do not work properly for you.

In the following steps, we explain how to resize an existing partition, create the new partitions that Ubuntu needs, and assign mount points so that Ubuntu is able to use them.

■ **Tip** GParted is a graphical partition tool that you can use to add, edit, and delete partitions easily. GParted looks similar to the third-party commercial partition tools you may have already used. You can run this utility by starting Ubuntu in live distro mode and choosing System ➤ Partition Editor from the menu. After you have made the desired changes with this partition editor, you can reboot and start the Ubuntu installer again. Then when you manually edit the partitions in the installer, you need to set mount points only on the partitions that you created in GParted.

Prepare Partitions

When the disk partitioning choices appear, click the Manual radio button and click Forward. The Prepare Partitions window will appear, as shown in Figure 5-8. This window lists the hard disks detected by Ubuntu and their corresponding partitions. Each item has the following properties:

- **Device**: This is the logical representation of the hardware device in Ubuntu. See the previous section for an explanation of the drive identification, but note that here the drive references are preceded with `/dev`. You can ignore this. The numbers at the end refer to the order of partitions. For example, `sda1` refers to the first partition of the first hard disk, and `sda2` refers to the second partition of the first hard disk.

- **Type**: This specifies the file system type of the partition. For example, NTFS and VFAT are Windows file systems, ext3 indicates the Ubuntu partition, and swap indicates a swap file partition.

- **Mount Point**: The mount point is how Ubuntu will see the partition after it is up and running. At least one partition needs to be mounted as root, denoted with a single `/`. Mounting is discussed further in Chapter 14.

- **Format?**: This indicates whether the partition will be formatted during installation. Formatting will destroy any data on a partition, so ensure that you have backups of important data and that you really do want to format.

- **Size**: This determines the disk space of the partition, in megabytes. Note that the strict definition of the word *megabyte* is used, meaning 1,000,000 bytes, rather than the more commonly understood 1,024,000 bytes (1,024KB). To confuse matters, the 1,024KB definition is used in the rest of the installation program.
- **Used**: This determines how much disk space has been consumed, in megabytes.

At the bottom of the window are buttons to manipulate the hard disk as a whole or each individual partition. For the hard disk, you can opt to create a new partition table. This effectively returns the disk to as-new status, with no partition information, so creating a new partition table is tantamount to erasing the whole hard disk. Be sure you know what you're doing! For unallocated free space, you have an option to create a new partition. For an existing partition, you have an option to edit its properties (this option lets you resize the disk and assign a mount point) or delete the partition to accumulate free disk space. You also have an option to undo all hard disk changes, which applies to all desired changes except resizing a partition, because resizing is carried out as soon as you select to do so, unlike the other changes, which are carried out after working through all the installation stages.

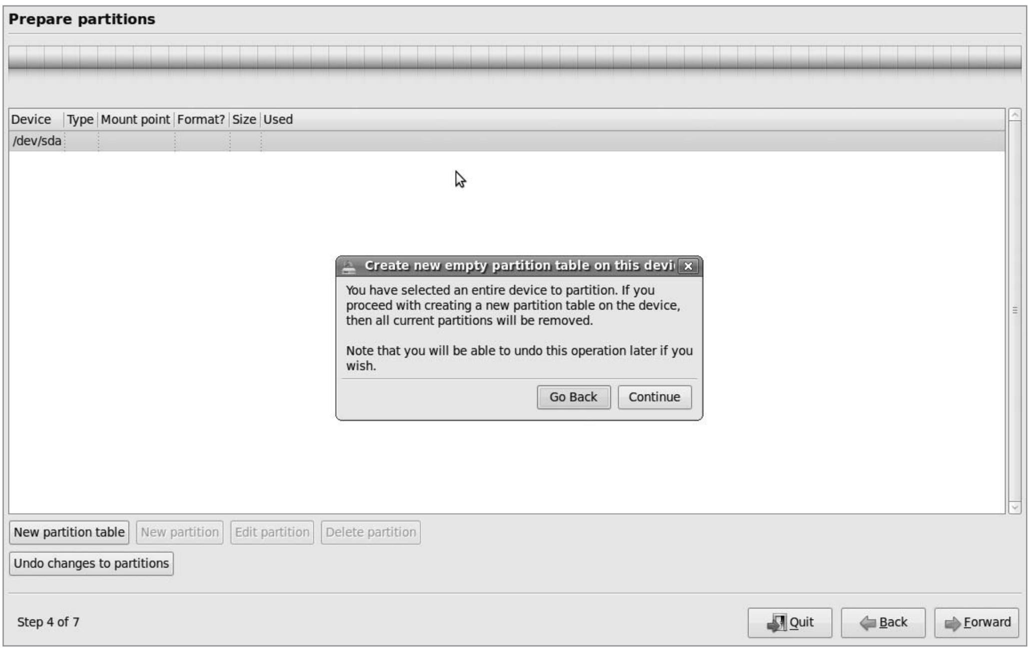

Figure 5-8. *Creating a new partition table has the same effect as completely wiping the contents of a disk. Use with extreme care.*

You want to resize the main NTFS (Windows) partition. Search for that partition in the partition type list; it will be shown as ntfs.

Determine Windows Partition Size

After you have found the NTFS partition, you should determine how much space should be retained in your Windows partition so that Windows will still function properly while providing a sufficient amount of space for Ubuntu. At the bare minimum, your Windows partition should have 2GB of available disk space for new applications, software upgrades, and your data, though this will give you very little space for documents or other data.

You should free up as much space as possible for Ubuntu. But if disk space is a concern, you will need to determine the minimum of disk space that should be put aside for the main and swap partitions of Ubuntu.

The main partition will contain the Ubuntu operating system itself. This partition should have at least 3GB of disk space (2GB for the base installation, and the rest for new applications, software upgrades, and your data).

The swap partition is similar to the swap file under Windows (sometimes referred to as *virtual memory* or the *paging file*), except that it resides on its own partition. The swap partition acts as additional memory should the main memory become full. Because accessing the hard disk takes longer than accessing the RAM, using the swap partition is undesirable and is a last resort. However, all operating systems need this partition just in case. Additionally, the swap file is used when the computer enters Hibernate (Suspend to Disk) power-saving mode.

The size of the swap partition depends on the size of your physical RAM. See Table 5-1 for some suggestions. However, if you want to use the Hibernate feature on your computer, your swap partition size should be at least equal to the size of the physical RAM.

Table 5-1. *Suggested Swap Partition Sizes for a Desktop Ubuntu System*

Physical RAM Size	Swap Partition Size[a]
512MB	1,024MB
1,024MB (1GB)	1,025MB
2,048MB (2GB)	2,049MB
3,072MB (3GB)	3,073MB
4,096MB (4GB)	4,097MB

[a] *Swap partition sizes have been adjusted to take into account the strict definition that 1 megabyte = 1,000,000 bytes, as stated in the Create Partition dialog box.*

After you have determined the size of your main and swap partitions, total their sizes. This is how much free space you need to allocate for Ubuntu.

Edit Partition Properties

In the Prepare Partitions window, select the NTFS partition and click Edit to change its properties. Figure 5-9 shows how to edit a partition. In the Edit Partition dialog box, you can edit three partition properties:

- **New Partition Size in Megabytes**: This allows you to adjust the size of the selected partition. If you reduce the size of the selected partition, the remaining space will be allocated for free space. For example, if you have an NTFS partition with a size of 104,847MB and you would like to allocate 4,096MB for Ubuntu, you would need to reduce the size of the NTFS partition to 100,751MB. Adjust the size of the NTFS partition as you determined in the previous step.
- **Use As**: This either changes or displays the file system of the selected partition. The current file system is NTFS, because you are editing a Windows partition, so select ntfs from the list if it isn't already displayed. Be careful not to select any of the other entries from the list, because this could damage your Windows setup irreversibly.
- **Mount Point**: Ubuntu makes non-Linux file systems (such as Windows) available by *mounting* them. Mounting is explained in Chapter 14, but for now you can either select one of the default suggestions (on our test system, these were `/OS` and `/windows`) or type your own path (but only if you know what you're doing).

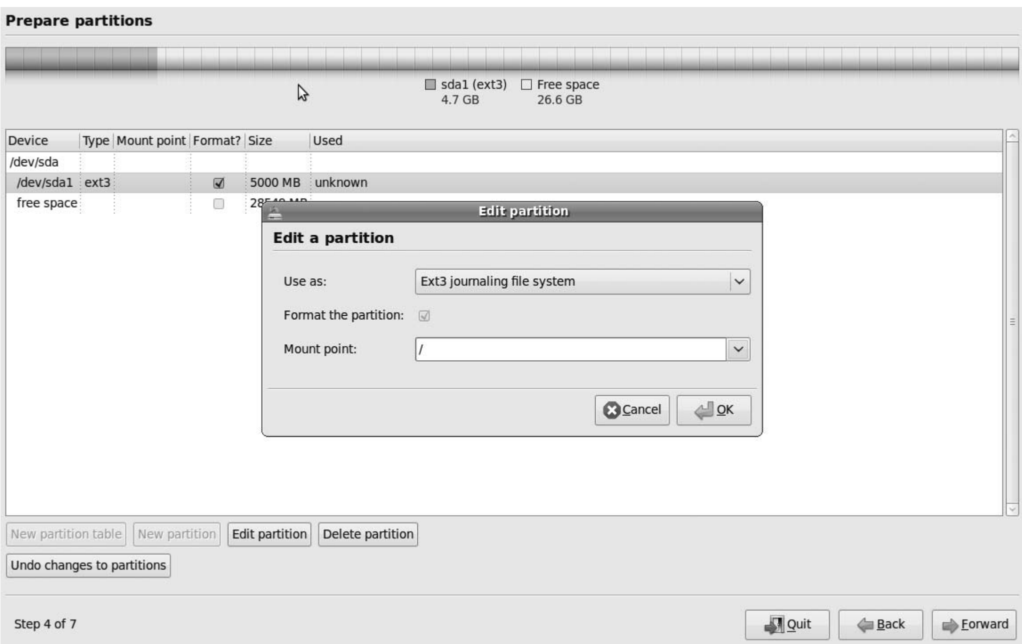

Figure 5-9. *Choose the partition type and mount point.*

After you are satisfied with your choices, click the OK button. At this point, you are prompted to confirm that your desired changes will be made to the disk. It's a good idea to read through the summary carefully, because after you click Continue, there's no going back. Any data on the disk will be lost. Click Continue when you're ready to start the resizing process. After the process is finished, you will have free space to allocate for Ubuntu.

If you see an error message while trying to resize the partition, it's likely that Windows was not shut down correctly. To fix this situation, exit the Ubuntu installer, reboot Windows, and opt to check the disk. Then reboot so the check can take place. After that, reboot again, ensuring that Windows is properly shut down. Then you can return to the Ubuntu installer.

Create Main and Swap Partitions

The next step is to create partitions with the free space. Select the new free space you have created and click the New Partition button. The Create Partition dialog box will appear, as shown in Figure 5-10. This dialog box has five options:

- **Type for the New Partition**: This option allows you to set the partition as primary or logical. Unless the hard disk has more than one operating system installed, you should select the Primary option. With primary partitions, you can divide your hard disk up to only four partitions. If you need more than four partitions, or if there are already three partitions on the disk, select the Logical option.

- **New Partition Size in Megabytes**: This option sets the number of megabytes that will be allocated to the new partition. The default value takes all of the free space.

- **Location for the New Partition**: This option specifies whether the new partition will be created on the beginning or end area of the free space. It's recommended that you use the beginning. This way, the free space can be seen easily, because it always appears just below all of the partitions.

- **Use As**: This option specifies the file system of the new partition. The default option of Ext3 Journaling File System is fine when you are creating the main partition.

- **Mount Point**: The mount point is a directory that will act as a location where you can make a disk accessible. The main partition you create for Ubuntu must be mounted as root. This is always represented as a single forward slash (`/`).

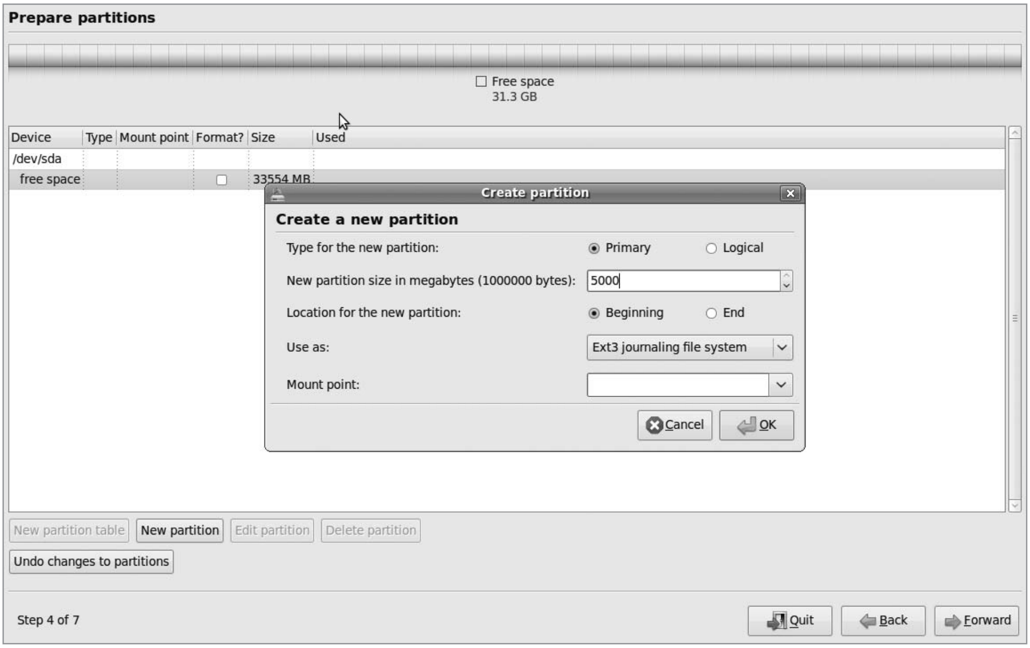

Figure 5-10. *You can create a new partition as long as there is free/unallocated space available.*

We'll begin with the main partition, where the operating system and data will all be stored. Select the free space and click the New Partition button to open the Create Partition dialog box. Choose Ext3 as the format and then set the Mount Point to the forward slash (/) to specify that this partition is the main partition or root file system. Your dialog box should look similar to the one shown in Figure 5-10. Click the OK button to continue.

Next we'll create the swap partition. You've already determined the size of this partition in a previous step. Enter the desired partition size and change the Use As option to Swap Area. Leave the rest of the options untouched (note that the swap partition doesn't need a mount point). For example, if the size of the physical RAM is 1GB, the partition size for the swap partition should be set to 1,024MB, as shown in Figure 5-11. Click OK to continue.

You should now have partitions ready to go, as shown in Figure 5-12. Note that you may also have an NTFS partition visible if you're dual-booting with Windows. Click Forward to continue.

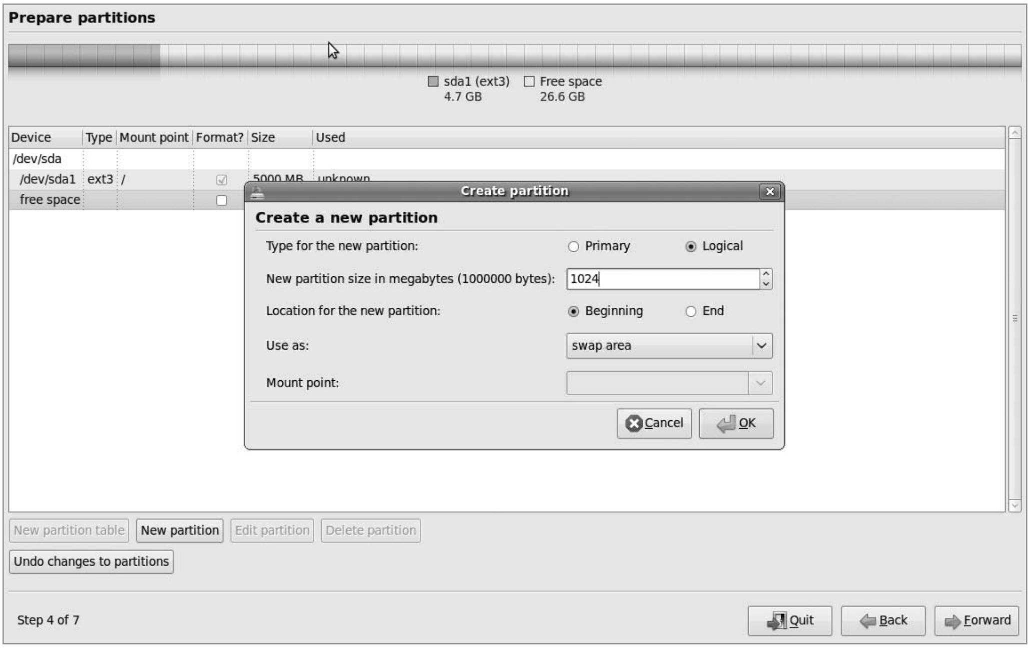

Figure 5-11. *The size of your swap partition depends on the amount of physical RAM in your computer.*

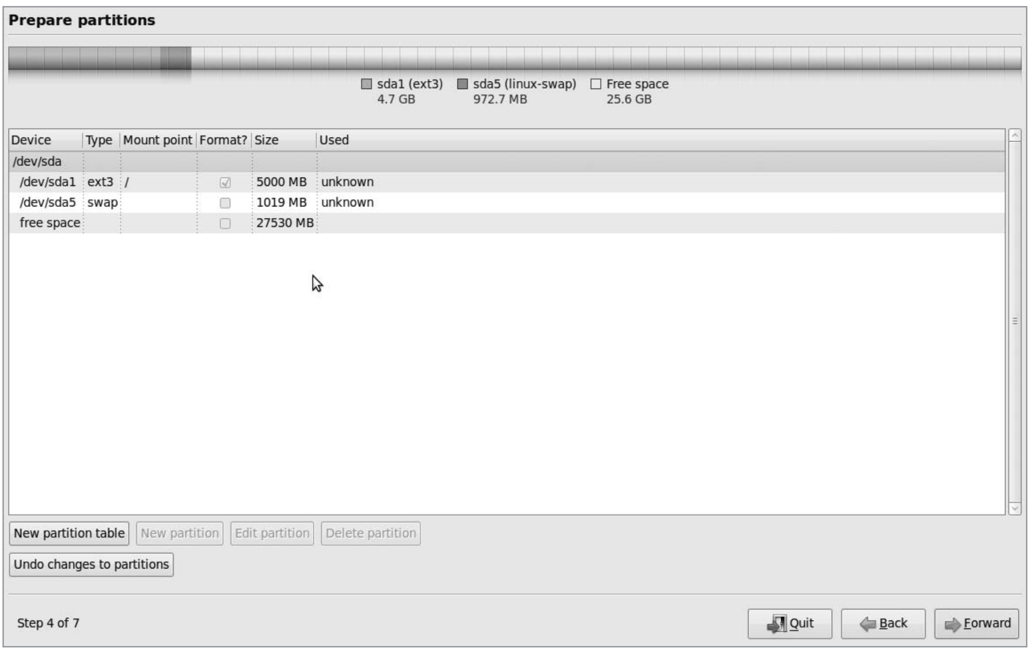

Figure 5-12. *With your partitions configured, you're ready to move on.*

Stage 9: Enter a Username

Next you'll be prompted to enter your real name and your username. *Real name* refers to how you'll be formally identified on the system to anyone who uses it and should be typed into the What Is Your Name? text field. The standard practice is to use your full name, including first and last names, separated by a space.

The username is how the computer itself will identify you, and this should be typed into the What Name Do You Want to Use to Log In? text field. This name needs to be unique; two users on the same computer cannot have the same username. Also, it must follow these rules:

- The username should be one word without any spaces in it.
- You can choose any username consisting of uppercase and lowercase letters and numbers, but not symbols or punctuation.
- The username cannot begin with an uppercase letter, although you can use uppercase in the rest of the name.

The simplest procedure for choosing a username is to use your own first name, typed entirely in lowercase letters. For example, in Figure 5-13, we've set the full name to Andy Channelle and the login name to andy. Helpfully, Ubuntu will add the first part of the full name to the username space automatically.

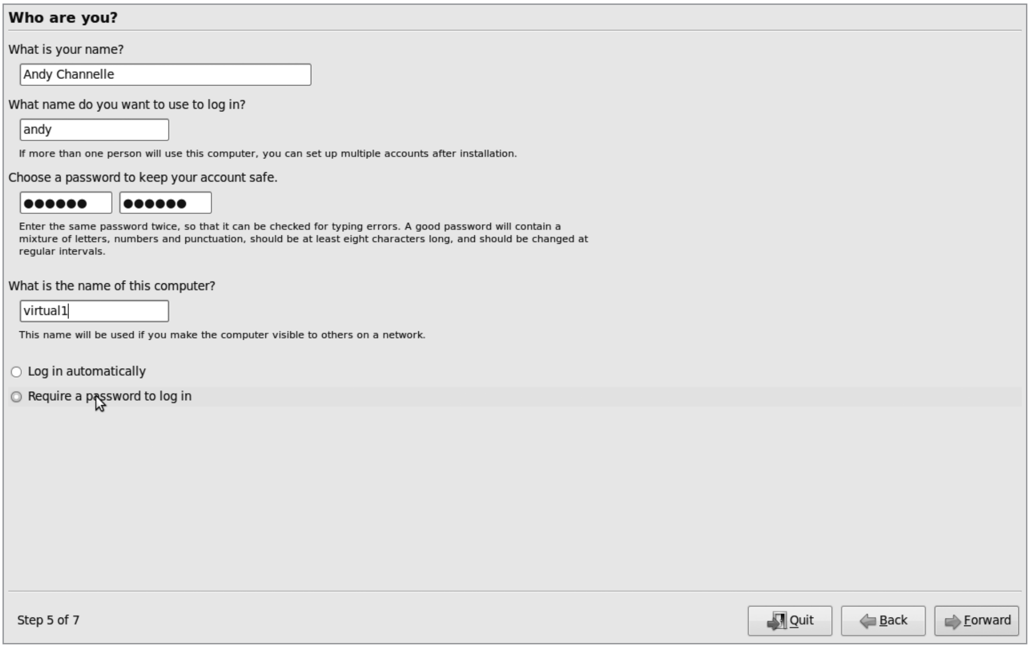

Figure 5-13. *You should enter a real name, a username, a password, and, if you wish, a name to give your computer.*

Following the username, enter a password. Here, the rules are the inverse of those for your username. A good password contains numbers, uppercase and lowercase letters, punctuation marks, and anything else you can get in there! This helps make your password almost impossible for someone else to guess, and thus makes your system more secure. (If you want to be really secure, create a password that's ten or more characters long.) You'll need to enter the password twice; the second time confirms that you didn't make a typo the first time around.

The What Is the Name of This Computer? text box contains the hostname for the computer. This is how the computer is identified on certain types of networks, if you choose to share files or resources with other computers. It is also the name that will appear at the front of the command-line prompt, as described in Part 4 of this book. Ubuntu will fill in this field automatically based on your username, but you can replace that with something else more personal. The rules for the hostname are broadly similar to those for the username; it cannot contain spaces or symbols. For example, if your computer is a Dell PC, you might type **Office_Dell** (note that you can use an underscore character in place of a space character).

After you're finished, click the Forward button.

Stage 10: Import Documents and Settings

The next step is to migrate accounts by importing documents and settings of existing user accounts from your Windows partition to Ubuntu. (You won't be prompted to do this if you're installing Ubuntu on a fresh hard disk or have chosen to overwrite your Windows partition.) Just select the items you would like to import to your account, as shown in Figure 5-14. Then click the Forward button to continue.

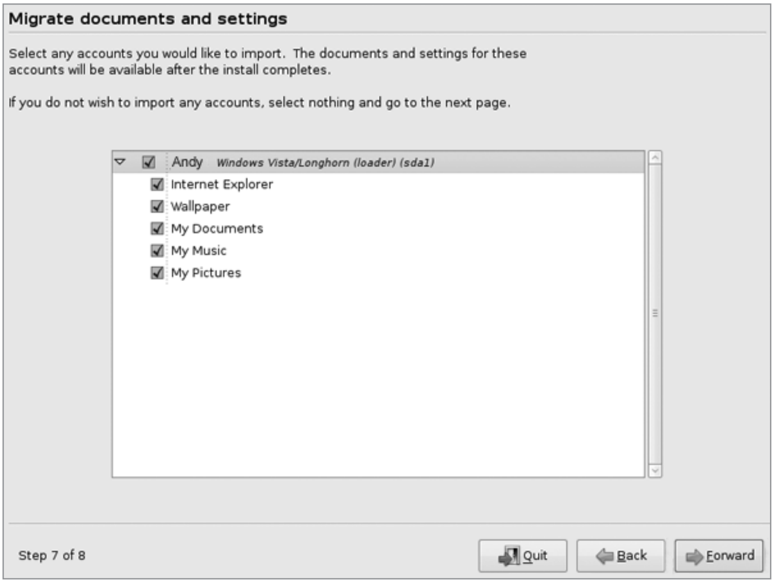

Figure 5-14. *Select the items you would like to migrate from Windows to your account.*

Stage 11: Confirm Installation Choices

At this point, you'll see the Ready to Install window, which lists the choices you've made, as shown in Figure 5-15. It's a good idea to check to make sure everything is correct before clicking the Install button.

When you're ready to install Ubuntu, click the Install button. This will start the installation procedure. The new partitions you created will be formatted, and the Ubuntu files will be copied.

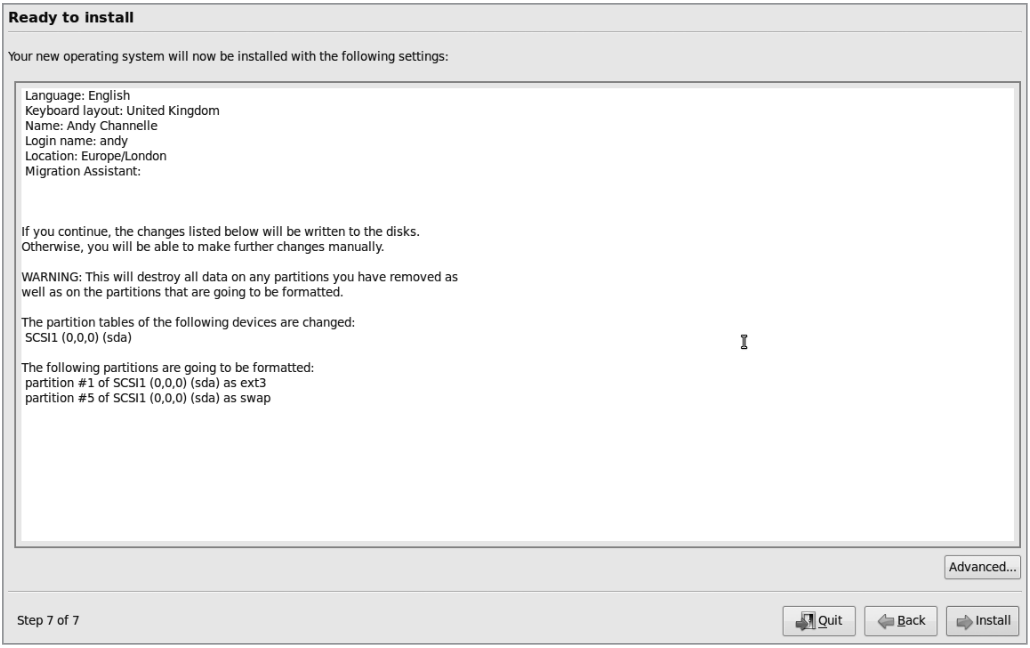

Figure 5-15. *Confirm the installation choices, and click the Install button to format the new partitions and copy the Ubuntu files.*

If you click the Advanced button (which isn't required), you will be prompted to customize the boot loader and join the popularity contest. For the boot loader settings, you have the option not to write the boot loader to the disk. The option makes sense if you already have an existing boot loader, perhaps from another Linux installation, and you would prefer to use it as the primary boot loader for all the operating systems installed on your computer. Selecting the Popularity Contest option allows Ubuntu to poll program/package usage in your system and report this information to a central server to generate overall statistics on package usage. This information helps Ubuntu developers prioritize which packages to work on based on popularity. The statistics are available at `http://popcon.ubuntu.com`.

Stage 12: Perform Installation

Now all you have to do is wait! The Ubuntu installation routine will copy the necessary files and install Ubuntu, as shown in Figure 5-16. It won't require any further input from you, unless something goes wrong. For example, if you've created partitions that are too small in the previous section, this is the point at which you'll be told. If you do encounter an error, the installation program will quit, and you will need to start it again by clicking the icon on the desktop, this time altering your choices accordingly.

Installation should take no more than 30 minutes, and it completed in half that time on most of our test systems.

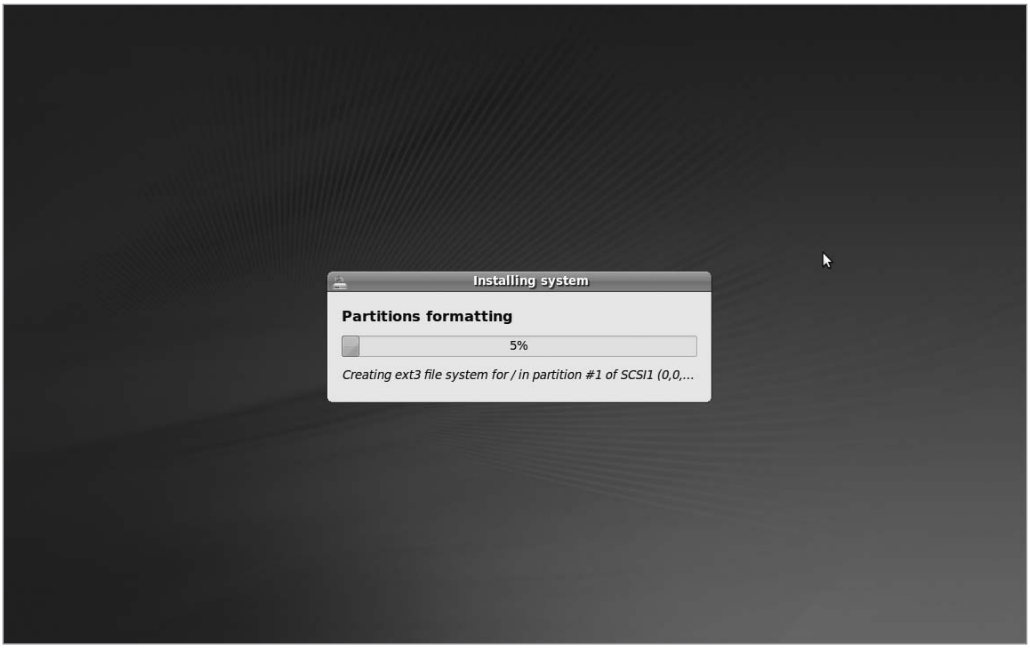

Figure 5-16. *All you have to do now is wait while the Ubuntu files are copied!*

Stage 13: Reboot and Enjoy Ubuntu!

When installation has finished, a dialog box will appear telling you to restart the computer (see Figure 5-17). After you click the Restart Now button, the DVD will be ejected automatically. It's important that you remove it so that you don't accidentally boot Ubuntu's installer again when the machine restarts. In fact, Ubuntu will prompt you to remove the disk and press Enter to confirm the removal.

Following this, the system will restart. If you've installed Ubuntu on a computer that contains Windows, you'll first see the GRUB boot menu. This offers a number of choices, including the chance to boot Ubuntu into recovery mode, which can help fix your computer (discussed in Chapter 6). You can also choose to boot into Windows. You can switch between the menu choices by using the arrow keys; press Enter to make your selection.

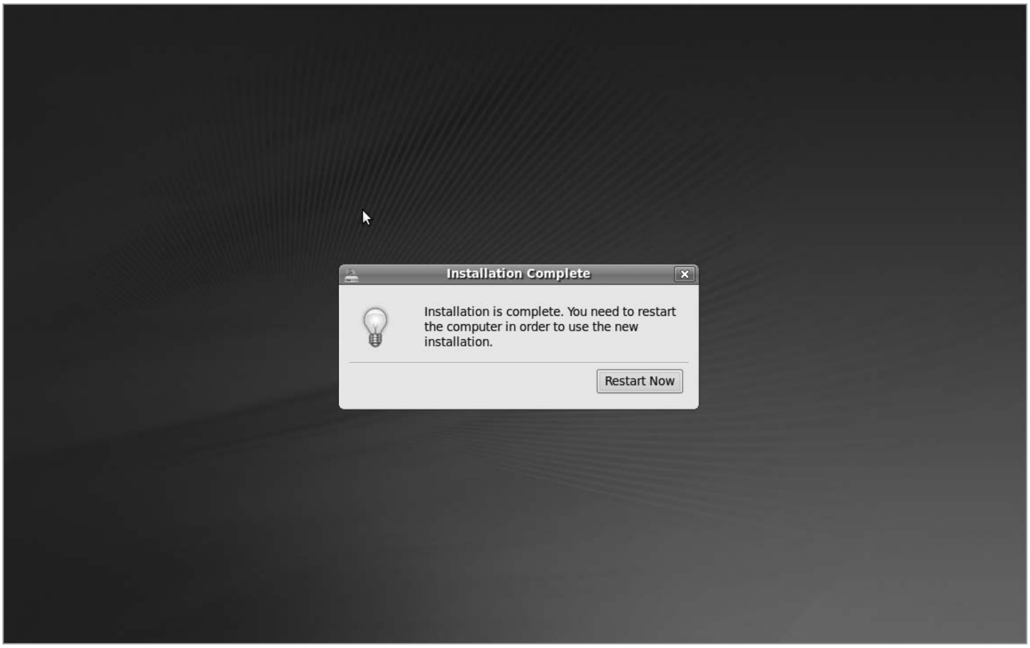

Figure 5-17. *You're almost ready to get started with Ubuntu.*

You can also run Memtest86, as described previously in stage 4. However, most users can simply press Enter when the menu appears, which will select the topmost entry, thereby booting Ubuntu in normal mode. Alternatively, after 10 seconds, the default choice will be automatically selected.

If you installed Ubuntu onto a computer or hard disk without any other operating system, you'll see a brief countdown timer, during which you can press any key to make the boot menu appear. Otherwise, it will be hidden, and after the countdown has finished, Ubuntu will start its boot procedure.

After the boot menu is out of the way and after a few seconds have passed while Ubuntu loads, you'll see the Ubuntu login screen, as shown in Figure 5-18. From here, you can progress to Chapter 7 to learn how to get started. Alternatively, if you've run into any problems, see Chapter 6.

Figure 5-18. *When the computer has rebooted after installation, the standard Ubuntu login screen will appear.*

INSTALLING UBUNTU ON AN APPLE MAC

Ubuntu can also run on Apple Macintosh computers, as well as PCs, and the DVD-ROM supplied with this book contains everything you need. However, the instructions vary depending on the processor installed in your Macintosh. To find out which type of processor your Mac uses, click the Apple menu and select About This Mac. In the summary dialog box, look for the Processor heading. If the line reads "PowerPC," see the instructions under that heading. If the line contains "Intel" in combination with any other words, such as "Intel Core Duo," continue with the following instructions.

Intel

If your Mac contains an Intel processor, you might be able to boot from the DVD-ROM supplied with this book and use it to install Ubuntu. However, some extra steps are necessary. If you're using Mac OS X 10.5, also known as Leopard, you can use Apple's Boot Camp utility (located in Applications ➤ Utilities) to resize the existing Mac OS X partition. Boot Camp is also used to provide a boot menu to let you switch between Mac OS X and Ubuntu. However, Boot Camp is designed to allow Windows to be installed alongside Mac OS X, so some additional steps are necessary to make it work with Ubuntu. A full guide is provided at the official Ubuntu wiki: `https://help.ubuntu.com/community/MacBook`.

If you're running Mac OS X Tiger (10.4), you may want to look into using third-party boot menu software called rEFIt (`http://refit.sourceforge.net`). This utility can also be used in Leopard in place of Boot Camp.

After the computer has been correctly configured by following the guide, you can boot from the DVD-ROM and follow the instructions in the rest of this chapter. Hold down the C key (or Cmd+Shift+Option+Delete on older systems) when the Apple symbol appears during booting to boot from the DVD-ROM disc.

PowerPC

Ubuntu also works on a Mac based on a PowerPC processor, although a special version must be used. Note that the only version commercially supported by Canonical, the company that sponsors Ubuntu, is the older 6.06 release. Newer versions are supported solely by the community. The PowerPC version of Ubuntu on Side B of the DVD-ROM is the 9.04 release of Ubuntu, and is supplied as an `.iso` image. You'll need to manually burn this to a blank CD-R or CD-RW, and then boot from it to install Ubuntu. However, first you must create some free space on the hard disk, so you can install Ubuntu alongside your existing operating system (assuming you want to dual-boot Mac OS X and Ubuntu; if you want to let Ubuntu use the entire hard disk, the Ubuntu installer will be able to wipe the existing partitions, and no further action is necessary). Boot from the Mac OS X installation DVD-ROM and quit the installer. Then use Disk Utility from the menus to resize the hard disk in order to make space.

To create the Ubuntu installation CD, boot to Mac OS X. Next, insert the DVD-ROM with Side B topmost and copy the `ubuntu-9.04.1-desktop-powerpc.iso` file to the desktop. Insert a blank CD-R or CD-RW, and then start Disk Utility. Choose Images ➤ Burn, navigate to the `ubuntu-9.04-desktop-powerpc.iso` file on the desktop, and then click the Burn button. When the burn has finished, use the disc to boot from and install Ubuntu, following the instructions provided in this chapter. Hold down the C key (or Cmd+Shift+Option+Delete on older systems) when the Apple symbol appears during booting to boot from the CD.

Summary

By following the steps outlined in this chapter, you should now have Ubuntu installed on your computer. We've tried to provide you with enough information to get around any problems, and explain each step of the installation.

Alas, it's still possible that you encountered hurdles that weren't addressed here. In the next chapter, you'll find solutions to common problems associated with Ubuntu installation.

CHAPTER 6

Solving Installation Problems

It's unlikely that you'll encounter any problems during your Ubuntu installation, and you'll find yourself with a first-rate operating system up and running within just a few minutes. However, sometimes issues do arise, so we've drawn together a list of possible problems alongside their solutions, which should get you out of any tight spot. These problems are organized by the time that they occur: before you start Ubuntu's live distro mode; while running the installation program; and after the installation, when you boot for the first time. The final section of the chapter describes how to configure the graphical subsystem with the X.org configuration utility, which can be useful if graphical glitches arise. The latest version of Ubuntu has an all-encompassing recovery mode, which should assist in solving any problems.

Preinstallation Problems

Some problems might arise before you even boot Ubuntu's live distro mode in order to run the installation program. This section addresses such issues.

The Disc Doesn't Boot

When I boot from the Ubuntu DVD-ROM, the drive spins up as if something is happening, but I see either nothing or a few strange graphics on the screen.

Solution

The DVD-ROM disc might be either dirty or faulty. Examine its surface for scratches or try cleaning it with a moist tissue. A typical indicator of a dirty or damaged disc is that the drive spins up and then instantly spins down several times in succession—listen to the whir of the drive's motor to tell whether this is the case.

If the disc seems okay, it might be that your computer is not set to boot from the DVD or is unable to display the Ubuntu boot menu. In the case of the former, you'll need to redefine the boot order in the computer's BIOS, as covered in Chapter 5. To get around the latter problem, when you see the blank screen or graphical corruption, press the Esc key twice. Then press Enter. You'll see the word `boot:` at the top left of the screen, along with a prompt at which you can enter commands. Type `live`, and press Enter.

The Disc Boots Up, but Installation Doesn't Start

The computer boots from the DVD-ROM, but when the boot menu appears, pressing Enter doesn't start the installation. In fact, nothing happens at all! I'm unable to move up and down through the menu choices either—the keyboard is totally unresponsive.

Solution

If your PC uses a USB keyboard, it might be that it's not being recognized by the Ubuntu boot loader. To get around this, it's possible to make most computers pretend that USB keyboards are older PS/2 keyboards. This is done on a fundamental hardware level and is invisible to the operating system. Here are the steps:

1. Enter the BIOS setup program by pressing Delete during the initial stages of your computer's boot routine (while memory testing and drive identification are still taking place). Some computers might use a different key combination to enter BIOS setup, such as Ctrl+Insert, but this information will be displayed on your screen.

2. Use the cursor keys to navigate to the Integrated Peripherals section, and then look for an entry along the lines of USB Legacy Support. Set it to Enabled.

3. Press Esc to return to the main menu, and opt to save the changes.

4. Reboot the computer.

Note that you should repeat this procedure and deactivate USB Legacy Support after Ubuntu has been installed. At that stage, Ubuntu should be able to recognize the USB keyboard properly. You might also try to use a PS/2 adaptor, but be aware that these will often be tied to a particular manufacturer's product and may not work across the board.

I'm Using a KVM, and the Screen Looks Wrong

I'm using the same keyboard, mouse, and monitor across several computers, courtesy of a keyboard, video, and mouse (KVM) switch. When Ubuntu boots, the resolution is wrong and the graphics are corrupted. (Also, my keyboard or mouse doesn't work correctly.)

Solution

A KVM switch may not allow Ubuntu to correctly probe the attached hardware. Consider attaching the keyboard, monitor, and mouse directly to the computer for the duration of the installation. After installation is accomplished, you can reintroduce the KVM, and things should be fine.

The Computer Is Having a Kernel Panic

After I've pressed Enter at the boot menu to start booting Ubuntu, the computer freezes and eventually displays a message along the lines of "Kernel Panic."

Solution

Kernel Panic errors occur when Ubuntu cannot continue to load for various reasons. In this context, it's likely that either the DVD is faulty (or dirty) or that the PC has a hardware problem.

First, check to make sure that the DVD is clean and not scratched. If possible, try it on a different computer. If it works, then it's clearly not at fault, and your computer most likely has a hardware issue. In particular, bad memory can cause problems. Does the computer already have an operating system installed? Does this run without problems? If not, consider replacing your memory modules.

To thoroughly test your computer's memory, boot from the Ubuntu DVD and select the Test Memory option on the menu (use the arrow keys to move up or down in the list, and press Enter to make a selection). This will run the Memtest86 program, and any problems with your memory will be reported in the Errors column on the right side of the program screen. For more details about how to use Memtest86, see `www.memtest86.com`.

The Graphics Look All Wrong

Immediately after I press Enter at the boot menu to start Ubuntu's live distro mode, the computer looks like it has crashed—the graphics are corrupted!

Solution

Your graphics card may be incompatible with the framebuffer graphical mode used by Ubuntu's boot routine. You can overcome this problem by following these steps:

1. Reboot the computer. Press Esc, and then press F6 to see a list of options. Press Esc once more to dismiss this menu.

2. Use the cursor keys to select the first option, and you should see a line of text appear below the menu that reads `Boot Options`. Using the Backspace key, delete `quiet splash --` from the end of the line, as shown in Figure 6-1. Then press Enter.

If you continue to see graphical corruption, try using the solution to the next problem.

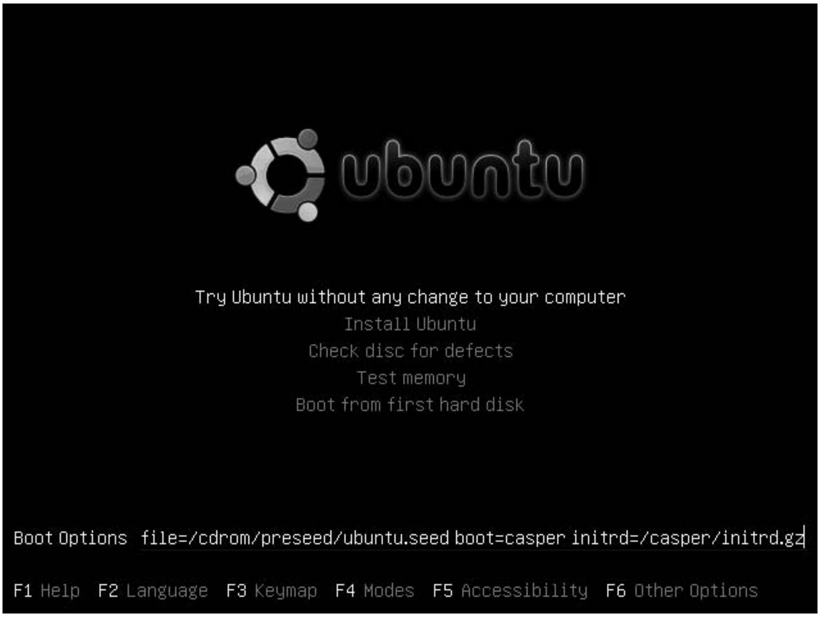

Figure 6-1. *Use the cursor keys to remove the last element from the boot parameters.*

Installation Doesn't Finish

When I select the Install Ubuntu option and press Enter, I see a status bar, but when the Ubuntu desktop should appear, it looks like my computer has crashed—all I see is graphical corruption.

Solution

Reboot the computer, and when the Ubuntu boot menu appears, select Ubuntu and press F4. Select Safe Graphics Mode and then press Enter. This will start Ubuntu using VESA graphics drivers, which are compatible with practically every graphics card made within the last ten years.

If you're trying this solution after trying the solution to the previous problem, edit the `Boot Options` line first, as stated in the previous solution, and then press F4 and select Safe Graphics Mode.

If, after installing Ubuntu onto your computer's hard disk, you find that there's still graphical corruption when you boot Ubuntu, see the instructions under the "Graphical Problems" heading toward the end of this chapter.

The Computer Freezes During Installation

After I've selected the Install Ubuntu option on the menu, the status bar appears, but then the computer freezes.

Solution

It's possible that the power-saving feature or the advanced programmable interrupt controller (APIC) in your computer is causing problems. Press the F6 key, and after selecting the live or install option, type the following at the end of the `Boot Options` line that appears:

```
acpi=off noapic nolapic
```

Then press Enter to boot Ubuntu.

My Notebook Display Looks Corrupted During Installation

I'm attempting to install Ubuntu on a notebook computer. After I select the Install Ubuntu option and press Enter, the screen is filled with graphical corruption, and it looks like Ubuntu has crashed. (Alternatively, the screen looks squashed, or some elements are off-center or off the edge of the screen.)

Solution

When the Ubuntu boot menu appears, press the Esc key twice and then press Enter. At the `boot:` prompt, type `live vga=771`. Then press Enter. This starts the live mode in a safe, VGA resolution. You should be able to change the resolution after the system has loaded.

Installation Stops and Leaves a Message

During booting, my computer hangs. Onscreen I see a lot of output, but at the bottom of it are the words `aec671x-detect...`.

Solution

This error is caused by your computer's hard disk controller. When the Ubuntu boot menu appears, press the Esc key twice and press Enter. At the `boot:` prompt, type `live gdth=disable:y`. Then press Enter.

The Installer Doesn't Appear on My Monitor

The Ubuntu DVD-ROM seems to boot into the Ubuntu installer program, but then the screen goes blank, and my monitor flashes an error along the lines of "Cannot display this mode" or "Out of mode." (This problem might affect users of widescreen monitors in particular.)

Solution

It sounds like the graphical configuration Ubuntu automatically generates for your computer isn't correct. Reboot the computer, and when the Ubuntu boot menu appears, select Install Ubuntu, press F4, and select Safe Graphics Mode. Then press Enter. This will start Ubuntu using VESA graphics drivers, which are compatible with practically every graphics card made within the last ten years.

Alternatively, it's possible that although the screen is blank, the Ubuntu login screen is running in the background. You can, therefore, try logging in "blind" (that is, without any visual feedback onscreen). Type your username, press Enter, type your password, and press Enter again. At this point, you may find that the desktop appears as it should. Then use the Screen Resolution program (System ➤ Preferences) to set the correct resolution and refresh rate.

NONE OF THESE SOLUTIONS WORK!

If you run into installation problems for which you can't find a solution here, you can try using the text-mode-based installation option on the DVD-ROM boot menu, available by pressing the F4 key. Another option is to use the Alternative installer, which is based on the older Debian installer. To do the former, simply select Install Ubuntu in Text Mode. The Alternative install, though, will need to be burned to a CD as an image and booted as before. The Alternative installer can be found here: `www.ubuntu.com/getubuntu/downloadmirrors#alternate`.

Unfortunately, there isn't space to provide a full installation guide here, although most installation options should correspond loosely to those discussed in Chapter 5.

We've provided an ISO image of a CD version of Ubuntu that uses the Alternative installer. This can be found on Side B of the DVD-ROM. You can learn more about it in Appendix D.

Installation Problems

After the DVD-ROM has booted in live distro mode, and you've run the installation program, you may get error messages or experience other difficulties. This section offers some solutions to common installation problems.

I'm Offered Only a Text Login

I've partitioned my disk and clicked to start the installation, after which the Installing System progress bar appears. However, it stops at a certain percentage with an error message. If I click the Continue button, everything continues, and at the end, I'm offered the chance to reboot into the new installation. However, when I reboot, the Ubuntu desktop doesn't appear. Instead, all I see is a black screen with a text-mode login prompt.

Solution

For some reason, vital Ubuntu software hasn't been correctly copied to the machine. Make sure the DVD is in your computer's drive and, at the login prompt, type your username, and type your password when it's requested. Then, at the command prompt, type the following, pressing Enter or Return after each line:

```
sudo apt-get update
   [At this point you'll need to type your password; do so]
sudo apt-get -f install
sudo apt-get install ubuntu-desktop
```

If you find this doesn't work, follow the instructions in the "None of These Solutions Work!" sidebar, and install Ubuntu using the alternate installer.

The Computer Can't Find My Hard Disk

When the Ubuntu installation program gets to the Starting Up the Partitioner stage, it reports that it can't find any hard disk in my computer.

Solution

There are many possible reasons for this, but here are three potential solutions that you might try in sequence:

1. Select Manual and click the Forward button. You should see a list of hard disks with each of its partitions displayed, and you should then be able to follow the instructions under the "Manually Edit the Partition Table" heading in Chapter 5.
2. Ensure that the jumpers are set correctly on the hard disk (consult the hard disk's documentation if necessary). This is particularly worth checking if you have more than one hard disk installed in your computer. If this doesn't solve the problem, and your second hard disk is nonbootable (that is, it's used only for data storage), try temporarily removing it, and then install Ubuntu. Reconnect it after installation has completed.
3. See the "None of These Solutions Work!" sidebar to learn how to use the alternate installer. This contains an older installation program that many consider more reliable on some problematic computers.

I See Lots of Hard Disks in the Partitioner

When I try to install Ubuntu, the Prepare Disk Space screen shows one (or several) additional small hard disks, usually identified as `/dev/sda` followed by a number.

Solution

If you have a USB memory stick inserted, or a photographic card reader, it will be identified by the Ubuntu installer in this way. You can ignore this or, if you want to avoid confusion, quit the installer, remove the memory stick or card reader, and restart the installer program. Note that many computers that ship with Windows Vista may have a System Restore partition on the main hard disk, which will also show up here.

I Have Too Many Partitions

When manually partitioning, I see an error message to the effect that I can't have more than four primary partitions.

Solution

This is a limitation in how hard disks work and not an issue with Ubuntu. A hard disk can contain only four primary partitions, but this can be extended by subdividing these further into logical partitions, as covered in Chapter 5. To resolve the problem, when creating a new partition, select Logical as the type of partition.

For more details about primary and extended hard disk partitioning, see `http://en.wikipedia.org/wiki/Disk_partitioning`.

Postinstallation Problems

Problems might also occur after you install Ubuntu. This section addresses several possible postinstallation problems. This section covers only problems that appear immediately after installation—those that prevent Ubuntu from working correctly immediately after its first boot. Issues surrounding the configuration of hardware or software are dealt with in Chapter 8.

My Monitor Resolution Is Not Recognized

I use a widescreen monitor (or a widescreen notebook). When I boot to the desktop, the resolution is set too low. When I try to switch resolutions (by clicking System ➤ Preferences ➤ Screen Resolution), the resolution my monitor usually runs at isn't available in the list.

Solution

In a minority of cases, the open source drivers for ATI and Nvidia cards can't support certain resolutions on particular monitors, especially widescreen ones. One solution is to install proprietary graphics drivers, as discussed in Chapter 8, although you should also update your system online as soon as possible (see Chapter 9) to see if the open source graphics drivers have been updated and improved. In both cases, you'll need to configure your computer to go online, which is also explained in Chapter 8.

My Keyboard or Mouse Isn't Working

After booting up, my USB mouse and/or USB keyboard are not recognized.

Solution

Try unplugging the keyboard and/or mouse, and then reattaching them. If you find they now work, log in to Ubuntu and perform an online system upgrade. See Chapter 9 for more information about this task.

If this fails to solve the problem, you can configure your BIOS to pretend your mouse and keyboard are traditional PS/2-style devices, as follows:

1. Enter the BIOS setup program by pressing Delete during the initial stages of your computer boot routine (while memory testing and drive identification are still taking place). Some computers might use a different key combination to enter BIOS setup, such as Ctrl+Insert, but this information will be displayed on your screen.
2. Use the cursor keys to navigate to the Integrated Peripherals section, and then look for an entry along the lines of USB Legacy Support. Set it to Enabled.
3. Press Esc to return to the main menu, and opt to save the changes.
4. Reboot the computer.

The Computer No Longer Boots

When I boot for the first time, I see an error message along the lines of "No operating system could be found on the hard disk."

Solution

It seems that, for whatever reason, the GRUB boot loader wasn't installed correctly. Boot from the DVD-ROM, and select Try Ubuntu Without Any Change to Your Computer when prompted. When the Ubuntu desktop appears, click Applications ➤ Accessories ➤ Terminal. This will open a command-prompt window. Type the following commands in sequence:

```
sudo grub
root (hd0,1)
setup (hd0)
quit
```

Then restart Ubuntu (click System ➤ Quit). Ensure that you remove the DVD-ROM when prompted. You should find that the Ubuntu boot menu now appears when you boot.

Ubuntu Is Working, but Windows Won't Boot

After I've installed Ubuntu, Windows will no longer boot, although Ubuntu works fine. After I select Windows from the boot menu, the Windows boot procedure either freezes when "Starting Windows . . ." appears or the boot status bar is shown, but the desktop never appears.

Solution

Try repairing your Windows disk by using the Windows command-line tool `chkdsk`. This can be done from the recovery mode of the Windows installation CD/DVD, but the instructions for how to do this vary depending on whether you're running Windows Vista or XP.

Windows Vista

If you're running Windows Vista, follow these steps to run `chkdsk`:

1. Insert the Windows Vista installation DVD and select to boot from it. For details on how to configure your computer to boot from the DVD, see stage 2 of the Ubuntu installation guide in Chapter 5.
2. You'll see the message "Windows is Loading Files," along with a progress bar. After this has cleared, select your language/locale settings from the Install Windows dialog box, and then click Next.
3. On the next screen, don't click the Install Now button. Instead, click the Repair Your Computer link at the bottom-left corner of the window.
4. In the System Recovery Options dialog box, select your Windows Vista partition and then click Next.
5. On the next screen, select Command Prompt.
6. In the command-prompt window that appears, type the following (this assumes Vista is installed on drive `C:`):

   ```
   chkdsk c: /R
   ```

7. Wait until the check has completed, and then type `exit` at the prompt.
8. Back in the System Recovery Options dialog box, click Restart. This will reboot your computer. Be sure to eject the Windows Vista DVD before doing so.

Windows XP

If you're running Windows XP, follow these steps to run `chkdsk`:

1. Insert the Windows XP installation CD, and select to boot from it. For details of how to configure your computer to boot from the CD, see stage 2 of the Ubuntu installation guide in Chapter 5.
2. You'll see status messages that Windows is loading driver files. Eventually, the Windows Setup menu will appear. Press R to start the Recovery Console.
3. You'll be asked to confirm which Windows installation you would like to boot into; do so.

4. You'll then be prompted for the administrator's password. If you don't have one, simply press Enter.

5. At the command prompt, type the following:

```
chkdsk c: /R
```

6. Wait until the check has completed, and then type `exit` at the prompt. This will reboot your computer. Be sure to eject the Windows XP CD before rebooting.

You can also use Super GRUB Disk (`www.supergrubdisk.org`) to boot the computer and examine the boot process to find and fix the problem.

I Can See Only a Text Login Prompt

When I boot for the first time, all I see is a black screen with some text at the top reading, "Ubuntu jaunty ubuntu tty1" and beneath that, "ubuntu login:."

Solution

For some reason, the automatic configuration of your graphics card failed during installation. See the following section for instructions on configuring your GUI manually.

Graphical Problems

Although Ubuntu is extremely adept at automatically detecting and configuring your PC's graphics hardware, it sometimes gets things wrong. Such problems are characterized by one of the following:

- Ubuntu freezes when the desktop would usually appear.
- You see onscreen graphical corruption of either text or graphics.
- The resolution is set too low or too high, and you can't change it to the correct resolution because it isn't offered.
- You see a black screen with only a text login prompt.

■ **Tip** If the desktop is off center and the menus can't be accessed to change the resolution, right-click somewhere on the panel and temporarily add a new main menu applet. You'll then be able to access the Preferences section from this.

Troubleshooting graphical problems has never been as easy as in the latest versions of Ubuntu. Starting with Ubuntu 7.10, code-named Gusty Gibbon, Ubuntu added a system component called BulletProofX. This is a kind of rescue program that ensures that X.org (Ubuntu's graphical subsystem, often referred to simply as *X*) will run in low-graphics mode should X.org fail to start with the current display settings. In other words, it's a lot like Safe Mode that you might be used to with Microsoft Windows.

Low-graphics mode uses 640×480 or 800×600 resolution, 16 or 256 colors, and a VESA driver to operate the graphics card. Obviously, these are not optimal settings for using the desktop, but they're chosen for their wide compatibility with most graphics hardware.

The latest version of Ubuntu also features a recovery mode that will attempt to fix common problems such as poor graphics performance and broken packages. From the boot menu, select the second Ubuntu option, labeled Recovery Mode. For graphics issues, choose the last option on the list, xfix. This will try to fix common X.org issues and then resume the boot process.

■ **Note** On a technical level, Jaunty uses the latest version of X.org, 7.4. This version of X.org is able to autodetect and autoconfigure monitors, graphic cards, and mice, which means manual customization of display settings—long the bane of Linux users around the world—is rarely necessary. Because of this, the command-line reconfiguration utility `dpkg-reconfigure xorg-xserver`, which was previously used to set the monitor, graphics card, and keyboard settings, has been stripped down to customizing the framebuffer (a method of accessing the graphics card memory) and the keyboard settings. It's unlikely you'll ever need to use it.

Additionally, if your computer utilizes a recent Nvidia or ATI 3D graphics card, you can try installing the proprietary drivers. This is best done when the system is up and running, so follow the instructions here to get a workable graphical system and then follow the instructions in the "Installing 3D Drivers and Activating Desktop Visual Effects" section of Chapter 8. Installing a proprietary driver might be the only way to get visual desktop effects working and utilize the full resolution of a widescreen monitor.

If you still can't access the correct resolutions for your monitor, the best solution may be to add these options to the computer, which involves editing the `xorg.conf` file. This is a system file, so you'll need to access it by using superuser privileges.

Open a terminal (Application ➤ Accessories ➤ Terminal) and type `sudo gedit`. After you input your password, Ubuntu's default text editor will open in superuser mode. Choose File ➤ Open and navigate to `/etc/X11/xorg.conf`.

This is a system file, so it's worth being very sensible about editing, and use the following structure exactly. You need to add a new subsection beneath the section labeled Screen, as shown in Figure 6-2.

```
SubSection     "Display"
     Modes     "1440x900"  "1280x960"
EndSubSection
```

The resolutions we've added are both widescreen modes, but you should be able to see what resolutions your monitor supports in its documentation. After you've added the modes—making sure you add the `EndSubSection` element—select the Save option and then restart the computer.

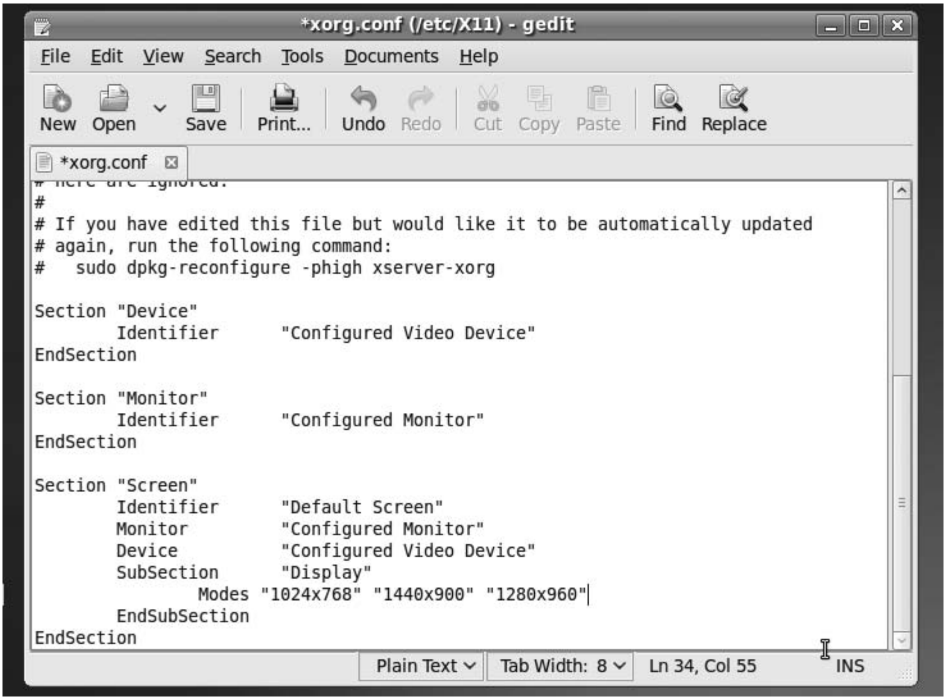

Figure 6-2. *New display modes can be added manually to `xorg.conf`.*

Now when you go into the display settings (System ➤ Preferences ➤ Display), you should see the new modes available, as shown in Figure 6-3. Table 6-1 shows the most common monitor resolutions.

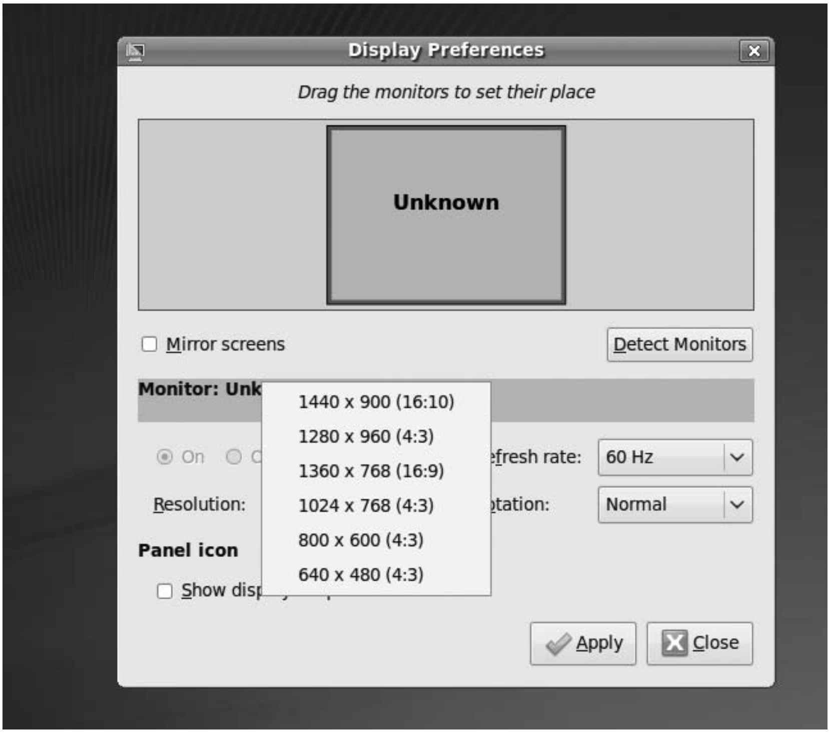

Figure 6-3. *New resolutions are available from the Display Preferences section.*

Table 6-1. *Typical Monitor Resolutions*

Monitor Size	Typical Resolutions
CRT Monitors	
14 inches	800×600, 640×480
15 inches	800×600, 640×480
17 inches	1024×768, 800×600, 640×480
19 inches	1280×1024, 1024×768, 800×600, 640×480
20 inches	1600×1200, 1280×1024, 1024×768, 800×600, 640×480

Continued

Table 6-1. *Continued*

Monitor Size	Typical Resolutions
TFT Screens	
14 inches	1024×768
15 inches	1024×768
17 inches	1280×1024
19 inches	1280×1024, 1440×900 (widescreen)
20 inches	1680×1050 (widescreen)
21 inches	1600×1200
22 inches	1680×1050 (widescreen)
23 inches	1920×1080 (widescreen)
23 inches	1920×1200 (widescreen)
24 inches	1920×1200 (widescreen)
26 inches	1920×1200 (widescreen)
27 inches	1920×1200 (widescreen)
28 inches	1920×1200 (widescreen)
30 inches	2560×1600 (widescreen)
40 inches	1366×768 (widescreen)

Note that if you've installed proprietary drivers for an Nvidia or ATI graphics card, you'll see a different display configuration screen. The Nvidia options are shown in Figure 6-4.

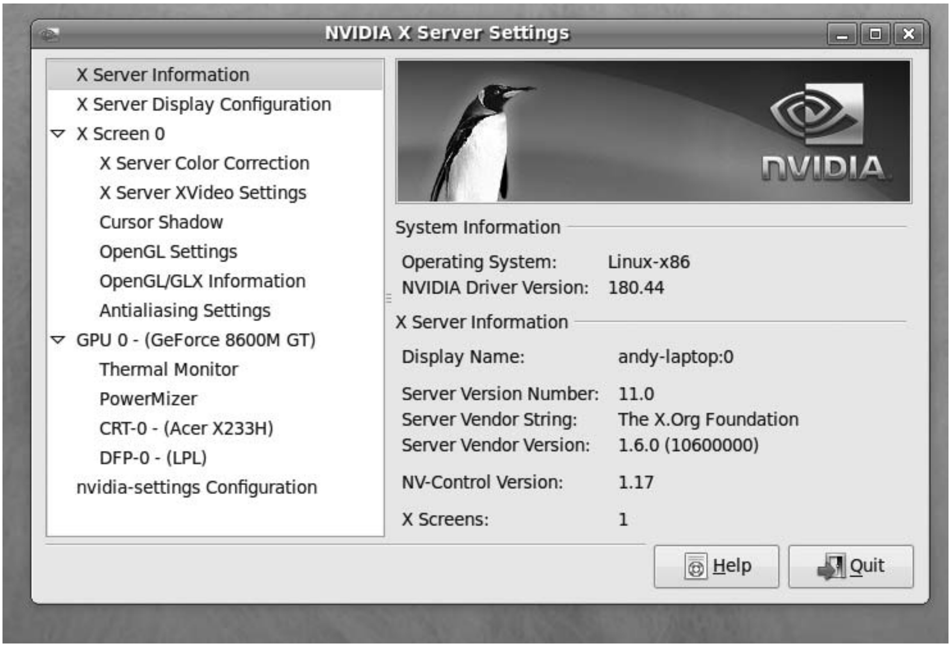

Figure 6-4. *Nvidia users will see a different set of options for configuring displays.*

Summary

This chapter's goal was to address problems that might occur during the installation of Ubuntu. It discussed preinstallation, installation, and postinstallation issues. It also covered some of the graphical problems you may encounter.

You should now have Ubuntu installed. The next part of this book focuses on helping you get everything up and running. You'll learn essential skills and become a confident Linux user.

PART 3

The No-Nonsense Getting Started Guide

CHAPTER 7

Booting Ubuntu for the First Time

Now that Ubuntu is installed, you'll no doubt want to get started immediately, and that's what Part 3 of this book is all about. In later chapters, we'll present specific details of using Ubuntu and getting essential hardware up and running. We'll also show you how to personalize the desktop so it works in a way that's best for you on a day-to-day basis. But right now, the goal of this chapter is to get you doing the same things you did under Windows as quickly as possible.

This chapter explains how to start up Ubuntu for the first time and work with the desktop. It also shows how some familiar aspects of your computer, such as using the mouse, are slightly enhanced under Ubuntu.

Starting Up

If you've chosen to dual-boot with Windows, the first Ubuntu screen you'll see is the boot loader menu, which appears shortly after you switch on your PC. If Ubuntu is the only operating system on your hard disk, you'll see a brief one-line message pointing out that if you press a key, you can access this boot menu. You won't need to do so unless you want to access the recovery mode boot settings. In fact, if Ubuntu is the only operating system on your computer, you can skip to the next section of this chapter.

Note The boot loader is actually a separate program called GRUB. This program kicks off everything and starts Ubuntu.

The boot loader menu you see when your PC is set to dual-boot has three or four choices, as shown in Figure 7-1. The top one is what you need to boot Ubuntu. The Ubuntu option will be selected automatically within 10 seconds, but you can press Enter to start immediately.

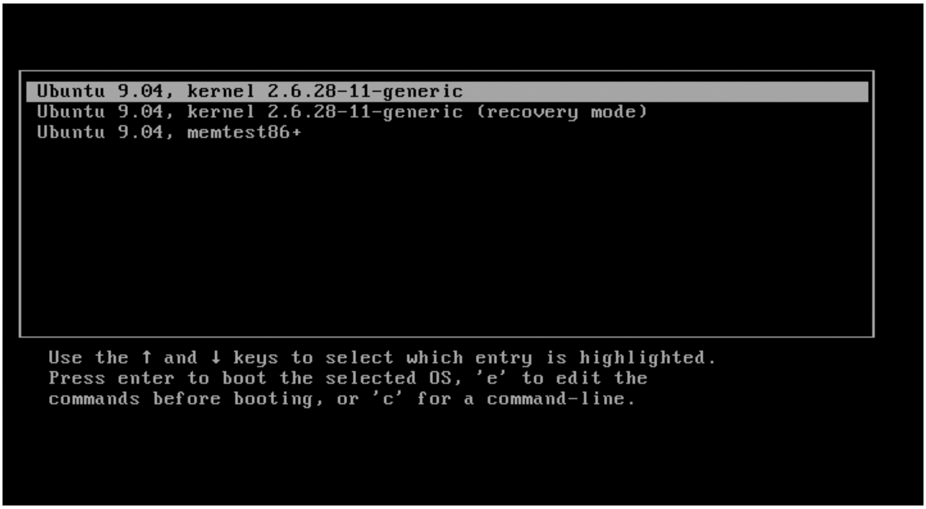

Figure 7-1. *The default choice is fine on the boot menu, so press Enter to start Ubuntu.*

You should find that you also have an entry for Windows, located at the bottom of the list, and labeled with whichever version of the operating system you have installed. To boot into Windows, simply use the cursor keys to move the selection to the appropriate option and then press Enter.

You should also see an entry ending in "(recovery mode)." This is a little like Safe Mode within Windows. If you select recovery mode, Ubuntu will boot to a text mode menu with three options:

Resume—Resume normal boot: This option allows you to boot normally, as if you didn't need to fix anything at all. However, the big difference with this option compared to a graphical boot is that Ubuntu boots in text mode, which means that you are able to see system messages scroll past as Ubuntu is starting up. If you have problems with booting Ubuntu, you can run in recovery mode and choose this option to find error messages in the boot process.

Root—Drop to root shell prompt: This option boots with conservative system settings and then presents you with a command-line prompt in administrator mode (you run as the *root user*—see Chapter 29 for more information on the root user account). The typical usage of the administrator prompt is to change passwords of users if they forget their passwords, free up disk space to run normally, and uninstall buggy software to bring back system stability. The system commands that can be used for recovery are `passwd`, `mv`, `rm`, `cp`, `mkdir`, and `dpkg`. These are discussed further in Chapters 13 (copying, deleting, and moving files and folders), 28 (uninstalling packages), and 29 (changing passwords). When you've finished, type `exit` to return to the recovery menu.

Xfix—Try to fix X server: This option replaces the current keyboard, screen, mouse, and graphics configuration with the information it has gathered through autodetection. Refer to the "Graphical Problems" section in Chapter 6 for information about troubleshooting X server-related issues.

When you update your system software, you might find that new entries are added to the boot menu list. This is because the kernel has been updated. The kernel is the central system file that Ubuntu relies on, and essentially, the boot menu exists to let you choose between different kernels.

Without exception, the topmost entry is the one you'll want each time to boot Ubuntu, because this will always use the most recent version of the kernel, along with the latest versions of other system software. The entries beneath this will start the system with older versions of the kernel and are provided in the unlikely situation that the latest kernel causes problems.

■ **Note** All operating systems need a boot loader—even Windows. However, the Windows boot loader is hidden and simply starts the operating system. Under Ubuntu, the boot loader usually has a menu, so you can select Linux or perhaps an option that lets you access your PC for troubleshooting problems. When you gain some experience with Ubuntu, you might choose to install two or more versions of Linux on the same hard disk, and you'll be able to select among them by using the boot menu.

Logging In

After Ubuntu has booted, you should see the login screen, as shown in Figure 7-2. Here you enter the username and the password you created during the installation process. Clicking the Options button in the bottom-left corner of the screen brings up a menu from which you can opt to reboot the system or shut it down.

The user account you created during installation is similar to what Windows Vista and XP refer to as an *administrator* account. This means that the account you use on a day-to-day basis can also change important system settings and reconfigure the system. However, the main difference between Ubuntu and Windows is that you'll need to enter your password to make any serious changes, rather than clicking in a confirmation dialog box, as you do with Vista (of course, XP doesn't have any kind of confirmation requirement at all!).

Don't worry about damaging anything accidentally; trying to reconfigure the system or access a serious system setting will invariably bring up a password prompt. You can simply click the Cancel button if you don't want to continue.

■ **Note** Unlike some versions of Linux, Ubuntu doesn't encourage the user to use an actual root (or administrator) account. Instead, it operates on the principle of certain ordinary users adopting superuser privileges that allow them to administer the system when they need to. The user account you create during setup has these privileges.

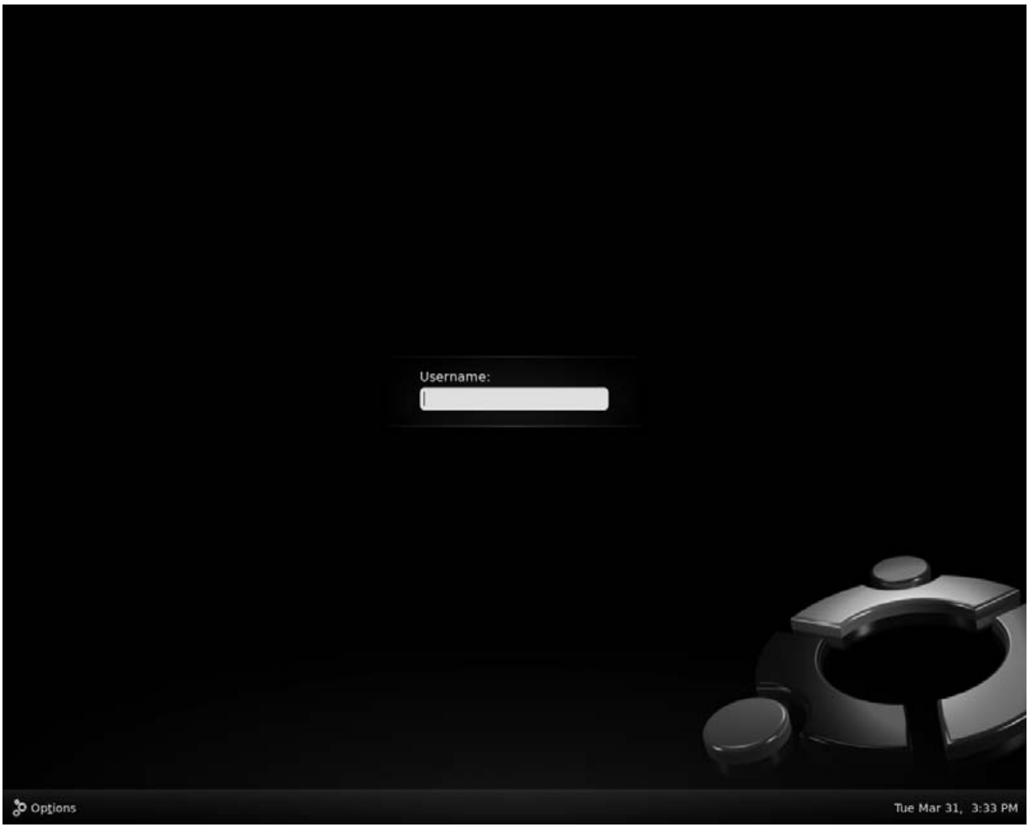

Figure 7-2. *Type your username, enter your password, and then press Enter to log in.*

Exploring the Desktop

After you've logged in, you'll see the welcoming theme of the Ubuntu desktop, as shown in Figure 7-3. Feel free to click around and see what you can discover. There's little chance of you doing serious damage, so let yourself go wild and play around with your new operating system! However, be careful if any dialog boxes ask you to type your password—this indicates that you've clicked an action that has the potential to change the system in a fundamental way.

■ Tip Although you can't damage the system by messing around, you might find that you somehow cause programs to work incorrectly. Don't worry if this happens. You can always create a new account for yourself following the instructions in Chapter 29. When using this new account, you should find that all the settings are returned to normal, and you'll be back to square one!

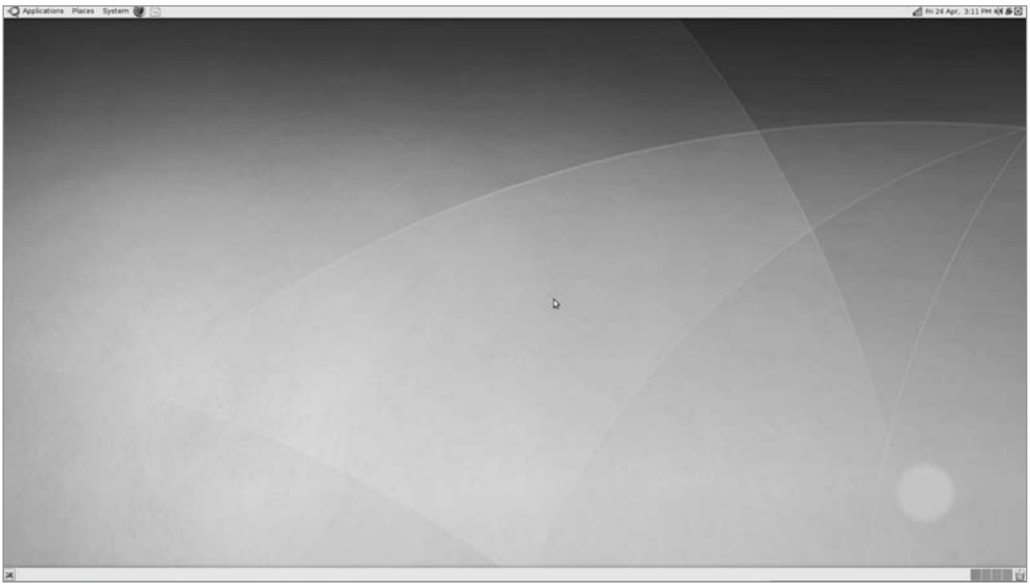

Figure 7-3. *Feel free to experiment with the Ubuntu desktop and see what you can discover.*

First Impressions

The first thing you'll notice is that the desktop is clean compared to Windows. You don't have a lot of icons littering the screen.

Of course, you can fill the desktop with all of the icons you please. As with Windows, you can save files to the desktop for easy access. In addition, you can click and drag icons from any of the menus onto the desktop in order to create shortcuts.

Along the top of the desktop, you see three menus:

Applications: This menu is the equivalent of the Windows Start ➤ Programs menu. Here you'll find access to all the software available under Ubuntu.

Places: This menu is somewhat like My Computer in Windows, in that it gives quick access to locations within the file system. The Places menu also provides access to network locations, such as file servers (this will probably be important only if you use Ubuntu in a business context). You can add and remove folders and files here for quick access to your favorite places.

System: This menu is a little like the Windows Control Panel, in that it allows you to change various system settings. The Preferences submenu lets you change trivial system settings, such as the screen saver, or start new system services, such as the remote desktop service that lets you view your desktop across a network connection. The Administration submenu lets you change underlying system settings, such as configuring new hardware (like printers) and installing software.

The counterpart of the Windows Recycle Bin lives at the bottom-right corner of the screen as a small icon in the lower panel and is called the Deleted Items folder (or Wastebasket). Although diminished in stature compared to the Windows representation, it works in a similar way: you can drag icons and files onto the icon to delete them, and you can click it to open the folder and salvage files.

■ **Note** There's one important difference between the Recycle Bin in Windows and Ubuntu's Wastebasket. By default, the Recycle Bin uses only uses 10 percent of the remaining space on a hard disk. After this, the oldest items are automatically deleted. With Ubuntu's version, the only limit on the contents is the remaining free space on the disk. Nothing will ever be removed from the Wastebasket unless you specifically choose to remove it.

The mouse works largely as it does in Windows, in that you can move it around and click on things. You can also right-click virtually everything and everywhere to bring up context menus, which usually let you alter settings. And you should find that the scroll wheel in between the mouse buttons lets you scroll windows.

Whenever Ubuntu is busy, an animated, circular icon will appear that is similar in principle to the hourglass icon used in Windows. It also appears when programs are being launched.

■ **Caution** Bear in mind that Ubuntu isn't a clone of Windows and doesn't try to be. Although it works in a similar way—by providing menus and icons, and containing programs within windows—there are differences and refinements that may trip you up as you explore.

Shutting Down or Restarting Ubuntu

You can shut down or reboot your PC by clicking the red Off button in the top-right corner of the screen. On many laptops and desktops, you can also briefly press the on/off button on the computer. The former method will present you with a selection of options in a drop-down list, while the latter will launch a dialog box showing icons for various options, as shown in Figure 7-4. Note that not all of the options appear if you use the hardware method to close down. The options in the drop-down list are as follows:

Guest Session/Switch User: This launches a new guest session of the desktop. It is ideal for users who are hot desking, for example, or for friends who visit and want to check their e-mail or Facebook without leaving any trace on your PC. Any files downloaded on a guest account are deleted when the user logs out. If multiple users are defined on the system (Chapter 29 discusses how to add user accounts), this option will allow others to log in without closing down the original user's account. To switch back to the original user, choose Switch User again or log out the guest/second user. The original user will need to enter their password to regain access.

Lock Screen: This enables the screen saver and password-protects the system. The only way to leave Lock Screen mode is to enter the user's password into the dialog box that will appear whenever you move the mouse or press a key.

Log Out: This option logs you out of the current user account and returns you to the Ubuntu login screen. Any open programs will be shut down automatically.

■ **Caution** During shutdown or logout operations, Ubuntu sometimes automatically shuts down applications that contain unsaved data without prompting you, so you should always save files prior to selecting any of the options here.

Suspend: This uses your computer's suspend mode, in which most of the PC's systems are powered down except for the computer's memory. Suspend mode is designed to save power and allow a quick reactivation of the PC. Not all computers support suspend mode, however, so you should experiment to see if your computer works correctly. Ensure that you save any open files before doing so. If your PC goes into suspend mode but fails to wake up when you shake the mouse or push keys, you may need to reboot. This can often be done by holding down the power button for about 5 seconds.

Hibernate: This saves the contents of the computer's memory to the hard disk and then completely powers down the computer. When the computer is reactivated, the user chooses to start Ubuntu as normal, and the memory contents are read in from disk. This allows a faster startup and allows users to resume from where they were last working. For the hibernate feature to work, the swap file needs to be as large as or larger than the main memory. Ubuntu's installation program should have automatically done this, but if you didn't dedicate enough disk space to Ubuntu when repartitioning, it might not have been able to do so. The only way to find out is to attempt to hibernate your system and see whether it works.

Caution Some users have reported that their computer is sometimes unable to "wake" from hibernation, so you should save any open files before hibernating as insurance against the unlikely prospect that this happens. We've seen this happen a few times, although hundreds of other times it's worked fine.

Restart: This option shuts down Ubuntu and then restarts the computer.

Shut Down: This shuts down Ubuntu and then powers off your computer, provided its BIOS is compatible with the standard shutdown commands. (All computers bought within the past five years or so are compatible; if you find that the computer hangs at the end of the Ubuntu shutdown procedure, simply turn it off manually via the power switch.)

Only the last four of these options are available via the hardware shutdown button. If you leave the computer after pushing this button, it will pause for 40 seconds and then shut down.

Figure 7-4. *A variety of shutdown operations are available, some allowing for a quick resumption later on.*

WRONG RESOLUTION!

You might find when you boot up that Ubuntu has defaulted to the wrong resolution. In other words, everything might be a little too large or too small. You might have trouble reading text, for example, or you might find that program windows fill the screen to the extent that their contents partially disappear off the edges.

Changing the resolution is simple. Choose System ➤ Preferences ➤ Screen Resolution from the menu (at the top of the screen). In the Resolution drop-down list, select the appropriate setting for your monitor. For a 17-inch CRT monitor, the standard resolution is 1024×768. Most 17-inch TFT screens run at 1280×1024 resolution. A 15-inch TFT screen will usually run at 1024×768 resolution. For laptops, 13-inch to 15-inch LCD panels typically run at 1280×800 resolution. If you have a 15-inch CRT monitor (common on PCs made before 2000), you'll probably find 800×600 a maximum setting; others prefer 640×480. More-recent wide-screen monitors can be pushed up to 1920×1080 resolution, but this is likely to demand a higher-end graphics card to work well. If you're in doubt as to your monitor's resolution, consult your monitor's manual for more information.

If the resolution you want isn't available, Ubuntu might have incorrectly set up your graphics card and monitor. See the "Graphical Problems" section in Chapter 6 to learn how to reconfigure the graphical subsystem.

Desktop Elements

The Ubuntu desktop is similar to that of Windows and has the following elements:

Menus: The three menus at the top left of the screen provide access to all of Ubuntu's functionality. As noted earlier, the Applications menu provides access to programs; the Places menu provides access to the file system, and the System menu provides access to configuration settings. You can click and drag practically every menu entry onto the desktop in order to create a shortcut.

Icons: Although the Ubuntu desktop is largely clean, some icons are tucked away at the top and bottom of the screen. Those at the top are located to the right of the menus and enable you to start the browser, e-mail client, and help system (and they are arranged in that order). At the top right is a speaker icon that lets you alter the sound volume, along with the Quit icon (additionally, if your system is online, you might see the System Update icon—this is explained in Chapter 9) and any network connection settings such as Wi-Fi signal strength. At the bottom left is the Hide Windows button that instantly minimizes all open windows to give access to the desktop underneath. At the bottom right are the two virtual desktop buttons, which we discuss in the "Working with Virtual Desktops" section later in this chapter, and also the Deleted Items folder icon.

■ **Note** If you're dual-booting with Windows, you might see an icon at the top left of the desktop that will let you access your Windows files. On one system, this was identified as `sda1`. Double-click the icon to view the Windows file system. Similarly, if you have a memory card reader or digital camera plugged in to your PC, you might see desktop icons for them too, and any inserted CD/DVD discs will also be represented by desktop icons.

Window List: The bar at the bottom of the screen, called the Window List, shows which programs are currently running (if any). As with Windows, you can simply click the button for any program to bring that window "to the top." Alternatively, you can right-click each entry to instantly minimize or maximize that particular window. It's also possible to switch between running applications on the Window List by pressing Alt+Tab.

Clock: The clock is located at the top right of the screen. Clicking it brings up a handy monthly calendar and a drop-down panel that contains a mini world map, regional time, and weather for several locations. Click it again to hide this display. Right-clicking the clock brings up a context menu. On this menu, the Preferences option lets you alter the way the date and time are displayed and enables you to define a default location for weather information (which will be displayed in the system tray to the left of the clock). The Adjust Date & Time option lets you change the time and/or date if they're incorrect.

Notification area: The speaker icon and clock are located in the notification area, which is similar to the Windows system tray. Programs that like to hang around in memory, such as the Rhythmbox media player, will add an icon in this top-right area, to allow quick access to their functions. The Software Update Notifier appears in this area to let you know that software updates are available (similar to Windows Update). Network Manager displays an icon here when you are connected to the network. The notification area also has icons for other Ubuntu tools, such as the Tracker (for searching for your data) and the Restricted Device Manager (for managing proprietary drivers). Usually, you simply need to click (or right-click) their icons to access the program features.

Notifications: In addition to the notification area, Ubuntu also has a pop-up short-term notification system that is used to keep you informed of changes to your system's volume, screen brightness, network availability, instant messaging friends status, and other useful things.

■ **Tip** The small bar marks the leftmost boundary of the notification area. To resize the notification area, right-click this bar and remove the check from the Lock to Panel menu entry. Then you can click and drag the bar to a different size. This might be handy if the notification area starts to fill up with icons!

BEHIND THE DESKTOP: GNOME

Although we refer to the *Ubuntu desktop*, the fundamental software behind it is created by GNOME: the Free Software Desktop Project. This is one of the most well-established organizations currently producing desktop interfaces for Linux, as well as for other versions of Unix. Its home page is `www.gnome.org`.

Although it's based on GNOME, Ubuntu's desktop has its own set of individual features and programs, as well as a unique look and feel. That said, it works in an almost identical way to versions of GNOME that are used in other Linux distributions, such as Fedora.

The nature of open source software—whereby anyone can take the source code and create their own version of a program—makes Ubuntu's remodeling of the GNOME desktop possible. Unlike with Windows software, more than one current version of a particular program or software suite can exist, and each is usually tailored to the particular needs of one of the various Linux distributions.

There are also versions of Ubuntu built around KDE (`www.kde.org`) and Xfce (`www.xfce.org`), two similar desktop environments. They're called Kubuntu and Xubuntu, respectively, and they're supplied on the DVD-ROM that comes with this book. For more details, including installation instructions, see Appendix D.

Quick Desktop Guides

Refer to Figure 7-5 for an annotated diagram of the desktop. The figure includes an open menu, browser window, and program window, so you can get an idea of working from the desktop.

As another handy reference, Table 7-1 lists standard Windows desktop features and where similar functionality can be found on the Ubuntu desktop.

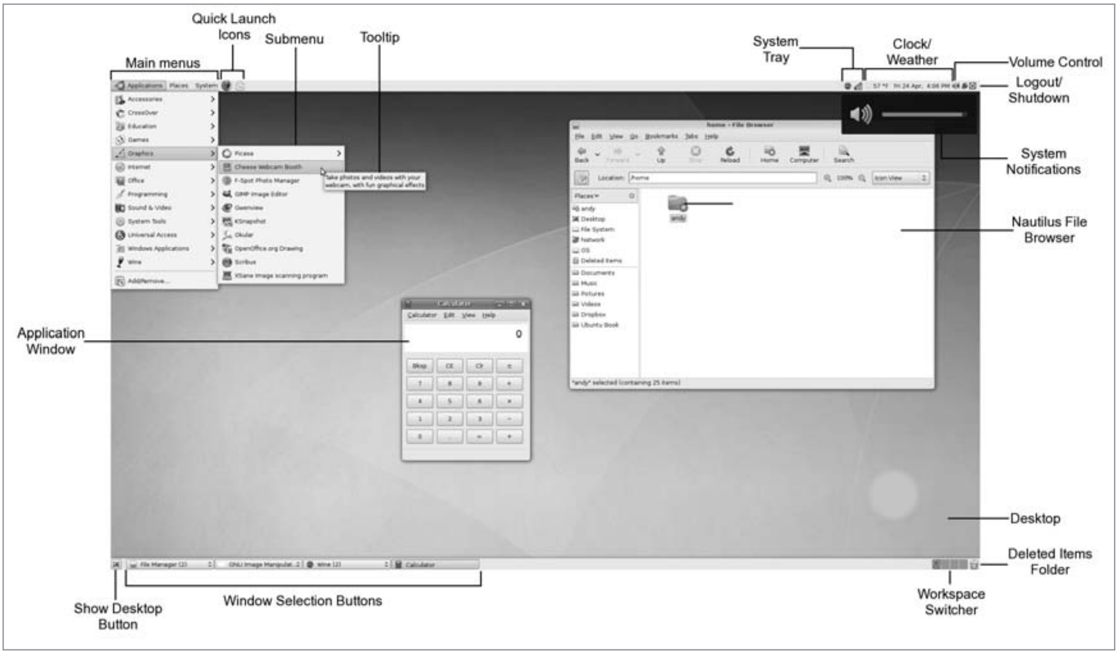

Figure 7-5. *The Ubuntu desktop is broadly similar to the Windows desktop, with a few minor differences.*

Table 7-1. *Ubuntu Equivalents of Windows Desktop Features*

Windows Function	Description	Ubuntu Equivalent
My Computer/Computer	Double-clicking the My Computer/Computer icon gives you access to the PC system. In particular, it lets you browse the file system.	Click Places ➤ Computer to see all the drives attached to the computer in the file browser window. If you wish to browse the file system, double-click File System in the list on the left side of the file browser window.
Recycle Bin	The Recycle Bin is the repository of deleted files.	Click the small trash icon located at the bottom-right corner of the Ubuntu desktop.
Start menu	The Start menu provides access to many computer functions, as well as a list of the programs installed on the system.	This function is split between the Applications and System menus. The Applications menu provides access to software installed under Ubuntu. The System menu lets you configure and administer the system, similar to the Windows Control Panel.

Continued

Table 7-1. *Continued*

Windows Function	Description	Ubuntu Equivalent
Quick Launch toolbar	Located just to the right of the Start button, these small icons let you launch popular programs with a single click.	Similar icons are located to the right of the main menus at the top of the Ubuntu desktop. You can add your own entries here by clicking and dragging program icons from the Applications menu or by right-clicking, selecting Add to Panel, and choosing an Application launcher.
My Network Places/ Network Neighborhood	This icon is used to access network services, usually within a business environment (on newer versions of Windows, this icon is often hidden by default).	To browse the local network, click Places ➤ Network Servers.
My Documents/ Documents	The My Documents/Documents folder, accessed via its icon on the Windows desktop, is a storage space set aside for a user's documents.	The user's Home folder serves this purpose and can be accessed by clicking Places ➤ Home Folder.
Control Panel	The Windows Control Panel, located off the Start menu, enables the user to change system settings and preferences.	Similar functionality can be found under the System ➤ Administration and System ➤ Preferences menu options. If you'd like a more Windows-esque control panel, press Alt+F2 and type `gnome-control-center`. This presents a familiar-looking grid of icons from which you can select all of the configuration options for the operating system.
Find Files/Start Search	Located on the Start menu, the Find Files/Start Search function lets a user search the file system for missing items.	To find files, click Places ➤ Search for Files. You can also add the Deskbar applet to any of your panels (right-click the panel, select Add to Panel, and choose Deskbar from the list).
Shutdown/Reboot	At the bottom of the Start menu within Windows is the Shutdown/ Reboot button.	Clicking System ➤ Quit brings up a dialog box that is almost identical to the one displayed in Windows XP and offers the same options as the Windows Vista shutdown submenu.
Windows Update	Located in the system tray, the Windows Update program checks for and downloads software updates, and then notifies you that the updates are ready to be installed at your command.	The Software Update Notifier checks for software updates and then notifies you when updates are available. Clicking the Update Manager icon pops up a window from which you can download and install updates. In contrast to the Windows system, Ubuntu keeps track of the majority of software installed on your PC and can upgrade almost any application or system file when new versions become available.

Windows Function	Description	Ubuntu Equivalent
Switch User	This option is available when you choose to log off from Windows. You can keep the login session of the current user alive, while allowing another user to log in to Windows.	The User Switcher is located on the left side of the notification area. Click the username or real name, select another user to log in to the system, and supply the correct password. The current user's session will be locked, while a new session will be activated for the new logged-in user.

It will take some time to get used to the look and feel of Ubuntu; everything may initially seem a little unusual. You'll find that the onscreen fonts look a little different from those in Windows, for example. The icons also won't be the same as you're used to in Windows. This can be a little disconcerting, but that feeling will quickly pass, and everything will become second nature. You'll look at how to personalize the desktop in Chapter 10.

UBUNTU FOR MAC OS X USERS

Migrating to Ubuntu from Mac OS X shouldn't present too many surprises and, in some ways, Ubuntu has more in common with OS X than it does with Windows. After all, both Linux and OS X are versions of Unix. Here is a list of OS X functions alongside details of where they can be found within Ubuntu:

- **Finder (File Browsing)**: Finder under OS X offers access to files, applications, and much more and is represented on the Dock by the Mac smiley face icon. In terms of file browsing functionality, clicking Places ➤ Home under Ubuntu is all that's needed for similar behavior.
- **Finder (Applications)**: The Applications option within Finder shows a list of all installed programs. Exactly the same thing can be found by clicking the Applications button under Ubuntu, although the programs are arranged into submenus to make finding what you're looking for easier.
- **Finder (Network Locations)**: Clicking the Network button in Finder enables the user to browse the local area network or access remote file servers. This functionality can be found on the Places menu—click Places ➤ Network Servers to browse the local network and Places ➤ Connect to Server to access a remote server, such as FTP (this function also allows the user to connect to local servers by specifying their addresses).
- **Macintosh HD**: Double-clicking this icon on the desktop allows the user to access the root of the Macintosh file system. To access the root file system under Ubuntu, click Places ➤ Computer, and then click the File System link in the left pane of the file browsing window.

- **Dock**: There is no direct analogy to the Mac OS X Dock under Ubuntu, but the Quick Launch icons to the right of the Applications/Places/System menus offer quick access to the web browser, e-mail client, and help system. Additional programs can be added to the Quick Launch toolbar by clicking and dragging them from the Applications menu. The Window List controls the active window. Additional software can be used to mimic the look and feel of the Dock if you're a big fan.
- **Trash**: Located on the Dock, the Trash icon lets OS X users salvage deleted files. The same functionality is offered by the Ubuntu Deleted Items folder icon, which is located at the bottom-right corner of the screen.
- **System Preferences**: Located on the Dock and in the Applications menu, the System Preferences icon offers access to all of OS X's configuration utilities. Similar functionality can be found on the System ➤ Preferences and System ➤ Administration menus.
- **Spaces (version 10.5 and above):** Spaces allow you to unclutter your desktop by arranging your applications into separate workspaces. Similar functionality is available by using virtual desktops, which are located at the right side of the Window List.
- **Spotlight (version 10.4 and above)**: Spotlight allows users to search their hard disk for files. To access Ubuntu's search function, click Places ➤ Search for Files. You can also click the Deskbar applet, located to the left of the notification area, or the Tracker search tool icon, located in the notification area, to search for files.

Running Programs

Starting a new program is easy. Just click the Applications menu and then choose a program from the list, just as you would in Windows when using the Start ➤ Programs menu. The Applications menu, shown in Figure 7-6, is split into various subcategories of programs, such as office tools, graphics programs, and even games!

If you want to start the web browser or e-mail client (arguably two of the most popular programs offered by Ubuntu), you can click their icons on the top panel bar, just to the right of the menus at the top of the screen (see Figure 7-6).

At the top right of every program window under Ubuntu, you'll see the familiar Close, Minimize, and Maximize buttons, albeit with a slightly different look and feel than you're used to. Clicking the Close button will end each program, as in Windows.

Figure 7-6. *The programs on the Applications menu are split into various categories.*

Working with Virtual Desktops

Windows works on the premise of everything taking place on top of a single desktop. When you start a new program, it runs on top of the desktop, effectively covering up the desktop. In fact, all programs are run on this desktop, so it can get a bit confusing when you have more than a couple of programs running at the same time. Which Microsoft Word window contains the document you're working on, rather than the one you've opened to take notes from? Where is that My Computer window you were using to copy files?

Ubuntu overcomes this problem by having more than one desktop area. By using the Workspace Switcher tool, located at the bottom right of the desktop, you can switch between two or more virtual desktops. This is best explained by a demonstration.

1. Make sure that you're currently on the first virtual desktop (click the leftmost square on the Workspace Switcher), and start up the web browser by clicking its icon at the top of the screen (the globe icon located to the right of the menus).
2. Click the second square on the Workspace Switcher. This will switch you to a clean desktop, where no programs are visible—desktop number two.
3. Start up the file browser by selecting the Places ➤ Home menu option. A file browser window appears.
4. Click the first square in the Workspace Switcher again. You should switch back to the desktop that is running the web browser.
5. Click the second square, and you'll switch back to the other desktop, which is running the file browser.

Tip Right-clicking any of the program entries in the Window List will bring up a menu where you can move a program from one virtual desktop to another. Just select Move to Another Workspace.

See how it works? You can create more than two virtual desktops—as many as 36, in fact! To set the number of workspaces, right-click the Workspace Switcher and select Preferences. In the window that appears, click the up/down arrow next to the Number of Workspaces entry, as shown in Figure 7-7. The default is four workspaces arranged in a single row, but you can increase both of these figures.

Figure 7-7. *Four virtual desktops are set up by default, but you can have as many as 36.*

■ **Tip** Putting your mouse over the Workspace Switcher and scrolling the mouse wheel switches between the various virtual desktops instantly. Alternatively, you can hold down Ctrl+Alt and press the left and right cursor keys to switch between virtual desktops.

If you want to keep one application, for example, a web browser, instantly available regardless of the workspace you happen to be on, you can right-click it in the Window List and click the Always on Visible Workspace button. Now as you navigate your various workspaces, that particular button will follow you.

You can also click and drag the small representations of an application window from one workspace to another in the Switcher itself, though this is quite fiddly. The Workspace Switcher provides a way of organizing your programs and also reducing the clutter. You can experiment with virtual desktops to see whether you want to organize your work this way. Some people swear by them. Experienced Ubuntu users may have in excess of ten virtual desktops, although clearly this will appeal only to organizational geniuses! Other users think multiple desktops are a waste of time. They're certainly worth trying out to see whether they suit the way you work.

Using the Mouse

As noted earlier, the mouse works mostly the same under Ubuntu as it does under Windows: a left-click selects things, and a right-click usually brings up a context menu. Try right-clicking various items, such as icons on the desktop or even the desktop itself.

■ **Tip** Right-clicking a blank spot on the desktop and selecting Create Launcher lets you create shortcuts to applications. Clicking Create Folder lets you create new empty folders.

You can use the mouse to drag icons on top of other icons. For example, you can drag a file onto a program icon in order to run it. You can also click and drag in certain areas to create an "elastic band" and, as in Windows, this lets you select more than one icon at once.

You can resize windows by using the mouse in much the same way as in Windows. Just click and drag the edges and corners of the windows. In addition, you can double-click the title bar to maximize and subsequently restore windows.

Ubuntu also makes use of the third mouse button for middle-clicking. You might not think your mouse has one of these but, actually, if it's relatively modern, it probably does. Such mice have a scroll wheel between the buttons, and this can act as a third button when pressed.

In Ubuntu, the main use of the middle mouse button is in copying and pasting, as described in the next section. Middle-clicking also has a handful of other functions; for example, middle-clicking the title bar of any open window will switch to the window underneath.

■ **Tip** If your mouse doesn't have a scroll wheel, or if it has one that doesn't click, you can still middle-click. Simply press the left and right mouse buttons at the same time. This emulates a middle-click, although it takes a little skill to get right. Generally speaking, you need to press one button a fraction of a second before you press the other button.

Cutting and Pasting Text

Ubuntu offers two separate methods of cutting and pasting text. The first method is identical to that under Windows. In a word processor or another application that deals with text, you can click and drag the mouse to highlight text, right-click anywhere on it, and then select to copy or cut the text. In many programs, you can also use the keyboard shortcuts of Ctrl+X to cut, Ctrl+C to copy, and Ctrl+V to paste.

However, there's a quicker method of copying and pasting. Simply click and drag to highlight some text, and then immediately click the middle mouse button where you want the text to appear. This will copy and paste the highlighted text automatically, as shown in Figure 7-8.

This special method of cutting and pasting bypasses the usual clipboard, so you should find that any text you've copied or cut previously should still be there. The downside is that it doesn't work across all applications within Ubuntu, although it does work with the majority of them.

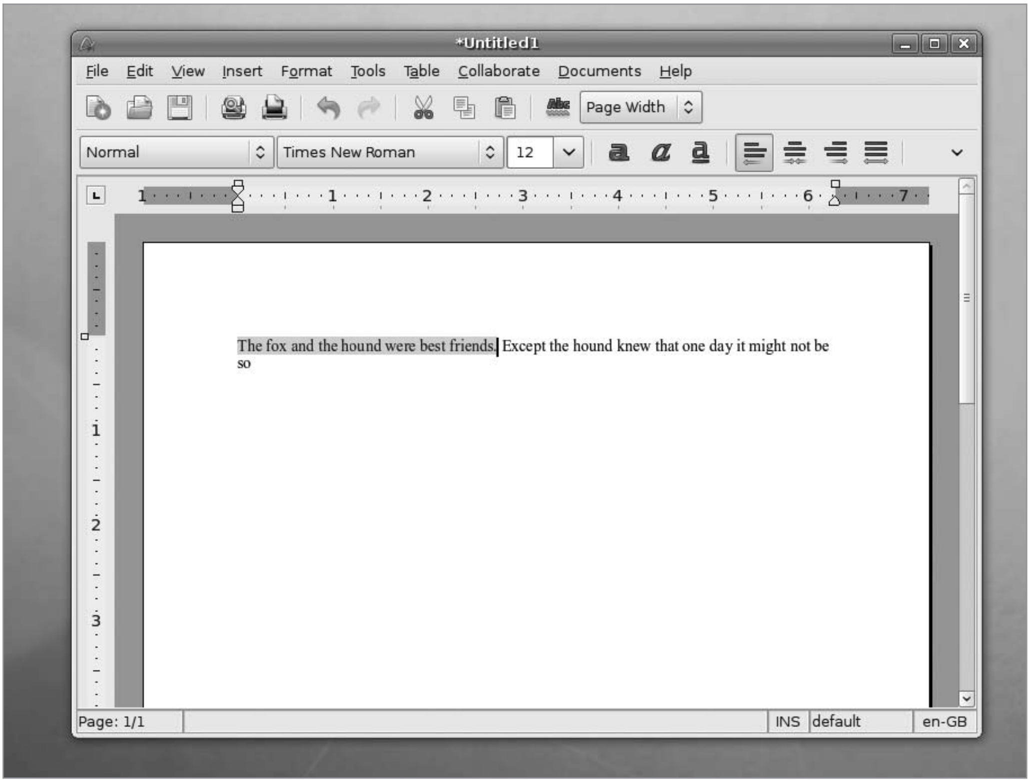

Figure 7-8. *Highlight the text, and then middle-click to paste it instantly.*

Summary

This chapter covered booting into Ubuntu for the first time and discovering the desktop. You've looked at starting programs, working with virtual desktops, using the mouse on the Ubuntu desktop, and much more. You should be confident in some basic Ubuntu skills and ready to learn more!

In the next chapter, you'll look at getting your system up and running, focusing on items of hardware that you may encounter in day-to-day use.

CHAPTER 8

Getting Everything Up and Running

This chapter guides you through setting up all the essential components of your Ubuntu installation. This includes hardware configuration, as well as setting up e-mail. It covers the postinstallation steps necessary to get your system up and running efficiently.

Like all modern Linux distributions, Ubuntu is practically automated when it comes to setting up key hardware and software components. Key software will work from the start, and most hardware will be automatically configured. However, you might need to tweak a few settings to make everything work correctly. Read on to learn more.

Ensuring Ubuntu Hardware Support

The age-old criticism that the Linux operating system lags behind Windows in terms of hardware support is long dead. The majority of add-ins, such as digital cameras and printers, will all work with Ubuntu immediately, with little, if any, configuration.

In fact, most underlying PC hardware is preconfigured during installation without your knowledge and without requiring further work, so there probably won't be any hunting around for drivers! Both your graphics and sound cards should work without a hitch, for example. In addition, nearly all USB and FireWire devices you plug in after installation will be supported. Table 8-1 lists some online sources of information about hardware support for Ubuntu.

Ubuntu doesn't support a few hardware items. Generally, it's a black or white situation: Ubuntu either works with a piece of hardware or it doesn't.

The types of hardware that Ubuntu doesn't support tend to be esoteric devices that rely on custom software provided by the hardware manufacturer. It's also sometimes the case that brand-new models of hardware won't work with Ubuntu because support has yet to be added. However, as soon as a new piece of hardware comes out, work is usually undertaken to ensure that Linux is made compatible with it. This is especially true of hardware such as printers and scanners, and it's one more reason why you should regularly update your system online, as explained in Chapter 9.

■ **Tip** Before you hit the stores to buy a new piece of hardware, it's a good idea to do a little research. Compatibility with Linux is sometimes listed on the hardware box or at the manufacturer's web site (even if you sometimes need to search through the FAQ section to find out about it!). And, of course, others may have tried your particular small object of desire, so searching **<hardware name> + Linux compatibility** in Google may provide enlightenment.

Table 8-1. *Hardware Information Sources*

Hardware	Web Sources
Graphics cards	`http://xorg.freedesktop.org/wiki/Projects/Drivers`
Sound cards	`http://linux-sound.org/hardware.html`
Printers	`www.linuxfoundation.org/en/OpenPrinting`
Scanners	`www.sane-project.org/cgi-bin/driver.pl`
Cameras	`www.gphoto.org/proj/libgphoto2/support.php`
Wi-Fi cards	`www.hpl.hp.com/personal/Jean_Tourrilhes/Linux/`
Laptops	`http://tuxmobil.org/`

Unfortunately, unlike with Windows, it's rare to find Linux drivers on the CD that comes with the hardware. Even if you do find a Linux driver supplied, chances are that it will work with only certain versions of Linux, such as Red Hat or SUSE Linux. Some drivers are usable but imperfect or lack features that are available in their Windows counterparts. At the time of this writing, Ubuntu has yet to gain the kind of momentum that leads manufacturers to specifically produce drivers for it, but this may change in the future, especially as more users encounter the system via netbooks. At least Dell, Everex, ASUS, and Shuttle are now bundling Linux with their product offerings. Other OEMs may soon follow suit.

■ **Note** It's possible to use a program called alien to convert software installation packages designed for other distributions into Ubuntu installation files. Doing so isn't complicated but may not work well with driver files because of the subtle differences in where system files are stored across different Linux distributions. You can find more information about alien at `http://kitenet.net/~joey/code/alien/`. It's contained within the Ubuntu software repositories and can be downloaded using the Synaptic Package Manager, as explained Chapter 28.

Using Proprietary vs. Open Source Drivers

As discussed earlier in this book, Linux is an open source operating system. This means that the source code underlying Linux programs is available for study and even reuse. This is a good thing when it comes to hardware drivers, because bugs in the code can be spotted and repaired by anyone with an interest in doing so. If you consider that a bug in a graphics driver could mean your PC crashes every 5 minutes, the value of such an approach is abundantly clear.

Unfortunately, some hardware manufacturers don't like to disclose how their hardware works, because they want to protect their trade secrets. This makes it impossible for them to release open source drivers, because such drivers would expose exactly how the hardware operates. Because such companies are aware that growing numbers of people use Linux, they release *proprietary drivers*, whose source code is not made publicly available (in the same way that Windows code is not released to the public).

Aside from ethical issues surrounding not being able to study the source code, the biggest issue with proprietary drivers relates to bug fixing. To use a proprietary driver is to be at the mercy of the hardware manufacturer's own development and release schedule. If the driver has a serious bug, you'll either have to work around it or put up with troubling issues until the manufacturer offers an update. A few years ago, a proprietary driver for a 3D graphics card stopped any computer it was installed on from going into hibernation mode (that is, suspending to disk). Those using the drivers had to wait months until the fix was released.

Despite this, and although the folks behind Ubuntu strongly support open source software, they realize proprietary drivers need to be used in certain situations. For example, it's impossible to use the 3D graphics elements of some graphics cards unless you have a proprietary driver, and this means that desktop visual effects will be unavailable to users who happen to have hardware that isn't currently fully supported by open source drivers.

Because of this, Ubuntu automatically installs Wi-Fi proprietary drivers by default if no open source alternative exists (or if the open source version is not yet good enough). It also offers the opportunity to easily install some proprietary graphics card drivers if they provide more functionality than the open source versions.

■ **Note** Linux sees hardware in a technical way, rather than in the way humans do. If you attach something such as a USB CD-R/RW drive, Linux will recognize the drive hardware and attempt to make it work. It won't try to find a driver for that specific make and model of CD-R/RW drive. Thus, Linux is able to work with a wide range of hardware, because a lot of hardware is similar on a technical level, despite the differences in case design, model names, and even prices!

WHAT HARDWARE WORKS?

The question of what hardware works under Ubuntu is one that's not easily answered. However, you can take a look at `http://wiki.ubuntu.com/HardwareSupport` to see if your hardware is listed. This is an informal list created by the Ubuntu community, and it's not comprehensive (which is to say that there may be hardware that works fine that isn't mentioned). Nor is the list guaranteed to be 100 percent accurate. But it's certainly worth a look.

A search engine such as Google is your best friend if the Ubuntu hardware list doesn't help. Simply search for the brand and model of your hardware and add **Ubuntu** to the search string. This should return results, usually from the Ubuntu forums (`http://ubuntuforums.org`) or blogs, written by those who have found a way to make that type of hardware work.

Installing Device Manager

When using Windows, you might have come across Device Manager, the handy tool that lists your PC's hardware and provides access to various properties. Ubuntu offers a similar piece of software, as shown in Figure 8-1, but it isn't installed by default.

After you can connect to the Internet (following the instructions in the "Getting Online" section of this chapter), you can install Device Manager by using the Synaptic Package Manager (see the "Installing Software" section of this chapter), as follows:

1. Choose System ➤ Administration ➤ Synaptic Package Manager.
2. Click the Search button on the toolbar, and then type `gnome-device-manager` in the Search field. Click the Search button.
3. Click the program's entry in the list of results. Select to mark it for installation (don't worry if a dialog box appears telling you additional software needs to be installed).
4. Click Apply on the toolbar.

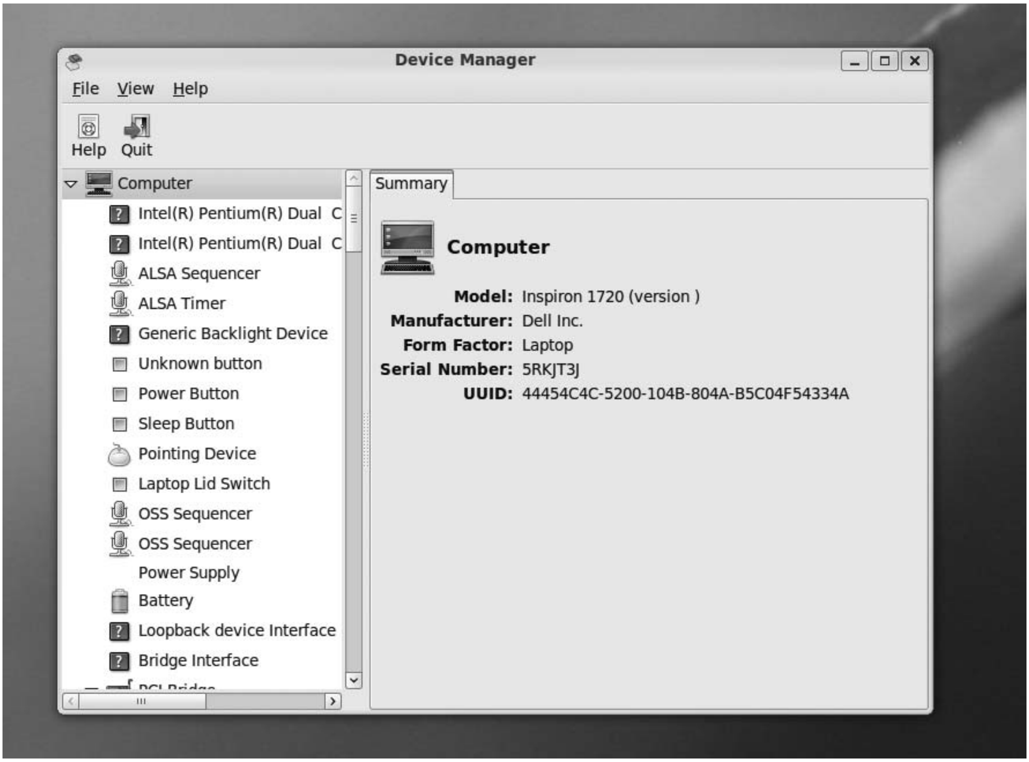

Figure 8-1. *Ubuntu's Device Manager program can display just about everything you need to know about attached hardware.*

If your computer is not yet online, you'll need to use a computer that is online (perhaps another computer, or Windows XP if you dual-boot) to download the software, and then copy it across to your Ubuntu computer for installation. To download the software, visit the following two addresses in your browser. You will be prompted to download a file after typing each address:

```
http://us.archive.ubuntu.com/ubuntu/pool/universe/g/gnome-device-manager/
gnome-device-manager_0.2-2_i386.deb
```

```
http://us.archive.ubuntu.com/ubuntu/pool/universe/g/gnome-device-manager/
libgnome-device-manager0_0.2-2_i386.deb
```

After the files are downloaded, copy them to the desktop on your Ubuntu machine, using a floppy disk or maybe a USB memory stick. Then open a command-prompt window on the Ubuntu computer by clicking Applications ➤ Accessories ➤ Terminal. In the terminal window, type the following, hitting Enter after each line:

```
cd ~/Desktop
sudo dpkg -i libgnome-device-manager0_0.2-2_i386.deb
sudo dpkg -i gnome-device-manager_0.2-2_i386.deb
```

After you've installed Device Manager, you can open it by choosing Applications ➤ System Tools ➤ Device Manager. You'll need to click View ➤ Device Properties to ensure that Device Manager adds the useful (but occasionally overwhelming) Properties tab.

You should be aware of a few important differences between the Windows and Ubuntu versions of Device Manager. Though the aim of Ubuntu's Device Manager is to manage hardware devices, the project is still in its infancy and can provide only hardware information at the time of this writing. On the other hand, Ubuntu's list is far more comprehensive than that in Windows. In Ubuntu, Device Manager thoroughly probes the hardware to discover its capabilities.

Perhaps the biggest difference, however, is that just because a piece of hardware is listed within Ubuntu's Device Manager doesn't mean that the hardware is configured to work with Ubuntu. In fact, it doesn't even imply that the hardware will *ever* work under Ubuntu. Device Manager's list is simply the result of probing devices attached to the various system buses (PCI, AGP, USB, and so on) and reporting the data.

Nonetheless, Device Manager is the best starting place if you find that a certain piece of hardware isn't working. If a piece of hardware is listed, then it proves, if nothing else, that the system recognizes that the hardware is attached. For example, later in this chapter, we describe how you can use Device Manager to discover crucial details about wireless network devices, which you can then use to install drivers.

Configuring Ubuntu

Unlike some versions of Linux, Ubuntu doesn't rely on a centralized configuration software package. Instead, it uses smaller programs to configure hardware. For example, to configure the network, you'll use the NetworkManager program, and printers are configured using a separate printer configuration program. Because using some of the configuration software involves reconfiguring your entire system, doing so requires administrator privileges. Therefore, you'll be prompted for your login password each time you use some of the programs. In some cases, after you've made changes, you'll need to click the Apply button to put the changes into effect. When you've finished configuration, simply close the program window by clicking the Close button.

■**Note** Ubuntu remembers your password for 5 minutes after you enter it. Therefore, if you open the same application or another that requires administrator privileges within that amount of time, you won't be prompted to enter your password again.

Along with the individual configuration programs, you may also need to use the command line and install software to get your system up and running. Let's take a quick look at how you can do both, before proceeding with the instructions for getting online.

Using the Command Line

For some of the Ubuntu configuration steps, we ask you to open a terminal window. This gives you access to the command-line prompt, by which you can issue commands directly to Ubuntu. The Linux command-line prompt is a little like MS-DOS, which you might have used in the early days of Windows, except it's a lot more powerful. As with DOS, you should press Enter after typing each command. Nearly all the commands affect your system, so they will require you to enter your password when prompted.

We explain all about the command-line prompt in Part 4 of this book, beginning with Chapter 13, but for the moment, you should bear in mind the following points:

- Check the command after you've typed it to ensure that it reads as is printed on the page. Even a stray space in the command could cause havoc.
- Don't be tempted to experiment at the prompt at this stage of your Linux learning curve. This is especially true if you use administrator powers, which you'll be doing for nearly all the commands.

To open a terminal window, click Applications ➤ Accessories ➤ Terminal. After you've finished entering the commands and they have completed, simply close the program window.

Installing Software

Throughout this chapter and in other chapters in this book, we might ask that you install software packages by using Ubuntu's software configuration tool, the Synaptic Package Manager. Some software packages might be installed from the DVD-ROM disc, so you'll need to keep that handy, but the majority will be automatically downloaded from online repositories after you've configured your computer to go online.

We explain all about software installation in Chapter 28, but here's a brief primer on what to do:

- To open the Synaptic Package Manager, click System ➤ Administration ➤ Synaptic Package Manager. Because you're reconfiguring your system, you'll need to enter your login password when prompted.
- Every time you use the Synaptic Package Manager, you should click the Reload button, at the left side of the toolbar running across the top of the screen. This will grab the most up-to-date list of software from the online servers.

- To search for software, click the Search button on the toolbar, and type the name into the Search field of the dialog box. Then click the dialog box's Search button.
- To install a software package, click the check box alongside it in the list of results, and click Mark for Installation on the menu that pops up. Sometimes you might be informed that extra software packages need to be installed. This is fine, and they will automatically be added to the list.
- When you've finished making your choices, click the Apply button on the main toolbar. Click Apply once more in the dialog box that appears to confirm your choices. This dialog box will tell you how much space the new downloads will take on your system.
- When installation has finished, click the Close button in the dialog box, and close the Synaptic Package Manager.

Synaptic is not the only way to add applications to your system, though it is the most comprehensive. If you're installing fairly mainstream software, look at the base of the Applications menu for the Add/Remove button. This opens a management application (see Figure 8-2) that is simpler and faster to use than Synaptic and looks quite similar to Windows' own Add/Remove Software application, though with masses of free software included. Select the application category from the list on the left and then choose an application from the list. Click Apply, review your changes, and then click Apply Changes. As with Synaptic, the application will download from the Internet, install, and appear on your menu system under the menu entry corresponding to the category in the application.

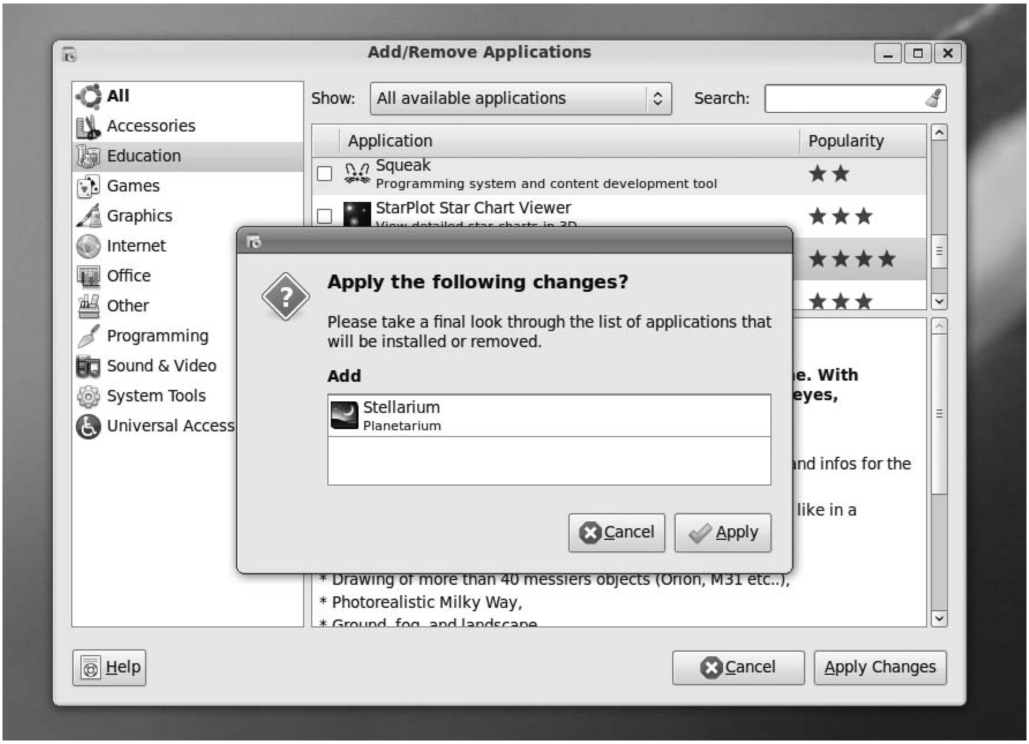

Figure 8-2. *Many applications are available via Ubuntu's Add/Remove Applications package, which is under the Applications menu.*

GETTING HELP FROM THE COMMUNITY

Configuring hardware is one area where the value of the Ubuntu community becomes very apparent. If you run into a problem, it's unlikely your situation will be unique. Others will probably have encountered the same problem and may have figured out a solution. If so, they may have posted it online. If nothing else, you might find sufficient clues to be able to solve the problem by yourself. Sharing information in this way is part of the spirit of Ubuntu and also Linux.

We've tried to provide complete guides to most hardware configuration in this chapter, but if you run into problems, your first port of call should be the Ubuntu forums, at `www.ubuntuforums.org`. This is the central meeting place for the Ubuntu community. You can search through existing forum postings or start your own thread asking for help. We explain a little more about the protocols of asking for help in Appendix C.

Also worth visiting in times of trouble is the community-written wiki, which can be found at `https://help.ubuntu.com/community`. Here you'll find a range of guides to help configure various aspects of Ubuntu. A *wiki* is a form of web site that anyone can edit or contribute to. The idea is that it's constructed by its readers.

We also recommend taking a look at the Ubuntu Guide, at `http://ubuntuguide.org`, which is also community written. The Ubuntu Guide can be concise and often expects a relatively high degree of technical knowledge, but it is also comprehensive.

Finally, don't forget that you're a member of the community too. If you encounter and subsequently solve a configuration problem, share the solution with others. You can do this by editing the Ubuntu wiki or posting to the forums.

Getting Online

Getting online is vital in our modern Internet age, and Ubuntu caters to all the standard ways of doing so. Linux was built from the ground up to be an online operating system and is based on Unix, which pioneered the concept of networking computers together to share data back in the 1970s. However, none of this is to say that getting online with Ubuntu is difficult! In fact, it's easy.

Regardless of whether you use a modem, standard Ethernet network device, or wireless network device, the same program, NetworkManager, is used to configure your network settings under Ubuntu. Support for many makes and models of equipment is built in, so in most cases, all you need to do is enter a few configuration details.

■ **Note** Linux runs about 60 percent of the computers that make the Internet work! If you use Google, Facebook, or Wikipedia, you're using Linux. As your Linux skills increase, you'll eventually get to a stage where you, too, can run your own Internet servers. It sounds difficult but can be quite easy.

Using NetworkManager

NetworkManager lets users easily manage both wireless (also known as Wi-Fi) and wired connections, such as Ethernet connections. It sits in the notification area at the top right of the desktop (look for the icon of two screens inset against each other) and automatically detects any wireless networks that are in range, as well as if you're currently plugged in to a wired network. If you automatically connect to a network, a black notification box will appear on the top right of your screen for a few seconds and then fade away.

Clicking the NetworkManager icon will show a list of networks that have been detected. By selecting the entry in the list, you can then connect to the network, and you'll be prompted to configure WEP/WPA protection, if applicable.

■ **Caution** At times we have been prompted for the *wrong kind* of wireless protection—for example, we were asked for a 128-bit WEP key rather than a 64-bit key when trying to connect to a network. In other words, it pays to check that you're being prompted for the right thing, and to select the correct option if you're not. Failure to do so might result in frustration! If you are really stuck, make sure to read your wireless router documentation.

Following this, the NetworkManager icon will display the signal strength of the connection for as long as you're connected. By clicking it, you'll be able to see at a glance what network you're connected to and any others within range. If you want to switch networks, just click the NetworkManager icon and select a different network in the list. If it's a secure network, you'll be prompted for a password before you're granted access.

■ **Tip** By right-clicking the NetworkManager icon, you can opt to completely disable your network hardware if you wish. This is quite useful if you don't need a network and would like to conserve your laptop battery.

NetworkManager settings persist across reboots, provided the network that was last configured is in range. This means that NetworkManager is ideal for all kinds of wireless network users, from those who frequently switch between different networks (that is, mobile workers) to those who just use a single wireless network connection, such as that provided by a wireless network broadband router in a home/small office environment. NetworkManager will also let you switch to a wired (Ethernet) connection, if and when you attach one to your computer.

NetworkManager works in two modes: roaming and manual. Roaming mode is the default and works as we've just described: NetworkManager will automatically detect networks and the type of connection. In manual mode, you can opt to manually supply details, such as the IP address and gateway, or the name of the wireless base station, which might be necessary if your base station doesn't broadcast its name or if you need to connect to a specialized setup. However, for most users, roaming mode will suffice, and you won't need to bother with manual mode.

Configuring an Ethernet Network Device

Ethernet is one of the oldest and most established network technologies. When we talk of Ethernet, we are referring to wired networks—all the computers on the network are connected by cabling to a central hub or router.

You might go online via Ethernet in a variety of situations. If you have DSL or cable broadband service at your home or workplace, for example, you might use a DSL router that has a number of Ethernet ports. Your computer will then connect to this router via an Ethernet cable.

If you're running Ubuntu on a PC in an office environment, it's likely that you will connect to the local area network using Ethernet. This lets your computer communicate with other computers, as well as with shared printers. In some offices in which an Internet connection is provided, this connection might also allow you to go online.

In most cases, NetworkManager's roaming mode will sense a wired Ethernet connection and automatically connect using the Dynamic Host Control Protocol (DHCP). This means that your computer receives its IP address, gateway, subnet mask, and Domain Name System (DNS) addresses automatically. All routers manufactured today are set up to automatically use DHCP out of the box.

■ **Tip** If a DHCP server is not available, Ubuntu will attempt to set up a network automatically using the Zeroconf (or Zero Configuration Networking) system, just like Microsoft Windows systems. (Microsoft refers to this as Automatic Private IP Addressing, but it's also known as *link-local*.) In other words, if a bunch of computers plug into a hub or router on an ad hoc basis, without being configured and without a DHCP server operating, they will be able to network with each other. To make this work, each computer randomly assigns itself a unique IP address that starts with `169.254` with a subnet mask of `255.255.0.0`.

If you need to manually specify network details such as IP and router addresses, perhaps because you work in an office environment with nonstandard systems, start by speaking to your system administrator or technical support person to determine the settings you need. Ask the administrator for your IP address, DNS server addresses (there are usually two or three of these), your subnet mask, and the router address (sometimes referred to as the *gateway address*). The settings you will get from your system administrator will usually be in the form of a series of four numbers separated by dots, something like `192.168.0.233`. After you have this information, follow these steps:

1. Right-click the NetworkManager icon in the notification area and select Edit Connections from the menu.

2. Select the Wired tab from the tab bar and click the Add button. This launches the new network configuration screen, where you can create a profile for the wired network.

3. Provide a name for the new connection. Then select the IPv4 Settings tab and change the Method drop-down from DHCP to Manual.

4. Click Add and supply the IP address, subnet mask, and gateway address for the device. You should also fill in the areas for DNS Servers and Search Domains. You can add more than one address to these sections by separating each one with a comma. Figure 8-3 shows an example of these settings. Click Apply after filling in the information. The network will be added to the list.

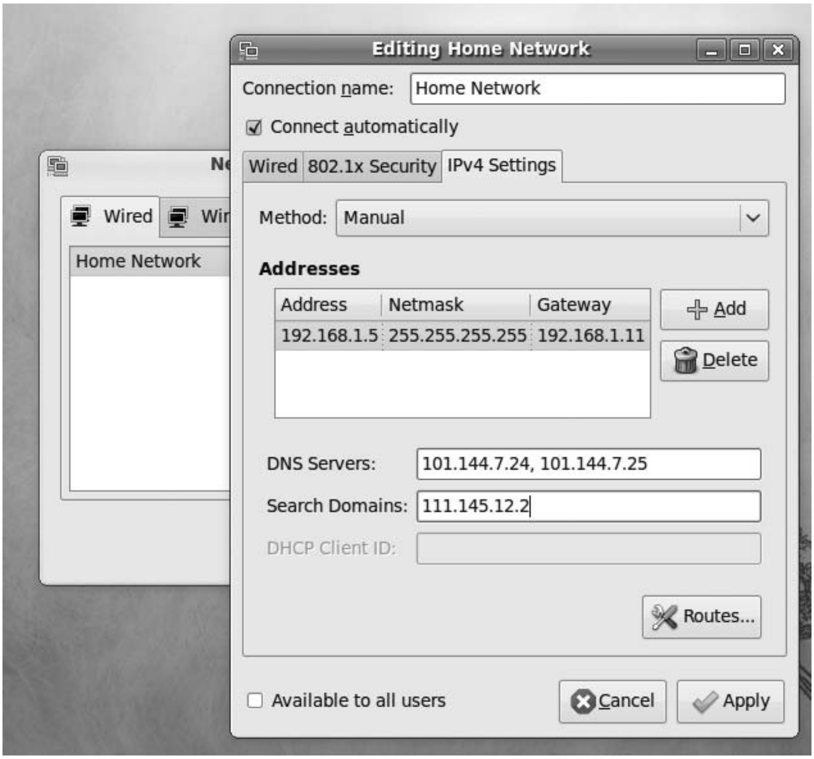

Figure 8-3. *Ubuntu will automatically work with DHCP networks, or you can define a static IP address.*

Tip If you're using a static IP address with a router, such as that provided by a DSL modem, the DNS address will probably be the same as the router/gateway address.

Your network connection should now work. If it isn't working, try rebooting. However, if your system administrator mentioned that a proxy must also be configured, you'll need to follow the instructions in the "Working with a Proxy Server" section later in this chapter.

Connecting to a Wireless Network

A wireless (Wi-Fi) network is, as its name suggests, a network that does away with cabling and uses radio frequencies to communicate. It's more common for notebooks and handheld computers to use wireless connections, but some desktop computers also do. Indeed, it's increasingly the case that many workplaces are switching to wireless networking, eschewing old-fashioned, cable-based networking.

■ **Note** Slowly but surely, Wi-Fi is replacing wired Ethernet networks. However, sometimes Wi-Fi networks are impractical or simply undesirable. For example, the metal infrastructure in some buildings means the signal becomes unreliable. Wi-Fi is also considered too insecure for some companies, as the Wi-Fi signal often spreads to the street outside the building. Although such transmissions are nearly always secured and WPA2 is considered secure, Wi-Fi security implementations have been broken. Ethernet might be considered old technology, but trying to steal data from physical cables is an order of magnitude more difficult, to the point of being practically impossible.

Notebooks and PDAs typically use built-in wireless network devices, with an invisible antenna built into the case. However, some notebooks might use PCMCIA cards, which have an external square antenna, and some desktop computers might use PCI-based wireless cards or USB dongles, which have external rubber/plastic antennas, in the style of old cell phones.

Ubuntu includes support for most wireless network devices. However, it's possible to use Windows wireless network device drivers for unsupported hardware. Also, sometimes Ubuntu appears to support a wireless network device, in that it identifies it and lets you configure it, but you might find that it simply doesn't work (or works very badly, perhaps with an intermittent connection). In this situation, you can also try installing Windows drivers. See the "Installing Windows Wireless Network Device Drivers" section later in this chapter for details.

■ **Note** Ubuntu is rare in the Linux world in that it uses some proprietary (closed source) wireless device drivers by default. Ubuntu is, after all, an open source operating system and is committed to the goals of open source software. The use of proprietary drivers is a necessary evil because not all devices have open source drivers right now, and not all open source drivers support all the functions you might be used to (typically, they might not support the WPA functionality of your Wi-Fi device, for example). The use of proprietary drivers is only a stopgap measure, and it's hoped that open source driver development will catch up, making proprietary drivers redundant.

Connecting to a wireless network device is easy with NetworkManager. Just click the NetworkManager icon, and you will see the available Wi-Fi networks in the Wireless Network list. Networks protected with WEP/WPA will have a shield icon to the right of the name, as shown in Figure 8-4. Those that are "open" will not have this icon.

Figure 8-4. *Clicking the network icon displays a list of available wireless networks.*

You might see many Wi-Fi networks listed, depending on your location. The wireless base stations are identified by their Service Set Identifier (SSID) or sometimes ESSID, with *E* standing for *Extended*.

If the SSID you would like to connect to is not listed by NetworkManager, it could mean that your wireless base station isn't set to broadcast its SSID or, worse, Ubuntu's Wi-Fi drivers aren't functioning correctly. If it's the former, all you need to do is right-click the NetworkManager icon and select Connect to Other Wireless Network. Then, in the new dialog box, type the SSID under Network Name, set Wireless Security to None or the appropriate security type, fill in the other information depending on the type of wireless security you selected, and click Connect. If it's the latter, you may need to use a Windows driver, as described in the next section.

Tip If you are not offered any wireless networks at all, ensure that the wireless hardware is switched on. Some notebooks have a keyboard combination to turn it off to save battery power. Right-click the NetworkManager icon and ensure that Enable Networking and Enable Wireless are both selected.

To connect to a Wi-Fi network, select the wireless base station you wish to connect to in the list. If it isn't protected by WEP/WPA, you will be connected to it automatically.

If the Wi-Fi network you wish to connect to is protected with WEP or WPA, a dialog box will appear, prompting you for the password/passphrase, as shown in Figure 8-5. In the Wireless Security field, make sure the correct type of security for the wireless network is selected—don't assume it's automatically correct! By default, the password/passphrase is obfuscated by circle characters so that anyone looking over your shoulder can't see what you're typing. If it helps (and if your shoulder is clear!), check the Show Password box. This can be really handy when you're typing a particularly long passphrase.

■ **Note** WEP keys come in either hexadecimal (hex) or plain text (passphrase) varieties. Hex keys look similar to this in their 128-bit form: `CB4C4189B1861E19BC9A9BDA59`. In their 64-bit form, they will be shorter and may look similar to `4D9ED51E23`. A passphrase will take the form of a single short sentence. In home and office environments, WPA networks are usually protected with passphrases. In larger corporate or academic environments, you might find that the network is protected with a WPA certificate.

Figure 8-5. *Ubuntu is able to join WPA-protected wireless networks.*

When you're finished, click the Connect button. You should see the NetworkManager icon start to animate as the program attempts to connect and find an IP address. After a few seconds, when the animation finishes and the icon switches to display signal bars, you should find yourself online.

If your computer doesn't seem to connect, try rebooting. If the hardware doesn't work after this, it might be that the drivers Ubuntu installed by default are incompatible with your network device. In this case, you can try using a Windows wireless network device driver, as described in the next section.

Should you find yourself in the unusual situation of needing to specify the IP address, subnet mask, and gateway for a wireless connection, you can do so using the manual configuration mode of NetworkManager, as outlined in the "Configuring an Ethernet

Network Device" section earlier in this chapter. Simply follow the instructions in that section, but select the Wireless Connection entry in the list, rather than Wired Connection. In the dialog box that appears, you'll see additional areas for entering your SSID and WEP/WPA protection details.

WEP VS. WPA

Some wireless networks are protected using either the Wired Equivalent Privacy (WEP) or Wi-Fi Protected Access (WPA) systems. WPA is effectively an updated version of WEP and offers stronger protection. There are two versions of WPA: WPA and WPA2. WPA2 is newer and corrected several security flaws in WPA. Both work in roughly the same way.

WEP and WPA encrypt the data being transmitted on the network, the idea being that it cannot be stolen by crackers with special equipment. Also, people can't join the wireless network unless they know the encryption key, which is basically an access code or password that prevents unauthorized people from accessing the network. As with other situations where security is important, you should choose a strong password containing letters of both cases, punctuation, and numbers.

Of the two, you should ideally configure your Wi-Fi base station to use WPA, because, sadly, WEP can be compromised within 5 minutes by using easily available software. However, the situation isn't quite so clear-cut for some Ubuntu users. Not all of Ubuntu's built-in Wi-Fi drivers support WPA. Some might claim to support it, but you might find they don't work reliably. Unfortunately, the only way you will be able to find out whether this is the case for you is to try to configure your network device and see what happens.

If you fall into the camp of not having good WPA support on your Ubuntu PC (and only a small percentage of users will), you might find WEP is your only reliable option, and you might therefore need to reconfigure your base station to use it. Our experience has shown that WEP has a very high success rate under Ubuntu. However, sometimes 128-bit WEP won't work on some troublesome Wi-Fi devices, and you might need to switch your network to 64-bit WEP instead.

WEP is a compromise in security terms, but try to remain realistic when considering your immediate environment. If your wireless network is within your home, is it likely that the couple living next door will have the know-how to crack a wireless network connection? Are they likely to want to do so?

On the other hand, if you live in an apartment block with several other computer-literate people, or if you work in an office, the risk might be considerably higher. Some people suggest that breaking into wireless networks is almost a sport for certain individuals. If this is the case, and you feel you simply can't use WEP, consider installing Windows drivers using NdisWrapper, as explained later in this chapter.

But whatever the case, bear in mind that confidential Internet connections, such as those for banking and shopping sites, are independently protected using a separate technology. See the sidebar titled "Secure Connections on the Net" later in this chapter for details.

Installing Windows Wireless Network Device Drivers

NdisWrapper is effectively an open source driver (technically described as a *kernel module*) that allows Linux to use standard Windows XP drivers for wireless network devices. You might describe NdisWrapper as being a translation layer between the Linux kernel and the Windows drivers, which can be installed by using NdisWrapper's configuration tools.

You should use NdisWrapper in only one of two situations:

- Your wireless network hardware simply isn't recognized by Ubuntu, which is to say, all you see when you click the NetworkManager icon is a Manual Configuration option; you don't see any wireless networks listed. Of course, you should first ensure that the wireless hardware in your computer is switched on—some notebooks offer the facility to deactivate it to save battery life.
- Your network hardware is recognized by Ubuntu but fails to work correctly or adequately when you configure it. Perhaps it is unable to associate with wireless base stations, for example, or maybe you can't connect to WPA-enabled base stations and consider WEP too insecure for your surroundings. If this is the case, in addition to installing NdisWrapper, you'll need to undertake an additional step in order to blacklist the existing Ubuntu driver.

Using NdisWrapper is relatively simple, and just a handful of commands are required. However, getting hold of the necessary Windows driver files is harder work because, unfortunately, NdisWrapper isn't designed to work with the usual method of driver distribution: `.exe` files. Instead, NdisWrapper needs the specific `.inf` and `.sys` files that constitute the driver—effectively, the Windows system files. These are contained within the `.exe` file and must be manually extracted.

■ **Note** Sometimes drivers are distributed as `.zip` files, in which case the relevant files are easy to get at. Keep your fingers crossed that this will be the case for your particular hardware!

NdisWrapper is far from perfect. Not all wireless devices have been proven to work with it, and it's not necessarily the case that a driver available for Windows will work under Linux. Sometimes trial and error is required. Annoyingly, Windows drivers sometimes appear to work but then prove unreliable. Some might stop working. Some might even crash your system. The best plan is simply to give it a try.

■ **Tip** NdisWrapper gets better and better with every new release. This is why it's a good idea to update your system on a regular basis, as described in Chapter 9.

In the instructions in this section, we explain how to make an Atheros AR5008 wireless network device that's built into an Apple MacBook work under Ubuntu using NdisWrapper. The instructions remain essentially the same for all types of wireless network hardware. However, some specific details, such as download addresses, will obviously differ.

First, you'll need to install the NdisWrapper software, and then you can install the necessary Windows drivers. These steps will make your wireless network device available under Ubuntu. Then you can follow the instructions in the previous section to connect to that wireless network.

Installing the NdisWrapper Configuration Tools

NdisWrapper consists of two components: a kernel module and configuration tools. The kernel module comes as part of the default kernel package, so is installed by default, but you will need to download and install the configuration tools manually. To do so, using another computer that is already online (or by switching to Windows XP if you dual-boot), use a web browser to visit the following address:

```
http://us.archive.ubuntu.com/ubuntu/pool/main/n/ndiswrapper/
```

and download the following two files:

```
ndiswrapper-utils-1.9_1.50-1ubuntu1_i386.deb

ndiswrapper-common_1.50-1ubuntu1_all.deb
```

Now go to the following site:

```
http://us.archive.ubuntu.com/ubuntu/pool/main/n/ndisgtk/
```

and download this file:

```
ndisgtk_0.8.3-1_i386.deb
```

Save the files to a floppy disk or USB memory stick, or burn them to a blank CD-R/RW disk. Then, on the Ubuntu computer, copy the downloaded files to the desktop.

Next, open a terminal window (Applications ➤ Accessories ➤ Terminal) and type the following, which will install the new software:

```
cd ~/Desktop
sudo dpkg -i ndis*
```

You'll need to enter your password when prompted. When the commands have finished and you see the command prompt again, close the terminal window.

Installing the Windows XP Drivers

After the NdisWrapper configuration software is installed, you can install the Windows XP wireless network device drivers. There are several parts to the procedure:

- Identify the wireless network hardware and then source the appropriate Windows driver. If you're dual-booting with Windows, the drivers may already be available on your Windows partition.
- Extract the necessary `.sys` and `.inf` files from the driver archive (and possibly `.bin` files, although this is rare).
- You may need to blacklist the built-in Ubuntu driver, so that NdisWrapper can associate with the hardware.
- Use the NdisWrapper configuration tool to install the Windows driver.

These steps are covered in the following sections. You will need another computer that's already online to download some files and check the NdisWrapper web site for information. If your computer dual-boots, you can use your Windows setup to do this, or if you have an Ethernet port on your computer, you could plug into a wired network.

Identifying Your Wireless Network Hardware and Sourcing Drivers

To identify the wireless network hardware for use with NdisWrapper, you need two pieces of information: the make and model of the hardware and the PCI ID number. The former is the make and model of the hardware as identified by Ubuntu as a result of system probing, rather than what's quoted on the packaging for the wireless network device or in its documentation. These details discovered by Ubuntu will usually relate to the manufacturer of the underlying components, rather than the company that manufactured the hardware. The PCI ID is two four-digit hexadecimal numbers used by your computer to identify the device internally. The same PCI ID numbering system is used by both Windows and Ubuntu, which is why it's so useful in this instance.

You can find both the PCI ID and the make/model information by using the Device Manager tool. Follow the instructions in the "Installing Device Manager" section earlier in this chapter if you haven't already installed this program. Then follow these steps:

1. Choose Applications ➤ System Tools ➤ Device Manager. In the left column, find the entry that reads Network Controller, Networking Wireless Control Interface, or WLAN Interface. You might also look for USB Interface, PCI Bridge, or 802.11 to exhaust your search. Then look at the corresponding summary in the right column, where you'll find the make and model of the hardware listed under the Vendor and Model headings. If no useful details are listed, you might need to click the parent entry in the list. On one test system, we found the WLAN Interface entry, but saw the make and model details only after we clicked the Ethernet Controller parent entry in the list on the left.

2. Write down the make and model shown in Device Manager. For example, on a test notebook containing an Atheros wireless network device, the make and model read "AR5418 802.11abgn Wireless PCI Express Adapter." Remember that these details don't relate to those listed in the instruction manual or computer packaging (our notebook's specification lists the hardware simply as "Built-in AirPort Extreme Wi-Fi"). This is because Ubuntu is identifying the hardware generically, reading information from its component hardware.

3. Click the Properties tab of Device Manager (if this isn't visible, click View ➤ Device Properties) and look through the information there for a line that begins `info.udi`. Look at the end of the line, and make a note of the two sets of characters that are separated by an underscore and preceded by `pci_`. Look at Figure 8-6 for an example taken from our test machine. Yours may differ, but the line should always end with `pci_` and then the digits. If it doesn't, you have selected the wrong entry in the list of devices on the left. Try examining a different entry, such as the parent of the entry in the list.

4. Write down the characters following `pci_` at the end of the `info.udi` line. Written alongside each other, the two sets of digits that are separated by an underscore form the all-important *PCI ID number*. In written form, they're usually separated by a colon. If either of the sets of letters or numbers is fewer than four characters long, simply add zeros before them in order to make four characters. In one of our test machines (not the one pictured in Figure 8-6), the end of the `info.udi` line reads `168c_24`. We add two zeros before `24`, making a complete PCI ID of `168c:0024`. On another PC, the end of the line reads `168c_13`. Adding two zeros before `13` gives a PCI ID of `168c:0013`.

5. Using another computer that's able to go online, visit `http://sourceforge.net/projects/ndiswrapper/`. On the main menu, click Documents/Wiki, and then click the List of Cards Known to Work link. This is a community-generated listing of the wireless network devices that have been proven to work with NdisWrapper.

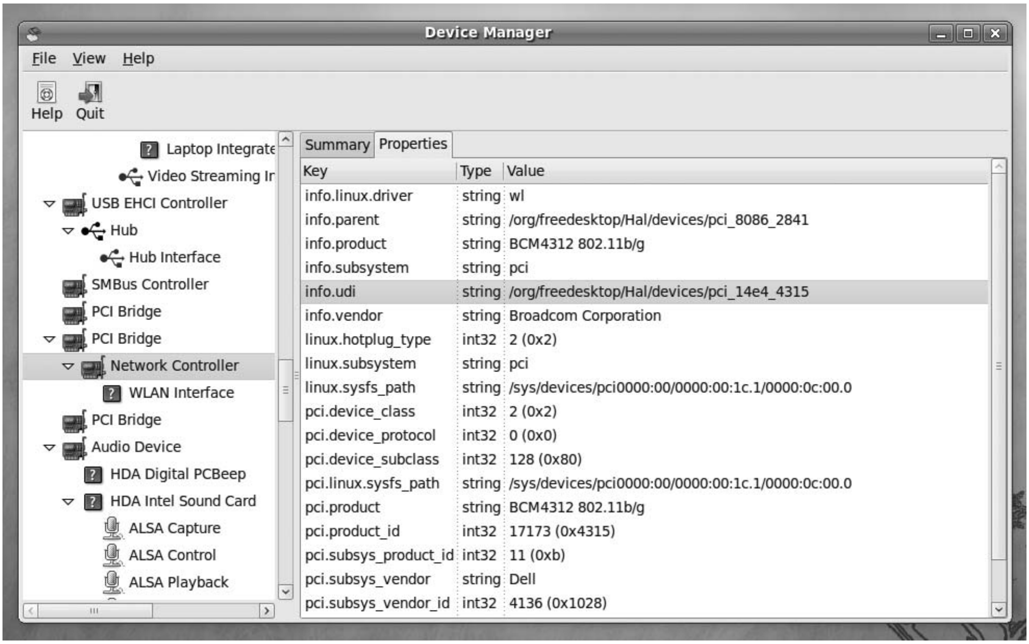

Figure 8-6. *Find the PCI ID of your wireless network hardware by looking at the end of the* `info.udi` *line.*

■ **Tip** The URL in step 5 was correct as this book went to press. If you find it no longer accurate, search Google, using **NdisWrapper list** as a search term.

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6. The “known to work” cards are grouped in alphabetical order. Select the appropriate list based on the card manufacturer’s name. (Remember to use the name you discovered using Device Manager in steps 1 and 2, and *not* the official name in the computer’s manual or packaging.)

7. Using the search function of your browser (Ctrl+F within Firefox), look for the PCI ID number you noted earlier, in the format described in step 4. For the example in Figure 8-6, we would search for `14e4:4315`. In the list, look to match the following things, presented in order of importance:

   a. The PCI ID

   b. The model name of the wireless hardware, as reported by Device Manager (listed on the Summary tab)

   c. The manufacturer and model of the notebook, as mentioned on its case or within its documentation

It's likely many entries in the list may match your PCI ID, so search until you find the one that best matches the model of the hardware. If there are *still* many matches, search until you find an entry that matches the manufacturer and model of the notebook. You might not be lucky enough to find an exact match for the notebook manufacturer and model, however, and you might need to select the most likely choice. Use your common sense and judgment. If your notebook is manufactured by ASUS, for example, but you can't find the drivers for the exact model, then choose drivers for another ASUS model.

Caution Watch out for any mention of `x86_64` in the description of the driver file. This indicates that the entry in the list relates to 64-bit Linux. The version of Ubuntu supplied with this book is 32-bit. If you encounter an entry relating to `x86_64`, keep searching.

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8. Look within the entry in the list for a direct link to the driver file. Sometimes this isn't given, and a manufacturer web site address will be mentioned, which you can visit and navigate through to the driver download section (usually under the Support section within the web site). Download the Windows XP driver release.

Extracting the Driver Components

After downloading the drivers, you'll need to extract the `.sys` and `.inf` files relevant to your wireless network hardware. These are all that NdisWrapper needs, and the rest of the driver files can be discarded. However, extracting the files can be hard to do, because often they're contained within an `.exe` file. (Most driver `.exe` files are actually self-extracting archive files.) Additionally, the driver file might contain drivers for several different models of hardware, and it's necessary to identify the particular driver `.inf` file relevant to your wireless network device.

If the driver you've downloaded is a `.zip` file, your task will probably be much easier. Simply double-click the downloaded `.zip` file to look within it for the directory containing the actual driver files.

If the driver is an `.exe` file, it's necessary to extract the files within it. With any luck, you might be able to do this by using an archive tool like WinZip (`www.winzip.com`), assuming that you've downloaded the file using Windows. Simply open the archive by using the File ➤ Open menu option within WinZip. You may have to select All Files from the File Type drop-down list in order for the `.exe` file to show up in the file list. However, if you're using Windows, we recommend an open source and free-of-charge program called Universal Extractor, which can be downloaded from `www.legroom.net/software/uniextract`. This program can extract files from virtually every kind of archive, including most driver installation files. After it is installed, simply right-click the installation `.exe` file, and select

UniExtract to Subdir. This will then create a new folder in the same directory as the downloaded file, containing the contents of the installer file.

After you've extracted the files within your downloaded driver file, look for the files you need. The driver files will likely be contained in a folder called something like `Driver` or named after the operating system, like `Win_XP`. After you've found the relevant directory, look for `.inf`, `.sys`, and `.bin` files (although you may not find any `.bin` files; they're used in only a handful of drivers). You can ignore any other files, such as `.cab` and `.cat` files. Click and drag the `.inf`, `.sys`, and `.bin` files to a separate folder.

The task now is to find the `.inf` file for your hardware. If there's more than one, you'll need to search each until you find the one you need. You need to look for text that corresponds to the PCI ID you noted earlier. Open the first `.inf` file in a text editor (double-clicking will do this in Windows), and using the search tool, search for the first part of the PCI ID, as discovered earlier. For the example in Figure 8-6, we would search for `14e4`. If you don't find it within the file, move on to the next `.inf` file and search again. When you get a search match, it will probably be in a long line of text and to the right of the text `VEN_`. Then look farther along that line to see if the second part of the PCI ID is mentioned, probably to the right of the text that reads `DEV_`. In the case of the driver file we downloaded for the example, the entire line within the `.inf` file read as follows (the two component PCI ID parts are shown in bold):

```
%ATHER.DeviceDesc.0023%  = ATHER_DEV_0023.ndi,  PCI\VEN_14e4&DEV_4315
```

If you find both component parts of the PCI ID in the line, as in this example, then you've found the `.inf` file you need. (In fact, you'll probably find *many* lines matching what you need, which is fine.)

You must now transfer the `.inf` file, along with the `.sys` and `.bin` files (if any `.bin` files were included with the driver) to the computer on which you want to install the drivers. This can be done by putting them onto a floppy disk, CD, or USB memory stick. Create a new directory called `driver` on the desktop and save them there.

Your procedure from this point depends on whether Ubuntu recognized your wireless networking device when you first booted but was unable to make it work correctly. If it did, you will need to blacklist the built-in driver so that NdisWrapper can associate with the hardware. If the device wasn't recognized, you can skip straight to the "Using NdisWrapper to Install the Drivers" section.

Blacklisting Existing Drivers

To blacklist the existing built-in driver that didn't work with your wireless device, you need to find out the name of the kernel module and then add it to the `/etc/modprobe.d/blacklist` file. Here are the steps:

1. Open Device Manager (System ➤ Administration ➤ Device Manager) and then select the entry in the list for your wireless network device. This is the one you discovered in steps 1 and 2 earlier, in the "Identifying Your Wireless Network Hardware and Sourcing Drivers" section.

2. Click the Properties tab (if this isn't visible, click View ➤ Device Properties) and look for the line that begins `info.linux.driver`. Then look in the Value column and make a note of what's there. For example, on our test notebooks, the Value column read `rt2500usb`. Close Device Manager.

3. Open a terminal window (Applications ➤ Accessories ➤ Terminal). Type the following to open the `blacklist` configuration file in the Gedit text editor:

   ```
   gksu gedit /etc/modprobe.d/blacklist.conf
   ```

4. At the bottom of the file, type the following on a new line:

   ```
   blacklist modulename
   ```

   Replace *`modulename`* with the name of the module you discovered earlier. For example, on our test system, we typed the following (as shown in Figure 8-7):

   ```
   blacklist rt2500usb
   ```

5. Save the file and then reboot your computer.

You should now find that the wireless network device is no longer visible when you click the NetworkManager icon, and all you see is a Manual Configuration option. This is good, because it means the hardware no longer has a driver attached, and you can now tell NdisWrapper to use the hardware.

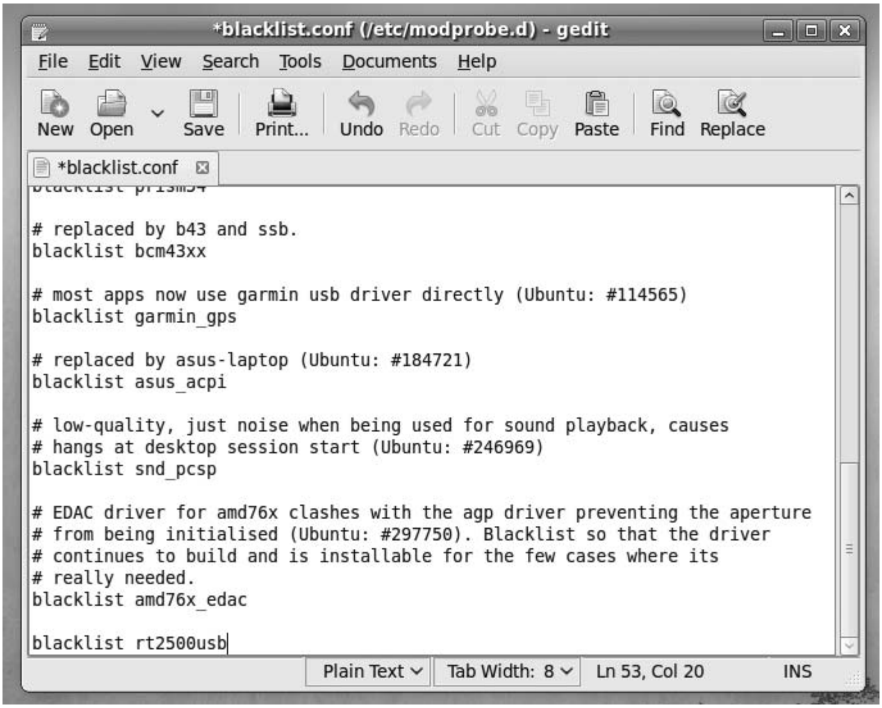

Figure 8-7. *To stop Ubuntu from loading its own drivers, you'll need to blacklist the module.*

Using NdisWrapper to Install the Drivers

On the Ubuntu computer on which you wish to install the drivers, you should now have the `.inf` file from the previous steps, plus the `.sys` and possibly `.bin` files that constitute the driver. You should have copied these files from the removable storage device into a new folder on your desktop named `driver`.

■ **Note** If you've used a USB memory stick to transfer the files, it should appear automatically on the desktop as soon as it's inserted. When you've finished with it, right-click the desktop icon and select Unmount. You must do this before physically removing any kind of USB memory device, as explained later in this chapter.

To install the driver by using NdisWrapper, follow these instructions:

1. Click System ➤ Administration ➤ Windows Wireless Drivers. Enter your password when prompted.

2. Click the Install New Driver button.

3. The Install Driver dialog box appears, prompting you to select the `.inf` file for your wireless device. Click the Location drop-down list to open a file-browsing dialog box.

4. Navigate to the `.inf` file you copied to your system, which you have placed in the `driver` folder on your desktop. Double-click the desktop folder, and then double-click the `driver` folder listed in the right column. Select the `.inf` file you copied in the `driver` folder and then click the Open button.

5. Back in the Install Driver dialog box, click the Install button.

6. At this point, you should see the driver listed at the left column of the Wireless Network Drivers dialog box. It specifies the name of the driver installed and whether the hardware is installed. If it says the hardware isn't installed, you've probably selected the wrong `.inf` file, or might be using the wrong driver file. Return to the previous sections and try to get an alternative Windows driver.

7. No reboot is necessary, and your wireless network card should work immediately. To test whether the driver works, click the NetworkManager icon and see if there are wireless networks listed. If it works, click Close to exit the Wireless Network Drivers dialog box.

Following this, you should find that the network device is available for configuration. Follow the earlier instructions for connecting to a wireless network.

Removing NdisWrapper Drivers

As mentioned earlier, although NdisWrapper can solve a lot of headaches with nonworking wireless hardware, it isn't perfect. You might find that the Windows driver you install simply doesn't work. In such a case, you can download a different version of the driver and try again. But first you'll need to remove the existing driver.

Choose System ➤ Administration ➤ Windows Wireless Drivers and enter your password when prompted. In the Windows Network Drivers dialog box, select the driver you want to remove in the left column and click Remove Driver. Click Yes when prompted to confirm the removal. Click Close to exit the tool.

SECURE CONNECTIONS ON THE NET

For home users, the use of online banking services requires the transfer of confidential data. So is this a good reason to use the strongest form of wireless network encryption with your broadband router? No, it isn't. In fact, it makes no difference.

This is because the transfer of confidential or financial data across the Web—to and from online banking sites, for example—is nearly always protected by Secure Sockets Layer (SSL) HTTP. This works across any type of network connection, including wireless and Ethernet, regardless of whether the connection has its own protection.

You can tell you're browsing a site that's using SSL because the address will begin with `https`. Additionally, most browsers display a padlock symbol at the bottom of the screen (the Firefox browser will also turn the background of the address bar yellow). Accessing such sites should be safe, even if your wireless network connection is "open," which is to say it isn't protected with either WEP or WPA.

Similarly, although online shopping sites might not use SSL while you're browsing, when it's time to pay, they always use SSL. This ensures that your credit card details are encrypted. If the store doesn't adopt an `https://` address when you click to visit the virtual checkout, you shouldn't shop there!

So do you even need WEP or WPA protection if you simply use your wireless connection to browse the Internet? Yes. In addition to the risk of unauthorized users hopping onto your connection if it isn't protected, some web mail services transfer your username and password "in the clear," which is to say without using SSL. This means your information could be picked up by an eavesdropper. In the case of Hotmail and Yahoo! Mail, you can select secure login, but it isn't activated by default. Google Mail appears to use SSL all the time for login, but after this, your e-mail messages are transmitted across the Internet in the clear and, in theory, anyone can eavesdrop.

Using Dial-Up Telephone Modems

In our world of high-speed broadband connections, we sometimes forget that a sizable minority of people use telephone dial-up to connect to an ISP.

For such people, Ubuntu offers good and bad news. The good news is that the Ubuntu software repository includes fuss-free software that can be used to configure connections and dial-up with the click of a mouse. The bad news is that, taken as a whole, Ubuntu support for dial-up modems isn't very strong.

If your modem is external and connects to the serial port, then there's a very good chance Ubuntu will work fine with it. However, if the modem connects to the USB port, is built into your computer, or is provided on a PCMCIA card, then Ubuntu support is less certain. This is because many modems need additional and specialized configuration. See the following "Winmodems" sidebar.

There's no quick way to find out if your modem is supported, other than to follow the instructions in this section and attempt to use it. To follow the instructions, you'll need access to a computer that's already online to download a software package. If you dual-boot with Windows, you can use it to download the software.

To configure your modem after the software is downloaded, you will need three pieces of information: the telephone number you should use to dial up, your username, and your password for your ISP (*not* your Ubuntu login username and password!).

WINMODEMS

Some years ago, hardware manufacturers realized that they could produce dial-up modems more cheaply if they shifted the hard work of decoding the signal onto the computer's operating system. With the work off-loaded, the modem's circuitry could contain fewer and simpler components, thus saving money.

For this to work, a special hardware driver was needed that effectively worked as a middleman, handing the decoding work to the computer's CPU. Unlike with other hardware drivers, these modem drivers aren't around simply to make the hardware work with the operating system. Effectively, the drivers for such modems are a separate piece of software within themselves.

Because of their need for this special driver software, which usually runs only on Windows, the modems are known as *winmodems*.

As you might anticipate, using the modems under Linux presents many problems, chief among them being that Windows and Linux are two separate operating systems and, generally speaking, are incompatible. Although solutions exist and the problems aren't insurmountable, setting up a winmodem under Linux often requires quite a lot of additional configuration.

There are many types of winmodems, all of which need to be configured in different ways. An excellent web site exists that provides both step-by-step information and the necessary software. Using a computer that can get online, visit `http://linmodems.org`. Additionally, the user-friendly guide at `http://linmodems.technion.ac.il/first.html` might also be of help. As always, searching the Ubuntu forums (`www.ubuntuforums.org`) and specifying the make and model of your modem is also a good idea, because it's almost certain that at least one other person will have tried to make the modem work under Ubuntu.

Here are the steps necessary to configure a modem to dial up. You should ensure that your modem is plugged into the phone socket and is powered up. These instructions involve downloading the GNOME PPP dial-up tool, which will handle your dial-up requests.

1. Using another computer that's already online (or by switching to Windows if you dual-boot), use a web browser to visit the following address. You'll be prompted to download a file. Save the file to a floppy disk or USB memory stick, or burn it to a blank CD-R/RW disk. This is necessary because you'll need to transfer the file to your Ubuntu computer.

   ```
   http://us.archive.ubuntu.com/ubuntu/pool/universe/g/gnome-ppp/
   gnome-ppp_0.3.23-1_i386.deb
   ```

2. On the Ubuntu computer, copy the downloaded file to the desktop.

3. Open a terminal window (Applications ➤ Accessories ➤ Terminal) and type the following:

   ```
   sudo dpkg –i Desktop/gnome-ppp_0.3.23-1_i386.deb
   ```

   You'll need to enter your password when prompted.

4. You'll find GNOME PPP on the Applications ➤ Internet menu. When the program starts, click the Setup button.

5. In the Setup window, click the Detect button. This will probe your modem and change GNOME PPP's configuration settings to match. After probing is complete, remove the check from Wait for Dialtone, but don't change any other settings on the Modem tab.

6. Click the Options tab. Put a check alongside Dock in Notification Area. Then click the Close button.

7. In the Username, Password, and Phone Number fields, enter the relevant details, as illustrated in Figure 8-8. Remember that you should enter your dial-up username and password here, and not your Ubuntu username and password! Don't forget to add any additional numbers to the front of the phone number if it's necessary to deactivate call waiting or similar services on your phone line. It's also wise to put a check in the Remember Password box, so you won't be prompted for your password each time you dial up.

8. Click the Connect button to dial up. When you're connected, you'll see a new icon appear in the notification area. When you want to disconnect, right-click this icon and select the relevant option.

Figure 8-8. *GNOME PPP can be used to connect to the Internet if you use a dial-up modem.*

Following the initial setup, it makes sense to create a desktop shortcut for GNOME PPP. This can be done by clicking and dragging the icon from the menu to a convenient spot.

Working with a Proxy Server

Some networks in offices require that you use a web proxy (often referred to as an *HTTP proxy*). A *proxy* is a server computer that provides additional security by providing a single portal to all web pages. It also helps speed up Internet access by storing frequently accessed pages. This means that if ten people request the same web page, there's no need to get the same ten pieces of data from the Internet. The proxy computer can send them its own copies.

You'll need to speak to your system administrator to see whether your office uses a proxy. If it does, your administrator will most likely give you an address, which may take the form of a web address (a URL) or an IP address. When you have this information, follow these steps to configure the proxy:

1. Open Network Proxy Preferences (System ➤ Preferences ➤ Network Proxy).

2. On the Proxy Configuration tab, choose one of the three types of proxy configuration:

- Direct Internet Connection is basically not using a proxy at all when accessing the Internet.
- Manual Proxy Configuration enables you to set the proxy servers and respective ports for HTTP Proxy, Secure HTTP Proxy, FTP Proxy, and Socks Host. You can fill in this information based on the settings you received from your system administrator. If you were provided with one proxy for Internet access, select the Use the Same Proxy for All Protocols check box, and fill in the details for the HTTP proxy and port, as shown in Figure 8-9. If your proxy uses authentication, click the Details button. In the HTTP Proxy Details dialog box, select the Use Authentication check box, and then supply the username and password. Click the Close button.
- Automatic Proxy Configuration allows you to enter the link (URL) to discover the proxy settings in your office.

3. On the Ignored Hosts tab, you can set the list of sites that will bypass the proxy. By default, any site hosted on your computer is bypassed. You can add and remove sites as well. You normally add intranet (internal) web sites to this list.
4. Click the Close button after you're finished making changes to the proxy settings.

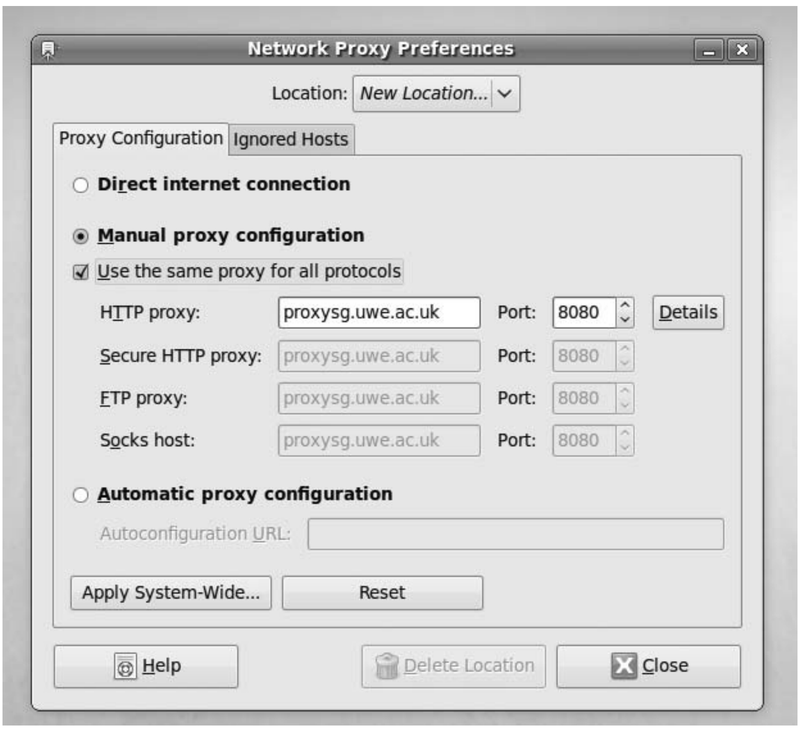

Figure 8-9. *Proxy settings can be configured for a variety of locations.*

If you have a laptop that is used in various locations, you can set up a series of proxy configurations that can then be selected whenever you move around. To create a new one, select New Location from the Location drop-down at the top of the window, input a name, and then set the appropriate values. After it is saved, each configuration remains available under the Location drop-down.

■ **Tip** Some ISPs run proxy servers too. However, unlike proxies in offices, it's typically up to you whether you choose to use them. You might find that using a proxy speeds up your connection, especially when you access popular sites, so it's worth trying out. To find out whether your ISP offers a proxy, visit its technical support web pages or phone its technical support line.

ADDITIONAL NOTEBOOK CONFIGURATION

Generally speaking, a notebook computer will not need any configuration above and beyond what's outlined in this chapter. For example, if you have a wireless network card, you can simply follow the instructions in the "Connecting to a Wireless Network" section presented earlier.

You might also want to use the GNOME CPU Frequency Scaling Monitor. If you have a compatible CPU in your notebook (or even some desktop PCs), this tool lets you adjust the speed of the chip to save power. Most modern mobile-oriented CPUs support this function. Unfortunately, because of the possibility of crackers using it to slow down your system, the applet is considered a security risk. Before you use it, you must reconfigure your system to allow it to work.

Open a terminal window (Applications ➤ Accessories ➤ Terminal) and proceed by typing `sudo dpkg-reconfigure gnome-applets`. You'll then be asked whether you want to set `suid` root for the `cpufreq-selector` applet. Select Yes by using the arrow keys and press Enter. Reboot your computer and then right-click a blank spot on the panel at the top of the screen. Click Add to Panel and, in the dialog box that appears, scroll down to the System & Hardware heading. Click the CPU Frequency Scaling Monitor icon and then click the Add button. To alter your CPU frequency, click the applet and choose the clock speed setting you desire.

Configuring Power-Saving Features

Ubuntu includes a number of features that can utilize the power-saving utilities of your computer, including switching off the monitor after a set period of inactivity and placing the computer into standby mode, whereby only the RAM subsystem is kept powered. However, some quick configuration is necessary to set up the system just the way you want it.

Tip If your computer has a CPU that can adjust its clock speed on the fly, such as a mobile processor, Intel Core Duo, Intel Pentium M, AMD Turion, or AMD chip with the PowerNow! function, Ubuntu will automatically install software that will make this work. This software will run in the background. To see a live view showing the speed of your processor, right-click the panel, select Add to Panel, and choose the CPU Frequency Scaling Monitor under the System & Hardware heading. Note that to manually control the speed of the processor, you might need to undertake the steps described in the "Additional Notebook Configuration" sidebar. If your computer subsequently crashes when you attempt to scale the processor speed, use the Synaptic Package Manager to install `cpufreqd`. This should fix the issue. As always, updating online might also provide a cure.

Adding a Printer

Most people have a printer nowadays, and Ubuntu supports a wide variety of models—everything from laser printers to color ink-jet models, and even some of the very old dot-matrix printers.

If you work in an office environment, you might be expected to access a shared printer. Sharing a printer is usually achieved by connecting the device directly to the network. The printer itself typically has special built-in hardware to allow this to happen. Alternatively, the printer might be plugged into a Windows computer, such as a Windows server (or even simply someone's desktop PC), and shared so that other users can access it, a setup that is known as *Windows printer sharing*. Ubuntu will work with network printers of both types.

Configuring a Local Printer

A *local printer* is one that's directly connected to your computer, typically via USB. Any printer you attach to your computer will be configured by Ubuntu automatically and ready to use immediately, as shown in Figure 8-10.

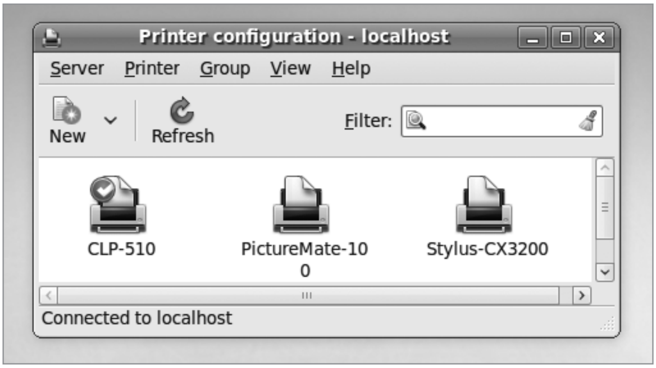

Figure 8-10. *Any local printers are automatically configured when you connect them to the computer and then turn them on.*

However, if the printer malfunctions when printing, such as churning out paper when a print job is sent to it, printing garbage, or not working at all, you can attempt to configure it yourself. To set up a local printer, follow these instructions:

1. Click System ➤ Administration ➤ Printing. In the Printer configuration window, click the New Printer button. You'll see the message "Searching for Printers." This might take a few moments to work through.

2. In the New Printer dialog box, you need to select which printer to configure. The printers that Ubuntu detected are listed under Devices. Click the printer you want to use, and then click the Forward button to continue. You'll see the message "Searching for Drivers."

3. Select the printer manufacturer. By default, Ubuntu selects the manufacturer that best fits your printer, but you can select another manufacturer from the list. Alternatively, you can provide the PostScript Printer Description (PPD) file if the built-in drivers cannot operate your printer. When you've finished, click Forward.

■ **Tip** You can find PPD files on the CD that came with your printer or download them. OpenPrinting (`www.linux-foundation.org/en/OpenPrinting`) and Adobe (`www.adobe.com/products/printerdrivers/winppd.html`) offer many printer drivers for download.

---

4. Ubuntu again selects the detected model and corresponding driver for your printer, but you can change these selections. If the default driver simply doesn't work correctly, try a similar but different model. Select the appropriate model in the Model list in the left column, and then select the appropriate driver for your printer from the Drivers list in the right column. Click the Forward button to continue.

5. You'll be invited to give the printer a name. The default should be OK. You can fill in the Description and Location fields if you want, but these are necessary only if you intend to share the printer across a network. Click Apply when you've finished.

■ **Tip** Sharing your printer on the network so that other computers can use it is simple: open the Printer configuration window (System ➤ Administration ➤ Printing), select Server Settings in the list on the left, and put a check in the Share Published Printers Connected to This System box on the right. Then click the Apply button.

After installation has finished, the printer will then appear in the Printer Configuration window. To see whether it's working correctly, double-click to see the printer properties, as seen in Figure 8-11, and then click the Print Test Page button at the base of the window.

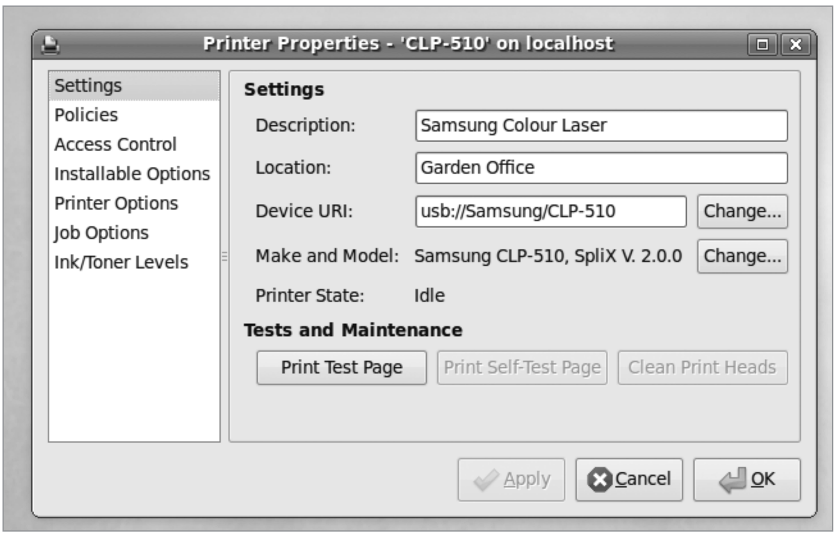

Figure 8-11. *After the printer is configured, you can see its properties and test it by printing a test page.*

If the printer is installed correctly, you should find yourself with a test page showing color gradations.

If the printer hasn't been installed correctly, it either won't work at all or will start spewing out page after page of junk text. If this is the case, click Cancel Tests (where the Print Test Page button used to be), and then turn off the printer. Delete the printer driver by selecting the printer in the list on the left and clicking the Delete button at the top of the Printer configuration window. Then repeat the installation steps, this time trying different settings.

Configuring a Network Printer

A network printer is one that is not directly connected to any computer. Instead, it connects to the network via an Ethernet cable. In this way, all computers in the office will be able to use it. If the network printer is directly connected to a computer, it will probably be shared via Windows/SMB. In this case, follow the instructions in the next section.

Some printers have the required server hardware built in, but others might use a special print server module that attaches to the printer's USB or parallel printer port. Ubuntu can work with both types of hardware.

Ubuntu is compatible with Unix (LPD), HP JetDirect, and Internet Printing Protocol (IPP) server types. These are the most ubiquitous types currently in use for stand-alone printer servers.

Before beginning, you'll need to find out the printer's network address and, if relevant, the queue name or the port number. You should be able to find out these details by speaking to your network administrator or the person who configured the printer.

Follow these steps to configure a network printer:

1. Click System ➤ Administration ➤ Printing. In the Printer configuration window, click the New Printer button.

■ **Tip** You can add as many printers as you want. You could configure a local printer (that is, one attached to your computer) and then configure a network printer.

---

2. In the Devices list of the New Printer dialog box, select the type of shared printer you want to connect to. If you're unsure of which to choose, try Internet Printing Protocol (IPP). If you wish to connect to a Hewlett Packard (HP) printer with an HP print server attached, select AppSocket/HP JetDirect. (You could also choose LPD/LPR Host or Printer, but this has long been replaced by IPP.)

3. In the Host field, enter the network address of the printer. In the case of HP JetDirect, the default port number should work, unless you have been specifically told to enter a different number. Depending on which server option you chose, you may also need to enter the queue name. If it's IPP, you need to provide the host and printer queue, but Ubuntu makes it easy to set this up. Just type the network address in the Host field, and then click Find Queue. The IPP Browser dialog box will pop up and display a list of printer queues. Select a printer queue and then click OK. Ubuntu will update the entries in the Host and Queue fields automatically. Click the Verify button to check whether you can access the printer with the updated settings. If it fails, try changing the Host field to the host's IP address (ask your system administrator for this information if you don't have it). After you have the correct settings, click Forward.

4. As prompted, choose the printer manufacturer, printer model and driver, and printer name, just as if you were configuring a local printer. See steps 3, 4, and 5 in the previous section for guidance. Click the Apply button after you've made your selections.

5. When the printer is installed, select the printer from the list in the Printer configuration window and then click Print Test Page.

If the printer doesn't work, it's likely that you set the wrong server type. Try an alternative type; if you chose IPP the first time, try App Socket/HP JetDirect the second time. Many print servers can emulate a variety of modes, so trying a different setting may work.

If the printer starts spewing out page after page of text, you likely selected an incorrect printer driver. Cancel the job at the printer by clicking Cancel Tests. Next, select the printer in the list on the left and click the Delete button at the top of the window to remove the printer. Then repeat the installation steps, this time trying an alternative driver.

Configuring a Windows/SMB Shared Printer

A Windows (or SMB) printer is one that's directly connected to a computer, and then made available across the network via the network sharing function of the operating system. Effectively, the computer acts as the printer server. Often, in corporate environments, such printers are attached to server computers, but an individual may share the printer attached to a workstation.

In a home situation, a Windows/SMB share is an excellent and inexpensive way of sharing a printer among many computers. The printer is attached to one PC, and, as long as that computer is switched on, the printer will be available to the other computers in the household.

Assuming that the printer has been correctly set up to be shared on the host computer, connecting to a Windows/SMB printer share is easy. In fact, you may find that Ubuntu finds the printer in the background and sets it up automatically! If you find the printer is available when you choose to print from an application, try it out and see if it works.

However, more likely, you'll need to add it manually. Follow these steps to set up a Windows/SMB shared printer:

1. Click System ➤ Administration ➤ Printing. In the Printer configuration window, click the New Printer button.

2. In the Devices list, select Windows Printer via SAMBA.

3. Click the Browse button to probe the network to see whether any printer shares are available. More than one might appear, so navigate through the printer shares until you find the desired printer. Select the printer and click the OK button. If you cannot find the printer share listed in the SMB Browser dialog box, you may need to enter the details in the `smb://` field manually, as shown in Figure 8-12. This entry will probably take the form of the address followed by the printer name (for example, `officepc/epson`). Speak to your system administrator or the individual in charge of the shared printer to find out what these are.

4. Click the Verify button to check whether the printer is accessible. If it succeeds, skip to step 6. If it fails, you may need to supply the username and password to access the shared printer, as described next.

5. Select the Authentication Required check box. In the Username and Password fields, type the username and password required to access the shared printer. These can be the login details of any user of the computer or, if the shared computer and printer are configured for Guest access, you can try typing `Guest` for the username and leaving the Password field blank. After the details have been filled in, click Forward.

6. As prompted, choose the printer manufacturer, model, driver, and name, just as if you were configuring a local printer. See steps 3, 4, and 5 in the "Configuring a Local Printer" section for guidance. Click the Apply button after you've made your selections.

7. When the printer is installed, select the printer from the list in the Printer configuration window and then click Print Test Page.

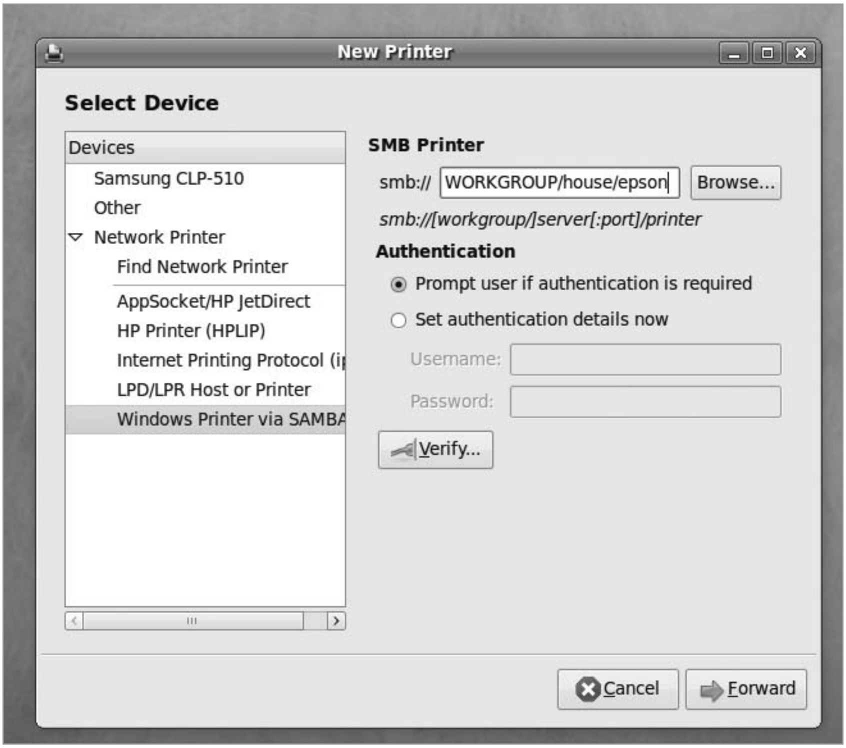

Figure 8-12. *Ubuntu should be able to automatically detect any Windows or SMB shared printers on your network.*

If the printer makes a noise as if to start printing but then decides not to, you might need to change a setting on the Windows machine. Click Start ➤ Printers and Faxes, and then right-click the shared printer's icon. Select Properties, and click the Ports tab in the Properties window. Remove the check in the Enable Bidirectional Support box and then click OK. Then restart both the Windows and Ubuntu computers.

If the printer starts spewing out page after page of text instead of the test page, it's likely that you selected the wrong printer driver. Cancel the job at the printer by clicking Cancel Tests. Next, select the printer in the list and click the Delete button at the top of the Printer configuration window to remove the printer. Then repeat the installation steps, this time using an alternative driver.

Administering a Printer

Like Windows, Ubuntu uses the concepts of print queues to handle printing. When you print from an application, the print job is held in the print queue. If the queue is empty, the job is printed immediately. If there are already jobs waiting to be printed, or if a print job is already in progress, the new job is added to the queue.

■ **Tip** If you have more than one printer installed (maybe you have a printer attached to your PC but also print to a network printer), you can set one as a default, which will automatically be chosen whenever you choose to print. Simply click System ➤ Preferences ➤ Default Printer. Then select the printer from the list, click the Set Default button, and close the program window. The default printer will be shown with a check icon in the Printer configuration window.

When you print a document, the Document Print Status icon appears in the notification area (it looks like a printer). Double-click the icon to view the jobs waiting to be printed, if any. Right-clicking a job displays a context menu that lets you cancel, pause, or resume the job.

When you attempt to print from applications, Ubuntu will display a unified printer interface, as you might be used to in Windows. You will find similarities when you print in Gedit, GIMP, and Firefox. The only exception is OpenOffice.org, which offers its own simplified print dialog box.

Most applications that use the unified print dialog box will provide additional unique options related to that particular application. For example, GIMP offers quality settings useful for printing high-resolution photographs, and Gedit offers functions related to basic text printing.

Ensure that you select your printer in the list on the left of the print dialog box (on the General tab) in order to see all the available options.

Using Digital Cameras, MP3 Players, and USB Memory Sticks

Removable storage is the term applied to peripherals that you might attach to your computer and that contain their own storage. Examples include USB memory sticks, external hard drives, MP3 players, digital cameras, and photographic memory card readers. You might also find that devices such as mobile phones are treated as removable storage devices when you attach them directly to your computer.

When you attach any removable storage device, Ubuntu does the following:

- Displays an icon on the desktop, which you can double-click to view the removable storage device contents.
- Adds an icon to Nautilus's Computer view, which can be accessed by clicking Places ➤ Computer (or Go ➤ Computer in a currently open Nautilus window). As with the desktop icon, double-clicking this will display the contents of the removable storage device. The Computer view is a good way to see at a glance all removable storage devices attached to your computer.
- If the removable storage device contains digital images (if it's a digital camera, for example), and you view the contents using a Nautilus window, an orange bar will appear across the top of the window, alongside a button asking whether you want to import the images to the F-Spot photo library program. You'll learn more about this in Chapter 20, which provides a concise guide to cataloging and manipulating your digital images.

The contents of the removable storage device will be accessible in exactly the same way as any other files on your system. You should be able to copy, delete, and create files on the device, provided the device isn't read-only (if the read-only switch isn't set on a USB memory stick, for example). If the device contains MP3 tunes, you should be able to double-click them to play them, provided the playback codecs are installed (see Chapter 18).

However, a very important rule must be followed when you've finished with removable storage devices under Ubuntu: the device must be *unmounted* before you physically remove it. This applies also to memory cards that are inserted into a card reader—before removing any card from the card reader, it must be unmounted.

This is quite simple to do. Just right-click the icon on the desktop or within the Computer window and select Unmount Volume, as shown in Figure 8-13. Make sure you save and close any files that you may have been working on before you do so, or you may see an error. You'll need to close any Nautilus windows that might have been browsing the storage device too.

If you've used the command line to manipulate files on the removable storage device, remember to close any running programs in the terminal window. You'll also need to switch out of the removable storage device directory before you'll be allowed to unmount it (alternatively, you can simply close the terminal window).

Following this, you can safely physically remove the card or unattach the device. Reinserting it will make it available once again.

Figure 8-13. *You may be tempted to just whip out a USB drive, but it should be unmounted properly in order to protect your data.*

■ **Caution** Be very careful not to remove a memory card from a card reader while you're writing to or reading from it on your PC. This will most likely damage the card irreparably. At the very least, it will wipe the contents of the card, so you'll lose your photographs.

Configuring a Scanner

Scanners may seem like archaic machines that have been superseded by digital cameras or absorbed into multifunction devices, but they're still the best method of transcoding nondigital images and textual documents into a digital format.

A lot of flatbed scanners can be made to work under Ubuntu, but not all types are supported. You can check the list of currently supported scanners by visiting `www.sane-project.org`. Additional models are added to the list all the time, and this is another reason to make sure your system is completely up-to-date (see Chapter 9 and Appendix D; the former explains how to update your system software, while the latter describes how to update to the latest version of Ubuntu).

The best test of whether your scanner is supported under Ubuntu is simply to see whether it will work. Scanning within Ubuntu is handled by the XSane utility. This is a stand-alone program that operates like the TWAIN drivers that you might have used under Windows.

Tip XSane is even capable of optical character recognition! Simply use the Synaptic Package Manager to download and install the gocr program. Then, after you scan an image, in the viewer window, choose File ➤ OCR - Save As Text.

To configure a scanner and scan images, follow these steps:

1. Choose Applications ➤ Graphics ➤ XSane Image Scanner. On startup, the program attempts to detect your scanner. If it finds a compatible model, XSane will start. If the scanner isn't recognized, a dialog box will appear telling you so.

2. XSane consists of a handful of windows, including the main program window, the Standard Options dialog box, the Histogram window, and the Preview window. You can close the Standard Options and Histogram windows for the moment and concentrate on the main XSane program window, which should be similar in appearance to the TWAIN scanner drivers you might have used under Windows.

   At the top of the window is the automatic document feeder option, where you can set the number of pages in the feeder to scan in one sitting. If your scanner does not have an automatic document feeder, you can do this manually by changing the paper yourself immediately after the previous paper has been scanned.

3. Beside the automatic document feeder option is the XSane mode drop-down list. Here you can select from a variety of scanning modes, such as those to scan documents for faxing. However, in most cases, the Save setting is best. This lets you preview your scans and then save them to disk if you're happy with them.

4. Beneath this is the filename field. Here you should type the filename you wish to use for the scanned file. XSane can save in a variety of file formats, and it detects which you want to use from the file extension you choose. For example, typing `picture.jpg` will cause the picture to be saved as a JPEG image. Typing `picture.tif` will cause the image to be saved as a TIFF file.

5. Beneath the filename field, on the left, is the filename number count. This is used when you want to scan many images in succession—a number is added to the end of the filename, and this control configures the increment. A setting of +1 is fine.

6. Beneath the filename field, and to the right, is the type drop-down list, by which you can force a certain file type to be used when saving files. However, leaving this at the default By Ext is best. This means that, as mentioned previously, you can define the type of image saved by the filename extension.

7. Next down is the color/monochrome drop-down list. Here you can select to scan Lineart (binary), Gray (grayscale), Halftone, or Color. If you select anything other than Lineart, additional sliders will appear to let you control the gamma, brightness, and contrast of the scanned image, in that order. In addition, several other buttons will appear at the bottom of the program window, all of which you can leave at default settings. Remember that hovering the mouse cursor over each will explain what it does.

8. Next is the source medium type drop-down list. Here you can specify the type of medium you are scanning—whether it's a full-color picture, a slide/transparency, or a negative. For normal operations, select Full Color Range.

9. Next is the dots per inch (DPI) setting. Generally speaking, 300 DPI is acceptable for scanned photos, whereas 150 DPI will be acceptable for artwork such as diagrams.

10. To scan a preview, click the Acquire Preview button within the preview window. The results should be something similar to what's shown in Figure 8-14.

11. When the preview scan has finished, you can adjust the brightness/contrast settings by using the sliders in the XSane program window (assuming you selected color scanning earlier). You should also click and drag to crop the image in the preview window, if XSane doesn't do so automatically.

12. When you're satisfied with the preview, click the Scan button in the main XSane program window. The image will then be scanned at your chosen resolution and saved to your `/home` directory, using the filename you specified earlier.

Figure 8-14. *The XSane program works a little like TWAIN drivers under Windows and makes scanning easy.*

Installing 3D Drivers and Activating Desktop Visual Effects

The modern trend is for operating systems to incorporate flashy graphical effects into ordinary desktop functions. For example, when windows are minimized in Windows Vista, they physically shrink and fade down to the taskbar. Under Mac OS X, program windows appear to be "poured" into the Dock when minimized. In Windows Vista, when you press Alt+Tab to switch through open programs, the program windows are previewed vertically in a graphical arrangement, and you can flick through them, rather like searching through a card index. These effects are achieved using the 3D processing power of the computer's graphics card, even though the effects aren't necessarily 3D in nature.

■ **Note** On a technical level, the technique is known as *compositing*. What you see on the screen is first drawn in the graphics card memory and then transferred to the screen, rather than everything simply being drawn directly onto the screen.

Ubuntu includes similar desktop visual effects, courtesy of a system called Compiz Fusion (`www.compiz-fusion.org`). However, all desktop visual effect systems have a couple requirements, and these apply to Ubuntu as well:

- For desktop effects to work, your graphics card (or motherboard graphics chipset) must be comparatively recent. Examples include the ATI Radeon, Nvidia GeForce, and Intel GMA product lines. Most graphics cards manufactured within the last two or three years with a graphics processing unit (GPU) should be adequate, and very recent models definitely will work.
- The correct graphics drivers must be installed. Some of Ubuntu's built-in graphics drivers lack the necessary 3D functionality to support desktop effects. Currently, Intel GMA and some ATI Radeon graphics cards are supported by default because Intel and ATI provide open source 3D-capable drivers. For other hardware, including Nvidia cards, you will need to manually install a proprietary driver, which is not difficult to do.

■ **Note** You need to install the proprietary driver only if you wish to utilize desktop visual effects. Ubuntu includes a default 2D graphics driver that provides excellent functionality for everyday desktop use.

Some proprietary 3D graphics drivers are provided under Ubuntu, but *only* if open source equivalents are missing. It is hoped that open source drivers will one day replace the need for proprietary drivers.

So do you actually need to install new drivers? If you find that desktop effects are working, the correct drivers are already installed. A good way to test this is to hold down Ctrl+Alt and then tap the left or right arrow key. This will switch to the next virtual desktop. If the entire desktop physically slides out of the way, desktop effects are activated. If the desktop remains static and a small dialog box appears in the center of the screen to let you choose a virtual desktop, then desktop effects are not activated.

A utility called Hardware Drivers lets you manage proprietary drivers for your graphics card. This should appear automatically in the notification area immediately after installation if your hardware requires proprietary drivers.

Follow these instructions to activate the proprietary graphics driver:

1. Click the Hardware Drivers icon to run the Hardware Drivers program. If it's not visible, click System ➤ Administration ➤ Hardware Drivers.
2. Supply your password in the authorization dialog box and click OK.
3. In the Hardware Drivers window, select the Enabled check box beside your graphics card device driver.

4. A dialog box appears, asking you to confirm that you want to enable the driver. It explains that enabling the driver enables visual effects on your desktop. Click the Enable button.

5. The Summary dialog box appears to tell you what new software will be installed. Click the Apply button.

6. The driver is downloaded and installed. Then the Changes Applied dialog box appears to tell you that the changes are completed. Click the Close button.

7. In the Hardware Drivers window, click the Close button.

8. You need to restart the computer so that Ubuntu will use the new driver. Choose System ➤ Quit, and then click Restart.

After the new graphics driver is installed, desktop visual effects should start working immediately, as shown in Figure 8-15. If you experience seemingly random systemwide crashes or freezing after installing a 3D graphics driver, consider reverting to your old setup by using the Hardware Drivers program (System ➤ Administration ➤ Hardware Drivers) to disable the new driver. Unfortunately, in a small minority of cases, the proprietary driver can prove buggy.

Figure 8-15. *Using the correct graphics drivers can add sophisticated effects to your desktop.*

Two modes of operation are available for desktop visual effects: Normal and Extra. Normal is the default and provides a good subset of the available effects: menus fade into view, program windows shrink when minimized, and so on. Extra provides a lot more effects, some of them rather extreme, such as wobbling when you click and move a window, and windows appearing to explode to the corners of the screen when maximized. To switch between the two settings, right-click the desktop, select Change Desktop Background, and then click the Visual Effects tab in the dialog box that appears. You can play with individual effects by choosing System ➤ Preferences ➤ CompizConfig Settings Manager. The effects are divided into logical sections and can be activated by selecting.

Configuring Bluetooth

Bluetooth is the short-range networking facility that allows various items of hardware to work with each other wirelessly. You can use Bluetooth for everything from file transfers between a mobile phone and computer to employing a wireless keyboard or mouse with your desktop computer.

For Bluetooth to work, both devices need to have Bluetooth support. Many mobile phones come with Bluetooth nowadays, as do an increasing number of notebook computers. It's also possible to buy very inexpensive Bluetooth USB adapters.

Bluetooth support is built into Ubuntu and should activate automatically if Bluetooth hardware is present on your PC. You will know if this is the case because a Bluetooth icon will appear in the notification area. This is used to administer all Bluetooth devices that you might want to connect to your computer.

Pairing Bluetooth Devices

When two pieces of Bluetooth-compatible hardware need to communicate on a regular basis, they can pair together, a process also known as *pairing* or *bonding*. This means that they trust each other, so you don't need to authorize every attempt at communication between the devices. Indeed, some devices won't communicate unless they're paired in this way.

Pairing is simple in practice and works on the principle of a shared personal ID number (PIN). The first Bluetooth device generates the PIN and then asks the second Bluetooth device to confirm it. After the user has typed in the PIN, the devices are paired. Pairing is easily accomplished under Ubuntu and doesn't require any additional software.

As an example, the following are the steps for bonding a mobile phone to an Ubuntu PC. Bonding for devices without a user interface, such as keyboards, is handled differently, as explained in the "Using a Bluetooth Keyboard or Mouse" section a little later in the chapter.

1. Ensure that the Ubuntu PC is visible, which is to say that other Bluetooth devices can detect it. Right-click the Bluetooth icon in the notification area, click Preferences, and make sure that the Always Visible radio button is selected. Click Close.

2. You can pair up two devices from either end, but we're going to begin using Ubuntu. To do this, click the Bluetooth icon in the notification area and select Setup new device. This launches the Bluetooth Device Wizard. Click the Forward button.

3. The wizard probes the ether and finds any connectable devices. These will appear first as a series of numbers and then using their friendly names, as shown in Figure 8-16.

Figure 8-16. *A pairing request is easily accomplished through the Bluetooth applet.*

4. Select the device you want to connect to and click Forward. You can choose to use a random PIN code, or create a custom one with the appropriate option. You should now receive a prompt on the phone to input the PIN code, and the two devices will be paired.

If you subsequently wish to remove the pairing, right-click the Bluetooth icon and select Preferences. In the list of Bonded Devices at the bottom of the dialog box, select the entry for your Bluetooth device and click the Delete button. Don't forget to remove the pairing on the Bluetooth device too.

Transferring Files Between Bluetooth Devices

If you own a Bluetooth-equipped camera phone, you might be used to transferring pictures to your computer using Bluetooth. It's by far the easiest way of getting pictures off the phone and avoids the need for USB cables or card readers. To transfer files via Bluetooth, you can use the Bluetooth applet.

Note Some phones refuse to transfer files unless the phone and computer are paired, so follow the instructions in the previous section first. Phones such as like the Nokia 6680 don't need pairing for file transfer, although each transfer will need to be confirmed manually.

Browsing Files on a Remote Device

The easiest way to get files to or from a device is to use Nautilus:

1. Right-click the Bluetooth icon in the notification area and select Browse Files on Device.

2. Choose your phone (or other device) from the list and click Connect. You may need to confirm the action on your phone by selecting Yes.

3. Nautilus opens up with the folders available on the device (see Figure 8-17). You can then navigate through these and copy files to your desktop in the usual drag-and-drop fashion. You can also add files to the phone in the same way.

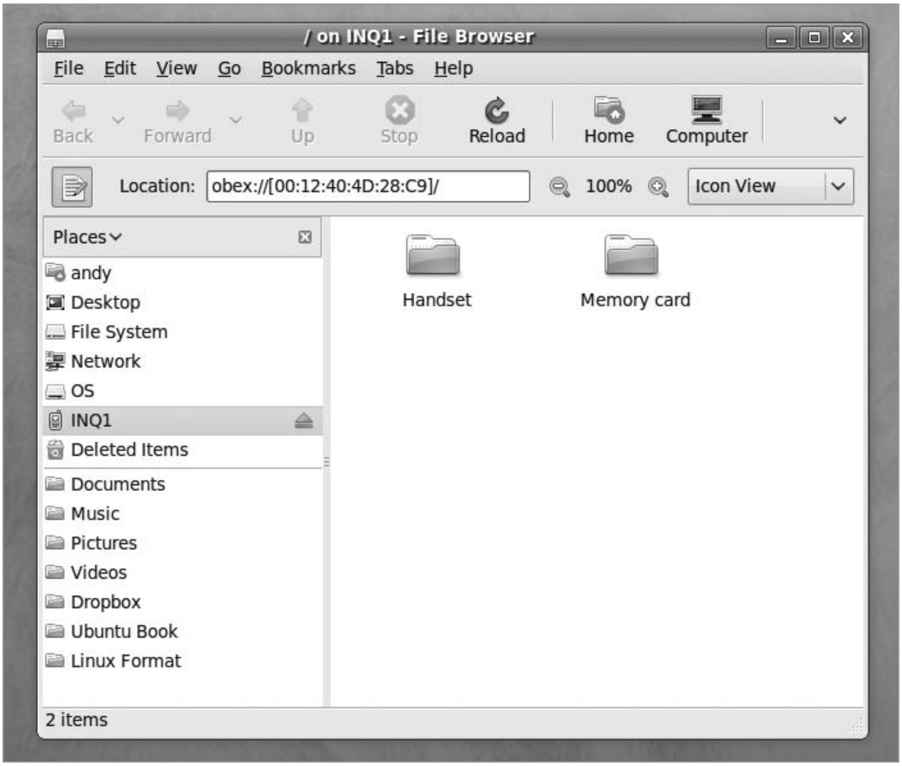

Figure 8-17. *You can use Nautilus to access a Bluetooth device.*

Sending Files from an Ubuntu PC to Another Device

There are two ways to send files to another Bluetooth device from your Ubuntu PC. The first is to use the Bluetooth applet. The second is to right-click the file in question and select Send To. The second method is useful if you wish to send many files at once, and you will have the option of automatically zipping the files into a single archive (but bear in mind that the Bluetooth device receiving the file will need to be able to subsequently unarchive the file).

Using the Bluetooth Applet

Follow these steps to use the Bluetooth applet to send files:

1. Right-click the Bluetooth icon in the navigation area and click Send File.
2. In the Choose Files to Send dialog box, navigate to the file you want to send and click Open.

3. In the Select Device dialog box, select the target Bluetooth device and click the Connect button.

4. The target Bluetooth device might prompt you to accept or deny a file transfer request from Ubuntu. Choose to accept it.

5. After the file has been received by the Bluetooth device, click Close.

Using the Send To Option

To use the Send To option on the context menu to send one or more files, follow these steps:

1. Either right-click an individual file, or select several files and click one of them. Right-click and select Send To.

2. In the Send As drop-down list in the dialog box that appears, select Bluetooth (OBEX Push). In the Send To drop-down list, ensure that your Bluetooth device is selected.

3. If you're sending several files, you can put a check in the Send Packed In check box. This will create a new single `.zip` archive and add the files to it automatically. Otherwise, each file will simply be sent one after the other.

4. Click the Send button. You may be prompted to authorize receipt of the files on the Bluetooth device, so do so. Bear in mind that transfer of many files may take some time because Bluetooth is not a particularly speedy form of data transfer.

5. After the file transfer is complete, click the Close button.

Using a Bluetooth Keyboard or Mouse

Your Bluetooth-equipped keyboard or mouse may work automatically under Ubuntu. However, if not, you may need to pair it to your PC, as follows:

1. Before you can pair your keyboard or mouse with Ubuntu, you must edit a system configuration file. Open a terminal window (Applications ➤ Accessories ➤ Terminal) and type the following, which will open the file in the text editor:

   ```
   gksu gedit /etc/default/bluetooth
   ```

2. In the document that appears, look for the line that reads `HIDD_ENABLED=0` and change the `0` to a `1`, so it reads `HIDD_ENABLED=1`. Then save the file and quit Gedit.

3. Ensure that the Ubuntu PC is set to be discoverable. Right-click the Bluetooth icon in the notification area, click Preferences, and make sure that the radio button alongside Visible and Connectable for Other Devices is selected. Click Close.

4. Switch your keyboard or mouse to discoverable mode. Read the instructions for your device to find out how this is done. On an iGo Stowaway keyboard we used during testing, this required pressing the Ctrl+blue Fn+green Fn keys simultaneously.

   While you're reading the manual, find out whether the device has a default passkey. Mice almost certainly will (and it's nearly always 0000), but keyboards might require you to type one manually when it comes to the pairing request.

5. Right-click the Bluetooth icon and select Preferences. In the Bluetooth Preferences dialog box, click the Services tab. Ensure that there is a check alongside Input Service in the list, and then click the Input Services entry in the list so that it is selected. Click the Add button at the bottom of the dialog box.

6. You should find that your keyboard or mouse is detected automatically and appears in the list below the Select Device heading (if not, ensure that it is still in discoverable mode and hasn't switched itself off). Click the entry for the keyboard or mouse, and then click the Connect button.

7. A comment box should pop up on the Ubuntu computer, notifying you of a pairing request between Ubuntu and the keyboard or mouse. Click the Enter Passkey button.

8. What happens next depends on whether you're trying to connect a keyboard or mouse. Bear in mind that the process of pairing quickly times out on the Ubuntu computer, so you need to complete the following steps without hesitation:

   - In the case of a mouse, enter the passkey that you read earlier in the manual for the mouse. As mentioned, this is usually 0000. After you click OK, the mouse should be paired and should start working.

   - Some keyboards also use a default passkey of 0000, and, if so, you can enter that, and the keyboard should be paired. However, some Bluetooth keyboards might require you to enter a passkey created on the computer. In the Authentication Request dialog box on the Ubuntu PC, type a random four-digit passkey—something like 1234 (although for security reasons, you might want to choose something that's slightly less easy to guess). Click OK. On the Bluetooth keyboard, type the same number and hit Enter. Following this, you should find that the keyboard is paired with the computer and will work.

9. Click Close in the Bluetooth Preferences dialog box.

If the keyboard or mouse does not work after a reboot, try turning it on and off again. If that doesn't work, deactivate the Bluetooth functionality on the PC, perhaps by momentarily unplugging the Bluetooth dongle or, on a notebook, using the relevant keyboard combination to turn off and on again the Bluetooth system.

Configuring Sound Cards

Generally speaking, your sound card shouldn't require any additional configuration and should work immediately after you install Ubuntu. The icon for the volume control applet is located at the top right of the Ubuntu desktop, and it offers a quick way to control the master volume.

However, if your sound card offers more than stereo output, such as multiple-speaker surround sound, then it might be necessary to take some simple steps to allow full control of the hardware:

1. Right-click the volume control icon (the one that looks like a speaker) and select Open Volume Control.
2. Click the Preferences button at the base of the window.
3. The Volume Control Preferences dialog box appears, as shown in Figure 8-18. Select the sliders that you wish to be visible. For example, on a desktop computer that has 5.1 surround sound, we were able to add a slider for the center and back speakers. On a notebook that has a sound card featuring pseudo-surround sound, we could add a control to alter the intensity of the effect.

   When you've finished, click the Close button. The new controls should then be visible in the Volume Control window.

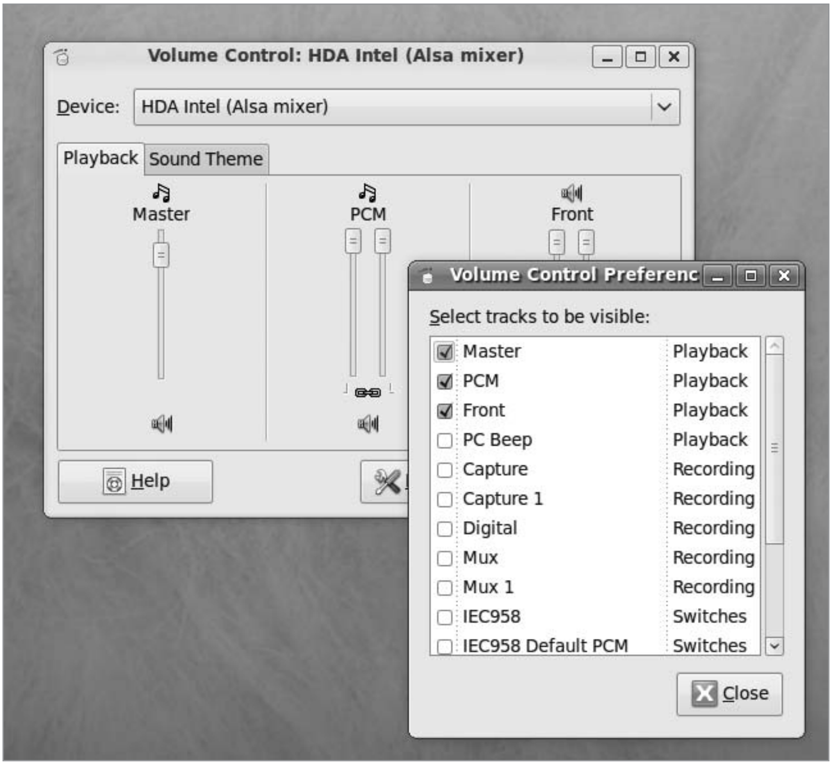

Figure 8-18. *You can add sliders to control all aspects of your sound card's output.*

Configuring E-Mail and Instant Messaging

Being online is all about staying in touch, and Ubuntu is no slouch in this regard. Ubuntu offers a full-featured e-mail program, called Evolution, as well as an instant messaging client called Pidgin.

Unlike similar instant messaging clients, Pidgin supports a wide variety of Internet chat protocols, such as AIM/ICQ, MSN, Yahoo!, Jabber, and IRC. This means you can chat with friends and colleagues on different networks by using this one program.

Evolution is able to work with both IMAP and the popular POP3 mail servers offered by ISPs and used within corporate environments. Additionally, it can work with the Microsoft Exchange protocol used by offices running the Outlook mail program and also Novell GroupWise. We'll look at the specifics of using Evolution in Chapter 27. Here you'll learn how to configure the e-mail client to receive and send mail.

Configuring E-Mail Access

Before starting, you'll need to find out the addresses of the mail servers you intend to use. In the case of POP3 and IMAP mail accounts, you'll need to know the incoming and outgoing server addresses (outgoing may be referred to as *SMTP*). In the case of Microsoft Exchange, you'll need to know the OWA URL and, optionally, the Active Directory/Global Address List server. With Novell GroupWare, you'll simply need to know the server name. You'll also need to know your username and password details for the incoming and possibly outgoing mail servers.

After gathering the necessary information, follow these steps to configure Evolution:

1. Start the Evolution e-mail client by clicking its icon at the top of the screen, to the right of the menus. Alternatively, you can choose Applications ➤ Office ➤ Evolution Mail and Calendar.

2. When Evolution starts for the first time, you'll be invited to enter your configuration details via a wizard. Click the Forward button.

3. The next screen offers an option to restore Evolution settings from backup. This is a convenient option for migrating accounts from one Evolution client to another. Because this is your first time using Evolution, you can simply ignore this option by clicking the Forward button.

   You are asked for your name and the e-mail address you wish to use within Evolution. These are what will appear in outgoing messages. Beneath this is a check box that you should leave selected if you want the account you're about to create to be the default account. In nearly all situations, this will be the correct choice. You can also fill in the Reply-To and Organization information if you wish, but these fields can be left blank. They're not usually displayed by most e-mail clients. Click the Forward button to continue.

4. The next screen asks for details of the receiving (incoming) mail server that you want to use, as shown in Figure 8-19. First, select the server type from the drop-down list. If you don't know which option to go with, select POP. This is by far the most common type of incoming mail server currently in use.

   Additional configuration fields will appear when you make the selection of server type. Enter the server address and username in the relevant fields. Click Check for Supported Types to find out what kind of authentication security, if any, your mail server uses. Following this, you should find that the details are filled in automatically. Click Forward to continue.

Figure 8-19. *Evolution can work with a variety of mail servers, including POP3, Microsoft Exchange, and IMAP.*

5. You might need to enter your mail password, depending on which server type you chose. In some cases, you'll need to type this later when you download your mail for the first time. Click Forward to continue.

6. You're given the chance to choose between various additional options, such as how often you want Evolution to check for new mail or whether you want to delete mail from the server after it has been downloaded. Unless you have been told otherwise or have special requirements, it should be okay to leave the default settings as they are. If you use a Microsoft Exchange server, you may need to enter the Active Directory/Global Address List server details here. Click Forward to continue.

7. Depending on the server type you chose, you might now need to fill in the outgoing (SMTP) server address. Type this into the Server field. If your SMTP server requires authentication, put a check in the relevant box and then enter your username. Once again, you can click the Check for Supported Types button to automatically fill in the authentication details. Click Forward to continue.

8. You're invited to enter a name for the account. This is the account name you will see when you use Evolution. The default is your e-mail address, but you can type something more memorable if you wish. Click Forward to continue.

9. Finally, choose your location, which will have the effect of automatically defining your time zone. This will ensure that e-mail messages are correctly time-stamped. You can choose your location from the Selection drop-down list (choose the nearest large city in your time zone), or click your location on the map. As during initial installation of Ubuntu, the map will zoom in when you click continents, to let you more precisely click the place where you live. Click Forward to continue, and then click the Apply button to finish the wizard.

As noted earlier, Chapter 27 includes a full run-through of Evolution's main functions.

Setting Up Instant Messaging

Instant messaging is a way of chatting with other people in real time. It's as if you were having a phone conversation, but you're typing instead of speaking. You can talk to one other person or a whole group of people and sometimes share files with them.

The instant messaging program under Ubuntu, Pidgin, offers the same functions and works in an almost identical way to programs that you might have used under Windows. It supports virtually all the popular chat standards, such as ICQ/AOL, Google Talk, Yahoo!, and MSN (Hotmail/Passport). It assumes that you already have an account with each service, which will likely be the case if you've used instant messaging programs under Windows. You can have as many accounts as you wish and can select the one you want to use when you log in.

To transfer your instant messaging account over to Pidgin, you just need your screen name and password. As with other instant messaging clients, you'll be able to choose an onscreen alias.

Follow these steps to set up Pidgin:

1. Start Pidgin by clicking Applications ➤ Internet ➤ Pidgin Internet Messenger. When the program starts for the first time, it will automatically open the Accounts dialog box, although it might be behind the main login window. If so, click to bring it to the front of the desktop.
2. In the Accounts dialog box, click the Add button. In the window that appears, select the account type you want to set up from the Protocol drop-down list, as shown in Figure 8-20.
3. Enter your screen name, password, and alias details, as required.
4. If you don't want to type your password each time you run Pidgin, select the Remember Password check box. However, be aware that someone else using the computer could abuse your account.
5. You can put a check in the New Mail Notifications box if you want to be notified of any mail sent to you via the address registered with your instant messaging service.
6. If you want to use a buddy icon (the icon that others will see when they connect to you), click the Open button and browse to a picture.
7. If you wish to connect to a specific instant messaging server or if your network uses a proxy, click the Advanced tab and enter the details accordingly. In most cases, you won't need to do this.
8. When you've finished, click the Save button.
9. Pidgin will attempt to connect to the chat service. In the main Pidgin window, you should be able to see your chat contacts. Close the Accounts window.

After this, you should find that the program works just like any other instant messaging program. You can double-click each contact in your list to start a conversation. To sign off, right-click the icon in the notification area and then select the Change Status option from the menu. To add another account, click Accounts ➤ Manage, click the Add button in the Accounts window, and then follow the preceding step-by-step instructions.

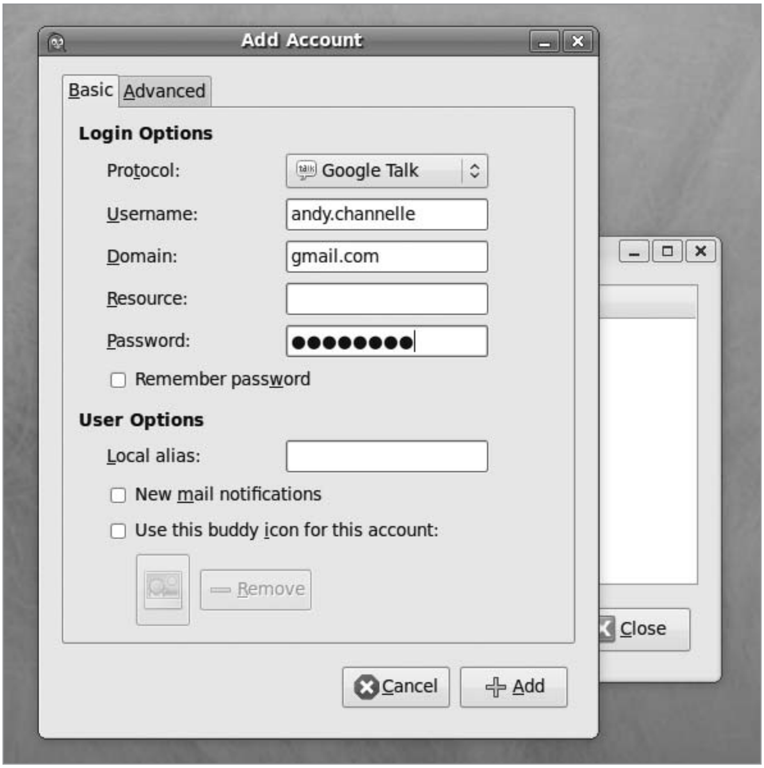

Figure 8-20. *Pidgin can communicate with users across a range of different protocols.*

Using Power-Management Preferences

Depending on the degree to which your computer supports power-saving functionality, Ubuntu will let you configure your display to go into standby mode after a certain amount of time and will also allow you to configure your notebook to enter sleep (standby) mode. In addition, if you use a notebook computer, Ubuntu might let you configure additional aspects, such as the display brightness. These functions are controlled by using the Power Management applet. To start this, click System ➤ Preferences ➤ Power Management. If Ubuntu is installed on a notebook computer, you'll see three tabs in the program window: On AC Power, On Battery Power, and General. If Ubuntu is installed on a desktop computer, you'll see just the On AC Power and General tabs.

■**Note** Not all PCs are created equal when it comes to power-saving features. Some support more functionality than others. In addition, Ubuntu is compatible with most but not all power-management systems, and it might not be able to support certain power-management functionality on your system, even if such functionality works under Windows.

Notebooks have the additional tab because it's possible to define two separate power management profiles: one for when the computer is plugged in and one for running on battery power. This makes sense, because you might never want your display to switch off when connected to an outlet, but it's advisable that it should deactivate within, say, 15 minutes of inactivity if the computer is running on battery power (to extend the life of the battery).

The three tabs of the Power Management applet are explained in the following sections.

On AC Power

If your computer is a desktop PC without a battery, you'll see two options under the On AC Power tab: Put Computer to Sleep When Inactive For and Put Display to Sleep When Inactive For. By clicking and dragging the sliders for these options, you can control the amount of time before each feature kicks in. By dragging each to the far right, you can set a value of Never, which will deactivate that feature.

■**Note** The sleep mode can be to either suspend to RAM (that is, standby) or hibernate. You can set this under the General tab, as discussed in a moment.

If your computer is a notebook computer, you'll see some extra options. Depending on the technology used in your computer, you might see a Set Display Brightness To slider, which you can use to set the brightness of the screen when the power is connected. Whenever AC power is connected, the display brightness will be changed to match this setting.

You may see a When Laptop Lid Is Closed option, with a drop-down list. As it suggests, this will control what happens when the notebook is closed. Depending on the hardware contained in your computer, you might have the choice of doing nothing, blanking the screen, suspending the computer (shutting down all systems but RAM), hibernating (suspending RAM to disk and turning off the notebook), and shutting down the computer. However, not all computers support each of these modes, so the choices you see might vary.

Additionally, you may see a Dim Display When Idle check box, which you can select to conserve power by dimming the screen when your system is idle.

On Battery Power

The options under the On Battery Power tab, which will be present only on a notebook computer, are largely the same as those under the On AC Power tab, as you can see in Figure 8-21. These settings come into operation the instant the main power is disconnected from your notebook and the battery kicks in.

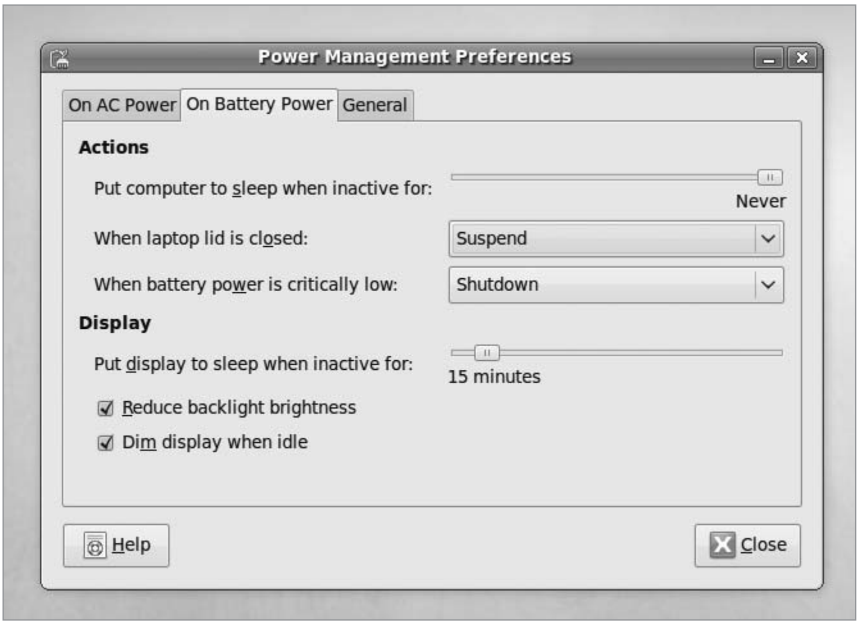

Figure 8-21. *Notebook users can define an additional power profile that will kick in when the battery is in use.*

An extra option appears as the last item in the Actions section: When Battery Power Is Critically Low. Here you can opt to automatically suspend, hibernate, or shut down the notebook when the battery power is nearly gone.

The check boxes at the bottom of the Display section could help save battery power considerably. You may select the Reduce Backlight Brightness option, which as it suggests, sets backlight brightness to a lower setting when you run on battery power. As with On AC Power, the Dim Display When Idle option may also be available for battery power.

■ **Caution** Be aware that sleep mode requires a little battery power to work and will eventually drain your battery, especially if it's already on its last legs!

General

Under the General tab, you have options to customize button actions and notifications. These settings persist whether the computer is on AC or battery power.

In the Actions section, you can set what happens when the power button is pressed and the computer is active. Effectively, this controls whether pressing the button when Ubuntu is running should shut down the computer, suspend it, or hibernate it. You can select Ask Me, which will cause the standard Quit dialog box to appear (that is, the same dialog that appears if you click System ➤ Quit). You can also customize the action for the suspend button. The available actions are to do nothing, suspend, and hibernate. Hibernate will write the contents of RAM to the hard disk and then shut down the computer. Suspend will shut down most systems of the computer except for the RAM, which will be kept active. Then, when you press a key or move the mouse, the computer will wake up almost instantly as the subsystems are reactivated.

■ **Caution** Hibernate doesn't work on all systems. The best plan is to test it by choosing System ➤ Quit and selecting Hibernate. Even if Hibernate appears to work, there are reports of it being unreliable. Some users report that their computer occasionally fails to wake up, causing a loss of data. Therefore, you should always save any open files before using the hibernate function or before leaving your computer unattended for any period in which hibernate mode might kick in automatically.

The General tab also lets you select whether the power icon is visible in the notification area. If you're using a notebook, you can display the icon only when the battery is nearly drained, when your battery is charging or discharging, or regardless of the battery state. Desktop PC users can choose not to display the power icon, which makes sense. The most fuss-free option is perhaps Only Display an Icon When Charging or Discharging, which is selected by default.

Finally, there's also an extra option you can select to play sounds when error events occur.

Tip Clicking the power icon in the notification area lets you quickly hibernate or suspend the computer. Just select the entry from the menu that appears. It will also give you an indication of the charge status of your battery if you're using a laptop.

Spinning Down the Hard Disk

All modern hard disks come with the ability to spin down their motors to save energy. Then, when data is requested, the motors spin up again. There may be a slight delay while this happens, and some people dislike using disk spin-down because of this. However, on a notebook, it can lead to a substantial increase in battery life. On a desktop system, it's worth considering, because over the lifetime of a computer, it can save a lot of electricity (and therefore money!).

The spin-down settings are contained in the `/etc/hdparm.conf` file, which you'll need to edit by hand. Follow these steps to adjust the spin-down settings:

1. Open a terminal window (Applications ➤ Accessories ➤ Terminal) and type the following:

   ```
   gksu gedit /etc/hdparm.conf
   ```

2. Click Search ➤ Find, and in the box, type `spindown_time`.

3. Click the Find button. You should find that a line in the file is now highlighted. Close the Search dialog box.

4. Change the line to remove the hash mark from the beginning, so it reads like this:

   ```
   spindown_time = 24
   ```

   You can alter the value to anything you want. Each time unit is 5 seconds, so 24 equates to 120 seconds (24×5 seconds), or 2 minutes. To set a time of 20 minutes, enter 240 (240×5 seconds). If you specify a number above 240, the time units are increased to 30 minutes. In other words, a value of 241 will equate to 30 minutes, a value of 242 will equate to 60 minutes, and so on.

5. When you've finished, save the file.

6. Reboot for the settings to take effect.

POWER SAVING: IS IT WORTH IT?

An average computer draws anywhere between 100 to 1,000 watts of power. An average incandescent lightbulb draws about 150 watts of power, so you can see that, relatively speaking, computers are low-power consumers compared to many household devices. However, it's still worth considering employing power-saving techniques. You might not save yourself a lot of money, but if you switch on power saving, and your neighbor does too, and her neighbor does, then the cumulative effect will add up, and we can all contribute less toward global warming.

Try to avoid leaving your computer turned on overnight or when you're away from it for long periods. As well as saving power, switching off your computer will avoid wear and tear on its components. Although the CPU can work 24×7 without trouble, it's cooled by a fan that's a simple mechanical device. There are other fans in your computer too, such as the graphics card fan and case fan. Each of these will eventually wear out. If your graphics card fan stops working, the card itself will overheat and might burn out. The same is true of the CPU fan. However, by shutting down your computer overnight, you can effectively double the life of the fans and radically reduce the risk of catastrophic failure. Isn't that worth considering?

Summary

In this chapter, you learned how to set up the common types of hardware you might have attached to your computer. Additionally, you looked at configuring various software components that are vital for Ubuntu's correct functioning.

You stepped through getting online with Ubuntu (including joining a wireless network), configuring e-mail, adding a printer, connecting to a digital camera, configuring a 3D graphics card, and much more.

In Chapter 9, we move on to look at how you can ensure that your system is secure and protected.

CHAPTER 9

How to Secure Your Computer

Linux is widely considered one of the most secure operating systems available. On a basic level, Linux is built from the ground up to be fundamentally sound, and it forces users to work with security in mind. For instance, it enforces the system of ordinary users who are limited in what they can do, thus making it harder for security breaches such as virus infections to occur.

In addition, Linux contains a firewall that is hardwired into the kernel. It's called iptables (`www.netfilter.org`) and is considered among the best solutions by practically all computer security experts. Not only that, but it can protect your home PC just as well as it can protect the most powerful supercomputer.

But, as with many Linux kernel components, iptables is difficult to use. It requires in-depth knowledge of how networks operate and an ability to hack configuration files, both of which are beyond the skills of many ordinary computer users. Fortunately, several programs act as interfaces to iptables and make it simple to operate (or at least as simple as any equivalent Windows-based software firewall, such as ZoneAlarm from Check Point Software Technologies).

Ubuntu has a built-in firewall, but it is not configured by default. This is because the developers don't think that Ubuntu requires a firewall, and on a technical level, they're correct. Unlike with Windows, Ubuntu has no Internet-facing services (programs that wait for connections from the Internet or local area network). It was just such a service on Windows XP that allowed the Blaster worm to bring the Internet to its knees in 2003 (see `http://en.wikipedia.org/wiki/Blaster_worm`). Expressed metaphorically, the theory is that without any windows or doors, Ubuntu will be difficult, if not impossible, for hackers to break into (or for viruses or worms to infect). However, configuring the firewall with a program like Firestarter, which we examine later in this chapter, can be done so quickly and with such little effort that, in our opinion, there's no reason not to use the Linux firewall.

In addition, as with most versions of Linux, Ubuntu doesn't come with antivirus protection out of the box. This is because there are practically no viruses affecting Linux, and it is reasoned that there simply isn't a need for virus protection. However, as with a firewall configuration program, installing an antivirus program is easily done, and we explain how in this chapter. But first, you'll spend some time examining more-basic security concepts. Following that, you'll look at how to encrypt files and e-mail so they can be opened only by the intended recipients. Then we'll cover some elementary steps that you can take to protect your system.

Windows Security vs. Linux Security

If you've switched to Ubuntu from Windows, there's a very good chance that the security failings of Windows featured in your decision. Windows Vista contains many improvements, but Microsoft's record on security over the past few years has not been great. New and serious security warnings appeared on an ongoing basis, and even now, new and devastating viruses and Trojans such as Conficker make news headlines with worrying frequency (usually described as a *PC virus* rather than what it actually is—a Windows virus).

One argument is that Windows is the target of so many viruses merely because it's so popular. Although it's true that some of those who write viruses do so because they dislike Microsoft, there's also little doubt that Windows has more than its fair share of security issues.

Many people are still critical of Microsoft's approach to security. For example, Microsoft's latest operating system, Windows Vista, features User Account Control (UAC) dialog boxes that appear whenever a system-affecting action is required. However, they are so common that many people stop reading what they warn about and simply click OK by reflex. Many even switch them off. Compare this to Ubuntu. Similar dialog boxes appear whenever a system-affecting action is required, but here the user's password must be entered. This forces the user to stop and think, rather than simply clicking a mouse button. Also, the Ubuntu password dialog boxes have more of an impact because they appear far less frequently than UAC dialog boxes.

While Vista offers reasonable security, Microsoft's previous operating system, Windows XP, is considered an easy target for hackers and virus writers. Upon installation, the default user is given root powers. True, a handful of tasks can be performed only by the genuine administrator, but the default user can configure hardware, remove system software, and even wipe every file from the hard disk. Although you would never intentionally damage your own system, computer attackers use various techniques to get you to run malicious software (by pretending it's a different file, for example) or simply infect your computer across the Internet without your knowledge, which is how most worms work.

Viruses and worms also usually take advantage of security holes within Windows software. As just one example, a famous security hole within Outlook Express some years ago allowed a program attached to an e-mail message to run when the user simply clicked a particular message to view it. In other words, infecting a Windows machine was as easy as sending someone an e-mail message!

It's a different story with Linux. Viruses and worms are far rarer than they are on Windows. In fact, the total number of viruses and worms that have been found in the wild infecting Linux systems are likely less than 1,000 (one report published in 2005 put the number at 863, and the number is unlikely to have grown much since then). Compare that to Windows, where according to the Sophos antivirus labs (`www.sophos.com`), approximately 1,000 new viruses are discovered every month! One estimate puts the number of viruses out there for Windows at over 140,000.

■ **Caution** Linux fans constantly note that viruses can't cause a problem on their system because the core of the operating system is well protected. However, you should remember that the most important part of any computer system is, arguably, the data on it, so it's worth devoting time and effort to protecting this too. (See the following "Encryption" section for more information.)

But although we would love to say that security holes are not found on Linux, the sad truth is that they're a fact of life for users of every operating system. Many so-called *rootkits*—specialized software toolkits that aim to exploit holes within the Linux operating system and its software—are available.

The bottom line is that although writing a virus or worm for Linux is much harder than doing the same thing on Windows, all Linux users should spend time securing their system and never assume that they're safe.

Root and Ordinary Users

As we've mentioned in earlier chapters, Linux makes use of something called the *root* user account. This is sometimes referred to as the *superuser* account, and that gives you an idea of its purpose in life: the root user has unrestricted access to all aspects of the system. The root user can delete, modify, or view any file, as well as alter hardware settings. Because everything on a Linux system is a file, this gives the root user immense power.

Linux systems also have ordinary user accounts, which are limited in what they can do. Such users are limited to saving files in their own directory within the `/home` directory (although the system is usually configured so that an ordinary user can read files outside the `/home` directory too). But an ordinary Ubuntu user cannot delete or modify files outside of their `/home` directory unless explicitly given this permission by the root user.

The user account you created during the installation of Ubuntu is a limited account, but on some Linux systems, it's possible to type `root` at the login prompt and, after providing the correct password, actually log in as root and perform system maintenance tasks. Ubuntu is slightly different in that the root account is disabled by default, and users are instead able to borrow superuser powers whenever they're required, in a similar way to Mac OS X. For this to happen, they simply need to provide their own login password. With desktop programs, a password prompt dialog box will appear automatically, but at the command prompt, users need to preface commands with `sudo`.

Although the root account is disabled, most key operating system files “belong” to the root user, which is to say that only someone with superuser powers can alter them. Ordinary users are simply unable to modify or delete these system files, as shown in Figure 9-1. This is a powerful method of protecting the operating system configuration from accidental or even deliberate damage.

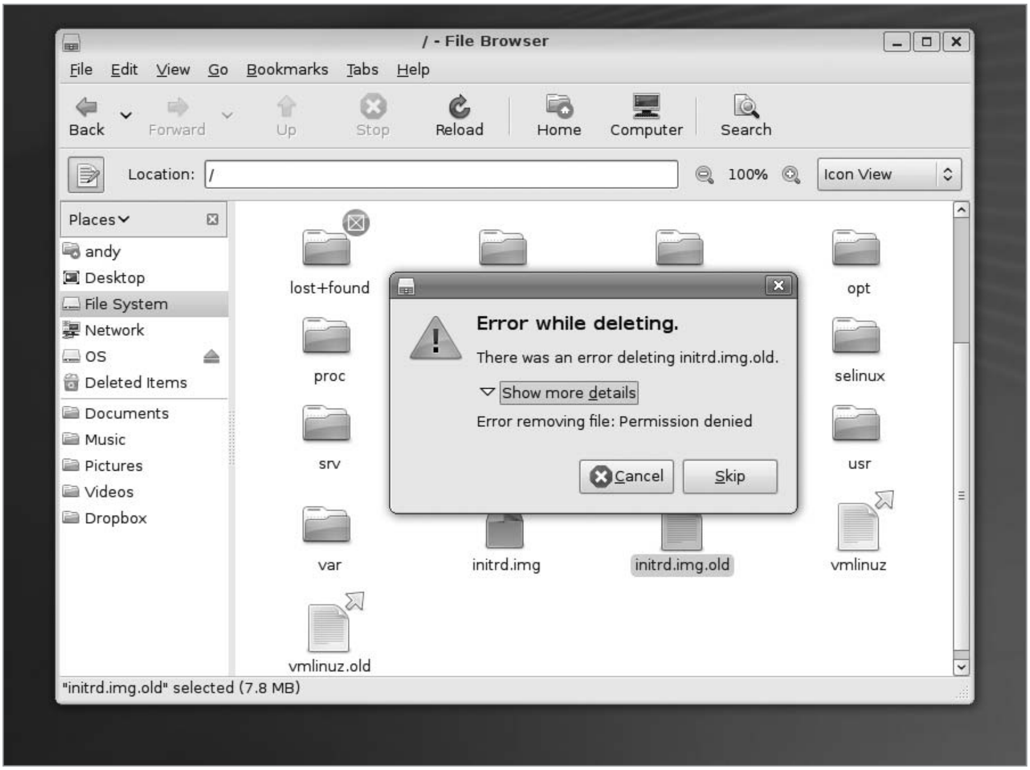

Figure 9-1. *Ordinary users are simply unable to modify or delete essential system files under Linux.*

■ **Note** Along with the root and ordinary user accounts, there is a third type of Linux account, which is similar to a limited user account, except that it’s used by the system for various tasks. These user accounts are usually invisible to ordinary users and work in the background. For example, the CD/DVD-ROM subsystem has its own user account that Ubuntu uses to access the CD/DVD-ROM hardware. The concepts of users and files are discussed in more depth in Chapter 14.

ARE YOU A CRACKER OR A HACKER?

Linux users are often described as *hackers*. This doesn't mean they maliciously break into computers or write viruses. It's simply using the word *hacker* in its original sense from the 1970s, when it described a computer enthusiast who was interested in exploring the capabilities of computers. Many of the people behind multinational computing corporations started out as hackers. Examples are Steve Wozniak, cofounder of Apple Computer, and Bill Joy, cofounder of Sun Microsystems.

The word *hacker* is believed to derive from model train enthusiasts who "hacked" train tracks together as part of their hobby. When computing became popular in the early 1970s, several of these enthusiasts also became interested in computing, and the term was carried across with them.

However, in recent years, the media has subverted the term *hacker* to apply to an individual who breaks into computer systems. This was based on ignorance, and many true hackers find the comparison extremely offensive. Because of this, the term *cracker* was coined to clearly define an individual who maliciously attacks computers.

So, don't worry if an acquaintance describes herself as a Linux hacker or tells you that she has spent the night hacking some PHP code. Many Linux types use the term as a badge of honor.

Encryption

Encryption is a means of protecting data by encoding it in such a way that the casual observer can't view it without a password/passphrase or a special file known as a *cryptographic key* (normally abbreviated to *key*). Encryption is used for privacy purposes and also to verify the identity of the person who originated a file or an e-mail message.

Two types of encryption are normally utilized on home computers and offered by Ubuntu:

File encryption: Files can be encrypted so that they require a secret passphrase to be decrypted. Alternatively, you can encrypt files so that they can be decrypted only by a particular individual.

E-mail encryption: E-mail messages can either be encrypted, so that only the recipient will be able to read them, or authenticated via a cryptographically generated signature, so that the recipient can be sure the e-mail genuinely originated from you and not a third party.

Ubuntu's e-mail program, Evolution, supports the digital signing of e-mail, as well as full encryption of e-mail sent to others or decryption of e-mail sent to you. The Nautilus file manager can also be used to encrypt files for personal use or so that only a particular individual will be able to decrypt them. Password encryption is also available in applications such as OpenOffice.org, which may be used to write or organize sensitive data such as accounts or confidential correspondence.

■ **Note** Although Evolution supports encryption, you don't have to use it. Indeed, many Ubuntu users don't utilize public key encryption, although power users often go this route. And, in general, relatively few people use e-mail encryption.

Underpinning Ubuntu's encryption system is a *public key encryption system*. Two keys are generated by an individual: the *private key* and the *public key*. The private key is kept private by the individual who generated it, while the public key is passed around to anyone who wants it (or even published on Internet databases). The two keys are related in that one key can encrypt data so that only the corresponding key can decrypt it.

For example, you could encrypt a file or e-mail message intended for Jane by using her *public* key, and only Jane would be able to decrypt it, by using her *private* key. However, and crucially, you would not be able to subsequently decrypt the file, even though you had encrypted it in the first place—data encrypted with a public key cannot then be decrypted with that same public key. Only the private key can decrypt it. If Jane wanted to encrypt a file so that only you could decrypt it, she would need to use *your* public key. You would then use your *private* key to decrypt it. No one else would be able to decrypt it after it was encrypted.

When utilized in an e-mail program, public key encryption works in two ways. Someone sending you a message can encrypt it and any attached files with your public key so that only you can read it. This ensures confidentiality. In the same way, you can encrypt a message sent to others by using their public key, so that only they can read it. Alternatively, and more commonly, a digital signature can be added to an e-mail file, even though the e-mail itself is sent unencrypted. This signature is generated from your private key along with the body of the message, and it is decrypted at the other end by using your public key, therefore proving the e-mail could have come only from you. This is known as *signing* an e-mail message, because it is as if you personally signed it in your own handwriting, thereby vouching for its authenticity. The e-mail is sent in plain text in case the recipient doesn't use public key encryption.

Setting Up for Encryption

To manage your encryption keys, you use the Seahorse application, which comes with Ubuntu. You first generate a key pair (your private key and the public key), and then you can export or publish the public key so others can use it.

Generating a Key Pair

Regardless of whether you want to use Evolution's encryption/signing feature or Nautilus's file-encryption abilities, you must first create a key pair. Here are the steps for doing so:

1. Click Applications ➤ Accessories ➤ Passwords and Encryption Keys. This will run the Seahorse application, as shown in Figure 9-2.

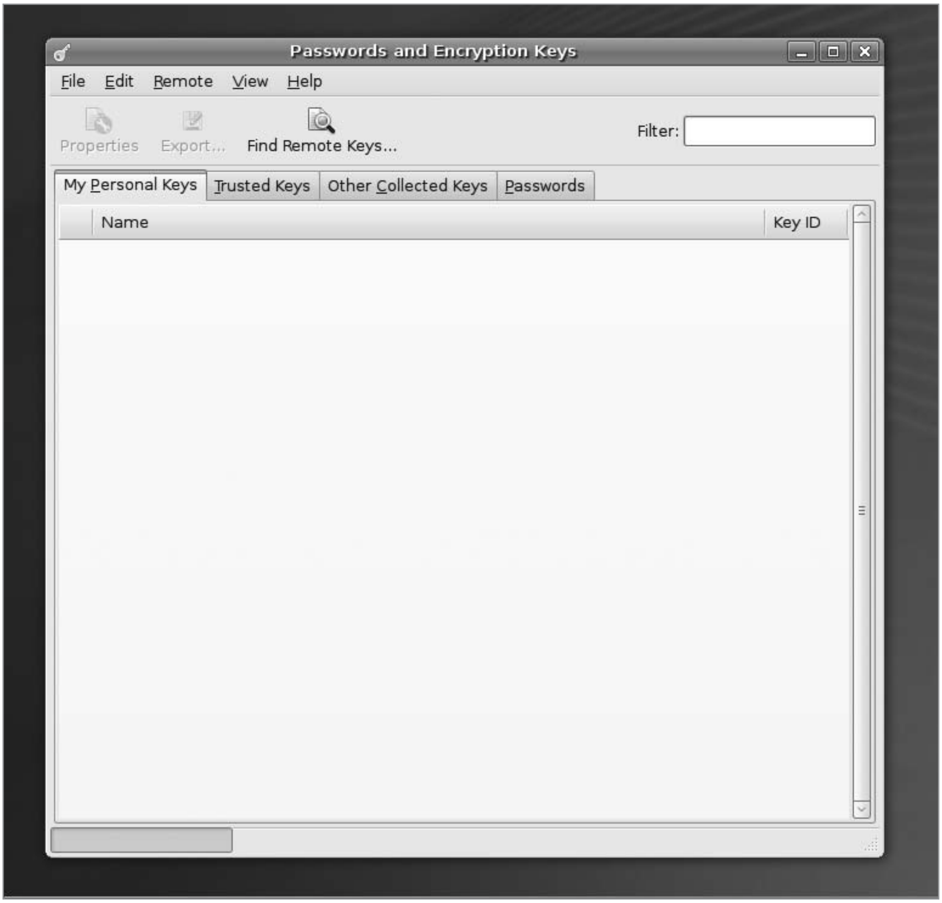

Figure 9-2. *Seahorse is an easy-to-use management tool for passwords and encryption keys.*

2. Click File ➤ New and select PGP Key from the available options, as shown in Figure 9-3. PGP, which stands for Pretty Good Privacy, is an industry-standard public key encryption system and is typically used to secure e-mails or files. The Secure Shell key is used as an extra security measure when connecting to remote machines, as discussed in Chapter 33. The Password Keyring can act as a kind of wallet for securely storing a collection of passwords that would then be accessible with a single password.

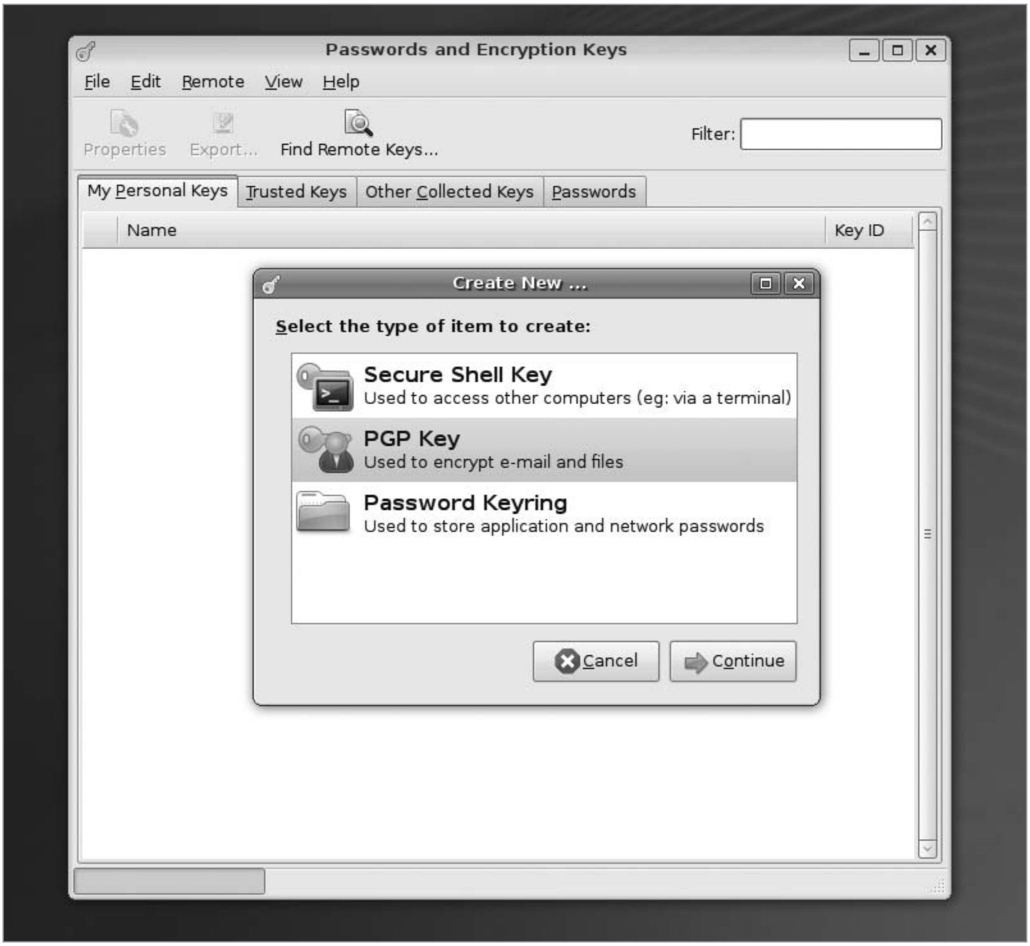

Figure 9-3. *Choose PGP Key to create a key pair for e-mail or file encryption.*

3. The New PGP Key dialog box appears. Fill in a full name, e-mail address, and optionally, a comment, as shown in Figure 9-4. The e-mail address you use for your PGP key should be the same as the one you used in creating an e-mail account in Evolution (see Chapter 8 for instructions on creating an e-mail account in Evolution). You may also set three advanced options, available in the Advanced Key Options drop-down list:

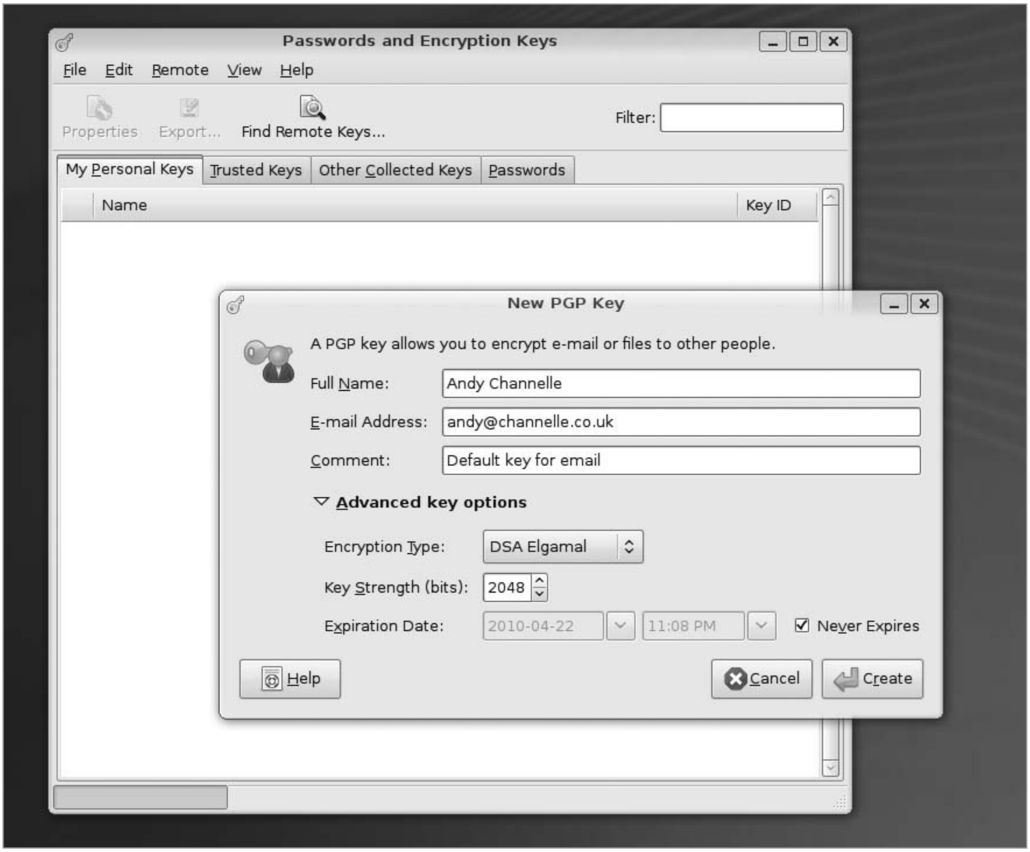

Figure 9-4. *Fill in the fields in the New PGP Key dialog box and optionally set advanced options for your keys.*

- Encryption Type lets you choose the type of cipher for your new keys. The default is DSA Elgamal, and this is the best choice because it will enable you to encrypt, decrypt, sign, and authenticate files and e-mail. DSA and RSA can only sign files and e-mail.
- The Key Strength option specifies the strength of your key, set in bits. The lower the key strength, the faster it is to encrypt and decrypt, but choosing a lower strength will make it easier for others to crack the encryption. Increasing the key strength means slower encryption, but this should be weighed against the fact that it reduces the chance of your messages being intercepted—to the point where larger keys of 2,048+ bits are currently considered unbreakable. This is why the default is set as 2,048 bits, which is a sensible compromise.
- The Expiration Date option sets an expiration date on your keys. The default is that the keys are set to never expire. An expiration date is useful if you suspect your private key might fall into the wrong hands (for example, if you use a laptop that could get stolen), as the key will be useful only until the expiration date. If you decide to assign an expiration date, you must create a new key before the old one expires and use the old key to sign your new one, in order to maintain authentication.

■**Note** The Key Strength option aids in strengthening your key, because the key strength is based on the type of cipher used together with the size of the key. Sometimes, a key based on a weak cipher can still be made into a strong key by increasing the key length.

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4. Click the Create button to create the keys.
5. The Passphrase for New PGP Key dialog box appears. You need to create a passphrase for your new PGP key. This is a block of text (perhaps a sentence or simply a long stream of characters) that will have to be entered when decrypting files you have encrypted while using Nautilus, and encrypted e-mails you receive via Evolution. The best passphrase is easy for you to remember but hard for others to guess; ideally, it should include uppercase and lowercase letters, punctuation, and numbers to make it harder for a brute force dictionary attack (that is, a machine systematically entering real words) to break. Enter your passphrase twice: once in the Password box and again in the Confirm box. As shown in Figure 9-5, the characters won't appear on the screen. Click OK to continue.

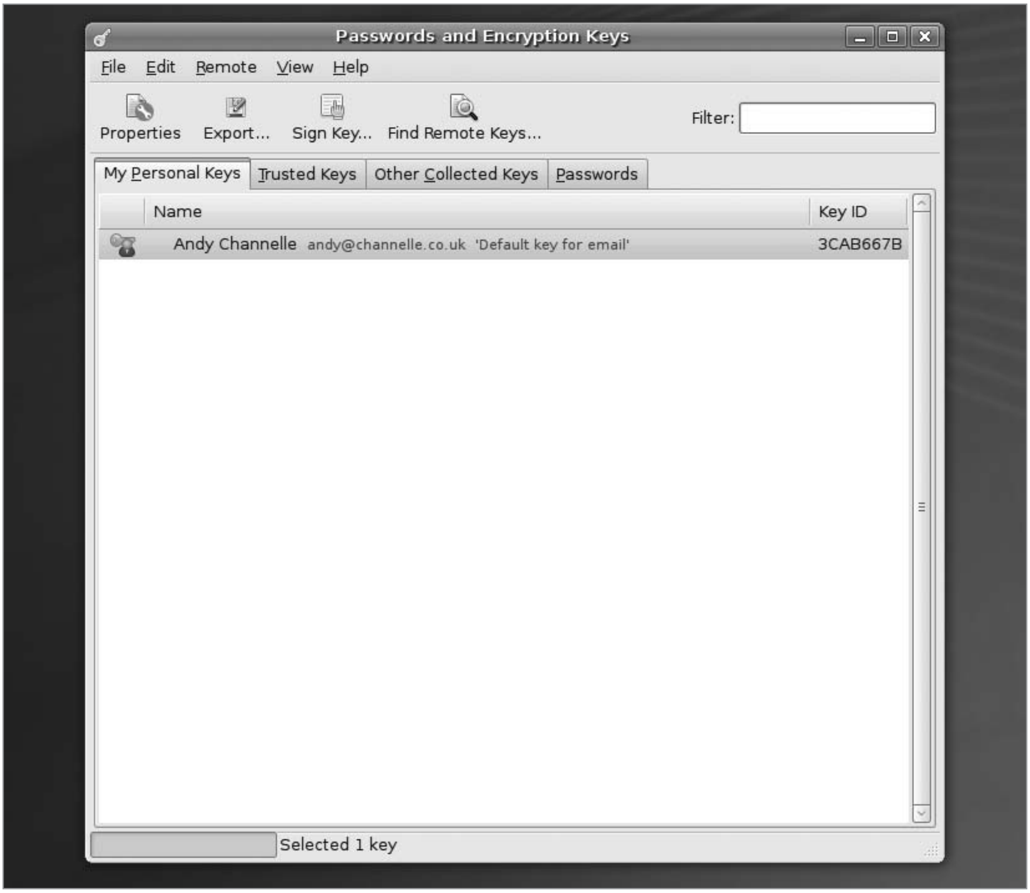

Figure 9-5. *After the PGP key has been generated, it will be listed on the My Personal Keys tab.*

6. Wait while the PGP key is being created. Depending on the key length you've chosen, this may take some time. After the process is finished, your new PGP key will be listed in the My Personal Keys tab of the main Seahorse window, as shown in Figure 9-5.

7. It's possible to redefine your passphrase at a later date without affecting the actual encrypted files. Right-click the PGP key in the My Personal Keys tab and select Properties. Click the Change Passphrase button and, after you've entered the existing passphrase, you'll be able to add another one. The small + icon shown on the left edge of Figure 9-6 allows you to tag a key with a photo or icon from your system.

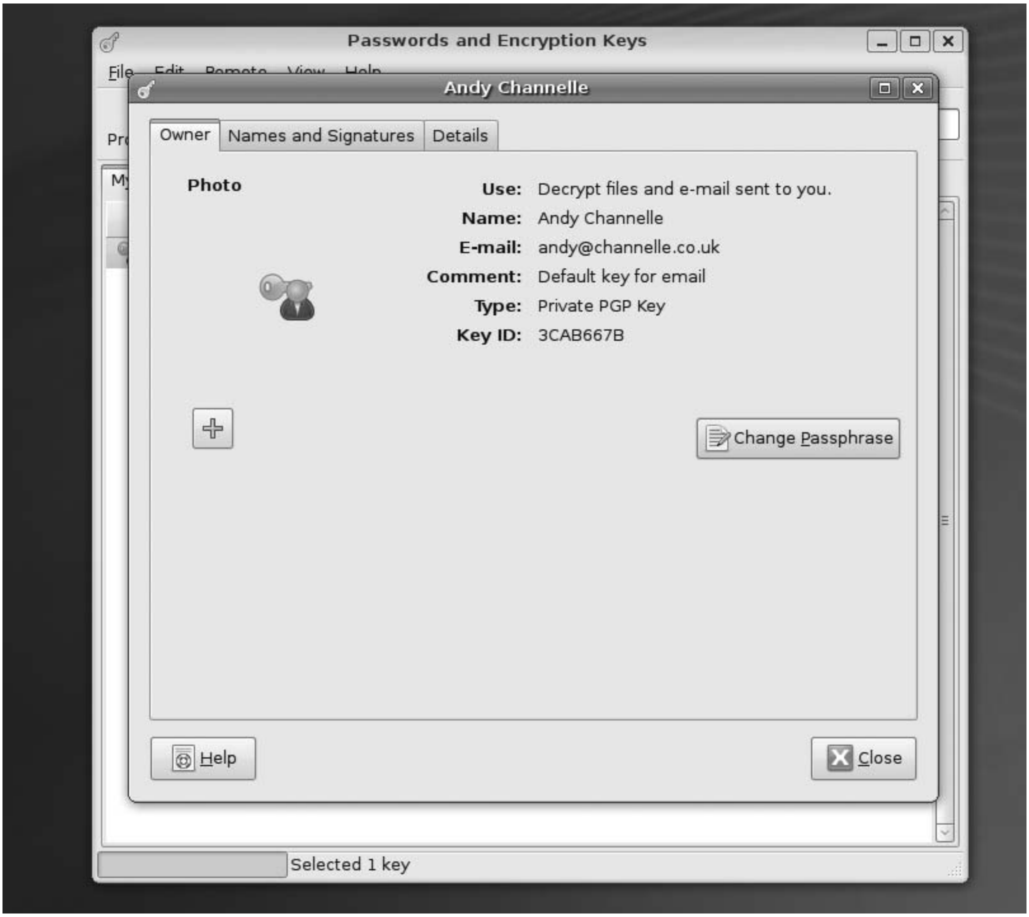

Figure 9-6. *You can change your passphrase anytime by using the Properties box. You'll need your original passphrase to do it, though.*

Exporting Your Public Key

As mentioned earlier, your public key must be shared with others if you want them to be able to encrypt messages or files so that only you can access them, or if you want them to authenticate any signed e-mail messages you send them. To do this, you use Seahorse to export your public key—effectively, to make it available as a file that can be e-mailed to others, or perhaps stored in a flash disk that is given to other people.

Note If recipients of signed e-mail don't have your public key, they won't be able to authenticate your e-mail signature, but they will still be able to read the message and access any attached files. The signature will probably show up as a `.pgp` file attached to the e-mail. Have you ever received an e-mail message with a file called something like `signature.pgp` attached? Now you know what it is!

Exporting the key is as simple as running Seahorse (Applications ➤ Accessories ➤ Passwords and Encryption Keys), selecting your key in the My Personal Keys tab, and then clicking the Export button. You'll be prompted to save the file to your preferred location, as shown in Figure 9-7. After the file is saved in your `/home` directory, you can distribute it in any way you like.

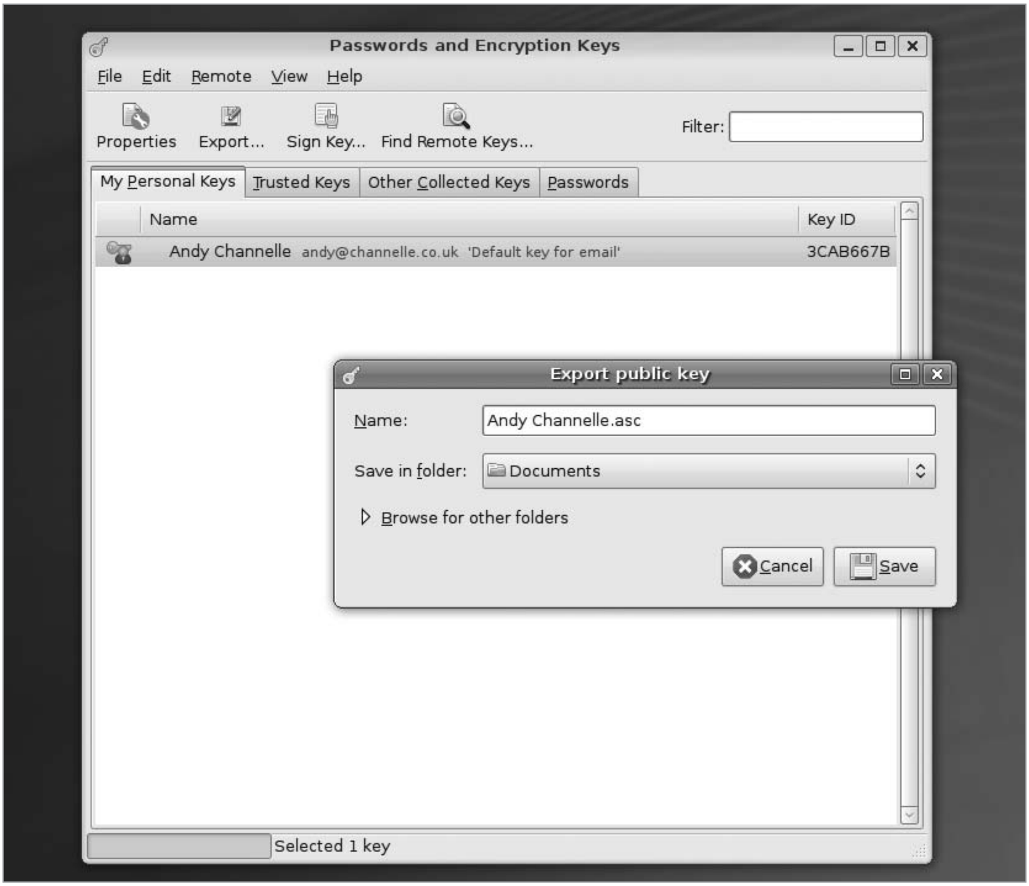

Figure 9-7. *Using Seahorse, you can export your public key for distribution.*

Publishing Your Public Key

For wider distribution of your public key, you can publish it in a public key server. This makes it easily available to anyone with Internet access, and it is the preferred method of sharing public keys. The steps to publish your key are as follows:

1. Run Seahorse (Applications ➤ Accessories ➤ Passwords and Encryption Keys) and click Remote ➤ Sync and Publish Keys.
2. The Sync Keys dialog box appears, as shown in Figure 9-8. To be able to sync your key, you first need to click the Key Servers button and specify where your key will be published.

Figure 9-8. *You need to edit your key servers settings to be able to sync your public key to your preferred key server.*

3. You will be taken to the Key Servers tab of the Preferences dialog box to customize key server settings. Here you can specify where to look for keys and where to publish your key. The most popular key server to use is `pgp.mit.edu`, which you can select from the Publish Keys To drop-down list, as shown in Figure 9-9. Choose your server and then click the Close button.

4. Back in the Sync Keys dialog box, click the Sync button to publish your key.

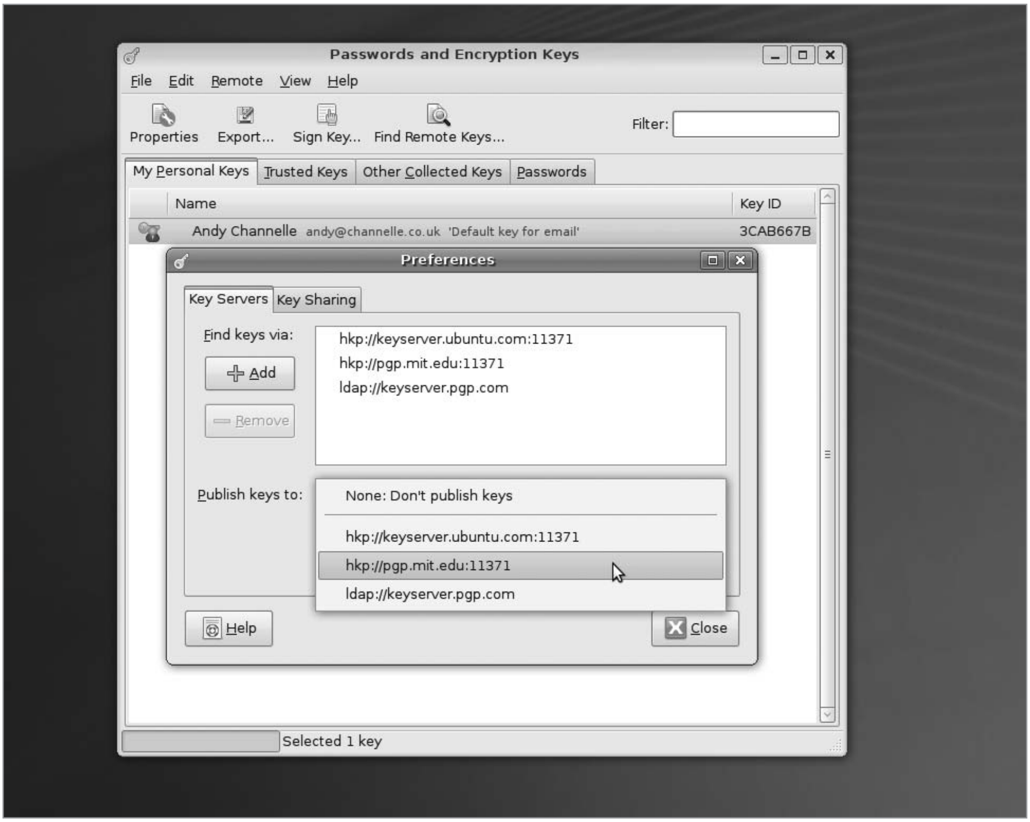

Figure 9-9. *Click the Publish Keys To combo box to select where your key will be published.*

Importing and Signing Public Keys

To be able to encrypt e-mail or files for others, and also verify their signatures, you need to import and then trust *their* public keys. You can obtain a public key from the person who created it or from other people who have that person's public key, or look it up from a key server.

If you've obtained the public key file personally (maybe on a floppy disk or via a USB flash drive) and is it is accessible on your computer, you can import the key by running Seahorse (Applications ➤ Accessories ➤ Passwords and Encryption Keys) and choosing File ➤ Import. In the file dialog box that appears, browse your folders for the public key file that you would like to import, select that file, and click the Open button. To verify that the key was imported, in the Passwords and Encryption Keys dialog box, click Other Collected Keys and make sure that the key you just imported appears in the list.

You can also look for the key from the key server, which is perhaps easier and preferred by most people. To do so, click the Find Remote Keys button in the Passwords and Encryption Keys dialog box. The Find Remote Keys dialog box appears. In the Search for Keys Containing text box, type the name of the person you are looking for and click the Search button. In the search results area, select the key you want to import, and then click the Import button.

■ **Caution** When importing keys from a public key server, you cannot be so sure that these keys are actually owned by persons you want to communicate with in a secure manner. However, one solution for this is the so-called *web of trust*, whereby people can vouch for the authenticity of a key by signing it. See `http://en.wikipedia.org/wiki/Web_of_trust` for more information.

After the imported key is in the Other Collected Keys tab, you need to sign the key to be able to send encrypted e-mail messages to the person who owns the key. You can also use the imported key to verify the authenticity of the e-mail messages you have received from that person. To do so, follow these steps:

1. Select the key to sign in the Other Collected Keys tab and click the Sign Key button. The Sign Key dialog box appears, as shown in Figure 9-10.

   You can answer the question "How carefully have you checked this key?" based on how you verified the key: Not At All, Casually, or Very Carefully.

2. Your choice for "Others may not see this signature" affects the credibility of the key when you subscribe and sync your relationships to the key server. If you don't select this check box, your trust relationship will be manifested on the key server for the public to see, which is basically saying that you are vouching for the authenticity of this person's key to the public. This is helpful and convenient in reducing the number of keys to sign by others, by trusting the keys signed by you.

3. The "I can revoke this signature at a later date" option allows you to revoke the key. This lets you invalidate your trust with the key for reasons such as the key has been compromised and misused or if you discover the key is actually a fake.

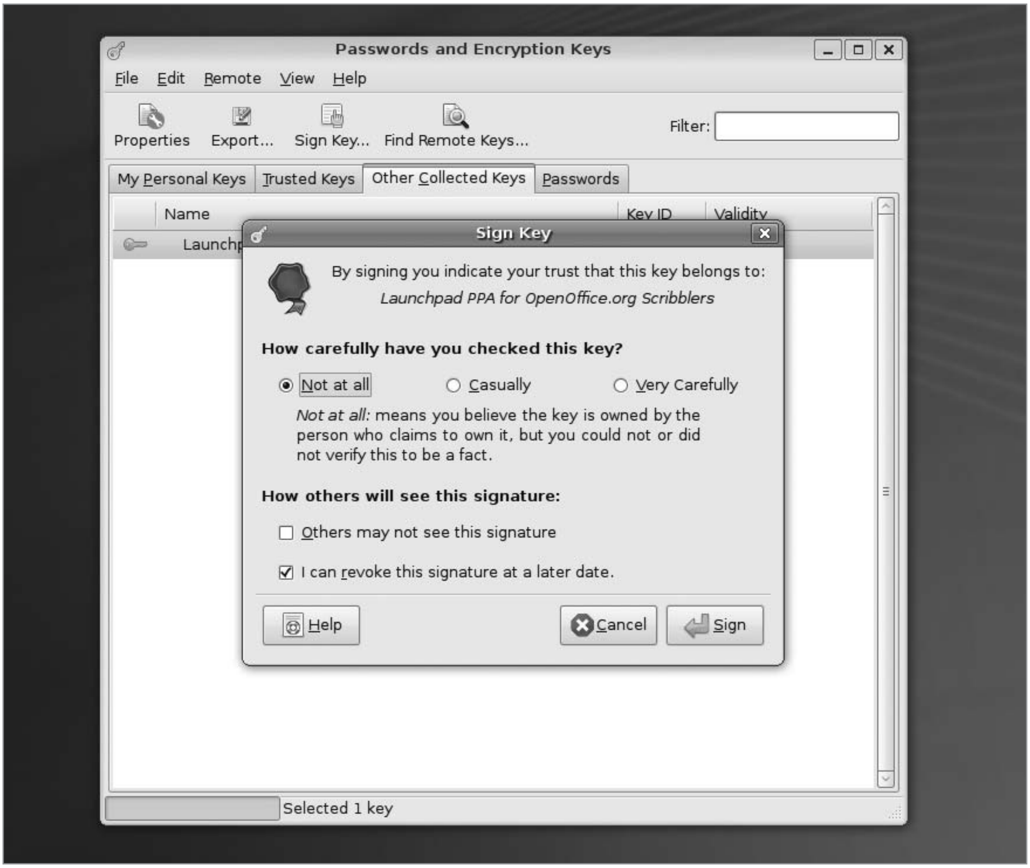

Figure 9-10. *Signing a key is a way of vouching for the key's authenticity.*

4. After making your selections in the Sign Key dialog box, click the Sign button to continue.

5. The Enter Passphrase dialog box appears. You need to provide the password you have entered when you created your PGP key. Supply that password and click OK. At this point, the key has been signed and is now listed in the Trusted Keys tab.

■ Tip To reduce the number of keys to sign, you can trust the keys signed by the key that you trust. Click the Trusted Keys tab in Seahorse, and then double-click the key to view the key's properties. When the key's properties appear, click the Trust tab and select the option "I have checked that this key belongs to <*name*> and I trust signatures from <*name*> on other keys." Click Close. When you import new keys that are trusted by this key, those keys will automatically be part of the trusted list in the Trusted Keys tab.

Encrypting and Decrypting Files

After you've set up your encryption keys, you start encrypting files, either to store them in encrypted form within your own system or to pass them on to others. You can also decrypt your own encrypted files or files encrypted by others that are intended for you. These features are integrated into Nautilus, which makes encryption and decryption easy to accomplish.

Encrypting a File

To encrypt a file, follow these steps:

1. Open your `/home` directory by clicking Places ➤ Home Folder.
2. Select a file or folder that you want to encrypt. Right-click the selected item and select Encrypt, as shown in Figure 9-11.

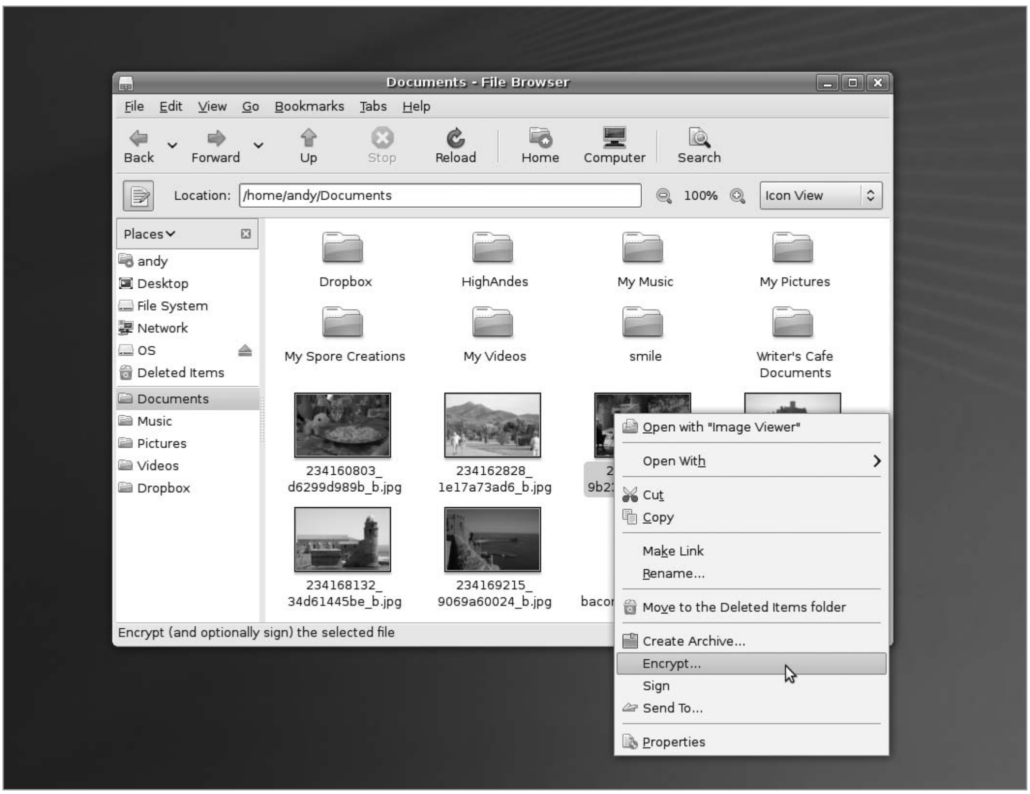

Figure 9-11. *Encrypting a file or folder is a context menu option in Nautilus.*

3. Select the recipients of the encrypted file, as shown in Figure 9-12. To encrypt a file for yourself, put a check alongside your own key. To encrypt for others, put a check alongside their names. You will need to have imported their public keys, of course. Click OK to continue.

Caution Remember that the persons you select will be the only ones able to decrypt the file. After the file is encrypted for someone else, you *won't* be able to decrypt it!

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4. If you selected to encrypt more than one file, the Encrypt Multiple Files dialog box will appear, as shown in Figure 9-13. You can opt to encrypt each file separately or have the multiple files packed together in an encrypted compressed file, with the compression type of your choice. Select your preferred settings, and then click the OK button to continue.

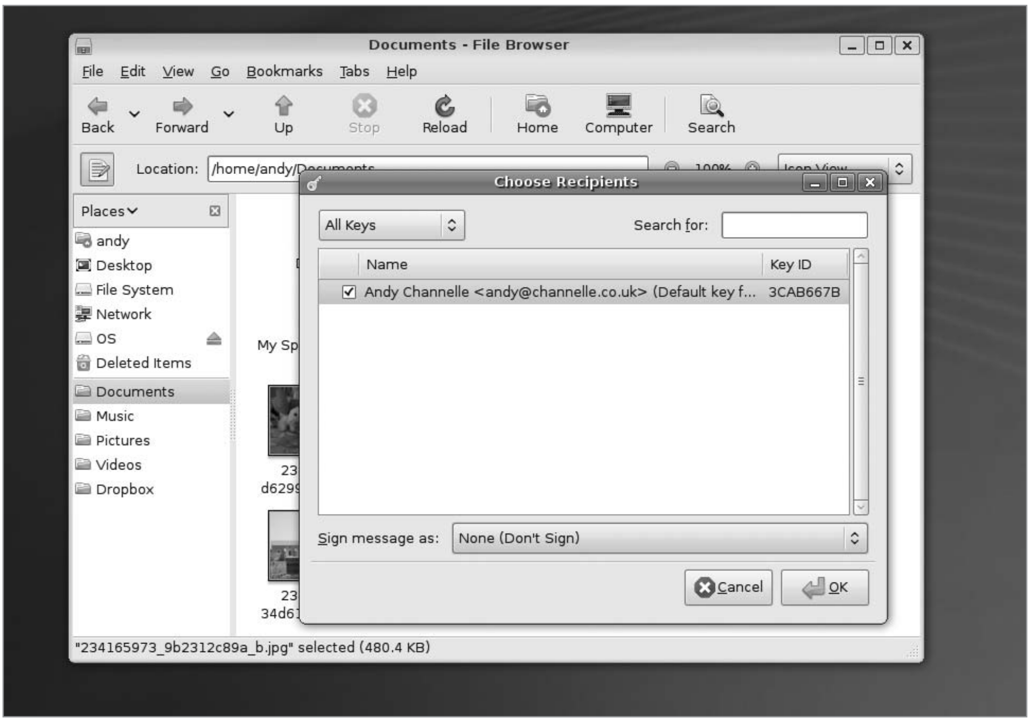

Figure 9-12. *Select recipients of the files or folders you would like to encrypt from your created and imported keys.*

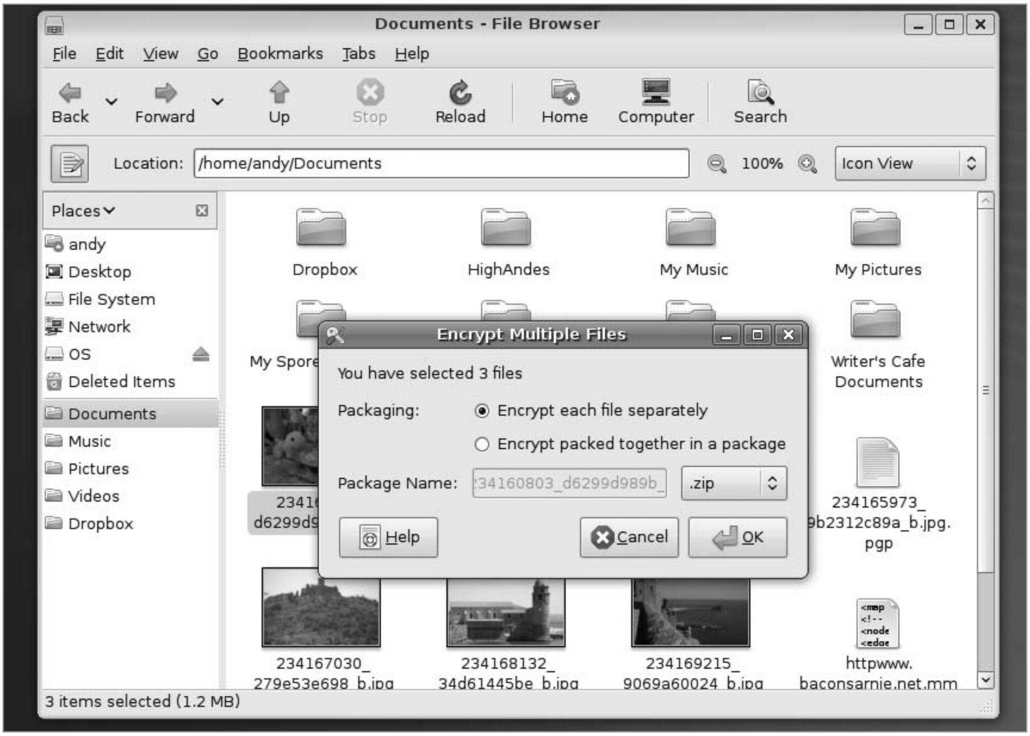

Figure 9-13. *If you are encrypting multiple files, you can opt to encrypt each file or store all files in a compressed file and have that compressed file encrypted.*

5. After a file or folder has been encrypted, it will appear on your file system as a new file with a `.pgp` extension, as shown in Figure 9-14. This can then be passed on to your contact, if the file was encrypted with her public key, or filed away for storage if it was encrypted using your private key. For instructions on how to decrypt the file, see the following section.

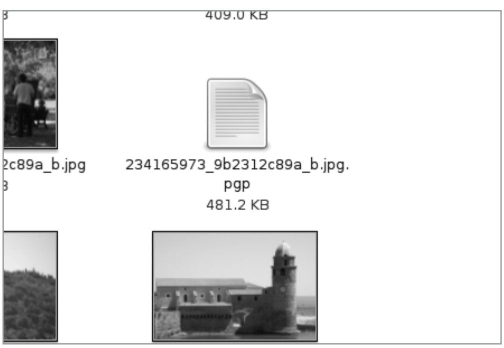

Figure 9-14. *The encrypted file has the extension of* `.pgp`.

Decrypting a File

To decrypt a file, do the following:

1. Open your `/home` directory by clicking Places ➤ Home Folder.
2. Select the file that you want to decrypt. The file extension is typically `.pgp`.
3. Double-click the file.
4. Type the passphrase that you entered when creating your key earlier.
5. The file will then be decrypted in the folder where the encrypted file is stored. It will have its original filename.

Signing and Encrypting E-Mail

After you've set up your encryption keys, you can send e-mail with your digital signature to signify the authenticity of your e-mail, as well as encrypt e-mail so that the intended recipient is the only one capable of reading your mail, and vice versa. As long as you've configured your PGP key, imported keys to trust, and configured your Evolution account, integrating this kind of security is seamless.

To sign and/or encrypt an e-mail message in Evolution, do the following:

1. In Evolution, choose File ➤ New ➤ Mail Message to compose a new e-mail message.
2. The Compose Message dialog box appears. Fill in the To field, Subject field, and the message.
3. Click Security. To mark the e-mail for signing, select the PGP Sign check box. To mark the e-mail for encryption, select the PGP Encrypt check box.
4. Click the Send button to send the e-mail.
5. If you chose to sign the message, the Enter Passphrase dialog box appears. Enter the password you assigned when you created your PGP key, and then click OK.

Your e-mail will be sent, signed, and encrypted as you specified.

Validating E-Mail

To be able to validate signed e-mail messages you have received from other people, you need to import their public keys and then trust them using Seahorse. When you receive signed e-mail messages, a note indicating the authenticity of the e-mail signature is placed at the very bottom of the message.

Decrypting E-Mail

To decrypt e-mail received from other people, your PGP key needs to be configured in Seahorse. You will need to use your key to decrypt the e-mail.

Just select the e-mail message you wish to decrypt, and you will see the Enter Passphrase dialog box. Enter the password to your PGP key and click OK. You will now be able to view the e-mail in plain text form.

Commonsense Security

As you start to understand how Ubuntu works, you'll become more and more aware of commonsense methods that will protect your system. However, we'll outline a few of these now to get you started:

Entering your password: Be very wary if you're asked to enter your password (outside initial login, of course). You'll be asked to provide your password when following many of the configuration steps within this book, for example, and this is acceptable and safe. But if you're asked to do so out of the blue, you should be suspicious. If the root password prompt dialog box (shown in Figure 9-15) appears when you run a file that shouldn't really need root permissions, such as an MP3 or OpenOffice.org file, you should treat the situation with caution.

Creating perfect passwords: Setting up good security inevitably involves having a good, strong password. The challenge is to create something easy to remember but hard to crack, so it should involve punctuation, numbers, and an assortment of uppercase and lowercase letters. Perhaps you could base a password on a favorite song. For instance, `TiaLTNGO@TQiD1986-4:02` is a great password. To remember it, I just need to know that "There is a Light That Never Goes Out" was a track on *The Queen is Dead* in 1986 and it was 4 minutes and 2 seconds long. In contrast, `password`, `password4`, and `andy1302` are poor because they are open to dictionary attacks, in the case of the first two, or personal information attack in the third case.

Installing new software: Be careful in choosing programs to download and install. Because Linux works on the basis of open source code, theoretically, anyone can tamper with a program and then offer it for download by the unwary. This rarely happens in real life. Even so, it's wise to avoid downloading programs from unofficial sources, such as web sites you find online via a search engine and whose authenticity you cannot totally trust. Instead, get software from the web site of the people who made it in the first place or, ideally, from the official Ubuntu software repositories (discussed in Chapter 28).

Figure 9-15. *Beware if you're asked to type your password out of the blue and for no apparent reason.*

Updating your system: Always ensure that your system software is completely up-to-date. As with Windows, many Ubuntu programs have bugs that lead to security holes. Crackers target such vulnerabilities. Downloading the latest versions of Ubuntu software ensures that you not only get the latest features, but also that any critical security holes are patched. As with most versions of Linux, updating Ubuntu is easy and, of course, it's also free of charge. You'll learn how to get online updates in the next section.

Locking up your PC: Attacks can be either remote or local, so in addition to online security, you should limit who has physical access to your computer. Any Ubuntu system can be compromised by a simple floppy boot disk, or even by just selecting the rescue mode entry on the boot menu, which will provide the user with root access to the computer. This is for obvious reasons; the idea of a boot disk or the rescue mode is to let you fix your PC should something go wrong, and you cannot do this if you're blocked from accessing certain files. When Linux is used on servers that hold confidential data, it's not uncommon for the floppy and CD-ROM drives to be removed, thus avoiding booting via a boot disk. Such computers are also usually locked away in a room or even in a cupboard, denying physical access to the machine. Another option might be to add a BIOS password to the computer, meaning you'll be prompted for it during the boot process. The method for setting this up will be dependent on your computer type, but generally, look for the BIOS Setup option when the computer is booting. Obviously, make sure you never forget a BIOS password, because a computer that doesn't boot is not very useful.

Online Updates

The Ubuntu notification area (the equivalent of the Windows system tray) at the top right of the screen contains a program that automatically monitors the package repositories and tells you when updates are available. This is an extension of the Synaptic Package Manager program, called Update Manager. If you haven't yet updated your system, this icon will have probably turned into a white arrow pointing down, enclosed in an orange star. This is informing you that updates are available. In addition, each time you boot, you will see a speech bubble telling you that updates are available. When your system is completely up-to-date, the icon will not be visible.

Clicking the Update Manager icon opens the Update Manager window, as shown in Figure 9-16. To go online and grab the updated files, simply click the Install Updates button at the bottom-right side of the window. You will probably be asked to enter your root password, because system files will need to be altered.

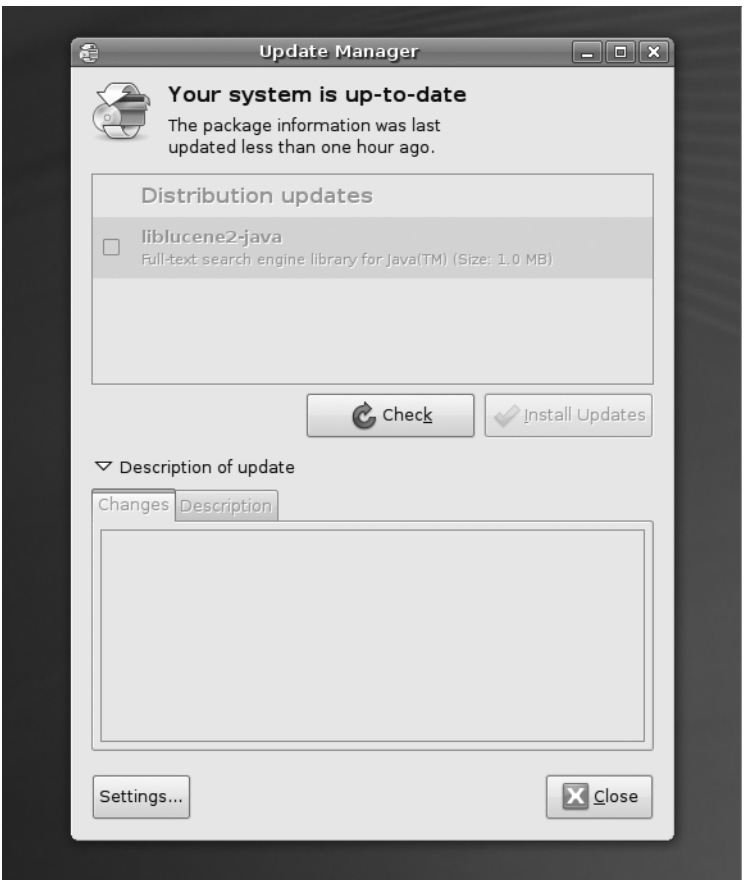

Figure 9-16. *You'll be informed if your system is in need of updates, and the Update Manager program can take care of everything for you.*

Be aware that some updates can be large and might take some time to download, particularly if you're doing it for the first time after installing Ubuntu.

After the downloads have finished, you probably won't need to reboot unless the kernel file has been updated. If you do need to reboot, or if the update requires you to take any other action (such as logging out and then back in again), the Update Manager icon in the notification area will turn into an information icon, or into two encircled arrows. You should then click the icon to see what action you're advised to take.

APPLICATION SECURITY WITH APPARMOR

A sad fact of computing life is that all software applications have bugs of some kind. Some of these are not serious (in fact, they may remain invisible), but some might lead to abnormal program termination, data corruption, or even system failure. The worst kind of bugs provide "back doors" into your system that can be used by crackers to wreak havoc.

Software developers fix reported bugs as quickly as possible (and one benefit of the open source approach is that solutions can come from third parties, speeding up the process), but the gap between discovering the bugs and providing a fix is a time when systems are vulnerable to attack. Taking advantage of such a vulnerability is called a *zero-day exploit*.

Fortunately, Ubuntu and several other types of Linux distributions have a clever built-in security mechanism called AppArmor, which oversees software applications and ensures that they don't do things that they shouldn't. Effectively, AppArmor "sandboxes" applications so they go only where they should within the system.

AppArmor is relatively new to Ubuntu. Although it's integrated into the underlying systems, it has yet to be made easily available to the user for configuration. Currently, the only way to configure AppArmor under Ubuntu is by using the command line. This will probably change in the future.

AppArmor is primarily intended to protect server systems—large computers that store and distribute data to others. As such, AppArmor is not particularly aimed at desktop users, although there is no reason why the intrepid desktop user can't make use of it.

The software works on the principle of *least privilege*, which means that each application is granted only the bare minimum of system resources it requires to run properly. Should the application prove to have a flaw, that means it can be compromised; the damage would therefore be limited in its scope.

AppArmor implements this scope by way of *profiling* each application. A profile is a configuration file that contains details about what the application may do. The default installation of Ubuntu contains several profiles stored in `/etc/apparmor.d`. Several more profiles can be added by using the Synaptic Package Manager to install the package `apparmor-profiles`. Additionally, new applications you install may come with their own AppArmor profiles. After additional profiles are installed, they are automatically utilized.

Each application can run in one of two modes:

- **Enforce mode**: In this mode, AppArmor implements the permissions and capabilities listed in the profile. If the application tries to access a file or use a capability that is not listed in the profile, the operation will not be permitted.
- **Complain mode**: In this mode, AppArmor records the violations incurred by an application when it violates the rules imposed in the profile and stores them in the system log. These logs can be used later for creating or updating a profile of an application.

To determine which profiles and programs are running in enforce or complain mode, open a terminal window (Applications ➤ Accessories ➤ Terminal) and issue the command `sudo apparmor_status`.

To learn more about how to use AppArmor with Ubuntu, including how to create your own application profiles, see `https://help.ubuntu.com/community/AppArmor`.

Configuring the Ubuntu Firewall

A *firewall* is a set of programs that protects your PC when it's online. It does this by watching incoming and outgoing connections between your PC and the Internet and allowing past only what it is sure is secure (which usually is what you've asked for). It also attempts to close off various aspects of your Internet connection, so that crackers don't have a way in should they target your system.

The benefit of configuring the firewall is that even if your system has security vulnerabilities because of buggy software, crackers will find it a lot harder to exploit them across the Internet. When someone attempts to probe your system, it will appear to be virtually invisible.

Caution Although software firewalls such as the one built into Linux offer a high level of protection, it's best to use them in concert with a hardware firewall, such as that provided by most DSL/cable broadband routers (curiously, some of these routers actually use Linux's iptables software as well). Many security experts agree that relying solely on a software firewall to protect a PC affords less than the optimal level of protection.

Although Ubuntu includes a powerful firewall in the form of iptables, you'll also need a program that can manage it. Here we'll show you how to use Firestarter, available from the Ubuntu software repository, for this purpose. The configured built-in firewall really does provide very strong protection.

■ **Note** Power users might choose to configure Ubuntu's firewall without installing Firestarter. The command-line tools iptables and ufw are installed by default and are preferred by some system administrators. Iptables is a configuration tool used to manage Netfilter, the feature in the kernel that handles the firewall. Unfortunately, with iptables, you need to understand how TCP/IP works and learn cryptic commands to be able to make full use of it. But armed with that knowledge, you can turn your PC into a full-fledged, budget software router with features that rival or surpass hardware routers. Ufw (for *uncomplicated firewall*) is a configuration tool that also manages the Netfilter firewall. It's easier to use than iptables because a firewall rule in ufw is usually terse and readable by humans. For more information about ufw, refer to its man page (choose Applications ➤ Accessories ➤ Terminal to open a terminal window and issue the command `man ufw`).

Installing Firestarter

Let's get started by downloading and installing Firestarter. Follow these steps:

1. Choose System ➤ Administration ➤ Synaptic Package Manager. You'll need to enter your password when prompted. Click the Search button and enter **firestarter** as a search term. In the list of results, locate the program and click the check box. Then choose to install the package, and click Apply on the Synaptic toolbar.

2. After the desktop is back up and running, choose System ➤ Administration ➤ Firestarter, or Application ➤ Internet ➤ Firestarter. When you run Firestarter for the first time, you'll be prompted for your password. Then a wizard will start to take you through the setup.

3. Click the Forward button to continue the wizard beyond the introductory page.

4. The first step asks which network interface Firestarter should configure, as shown in Figure 9-17. If you use an Ethernet card, have a wireless card, or attach a broadband modem directly to your computer, the answer will probably be `eth0` or `wlan0`. However, if you use a modem, the answer is `ppp0`.

Figure 9-17. *Firestarter includes a wizard to walk you through the basics of firewall configuration.*

5. Put a check in the "IP address is assigned via DHCP" box, unless you're using a dial-up modem. If you are using a dial-up modem, select "Start the firewall on dial-out" check box. After making your choices, click the Forward button.

   You're asked whether you want to enable Internet connection sharing. This allows you to turn your computer into an Internet router and can be very useful in certain circumstances. You can activate this later on by running the wizard again. Click Forward to continue.

■ **Note** To rerun the wizard, simply click Firewall in Firestarter's main window, and then click Run Wizard.

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6. The wizard will finish. Click the Save button to save your settings to disk. In addition, ensure that the Start Firewall Now check box is selected. After this, the Firestarter main window opens, and the software is active. You'll also see a new icon appear in the notification area of the desktop. This tells you that the firewall is running and will react to different types of threats or connections.

Configuring Firestarter

Firestarter works by controlling the data that goes into and out of your computer via your Internet or network connection. By default, it blocks every type of uninvited inbound connection but allows every type of outbound connection.

Whenever you click a link on a web page, your computer sends a request for data to the web server hosting the web page. Within a few milliseconds, that data will be sent to your computer. This is an inbound data connection. The Linux firewall is clever enough to realize that the data was requested by you, so it is allowed through. However, any uninvited connections are turned away. If, out of the blue, someone attempts to connect to your computer via the popular Secure Shell (SSH) tool, as just one example, he won't be allowed to make that connection. This is a good thing, because it makes your computer secure. Crackers are turned away whenever they try to connect, no matter how they try to connect.

But in some circumstances, allowing uninvited connections is useful. For example, if you create a shared folder for other computers in your office to connect to, they will frequently make uninvited inbound connections to your computer whenever they want to grab a file. Protocols such as BitTorrent, too, rely on many incoming connections. Also, if you want to make use of SSH to connect to your computer remotely, you will need to allow such incoming connections. Therefore, Firestarter lets you allow through certain types of inbound connections.

In the terminology of Firestarter (and many firewall programs), *outbound traffic* is any kind of data originating on your computer that is sent out on the network and/or Internet. By default, Firestarter allows out all data, no matter what it is. This is described as a *permissive policy*. But Firestarter can be configured to block all outgoing connections apart from those you configure Firestarter to allow. This is described as a *restrictive policy* and can be useful in blocking certain types of programs that "phone home" with personal data about you, such as spyware.

■ **Note** Unlike with Windows, we've never heard of a Linux program that contains spyware that "phones home" in this way. Nevertheless, a cautious attitude often pays dividends.

A restrictive policy can also prevent certain types of viruses and worms from spreading. The downside of a restrictive policy is that you must configure Firestarter to take into account every type of outgoing data connection that you do want to allow through, such as those for web browsers, instant messaging programs, and so on.

You can configure Firestarter by clicking the Policy tab in the main program window. Click the Editing drop-down list, and choose to configure either the inbound traffic policy or the outbound traffic policy.

■ **Note** Firestarter is used only to configure the built-in firewall and doesn't need to be running for the firewall to work. After you've finished configuration, you can quit the program. You'll need to use it again only if you want to reconfigure the firewall.

Setting Inbound Rules

For most users, Firestarter's default inbound traffic policy will be perfectly acceptable. It configures the firewall to disallow all uninvited incoming data connections, apart from certain diagnostic tools, such as ping, traceroute, and so on. You can choose to disallow those as well, as described shortly in the "Turning Off Diagnostic Services" section.

You might want to allow an incoming connection if you intend to connect to your computer via SSH from a remote location or if you have a shared folder created for other computers in your office. It's a must if you're running the BitTorrent file-sharing application. Additionally, if you run a web, an e-mail, or another type of server on your computer, you will need to allow the correct type of incoming connection here.

Here's how to set inbound connection rules:

1. In the Firestarter main window, click the Policy tab. Select Inbound Traffic Policy in the Editing drop-down list.

2. Right-click in the second box on the Policy tab (with the headings Allow Service/Port/For), and then select Add Rule.

3. The Add New Inbound Rule dialog box appears. In the Name drop-down list, select the type of outgoing connection you want to allow, as shown in Figure 9-18. To allow others to access shared folders on your computer, select Samba (SMB). To allow SSH or BitTorrent connections to your computer, select the relevant entry from the list. Selecting the service will automatically fill in the Port box, which you shouldn't alter unless you know exactly what you're doing.

4. If you know the IP address of the computer that's going to make the incoming connection, you can click the IP, Host, or Network radio button, and then type in that address. However, the default of Anyone will allow anyone using any IP address to connect to your computer.

5. Click Add. Back in the main Firestarter window, click the Apply Policy button on the toolbar.

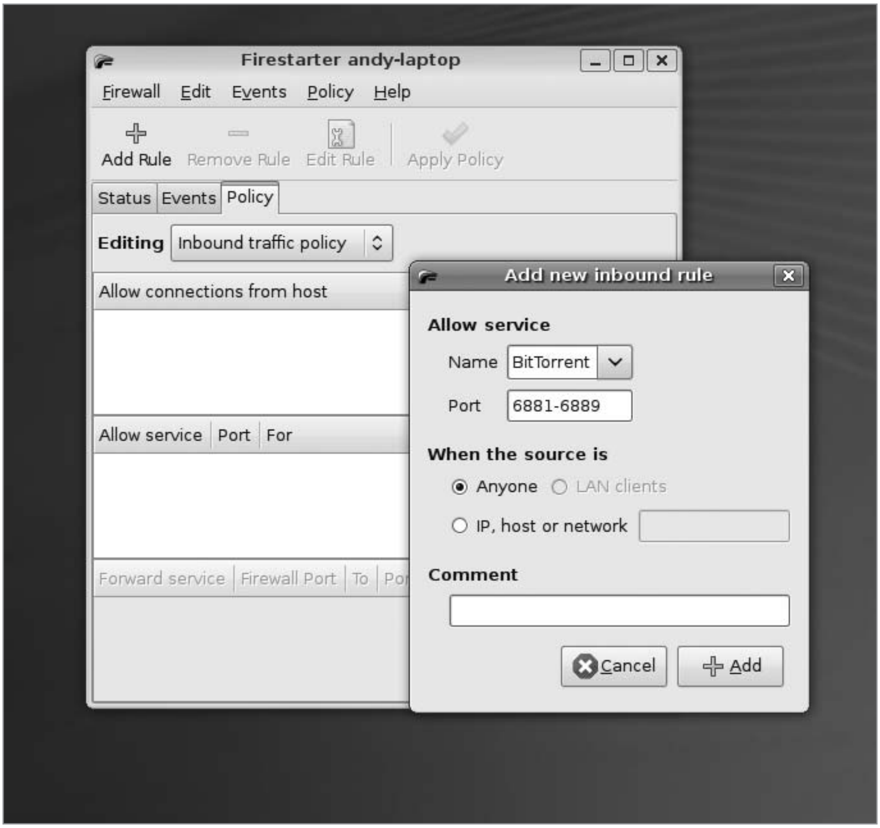

Figure 9-18. *Creating an inbound rule enables computers to connect to your PC uninvited, but only if they meet the conditions of the rule.*

■ **Note** You'll need to return to Firestarter whenever you activate new services on your computer. For example, in Chapter 12, you will look at accessing Windows shares across a network, and you'll need to enable SMB incoming and outgoing access for this to work. In Chapter 33, you will look at using the SSH service, which will have to be allowed through the firewall. In other words, securing your computer isn't something you can do once and then forget about. It's a continual process.

Setting Outbound Rules

By default, Firestarter allows all types of outgoing connections and, as with its incoming connections policy, this is by no means a bad choice for the average user. It's certainly the option that involves the least fuss. However, by opting to go with a restrictive traffic policy, you can completely control what kind of data leaves your computer. Any type of data connection that isn't authorized will be refused; as far as the program sending the data is concerned, it will be as if your computer did not have a network or Internet connection.

Here's how to set outbound connection rules:

1. In the Firestarter main window, click the Policy tab. Select Outbound Traffic Policy in the Editing drop-down list.
2. Click the Restrictive by Default, Whitelist Traffic radio button.
3. In the second empty box at the bottom of the Policy tab (which has the Allow Service/ Port/For headings), right-click and select Add Rule.
4. The Add New Outbound Rule dialog box appears. In the Name drop-down list, select the type of data connection you wish to allow. At the very least, you should select HTTP. This will allow your web browser to operate correctly (it's also needed to allow the Synaptic Package Manager and Update Manager programs to work). HTTPS should also be allowed—this is the secure version of HTTP used to access the likes of online banking sites, online shopping services, and some online e-mail services. You should also add a rule for POP3 and another for SMTP, without which your e-mail program won't work. Selecting the type of service will fill in the Port box automatically. You shouldn't alter this unless you know what you're doing.

■ **Note** You can add only one rule at a time. You'll have to repeat steps 3 and 4 several times to add rules for each service you want to allow.

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5. Click the Add button to add the rule. Back in the Firestarter main window, click Apply Policy.
6. Test your settings with a program that uses the services you've just authorized.

■ **Caution** If you created an inbound rule, you'll need to create a matching outbound rule. If you created an incoming rule for BitTorrent, for example, you'll need to create an outgoing rule for BitTorrent too.

You can delete both incoming and outgoing rules by right-clicking their entries in the list and selecting Remove Rule.

Turning Off Diagnostic Services

Certain network tools can be misused by crackers to break into a computer or just cause it problems. In the past, the traceroute and ping tools, among others, have been used to launch denial-of-service (DoS) attacks against computers.

Ubuntu is set to allow these tools to operate by default. If you want to adopt a belts-and-suspenders approach to your computer's security, you can opt to disable them. If you don't know what ping and traceroute are, you're clearly not going to miss them, so there will be no harm in disallowing them. Here's how:

1. In the Firestarter main window, click Edit ➤ Preferences.

2. On the left side of the Preferences window, click ICMP Filtering. Then click the Enable ICMP Filtering check box, as shown in Figure 9-19. Don't put a check in any of the boxes underneath, unless you specifically want to permit one of the services.

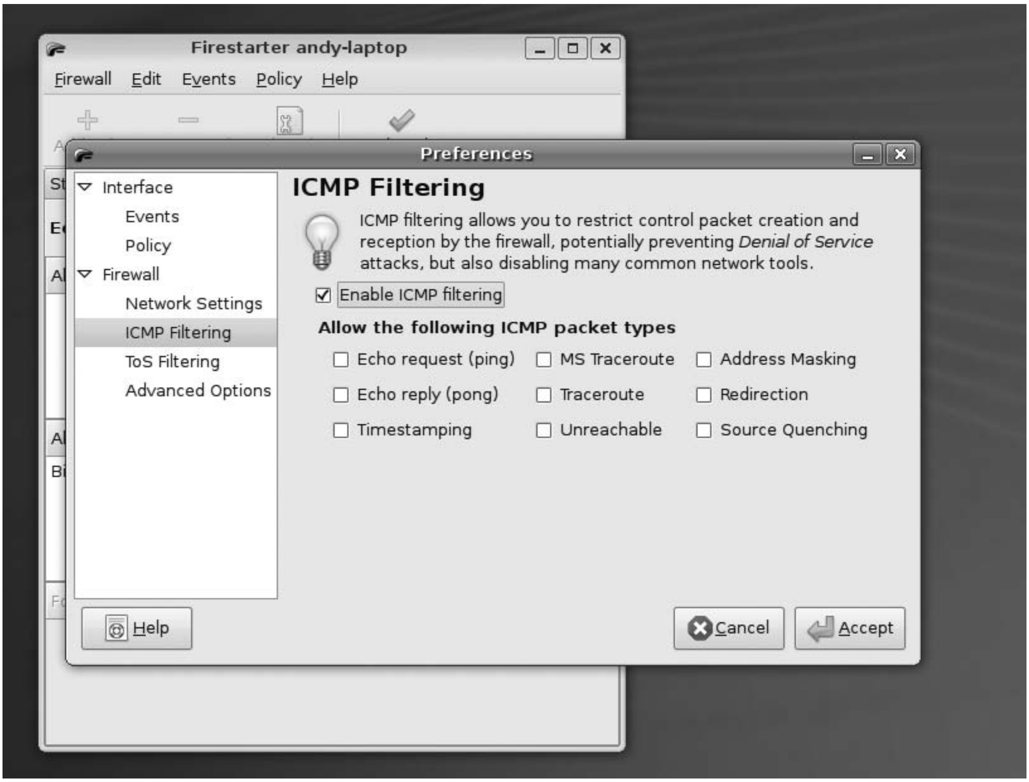

Figure 9-19. *By deactivating traceroute, ping, and other services, you can add extra protection to your PC.*

3. Click the Accept button to finish.

PARANOIA AND SECURITY

There's a fine line between security and paranoia. Using Firestarter gives you the opportunity to ensure that your system is secure, without needing to constantly reassess your system for threats and live in fear.

When considering your system security, remember that most burglars don't enter a house through the front door. Most take advantage of an open window or poor security elsewhere in the house. In other words, when configuring your system's security, you should always select every option and extra layer of security, even if it might not appear to be useful. You should lock every door and close every window, even if you don't think an attacker would ever use them.

Provided a security setting doesn't impact your ordinary use of the computer, you should select it. For example, deactivating the ping response of your computer might sound like a paranoid action, but it's useful on several levels. First, it means your computer is less easy to detect when it's online. Second, and equally important, it means that if there's ever a security flaw in the ping tool (or any software connected with it), you'll be automatically protected.

This illustrates how you must think when configuring your system's security. Try to imagine every situation that might arise. Remember that you can never take too many precautions!

Adding Virus Scanning to Ubuntu

As mentioned in the chapter introduction, Linux (and therefore Ubuntu) is not currently affected by many viruses. Nobody knows the true number of viruses affecting Linux, but it is probably less than 1,000, and that's the total since Linux was created back in the early 1990s! At the time of this writing, there are relatively few Linux viruses in the wild, which is to say, actively infecting computers.

However, there can be no room for complacency. It's probable that virus writers will turn their attention to Linux in the coming years as it becomes a popular desktop solution. It's also important to be vigilant because your Ubuntu system may be interacting with Windows computers and may act as a carrier of Windows viruses.

This section describes how to use ClamTk, which is a graphical front end for the Clam AntiVirus (ClamAV) program (`www.clamav.org`). ClamAV is an open source, industrial-strength antivirus scanner designed to work on all kinds of computers and operating systems. It detects Windows and even Macintosh viruses, as well as Linux and Unix viruses. This has obvious benefits if you share files with Windows users—you can inform your friends and colleagues if any files they give you are infected (and bask in the warm feeling that arises when you realize the viruses can't affect your system!).

ClamAV's only drawback is that it is limited to virus scanning. It isn't able to disinfect files, like the more sophisticated virus scanners available for Windows. However, it should be noted that disinfection rarely works very well, as discussed in the ClamAV FAQ (`www.clamav.org/support/faq`).

Installing ClamTk

You can install ClamAV and ClamTk through the Synaptic Package Manager, as follows:

1. Choose System ➤ Administration ➤ Synaptic Package Manager. You'll need to enter your password when prompted.
2. Click the Search button and enter **clamtk** as a search term.
3. In the list of results, locate the program and click the check box.
4. Choose to Mark for Installation.
5. When prompted to mark additional required changes, click the Mark button. This ensures that ClamTk, ClamAV, and their dependencies will be installed. The whole antivirus system involves a 26MB download.
6. Click the Apply button on the Synaptic toolbar.

Updating the ClamAV Database

Before you scan for viruses, you should update the virus database. This should be done every time you scan and can be done using the ClamTk program.

■ **Note** When you installed ClamAV, it added a background service called `freshclam`, which periodically downloads updates for ClamAV's database. However, manually updating before scanning is also a good idea, to ensure that you're always using the very latest version of the database at the time of scanning.

In order to update the database, ClamTk needs to access system files, so it needs to be run with root powers. To do this, open a terminal window (click Accessories ➤ Terminal), type `gksu clamtk`, and press Enter. Enter your password when prompted. (`gksu` is like `sudo`, in that it gives the program you specify administrator powers, except it's used for GUI applications.) Click Help ➤ Update Signatures. Updating can take a few moments, and you'll see a progress report in the ClamTk window beneath the toolbar. When ClamAV is first installed, it automatically grabs the latest database file, so ClamTk will probably report it's already up-to-date the first time an update is run.

It's also possible to update ClamAV without using ClamTk—just type `sudo freshclam` in a terminal window. Note that when using the `freshclam` command to update, you might see a warning that your version of ClamAV is out-of-date. This is because the Ubuntu packages are sometimes a version or two behind the main release. However, this isn't a significant issue, and ClamAV will still be able to scan for viruses, and virus definitions will stay up-to-date.

Scanning for Viruses

With Windows virus scanners, you might be used to performing whole system scans. This isn't advisable with ClamAV, because it simply isn't designed for that task. Instead, ClamAV is designed to scan user files, such as documents.

■ **Note** ClamAV is actually primarily designed to be used in concert with a mail server and to scan incoming or outgoing mail attachments. See the About page at the ClamAV web site (`www.clamav.org/about`).

You can try performing a full system scan, but in our tests, several false positives were identified, meaning that ClamAV identified innocent files as containing viruses. Because of this, it's best to use ClamAV to scan just your personal files for viruses, which is to say, those within your `/home` directory. Bear in mind that this is where all files you import to your computer will likely be installed, so this is where an infection is most likely to be found.

To scan your personal files, follow these instructions:

1. Start ClamTk by clicking Applications ➤ System Tools ➤ Virus Scanner. On the initial launch, you can define whether antivirus signatures are updated for a single user or for all users. If you have a multiuser system, you should choose the latter.

2. Before starting the scan, it's useful to ensure that hidden files are scanned. After all, a virus is likely to try to hide, rather than make its presence obvious! This can be done by clicking Options ➤ Scan Hidden Files (.*).

■ **Note** Resist the temptation at this stage to select Delete Infected Files from the Options menu. This is because ClamTk might return a false positive—a file that it thinks contains a virus but that is actually perfectly safe. It's better to deal with viruses after they've been found on a one-by-one basis, rather than automatically.

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3. Although there's a button on the toolbar that lets you scan your `/home` directory with a single click, it won't scan recursively. That means it won't scan any folders (or folders of folders) within your `/home` directory, so it isn't of much use. To perform a recursive scan of your `/home` directory, click File ➤ Recursive Scan. Then click the OK button in the Select a Directory (Recursive) dialog box. This will select your `/home` directory. Of course, you can also select any other folders to scan at this stage.

4. The scan will start. Depending on the quantity of files in your `/home` directory and their sizes, it may take some time. You'll see a live status report beneath the toolbar, showing which file is currently being scanned. When the status line reads "Scanning Complete," the scan has finished. Running along the bottom of the window will be a complete status report, showing the number of files scanned and the number of viruses found, if any. See Figure 9-20 for an example. If any viruses are found, move on to the next section.

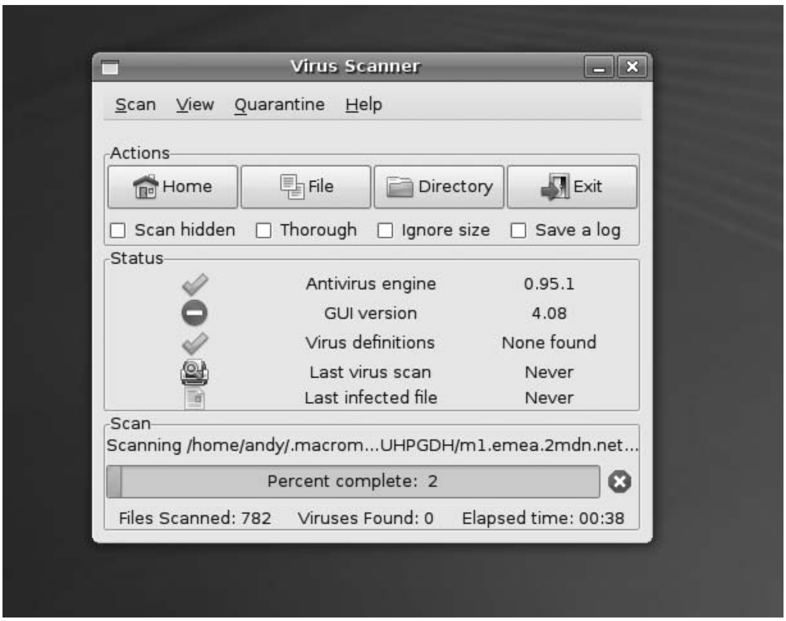


Figure 9-20. *You'll see a live status report detailing which files are being scanned below the toolbar in the ClamTk program window.*

Dealing with Infections

If any viruses are found, they will be listed in the ClamTk program window. The type of virus that's allegedly infecting the file will be listed in the Status column.

Be aware that ClamTk sometimes reports a virus when it simply can't access a particular file, perhaps because of file permission problems. If this is the case, you'll see Access Denied or Can't Open Directory in the Status column. You can ignore these files.

■Tip If you really want to scan files that require superuser permissions, you can run ScanTk with superuser powers. Open a terminal window (Applications ➤ Accessories ➤ Terminal) and type `gksu scantk`.

Entries in the list can be right-clicked and quarantined or deleted. Quarantining moves the file to a special directory for inspection or deletion later on. You can manage quarantined files by using the Quarantine ➤ Maintenance menu.

Although your impulse might be to simply delete the file, you should be cautious. Be aware that ClamTk might be reporting a *false positive*—a file that it thinks is infected with a virus, but which isn't. This is rare but can happen. If you do find a file you know is a false positive, right-click it and select Quarantine. Then click Quarantine ➤ Maintenance. In the list, select the file and click False Positive. This will ensure it's ignored next time you scan.

So what should you do if you find that a file is infected? First, don't panic. Remember that practically all viruses that ClamAV is likely to find are targeted at Windows systems and don't affect Linux.

■Note If we assume there are 140,000 viruses for Windows and fewer than 1,000 for Linux, then in theory, there's 99.999 percent chance that any virus ClamAV finds will be a Windows virus!

Next, find the name of the virus in the Status column, and look it up online to learn more about it. This is the point at which you'll learn whether it's a Linux virus and, if so, its potential impact on your system.

You can hover your mouse over the filename in the scanner window to see its path. If the file is located in your Firefox cache, there's nothing to worry about, and the file can be deleted with impunity—just right-click and select Delete from the menu. In fact, the Firefox cache is where you're most likely to find virus infections, because this is where all the files are temporarily downloaded when you're browsing the web (including HTML files, images, and so on). But, once again, you should remember that most nefarious web sites that attempt to spread virus infections are targeted at Windows users, usually via security holes within Internet Explorer. As a Linux user using the Firefox web browser, you have far less to worry about.

WEB BROWSER SECURITY

It's not enough to rely on antivirus software for safe web browsing. In Firefox, you can tweak settings to enhance the security of browsing. However, note that improved security sometimes equates to reduced features, which can be quite frustrating.

To set security options in Firefox, choose Edit ➤ Preferences. Settings on the following tabs affect browser security (see Figure 9-21):

- **Content**: You can disable pop-up windows and disable JavaScript and Java. Note that it's quite unlikely that you would want to completely disable JavaScript, because many modern web sites make heavy use of it (including online shopping sites and web-based e-mail, such as Google's Gmail). You could add exceptions for certain web sites, but an easier way is to use a third-party plug-in called NoScript (`http://noscript.net`). This tool allows you to disable JavaScript, Java, Flash, and other plug-ins that could potentially be harmful to Firefox on all web sites by default. You can easily re-enable these scripts on each web site that you trust through the NoScript applet, located in the lower-right corner of the browser window.

- **Privacy**: You can customize retention of browser history, cookies, and private data. If privacy is of utmost importance, you can check the "Always clear my private data when I close Firefox" check box in the Private Data section, click the Settings button, and select which of the items to delete when you close Firefox.

- **Security**: You can customize attack site and forgery detection, passwords, and warning messages. You should customize these settings based on how you use the Web. For example, it's obvious that the "Warn me when sites try to install add-ons" check box should be selected, since malware is distributed this way. And if you transact business on the Web, the "Tell me if the site I'm visiting is a suspected forgery" option offers added protection from getting duped.

Figure 9-21. *Customizing Firefox Privacy settings*

Summary

In this chapter, you've looked at what threats your system faces and how security holes can be exploited by malicious interests. You learned about measures you can take to protect your system, such as updating it online, using AppArmor to guard against errant applications, configuring the system's firewall, using encryption for e-mail and file privacy and authentication, installing an antivirus program, and customizing web browser security. We also discussed some commonsense rules you can follow to keep your system safe.

In the next chapter, we move on to looking at how your Ubuntu system can be personalized and how to set up everything to suit your own preferences.

CHAPTER 10

Personalizing Ubuntu: Getting Everything Just Right

If you've read this book from Chapter 1, by this stage you no doubt have become comfortable with Ubuntu. You've started to realize its advantages and are on the way to making it your operating system of choice.

But things might still not be quite right. For instance, you might find the color scheme is not to your taste. Or perhaps the mouse cursor moves a little too fast (or too slowly). Maybe you simply want to get away from the default theme and stamp your own identity on the desktop. That's what this chapter is all about: personalizing Ubuntu so you're completely happy with your user experience. To do this, you will thoroughly examine the GNOME desktop and explore its potential. You'll also add some panache to that most important application, the web browser, so it fits perfectly into your desktop.

Changing the Look and Feel

Ubuntu is similar to Windows in many ways, but the developers behind it introduced improvements and tweaks that many claim make the software easier to use. For example, Ubuntu offers multiple virtual desktops (also called workspaces)—long considered a very useful user-interface feature that hasn't found favor in Microsoft's designs.

Note The virtual desktop feature also passed by Apple for a long time. However, it was recently included in OS X Leopard, in the form of Spaces.

The Ubuntu desktop also moves the programs menu to the top of the screen, leaving the whole width of the screen at the bottom to display taskbar buttons. This is very sensible, because the buttons don't look cramped when more than a handful of applications are open. However, if you're not satisfied with Ubuntu's out-of-the-box look and feel, almost every aspect of the desktop experience is available for tweaking.

You might be used to changing the desktop colors or wallpaper under Windows, but Ubuntu goes to extremes and lets you alter the look and feel of the entire desktop. Everything from the styling of the program windows to the desktop icons can be altered quickly and easily.

Altering the Theme

Ubuntu refers to the look of the desktop as a *theme*. Whether you opt to use GNOME or KDE as your main desktop, Ubuntu allows you to radically personalize the whole visual experience. Several themes come with the distribution, and you can download many more. Each lets you change the way the windows look, including the buttons, scrollbars, window decoration, and the icon set (although some themes come without additional icons). There is also a small selection of Assistive Themes designed to improve the desktop experience for partially sighted users.

However, unlike Windows themes, GNOME themes don't usually change the fonts used on the desktop, and the background will probably remain broadly the same. You can change these manually, as described in the "Setting Font Preferences" and "Changing the Desktop Background" sections a bit later in this chapter. The other difference is that GNOME has these facilities built in—you won't need to buy or install extra software just to change the desktop appearance.

To alter the theme, choose System ➤ Preferences ➤ Appearance. Then it's simply a matter of choosing a theme from the list on the Theme tab in the Appearance Preferences dialog box, as shown in Figure 10-1. Each selection has a small thumbnail to show you what the theme looks like. When you select one, it will be applied immediately to the desktop, including any open applications and windows. To get a really good idea of how the theme looks, you can open a Nautilus window by choosing Place ➤ Home Folder. This will give you a feel for how the icons, window decorations, and widgets such as scrollbars and menu bars look in a real-world context.

■ **Note** The default Ubuntu theme is called Human and is designed to represent the skin tones of the world's population. This is intended to reflect Ubuntu's mission of being accessible to everyone, no matter where or who they are. In fact, there are three variations of the theme available in the Appearance Preferences dialog box: Human, Human Clearlooks, and Human Murrine. All vary the design very slightly. Try them to see which you like best! The most recent versions of Ubuntu ship with a selection of dark themes (New Wave, Dust, and Darkroom), one of which may become the default in the future.

Our favorite themes are Clearlooks and Mist, largely because they're simple and uncomplicated. Remember that you'll be working with the theme on a daily basis, so it should be practical and not too distracting. Those miniature Close, Minimize, and Maximize buttons might look stylish, but they're useless if they're so small that you can't reliably click them with your mouse, and if your eyes are constantly wandering to a beautiful but overpowering title bar, you won't be concentrating on your work or play.

In addition to changing the overall theme, you can also modify individual theme components and even download more theme components.

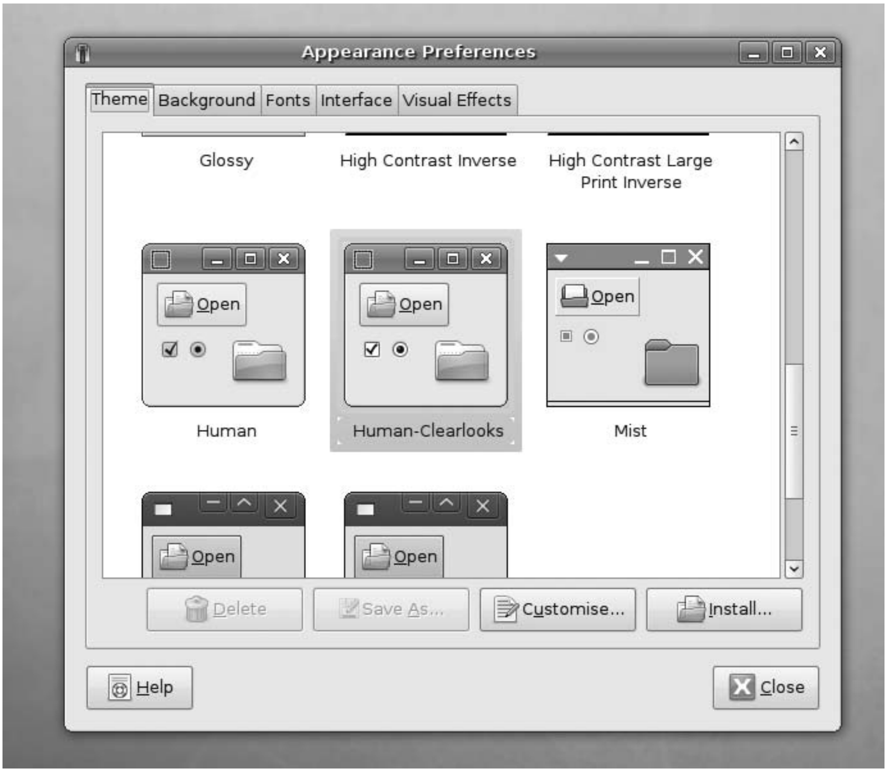


Figure 10-1. *Ubuntu comes with several theme choices.*

Changing Individual Theme Components

You can alter the five aspects that constitute a GNOME theme: the controls (sometimes known as widgets), color scheme, window borders, icons, and mouse pointer. To make changes to a theme, select it on the Theme tab of the Appearance Preferences dialog box (see Figure 10-1) and then click the Customize button. You will see the Customize Theme dialog box, as shown in Figure 10-2.

Figure 10-2. *You can customize a theme by choosing your own controls, colors, window border, icons, and mouse pointer.*

Click each tab to see your choices:

Controls: These are the elements you click within dialog boxes and windows: buttons, scrollbars, check boxes, radio buttons, and so on. The chief difference between one set of controls and another relates to their 3D effect—some are inset against the background, and some appear to be prominent. Some controls are shiny, and some appear flat. Additionally, some are rounded, and some are square. Rounded controls feel more friendly, maybe even playful, while squared controls tend to feel more businesslike.

Colors: You can set the background and text color of windows, input boxes, selected items, and tooltips. However, note that controls nearly always come with their own color schemes, which override any changes you make to color settings. A few controls not only override color settings, but also do not support tweakable color schemes. Examples include the High Contrast Inverse and High Contrast Large Print Inverse controls. If you adjust these, ensure that you have enough contrast between the various elements; otherwise, you may end up with eye strain or a headache!

Window Border: The options on this tab control the borders of program windows and dialog boxes. Particular attention is paid to the top of the window, where the program name appears along with the Minimize, Maximize, and Close buttons.

Icons: This tab lets you control which icon set is in use. An icon set includes icons for everything you see on the screen or in menus, including folders, the Trash, programs, hard disks, network servers, and so on. Selecting a new icon set will change all icons.

■**Note** The Icons tab of the Customize Theme dialog box doesn't let you change the icons for *specific* desktop items. This can be done by right-clicking the icon, selecting Properties from the menu that appears, and then clicking the icon preview button at the top left of the dialog box. Note that most stock icons are stored in `/usr/share/icons`, but if you've downloaded a particularly fine icon into your home folder, click the Browse button and locate that. Any icons you change individually in this way won't be affected by changes made to the icon set.

Pointer: On this tab, you can set the appearance of the mouse pointer. Aside from the pointer's design, you can change its size (although this is not supported on all mouse pointers) by adjusting the Size slider. A larger mouse pointer might help the visually impaired. A small mouse pointer would be appropriate for low-resolution or small screens like those on ultraportable laptops.

If you change any of these options, the Theme thumbnail will change to the first one in the Appearance Preferences window, labeled Custom. To preview the effects fully, the best policy is to keep a Nautilus window open (Places ➤ Home Folder).

When you've made your choices, you can save the theme for further use. Click Close in the Customize Theme dialog box, and then click the Save As button in the Theme tab of the Appearance Preferences dialog box. You'll need to give the theme a name and, if you wish, a short description for future reference. By putting a check in the Save Background Image check box, the theme will also remember the background that's in use. Once saved, the theme will be available for selection from the Theme tab, where the themes are listed in alphabetical order. If you selected the Save Background Image check box, when you select the theme in the future, the background will be suggested at the bottom of the Theme tab. To select it, just click the Apply Background button.

If you don't save the theme, as soon as you select another one, the changes you made will be lost.

Installing Additional Components

If you get tired of the built-in possibilities, you can download additional theme components, such as window borders and controls, to enhance your desktop experience. Two popular web sites (among others) that you can visit are GNOME Art (`http://art.gnome.org`) and GNOME-Look (`http://gnome-look.org`). The GNOME Art web site is officially supported. GNOME-Look tends to be driven more by enthusiasts. Both offer a massive choice of theme components.

Caution Be warned that some of the backgrounds available from GNOME-Look display artistic nudity.

The GNOME Art site, shown in Figure 10-3, gives you access to just about every theme ever created for GNOME. In fact, the site also contains background selections, icons, and much more. All of the offerings are free to use.

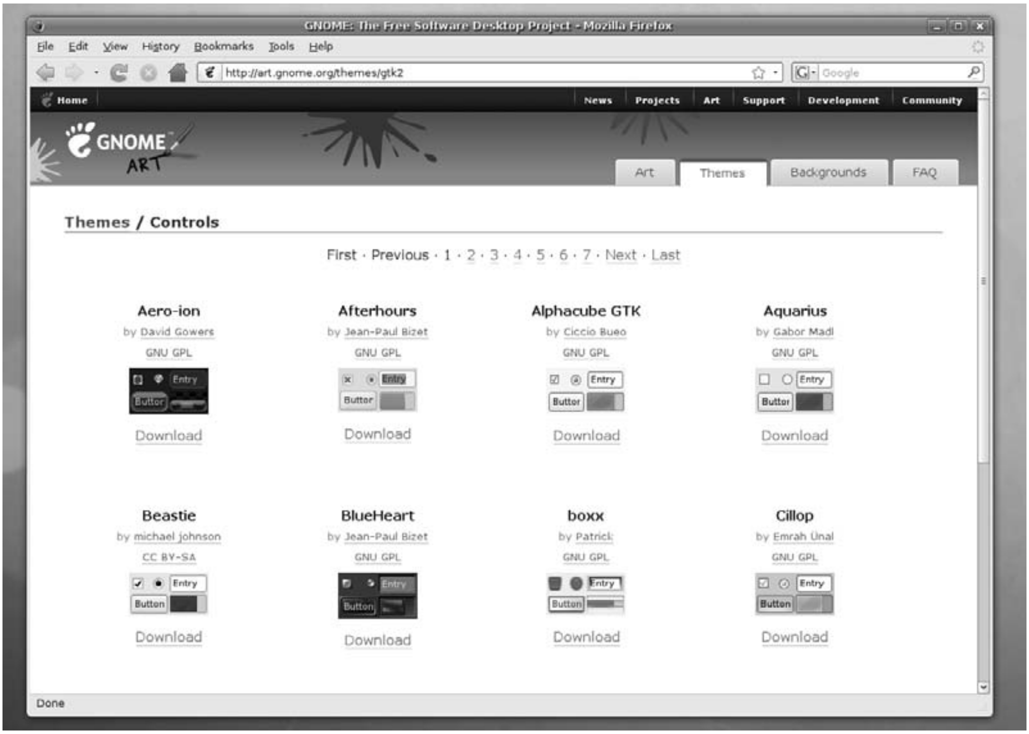


Figure 10-3. *The GNOME Art site contains the latest themes, and you can use all of them with Ubuntu.*

Installing new theme components is easy, and the instructions here work just as well for the GNOME-Look site. If you wish to install a new window border, for example, click the link to browse the examples, and when you find one you like, click to download it. It will be contained in a `.tar.gz` or `.tar.bz2` archive, but you don't need to unpack it (be sure to select the Save File option from the Firefox dialog box). Simply choose System ➤ Preferences ➤ Appearance, and click the Install button on the Theme tab. Then browse to the downloaded theme and click Open. You can also just drag the `.tar.gz` or `.tar.bz2` file onto the Theme tab of the Appearance Preferences dialog box for an instant installation. Either way, you'll be asked whether you want to use the new theme component immediately. You can say yes, or choose it later from the Customize Theme dialog box (opened by clicking the Customize button in the Appearance Preferences dialog box), where it will be available on the relevant tab.

You can delete the downloaded file when you're finished, because the information will be copied automatically to the correct place.

■ **Note** The same principle of sharing that underlines the GPL software license is also usually applied to themes. This means that one person can take a theme created by someone else, tweak it, and then release it as a new theme. This ensures constant innovation and improvement.

Changing the Desktop Background

It's easy to switch backgrounds under Ubuntu. You can also add your own images and set background size, or select a background color if you don't wish to use an image. These changes can be made from the Background tab of the Appearance Preferences dialog box (System ➤ Preferences ➤ Appearance), shown in Figure 10-4.

■ **Tip** The default backgrounds provided by the GNOME project include several wonderful nature pictures and some cool patterns. However, they aren't included out of the box with Ubuntu. To install them, search for `gnome-backgrounds` in the Synaptic Package Manager. Also, don't forget that the GNOME Art web site (`http://art.gnome.org`) offers many desktop background packages for download, and the `propaganda-debian` package also contains some nice desktop images.

Figure 10-4. *Backgrounds can be zoomed or scaled to fill the screen by using the Style drop-down list (this figure includes backgrounds from the package).*

Switching and Adding Background Images

On the Background tab, you can select from a short list of images. You can choose any of the installed images or, by selecting the thumbnail at the top left, opt for no image at all. In the case of the latter, you can use the drop-down toward the base of the window to choose the color background style (detailed in the following options), and the colors to include by using the selector(s). You have the following options:

Solid color: This option fills the desktop with one uniform color. You are provided one color button to set the color.

Horizontal gradient: This option fills the desktop with one color on the left, blending with another color from the right. You are provided two color buttons to specify both colors.

Vertical gradient: This option fills the desktop with a color on top, blending with another color at the bottom. You are provided two color buttons to specify both colors.

To specify the color or colors that will be used, click the color buttons beside the Colors drop-down list. The Pick a Color dialog box will appear. Select a color by clicking or dragging the color wheel. You can also use the eyedropper tool to obtain any color displayed on your screen, including anywhere on the desktop or in open windows. Simply click the tool on the color.

If none of this works for you, you can manually provide the hue, saturation value (HSV) or red, green, blue (RGB) values or color name by specifying the combination of hexadecimal digits (this will be familiar to web designers).

A preview of your selection is shown at the bottom left of the dialog box, in the right color preview bar. The previous color that you selected is shown in the left color preview bar. Click the OK button after you've chosen your preferred color.

■ **Tip** You can right-click the desktop and choose Change Desktop Background to access the same menu of background choices.

If you want to use a picture of your own as the desktop background, click the Add button and then browse to the picture's location. In contrast to theme element installation, your own images are not copied to a new location, so if you delete a picture used for a background, the background image will disappear and be replaced with the normal background color.

Choosing a Background Style

From the Style drop-down list on the Background tab, you can select from the following choices:

Centered: This option places the picture in the center of the screen. If the image is not big enough to fill the screen, a border appears around the edge. If it's bigger than the screen, the edges of the picture are cropped off.

Fill Screen: This option forces the picture to fit the screen, including squashing or expanding it if necessary (known as altering its aspect ratio). If the picture isn't in the same ratio as the screen, it will look distorted. Most digital camera shots should be okay, because they use the same 4:3 ratio as most monitors (although if you have a widescreen monitor with a 16:9 ratio, a digital camera picture will be stretched horizontally).

Scaled: Like the Fill Screen option, this option enlarges the image if it's too small or shrinks it if it's too big, but it maintains the aspect ratio, thus avoiding distortion. However, if the picture is in a different aspect ratio than the monitor, it may have borders at the edges.

Zoom: Like Fill Screen, this option forces the picture to fit the screen, without any borders at the top and bottom. However, it avoids altering the aspect ratio. If the wallpaper isn't the correct aspect ratio, parts of the top/bottom or left/right of the image may be cropped off.

Tiled: If the picture is smaller than the desktop resolution, this option simply repeats the picture (starting from the top left) until the screen is filled. This option is primarily designed for patterned graphics.

Setting Font Preferences

Ubuntu lets you change the fonts that are used throughout the desktop and applications (referred to as *system fonts*). You can also alter how they're displayed, which is useful if you want to get the best image on an LCD monitor.

To change a system font, open the Appearance Preferences dialog box (System ➤ Preferences ➤ Appearance) and click the Fonts tab, as shown in Figure 10-5. Click the button next to the system font you want to change, and then choose from the list. You can also set the font point size, perhaps to make the labels beneath icons easier to read.

By clicking the entries in the Rendering section of the Fonts tab, you can change how fonts look on your monitor. This will alter the antialiasing and hinting of the font. Antialiasing softens the edges of each letter to make them appear less jagged. Hinting affects the spacing and shaping of the letters. Used together, they can make the onscreen text look more pleasant and easier to read. Try each Rendering setting in sequence to see which looks best to you (the text in the dialog box will update automatically to show the changes). Nearly everyone with a TFT-based screen, including notebook users, finds the Subpixel Smoothing option best.

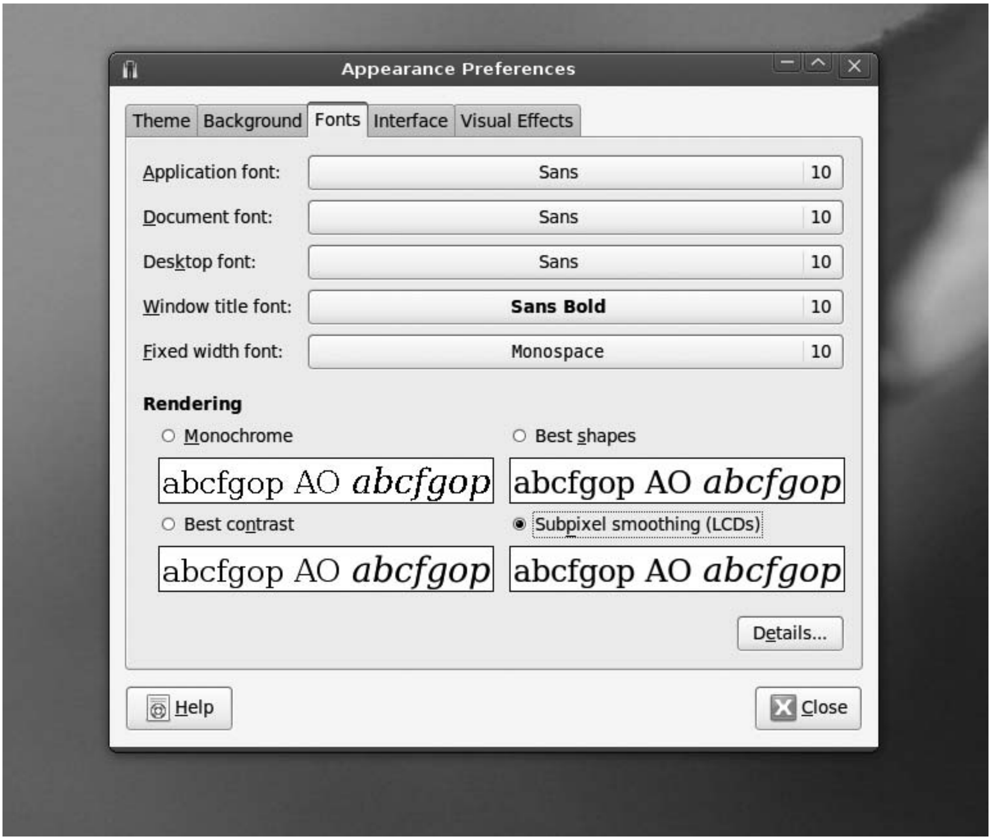


Figure 10-5. *You can alter the way fonts appear onscreen by using the Fonts tab of the Appearance Preferences dialog box.*

BYTECODE HINTING

Two font-hinting subsystems are available under Ubuntu: Autohinting and Bytecode Interpreter. There's a lengthy debate about which produces the best results. Personally, we prefer to use the Bytecode Interpreter, because we believe it leads to cleaner fonts, but others say Autohinting is better in this regard. Some people say that the Bytecode Interpreter is worth using only if you make heavy use of the Microsoft TrueType Core Fonts (see Chapter 21 to learn how to install these fonts).

Follow these steps to switch between the Bytecode Interpreter and Autohinting systems:

1. Open a terminal window (Applications ➤ Accessories ➤ Terminal).

2. In the terminal window, type the following:

```
sudo dpkg-reconfigure fontconfig-config
```

3. On the first screen of the configuration program, select Native to activate the Bytecode Interpreter. Alternatively, you can choose Autohinting or even None, which will turn off the hinting system.

4. On the next screen, you can select whether subpixel rendering is activated. This is useful only for TFT screens (including notebooks). Select Automatic, or if you use a TFT monitor and want to ensure that the option is activated, select Always.

5. The third screen offers the option of using bitmap fonts. These are fonts that, unlike the TrueType fonts used within the rest of Ubuntu, don't scale beyond their original sizes. There's no harm in enabling them, because they can sometimes be useful as system fonts.

6. After making this choice, the configuration program will quit. Then you must update the changes you've made by using the following command:

```
sudo dpkg-reconfigure fontconfig
```

7. After the program has finished configuring the software, restart your X server by logging out and then back in again.

Configuring General Interface Options

Ubuntu lets you modify the way the menus and toolbars are displayed across the system. To configure these interface options, open the Appearance Preferences dialog box (System ➤ Preferences ➤ Appearance) and click the Interface tab. This tab offers three options:

Show icons in menus: Here you have the option to display/hide the icon placed before each item in menus used throughout the GNOME desktop and GNOME applications, such as the Gedit text editor. It's best to leave the icons visible, because visuals help describe the purpose of each menu item, but ultimately it's a matter of personal choice. Menus are certainly smaller if they have no icons. You can get an idea of the changes when you click the File or Edit faux menu in the Preview section below the options.

Editable menu shortcut keys: By enabling this option, you can add, modify, or delete a keyboard shortcut of a menu item in most GNOME applications. To add or modify a keyboard shortcut in an application, click the menu containing the option, hover your mouse pointer over the menu item of interest, and then press your desired key or a combination of keys. To delete a keyboard shortcut, just hover your mouse pointer over the menu item you want to remove and press the Delete key.

Note Bear in mind that some applications included with Ubuntu, such as OpenOffice.org, are not GNOME applications, so they may not allow you to edit their shortcut keys without going into that particular application's settings. Those that are GNOME desktop applications will say so in the Help ➤ About dialog box. It's also worth remembering that many applications use a consistent set of shortcuts (Ctrl+C for copy, Ctrl+S for save, and so forth), and so changing these could lead to confusion later on.

Toolbar button labels: This will affect where the text in toolbar buttons appears: below or beside the icon (buttons in dialog boxes are not affected). You can also select to display only icons or only text in buttons. Select the desired option from the drop-down list, and then view the results in the faux buttons in the Preview section.

Tip The Preview section of the Appearance Preferences dialog box is useful for showing the effects of the changes, but to see how what you're changing affects a real application, we suggest opening Gedit and leaving it in the background behind the Appearance Preferences dialog box. Gedit is a standard GNOME application that ably demonstrates the GNOME look and feel.

Using Desktop Visual Effects

Provided your computer is compatible with enabling these effects and is utilizing the correct graphics card drivers (see the "Installing 3D Drivers and Activating Desktop Visual Effects" section in Chapter 8), you can introduce a range of cool, useful—and occasionally, just plain weird—effects to your computer desktop.

Three basic settings for desktop visual effects are available: None, Normal, and Extra. You can switch between them by clicking System ➤ Preferences ➤ Appearance, and then selecting the Visual Effects tab of the Appearance Preferences dialog box.

As you might expect, the None option turns off the effects. This can be useful if your computer slows down when the effects are in use or if you're using older hardware. The Normal setting implements the standard set of effects, offering subtle but not overly noticeable changes to the interface, and is the default choice if your computer is capable of effects. The Extra setting adds more effects, largely for fun but also with some offering productivity benefits. Additionally, you can opt to install some extra software that gives you even more fine-grained control over what effects are used. The following sections discuss each of these choices for visual effects.

Using the Standard Visual Effects

The standard visual effects, used when the Normal setting is chosen, add shadows to windows and also add minimize animations so that programs literally appear to shrink into the panel. You might also notice that inactive windows and their title bars are translucent. Additionally, when a window is opened or closed, you see the window appear or fade away, respectively.

There are several more subtle visual effects, requiring particular key combinations, as follows:

> **Tools for the visually impaired**: To zoom into any area of the screen, press the Windows key and turn the mouse wheel to adjust the zoom level. You can also press Windows+1, 2, or 3 to zoom into three different levels, respectively. Additionally, you can invert the colors (like a photographic negative) either for the entire desktop or just for the current program window. Press Windows+N to toggle the window as a negative, as shown in Figure 10-6. Press Windows+M to toggle the entire screen as a negative. Use the same combination to restore the original colors. Ubuntu also includes an advanced Zoom tool, which is activated via the CompizConfig Settings Manager, which provides facilities comparable to the leading Windows application for the partially sighted.

Figure 10-6. *You can filter colors of windows or the entire screen as a visual aid.*

Virtual desktops: If you use virtual desktops, as described in Chapter 7, you'll be pleased to know that the desktop effects system enhances the experience. Press Windows+E to get a miniature view of your virtual desktops arranged in a grid, as shown in Figure 10-7. (Note that the figure shows four virtual desktops; the default setting on an Ubuntu system is only two desktops.) To switch to a virtual desktop, just point your mouse to the virtual desktop of choice and double-click, or use the cursor keys and Windows+E once more. You can also switch from one virtual desktop to another from the desktop by moving the mouse pointer to an empty area of the desktop and then turning the mouse wheel, which will cause the desktops to slide sideways out of view. Press Ctrl+Alt+arrow key for the same effect. As you navigate from one virtual desktop to another, a grid in which each cell represents each virtual desktop will appear in the center of the screen, and a cell will be highlighted for a short period of time to let you know which virtual desktop you are on right now.

Figure 10-7. *Pressing Windows+E gives you a miniature view of your virtual desktops.*

Application Switcher: As well as moving between virtual desktops, you can navigate through applications with the Application Switcher. Just press Alt+Tab to see the list of running applications in miniature view, arranged horizontally in the center of the screen, as shown in Figure 10-8. Press the Tab key repeatedly until you find the desired application at the center of the list. Release the Alt key to switch to the desired application. Minimized applications are represented by their application icon, because Ubuntu doesn't have the option of grabbing a live screen of them. Releasing the Alt key on a minimized window will open it out.

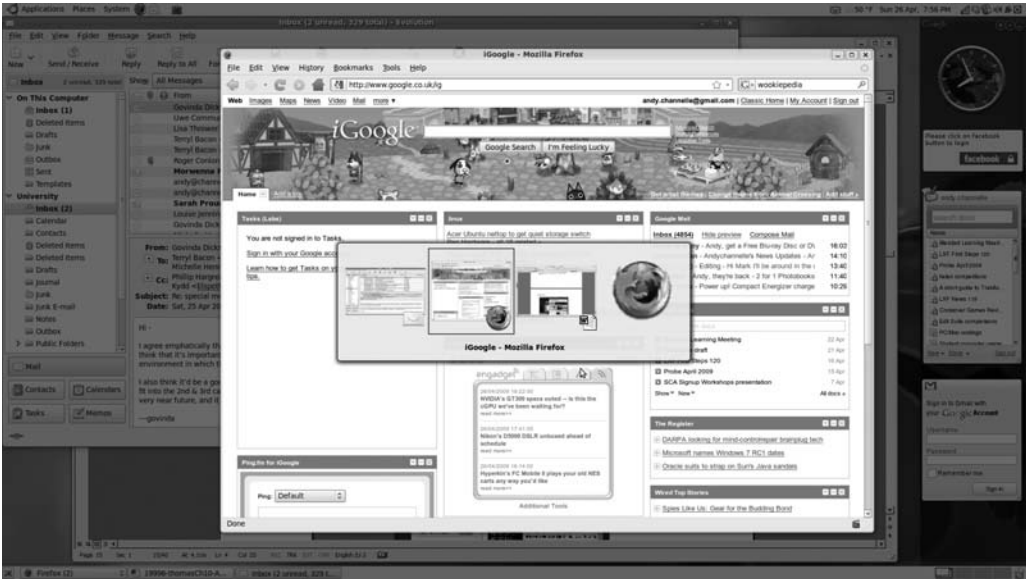


Figure 10-8. *To use the Application Switcher, hold the Alt key and press the Tab key until you find the desired application at the center of the list.*

Using the Extra Visual Effects

By selecting the Extra option from the Visual Effects tab of the Appearance Preferences dialog box, you can enable a handful more visual effects. These include all the features of the Normal effects and then some. For starters, you will notice that when you drag or maximize a window, the window becomes "wobbly"—part of it will linger behind the rest of the window, as if affected by momentum. The Application Switcher effect is also enhanced and will display previews of open programs in 3D form, as shown in Figure 10-9. This obviously depends on you having the graphics power to render, but if you do have it, the 3D switcher even plays live video in the previews.

Figure 10-9. *The 3D Application Switcher is displayed by pressing Windows+Tab.*

Personalizing Visual Effects

If you are unsatisfied with the default choices for visual effects, you can install the CompizConfig Settings Manager tool. This gives you complete control over the Compiz Fusion system, which provides Ubuntu's visual effects (see Chapter 8). Bear in mind that some of these settings are very technical, and little provision is made for those who are new to the effects subsystems.

You can install the tool by using the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager). You'll need to enter your password when prompted. Click the Refresh button to reload the repository listings. Then click the Search button and enter `compizconfig-settings-manager` as a search term. In the list of results, locate the program and click the check box. Then choose to Mark for Installation. When prompted to mark additional required changes, click the Mark button. Finally, click the Apply button on the Synaptic toolbar.

After the tool is installed, choose System ➤ Preferences ➤ Advanced Desktop Effects Settings. The CompizConfig Settings Manager window will appear, as shown in Figure 10-10.

Figure 10-10. *The CompizConfig Settings Manager tool offers advanced customization of visual effects in Ubuntu.*

Compiz Fusion works by packaging each effect as a plug-in, and CompizConfig Settings Manager simply lets you switch these plug-ins on and off, as well as change their settings. One of the most important settings you can change for most plug-ins is the keyboard combination that activates them.

On the right side of the main window is the list of plug-ins grouped into logical sections. You can enable them by selecting the check box beside them. You can also change the settings of the plug-in by clicking the plug-in name and icon. This opens the settings page for the plug-in, with a single or few tabs containing configuration settings. You'll also see a brief description of the effect on the left side of the program window. When you've finished, click the Back button.

In the left column, you can use the Filter text box at the top to search for a particular plug-in; the search results will be displayed on the right side of the window. Beneath the Filter section is the Category listing, which groups the plug-ins by purpose. Clicking any category will update the list of plug-ins on the right side of the window. To return to the main program window, click the Back button. The categories are as follows:

All: All available plug-ins will be displayed in the main window.

General: This section contains just the General Options plug-in, which provides configuration settings for keyboard shortcuts for some of the effects, virtual desktop size, display settings, transparency settings for windows, and more. Some of the settings are quite technical and are perhaps best left alone unless you know what you are doing.

Accessibility: This section contains plug-ins that will help people with physical disabilities use the desktop more conveniently with visual aids. It contains plug-ins to make the active window more visible, magnify the screen for visibility issues, change colors, and assist in finding the mouse pointer. To find out what keyboard combination is required to activate any particular effect, click the plug-in's icon to change its settings and look to the button alongside each heading. Note that when a setting specifies Button 2 or Button 3, these relate to the mouse, and the super key is commonly known as the Windows key on a standard keyboard.

Desktop: This section contains plug-ins that enhance desktop behavior. If you use virtual desktops, plug-ins such as Desktop Cube and Rotate Cube can turn these into sides of a 3D cube that rotates when you switch desktops, as shown in Figure 10-11. Desktop Wall and Desktop Plane render these workspaces as if they were part of one surface. You might notice that some plug-ins have the same functionality; CompizConfig Settings Manager will offer to disable any that do when you select a new option. Plug-ins such as Viewport Switcher and Expo make it easier to preview and navigate workspaces. Show Desktop and Fade to Desktop add special effects to clear the desktop of clutter. Like many effects plug-ins, these tie in with the existing features of Ubuntu— in this case, the Show Desktop feature and button, located at the bottom left of the desktop by default.

Effects: This section contains plug-ins that add special effects to certain aspects of the desktop. Some you have already seen, such as Wobbly Windows, which is part of the Extras scheme. But others are more extreme. For example, there are several plug-ins that add eye candy to windows, such as Blur Windows, Animations, Fading Windows, and Window Decoration Reflection. 3D Windows, Cube Gears, and Cube Reflection add decorations as you traverse the 3D cube. Other plug-ins affect the entire screen, such as adding water puddles and wipers with the Water effect or adding fire on the screen with the Paint Fire on the Screen effect. Some need keyboard combinations to activate them—to find out what these are, click the plug-in icon.

Figure 10-11. *The rotating desktop cube, complete with 3D raised application windows, is just about the coolest special effect you'll see on a computer desktop.*

Extras: This section includes effects useful for developers, as well as some plug-ins that simply could not be filed elsewhere. These include displaying the Compiz Fusion splash screen after logging in, benchmarking the performance of Compiz Fusion, viewing a thumbnail of a window by pointing the mouse at its entry on the Taskbar, and taking a screenshot. One notable plug-in is Annotate, which enables you to draw on the screen. This can be useful for demos and presentations when stressing key points.

Image loading: These plug-ins are technical and are required in the background to load image formats and text that will be used by other plug-ins for rendering. Do not disable them.

Utility: This section contains mostly plug-ins that work behind the scenes and a few that work externally. Unless you know what you are doing, you shouldn't change any of these settings or disable any of the plug-ins. If you have a fairly powerful machine, enable the Video Playback option, which puts live previews where application thumbnails are generated.

Window management: These plug-ins enhance window management functionality. For example, some of the plug-ins project the Taskbar in different ways, such as in 2D, in a ring, and in a 3D ring. Another example is the Group and Tab Windows plug-in, which you can use to group and tab windows. Fans of the Vista application switch method should go into Shift Switcher, look under the Appearance tab, and change Cover (which is very Apple-esque) to Flip (as in Figure 10-12).

Figure 10-12. *The Flip Switcher might make Windows Vista converts feel more at home.*

Beneath the Categories list is the Preferences option, which is used for adjusting internal settings of Compiz Fusion, such as the back-end profile and including and excluding plug-ins. You can leave these settings untouched.

Finally, the Advanced Search option allows you to search through options within plug-ins. The search results will first be narrowed down to a list of plug-ins in the main window. After selecting from the list of plug-ins, a new list will be displayed with narrowed-down results containing a list of grouped options. After selecting from the list of grouped options, you'll see a narrowed-down list of options that you can use to configure the plug-in's settings.

USING DESKTOP WIDGETS

If you are a fan of Windows Vista's Sidebar, Macintosh OS X's Dashboard, or Yahoo!'s Widgets, you can use something similar under Ubuntu, called *screenlets*. To use these, you need to install the Screenlets package. This requires you to first install CompizConfig Settings Manager, as described in the main text. Then use that program to enable the Widgets Layer plug-in (look under the Desktop category). Finally, use the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager) to search for and install the Screenlets package.

Run Screenlets by clicking System ➤ Preferences ➤ Screenlets. After the Screenlets Manager window appears, select the screenlet you would like to enable by clicking it and then clicking the Launch/Add button. Following this, you should be able to click and drag the screenlet. Right-click a screenlet and select Properties to change its settings.

You have two choices regarding how and when the screenlet appears:

- Keep the widget on the screen at all times (the default), perhaps arranging widgets on the right side of the screen as with Windows Vista or the Google Sidebar (which can also, by the way, be used on Linux).
- Add the widget to the Widget Layer, which is just like OS X's Dashboard and will appear only when you hit F9 (and will subsequently disappear when the mouse is clicked). To add the widget to the Widget Layer, right-click it, select Window, and then click Widget.

Of course, you can have the best of both worlds, keeping some widgets on the screen and putting lesser-used items on the Widget Layer.

If you would like to add more screenlets than those available by default, go to `http://screenlets.org`. Under the Downloads heading, click the Third-Party Screenlets link. After you've downloaded the screenlet, you can install it by clicking Install Screenlet in the Screenlets Manager window and then navigating to the downloaded screenlet.

Dressing Up Firefox

You'll likely spend quite a lot of computer time looking at Firefox, the web browser. For this reason, it's a nice idea to take as much care over the look of this vital application as your desktop. Firefox has been theme-able since the first version was released, but recently, the Mozilla project, which oversees development of the application, has added Personas to the application's features, enabling you to instantly change the look and feel of the application. To get started, visit the project's web site (`www.getpersonas.com`) and select the Get Personas button. This will download a small extension and ask you to restart your browser. After the browser has relaunched, you'll be presented with a very different-looking browser, as in Figure 10-13. You can change the skin by clicking the fox mask icon at the bottom left of the browser window and selecting a new one. This is a live list, so it is updated constantly. Changes should be almost instant, meaning you can reskin your browser depending on your mood.

If nothing in the list takes your fancy, create your own skin and share it with the world. See `https://personas.services.mozilla.com` for more.

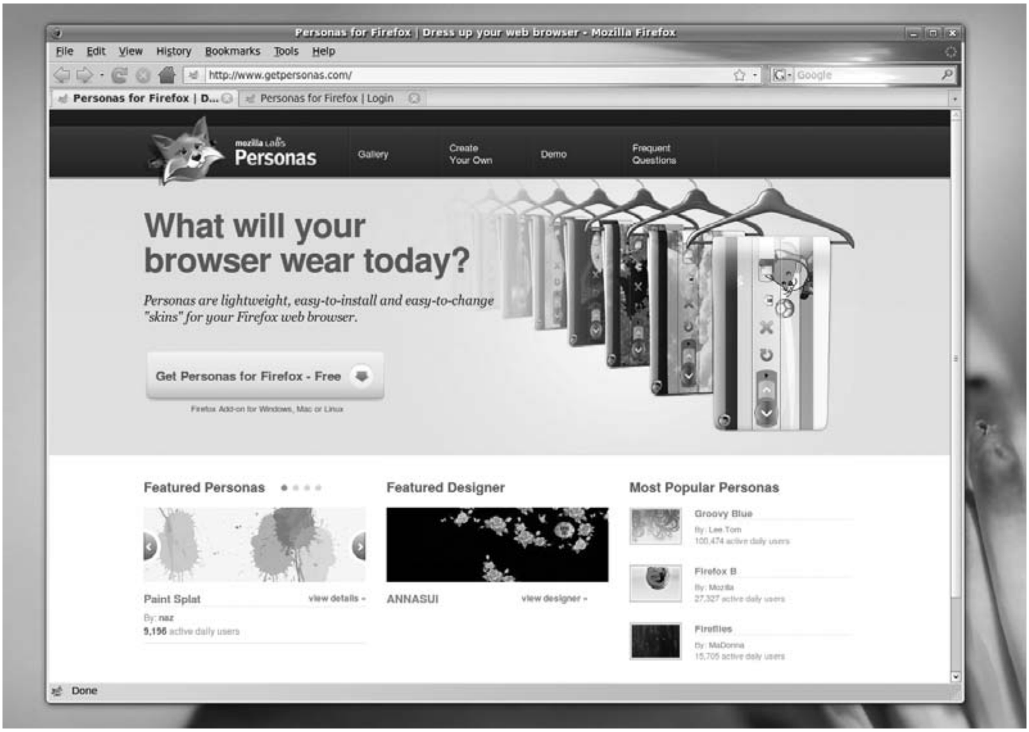


Figure 10-13. *Add some personality to Firefox and make it fit in with your desktop theme.*

Firefox also has a large collection of other extensions that can alter the way the browser looks or works. For instance, Tree Style Tabs arranges your open tabs in a treelike structure on the left edge of your browser.

Configuring Input Devices

Mouse and key repeat speeds are personal to each user, and you may find the default Ubuntu settings not to your taste, particularly if you have a high-resolution mouse such as a gaming model. Fortunately, changing each setting is easy. You'll find the relevant options under the System ➤ Preferences menu.

Configuring Mouse Options

Choose System ➤ Preferences ➤ Mouse to open the Mouse Preferences dialog box, which has General and Accessibility tabs. On a laptop, you might also see the Touchpad tab.

General Mouse Settings

On the General tab of the Mouse Preferences dialog box, shown in Figure 10-14, you can configure several options.

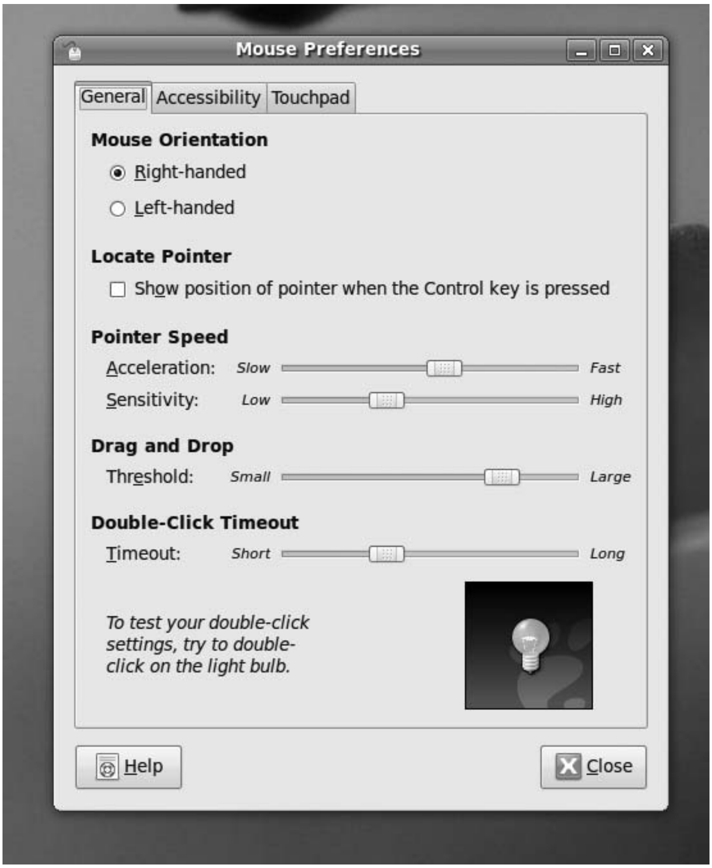


Figure 10-14. *The Mouse Preferences dialog box lets you tame that mouse.*

These options are as follows:

Mouse Orientation: This option lets you set whether the mouse is to be used by a left-handed or right-handed person. Effectively, it swaps the functions of the right and left buttons.

Locate Pointer: This option allows you to show where the mouse is by displaying a ripple surrounding the mouse pointer when you press the Ctrl key. This can be useful for partially sighted people who may not be able to locate the cursor on a busy desktop.

Acceleration: This setting controls how fast the mouse moves. Whenever you move the mouse, the pointer on the screen moves a corresponding amount. However, the cursor actually increases in speed the more you move your hand (otherwise, you would need to drag your hand across the desk to get from one side of the screen to the other). This is referred to as *acceleration*. If you set the acceleration too high, the pointer will fly around the screen, seemingly unable to stop. If you set it too slow, you'll need to ramp the mouse several times to make it go anywhere.

Sensitivity: This setting controls how quickly the acceleration kicks in when you first move the mouse. Choosing a higher setting means that you can move the mouse relatively quickly before it starts to accelerate and cover more screen space. A low setting means that acceleration will begin almost as soon as you move the mouse. Higher sensitivity settings give you more control over the mouse, which can be useful if you use image-editing programs, for example.

Drag and Drop: This setting determines the amount of mouse movement allowed in a click-and-drag maneuver before the item under the cursor is moved. It is designed for people who have limited dexterity and who might be unable to keep the mouse perfectly still when selecting an item. In such cases, a large threshold value may be preferred.

Double-Click Timeout: This is ideal for those who are less physically dexterous, because the double-click speed can be slowed down. On the other hand, if you find yourself accidentally double-clicking items, you can speed it up. Test your settings by double-clicking the lightbulb image.

Changes are made as each setting is adjusted, so to test the new settings, simply move your mouse.

Accessibility Settings

The settings on the Accessibility tab can help people with physical disabilities use the mouse. However, to enable these features, you need to enable Assistive Technologies in Ubuntu first, as follows:

1. Open the Assistive Technologies Preferences dialog box (System ➤ Preferences ➤ Assistive Technologies).
2. Select the Enable Assistive Technologies check box, and then click the Close and Log Out button (this is necessary to start the background services).
3. Select Log Out in the Shutdown dialog box, and then log back in again when prompted.
4. After logging in, return to the Accessibility tab of the Mouse Preferences dialog box (System ➤ Preferences ➤ Mouse).

From the Accessibility tab, you can enable simulated secondary click and dwell click options. Selecting the "Trigger secondary click by holding down the primary button" check box simulates a right-click when you hold the left-click for a certain amount of time (useful for those having trouble right-clicking). This amount of time can be configured by moving the Delay slider to the left for a faster response or to the right for a longer delay.

A *dwell click* allows you to simulate a mouse-click action after the mouse pointer has been left idle for a certain amount of the time so, for instance, hovering over an icon for a few seconds could double-click it to launch an application. To enable this feature, select "Initiate click when stopping pointer movement." You can set the length of the idle time by moving the Delay slider to the left for less idle time or to the right for a longer delay. The Motion Threshold setting determines the amount of mouse movement allowed while the mouse is still considered idle (useful for those who might be unable to control small movements of their hands). Moving the Motion Threshold slider to the left makes the mouse pointer sensitive; moving it to the right makes the pointer less sensitive. You can choose two types of dwell click:

Choose type of click beforehand: This option automatically clicks the mouse when the mouse pointer is idle. If you want to choose the type of mouse click each time, put a check in the box beside Show Click Type Window. This will show a floating window, from which you can select various types of clicks, such as single-click, double-click, and so on. Alternatively, you can choose the mouse click from the Dwell Click applet instead. (Applets are discussed in the "Working with Applets" section later in this chapter.)

Choose type of click with mouse gestures: This option allows you to choose the type of mouse click to execute when the mouse movement is idle by moving the mouse in a certain direction, usually up, down, left, or right. Just wait until the mouse turns into a cross and then move the mouse. After you've performed the movement, the mouse will return to its original location before it was moved. All of the mouse movements can be customized by changing the gestures in the drop-down lists for Single Click, Double Click, Drag Click, and Secondary Click.

■ **Note** Orca, GNOME's screen reader software, also includes a tool that magnifies the area under the mouse pointer. It is available under System ➤ Preferences ➤ Assistive Technologies. Select the Preferred Applications option and set Orca to start at launch. The software can be used to both magnify an area of the screen under the mouse and, using a speech synthesizer, read onscreen elements out loud.

Touchpad Settings

The Touchpad tab appears on laptops only. You can set the following options:

Enable touchpad: This allows you to enable or disable the touchpad. Disabling the touchpad is useful, because typing while inadvertently touching the touchpad will change the position of the cursor, which is a pain.

Enable mouse clicks with touchpad: This allows you to simulate a mouse click by tapping the mouse pad. Depending on the sensitivity of your track pad, this is either great or the most annoying thing in the world.

Enable vertical and horizontal scrolling on your touchpad: This is similar to the effect of turning the scroll wheel. For vertical scrolling, a small region from the top-right corner down to the bottom-right corner of the touchpad becomes the vertical scroll region. For horizontal scrolling, a small region from the lower-left corner to the lower-right corner of your touchpad becomes the horizontal region.

Changing Keyboard Settings

Choose System ➤ Preferences ➤ Keyboard to open the Keyboard Preferences dialog box. This dialog box has five tabs: General, Layouts, Accessibility, Mouse Keys, and Typing Break.

General Settings

The General tab offers Repeat Keys settings and a Cursor Blinking slider. You can alter the rate of key repeat, which can be useful if you often find yourself holding down the Backspace key to delete a sentence; a shorter setting on the Delay slider and a faster setting on the Speed slider can help. However, if you get the settings wrong, you may find double characters creeping into your documents; typing an *f* may result in *ff*, for example.

Modifying the Cursor Blinking slider setting may help if you sometimes lose the cursor in a document. A faster speed will mean that the cursor spends less time being invisible between flashes.

Layouts Settings

On the Layouts tab, you can choose your keyboard model, add an alternative keyboard layout, and configure layout options, as shown in Figure 10-15. Typically, the generic keyboard works fine for most setups. However, if you want to make full use of the extra keys on your keyboard, such as Mail, Web, Power, Sleep, Suspend, and so on, you should select your keyboard model.

If you write in two different languages on your keyboard, it may be helpful to be able to switch between them. Click the Add button, and select the second language from the list. To switch from one language to another, you can add the Keyboard Indicator applet in a panel and toggle from one language to another by clicking the applet. (Applets are discussed in the "Working with Applets" section later in this chapter.)

The Layout Options dialog box, accessed by clicking the Layout Options button, lets you select from a multitude of handy tweaks that affect how the keyboard works. For example, you can configure the Caps Lock key to act like a simple Shift key, or you can turn it off altogether. You can configure the Windows key so that it performs a different function too. Put a check alongside the options you want after reading through the extensive list.

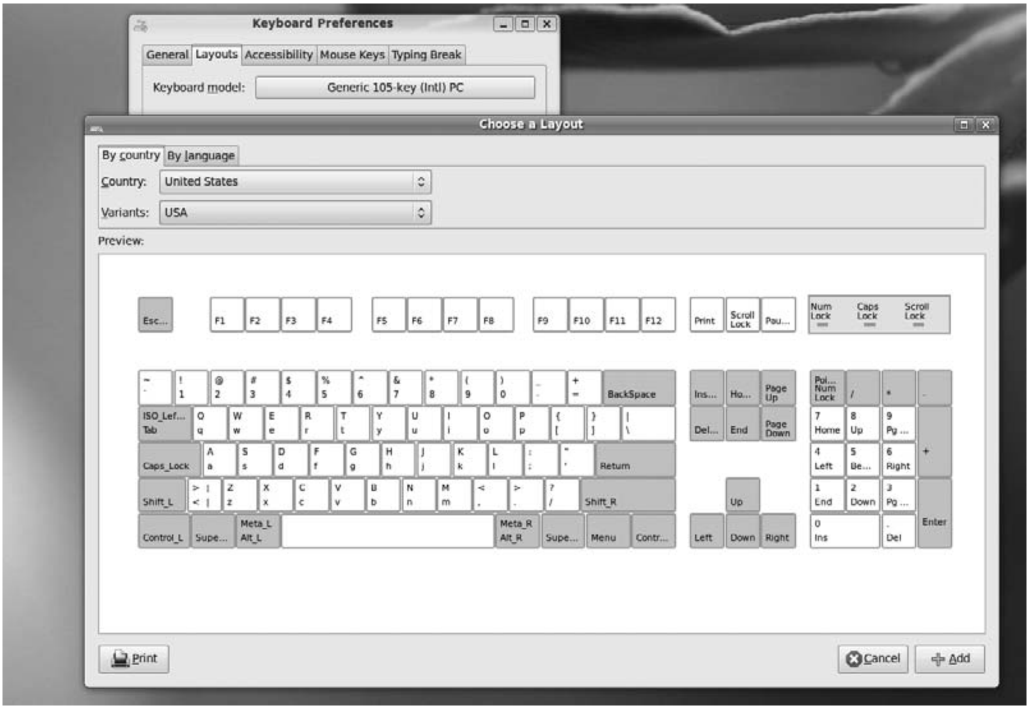


Figure 10-15. *You can have more than one language setting in place for a keyboard, which is handy if you need to type in a foreign language.*

Accessibility Settings

As with the mouse, there are also accessibility options for keyboard users to help people with physical disabilities. On the Accessibility tab, you can configure the following settings:

General: You have an option to enable/disable accessibility features from the keyboard.

Sticky keys: As its name suggests, this feature holds down keys such as Shift, Ctrl, and Alt while you press another key on the keyboard. This is useful for people unable to press more than one key at once, but who need to use keyboard shortcuts such as Ctrl+S within applications. To enable sticky keys, select the Simulate Simultaneous Keypresses check box. You can test sticky keys by running Nautilus (Places ➤ Home Folder). Try pressing Alt and F sequentially; Nautilus will open the File menu as if you pressed those keys simultaneously. If you would like to disable sticky keys on the fly, without having to use this dialog box, select "Disable sticky keys if two keys are pressed together." You can test this by pressing Ctrl+Alt. A Sticky Keys Alert dialog box will appear to prompt you to disable sticky keys.

Slow keys: This feature controls the reaction rate of keys. By moving the Delay slider to the left, the reaction rate of the keys becomes faster. By moving the slider to the right, the reaction rate of the keys becomes slower, to the point that you would need to hold the key for a certain amount of time for it to be considered as a key press. This has obvious uses for people with limited dexterity in their fingers.

■ **Tip** To enable/disable sticky keys at any time, just press the Shift key five times to toggle the sticky keys feature. To enable/disable slow keys, hold the Shift key for 8 seconds.

Bounce keys: This feature controls the repetition of letters on the screen when the same key is accidentally pressed. By moving the slider to the left, the repeat rate will be quicker; moving it to the right adds time for the key to be repeated.

At the bottom of the dialog box is a text box for typing to test the settings you've just configured. You can also enable sound notifications by clicking the Notifications button. These notifications will let you know when the keyboard accessibility features have been enabled or disabled. You can set sound alerts for accessibility in general, sticky keys, slow keys, and bounce keys.

Mouse Keys Settings

The mouse keys feature lets you use your numeric keypad to control the mouse pointer. By selecting the "Allow to control the pointer using the keyboard" check box and pressing the Num Lock key, you can move the mouse pointer by typing from the numeric keypad.

With mouse keys enabled, the 5 key both simulates a mouse click and acts as the center of a directional wheel surrounding it. The 1, 2, 3, 4, 6, 7, 8, and 9 keys simulate mouse direction. Some numeric keypads have arrows on them to indicate this.

You can move the Acceleration slider to adjust the time it takes while pressing the mouse keys for the mouse movement to reach full speed.

The Speed slider sets the distance offset of the mouse pointer when you press a mouse key. By moving the Speed slider left, the mouse pointer covers a smaller distance when you press a mouse key, giving you the illusion that the mouse movement is slower. By moving the Speed slider right, the mouse pointer covers a larger distance when you press a mouse key, giving you the illusion that the mouse movement is faster.

The Delay slider determines the amount of time to press the mouse keys before the mouse pointer starts to move. You can set the delay by moving the Delay slider to the left for a quicker response time and to the right for a longer delay.

Typing Break Settings

The Typing Break tab features a function that can force you to stop typing after a predetermined number of minutes. It does this by blanking the screen and displaying a "Take a break!" message. Note that a notification area icon will appear before the break time to give you advanced warning of the lockout.

Creating Keyboard Shortcuts

Ubuntu lets you define your own keyboard shortcuts for just about any action on the system. To create a shortcut, choose System ➤ Preferences ➤ Keyboard Shortcuts. In the dialog box, search through the list for the action you want to create a shortcut for, click it, and then press the key combination you want to use. For example, you might locate the Volume Up and Volume Down entries in the list, click each, and press Ctrl+left arrow and Ctrl+right arrow. Then you will be able to turn the volume of your sound card up or down by holding down Ctrl and tapping the left or right arrow key, respectively.

■ **Caution** Be careful not to assign a shortcut to a popular key. It might be nice to make Totem media player appear when you hit the spacebar, for example, but that will mean that it will start up several times whenever you type a sentence in a word processor! Also be aware that some key combinations are used by applications. Within OpenOffice.org's Writer, for example, the Ctrl+left/right arrow key combination moves you from word to word in a paragraph. If you define those combinations as shortcuts, you will no longer have this functionality.

An example of a handy shortcut is to configure your `/home` folder to appear whenever you press Ctrl+Home. This can be done by locating the Home Folder option under the Desktop heading.

Personalizing Login Options

You can even personalize the login screen under Ubuntu. This is known technically as the GNOME Display Manager, or GDM. To access its configuration options, choose System ➤ Administration ➤ Login Window.

You will see the Login Windows Preferences dialog box, which has six tabs: General, Local, Remote, Accessibility, Security, and Users.

General Settings

The General tab enables you to customize the following settings:

Hide visual feedback in the password entry: When you select this option, the password mask (the circles that appear when you type in a password field) is not displayed as you type your password when you are logging in. This prevents people from determining the length of your password by looking at your screen as you type.

Disable multiple logins for a single user: When you select this option, a user will have only one session to work on, even if he logs on multiple times, to save on computing resources.

Default session: This is basically the type of session that will run when you log in. You have five options:

- The Run Xclient Script option allows you to run a customized script, if it exists, or the systemwide script (if the customized script does not exist) that specifies which programs you would like to run during startup. This is for very advanced users. If you wish to control which programs start when GNOME does, it's best to use the Sessions program instead (System ➤ Preferences ➤ Sessions), as described in Chapter 30.
- The GNOME option allows you to run the GNOME desktop environment during startup. GNOME is Ubuntu's default desktop environment, but you can also install other desktop environments such as KDE and Xfce by using the Synaptic Package Manager, as described in Appendix D.
- The Secure Remote Connection option allows you to connect to a remote desktop with a secure/encrypted connection. After you log in to your computer, you will be prompted to specify the IP address or hostname of the remote desktop, username, and password. At this point, the desktop that will appear on your screen is the remote desktop and not the local desktop. The main requirement is that the remote desktop has the `ssh` server program installed (see Chapter 33 for instructions on how to install the `ssh` program).
- The Failsafe GNOME and Failsafe Terminal options are used for troubleshooting if you fail to log in normally.

GtkRC file: This option is useful if you want to customize the theme for GDM, but this is again only for advanced users. It's easier to customize the login screen by using the options on the Local tab, as described next.

Clock notation: You have the option to display the time in 24- or 12-hour notation on the login screen. The Auto setting will match the rest of the system preferences for display of 12- or 24-hour time.

Local Settings

On the Local tab, you can configure settings for the look and feel of the login screen. These settings do not affect remote logins (those that take place over a network or even the Internet). Local logins are the standard type that you use to access Ubuntu while sitting in front of the computer. The options are as follows:

Style: In the Style drop-down list, you can choose the type of login screen that will be seen by people logging in locally:

- Themed, which is to say one that includes a pretty graphic such as the Ubuntu logo
- Themed with Face Browser, which shows a pretty graphic and user-selected photographs (see the "Changing Your Login Picture" section later in this chapter)
- Plain, which shows a simple plain color background with the GNOME logo
- Plain with Face Browser, which is like the Plain option but also shows user-selected photographs

Theme: In the Theme drop-down list, you have two choices on how many login screen themes you would like to use. The first choice is Selected Only, which means you will use only one login theme from the selection. The second choice is Random from Selected, which means you can select several login screen themes, and the login theme that will be displayed is randomly selected from those themes. Assuming that you select Themed from the Style drop-down list, you can select the actual theme you want from the Theme list. The default choice is Human, which features the Ubuntu logo and color scheme, but you can also select from a handful of other designs.

Show Actions menu: By unchecking this option in the Menu Bar section, you can deactivate the Actions menu on the login screen, so the user will not be able to restart or shut down the computer from the login screen. This can be useful for security purposes.

Include Hostname Chooser (XDMCP) menu item: By unchecking this option, you can remove the option from the Actions menu that allows users to log in to a remote system.

Custom: By selecting Custom under the Welcome Message heading, you can have the login screen display a custom sentence, but only if the Theme allows this—the default Human login screen doesn't.

By clicking the Add button, you can install new login screen themes, which, as with other GNOME theme components, can be downloaded from `http://art.gnome.org`.

Remote Settings

The Remote tab controls X Display Manager Control Protocol (XDMCP) logins. This is considered a very insecure method of remotely accessing Ubuntu and should be disabled. We discuss more-secure options for remotely accessing Ubuntu in Chapter 33.

Accessibility Settings

The Accessibility tab lets you activate GNOME's accessibility tools during login, which can aid those with physical disabilities. If you've chosen Plain or Plain with Face Browser as your login theme (on the Local tab), you'll see the option Allow Users to Change Fonts and Colors. This allows you to change the font and colors of the login screen by selecting a different theme from the Theme menu of the login screen.

Additionally, you can alter the sound that is heard when the login prompt is ready to take input. By putting a check alongside Login Successful and Login Failed, you can also choose sound effects to accompany those two actions.

Security Settings

The Security tab lets you alter login settings that might present a security risk to your system. The following options are available:

Enable automatic login: This check box lets you do away with the login screen completely when Ubuntu starts up and lets you go straight to the desktop. Simply put a check in the box and provide the login username.

■ **Caution** Automatic login presents obvious security issues. If you're the only person using the computer and it's located in a secure location, this option will save you a few seconds, but really it's better to be secure.

Enable timed login: This option lets you select a user who will be logged in by default after a given period. This is useful if you want to present the opportunity to log in as a different user but also want to have the fail-safe of logging in automatically too.

Login retry delay: This option controls how long Ubuntu will pause after an incorrect username or password has been entered on the login screen. Increasing this value can put an irritating block in the way of anyone who intends to try various random username or password combinations to break into your system. But it can also be annoying to you if you mistype and then have to wait!

Minimal UID: This option allows only users whose UIDs are higher than the one listed to log in.

Allow local system administrator login: This option controls whether the root user is allowed to log in, something that is considered a security risk. (This is relevant only if the root user account is enabled, which it isn't by default under Ubuntu.)

Enable debug messages to system log/Deny TCP connections to X server: These two options relate to security, and it's unlikely you'll ever need to use them.

Allow login if all write permissions on user's home directory: Because GDM saves user settings on your `/home` directory, the permissions settings provide the conditions for GDM to access those files. If you receive error messages about problems accessing user settings such as the `.drmc` file when logging in, you may want to try to make GDM's permissions lax by selecting this option. However, the better solution is to change the ownership and permissions of the affected files (see Chapter 14 for instructions on how to change permissions and ownership of files).

The Configure X Server button lets you configure the X server that starts by default. Changing these settings could stop your computer booting to a GUI, so you shouldn't alter the settings unless you know exactly what you're doing.

Users Settings

On the Users tab, you can specify which users are offered as choices within GDM if the Face Browser option is activated on the Security tab. Bear in mind that Linux has many system user accounts that aren't designed to allow logins.

The "Include all users from `/etc/passwd` (not for NIS)" option is selected by default. This is a convenient setting, because all user accounts will be displayed in the login screen, except for usernames whose user IDs are lower than the Minimal UID setting in the Security tab and users listed in the Exclude list. To reduce the list of users, you can add users to the Exclude list by clicking the Add button under the Exclude list. When the Add User dialog box appears, provide the username of the user to exclude from the list, and then click the Add button. However, if there are more users to exclude than users you would like to include on the login screen, it's more appropriate to add users in the Include list instead. Uncheck "Include all users from `/etc/passwd` (not for NIS)" so that you can add users to the Include list. Then click the Add button under the Include list. When the Add User dialog box appears, provide the username of the user you wish to include, and then click the Add button.

The Default Face and Global Face Dir options provide the default pictures of users in the face browser, if these users did not define a face image for themselves (see the next section). There is already a custom default face image per theme, but you can change the default image by providing the link to your preferred image in the Default Face option. The Global Face Dir, on the other hand, provides the directory where systemwide face images are stored. The default face image directory is `/usr/share/pixmaps/faces`, so you would need to add new default images there. To be able to use these face images in the face browser, the image must have the same name as the username of the user. For example, if you have a user whose name is `jane`, the image filename must be renamed to `jane` followed by the image extension. Many image types are supported—you can use `.gif`, `.tif`, `.png`, and other files.

ASSISTIVE TECHNOLOGIES

You might know about the Accessibility tools under Windows, which help people with disabilities use the computer. It's possible to use an onscreen magnifier, so that users can better see what they're typing or reading, for example.

Under the GNOME desktop, the Accessibility tools are referred to as Assistive Technologies. To use them, choose System ➤ Administration ➤ Preferences ➤ Assistive Technology. Click the check box alongside Enable Assistive Technologies. You can configure the mouse, keyboard, and login options by using the appropriate button, and select from installed screen readers by using the Preferred Applications button.

The main screen reader application included in Ubuntu is called Orca, and this can be enabled under the Preferred Applications option—with or without a mouse magnifier. Some users have reported problems with Orca reading screen content too fast under Jaunty because of an issue with Pulse Audio. If this happens, open a terminal (Applications ➤ Accessories ➤ Terminal) and type `touch ~/.pulse_a11y_nostart` and then reboot the machine.

Changing Your Login Picture

If, when configuring the login options on the Local tab of the Login Window Preferences dialog box, as described in the previous section, you selected the Happy GNOME with Browser theme, or activated the Plain with Face Browser style, the login screen will display a picture alongside your name. You can click this and type your password to log in. You might be familiar with a similar system under Windows XP or Vista, or Mac OS X.

Users can choose their own login pictures by clicking System ➤ Preferences ➤ About Me. The About Me dialog box, seen in Figure 10-16, is designed for users to enter their personal details, such as their addresses, but they can also simply use it to choose photographs of themselves or to add pictorial icons. To do this, click the empty square alongside your name at the top of the dialog box. You'll be shown a file list of default icons, or you can navigate to your own. Ideally, the image you choose should be square and 96×96 pixels, although if the picture is too large, it will be automatically scaled down. Click OK when you've finished.

Figure 10-16. *The About Me dialog box*

Adding and Removing Desktop Items

Virtually the entire Ubuntu desktop can be redesigned and restructured. You can move the Applications menu from the top of the screen to the bottom to be more like Windows, for example, or you can add numerous desktop shortcuts to popular applications and/or files.

Adding a Shortcut

Ubuntu's nearest equivalent to a Windows-style desktop shortcut is a launcher, and you can create a launcher that points to a program or a file. If a launcher is created for a file, Ubuntu will automatically launch the correct program to display the file. If you create a launcher to a `.jpg` file, for example, Ubuntu will know to launch the Eye of GNOME image viewer when the launcher is double-clicked.

Creating a Launcher

You can create a launcher two ways. One way is to simply click and drag an icon from one of the main menus to the desktop. This effectively copies the menu's launcher to the desktop, rather than creating a new launcher, but the effect is the same.

The other way to create a launcher is to right-click the desktop and select Create Launcher. In the Create Launcher dialog box, select whether you want to create a launcher to a file or application from the Type drop-down list (the third option, Application in Terminal, will open a terminal window and run the program within it; this is only for specialized use). Then fill in the Name and Command fields. Alternatively, if you don't know the exact name and path of the file, click the Browse button, use the file browser dialog box to navigate to the file or program, and click to select it. (If you are creating a launcher to a program, you'll probably find it in `/usr/bin`, which stores most of the Linux programs you use from day to day.) The Comment field can be left blank. If it's filled in, it forms the tooltip text that will appear if you hover the mouse cursor over the launcher icon.

To choose an icon for your launcher, click the icon button on the left side of the Create Launcher dialog box. You can select from several predefined icons, as shown in Figure 10-17, or choose your own picture by clicking the Browse button and navigating to the location of a saved icon. As with desktop backgrounds and themes, there are many icon sets available at `http://art.gnome.org`. Additional icon sets can be added by choosing System ➤ Preferences ➤ Appearance and looking under the Theme tab. In the bottom-right of the window, select Customize. You can drag and drop downloaded icon packs to the Icon tab, and they will be installed immediately. If you don't choose an icon, a stock GNOME icon is used.

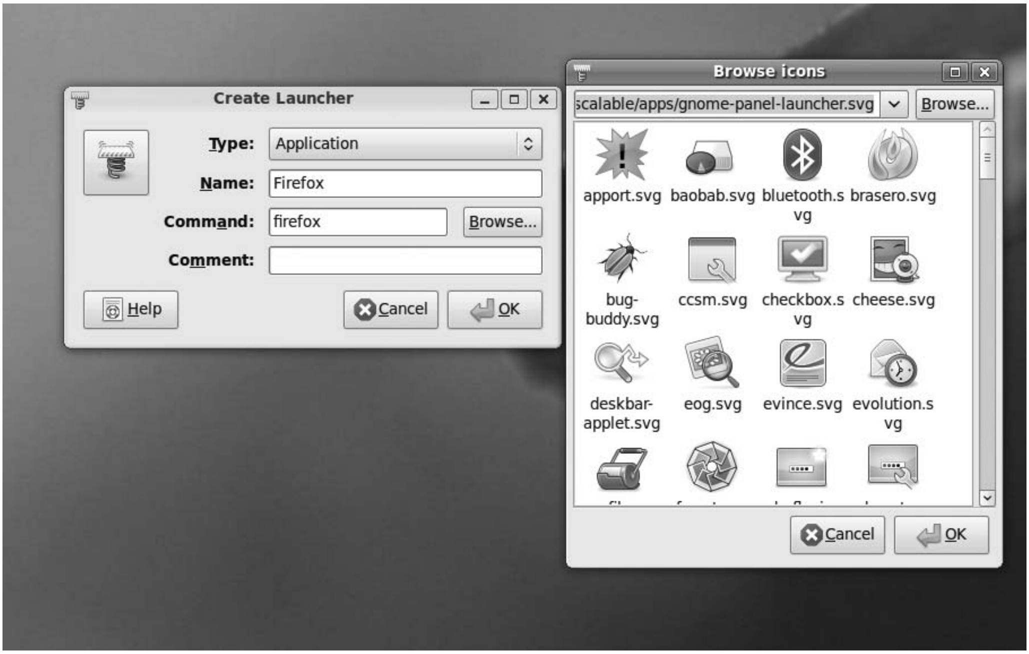


Figure 10-17. *Creating a launcher is easy. Just fill in the Name and Command fields, and choose an icon.*

Using Ubuntu Tweak

If you've used Windows extensively, you may have come across an application called Tweak UI, which lets you perform some useful desktop operations. Well, Ubuntu has its own version, which is perfect for adding an icon to your `/home` folder, the computer, or the Deleted Items folder on the desktop. It can do lots of other things, but desktop icons are what we're interested in here.

To get the application, open the Synaptic Package Manager and then search for and install Ubuntu Tweak. After it is installed, it will be available via Application ➤ System Tools ➤ Ubuntu Tweak. There are lots of options in here, including another way of finding and installing applications, but the section you need to look under is labeled Desktop. In here, select the icons you'd like to see, and they will appear as you click the buttons, as in Figure 10-18. Deselect to remove. You can also rename the icons without renaming the actual folders, which could be useful.

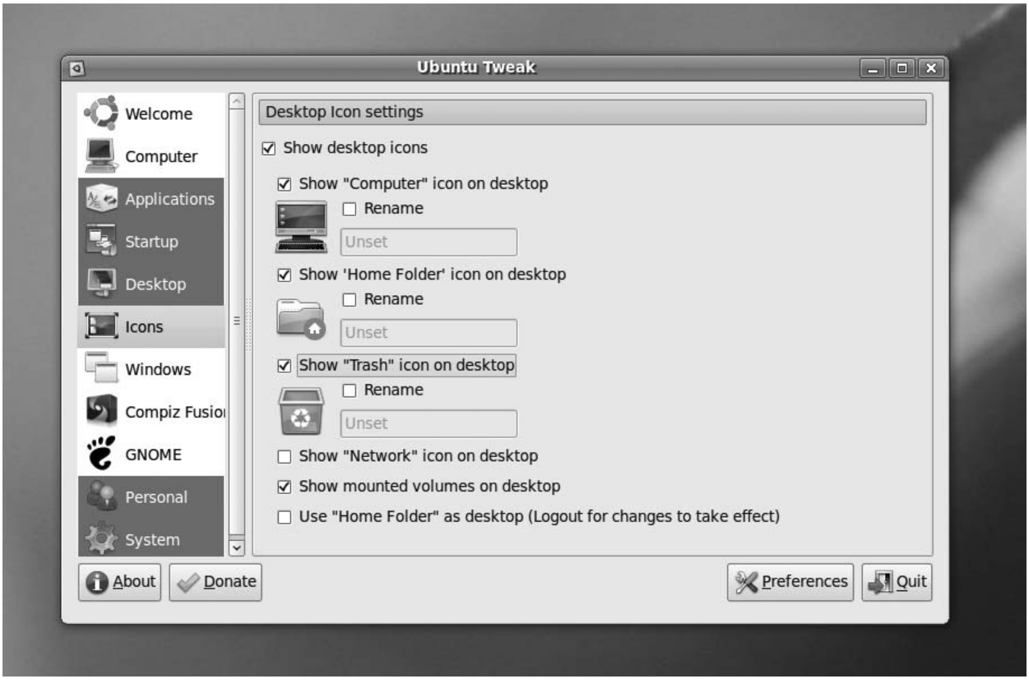


Figure 10-18. *If you're familiar with the desktop icon scheme in Windows, you can add your favorites by using Ubuntu Tweak.*

Creating a Link

Launchers have one failing: they're recognized only by GNOME (and other desktop environments, such as KDE). You can't create a launcher to an application and use it from the command line or the Alt+F2 run application box, for example. In technical terms, a launcher isn't recognized by the underlying Linux file system.

The solution is to create a *link* to the file or program. This will actually create a symbolic link to the file. We explain more about file links in Chapter 14, but it's enough to know that a link is very similar to a launcher, except it works on a file-system level.

■ **Note** Actually, Linux offers two types of link: a symbolic link, which is the most common type of link used under Linux, and a hard link, which is a cross between copying a file and creating a shortcut.

To create a link, locate the file you want to create the link to, right-click it, and select Make Link. The link will be created in the same directory as the original file, and you can then click and drag the new link to wherever you want it to appear, such as the desktop. You don't need to choose an icon, because the link inherits the icon of the original file. For example, if it's a picture link, it will inherit the thumbnail preview icon.

Note If you find the Make Link option grayed out, it's likely that you don't have sufficient permissions to write the link to the directory in question.

Personalizing the Panels

Panels are the long strips that appear at the top and bottom of the Ubuntu screen and play host to a choice of menus, applets, and icons. You can add a new panel by right-clicking a blank spot on an existing panel and selecting New Panel. The new panel will appear on one of the sides of the desktop. If you add a third one, in addition to the two default panels, it will appear on the right side of the desktop, vertically. You can also remove a panel by right-clicking it and selecting Delete This Panel.

Caution If you delete a panel, the arrangement of items it contains will be lost. Of course, you can always re-create the collection on a different panel.

By right-clicking a panel and selecting Properties, you can change its size and dimensions. For example, by unchecking the Expand box, you can make the panel shrink to its smallest possible size. Then, when you add new components (or, in the case of a panel containing the Window List, a new program is run), the panel will expand as necessary. This can be a neat effect and also creates more desktop space. (This effect is a little like the Mac OS X Dock and might help migrating OS X users feel at home!)

Selecting the Autohide feature will make the panel slide off the screen when there isn't a mouse over it. Choosing Show Hide Buttons will make small arrows appear on either side of the panel so that you can click to slide it off the side of the screen when it's not in use. Both techniques create more desktop space.

You can also change the panel's alignment to top, bottom, left, or right by changing the selection in the Orientation drop-down list.

Adding and Removing Menus

You can add either just the Applications menu or the entire set of menus (Applications, Places, and System) to the panel at the bottom of the screen. This can help those who long for the Windows Start button approach to access programs.

Adding All the Menus to a Panel

To add the Application, Places, and System menus to the panel at the bottom of the Ubuntu desktop, follow these steps:

1. Right-click a blank spot on the bottom panel and select Add to Panel.
2. In the dialog box that appears, click the Menu Bar option to add all three menus. You'll find this under the Utilities heading in the list; you'll need to scroll down to see it.
3. Click the Add button at the bottom of the dialog box.
4. Click the Close button.

Adding a Start-Like Button to a Panel

As an alternative to the Applications, Places, and System menus, you can add a Start-like button that offers submenus for all three menus. Here's how to add this button:

1. Right-click a blank spot on the bottom panel and select Add to Panel.
2. In the dialog box that appears, click the Main Menu option, shown in Figure 10-19. You'll find this under the Utilities heading in the list; you'll need to scroll down to see it.
3. Click the Add button at the bottom of the dialog box.
4. Click the Close button.

Figure 10-19. *Use the Main Menu applet to add a Windows-like Start button to any panel on your screen.*

Deleting a Menu

Creating new instances of the menus won't delete the old ones. If you create a new Applications menu at the bottom of the screen, for example, the old Applications menu will remain at the top of the screen. In fact, you can have as many instances of the menus on the desktop as you wish, although this won't be a good use of desktop space!

To delete any menu, simply right-click anywhere on that menu and select Remove from Panel.

Tip You can personalize the Applications and System menus by right-clicking either and selecting Edit Menus. This will start the Main Menu program (also accessible from the System ➤ Preferences menu). Simply check or uncheck existing entries to add or remove them from the menus, or click the New Item button to create new entries. New application entries can be created as with the launchers discussed earlier.

Moving Panel Items

To move a panel item, right-click it and select Move. Then drag the mouse to the new location, and click the mouse button once to set the item in place. All panel items can be moved, including menus, and items can be moved between different panels. Any item that's in the way will be shifted to make space.

If the Move option is grayed out, right-click it and ensure that Lock to Panel doesn't have a check alongside it. This is especially relevant if you're trying to move an item into the space occupied by something else—if the other item is locked, it won't automatically shift out of the way!

Working with Applets

Almost everything you see on the desktop is considered by the GNOME desktop to be an applet, with the exception of application/file icons and the panels. A menu is a form of applet, for example, as is the Workspace Switcher.

■ **Note** Applets are completely separate from screenlets, which were discussed earlier in this chapter. Applets are built into the GNOME desktop to provide essential functionality. Screenlets are provided by the Screenlets subsystem and "float" on top of the desktop. However, there are often overlaps in terms of the functions offered by applets and screenlets.

Ubuntu provides many more applets that you can choose to add to the desktop to provide a host of useful or entertaining functionality. To add an applet, right-click a blank spot on a panel and select Add to Panel. Some applets require configuration when they're added, so you may need to right-click them and select Properties. For example, you'll need to set your location in the Weather Report applet's properties so it can provide accurate forecasting. For more details about each applet and whether it needs additional configuration, see Table 10-1. To remove an applet, simply right-click it and select Remove from Panel.

Table 10-1. *Ubuntu Desktop Applets*

Applet	Description	Configuration[a]
Address Book Search	Lets you quickly retrieve contact information from your Evolution address book.	None needed.
Battery Charge Monitor	Shows the battery level on notebooks and whether outlet power is in use.	None needed.

Applet	Description	Configuration[a]
Brightness	Allows you to adjust the brightness of a laptop screen.	None needed.
Character Palette	Displays a palette of accented or unusual characters; click a character to insert it into the text.	None needed.
Clipboard Text Encryption	Allows you to decrypt, encrypt, or sign contents of the clipboard, provided encryption is set up (see Chapter 9).	Click to encrypt, sign, decrypt, or verify clipboard contents.
Clock	Displays the time and date (active by default).	None needed.
Connect to Server	Lets you quickly connect to remote servers, such as FTP (the equivalent of clicking Places ➤ Connect to Server).	None needed.
CPU Frequency Scaling Monitor	Shows CPU frequency and, on compatible hardware and if correctly configured (see Chapter 8), lets you change CPU frequency.	Right-click to change frequency.
Deskbar	Adds a quick search text box that allows you to search the Ubuntu software library or the Web.	None needed.
Dictionary Lookup	Displays a text box that will look up words according to online dictionaries.	None needed.
Disk Mounter	Lets you quickly mount and unmount removable disks.	None needed.
Drawer	Displays a drawer icon that, when clicked, "slides out" to reveal yet more applets.	Right-click and select Add to Drawer to add applets.
Dwell Click	Displays a selection of mouse actions to choose from for the dwell click feature (see the "Accessibility Settings" section earlier in this chapter).	Click the preferred mouse action.
Eyes	Displays two eyes whose pupils follow the mouse cursor.	None needed.
Fish	Adds a couple of fish to the panel that, when clicked, will spout wisdom.	None needed.
Force Quit	Lets you quit a crashed program.	None needed.
Invest	Adds a text-based scrolling stock ticker to the panel.	Right-click and select Preferences to add individual stock symbols to the list.
Inhibit Applet	Allows you to temporarily switch off automatic power saving, such as hard disk spin-down.	Click to forbid/allow automatic power saving.

Continued

Table 10-1. *Continued*

Applet	Description	Configuration[a]
Keyboard Accessibility Status	Shows whether sticky keys or other accessibility functions are activated.	None needed.
Keyboard Indicator	Shows the current language settings of the keyboard.	None needed.
Lock Screen	Adds an icon that, when clicked, blanks the screen and displays a password prompt.	None needed.
Main Menu	Lets you add a single icon Start-like system menu.	None needed.
Menu Bar	Adds a new Applications, Places, and Desktop menu bar to the panel.	None needed.
Modem Monitor	Displays virtual LEDs showing when modem data is sent/received and lets you quickly dial up with a single click.	None needed.
Network Monitor	Displays virtual LEDs showing data sent/received via networking devices.	None needed.
Notification Area	Adds a notification area to the panel (active by default).	None needed.
Pilot Applet	Lets you quickly connect to Palm devices via GNOME-Pilot software.	If GNOME-Pilot hasn't already been set up, a configuration dialog box will appear.
Pointer Capture	Lets you temporarily switch off the mouse pointer, to prevent mouse movement from getting in the way of typing.	Point the mouse cursor to the Pointer Capture icon (a green bar) and click to lock the mouse pointer. Click again to release the mouse pointer.
Quit	Lets you log out or shut down.	None needed.
Run Application	Adds an icon that, when clicked, makes the Run Application dialog box appear.	None needed.
Search for Files	Provides one-click access to Nautilus's search mode.	None needed.
Separator	Simply inserts a graphical separator—useful for making several applets alongside each other look neater.	None needed.
Show Desktop	Minimizes all desktop windows (active by default).	None needed.
Sticky Notes	Lets you create virtual sticky notes.	None needed.
System Monitor	Adds a small graph that shows system resource usage.	Right-click and select Preferences to choose system areas to be monitored.

Applet	Description	Configuration[a]
Terminal Server Client Applet	Provides one-click access to locations set up within the Terminal Server program (see Chapter 33).	None needed.
Tomboy Notes	Lets you add sticky notes to the desktop.	None needed.
Trash	Adds the Trash icon to the panel, where files can be dropped for removal to Trash.	None needed.
User Switcher	Adds an icon that, when clicked, allows you to switch to another user.	None needed.
Volume Control	Adds volume controls (active by default).	None needed.
Weather Report	Adds an icon that shows current weather conditions.	Right-click, and select Preferences and then the Location tab to set your location.
Window List	Adds a list of windows, which you can use to switch between currently running programs (active by default).	None needed.
Window Selector	Adds an icon that, when clicked, switches between currently open windows (alternative to Window List).	None needed.
Workspace Switcher	Shows virtual desktop selector.	None needed.

[a] *Nearly all applets have configuration options that can be used to tweak them in various ways. This column indicates only whether immediate configuration is needed.*

Summary

In this chapter, you learned how to completely personalize Ubuntu to your own tastes. You looked at changing the theme so that the desktop has a new appearance, and you examined how to make the input devices behave exactly as you would like.

In addition, you learned how to add and remove applets from the desktop in order to add functionality or simply make Ubuntu work the way you would like.

In the next chapter, you will look at what programs are available under Ubuntu to replace those Windows favorites you might miss.

CHAPTER 11

Ubuntu Replacements for Windows Programs

Ubuntu is a thoroughly modern operating system and, as such, includes a comprehensive selection of software for just about every day-to-day task. Regardless of whether you want to write letters, edit images, or listen to music, Ubuntu offers something for you.

This chapter introduces the software under Ubuntu that performs the tasks you might be used to under Windows. It's not a detailed guide to each piece of software. Instead, this chapter aims to get you up and running with the Ubuntu replacement as quickly as possible. The chapter will tell you the name of the software, where you can find it on Ubuntu's menus, and a few basic facts about how to use it. In many cases, these applications are covered in far more depth later in the book.

Available Software

Table 11-1 lists various popular Windows programs alongside their Ubuntu counterparts. You'll find most of the programs listed on the Applications menu. Table 11-1 also includes a number of other mainstream alternatives, most of which aren't installed by default under Ubuntu but are available from the Ubuntu online software repositories. You might want to try these later on. As you might expect, they're all free of charge, so you have nothing to lose.

Note Table 11-1 lists only a fraction of the programs available under Linux. There are quite literally thousands of others, including some that have similar facilities as those mentioned. The programs listed here are those that work like their Windows equivalents and therefore provide an easy transition.

Table 11-1. *Ubuntu Alternatives to Windows Software*

Type of Program	Windows	Ubuntu	Alternative Choices
Word processor	Microsoft Word	OpenOffice.org Writer	AbiWord (`www.abisource.com`), KOffice Kword[a] (`www.koffice.org/kword`)
Spreadsheet	Microsoft Excel	OpenOffice.org Calc	Gnumeric (`www.gnome.org/projects/gnumeric`), KOffice KSpread (`www.koffice.org/kspread`)
Presentations	Microsoft PowerPoint	OpenOffice.org Impress	KOffice KPresenter (`www.koffice.org/kpresenter`)
Drawing (vector art)	Adobe Illustrator	OpenOffice.org Draw	Inkscape (`www.inkscape.org`), KOffice Karbon 14 (`www.koffice.org/karbon`)
Database	Microsoft Access	OpenOffice.org Base[b]	Knoda (`www.knoda.org`)
Web page creation	Microsoft FrontPage	OpenOffice.org Writer	KompoZer (`http://kompozer.net/`), Amaya (`www.w3.org/Amaya`)
E-mail	Microsoft Outlook	Evolution	Mozilla Thunderbird (`www.mozilla.com`), KMail (`http://kontact.kde.org/kmail`)
Contacts manager/calendar	Microsoft Outlook	Evolution	Kontact (`www.kontact.kde.org`)
Web browser	Microsoft Internet Explorer	Mozilla Firefox	Konqueror (`www.konqueror.org`), Midori (`www.twotoasts.de`), Opera (`www.opera.com`)[c]
CD/DVD burning	Nero	Brasero	K3b (`www.k3b.org`)
MP3 player	Winamp	Rhythmbox	Aqualung (`http://aqualung.factorial.hu`), Banshee (`http://banshee-project.org`)
CD player/ripper	Windows Media Player	Sound Juicer	Grip (`http://nostatic.org/grip`)
Movie/DVD player	Windows Media Player	Totem media player	VLC (`www.videolan.org`), MPlayer (`www.mplayerhq.hu/homepage`)
Image editor	Adobe Photoshop	GIMP	KOffice Krita (`www.koffice.org/krita`)
Video editor	Premiere Elements	Kino (`www.kinodv.org`)	Kdenlive (`www.kdenlive.org`)
Zip files	WinZip	File Roller	KArchiver (`http://pages perso-orange.fr/coquelle/karchiver`)
MS-DOS prompt	`cmd.exe/command.exe`	GNOME Terminal	Xterm (`www.x.org`)[d]

Type of Program	Windows	Ubuntu	Alternative Choices
Calculator	Calc	Calculator	Too many to mention!
Text editor/viewer	Notepad	Gedit	Kate (`www.kate-editor.org`)
Desktop games	Minesweeper/ Solitaire	Mines/AisleRiot Solitaire	Too many to mention!

[a] *Some of the applications here are based on KDE. When using the standard Ubuntu GNOME desktop, you will have to install the core KDE libraries in order to use these. Installing software via the Synaptic Package Manager should ensure that these issues are taken care of.*

[b] *Base isn't installed by default but is easily installed via the* `openoffice.org-base` *package. This database tool is tightly integrated with the rest of the OpenOffice.org suite.*

[c] *Opera is a proprietary product, rather than open source; however, it is free of charge.*

[d] *Xterm is part of the X.org package, so it is installed by default under Ubuntu. To use it, type* `xterm` *in a GNOME Terminal window. See Chapter 10 to learn how to create a permanent desktop launcher for Xterm.*

LINUX HAS IT ALL

The Ubuntu software archives contain thousands of programs to cover just about every task you might wish to do on your computer. Diversity is vitally important within the Linux world. For example, rather than just one e-mail program, you'll find many available. They compete with each other in a gentle way, and it's up to you which one you settle down with and use.

Part of the fun of using Linux is exploring what's available. Of course, the added bonus is that virtually all this software is free of charge, so you can simply download, install, and play around. If you don't like a program, just remove it from your system. However, don't forget to revisit the program's home page after a few months; chances are the program will have been expanded and improved in that short period, and it might be better at meeting your needs.

A Quick Start with Common Ubuntu Programs

The remainder of this chapter outlines a handful of the programs listed in Table 11-1. Our goal is to give you a head start in using each program, pointing out where most of the main functions can be found. You'll find more details about the GIMP image editor, multimedia tools, and office applications in Parts 5 and 6 of this book.

Keep in mind that Ubuntu doesn't aim to be an exact clone of other operating systems. Some of the programs will work in a similar way to what you're used to, but that's not true of all of them. Because of this, it's easy to get frustrated early on when programs don't seem to work quite how you want or respond in strange ways. Some programs might hide functions in what seem like illogical places compared with their counterparts on other operating systems. Some patience is required, but it will eventually pay off as you get used to Ubuntu.

Word Processing: OpenOffice.org Writer

OpenOffice.org is an entire office suite for Linux that was built from the ground up to compete with Microsoft Office. Because of this, you'll find that much of the functionality of Microsoft Office is replicated in OpenOffice.org, and the look and feel are also similar to pre-2007 releases of Office. The major difference is that OpenOffice.org is open source and therefore free of charge.

OpenOffice.org Writer (Applications ➤ Office ➤ OpenOffice.org Word Processor), shown in Figure 11-1, is the word processor component. As with Microsoft Word, it's fully WYSIWYG (What You See Is What You Get), so you can quickly format text and paragraphs. This means the program can be used for quite sophisticated desktop publishing, and pictures can be easily inserted (via the Insert menu).

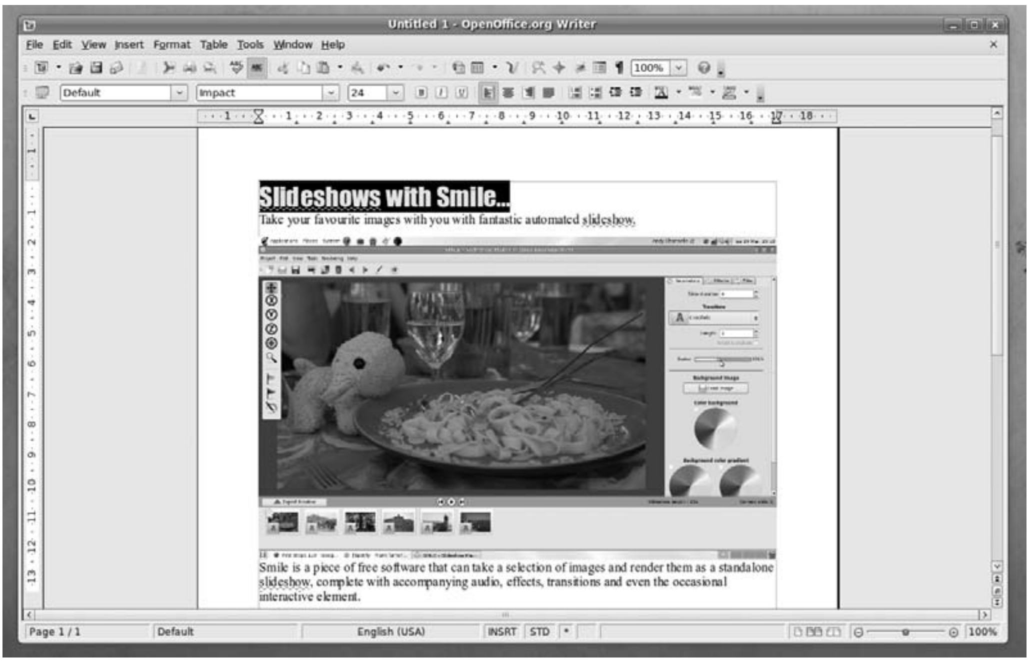


Figure 11-1. *OpenOffice.org Writer*

Writer's toolbars provide quick access to the formatting tools, as well as to other common functions. The vast majority of menu options match those found in Word. Right-clicking the text itself also offers quick access to text-formatting tools.

A number of higher-level functions are provided, such as mail merge and spell-checking, (found on the Tools menu). You can perform spell-checking on the fly, with incorrect words underlined in red as you type.

As with all OpenOffice.org packages, Writer is mostly compatible with Microsoft Office files, so you can save and open `.doc` files. Just click File ➤ Save As, and click the arrow alongside File Type to choose a document format. The only exception is password-protected Word files, which cannot be opened. You can also export documents as PDF files (by choosing File ➤ Export As PDF), so they can be read on any computer that has Adobe Acrobat Reader installed.

■ **Note** Although compatible with Microsoft Office 2003 (and below) file formats, OpenOffice.org isn't entirely compatible with Office 2007's Open XML file format at the time of this writing. Documents will probably open, but might not look or operate as they should. However, this will almost certainly change, which is another reason to regularly update your Ubuntu system.

OpenOffice.org Writer is covered in more detail in Chapter 23.

Spreadsheet: OpenOffice.org Calc

As with most of the packages that form the OpenOffice.org suite, Calc (Applications ➤ Office ➤ OpenOffice.org Spreadsheet) does a good impersonation of its proprietary counterpart, Microsoft Excel, both in terms of powerful features and the look and feel, as you can see in Figure 11-2. However, it has only limited support for Excel's Visual Basic for Applications (VBA) macros at present. Instead, Calc and other OpenOffice.org programs use their own macro language, called OpenOffice.org Basic (for more information, see `http://development.openoffice.org`).

Calc has a vast number of mathematical functions. To see a list, choose Insert ➤ Function. The list on the left side of the dialog box includes a brief explanation of each function to help you get started. Just as with Excel, you can access the functions via the toolbar (by clicking the Function Wizard button), or you can enter them directly into cells by typing an equal sign and then the formula code. Calc is intelligent enough to realize when formula cells have been moved and to recalculate accordingly. It will even attempt to calculate formulas automatically and can work out what you mean if you type something like `sales + expenses` as a formula.

As you would expect, Calc also provides automated charting and graphing tools (under Insert ➤ Chart). In Figure 11-2, you can see an example of a simple chart created automatically by the charting tool.

You can format cells by using the main toolbar buttons, or automatically apply user-defined styles (choose Format ➤ Styles and Formatting).

Tip In all the OpenOffice.org applications, you can hover the mouse cursor over each button for 1 second to see a tooltip showing what it does.

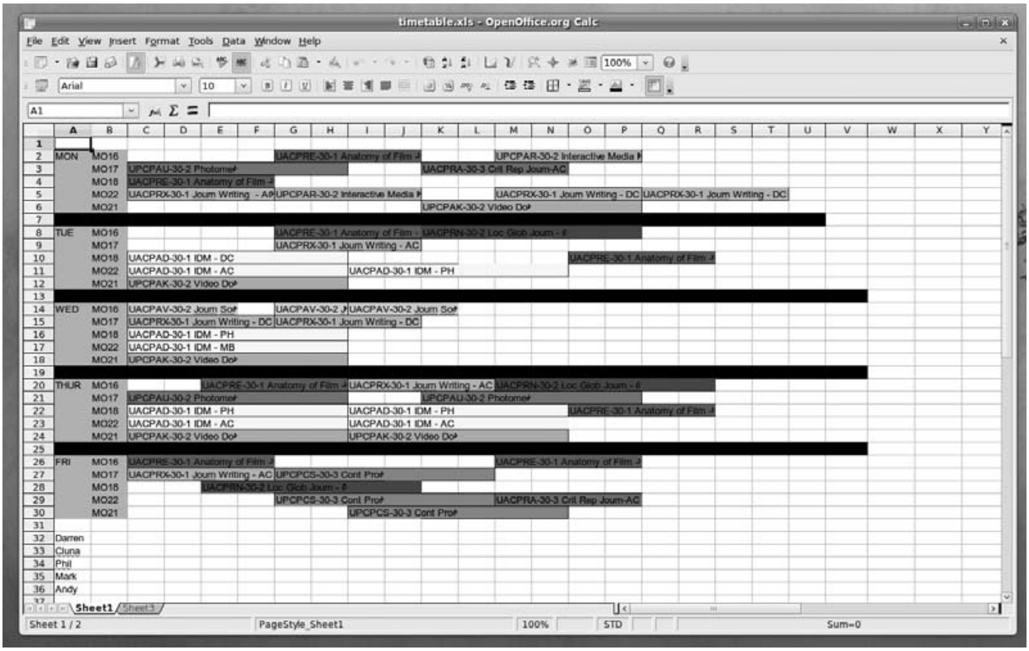


Figure 11-2. *OpenOffice.org Calc*

If you're a business user, you'll be pleased to hear that you can import databases to perform serious number crunching. Use Insert ➤ Link to External Data to get the data, and then employ the tools on the Data and Tools menu to manipulate it.

As with all OpenOffice.org programs, compatibility with its Microsoft counterpart—Excel files in this case—is pretty good. You can also open other common data file formats, such as comma-separated values (CSV) and Lotus 1-2-3 files.

OpenOffice.org Calc is covered in more detail in Chapter 24.

Presentations: OpenOffice.org Impress

Anyone who has used PowerPoint will immediately feel at home with Impress, OpenOffice.org's presentation package (Applications ➤ Office ➤ OpenOffice.org Presentation), shown in Figure 11-3. Impress duplicates most of the common features found in PowerPoint, with a helping of OpenOffice.org-specific extras.

The program works via templates into which you enter your data. Starting the program causes the Presentation Wizard to appear. This wizard guides you through selecting a style of presentation fitting the job you have in mind. At this point, you can even select the type of transition effects you want between the various slides.

After the wizard has finished, you can choose from the usual normal and outline view modes (available from the View menu, or by clicking the tabs in the main work area). Outline mode lets you enter your thoughts quickly, while normal mode lets you type straight onto presentation slides.

You can format text by highlighting it and right-clicking it, by using the Text Formatting toolbar that appears whenever you click inside a text box, or by selecting an entry on the Format menu. Impress also features a healthy selection of drawing tools, so you can create quite complex diagrams. These are available on the Drawing toolbar along the bottom of the screen. You can also easily insert pictures, other graphics, and sound effects.

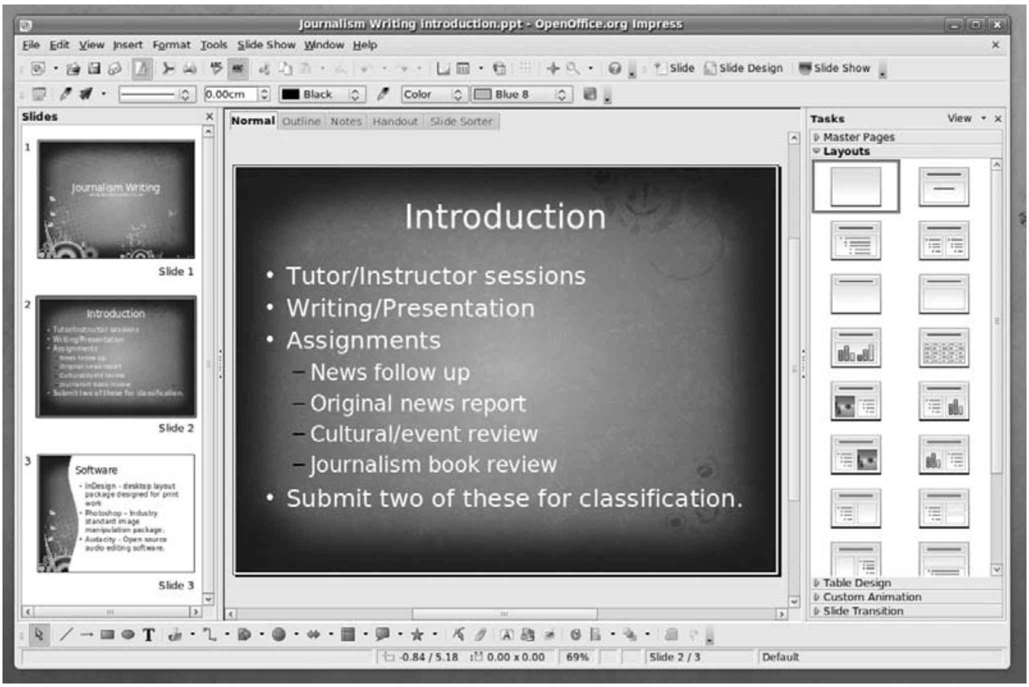


Figure 11-3. *OpenOffice.org Impress*

You can open and edit existing PowerPoint (PPT) files and, as with all OpenOffice.org packages, save your presentation as a PDF file. Impress also lets you export your presentation as a Macromedia Flash file (SWF). This means that anyone with a browser and Macromedia's Flash plug-in can view the file, either online or via e-mail. Simply click File ➤ Export, and then choose Macromedia Flash (SWF) from the File Format list.

Along with slide presentations, Impress also lets you produce handouts to support your work.

OpenOffice.org Impress is covered in more detail in Chapter 25.

Database: OpenOffice.org Base

Base, shown in Figure 11-4, allows you to create relational databases by using a built-in database engine, as well as interface with external databases. Base is not installed by default, so you will need to install the `openoffice.org-base` package by using System ➤ Administration ➤ Synaptic Package Manager. Then you can access it by clicking Applications ➤ Office ➤ OpenOffice.org Database.

Base is very similar to Microsoft Access in look and feel, although it lacks some of Access's high-end functions. For most database uses, it should prove perfectly adequate.

If you know the fundamentals of database technology, you shouldn't have any trouble getting started with Base immediately. This is made even easier than you might expect, because when the program starts, a wizard guides you through the creation of a simple database.

As with Access, Base is designed on the principles of tables of data, forms by which the data is input or accessed, and queries and reports by which the data can be examined and outputted. Once again, wizards are available to walk you through the creation of each of these, or you can dive straight in and edit each by hand, by selecting the relevant option.

Each field in the table can be of various types, including several different integer and text types, as well as binary and Boolean values. Forms can contain a variety of controls, ranging from simple text boxes to radio buttons and scrolling lists, all of which can make data entry easier. Reports can feature a variety of text formatting and can also rely on queries to manipulate the data. The queries themselves can feature a variety of functions and filters in order to sort data down to the finest detail.

You'll learn more about Base in Chapter 26.

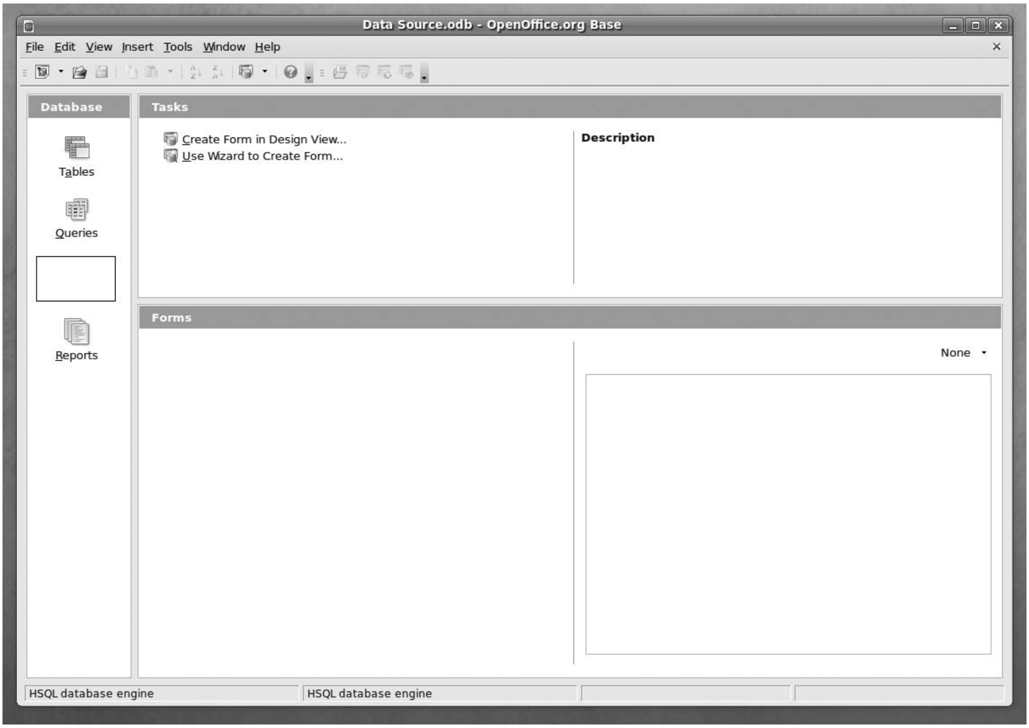


Figure 11-4. *OpenOffice.org Base*

E-Mail/Personal Information Manager: Evolution

Evolution is a little like Microsoft Outlook in that, in addition to being an e-mail client, it can also keep track of your appointments and contacts. You can start Evolution by clicking Applications ➤ Office ➤ Evolution Mail and Calendar.

Before using the program, you'll need to set it up with your mail server settings, as detailed in Chapter 8. Evolution is compatible with POP/SMTP, IMAP, Novell GroupWise, Hula, Microsoft Exchange, and a handful of Unix mail formats rarely used nowadays.

After the program is up and running, as shown in Figure 11-5, you can create a new message by clicking the New button on the toolbar. To reply to any e-mail, simply select it in the list, and then click the Reply or Reply To All button, depending on whether you want to reply to the sender or to all the recipients of the message.

To switch to Contacts view, click the relevant button on the bottom left. If you reply to anyone via e-mail, they're automatically added to this Contacts list. You can also add entries manually by either right-clicking someone's address in an open e-mail or right-clicking in a blank space in the Contacts view.

Clicking the Calendars view shows a day-and-month diary. To add an appointment, simply select the day, and then double-click the time you want the appointment to start. You can opt to set an alarm when creating the appointment, so that you're reminded of it when it's scheduled.

Finally, by clicking the Tasks and Memos buttons, you can create a to-do list and jot down quick notes, respectively. To add a task, click the bar at the top of the list. After an entry has been created, you can put a check in its box to mark it as completed. Completed tasks are marked with a strike-through, so you can see at a glance what you still need to do. To add a memo, click the bar at the top of the memo list, and simply type what you want to remember.

In addition to the setup guide in Chapter 8, you'll find a full explanation of Evolution's features in Chapter 27.

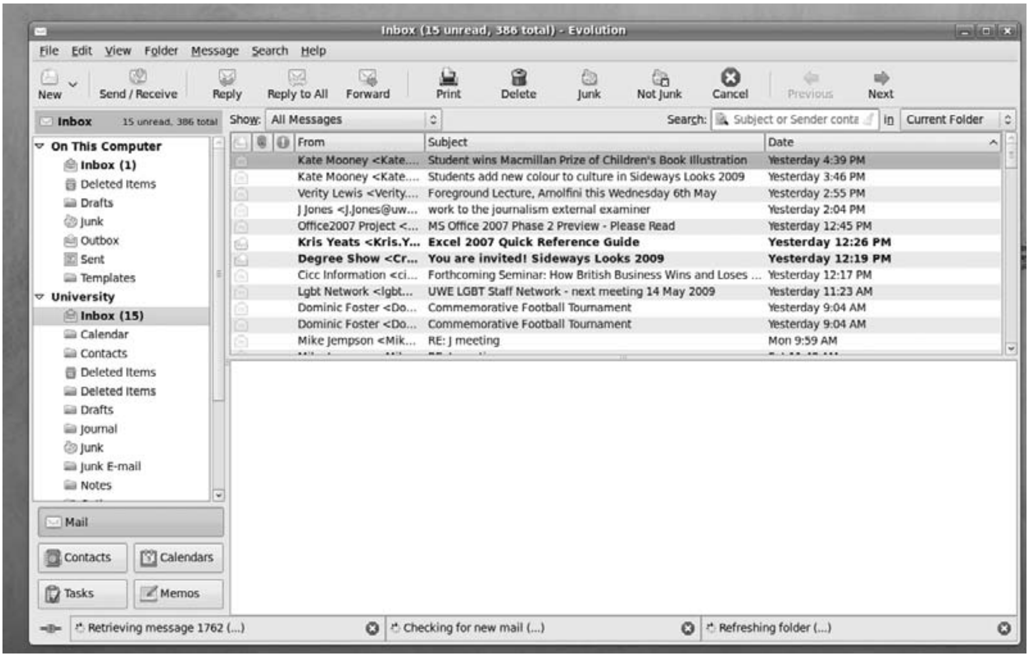


Figure 11-5. *Evolution*

Web Browser: Firefox

You might already know of Mozilla Firefox under Windows, where it has firmly established itself as the alternative browser of choice. The good news is that the Linux version of Firefox is nearly identical to its Windows counterpart. Start it by choosing Applications ➤ Internet ➤ Firefox Web Browser.

When the program starts, as shown in Figure 11-6, you can type an address into the URL bar to visit a web site. If you wish to add a site to your bookmarks list, click Bookmarks ➤ Bookmark This Page. Alternatively, you can press Ctrl+D.

Searching is easy within Firefox. You use the search bar at the top right of the window. By default, Firefox uses Google for searches. To choose from other search engines, click the small down arrow on the left side of the search box. You can even enter your own choice of site if your favorite isn't already in the list—click Manage Search Engines, and then click the Get More Search Engines link in the dialog box that appears.

Firefox popularized the principle of tabbed browsing, which means you can have more than one site open at once. To open a new tab, press Ctrl+T. You can move between the tabs by clicking them.

Figure 11-6. *Mozilla Firefox*

Tip When Firefox starts, tabs aren't activated. If you would like to keep tabs in view all the time, click Edit ➤ Preferences, and then click the Tabs button. Then put a check alongside Always Show the Tab Bar.

Firefox is compatible with most of the same add-ons (extensions) you might have used under the Windows version of the browser. You can download new add-ons from https://addons.mozilla.org, or click Tools ➤ Add Ons, and select the Get Add-ons icon. In addition, Firefox under Ubuntu can work with Flash animations and multimedia content; the relevant software (including the Flash Player) is installed on demand the first time it's needed. See the instructions in Chapter 19 to learn more.

Audio Playback: Rhythmbox

Ubuntu's multimedia software is uncomplicated and effective. It can play back the majority of audio files, as long as it's properly configured, which is to say after additional software has been installed. We describe how to set up this software in Chapter 18, and if you're thinking of playing audio files on your computer, you may want to read that chapter immediately.

Rhythmbox plays audio files on your computer's hard disk, as well as audio CDs, and it can be started by clicking Applications ➤ Sound & Video ➤ Rhythmbox Music Player. Figure 11-7 shows it in action.

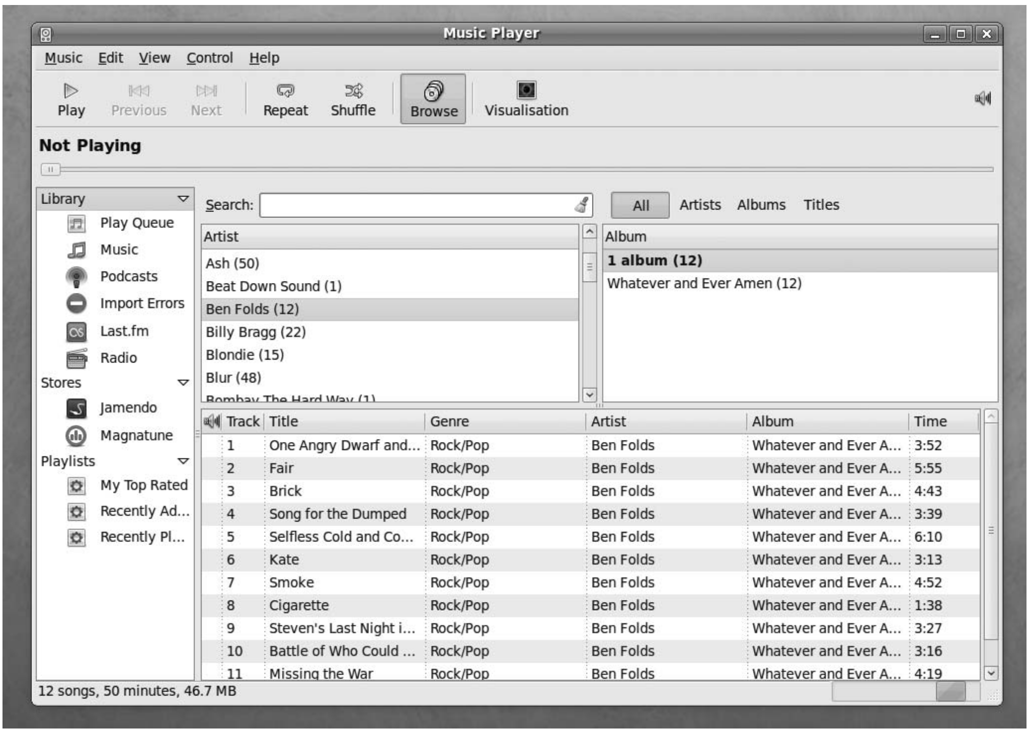


Figure 11-7. *Rhythmbox*

When you run Rhythmbox for the first time, it's a good idea to configure it to find and then catalog your music collection. You might be used to this kind of functionality with other applications like iTunes, and you can do it by clicking Music ➤ Import Folder. After the initial file cataloging has taken place, whenever Rhythmbox runs, you will find your tracks listed by artist or name, providing they have the relevant tag information embedded in them (such as ID3 tags in MP3 music). Ensure that the Music link in the list at the left of the program window is selected. If you already have a large established collection, you can also set Rhythmbox to index that by clicking Edit ➤ Preferences and looking under the Music tab. Next to the Library Location section, click the Browse button and navigate to the folder containing your music. Click the Watch My Library for New Files option to have the software automatically index your collection.

■ **Note** Unlike iTunes, Rhythmbox can't play Digital Rights Management (DRM)-protected files, including standard tracks bought through the iTunes Music Store. iTunes, Amazon.com, and others offer music not encumbered with DRM, and these, as well as music you've ripped from CDs, will play perfectly.

To start playing a music track, double-click it in the list. To make the player smaller so that it doesn't dominate the screen, click View ➤ Small Display.

When an audio CD is inserted, you'll be asked whether you want to open it with Rhythmbox. Assuming you agree, you'll find it listed on the left of the program window under the Devices heading. It will be identified by its name because the name of the CD and the track listing are automatically looked up in online databases. To rip the tracks to your own personal music collection, just right-click the CD icon and click Extract to Library. Note that, unless you have specifically added MP3 support, Rhythmbox will rip tracks to Ogg format. This is similar to MP3 in quality, but otherwise incompatible. Choosing an audio format is covered in Chapter 18. You can control the volume within Rhythmbox by clicking the volume icon at the top right of the program window, or you can use the volume control applet, which is located at the top-right side of the Ubuntu desktop, near the clock. Simply click and then drag the slider to adjust the volume.

Movie Playback: Totem Movie Player

Totem movie player, which can be started by clicking Applications ➤ Sound & Video ➤ Movie Player, is able to handle the majority of video files you might own, as long as some additional software is installed. Totem can also play back DVD movies, which, again, requires the installation of software. We cover setting up this software in Chapters 18 and 19; if you intend to play back video files and DVDs, these chapters should be your first port of call.

Like Rhythmbox, Totem is an uncomplicated application. As shown in Figure 11-8, the video will play on the left side of the window. A playlist detailing movies you have queued appears on the right side. You can remove this, to give the video more room, by clicking the Sidebar button.

You can control video playback by using the play/pause, fast-forward, and rewind buttons at the bottom left. In addition, provided a compatible video format is being played, you can use the Time bar to move backward and forward within the video file. You can switch to full-screen playback by clicking View ➤ Fullscreen. To switch back, simply press the Esc key.

Provided the software described in Chapter 19 is installed, DVD playback will start automatically as soon as a disc is inserted, and you should be able to use the mouse with any onscreen menus. In addition, you can skip between chapters on the disc by using the Go menu, and also return to the DVD's main or submenu systems. To switch between the various languages on a DVD (if applicable), click Sound ➤ Languages and choose from the list.

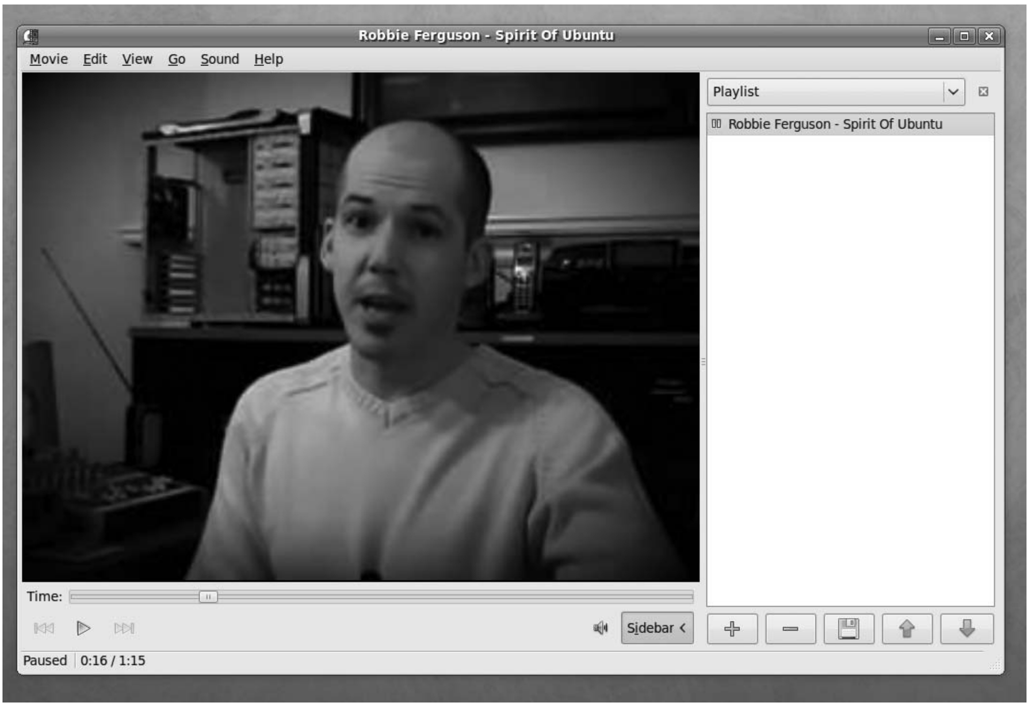


Figure 11-8. *Totem movie player*

CD/DVD Burning: Brasero/Nautilus CD/DVD Creator

As soon as you insert a blank writeable disc, whether it's a CD or DVD, Ubuntu will detect it and offer a handful of choices: Do Nothing, Open Folder, and Open Disc Burner.

The first option should be obvious, while the second option will start Nautilus's CD/DVD burning mode. This is a simple disc-burning interface where files can be dragged into the window and subsequently burned to data CD/DVD.

However, the third option—Open Disc Burner—is most useful. This activates Ubuntu's dedicated CD/DVD-burning software, Brasero, which is able to create data CD/DVDs, as well as audio and video CDs. Brasero, shown in Figure 11-9, can also copy some kinds of discs.

If you want to start Brasero manually, you'll find it on the Applications ➤ Sound & Video menu. When the Brasero interface appears, select from the list whichever kind of project you want to create. For example, to create an audio CD, click the Audio Project button. Then drag and drop your music files onto the program window, and then click the Burn button. Keep an eye on the meter at the bottom right. This is like a progress bar; when the green portion is full, the disc is full. Note that you won't be able to write certain audio files, like MP3s, to CDs unless you have the relevant codecs installed. See Chapter 18 to learn more.

Using the Nautilus CD/DVD Creator is similar to using Brasero. Just drag and drop files onto the window to create shortcuts to the files. When it comes time to burn, Nautilus will copy the files from their original locations. When you've finished choosing files, click the Write to Disc button. Unfortunately, you won't see a warning if the disc's capacity has been exceeded until you try to write to the disc. However, by right-clicking an empty space in the Nautilus window and selecting Properties, you can discover the total size of the files. Remember that most CDs hold 700MB, and most DVD+/-R discs hold around 4.7GB (some dual-layer discs hold twice this amount; see the DVD disc packaging for details).

■ Tip Most modern CD/DVD recorders utilize burn-proof technology, which helps ensure error-free disc creation. To activate this for the Nautilus CD/DVD Creator, open a terminal window (Applications ➤ Accessories ➤ Terminal) and type `gconf-editor`. When the program starts, click Edit ➤ Find, and then type `burnproof`. Make sure there's a check in Search Also in Key Names. In the search results at the bottom of the window, click the first result (`/apps/nautilus-cd-burner/burnproof`) and make sure there's a check in `burnproof` at the top right of the window. Then close the configuration editor.

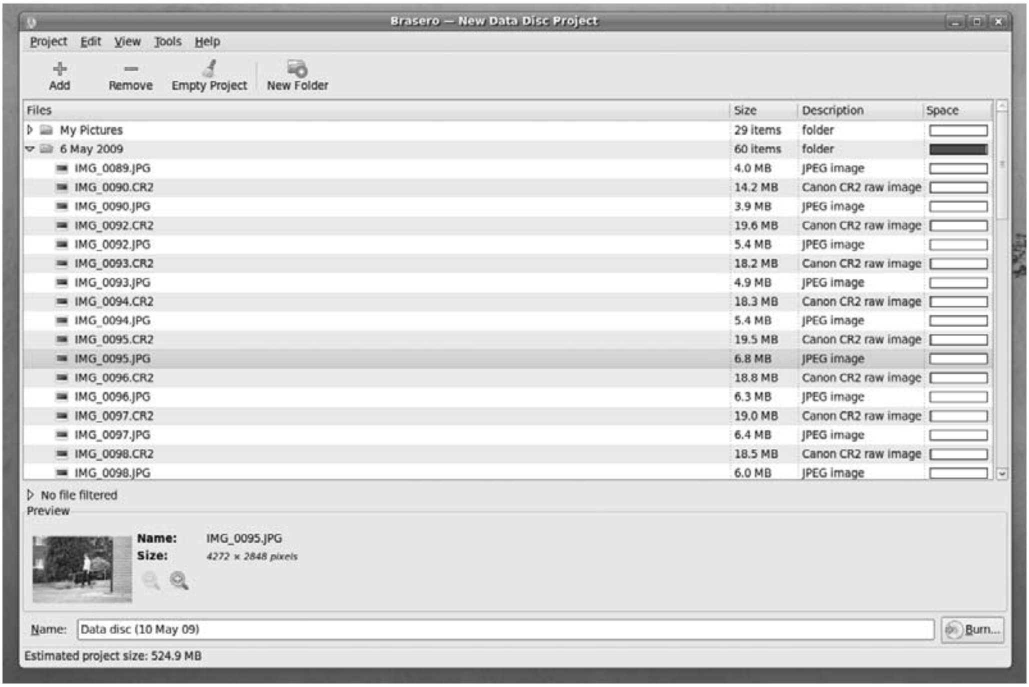


Figure 11-9. *Nautilus CD/DVD Creator and Brasero*

Photo Editing: GIMP

GIMP offers photo-editing tools on par with professional products like Adobe Photoshop. It's certainly more than powerful enough for tweaking digital camera snapshots.

To start GIMP, choose Applications ➤ Graphics ➤ GIMP Image Editor. After the program is running, you'll notice that its main program component is a large toolbar on the left side of the screen. On the right are certain floating palettes, while in the middle is the main image-editing program window. This can be maximized to fill the desktop, and this is a good idea if you wish to make serious use of GIMP.

To open a picture, choose File ➤ Open and select your image from the hard disk. After an image file is opened, you can manipulate it by using the tools on the toolbar (which are similar to those found in other image editors). On the bottom half of the main program window, you'll find the settings for each tool, which can be altered, usually via click-and-drag sliders.

To apply filters or other corrective changes, right-click anywhere on the image to bring up a context menu with a variety of options. For example, simple tools to improve brightness and contrast can be found on the Colors submenu, as shown in Figure 11-10.

For an in-depth look at the GIMP package, see Chapter 20.

Figure 11-10. *GIMP*

Other Handy Applications

Many additional applications might prove useful on a day-to-day basis. Here we'll review some of the more common ones.

Calculator

The GNOME Calculator (also known as Gcalctool) can be found on the Applications ➤ Accessories menu. In its default mode, shown in Figure 11-11, it shouldn't present any challenges to anyone who has ever used a real-life calculator, although the Bksp key might be new. This simply deletes the last number you typed (handy if you miskey during a calculation).

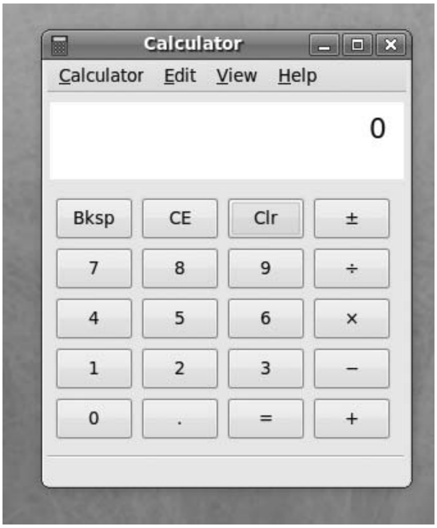


Figure 11-11. *GNOME Calculator*

Calculator also has other modes that you can switch into by using the View menu. Perhaps the three most useful modes for general use are Advanced, Financial, and Scientific. All offer calculator functions relevant to their settings. The Advanced mode is simply a more complicated version of the basic Calculator. It can store numbers in several memory locations, for example, and can also carry out less-common calculations, such as square roots and reciprocals.

Archive Manager

Archive Manager (also known as File Roller), shown in Figure 11-12, is Ubuntu's archive tool. It's the default program that opens whenever you double-click `.zip` files (or `.tar`, `.gz`, or `.bzip2` files, which are the native archive file formats under Linux).

To extract files from an archive, select them (hold down the Ctrl key to select more than one file), and then click the Extract button on the toolbar.

To create an archive on the fly, select files or folders in a Nautilus file browser window, right-click the selection, and select Create Archive. Give the archive a name, and the archive will be created. To add new files to an existing archive, double-click an archive file, and then drag and drop files into the Archive Manager window. When you've finished, simply close the Archive Manager window.

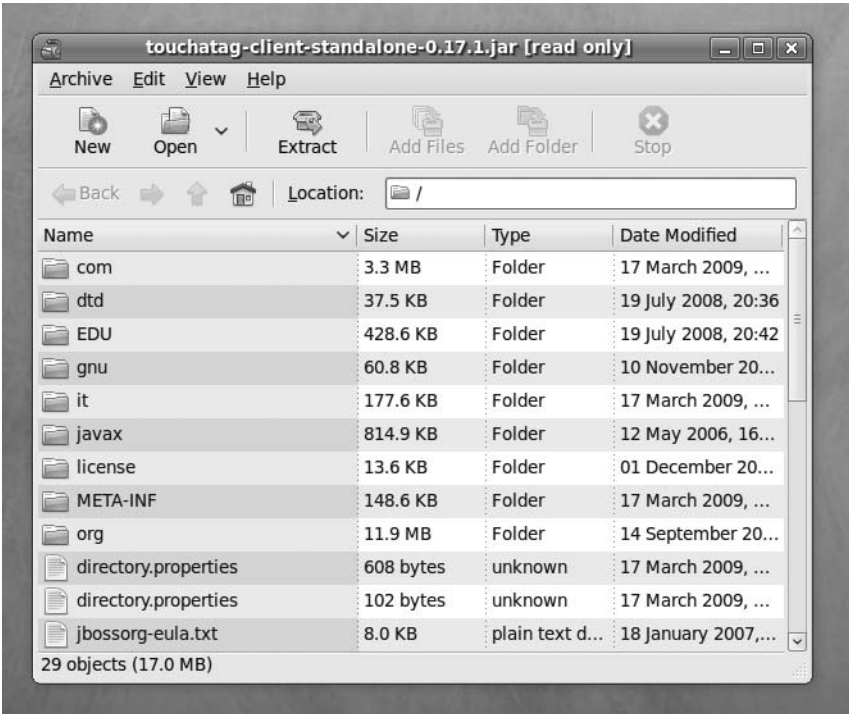


Figure 11-12. *Archive Manager*

Dictionary

You can use the Dictionary tool to look up the definitions of words in the *Collaborative International Dictionary of English*. This dictionary is based on a 1913 edition of *Webster's Revised Unabridged Dictionary*, but with some additional modern definitions. The Dictionary tool is useful for quick lookups, although if you want a precise and modern definition of a word, you might consider using a more contemporary source.

You'll find the Dictionary program on the Applications ➤ Office menu. Type the word in the Look Up text box at the top of the window, and its definition will appear in the area below, as shown in Figure 11-13. As soon as you start typing, the program will begin to look up the word in the dictionary, and this can cause a momentary delay before the letters appear on your screen.

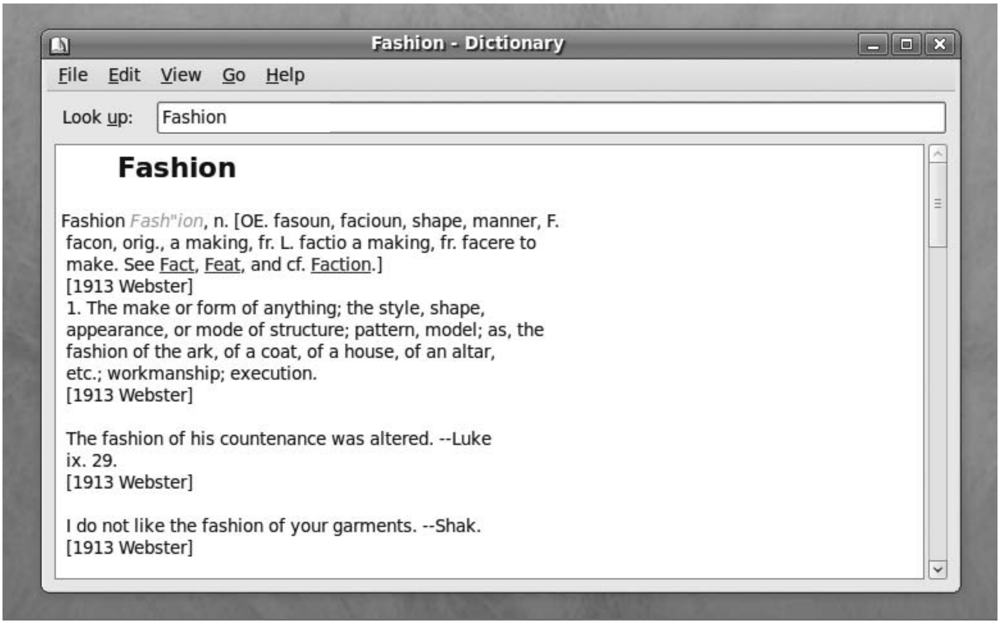


Figure 11-13. *Dictionary*

Pidgin Internet Messenger

Pidgin is the instant messaging software provided with Ubuntu. Unlike most other messaging programs, Pidgin isn't exclusive to one chat protocol. You can use it to connect to MSN, AOL/ICQ, Yahoo!, and many other services. The program can be found on the Applications ➤ Internet menu.

Details for setting up Pidgin are in Chapter 8. After the program is up and running, you can chat with any of your buddies by double-clicking their icon, as shown in Figure 11-14.

The rest of the program can be administered by right-clicking the notification area icon that appears when the program starts. For example, you can change your status or sign off from there.

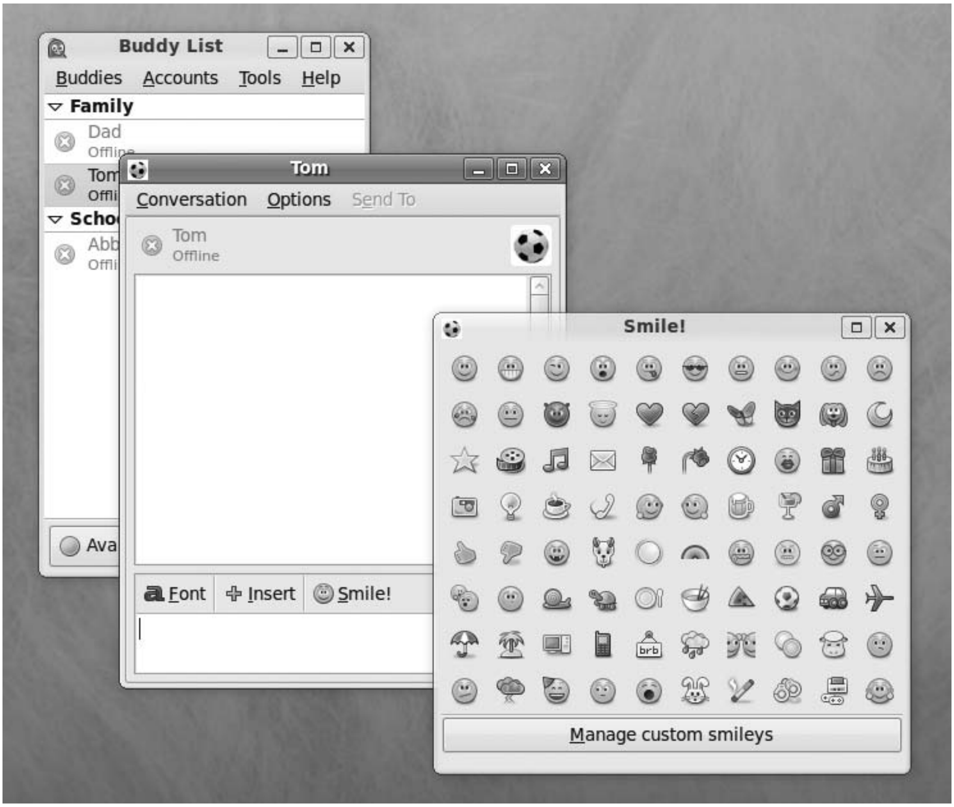


Figure 11-14. *Pidgin*

Ekiga

Ekiga provides Internet telephony (known as Voice over IP, or VoIP) via the SIP and H.323 protocols. It also provides video conferencing, and is compatible with all major features specified within SIP and H.323, such as holding, forwarding, and transferring calls. Ekiga can be found on the Applications ➤ Internet menu.

To activate the camera mode for a video conference, click the webcam icon on the left side of the window. To text chat, click the top icon on the left side of the window.

When the program starts, it will walk you through setup via a wizard. Simply answer the questions with your details. After the program is up and running, as shown in Figure 11-15, type the URL of the person you would like to call into the address bar and click Call.

Note that Ekiga is not compatible with proprietary VoIP software, such as Skype. To learn how to install Skype under Ubuntu, see Chapter 18.

Figure 11-15. *Ekiga*

Games

Ubuntu comes with a great selection of simple games including Mines, shown in Figure 11-16. The equivalent of the Windows Minesweeper game, Mines can be found on the Applications ➤ Games menu. The rules are identical, too: on each grid are several hidden mines, and it's your job to locate them. After you've clicked one square at random, you'll see a series of empty squares and several with numbers in them. Those with numbers indicate that a bomb is near. Your job is to deduce where the bombs are, and then mark them by right-clicking them. You have to do this as quickly as possible because you're being timed.

To change the grid size, click Settings ➤ Preferences. Your choices are Small, Medium, Large, and Custom.

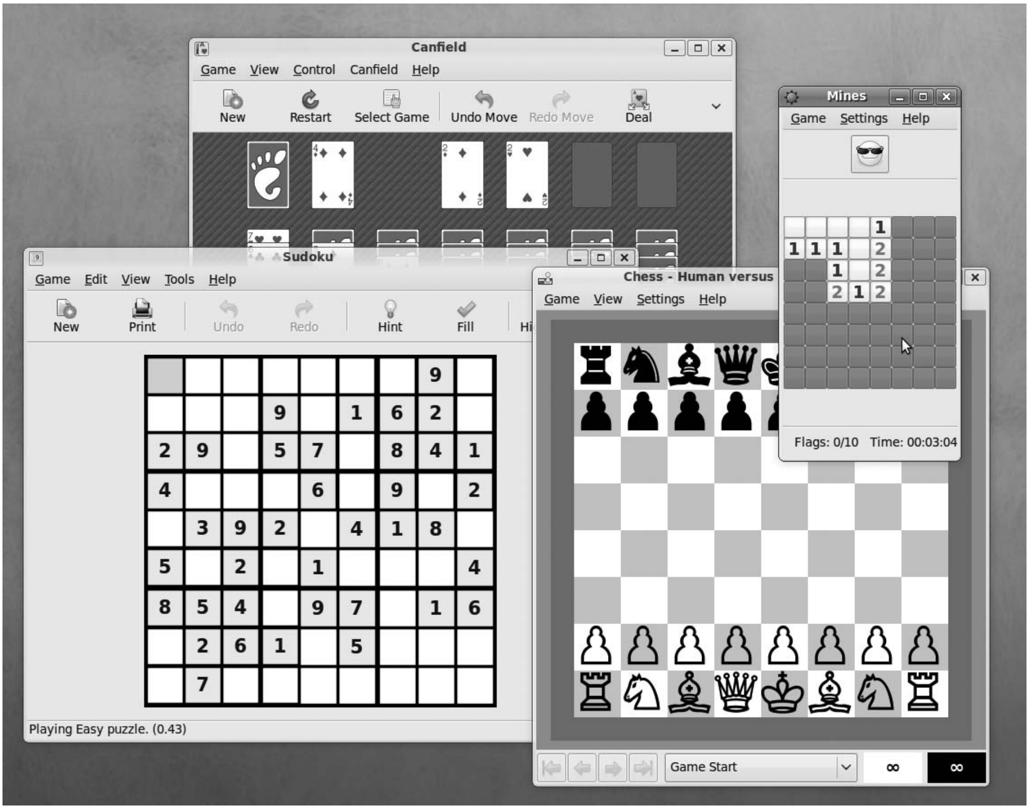


Figure 11-16. *Mines*

Windows Applications

Although Ubuntu doesn't officially support Windows applications, the Wine project is attempting to add a degree of compatibility and is currently good enough to run many of the most common Windows applications. Wine can be installed by using the Synaptic Package Manager, and then applications can be installed by using the standard Windows installer.

Although not every application will work, Wine supports quite a lot of software, including Microsoft Office XP, Spotify (shown in Figure 11-17), Photoshop 7, and even some games. See `www.winehq.org` for more information.

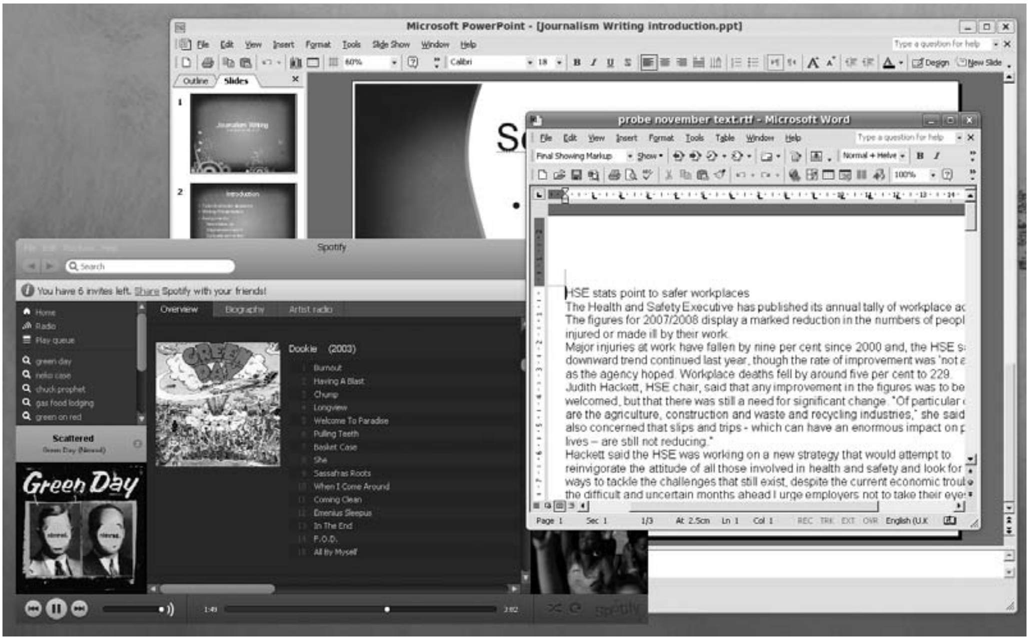


Figure 11-17. *Wine*

Summary

In this chapter, you've taken a look at some Ubuntu programs that provide vital functions that you might have used daily under Windows. The aim was to get you started with this software as quickly as possible by pointing out key features. You've seen how some programs mirror the look and feel of their Windows counterparts almost to the letter, while others resolutely strike out on their own path. It takes just a little time to become familiar with Ubuntu software, and then using these programs will become second nature.

In the next chapter, we'll move on to more fundamental Ubuntu tasks: manipulating files. However, once again, this is not too dissimilar from the Windows experience, which makes getting used to the system very easy.

CHAPTER 12

Managing Your Files

Files are what make the world of Linux go round. They're the currency of any kind of operating system, because every time you use your computer, you generate new files, even if they're only temporary.

How Linux views files, as well as the disks and partitions that contain them, varies somewhat from how Windows handles files. In many ways, the Linux system of file management is far simpler than that in Windows (which, ironically, was created as an attempt to make everything easy!).

In this chapter, we explain how you can manage your files—that is pictures, documents, videos, MP3s, etc.—under Ubuntu. This isn't a definitive guide; you'll need to wait until Chapter 14 to learn the technical ins and outs of the file system and the all-important system of user accounts that goes hand-in-hand with files. However, this chapter provides enough information for you to understand how the system works, and where and how you should store your data.

Understanding File System Concepts

Just like Windows, Ubuntu has a file system that is shared among software components and your own personal data, which you generate within various applications or perhaps download from the Internet. However, Ubuntu differs from Windows in a couple of important ways.

Drive References

Perhaps the most important differences between Linux and Windows are the following:

- The Linux file system doesn't use drive letters.
- The Linux file system uses a forward slash (`/`) instead of a backslash (`\`) in filename paths.

In other words, something like `/home/john/myfile` is typical under Ubuntu, as opposed to `C:\Documents and Settings\John\myfile` under Windows. The root of the hard disk partition is usually referred to as `C:\` under Windows. In Ubuntu, it's referred to simply with a forward slash (`/`).

If you have more than one drive, the drives are usually combined into one file system under Linux. This is done by *mounting*, so that any additional drives appear as virtual folders under the file system. In other words, you browse the other hard disks by switching to various directories within the main file system. We explain mounting in Chapter 14.

■ **Note** If you're used to Mac OS X, the Ubuntu file system shouldn't come as much of a surprise, because both OS X and Ubuntu are based on Unix and utilize similar concepts.

Names of Files

Another important difference between Ubuntu and Windows is that filenames in Ubuntu are case sensitive. This means that `MyFile` is distinctly different from `myfile`. Uppercase letters are vitally important. In Windows, filenames might appear to have uppercase letters in them, but these actually are ignored when you rename or otherwise manipulate files.

Because of this case sensitivity, you could have two separate files existing in the same place, one called `MyFile` and another called `myfile`. In fact, you could also have `myFile`, `Myfile`, `MYFILE`, and so on, as shown in Figure 12-1.

As with Windows, filenames can have spaces within them. This means it's possible to have file or folder names like `Pictures from Disneyland` or `party at bob's house.jpg`.

■ **Note** You might notice that some Linux old-hands avoid using spaces in filenames and use an underscore character (_) or a hyphen (-) instead. There are two main reasons for this. The first is that it's tricky to manipulate filenames with spaces in them at the command prompt (discussed in Part 4 of this book). Second, Internet services are often incompatible with filenames with spaces in them, which means that to use those services, you would need to rename files (unless you put them in an archive first).

Unlike with Windows, filenames can include virtually any symbol, including an asterisk (`*`), backslash (`\`), question mark (`?`), less-than/greater-than signs (`<` and `>`), and so on. The only symbol that's prohibited is the forward slash (`/`), and that's because it has a special use in file paths, as described in the previous section. Be aware, however, that if you wish to share files with colleagues running Windows, you should stick to Windows conventions to avoid incompatibilities, and refrain from using the following symbols: `\/:*?"<>|`.

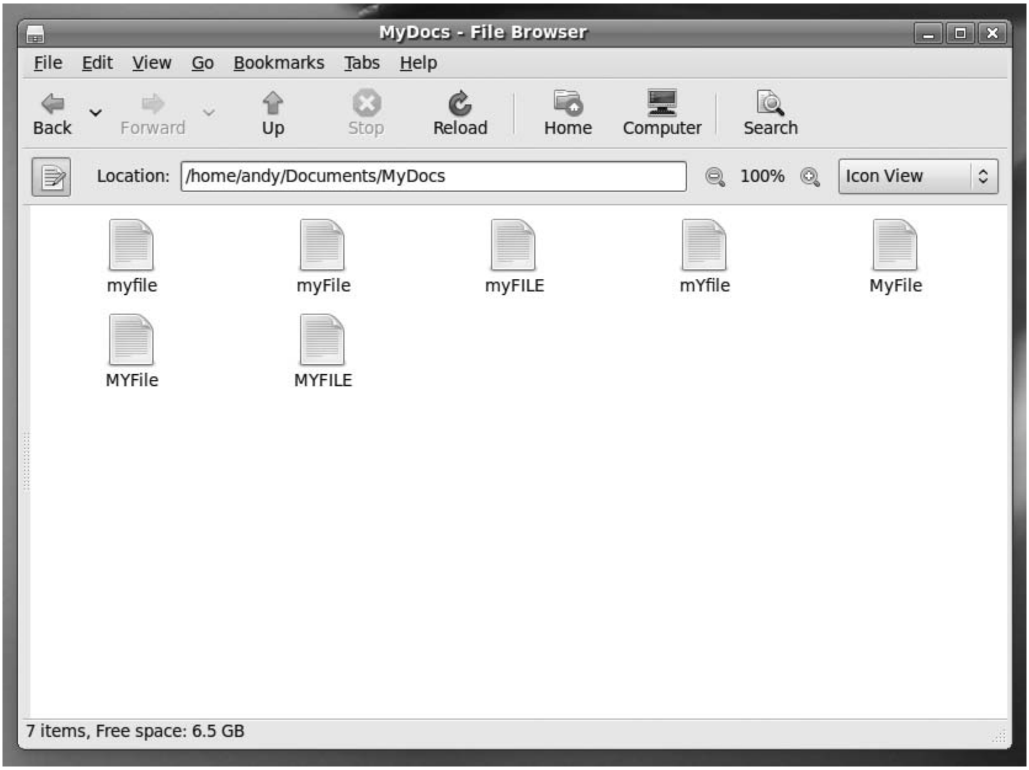


Figure 12-1. *Ubuntu filenames are case sensitive, so many similar filenames can exist, differing only in which letters are capitalized.*

■ **Note** If you try to copy a file with illegal symbols in its name to a Windows machine across a network, Ubuntu simply won't let you, and will report an Invalid Parameters error. In our experience, it *will* let you copy a file with illegal symbols in its name to a Windows partition, however. This results in the file being inaccessible from within Windows, so be careful!

File Access and Storage

Under Windows, you have access to the entire hard disk. You can write, read, or delete files anywhere (unless the system has specifically been configured otherwise). You can save your personal files in `C:\Windows`, for example.

Under Ubuntu, ordinary users can browse most of the hard disk, but they aren't able to write files to the majority of folders (in some cases, they won't even be able to access files).

Although we cover the file system in much more depth in Chapter 14, for the moment, it's enough to know that you've been given your own part of the hard disk in which to store your stuff. This is a directory located within the `/home` directory, and its name is taken from your username. If your login name is `louisesmith`, your place for storing files will be `/home/louisesmith`. Figure 12-2 shows an example of a user's `/home` directory.

■ Note Linux generally uses the terms *directory* and *subdirectory* for the places you put files, whereas Windows refers to them as folders. It's merely a matter of semantics. However, within the Nautilus file browser, directories are pictured as folders and are referred to as such.

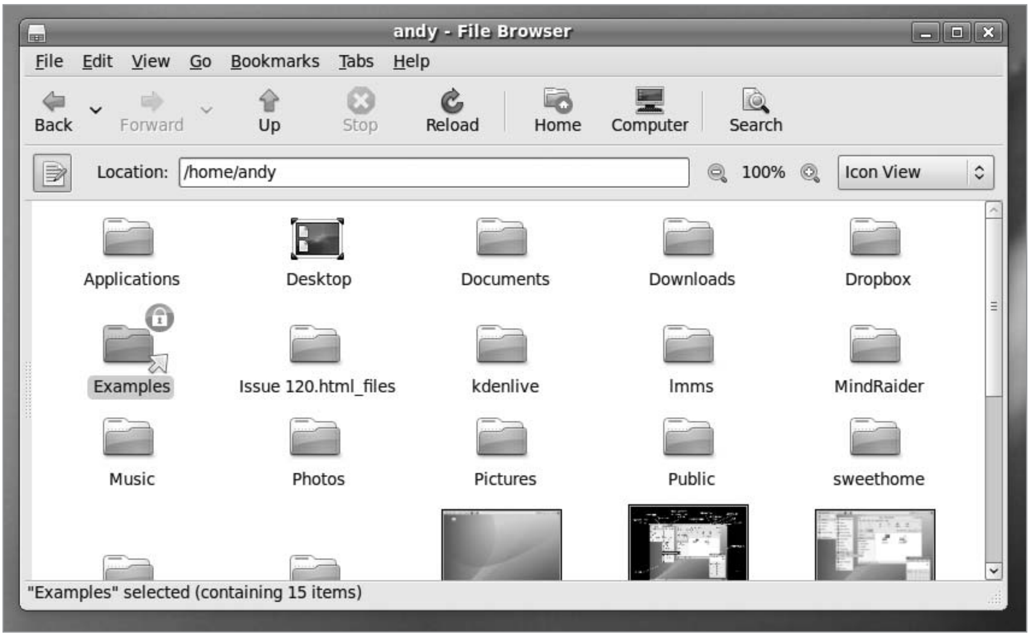


Figure 12-2. *Your personal area on the hard disk is in the* `/home` *directory and is named after your username.*

Some programs might utilize subdirectories in your `/home` directory in order to store and organize their output. For example, a digital camera program might utilize the `Pictures` directory within your `/home` directory. It's up to you whether you use these. The standard practice within the Linux community is to simply save everything into your `/home` subdirectory (for example, `/home/keir`) and sort it out later!

Files within Ubuntu remember who owns them. If user `johnsmith` creates a file, he can make it so that only he can read or write the file (see Chapter 14). The default setting is that other users will be able to read the file, but not write any new data to it. Directories, too, are owned by people, and the owner can set access permissions. By default, all users on a system can access each other's `/home` directories and read files, but they won't be able to change the files or write new files to any directory within `/home` that isn't theirs.

■ **Note** Any user with superuser powers has access to all of the system and can create, edit, and delete files in all directories. This is so the user can perform essential system maintenance.

Using Nautilus

Nautilus is the name of the default file browser in Ubuntu. It's similar to My Computer or Windows Explorer under Windows, in that in its default view mode it presents a list of files on the right side of the window and a series of shortcuts to popular locations within the file system on the left side.

Starting Nautilus is simply a matter of clicking the Places menu and choosing a location, as shown in Figure 12-3.

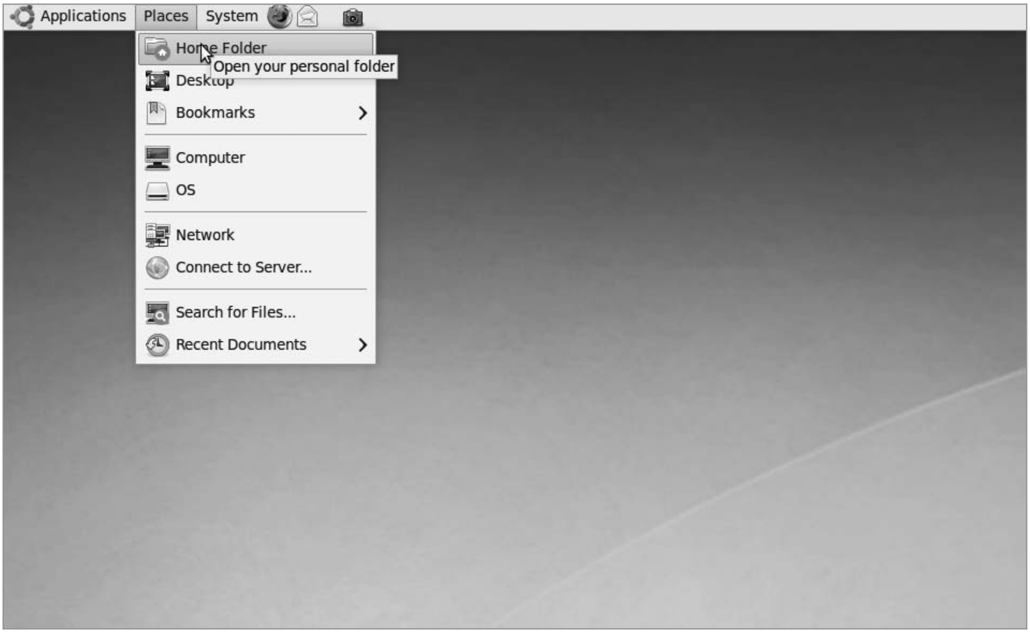


Figure 12-3. *You can open a file browser window by selecting a location from the Places menu.*

The Nautilus window (see Figures 12-1, 12-2, and 12-4) consists of several elements:

Menu bar: The Nautilus menu bar has File, Edit, View, Go, Bookmarks, Tabs, and Help menus. The View menu offers options for controlling the way files are displayed in the Nautilus window, as well as the look and feel of Nautilus itself. The Edit menu lets you manually cut, copy, and paste files. The Go menu lets you quickly jump to other locations in the file system or on a remote server. Using the Bookmarks menu options, you can create web browser–like shortcuts to certain file system locations or servers, so you can access them instantly. There are also some ready-made bookmarks for folders in your `/home` directory: `Documents`, `Music`, `Pictures`, and `Videos`. The Tabs menu lets you manipulate the tabbed browsing interface, which is discussed later in this chapter.

Toolbar: As in a web browser, the toolbar enables you to quickly move backward and forward from place to place in your browsing history. In addition, you can reload the file listing, in order to reflect any changes that might have taken place since the Nautilus window opened, and quickly navigate to popular file system locations, such as your `/home` directory.

Location bar: This feature, located beneath the toolbar, is unique to Nautilus and works in two modes. The first mode, which we'll call *button mode*, is activated by default. This shows individual directories as buttons on the location bar and lets you see where you are in your file system at a glance, as well as quickly and easily move through your file-browsing history. For example, if you start in `/home/andy` (displayed as the andy button), and then browse to `/home/andy/Pictures/holiday/disneyworld`, clicking the Pictures button will return you to `/home/andy/Pictures`. The other folders listed on the location bar (`holiday` and `disneyworld` in this example) won't disappear and will still have buttons, so you can return to those as well. It's best demonstrated by example, so give it a try! The second mode, activated by clicking the icon to the left of the location bar buttons, switches the location bar into a more traditional, text-based bar, where you can type paths and filenames manually. To switch back to button mode, click the icon again.

Zoom controls: To the right of the location bar are the zoom controls. These make the icons representing the files bigger or smaller. When you're browsing a lot of files at once, shrinking them will fit more in the window. On the other hand, when you're viewing photo thumbnails, it can be handy to increase the zoom setting, so you can see more detail in the pictures. This also works for text files, where you'll see a portion of the text contained within the file.

View As Icons/List: To the right of the zoom controls is a drop-down list that switches between Icon, List, and Compact view. List view shows details about the files, such as file size, the type of file, its permissions, and so on. Icon view presents the files as a series of large icons. In many cases, the icons will give a clue as to the nature of the file; for example, audio files appear with musical note graphics. If the folder you're browsing contains image files (or certain document files, such as PDFs), these will be automatically thumbnailed—the icon will be a small version of the contents of the file, as shown in Figure 12-4. By default Nautilus will display only previews of local files smaller than 10MB, but this can be changed by choosing Edit ➤ Preferences and looking under the Preview tab. If you change any of these settings to Always, this could have an impact on performance when you're browsing remote directories. The preview is very handy when browsing pictures for printing or editing. Compact view lists the files in columns, like List view, but without the details. This means that several columns of files can usually fit within a single file-browsing window.

Places pane: The Places pane on the left in Figure 12-4 lists the most popular locations within the file system, as well as any locations that you've bookmarked. Clicking each icon takes you to that location instantly. Clicking the File System entry takes you to the root of the file system (`/`). There are also bookmarks for your floppy drive (if you have one), the Trash folder, any attached removable storage, and any servers available on the local network.

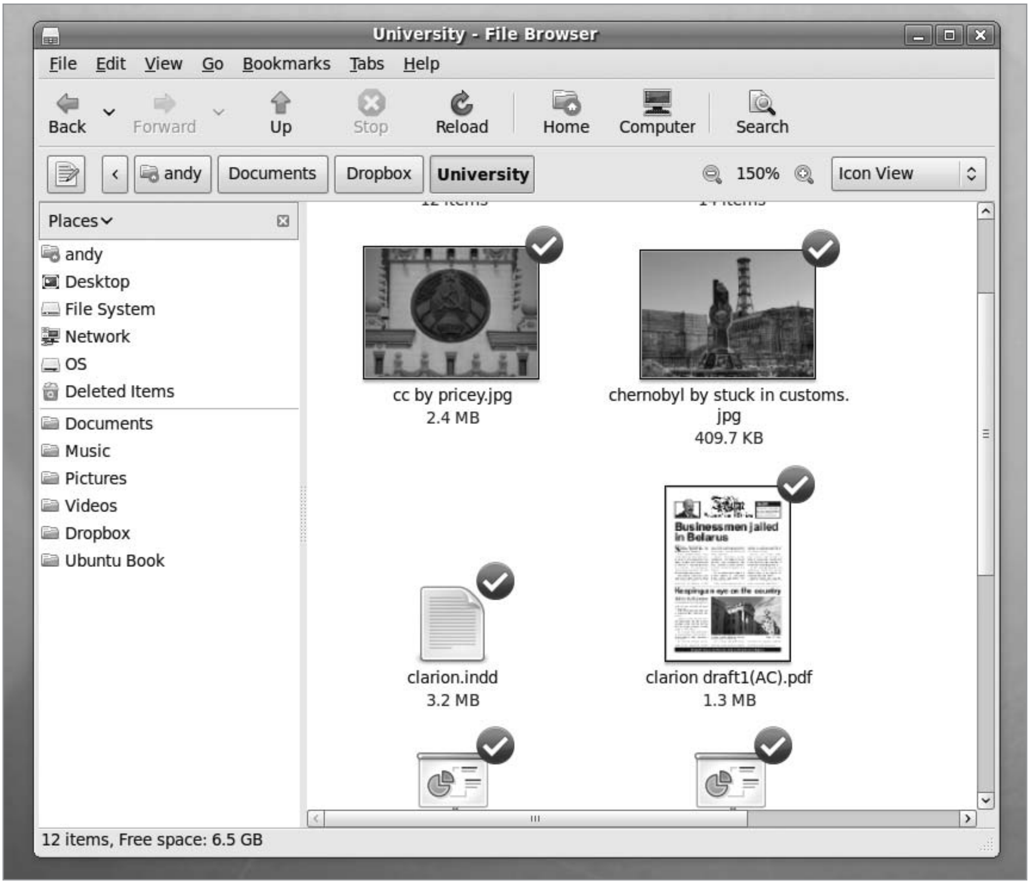


Figure 12-4. *Whenever you view a folder full of pictures in Icon view, they will be automatically thumbnailed.*

■Tip To bookmark a location, drag a folder to the blank area beneath the currently bookmarked folders in the Places pane. This new location will then appear with other bookmarks in the main Places menu.

As under Windows, you can right-click each file in the file browser window to see a context menu with options to rename the file, delete it, open it with particular applications, and so on. The Properties option on the context menu lets you view information about the file and alter certain aspects of it, such as its access permissions (discussed in Chapter 14). You can even add some text notes about the file if you wish!

Caution You should never delete your `/home` folder. Doing so will most likely destroy your personal Ubuntu configuration and prevent you from logging in, because many personal system and program settings are also stored in your `/home` folder.

Changing the View Mode

Nautilus comes equipped with several different view modes, which alter what appears in the sidebar on the left of the program window. The default mode—Places—is described in the preceding section, but several others can be selected by clicking the drop-down list at the top of the side pane. The modes are as follows:

Information: This displays simple information in the side pane about the currently browsed directory, including the number of files it contains and its date of creation. This is similar to how Windows file-browsing windows looked in the Windows 98 and Me releases.

Tree: This option shows a complete list of directories in the file system, along with the complete contents of directories within the user's `/home` directory. Each directory has a chevron alongside it that, when clicked, unfolds that directory so its contents become visible within the side pane (only directories are shown in the side pane). This view is very similar to how file-browsing windows operated back in Windows 95.

History: This view shows a list of the directories that you've visited, with the newest at the top, and the oldest at the bottom. To switch to one of the directories, simply double-click its entry in the list.

Notes: This is another informational display mode. However, this time a text entry field appears, in which you can enter information about the currently browsed directory that will be recorded for future reference. This can be useful in a very large file system.

Emblems: This shows a list of icons that can be clicked and dragged onto any file or directory, as a method of identifying or organizing the file for future reference. See the upcoming "Working with File and Folder Icons" section for more information.

Searching for Files

Nautilus includes a simple search tool. Click the Search button on the toolbar, and you will see a text box below the toolbar. In this text box, type any part of the filename you want to find. For example, typing **festival** will return any filenames with *festival* in them.

By clicking the plus sign icon next to the Reload button after a search, you can specify an exact file type. To do this, click the drop-down list that appears and ensure that File Type is selected. Then click the drop-down list alongside this and select the particular file type you want to find. For example, suppose you're searching for a picture taken at a festival, and you know the filename contains the word *festival*. You also have various documents you created related to attending the festival, and their filenames also contain the word *festival*. In this case, to find only photo files, you can select Picture from the drop-down list. The list, including the Picture type, is shown in Figure 12-5.

■ **Note** The simple search tool in Nautilus is not as powerful as the Search for Files option, available from the Places menu.

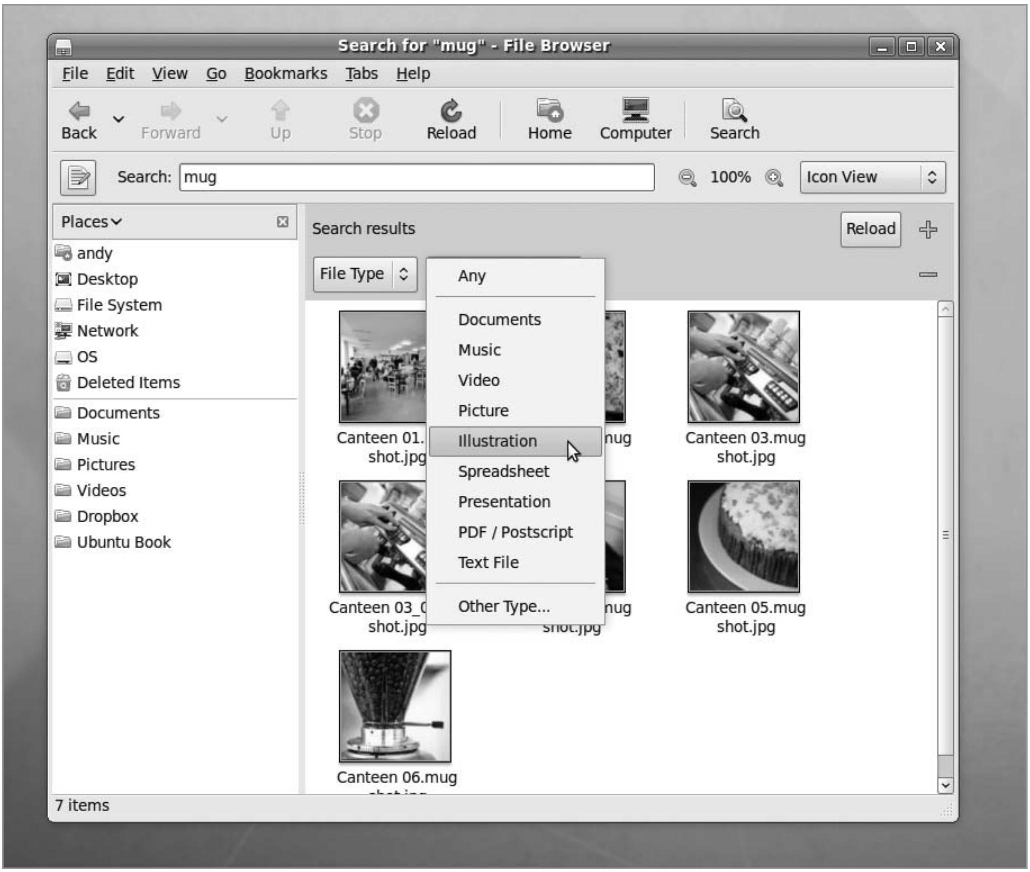


Figure 12-5. *The Nautilus search function lets you filter by file type.*

Working with File and Folder Icons

Files and folders can have *emblems* assigned to them. These are smaller icons that are "tagged on" to the larger icons in both List view and Icon view. Emblems are designed to give you quick clues about the nature of the file. To apply an emblem, right-click the file or folder, select Properties, and then click the Emblems tab. As shown in Figure 12-6, a range of icons is available; in fact, any file or folder can have several emblems applied at once. Simply put a check in the box beside the icons you wish to apply. Pick the ones that are meaningful to you. For example, a "cvs-conflict" emblem will probably be of interest only to programmers.

Nautilus makes use of a handful of emblem icons for its own needs too. For example, a square with an *X* in it indicates that you don't have permissions to access that file or folder at all—not even to view it. A padlock indicates a file or directory is read-only. In most cases, the file system emblems are self-explanatory.

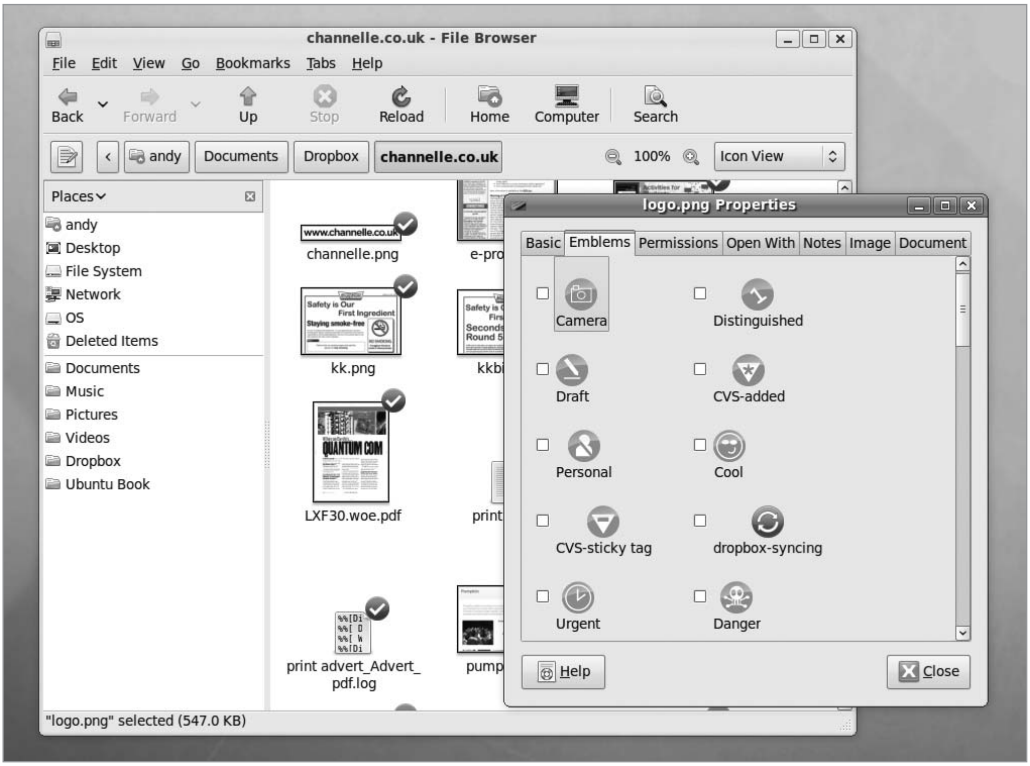


Figure 12-6. *A variety of miniature emblems can be applied to an icon to aid recognition of the file.*

■ **Tip** Want to have some fun with desktop icons? Right-click them and select Stretch Icon. Then click and drag the handles at one of the corners. To restore an icon to its original size, right-click it and select Restore Icon's Original Size. This can be useful if a nonstandard icon doesn't match the size of your normal GNOME icons.

Special Nautilus Windows

As well as letting you view your files, Nautilus has a number of object modes. This is a complicated way of saying that Nautilus lets you view things other than files.

The most obvious example of this is the Computer view of your file system, which presents an eagle's eye view of your storage devices. To access this view, click Go ➤ Computer. If you have a card reader attached, it will appear here, as will any Windows partitions that may be on your hard disk. Double-clicking each item opens a standard Nautilus file browser window (for this to work with Windows partitions, they must be set up correctly, as described in the "Accessing Windows Files" section later in this chapter).

Object mode comes into its own when viewing network locations. Clicking Go ➤ Network brings up the browsing network object view, for example, which is a little like Network Neighborhood or My Network Places under Windows. You can also browse to FTP sites by clicking Go ➤ Location in a file browser window and entering an FTP address (prefacing it with `ftp://`).

■ **Note** You might be used to dragging and dropping files onto program windows or taskbar buttons within Windows in order to open the file. This works with only some programs within Ubuntu. Generally, the best policy is to try it and see what happens. If the program starts but your file isn't opened, it obviously didn't work.

HIDDEN FILES AND DIRECTORIES

When you view your `/home` directory via Nautilus, you're not seeing every file that's there. Several hidden files and directories relating to your system configuration also exist. You can take a look at them by clicking View ➤ Show Hidden Files in the Nautilus menu. Clicking this option again will hide the files and directories.

You might notice something curious about the hidden items: they all have a period before their filenames. In fact, this is all that's needed to hide any file or directory: simply place a period at the front of the filename. There's no magic involved above and beyond this.

For example, to hide the file `partypicture.jpg`, you could simply right-click it and rename it `.partypicture.jpg`. You'll need to click the Reload button on the toolbar for the file view to be updated and for the file to disappear. As you might expect, removing the period will unhide the file.

Files are usually hidden for a reason—for instance, they're not supposed to be editable or are used to configure application elements—and it's no coincidence that most of the hidden files are system files. In addition, every program that you install, or is installed by default, will usually create its own hidden folder for its system configuration data. Deleting such files by accident will usually result in losing your personal settings for that particular program.

The Nautilus file manager has an additional method of hiding files. Any filename that ends with a ~ symbol (the same symbol that indicates your `/home` directory at the command line) does not appear in Nautilus file-browsing windows or on the desktop. For example, `partypicture.jpg~` would be invisible. This method is primarily used to make temporary files created by GNOME applications invisible, but any user can also use it to hide sensitive files. Be aware that this technique is respected only by some GNOME applications, and the files will be entirely visible at the command line.

Tips and Tricks for Nautilus

Although ostensibly simple, Nautilus is packed with features, and it can be a rewarding experience working through the menus in order to see what you can find. Here are a handful of the more useful Nautilus features that can help optimize workflow:

Tabbed browsing: You might have used tabbed browsing with the Firefox web browser, enabling you to visit more than one site simultaneously. The same principle applies to tabbed browsing in Nautilus: pressing Ctrl+T opens a new tab, which appears at the top of the program window and enables you to browse to a different location in the file system. Files can be dragged and dropped between tabs—just click and drag them to a different tab—and tabs can be reordered by clicking and dragging them. Many tabs can be open at any one time, and the only practical limitation is the width of the program window. To close a tab, click its X button.

Matched selection: Imagine that you're working on a large project and have generated a great many files. However, lacking foresight, you failed to create a special project folder and mixed all the files in with others in your `Documents` folder. The project files have a unique characteristic: they all have the name of the project within them. But some filenames contain other text, and there are varying types of files among the collection (images, documents, and so forth). Nautilus's matched selection feature, available on the Edit menu (click Select Items Matching), provides a solution: it lets you select files based on key text within the filenames. With the example quoted previously, you could type the project name into the Pattern dialog box that appears, surrounded by the asterisk wildcard (that is, `*projectname*`), which indicates that any number of characters can appear before or after the keyword. After you click OK, any filenames matching the text will be automatically selected, and you can then click and drag them to a new location or perform any other operation on them.

E-mailing files: By right-clicking a file and selecting the Send To option, you can instantly send a file by e-mail. Ensure that Evolution is selected in the Send As drop-down list in the dialog box that appears, and enter the e-mail address within the Send As text field. Under the Compression heading, you can optionally choose to compress the file first.

Extensions: Just like Firefox, it's possible to add extensions to Nautilus. There are extensions to open a file as the system administrator (`nautilus-gksu`), resize a picture (`nautilus-image-converter`), or set an image as the desktop background (`nautilus-wallpaper`), and these can be installed through the terminal with something like `sudo apt-get install nautilus-wallpaper` or through Synaptic. Using the latter solution, simply type **nautilus-** in the search bar, as in Figure 12-7.

Figure 12-7. *Searching for Nautilus extensions in Synaptic*

Launching Files and Running Programs

As with Windows or Mac OS X, most of the programs on your Ubuntu system automatically associate themselves with various file types that they understand. For example, double-clicking a picture will automatically open the Eye of GNOME image viewer application, and double-clicking a `.doc` file will start OpenOffice.org Writer.

Ubuntu is automatically set up to view common file types. Table 12-1 shows which programs are required for viewing certain types of documents.

Note Whenever you install new software from the installation CD or the official software repositories, it should add an entry to the Applications menu. If for some reason this doesn't happen, you can create a shortcut by using the techniques explained in Chapter 10.

Table 12-1. *Common File Types*

File Type	File Extension	Viewer	Location on Applications Menu
Word processor document	`.doc`, `.rtf`, `.odt`	OpenOffice.org Writer	Office ➤ OpenOffice.org Word Processor
Spreadsheet	`.xls`, `.ods`	OpenOffice.org Calc	Office ➤ OpenOffice.org Spreadsheet
Presentation	`.ppt`, `.odp`	OpenOffice.org Impress	Office ➤ OpenOffice.org Presentation
PDF file	`.pdf`	Evince	Not on Applications menu[a]
Compressed file	`.zip`, `.tar`, `.gz`, `.bz2`, and others	File Roller	Not on Applications menu[a]
Image file	`.jpg`, `.gif`, `.bmp`, and others	Eye of GNOME	Not on Applications menu[a]
HTML file	`.htm`, `.html`	Firefox	Internet ➤ Firefox Web Browser
Text file	`.txt`	Gedit	Accessories ➤ Text Editor
Audio file	`.wav`, `.mp3`, `.ogg`[b]	Rhythmbox	Sound & Video ➤ Rhythmbox
Music Player Video file	`.mpg`, `.mpeg`, `.avi`[b]	Totem	Sound & Video ➤ Movie Player

[a] *Evince, File Roller, and Eye of GNOME are not present on the Applications menu. If you wish, you can add your own shortcuts for these applications by following the instructions in Chapter 10.*

[b] *Playback of many media files is possible only after extra software is installed. See Chapters 18 and 19 for more information.*

If you want to temporarily open a file type with a different program, right-click the file, select Open with Other Application, and choose the other program. From that point on, every time you right-click, you'll be offered the choice of that program to open the file.

To make Nautilus automatically and permanently use the application to open the file type, right-click it and select Properties, and then click the Open With tab. Click the Add button to locate the application you wish to use if it's not in the list. Finally, ensure that the radio button alongside the program you wish to use is highlighted (you may need to click twice for this to happen), as shown in Figure 12-8, and then click the Close button.

Figure 12-8. *You can change which program opens a file by right-clicking, selecting Properties, and clicking the Open With tab.*

Note Under Windows, you can use Windows Explorer to launch program executables by just browsing to their locations within Program Files and double-clicking their `.exe` files. It's technically possible to run programs by using Nautilus to browse to their locations, but this is discouraged. One reason is that Ubuntu doesn't store all of its programs in one central folder, as does Windows. However, most programs that are used on a daily basis can be found in `/usr/bin`. If the program itself isn't stored in `/usr/bin`, it will contain a symbolic link (effectively, a shortcut) to the program's genuine location on the hard disk, which means its usually possible to launch an application either by typing its name into the terminal or by pressing Alt+F2 and typing the name.

Accessing Windows Files

Running Ubuntu on your PC may mark you out as more adventurous than the majority of Windows users, but it's likely that you'll need to access Windows files on a regular basis. If you've chosen to dual-boot with Windows, you might want to grab files from the Windows partition on your own hard disk. If your PC is part of a network, you might want to access files on a Windows-based server or workstation on which a shared folder has been created. You may simply work with others who send you Windows files via e-mail.

Note Accessing shared printers attached to Windows computers is explained in Chapter 8, in the "Configuring a Windows/SMB Shared Printer" section.

Working with Files in Windows Partitions

If you've chosen to dual-boot Ubuntu with Windows on the same hard disk, Ubuntu will allow you to access your Windows partition.

An icon for it should appear on the Places menu, where it will be identified by its size (for example, if the Windows partition is 100GB in size, the icon will read 100GB Media). Selecting this should show your Windows partition contents, although you'll need to type your password when prompted in order to mount it.

After the partition has been made available, an icon for it will appear on the desktop, and it will be listed as a shortcut on the left of any file-browsing window.

■ **Note** You can write to or edit files in an NTFS partition. However, be aware that you could easily destroy your Windows partition because on Ubuntu, all Windows files (even the system-critical files) can be overwritten without warning. On the positive side, this feature allows you to easily recover your files from Windows if it has crashed.

Accessing Networked Files

The easiest way to access shared folders on Windows workstations or servers over a network is to click Places ➤ Network. This will start Nautilus and attempt to search for Windows machines on your local network, just as with Network Neighborhood and My Network Places on the various versions of Windows.

If you've ever used the network-browsing services under Windows, you might already know how unreliable they can be—some computers simply don't appear in the list, others appear eventually after a wait, and others appear but then prove to be mysteriously inaccessible.

A far quicker and more reliable method of accessing a Windows shared folder is to manually specify its network name or IP address. The network name is simply the name of the computer that's used during networking. The IP address is the computer's identifying number and usually takes the form of four octets separated by periods, like this: `192.168.1.4`.

You should try using the network name first when connecting to a computer. If that proves unreliable, try using the IP address instead. You can discover the network name and IP address as follows:

Network name: You can discover the network name of a Windows Vista computer by clicking Start and right-clicking Network on the menu. Click Properties on the menu, and in the window that appears, look at the name of This Computer on the diagram beneath the Network and Sharing Center heading. For example, the name of our test PC is `keir-pc`. To discover the network name within Windows XP, right-click My Computer, select Properties, and then click the Computer Name tab in the window that appears. Look under the Full Computer Name heading.

IP address: To find out the IP address, open an MS-DOS command prompt. To do this under Windows XP, click Start ➤ Run, and type `cmd`. Under Windows Vista, click the Start button and type `cmd` into the Start Search text box. Under both XP and Vista, type `ipconfig` at the prompt. Then, under XP, look for the line that reads *IP Address* and note the details. Under Windows Vista, look for the line that reads *IPv4 Address* and note the number (on our test computer, we had to scroll up the window to see the line).

To access a shared folder, open a Nautilus file browser window (Places ➤ Home), and then click Go ➤ Location. In the box, type the following:

```
smb://computer name/
```

Alternatively, if you wish to use the IP address as shown in Figure 12-9, type the following:

```
smb://IP address/
```

Obviously, in both cases, you should replace `computer name` and `IP address` with the details you noted earlier.

You may also be prompted to enter a username and/or password to access the shared folder.

■**Note** If you're accessing a Windows 95, 98, or Me shared folder, only password protection will have been set (these versions of Windows are unable to specify a username). However, when prompted by Nautilus, you still need to type something into the Username box to gain access—anything will do, as long as the password is correct. You cannot leave the Username box blank.

To create a permanent desktop shortcut to the Windows folder, right-click a blank spot on the desktop and create a launcher. In the Command text box, enter `nautilus`, followed by the full network path to the share. You can discover this by using Nautilus to browse to the shared directory, as described previously, and then clicking the icon next to the location bar to switch to the text-mode view of the path. Then cut and paste the text into the Command box.

For example, on our Ubuntu setup, we created a shortcut to the `Pictures` directory on the computer `keir-office-pc` by typing the following into the Command box:

```
nautilus smb://keir-office-pc/pictures
```

For more information about creating desktop launchers, see Chapter 10.

When using the launcher after rebooting your Ubuntu system, you might notice that the folder takes a few seconds to appear. This is normal and merely the result of the time Ubuntu takes to log on to the computer sharing the files.

Figure 12-9. *If the shared folder requires a username and/or password, you'll be invited to enter these.*

Sharing a Folder from Within Ubuntu

In addition to accessing the shared files of other Windows users, you can also set up your own shared folder under Ubuntu for Windows users to access (or, indeed, other Ubuntu computers). To do this, follow these instructions:

1. Right-click the folder you wish to share, and select Sharing Options from the menu.

2. In the dialog box that appears, put a check in the Share This Folder check box. If this is the first time you've shared a folder, a dialog box will appear telling you the sharing service software is not installed. Click the Install Service button to add it.

You'll be prompted to type your password because some additional software needs to be installed. Following this, Ubuntu will automatically download and install the Samba file-sharing components. You'll be prompted to restart your session after it's finished (that is, log in and out again), so save any open files and restart.

3. When the desktop reappears, repeat the first step—right-click the folder you want to share, and select Sharing Options. Then put a check in Share This Folder again.

4. In the Share Name text box, type a name by which the share will be identified by other computers on the network. At the bottom of the dialog box you might see some warning messages. However, we found some of these were wrong or simply didn't make sense. This is obviously a bug, and our advice is to ignore them. If you genuinely do something wrong, like type too long a share name, Ubuntu will tell you later on.

5. By selecting the Allow Other People to Write in This Folder check box, the shared folder will be made writeable, rather than read-only.

6. At this point, you can click the Create Share check box, and the folder will then be shared. However, anybody who wants to access the folder will need to type your username and password to do so (they will be prompted automatically when they attempt to access it). By putting a check in the Guest Access check box, you can allow anybody on the network to access the shared folder in read-only mode. Then they won't need a username and password. After the shared folder is created, Windows users can access the shared folder by using My Network Places/Network Neighborhood, where it should be "detected" alongside other Windows computers (under Vista, click Start ➤ Network).

There are caveats, however. When we tried to access a "guest access" shared folder from a Windows Vista computer, the username and password prompt still appeared, even though none was required. To gain access, we typed gibberish into the Username field and left the Password field blank. However, we were then unable to access any other shared folders on that computer for which we needed to log in as authorized users (that is, enter the Ubuntu username/password) without logging out and then back in to the Vista computer, which serves all existing network connections.

A separate issue is privacy: by using the preceding method to share a folder within your Ubuntu login, you must reveal to others on the network your username and password details. If you don't want this to happen, you can create a *dummy account* under Ubuntu that exists solely to share folders across the network. This is possible because you don't have to be logged in to a user account for the folders to be shared—they're shared so long as the PC is up and running (even if no user is logged in). We discuss creating new user accounts in Chapter 29; you only need to create a standard nonadministrator user account. After the dummy account is set up, log in to it and create the shared folders, as described earlier. Then log out and return to the standard user account, where you can subsequently access the shared folders by clicking Go ➤ Network—your own computer's shared folders will appear alongside those on other computers on the network. You will need to provide the username and password details of the dummy account, just as if you were logging in across the network.

■**Note** To access the shared folder from another Ubuntu computer, you might need to specify its IP address. To find out the IP address, open a GNOME Terminal window (Applications ➤ Accessories ➤ Terminal) and type `ifconfig`. Then look for the numbers alongside the `inet addr` entry.

Accessing Removable Storage Devices

Ubuntu automatically makes available any CDs or DVDs you insert into your computer, and they'll appear instantly as icons on the desktop. The same is true of any card readers or USB memory devices that you use. Alternatively, you can access the storage devices by clicking their entries on the Places menu, where entries for them will appear automatically upon attachment, or by clicking Places ➤ Computer.

Working in the Computer Window

In the Places ➤ Computer window, you'll find icons for all of the storage devices attached to your computer, including the floppy disk drive if your computer has one, as shown in Figure 12-10. However, because of the way floppy disk drives work, Ubuntu isn't able to automatically detect that a floppy has been inserted. Instead, you'll need to double-click the icon, as with Windows.

■**Note** In days of old, special tools were used to access MS-DOS floppies under Linux, and you might hear some Linux old-hands talking about them. Nowadays, you can simply use Nautilus without needing to take any special steps.

Whenever you double-click any entry in the Computer window, it will open a Nautilus file browser window. You can copy files by clicking and dragging, and right-clicking files offers virtually all the options you could need.

Tip You don't need to use Places ➤ Computer each time to access your floppy, CD, or DVD drive. These drives are mounted in the `/media` folder on your hard disk. Just browse to `/media/floppy` and `/media/cdrom`.

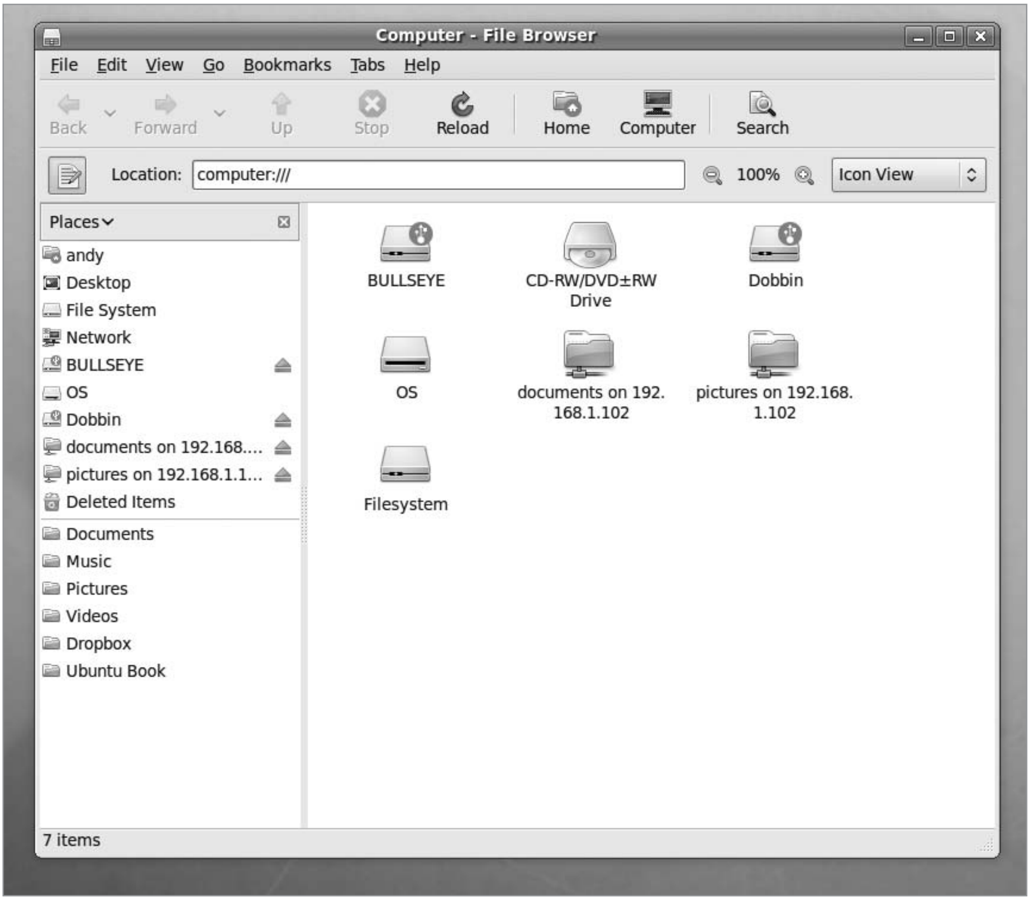


Figure 12-10. *Select Places ➤ Computer to access your removable storage drive and network shares.*

Ejecting Media

Ubuntu isn't quite like Windows when it comes to ejecting or unplugging removable storage devices. In practically all cases, devices must be unmounted, which is to say that you need to tell Ubuntu that you're finished with the device in question and that you're about to unplug it.

In the case of CD or DVD discs, you can simply press the Eject button on the drive itself. Ubuntu is able to detect that the disc is being ejected, so it will automatically unmount the drive. If the disc ever refuses to eject, right-click its icon on the desktop or within Computer and select Eject.

In the case of floppy disks, USB memory sticks, and other USB storage devices, you should always right-click the icon and select Unmount Volume. When unmounting, you may need to wait a short while for any file operations to complete on the drive. If this is the case, you'll receive a notification in the system tray. Then you can unplug or remove the device. This also applies when you're removing a memory card from a card reader—before pulling out the card from the reader, it needs to be unmounted.

■**Note** It's necessary to close any files that were open on the device before unmounting, and even close any file browser windows that were accessing the device.

If you fail to unmount the device, Ubuntu will still believe the device is attached. This shouldn't cause too many problems, but it could crash any programs that were accessing the device. It might also mean the card isn't recognized properly when you reinsert it. In rare instances, data loss can occur.

Summary

This chapter has led you on your first steps in exploring the Linux file system. The file system is vitally important to how Linux works, and we'll go into it in much depth in upcoming chapters.

Here you were introduced to elementary concepts, such as where personal files are stored and the basic rules that govern what you can and cannot do with files. You also looked at the principal method of accessing files via the GUI: the Nautilus file manager. Additionally, you learned how to run programs manually, as well as how to access any Windows partitions or files that may exist on your hard disk or across a network.

In Part 4 of this book, starting in the next chapter, you will look at some of the underlying technology that makes Ubuntu work, and how you can gain more control over your computer. Chapter 13 introduces the BASH shell—perhaps the most powerful piece of software offered by Ubuntu to control your system.

PART 4

The Shell and Beyond

CHAPTER 13

Introducing the BASH Shell

As you learned in Chapter 1, strictly speaking, the word *Linux* refers to just the kernel, which is the fundamental, invisible program that runs your PC and lets everything happen. However, on its own, the kernel is completely useless. It needs programs to let users interact with the PC and do cool stuff, and it needs a lot of system files (also referred to as *libraries*) to provide vital functions.

The GNU Project provides many of these low-level pieces of code and programs. This is why many people refer to the Linux operating system as GNU/Linux, acknowledging that without the GNU components, Linux wouldn't have gotten off the starting blocks.

The GNU Project provides various shell programs too. A *shell* is what the user interacts with on a day-to-day basis, whether by mouse or keyboard. The word originates from the fact that the shell is the outer layer of the operating system, which encompasses the kernel (and in some instances protects it by filtering out bad user commands!). Some shells offer graphical functionality but, in general, the word *shell* is understood to mean text-only interfaces. These text shell programs are also known as *terminal programs*, and they're often colloquially referred to as *command-line prompts*, in reference to the most important component they provide. This kind of shell lets you take control of your system in a quick and efficient way.

By learning how to use the shell, you'll become the true master of your own system. In this part of the book, you'll learn all you need to know about using the shell. This chapter introduces the BASH shell, which is the default one in Ubuntu.

What Is the BASH Shell?

The best way of explaining the BASH shell to a Windows user is to compare it to the DOS command prompt. It lets you issue commands directly to the operating system via the keyboard without needing to mess around with the mouse and windows (although it is sometimes possible to use the mouse within a BASH shell to copy and paste text, and sometimes to control simple text-based menus). The big difference is that the BASH shell has commands for just about everything you might do on your system, whereas the DOS command prompt is mostly limited to tools capable of manipulating and viewing files and directories.

In the old days, the DOS command prompt was also the visible layer of an entire operating system in which DOS programs were designed to be run. However, the shell is merely one of the many ways of accessing the Linux kernel and subsystems. It's true that many programs are designed to run via the BASH shell, but technically speaking, most actually run on the Linux operating system, and simply take input and show their output via the BASH shell.

The instinctive response of a longtime Windows user is to be wary of the BASH shell, because it presents an entirely new way of working and a new set of concepts to learn. There's no denying that the shell provides plenty of challenges for the newbie user, but the rewards it brings—both in terms of sense of achievement, as well as making users more effective at controlling their computers—more than outweigh the initial difficulties.

Linux finds itself with the BASH shell largely because Linux is a clone of Unix. In the early days of Unix, the text-based shell was all that was offered as a way of letting users control the computer. Typing in commands directly is one of the most fundamental ways of controlling any type of computer and, in the evolutionary scale, comes straight after needing to set switches and watch blinking lights in order to run programs.

That the BASH shell can trace its history back to the early days of Unix might sound like a tacit indication that the BASH is somehow primitive—far from it. It's one of the most efficient and immediate ways of working with your computer. Many people consider the command-line shell to be a way of using a computer that has yet to be superseded by a better method.

■ **Note** When you run a shell on a Linux system, the system refers to it as a `tty` device. This stands for *teletypewriter*, a direct reference to the old system of inputting data on what were effectively electronic typewriters connected to mainframe computers. These, in turn, took their names from the devices used to automate the sending and receiving of telegrams in the early part of the 20th century.

Most Linux distributions come with a choice of different kinds of shell programs. However, the default shell is BASH, as is the case in Ubuntu. *BASH* stands for *Bourne Again SHell*. This is based on the Bourne shell, a tried-and-tested program that originated in the heyday of Unix in the late 1970s.

The other shells available include PDKSH (Public Domain Korn SHell, based on Korn Shell, another early Unix shell) and ZSH (Z SHell), a more recent addition. These are usually used by people who want to program Linux in various ways or by those who simply aren't happy with BASH.

■ **Note** Discussing the technical differentiators between shells is beyond the scope of this book, but you'll find an excellent comparison at Wikipedia: `http://en.wikipedia.org/wiki/Comparison_of_computer_shells`.

The BASH shell is considered by many to be the best of all worlds in that it's easy enough for beginners to learn, yet is able to grow with them and offer additional capabilities as necessary. BASH is capable of scripting, for example, which means you can even create your own simple programs.

Why Bother with the Shell?

You might have followed the instructions in Part 2 of this book and consider yourself an expert in Linux. But the real measure of a Linux user comes from your abilities at the shell.

In our modern age, the GUI is mistakenly considered progress. For instance, users of the Microsoft and Apple-based operating systems are quite accustomed to using a mouse to navigate and perform various tasks. Although it's handy in certain situations—it would be difficult to imagine image editing without a mouse, for example—in many other situations, such as when manipulating files, directly typing commands is far more efficient.

Most modern Linux distributions prefer you to use the GUI to do nearly everything. This is because they acknowledge the dominance of Windows and realize they need to cater to mouse users who might not even know the shell exists (and, of course, programs like web browsers would be unusable without a GUI!). To this end, they provide GUI tools for just about every task you might wish to undertake. Ubuntu is strong in this regard, and you can configure a lot of things from the desktop.

However, it's well worth developing at least some command-line shell skills, for a number of reasons:

It's simple and fast. The shell is the simplest and fastest way of working with Ubuntu. As just one example, consider the task of changing the IP address of your network card. You could right-click the NetworkManager icon, select the relevant menu option, and then work your way through the Network Connection dialog box options. That will take at least a minute or two if you know what you're doing, and perhaps longer if it's new to you. Alternatively, you could simply open a shell and type this:

```
ifconfig eth0 192.168.0.15 up
```

It's versatile. Everything can be done via the shell—from deleting files, to configuring hardware, to creating MP3s. A lot of GUI applications actually make use of programs you can access via the shell, although it isn't always the case that you'll find a GUI program that does the job of a well-crafted shell command. Sometimes you simply have to use the shell for a particular task.

It's consistent among distributions. All Linux systems have shells and understand the same commands (broadly speaking). However, not all Linux systems will have Ubuntu's graphical configuration programs. SUSE Linux uses its own GUI configuration tool, as does Mandriva Linux. Therefore, if you ever need to use another system or decide to switch distributions, a reliance on GUI tools will mean learning everything from scratch. Knowing a few shell commands will help you get started instantly.

It's crucial for troubleshooting. The shell offers a vital way of fixing your system should it go wrong. Your Linux installation might be damaged to the extent that it cannot boot to the GUI, but you'll almost certainly be able to boot into a shell. A shell doesn't require much of the system other than the ability to display characters on the screen and take input from the keyboard, which most PCs can do, even when they're in a sorry state. This is why most rescue floppy disks or CDs offer shells to let you fix your system.

It's useful for remote access. One handy thing about the shell is that you don't need to be in front of your PC to use it. Programs such as `ssh` let you log in to your PC across the Internet and use the shell to control your PC (as described in Chapter 34). For example, you can access data on a remote machine, or even fix it when you're unable to be at the machine's location. This is why Linux is preferred on many server systems when the system administrator isn't always present on the site.

It's respected in the community. Using a shell earns you enormous brownie points when speaking to other Linux users. It separates the wheat from the chaff, the men from the boys, and the women from the girls. If you intend to use Linux professionally, you will most certainly need to be a master at the shell.

Seen in this light, learning at least a handful of shell commands is vital to truly mastering your PC.

The drawback when using a command-line shell is that it's not entirely intuitive. Take for instance the command discussed earlier that changes the network card's IP address:

```
ifconfig eth0 192.168.0.15 up
```

If you've never used the shell before, it might as well be Sanskrit written on the side of an ancient tomb. What on Earth does `ifconfig` mean? And why is the word `up` at the end?

■ **Note** If you're curious, the command tells the network card, referred to by Linux as `eth0`, to adopt the specified IP address. The word `up` at the end merely tells it to activate—to start working now. If the word `down` were there instead, it would deactivate! Don't worry about understanding all this right now; later in this chapter, we explain how you can learn about every Linux command.

Learning to use the shell requires learning terms like these. Hundreds of commands are available, but you really need to learn only about 10 or 20 for everyday use. The comparison with a new language is apt because, although you might think it daunting to learn new terminology, with a bit of practice it will all become second nature. After you've used a command a few times, you'll know how to use it in the future. And as we discuss later, lots of built-in help is available. The main thing to realize is that the shell is your friend. It's there to help you get stuff done as quickly as possible. When you become familiar with it, you'll see that it is a beautiful concept. The shell is simple, elegant, and powerful.

When Should You Use the Shell?

The amount of use the Linux shell sees is highly dependent on the user. Some Linux buffs couldn't manage without it. They use it to read and compose e-mail, and even to browse the Web (usually using Mailutils and the Lynx program, respectively).

However, most people simply use it to manage files, view text files (such as program documentation), run programs, and administer the system. All kinds of programs—including GUI and command-line—can be started from the shell. As you'll learn in Chapter 29, unlike with Windows, installing a program on Ubuntu doesn't necessarily mean the program will automatically appear on the Applications menu. In fact, unless the installation routine is specifically made for the version of Linux you're running, this is unlikely.

■ **Note** Unlike with DOS programs, Ubuntu programs that describe themselves as *command-line* are rarely designed to run solely via the command-line shell. All programs are like machines that take input at one end and output objects at the other. Where the input comes from and where the output goes to is by no means limited to the command line. Usually, with a command-line program, the input and output are provided via the shell, and the programmer makes special dispensation for this, but this way of working is why GUI programs often use what might be considered shell programs. You'll often find that a GUI program designed to, for example, burn CDs, will also require the installation of a command-line program that will actually do the hard work for it.

There's another reason why the shell is used to run programs: you can specify how a particular program runs before starting it. For example, to launch the Totem movie player in full-screen mode playing the `myvideofile.mpg` file, you could type this:

```
totem --fullscreen myvideofile.mpg
```

This saves the bother of starting the program, loading a clip, and then selecting the full- screen option. After you've typed the command once or twice, you'll be able to remember it for the next time. No matter how much you love the mouse, you'll have to admit that this method of running programs is more efficient.

When you get used to using the shell, it's likely you'll have it open most of the time behind your other program windows.

Getting Started with the Shell

You can start the shell in a number of ways. The most common is to use a terminal emulator program. As its name suggests, this runs a shell inside a program window on your desktop.

You can start GNOME Terminal, the built-in GNOME shell emulator, by clicking Applications ➤ Accessories ➤ Terminal, as shown in Figure 13-1.

Figure 13-1. *Start the The GNOME Terminal program from the Accessories submenu.*

You'll see the terminal window—a blank, white window that's similar to a simple text editor window. When you run the terminal for the first time, at the top of the window will be a handful of lines telling you about the `sudo` command. We explain the importance of this in Chapter 14, but right now there's no need to worry about it.

Below this will be the most important component of the terminal window—the *command prompt*: a few words followed by the dollar symbol (`$`). On our test system, this is what we see:

```
keir@keir-desktop:~$
```

The first part is the username—the user account we created during installation and use to log in to the PC. After the `@` sign is the hostname of the PC, which we also chose when installing Ubuntu. The hostname of the PC isn't important on most desktop PCs; it's a legacy from the days of Unix.

■**Note** What's with the `@` sign? Again, it's a legacy from the days of Unix, when the hostname referred to the computer's location (such as the university or military facility). Reading the command prompt in this context, the line reads that the user `keir` is logged in to the computer located at the site specified in the hostname! Like we said, this is a legacy of Unix's origins and doesn't mean much nowadays.

After the colon is the current directory you're browsing. In this example, the tilde symbol (`~`) appears instead of an actual path or directory name. This is merely Linux shorthand for the user's `/home` directory. In other words, wherever we see a `~` on our test PC, we read it as `/home/keir/`. After this is the dollar symbol (`$`), which indicates being currently logged in as an ordinary user, as opposed to the root user. However, unlike most other Linux distributions, Ubuntu doesn't use the root account during day-to-day operations, so this is a moot point. Finally, there is a cursor, and this is where you can start typing commands!

■**Note** If you were to log in as root, a hash (`#`) would appear instead of the dollar symbol prompt. This is important to remember, because often in magazines and some computer manuals, the use of the hash symbol before a command indicates that it should be run as root. In addition, if you select the recovery option of the installation CD, you'll be running as root, and a hash will appear at the prompt. See Chapter 14 for more information about the root user.

Running Programs

When we refer to *commands* at the shell, we're actually talking about small programs. When you type a command to list a directory, for example, you're starting a small program that will do that job. Seen in this light, the shell's main function is to simply let you run programs—either those that are built into the shell, such as ones that let you manipulate files, or other, more-complicated programs (including those that you've installed yourself).

The shell is clever enough to know where your programs are likely to be stored. This information was given to it when you first installed Ubuntu and is stored in a system variable.

■Note A *variable* is the method Linux uses to remember things such as names, directory paths, or other data. Many system variables are vital for the running of Ubuntu. These variables can be seen by typing `set` at the command prompt.

The information about where your programs are stored and therefore where Ubuntu should look for commands you type in, as well as any programs you might want to run, is stored in the `PATH` variable. You can take a look at what's currently stored there by typing the following:

```
echo $PATH
```

Don't forget that the difference between uppercase and lowercase letters matters to Ubuntu, unlike with Windows and DOS.

The `echo` command merely tells the shell to print something onscreen. In this case, you're telling it to "echo" the `PATH` variable onto your screen. On our test PC, this returned the following information:

```
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games
```

Several directories are in this list, each separated by a colon.

Don't worry too much about the details right now. The important thing to know is that whenever you type a program name, the shell looks in each of the listed directories in sequence. In other words, when you type `ls`, the shell will look in each of the directories stored in the `PATH` variable, starting with the first in the list, to see whether the `ls` program can be found. The first instance it finds is the one it will run. (The `ls` command gives you a directory listing, as described in the "Listing Files" section later in this chapter.)

But what if you want to run a program that is not contained in a directory listed in your `PATH`? In this case, you must tell the shell exactly where the program is. Here's an example:

```
/home/keir/myprogram
```

This will run a program called `myprogram` in the `/home/keir` directory. It will do this regardless of the directory you're currently browsing, and regardless of whether there is anything else on your system called `myprogram`.

If you're already in the directory where the program in question is located, you can type the following:

```
./myprogram
```

So, just enter a dot and a forward slash, followed by the program name. The dot tells BASH that what you're referring to is "right here." Like the tilde symbol (~) mentioned earlier, this dot is BASH shorthand.

■ **Note** Some of the most basic commands are built into the BASH program and aren't stand-alone programs. Examples include the command to change directory (`cd`) and the aforementioned `echo` command. Logically enough, these commands are known as BASH *built-ins*. Should you type such a command, BASH will not search the `PATH` directories to find the command because there is no need. You can find out whether a command is a built-in by preceding it with `type`—for example, `type cd`.

Getting Help

Each command usually has help built in, which you can query (a little like typing `/?` after a command when using DOS). This will explain what the command does and how it should be used. In most cases, you'll see a hypothetical example of the command in use, along with the range of command options that can be used with it. For example, you can get some instant help on the `ifconfig` command by typing this:

```
ifconfig --help
```

You'll see the help screen shown in Figure 13-2.

The `--help` option is fairly universal, and most programs will respond to it, although sometimes you might need to use a single dash. Just type the command along with `--help` to see what happens. You'll be told if you're doing anything wrong.

In addition, most commands have technical manuals that you can read to gain a fairly complete understanding of how they work. Virtually every Ubuntu setup has a set of these *man* pages, which can be accessed by typing this:

```
man <command>
```

However, man pages are often designed for experienced Ubuntu users who understand the terminology.

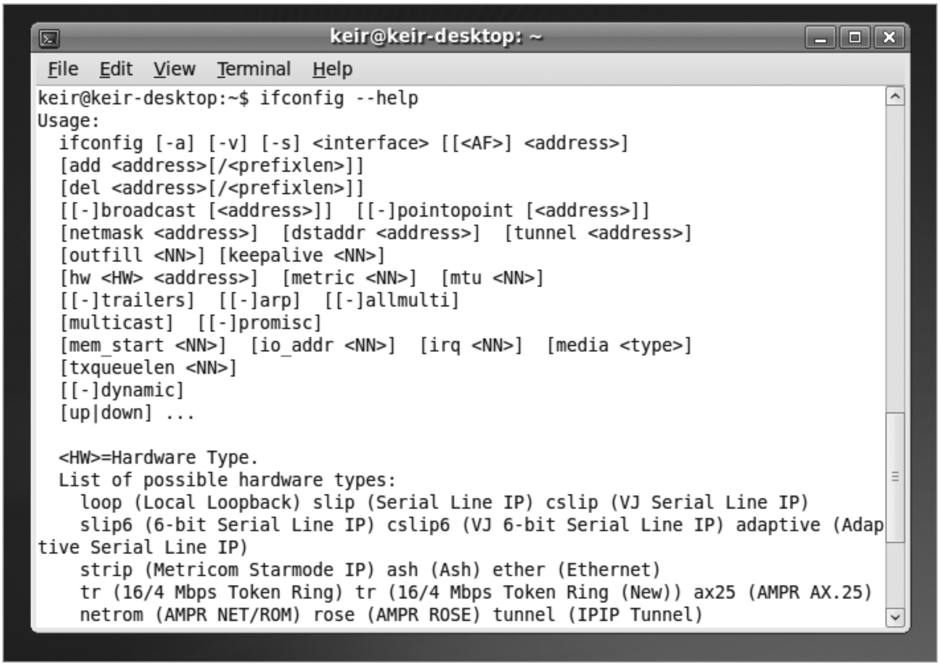


Figure 13-2. *Most commands contain built-in help to give you a clue as to how they're used.*

Some commands also have info pages, which offer slightly more down-to-earth guides. You can read these by typing this:

```
info <command>
```

If a command isn't covered by the info system, you'll be shown the default screen explaining basic facts about how the `info` command works.

Note that both `man` and `info` have their own man and info pages, explaining how they work. Just type `man man` or `info info`. We explain how to read man and info pages in Appendix C.

Running the Shell via a Virtual Console

As noted earlier, you can start the shell in a number of ways. The most common way among Linux diehards is via a virtual console. To access a virtual console, press Ctrl+Alt and then press one of the function keys from F1 through F6 (the keys at the top of your keyboard).

Using a virtual console is a little like switching desks to a completely different PC. Pressing Ctrl+Alt+F1 will cause your GUI to disappear and the screen to be taken over by a command-line prompt (don't worry—your GUI is still there and running in the background). You'll be asked to enter your username and your password to log in.

Any programs you run in a virtual console won't affect the rest of the system, unless they're system commands specifically designed to affect other programs. (This can be very useful—as discussed in Chapter 16, one way to rescue a crashed GUI program is to switch to a virtual console and attempt to terminate the program from there.)

You can switch back to the GUI by pressing Ctrl+Alt+F7. Don't forget to quit your virtual console when you're finished with it, by typing `exit`.

BOOTING INTO THE SHELL

If you're really in love with the shell, you can choose to boot into it, avoiding the GUI completely.

Booting into the shell is done by defining a custom run level. A *run level* is how the operating mode that Ubuntu is currently running in is described. For example, one particular run level might start a GUI, while another might start only a command prompt.

There are usually seven run levels under Linux, numbered from 0 to 6. Not all of them do something interesting. On Ubuntu, run levels 2 through 5 are exactly the same. Each runs the GUI. Run level 1 runs a command prompt, so it might seem ideal for booting into the shell, but it also shuts down a few essential services. This means it isn't suitable for everyday use.

The trick is to take one of the existing run levels and alter it slightly so that it doesn't run a GUI by default. On many distributions, run level 3 is reserved for this purpose, so it makes sense to alter it under Ubuntu. (For what it's worth, the default Ubuntu run level is 2.)

Stopping Ubuntu from running a GUI upon booting is simply a matter of stopping the program that appears when Ubuntu boots—GDM. This provides the login window that appears and starts the whole graphical subsystem. Type the following command at the shell to remove the shortcut to GDM within the run level 3 configuration:

```
sudo rm /etc/rc3.d/S30GDM
```

After this, you'll need to tell Ubuntu to boot straight to run level 3, rather than the default of 2. You do this by creating the `/etc/inittab` file, which then becomes one of the first configuration files Ubuntu reads when booting. Issue the following command at the shell to create and then open the file in the Gedit text editor:

```
gksu gedit /etc/inittab
```

Then add the following line at the top of the file:

```
id:3:initdefault:
```

Note the final colon at the end of the line. After you are finished typing, save the file. From now on, you'll always boot straight to a BASH prompt. To start a GUI, switch to run level 2 by typing `sudo telinit 2` and then log in as usual.

To restore things to the way they were, with a GUI starting by default (that is, run level 2), simply delete the `/etc/inittab` file by typing the following at the prompt:

```
sudo rm /etc/inittab
```

It's worth mentioning quickly, and purely for technical reference, that Ubuntu uses a system called Upstart, which *emulates* run levels. Other versions of Linux are not likely to use Upstart but use an older system called SysVInit, in which case they will already have an existing `/etc/inittab` file that you must edit in order to change the run level. However, the other instructions here will work just as well.

Working with Files

So let's start actually using the shell. If you've ever used DOS, you have a head start over most shell beginners, although you'll still need to learn some new commands and forget some entrenched ones! Table 13-1 shows various DOS commands alongside their Ubuntu equivalents. This table also serves as a handy guide to some BASH commands, even if you've never used DOS. In Appendix B, you'll find a comprehensive list of useful shell commands, together with explanations of what they do and examples of typical usage. Perhaps it's obvious, but most commands are abbreviations of the words that describe their function. The `cp` command copies files, for example, and the `rm` file removes files. This can often help identify commands when you first encounter them, and also aid in memorizing.

Table 13-1. *DOS Commands and Their Shell Equivalents*

Command	DOS Command	Linux Shell Command	Usage
Copy files	`COPY`	`cp`	`cp <filename> <new location>`
Move files	`MOVE`	`mv`	`mv <filename> <new location>`
Rename files	`RENAME`	`mv`	`mv <old filename> <new filename>`[a]
Delete files	`DEL`	`rm`	`rm <filename>`[b]
Create directories	`MKDIR`	`mkdir`	`mkdir <directory name>`
Delete directories	`DELTREE/RMDIR`	`rm`	`rm -rf <directory name>`

Command	DOS Command	Linux Shell Command	Usage
Change directory	`CD`	`cd`	`cd <directory name>`
Edit text files	`EDIT`	`vi`	`vi <filename>`
View text files	`TYPE`	`less`	`less <filename>`[c]
Print text files	`PRINT`	`lpr`	`lpr <filename>`
Compare files	`FC`	`diff`	`diff <file1> <file2>`
Find files	`FIND`	`find`	`find -name <filename>`
Check disk integrity	`SCANDISK`	`fsck`	`fsck`[d]
View network settings	`IPCONFIG`	`ifconfig`	`ifconfig`
Check a network connection	`PING`	`ping`	`ping <address>`
View a network route	`TRACERT`	`tracepath`	`tracepath <address>`
Clear screen	`CLS`	`clear`	`clear`
Get help	`HELP`	`man`	`man <command>`[e]
Quit	`EXIT`	`exit`	`exit`

[a] *The BASH shell offers a* `rename` *command, but this is chiefly used to rename many files at once.*

[b] *To avoid being asked to confirm each file deletion, you can add the* `-f` *option. Be aware that the* `rm` *command deletes data instantly, without the safety net of the Recycle Bin, as with the GNOME desktop.*

[c] *Use the cursor keys to move up and down in the document. Type* `Q` *to quit.*

[d] *This is a system command and can be run only on a disk that isn't currently in use. To scan the main partition, you'll need to boot from the installation CD and select the rescue option. Then issue the* `fsck` *command.*

[e] *The* `info` *command can also be used.*

CREATING ALIASES

If you've ever used DOS, you might find yourself inadvertently typing DOS commands at the shell prompt. Some of these will actually work, because most distribution companies create command aliases to ease the transition of newcomers to Linux.

Using aliases means that whenever you type certain words, they will be interpreted as meaning something else. However, an alias won't work with any of the command-line switches used in DOS. In the long run, you should try to learn the BASH equivalents. You can create your own command aliases quickly and simply. Just start a BASH shell and type the following:

```
alias <DOS command>='<Linux shell command>'
```

For example, to create an alias that lets you type `del` instead of `rm`, type this:

```
alias del='rm'
```

Note that the Ubuntu command must appear in single quotation marks. Also note that the `dir` command is already implemented under Ubuntu as a separate command that functions almost identically to the Linux `ls` command, although it's intended for only brief file listings. In most cases, it's far better just to use the `ls` command.

To make aliases permanent, you need to add them to your `.bashrc` file.

Open the file in the Gedit text editor by typing the following:

```
gedit .bashrc
```

At the bottom of the file, add new lines for all the aliases you want to make permanent. Simply type the command shown previously. Save the file when you've finished.

Note that the aliases won't go into effect until you open a new terminal window or reboot the computer.

Listing Files

Possibly the most fundamentally useful BASH command is `ls`. This will list the files in the current directory, as shown in Figure 13-3. If you have a lot of files, they might scroll off the screen. If you're running GNOME Terminal, you can use the scrollbar on the right side of the window to view the list.

Having the files scroll off the screen can be annoying, so you can cram as many as possible onto each line by typing the following:

```
ls -m
```

The dash after the command indicates that you're using a command option. These are also referred to as command-line *flags* or *switches*, and they modify how a command works. Nearly all shell commands have options. In fact, some commands won't do anything unless you specify various options. In the case of the `ls` command, only one dash is necessary, but some commands need two dashes to indicate an option.

Note Technically speaking, using two dashes before a command option is a relatively modern convention introduced by the GNU Project in the 1980s. Prior to this, Unix used a single dash for command options. Thus, two dashes usually indicate GNU-specific command options. However, this is a moot point nowadays because even versions of Unix, such as Mac OS X, tend to use the GNU BASH shell.

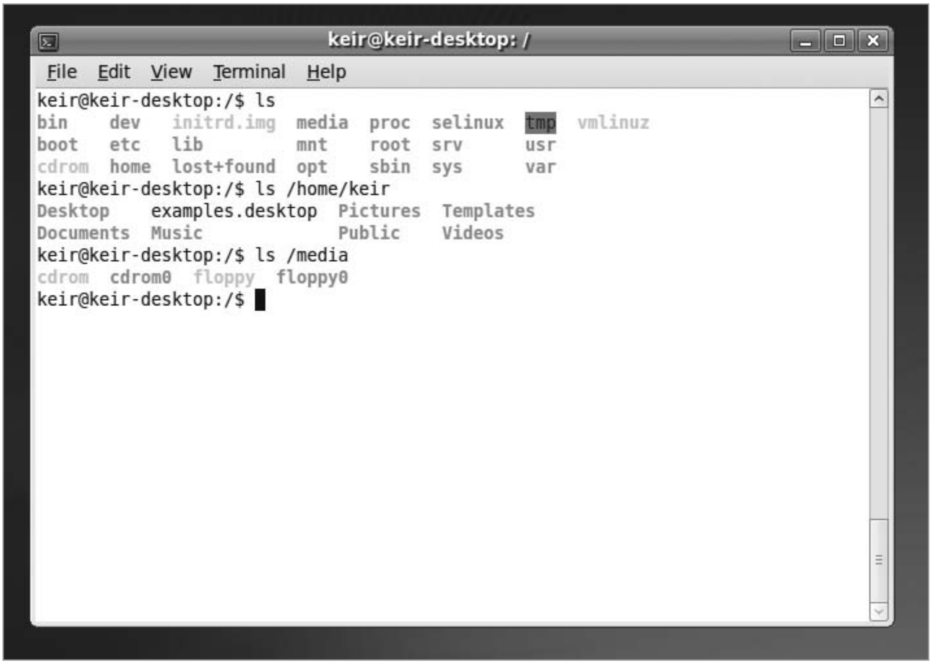


Figure 13-3. *The* `ls` *command lists the files in the current directory.*

You can see a list of all the command options for `ls` by typing the following (ironically, itself a command option):

```
ls --help
```

Once again, the output will scroll off the screen, and you can use the window's scrollbars to examine it. (In Chapter 17, you'll learn a trick you can use to be able to read this output without needing to fiddle around with the scrollbars, even if there's screen after screen of it.)

With most commands, you can use many command options at once, as long as they don't contradict each other. For example, you could type the following:

```
ls -lh
```

This tells the `ls` command to produce "long" output and also to produce "human-readable" output. The long option (`-l`) lists file sizes and ownership permissions, among other details (permissions are covered in the next chapter). The human-readable option (`-h`) means that rather than listing files in terms of bytes (such as 1,029,725 bytes), it will list them in kilobytes, megabytes, gigabytes, and so on. Notice that you can simply list the options after the dash; you don't need to give each option its own dash.

■ **Caution** Don't forget that case-sensitivity is vitally important in Ubuntu! Typing `ls -L` is not the same as typing `ls -l`. Each will produce different results.

Copying Files and Directories

Another useful command for dealing with files is `cp`, which copies files. You can use the `cp` command in the following way:

```
cp myfile /home/keir/
```

This will copy the file to the location specified. In this example, the filename and location are technically known as *arguments*. Anything that you specify a command should work with is referred to as an argument, and this can often be important when you try to figure out what the man pages are saying about how a command works.

One important command-line option for `cp` is `-r`. This stands for *recursive* and tells BASH that you want to copy a directory and its contents (as well as any directories within this directory). Most commands that deal with files have a recursive option.

■ **Note** Only a handful of BASH commands default to recursive copying. Even though it's extremely common to copy folders, you still need to specify the `-r` command option most of the time.

One curious trick is that you can copy a file from one place to another but, by specifying a filename in the destination part of the command, change its name. Here's an example:

```
cp myfile /home/keir/myfile2
```

This will copy `myfile` to `/home/keir`, but rename it as `myfile2`. Be careful not to add a final slash to the command when you do this. In the example here, doing so would cause BASH to think that `myfile2` is a directory.

This way of copying files is a handy way of duplicating files. By not specifying a new location in the destination part of the command, but still specifying a different filename, you effectively duplicate the file within the same directory:

```
cp myfile myfile2
```

This will result in two identical files: one called `myfile` and one called `myfile2`.

Moving Files and Directories

The `mv` command is similar to `cp`, except that rather than copying the file, the old one is effectively removed. You can move files from one directory to another, for example, like this:

```
mv myfile /home/keir/
```

You can also use the `mv` command to quickly rename files:

```
mv myfile myfile2
```

Figure 13-4 shows the results of using `mv` to rename a file. The `mv` command can be used to move a directory in the same way as with files. However, there's no need to use a command option to specify recursivity, as with other commands.

For instance, to move the directory `/daffodil` into the directory `/flowers`, you could type the following (assuming both directories are in the one you're currently browsing):

```
mv daffodil/ flowers/
```

Note the use of the slash after each directory.

To rename directories, simply leave off the slashes. To rename the directory `/daffodil` to `/hyacinth`, for example, you could type the following:

```
mv daffodil hyacinth
```

■ **Note** Getting technical for a moment, moving a file in Linux isn't the same as in Windows, where a file is copied and then the original deleted. Under Ubuntu, the file's absolute path is rewritten, causing it to simply appear in a different place in the file structure. However, the end result is the same.

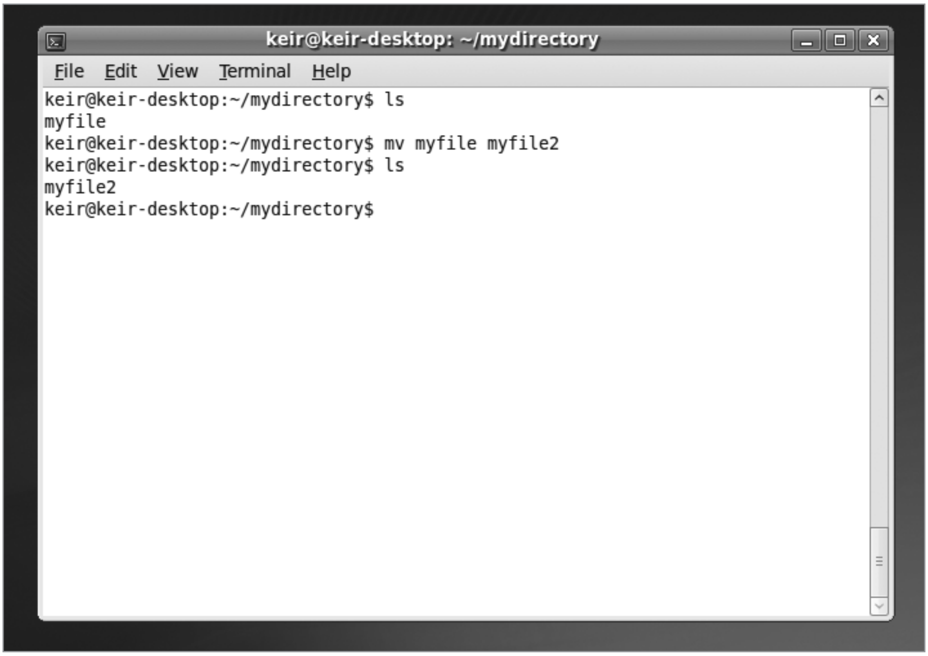


Figure 13-4. *You can also use the* `mv` *command to rename files.*

Deleting Files and Directories

But how do you get rid of files? Again, this is relatively easy, but first a word of caution: the shell doesn't operate any kind of Recycle Bin. After a file is deleted, it's gone forever. (There are utilities you can use to recover files, but these are specialized tools and aren't to be relied on for everyday use.)

Removing a file is achieved by typing something like this:

```
rm myfile
```

It's as simple as that.

In some instances, you'll be asked to confirm the deletion after you issue the command. If you want to delete a file without being asked to confirm it, type the following:

```
rm -f myfile
```

The `f` command option stands for *force* (that is, force the deletion).

If you try to use the `rm` command to remove a directory, you'll see an error message. This is because the command needs an additional option:

```
rm -rf mydirectory
```

As noted earlier, the r stands for *recursive* and indicates that any folder specified afterward should be deleted, in addition to any files it contains.

Tip You might have used wildcards within Windows and DOS. They can be used within Ubuntu, too. For example, the asterisk (*) can be used to mean any file. So, you can type `rm -f *` to delete all files within a directory, or type `rm -f myfile*` to delete all files that start with the word `myfile`. But remember to be careful with the `rm` command. Keep in mind that you cannot salvage files easily if you accidentally delete them!

WORKING WITH FILENAMES THAT HAVE SPACES

If, at the command prompt, you try to copy, move, or otherwise manipulate files that have spaces in their names, you'll run into problems. For example, suppose you want to move the file `picture from germany.jpg` to the directory `/mydirectory`. In theory, the following command should do the trick:

```
mv picture from germany.jpg mydirectory/
```

But when we tried it on our test Ubuntu setup, we got the following errors:

```
mv: cannot stat 'picture': No such file or directory
mv: cannot stat 'from': No such file or directory
mv: cannot stat 'germany.jpg': No such file or directory
```

In other words, BASH had interpreted each word as a separate file and tried to move each of them! The error messages tell us that BASH cannot find the file `picture`, `from`, or `germany.jpg`.

There are two solutions. The easiest is to enclose the filename in quotation marks (either double or single), so the previous command would read as follows:

```
mv "picture from germany.jpg" mydirectory/
```

The other solution is to precede each space with a backslash. Known as *escaping the character*, this tells BASH you're including a *literal character* in the filename. In other words, you're telling BASH not to interpret the space in the way it usually does, which is as a separator between filenames or commands. Here's how the command looks if you use backslashes:

```
mv picture\ from\ germany.jpg mydirectory/
```

The backslash can also be used to stop BASH from interpreting other symbols in the way it usually does. For example, the less-than and greater-than symbols (<>) have a specific meaning in BASH, which we discuss in Chapter 17, but they're allowed in filenames. So to copy the file <bach>.mp3 to the directory /mydirectory, you could type the following:

```
cp /<bach/>.mp3 mydirectory/
```

Generally speaking, however, simply enclosing filenames in quotation marks is the easiest approach. Often you might find that filenames under Linux avoid using spaces completely by using hyphens or underscore characters instead, or by simply not including the space characters and running the words into each other (for example, thirdquarterreport.doc).

Changing and Creating Directories

Another handy command is cd, for *change directory*. This lets you move around the file system from directory to directory. Say you're in a directory that has another directory in it, named mydirectory2. Switching to it is easy:

```
cd mydirectory2
```

But how do you get out of this directory after you're in it? Try the following command:

```
cd ..
```

The .. refers to the *parent* directory, which is the one containing the directory you're currently browsing. Using two dots to indicate this may seem odd, but it's just the way that Ubuntu (and Unix before it) does things. It's one of the many conventions that Unix relies on and that you'll pick up as you go along.

To switch to the root of the file system, you would type the following:

```
cd /
```

Tip BASH always remembers the last directory you were in, and you can switch to it instantly by typing cd -.

You can create directories with the `mkdir` command:

```
mkdir mydirectory
```

What if you want to create a new directory and, at the same time, create a new directory to contain it? Simply use the `-p` command option. The following command will create a new folder called `flowers` and, at the same time, create a directory within `/flowers` called `/daffodil`:

```
mkdir -p flowers/daffodil
```

RELATIVE AND ABSOLUTE PATHS

A *path* is simply the description of where in the file system a particular file or folder lives—for example, `/home/keir/Music/britneyspears.mp3`. Paths come in two forms: absolute and relative. The differences are simple.

An *absolute path* shows the location of the file from the ground up—from the root of the file system, specifying each individual folder along the way. The preceding example (`/home/keir/Music/britneyspears.mp3`) is an absolute path. There's an elementary way of identifying them: absolute paths always begin with a forward slash, which indicates the root of the file system.

A *relative path* is one that's expressed relative to the currently browsed directory. That might be a little difficult to understand, so here's an example. We already know that, when used with the `cd` command, two dots (`..`) refer to the parent directory of the one currently being browsed. With this in mind, what if the user Frank was browsing `/home/Frank/Music` and wanted to switch to the `/etc` directory, which contains configuration files? He could simply type `cd /etc`, thereby specifying the absolute path. That's certainly the simplest method. But he also could specify a relative path as follows:

```
cd ../../../etc
```

In other words, he's specified the parent of the current directory, then the parent of that directory, and finally the parent of *that* directory! That takes him all the way back to the root of the file system, so finally he specifies the `/etc` directory, which is where he wants to be.

You can move from any position in the file system to anywhere else by specifying a relative path, and the same technique works when you're manipulating files by copying, moving, and so on. To be honest, specifying an absolute path is usually the simplest option, but relative paths can prove surprisingly useful in some situations.

Summary

This chapter introduced the command-line shell, considered by many to be the heart of Linux. We've discussed its similarities to MS-DOS and shown that these are only cursory; knowledge of DOS doesn't equate to skill within BASH. In the long run, you should work to polish your BASH skills.

This chapter also introduced some elementary commands used within BASH, such as those used to provide directory listings and to copy files. We showed how you can use command-line options to control BASH tools. In many cases these are mandatory, so you learned how the BASH shell itself can be used to investigate a command and find out vital information about how it works.

At this point, your newfound knowledge will have no doubt caused you to venture into the Ubuntu file system itself, which can be a confusing, if not terrifying, place for the inexperienced. But don't worry. The next chapter explains everything you need to know about the file system and what you'll find in it.

CHAPTER 14

Understanding Linux Files and Users

Most of us are used to dealing with files—the things that live on our hard disks, floppies, and DVD-ROMs, and contain data and program code. It should come as no surprise that Linux has its own file structure, which is different from Windows in terms of where data is stored and also the underlying technology.

Taking a page from Unix, Ubuntu takes the concept of the file system to an extreme. To Ubuntu, almost everything is treated as a file: your PC's hardware, network computers connected to your PC, information about the current state of your computer—almost everything finds a home within the Linux file system.

Linux places an equal emphasis on the users of the system. They own the various files and can decide who can and cannot access various files that they create or that are transferred to their ownership.

In this chapter, you'll delve into users, files, and permissions. You'll be introduced to how Ubuntu handles files and how files are tied into the system of user accounts.

Real Files and Virtual Files

Linux sees virtually everything as a series of files. This might sound absurd and certainly requires further explanation.

Let's start with the example of plugging in a piece of hardware. Whenever you attach something to a USB socket, the Linux kernel finds it, sees whether it can make the hardware work, and if everything checks out okay, it will usually make the hardware available as a file under the `/dev` directory on your hard disk (`dev` is short for *devices*). Figure 14-1 shows an example of a `/dev` directory.

The file created in the `/dev` directory is not a real file, of course. It's a file system shortcut plumbed through to the input and output components of the hardware you've just attached.

Note As a user, you're not expected to delve into the `/dev` directory and deal with this hardware directly. Most of the time, you'll use various software packages that will access the hardware for you or use special BASH commands or GUI programs to make the hardware available in a more accessible way for day-to-day use.

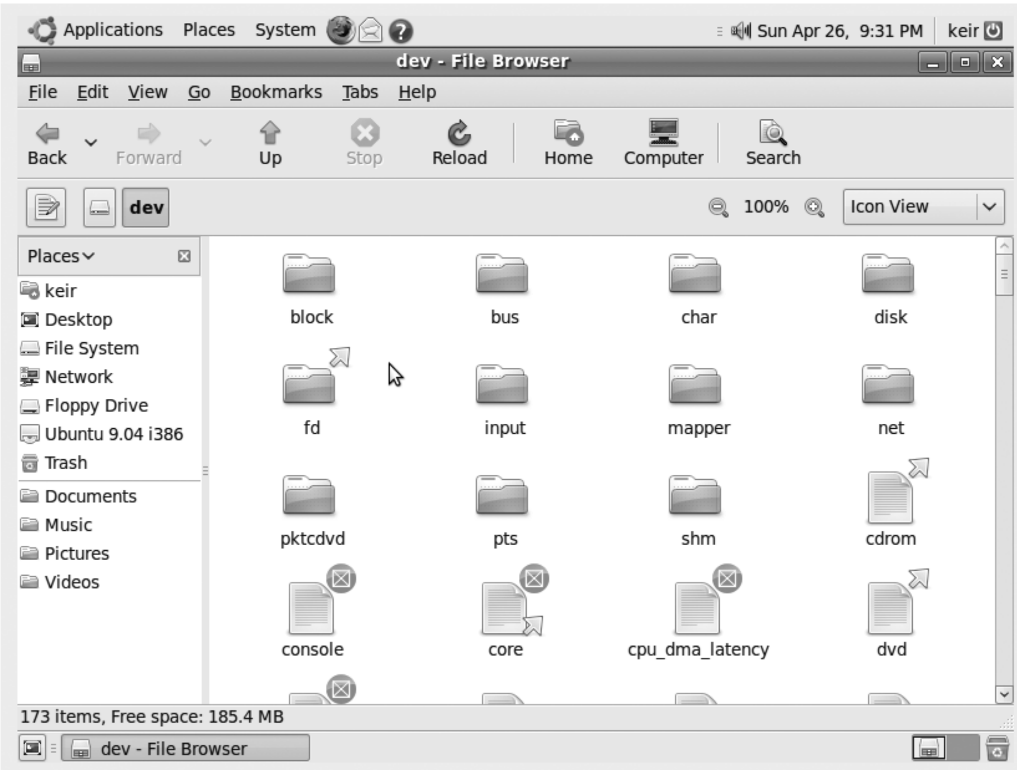


Figure 14-1. *Hardware devices under Linux are accessed as if they were files and can be found in the* `/dev` *folder.*

Here's another example. Say you're working in an office, and you want to connect to a central file server. To do this under Linux, you must *mount* the files that the server offers, making it a part of the Ubuntu file system. Doing this involves creating an empty directory (or using one that already exists) and using the `mount` command at the BASH shell to make the server's contents magically appear whenever that directory is accessed. We discuss how this is done later in this chapter, in the "Mounting" section.

Note Bear in mind that, in most cases, Ubuntu takes care of mounting automatically, as discussed in Chapter 12. For example, when you try to connect to a shared folder by clicking Places ➤ Network Servers, Ubuntu will automatically handle the mounting of the shared folder.

After the network server is mounted, it is treated exactly like a directory on your hard disk. You can copy files to and from it, just as you would normally, using the same tools as you use for dealing with any other files. In fact, less-knowledgeable users won't even be aware that they're accessing something that isn't located on their PC's hard disk (or, technically speaking, within their Ubuntu partition and file system). By treating everything as a file, Linux makes system administration easier. To probe and test your hardware, for example, you can use the same tools you use to manipulate files.

So how do you know which files are real and which are virtual? One method is to use the following command, which was introduced in the previous chapter:

```
ls -l
```

The `-l` command option tells the `ls` command to list nearly all the details about the files. If you do this in GNOME Terminal, you'll see that the listing is color-coded. There are many combinations of colors, but Table 14-1 shows some typical examples that you're likely to come across.

The `ls -l` command returns a lot of additional information, including who owns which file and what you and others can do with it. This requires an understanding of users and file permissions, which we'll discuss next.

Tip The command `ls -la` will give you even more information—perhaps too much for general use. In most instances, `ls -l` should show enough information.

Table 14-1. *Color-Coding Within GNOME Terminal*

Color	Type of File
Black text	Standard file
Light-blue text	Directory
Black outline with yellow text	Virtual device[a]
Green text	Program or script[b]

Continued

Table 14-1. *Continued*

Color	Type of File
Red outline with white text	Program or script with set user ID set[c]
Cyan text	Symbolic link to another file[d]
Pink/purple text	Image or video file
Aquamarine text	Audio file
Red text	Archive (also program installation package)

[a] *This is found only in the* /dev *directory.*

[b] *Technically speaking, green text indicates a program or script that has merely been marked as being executable.*

[c] *SETUID allows the program to run with the powers of another user, usually root; see the "Less-Common File Permissions" sidebar later in this chapter.*

[d] *This is similar to a Windows desktop shortcut.*

Users and File Permissions

The concept of users and permissions is as important to Ubuntu as the idea of a central and all-encompassing file system. In fact, the two are implicitly linked.

When initially installing Linux, you should have created at least one user account. By now, this will have formed the day-to-day login that you use to access Linux and run programs.

Although you might not realize it, as a user, you also belong to a group. In fact, every user on the system belongs to a group. Under Ubuntu, ordinary users belong to a group based on their usernames (under other versions of Linux, you might find that you belong to a group called `users`).

■ **Note** Groups are yet another reminder of Ubuntu's Unix origins. Unix is often used on huge computer systems with hundreds or thousands of users. Putting each user into a group makes the system administrator's job a lot easier. When controlling system resources, the administrator can control groups of users rather than hundreds of individual users. On most home-user PCs, the concept of groups is a little redundant because there's typically a single user, or at most, two or three. However, the concept of groups is central to the way that Linux handles files.

A standard user account under Ubuntu is typically limited in what it can do. As a standard user, you can save files to your own private area of the disk, located in the `/home` directory, but usually nowhere else. You can move around the file system, but some directories are strictly out of bounds. In a similar way, some files can be opened as read-only, so you cannot save changes to them. All of this is enforced by using file permissions.

Every file and directory is owned by a user. In addition, files and directories have three separate settings that indicate who within the Linux system can read them, who can write to them, and, if the file in question is "runnable" (usually a program or a script), who can run it (execute it). In the case of directories, it's also possible to set who can browse them, as well as who can write files to them. If you try to access a file or directory for which you don't have permission, you'll be turned away with an *access denied* error message.

Understanding Root vs. Sudo

Most versions of Linux have two types of user accounts: standard and root. Standard users are those who can run programs on the system but are limited in what they can do. The root user has complete run of the system, and as such, is often referred to as the *superuser*. The root user can access and/or delete whatever files it wants. It can configure hardware, change settings, and so on.

Most versions of Linux create a user account called `root` and let users log in as `root` to perform system maintenance. However, for practical as well as security reasons, most of the time the user is logged in as a standard user.

Ubuntu is different in that it doesn't allow login as the root user. Instead, it allows certain users, including the one created during installation, to adopt temporarily root-like powers. You will already have encountered this when configuring hardware. As you've seen, all you need to do is type your password when prompted in order to administer the system.

This way of working is referred to as *sudo*, which is short for *superuser do*. In fact, the command `sudo` will let you adopt root powers at the shell prompt—simply preface any command with `sudo` and type your password when prompted in order to run it with root privileges. (A different command is normally used if you want to run graphical applications from the shell prompt—`gksu`. However, the effect is the same.) Ubuntu remembers when you last used `sudo` too, so that it won't annoy you by asking you again for your password within 15 minutes of its first use. You can avoid this grace period by typing `sudo -k`.

In some ways, the sudo system is arguably slightly less secure than using a standard root account. But it's also a lot simpler. It reduces the chance of serious errors too. Any command or tweak that can cause damage will invariably require administrative powers, and therefore require you to type your password or preface the command with `sudo`. This serves as a warning and prevents mistakes.

TEMPORARILY SWITCHING TO ROOT

If you're an experienced Linux user, it's possible to configure Ubuntu so that the root account login is activated. Simply type the following at the command prompt:

```
sudo passwd root
```

Then type a password. To switch to the root user in the future, type `su -`. To quit, type `exit` or hit Ctrl+D.

If you subsequently want to deactivate the root account, type this:

```
sudo passwd -l root
```

If you ever want to slip into the root account for a short period, even if you haven't followed the previous instructions to activate the root account login, you can do so by typing the following:

```
sudo su
```

You'll be prompted to type your ordinary account login password; do so. When you've finished, type `exit` to return to your standard user account (or hit Ctrl+D).

Viewing Permissions

When you issue the `ls -l` command, each file is listed on an individual line. Here's an example of one line of a file listing from our test PC:

```
-rw-r--r--   2 keir keir 673985982 2006-11-31 17:19 myfile
```

The `r`, `w`, and `-` symbols on the very left of the listing indicate the file permissions. The permission list usually consists of the characters `r` (for read), `w` (for write), `x` (for execute), or – (meaning none are applicable).

They're followed by a number indicating the link count, which indicates how many hard/soft links have been made to the file, but you can ignore this for the moment (for more information about file links, see the "Creating File Shortcuts" sidebar).

After this is listed the owner of the file (`keir` in the example) and then the group that also has permission to access the file (in this case, the group is also called `keir`). This is followed by the file size (in bytes), the date and time the file was last accessed, and finally, the filename itself appears.

The file permissions part of the listing might look confusing, but it's actually quite simple. To understand what's going on, you need to split it into groups of four, as illustrated in Figure 14-2.

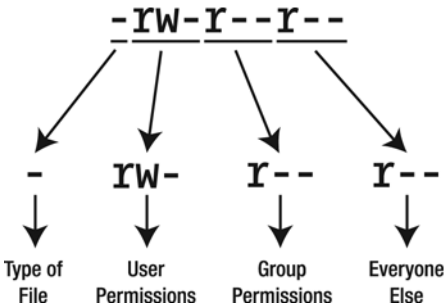


Figure 14-2. *The file permissions part of a file listing can be broken down into four separate parts.*

The four groups are as follows:

Type of file: This character represents the file type. A standard data file is indicated with a dash (`-`). Most files on your system fall into this category. A `d` shows that the entry is not a file but a directory. Table 14-2 lists the file type codes.

User permissions: Next come the permissions of the person who owns the file. The three characters indicate what the person who owns the file can do with it. The owner of a file is usually the user who created it, although it's also possible to change the owner later on. In this example, you see `rw-`. This means that the owner of the file can read (`r`) and write (`w`) to the file. In other words, he can look at it and also save changes to it. However, there's a dash afterward, and this indicates that the user cannot execute the file. If this were possible, there would be an `x` in this spot instead.

Group permissions: After the owner's permissions are the permissions given to the specified group that the file is assigned to. This is indicated by another three characters in the same style as those for user permissions. In the example, the group's permission is `r--`, which means that the members of the specified group can read the file but don't have permission to write to it, because there's a dash where the `w` would normally appear. In other words, as far as they're concerned, the file is read-only.

Everyone else's permissions: The last set of permissions indicates the permissions of everyone else on the system (other users in other groups). In the example, they can only read the file (`r`); the two dashes afterward indicate that they cannot write to the file nor execute it.

Table 14-2. *File Type Codes*

Code	File Type
-	Standard file
d	Standard directory
l	Symbolic link (a shortcut to another file)
p	Named pipe (a file that acts as a conduit for data between two programs)
s	Socket (a file designed to send and receive data over a network)
c	Character device (a hardware device driver, usually found in /dev)
b	Block device (a hardware device driver, usually found in /dev)

As you might remember from Windows, programs are stored as files on your hard disk, just like standard data files. On Linux, program files need to be explicitly marked as being executable. This is indicated in the permission listing by an `x`. Therefore, if there's no `x` in a file's permissions, it's a good bet that the file in question isn't a program or script (although this isn't always true for various technical reasons).

To make matters a little more confusing, if the entry in the list of files is a directory (indicated by a `d`), then the rules are different. In this case, an `x` indicates that the user can access that directory. If there's no `x`, the user's attempts to browse to that directory will be met with an *access denied* message.

File permissions can be difficult to understand, so let's look at a few real-world examples. These examples assume that you're logged in to Linux as the user `keir`.

LESS COMMON FILE PERMISSIONS

Instead of the `x` or dash in the list of permissions for a directory, you might sometimes see a `t`. This is referred to as the *sticky bit* and means that the only people who can delete or alter a file in that directory are the users who created the file in the first place. This is a useful option to have in some circumstances. It's used with the `/tmp` (temporary) folder, for example, to ensure that one user can't delete another user's temporary files but is able to delete her own temporary files. To set the sticky bit for a directory, type `chmod +t directoryname`.

You might sometimes see a set of permissions like `rws`. The `s` stands for *set user ID*, sometimes written as SETUID, and is often referred to as the *suid bit*. Like `x`, it indicates that the file is executable, except in this case it means that the file will be run with the permissions of the person who owns it, rather than the user who is executing it. In other words, if user `frank` tries to run a program owned by `keir` that has the execute permission set as `s`, that program will be run as if `keir` were running it. This is very useful, because it can make programs that require root powers usable by ordinary users, although this brings with it obvious security risks.

To set the suid bit, you can type `chmod +s <filename>`. However, it's unlikely you'll ever need to use this command. You should avoid using it, in fact, because it is considered an insecure way of working and in the past has provided hackers with a method of gaining root access to a system.

Typical Data File Permissions

Here's the first example:

```
-rw-rw----   2  keir  keir  1450  2006-07-07  09:19  myfile2
```

You see immediately that this file is owned by user `keir`, because that username appears directly after the permissions. You also see that the group `keir` has access to the file, although precisely how much depends on the permissions.

Reading the file permissions from left to right, you see that the initial character is a dash. That indicates that this is an ordinary file and has no special characteristics. It's also not a directory.

After that is the first part of the permissions, `rw-`. These are the permissions for the owner of the file, `keir`. You're logged in as that user, so this file belongs to you, and these permissions apply to you. You can read and write the file but not execute it. Because you cannot execute the file, you can infer that this is a data file rather than a program (there are certain exceptions to this rule, but we'll ignore them for the sake of simplicity).

Following this is the next part of the file permissions, `rw-`. This tells you what members of the group called `keir` can do with the file. It's fairly useless information if you're the only user of your PC, but for the record, you're told that anyone else belonging to the group called `keir` can also read and write the file but not execute it. If you're not the only user of a computer, group permissions can be important. The "Altering Permissions" section, coming up shortly, describes how to change file permissions to control who can access files.

Finally, the last three characters tell you the permissions of everyone else on the system. The three dashes (`---`) mean that they have no permissions at all regarding the file. There's a dash where the `r` normally appears, so they cannot even read it. The dashes afterward tell you they cannot write to the file or execute it. If they try to do anything with the file, they'll get a *permission denied* error.

Permissions on a User's Directory

Here's example number two:

```
drwxr-xr-x   7  keir  keir  824  2006-07-07  10:01  mydirectory
```

The list of permissions starts with `d`, which tells you that this isn't a file but a directory. After this is the list of permissions for the owner of the directory (`keir`), who can read files in the directory and also create new ones there. The `x` indicates that you can access this directory, as opposed to being turned away with an *access denied* message. You might think being able to access the directory is taken for granted if the user can read and write to it, but that's not the case.

Next are the permissions for the group members. They can read files in the directory but not write any new ones there (although they can modify files already in there, provided the permissions of the individual files allow this). Once again, there's an `x` at the end of their particular permission listing, which indicates that the group members can access the directory.

Following the group's permissions are those of everyone else. They can read the directory and browse it, but not write new files to it, as with the group users' permissions.

Permissions on a Directory Owned by Root

Here's the last example:

```
drwx------   25  root  root  1000  2004-08-06  15:44  root
```

You can see that the file is owned by `root`. Remember that in this example, you're logged in as `keir` and your group is `keir`.

The list of permissions starts with a `d`, so you can tell that this is actually a directory. After this, you see that the owner of the directory, `root`, has permission to read, write, and access the directory.

Next are the permissions for the group: three dashes. In other words, members of the group called `root` have no permission to access this directory in any way. They cannot browse it, create new files in it, or even access it.

Following this are the permissions for the rest of the users. This includes you, because you're not the user `root` and don't belong to its group. The three dashes mean you don't have permission to read, write, or access this directory. In other words, it's out of bounds to you, probably because it contains files that only the root user should access!

SWITCHING USERS

If you have more than one user set up on your system, it's possible to switch users on the fly while you're working at the shell. On our test PC, we have an additional user account called `frank`. While logged in as any user, we can temporarily switch to this user by typing the following command, which stands for *substitute user*:

```
su frank
```

We'll then be asked for user `frank`'s password. After this is typed, we will effectively have logged in as user `frank`. Any files we create will be saved with `frank`'s ownership.

If you activated the root login (by using the command `sudo passwd root`), you can temporarily switch into it by typing just `su -`, without any username afterward.

To return to your own account from any other account, type `exit` or hit Ctrl+D.

Altering Permissions

You can easily change permissions of files and directories by using the `chmod` command. For example, if you want to change a file so that everyone on the system can read and write to it, type the following:

```
chmod a+rw myfile
```

In other words, you're adding (`+`) read and write (`rw`) permissions for all users (`a`), including the owner, the group, and everybody else. Here's another example:

```
chmod a-w myfile
```

This tells Linux that you want to take away (`-`) the ability of all users (`a`) to write (`w`) to the file. However, you want to leave the other permissions as they are.

■ **Tip** If you leave out the `a`, `chmod` assumes you mean *all*. In other words, commands such as `chmod a+r myfile` and `chmod +r myfile` do the same thing.

If you specify `u`, you can change permissions just for the owner (`u` is for *user*, which is the same as *owner*):

```
chmod u+rw
```

This will add (`+`) read/write (`rw`) permissions for the owner.

As you might already have guessed, you can substitute a `g` to change group permissions:

```
chmod g-rw
```

This will configure the file so that members of the group that owns the file can't read or write to it. Using an `o`, which is for *others*, will configure the file permissions for those who aren't the owner of the file or who are not in the group that owns the file—the last three digits of the permission list.

A typical day-to-day use of `chmod` is in making a program file that you've manually downloaded executable. Because of the way the Internet works, if you manually download a program to install on your computer, it can lose its executable status while in transit. In this case, issue the following command:

```
chmod u+x myprogram
```

This will configure the file so that the owner (`u`) can execute (`x`) it. Changing the execute permission of a directory will make it accessible.

■ **Tip** Directory permissions are rather strange in that it's easy to set confusing and even illogical permissions. Generally speaking, the rules you should follow day-do-day are simple. If you wish to stop a particular user from accessing a directory, remove all permissions—read, write, and execute (`rwx`). If you wish to make a directory read-only, leave read and execute permissions in place, but remove the write permission (`r-x`). It's even possible to make a directory write-only, by leaving the write and execute permissions in place and removing the read permission (`-wx`). However, it's rare you would want to do this!

NUMERIC FILE PERMISSIONS

In this chapter, we've discussed file permissions exclusively in terms of their abbreviations: `r` for read, `w` for write, and `x` for executable. This is known as *symbolic notation*, and its goal is to make file permissions intuitive and easy for the user to understand. However, Unix and Linux file permissions are traditionally expressed as *octal notation*. File permissions are expressed as a series of three numbers ranging from 0–7, each of the three numbers representing the read, write, and execute permission for user, group, and other assignations of the file or directory.

For example, a file with a permission listing of `-rwxr-xr--` can be expressed as `754` in octal notation. File permissions of `-rwxrwxrwx` can be expressed as `777`.

This sounds more complicated than it is. It's enough to know that read permissions have a value of `4`, write permissions have a value of `2`, and execute permissions have a value of `1`. Permissions can be "added together" to make a larger number: read and write permissions have a value of `6`, for example (`4` + `2`). The "full" file permission setting (`rwx`) has a value of `7` (`4` + `2` + `1`).

Octal permissions can be used with the `chmod` command in exactly the same way as symbolic notation (that is, `r`, `w`, and `x`), as described in this chapter. For example, the following will set permissions of `-rw-r--r--` for `myfile.txt`:

```
chmod 644 myfile.txt
```

The following will set permissions of `-rwx------` for `myprogram`, thereby making it executable but private to the file's owner:

```
chmod 700 myprogram
```

In fact, octal notation can consist of four digits, because—as with symbolic notation—a total of four permission groups can be set: read, write, execute, and also special file permissions such as the sticky bit, SetUserID, and SetGroupID (see the "Less-Common File Permissions" sidebar earlier in this chapter). However, in most cases octal notation file permissions are expressed as three digits.

It should be kept in mind that, for most tasks, it's not necessary to use octal notation. Symbolic notation is usually enough and has the added bonus of being less inclined to induce a migraine. However, when changing some system settings (for example, the `umask` variable that controls what permissions newly created files have), it's often necessary to specify an octal value. Additionally, some Linux and Unix technical documentation prefers to specify octal notation, rather than the more modern symbolic.

Changing the Ownership of a File

To change the owner of a file, use the chown command. For security reasons, this must be prefaced with the sudo command, which is to say that chown and chgrp (to change the group ownership) require superuser powers.

For example, to switch the owner of myfile to frank, type this command:

```
sudo chown frank myfile
```

You can also change the owner *and* the group of a file by using chown. Simply type each separated by a period:

```
sudo chown frank.mygroup myfile
```

This will change myfile so that its owner is frank and its group is mygroup.

To change just the group of a file, you can use the chgrp command in exactly the same way as chown:

```
sudo chgrp mygroup myfile
```

CREATING FILE SHORTCUTS

We touched on the idea of file system shortcuts in Chapter 12, when we discussed creating launchers on the GNOME desktop. The problem with launchers is that they are recognized only within GNOME. In other words, they mean nothing when you're using the command prompt (or virtually every other program that loads/saves files, with the exception of some programs created specially for the GNOME desktop environment).

The Ubuntu file system offers two types of genuine shortcuts, which it refers to as *file links*. They are *symbolic links* and *hard links*. Both are created using the ln command.

Symbolic links are the most commonly used. A symbolic link is the most similar to a Windows shortcut in that a small file is created that "points toward" another file. Unlike a Windows shortcut, the symbolic link isn't a real file—it exists at the file system level, so it can't be viewed in a text editor, for example.

You can spot a symbolic link in a file listing, because it will be followed by an arrow and then the name and path (if necessary) of the file it links to. For example, in your /home directory, the directory /Examples is symbolically linked to /usr/share/example-content. When you type ls -l, it appears as follows:

```
Examples -> /usr/share/example-content
```

A hard link is more complex and needs some understanding of how files work. In simple terms, all files consist of a pointer and actual data. As you might expect, the pointer tells the file system where on the disk to find the data. Creating a hard link effectively creates an additional pointer to the data that has exactly the same attributes as the original pointer, except with a different name. Performing any operation on the linked file will perform that operation on the original file. Additionally, there will be no obvious sign the hard link isn't a genuine file, apart from the fact that the *link count*—the number after the file permissions—will be more than 1. This indicates that more than one file *links* to the data. Maybe now you can see why people prefer to use the more obviously detectable symbolic links!

To create a symbolic link, the `-s` command option is used with the `ln` command. First, specify the original file and then the new link's name. Here's an example, followed immediately by the output of the `ls -l` command, which shows the results:

```
ln -s original_file link
ls -l
lrwxrwxrwx 1 keir keir 13 2006-11-22 12:05 link -> original_file
-rw-r--r-- 1 keir keir  0 2006-11-21 15:30 original_file
```

The new link has odd file permissions. It claims to have read/write/execute permissions for everybody (`rwxrwxrwx`), but actually, because it's a link, it mirrors the permissions of the file it links to. So if you attempt to access a shortcut that links to a file you don't have permission to access, you'll see the appropriate error message.

To create a hard link, simply use `ln` on its own:

```
ln original_file link
```

As mentioned, apart from the link count, there will be no obvious sign the new link is, in fact, a link:

```
-rw-r--r--   2 keir keir  0 2006-11-21 15:30 original_file
-rw-r--r--   2 keir keir  0 2006-11-21 15:30 link
```

The hard link adopts all the properties of the file, including its permissions and date/time of creation. It even has the same link count!

The File System Explained

Now that you understand the principles of files and users, you can take a bird's-eye view of the Linux file system and start to make sense of it.

You might already have ventured beyond the /home directory and wandered through the file system. You no doubt found it thoroughly confusing, largely because it's not like anything you're used to. The good news is that it's not actually very hard to understand. If nothing else, you should be aware that nearly everything can be ignored during everyday use.

■ **Note** The Ubuntu file system is referred to as a *hierarchical* file system. This means that it consists of a lot of directories that contain files. Windows also uses a hierarchical file system. Ubuntu refers to the very bottom level of the file system as the root. This has no connection with the root user, or the directory named /root, which is the personal file storage area for the root user.

You can switch to the root of the file system by typing the following shell command:

```
cd /
```

When used on its own, the forward slash is interpreted as a shortcut for root.

If we do this on our PC and then ask for a long file listing (ls -l), we see the following:

```
total 84
drwxr-xr-x   2 root root  4096 2009-02-10 18:06 bin
drwxr-xr-x   3 root root  4096 2009-02-10 18:09 boot
lrwxrwxrwx   1 root root    11 2009-01-21 15:27 cdrom -> media/cdrom
drwxr-xr-x  15 root root  3800 2009-02-11 09:43 dev
drwxr-xr-x 125 root root 12288 2009-02-11 09:44 etc
drwxr-xr-x   3 root root  4096 2009-01-21 15:31 home
lrwxrwxrwx   1 root root    32 2009-02-10 18:08 initrd.img ->
boot/initrd.img-2.6.28-7-generic
drwxr-xr-x  16 root root  4096 2009-02-10 18:07 lib
drwx------   2 root root 16384 2009-01-21 15:27 lost+found
drwxr-xr-x   3 root root  4096 2009-02-09 19:52 media
drwxr-xr-x   2 root root  4096 2008-12-23 14:06 mnt
drwxr-xr-x   2 root root  4096 2009-02-04 00:06 opt
dr-xr-xr-x 120 root root     0 2009-02-11 09:43 proc
drwxr-xr-x  11 root root  4096 2009-02-10 11:30 root
drwxr-xr-x   2 root root  4096 2009-02-10 18:08 sbin
drwxr-xr-x   2 root root  4096 2008-11-04 21:38 selinux
drwxr-xr-x   2 root root  4096 2009-02-04 00:06 srv
drwxr-xr-x  12 root root     0 2009-02-11 09:43 sys
```

```
drwxrwxrwt  13 root root  4096 2009-02-11 09:45 tmp
drwxr-xr-x  11 root root  4096 2009-02-04 00:09 usr
drwxr-xr-x  15 root root  4096 2009-02-04 00:25 var
lrwxrwxrwx   1 root root    29 2009-02-10 18:08 vmlinuz ->
boot/vmlinuz-2.6.28-7-generic
```

The first thing you'll notice from this is that the root of the file system contains largely directories and that all files and directories are owned by `root`.

Only users with administrative powers can write files to the root of the file system. That means if you wanted to write to the root of the file system or otherwise access those files, you would need to use the `sudo` command. This is to prevent damage, because most of the directories in the root of the file system are vital to the correct running of Linux and contain essential programs or data.

■ **Caution** It's incredibly easy to slip up when using the command-line shell and thereby cause a lot of damage. For example, simply mistyping a forward slash in a command can mean the difference between deleting the files in a directory and deleting the directory itself. This is just another reason why you should always be careful when working at the command line, especially if you use the `sudo` command.

As you can see from the file permissions of each directory in the root of the file system, most directories allow all users to browse them and access the files within (the last three characters of the permissions read `r-x`). You just won't be able to write new files there or delete the directories themselves. You might be able to modify or execute programs contained within the directory, but this will depend on the permissions of each individual file.

Table 14-3 provides a brief description of what each directory and file in the Ubuntu root file system contains. This is for reference only; there's no need for you to learn this information. The Ubuntu file system broadly follows the principles in the Filesystem Hierarchy Standard, as do most versions of Linux, but it does have its own subtleties.

Table 14-3. *Directories and Files in the Ubuntu Root File System*

Directory	Contents
`bin`	Vital tools necessary to get the system running or for use when repairing the system and diagnosing problems.
`boot`	Boot loader programs and configuration files. (The boot loader is the menu that appears when you first boot Linux.)

Continued

Table 14-3. *Continued*

Directory	Contents
`cdrom -> media/cdrom`	Symbolic link (shortcut) to the entry for the CD- or DVD-ROM drive in the `/dev` folder. (Accessing this file will let you access the CD- or DVD-ROM drive.)
`dev`	Virtual files representing hardware installed on your system.
`etc`	Central repository of configuration files for your system.
`home`	Where each user's personal directory is stored.
`initrd`	Used during booting to mount the initial ramdisk.
`initrd.img -> boot/initrd.img-2.6.28-7-generic`	Symbolic link to the initial ramdisk, which is used to boot Linux.
`lib`	Shared system files used by Linux as well as the software that runs on it.
`lost+found`	Folder where salvaged scraps of files are saved in the event of a problematic shutdown and subsequent file system check.
`media`	Where the directories representing various mounted storage systems are made available (including Windows partitions on the disk).
`mnt`	Directory in which external file systems can be temporarily mounted.
`opt`	Software that is theoretically optional and not vital to the running of the system. (Many software packages you use daily can be found here.)
`proc`	Virtual directory containing data about your system and its current status.
`root`	The root user's personal directory.
`sbin`	Programs essential to administration of the system.
`selinux`	Commands used in the SELinux security subsystem.
`srv`	Configuration files for any network servers you might have running on your system.
`sys`	Mount point of the sysfs file system, which is used by the kernel to administer your system's hardware.
`tmp`	Temporary files stored by the system.
`usr`	Programs and data that might be shared with other systems (such as in a large networking setup with many users).[a]
`var`	Used by the system to store data that is constantly updated, such as printer spooling output.
`vmlinuz -> boot/vmlinuz-2.6.28-7-generic`	Symbolic link to the kernel file used during bootup.

[a] *The `/usr` directory contains its own set of directories that are full of programs and data. Many system programs, such as the X11 GUI software, are located within the `/usr` directory. Note that the `/usr` directory is used even if your system will never act as a server to other systems.*

TYPES OF FILE SYSTEMS

Linux is all about choice, and this extends to the technology that makes the file system work. Unlike with Windows, where the only choice is NTFS, Linux offers many types of file system technology. Each is designed for varying tasks. Most are scalable, however, which means that they will work just as happily on a desktop PC as on a massive cluster of computers.

Ubuntu uses the ext3 file system. This is a popular choice among distros, and nearly all home- or office-oriented distros use it. That said, people are constantly arguing about which file system is best. The principal measuring stick is performance. Your computer spends a lot of time writing and reading files, so the faster a file system is, the faster your PC will be overall (although, in reality, the hardware is of equal importance).

Note that what we're talking about here is the underlying and invisible technology of the file system. In day-to-day use, the end user won't be aware of any difference between ext3, reiserfs, or another file system technology (although when things go wrong, different tools are used to attempt repairs; their selection is automated within Ubuntu).

Here are the various types along with notes about what they offer:

- **ext2**: Fast, stable, and well established, ext2 was once the most popular type of file system technology used on Linux. It has now been eclipsed by ext3.
- **ext3**: An extension of ext2, ext3 allows journaling, a way of recording what has been written to disk so that a recovery can be attempted when things go wrong. This is the default file system used by Ubuntu and most other Linux distros, and not without reason: it's a reliable and proven technology. It is undoubtedly the best choice for most desktop computer systems.
- **ext4**: Understandably, and logically, this is an extension of ext3! Among other things, it features support for much larger hard disks and is also faster. However, at the time of this writing, it is considered very new technology and isn't yet widely implemented.
- **reiserfs**: This is another journaling file system, which claims to be faster than others and also offers better security features. This has fallen out of favor in recent years.
- **jfs**: This is a journaling file system created by IBM. It's used on industrial implementations of Unix.
- **xfs**: This is a 64-bit journaling file system created by Silicon Graphics, Inc. (SGI) and used on its own version of Unix as well as Linux.
- **zfs**: Another new file system technology (like ext4), its main benefit is support for huge storage systems. This is because of its 128-bit approach. It is used in the Sun Microsystems Solaris and OpenSolaris operating systems.

Mounting

Described in technical terms, *mounting* is the practice of making a file system available under Linux. Whereas Windows uses drive letters to make other file systems available within Windows Explorer, Linux integrates the new file system within the root file system, usually by making the contents appear whenever a particular directory is accessed.

The mounted file system could be a partition on your hard disk, a CD-ROM, a network server, or many other things.

Mounting drives might seem a strange concept, but it makes everything much simpler than it might be otherwise. For example, after a drive is mounted, you don't need to use any special commands or software to access its contents. You can use the same programs and tools that you use to access all of your other files. Mounting creates a level playing field on which everything is equal and can therefore be accessed quickly and efficiently.

Most of the time, external storage devices are mounted automatically by the GNOME desktop software used under Ubuntu; a GNOME background service runs constantly and watches for the user attaching any storage devices to the PC. If this occurs, the external storage device is *automounted* by the GNOME desktop, usually in a folder named after the device's label within the `/mount` directory (in other words, a USB memory stick with the label `KINGSTON` will be mounted at `/mount/KINGSTON`). An entry appears on the Places menu, and an icon for the device appears on the desktop, pointing to the *mount point* (the directory used to mount the device).

In the case of mounting network storage, such as those accessed by clicking Places ➤ Network, a system called `gvfs-fuse` mounts the devices. Upon being mounted, these also appear on the Places menu and are given a desktop icon, but you can access them from the command line by browsing the hidden `.gvfs` directory within your `/home` directory. Should you access shared storage on Bluetooth hardware devices, these will also appear within the `.gvfs` directory.

Using the mount Command

At the command line, mounting is done via the `mount` command. Under Ubuntu, you must have administrator powers to use the `mount` command, which means prefacing it with `sudo` and providing your password when prompted.

As previously mentioned, mounting is usually handled automatically by the GNOME desktop. Therefore, the only time you will likely need to use the `mount` command is in an environment where the desktop isn't running. Server administrators will need to know how to manually mount external file systems, for example, although more-humble users also need to know how to use the command when things go wrong and the GNOME desktop isn't able to run.

With most modern versions of Linux, `mount` can be used in two ways: by specifying all the settings immediately after the command or by making reference to an entry within the `fstab` file. `fstab` stands for *File System Table*, and that gives an indication of what it's used for—it's a look-up file stored in the `/etc` directory that contains details of all file systems on the PC that need to be regularly mounted. Figure 14-3 shows an example of a typical `fstab` file.

■ **Note** The root file system is itself mounted automatically during bootup, shortly after the kernel has started and has all your hardware up and running. If you look within `/etc/fstab`, you'll see that it too has its own entry, as does the swap partition. Every file system that Linux uses must be mounted at some point.

Let's say that you insert a CD or DVD into your computer's DVD-ROM drive. To mount the CD or DVD and make it available to Linux, you would type the following:

```
sudo mount /media/cdrom
```

As mentioned previously, these instructions assume that the GNOME desktop isn't running and that the CD-ROM won't be automounted.

The `mount` command first looks in your `fstab` file to find what you're referring to. It then matches up the directory you've specified as the mount point against the hardware details, in the form of a file in the `/dev` directory representing the hardware, or a UUID number, which is then translated by Ubuntu into a file within the `/dev` directory. The mount directory and hardware device are then magically connected together.

Note that the contents of the mounted file system are made available in a virtual way. The files are not literally copied into the directory. The directory is merely a conduit that allows you to read the CD's contents.

There aren't any special commands used to work with drives that have been mounted. The shell commands discussed in Chapter 13 should do everything you need, and file managers such as Nautilus will have no trouble browsing its contents.

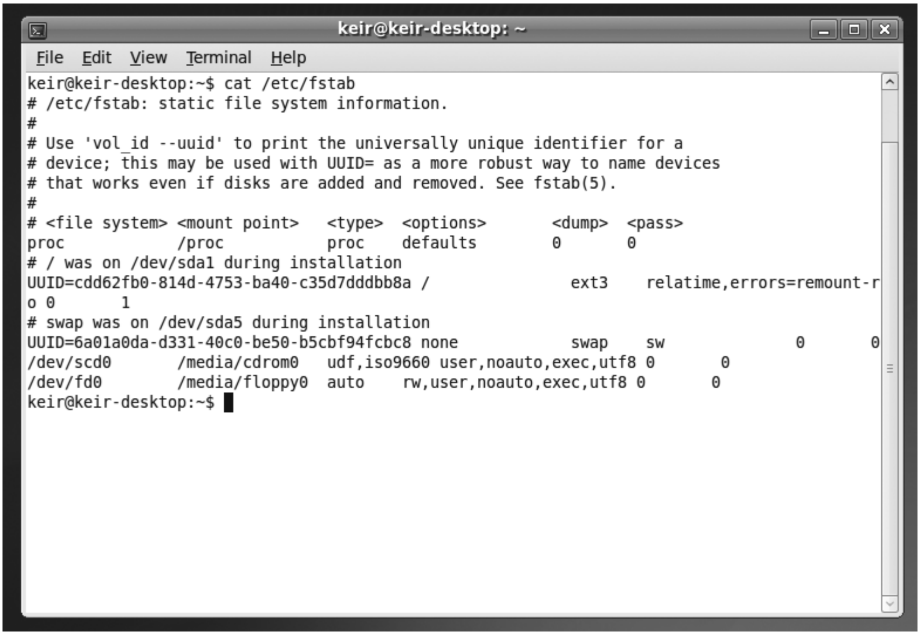


Figure 14-3. *Details of all regularly mounted file systems are held in the `/etc/fstab` file.*

Mounting a Drive Manually

Let's look at an example of when you might need to mount a drive manually. Suppose that you've just added a second hard disk to your PC that has previously been used on a Windows system, and you want to salvage some data before formatting the disk. Let's also assume the new disk has been added as the slave on the primary IDE channel, which is the usual method of adding a second disk to an IDE-based computer.

As before, this is a moot exercise, because the instant you boot with the hard disk attached, it will be autodetected by the GNOME desktop and an entry will be added to the Places menu. Clicking this menu entry will then automatically mount the new storage device. However, here we assume that the GNOME desktop isn't running. The following are the steps you would typically follow, but before booting your computer after attaching the new disk, remove any other kind of removable storage device from your computer, such as USB memory sticks or digital cameras. This will avoid confusion identifying the hard disk on a technical level:

1. The first thing to do is create a *mount point*, which is a directory that will act as a location where you can tell `mount` to make the disk accessible.

Note The mount point directory doesn't necessarily have to be empty or new! You can use any directory as a mount point, and as long as the file system is mounted, the original contents of the directory will be invisible. However, to avoid confusion, it's best to create a new independent mount point.

You can create the new directory anywhere, but under Ubuntu, the convention is to create it in the `/media` directory. Therefore, the following command should do the trick (note that you need to use the `sudo` command, because writing to system directories requires administrator privileges):

```
sudo mkdir /media/newdisk
```

2. You now need to know what kind of partition type is used on the disk, because you need to specify this when mounting. To find this out, use the `fdisk` command. Type the following exactly as it appears:

```
sudo fdisk -l /dev/sdb
```

3. This will list the partitions on the second disk drive (assuming an average PC system). With most hard disks used under Windows, you should find a single partition that will be either NTFS or FAT32. The examples here assume that this is `sdb1`.

Caution Be aware that `fdisk` is a dangerous system command that can damage your system. The program is designed to partition disks and can wipe out your data if you're not careful!

---

4. With this information in hand, you're now ready to mount the disk. For a FAT32 disk (that is, one from an older Windows installation, such as 95, 98, Me, or older Windows XP setups), type the following:

```
sudo mount -t vfat –o umask=000 /dev/sdb1 /media/newdisk
```

For an NTFS disk, type the following:

```
sudo mount -t ntfs-3g /dev/sdb1 /media/newdisk
```

The -t command option is used to specify the file system type. The -o flag indicates that you're going to specify some more command options, and with a FAT32 you do so in the form of umask, which tells mount to ensure that the directory is readable and writable (this is not needed for mounting the NTFS drive, which is automatically mounted as readable and writable). After this, you specify the relevant file in the /dev directory (this file is only virtual, of course, and merely represents the hardware) and then specify the directory that is acting as your mount point.

■**Note** Although the fstab file refers to UUID numbers, for a temporary mount it's fine to refer specifically to the hardware within the /dev directory.

Now when you browse to the /mount/newdisk directory by typing cd /mount/newdisk, you should find the contents of the hard disk accessible. You should also have found that a new icon appeared on the desktop for the file system, which you can double-click to access the new disk via Nautilus.

For more information about the mount command, read its man page (type man mount).

Removing a Mounted System

To unmount a system (so that you can detach it from your computer, for example, as you might wish to do with a USB memory stick), you use the special command umount (notice there's no n after the first u). Here's an example of using the command to unmount the hard disk we mounted previously:

```
sudo umount /media/newdisk
```

All you need to do is tell the umount command the mount point. Alternatively, you can specify the file in the /dev directory that refers to the mounted resource, but this is a little complicated, so in most cases it's better to simply specify the file system location of the mount.

If you're currently browsing the mounted directory, you'll need to leave it before you can unmount it. The same is true of all kinds of access to the mounted directory. If you're browsing the mounted drive with Nautilus or if a piece of software is accessing it, you won't be able to unmount it until you've quit the program and closed the Nautilus window (or browsed to a different part of the file system).

File Searches

Files frequently get lost. Well, technically speaking, they don't actually get lost. We just forget where we've put them. But because of this, the shell includes some handy commands to search for files.

Using the find Command

The `find` command manually searches through all the files on the hard disk. It's not a particularly fast way of finding a file, but it is reliable.

Here's an example:

```
find /home/keir -name "myfile"
```

This will search for `myfile` using `/home/keir` as a starting point (which is to say that it will search all directories within `/home/keir`, any directories within those directories, and so on, because it's recursive). To search the entire file system, type `/` as the path. Remember that `/` is interpreted by BASH as the root of the file system.

If the file is found, you'll see it appear in the output of the command. The full path will be shown next to the filename.

If you give `find` a try, you'll see that it's not a particularly good way of searching. Apart from being slow, it will also return a lot of error messages about directories it cannot search. This is because when you run the `find` command, it takes on your user permissions. Whenever `find` comes across a directory it cannot access, it will report it to you, as shown in the example in Figure 14-4. There are frequently so many of these warnings that the output can hide the instances where `find` actually locates the file in question!

You can avoid these error messages in various ways, but perhaps the quickest solution is to preface the `find` command with `sudo` to invoke superuser powers. In this way, you'll have access to every file on the hard disk, so the `find` command will be unrestricted in where it can search and won't run into any directories it doesn't have permission to enter.

Caution Using the `sudo` command with `find` may represent an invasion of privacy if you have more than one user on your system. The `find` command will search other users' `/home` directories and report any instances of files found there too.

However, an even better solution for finding files is to use the `locate` command.

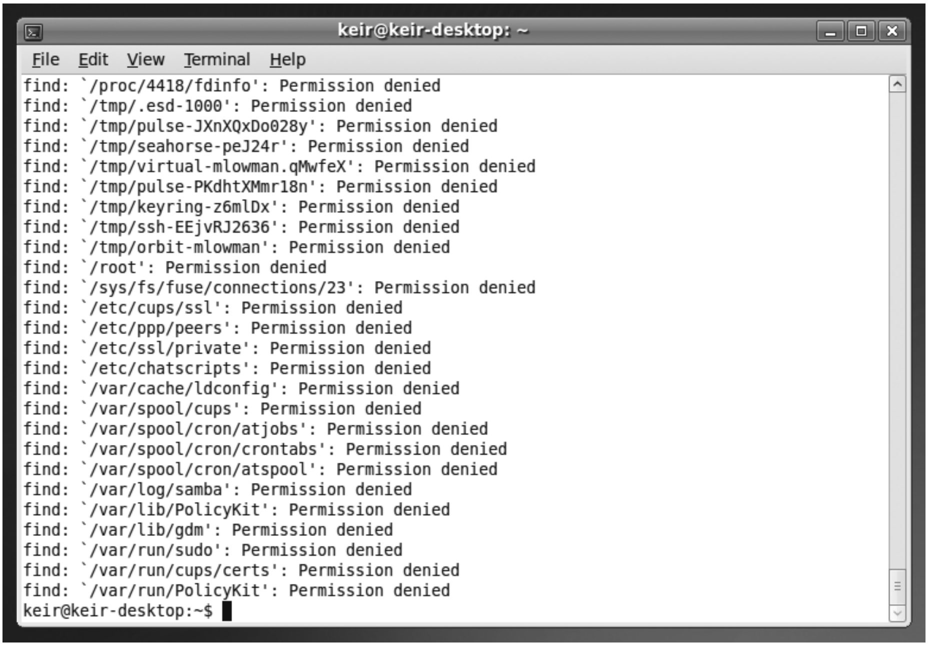


Figure 14-4. *The `find` command is useful for finding files but isn't problem-free.*

Using the locate Command

The alternative to using `find` is to use the `locate` command. This is far quicker than `find`, because it relies on a central database of files, which is periodically updated. In other words, it doesn't literally search the file system each time.

The problem is that if you've saved a file recently and are hoping to find it, there's a chance that it won't yet appear in `locate`'s database, so it won't turn up in the list of results.

Using `locate` is easy. You can use the following command to search for a file (you don't need to precede the command with `sudo`):

```
locate myfile
```

It's possible to update the `locate` database manually, although this might take a few minutes to work through. Simply issue this command:

```
sudo updatedb
```

After this, all files in the system should be indexed, making your search results more accurate.

Using the whereis Command

One other command worth mentioning in the context of searching is `whereis`. This locates where programs are stored and is an excellent way of exploring your system. Using it is simply a matter of typing something like this:

```
whereis cp
```

This will tell you where the `cp` program is located on your hard disk. It will also tell you where its source code and man page are located (if applicable). However, the first path returned by the search will be the location of the program itself.

File Size and Free Space

Often it's necessary to know how large files are and to know how much space they're taking up on the hard disk. In addition, it's often handy to know how much free space is left on a disk.

Viewing File Sizes

Using the `ls -l` command option will tell you how large each file is in terms of bytes. Adding the `-h` option converts these file sizes to kilobytes, megabytes, and even gigabytes, depending on how large they are.

In order to get an idea of which are the largest files and which are the smallest, you can add the `-S` command option. This will order the files in the list in terms of the largest and smallest files.

The following will return a list of all the files in the current directory, in order of size (largest first), detailing the sizes in kilobytes, megabytes, or gigabytes:

```
ls -Slh
```

There's another, more powerful way of presenting this information: using the `du` command, which stands for *disk usage*. When used on its own without command switches, `du` simply presents the size of directories alongside their names (starting in the current directory). It will show any hidden directories (directories whose names start with a period) and will also present a total at the end of the list. This will probably be quite a long list. Once again, you can add the `-h` command option to force the `du` command to produce human-readable measurements of kilobytes and megabytes.

If you specify a file or directory when using the `du` command, along with the `-s` command option, you can find out its total file size:

```
du -sh mydirectory
```

This will show the size taken up on the disk by `mydirectory`, adding to the total any files and/or subdirectories it contains.

However, `du` is limited by the same file permission problems as the `find` tool, as shown in Figure 14-5. If you run `du` as an ordinary user, it won't be able to calculate the total for any directories you don't have permission to access. Therefore, you might consider prefacing the command with `sudo`.

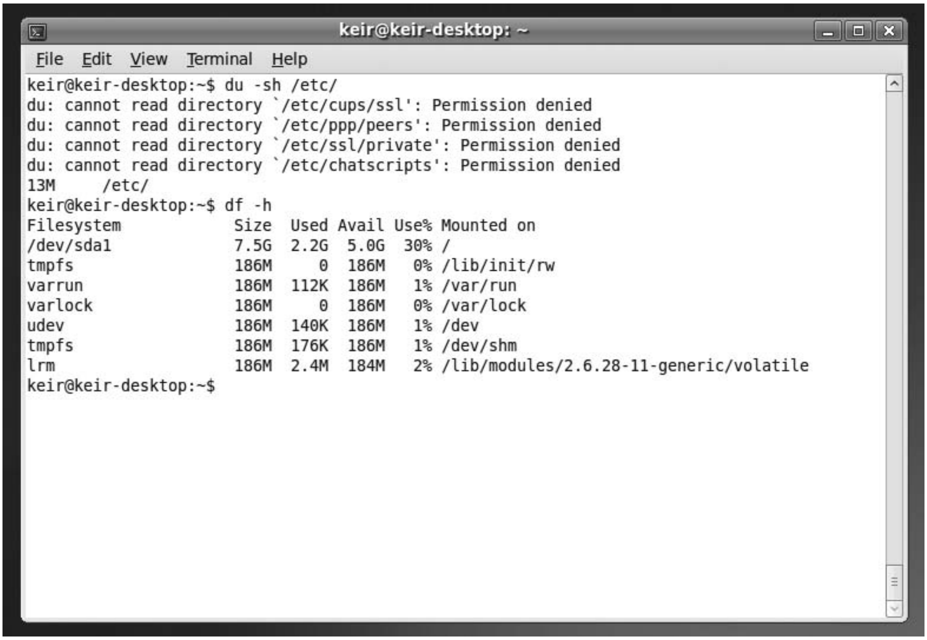


Figure 14-5. *The `du` command shows the size of a file, and the `df` command can be used to gauge the amount of free space on the disk.*

Finding Out the Amount of Free Space

What if you want to find out how much free space is left on the disk? In this case, you can use the `df` command. This command is also demonstrated in Figure 14-5.

The `df` command reports the free space in *all* mounted file systems, as well as just the root file system. This can lead to confusing results, because you'll also see results for the `/var` directory, for example, or `/dev`. You'll see results for your Windows file system too!

To make sense of it all, look under the Mounted On heading for `/`, which always indicates the root file system. If you have a memory card inserted and want to find out its free space, look under this list for its mount point (which will probably be in `/media`).

Once again, you can add the `-h` option to the `df` command to have the file sizes returned in megabytes and gigabytes (and even terabytes if your hard disk is big enough!).

Note There is as much space free in any directory as there is space on the disk, which is why `df` displays data about the entire partition and not individual directories. If you're using a system managed by a system administrator within a business environment, you might find that quotas have been used to limit how much disk space you can take up. However, if you're using a desktop PC and are the only user, this won't be activated.

USEFUL BASIC SHELL COMMANDS

Here are some additional shell commands that you might find useful on a day-to-day basis. Don't forget that you can view the man pages of these commands to learn more. Note that commands for manipulating text files are covered in the next chapter.

- `clear`: Clear the terminal window and put the cursor at the top of the window.
- `date`: Display current date and time.
- `dmesg`: Show the output of the kernel, including error messages (useful for problem solving).
- `eject`: Eject a CD/DVD.
- `exit`: Log out of the current user account being accessed at the command line. (If issued in a terminal window, the window will close.)
- `file`: Display useful information about the specified file; the filename should be stated immediately afterward (that is, `file myfile.txt`).
- `free`: Display information about memory usage; add the `-m` command option to see output in megabytes.
- `halt`: Shut down the computer (needs to be run as root, so preface with `sudo`).
- `help`: Show a list of commonly used BASH commands.
- `last`: Show recent system logins.
- `pwd`: Print the working directory; this will simply tell you the full path of where you're currently browsing.

- `reboot`: Reboot the computer (needs to be run as root, so preface with `sudo`).
- `shred`: Destroy the specified file (or contents of a storage device) beyond recovery by overwriting with junk data; the filename or device (in the form of an entry in the `/dev` directory) should be specified immediately afterward.
- `touch`: Give the specified file's current date and time; if the specified file doesn't exist, create an empty file. The filename should be specified immediately afterward.
- `uptime`: Display how long the computer has been booted, plus various CPU usage statistics.
- `whatis`: Display a one-line summary of the specified command; the command name should follow immediately afterward.

Summary

In this chapter, we examined how the Ubuntu file system lies at the heart of understanding how the operating system works. We also discussed how the file system and user accounts go hand in hand and are inextricably linked. This involved discussing the concept of file ownership and usage permissions, plus how these can be manipulated by using command-line shell tools.

We also discussed the overall structure of the Ubuntu file system and how external file systems can be mounted and made available within Ubuntu. Finally, we showed how to find files and how to gauge how much free space there is within the file system.

In the next chapter, you'll look at how the BASH shell can be used to view and otherwise manipulate text files, which are also important to the way Ubuntu works.

CHAPTER 15

Working with Text Files

Windows views text files as just another file type, but to Ubuntu, they can be essential components that make the system work. Configuration files are stored as plain text, and program documentation is also stored as text. This is clearly different from Windows, where any information you're supposed to read will likely be contained in a Windows help file, a rich text format (RTF) file, or even a Microsoft Word document.

Because of the reliance on text files, the shell includes several commands that let you display, edit, and otherwise manipulate text files in various ways. Learning to use the shell, and therefore learning how to administer your Ubuntu system, requires having a good understanding of these text tools. You'll use text tools for editing configuration files and viewing log files, as just two examples.

It's worth mentioning that text files under Linux usually don't have a file extension. Unlike with Windows or other operating systems, the `.txt` file extension is rarely used. Sometimes a `.conf` extension is added to plain-text configuration files, but more often they have no extension at all.

Viewing Text Files

You can easily view files by using command-line tools, including `cat`, `less`, `head`, and `tail`. The simplest command for dealing with text files is `cat`.

Using the cat Command

When followed by a filename, the `cat` command will display the text file onscreen:

```
cat mytextfile
```

`cat` is short for *concatenate*, and it isn't designed just to display text files. That it can do so is simply a side effect of its real purpose in life, which is to join two or more files together. However, when used with a single file, it simply displays its contents onscreen.

If you try to use `cat`, you'll realize that it's good for only short text files; large files scroll off the screen.

Using the less Command

To give you more control when viewing longer text files, the `less` and `more` commands were created. The `more` command came first but was considered too primitive, so someone came up with `less`, which is preferred by many Linux users. However, both are usually available on the average Linux installation.

■ **Note** The `less` and `more` commands are sometimes known as *pagers* because of their ability to let you scroll through pages of text. You might still hear them referred to as such in the wider Linux community, although the term has fallen out of use.

Let's look at using `less` to read the Eye of GNOME `README` file, which contains information about the current release of the default Ubuntu image viewer. The file is located at `/usr/share/doc/eog/README`, so to use `less` to read it, type the following:

```
less /usr/share/doc/eog/README
```

■ **Tip** Most program `README` files, along with other assorted documentation, can be found in a directory named after the program in question within the `/usr/share/doc` directory.

You can scroll up and down within the `less` display by using the cursor keys. If you want to scroll by bigger amounts of text, you can use the Page Up and Page Down keys. Alternatively, you can use the spacebar and B key, both of which are commonly used by old-hand Linux users for the same functions. In addition, the Home and End keys will take you to the start and end of the document, respectively.

A useful command option to use with `less` is `-M`, which adds a short status bar to the bottom left. Alongside the filename, you'll see how many lines the document has and which line you're currently up to. In addition, you'll see, as a percentage, the amount of document you've already read through, so you'll know how much is left.

`less` lets you search forward through the file by typing a slash (`/`) and then entering your search term. Any words that are matched will be highlighted onscreen. To repeat the search, type `n`. To search backward in a file from your current point, type a question mark (`?`). To quit `less`, simply type `q`.

Although it's supposedly a simple program, `less` is packed with features. You can see what options are available by reading its man page or by typing `less --help`.

Using the head and tail Commands

A couple of other handy commands that you can use to view text files are `head` and `tail`. As their names suggest, these let you quickly view the beginning (head) of a file or the end (tail) of it.

Using the commands is simple:

```
tail mytextfile
```

or

```
head mytextfile
```

By default, both commands will display ten lines of the file. You can override this by using the `-n` command option followed by the number of lines you want to see. For example, the following will show the last five lines of `mytextfile`:

```
tail -n5 mytextfile
```

These two commands are very useful when viewing log files that might contain hundreds of lines of text. The most recent information is always at the end, so `tail` can be used to see what's happened last on your system, as shown in the example in Figure 15-1.

Although they're powerful, all of these shell commands don't let you do much more than view text files. If you want to edit files, you'll need to use a text editor such as `vim`.

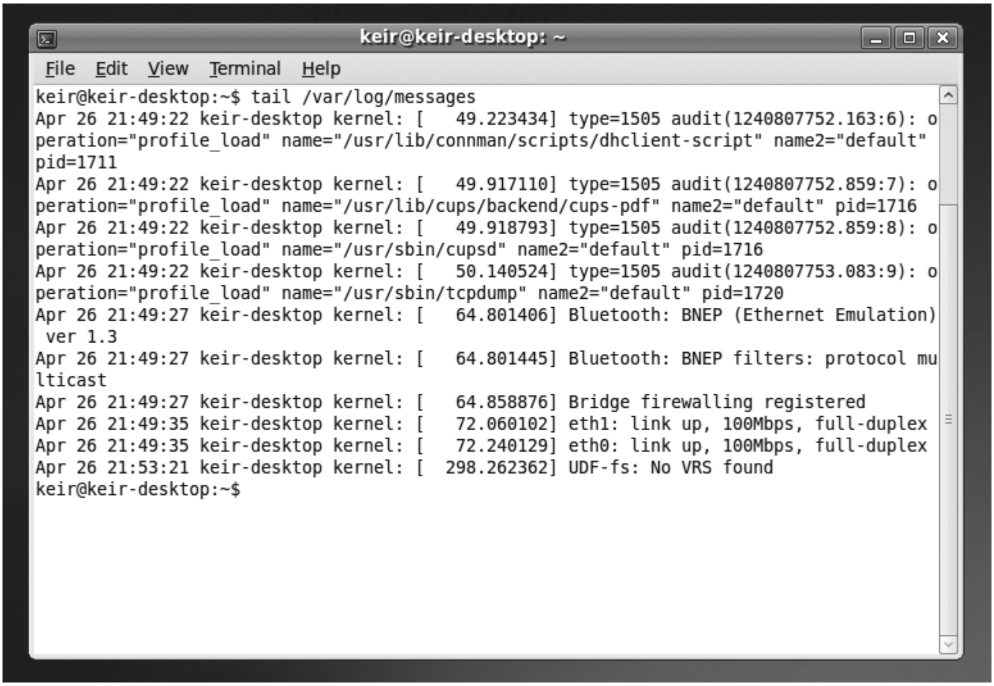


Figure 15-1. *The* `tail` *command can be very useful for viewing the last few lines of a log file.*

STANDARD INPUT AND OUTPUT

If you've read any of the Ubuntu man pages, you might have seen references to *standard input* and *standard output*. Like many things in Linux, this sounds complicated but is merely a long-winded way of referring to something that is relatively simple (although the terms have specific meanings to programmers). Standard input is simply the device that programs running under Ubuntu normally take input from. In other words, on the majority of desktop PCs when you're using the command-line shell, standard input refers to the keyboard. However, it's important to note that it could also refer to the mouse or any other device on your system capable of providing input; even some software can take the role of providing standard input.

Standard output is similar. It refers to the device to which output from a command is usually sent from software. In the majority of cases at the command line, this refers to the monitor screen, although it could be any kind of output device, such as your PC's sound card and speakers.

The man page for the `cat` command says that it will "concatenate files and print on the standard output." In other words, for the majority of desktop Ubuntu installations, it will combine (concatenate) any number of files together and print the results onscreen. If you specify just one file, it will display that single file on your screen.

In addition to hardware devices, input can also come from a file containing commands, and output can also be sent to a file instead of the screen, or even sent directly to another command. This is just one reason why the command-line shell is so flexible and powerful.

Using a Command-Line Text Editor

A variety of text editors can be used within the shell, but three stand out as being ubiquitous: ed, `vim`, and Emacs. The first in that list, ed, is by far the simplest. That doesn't necessarily mean that it's simple to use or lacks powerful features, but it just doesn't match the astonishing power of both `vim` and Emacs. To call `vim` and Emacs simple text editors is to do them a disservice, because both are extremely powerful interactive environments. In particular, Emacs is considered practically an operating system in itself, and some users of Linux treat it as their shell, executing commands and performing everyday tasks, such as reading and sending e-mail from within it. There are entire books written solely about Emacs and `vim`.

■ **Tip** A fourth shell-based text editor found on many Linux systems is `nano`. This offers many word processor–like features that can be helpful if you've come to Linux from a Windows background.

The downside of all the power within Emacs and `vim` is that both packages can be difficult to learn to use. They're considered idiosyncratic by even their most ardent fans. Both require the user to learn certain unfamiliar concepts, as well as keyboard shortcuts and commands.

Although there are debates about which text editor is better and which is best, it's generally agreed that `vim` offers substantial text-editing power but isn't too all-encompassing. It's also installed by default on Ubuntu. On Ubuntu, Emacs must be installed as an optional extra. Both text editors are normally available on virtually every installation of Linux or Unix. We'll concentrate on using `vim` here.

It's important to understand that `vim` is an update of a classic piece of software called `vi`. In fact, there are many versions and updates of `vi`. The original program, once supplied with Unix, is rarely used nowadays. `vim` is the most commonly used clone; `vim` stands for *vi improved*. Other versions include `elvis` (`http://elvis.the-little-red-haired-girl.org/`). However, most people still refer to `vim` and `elvis` as `vi`, even though they are entirely new pieces of software.

■ **Note** There used to be a constant flame war between advocates of `vi` and Emacs, as to which was better. This could be quite a vicious and desperate debate, and the text editor you used was often taken as a measure of your character! Nowadays, the battle between the two camps has softened, and the Emacs vs. `vi` debate is considered an entertaining cliché of Linux and Unix use. Declaring online which text editor a user prefers is often followed by a smiley symbol to acknowledge the once-fevered emotions.

Ensuring That vim Is Correctly Configured

As mentioned, there are several versions of `vi`. However, there are also several ways of configuring the software. The `vim` software comes ready-installed on Ubuntu but isn't configured for optimal use.

■ **Note** The configuration problem is primarily key bindings for cursor keys—unless `vim` is correctly configured, cursor key navigation won't work while inserting text.

The quick and easy way of getting around this is to install the `vim` software package, which comes complete with an optimal configuration. We explain software installation in Chapter 28, but for the moment it's enough to know that the following commands, issued in sequence within a terminal window, will install the correctly configured software (assuming your computer is online—see Chapter 8):

```
sudo apt-get update
sudo apt-get install vim
```

You'll be asked to confirm installation, so hit Y. After installation has finished, no further configuration is necessary.

After `vim` is installed, you can start editing a blank document at the command line by simply typing `vim`. To edit a file, just precede its filename with `vim` (for example, `vim README`).

Understanding vim Modes

The key to understanding how `vim` works is to learn the difference between the various operating modes. Three modes are important: Command mode, Insert mode, and Command-Line mode. You will need to switch modes depending on whether you want to insert text, perform some major text edits (such as deleting lines or paragraphs), or perform file operations, such as saving.

Command Mode

Command mode is `vim`'s central mode. When the editor starts up, it's in Command mode, as shown in Figure 15-2. This lets you move around the text and delete words or lines of text. `vim` returns to Command mode after most operations. In this mode, the status bar at the bottom of the screen shows information such as the percentage progress through the document. Although you cannot insert text in this mode, you can delete and otherwise manipulate words and lines within the file. You can also move through the text by using the cursor keys and the Page Up and Page Down keys.

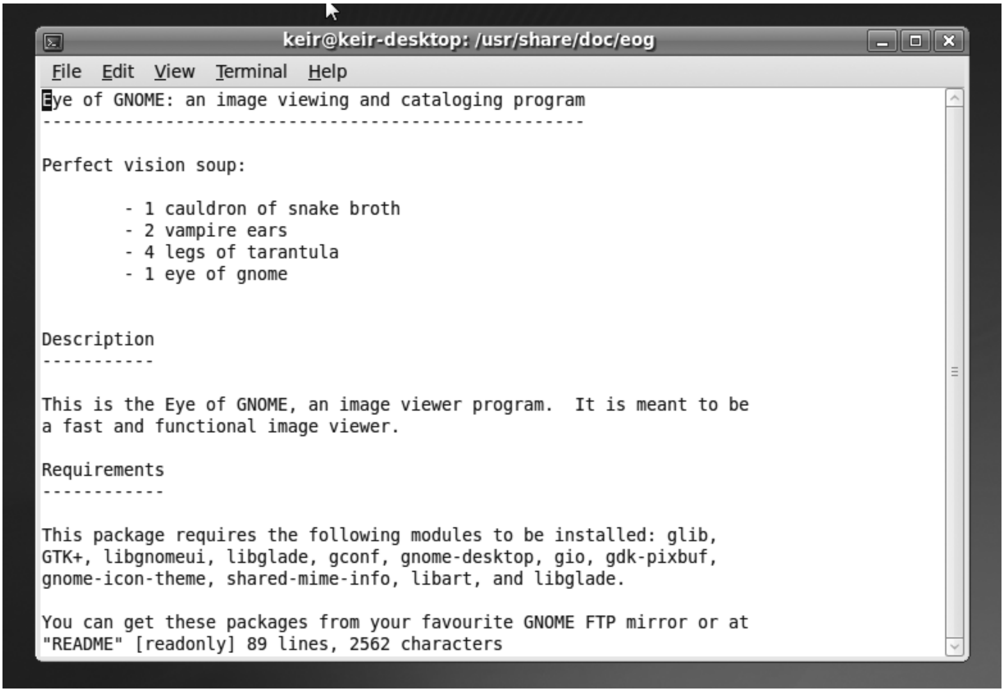


Figure 15-2. *In* `vim`*, the main mode is Command mode.*

Table 15-1 shows a list of the commands you can use in Command mode (consider photocopying it and sticking it to the side of your monitor as a handy reference).

Table 15-1. `vim` *Command Mode Commands*

Command	Description
Delete Text	
`dd`	Deletes current line
`ndd`	Deletes *n* number of lines (for example, `5dd` will delete five lines)[a]
`dw`	Deletes the current word under the cursor [b]
`db`	Deletes the word before the cursor[b]
`D`	Deletes everything from the cursor to the end of the line[a]

Continued

Table 15-1. *Continued*

Command	Description
Search	
`/`	Searches forward (type the search text directly after the slash)
`?`	Searches backward
`n`	Repeats search in a forward direction
`N`	Repeats search in a backward direction
Cut and Paste	
`yy`	Copies the current line[c]
`nyy`	Copies *n* number of lines into the buffer from the cursor downward (for example, `5yy` copies five lines of text)
`p`	Pastes the contents of the clipboard[c]
Insert Text	
`i`	Switches to Insert mode at the cursor
`o`	Switches to Insert mode, placing the cursor below the current line
`O`	Switches to Insert mode, placing the cursor above the current line
`A`	Appends text to the end of the line
Navigation[d]	
`$`	Moves the cursor to the end of the current line
`w`	Moves the cursor to the next word
`b`	Moves the cursor to beginning of the current or previous word
Miscellaneous	
`.`	Repeats the last command
`u`	Undoes the last command

[a] *A line ends where a line-break control character occurs in the file. Because of this, a line of text may actually take up several lines of the onscreen display.*

[b] *This will delete the remainder of the current word before/after the cursor if the cursor is in the middle of a word.*

[c] *The standard documentation refers to copying as* yanking *and the clipboard as the* buffer.

[d] *You can also use the cursor keys to move around the file, and the Page Up and Page Down keys to move up and down a page at a time. Additionally, press 0 (zero) on the main keyboard, not the numeric keypad, to move the cursor to the start of the current line, or Shift+0 to move forward one sentence (until the next full stop).*

Insert Mode

To type your own text or to edit text, you need to switch to Insert mode. This is usually done by typing `i`, but you can also type `O` or `o` to change to Insert mode, which is indicated by the word *INSERT* appearing at the bottom of the screen, as shown in Figure 15-3. The difference between the commands required to switch into Insert mode is that some let you insert before or after the cursor. Generally, `i` is most useful, because what you type will appear before the character under the cursor, as with most word processors. The commands that activate Insert mode are listed in Table 15-1, under "Insert Text."

Tip By typing A (Shift+A), you can add text to the end of the line on which the cursor currently resides.

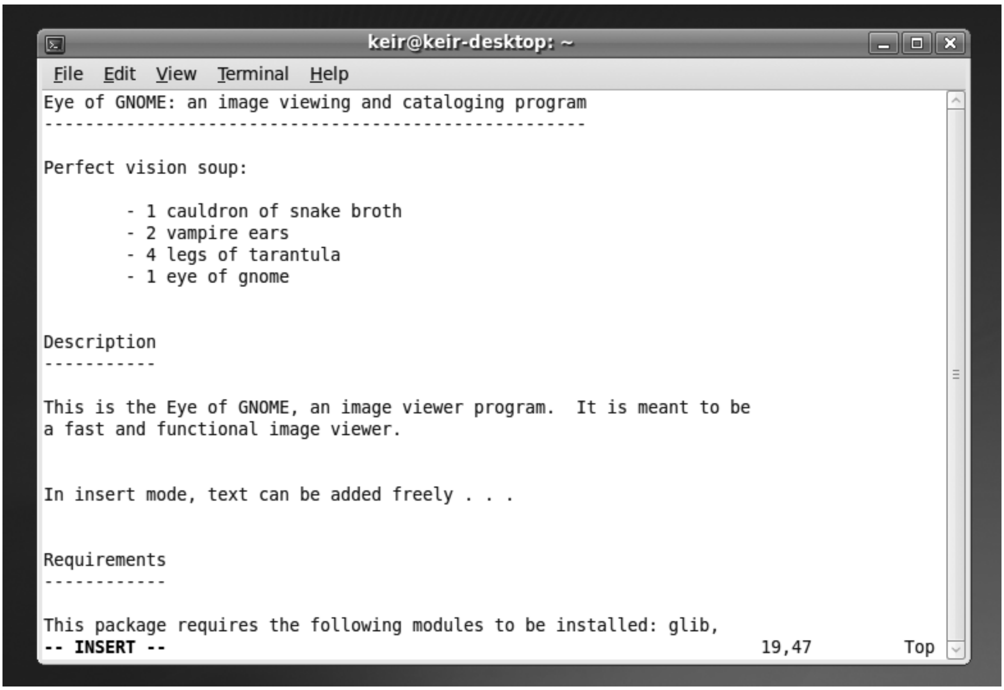


Figure 15-3. *Use* `vim`*'s Insert mode to add and edit text.*

In Insert mode, you can still move around the text by using the cursor keys. Anything you type will appear at the point of the cursor. To quit this mode, press the Esc key. This will return you to Command mode.

Command-Line Mode

The third mode you should be aware of is Command-Line mode (note that, irritatingly, this is not the same as Command mode). As its name suggests, this is the mode in which you can enter commands to save and load files, as well as perform other fundamental tasks to control `vim` or to quit the program. You can enter Command-Line mode by typing a colon (`:`), although if you're in Insert mode, you'll first need to leave it by pressing the Esc key. You can identify when `vim` is in this mode, because the cursor will be at the bottom of the screen next to a colon symbol, as shown in Figure 15-4. To quit Command-Line mode, press the Esc key. You'll be returned to Command mode. Note that you'll automatically leave Command-Line mode after each command you issue has completed.

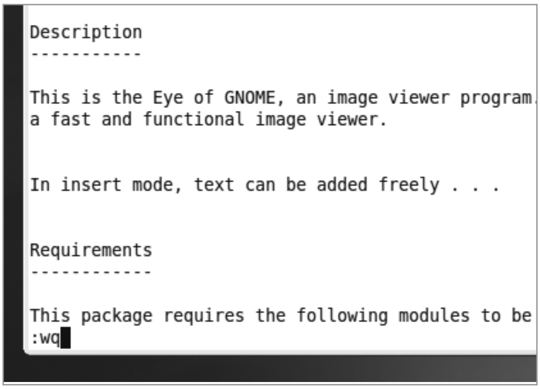


Figure 15-4. *Use* `vim`*'s Command-Line mode to issue commands.*

For a list of basic Command-Line mode commands, see Table 15-2.

Table 15-2. *Some* `vim` *Command-Line Mode Commands*

Command	Description
`:w`	Saves the file
`:w!`	Saves the file and ignores errors such as an existing file with the same filename
`:q`	Quits `vim`
`:q!`	Quits `vim` and ignores errors such as an unsaved file
`:s/word/replacement/`	Searches from the cursor downward and replaces any instances of the word with the replacement[a]
`:help`	Displays the help documentation

[a] *The search tool is very powerful and uses command options for additional flexibility. Read the* `vim` *help file to learn more.*

Using vim to Edit a File

As an example, let's use `vim` to edit the Nautilus `README` file. You don't want to actually alter this file, so start by making a copy of it in your `/home` directory:

```
cp /usr/share/doc/nautilus/README ~
```

This will copy the file `README` to your `/home` directory, which you indicate by using the ~ symbol.

Then fire up `vim` with the file, like this:

```
vim ~/README
```

Note Windows uses file extensions in order to recognize files and therefore know what program to use to run them. By default, a file with a `.doc` extension tells Windows that it should use Microsoft Word to open the file, for example. At the command line, Linux uses a different system based on the first few bytes of each file. Because of this, file extensions are used within Linux simply to let the users know what type of file they're dealing with. Often, they're not used at all. If a file is called `README`, you can be fairly certain that it's a text file, for example.

After the file is opened, you'll find yourself automatically in Command mode and will be able to move around the file by using the cursor keys. Altering the text is achieved by using various commands (see Table 15-1). For example, typing `dd` will delete the line of text that the cursor is currently within. Typing `x` will delete the letter under the cursor. Typing `dw` will delete the current word under the cursor. Try some of these to see how they work.

To actually edit a file and type text, you'll need to switch to Insert mode. Type `i` to do this. Insert mode is fairly easy to understand. You can move around the text by using the cursor keys, and then simply start typing wherever you want. The Backspace key will delete text behind the cursor, and the Delete key will delete text in front of the cursor.

When you're finished, press the Esc key to return to Command mode. Once back in Command mode, you can page through the text. The Page Up and Page Down keys will move a screenful of text at a time. Pressing the up and down cursor keys will cause the screen to scroll when the cursor reaches the top or bottom.

After you're finished editing, you'll need to save the file. This is done in Command-Line mode. You can enter this mode by typing a colon (`:`). You'll see a colon appear at the bottom of the screen, and this is where you type the commands. Note that after you type a command, you'll immediately exit Command-Line mode, so if you want to issue another command, you'll need to type a colon again.

To save a file, in Command-Line mode, type `:w` (which stands for *write*). If you want to save the current file with a different name, you'll need to enter a filename after the `w` command, like this:

```
:w mytextfile
```

■ **Note** Unlike with GUI applications, saving a file with a new name doesn't rename the entire document within `vim`! In other words, if you open `README` and then save it as `NEWVERSION` (that is, `:w NEWVERSION`), the file will still be called `README` within `vim`. If you save it without specifying a new name (that is, `:w`), `README` will be updated, rather than `NEWVERSION`.

To quit `vim`, type `:q`. However, if you've edited a file, you won't be able to quit until the file has been saved. If you want to save the file and then quit, you can type `:wq`. If you don't want to save the file, type `:q!`. The exclamation point tells `vim` to override any objections it might have. You can also use it with the save command—`:w!`—to force the overwriting of a file that already exists.

■ **Note** If you don't have the correct permissions to write a file, `vim` might tell you that you can use `:w!` to override. In this case, it's wrong. The only way to write to a file for which you don't have permissions is to change its permissions.

Using vim to Create a New Text File

Creating and editing a new file with `vim` is easy. From any command-line shell, simply type this:

```
vim myfile
```

This will start `vim` and give your new file a name. However, the file won't be saved until you manually issue the save command (`:w`) in `vim`. This means that if your computer crashes before you save, the file will be lost!

■ **Note** `vim` includes some elementary file-save protection. If, for any reason, `vim` is not shut down properly, there's a chance you'll be able to recover a version of file the next time `vim` starts. However, as with all such protection in any kind of program, you shouldn't rely on this. You should use the `:w` command to save your file periodically.

As always with vim, you start out in the default Command mode. To start typing immediately, enter Insert mode by typing i. You'll notice when typing that although the text is wrapped on each line, words are not carried over, and they often break across lines in an ugly way. This is because vim is primarily a text editor, not a word processor. For people who create text files, like programmers, having line breaks shown in this way can be useful.

When you're finished typing a sentence or paragraph, you can press the Enter key as usual to start a new line. You should then be able to move between lines by using the up and down cursor keys. You'll notice an odd thing when you try to do this, however: unlike with a word processor, moving up a line of text that spreads across more than one line onscreen will take the cursor to the start of the line, rather than into the middle of it. This again relates to vim's text editor focus, where such a feature is useful when editing documents such as program configuration files.

When you're finished, press the Esc key to switch to Command mode. Then type a colon to enter Command-Line mode. Type :w to save the file using the filename you gave it earlier. If you started vim without specifying a filename, you'll need to specify a filename with the save command, such as :w myfile.

USING GEDIT TO EDIT TEXT FILES

If all this talk of vim sounds like too much hard work, don't forget that the GNOME desktop includes an excellent text editor in the form of Gedit. In fact, to describe Gedit as merely a text editor is to do it something of a disservice, because it includes many handy word processor–like features.

You can call Gedit and open a file in it from the command-line prompt as follows:

```
gedit <filename>
```

If you need to adopt superuser powers to edit the likes of configuration files, simply preface the command with gksu:

```
gksu gedit <filename>
```

You'll find Gedit fairly straightforward to use and very much like using a word processor.

Searching Through Files

You can search for particular words or phrases in text files by loading the file into less or vim (see Table 15-1). The maneuverability offered by both programs lets you leap from point to point in the text, and their use is generally user friendly.

However, using vim or less can take precious seconds. There's a quicker command-line option that will search through a file in double-quick speed: grep.

Using grep to Find Text

grep stands for *global regular expression print*. grep is an extremely powerful tool that can use pattern-based searching techniques to find text in files. Pattern-based searching means that grep offers various options to loosen the search so that more results are returned.

The simplest way of using grep is to specify some brief text, followed by the name of the file you want to search. Here's an example:

```
grep 'hello world' myfile
```

This will search for the phrase hello world within myfile. If it's found, the entire line that hello world is on will be displayed onscreen.

If you specify the * wildcard instead of a filename, grep will search every file in the directory for the text. Adding the -r command option will cause grep to search all the files, and also search through any directories that are present:

```
grep -r 'hello world' *
```

Another handy command option is -i, which tells grep to ignore uppercase and lowercase letters when it's searching. Figure 15-5 shows an example of using grep.

■ **Tip** You might never choose to use grep for searching for text within files, but it can prove very handy when used to search through the output of other commands. This is done by *piping* the output from one command to another, as explained in Chapter 17.

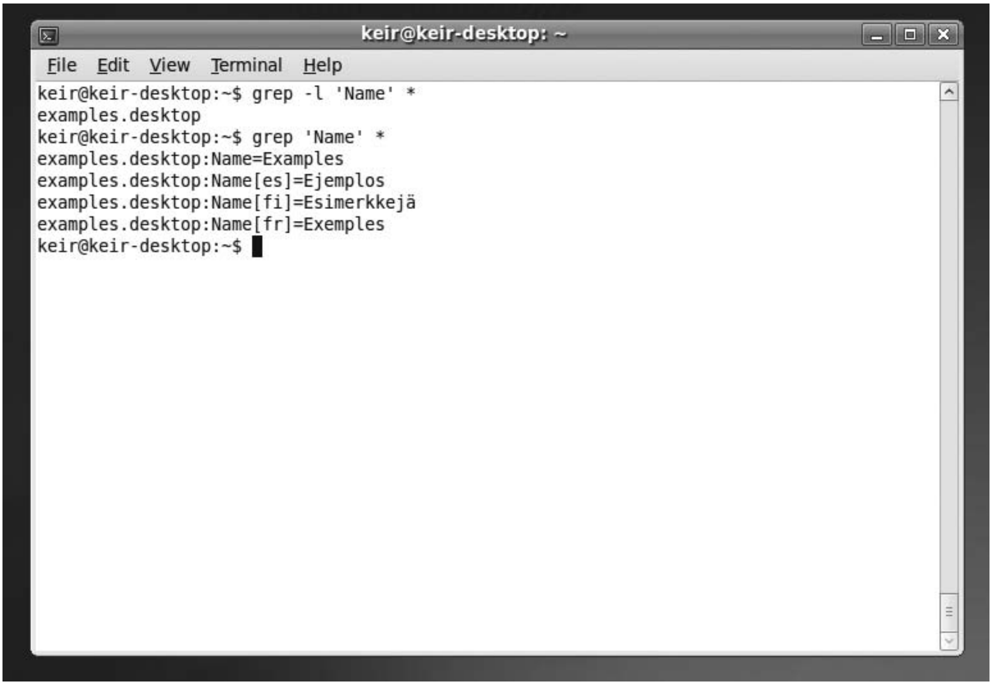


Figure 15-5. `grep` *is a powerful tool that can search for text within files.*

Using Regular Expressions

The true power of `grep` is achieved by the use of search patterns known as *regular expressions*, or *regexes* for short. Put simply, regexes allow you to be vague rather than specific when searching, meaning that `grep` (and many similar tools that use the system of regexes, such as the `find` command discussed in Chapter 14) will return more results. For example, you can specify a selection or series of characters (called a *string* in regex terminology) that might appear in a word or phrase you're searching for. This can be useful if you're looking for a word that might be spelled differently from how you anticipate, for example.

■ **Note** It's said by some that crafting regexes is an art form, and it's certainly true that some well-crafted regex search terms are ingenious. The more you learn about regexes, the better you will become at searching, and the more accurate your search results will be.

The most basic form of regex is the bracket expansion. This is where additional search terms are enclosed in square brackets within a search string. For example, suppose you want to find a file that refers to several drafts of a document you've been working on. The files are called `myfile_1draft.doc`, `myfile_2draft.doc`, and so on. To find any document that mentions these files, you could type this:

```
grep 'myfile_[1-9]draft\.doc' *
```

The use of square brackets tells `grep` to fill in details within the search string based on what's inside the square brackets. In this case, `1-9` means that all the numbers from one to nine should be applied to the search string. It's as if you've told `grep` to search for `myfile_1draft.doc`, and then told it to search for `myfile_2draft.doc`, and so on. Notice that the example has a backslash before the period separating the file extension from the filename. This indicates to `grep` that it should interpret the period as an element of the string to be searched for, rather than as a wildcard character, which is how `grep` usually interprets periods.

You don't need to specify a range of characters in this way. You can simply enter whatever selection of characters you want to substitute into the search string. Here's an example:

```
grep 'myfile[12345]\.doc' *
```

This will attempt to find any mention of `myfile1.doc`, `myfile2.doc`, `myfile3.doc`, and so on, in any file within the directory.

Here's another example:

```
grep '[GgNn]ome' *
```

This will let you search for the word *Gnome* within files but takes into account any possible misspelling of the word by people who forget to use the silent *G*, and any use of uppercase or lowercase.

This is only scratching the surface of what regexes can do. For example, many regexes can be combined into one long search string, which can provide astonishing accuracy when searching. Table 15-3 contains some simple examples that should give you an idea of the power and flexibility of regexes.

Table 15-3. *Some Examples of Regular Expressions*

Search String	Description
`'document[a-z]'`	Returns any lines containing the string "document" followed by any single letter from the range *a* through *z*.
`'document[A-Za-z]'`	Returns any lines containing the string "document" followed by the letters *A* through *Z* or *a* through *z*. Note that no comma or other character is needed to separate possibilities within square brackets.
`'document.'`	Returns any lines containing the string "document" followed by any other character. The period is used as a wildcard signifying any single character.
`'document[[:digit:]]'`	Returns any lines containing the string "document" followed by any number.
`'document[[:alpha:]]'`	Returns any lines containing the string "document" followed by any character.
`'^document'`	Returns any lines that have the string "document" at the beginning. The caret symbol (`^`) tells `grep` to look only at the beginning of each line.
`'document$'`	Returns any line that has the string "document" at the end of the line. The dollar sign (`$`) tells `grep` to look for the string only at the end of lines.
`'document[^1-6]'`	Returns lines that have the string "document" in them but not if it's followed by the numbers 1 through 6. When used in square brackets, the caret character (`^`) produces a nonmatching list—a list of results that don't contain the string.

`grep` is powerful. It can be complicated to master, but it offers a lot of scope for performing extremely precise searches that ensure you find only what you're seeking. It's well worth reading through its man pages. You can also refer to books on the subject, of which there are many. A good example is *Regular Expression Recipes: A Problem-Solution Approach* by Nathan A. Good (1-59059-441-X; Apress, 2004).

WILDCARDS

A *wildcard* is a symbol that can be used to represent any character or number of characters. They are used most commonly at the command line to specify any number of files. You may already have encountered the most commonly used wildcard—the asterisk—but there are a handful of others that can be equally useful.

`*` As mentioned, the asterisk is the most commonly used wildcard character, but it's worth fully understanding what it represents. At its most simple, the asterisk represents *zero or any number of characters*. For example, the command `rm *` will remove all files in a directory, because the asterisk is used to represent any files whose filenames contain any number of characters—and that's all of them! Typing `rm picture*` will remove any files that begin with `picture`, including a file called `picture` itself if it exists, along with any files that begin with `picture` but have any number (or type) or characters following. (This includes files that have file extensions; under Linux, the file extension is simply considered a part of the entire filename, unlike with Windows, where there's a tendency to accord it special status when renaming or otherwise manipulating files.)

`?` The question mark represents any single character. Typing `rm picture?.jpg` will remove files such as `picture1.jpg`, `pictureX.jpg`, and so on. However, `picture.jpg` (if it exists) will remain untouched.

`[]` Square brackets can be used to specify a range of characters. For example, the command `rm picture[12XY].jpg` will remove `picture1.jpg`, `picture2.jpg`, `pictureX.jpg`, and `pictureY.jpg`. Alternatively, a range of letters or numbers can be specified. The command `rm picture[1-4].jpg` will remove `picture1.jpg`, `picture2.jpg`, `picture3.jpg`, and `picture4.jpg`.

`{}` Curly brackets let you specify individual items separated by a comma. For example, the command `rm picture{germany,france}.jpg` would delete `picturegermany.jpg` and `picturefrance.jpg`.

It's worth mentioning that wildcards can be joined together and combined in various ways. For example, to remove all the JPEG and GIF files in a directory (that is, those with a `.jpg` or `.gif` file extension) but leave any others, you could type `rm *.{jpg,gif}`.

Comparing Text Files

If you want to compare the differences between two text files, one way to do this is to use the `diff` command. This is designed primarily to uncover small changes in otherwise identical documents, such as revisions made by another person. Of course, it can also be used to prove that two files are identical. If you run the files through `diff`, and it shows no output, it has been unable to spot any differences.

`diff` is ordinarily used like this:

```
diff mytextfile1 mytextfile2
```

If `diff` spots any differences between the files, the results are a little more complicated than you might be used to. Any lines that are different within the files will appear onscreen. Those lines that are identical won't be displayed. Lines preceded with a left angle bracket (`<`) are from the first file, while those with a right angle bracket (`>`) are from the second file. For a different display, you could type something like this:

```
diff -y mytextfile1 mytextfile2
```

This places the two lists side by side and highlights lines that are different with a pipe symbol (`|`). However, it requires a lot more screen space than using `diff` without the `-y` option.

■ **Note** When you use the `-y` command option with `diff`, it will struggle to fit the output in a standard GNOME Terminal window. If it is maximized on a 1024×768 resolution screen, it should be just large enough to fit the information in, depending on the complexity of the files being compared.

By specifying the `-a` command option, you can make `diff` process binary files too. This is a handy way of comparing virtually any kind of files, including program files, to see whether they're identical. If there's no output from `diff`, the two files are identical. If your screen fills with gibberish, the files are clearly different.

Incidentally, if you want to compare three documents, you can use a similar command: `diff3`. Check the command's man page to learn more about how it works.

Exploring More Text Tools

BASH is an incredibly capable tool when it comes to text manipulation, and some of its tool set offers modest word processing–like functionality. It's no wonder that some people live their lives working at the BASH prompt and have no need of sophisticated GUI tools!

Table 15-4 lists some more text-processing tools that you can use on the command line. Along with the commands are listed any command options needed to make them work in a useful way. Some commands rely on redirection and piping, which are explained in depth in Chapter 17.

■ **Note** Most text-processing tools under BASH were created for programmers, so some options might seem a little odd when you read the man pages. However, all the tools all extremely flexible and offer functions for every kind of user.

Table 15-4. *Useful Text-Processing Commands*

Function	Command	Notes
Spell-check	`aspell -c filename`	Any questionable words within `filename` are highlighted, and a choice of replacements is offered, rather like a standard word processor's spell-checker. Press X if you wish to exit after spell-checking starts.
Single word spell-check	`look word`	Looks up `word` in the dictionary; if the word is displayed in output, the word has been found. If not, the word hasn't been found. Note that this command returns loose matches—searching for `test`, for example, will return every word beginning with `test` (`testing`, `testimony`, `testosterone`, and so forth).
Word count	`wc -w filename`	Outputs the number of words in `filename`. Used without the `-w` command switch, `wc` outputs the number of lines, followed by the word count, followed by the number of bytes in the file.
Remove line breaks	`fmt filename > newfile`	Creates `newfile`, removing breaks at the end of lines in `filename`. Double-line breaks between paragraphs aren't affected. Adding the `-u` command switch removes instances of double spaces too.
Remove duplicate lines	`uniq filename > newfile`	Creates `newfile` from `filename` but removes duplicate lines.
Join two files	`paste file1 file2 > file3`	Creates `file3` by joining `file1` and `file2` side by side (effectively creating two columns of text). Each line is separated by a tab.

Function	Command	Notes
Word wrap	`fold -sw20 filename > newfile`	Creates `newfile` from `filename`, wrapping lines at the specified `20` characters (increase/decrease this value for shorter/longer lines). Note that the `-s` switch ensures that lines don't break across words, even if this means exceeding the specified character count.
Add line numbers	`nl filename > newfile`	Creates `newfile` from `filename`, adding line numbers to the beginning of each line.
Sort list	`sort file1 > file2`	Creates `file2` from `file1`, sorting its contents alphanumerically (technically, it sorts according to ASCII, so some symbols appear above numbers). For obvious reasons, this command works best on lists.

Summary

In this chapter, we showed how text files can be manipulated. In many ways, the BASH shell is built around manipulating text, and we presented various tools created with this goal in mind. We started with the commands that can display text files (or part of them). We then showed you how the `vim` text editor can be used to both edit and create documents. Next, you learned how regexes can be used with the `grep` command to create sophisticated search strings, which can uncover any text within documents. Finally, you saw how to compare text files.

In the next chapter, you'll look at processes (the individual components of programs), and how you can use various command-line tools to take control of your system.

CHAPTER 16

Taking Control of the System

By now, you should be starting to realize that the shell offers an enormous amount of power when it comes to administering your PC. The BASH shell commands give you quick and efficient control over most aspects of your Linux setup. However, the shell truly excels in one area: controlling the processes on your system.

Controlling processes is essential for administration of your system. You can tidy up crashed programs, for example, or even alter the priority of a program so that it runs with a little more consideration for other programs. Unlike with Windows, this degree of control is not considered out of bounds. This is just one more example of how Linux provides complete access to its inner workings and puts you in control.

Without further ado, let's take a look at what can be done.

Viewing Processes

A *process* is something that exists entirely behind the scenes. When the user runs a program, one or many processes might be started, but they're usually invisible unless the user specifically chooses to manipulate them. You might say that programs exist in the world of the user, but processes belong in the world of the system.

Processes can be started not only by the user, but also by the system itself to undertake tasks such as system maintenance, or even to provide basic functionality, such as the GUI system. Many processes are started when the computer boots up, and then they sit in the background, waiting until they're needed (such as programs that provide printing functionality). Other processes are designed to work periodically to accomplish certain tasks, such as ensuring that system files are up to date.

You can see what processes are currently running on your computer by running the `top` program. Running `top` is simply a matter of typing the command at the shell prompt.

As you can see in Figure 16-1, `top` provides comprehensive information and can be a bit overwhelming at first sight. However, the main area of interest is the list of processes (which `top` refers to as *tasks*).

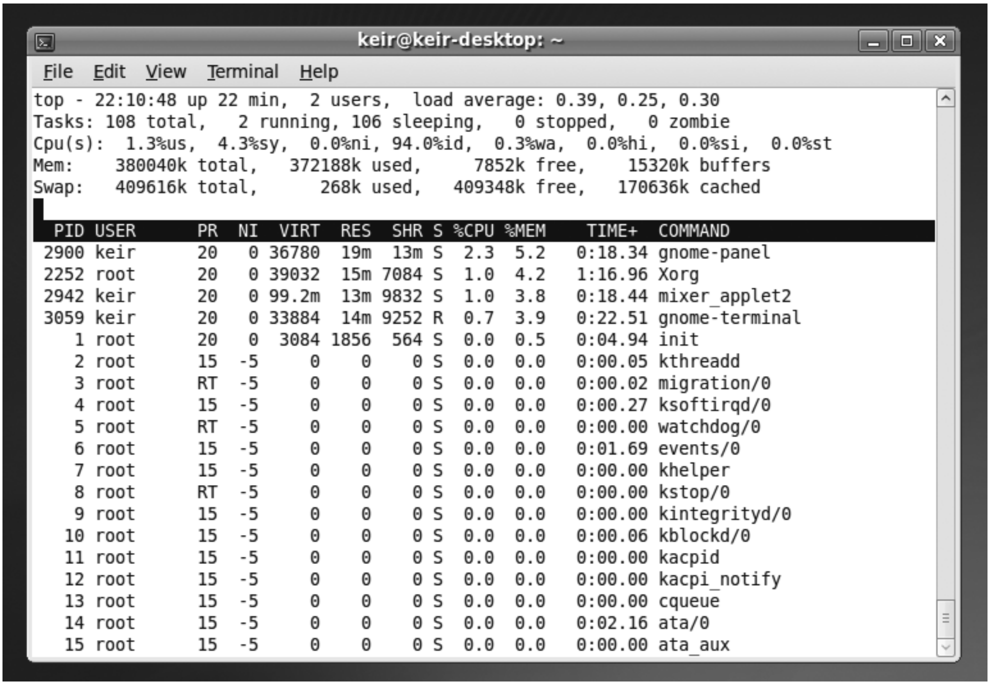


Figure 16-1. *The `top` program gives you an eagle-eye view of the processes running on your system.*

Here's an example of a line taken from `top` on our test PC, shown with the column headings from the process list:

```
PID   USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
5499 root       15   0 78052  25m  60m S  2.3  5.0   6:11.72 Xorg
```

A lot of information is presented here, as described in Table 16-1.

Table 16-1. *The* `top` *Program Process Information*

Column	Description
`PID`	The first number is the process ID (PID). This is the unique number that the system uses to track the process. The PID comes in handy if you want to kill (terminate) the process (as explained in the next section of this chapter).
`USER`	This column lists the owner of the particular process. As with files, all processes must have an owner. A lot of processes will appear to be owned by the root user. Some of them are system processes that need to access the system hardware, which is something only the root user is allowed to do. Other processes are owned by root for protection; root ownership means that ordinary users cannot tamper with these processes.
`PR`	This column shows the priority of the process (that is, how important it is compared to other processes, and therefore how much attention it will gain from the CPU). This is a dynamic number, showing where the particular process is in the CPU queue at the present time.
`NI`	This column shows the "nice" value of the process. This refers to how charitable a process is in its desire for CPU time. A high figure here (up to 19) indicates that the process is willing to be interrupted for the sake of other processes. A negative value means the opposite: the process is more aggressive than others in its desire for CPU time. Some programs need to operate in this way, and this is not necessarily a bad thing.
`VIRT`	This column shows the amount of virtual memory used by the process.[a]
`RES`	This column shows the total amount of physical memory used.[a]
`SHR`	This column shows the amount of shared memory used. This refers to memory that contains code that is relied on by other processes and programs.
`S`	This column shows the current status of the task. Generally, the status will either be sleeping, in which case an *S* will appear, or running, in which case an *R* will appear. Most processes will be sleeping, even ones that appear to be active. Don't worry about this; it just reflects the way the Linux kernel works. Having a *Z* in this column indicates a zombie process (a child of a process that has been terminated).
`%CPU`	This column shows the CPU use, expressed as a percentage.[b]
`%MEM`	This column shows the memory use, again expressed as a percentage.[b]
`TIME+`	This column shows a measure of how long the process has been up and running.
`COMMAND`	This shows the actual name of the process itself.

[a] *Both* `VIRT` *and* `RES` *are measured in kilobytes, unless an* `m` *appears alongside the number—in which case, you should read the figure as megabytes.*

[b] *The* `%CPU` *and* `%MEM` *entries tell you in easy-to-understand terms how much of the system resources a process is taking up.*

This list will probably be longer than the screen has space to display, so `top` orders the list of processes by the amount of CPU time the processes are using. Every few seconds, it updates the list. You can test this quite easily. Open a Nautilus file-browsing window (Places ➤ Home) and then let your PC rest for a few seconds, without touching the mouse or typing. Then click an icon in the Nautilus window. You'll see that the process called `nautilus` leaps to the top of the list (or appears very near the top).

At the top of the list will probably be Xorg. This is the program that provides the graphical subsystem for Linux, and making the mouse cursor appear to move around the screen and drawing program windows requires CPU time.

■ **Tip** Typing `d` while `top` is running lets you alter the update interval, which is the time between screen updates. The default is 3 seconds, but you can reduce that to 1 second or even less if you wish (that is, a fraction of a second, such as 0.5). However, a constantly updating `top` program starts to consume system resources and can therefore skew the diagnostic results you're investigating. Because of this, a longer, rather than shorter, interval is preferable.

It's possible to alter the ordering of the process list according to other criteria. For example, you can list the processes by the quantity of memory they're using, by typing `M` while `top` is up and running. You can switch back to CPU ordering by typing `P`.

To quit `top`, type `Q`.

RENICING A PROCESS

You can set how much CPU time a process receives while it's actually running. This is done by *renicing* the process. This isn't something you should do on a regular basis, but it can prove handy if you start a program that then uses a lot of system resources and makes the system unbearably slow.

The first thing to do is to use `top` to spot the process that needs to be restrained and find out its PID number. Renicing is best done as the root user, because in order to protect the system, limitations are placed on what ordinary users can set in terms of CPU scheduling. Run `top` as root by typing `sudo top` (although be careful—with `top` running as root, you can kill any process!). The PID will be listed on the left of the program's entry on the list.

Once you know this, type `r`, and then type in the PID number. You'll then be asked to specify a renice value. The scale goes from –20, which is considered the highest priority, to 19, which is considered the lowest. Zero is the median value, and most new user-started processes are given a value of 0. Therefore, using a value of 19 is perhaps a good idea to ensure that a process stops hogging system resources. After this, you should find that some responsiveness has returned to the system, although how much (if any) depends on the nature of the programs you're running.

You might be tempted to bump up the priority of a process to make it run faster, but this may not work the way you want because of complexities in the Linux kernel. In fact, it might cause serious problems. Therefore, you should renice with care and only when you must.

Renicing can also be carried out via the `renice` command at the prompt, avoiding the need to use `top`. Also useful is the `nice` command, which can be used to set the initial priority of a process before it starts to run. To learn more, see the man pages for `renice` and `nice`.

Controlling Processes

Despite the fact that processes running on your computer are usually hidden away, Linux offers complete, unrestricted, and unapologetic control over them. You can terminate processes, change their properties, and learn every item of information there is to know about them.

This provides ample scope for damaging the currently running system but, in spite of this, even standard users have complete control over processes that they personally started (one exception is zombie processes, described a bit later in this section). As you might expect, the root user (or any user who adopts superuser powers) has control over all processes that were created by ordinary users, as well as those processes started by the system itself.

The user is given this degree of control over processes in order to enact repairs when something goes wrong, such as when a program crashes and won't terminate cleanly. It's impossible for standard users to damage the currently running system by undertaking such work, although they can cause themselves a number of problems.

Note This control over processes is what makes Linux so reliable. Because any user can delve into the workings of the kernel and terminate individual processes, crashed programs can be cleaned up with negligible impact on the rest of the system.

Killing Processes

Whenever you quit a program or, in some cases, when it completes the task you've asked of it, it will terminate itself. This means ending its own process and also that of any other processes it created in order to run. The main process is called the *parent*, and the ones it creates are referred to as *child* processes.

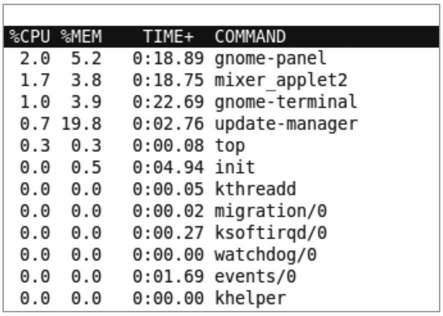
Tip You can see a nice graphical display of which parent owns which child process by typing `pstree` at the command-line shell. It's useful to add the `-p` command option (that is, `pstree -p`). This adds the PIDs to the output. It's worth piping this into the `less` command so you can scroll through it: type `pstree | less`. We explain what piping is in the next chapter.

Although this termination should mean that your system runs smoothly, badly behaved programs sometimes don't go away. They stick around in the process list. Alternatively, you might find that a program crashes and so isn't able to terminate itself.

In rare cases, some programs that appear otherwise healthy might get carried away and start consuming a lot of system resources. You can tell when this happens because your system will start slowing down for no reason, as less and less memory and/or CPU time is available to run actual programs.

In all of these cases, the user usually must kill the process in order to terminate it manually. This is easily done by using `top`.

The first task is to track down the crashed or otherwise problematic process. In `top`, look for a process that matches the name of the program, as shown in Figure 16-2. For example, the Mozilla Firefox web browser generally runs as a process called `firefox`.



```
%CPU %MEM    TIME+  COMMAND
 2.0  5.2   0:18.89 gnome-panel
 1.7  3.8   0:18.75 mixer_applet2
 1.0  3.9   0:22.69 gnome-terminal
 0.7 19.8   0:02.76 update-manager
 0.3  0.3   0:00.08 top
 0.0  0.5   0:04.94 init
 0.0  0.0   0:00.05 kthreadd
 0.0  0.0   0:00.02 migration/0
 0.0  0.0   0:00.27 ksoftirqd/0
 0.0  0.0   0:00.00 watchdog/0
 0.0  0.0   0:01.69 events/0
 0.0  0.0   0:00.00 khelper
```

Figure 16-2. *You can usually identify a program by its name in the process list.*

Caution You should be absolutely sure that you know the correct process before killing it. If you get it wrong, you could cause other programs to stop running.

Because `top` doesn't show every single process on its screen, tracking down the trouble-causing process can be difficult. A handy tip is to make `top` show only the processes created by the user you're logged in under. This will remove the background processes started by root. You can do this within `top` by typing `u` and then entering your username.

After you've spotted the crashed process, make a note of its PID number, which will be at the very left of its entry in the list. Then type `k`. You'll be asked to enter the PID number. Enter that number, and then press Enter once again (this will accept the default signal value of 15, which will tell the program to terminate).

With any luck, the process (and the program in question) will disappear. If it doesn't, the process you've killed might be the child of another process that also must be killed. To track down the parent process, you need to configure `top` to add the PPID field (for the *parent process ID*) to its display. To add this field, type `f` and then `b`. Press Enter to return to the process list. The PPID column will appear next to the process name on the right of the window. It simply shows the PID of the parent process. You can use this information to look for the parent process within the main list of processes.

The trick here is to make sure that the parent process isn't something that's vital to the running of the system. If it isn't, you can safely kill it. This should have the result of killing the child process you uncovered prior to this.

Caution In both the PPID and PID fields, you should always watch out for low numbers, particularly one-, two-, or three-digit numbers. These are usually processes that started early on when Linux booted and that are essential to the system.

Controlling Zombie Processes

Zombie processes are those that are children of processes that have terminated. However, for some reason, they failed to take their child processes with them. Zombie processes are rare on most Linux systems.

Despite their name, zombie processes are harmless. They're not actually running and don't take up system resources. However, if you want your system to be spick-and-span, you can attempt to kill them.

In the top-right area of `top`, you can see a display that shows how many zombie processes are running on your system, as shown in Figure 16-3. Zombie processes are easily identified because they have a `Z` in the status `(S)` column within `top`'s process list. To kill a zombie process, type `k` and then type its PID. Then type `9`, rather than accept the default signal of 15.

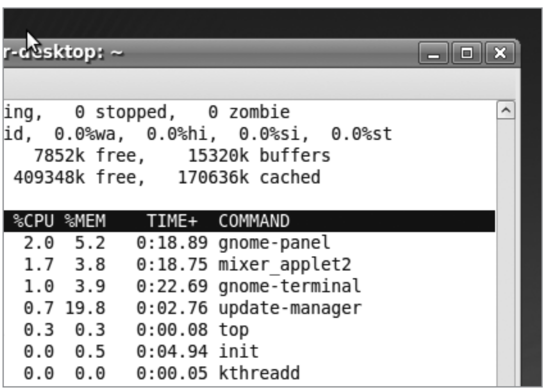


Figure 16-3. *You can see at a glance how many zombie processes are on your system by looking at the top right of `top`'s display.*

■Note No magic is involved in killing processes. All that happens is that `top` sends them a "terminate" signal. In other words, it contacts them and asks them to terminate. By default, all processes are designed to listen for commands such as this; it's part and parcel of how programs work under Linux. When a program is described as *crashed*, it means that the user is unable to use the program itself to issue the terminate command (such as Quit). A crashed program might not be taking input, but its *processes* will probably still be running.

In many cases, zombie processes simply won't go away. When this happens, you have two options. The first is to restart the program that is likely to be the zombie's owner, in the hope that it will reattach with the zombie and then quit the program. With any luck, it will take the zombie child with it this time. Alternatively, you can simply reboot your PC. But it's important to note that zombie processes are harmless and can be left in peace on your system!

Using Other Commands to Control Processes

You don't always need to use `top` to control processes. A range of quick and cheerful shell commands can diagnose and treat process problems.

The first of these is the `ps` command. This stands for *process status* and will report a list of currently running processes on your system. This command is typically used with the `aux` command options (there's no need to provide a dash before the options, as with most commands):

```
ps aux
```

This will return a list something like what you see when you run `top`.

If you can spot the problematic process, look for its PID and issue the following command:

```
kill <PID number>
```

For example, to kill a process with a PID of 5122, you would type this:

```
kill 5122
```

If, after this, you find the process isn't killed, then you should use the `top` program, as described in the previous sections, because it allows for a more in-depth investigation.

Another handy process-killing command lets you use the actual process name. The `killall` command is handy if you already know from past experience what a program's process is called. For example, to kill the process called `firefox`, which is the chief process of the Firefox web browser, you would use the following command:

```
killall firefox
```

Caution Make sure you're as specific as possible when using the `killall` command. Issuing a command like `killall bin` will kill all processes that might have the word `bin` in their name!

CLEARING UP CRASHES

Sometimes a crashed process can cause all kinds of problems. The shell you're working at may stop working, or the GUI itself might stop working properly.

In cases like this, it's important to remember that you can have more than one instance of the command-line shell up and running at any one time. For example, if a process crashes and locks up GNOME Terminal, simply start a new instance of GNOME Terminal (Applications ➤ Accessories ➤ Terminal). Then use `top` within the new window to kill the process that is causing trouble for the other terminal window.

If the crashed program affects the entire GUI, you can switch to a virtual console by pressing Ctrl+Alt+F1. Although the GUI disappears, you will not have killed it, and no programs will stop running. Instead, you've simply moved the GUI to the background while a shell console takes over the screen. Then you can use the virtual console to run `top` and attempt to kill the process that is causing all the problems. When you're ready, you can switch back to the GUI by pressing Ctrl+Alt+F7.

If you know the name of the program that's crashed, a quick way of getting rid of it is to use the `pgrep` command. This searches the list of processes for the program name you specify and then outputs the PID number. So if, say, Nautilus had frozen, you could type `pgrep nautilus`. Then you would use the `kill` command with the PID number that's returned.

Controlling Jobs

Whenever you start a program at the shell, it's assigned a job number. *Jobs* are quite separate from processes and are designed primarily for users to understand what programs are running on the system.

You can see which jobs are running at any one time by typing the following at the shell prompt:

```
jobs
```

When you run a program, it usually takes over the shell in some way and stops you from doing anything until it's finished what it's doing. However, it doesn't have to be this way. Adding an ampersand symbol (`&`) after the command will cause it to run in the background. This is not much use for commands that require user input, such as `vim` or `top`, but it can be handy for commands that churn away until they're completed.

For example, suppose that you want to decompress a large zip file. For this, you can use the `unzip` command. As with Windows, decompressing large zip files can take a lot of time, during which time the shell would effectively be unusable. However, you can type the following to retain use of the shell:

```
unzip myfile.zip &
```

When you do this, you'll see something similar to the following, although the four-digit number will be different:

```
[1] 7483
```

This tells you that `unzip` is running in the background and has been given job number `1`. It also has been given process number `7483` (although bear in mind that when some programs start, they instantly kick off other processes and terminate the one they're currently running, so this won't necessarily be accurate).

■ **Tip** If you've ever tried to run a GUI program from the shell, you might have realized that the shell is inaccessible while it's running. After you quit the GUI program, the control of the shell will be returned to you. By specifying that the program should run in the background with the `&` (ampersand symbol), you can run the GUI program and still be able to type away and run other commands.

You can send several jobs to the background, and each one will be given a different job number. In this case, when you wish to switch to a running job, you can type its number. For example, the following command will switch you to the background job assigned the number 3:

```
%3
```

You can exit a job that is currently running by pressing Ctrl+Z. It will still be there in the background, but it won't be running (officially, it's said to be *sleeping*). To restart it, you can switch back to it, as just described. Alternatively, you can restart it but still keep it in the background. For example, to restart job 2 in the background, leaving the shell prompt free for you to enter other commands, type the following:

```
%2 &
```

You can bring the command in the background into the foreground by typing the following:

```
fg
```

When a background job has finished, something like the following will appear at the shell:

```
[1]+  Done            unzip myfile.zip
```

Using jobs within the shell can be a good way of managing your workload. For example, you can move programs into the background temporarily while you get on with something else. If you're editing a file in `vim`, you can press Ctrl+Z to stop the program. It will remain in the background, and you'll be returned to the shell, where you can type other commands. You can then resume `vim` later on by typing `fg` or typing `%` followed by its job number.

Tip Also useful is Ctrl+C, which will kill a job that's currently running. For example, if you previously started the `unzip` command in the foreground, hitting Ctrl+C will immediately terminate it. Ctrl+C is useful if you accidentally start commands that take an unexpectedly long time to complete.

NOHUP

What if you want to start a command running in a terminal window, but then want to close that terminal window? As soon as you close the window, any processes started within it are also closed. Try this now—type `gcalctool` at the prompt to start the Calculator application and then quit the terminal window.

This happens because, when you quit, the parent process sends any process that it started a hang-up signal. Some processes are designed to ignore the hang-up signal, so in the preceding example not all will quit when the terminal window does, but most obey it. As you might expect, the hang-up signal is a remnant of the way Unix used to work many years ago, when people dialed into computers across slow connections; it is designed to stop processes from continuing to consume resources after the user has hung up the phone and thereby ended the session!

To get around processes quitting like this, you can use the `nohup` command. This stands for *no hang-up*, and in simple terms, it tells the command you specify to stick around, even after the process that started it has ended (technically, the command is told to ignore the SIGHUP signal). However, commands run via `nohup` can still be killed in the usual way.

To use `nohup`, simply add it before the command, for example:

```
nohup unzip myfile.zip
```

If the command requires `sudo` or `gksu` powers, add either of these after the `nohup` command.

Any command output (including error messages) is sent to the file `nohup.out`, which you can then view in a text editor. Note that if you run a command via `nohup` using `sudo` or `gksu`, the `nohup.out` file will have root privileges. If that's the case, you will also have to delete the `nohup.out` file via `sudo` before you can use `nohup` again as an ordinary user—because, otherwise, `nohup` will be unable to overwrite the root-owned `nohup.out`.

Summary

This chapter has covered taking complete control of your system. You looked at what processes are, how they're separate from programs, and how they can be controlled or viewed by using programs such as `top` and `ps`. In addition, you explored job management under BASH. You saw that you can stop, start, and pause programs at your convenience.

In the next chapter, you'll take a look at several tricks and techniques that you can use with the BASH shell to finely hone your command-line skills.

CHAPTER 17

Cool Shell Tricks

The BASH shell is the product of many years of development work by a lot of people. It's directly descended from software used in the old days of Unix and was an important step in computer software evolution. It's a program that retains complete logical simplicity yet packs in more features than most users could ever hope to use.

One of the best things about the shell is its sheer power. If you ever wonder whether you can do a task differently (and more efficiently), you'll probably find that one of the many BASH developers has implemented a method to do so. After you learn these techniques, you'll find that you can whiz around the shell at blinding speed. It's just a matter of exploring the far reaches of the shell, and that's what you'll do in this chapter. Hold on to your hats, because it's an exciting ride!

Using Autocompletion

The Tab key is your best friend when using the shell, because it will cause BASH to automatically complete whatever you type. For example, if you want to run Ubuntu's web browser, you can enter `firefox` at the command line. However, to save yourself some time, you can type `fir` and then press Tab. You'll then find that BASH fills in the rest for you. It does this by caching the names of the programs you might run according to the directories listed in your `$PATH` variable (see Chapter 13).

Of course, autocompletion has some limitations. On my Ubuntu test system, typing `loc` didn't autocomplete the useful `locate` command. Instead, it caused BASH to beep. This is because on a default Ubuntu installation, there is more than one possible match. Pressing Tab again immediately shows those matches. Depending on how much you type (how much of an initial clue you give BASH), you might find there are many possible matches.

In this case, the experienced BASH user simply types another letter, which will be enough to distinguish the almost-typed word from the rest, and presses Tab again. With any luck, this should be enough for BASH to fill in the rest.

Autocompletion with Files and Paths

Tab autocompletion also works with files and paths. If you type the first few letters of a folder name, BASH will try to fill in the rest. This also obviously has limitations. There's no point in typing `cd myfol` and pressing Tab if there's nothing in the current directory that starts with the letters `myfol`. This particular autocomplete function works by looking at your current directory and seeing what's available.

Alternatively, you can specify an initial path for BASH to use in order to autocomplete. Typing `cd /ho` and pressing Tab will cause BASH to autocomplete the path by looking in the root directory (`/`). In other words, it will autocomplete the command with the directory `/home`. In a similar way, typing `cd myfolder/myfo` will cause BASH to attempt to autocomplete by looking for a match in `myfolder`.

If you want to run a program that resides in the current directory, such as one you've just downloaded, for example, typing `./`, followed by the first part of the program name, and then pressing Tab should be enough to have BASH autocomplete the rest. In this case, the dot and slash tell BASH to look in the current directory for any executable programs or scripts (programs with `x` as part of their permissions) and use them as possible autocomplete options.

BASH is clever enough to spot whether the command you're using is likely to require a file, directory, or executable, and it will autocomplete with only relevant file or directory names.

Viewing Available Options

The autocomplete function has a neat side effect. As we mentioned earlier, if BASH cannot find a match, pressing Tab again causes BASH to show all the available options. For example, typing `ba` at the shell and then pressing Tab twice will cause BASH to show all the possible commands starting with the letters *ba*. On our test PC, this produces the following list of commands:

```
badblocks  baobab  basename  bashbug
banner  base64  bash  batch
```

This can be a nice way of exploring what commands are available on your system. You can then use each command with the `--help` command option to find out what it does, or browse the command's man page.

When you apply this trick to directory and filename autocompletion, it's even more useful. For example, typing `cd` in a directory and then pressing the Tab key twice will cause BASH to show the available directories, providing a handy way of retrieving a brief directory listing. Alternatively, if you've forgotten how a directory name is spelled, you can use this technique to find out prior to switching into it.

Figure 17-1 shows a few examples of using this technique with BASH.

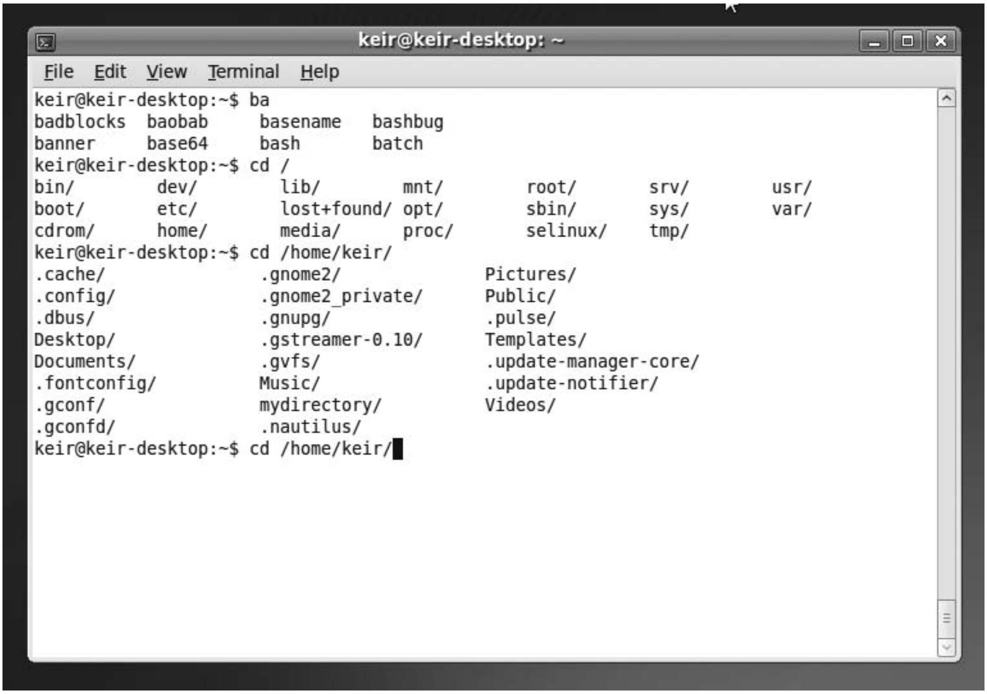


Figure 17-1. *Autocompletion makes using BASH much easier.*

Other Autocompletion Examples

Under Ubuntu, but not under most Linux distros, you can also use Tab autocomplete with other commands. In fact, anywhere you might think autocomplete will prove useful, you'll probably find it works. For example, when installing software by using the `apt-get` command (as described in Chapter 28), you can type a little of the package name you'd like to install, and then hit Tab to have it autocompleted. As when exploring commands by using the Tab key (as explained earlier), this is a neat way of exploring what packages are available.

You will also find that Tab autocomplete works with the `man` command, used to view technical documentation. Just type `man` and then a little of the command you're interested in, before hitting Tab to autocomplete.

Using Keyboard Shortcuts

Your other good friends when using BASH are the Ctrl and Alt keys. These keys provide shortcuts to vital command-line shell functions. They also let you work more efficiently when typing by providing what most programs call keyboard shortcuts.

Shortcuts for Working in BASH

Table 17-1 lists the most common keyboard shortcuts in BASH (there are many more; see BASH's man page for details). If you've explored the Emacs text editor, you might find these shortcuts familiar. Such keyboard shortcuts are largely the same across many of the software packages that originate from the GNU Project. Often, you'll find an option within many Ubuntu software packages that lets you use Emacs-style navigation, in which case, these keyboard shortcuts will most likely work equally well.

Table 17-1. *Keyboard Shortcuts in BASH*

Shortcut	Description
Navigation	
Left/right cursor key	Moves left/right in text
Ctrl+A	Moves to beginning of line
Ctrl+E	Moves to end of line
Ctrl+right arrow	Moves forward one word
Ctrl+left arrow	Moves left one word
Editing	
Ctrl+U	Deletes everything behind cursor to start of line
Ctrl+K	Deletes from cursor to end of line
Ctrl+W	Deletes from cursor to beginning of word
Alt+D	Deletes from cursor to end of word
Ctrl+T	Transposes characters on left and right of cursor
Alt+T	Transposes words on left and right of cursor

Shortcut	Description
Miscellaneous	
Ctrl+L	Clears screen (everything above current line)
Ctrl+U	Undoes everything since last command[a]
Alt+R	Undoes changes made to the line[b]
Ctrl+Y	Undoes deletion of word or line caused by using Ctrl+K, Ctrl+W, and so on[c]
Alt+L	Lowercases current word (from the cursor to end of word)

[a] *In most cases, this has the effect of clearing the line.*

[b] *This is different from Ctrl+U, because it will leave intact any command already on the line, such as one pulled from your command history.*

[c] *This allows primitive cutting and pasting. Delete the text and then immediately undo, after which the text will remain in the buffer and can be pasted with Ctrl+Y.*

Shortcuts for System Control

In terms of the control over your system offered by keyboard commands, as mentioned in Chapter 16, pressing Ctrl+Z has the effect of stopping the current program. It suspends the program until you switch back into it or tell it to resume in another way, or manually kill it.

In the same style, pressing Ctrl+C while a program is running will quit it. This sends the program's process a termination signal, a little like killing it by using the `top` program. Ctrl+C can prove handy if you start a program running by accident and quickly want to end it, or if a command takes longer than you expected to work and you cannot wait for it to complete. It's also a handy way of attempting to end crashed programs. Some complicated programs don't take too kindly to being quit in this way, particularly those that need to save data before they terminate. However, most should be okay.

Ctrl+D is another handy keyboard shortcut. This sends the program an end-of-file (EOF) message. In effect, this tells the program that you've finished your input. This can have a variety of effects, depending on the program you're running. For example, pressing Ctrl+D on its own at the shell prompt when no program is running will cause you to log out (if you're using a GUI terminal emulator like GNOME Terminal, the program will quit). This happens because pressing Ctrl+D informs the BASH shell program that you've finished your input. BASH then interprets this as the cue that it should log you out. After all, what else can it do if told there will be no more input?

Although it might not seem very useful for day-to-day work, Ctrl+D is vital for programs that expect you to enter data at the command line. You might run into these as you explore BASH. If you ever read in a man page that a program requires an EOF message during input, you'll know what to press.

Using the Command History

The original hackers who invented the tools used under Unix hated waiting around for things to happen. After all, being a hacker is all about finding the most efficient way of doing any particular task.

Because of this, the BASH shell includes many features designed to optimize the user experience. The most important of these is the *command history*. BASH remembers every command you enter (even the ones that didn't work!) and stores them as a list on your hard disk.

During any BASH session, you can cycle through this history by using the up and down arrow keys. Pressing the up arrow key takes you back into the command history, and pressing the down arrow key takes you forward.

The potential of the command history is enormous. For example, rather than retype that long command that runs a program with command options, you can simply use the cursor keys to locate it in the history and press Enter.

■ **Tip** Typing `!-3` will cause BASH to move three paces back in the history file and run that command. In other words, it will run what you entered three commands ago.

On my Ubuntu test system, BASH remembers 500 commands. You can view all of the remembered commands by typing `history` at the command prompt. The history list will scroll off the screen because it's so large, but you can use the scrollbars of the GNOME Terminal window to read it. To view the last 20 commands, type `history 20`. You can specify any number here, in fact. Each command in the history list is assigned a number. You can run any of the history commands by preceding their number with an exclamation mark (`!`), referred to as a *bang*, or sometimes a *shriek*. For example, you might type `!923`. On our test system, command number `923` in the BASH history is `cd ..`, so this has the effect of switching us into the parent directory.

Command numbering remains in place until you log out (close the GNOME Terminal window or end a virtual console session). After this, the numbering is reordered. There will still be 500 commands, but the last command you entered before logging out will be at the end of the list, and the numbering will work back 500 places until the first command in the history list.

■ **Tip** One neat trick is to type two bangs: `!!`. This tells BASH to repeat the last command you entered.

Rather than specifying a command number, you can type something like `!cd`. This will cause BASH to look in the history file, find the last instance of a command line that started with `cd`, and then run it.

Pressing Ctrl+R lets you search the command history from the command prompt. This particular tool can be tricky to get used to, however. As soon as you start typing, BASH will autocomplete the command based on matches found in the history file, starting with the last command in the history. What you type appears before the colon, while the autocompletion appears afterward.

Because BASH autocompletes as you type, things can get a little confusing when you're working with the command history, particularly if it initially gets the match wrong. For example, typing `cd` will show the last instance of the use of `cd`, as in the example in Figure 17-2. This might not be what you're looking for, so you must keep typing the command you do want until it autocompletes correctly. Alternatively, you can hit Ctrl+R to cycle through older examples of the particular command that you've started typing.

Figure 17-2. *BASH history completion is useful but can also be confusing.*

Piping and Directing Output

It's not uncommon for a directory listing or output from another command to scroll off the screen. When using a GUI program such as GNOME Terminal, you can use the scrollbars to view the output, but what if you are working at the bare command-line prompt?

By pressing Shift+Page Up and Shift+Page Down, you can "scroll" the window up to take a look at some of the old output, but very little is cached in this way, and you won't see more than a few screens. A far better solution is to pipe the output of the directory listing into a text viewer. Another useful technique is to redirect output to a file.

Piping the Output of Commands

Piping was one of the original innovations provided by Unix. It simply means that you can pass the output of one command to another, which is to say the output of one command can be used as input for another.

This is possible because shell commands work like machines. They usually take input from the keyboard (referred to technically as *standard input*) and, when they've done their job, usually show their output on the screen (known as *standard output*).

The commands don't need to take input from the keyboard, and they don't need to output to the screen. Piping is the process of diverting the output before it reaches the screen and passing it to another command for further processing.

Let's assume that you have a directory that is packed full of files. You want to do a long directory listing (`ls -l`) to see what permissions various files have. But doing this produces reams of output that fly off the screen. Typing something like the following provides a solution:

```
ls -l | less
```

The | symbol between the two commands is the pipe. It can be found on most US keyboards next to the square bracket keys (near the Enter key—you'll need to hold down the Shift key to get it).

What happens in the example is that `ls -l` is run by the shell, but rather than sending the output to the screen, the pipe symbol (`|`) tells BASH to send it to the command that follows—to `less`. In other words, the listing is displayed within `less`, where you can read it at your leisure. You can use Page Up and Page Down or the arrow keys to scroll through it. After you quit `less`, the listing evaporates into thin air; the piped output is never stored as a file.

In the previous section, you saw how you can use the `history` command to view the command history. At around 500 entries, its output scrolls off the screen in seconds. However, you can pipe it to `less`, like so:

```
history | less
```

Figure 17-3 shows the result on our test PC.

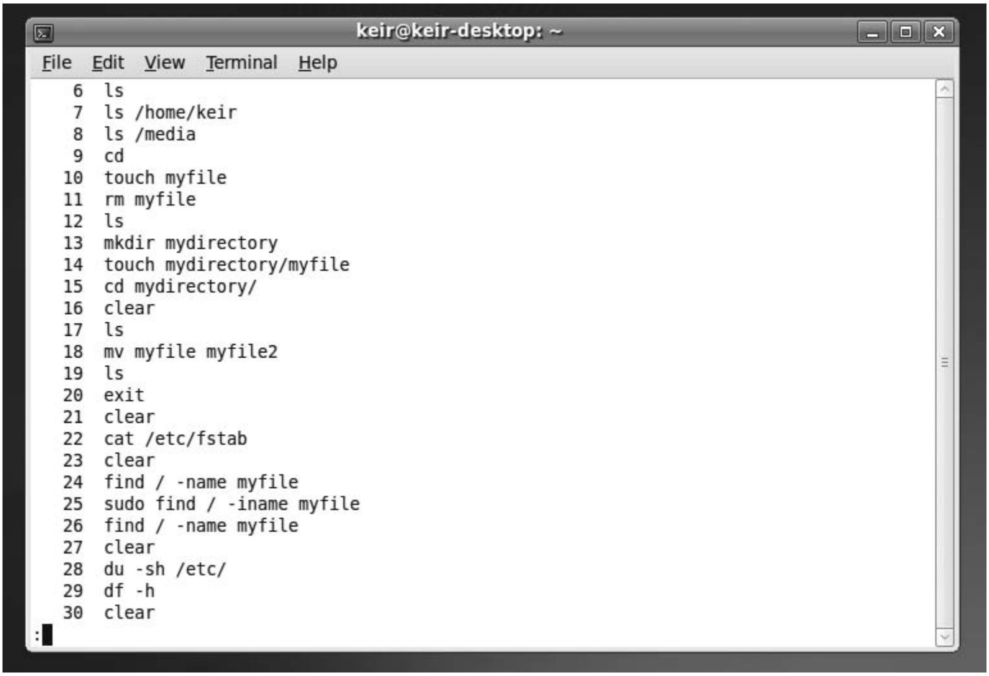


Figure 17-3. *Piping the output of the `history` command into the `less` command lets you read the output fully.*

You can pipe the output of any command. One of the most common uses is when searching for a particular string in the output of a command. For example, let's say you know that, within a crowded directory, there's a file with a picture of some flowers. You know that the word *flower* is in the filename, but you can't recall any other details. One solution is to perform a directory listing and then pipe the results to `grep`, which is able to search through text for a user-defined string (see Chapter 15):

```
ls -l | grep -i 'flower'
```

In this example, the shell runs the `ls -l` command and then passes the output to `grep`. The `grep` command then searches the output for the word *flower* (the `-i` option tells it to ignore uppercase and lowercase). If `grep` finds any results, it will show them on your screen.

The key point to remember is that `grep` is used here as it normally is at the command prompt. The only difference is that it's being passed input from a previous command, rather than being used on its own.

You can pipe more than once on a command line. Suppose you know that the filename of the picture you want includes the words *flower* and *daffodil*, yet you're unsure of where they might fall in the filename. In this case, you could type the following:

```
ls -l | grep -i flower | grep -i daffodil
```

This will pass the result of the directory listing to the first `grep`, which will search the output for the word *flower*. The second pipe causes the output from `grep` to be passed to the second `grep` command, where it's then searched for the word *daffodil*. Any results are then displayed on your screen.

Redirecting Output

Redirecting is like piping, except that the output is passed to a file rather than to another command. Redirecting can also work the other way: the contents of a file can be passed to a command.

If you wanted to create a file that contained a directory listing, you could type this:

```
ls -l > directorylisting.txt
```

The angle bracket (`>`) between the commands tells BASH to direct the output of the `ls -l` command into a file called `directorylisting.txt`. If a file with this name exists, it's overwritten with new data. If it doesn't exist, it's created from scratch.

You can add data to an already existing file by using two angle brackets:

```
ls -l >> directorylisting.txt
```

This will append the result of the directory listing to the end of the file called `directorylisting.txt`, although, once again, if the file doesn't exist, it will be created from scratch.

Redirecting output can get very sophisticated and useful. Take a look at the following:

```
cat myfile1.txt myfile2.txt > myfile3.txt
```

As you learned in Chapter 15, the `cat` command joins two or more files together. If the command were used on its own without the redirection, it would cause BASH to print `myfile1.txt` on the screen, immediately followed by `myfile2.txt`. As far as BASH is concerned, it has joined `myfile1.txt` to `myfile2.txt` and then sent them to standard output (the screen). By specifying a redirection, you have BASH send the output to a third file. Using `cat` with redirection is a handy way of combining two files.

It's also possible to direct the contents of a file back into a command. Take a look at the following:

```
sort < textfile.txt > sortedtext.txt
```

The `sort` command simply sorts words into alphanumeric order (it actually sorts them according to the ASCII table of characters, which places symbols and numbers before alphabetic characters). Directly after the `sort` command is a left angle bracket, which directs the contents of the file specified immediately after the bracket into the `sort` command. This is followed by a right angle bracket, which directs the output of the command into another file.

Tip To see a table of the ASCII characters, type `man ascii` at the command-line prompt.

There aren't many instances in day-to-day usage where you'll want to use the left angle bracket. It's mostly used with the text-based `mail` program (which lets you send e-mail from the shell), and in shell scripting, in which a lot of commands are combined together to form a simple program.

REDIRECTING STANDARD ERROR OUTPUT

Standard input and standard output are what BASH calls your keyboard and screen. These are the default input and output methods that programs use unless you specify something else, such as redirecting or piping output and input.

When a program goes wrong, its error message doesn't usually form part of standard output. Instead, it is output via *standard error*. Like standard output, this usually appears on the screen.

Sometimes it's beneficial to capture an error message in a text file. This can be done by redirecting the standard error output. The technique is similar to redirecting standard output:

```
wodim --scanbus 2> errormessage.txt
```

The `wodim` command is used to burn CDs, and with the `--scanbus` command option, you tell it to search for CD-R/RW drives on the system, something that frequently results in an error message if your system is not properly configured.

After the initial command, you see the redirection. To redirect standard error, all you need to do is type `2>`, rather than simply `>`. This effectively tells BASH to use the second type of output: standard error.

You can direct both standard output and standard error to the same file. This is done in the following way:

```
cdrecord --scanbus > error.txt 2>&1
```

This is a little more complicated. The standard output from `wodim --scanbus` is sent to the file `error.txt`. The second redirect tells BASH to include standard error in the standard output. In other words, it's not a case of standard output being written to a file, and then standard error being added to it. Instead, standard error is added to standard output by BASH, and then this is written to a file.

Using Brace Expansion

The ultimate labor-saving trick at the command-line is brace expansion. This is similar to the use of wildcards, mentioned in the sidebar earlier in Chapter 15, except that wildcards are designed to match existing patterns in filenames or strings. By way of contrast, brace expansion is used when *creating* files (or strings).

Put simply, anything within braces (`{}`) is substituted within the specified filename. The following will create new directories called `PhotosGermany`, `PhotosEngland`, and `PhotosSpain`:

```
mkdir Photos{Germany,England,Spain}
```

In other words, the `mkdir` command takes the word `Photos` and combines it with `Germany`, `England`, and `Spain`, creating three new directories.

If you also wanted to create a directory called `Photos`, with no country after it, you could do so via brace expansion by specifying a comma with nothing before it. Here's a repeat of the same command with this in place, followed by a file listing showing the results:

```
mkdir Photos{,Germany,England,Spain}
```

```
$ ls
Photos   PhotosEngland   PhotosGermany   PhotosSpain
```

A numeric or alphabetic range of expansions can be specified by using two dots (`..`). You will have observed that this is different from wildcards, where the dash is used to indicate a range. The following will create directories called `PhotosA`, `PhotosB`, `PhotosC`, and so on, all the way to `Z`:

```
mkdir Photos{A..Z}
```

Summary

In this chapter, you've looked at some tricks and tips to help you use the BASH shell more effectively. You've seen how BASH can help by autocompleting commands, filenames, and directories. You have also learned about keyboard shortcuts that can be used to speed up operations within the shell.

This chapter also covered the command history function and how it can be used to reuse old commands, saving valuable typing time. Finally, you looked at two key functions provided by BASH: redirection and piping. This involved the explanation of standard input, output, and error.

In Part 5 of the book, starting with the next chapter, we move on to discuss the multimedia functionality within Ubuntu.

PART 5

Multimedia

CHAPTER 18

Digital Audio

Today's PC is a multimedia powerhouse, and it's hard to come across a home computer that doesn't have at least a set of speakers attached. Some people take this to extremes and have surround-sound speakers on their computers, as well as large widescreen monitors for crystal-clear, high-definition video playback.

The people behind Ubuntu aren't blind to this, and include not only audio playback software but also a video player with the distribution. In this chapter, you'll learn how to listen to MP3s, CDs, and Internet radio on your Ubuntu system. You'll also learn how to configure Skype, the most popular Internet telephony application, and an open source alternative. In the next chapter, you'll learn how to manage video playback.

Issues Surrounding Multimedia Playback

Since the advent of digital distribution, record companies and content producers have sought ways of restricting the ability of users to copy music and films. This usually means digital rights management (DRM), which often has the side effect of restricting playback of various media formats on noncommercial operating systems, as the DRM required to play back some music and video needs to be licensed. Audio and video playback technologies such as MP3 and MPEG are patented in countries that allow software to be patented, such as the United States. A *patent* protects the implementation of an idea, as opposed to *copyright*, which protects the actual software. Patents are designed to restrict distribution of a particular technology, which implements an idea or concept, unless permission is granted, usually via a payment to the license holder.

Because Linux is based on the sharing of computing technology and knowledge, organizations like Ubuntu (and Canonical, the company behind Ubuntu) are fundamentally and philosophically opposed to software patents. As such, they try to avoid distributing such software, which is why MP3 playback is not supported by default within Ubuntu, for example. This doesn't make playback of popular music and video files impossible, but it means that, out of the box, Ubuntu lacks playback software. Extra software must be downloaded and installed (although the process is automated). Additionally, the use of patented software raises ethical issues because this use runs counter to the aims of Linux and the open source movement, which means the community often won't support the use of it.

■ **Note** It isn't the job of this book to dictate a position for you on the ethics of using software that has been patented. That's something you must do on your own. It's a complicated issue, but Wikipedia has a good summary of the arguments: `http://en.wikipedia.org/wiki/Software_patent`.

Much more devastating than patenting is DRM, a technology tied into audio or video playback software. It's designed to control how, where, when, and on what device you can play certain media. For example, Apple's iTunes DRM scheme means you can play back movies and some audio tracks bought from iTunes only on the iPod range of devices (including the Apple TV and iPhone range of devices) or using the iTunes software. DVD and Blu-ray movie players include forms of DRM called Content Scrambling System (CSS) and Advanced Access Content System (AACS), respectively, which prevent users from playing DVDs on computers unless special software is purchased. The situation for audio tracks is getting better, and many large music companies are slowly abandoning DRM on audio tracks they sell, but nearly all movie files remain affected.

As a community that celebrates openness, many Linux users and developers mistrust any technology that attempts to restrict their rights to use software in particular ways. Moreover, the relatively small user base and the preference for free rather than proprietary software has meant that no mainstream vendor has ported their DRM technology to Linux on the desktop. This means, for instance, that music downloaded from Napster or movies purchased via iTunes will not work on a Linux desktop.

■ **Note** Companies *do* make their DRM software available on Linux, only it tends to be developed for inclusion in set-top boxes, DVD players, HD televisions, MP3 players, and Internet-connected media players. One exception—and it's one you may want to consider if you're concerned with the legal issue of DVD playback—is CyberLink's $49 PowerDVD software, which is available to buy from Canonical's online store (`http://shop.canonical.com`).

Linux and other open source projects are very resourceful and are often able to reverse-engineer technology formats in order to get around DRM or patent issues. But the laws in many countries—the United States is a particularly strident example—prohibit reverse-engineering in this way. In addition, the laws in some countries seek to prohibit use of software resulting from this process.

The good news is that programmers have also come up with free software alternatives to proprietary formats. Examples include the Ogg media format, which is every bit as good as MP3 but is unencumbered by patent issues. We'll look at using Ogg later in this chapter, in the "Choosing a Format" section; it's an excellent way of avoiding issues surrounding patenting. However, at the moment, there's no ideal open source video format, or at least not one that's in widespread use.

As an end user migrating to Ubuntu from Windows or Mac OS X, it's likely you'll want to add support for MP3 and popular video file playback formats, at least until you can switch over to open source file formats. Throughout this and the next chapter, we'll examine installing media playback software and using it in concert with Ubuntu's built-in playback software, even though some of that software may have issues surrounding patenting. In one case, the software is designed to break the encryption that protects the content on DVD movie discs.

■ **Note** The United States and Japan both have laws allowing software to be patented. Most other countries, including those within the European Union, do not currently allow software patents.

Playing Audio Files

Audio playback under Ubuntu is normally handled by the Rhythmbox player. This is a feature-packed piece of software that can play back audio files, podcasts, Internet radio, and even CDs. However, Totem, the Ubuntu movie player, can also play back digital audio files.

Like many modern music players, Rhythmbox can also manage your music collection, arranging it into a library so you can locate songs easily and create playlists. This makes it a better choice for playback if you have many digital audio files, although Totem is good for quick playback of individual files, such as auditioning those you've just downloaded.

Out of the box, Ubuntu supports playback of Ogg Vorbis and FLAC across all its audio playback applications. These are two open source audio file formats, which you'll learn more about in the "Choosing a Format" section later in this chapter.

To play back other music file formats, such as the ubiquitous MP3 format, additional software known as *codecs* must be installed. A codec handles the decoding of multimedia files, both audio and video. The word is a shortened version of *coder-decoder*. For any digital multimedia file type you want to play on your computer, you'll need an appropriate codec. In addition, if you wish to create your own multimedia files—for example, to create MP3s from CD audio tracks—you might need to download an additional codec that allows the *encoding* of files.

Installation of codec software is largely automated in Ubuntu. However, the issue of patenting continues to have an impact on the distribution of codecs. What's more, the issue has not been resolved with 100 percent clarity, leaving many end users in a legal gray area. Several audio codecs available for Linux, contained in various `gstreamer-plugins` software packages, are not licensed with the patent holders. This is of little issue to you, as an end user. It's a practical concern only for the distributors of the codecs, because the laws of some countries state that it's their duty to pay patent licensing fees. But it's something you should be aware of. Fully licensed codecs are available for many formats via the commercial Fluendo plug-in suite, which is available from the Canonical store.

MULTIMEDIA PLAYBACK COMPONENTS

In simple terms, three software components are needed for multimedia playback under Ubuntu:

- **Player application**: This is the software that's used to listen to music or display videos. It's the part of the multimedia system that you interact with. Under Ubuntu, Totem movie player is used to play back video, and Rhythmbox is used to handle audio. However, if you install the KDE desktop, Kaffeine will be used to play back movies, and Amarok will be used to handle audio playback.
- **Multimedia framework**: This is the behind-the-scenes middleman that puts the player application in touch with the codec plug-ins. The multimedia framework preferred by Ubuntu is called GStreamer; the multimedia framework preferred by KDE is called Xine. The multimedia framework is a background component of your system, and you won't come into direct contact with it, apart from when you're initially configuring your system for media playback. However, it's important to note that more than one multimedia framework can be installed, because this is sometimes necessary to utilize certain codecs. In Chapter 19, you will learn how to install an additional framework in order to fully support DVD playback under Ubuntu.
- **Codec plug-ins**: Codecs are the small pieces of software that handle multimedia file decoding. Codecs do all the hard work—the number crunching. Most multimedia file formats are compressed, to make for smaller file sizes, and the codec's job is to expand the files again so they can be played back on your computer. Some codecs also work the other way around by shrinking files; if you rip CD tracks to MP3, or convert DVD videos to movie files on your hard disk, you will need to shrink them for ease of storage.

Under Ubuntu, the GStreamer multimedia framework is installed by default, along with a handful of codecs.

Installing Codecs

The codec software necessary for multimedia file playback and encoding can be found in Ubuntu's online software repositories. However, there's no need to use the Synaptic Package Manager program to install them manually. Multimedia applications automatically suggest which codecs to download and install when they attempt to play multimedia files.

What actually happens is that plug-ins for the GStreamer multimedia framework are installed. These plug-ins contain the codec software. The multimedia framework is the behind-the-scenes software that underpins all of Ubuntu's audio and video playback, including the Rhythmbox audio player and Totem movie player. As a user, you won't come into direct contact with GStreamer, except when initially installing codecs. The benefit is that all of Ubuntu's audio and video software uses it, so you need to install plug-ins only once for the entire system.

Here we will walk through installing the codec required for MP3 playback. The same procedure will apply when you try to play back any unsupported audio or video file format; all that will differ is the choice of codecs offered to you:

1. Copy an MP3 file to your desktop.

2. Double-click the MP3 file.

3. Totem movie player will start up, but because the underlying GStreamer framework doesn't yet include support for MP3 files, a dialog box will appear, asking whether you want to look for a suitable plug-in to play the file. Click the Search button to do so. The process is automated, but your computer will need to go online if it isn't already.

■ **Note** You might be told that your list of software packages is out-of-date. If this is the case, click the Reload button in the dialog box that appears. This will refresh the repository list; it's the equivalent of clicking the Reload button in the Synaptic Package Manager.

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4. The Install Multimedia Codecs dialog box will eventually appear, offering a choice of plug-ins to install. You'll rarely be offered an individual codec to install. Most are bundled together with similar codecs allowing the playback of other file formats. As you can see in Figure 18-1, for playback of MP3 files, we were offered the GStreamer Ugly plug-ins bundle and GStreamer FFmpeg. Although there are two choices, and therefore obviously some overlap in functionality, you should opt to install both by putting a check in the boxes alongside them. Ubuntu will handle any overlapping functionality automatically in the background. It's always best to install as many codecs as possible when offered the chance. This will mean your computer will be suitably equipped for playback of virtually any file type.

5. As soon as you put a check in each box, Ubuntu will ask you to confirm the choice and will explain that use of the software might be restricted in certain countries, although with certain provisos. Read through the dialog box and either cancel or confirm your choice, depending on whether you think the rules explained apply to you.

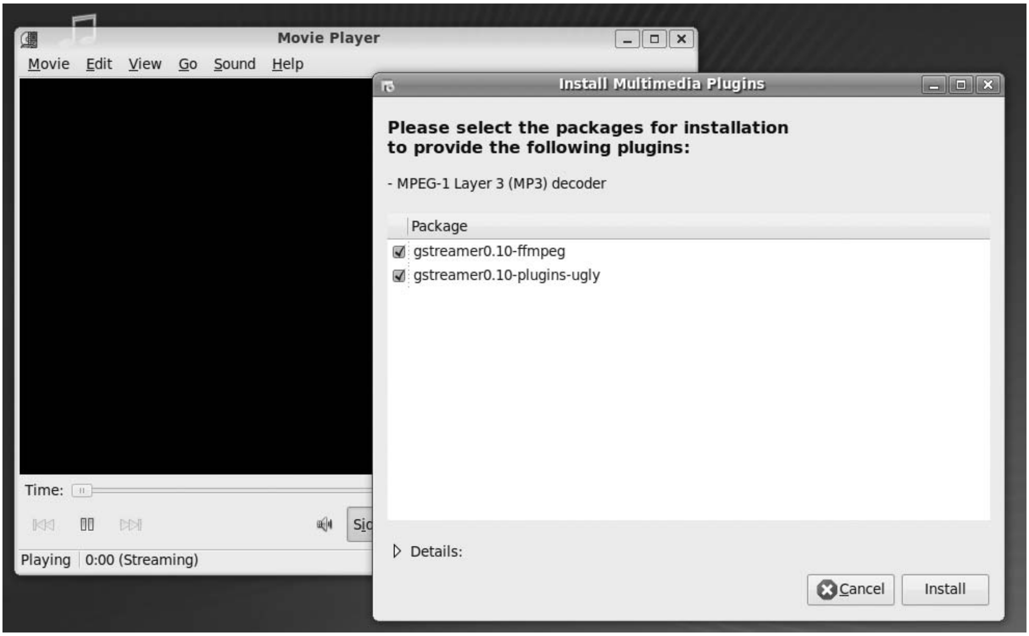

Figure 18-1. *Ubuntu recommends codec packages to install so you can play your multimedia files.*

6. Click the Confirm button in the dialog box. Because you are about to install software, you'll need to enter your password when prompted. Note that, although you appeared to select two packages, you actually selected to install package *bundles*, containing many individual packages. On the progress bar, you will see that quite a few individual packages are being downloaded—about 15 on our test computer!

7. The files will download and install automatically. After the process has completed, a dialog box will tell you that everything has been successful.

8. Playback of the file should start automatically in the player application. Every piece of playback software within Ubuntu will now automatically support MP3 files, including Totem, Rhythmbox, and any other playback software you install that relies on the GStreamer framework (this will include any playback software designed for the GNOME desktop).

FLUENDO MP3 CODEC

As mentioned, some codecs available for Ubuntu have certain legal issues surrounding the patenting of software. However, you might be pleased to hear that one audio codec available for Ubuntu *is* licensed with the MP3 patent holder and therefore washes cleaner than clean: the Fluendo MP3 codec. In an act of generosity, the Fluendo company paid the MP3 technology license and made its own decoder freely available for all Linux users. For more information, see `www.fluendo.com/shop/product/fluendo-mp3-decoder`.

The Fluendo codec doesn't avoid the ethical considerations surrounding using patented technology, as discussed early in this chapter, but it does leave you in the best possible position. However, the Fluendo codec can be used only to *decode* MP3 audio. It can't be used to *encode* MP3s, so if you wish to rip tracks to MP3 from audio CDs, you will have to use the less legally precise GStreamer plug-in packages (or, better still, encode your audio files using the open source Ogg Vorbis format, which avoids patenting issues and doesn't require installing *any* additional plug-ins!).

We would advise you to install the Fluendo codec if you simply want to listen to your existing MP3 tracks and would like to embrace open source audio file formats from this point onward. To install the Fluendo codec, open the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager) and click the Search button. Enter `gstreamer fluendo mp3` in the text box. It's likely only one result will be returned (in our tests, it was `gstreamer0.10-fluendo-mp3`), so click the check box alongside the entry, click Mark for Installation, and then click the Apply button on the toolbar. After the software is installed, MP3 files should play in both Totem and Rhythmbox.

Using Rhythmbox

Both Rhythmbox and Totem can be used for audio file playback under Ubuntu. Rhythmbox is best if you have a lot of tunes, because it is able to catalog and manage your collection. You'll find it on the Applications ➤ Sound & Video menu.

The first step when running Rhythmbox for the first time is to let it index your music files. To do so, click Music ➤ Import File or Music ➤ Import Folder. Then navigate to your music tracks on the hard disk. You can select more than one file or folder by Shift-clicking or Ctrl-clicking, just as in Windows.

Note that, unlike iTunes or some other comparable programs, Rhythmbox doesn't copy your music to its own library folders when cataloging your files. Instead, it merely creates an index of the files you already have. So before having Rhythmbox index your files, you should copy them to the Music folder within your `/home` directory.

If you subsequently move or delete any files, Rhythmbox might get confused. This can be resolved by clicking Music ➤ Import Folder and rebuilding the index (for single files, click Music ➤ Import File).

Tip If disk space is a concern and your audio files are in a Windows partition, you could simply leave the files there, rather than copy them across. Rhythmbox will still be able to index them. You just need to navigate to your Windows partition, which you should have as a shortcut under Places (otherwise, it will be in `/media/disk`).

Rhythmbox starts in browse mode, which means that your music files are listed at the bottom of the program window. In roughly the middle-left of the program window, you'll find a listing of the artists behind the MP3s in your collection. On the right, you'll see the album that the music track is taken from (provided that information is included in the music file itself, such as the MP3 ID3 tags). Figure 18-2 shows an example of a Rhythmbox window.

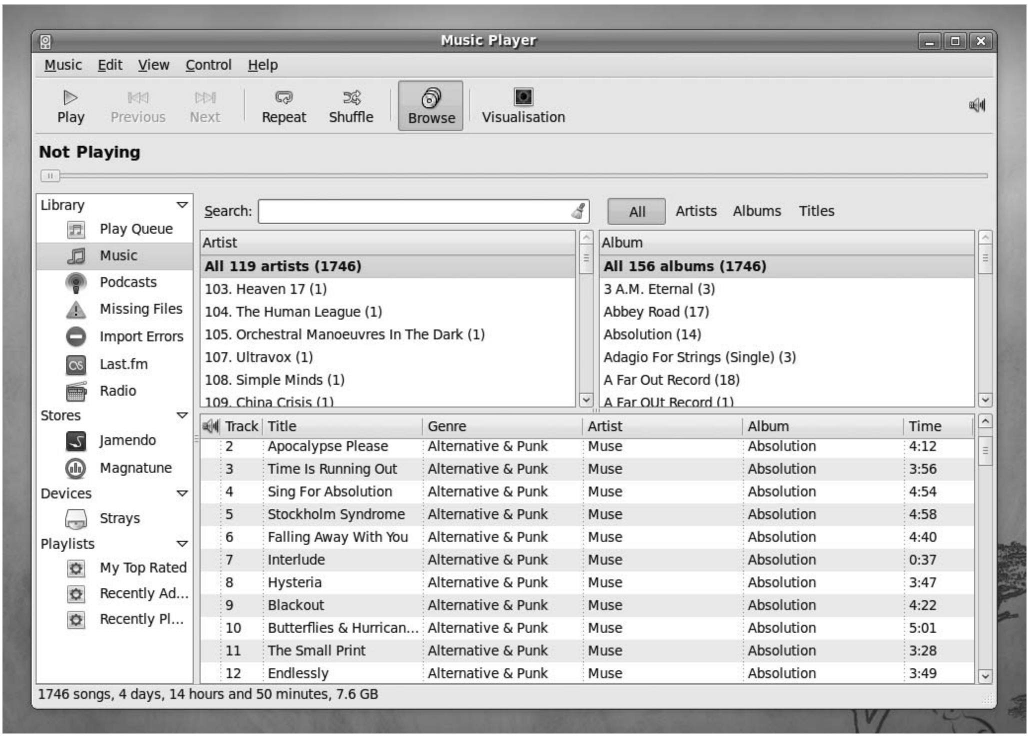

Figure 18-2. *Rhythmbox will organize your music tracks by artist or album.*

Clicking the Browse button on the toolbar will exit browse mode and present a list of the tracks in your collection, which can be ordered by clicking the headings in the list. The default sort order is by artist.

Playing a track is simply a matter of double-clicking it in the list at the bottom. After the track is finished, Rhythmbox will play the next track in the MP3 file list. At the top of the Rhythmbox window are transport controls that let you pause or play the track, skip tracks, repeat tracks, or switch to shuffle play (that is, random track selection).

You can toggle displaying visual effects with the Visualization button. The display output is shown in the main window by default. The controls for customizing the effects are available at the bottom of the visual effects display and are made visible when you hover your mouse over the visual effects. You have the option to change the nature of the visualization effect; the quality of the effect; and whether the effect will be displayed within Rhythmbox, in a different window, or in full-screen mode.

Beneath the transport controls and the artist/track name information is a slider that shows the progress through the current song and lets you cue forward and backward by clicking and dragging.

To create a new playlist, click Music ➤ Playlist ➤ New Playlist (or press Ctrl+N). A text box will appear under the Playlists heading in the pane on the far left side of the program window. Type the new playlist's name in the text box and press Enter. To add tracks to the playlist, click Music under the Library heading in the pane on the far left side of the program window, and then drag and drop files onto your new playlist entry. To start playing the tracks in the playlist, select it and double-click the first track in the list.

■ **Note** When you double-click an audio file in a Nautilus window, Ubuntu will start Totem movie player rather than Rhythmbox. This is good if you want to preview tracks, but to have them automatically imported into Rhythmbox when you double-click them, you'll need to change the Open With preferences. This is easily done. Right-click any MP3 file in a Nautilus file-browsing window, select Properties, and click the Open With tab. Ensure that the radio button alongside Rhythmbox's entry in the list is selected, and then click the Close button.

INSTALLING ALL THE CODECS YOU NEED

Ubuntu will download and install any codecs you need for video or audio playback automatically, upon demand. However, what if you've installed Ubuntu onto a computer that isn't configured to go online, so isn't able to download the necessary components? Provided the computer can be put online for just a few minutes, you can use the Add/Remove Programs component of Ubuntu to install all the codec packages in one fell swoop. This will then set up the computer for playback of virtually all audio and video file types.

Start Add/Remove Programs (it can be found on the Applications menu). In the Show drop-down list at the top of the program window, select All Available Applications. In the Search field, type **gstreamer**. Then, in the list of software packages returned in the list of results, put a check alongside the following:

- GStreamer FFmpeg video plug-in
- GStreamer extra plug-ins
- GStreamer plug-ins for mms, wavpack, quicktime, musepack
- Ubuntu restricted extras
- GStreamer plug-ins for aac, xvid, mpeg2, faad

Note that you will see a message upon each selection warning of possible legal issues.

After making your choices, click the Apply Changes button at the bottom left. This will then install the necessary software. After installation has finished, click the Close button in the dialog box that appears. If any audio or video playback applications are open, close and then restart them.

Purchasing from Online Music Stores

Rhythmbox allows you to purchase albums from the Magnatune (`www.magnatune.com`) and Jamendo (`www.jamendo.com`) online music stores. Jamendo works on the principle of Creative Commons (see `http://creativecommons.org`), so many tracks are free of charge, although you can donate money if you wish.

Under the Stores heading on the leftmost pane of the Rhythmbox window, click Magnatune or Jamendo. You'll see a brief introduction to the store while the catalog is downloaded. After the catalog is downloaded (indicated by the status bar at the bottom right of the program window), you will be able to browse through the available tracks, as if they were on your own computer. They will be sorted by artist and track name. Double-clicking each track will download and play a high-quality preview.

Note It might take a few moments for the catalog to download. In our tests, the Jamendo catalog took about 10 minutes to download.

You'll also see that the main toolbar of Rhythmbox has changed. Several new icons appear, allowing you to purchase and download the album, buy a physical CD, or learn more about the artist.

Purchasing from Magnatune

With Magnatune, you can listen to any of the songs in the album without paying for them. Any songs you do decide to purchase are free from copy protection (DRM), and artists earn 50 percent from your purchase. You can choose how much to pay for an album (the minimum is $5).

Tip You can learn more about artists by viewing their Magnatune web pages. Click a relevant track and click the Artist Information button on the toolbar. This will automatically load the relevant page in Firefox.

To purchase an album, select a song in the music list that is included in the album you would like to purchase, and then click the Purchase Album button on the toolbar. The Purchase Magnatune Tracks dialog box will appear and prompt you for the amount you want to pay (from $5 to $18), as well as the audio format you prefer (Ogg, FLAC, WAV, variable bit rate MP3, or 128k MP3), plus e-mail address and gift card or credit card information. After you've finished filling in the information, click the Purchase button to buy and download the songs.

To purchase a CD, click the relevant button on the toolbar. Firefox will open, and you'll be redirected to a page on the Magnatune web site where you can fill in your credit card and address details.

Using the Jamendo Store

Songs from Jamendo are free to listen to, download, and share, due to its flexible license based on Creative Commons. If you opt to purchase tracks of albums, 50 percent of the proceeds go to the artist.

■ **Tip** Not only can you download the tracks from Jamendo, but you can also remix them or use snippets of them in your own music. All of this is because of the use of the Creative Commons license.

If you want to download an album, select a song in the music list that is included in the album you would like to download, and then click the Download Album button on the toolbar. Firefox will visit a URL that includes a BitTorrent tracker file—effectively, a small file that opens the Transmission BitTorrent client built into Ubuntu. BitTorrent will then attempt to download the entire album.

■ **Note** BitTorrent is a unique file-sharing system designed to share bandwidth. Depending on your hardware setup, you might need to alter your router or firewall settings for it to work. For more information, see `www.dessent.net/btfaq/`.

If you want to make a donation to an artist, select a song in the music list that the artist performed and click the Donate to Artist button on the toolbar. Firefox will direct you to a web site where you can fill in a form to complete your donation.

Tuning In to Online Radio Stations

With Rhythmbox, you can listen to a number of predefined Internet radio stations or add your own. Provided the MP3 codec software is installed, as discussed previously, Rhythmbox is compatible with streaming MP3-based playlists, such as those listed at `http://shoutcast.com`.

To view a handful of stations that have been preprogrammed into Rhythmbox for demonstration purposes, click the Radio heading in the list on the left side of the Rhythmbox window. To listen to a radio station with Rhythmbox, double-click its entry in the list. To stop playback, deselect the Play button on the toolbar by clicking it.

To add a new station, you can do either of the following:

- Click the New button on the toolbar. Then enter its URL into the dialog box that appears. Radio stations usually show the URL for their audio streams on their web sites.

- Open the radio station's playlist (`.pls`) within Rhythmbox by downloading it directly from a web site. For example, browsing to the Shoutcast web site and clicking the Tune In button alongside a station listed there will open a dialog box that lets you download or open the `.pls` file.

Opening the `.pls` file is the easier way of adding a radio station, but unfortunately, the default player in Ubuntu for `.pls` files is Totem, which can cause some confusion. However, the situation can be remedied easily. To open the `.pls` file with Rhythmbox instead, follow these steps:

1. Under the Open With drop-down list that appears when you attempt to download a `.pls` file, select Other, and then click OK.

2. The Choose Helper Application dialog box appears. Press Ctrl+L, and then type the following in the Location box: `/usr/bin/rhythmbox`.

3. Click Open.

4. To make sure that Rhythmbox is the default helper application in Firefox for `.pls` files that you will download or open in the future in Firefox, in the file download dialog box, select Do This Automatically for Files Like This from Now On, and then click OK.

After the station has been imported into the list of stations, you'll then need to double-click its entry to tune in.

To delete a radio station from the list, simply right-click it and select Delete.

Listening to Podcasts

Podcasts are audio files that are distributed by RSS (Real Simple Syndication). This sounds complicated, but it's actually quite simple. When you're subscribed to a particular podcast, the audio files are downloaded automatically in the background, so that the latest episodes will always be available. This makes keeping up with the latest episodes effortless. Most podcasts take the form of MP3 files, but any audio file format can be used.

In terms of content, podcasts range from simple spoken blog entries, usually created by individuals, to podcasts that are more akin to radio shows and involve interviews. Some professional radio stations even release entire shows as podcasts, with the British Broadcasting Corporation (BBC) leading the charge (`www.bbc.co.uk/podcasts`).

Rhythmbox is able to handle podcast subscriptions under Ubuntu, and you can add a new subscription by clicking the Podcasts heading in the leftmost pane of Rhythmbox. Then right-click a blank spot in the track listing area, select New Podcast Feed, and enter the URL. However, a much easier way of adding a podcast is to use Firefox to browse to the link. Conveniently, Rhythmbox is fully compatible with the iTunes podcast format, which is perhaps the most prevalent podcast format at the present time. On the web page where the link is located, click the subscribe link for iTunes users. This will open a dialog box inviting you to choose to open the podcast. Ensure that Rhythmbox is selected, and click OK in the file dialog box. The latest podcast episode will immediately start downloading. After it's finished, you can double-click it to listen in.

Tip You can start listening to a podcast before it has completely downloaded.

If only an RSS link is provided for the podcast (usually indicated on a web site by the orange RSS button), after you click it, Firefox will offer to subscribe to the link itself. You don't want this to happen, so click the drop-down link alongside Subscribe to This Podcast Using, click Choose Application, and follow the previous instructions to browse to `/usr/bin/rhythmbox`, as shown in Figure 18-3. Put a check in the box alongside Always Use Rhythmbox to Subscribe to Podcasts, and then click Subscribe Now in the Firefox program window.

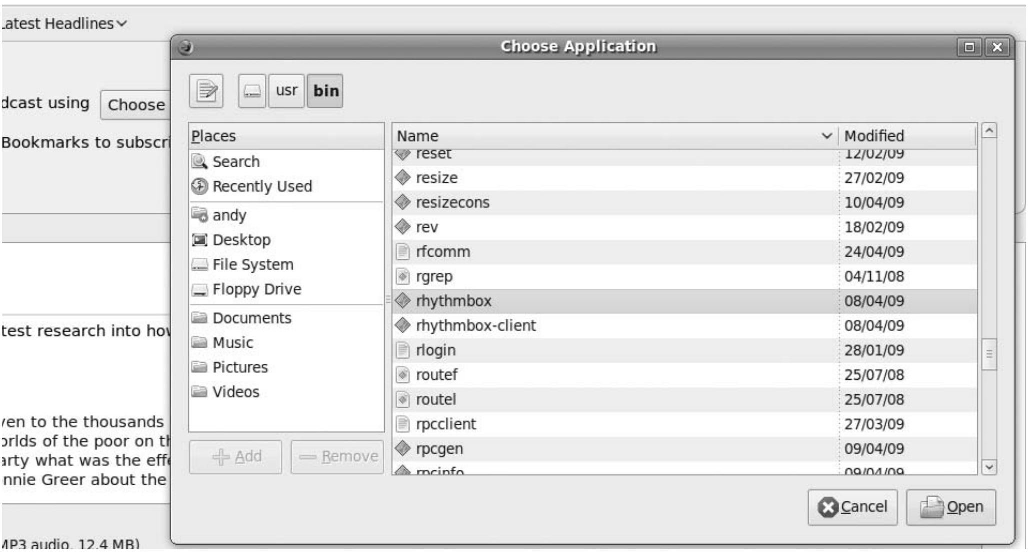

Figure 18-3. *The best way to subscribe to a podcast is to select it within Firefox and then choose to subscribe using Rhythmbox.*

Listening to Audio CDs and Ripping Tracks

Playing back audio CDs is simple. Just insert the CD, and you should see a prompt asking which application you wish to open the CD with. The two key choices are to open the CD in Rhythmbox, which will enable playback and ripping of the CD tracks to disk, and to open the Brasero software, which will allow you to copy the disc.

For simple playback, selecting Rhythmbox is the best option. You can ensure that Rhythmbox starts automatically in the future when you insert an audio CD by selecting the Always Perform This Action check box.

After Rhythmbox has started, click the name of the CD in the leftmost pane (look under the Devices heading), and then click the Play button on the toolbar. It might take a few seconds for the name of the CD to be looked up online and, provided you're online, the track and artist information will be looked up automatically, so you should find a complete listing, and perhaps even an image of the CD inlay within the bottom left of the Rhythmbox program window, as shown in Figure 18-4.

To cue backward and forward in the currently playing track, click and drag the slider beneath the transport buttons.

To eject the disk, press the button on the front of the drive. If this doesn't work, either click the toolbar icon within Rhythmbox, or right-click the Audio Disc desktop icon and select Eject Volume.

■ **Tip** As with all GNOME applications, hover the mouse cursor over each button to display a tooltip that describes what it does.

If you find that the track listing information is incorrect, as can sometimes happen with online lookups, you can correct it by right-clicking the track name and selecting Properties. Then type the new details in the dialog box that appears.

Converting audio tracks on a CD into digital music files you can store on your hard disk for personal use is informally known as *ripping*.

■ **Note** Because of the way audio CDs work, you can't simply insert the disc and then drag and drop the tracks onto your hard disk. They must be converted first.

Before you start to rip CDs, however, you'll need to decide the format in which you wish to store the audio files.

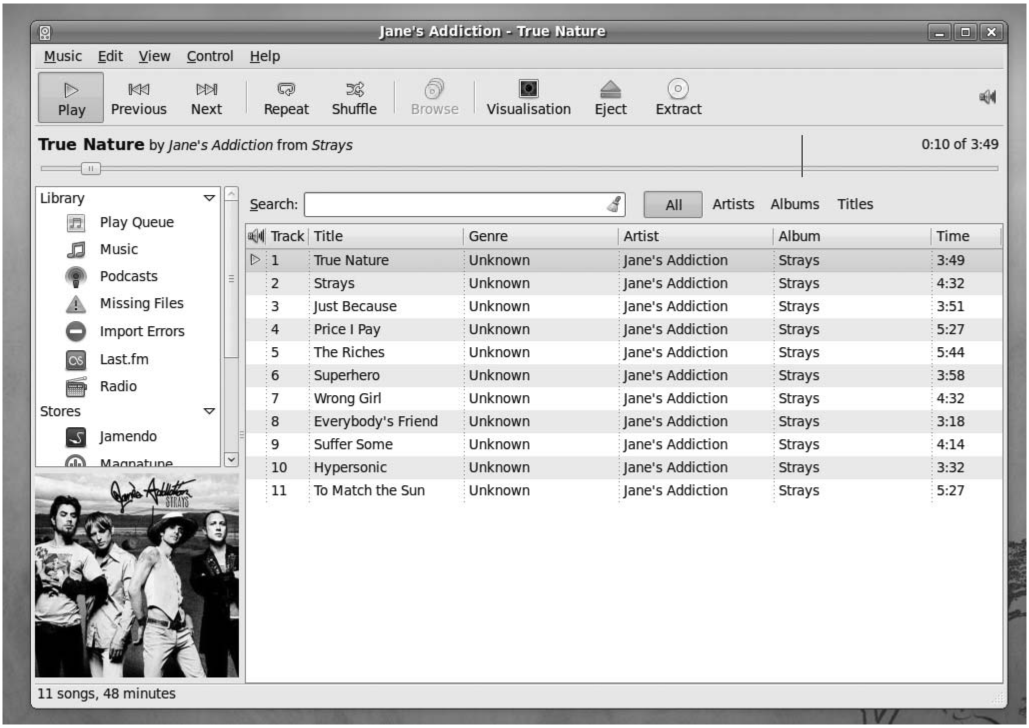

Figure 18-4. *Rhythmbox offers simple but effective CD playback, and will look up artist and track information online.*

Choosing a Format

You have several basic choices for audio file formats, the main ones being Ogg Vorbis, FLAC, and MP3. Let's look at what each has to offer:

Ogg Vorbis: This is the free software alternative to MP3. Unless you have a trained ear, you won't be able to tell the difference between a Vorbis and an MP3 file. (If you *do* have a trained ear, you may find Vorbis better!) The two technologies generate files of around the same size, an average of 4MB to 5MB per song, though you may get a slightly better compression rate with Vorbis. The advantage of Vorbis is that it's completely open source technology, so there isn't the ethical burden of using patented MP3 software and, therefore, working against the interests of the open source software movement. The downside of Vorbis is that not many portable audio players support it (there is a growing list, which includes players from Bang & Olufsen, LG, and iriver at `http://wiki.xiph.org/index.php/PortablePlayers`), and other operating systems like Windows won't be able to play back Vorbis files unless some additional software is installed (see `www.vorbis.com/setup`). Therefore, Vorbis is perhaps best if you're ripping files solely for use on your computer.

FLAC: This stands for Free Lossless Audio Codec, and it's the choice of the audiophile. Vorbis and MP3 are lossy formats, which means that some of the audio data is lost in order to significantly shrink the file. FLAC doesn't lose any audio data but still manages to compress files to a certain degree (although they're still much larger than an equivalent MP3 or Ogg file). FLAC scores points because it's open source, like Vorbis, but you'll face the same lack of support in portable audio players and other operating systems (unless additional software is installed; see `http://flac.sourceforge.net`).

Speex: Originally designed purely for Voice over IP (VoIP), Speex was created for speech encoding. As such, it concentrates on audio frequencies generated during ordinary conversation. Aside from the fact that Speex is an open source codec that claims to not employ any patented software methods, there really isn't any reason to use it, even if you're ripping speech tracks from a CD. It is built for transmission across low-bandwidth connections (or small file sizes). If hard-disk capacity is an issue, you might consider it, but Ogg and MP3 are better suited in virtually all situations. The Speex file extension is `.spx`.

WAV: This is perhaps the oldest audio file format. It uses the `.wav` file extension, which you may have seen in use on Microsoft Windows computers. WAV files are usually completely uncompressed and lossless. However, that doesn't necessarily mean they're high quality; as with any kind of audio encoding, the sampling and bit rate can be set to any value desired. For example, Ubuntu includes a default `.wav` encoding profile of low quality that can be used when encoding speech. Although WAV files tend to be supported on most computing platforms, the downside is file size. Uncompressed WAV files can be massive, even those with low-quality settings. If uncompressed audio is your aim, FLAC offers a far better alternative.

MP3: This is by far the most used music file format, and practically everyone who owns a computer has at least a handful of MP3 tracks. This means software support for MP3 playback is strong, and of course, most portable audio players are built around the MP3 standard. The only problem for you, as a Linux user, is the issue of surrounding patents, as explained at the beginning of this chapter. Using the MP3 format goes against a lot of what the Linux and open source movement stands for. But in the end, the choice is yours.

Adding MP3-Ripping Support to Sound Juicer

Support for Ogg and FLAC is built into Sound Juicer, but if you wish to encode CD tracks as MP3s, you'll need to enter some configuration details into Sound Juicer. You'll also need to manually install the `gstreamer0.10-plugins-ugly-multiverse` software package, which includes the necessary encoding codecs.

Follow these steps to configure MP3-encoding support and set MP3 as the default encoding format:

1. Quit Rhythmbox if it is running.
2. Open the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager) and then click the Search button.
3. In the Search dialog box, enter `gstreamer ugly multiverse`. Then click the dialog box's Search button.
4. In the list of results, look for something like `gstreamer0.10-plugins-ugly-multiverse`. (Ensure that you don't get it mixed up with the similar package that has `-dbg` at the end; note that the version number in the middle of the file might be different.) Click the check box alongside it and click Mark for Installation. You'll be told that additional files need to be installed. This is fine. Click Apply on the main toolbar.
5. After Synaptic has finished installation, close the program.
6. Start Rhythmbox again (Applications ➤ Sound & Video).
7. Click Edit ➤ Preferences. In the Preferences dialog box, click the Music tab and, in the preferred format, click CD Quality, MP3 (.mp3 Type) from the drop-down list.
8. Click the Close button.

Sound Juicer is now set up to rip CDs to MP3 format by default.

Ripping Tracks

When you're ready to rip some music, insert the audio CD and then start Rhythmbox (if it isn't already running). Select the disc under the Devices heading, as mentioned earlier in the directions for playing back audio CDs. Highlight the tracks you wish to rip by selecting them, and then click and drag them over to the Music heading within Rhythmbox. Alternatively, rather than clicking and dragging, you can click the Extract button on the main toolbar.

As the tracks are ripped to your hard disk, you will see a progress display at the bottom right of the Rhythmbox program window. Audio tracks will be saved in a directory named after the artist and album title, within your `/Music` directory, within your `/home` directory.

MAKING MUSIC AND RECORDING AUDIO

Most PCs come with sound cards that are capable of making music. You can use many open source programs, designed for both amateurs and professionals alike, to create music or record and edit audio.

In terms of musical sequencers, MusE (`www.muse-sequencer.org`), Rosegarden (`www.rosegardenmusic.com`), and Jazz++ (`http://jazzplusplus.sourceforge.net`) are well worth investigating. Like all modern MIDI sequencers, these programs let you record audio tracks, effectively turning your PC into a recording studio.

It's also possible to run virtual synthesizers on your PC, which turn even the most basic sound card into a powerful musical instrument. Examples include Bristol (`https://sourceforge.net/projects/bristol`) and FluidSynth (`http://fluidsynth.resonance.org/trac`).

If you're interested in only audio recording and processing, Sweep (`www.metadecks.org`) and Audacity (`http://audacity.sourceforge.net`) are worth a look. In addition to audio recording and playback, both feature graphical waveform editing and powerful filters.

Most of the packages mentioned here are available from the Ubuntu software repositories, and you can download them with the Synaptic Package Manager.

Creating Your Own CDs

You can create audio CDs by using Brasero, which aims to be a complete CD-burning suite, like Nero under Microsoft Windows. It's also possible to create audio CDs using only Nautilus, but Brasero offers finer control over the compilation and burn process.

Start by inserting a blank CD. A dialog box will appear, asking what you wish to do with the CD. The default choice of Open CD/DVD Creator isn't what you want, because it will start Nautilus's data CD creator, which is designed to write files to disc. Instead, click Open With Other Application from the drop-down list and select Brasero Disc Burner from the list of applications that appears. Then, in the parent dialog box, select Open Brasero Disc Burner from the drop-down list, if it isn't already selected. To always have Brasero start automatically when a blank disc is inserted, select the Always Perform This Action check box before clicking OK.

When Brasero's main window appears, it will by start with a new Data project by default. To switch to an audio CD project, click Project ➤ New Project ➤ New Audio Project.

The program is very simple to use:

1. Using a Nautilus file-browser window (Places ➤ Music), browse to where the audio files are located and click and drag them onto the Brasero program window. The files can be Ogg, FLAC, or MP3 files (if you installed the MP3 playback software, as described in the "Installing Codecs" section earlier in this chapter). Note that the Fluendo codec will also work for burning CDs from MP3 tracks.

2. You'll see the track listing build up in the window where you dropped the selected tracks. In addition, at the bottom of the program window, you'll see the estimated size of the project, shown in minutes. You'll need to check the size of the CD you're using on its packaging, but most blank CD-R discs can hold between 70 and 80 minutes of audio.

3. Click and drag each track to rearrange them, if necessary, to create an ideal running order. When you're satisfied with the track listing and are sure you haven't exceeded the maximum allowed total time for the disc, click the Burn button to prepare your disc for burning.

4. In the Disc Burning Setup dialog box, click the Properties button if you wish to alter any details about the actual burning process, such as the burn speed. However, the default settings are usually OK. Click the Burn button to start the write procedure. First, the tracks are converted to pure audio files, and their volume levels adjusted so no track is louder than any other (something known as *normalization*). Then they're actually burned to disc, as shown in Figure 18-5. This can take some time. When Brasero finishes with the burning, the CD will be ejected.

■ **Note** Depending on the quality of the blank CD, you might not be able to write audio CDs at full speed. If this is the case, Brasero will stop during the writing process with an error message. You'll need to adjust the burn speed. To do so, in the Disc Burning Setup dialog box, click the Properties button and choose a more conservative speed from the Burning Speed drop-down list.

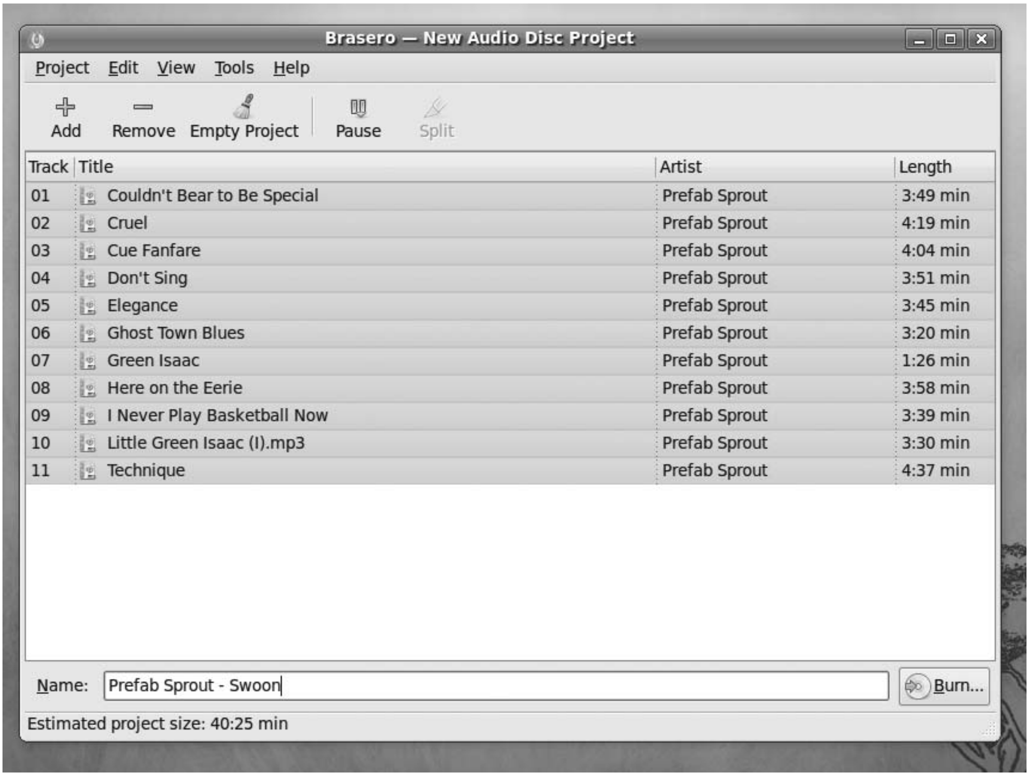

Figure 18-5. *Brasero makes it easy to create CDs from digital audio files.*

Installing Skype

Skype, shown in Figure 18-6, is used by millions of people around the world to make Internet telephone calls via VoIP. This is a complicated way of saying that voice calls are transmitted across the Internet. Using Skype, it's possible to call other Skype users for free, or to call various phone numbers around the world, usually for a small charge.

Installing Skype is easy, and the Skype developers have even created a software repository from which it can be installed. This means that you'll be informed via Update Manager whenever a new version of Skype becomes available.

To add the Skype repository, click System ➤ Administration ➤ Software Sources. Click the Third-Party Software tab in the window that appears, and then click the Add button. In the APT Line text box, type the following:

```
deb http://download.skype.com/linux/repos/debian/ stable non-free
```

Note the spaces between `debian/` and `stable` and between `stable` and `non-free`. Click the Add Source button. Click Close, and then click the Reload button in the dialog box that appears.

Figure 18-6. *It's easy to install Skype under Ubuntu, and it works in almost exactly the same way as it does under Windows or Macintosh.*

To subsequently install Skype, open the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager). Click Search, type `skype` into the search box, and click Search. In the list of results, put a check alongside the entry, and click Mark for Installation. You'll see an error message about Skype not being authenticated and that an additional package needs to be installed, but this is acceptable, so click the Mark button on the dialog box. Then click Apply on the toolbar to install the software.

After the software has installed, click Applications ➤ Internet ➤ Skype to start it. Using Skype under Linux is almost exactly the same as using the same program under Windows or Macintosh. You'll find excellent documentation at `www.skype.com`.

■ **Tip** To configure your audio input devices, such as a microphone, right-click the Speaker icon at the top-right of the desktop and select Open Volume Control. Then click and drag the Microphone slider as necessary. You may need to unmute the input by removing the red cross next to the speaker icon below the microphone sliders.

Ekiga, an open source alternative to Skype, offers a similar feature set. It is installed by default with Ubuntu and is available via Applications ➤ Internet ➤ Ekiga Softphone. When the software is launched for the first time, you'll be prompted to create an Ekiga.net account, which will give you a SIP address (which is the Voice over IP equivalent of an e-mail address) and an option to purchase *call-out* credit. After you've signed in to the service, it works in a similar way to Skype, with a buddy list and, as shown in Figure 18-7, a standard numerical dial pad for calling land lines or mobile numbers. Ekiga's integration with the Ubuntu desktop is very good so that, for example, you can receive alerts in the notification area if one of your contacts makes a call to you.

Figure 18-7. *Ekiga is an open source alternative to Skype.*

Summary

This chapter has covered the audio functions built into Ubuntu and shown how, by downloading a few extra system files, you can play back the majority of audio files in existence. We started by discussing the moral and legal dilemmas associated with multimedia playback on a computer. Then we moved on to how to install the necessary codec files on your computer, before discussing how you can listen to music files, CDs, and online radio stations.

We showed how you can convert CDs into music files, and then the inverse of this: how you can create CDs from audio files. Finally, we explained how you can install Skype and Ekiga on your computer.

In Chapter 19, you'll look at playing back movies and online animations when using Ubuntu.

CHAPTER 19

Movies and Multimedia

Movie playback is becoming increasingly popular on computers. Most PCs now ship with hardware capable of playing back DVDs, and web sites such as YouTube and Vimeo provide thousands of clips for viewing via your web browser.

Ubuntu provides support for movie playback. As with audio playback (discussed in the previous chapter), you'll need to install some additional codecs to access some types of files. And just as with audio playback codecs, multimedia applications suggest which movie playback codecs to download and install when you attempt to play unsupported multimedia files. This chapter explains how easy it is to set up Ubuntu for watching videos, DVDs, and TV on your computer, as well as playing web site Flash animations and videos.

Installing Playback Software

Like the other multimedia software provided with Ubuntu, its video playback application, the Totem movie player, is basic but effective and does the job well. However, because of patenting issues, Totem doesn't support all video formats out of the box. In fact, it supports very few of those you might be used to using under Windows or Macintosh. If you wish to play back the most common video files, such as those listed in Table 19-1, you must install additional software.

Table 19-1. *Popular Movie File Formats*

Format	Typical File Extensions	Web Site	Notes
Windows Media Player	`.wmv`, `.wma`, `.asx`, `.asf`	`www.microsoft.com/windows/windowsmedia`	Windows Media Player format is the default for most Windows users. Although it's possible to play Windows Media Player files under Ubuntu (files in WMP1, WMP2, and WMP3 formats), you won't be able to play DRM-restricted files (those that rely on the download and installation of a certificate), such as those from the increasing number of movie rental sites.
RealVideo	`.rm`, `.ram`	`www.real.com`	By downloading the GStreamer plug-in package when prompted, you can play back RealVideo files in Totem. However, you can also download a Linux version of RealPlayer.
QuickTime	`.mov`, `.qt`	`www.quicktime.com`	QuickTime is Apple's default media format and has gained ground on both Windows and Macintosh computers. As with Windows Media Player file playback, you won't be able to play DRM-restricted files.
DivX	`.avi`, `.divx`	`www.divx.com`	The DivX format is one of the most popular formats for those in the Internet community who like to encode their own movies. It's renowned for its ability to shrink movies to very small sizes.

Video and audio playback within the Firefox web browser are handled via the Totem browser plug-in, in exactly the same way as the Windows Media Player and QuickTime browser plug-ins work under Windows. This is set up automatically during initial installation of Ubuntu and is also compatible with the GStreamer codec plug-ins after they are installed. However, when you try to retrieve streaming content, many web sites attempt to probe your setup to ensure that you have the required media player software, and they may balk when unable to find Windows Media Player or QuickTime. This makes playback difficult, although more and more sites are switching to video playback via Flash Player. Additionally, some web sites use Java applets to present content. You can install support for both Flash and Java through Firefox.

Next we will cover how to install codecs for movie file formats, as well as how to install the Linux version of RealPlayer and support for Flash and Java.

Installing Codecs

The codecs for video playback are created by the open source community and are therefore entirely free of copyright issues, but it is claimed some utilize patented technology. As you might expect, this makes for another legally gray area. It's unlikely that the patent holders sanction the distribution of the codecs in countries that allow software to be patented. As with audio playback codecs, you will need to decide whether the caveats shown by Ubuntu during the installation of the codecs apply to you.

■**Note** Most of the movie playback codecs used under Ubuntu are provided by the excellent FFmpeg Project (`http://ffmpeg.mplayerhq.hu/`). This is part of the MPlayer Project, which aims to create an open source media player and platform, separate from GStreamer or Xine (used under the GNOME and KDE desktops, respectively). However, as with all open source projects, it is both possible and encouraged to take and reuse just the FFmpeg codec software, which is what the Ubuntu developers have done to bring support for a wide range of movie and audio formats to Ubuntu.

As stated earlier, codec installation for new file formats is automated (so long as you're online), just as with audio codecs. In fact, if you followed the instructions to install the MP3 codecs in the previous chapter, including the GStreamer `ffmpeg` video plug-in codec, then your system may already have support for the movie formats. In that case, the video file you've chosen to view will just start playing—you won't be prompted to download anything extra.

Here is the procedure for adding codecs to play a multimedia file:

1. From Nautilus, double-click a movie file.

2. The Totem movie player application will start and prompt you to search for a suitable codec. (As noted, the movie will just start playing if you already have the necessary codec.) Click the Search button.

3. Ubuntu will search for the applicable codec. After it has finished searching, the Install Multimedia Codecs dialog box will appear, prompting you to select from the list of codecs.

4. You can read through the descriptions to know which codec to choose, if more than one is offered. As with audio playback codecs, it's usually a good idea to select all of the codecs offered, to get the broadest range of support. Ubuntu will handle any functionality overlap in the background, so don't worry about installing two or more sets of codecs that seemingly do the same job. Check the options you want and click the Install button.

5. Ubuntu will ask you to confirm the installation of restricted software. Read through the conditions and warnings. If you want to continue, click Confirm. Otherwise, click the Cancel button to choose not to install the codec (meaning that your system will not be able to play the files).

6. Back in the Install Multimedia Codecs dialog box, click the Install button again.

7. Supply your password in the authorization dialog box and click OK to proceed with the installation.

8. Ubuntu will download and install the packages. After you have been notified that the packages have been installed successfully, click the Close button. At this point, your multimedia file will play in Totem.

■ **Tip** When trying to play back QuickTime movies in our tests, we found that a reboot was necessary after the codec was installed. If Totem once again asks you to install the codec when you try to play a QuickTime movie, just click the Cancel button and then reboot. This is probably because QuickTime support is provided by codecs that are still in the process of being developed and can be a little buggy. But after a reboot, you should find that QuickTime movies play back perfectly.

Installing RealPlayer 11

RealPlayer 11 is a media playback application designed for Linux, Windows, and Macintosh OS X and written by Real Networks. It will give you access to a range of media. Although the software has been available for Linux and Ubuntu for some years, its installation still occasionally causes confusion. There are a couple of ways to install the software, but we're going to use a native `.deb` package file that will automate much of the process:

1. Open a browser and go to `www.real.com/linux`. The site is dominated by a big Download RealPlayer button, which will download a static binary (that is, one that can be installed on any Linux system) to your desktop. This is not the file you want. Below the big button are the Advanced Installation Options. Click DEB Package here and save the file.

2. After the 7MB package has downloaded, it should automatically launch the `.deb` installation procedure. Click to install and then read through and acknowledge the end-user license.

3. The software will now begin to install. During the process, it will download other pieces of software to sort out dependencies, which can take some time. However, it will also pause at one point, waiting for you to configure the mail system for the software. Just click the Terminal disclosure arrow below the progress bar, click into the black window, and press 1 to select the first option.

4. After the software has finished installing, it will create icons under the Applications ➤ Sound and Video menu and will also set up the helpers for Firefox. The first time you run the software, it will do a network speed test and will install additional packages (see Figure 19-1) and will then be ready to go.

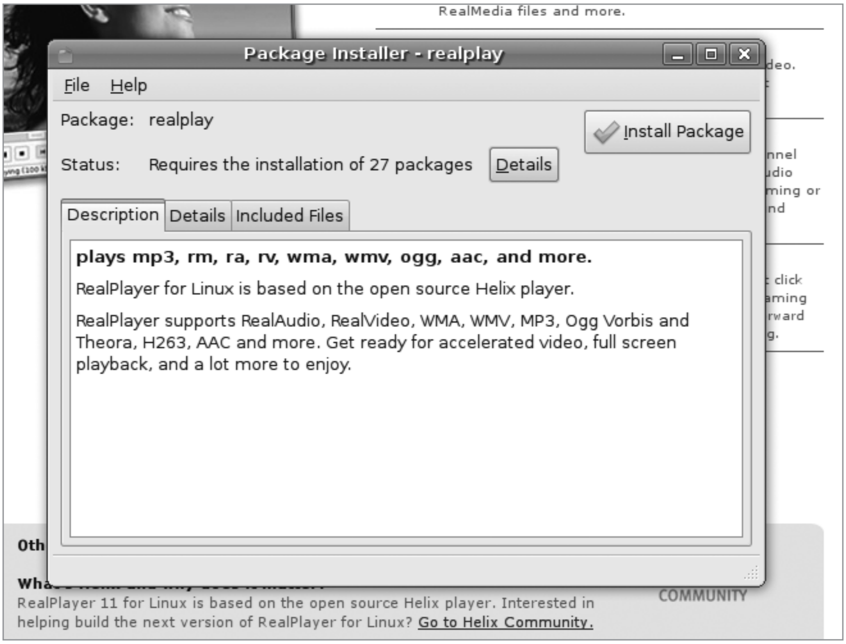

Figure 19-1. *After RealPlayer has been installed by a self-installer executable, you must run through its setup program to install the browser plug-in.*

Tip To see which plug-ins are installed under Firefox, type `about:plugins` in the address bar.

Adding Flash Support

Flash is a multimedia plug-in used for animations, games, and video playback on web sites. It is a standard requirement on modern Internet-equipped computers, and finding commercial sites that don't utilize it in some way is becoming difficult. For example, YouTube (`www.youtube.com`) uses Flash for the playback of video files, as shown in Figure 19-2.

Adobe is the originator of the Flash technology and makes a version of its proprietary Flash Player web browser plug-in especially for Linux, which can be easily installed under Ubuntu. You can also select to install one of two open source Flash players: Swfdec or Gnash. Of the three, Adobe's own Flash Player offers the best all-round compatibility with web sites of all kinds—general, video, games, and animations. Swfdec is perhaps the best open source choice, although it specializes primarily in video playback, such as that offered by YouTube or the BBC (`www.bbc.co.uk`). Gnash may be the weakest of the three (at the time this book was written), but might be worth investigating if you prefer to use open source software and find that Swfdec doesn't work correctly with your favorite web sites.

Figure 19-2. *Flash is increasingly popular on video playback sites such as YouTube.*

Note Sadly, there isn't a Linux version of the Shockwave Director browser plug-in. If you really need to have access to Shockwave sites under Linux, consider using CrossOver Professional (`www.codeweavers.com`) to install the Windows version. But be aware that CrossOver Professional is a commercial product, and you'll need to pay for it.

Installing a Flash Plug-in

As with multimedia codecs, Flash support is installed on demand and is entirely automated. However, this time, installation takes place from within the Firefox browser, as follows:

1. The first time you visit a web site that uses Flash, a yellow bar will appear at the top of the browser window, informing you that you need to install a missing plug-in. Click the Install Missing Plugins button.

2. In the Plugin Finder Service dialog box, click your choice of plug-in and then click the Next button. You're asked whether you want to install additional software. Click the Yes button.

3. The software is downloaded and installed in the background automatically. After installation has completed, click the Finish button to close the Plugin Finder Service dialog box. The browser will then display the Flash content.

4. Some users may find that this method doesn't work and that the plug-in is not available. In this case, go to `www.adobe.com`, select the link for Get Adobe Flash Player, select the appropriate version to download (`.deb` for Ubuntu 8.04+), and then install as with the RealPlayer software earlier. Note that you'll be prompted to close down all browsers during the installation procedure.

Removing a Flash Plug-in

If you wish to remove a Flash plug-in, perhaps because it doesn't work correctly and you wish to try an alternative, open the Synaptic Package Manager (System ➤ Administration) and search for the package: `gnash` to remove Gnash, `swfdec` to remove Swfdec, or `flashplugin-nonfree` to remove Adobe's Flash Player. Click the check box alongside the entry in the list and select Mark for Removal from the menu that appears. (If you wish to remove Gnash, you'll need to mark both `gnash` and `gnash-common` for removal.) Then click Apply on the main toolbar. Close Synaptic when the removal is complete.

Following this, whenever you visit a site requiring Flash, you will again be prompted to install a Flash plug-in. You can then select a different option from the list.

Adding Java Support

Java is a software platform that some programs use. The intention is that Java is cross-platform, which means that software developed for, say, Microsoft Windows will also work on Linux and Macintosh. Because of this, some web sites use Java applets—small programs embedded into the web page—to present interaction, animation, and even movies.

To access web sites that employ Java applets, you'll need to install Java Runtime software along with a browser plug-in. Previously, Java would have been a separate installation, but since Sun Microsystems released the software under an open source license, it has been available to distribution developers and hence is now included in the Ubuntu software repositories. The simplest way to install is to open Synaptic Package Manager, do a search for *Java*, and then select Sun Java6 JRE for installation. Other options will automatically be selected, including the binaries and plug-ins for Firefox, and you can just click Apply to install the software.

Watching Movies

The Totem movie player application (Applications ➤ Sound and Video ➤ Movie Player) is used to play back video under Ubuntu, as shown in Figure 19-3.

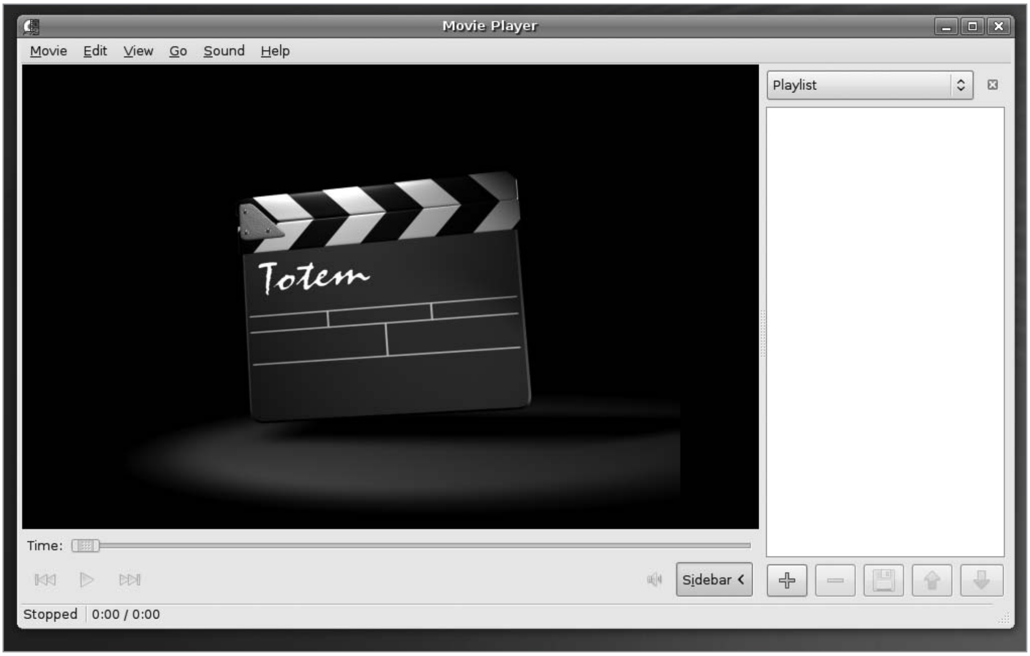

Figure 19-3. *Totem handles movie file playback under Ubuntu and is simple but effective.*

To play a movie file on your hard disk, simply double-click its icon. This will automatically start Totem and play the video, if Totem has the appropriate codecs, as shown in Figure 19-4. If not, Totem will suggest which codecs to download and install, as explained earlier in the chapter.

■ **Tip** By default, all video files will play in Totem, including RealMedia. To change this so that RealPlayer handles its own file types, right-click any RealPlayer movie file, select Properties, click the Open With tab, and click Add. Locate RealPlayer in the list, click the Add button, and then make sure the radio button alongside RealPlayer is selected.

Using Totem is easy, and the interface has only a handful of options. At the bottom left of the screen are the transport controls that enable you to pause, play, and move forward and backward in the video file. Alternatively, you can right-click the video window and select the controls from there.

Above the controls is the Time bar. You can drag the slider to move through the video, but not all files support this function. You might find that some dragging is allowed, but you're not able to click a new place in the Time bar and have the counter jump to that position.

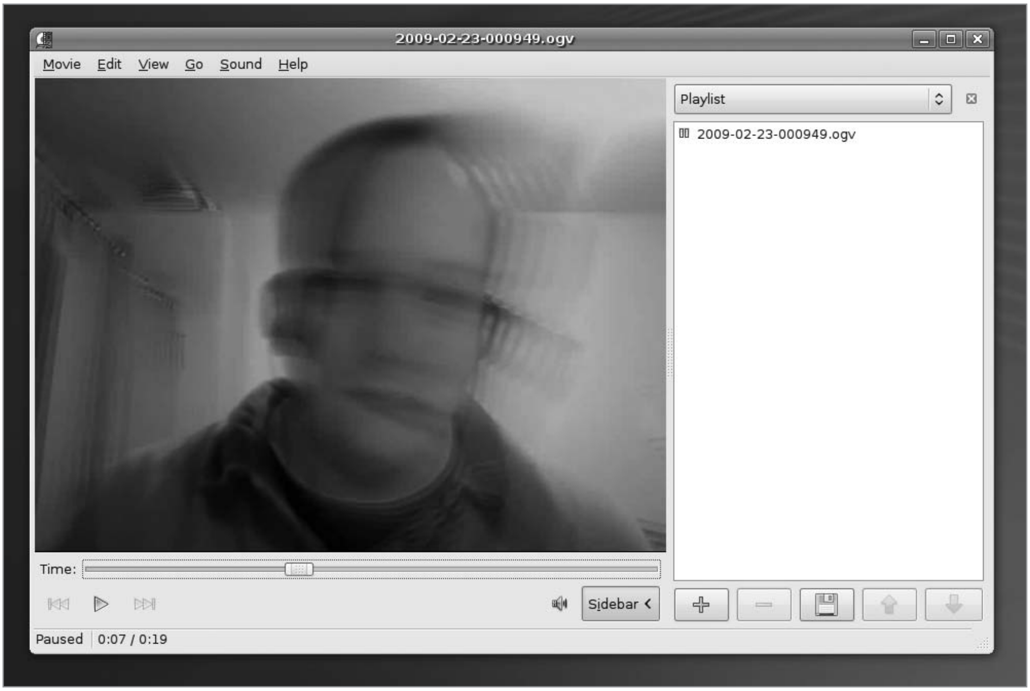

Figure 19-4. *Totem can play just about every kind of movie file, such as QuickTime, Windows Media Player, DivX, and Ogg files, as here.*

At the right of the program window is a playlist. You can queue several video files to be played in sequence by simply dragging and dropping movies from a Nautilus file browser window. You can hide the playlist by clicking the Sidebar button. This gives nearly all of Totem's program window to the playback window. To play the video full screen, thereby hiding the desktop and Totem controls, press the F key. To return to the program window, press Esc (or press F again). In full-screen mode, you can start and stop the video by pressing the spacebar.

To adjust the image quality, click Edit ➤ Preferences, and then click the Display tab in the Preferences dialog box. You can make adjustments by clicking and dragging the Brightness, Contrast, Saturation, and Hue sliders. If a video is playing in the background, the changes will be shown as you make them.

■ **Tip** If you find you have problems with video playback, such as Totem showing an error message about another application using the video output, try the following: click System ➤ Preferences ➤ Terminal, and at the prompt, type `gstreamer-properties`. Click the Video tab, and in the Plugin drop-down list under Default Output, select Xwindows (No XV).

OPEN SOURCE MOVIE FILE FORMATS

A number of promising open source movie file formats are in development. Some are more mature than others, but few see widespread use at the moment. All promise much for the future. Many consider the following two formats the chief contenders:

- Xvid (`www.xvid.org`) is a reworking of the popular DivX MPEG-4-based file format. Unfortunately, Xvid uses technology covered by patents in some parts of the world, so the project exists in a legally gray area. Xvid is able to encode movies to relatively small file sizes (a 90-minute movie can fit on a CD). Despite small file sizes, this format can maintain good image and sound quality. In theory, it should also be possible to play Xvid movies by using any MPEG-4 codec, such as DivX or QuickTime.
- Ogg Theora (`www.theora.org`) is being developed by the Xiph.org Foundation, the people behind the Ogg Vorbis audio codec project that's a favorite among Linux users. As such, it promises to be a completely open source project. Although the technology, again, is covered by patents, Xiph.org has promised never to enforce them, meaning that anyone in the world can use Theora without charge.

Watching DVDs

As explained in Chapter 18, DVD movie discs are protected by a form of DRM called CSS. This forces anyone who would like to create DVD playback software or hardware to pay a fee to the DVD Copy Control Association, an industry organization set up to protect DVD movie technology.

Nearly all Linux advocates are scornful of any kind of DRM system. Although it is possible to purchase playback software created by Fluendo and CyberLink through Ubuntu's online store, few appear to be willing to support what they see as restrictive software technology.

Some open source advocates reverse-engineered DVD protection and came up with the DeCSS software. This bypasses the CSS system and allows the playback of DVD movies under practically any operating system. Sadly, DeCSS is caught in a legal quagmire. The Motion Picture Association of America (MPAA) has attempted to stop its distribution within the United States but has failed. Some experts suggest that distributing DeCSS breaks copyright laws, but there has yet to be a case anywhere in the world that proves this. Nor has there been a case proving or even suggesting that using DeCSS is in any way illegal.

Ubuntu doesn't come with DeCSS installed by default, but you can download and install the software by issuing a simple command, following the installation of a software package. Here is the procedure:

1. Choose System ➤ Administration ➤ Synaptic Package Manager.
2. Click Search, and search for `libdvdread3`. In the list of results, click the check box alongside the package and click Mark for Installation. Click Apply on the main toolbar. Close Synaptic.
3. Open a terminal window (Applications ➤ Accessories ➤ Terminal). Type the following in the terminal window to download and install the DeCSS component:

   ```
   sudo /usr/share/doc/libdvdread3/install-css.sh
   ```

4. After the command has completed, you can close the terminal window.

■**Note** You must ensure that Synaptic and Update Manager are closed before typing the command to install the DeCSS software. It will fail if either program is running.

After you've installed DeCSS, just insert a DVD, and Totem will automatically start playing it, as shown in Figure 19-5.

■**Note** If the relevant codecs aren't installed when you insert a DVD, you will be prompted to install them, as with all kinds of multimedia file playback.

If the movie doesn't start playing automatically, double-click the disc's icon on the desktop. In the Nautilus file browser window, click the Open Movie Player button.

Unfortunately, there is a slight limitation to playing DVD movies within Totem: the chapter menus will not work, so you will not be able to navigate from chapter to chapter in the disc. Additionally, in our tests, we noticed that DVD playback could be a little glitchy. To get around both these issues, you can install the `totem-xine` package. This installs a separate but otherwise identical version of the Totem movie player that utilizes the Xine multimedia framework (Chapter 18 explains what a multimedia framework is). Then you will be able to choose between using the standard version of Totem, which relies on the GStreamer multimedia framework, or the Xine version of Totem. Installing the `totem-xine` package also installs Xine versions of the codecs you need for virtually all multimedia file playback, meaning no extra configuration is necessary.

Figure 19-5. *Just insert a DVD in your computer, and it will automatically play in Totem.*

Note You might be wondering why we didn't just advise you to install `totem-xine` back at the beginning of this chapter, if it installs all the codecs you need. The method we recommend installs codecs for the GStreamer multimedia framework, rather than just Totem. GStreamer is used by *all* of the GNOME desktop multimedia software. This means that if you install a different GNOME movie player in the future, it will automatically have support for all the file formats you've already added to Ubuntu. In contrast, the `totem-xine` package is rather self-contained and installs codecs for only the Xine framework, which isn't supported elsewhere under Ubuntu (but is the default framework under KDE).

To install the `totem-xine` package, start the Synaptic Package Manager (System ➤ Administration) and click the Search button. Search for `totem-xine`. Click the check box alongside the entry in the results list and select to install it. As you'll see from the warning dialog box, installing `totem-xine` also installs a lot of other packages, including the necessary codecs for playback of virtually all multimedia files. This is fine.

From now on, you'll need to run the Xine version of Totem to play DVD movies. You'll have to do this before you insert the DVD movie disc, to avoid the standard version of Totem attempting to play it. To run the Xine version of Totem, you can use either of these methods:

Run it from a terminal window: Click Applications ➤ Accessories ➤ Terminal and type `nohup totem-xine`.

Create a new launcher: Right-click the desktop, select Create Launcher, and in the Command text box, type `totem-xine`. In the Name box, type something like `Totem (Xine)` for easy identification, and then click OK.

■ **Tip** To find out which version of Totem you're using—GStreamer or Xine—click Help ➤ About in Totem. You'll see either "Movie Player using xine-lib," in the case of Xine, or "Movie Player using GStreamer," in the case of GStreamer.

MOVIE EDITING

The field of Linux movie-editing software is developing, and only a handful of programs are available for the nonprofessional user. One of the best is Kino (`www.kinodv.org`), which is available in the Ubuntu software archives. Although far from being a professional-level program, Kino allows competent users to import and edit videos, apply effects, and then output in either MPEG-1 or MPEG-2 format.

If you're looking for something more powerful but also more complicated, Cinelerra is worth a look (`http://heroinewarrior.com/cinelerra.php3`). Just follow the instructions at `http://cvs.cinelerra.org/getting_cinelerra.php#hardy` to install a version of Cinelerra for Ubuntu.

For those who want something a little simpler, the PiTiVi (`www.pitivi.org`) project is attempting to build a piece of software akin to Apple's iMovie. Although it's not quite there yet, it is an interesting project to keep an eye out for. Also Adobe's Premiere Express (available through the Photobucket picture-sharing service), which is designed specifically for online video editing and distribution, works very well under Ubuntu with the Flash plug-in.

Incidentally, professional moviemakers use Linux all the time, particularly when it comes to adding special effects to movies. Movies like *Shrek 2*, *Stuart Little*, and the *Harry Potter* series all benefited from the CinePaint software running under Linux! For more details, see `www.cinepaint.org`.

Watching TV

If you have a TV card, you may be able to use it to watch TV under Ubuntu. Ubuntu doesn't come with a TV tuner application by default, but you can download the tvtime program from the software repositories by using the Synaptic Package Manager.

Checking for Video Input

Ubuntu includes the Video for Linux project, an extension to the Linux kernel, to allow many popular TV and video-capture cards to work. You can find out whether yours is compatible by opening a terminal window (Applications ➤ Accessories ➤ Terminal) and typing `gstreamer-properties`. In the dialog box that appears, click the Video tab, and click the Test button in the Default Input part of the window. If you see a video window without an error message, your TV card is compatible. If you receive an error message, your card probably isn't compatible.

■ **Note** Getting Video for Linux to work can be troublesome, but there are a lot of resources out there to help. You can start by visiting `www.linuxtv.org` and `www.exploits.org/v4l/`.

Installing tvtime

To download and install tvtime, open the Synaptic Package Manager (System ➤ Administration), click the Search button, and enter `tvtime` as a search term. In the list of results, click the entry for the package, mark it for installation, and then click Apply.

When the download has completed, you'll be asked a number of questions during the configuration process. First, you need to choose your TV picture format. Users in the United States should choose NTSC. Users in the United Kingdom, Australia, and certain parts of Europe should choose PAL. To find out which TV system your country uses, look up your country at `www.videouniversity.com/standard.htm`. You also need to choose your geographical area from the list so that tvtime can set the correct radio frequency range for your TV card.

After the program is installed, you'll find it on the Applications ➤ Sound & Video menu. Using the program is straightforward, but if you need guidance, visit the program's web site at `http://tvtime.sourceforge.net`.

■ **Tip** If you're interested in setting up a low-cost personal video recorder (PVR) and entertainment system, you may want to install MythTV by using the Synaptic Package Manager. For more information, check out *Practical MythTV: Building a PVR and Media Center PC* by Stewart Smith and Michael Still (Apress, 2007).

Summary

In this chapter, you looked at how you can watch movies on your PC. You've seen how you can update Ubuntu to work with the most popular digital video technologies, such as Windows Media Player and QuickTime.

In addition, you looked at how you can view online multimedia such as Flash animations on your computer, and learned how you can watch TV on your PC.

In the next chapter, you'll take a look at image editing under Ubuntu. You'll learn about one of the crown jewels of the Linux software scene: GIMP.

CHAPTER 20

Digital Photos

The PC has become a vital tool in the field of photography. In fact, you're unlikely to find any photographer—professional or amateur—who doesn't use a PC somewhere in his or her work.

Ubuntu includes a number of applications for cataloging and editing images. Chief among these is GIMP (GNU Image Manipulation Program), which compares favorably with professional software such as Photoshop, but there are also applications for more-casual users. This chapter begins with a brief tour of F-Spot, an application ideal for cataloging and managing image collections and also doing some basic edits, before introducing GIMP.

Downloading and Cataloging Images

Before you can undertake any image editing, you need to transfer the images to your PC. Depending on the source of the pictures, there are a variety of methods of doing this, but in nearly every case, the work of importing your photos can be handled by F-Spot. But before we cover F-Spot, let's briefly recap the various methods of transferring images to your PC, some of which were outlined in Chapter 8.

Connecting Your Camera

Most modern cameras use memory cards to store pictures. If you have such a model, when you plug the camera into your PC's USB port, you should find that Ubuntu instantly recognizes it. An icon should appear on the desktop, and double-clicking it should display the memory card's contents in a Nautilus window. Along the top of the window, you'll see an orange bar reading, "This media contains digital photos" alongside a button marked Open F-Spot Photo Manager. Clicking this button will start F-Spot, with which you can copy the images to your hard disk, as explained in the next section. Of course, you can also drag and drop pictures to your hard disk manually using Nautilus.

In the unlikely event that your camera doesn't appear to be recognized by Ubuntu, you might have more luck with a generic memory card reader, which will make the card appear as a standard removable drive on the desktop. These devices are relatively inexpensive and can usually read a wide variety of card types such as SD, XD, and CompactFlash, making them a useful investment for the future. Some new PCs even come with card readers built in. Most generic card readers should work fine under Linux, as will most new digital cameras.

■ **Caution** Before detaching your camera or removing a photo card, you should right-click the desktop icon and select Unmount Volume. This tells Ubuntu that you've finished with the device. Failing to eject in this way could cause data errors, as information may be partially written back to the card, or transfers between the two devices may not have finished.

If you're working with print photos, negative film, or transparencies, you can use a scanner and the XSane program (Applications ➤ Graphics ➤ XSane Image Scanner) to digitize them, as explained in Chapter 8. This works in a virtually identical way to the TWAIN modules supplied with Windows scanners, in that you need to set the resolution in dots per inch (DPI), as well as the color depth. Generally speaking, 300 DPI and 24-bit color should provide an adequate representation of most printed photos. Because of their smaller size, transparency or negative film images will require higher resolutions, in the order of 1,200 or 2,400 DPI.

Importing Photos by Using F-Spot

F-Spot is designed to work in a similar way to applications you may have encountered under Windows or Mac OS X, such as iPhoto or Picasa. After you run F-Spot (Applications ➤ Graphics ➤ F-Spot Photo Manager), or after you click the Open F-Spot Photo Manager button that appears along the top of a Nautilus file browser window when you insert a memory card or attach your digital camera, the F-Spot Import window will appear. (Depending on your configuration, the Import window may appear within a file browser.)

The Import window contains a preview of the pictures stored in your camera, the option to tag the pictures, and the target directory where the photos will be copied. By default, all of the pictures are selected. You can deselect and select photos by using the standard selection techniques (Ctrl-click or Shift-click). Embedded tags are very useful in filtering and searching for pictures, as discussed in the "Tagging Images" section a little later in the chapter. The default target directory where the photos will be copied is `Photos` in your `/home` directory, but you can change it to any directory you prefer.

To import the pictures from your camera to your hard disk, just click the Import button. F-Spot will import your photos in the target location, in directories named after the year, month, and day the photos were originally taken.

Importing pictures from a mounted Windows partition is easy. Click Photo ➤ Import. In the Import window, click the Import Source drop-down list and then click Select Folder. Using the file browser, navigate to the Windows directory containing your images and then click OK. (Don't double-click the directory, because this will cause F-Spot to open the directory in the file browser.) After you've selected the folder, F-Spot will display thumbnail previews of the images, and this might take some time. Keep your eye on the orange status bar. When this indicates "Done Loading," you can click the Import button to import all the images in one go, or Ctrl-click to select photos in the left side of the window, and then click the Import button.

If you're importing the photos from a particular event, this is also a great time to define a set of tags for the whole set, which will save having to manually tag pictures later. As with photos from a camera, by default, F-Spot copies the images into a directory it creates within your `/home` directory, called `Photos`. Therefore, after you've imported the photos, you can delete the originals from the Windows partition if you wish.

■ **Tip** You may be familiar with Picasa from Google. This software is available for Ubuntu from `http://picasa.google.com/linux/`. One advantage of using the software is that it integrates well with Google's own photo-sharing service and also has a plug-in that allows one-click uploading from your library to Facebook.

After the photos have been imported, the main F-Spot window will appear. On the left are the default tags and a list of any tags added to imported files. On the right is the picture preview window, which can be set to either Browse or Edit Photo mode. You can switch between these two modes by using the buttons on the toolbar. You can also view an image full screen or start a slide show that will cycle through the images in sequence.

Above the picture window is the timeline. By clicking and dragging the slider, you can move backward and forward in the photograph collection, depending on when the pictures were taken. Each notch on the timeline represents a month within the year marked beneath the timeline. The graphs on the timeline give a general idea of how many photographs were taken during that particular month (or, indeed, if *any* were taken during a particular month). The arrows to the left and right of the timeline can be used to expose a different set of months.

Tweaking Photos

By either double-clicking an image or selecting an image and clicking Edit Photo on the toolbar, you can tweak images by cropping them, adjusting brightness and contrast, or setting the color saturation/balance. The available tools will appear in a docked toolbar, replacing the default tags pane, as shown in Figure 20-1. In addition, you can convert images to black-and-white or sepia tone, and you can remove red-eye caused by an indoor flash. All of this can be achieved by clicking the buttons under the image. (Hovering the mouse cursor over an icon will cause a tooltip to appear, explaining what the button does.) Simple rotations on single images or multiple selections can be performed by using the Rotate Left and Rotate Right buttons on the toolbar.

Figure 20-1. *Any edits to the image are made live, so it's a good idea to move the adjustment dialog box out of the way.*

You can also add a comment in the text field below the image. This will then be attached to the image for future reference and can act as a useful memory aid.

A note of caution is required when tweaking images with F-Spot, because there is no traditional undo mechanism. However, F-Spot keeps a copy of the original image alongside the modified one, and this can be accessed by clicking Photo ➤ Version ➤ Original. It's possible to create a new version of the image complete with modifications by clicking Photo ➤ Create New Version. You can then name this separately and, if necessary, continue to edit while retaining both the original and the intermediate version. You can do this as many times as you want, perhaps to save various image tweaks to choose the best one at a later date.

Tagging Images

F-Spot's cataloging power comes from its ability to tag each image. A *tag* is simply a word or short phrase that can be attached to any number of images, rather like a real-life tag that you might find attached to an item in a shop. After images have been tagged, you can then filter the images by using the tag word. For example, you could create a tag called `German vacation`, which you would attach to all images taken on a trip to Germany. Then, when you select the `German vacation` tag, only those images will be displayed. Alternatively, you could be more precise with tags—you could create the tags `Dusseldorf` and `Cologne` to subdivide pictures taken on the vacation.

If your collection involves a lot of pictures taken of your children at various stages during their lives, you could create a tag for each of their names. By selecting to view only photos tagged with a particular child's name, you could see all the pictures of that child, regardless of when or where they were taken.

Images can have more than one tag. A family photo could be tagged with the words `thanksgiving`, `grandma's house`, `family meal`, and the names of the individuals pictured. Then, if you searched using any of the tags, the picture would appear in the list.

A handful of tags are provided by default: `Favorites`, `Hidden`, `People`, `Places`, and `Events`. To create your own tags, right-click under the tag list on the left of the F-Spot program window and select Create New Tag. Simply type in the name of the new tag in the dialog box and click OK.

If you tagged items on importing, these will appear under the Import Tags parent. Drag and drop these tags to the appropriate parent tag (`Germany` under `Places`, for example).

■ **Note** Tags can have *parents*, which can help organize them. For instance, you might put the names of family members under the `People` parent tag, or put `Birthday` under the `Events` parent. You can reveal or hide child tags by clicking the disclosure arrow next to the parent.

Tags can also have icons attached to them. An icon based on the first photo that is tagged will automatically be added to the tag name, but to manually assign one, right-click it in the list and select Edit. Next, in the Edit Tag dialog box, click the icon button and select from the list of icons under the Predefined heading.

To attach a tag to a picture, simply right-click it (in either the Browse or Edit Photo mode), and click its entry on Attach Tag.

To filter by tag, double-click the tag in the tag list, as shown in Figure 20-2. To remove the filtering, right-click the tag in the orange bar at the top of the display and select Remove from Search.

F-Spot has a good range of export options for when you want to share your pictures with the wider world. You'll find these under the Photo ➤ Export To option, and supported services include Picasa Web Albums, SmugMug, and Flickr. When using Flickr, F-Spot even includes an option to turn your tags into Flickr tags during the upload process.

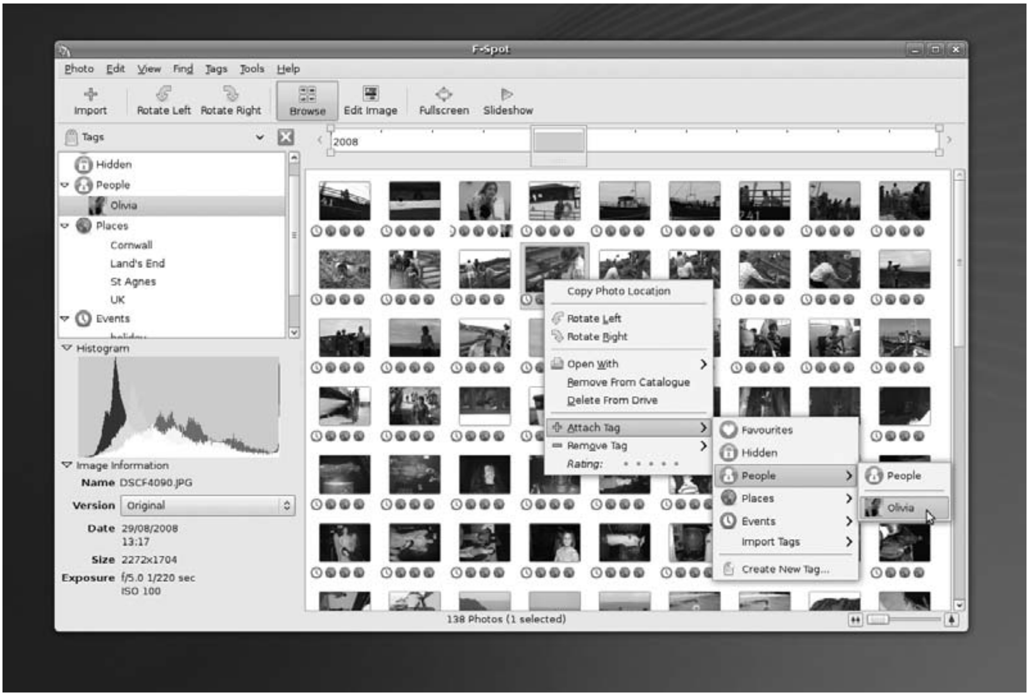

Figure 20-2. *Tag an image by right-clicking and selecting the appropriate entry from the Attatch Tag option.*

Using GIMP for Image Editing

GIMP is an extremely powerful image editor that offers the kind of functions usually associated with top-end software like Adobe Photoshop. Although GIMP is not aimed at beginners, those new to image manipulation can get a lot from it, though it may demand a little more work than the limited options available in F-Spot.

The program relies on a few unusual concepts within its interface, which can catch many people off guard. The first of these is that each of the windows within the program, such as floating dialog boxes or palettes, gets its own panel entry. In other words, the GIMP's icon bar, image window, settings window, and so on have their own buttons on the Ubuntu desktop panel alongside your other programs, as if they were separate programs.

■Note GIMP's way of working is referred to as a Single Document Interface, or SDI. It's favored by a handful of programs that run under Linux and seems to be especially popular among programs that let you create things. If your taskbar is getting a little crowded, edit its Preferences to Always group windows.

Because of the way that GIMP runs, before you start up the program, it's a wise idea to switch to a different virtual desktop, which you can then dedicate entirely to GIMP. (Virtual desktops are discussed in Chapter 7.)

Click Applications ➤ Graphics ➤ GIMP Image Editor to launch the application. You'll be greeted by what appears to be a complex assortment of program windows.

Now you need to be aware of a second unusual aspect of the program: its reliance on right-clicking. Whereas right-clicking usually brings up a context menu offering a handful of options, within GIMP, it's the principal way of accessing the program's functions. Right-clicking an image brings up a menu offering access to virtually everything you'll need while editing. Ubuntu includes the latest version of GIMP, 2.6, which includes a more traditional menu bar in the main image-editing window, so you can choose your preferred method of working.

The main toolbar window, shown in Figure 20-3, is on the left. This can be considered the heart of GIMP, because when you close it, all the other program windows are closed too. Version 2.6 also introduces a blank window that is visible when no image is open. This means that the traditional menus are available at all times. Closing this window will also cause the entire application to close. The menu bar on the toolbar window offers most of the options you're likely to use to start out with GIMP. For example, File ➤ Open will open a browser dialog box in which you can select files to open. It's even possible to create new artwork from scratch by choosing File ➤ New.

■Tip To create vector artwork, a better choice is a program like Inkscape (`www.inkscape.org`), which can be downloaded via the Synaptic Package Manager (to learn about software installation, see Chapter 28).

Beneath the menu bar in the main toolbar window are the tools for working with images. Their functions are described in Table 20-1, which lists the tools in order from left to right, starting at the top left.

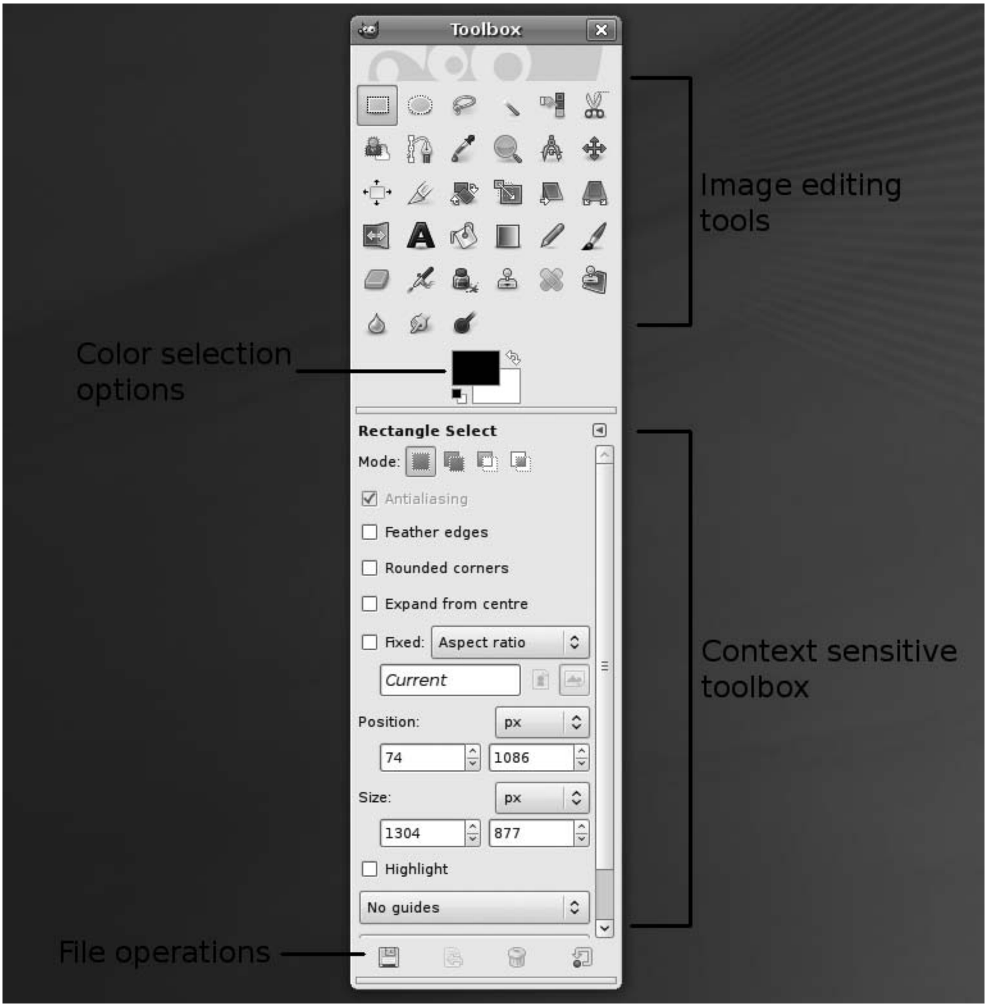

Figure 20-3. *GIMP's main toolbar window*

Table 20-1. *GIMP Image-Editing Tools*

Tool	Description of Use
Rectangle Select	Click and drag to select a rectangular area within the image. This selected area can then be copied and pasted into a different part of the image or turned into a new layer.
Ellipse Select	Create an oval or a circular selection area within the image, which you can then copy and paste.
Free Select	Click and draw with the mouse to create a hand-drawn selection area. Your selection should end where it started. If not, GIMP will draw a straight line between the start and end of the selection, which makes it easy to create geometric selections.

Tool	Description of Use
Fuzzy Select	Known as the *magic wand* in other image editors, this tool creates a selection area based on the color of the pixels where you click. For example, clicking a red car hood will select most, if not all of the hood, because it is mostly red. Define the threshold (that is, the closeness one color must be to the original) by using the context-sensitive tools.
Select by Color	Works like the Fuzzy Select tool, but will create a selection across the entire image based on the color you select. In other words, selecting a black T-shirt will also select a black signpost elsewhere in the picture if the hues are similar.
Scissors Select	Another "magical" tool that lets you create a selection by clicking on various points within an image, with the program joining the points together based on the color differences between the two points. This means that you can select the outline of a car by clicking a few points around the edge of the car and, provided the color of the car is different from the background, GIMP will work out the color differences and select the car's shape automatically.
Foreground Select	Lets you automatically create an intricate selection of an object in the foreground of a picture, via a three-step process. Click to draw roughly around the foreground object as with the Free Select tool. (Be careful you don't stray into the object; if you do, momentarily select a different tool, which will cancel the selection, and try again.) Then release the mouse button and draw across the main areas of the object by using a kind of paintbrush tool. For example, if the object is a face, draw a little on the skin and hair. The trick is to cover areas that have different color ranges, because that's how GIMP detects the edges. You'll see that the background—the area that *won't* be selected—is masked out in blue tint. If any of the foreground object is masked, draw on it to add it to the selection area. You can subtract from the selection area by Ctrl-clicking. When you're happy with the selection, press Enter.
Paths	Draws Bezier curves in order to create *paths*, which are akin to selections and can be saved for use later in the image-editing process. Just click and drag to draw a curve. Each extra click you make will define a new curve, which will be joined to the last one. To turn the path into a selection, click the button at the bottom of the toolbar.
Color Picker	Lets you see the RGB, HSV, or CMYK values of any color within the image. Simply click the mouse within the image.
Zoom	Click to zoom into the image, right-click to see various zoom options, and hold down the Alt key while clicking to zoom out.
Measure	Measures distances between two points (in pixels) and also angles. Just click and drag to use it. The measurements will appear at the bottom of the image window.
Move	Click and drag to move any selection areas within the image, as well as rearrange the positioning of various layers.

Continued

Table 20-1. *Continued*

Tool	Description of Use
Alignment	Allows you to align layers to other objects relative to each other. To choose a layer, click an object within the preferred layer. To select several layers, Shift-click objects inside the preferred layers. In the tool options of the Alignment tool, select how the layer or layers will be aligned relative to other layers or image objects. Alignment includes left, center horizontal, right, top, center vertical, and bottom, with an option to use offsets as well.
Crop	Click and drag to define an area of the image to be cropped. Anything outside the selection area you create will be discarded.
Rotate	Rotates any selections you make and can also rotate entire layers. It opens a dialog box in which you can set the rotation numerically. Alternatively, you can simply click and drag the handles behind the dialog box to rotate by hand.
Scale	Known in some other image editors as *transform*, this lets you resize the selection area or layer. It presents a dialog box for entering numeric values, or you can click and drag the handles to resize by hand.
Shear	Lets you transform the image by shearing it. Slant a selection by clicking and dragging the corners of the selection area (if the selection area isn't square, a rectangular grid will be applied to it for the purposes of transformation).
Perspective	Lets you transform a selection by clicking and dragging its four corners and independently moving them without affecting the other corners. In this way, a sense of perspective can be emulated.
Flip	Flips a selection or image so that it is reversed on itself, either horizontally (click) or vertically (Ctrl-click).
Text	Click the image to add text.
Bucket Fill	Fills a particular area with solid color or pattern, according to the color or pattern selected in the color box or fill type box below.
Blend	Creates a gradient fill based on the foreground and background colors. Just click and drag to add the fill. Hold down Ctrl to force the blend along predefined angles, including horizontal and vertical.
Pencil	Lets you draw individual pixels when zoomed in, or hard-edge lines when zoomed out. Simply click and drag to draw freehand, and hold down Shift to draw lines between two points. Again, holding Ctrl will constrain the angle of the lines.
Paintbrush	Lets you draw on the picture in a variety of brush styles to create artistic effects. A brush can also be created from an image, allowing for greater versatility.
Erase	Rather like the Paintbrush tool in reverse, deletes whatever is underneath the cursor. If layers are being used, the contents of the layer beneath will become visible.

Tool	Description of Use
Airbrush	Like the Paintbrush tool, in that it draws on the picture in a variety of styles. However, the density of the color depends on the length of time you press the mouse button. Tap the mouse button, and only a light color will appear. Press and hold the mouse button, and the color will become more saturated.
Ink	Like the Paintbrush tool, except that, rather like an ink pen, the faster you draw, the thinner the brushstroke.
Clone	Allows you to copy one part of an image to another via a brush. The origin point is defined by Ctrl-clicking.
Healing	Typically used to remove unwanted irregularities, such as pimples, scars, and blemishes in a person's face. Ctrl-click an ideal source similar to the area that needs to be healed, and then draw over the blemish, which will disappear. Effectively, the Healing tool is a Clone tool that has some intelligence built in to aid intermixing of the sample area and the area you're drawing over.
Perspective Clone	Similar to the Clone tool, but also allows you to take into account perspective within the picture. For example, you might want to clone a person standing in the foreground of a picture so she appears to be standing near a tree at the back of a photo. She should be smaller because of perspective, which you can accomplish with this tool. Click and drag the perspective bars at the corners of the image to roughly match the perspective within the picture (the depth), click the Perspective Clone tool, and Ctrl-click to select the area you want to clone. Then draw where you want the cloned material to appear.
Blur/Sharpen	Clicking and drawing on the image will spot blur or sharpen the image, depending on the settings in the tool options area, in the lower half of the toolbar.
Smudge	As its name suggests, clicking and drawing with this tool will smudge the image, rather like rubbing a still-wet painting with your finger.
Dodge/Burn	Lets you spot lighten and darken an image by clicking and drawing on the image. The results depend on the settings in the tool options part of the window.

Directly beneath the image-editing tool icons, on the left, is an icon that shows the foreground and background colors that will be used when drawing with tools such as the Paintbrush. To define a new color, double-click either the foreground (top) or background (bottom) color box.

Beneath these icons, you'll see the various options for the selected tool. The brush selector lets you choose the thickness of the brushstrokes and patterns that are used with various tools. Simply click each to change them. By using the buttons at the bottom of the window, you can save the current tool options, load tool options, and delete a previously saved set of tool options. Clicking the button on the bottom right lets you revert to the default settings for the tool currently being used (useful if you tweak too many settings!).

If you use particular options regularly, use the disclosure arrow on the right edge of the context-sensitive part of the toolbox to add a tab to the window. When you begin to experiment, having the Layers tab available here is useful, but you can add and remove as many as you like.

The Basics of GIMP

After you've started GIMP (and assigned it a virtual desktop), you can load an image by choosing File ➤ Open. The browser dialog box offers a preview facility on the right side of the window.

You will probably need to resize the image window, or change the zoom level, so the image fits within the remainder of the screen. You can then use the Zoom tool (see Table 20-1) to ensure that the image fills the editing window, which will make working with it much easier. Alternatively, you can click the Zoom drop-down list in the lower-left part of the image window.

You can save any changes you make to an image by right-clicking it and selecting File ➤ Save, or create a new, named version of the picture by using Save As. You can also print the image from the same menu.

Before you begin editing with GIMP, you need to be aware of some essential concepts that are vital in order to get the most from the program:

Copy, cut, and paste buffers: Unlike some Windows programs, GIMP lets you cut or copy many selections from the image and store them for use later. It refers to these saved selections as *buffers*, and each must be given a name for future reference. A new buffer is created by using any of the selection tools to select, and then right-clicking within the selection area and selecting Edit ➤ Buffer ➤ Copy Named (or Cut Named). Pasting a buffer back is a matter of right-clicking the image and selecting Edit ➤ Buffer ➤ Paste Named.

Paths: GIMP paths are not necessarily the same as selection areas, although it's nearly always possible to convert a selection into a path and vice versa (right-click within the selection or path, and look for the relevant option on the Select menu: Select ➤ To Path, or Select ➤ From Path, as shown in Figure 20-4). In general, paths allow the creation of complex shapes, rather than the simple geometric shapes offered by the selection tools. Paths can be saved for later use or can be taken from one image and applied to another. To view the Paths dialog box, right-click the image and select Dialogs ➤ Paths.

■ **Tip** Getting rid of a selection or path you've drawn is easy. In the case of a path, simply click any other tool or some other part of the canvas. This will cause the path to disappear. To get rid of a selection, use any selection tool to quickly click once on the image, being careful not to drag the mouse while doing so.

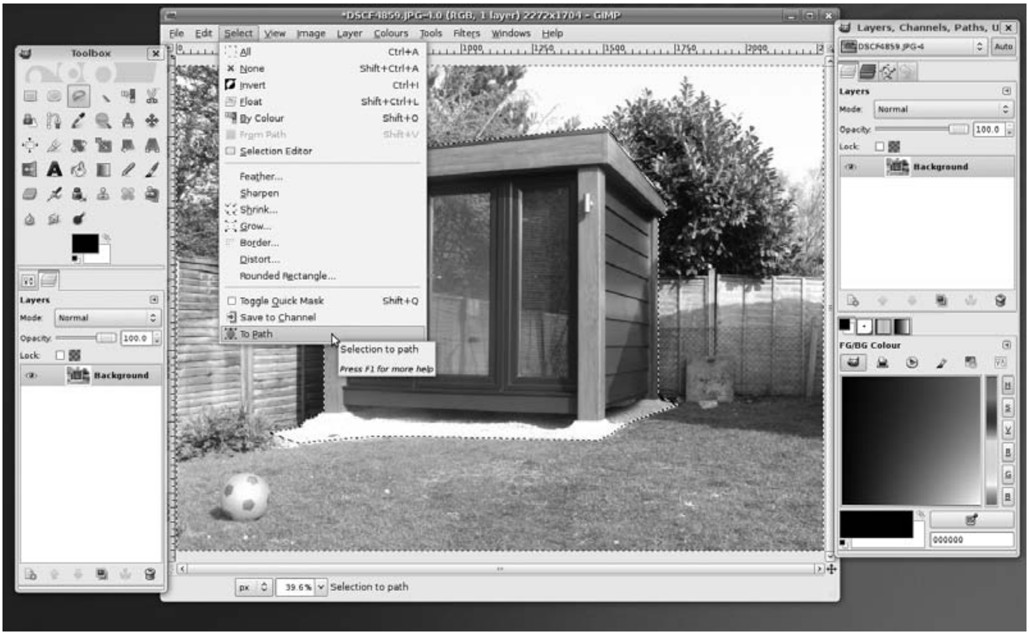

Figure 20-4. *Paths allow for more elaborate and intricate selections, such as those that involve curves.*

Layers: In GIMP (along with most other image-editing programs), *layers* are like transparent sheets of paper that are placed on top of the image. Anything can be drawn on each individual transparent sheet, and many layers can be overlaid in order to create a complicated image. Layers also let you cut and paste parts of the image between them. Though layers might be thought of as high-end, they are great if you need to add text to an image; the text will be added to a new layer, which can then be moved or resized simply. The Layers dialog box, shown in Figure 20-5, appears by default, but if you closed it earlier, you can open it again by right-clicking the image and selecting Dialogs ➤ Layers. The layers can be reordered by clicking and dragging them in the dialog box. In addition, the blending mode of each layer can be altered. This refers to how it interacts with the layer below it. For example, its opacity can be changed so that it appears semitransparent, thereby showing the contents of the layer beneath. You can also define how the colors from different layers interact by using the Mode drop-down list. The Layers menu also offers an option to collapse all of the layers back down to a single image (Layers ➤ Merge Visible Layers or Flatten Image).

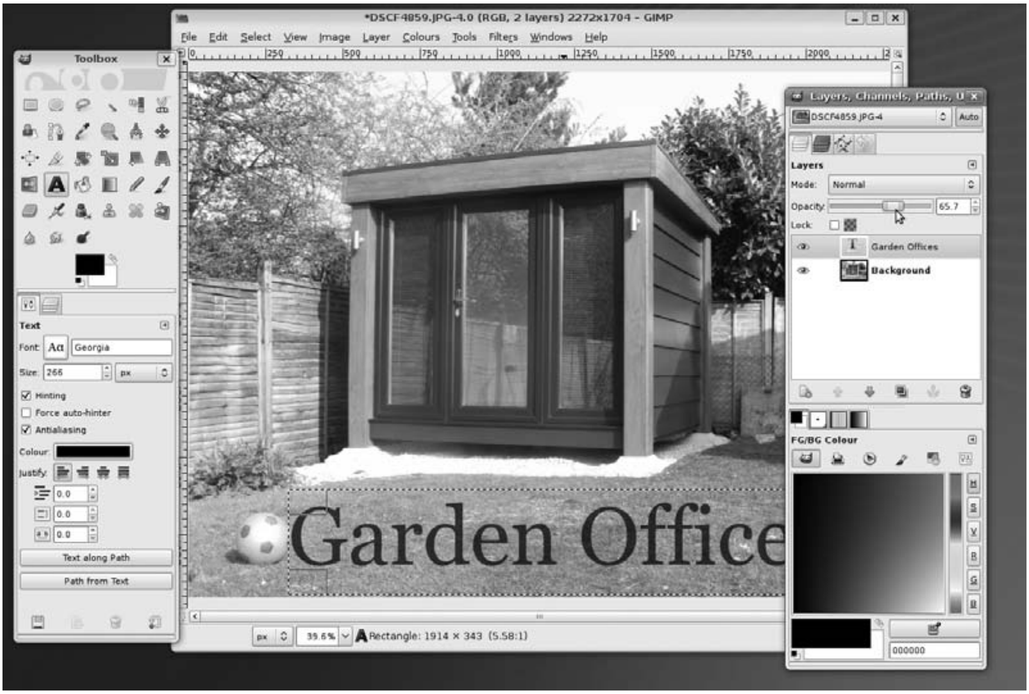

Figure 20-5. *Set the opacity of various layers by clicking and dragging the relevant slider in the Layers dialog box.*

Making Color Corrections

The first step when editing most images is to correct the brightness, contrast, and color saturation. This helps overcome some of the deficiencies that are commonly found in digital photographs or scanned-in images. To do this, right-click the image and select Colors. You'll find a variety of options to let you tweak the image, allowing you a lot of control over the process.

For simple brightness and contrast changes, selecting the Brightness-Contrast menu option will open a dialog box in which you can click and drag the sliders to alter the image. The changes you make will be previewed on the image itself, so you should be able to get things just right.

Similarly, the Hue-Saturation option will let you alter the color balance and the strength of the colors (the saturation) by clicking and dragging sliders. By selecting the color bar options at the top of the window, you can choose individual colors to boost. Clicking the Master button will let you once again alter all colors at the same time.

The trouble with clicking and dragging sliders is that it relies on human intuition. This can easily be clouded by a badly calibrated monitor, which might be set too dark or too light. Because of this, GIMP offers another handy option, which can ensure that the whites in your image are white and that your blacks are truly black: Levels. To access the Levels feature, right-click the image and select Colors ➤ Levels. This presents a chart of the brightness levels in the photo and lets you set the dark, shadows, and highlight points, as shown in Figure 20-6. Three sliders beneath the chart represent, from left to right, the darkest point, the midtones (shadows), and the highlights within the picture. The first step is to set the dark and light sliders at the left and right of the edges of the chart. This will make sure that the range of brightness from the lightest point to the darkest point is set correctly. The next step is to adjust the middle slider so that it's roughly in the middle of the highest peak within the chart. This will accurately set the midtone point, ensuring an even spread of brightness across the image.

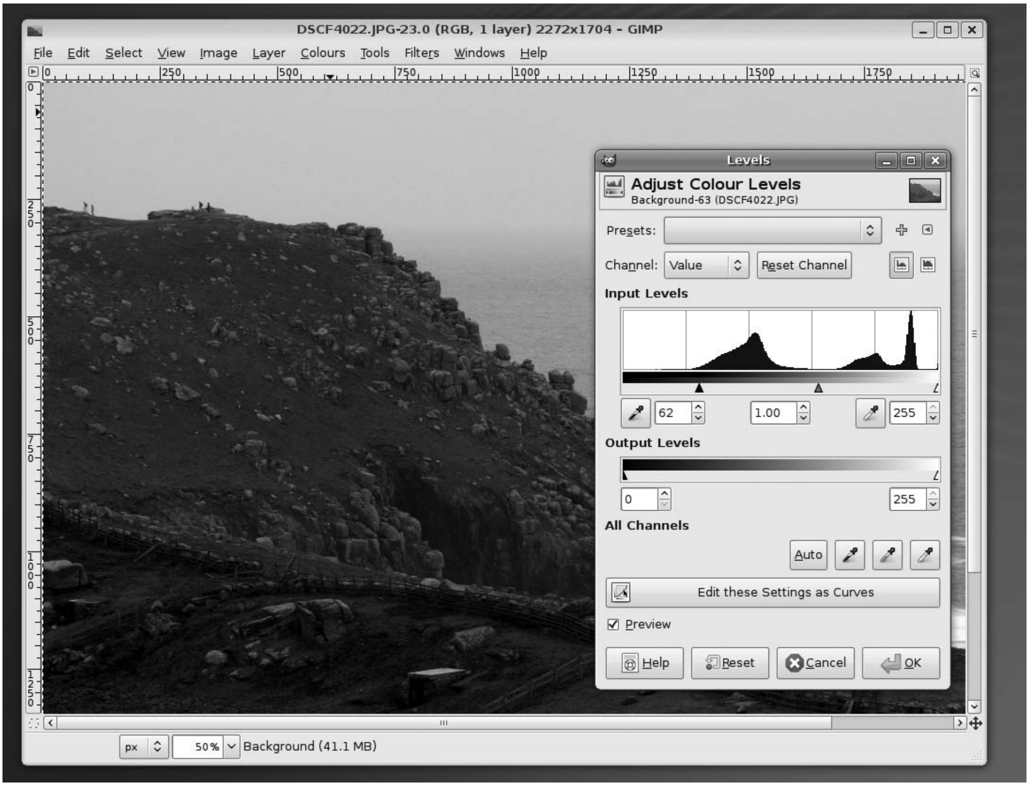

Figure 20-6. *The Levels function can be used to accurately set the brightness levels across an image.*

A little artistic license is usually allowed at this stage, and depending on the effect you want in the photo, moving the midtone slider a little to the left or right of the highest peak might produce more-acceptable results. However, be aware that the monitor might be showing incorrect brightness or color values.

Cropping and Healing

After you've adjusted the colors, you might want to use the Crop tool to remove any extraneous details outside the focus of the image. For example, in a portrait of someone taken from a distance away, you might choose to crop the photo to show only the person's head and shoulders, or you might separate a group of people from their surroundings, as shown in Figure 20-7.

Figure 20-7. *You can use the Crop tool to focus on one part of a picture or introduce a dramatic new shape.*

The Healing tool is great for removing small blemishes, not just on people, but also dust from an unclean lens or scratches on an old scanned photo. Start by using the Zoom tool to close in on the area. If the blemish is small, you might need to go in quite close. Then try to find an area of the image that is clear and from which you can copy. Ctrl-click that area. Then click and draw over the blemish. The crosshair indicates the area from which you're copying.

Sharpening

One handy trick that can improve your photos, when used with care, is to use the Sharpen filter. This has the effect of adding definition to the image and reducing any slight blur caused by camera shake or poor focusing. To apply the Sharpen filter, right-click the image and select Filters ➤ Enhance ➤ Sharpen.

As shown in Figure 20-8, a small preview window will show the effect of the sharpening on the image (you might need to use the scrollbars to move to an appropriate part of the image, or resize the preview by clicking and dragging the bottom-right corner). Clicking and dragging the slider at the bottom of the dialog box will alter the severity of the sharpening effect. Too much sharpening can ruin a picture, so be careful. Try to use the effect subtly.

Figure 20-8. *Sharpening an image can give it better definition, but keep checking the preview.*

The Sharpen filter is just one of many filters you can apply in GIMP, as explained in the next section.

Applying Filters

To take you beyond basic editing, GIMP includes a selection of filters that can add dramatic effects to your images. Filters are applied either to the currently selected layer or to a selection within the layer. To apply a filter, right-click the image and choose the relevant menu option. If you don't like an effect you've applied, you can reverse it by choosing Edit ➤ Undo, or by pressing Ctrl+Z.

The submenus offer filters grouped by categories, as follows:

Blur: These filters add various kinds of blur to the image or selection. For example, Motion Blur can imitate the effect of photographing an object moving at speed with a slow shutter. Perhaps the most popular blur option is Gaussian Blur, which has the effect of applying a soft and subtle blur and is great for creating drop shadows.

Enhance: The Enhance effects are designed to remove various artifacts from an image or otherwise improve it. For example, the Despeckle effect will attempt to remove unwanted noise within an image (such as flecks of dust in a scanned image). The Sharpen filter discussed in the previous section is located here, as is Unsharp Mask, which offers a high degree of control over the image-sharpening process.

Distort: As the name of this category of filters suggests, the effects available distort the image in various ways. For example, Whirl and Pinch allow you to tug and push the image to distort it (to understand what is meant here, imagine printing the image on rubber and then pinching or pushing the surface). This category also contains other special effects, such as Pagecurl, which imitates the curl of a page at one corner of the picture.

Light and Shadow: Here you will find filters that imitate the effects that light and shadow can have on a picture, such as adding sparkle effects to highlights or imitating the lens flare caused by a camera's lens.

Noise: This collection of filters is designed to add speckles or other types of artifacts to an image. These filters are offered within GIMP for their potential artistic effects, but they can also be used to create a grainy film effect—simply click Scatter RGB—or white noise.

Edge-Detect: This set of filters can be used to automatically detect and delineate the edges of objects within an image. Although this type of filter can result in some interesting results that might fall into the category of special effects, it's primarily used in conjunction with other tools and effects.

Generic: In this category, you can find a handful of filters that don't seem to fall into any other category. Of particular interest is the Convolution Matrix option, which lets you create your own filters by inputting numeric values. According to GIMP's programmers, this is designed primarily for mathematicians, but it can also be used by others to create random special effects. Simply input values and then preview the effect.

Combine: Here you'll find filters that combine two or more images into one.

Artistic: These filters allow you to add paint effects to the image, such as making it appear as if the photo has been painted in impressionistic brushstrokes or painted on canvas. Figure 20-9 shows an example of applying the Oilify filter for an oil painting effect.

Decor: This section has some interesting rendered effects such as coffee stains, bevels, and outlines that can be applied to images or layers.

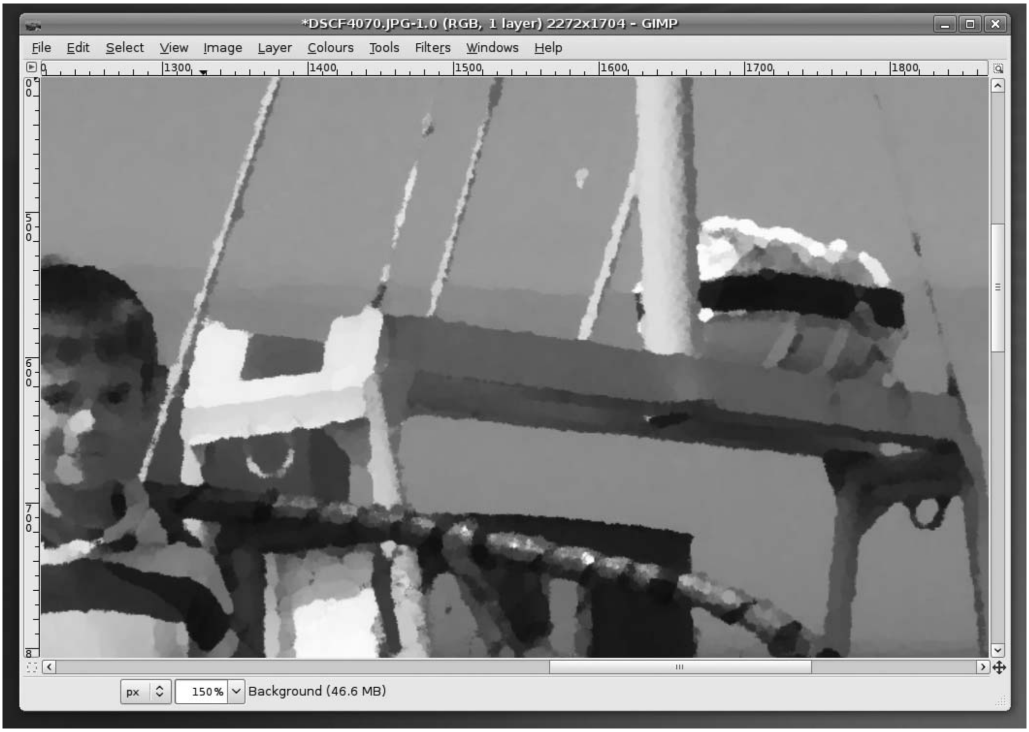

Figure 20-9. *The Artistic effects can be used to give images an oil painting effect.*

Map: These filters aim to manipulate the image by treating it like a piece of paper that can be folded in various ways and stuck onto 3D shapes (a process referred to as *mapping*). Because the image is treated as if it were a piece of paper, it can also be copied, and the copies placed on top of each other to create various effects.

Render: Here you'll find filters designed to create new images from scratch, such as clouds or flame effects. Most of the options here will completely cover the underlying image with their effect, but others, such as Difference Clouds, use the base image as part of its source material.

Web: Here you can create an image map for use in a web page. An *image map* is a single image broken up into separate hyperlinked areas, typically used on a web page as a sophisticated menu. For example, an image map is frequently used for a geographical map on which you can click to get more information about different regions. There's also a useful Slice tool, which can be used to break up a large image into smaller parts for display on a web page.

Animation: These filters aim to manipulate and optimize GIF images, which are commonly used to create simple animated images for use on web sites.

Alpha to Logo: These filters are typically used to create special effects for text. They are quite specialized and require an in-depth knowledge of how GIMP works, particularly the use of alpha channels.

■ **Tip** If you like GIMP, you might be interested in *Beginning GIMP: From Novice to Professional, Second Edition* by Akkana Peck (Apress, 2009). This book offers a comprehensive, contemporary, and highly readable guide to this software.

GIMPSHOP

GIMP is one of the most powerful programs available for Linux, but not everyone is enamored of its user interface. A bone of contention for some is that GIMP uses almost completely different terminology from that used by Adobe Photoshop.

One developer became so annoyed by this that he created a new version of GIMP called GIMPshop (`www.gimpshop.com`). This is ostensibly exactly the same as the GIMP program, but the names of the tools have been changed to match those of Photoshop (or the simpler Photoshop Elements program). In a similar way, many of the GIMP's right-click menu entries have also been changed so that they're identical to Photoshop's menu options.

The freedom to adapt programs in this way is one of the benefits of open source software. The ability to take program code and create your own version is the foundation of Linux.

GIMPshop isn't available via the Synaptic Package Manager, but the Linux version offered for download at the GIMPshop web site can be installed under Ubuntu. After you've downloaded the package, see Chapter 29 to learn how software installation works under Ubuntu.

A second Photoshop-like fork of the software is called GimPhoto (`/www.gimphoto.com`), but it is based on an older version of the software.

Summary

In this chapter, you've taken a look at working with images under Ubuntu. First you looked at the F-Spot photo manager tool. F-Spot lets you easily import pictures, catalog them, and make some adjustments. Then you learned how to edit your images by using GIMP, one of the best programs available for the task under any operating system.

As with most areas, we could have selected many more applications to cover such as Google's Picasa, digiKam, and gphoto2, but F-Spot and GIMP provide perfect tools for both users and uses across the spectrum.

In the next part of the book, we move on from multimedia to look at another core component of Ubuntu: the OpenOffice.org suite, which provides word processing, spreadsheet, presentation, and other functions.

PART 6

Office Tasks

CHAPTER 21

Making the Move to OpenOffice.org

You might be willing to believe that you can get a complete operating system for no cost. You might even be able to accept that this offers everything Windows does and much more. But one stumbling block many people have is in believing that a Microsoft Office–compatible office suite comes as part of the zero-cost bundle. It's a step too far. Office costs hundreds of dollars—are they expecting us to believe that there's a rival product that is free?

Well, there is, and it's called OpenOffice.org. It comes preinstalled with Ubuntu, as well as most other Linux distributions, making it the Linux office suite of choice. It's compatible with most Microsoft Office files too, and even looks similar and works in a comparable way to previous "classic" releases of Office (that is, those prior to Office 2007), making it easy to learn. What more could you want?

Office Similarities

OpenOffice.org started life as a proprietary product called StarOffice, created by a German company called StarDivision. Sun Microsystems subsequently bought StarDivision and released the source code of StarOffice in order to encourage community development. This led to the creation of the OpenOffice.org project, a collaboration between open source developers and Sun. This project has released several new versions of OpenOffice.org, and at the time of this writing, the current version is 3. This is the version supplied with Ubuntu.

Note For what it's worth, Sun still sells StarOffice. This is based on the OpenOffice.org code, so it's effectively the same program. However, in addition to the office suite itself, Sun includes several useful extras such as fonts, templates, and the all-important technical support, which you can contact if you get stuck trying to undertake a particular task.

OpenOffice.org features a word processor, spreadsheet program, presentation package, drawing tool (vector graphics), web site creation tool, database program, and several extras. As such, it matches Microsoft Office almost blow-by-blow in terms of core functionality. See Table 21-1 for a comparison of core packages.

Table 21-1. *How the Office and OpenOffice.org Suites Compare*

Microsoft Office	OpenOffice.org	Function
Word	Writer	Word processor
Excel	Calc	Spreadsheet
PowerPoint	Impress	Presentations
Visio	Draw[a]	Technical drawing/charting
FrontPage	Writer[b]	Web site creation
Access	Base[c]	Database

[a] *Draw is a vector graphics creation tool akin to Adobe Illustrator. Creating flowcharts or organizational diagrams is one of many things it can do. It is found on the Applications ➤ Graphics menu.*

[b] *Writer is used for word processing and HTML creation; when switched to Web mode, its functionality is altered appropriately.*

[c] *Writer and Calc can be coupled to a third-party database application such as MySQL or Firebird; however, OpenOffice.org also comes with the Base relational database. This must be installed separately—see Chapter 26.*

You should find that the functionality within the packages is duplicated too, although some of the very specific features of Microsoft Office are not in OpenOffice.org. But OpenOffice.org also has its own range of such tools not yet found in Microsoft Office!

■ **Tip** One extremely useful feature provided with OpenOffice.org, but still missing from Office 2007, is the ability to output high-quality PDF files.

OpenOffice.org does have a couple of notable omissions. Perhaps the main one is that it doesn't offer a directly comparable Outlook replacement. However, as we discuss in Chapter 27, the Evolution application offers a highly capable reproduction of Outlook, with e-mail, contacts management, and calendar functions all in one location. In Ubuntu, you'll find Evolution on the Applications ➤ Internet menu. Evolution isn't directly linked to OpenOffice.org (although it's possible to share some Evolution contacts data with OpenOffice.org applications), but it retains the overall Ubuntu look, feel, and way of operating.

OpenOffice.org Key Features

Key features of OpenOffice.org include the ability to export documents in Portable Document Format (PDF) across the entire suite of programs. PDF files can then be read on any computer equipped with PDF display software, such as Adobe Acrobat Reader.

In addition, OpenOffice.org features powerful accessibility features that can, for example, help those with vision disabilities use the programs more effectively. For those who are technically minded, OpenOffice.org can be extended very easily with a variety of plug-ins (see `http://extensions.services.openoffice.org`), which allow the easy creation of add-ons using many different programming languages.

Although OpenOffice.org largely mirrors the look and feel of Microsoft Office releases prior to the 2007 version (that is, those releases of Office prior to the major interface overhaul that's found in Office 2007), it adds its own flourishes here and there. This can mean that some functions are located on different menus, for example. However, none of this poses a challenge for most users, and OpenOffice.org is generally regarded as easy to learn.

■ **Note** Studies carried out by Sun Microsystems, the corporate sponsor of OpenOffice.org, have shown that it's easier for people to switch to OpenOffice.org from an older version of Office than it is for them to move to Office 2007, which introduces radical interface changes. For more information and to learn more about similar studies, see `www.openoffice.org/product/studies.html`.

File Compatibility

In addition to providing core feature compatibility, OpenOffice.org is able to read files from Microsoft Office versions up to and including Office 2003. Additionally, it can import documents in Office 2007 format (that is, `.docx`, `.xlsx`, and `.pptx` files). Currently, OpenOffice.org's support for Office 2007 files can be a little patchy, and often the results are less than perfect. However, improvements are being made all the time, and this is just one more reason why you should update Ubuntu frequently to ensure that you have the latest versions of the OpenOffice.org software.

■ **Note** A lack of complete compatibility with Office 2007 file formats isn't a big issue—it's fair to say that many people still use the older Office file formats, even if they're using the latest version of Office. This is done to retain compatibility with other users who may not yet have upgraded.

Although file compatibility problems are rare for most simple to moderately complex documents, two issues occasionally crop up when opening Microsoft Office files in OpenOffice.org:

VBA compatibility: OpenOffice.org has partial support for Microsoft Office Visual Basic for Applications (VBA) macros, although work is being undertaken to strengthen this aspect. OpenOffice.org uses a similar but incompatible internal programming language. Such macros are typically used in Excel spreadsheets designed to calculate time sheets, for example. Unfortunately, you won't know whether your VBA macros will work until you give them a try in OpenOffice.org, although the macros will be preserved within the document no matter what (provided you continue to save in the original Microsoft Office format and don't, for example, save the document in an OpenOffice.org file format instead).

■**Note** If compatibility with VBA macros is a deal breaker for you, and you've yet to install Ubuntu, why not try your documents containing VBA macros in the Windows version of OpenOffice.org? This will enable you to see how well they work in advance. You can download the Windows version from `www.openoffice.org`.

Document protection: OpenOffice.org is unable to open any Office files that have a password, either to protect the document from changes or to protect it from being viewed. Theoretically, it would be easy for OpenOffice.org's programmers to include such functionality, but the laws of many countries make creating such a program feature illegal (it would be seen as a device to overcome copy protection). The easiest solution is to ask whoever sent you the file to remove the password protection. For what it's worth, OpenOffice.org has its own form of password protection.

If you find that OpenOffice.org isn't able to open an Office file saved by your colleagues, you can always suggest that they, too, make the switch to OpenOffice.org. They don't need to be running Ubuntu to do so. Versions are available to run on all Windows platforms, as well as on the Apple Macintosh, and are available from `www.openoffice.org`.

■**Note** Two versions of OpenOffice.org are available for Mac OS X: the standard release, which at the time of this writing is still rather new and not fully tested, and NeoOffice, which has been adapted to run natively within Mac OS X. For more details, see `www.neooffice.org`.

As with the Ubuntu version, versions of OpenOffice.org available for other operating systems are entirely free of charge. Indeed, for many people who are running versions of Office they've installed from "borrowed" CDs, OpenOffice.org offers a way to come clean and avoid pirating software. For more details and to download OpenOffice.org, visit `www.openoffice.org`.

After your colleagues have made the switch, you can exchange files using OpenOffice.org's native format, or opt to save files in the Microsoft Office file formats (`.doc`, `.xls`, `.ppt`, and so on). Figure 21-1 shows the file type options available in OpenOffice.org's word processor component's Save As dialog box.

Note OpenOffice.org also supports Rich Text Format (RTF) text documents and comma-separated value (CSV) data files, which are supported by practically every office suite program ever made.

When it comes to sharing files, there's another option: save your files in a non-Office format such as PDF or HTML. OpenOffice.org is able to export documents in both formats, and most modern PCs equipped with Adobe Acrobat or a simple web browser will be able to read them. However, although OpenOffice.org can open and edit HTML files, it can export documents only as PDF files, so this format is best reserved for files not intended for further editing.

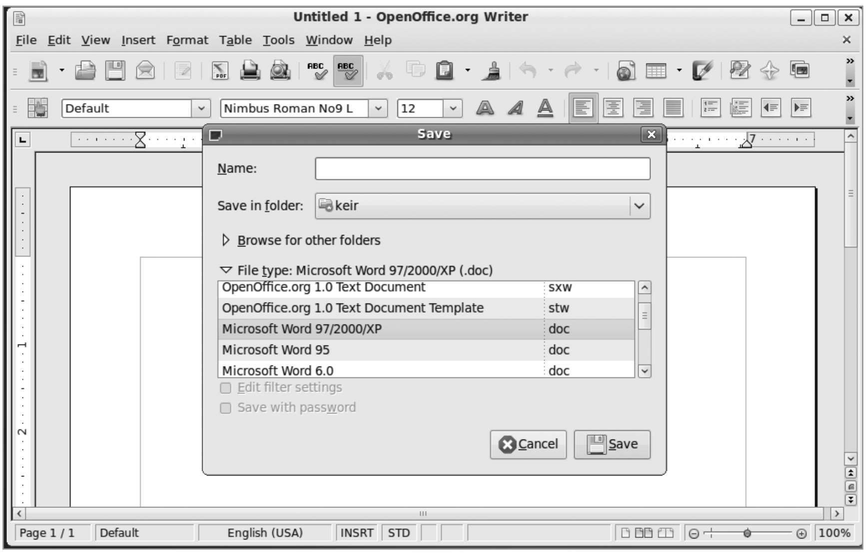

Figure 21-1. *All the OpenOffice.org components are compatible with Microsoft Office file formats.*

OPEN DOCUMENT FORMAT

One of the principles behind all open source software is the idea of open file formats. This means that if someone creates a new open source word processor, that person also makes sure that the technology behind the file format is explained, so that other people can adapt their programs to read or save in that file format.

To meet the goals of open source software, the OASIS OpenDocument Format (ODF) was created, and this is utilized in OpenOffice.org 3. This is a completely open and free-to-use office document file format that all software suites can adopt. The idea is that ODF will make swapping files between all office suites easy.

Sadly, Microsoft has decided not to support ODF and is sticking with its own proprietary file formats, although it has recently opened up the file formats and made a promise not to sue anybody who implements them in non-Microsoft software.

However, several local governments in countries all around the world have adopted ODF, and there's little doubt that ODF will become one of the main ways of disseminating and sharing documents online.

The Right Fonts

One key to compatibility with the majority of Microsoft Office files is ensuring that you have the correct fonts. This is an issue even when using Windows. It's common to open an Office document and find the formatting incorrect because you don't have the fonts used in the construction of the document.

Although most Windows systems have many fonts, most people tend to rely on a handful of core fonts, which are defaults on most Windows installations: Arial, Tahoma, Verdana, Trebuchet MS, and Times New Roman. (MS Comic Sans might also be included in that list, although it isn't often used within business documents.)

You can obtain these fonts and install them on your Ubuntu system in several ways. Here we cover two methods: copying your fonts from Windows, and installing Microsoft's TrueType core fonts. The latter method is by far the easier way of undertaking this task.

■ **Tip** As an alternative to installing Microsoft fonts, you might install the Liberation fonts. These are open source fonts designed to be metrically identical to Arial, Times New Roman, and Courier. In other words, in theory at least, the letter *A* in one of the aforementioned Microsoft fonts should be the same size (and therefore display the same onscreen and when printed) as the letter *A* in the matching Liberation font. You can install the Liberation fonts by installing the `ttf-liberation` package. To learn about package installation, see Chapter 28.

Copying Windows Fonts

If you dual-boot Ubuntu with Windows, you can delve into your Windows partition's font folder and copy every font you have available under Windows. This method is useful if you wish to copy *all* the fonts you use under Windows, such as those installed by third-party applications. If you wish to get just Arial and Times New Roman, you might want to skip ahead to the next section.

■ **Caution** Installing Windows fonts under Ubuntu is a legally gray area. Technically speaking, there's no reason why you shouldn't be able to use the fonts under Ubuntu. Purchasing Windows as well as any software running on it should also mean you purchased a license to use the fonts, and there's no restriction on how or where you use them. But the situation is far from clear. You'd be well-advised to read the Windows End-User License Agreement (EULA) for more guidance. This can usually be found in the packaging for your computer.

To copy your Windows fonts, follow these steps:

1. Click the entry on the Places menu for your Windows partition, so it is mounted and its icon appears on the desktop.
2. Click Applications ➤ Accessories ➤ Terminal. In the window that appears, type the following:

   ```
   mkdir .fonts;nautilus /media/disk/;nautilus .fonts
   ```

   This will cause two Nautilus file-browsing windows to appear: one displaying the directories in your Windows partition and the other displaying your personal fonts folder (the first command in the preceding line creates this folder).
3. In the Nautilus window displaying the Windows directories, navigate to your Windows fonts folder. The location of this varies depending on which version of Windows you're using. On our Windows Vista test computer, it was located in the `Windows/Fonts` directory, but on our Windows XP Home test machine, it was located in the `WINDOWS/Fonts` directory. Remember that case sensitivity is important under Ubuntu!
4. Still in the window displaying your Windows font directory, click View ➤ List, and then click the Type column header in the window so that the list is sorted according to file extensions. Scroll down to the list of TrueType fonts and select them all. This can be done by clicking the first, holding down Shift, and then clicking the last.

5. Click and drag all the TrueType fonts to the Nautilus window displaying your personal font directory. The fonts will be copied across and installed automatically. In some of our tests, this happened instantly, and there was no indication (such as a dialog box) that copying had happened.

6. Close any open program windows and start them again. You should find that your Windows fonts are now available.

Installing TrueType Core Fonts

If you don't want to undertake the font-copying maneuver, you can download and install Microsoft's TrueType core fonts. This package contains common Windows fonts, including Arial and Times New Roman.

■ **Note** These fonts were made legally available by Microsoft in 1996 for use under any operating system—for more details, see `http://en.wikipedia.org/wiki/Core_fonts_for_the_Web`.

Here's how it's done (note that these instructions assume that your computer is online; if it isn't, see Chapter 8 to learn how to do so):

1. Click System ➤ Administration ➤ Synaptic Package Manager. Enter your password to continue.

2. When the program window appears, click the Reload button at the top left of the window.

3. In the Quick Search text field at the top of the program window, type `msttcorefonts`. Click the check box alongside the entry in the results list, and select Mark for Installation. You'll be warned that an additional program needs to be installed; this is fine. Then click Apply on the main toolbar to install the fonts.

4. Close all program windows, click System ➤ Quit, and opt to log out of the system. Then log back in again. You should now find that the Windows fonts are available in all applications, including OpenOffice.org, as shown in Figure 21-2.

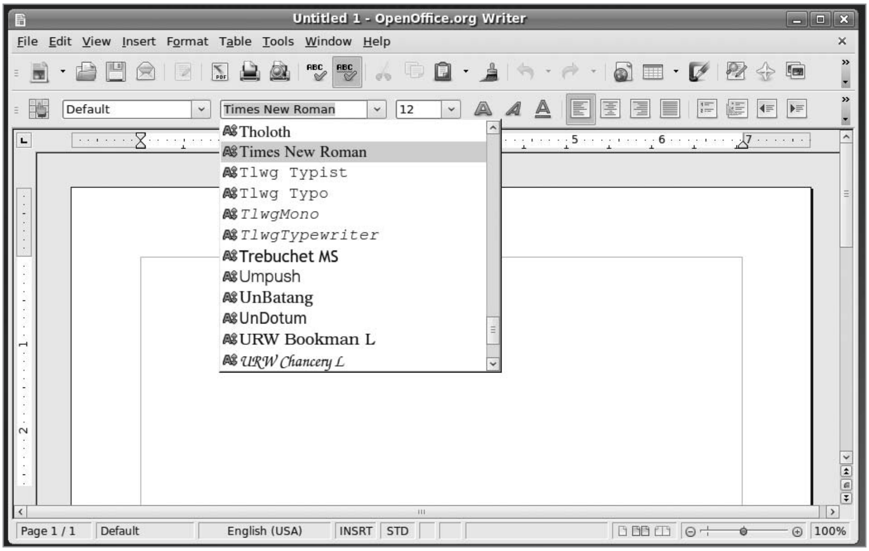

Figure 21-2. *Vital Microsoft fonts are just a download away, courtesy of the Synaptic Package Manager.*

OTHER LINUX OFFICE SOFTWARE

OpenOffice.org is widely regarded as one of the best Linux office suites, but it's not the only one. Its main competitor is KOffice. KOffice tightly integrates into the KDE desktop and mirrors much of its look and feel. It includes a word processor, spreadsheet, presentation package, flowcharting tool, database-access tool, graphical tools, and much more. As with OpenOffice.org, in most cases, you can load and save Microsoft Office files. For more details, see the KOffice home page at `www.koffice.org`. It's available with Ubuntu too. Just use the Synaptic Package Manager to search for and install it.

In addition, there are several open source office applications that aren't complete office suites. For example, AbiWord is considered an excellent word processor, which packs in a lot of features but keeps the user interface simple. It's partnered by Gnumeric, a spreadsheet application that is developed separately (although both aim to be integrated into the GNOME desktop environment). For more details, see `www.abisource.com` and `www.gnome.org/projects/gnumeric/`, respectively. You can also find both of these programs in the Ubuntu software repositories (use the Synaptic Package Manager to search for them).

Summary

This chapter was a general introduction to OpenOffice.org, providing an overview of what you can expect from the programs within the suite. In particular, we focused on the extent of the suite's similarities with Microsoft Office and discussed issues surrounding file compatibility with Microsoft Office. We also looked at how Windows fonts can be brought into Ubuntu, which aids in successfully importing and creating compatible documents.

In the next chapter, you'll learn about the configuration options globally applicable to the suite, as well as common functions provided across all the programs.

CHAPTER 22

OpenOffice.org Overview

All the programs in the OpenOffice.org suite rely on a common interface, and therefore look and operate in a similar way. They are also configured in an identical way, and all rely on central concepts such as wizards, which guide you through the creation of particular types of documents. In addition, many components within the suite are shared across the various programs. For example, the automatic chart creation tool within Calc can also be used within Writer.

In this chapter, you'll look at the OpenOffice.org suite as a whole as we explain how it's used and configured. In the following chapters, you'll examine some specific programs in the suite.

Introducing the Interface

If you've ever used an office suite, such as Microsoft Office, you shouldn't find it too hard to get around in OpenOffice.org. As with Microsoft Office, OpenOffice.org relies primarily on toolbars, a main menu, and separate context-sensitive menus that appear when you right-click. In addition, OpenOffice.org provides floating palettes that offer quick access to useful functions, such as paragraph styles within Writer.

Figure 22-1 provides a quick guide to the OpenOffice.org interface, showing the following components:

- **Menu bar**: The menus provide access to most of the OpenOffice.org functions.
- **Standard toolbar**: This toolbar provides quick access to global operations, such as saving, opening, and printing files, as well as key functions within the program being used. The Standard toolbar appears in all OpenOffice.org programs and also provides a way to activate the various floating palettes, such as the Navigator, which lets you easily move around various elements within the document.
- **Formatting toolbar**: As its name suggests, this toolbar offers quick access to text-formatting functions, similar to the type of toolbar used in Microsoft Office applications. Clicking the bold icon will boldface any selected text, for example. This toolbar appears in Calc, Writer, and Impress.

- **Ruler:** The ruler lets you set tabs and alter margins and indents (within programs that use rulers).

- **Status bar:** The status bar shows various aspects of the configuration, such as whether Insert or Overtype mode is in use. The information and options offered vary depending on which application is in use. Within Writer, for example, a slider to the right of the status bar allows the quick changing of the document's zoom level. If using Calc, you'll see a Sum area that shows the numeric total of any selected cells.

- **Document area:** This is the main editing area.

Most of the programs rely on the Standard and Formatting toolbars to provide access to their functions, and some programs have additional toolbars. For example, applications such as Impress (a presentation program) and Draw (for drawing vector graphics) have the Drawing toolbar, which provides quick access to tools for drawing shapes, adding lines, and creating fills (the blocks of color within shapes).

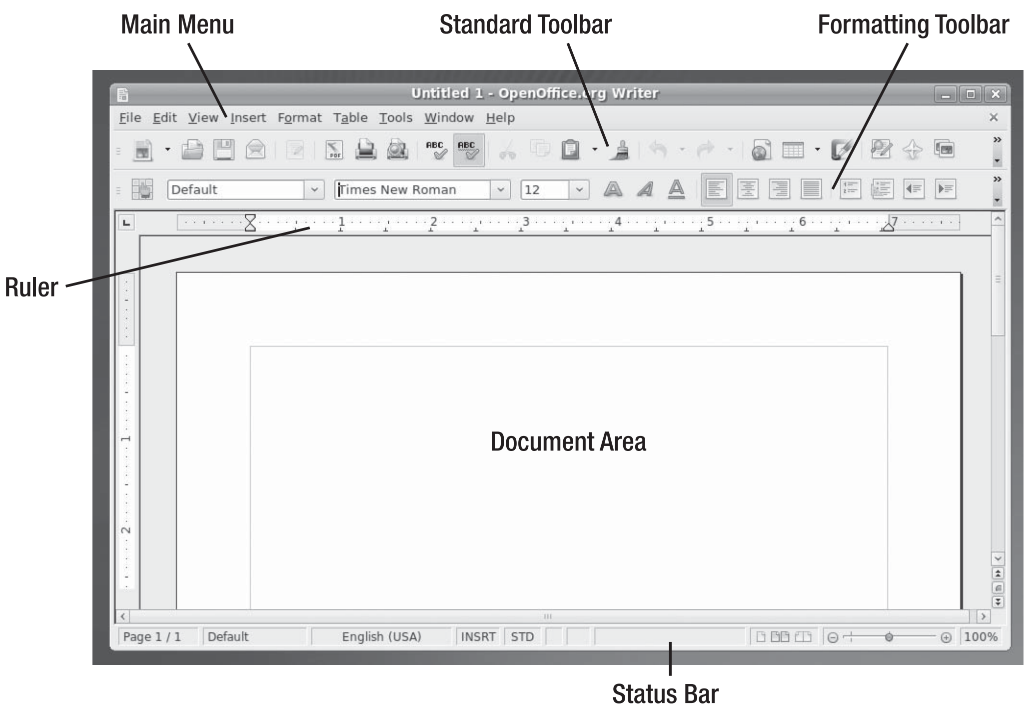

Figure 22-1. *The OpenOffice.org interface has several components.*

Customizing the Interface

You can select which toolbars are visible on your screen, as well as customize those that are already there. You can also add new toolbars and customize the OpenOffice.org menus. The color scheme of OpenOffice.org can be altered to your tastes, and you can also alter various trivial elements of the interface, such as the size of the icons.

Adding Functions to Toolbars

The quickest way to add icons and functions to any toolbar is to click the two small arrows at the right of a toolbar and select the Visible Buttons entry on the menu that appears. This will present a list of currently visible icons and functions, along with those that might prove useful on that toolbar but are currently hidden. Any option already visible will have a check next to it.

Additionally, you can add practically any function to a toolbar, including the options from the main menus and many more than those that are ordinarily visible. Here are the steps:

1. Click the small down arrow to the right of a toolbar and select the Customize Toolbar option.

2. In the Customize dialog box, click the Add button in the Toolbar Content section to open the Add Commands dialog box, as shown in Figure 22-2.

3. Choose a category from the list on the left to see the available commands in the list on the right. The categories of functions are extremely comprehensive. For example, under the Format category, you'll find entries related to specific functions, such as increasing font sizes or setting a shadow effect behind text. Table 22-1 provides brief descriptions of each of the categories listed in the Add Commands dialog box.

4. Select the function you want to add on the right side of the Add Commands dialog box and then click the Add button.

5. After you've finished making your choices, click the Close button. You'll then see your new function in the list of icons in the Customize dialog box, under the Toolbar Content heading. The last new icon you chose will be automatically selected.

6. Click and drag up or down in the list to move the new function left or right on the toolbar itself (you'll see the toolbar update when you release the mouse button). Alternatively, you can highlight the icon and click the up and down arrows next to the list. To temporarily hide the new icon, or any other icon, remove the check from alongside it.

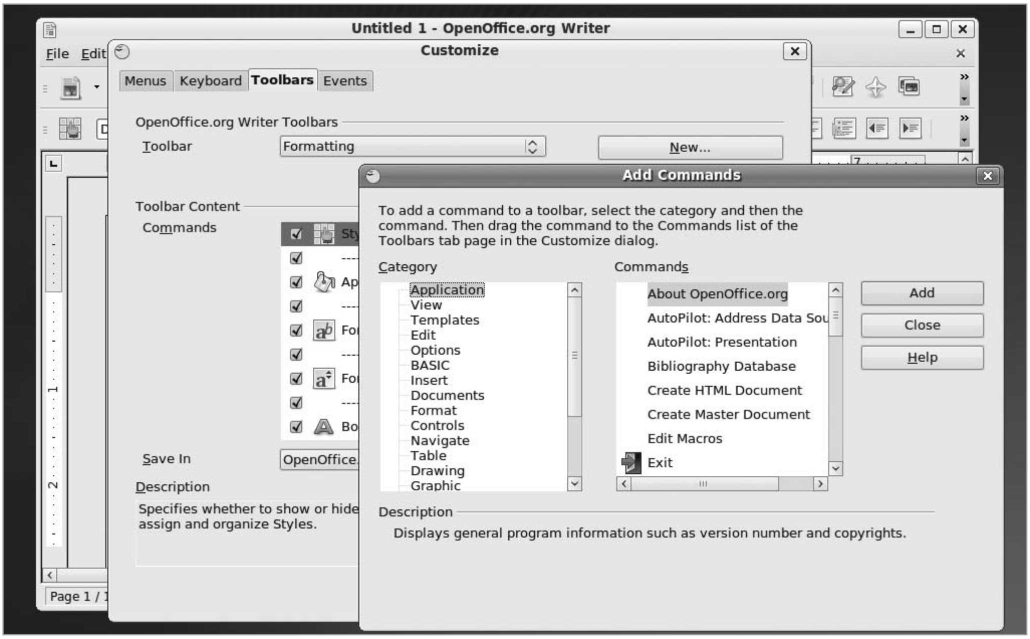

Figure 22-2. *Adding a new function to the toolbar is very easy within OpenOffice.org.*

Table 22-1. *OpenOffice.org Toolbar Customization Categories*

Category	Description
Application	These options relate to the specific OpenOffice.org application you're using. For example, if you select to customize a toolbar within Writer, the Application category menu will offer functions to start AutoPilots (effectively wizards) that will build word processor documents.
View	This category offers options related to the look and feel of the suite, such as which items are visible within the program interface.
Templates	In this category, you'll find options related to the creation and use of document templates.
Edit	This category contains options related to cutting, pasting, and copying items within the document, as well as updating elements within it.
Options	These are various options that relate to configuration choices in OpenOffice.org, allowing you to control how it works.
BASIC	Options under this category relate to the creation and playback of OpenOffice.org macros.
Insert	This category includes options related to inserting objects, such as sound, graphics, and elements from other OpenOffice.org documents.
Documents	This category provides options specific to document control, such as those related to exporting documents as PDF files or simply saving files.

Category	Description
Format	Here you'll find a range of options related largely to text formatting, but also some concerned with formatting other elements, such as drawings and images.
Controls	Under this heading, you'll find widgets that can be used in conjunction with formulas or macros, such as check boxes, buttons, text box creation tools, and so on.
Navigate	This category offers tools that let you move around a document quickly, such as the ability to quickly edit headers and footers, or move from the top of the page to the end very quickly.
Table	Here you'll find options related to the creation of tables.
Drawing	Here you'll find tools related to drawing objects, such as shapes and lines, and also tools for creating floating text boxes.
Graphic	This category presents options related to manipulating bitmap graphics that are inserted into the document.
Data	Here you'll find a couple of options related to working with information sources, such as databases.
Frame	These options relate to any frames inserted into the document, such as how elements within the frame are aligned and how text is wrapped around the frame.
Numbering	These are various options related to creating automatic numbered or bulleted lists.
Modify	These options relate to the drawing components within OpenOffice.org and let you manipulate images or drawings in various ways by applying filters.
OpenOffice.org BASIC Macros	Here you can select from various ready-made macros, which provide some of OpenOffice.org's functions. Any macros you create will also be listed here.

Many functions that can be added are automatically given a relevant toolbar icon, but you can choose another icon for a function by selecting the icon in the list in the Customize dialog box, clicking Modify, and then selecting Change Icon. You can also use this method to change an icon that already appears on a toolbar.

■ Note To delete an icon from a toolbar, click the two small arrows to the right of a toolbar and then select the Customize Toolbar option. Select the icon you want to remove, click the Modify button, and choose to delete it.

Adding a New Toolbar

If you want to add your own new toolbar to offer particular functions, you'll find it easy to do. Here are the steps:

1. Click the small down arrow to the right of any toolbar and select Customize Toolbar from the list of options. Don't worry—you're not actually going to customize that particular toolbar!
2. In the Customize dialog box, click the New button at the top right.
3. Give the toolbar a name. To make the toolbar permanent, keep the default entry in the Save In field, which should read OpenOffice.org. To have the toolbar "attach" to the currently open document, so it appears only when that document is opened, select the document's name in the Save In field. Note that this is effective only if documents are saved in native OpenOffice.org file formats.
4. Populate the new toolbar, following the instructions in the previous section.
5. After you've finished, click the OK button.

You should see your new toolbar either beneath or to the right of the main toolbars. If it is located to the right, you may have to click and drag its move handle at the left of the toolbar to reposition it so that all its features are visible. To hide the toolbar in the future, click View ➤ Toolbars, and then remove the check alongside the name of your toolbar.

Customizing Menus

You can also customize the OpenOffice.org menus. Here are the steps:

1. Choose Tools ➤ Customize from the menu bar.
2. In the Customize dialog box, select the Menus tab at the top left.
3. Choose which menu you wish to customize from the Menu drop-down list. Submenus are indicated by using a pipe symbol (|). File | Send indicates the Send submenu, located off the File menu, for example.
4. Select the position where you wish the new function to appear on the menu, by selecting an entry in the Menu Content Entries list, and then click the Add button.
5. Add commands to the menu, as described earlier in the "Adding Functions to Toolbars" section.

The up and down arrows in the Customize dialog box enable you to alter the position of entries on the menu. You could move those items you use frequently to the top of the menu, for example.

You can remove an existing menu item by highlighting it in the Customize dialog box, clicking the Modify button, and then clicking Delete.

If you make a mistake, simply click the Reset button at the bottom right of the Customize dialog box to return the menus to their default state.

Personalizing the Look and Feel

You can alter the color scheme used in OpenOffice.org by clicking Tools ➤ Options, and then clicking the Appearance entry under the OpenOffice.org heading on the left of the dialog box that appears. Each of the programs in the OpenOffice.org suite has its own heading in the Custom Colors list. To alter a particular color setting, click the drop-down alongside that particular entry under the Color Settings heading.

To alter how toolbars appear (that is, the size of the icons), click the View option under the OpenOffice.org heading. This preference panel also lets you set the default zoom level under the Scaling heading when starting new documents. You can also deactivate Font Antialiasing, which can help make some fonts look truer to life compared to printed output, although this option is one of personal preference.

Configuring OpenOffice.org Options

In addition to the wealth of customization options, OpenOffice.org offers a range of configuration options that enable you to make it work exactly how you wish (although it should be pointed out that the default configuration is fine for most users). Within an OpenOffice.org program, choose Tools ➤ Options from the menu to open the Options dialog box, as shown in Figure 22-3.

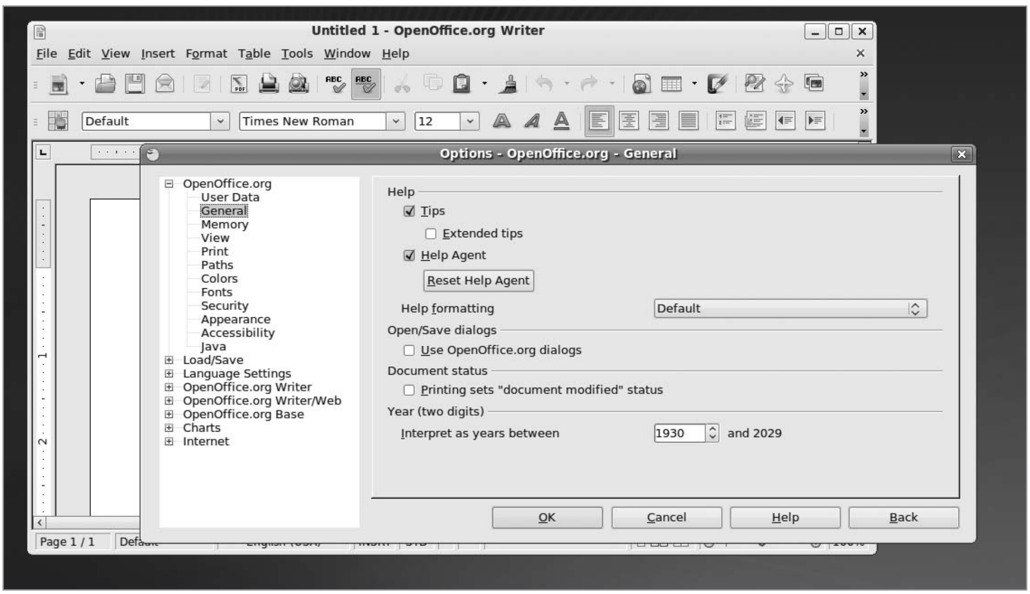

Figure 22-3. *OpenOffice.org's main configuration options are accessed by choosing Tools ➤ Options.*

Most of the configuration options offered within each program apply across the suite, but some settings are specific to each program, in which case you'll find them listed under their own heading on the left of the dialog box.

A variety of options are offered, enabling you to tweak everything from the default file format to the colors used by default within the software. Table 22-2 briefly describes each of the OpenOffice.org configuration options.

Table 22-2. *OpenOffice.org Configuration Options*

Option	Description
OpenOffice.org	
User Data	This is the personal data that will be added to the documents you create. You can leave this area blank if you wish.
General	This offers a handful of miscellaneous options, such as how to handle two-digit dates, when the help system should step in to offer tips, how the help system should be formatted (such as in high resolution for people with vision problems), and whether printing a document is interpreted by OpenOffice.org as modifying it.
Memory	This entry relates to how much system memory OpenOffice.org can use. You can limit the number of undo steps, for example, and alter the cache memory used for holding graphical objects.
View	Here you can alter the look, feel, and operation of OpenOffice.org. You can define whether the middle mouse button performs a paste operation (which is consistent with how Ubuntu works), or whether it should perform a scrolling function, as with Windows. You can also alter elements such as whether icons appear in menus and if fonts are previewed in the toolbar menu.
Print	This option lets you adjust how printing is handled within OpenOffice.org. The functions relate to those that can stop documents from printing incorrectly, such as reducing any transparency effects within the documents so on-page elements don't appear faint or completely disappear in the final output. (Note that specific print functions are handled within the Print dialog box when you actually print a document.)
Paths	This is where the file paths for user-configured and vital system tools are handled. Generally, there's little reason to edit this list, although you might choose to alter the default location where your documents are saved (simply double-click the My Documents entry to do this).
Colors	Here you can define the default color palette that appears in the various programs in the suite.
Fonts	By creating entries here, you can automatically substitute fonts within documents you open for others on your system. If you don't have the Microsoft core fonts installed, this might prove useful. For example, you might choose to substitute Arial, commonly used in Microsoft Office documents, for Luxi Sans, one of the sans serif fonts used under Ubuntu.
Security	This option controls which types of functions can be run within OpenOffice.org. For example, you can choose whether macros created by third parties should be run when you open a new document.

Option	Description
Appearance	Here you can alter the color scheme used within OpenOffice.org, in a similar way to how you can alter the default Ubuntu desktop color scheme. Individual elements within documents and pages can be modified too.
Accessibility	This option relates to features that might help people with vision disabilities to use OpenOffice.org. For example, you can define whether animated graphics are shown on the screen.
Java	This option lets you control whether you use the Java Runtime Environment, which may be necessary to use some of OpenOffice.org's features. However, deactivating this function can cause OpenOffice.org to run more quickly.
Load/Save	
General	Options here relate to how files are saved. You can select whether the default is to save in OpenOffice.org or Microsoft Office format. Choosing the latter is useful if you share a lot of documents with colleagues who are not running OpenOffice.org.
VBA Properties	This option relates to how Visual Basic for Applications (VBA) code is handled when Microsoft Office documents are opened. In particular, it ensures that the code isn't lost when the file is saved again.
Microsoft Office	This option provides functions specifically needed to convert or open Microsoft Office files within OpenOffice.org.
HTML Compatibility	Here you can set options that affect the compatibility of HTML files saved within OpenOffice.org.
Language Settings	
Languages	Here you can set your local language so that documents are spell-checked correctly. In addition, Asian language support can be activated, which allows for more-complex document layout options.
Writing Aids	Under this option, you can activate or deactivate various plug-ins designed to help format documents, such as the hyphenator or the spell-checking component. In addition, you can alter how the spell checker works, such as whether it ignores capitalized words.
OpenOffice.org Writer	
General	Here you can alter various options related to the editing of word processor documents, such as which measurements are used on the ruler (centimeters, inches, picas, and so on).
View	Under this option, you can configure the look and feel of the Writer program, such as which scrollbars are visible by default. You can also turn off the display of various page elements, such as tables and graphics.
Formatting Aids	This option lets you choose which symbols appear for "invisible" elements (such as the carriage return symbol or a dot symbol to indicate where spaces have been inserted) in Writer.
Grid	This controls whether page elements will snap to an invisible grid. You can also define the dimensions and spacing of the grid cells here.

Continued

Table 22-2. *Continued*

Option	Description
Basic Fonts (Western)	This controls which fonts are used by default in the various text styles, such as for the default text and within lists.
Print	This option offers control over printing options specific to Writer, such as which page elements are printed (you might choose to turn off the printing of graphics, for example).
Tables	Here you can control how tables are created and how you interact with them within Writer. For example, you can control what happens when a table is resized, such as whether the entire table responds to the changes or merely the cell you're resizing.
Changes	This option lets you define how changes are displayed when the Track Changes function is activated.
Compatibility	Here you can set specifics of how Writer handles the import and export of Microsoft Word documents.
AutoCaption	This offers settings for the AutoCaption feature within Writer.
Mail Merge E-mail	This option lets you control the sending of e-mail mail-merge messages.
OpenOffice.org Writer/Web	
View	Here you can control the HTML editor component of OpenOffice.org (effectively an extension of Writer). You can control the look and feel of the HTML editor, including which elements are displayed on the screen.
Formatting Aids	As with the similar entry for Writer under Text Document, this option lets you view symbols in place of usually hidden text elements.
Grid	This lets you define a grid that onscreen elements are able to snap to in order to aid accurate positioning.
Print	Here you can define how HTML documents created within OpenOffice.org are printed.
Table	Similar to the Tables entry under Text Document, this controls how tables are created and handled within HTML documents.
Background	This lets you set the default background color for HTML documents.
OpenOffice.org Calc	
General	Here you can modify miscellaneous options related to Calc, such as which measurement units are used within the program and how the formatting of cells is changed when new data is input.
View	This option relates to the look and feel of Calc, such as the color of the grid lines between cells and which elements are displayed on the screen. For example, you can configure whether zero values are displayed, and whether overflow text within cells is shown or simply truncated at the cell boundary.
Calculate	This option relates to how numbers are handled during certain types of formula calculations, such as those involving dates.
Sort Lists	This option lets you create lists that are applied to relevant cells when the user chooses to sort them. Several lists are predefined to correctly sort days of the week or months of the year.

Option	Description
Changes	This option relates to the onscreen formatting for changes when the track changes function is activated.
Grid	This option lets you configure an invisible grid that stretches across the sheet; page objects can be set to snap to this grid for correct alignment.
Print	This option relates to printing specifically from Calc, such as whether Calc should avoid printing empty pages that might occur within documents.
OpenOffice.org Impress	
General	This option refers to miscellaneous settings within the Impress program, such as whether the program should always start with a wizard and which units of measurement should be used.
View	This option relates to the look and feel of Impress, and, in particular, whether certain onscreen elements are displayed.
Grid	This controls whether an invisible grid is applied to the page and whether objects should snap to it.
Print	This option controls how printing is handled within Impress and, in particular, how items in the document will appear on the printed page.
OpenOffice.org Draw	
General	This option relates to miscellaneous settings within Draw (the vector graphics component of OpenOffice.org).
View	Here you can set specific preferences with regard to which objects are visible on the screen while you're editing with Draw.
Grid	This option relates to the invisible grid that can be applied to the page.
Print	This option lets you define which onscreen elements are printed and which are not printed.
OpenOffice.org Base	
Connections	This option lets you control how any data sources you attach to are handled.
Databases	Here you can configure which databases are registered for use within Base.
Chart	
Default Colors	Here you can set the default color palette that should be used when creating charts, usually within the Calc program.
Internet	
Proxy	Here you can configure network proxy settings specifically for OpenOffice.org, if necessary.
Search	Certain functions within various OpenOffice.org programs let you search the Internet. Here you can configure how these search functions work.
E-mail	This option lets you specify which program you wish OpenOffice.org to use for e-mail.

Using OpenOffice.org Core Functions

Although the various programs within OpenOffice.org are designed for very specific tasks, they all share several core functions that work in broadly similar ways. In addition, each program is able to borrow components from other programs in the suite.

Using the Document Selector

OpenOffice.org includes a central document creator that isn't activated by default. To start it, hit Alt+F2 to show the Run Program dialog box, and then type `openoffice` and hit Enter. If you find it useful, this program can be added to the desktop or panel as a launcher (see Chapter 10 to learn how to create launchers).

After the document creation window appears, simply click the relevant icon to start that application. Several buttons at the bottom of the program window allow you to visit various OpenOffice.org web sites, including a useful site packed full of document templates.

■ **Note** The Database button will be grayed out until the Base program components are installed, as described in Chapter 26.

Using Wizards

One of the core functions you'll find most useful when you're creating new documents is the wizard system, which you can access from the File menu. A wizard guides you through creating a new document by answering questions and following a wizard-based interface. This replaces the template-based approach within Microsoft Office, although it's worth noting that OpenOffice.org is still able to use templates.

A wizard will usually offer a variety of document styles. Some wizards will even prompt you to fill in salient details, which they will then insert into your document in the relevant areas.

Note that within some components of OpenOffice.org, such as Writer, the wizards offered on the File menu won't work unless Java Runtime Environment software is installed. This can be done quickly and easily by closing any open OpenOffice.org applications, opening a terminal window (Applications ➤ Accessories ➤ Terminal), and typing the following:

```
sudo apt-get install default-jre openoffice.org-java-common
```

You will need to type your password when prompted. The software will probably be in the 200MB range, so it might take a while to download. Installation is automatic, and after it has finished, close the terminal window and log out (System ➤ Log Out). When you log in again, open any OpenOffice.org application to test the installation by starting a wizard.

■ **Note** In case you're wondering why this useful software isn't included by default, you can blame the fact that it's over 200MB. Put simply, it just won't fit on the Ubuntu installation CD-ROM.

Getting Help

OpenOffice.org employs a comprehensive help system, complete with automatic context-sensitive help, called the Help Agent, which will appear if the program detects you're performing a particular task. Usually, the Help Agent takes the form of a light-bulb graphic, which will appear at the bottom-right corner of the screen. If you ignore the Help Agent, it will disappear within a few seconds. Clicking it causes a help window to open. Alternatively, you can access the main searchable help file by clicking the relevant menu entry.

■ **Tip** To permanently disable the Help Agent, open any OpenOffice.org application and click Tools ➤ Options, and then select the General heading under the OpenOffice.org heading within the dialog box that appears. Remove the check from the Help Agent box on the right of the program window.

Additionally, OpenOffice.org applications have a useful "What's This?" help option that provides point-and-click help. To activate it, select the entry on the Help menu, and then hover the cursor over any interface option that you want to learn about. After a second or two, a detailed help bubble will appear, providing an explanation. To cancel it, just click anywhere.

Inserting Objects with Object Linking and Embedding

All the OpenOffice.org programs are able to use Object Linking and Embedding (OLE). This effectively means that one OpenOffice.org document can be inserted into another. For example, you might choose to insert a Calc spreadsheet into a Writer document.

The main benefit of using OLE over simply copying and pasting the data is that the OLE item (referred to as an *object*) will be updated whenever the original document is revised. In this way, you can prepare a report featuring a spreadsheet full of figures, for example, and not need to worry about updating the report when the figures change. Figure 22-4 shows an example of a spreadsheet from Calc inserted into a Writer document.

Whenever you click inside the OLE object, the user interface will change so that you can access functions specific to that object. For example, if you had inserted an Impress object into a Calc document, clicking within the object would cause the Calc interface to temporarily turn into that of Impress. Clicking outside the OLE object would restore the interface back to Calc.

You can explore OLE objects by choosing Insert ➤ Object ➤ OLE Object. This option lets you create and insert a new OLE object, as well as add one based on an existing file. To ensure that the inserted OLE object is updated when the file is, select the Link to File check box in the Insert OLE Object dialog box.

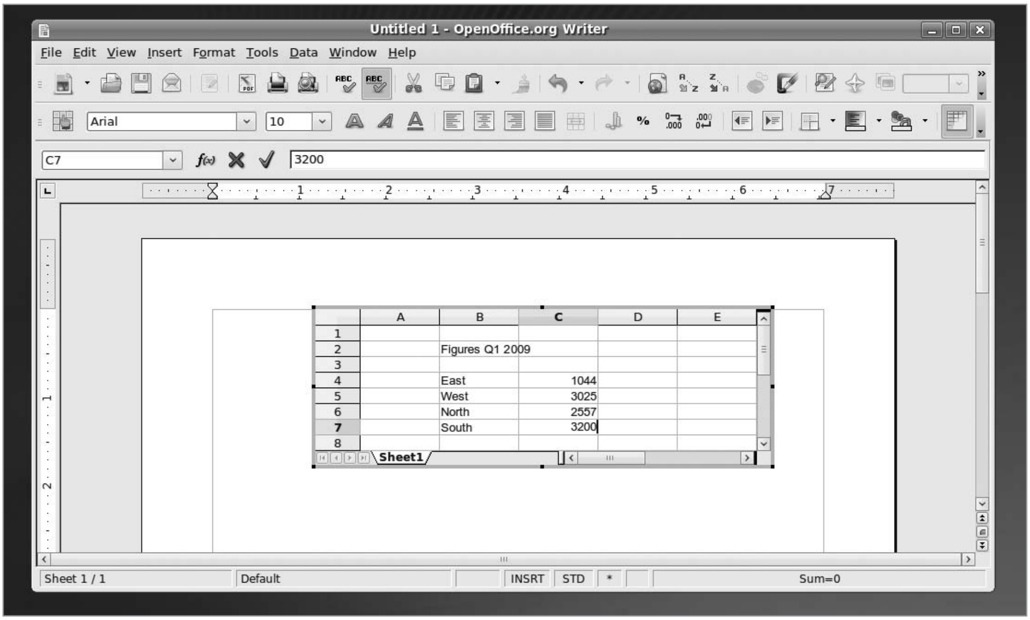

Figure 22-4. *Object Linking and Embedding (OLE) lets you incorporate one OpenOffice.org document into another.*

Creating Macros

OpenOffice.org employs a powerful BASIC-like programming language, which you can use to create your own functions. Although this language is called BASIC, it is several generations beyond the BASIC you might have used in the past. OpenOffice.org's BASIC is a high-level, object-oriented environment designed to appeal to programmers who wish to quickly add their own functions to the suite.

However, it's possible for any user to record a series of actions as a macro, which is then automatically turned into a simple BASIC program. This can be very useful if you wish to automate a simple, repetitive task, such as the insertion of a paragraph of text, or even something more complicated, such as searching and replacing text within a document.

To record a macro, choose Tools ➤ Macros ➤ Record Macro. After you've selected this option, any subsequent actions will be recorded. All keyboard strokes and clicks of the mouse will be captured and turned automatically into BASIC commands. To stop the recording, simply click the button on the floating toolbar. After this, you'll be invited to give the macro a name (look to the top left of the dialog box). Then click Save. You can then run your macro in the future by choosing Tools ➤ Macros ➤ Run Macro. Simply expand the My Macros and Standard entries at the top left of the dialog box, click Module1, select your macro in the list on the right, and click Run.

Saving Files

As mentioned in Chapter 21, OpenOffice.org uses the OpenDocument range of file formats. The files end with an `.ods`, `.odt`, `.odp`, or `.odb` file extension, depending on whether they've been saved by Calc, Writer, Impress, or Base, respectively. The OpenDocument format is the best choice when you're saving documents that you are likely to further edit within OpenOffice.org. However, if you wish to share files with colleagues who aren't running Ubuntu, another Linux version, or OpenOffice.org under Windows or Mac OS X, the solution is to save the files as Microsoft Office files. To save in this format, just choose that option from the File Type drop-down list in the Save As dialog box. If your colleague is running an older version of OpenOffice.org or StarOffice, you can also save in those file formats.

Alternatively, you might wish to save the file in one of the other file formats offered in the File Type drop-down list. However, saving files in an alternative format might result in the loss of some document components or formatting. For example, saving a Writer document as a simple text file (`.txt`) will lead to the loss of all of the formatting, as well as any of the original file's embedded objects, such as pictures.

To avoid losing document components or formatting, you might choose to output your OpenOffice.org files as Portable Document Format (PDF) files, which can be read by the Adobe Acrobat viewer. The benefit of this approach is that a complete facsimile of your document will be made available, with all the necessary fonts and onscreen elements included within the PDF file. The drawback is that PDF files cannot be loaded into OpenOffice.org for further editing, so you should always save an additional copy of the file in the native OpenOffice.org format. To save any file as a PDF throughout the suite, choose File ➤ Export as PDF. Then choose PDF in the File Type drop-down box, as shown in Figure 22-5.

■ **Tip** At the time of this writing, work is progressing on a plug-in for OpenOffice.org that allows the opening and subsequent editing of PDF files. For more details, see `http://extensions.services.openoffice.org/project/pdfimport`.

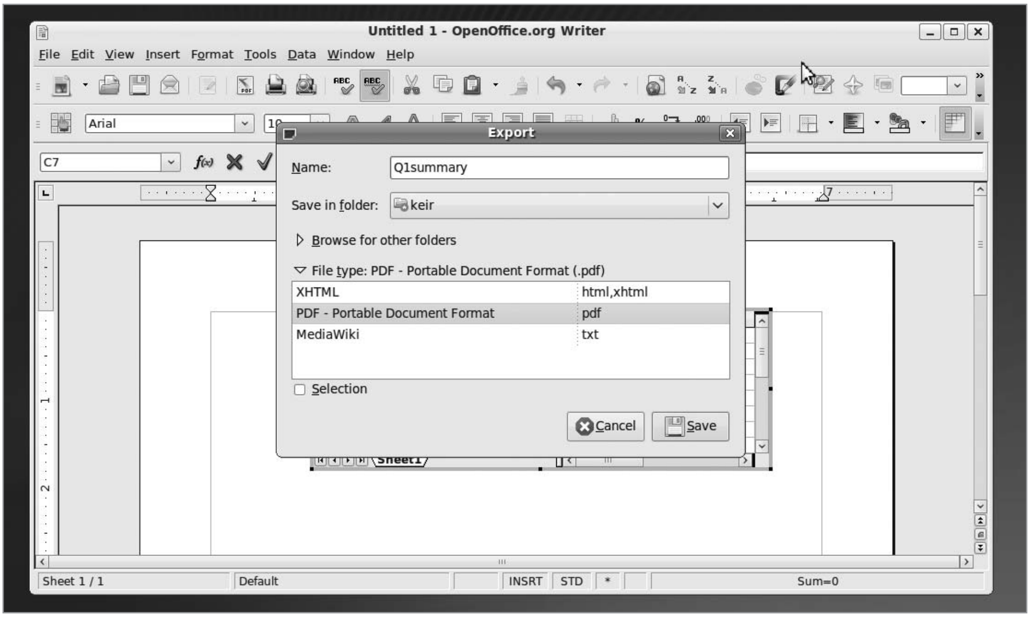

Figure 22-5. *All the programs in the suite can export files in Adobe PDF format.*

Summary

In this chapter, we presented the configuration options provided with OpenOffice.org. You were introduced to the user interface, which is shared across all the programs within the suite, and learned how it can be customized. You also examined some common tools provided across the suite of programs, such as macro generation.

Over the following chapters, you will look at each major component of the suite, starting with Writer.

CHAPTER 23

In Depth: Writer

The word processor is arguably the most popular element within any office suite. That said, you'll be happy to know that OpenOffice.org's Writer component doesn't skimp on features. It offers full text-editing and formatting functionality, along with powerful higher-level features such as mail merge.

In this chapter, you'll take a look at some of Writer's most useful features. As with all of the components in the OpenOffice.org suite, describing the features within Writer could easily fill an entire book. You should do some exploring on your own by clicking around to discover new features, as well as make judicious use of the help system. To start Writer, click Applications ➤ Office ➤ OpenOffice.org Word Processor.

Formatting Text

You can use several methods to format text within Writer. In this section, you'll look at using the Formatting toolbar, the context menu, and the Styles and Formatting palette.

The Formatting Toolbar

Formatting text is easy to do via the Formatting toolbar, which is just above the ruler and main document area. By using the toolbar buttons, you can select the type of font you wish to use, its point size, its style (normal, bold, italics, and so on), and more. As with elsewhere in Ubuntu, a tooltip will appear over each icon when you hover the mouse cursor over it, as shown in Figure 23-1.

From left to right, the features on the Formatting toolbar are as follows:

Styles and formatting: Clicking this button brings up the Styles and Formatting floating palette, on which all styles within the currently open document are listed. For more information, see the upcoming section on this palette.

Styles: This drop-down list shows the most popular styles used within the document. Clicking the More entry at the bottom of the list will open the Styles and Formatting floating palette.

Fonts: The range of fonts is previewed in the Font drop-down list, making it easy to select the right typeface.

Font size: Here you can select from a drop-down list the point size you wish to use.

Bold, italic, underline: These three icons activate or deactivate bold, italic, and underlined text styles, respectively.

Justification: Here you can select left, center, right, or full justification. Full justification aligns both the left and right edges of the paragraph against the left and right sides of the page (with the exception of the last line of the paragraph, which is always left-justified).

Bullets, numbering, indentation: Here you can select to activate automatic numbering or bulleting of paragraphs. To cancel bulleting or numbering, just hit Enter on an empty line. The indentation icons have the effect of in- or outdenting paragraphs, depending on the number of times they're clicked.

Font color, highlighting, and background color: Clicking any of these icons will turn the cursor into a pen, which can be dragged across text to color it. Clicking the small down arrow alongside each icon will display a small color palette, from which you can choose a color. Note that, after a color has been applied, any ensuing typed text is also colored; to switch back to the default colors (black text against a white background), click the down arrow alongside each icon and select Automatic at the top of the palette display.

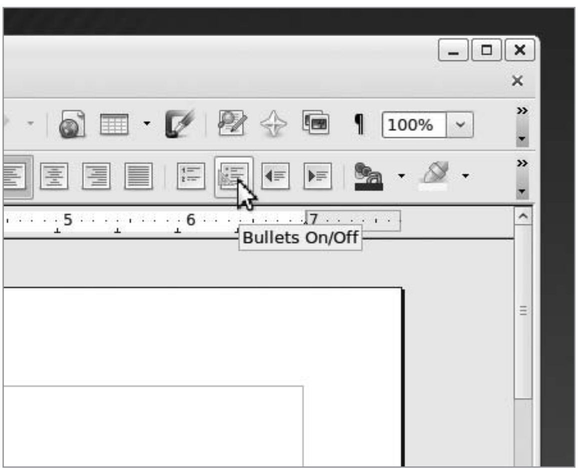

Figure 23-1. *When you hover your mouse over an icon, a tooltip appears to explain what the icon does.*

The Context Menu

Rather than use the Formatting toolbar, you can format text by using the context menu. Right-click the text you want to format, and a context menu will present options for the font, size, style, alignment, and line spacing. The context menu also enables you to change the case of the highlighted characters—from uppercase to lowercase, and vice versa.

By selecting the Character option from the context menu, you get ultimate control over the font formatting. This will present a dialog box that includes every possible option, such as rotating the text and altering the individual character spacing (look under the Position tab for these options).

Tip The Character dialog box lets you create interesting typographical effects. The Paragraph dialog box has many options for formatting paragraphs. These tools open up the possibility of using Writer for simple desktop publishing work.

Selecting Paragraph from the context menu displays the Paragraph dialog box, as shown in Figure 23-2. This gives you control over paragraph elements, such as line spacing, indentation, and automatic numbering. Here you will also find an option to automatically create drop caps, so you can start a piece of writing in style!

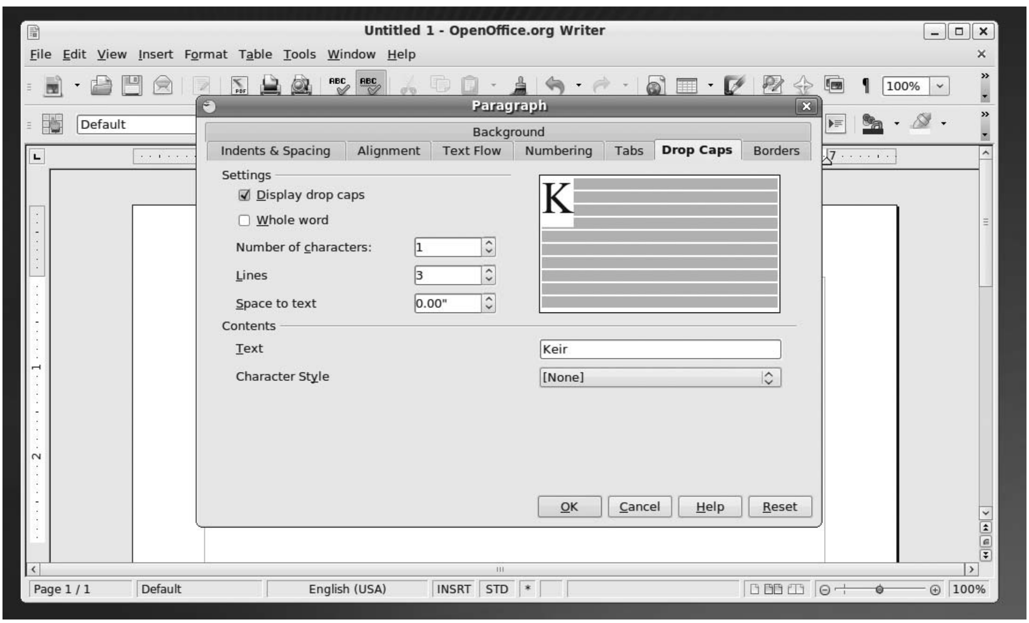

Figure 23-2. *Writer includes many elements found in desktop publishing packages, such as the ability to create drop caps.*

The Styles and Formatting Palette

The Styles and Formatting palette offers a variety of predefined formatting styles that you can apply to selected text or enable before you begin adding text. For example, a particular style might make any text it's applied to into bold and use a particular font, although styles are mostly used in simple word processing for headings. To make the palette appear, click the button on the Formatting toolbar or press F11. You can simply click the palette's Close button to get rid of it.

There are five categories of styles and/or formatting that can be selected by clicking the buttons on the Styles and Formatting palette toolbar, as follows:

Character: Applies formatting to only small amounts of text within a paragraph. To apply any character style, it is usually enough to highlight the relevant text and double-click the entry in the Styles and Formatting list.

Paragraph: Here you can apply formatting for the entire paragraph, which is to say, for a block of text separated from its neighbors by line breaks.

Frame: Applies styles to frames (including the positioning of the frame on the page, if relevant). *Frames* are floating boxes into which text or graphics can be inserted. New frames can be created by clicking the entry on the Insert menu.

Page: Applies formatting for the entire page, or elements on it, such as footnotes. Most usefully, here you can set left- or right-facing pages, which can be useful when creating documents that will be turned into a printed book.

List: Here you can choose between different bullet point and numbering styles.

You can easily add your own character text styles to the Styles and Formatting palette. Simply select some text that has the formatting applied, click the top-right button (denoted by a paragraph symbol next to a block of text), and then select New Style from Selection in the list. You'll be invited to give the style a name, and after you click OK, it will appear in the list.

Checking Spelling and Grammar, and Looking Up Synonyms

Writer provides features to help clarify your documents, including a spell checker, a grammar checker, and a thesaurus.

Writer is able to automatically spell-check as you type. Any words it considers misspelled will be underlined in red. You can choose from a list of possible corrections by right-clicking the word and selecting from the context menu. If you're sure the word is spelled correctly but it doesn't appear to be in the dictionary, you can choose Add ➤ Standard.dic from the context menu, as shown in Figure 23-3. This will add the word to your own personal dictionary extension (other users won't have access to your dictionary and will need to create their own list of approved words).

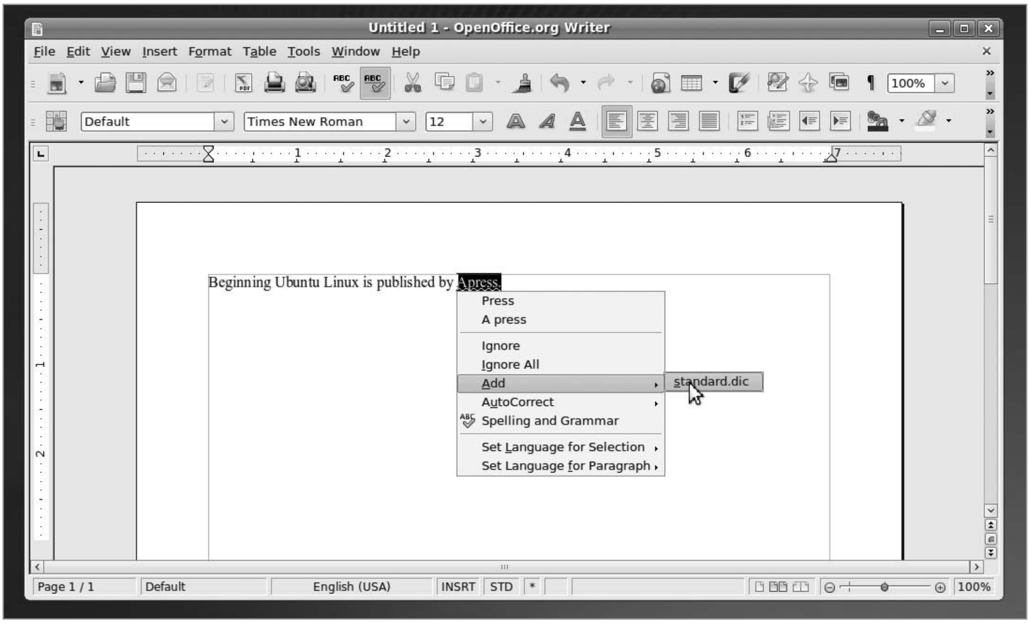

Figure 23-3. *Any words you're going to use frequently, but which Writer doesn't recognize, can be added to your personal dictionary.*

■ **Tip** You might find that the spell checker is set for US English. If you live outside the United States or need to create documents for readers in other countries, you can choose a dictionary tailored to your locality or needs. To change the language, choose Tools ➤ Options. In the list on the left, select Language Settings, and then Languages. In the Default Languages for Documents list, select your local variation. This will then become the default for all new documents.

If you find live spell-checking invasive or distracting, you can deactivate it by choosing Tools ➤ Spelling and Grammar, clicking the Options button, and removing the check next to Check Spelling as You Type.

■ **Note** If you find live spell-checking annoying, you might also opt to deactivate autocorrect too. To do so, click Format ➤ AutoFormat, and remove the check from the While Typing box.

You can manually spell-check the document at any time by clicking Tools ➤ Spelling and Grammar. This will scan through the document (or any selected text, if applicable) and prompt for corrections for words the program considers misspelled.

Checking grammar works in a similar way. Any sentences that OpenOffice.org thinks use bad grammar will be underlined in green, and right-clicking will bring up a context menu showing a possible correction or improvement. Bear in mind that checking for perfect grammar requires human intelligence, and the rules relied on by OpenOffice.org's grammar checker are far from perfect. It's up to you to know what's ultimately right and wrong!

To look up synonyms for a word, highlight the word and click Tools ➤ Language ➤ Thesaurus. A list of definitions will appear on the left of the dialog box that appears, and a list of synonyms on the right. Selecting a synonym and clicking OK will cause it to replace the original within the document. Double-clicking a synonym within the thesaurus dialog box will cause that word to be looked up afresh.

■ **Note** In our tests, we found that switching to a language other than US English caused the thesaurus to become inactive. To fix this, it was necessary to install an alternative thesaurus package. There are packages for most major world languages. To search for them, use `openoffice.org-l10n-` as a search term within the Synaptic Package Manager. The package you require will be appended by your country code (for example, `openoffice.org-l10n-gb` for UK English). You must restart OpenOffice.org after installation.

Inserting Pictures

Writer includes quite substantial desktop publishing–like functions, such as the ability to insert pictures into text documents and to have text flow around pictures.

Inserting any kind of graphic—a graph, digital camera photo, drawing, or any other type of image—is easy. Simply choose Insert ➤ Picture ➤ From File.

■ **Tip** If you have a scanner, you can also scan pictures directly into Writer documents. Simply click Insert ➤ Picture ➤ Scan ➤ Select Source. However, the functions offered are rather simple, and it might be better to use the XSane scanner program to scan in the image separately, as described in Chapter 8, and then insert the picture as a file within OpenOffice.org.

After you've inserted a picture, you can place it anywhere on the page. When you select the picture, a new toolbar appears. This toolbar contains various simple image-tweaking tools, such as those for altering the brightness, contrast, and color balance of the image. Additionally, by clicking and dragging the green handles surrounding the image, you can resize it.

Graphics that are imported into Writer must be anchored in some way. In other words, they must be linked to a page element so that they don't move unexpectedly. By default, they're anchored to the nearest paragraph break, which means that if that paragraph moves, the graphic will move too. Alternatively, by right-clicking the graphic, you can choose to anchor it to the page, paragraph, or character it is on or next to, as shown in Figure 23-4. Selecting to anchor it to the page will fix it firmly in place, regardless of what happens to the contents of the surrounding text. The As Character option is slightly different from the To Character option. When you choose As Character, the image will be anchored to the character it is next to, and it is actually inserted in the same line as that character, as if it were a character itself. If the image is bigger than the line it is anchored in, the line height will automatically change to accommodate it.

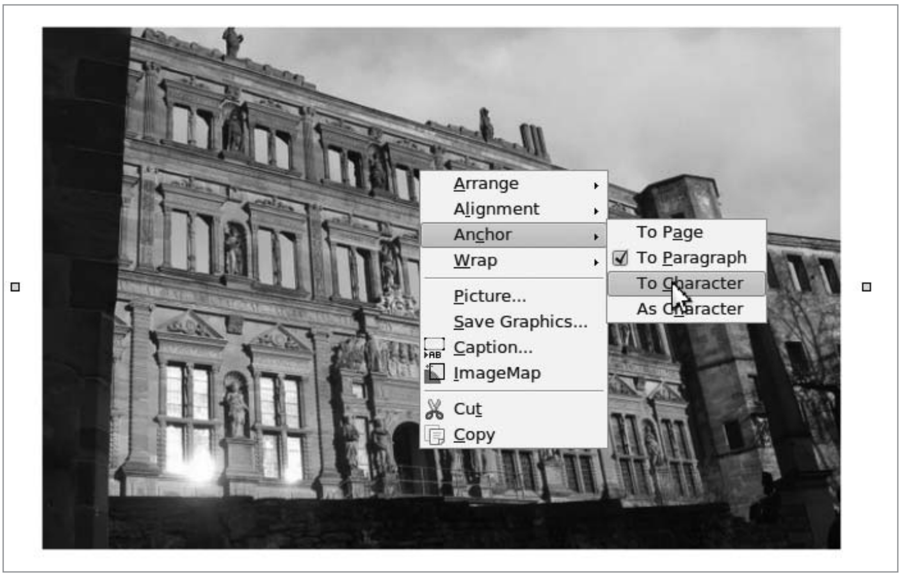

Figure 23-4. *A picture can be "anchored" to the page, a paragraph, or a character. This affects how it responds to the paragraphs surrounding it.*

As you can see in Figure 23-4, the context menu also includes a Wrap option, which lets you set the type of text wrap you want to use. By default, Optimal Page Wrap is selected. This causes the text to wrap down just one side of the picture—the side on which the picture is farthest from the edge of the page. Alternatives include No Wrap, which means that the graphic will occupy the entire space on the page; no text is allowed on either side of it. However, Page Wrap is the best option if you're looking for a desktop publishing–style effect, because the text will wrap around both sides of the picture.

Alternatively, if you want the image to appear in the background of the page with text flowing across it (useful when creating watermarks, for example, or when adding subtle background patterns), you can select the relevant option from the context menu.

As always within OpenOffice.org, ultimate control is achieved by opening the relevant dialog box. You can set up how graphics are treated on the page by right-clicking the image and selecting Picture. In the dialog box that appears, you can select the wrap effect, specify the invisible border around the wrap (which governs how close the text is to the image), and give the image a border frame.

Working with Tables

Often it's useful to present columns of numbers or text within a word processor document. To make it easy to align the columns, OpenOffice.org offers the Table tool. This lets you quickly and easily create a grid in which to enter numbers or other information. You can even turn tables into simple spreadsheets, and tally rows or columns via simple formulas.

To insert a table, click and hold the Table icon on the Standard toolbar (which runs across the top of the screen beneath the menu). Then simply drag the mouse in the table diagram that appears until you have the desired number of rows and columns, and release the mouse button to create the table, as shown in Figure 23-5.

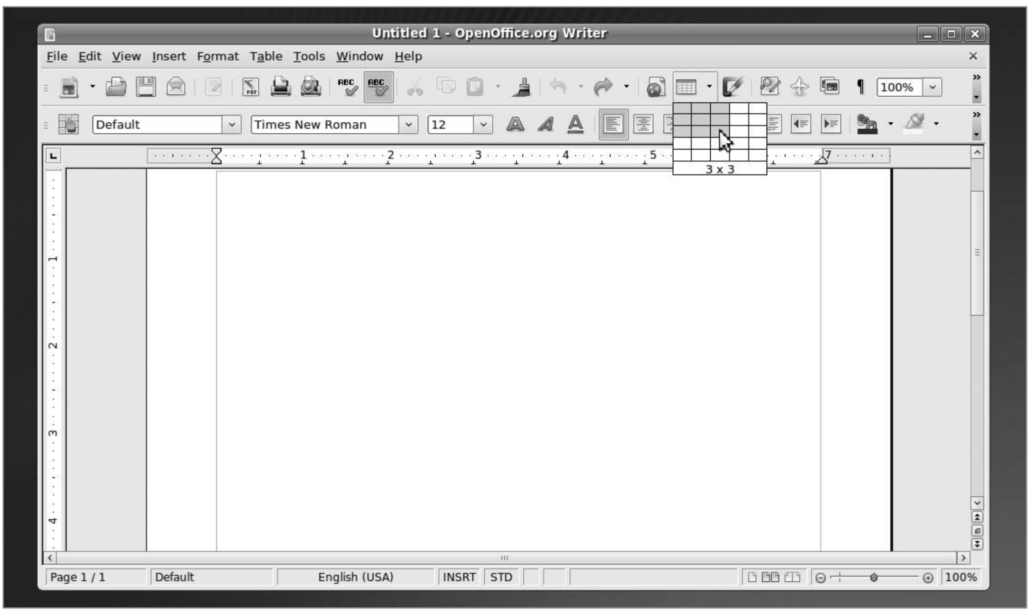

Figure 23-5. *Just select the Table icon on the Main toolbar and drag the mouse to define the size of the table. Release the mouse button when you're finished.*

Whenever your cursor is inside the table, a new toolbar will appear, offering handy options. Once again, simply hover your mouse over each button to find out what it does via a tooltip.

As with spreadsheets, tables consist of cells arranged into rows (running horizontally) and columns (running vertically). Altering the size of a column is easy. Just hover the mouse over the edge of a cell until it changes to a resizing cursor, and then click and drag. You can do the same on a horizontal bar to alter a cell's height, but another method allowing greater control and accuracy is to right-click within the cell, choose Row ➤ Height, and enter a value. The equivalent for setting column sizes can be accessed by right-clicking and choosing Column ➤ Width.

Tip Cells expand vertically to fit their contents, so when you reach the bottom of a cell, hitting Enter will cause the cell to grow in size. After the cursor is within a table, you can move from cell to cell by using the Tab key. Alternatively, you can move backward through the cells by pressing Shift+Tab.

To add more rows or columns, click the relevant icon on the Table toolbar (the fourth and fifth buttons on the bottom row). To split an existing cell, ensure that your cursor is inside it, right-click, select Cell from the menu, and then click Split.

If you want to total figures within a table, click in an empty cell, and then click the Sum icon on the Table toolbar (the Greek sigma symbol on the right side of the bottom row). This is similar to inserting a function in a spreadsheet. The cell holds the formula for the sum, and clicking additional cells, or a range of cells by clicking and dragging, adds them to the sum. Hit Enter when you've finished selecting cells, or Esc to cancel.

Note Only correctly formatted cells can be summed by using the Sum icon on the Table toolbar. Cells with spaces or text within them cannot be added to the formula.

You can alter the styling of any cell by using various icons on the Table toolbar, as well as the standard text-formatting tools on the Formatting toolbar. The Table toolbar enables you to add borders to the cells and change the background colors. Alternatively, you can choose to remove all borders from the cells by clicking the Borders icon and then the No Borders option (note that gray borders will remain in place, but these are only for your convenience and won't appear in printouts).

Tip You can use Writer's autotext function to quickly create a table by typing something similar to +—--+—--+—--+. The plus symbols define where the columns appear, and the hyphens define the width of the columns. The table will appear when you hit Enter. Give it a try! New rows can be added by hitting Tab at the end of existing columns.

Mail Merging

Mail merging refers to automatically applying a database of details, such as names and addresses, to a document so that many personalized copies are produced. It's ordinarily used to create form letters for mailings.

OpenOffice.org makes the procedure easy, but it requires source data that will be merged into the document. As with Microsoft Word, you can either enter this data within Writer itself or choose to import data from a separate document. Unless you have enough knowledge of databases to connect one to OpenOffice.org (the program works with dBASE and MySQL files, among others), you may want to input existing data in the form of a comma-separated value (CSV) text file. This is the simplest form of data file that is understood by the majority of office programs and databases.

Here you're going to look at entering the data within Writer, which is the best policy for smaller mail-merge operations. You can then output the data as a CSV file, so you can use it again later. Here are the steps for using mail merge (click the Next button after each step):

1. Start a blank document and choose Tools ➤ Mail Merge Wizard to start the wizard, as shown in Figure 23-6.

2. Specify your starting document, which is the document in which the merged data will appear. You can opt to use the current document, create a new document, open a document from a file, or use a template as the basis for your file.

3. Choose the mail-merge type. You can choose to create a merged e-mail (for sending to multiple recipients) or a merged letter.

4. You're asked to tell Writer about your data. Writer needs to know where to find the addresses that will be merged into the document. Click the Select Address List button.

5. In the window that appears, you have several options. You can raid your Evolution e-mail address book for the data, click Add to select an already existing data source (such as a database or CSV file), or create a data source from scratch. Click the Create button to create a data source to enter the data in Writer.

Note The fourth option for choosing a mail-merge data source, Filter, enables you to filter the database source you select after clicking Add, so you can import only specific data.

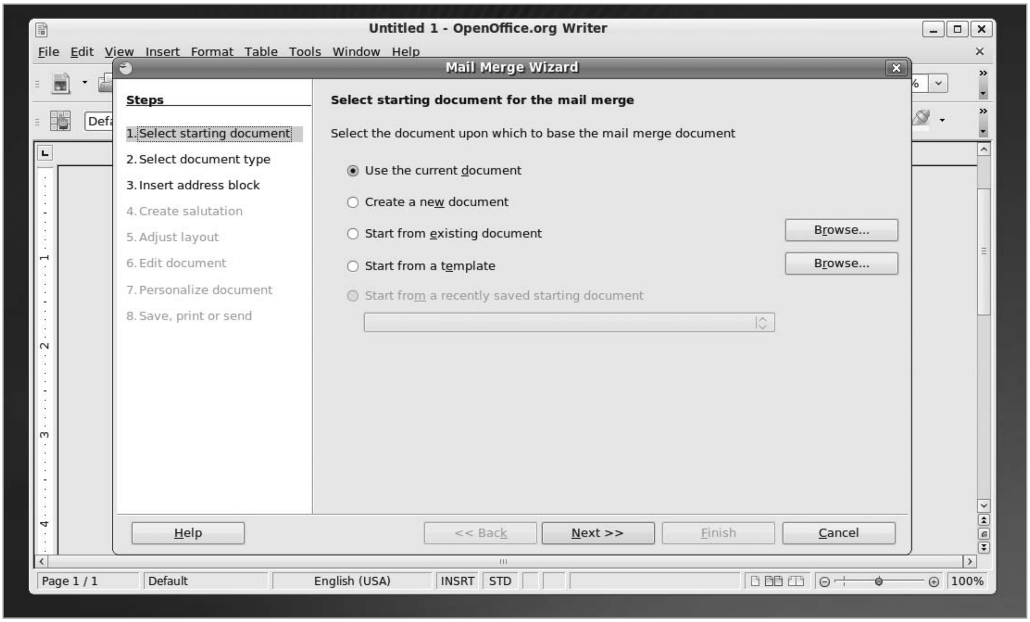

Figure 23-6. *The Mail Merge Wizard makes creating multiple documents from a data source incredibly easy.*

6. You're presented with a form for entering the data for each individual you want to receive the mail-merged letter, as shown in Figure 23-7. You don't need to fill in each field; you'll be able to choose which data fields to use in the document later. If you wish to enter your own specific data types in addition to address details, you can click the Customize button to add your own field to the list. Then click the Add button (alternatively, if there's a data field you're not using, you can highlight it and select Rename to reuse it). Using the up and down arrows in the window that appears, position the new data field where you would like it to appear in the list. Obviously, you should add any new data fields you want *before* you begin to enter data!

7. Type in the data and press Tab after each line. When you get to the last field, or you simply have no more data to input for that particular record, click the New button at the top right (hit Alt+N if you don't want to take your hands off the keyboard). When you've finished entering all the data, hit Enter or click OK. Then accept Writer's offer to save the data as a CSV file.

8. You're returned to the data-selection screen, and your just-saved file will be in the list. Click OK (click the new file's entry in the list if the OK button is grayed out).

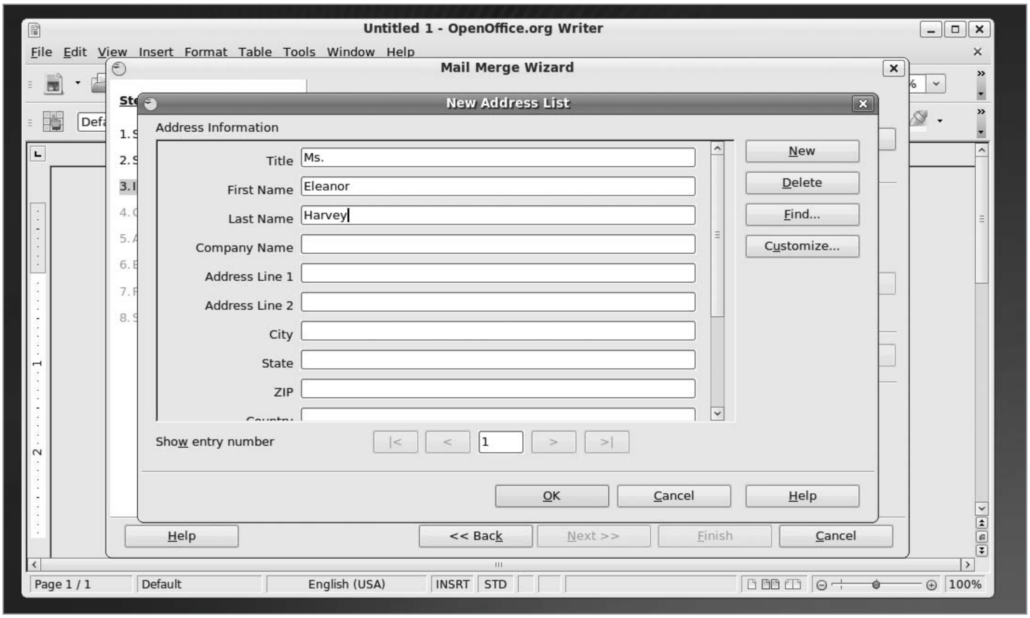

Figure 23-7. *Enter the data for each person you want to receive the letter.*

9. You're returned to the main Mail Merge Wizard window, where you can choose whether to include an address block. All this means is that Writer will automatically add the merge fields to your document in what it considers the correct format (for example, title, followed by first and last name, with each line of the address underneath, and so on). You can insert the merge fields manually later if you wish; in that case, remove the check from the "This document shall contain an address block" check box.

10. You're invited to create the salutation that will head the letter. This will contain the merge data as well, so you can personalize the letter. Again, you can accept the default, tweak it slightly, or choose not to have an automated salutation (so you can create your own later).

11. Depending on your previous choices, and whether you accepted the automatic address block and salutation, you are now given the choice to adjust the layout of the document in a rough way.

12. If you wish, you can now opt to edit the document by clicking the relevant button. Should you choose to do so, you can insert your choice of merge fields by clicking Insert ➤ Fields ➤ Other. Select the Database tab in the window that appears, and then select Mail Merge Fields on the left side of the window. Click the small plus symbol next to the data file you created earlier, which should be listed on the right, and you can then select and insert the merge fields. The address block is a floating text frame, which can be moved by clicking and dragging its border. After you've finished editing the document, click the Return to Mail Merge Wizard button on the floating toolbar.

13. Click Next to perform the merge. You're then given a chance to edit the actual mail-merged documents (which, depending on the quantity of data entries you created earlier, could number in the tens, hundreds, or even thousands!).

14. You can save or print the *merged* document containing the data. To save the document creating the merge fields, click Save Starting Document.

Adding Headers and Footers

You may want to add headers and footers to long documents to aid navigation. They appear at the top and bottom of each page, respectively, and can include the document title, page number, and other information. Headers and footers are created and edited independently of the main document, although they can utilize the same paragraph styles as the main document.

As you might expect, inserting both headers and footers takes just a couple of clicks. Choose Insert ➤ Header ➤ Default, or Insert ➤ Footer ➤ Default, depending on which you wish to insert (documents can have both, of course). Writer will then display an editing area where you can type text to appear in the header or footer. For more options, right-click in the area, select Page, and then click the Header or Footer tab. Here you can control the formatting and nature of the header or footer. Clicking the More button will let you apply borders or background colors.

You might wish to insert page numbers that will be updated automatically as the document progresses. OpenOffice.org refers to data that automatically updates as a *field*. You can insert a wide variety of fields by choosing from the submenu that appears when clicking Insert ➤ Fields, as shown in Figure 23-8. For example, along with the page number, you can insert the document title and author name (which is read from the details entered into the Options configuration dialog box, accessed from the Tools menu). In addition, you can enter mail-merge fields by clicking Other (see the previous section for a description of how to associate mail-merge data with a document).

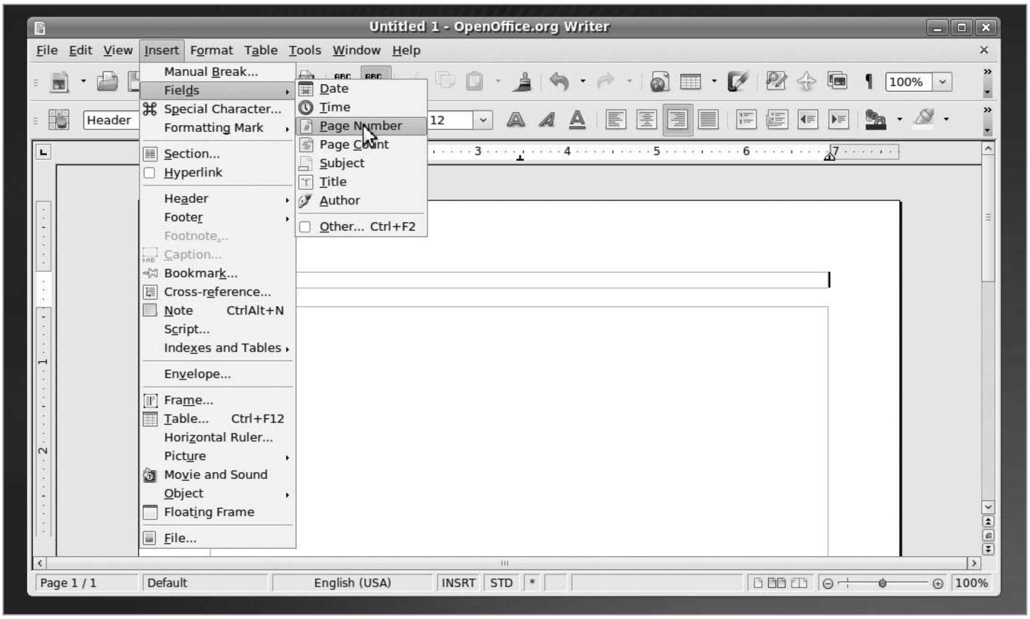

Figure 23-8. *Automatically updating data, such as page numbers, can be inserted into headers and footers.*

Working Collaboratively

If you work in an office environment, it's unlikely that you'll ever be the only person to read or even edit a document you create. Most documents tend to get shared between individuals, especially if you're working in a group or as part of a project. The people behind OpenOffice.org are aware of this, and there are two features in particular that can aid collaborative working: recording changes, and notes.

Recording changes—known as Track Changes in most Microsoft Word products—causes Writer to remember any edits and highlight them within documents. Any deletions are left in the document but simply crossed out, while any additions are highlighted in a different color. Inserting notes (known as Comments in Microsoft Word) enables you to effectively add remarks to the margin of the document, although as the name suggests, the comments appear in the form of "sticky notes" that have the appearance of small squares of yellow paper.

Each edit or note is automatically ascribed to the individual making the change, and so before utilizing such features, you should ensure that OpenOffice.org knows your name. This can be done by clicking Tools ➤ Options, and selecting the User Data entry on the left, beneath the OpenOffice.org heading. You don't have to fill in all the fields, but you should fill in the First/Last Name/Initials fields.

Recording Changes

To record changes within a document, click Edit ➤ Changes ➤ Record. From that point on, any additions made to the document will appear in a different color. Any deletions will stay in place but will be crossed out (note that this will adversely affect the document layout, especially if you opt to reject any deletions later). Any formatting changes that aren't accompanied by actual additions or deletions of the text will be highlighted in bold.

Tip You can alter what formatting changes accompany these edits by clicking Tools ➤ Options, selecting OpenOffice.org Writer in the list on the left of the dialog that appears, and then clicking the Changes entry in the submenu. Following this, make the formatting selections on the right of the dialog box.

The changes made by each individual who edits the document will appear in a different color within the document. To accept or reject changes, click Edit ➤ Changes ➤ Accept or Reject. This will open a dialog box in which the changes will be listed. By clicking each, you will highlight the change within the document (note that it's still possible to edit the document while the Accept or Reject Changes dialog is open).

To accept a change, click the relevant button in the dialog box. This will remove the special formatting indicating an addition, or delete the crossed-out text in the case of a deletion. To reject the change, click the Reject button. This will remove the text in the case of an addition, or remove the strike-through formatting in the case of a deletion.

Inserting a Note

To insert a note, first either highlight the text or object (such as a picture) that you'd like the note to be attached to, or simply position the cursor where you want the note to be, and then click Insert ➤ Note. This will make a "sticky note" appear in the margin at the right of the page that you can type a comment within. The note will be attached to the point of insertion by a dotted line.

To delete a note, right-click it and select the relevant option from the menu.

Summary

In this chapter, you examined Writer, one of the core components of OpenOffice.org. You looked at the some of the key tools, which enable quick and easy document creation. In particular, you learned how to format text, use the spell-checking component, insert pictures, create and edit tables, use mail merge, add headers and footers, and work collaboratively by tracking changes within documents and adding comments.

In the next chapter, we move on to another vital part of OpenOffice.org: Calc, the spreadsheet component.

CHAPTER 24

In Depth: Calc

Calc is the spreadsheet component of OpenOffice.org. Like most modern spreadsheet programs, it contains hundreds of features, many of which few average users will ever use. However, it doesn't abandon its user-friendliness in the process and remains very simple for those who want to work on modest calculations, such as home finances or mortgage interest payments. In terms of features, Calc is in many regards practically a clone of Excel, and anyone who has used Microsoft's spreadsheet program will be able to get started with Calc immediately.

In this chapter, you'll learn about some of the best features of Calc, as well as the basics of spreadsheet creation. To start Calc, click Applications ➤ Office ➤ OpenOffice.org Spreadsheet.

Entering and Formatting Data

As with all spreadsheets, entering data into a Calc document is simply a matter of selecting a cell and starting to type. Although by default cells "expect" to contain numbers, they can be configured to contain various types of data, such as dates or currency. This means that Calc will automatically attempt to set the correct formatting for the cell, if necessary, and also display an error if the wrong type of data is entered (or if the data is entered in the wrong format). Setting the correct cell type is vital with certain types of formulas that might refer to the cell—a formula that requires dates as input won't work if the cells are not set as Date format, for example.

To change the cell format, ensure that the cell(s) is selected and then click Format ➤ Cells. Ensure that the Numbers tab is selected in the dialog box, and select the format type from the Category list.

Note You might find that Calc is clever enough to automatically detect the nature of the data you're entering and set the cell formatting automatically. For example, if you enter a date, Calc will set the format of the cell to Date.

However, the default cell format type is Number. As you might expect, this anticipates numbers being entered in the cell by the user, although it's worth noting that text can also be entered without an error message appearing (but you will almost certainly see an error later if you try to involve that cell in a formula!). It's also worth noting that Number-format cells into which text is entered *aren't* automatically formatted as Text cells.

A handful of symbols are not allowed in a number cell if you use the cell to enter plain text. For example, you cannot enter an equals sign (=), because Calc will assume that this is part of a formula.

Tip To enter any character into a Number-formatted cell, including an equals sign followed by a digit, precede it with an apostrophe ('). The apostrophe itself won't be visible within the spreadsheet, and whatever you type won't be interpreted in any special way; it will be seen as plain text.

Entering a sequence of data across a range of cells can be automated. Start typing the sequence of numbers (or words), highlight them, and then click and drag the small handle to the bottom right of the last cell. This will continue the sequence. You'll see a tooltip window, indicating what the content of each cell will be. Figure 24-1 illustrates this process.

Cells can be formatted in a variety of ways. For trivial formatting changes, such as selecting a different font or changing the number format, you can use the Formatting toolbar. For example, to turn the cell into one that displays currency, click the Number Format: Currency icon (remember that hovering the mouse cursor over each icon will reveal a tooltip). You can also increase or decrease the number of visible decimal places by clicking the relevant Formatting toolbar icon.

For more formatting options, right-click the individual cell, and select Format Cells from the menu. This displays the Format Cell dialog box, where you can change the style of the typeface, rotate text, place text at various angles, and so on. The Borders tab of the Format Cell dialog box includes options for cell gridlines of varying thicknesses, which will appear when the document is eventually printed out.

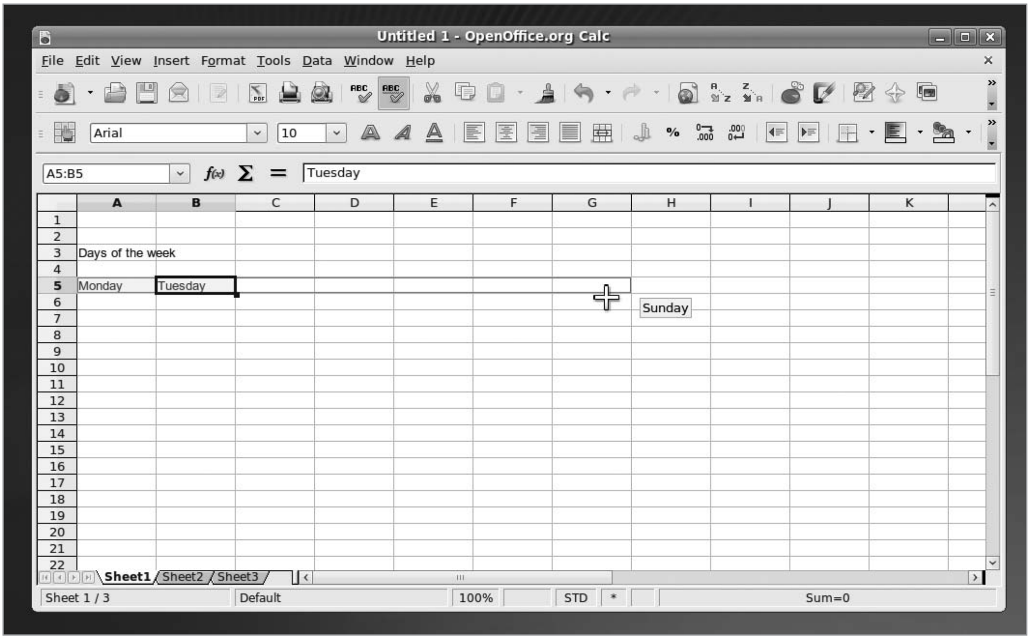

Figure 24-1. *You can automate the entering of data sequences by clicking and dragging.*

Deleting and Inserting Data and Cells

Deleting data is also easy. Just highlight the cell or cells with the data you want to delete and then press the Delete key. If you want to totally eradicate the cell along with its contents, right-click it and select Delete. This will cause the data to the sides of the cell to move in. You'll be given a choice on where you want the cells to shift from to fill the space: left, right, above, or below.

To insert a new cell, right-click where you would like it to appear and select Insert. Again, you'll be prompted about where you want to shift the surrounding cells in order to make space for the new cell.

Working with Formulas

Calc includes a large number of formulas. In addition to simple and complex math functions, Calc offers a range of logical functions, as well as statistical and database tools. Certain formulas can also be used to manipulate text strings, such as dates.

You can get an idea of the available functions by clicking the Function Wizard button on the Formula bar. (This reads *f(x)* and is located just below the Formatting toolbar.) This will bring up a categorized list of formulas, along with brief outlines of what function the formula performs. If you would like more details, use the help system, which contains comprehensive descriptions of most of the formulas, complete with examples of the correct syntax. Just click the Help button and then type the name of the function into the Search text field.

Note The Function Wizard is actually a continuation of the wizard system you've seen in other OpenOffice.org programs, and some of the functions are also available elsewhere in the suite. Among its many features, the Function Wizard also shows a preview of the result of a formula, which can be useful when experimenting with data and formulas.

You can reuse formulas simply by cutting and pasting them. Calc is intelligent enough to work out which cells the transplanted formula should refer to, but it's always a good idea to check to make sure the correct cells are referenced.

Using the Function Wizard

To use the Function Wizard to add a function, click the relevant button on the Formula bar, and in the dialog box that appears, select the desired type of formula from the Category drop-down list, and then double- click an entry in the Function list to select it. Following this, you'll be prompted to input the relevant figures or define the appropriate data sources. Next to the text-entry box will appear a Shrink button, which temporarily minimizes the size of the wizard window, so you can select cells to be used within the formula. Clicking the same button again on the minimized window will enlarge it.

Let's look at a quick example of using the wizard to work out an average value of a number of cells:

1. Open the spreadsheet containing the data that you want to average, and select a blank cell in which you'd like the output of the formula to appear.

2. Start the Function Wizard by clicking the button on the Formula bar. In the left-hand list of functions, ensure that All is selected in the Category drop-down list, and then double-click AVERAGE in the Function list. The wizard will then present a list of fields on the right side of the dialog box, where you can enter the values to be averaged. You could type cell references directly into these fields (for example, A3, D6, and so on), but it's easier to select individual cells from the spreadsheet.

3. Click the cursor in the Number 1 field of the dialog box, and then click the Shrink button alongside the text field. With the dialog box now out of the way, click the first cell you want to include in the calculation. This will automatically enter that cell reference into the field.

4. Unfold the dialog box by clicking the Shrink button again. Then click the next field in the dialog box and click the next cell you wish to include.

5. Repeat step 4 until all the fields you want to include have been added to the fields in the dialog box (up to 30 can be selected; use the scrollbar on the right side of the wizard dialog box to reveal more fields).

6. After you've finished, click the OK button. Calc will insert the formula into the cell you selected at the start, showing the result of the formula.

After you've added a formula with the wizard, you can edit it manually by clicking it and typing over its contents in the Formula bar editing area. Alternatively, you can use the Function Wizard once again, by clicking the button on the Formula bar.

Summing Figures

To add the values of a number of cells, you could use the Function Wizard and select the SUM function, as shown in Figure 24-2. The procedure for choosing the cells is the same as described in the previous section.

However, Calc provides a far easier method of creating the sum formula. After positioning the cursor in an empty cell, simply click the Sum icon (the Greek sigma character) on the Formula bar, and then select the cells you wish to include in the sum. Then press Enter to see the results. If you place the cursor in a cell directly beneath a column of numbers, Calc may be clever enough to guess what you want to add and automatically select those entries. If it's incorrect, simply highlight the correct range of cells.

Tip Just as when selecting files within Nautilus, you can select more than one discrete cell by holding down the Ctrl key. You can select a range of cells in succession by clicking and dragging the mouse.

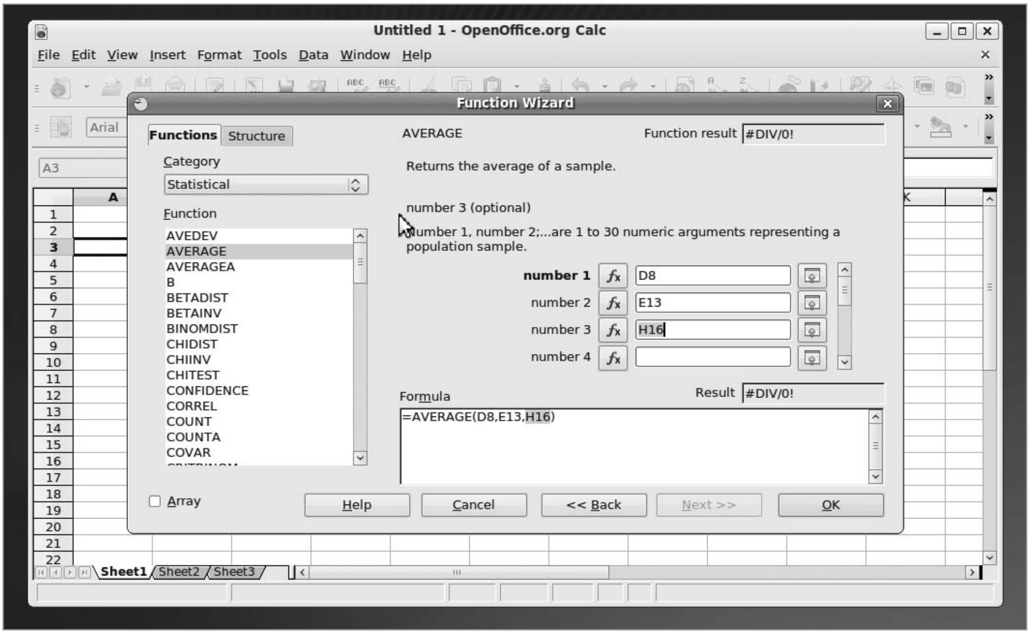

Figure 24-2. *Creating formulas is easy when using the Function Wizard.*

Sorting Data

Within a spreadsheet, you may want to sort data according to any number of criteria. For example, you might want to show a list of numbers from highest to lowest, or rearrange a list of names so that they're in alphabetical order. This is easy to do within Calc.

Start by highlighting the range of data you wish to sort. Alternatively, you can simply select one cell within it, because Calc is usually able to figure out the range of cells you want to use. Then select Data ➤ Sort from the main menu. Calc will automatically select a sort key, which will appear in the Sort By drop-down list, as shown in Figure 24-3. However, you can also choose your own sort key from the drop-down menu if you wish, and you can choose to further refine your selection by choosing up to two more sort subkeys from the other drop-down menus.

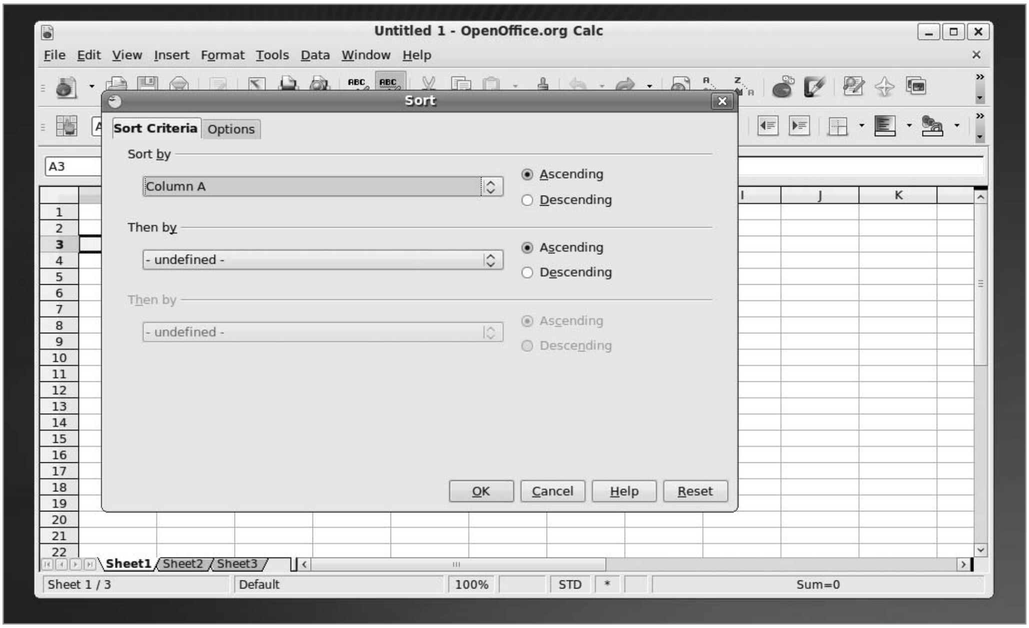

Figure 24-3. *Data can be sorted so that it's in alphabetical or numerical order.*

Using Filters

The Filter function in Calc lets you selectively hide rows of data. The spreadsheet user then selects which of the rows of data to view from a drop-down list that appears in the cell at the top of the rows, as shown in the example in Figure 24-4.

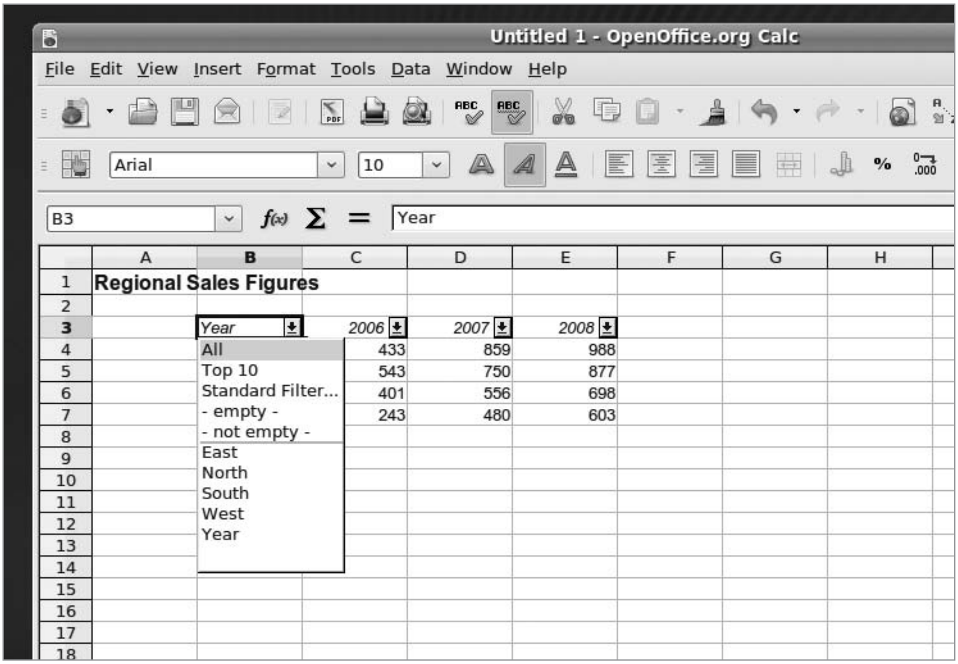

Figure 24-4. *Filters enables you to selectively hide or show rows of data in a spreadsheet.*

Using filters in this way can be useful when you're dealing with a very large table of data. It helps isolate figures so you can compare them side by side in an easy-to-follow format. For example, you could filter a table of sales figures by year.

To use the Filter function, start by highlighting the data you wish to see in the drop-down list. Make sure the column header for the data is included too. If you're using the Filter feature on a table of data, this selection can be any row or column within the table, although it obviously makes sense to use a column that is pertinent to the filtering that will take place. After you've selected the data to filter, choose Data ➤ Filter ➤ Autofilter. Click Yes if asked whether you want the first line to be used as the column header. You should find that, in place of the column or row header, a drop-down list appears. When a user selects an entry in the list, Calc will display only the corresponding row of the spreadsheet beneath.

To remove a filter, choose Data ➤ Filter ➤ Remove Filter.

Creating Charts

Charts are useful, because they present a quick visual summary of data. Calc produces charts through a step-by-step wizard, so it becomes very easy indeed. Here are the steps:

1. Highlight the data you want to graph. Be careful to include only the data itself and not any surrounding cells, or even the cell that contains the title for the array of data.

2. Choose the Insert ➤ Chart menu option, or click the Insert Chart button on the Standard toolbar.

3. A wizard dialog box appears, and a rough-draft of the chart appears behind. You can click and resize the chart at this point, although this is best done after the chart has been properly created.

4. The next step is to choose the type of chart you want. You can choose from the chart type list, and also opt to give the chart a 3D look, which is to say, give the impression of perspective. This can add a professional flourish to some charts. After you finish, click Next.

5. Define the range of cells to be used for the chart. By highlighting the cells before you started, you've already done this, so you can click the Next button. However, if the preview of your chart doesn't look right, you might choose to select the First Row as Label option. This can help Calc understand what's data, and what isn't!

6. Following this, you'll be asked whether you want to add additional series of data for the chart. It's unlikely you'll need to use this option if you're simply producing a pie or bar chart—by far the most common types of chart—so just click Next.

7. Finally, you'll be invited to enter a title for the chart, and a subtitle, if desired. You can also select where in relation to the chart this information is displayed or, if necessary, opt to not show a title by removing the check from the Display Legend box.

8. Click Create, and the chart will be created. Figure 24-5 shows an example.

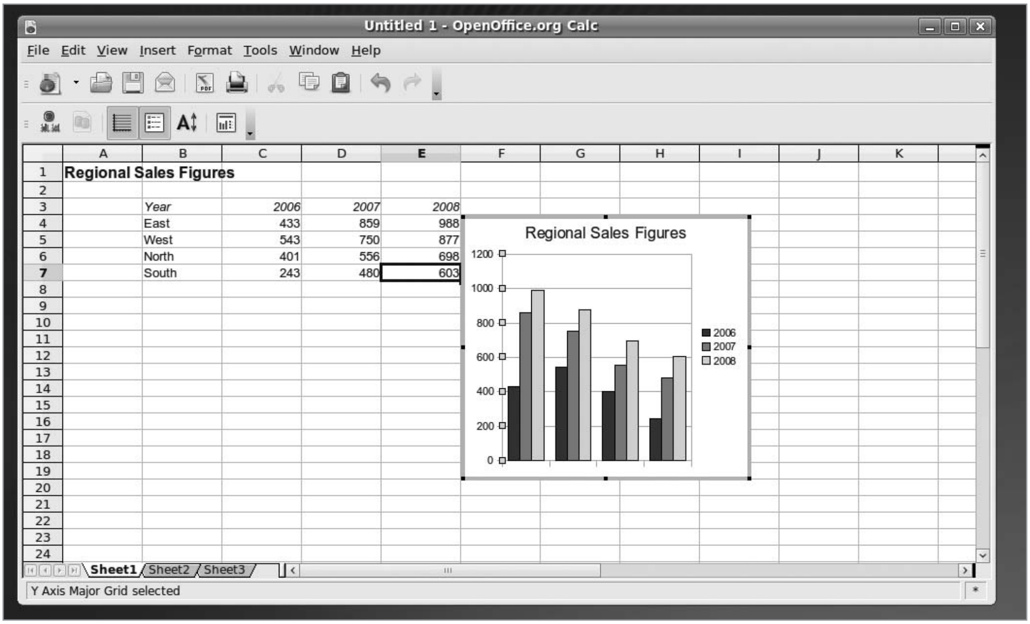

Figure 24-5. *Creating a chart is easy within Calc and adds a professional flourish to your spreadsheet.*

After you've created a chart, you can alter its size by clicking and dragging the handles at the corners and edges. Depending on the type of chart, you might also be able to change various graphical aspects by double-clicking them. However, keep in mind that the graph is actually a picture, so the properties you edit are limited to changing the color and size of various elements.

The chart is linked to your data. Whenever your data changes, so will your chart. This is done automatically and doesn't require any user input.

Summary

In this chapter, we presented OpenOffice.org Calc. You looked at the basics of how data can be entered into a cell and how it can be formatted. Then you learned how to create formulas. This is easy to do with the Function Wizard, which automates the task.

Next, you saw how to sort data in a spreadsheet. You also went through the steps for creating charts by using a Calc wizard. Finally, you looked at creating data filters, which work rather like pivot charts in Microsoft Excel.

In the next chapter, we move on to Impress, the presentations component of OpenOffice.org.

CHAPTER 25

In Depth: Impress

Impress is the presentation package within OpenOffice.org. At first glance, it appears to be the simplest of the key OpenOffice.org components, and also the one that most borrows the look and feel of some versions of Microsoft Office. However, delving into its feature set reveals more than a few surprises, including sophisticated animation effects and drawing tools. Impress can also export presentations as Adobe Flash–compatible files, which means that many Internet-enabled desktop computers around the world will be able to display the files, even if they don't have Impress or even Microsoft PowerPoint installed.

In this chapter, you'll learn about the main features of Impress, as well as the basics of working with presentations. You can start the program by clicking Applications ➤ Office ➤ OpenOffice.org Presentation.

Creating a Quick Presentation

As soon as Impress starts, it will offer to guide you through the creation of a presentation by using a wizard. This makes designing your document a matter of following a few steps.

You'll initially be offered three choices: Empty Presentation, From Template, or Open Existing Presentation.

Templates in Impress consist of two parts: the design elements, such as backgrounds, and slide structure, which provides a range of slide styles. On the first part of the wizard, you can select a presentation template and then, when you click Next, change the presentation background without affecting the slide structure.

Tip When you become experienced in working with Impress, you can create your own templates or download some from the Internet. To create your own template, simply select to save your document as a template in the File Type drop-down list in the Save As dialog box. If you want to share templates among users, make sure you place any templates you download or create in the `/usr/lib/openoffice/basis3.0/share/template/en-US/presnt/` directory (you will need to have superuser powers to do this and should make sure the file permissions are readable for all users). Otherwise, you can save them wherever you like.

The standard way of getting started is to create an empty presentation. This sounds more daunting than it is, because the software does a good job of holding your hand through the setup process. After you've chosen the Empty Presentation option and clicked Next, you will be given the chance to begin with a completely blank slide or a predesigned background. You'll also have the chance to opt for one of the prebuilt presentation designs by choosing Presentation Backgrounds from the drop-down list above the design list, as shown in Figure 25-1.

Select the output format for the final presentation—usually this will be Screen—and then click the Next button.

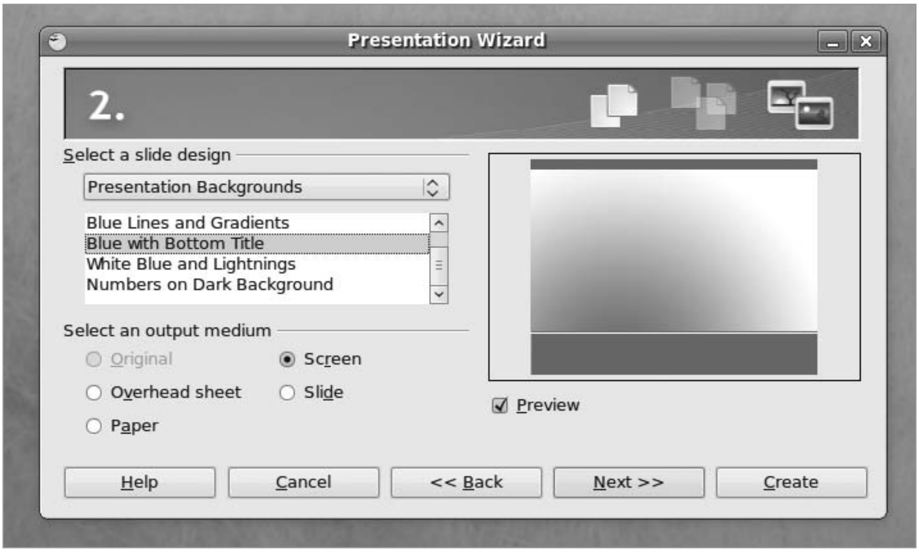

Figure 25-1. *The Impress Presentation Wizard guides you through the creation of a new presentation.*

After this, you'll be invited to choose the presentation effects, including the transition effect that will separate each slide when the presentation is viewed, and the speed of the transition. If you wish, you can set the pause between slides, too, as well as the length of time each slide stays on the screen. Selecting the Default option means each slide will appear for 10 seconds before changing.

■ **Tip** Adding fancy transitions and complex animations can seem like a good idea when you're designing a presentation, but they can be quite tedious when you're actually delivering it to your audience.

After clicking the Create button in the wizard, which you can do at any point in the wizard, Impress will launch. The first step is to choose a layout for your initial slide. These are previewed onscreen, on the right side of the program window. A variety of design concepts are available, ranging from those that contain mostly text to those that feature pictures and/or graphs.

Depending on which template you choose, you should end up with a handful of text boxes on your screen. Editing the text in these is simply a matter of clicking within them. The formatting of the text will be set automatically. In the case of images, double-clicking will open the file browser dialog box, in which you can choose the relevant image file. Images and other objects can be resized by clicking and dragging the handles at the corners and edges.

■ **Tip** You can move and shrink each text box by clicking the handles surrounding the box. To draw a new text box, select the relevant tool on the Drawing toolbar (indicated by the icon of a T in a box), which runs along the bottom of the screen. Simply click and drag to draw a box of whatever size you want.

Working in Impress

You'll notice three main elements in the program window, from left to right, as shown in Figure 25-2. The interface can feel a little crowded, so it's a good idea to maximize the window. You work in these panes as follows:

Slides pane: This pane shows the slides in your presentation in order, one beneath the other. Simply click to select whichever slide you want to work on, or click and drag to reorder the slides. To create a new slide, right-click in a blank area on the Slides pane and select the option from the small menu that appears. Right-clicking any existing slide will present a range of options, including one to delete the slide. The Slides pane can be torn off the main interface and positioned anywhere onscreen. To dock it back once again, hold down the Ctrl key and double-click the space next to where it reads "Slides."

Main work area: This is in the middle of the program window and lets you edit the various slides, as well as any other elements attached to the presentation, such as notes or handout documents. Simply click the relevant tab at the top of the work area. The tabs are as follows:

Normal: This is a simple full-scale preview of the slide as it will appear within the presentation, and is entirely editable. Items can be clicked and moved around.

Outline: Here you can roughly draft headings for each slide. The intention of this view is to let you quickly brainstorm ideas, or simply get ideas down as quickly and efficiently as possible. Hitting Enter after each line within the outline creates a new slide according to the heading you've just typed.

Notes: The Notes view lets you prepare printed notes that you may want to provide with the printed rendition of the presentation. Every slide can have a page of notes attached to it. After the Notes view is selected, a letter-sized page will be shown. The top half will contain a preview of the slide, while the bottom half will contain a text area for typing notes.

Handout: This view lets you set the formatting of the handouts, which is to say, the printed rendition of the presentation designed to be given to the audience. Each sheet of printed paper can contain between one and nine slides, depending on the selected design. To alter the layout of the handout, either click and drag the elements within the preview, or select a different design in the Layouts preview on the right of the program window.

Slide Sorter: The Slide Sorter tab shows thumbnail previews of the slides side by side, effectively in chronological order. You can click and drag each to reorder, or right-click each slide to change its properties (such as changing the transition effect).

Tasks pane: Here you can access the elements that will make up your presentation, such as slide layouts, animations, and transition effects. Select the slide you wish to apply the elements to in the Slides pane, and then click the effect or template you wish to apply in the Tasks pane. In the case of animations or transitions, you can change various detailed settings relating to the selected element. As with the Slides pane, this can also be undocked, but has a View menu for redocking it to the window (pressing Ctrl while double-clicking also works).

In addition, Impress has a Drawing toolbar, which appears at the bottom of the screen. This lets you draw various items onscreen, such as lines, circles, and rectangles, and also contains a handful of special-effect tools, which we'll discuss later in this chapter, in the "Applying Fontwork" and "Using 3D Effects" sections.

You can hide each onscreen item by clicking the View menu and then removing the check next to it. Alternatively, by clicking the vertical borders between each pane, you can resize the pane and make it either more or less prominent onscreen. This is handy if you wish to temporarily gain more work space but don't want to lose sight of the previews in the Slides pane, for example.

Figure 25-2. *The main Impress window is split into three elements: the Slides pane, the main work area, and the Tasks pane.*

Animating Slides

All elements within Impress can be animated in a variety of ways. For example, you might choose to have the contents of a particular text box fly in from the edge of the screen during the presentation. This can help add variety to your presentation and perhaps even wake up your audience, but be aware that too many animations can look unprofessional. They should never get in the way of your message.

Setting an animation effect is simply a matter of clicking the border of the object you wish to animate in the main editing area so that it is selected, selecting Custom Animation in the Tasks pane, and then clicking the Add button. In the dialog box that appears, select how you want the effect to work. As shown in Figure 25-3, you have the following five choices, each with its own tab within the dialog box:

Entrance: This lets you animate an appearance effect for the selected object. For example, you can choose to have a text box dissolve into view or fly in from the side of the screen. When you select any effect, it will be previewed within the main editing area.

Emphasis: This gives you control over what, if anything, happens to the object while it's onscreen. As the name suggests, you can use this animation to emphasize various elements of a slide while you're giving the presentation. Some emphasis effects are more dramatic than others, and this lets you control the impact. If you want to make an important point, you can use a dramatic effect, while more-moderate information is presented with a more subdued effect.

Exit: As you might expect, this lets you add an exit animation to the object. You might choose to have it fly off the side of the screen or spin away off the top of the screen. The animation choices here are largely identical to the Entrance choices.

Motion Paths: This makes the selected element fly around onscreen according to a particular path. For example, selecting Heart will cause the element to fly around, following the shape of a heart, eventually returning to its origin. You can define your own path for the object by selecting either Curve, Polygon, or Freeform Line in the list. The Curve option lets you define a Bezier curve, the Polygon option lets you define a motion path using straight lines, and the Freeform option lets you simply sketch a path by using the mouse cursor (to edit the path later, click Edit ➤ Points, and click the path). A motion path is effectively another way of emphasizing a particular object.

Misc Effects: This option doesn't actually apply an effect. Instead, it lets you control any media you have inserted into the slide, such as movie files. When applied to the media object within the slide, you can jump to the start or end of the media by clicking, or simply pause it.

Note You can apply only one effect at a time to an object, although several separate effects can be applied to any object.

With each animation, you can select the speed you wish it to play at, ranging from Very Slow to Fast. Simply make the selection at the bottom of the dialog box.

After the animation has been defined and you've clicked OK, it will appear in a list at the bottom of the Custom Animation pane. You can choose to add more than one animation to an object by clicking the Add button again (ensuring the object is still selected in the main editing area). The animations will play in the order they're listed. You can click the Change Order up and down arrows to alter the order.

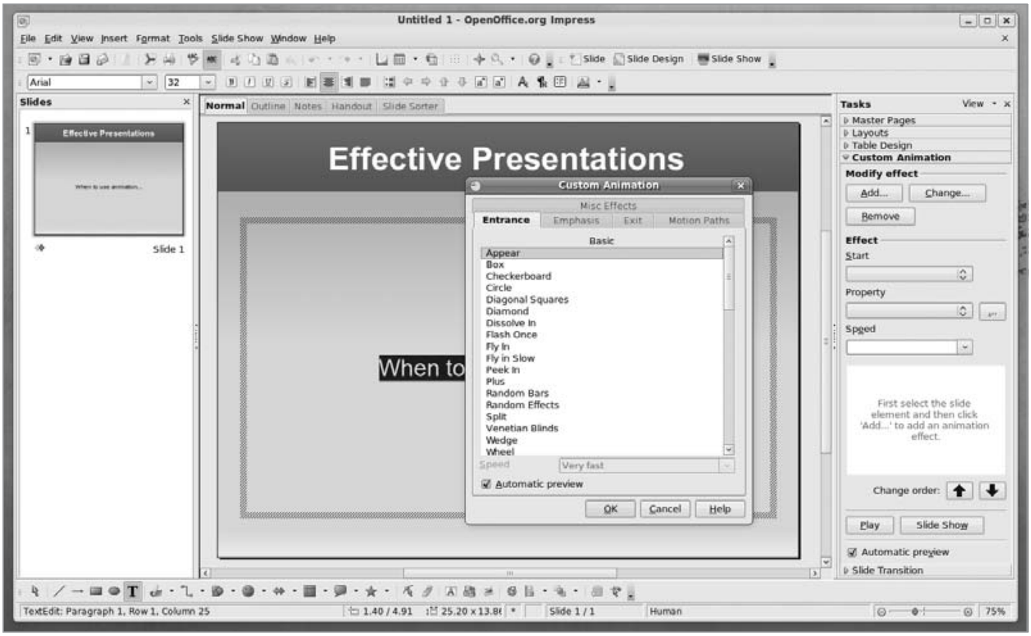

Figure 25-3. *A wide variety of animation effects is available for onscreen elements.*

To fine-tune an effect you've already created, double-click it in the list to open its Effect Options dialog box (you can even add sound effects here). Under the Timing tab, you can control what cues the effect, such as a click of a mouse, or whether it will appear in sequence with other effects before or after in the list.

Applying Fontwork

The Fontwork tool lets you manipulate text in various playful ways, such as making it follow specific curved paths. You can find this tool on the Drawing toolbar, located at the bottom of the program window. It's the icon that's an A in a frame.

When you click the icon, the Fontwork Gallery dialog box appears, offering a choice of predefined font effects. Don't worry if they're not quite what you want, because after you make a choice, you'll be invited to fine-tune it.

After you've made the selection, the dummy text *Fontwork* will appear onscreen. Editing the text is simple: just double-click the *Fontwork* text and type your own words (note that, confusingly, the text will appear underneath the fontwork itself, rather than in a dialog box). When you've finished, click outside the Fontwork selection.

Whenever the new Fontwork item is selected, one or two floating toolbars will appear, as shown in Figure 25-4. The first toolbar controls the fontwork itself, while the second—if applicable—controls the 3D effect of the text (it will not appear on fontwork effects that do not have 3D perspective). You can use these toolbars to alter various options. For example, you can select a completely different Fontwork selection from the gallery or, by clicking the second icon from the left on the Fontwork toolbar, select your own path that you want the Fontwork item to follow. If the Fontwork type is three-dimensional, the 3D-Settings toolbar will let you alter the perspective, texture, and lighting. For more info on the options available, see the “Using 3D Effects” section.

You’ll also see that the Formatting toolbar running along the top of the program window changes to allow you to alter the formatting of the Fontwork element. You can alter the thickness of the letter outlines, for example, or the color of the letters. Once again, the best way to learn how the tool works is to play around with the options and see what you can achieve.

To remove a Fontwork item, just select its border and press the Delete key on your keyboard.

Figure 25-4. *The Fontwork tool can add some special effects to your presentations.*

Using 3D Effects

In addition to Fontwork effects, Impress includes a powerful 3D tool, which can give just about any onscreen element a 3D flourish (this tool is also available in some other OpenOffice.org applications). To use it, create a text box or shape by using the Drawing toolbar at the bottom of the screen. Then right-click the text box or shape and select Convert ➤ To 3D.

Note The 3D option is designed simply to give your object depth. If you want to create a genuine 3D object that you can rotate in 3D space, select the 3D Rotation Object.

You can gain much more control over the 3D effect by right-clicking it and selecting 3D Effects. This will open a floating palette window with five configuration panels, as shown in Figure 25-5. Click the icons at the top of the palette to adjust the type of 3D effect and its lighting, as follows (click the check icon at the top right to apply any changes you make):

Geometry: This defines how the 3D effect will look when it's applied to onscreen selections. For example, you can increase or decrease the rounded-edges value, and this will make any sharp objects on the screen appear softer when the 3D effect is applied.

Shading: This doesn't affect the actual texture of the 3D object, but instead alters how the color gradient is applied to the object. This is best demonstrated in action, so select the various shading modes from the drop-down list to see the effect. In addition, you can choose whether a shadow is applied to the effect, as well as the position of the virtual camera (the position of the hypothetical viewer looking at the 3D object).

Illumination: This lets you set the lighting effect. All 3D graphics usually need a light source, because this helps illustrate the 3D effect; without a light source, the object will appear flat. Various predefined light sources are available. You can click and drag the light source in the preview window.

Textures: This affects how the textures will be applied to the 3D object. A texture is effectively a picture that is "wrapped around" the 3D object. Clever use of textures can add realism to a 3D object. A map of the world applied to a sphere can make it look like a globe, for example, or you could add wood or brickwork textures to make objects appear as tabletops or walls.

Material: This lets you apply various color overlays on the texture. This can radically alter the texture's look and feel, so it is quite a powerful option. To change the texture itself, right-click the object and select Area. This will present a list of predefined textures. Alternatively, you can select to use a color or pattern.

To apply any changes you make, click the check button at the top right of the palette. As with the other presentation effects, the best policy is simply to experiment until you're happy with the results.

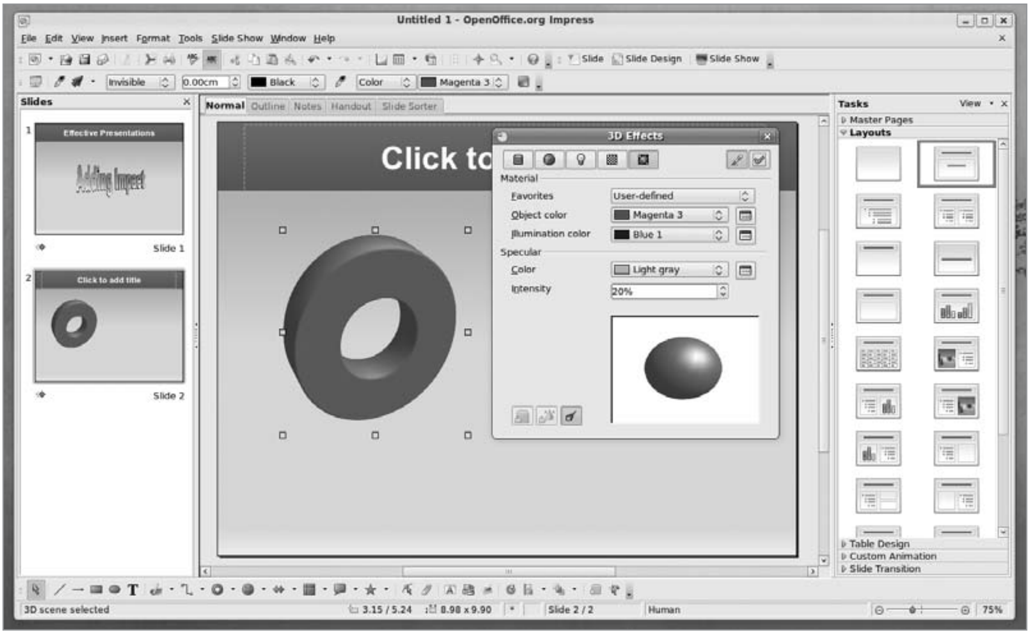

Figure 25-5. *You can fine-tune 3D objects to quite a high degree by using the 3D Effects palette.*

Exporting a Presentation As a Flash File

If you plan to put your presentation online, or you want to send it to a colleague who doesn't have Impress or PowerPoint installed, outputting your presentation as a Flash animation could be a good idea. The process is simple. Just choose File ➤ Export, and then select Macromedia Flash (SWF) in the File Type drop-down list (SWF is the Flash file extension, which stands for Shockwave Flash), as shown in Figure 25-6. No further configuration is necessary.

In order to play the file, it needs to be opened within a web browser that has the Flash Player installed. This can be done by choosing File ➤ Open on most browsers, although you can also drag and drop the SWF file onto the browser window under Microsoft Windows. There shouldn't be much of a problem with compatibility, because the Flash Player is ubiquitous these days. If the web browser doesn't already have Flash installed, it's easy to download and install it (see `www.adobe.com/products/flashplayer`).

When the Flash file is opened in a web browser, the presentation starts. You can progress through it by clicking anywhere on the screen.

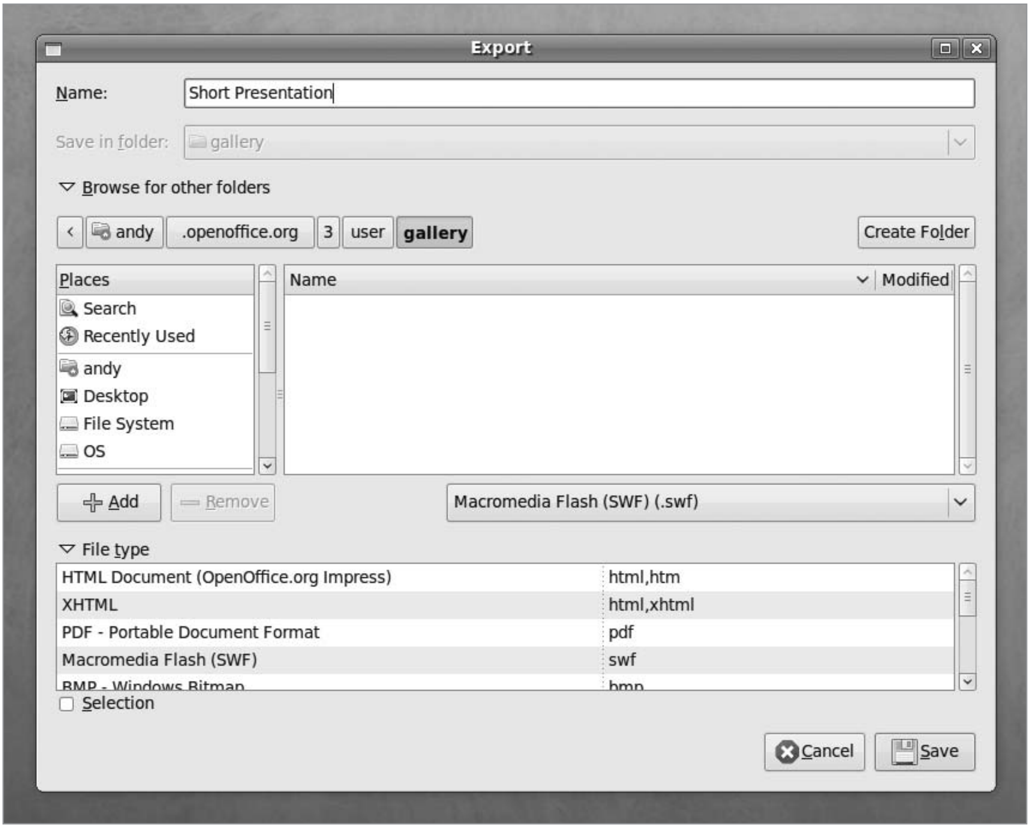

Figure 25-6. *You can save any presentation as a Flash animation, which can be played back in a suitably equipped web browser.*

Summary

In this chapter, you examined Impress, which is the presentations component within OpenOffice.org. You started by looking at how to use the Presentation Wizard function to automate production of a basic Impress document. Then you saw how various effects can be added to the presentation, including 3D effects. Finally, you looked at how the presentation can be exported as a Shockwave Flash file for playback on virtually any web browser.

In the next chapter, you will explore the database component within OpenOffice.org: Base.

CHAPTER 26

In Depth: Base

The various OpenOffice.org applications include a number of tools to both interface with database servers and perform tasks such as entering and editing data. However, for most day-to-day users who have humble needs, creating such a setup is rather complicated. It requires some knowledge of how databases work on a technical level. For this reason, a new component was added to OpenOffice.org with the 2.0 release: Base.

Base is a relational database application, complete with tools providing a GUI front end, along the lines of Microsoft Access. It is perfect for database applications of all sizes, including more-modest efforts. For example, you could use it to create an inventory database to produce a report showing all products added for a certain geographical region on a certain date, or you could use it to catalog items in your personal stamp collection.

Relational databases such as those created by Base are ideal for quickly creating catalogs of information, such as inventory lists. In addition to making database creation simple and quick, relational databases let you easily query data to produce reports tailored to individual needs.

Database vs. Spreadsheet

For many users, a database might be considered overkill, so you may opt to use a spreadsheet instead. The two types of software have converged somewhat; spreadsheets offer search and query options, while databases are capable of basic calculations. However, the way they present data is very different. In a spreadsheet, data is largely unstructured (though you may impose structure on it) so, for instance, a cell in column 5 might contain a zip code but could also contain a phone number. In a database, the data is formally structured so, when properly used, a cell in column 5 (in this instance) would always contain a zip code. Databases also make it easier to view information on a record-level basis, can be linked to forms that make data entry easier and, because of the way they work with RAM and hard drive memory, can hold much larger data sets.

Base works on a number of levels depending on the knowledge of the user, but in its most basic form, it offers a design-based approach to the creation of tables and forms. Anyone who has previously created a database under Access will feel right at home.

In this chapter, you'll work through an example of using Base to create a simple database cataloging a collection of music. You can use the same techniques to create any kind of relational database.

Getting Started with Base

Unfortunately, Base isn't installed on your Ubuntu system by default. You can download and install it by clicking System ➤ Administration ➤ Synaptic Package Manager. Click the Search button on the toolbar and type `openoffice.org-base` into the text box. In the list of results, click the empty check box alongside `openoffice.org-base` (don't click the other results!) and click Mark for Installation. You'll see a dialog box informing you that some additional programs need to be installed—this is fine. Click the Mark button in the dialog box to dismiss it. Then click the Apply button on the main toolbar, and the Apply button in the subsequent dialog box that appears. After the program has been downloaded and installed, close the Synaptic Package Manager.

■**Note** Over 200MB of new packages will need to be downloaded and installed for Base. This is because Base relies on several large Java system components, including the HSQLDB component that provides the actual database functionality. This also explains why Base isn't installed by default within Ubuntu—put simply, it is too big to fit on the installation CD!

After it's installed, you'll find Base under the Applications ➤ Office menu and labeled OpenOffice.org Database. When the program first starts, the Database Wizard guides you through either creating a new database or opening an existing one, as shown in Figure 26-1. After you've made your choice, click Next to continue.

The first step in creating a new database is to register it within OpenOffice.org. This means that it will be made available in other OpenOffice.org programs, such as Calc or Writer. Although the knowledge needed to use a database in this way is quite advanced, there's no harm in agreeing to this option. It might prove useful in the future as you learn more about OpenOffice.org.

Following this, you can choose to open the database for editing and/or start the Table Wizard. After you click the Finish button, you'll be invited to give the database a name and save it immediately.

■**Note** Databases aren't like other Office files in that they automatically save and update themselves. When using the finished database, you can simply enter data and then quit the program, without needing to deliberately opt to save the file.

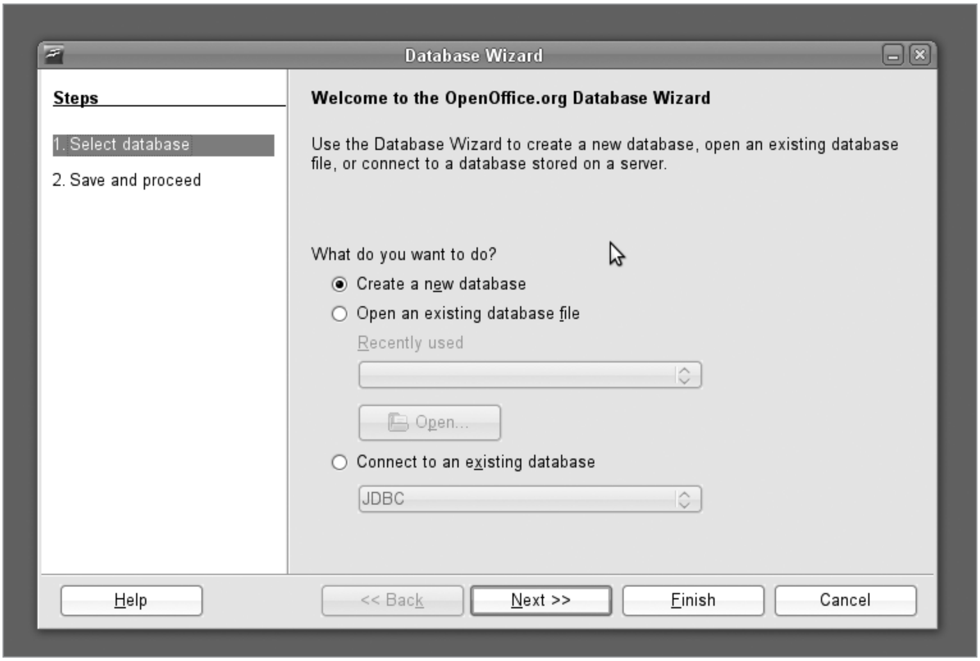

Figure 26-1. *Base starts with the Database Wizard to facilitate the quick and easy creation of new databases.*

Assuming that you did not opt to go directly to the Table Wizard, you'll now see the main Base program window. The right side of the Base program window contains the Tasks and data panes (labeled Tables in the default program view). The Tasks pane allows you to create new database elements, depending on what's selected in the data pane. The data pane shows any elements you've already created, and its content changes depending on whether you have the Tables, Queries, Forms, or Reports mode selected in the data pane, on the left. The components of the data pane relate to the four typical elements of a database, and they are as follows:

Tables: A table is what holds the actual data you'll eventually input. Therefore, a table is the first thing that needs to be created within a new database. Creating a table involves defining the types of data that you want to store and giving the individual data fields easy-to-understand names.

Forms: Although it's possible to enter data directly into a table, it isn't particularly intuitive or easy. Because of this, forms are used to make the data fields presentable. As the name suggests, in terms of layout these are not unlike the paper forms that you fill in to facilitate the collection of data by businesses. As with tables, forms must be created from scratch in a new database. Forms have *controls*, which are used to facilitate data entry, or to allow users to navigate the database or otherwise manipulate it. The most common type of control is a text-entry field, which is then tied to a data field within the table, but you can also have controls that perform certain functions, such as deleting a record in the database.

Queries: A query is a way of filtering the database so that you see only a subset of it. For example, in a database detailing sales figures from across the country, you might create a query to show only the data from a particular state.

Reports: A report is a way of presenting data for human consumption, usually in a printed format. For example, you could create a report that details sales figures in the form of a letter, or you might make a report to produce address labels using addresses stored in the database.

■ **Note** The usefulness of both queries and reports are that they can be saved and used over and over again, so you could use the same query each month to examine just a small section of the data. Base offers wizards to automate the creation of both queries and reports.

Double-clicking an item in the data pane displays or activates that item. Right-clicking a data pane item displays a variety of options related to editing the file.

Now, let's work through an example of using Base. First, you'll create a table, and then you'll create a form.

Creating a Database

As an example of using Base, you'll build a database, ready for data entry. The first step in the creation of a database is to make a table. This will hold the data that you will eventually enter by using a form.

Adding a Table

As with all components within Base, you can use a wizard to create the table. The Table Wizard offers a number of predefined data fields corresponding to typical databases. It is fine for general use, but if you have a specific and unusual database in mind, you will need to create the table manually.

Here you'll create a database to catalog music CDs. This is easily accomplished with the Table Wizard and, with a little effort, could be adapted to catalog any other collection of media including books, MP3s, and DVDs:

1. Click the Tables icon in the data pane, and then click the Use Wizard to Create Table icon. The Table Wizard starts.

2. You're given a choice between creating a business or personal database. As you would expect, business databases are likely to contain fields relating to business matters, such as accounting, and the fields in the personal section relate more to domestic matters. Choose Personal for this example.

3. Choose an entry from the Sample Tables drop-down list. For this example, select CD Collection.

4. In the Available Fields box, you now see a number of data fields that would prove handy for cataloging a CD collection. You don't need to use all of these. Instead, select only those you want in your table, and then click the single right-facing arrow button to transfer them to the Selected Fields box (the double-arrow button transfers across *all* the fields). For this example, select Album Title, Artist, Release Year, Rating, and Review, as shown in Figure 26-2 (hold the Ctrl key to select many items at once). Then click the Next button. (Don't worry if you find the fields lacking or if you want to add your own—you'll see how to do just that in step 6).

5. Check to make sure the fields you selected are of the correct type. Click each to see the information in the right-hand area of the dialog box. Fields can take various forms depending on what kind of data they're supposed to hold. For example, one field might be designed to contain text, while another might need to contain numbers. Yet another might need to contain dates, and some can even contain pictures. As you might expect, the wizard has automatically selected the correct data types for the predefined fields.

6. For this example, you want to add a check box that shows whether the CD is scratched. If the CD in question is scratched, the user can click in a check box. If the CD isn't scratched, the box can be left blank. To create a check box, you need a special kind of data field called a Boolean. This means that the data field can be either true or false or, to put it a simpler way, it can hold either yes or no. To create a new yes/no data field, click the plus button at the bottom of the Selected Fields box. This allows you to add another field. In the Field Name box, type **Scratched**. For the Field Type, click the drop-down list and locate the entry marked Yes/No [BOOLEAN]. The other options can remain as they are. Click Next to continue.

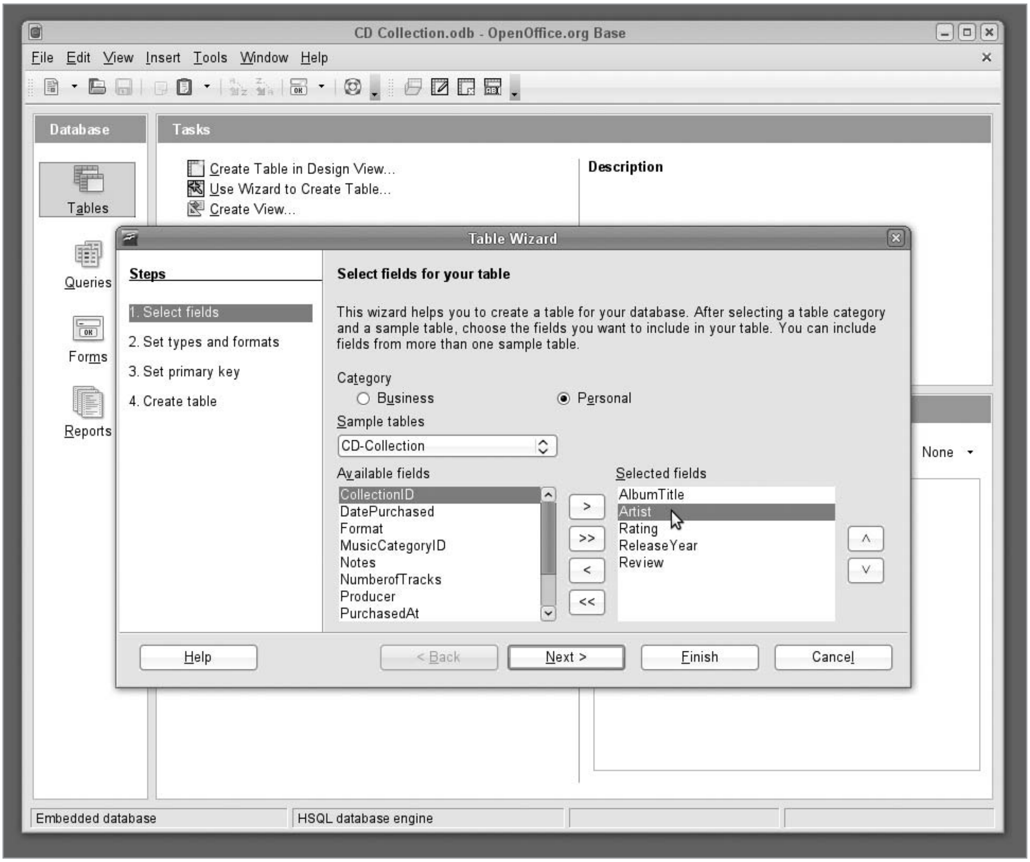

Figure 26-2. *The Table Wizard contains ready-made data fields for a wide variety of uses.*

7. You're asked whether you want to create a primary key. This is the unique numeric field that the database uses to keep track of each entry in the database. It's a must in a database like this one. The default choices are correct, so you can click Next again.

8. You've completed the Table Wizard. The next step is to create a form, so select Create a Form Based on This Table, and then click the Finish button.

Creating a Form

Forms are present in databases for the benefit of users to facilitate the quick and easy entry of data. They present data fields that you've just created within the table in an easy-to-understand form. In OpenOffice.org, forms are created by using the same tools and interface that are available in Writer, so if you've used this, you should feel quite at home. It also means you'll now have two OpenOffice.org windows open.

Base is able to walk you through the creation of forms via the Form Wizard. If you didn't select to run the Form Wizard previously, you can start it by clicking Forms in the data pane, and then clicking Use Wizard to Create Form. Then follow these steps:

1. In the Form Wizard's first step, select which fields you want to appear on the form. As with the Table Wizard, this is simply a matter of selecting the available fields and then clicking the right-arrow button so that they appear under the Fields on the Form heading. Alternatively, by clicking the double-arrow button, you can select all of them in one fell swoop, which is what you want for this example. Click Next.

2. You're asked whether you want to create a subform. As its name suggests, this is effectively a form within your main form. A subform is useful with more-complicated databases, where it might be necessary to view other data while filling in the form. For this simple example, leave the Add Subform check box empty and click Next.

3. Choose a general layout for the data fields. The default is the table view, which many find ugly, so you might choose one of the first two options (in our database, we chose the second option, as you can see in Figure 26-3). These arrange the data fields in a spacious manner and make the form much more usable. If you look behind the wizard dialog box, you'll see a preview of how the form will look. When you are finished, click Next.

4. You're asked whether you want existing data to be displayed on the form. You can choose to treat the form as one created only for entering new data, so that you can't use it to navigate through the database and see existing data you've already entered. This might be useful in applications where you don't want users to see the other data in the database. However, for a database for your own personal use, being able to see the existing data is very handy, which is why the Form Is to Display All Data option is selected by default. For this example, simply click the Next button to accept the default.

5. Choose a look and feel for your form from the variety of color schemes available, as shown in Figure 26-3. Again, you can see them previewed behind the wizard dialog box. Feel free to experiment with the options under the Field Border heading. We prefer the 3D Look option, which gives the form elements a slight interior shadow, a common feature on most modern user interfaces. The Flat option simply adds a black border to the boxes, and the No Border option removes the border completely. After you've made your choices, click Next.

6. You're invited to give the form a name. Enter a suitable name, such as **CD-Collection**. You are also given the option of entering data directly into the form or modifying it. After you've made your choice, click the Finish button. At this stage, the database is almost ready for use. You just need to take one more step to modify the table. However, first we'll take a brief look at adding custom controls to forms, which is something more-advanced users might want to do.

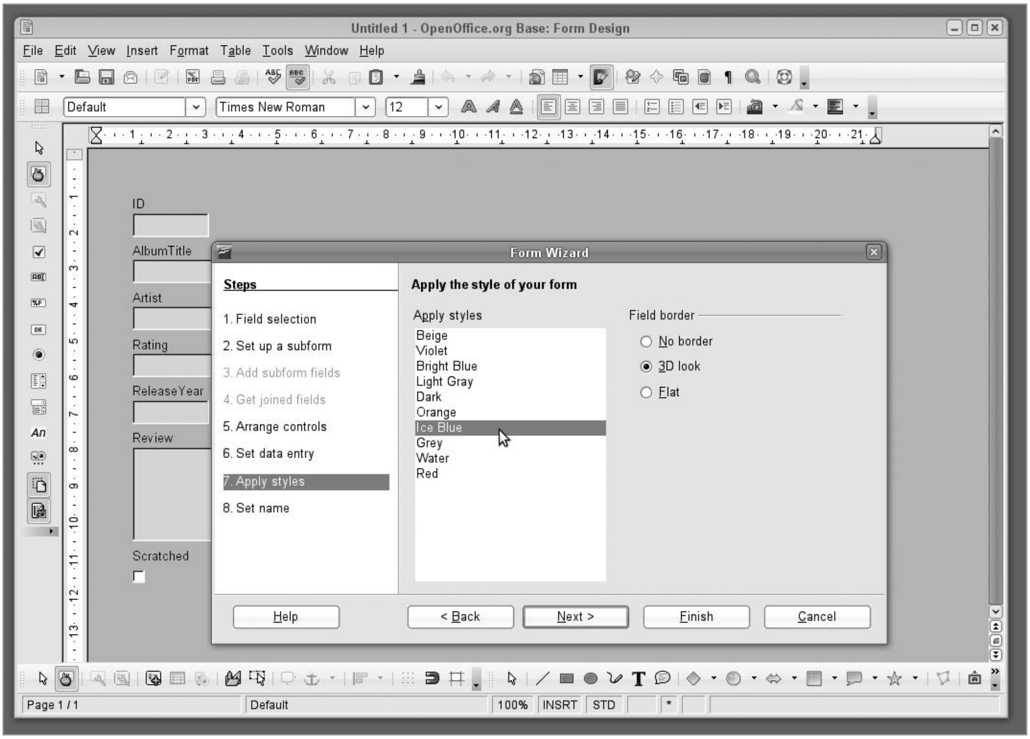

Figure 26-3. *You can choose from a variety of look-and-feel options for your form, and each will be previewed behind the wizard dialog box.*

Note There are no rules governing form names, and you can use virtually any symbols and also insert spaces into the name. However, it's a good idea to keep the form name simple and concise and to use a consistent name across forms and titles.

Manually Adding Controls to the Form

Although the form created by the wizard is good enough for our needs, in some instances you might want to edit the form manually to add your own controls. The following instructions describe how to do so:

1. Double-click the form to edit it and then ensure that the Form Controls toolbar is visible—click View ➤ Toolbars ➤ Form Controls. Then, on the Form Control toolbar, click the icon that represents the control you want to add to the form. Don't forget, you can hover your mouse over each icon to see a tooltip explaining what the icon is for. Next click and drag on the form to add the item. You need to make the item big enough so that the label can be seen. This is especially relevant in the case of smaller items, such as check boxes. If you release the mouse button too early, simply click and drag the handles at the edges to resize the control.

2. After the item has been drawn, double-click it. This will open the Properties dialog box. Click in the Label box, delete what's there already, and type the word(s) that will help the database users identify the item.

3. Click the Data tab and, in the Data Field box, select from the drop-down list the table data field that you wish to associate with the item.

4. Close and save the form.

You can add many custom controls following the same basic approach you used here. Simply draw them on to the form, and then match them up with an entry in the table by using the Data tab.

Editing the Database Table

Before you can use the CD database we created earlier, you need to make a small change to the table you created. Although the Table Wizard created a primary key, it didn't make it into an automatically updating number. Without this option activated, the user will need to manually number each entry in the database as it's created.

Follow these steps to edit the table and activate automatic numbering for the ID field:

1. Click the Tables icon in the data pane of the main program window, right-click the table you created earlier, and select Edit.

2. Look for the entry in the table list labeled ID. It should be first in the list. Make sure that the cursor is on the Field Name line, and click the AutoValue drop-down list at the bottom of the window. Make sure that it reads Yes, as shown in Figure 26-4.

3. Close the window and opt to save the table.

That's it! Your database is now ready to use.

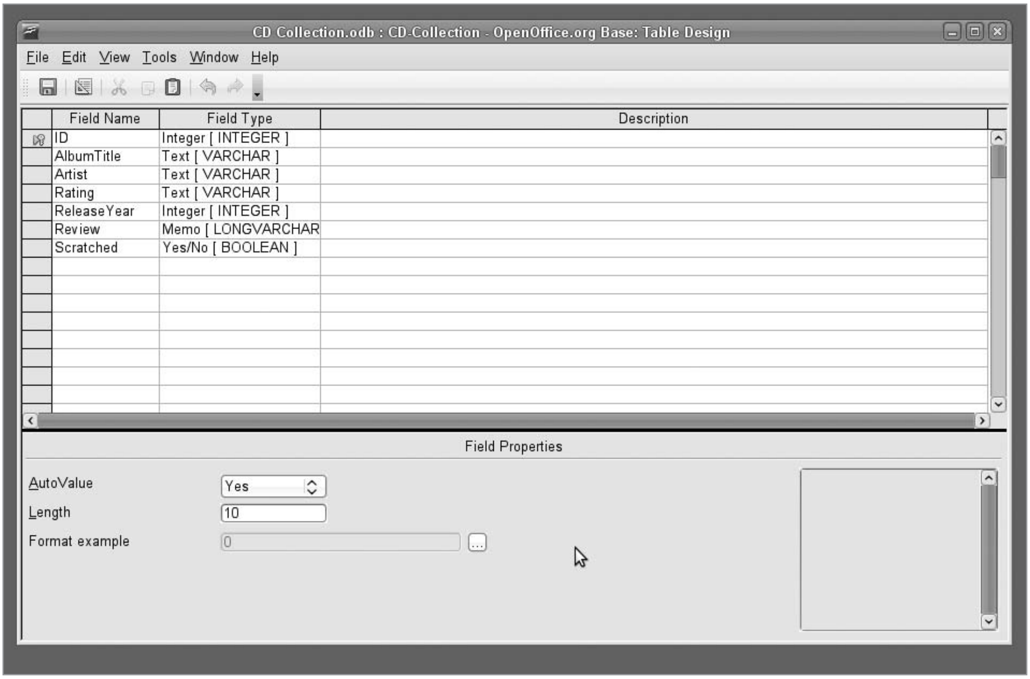

Figure 26-4. *Set the primary key to automatically update by editing its value in the table.*

Using the Database

Entering data into the finished database is easy. Click the Forms icon in the data pane, and then double-click the form you created earlier.

The Form Control toolbar might still be visible. To hide it, click View ➤ Toolbars on the menu, and remove the check alongside it on the submenu. After this, you can start to enter data into the form, as shown in the example in Figure 26-5. Note that you do not need to enter data in the ID field, because this will automatically be filled with the primary key number.

After you've filled in the form, you can click the Next Record button in the Form Navigation toolbar running along the bottom of the window (don't forget that hovering the mouse cursor over each button reveals a tooltip explaining what the button does). This will move you on to the next blank form, where you can enter more data. Repeat this as many times as necessary.

The Form Navigation toolbar contains other handy tools. For example, the first button—a magnifying glass—lets you search the database for a particular entry. It's well worth investigating the functions.

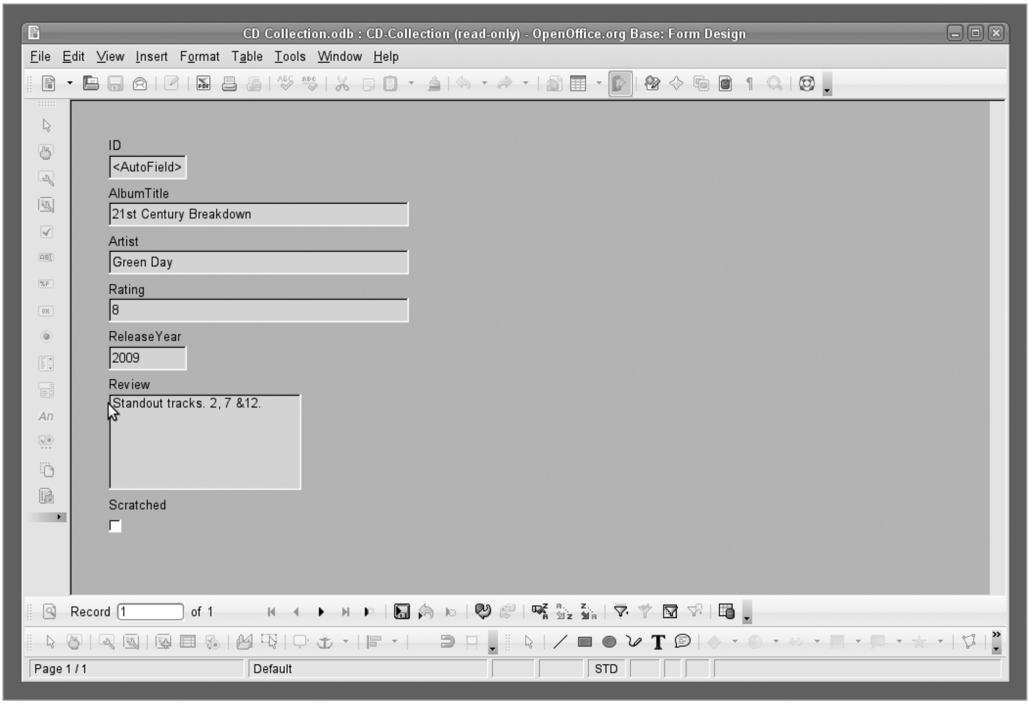

Figure 26-5. *The finished database form lets you enter data into the input fields and navigate by using the toolbar at the bottom.*

■ **Tip** For more in-depth coverage of the power of OpenOffice.org Base, look for *Beginning OpenOffice 3: From Novice to Professional* by Andy Channelle (Apress, 2008).

Summary

In this chapter, you looked at the Base database component of OpenOffice.org and how to use it to easily create and edit simple databases. You stepped through an example of setting up a database table and creating a database form that users can employ to enter and edit data.

In the next chapter, you will look at Evolution, the powerful e-mail and personal information manager offered under Ubuntu.

CHAPTER 27

In Depth: Evolution

Although I've included it in the "Office" section of this book, the Evolution program isn't part of the OpenOffice.org suite. However, although it's not explicitly described as such by its developers, Evolution is considered the "official" GNOME desktop e-mail program, and the Evolution interface retains the same look and feel as many elements of the Ubuntu desktop.

In terms of functionality, writing about Evolution in this section of the book makes complete sense. Evolution is similar to Microsoft Outlook: in addition to being a powerful e-mail client, it incorporates contact management, a calendar, a to-do list, and a memo function. It is a first-class business tool. Evolution is even able to connect to Microsoft Exchange (2000 and later) groupware servers and synchronize with contact and calendar data, in addition to fetching e-mail. Of course, it can also connect to standard POP3/SMTP e-mail servers, as well as IMAP, Novell GroupMail, and a handful of other mail server technologies. This means it is compatible with practically every e-mail system in common use today. For more details about how to set up Evolution, see Chapter 8.

Although Evolution offers many of the functions of Microsoft Outlook, it differs in some key ways. This chapter describes how to use Evolution's main features.

Evolution Modes

Evolution consists of five components: Mail, Contacts, Calendars, Memos, and Tasks. These are interconnected but operate as separate modes within the program. Each mode can be selected by using the switcher located at the bottom-left side of the program window. Simply click the button for the mode you wish to use. The program window, toolbar, and menu system will change to accommodate whichever mode is selected. Figure 27-1 shows the program in the default Mail mode.

Tip You can shrink the switcher component to small icons or even just text buttons by selecting from the choices on the View ➤ Switcher Appearance submenu.

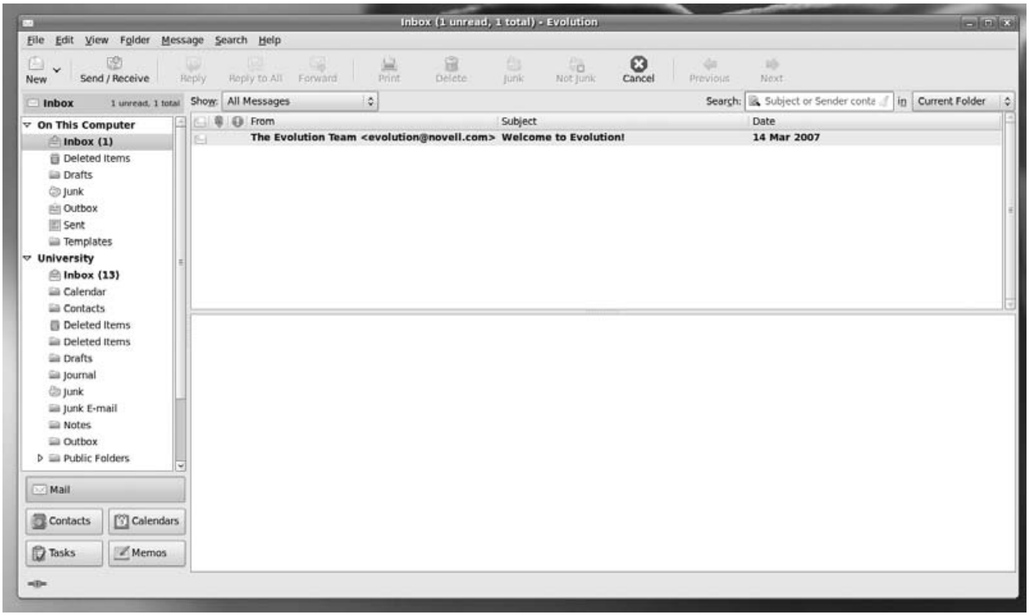

Figure 27-1. *You can switch between Evolution's modes by clicking the buttons at the bottom left of the program window.*

The five Evolution modes work as follows:

Mail: The e-mail component is at the heart of Evolution, and all the functions you might be used to are available here. After the Mail mode is selected, you'll find the mail folders at the top left of the program window. These include the Inbox and Sent folders, along with any other mail folders you create. On the right is the list of e-mail messages, and beneath this is the message preview pane, where the body of any message you select will be displayed. Above the message list is the search box, which works like most e-mail search routines: type the relevant word(s) and press Enter. Notable icons running along the top of the window include the New button, which will let you compose an e-mail message, and the Send/Receive button, which will download new messages and also send any messages in the Outbox folder. By default, Evolution checks for new mail when the application is launched and every 10 minutes thereafter, though this behavior is configurable for each account under the Edit ➤ Preferences menu.

Contacts: Tied in with the mail function but acting as a separate and powerful entity on its own, the Contacts mode lets you store every pertinent detail about colleagues, friends, and others. After the mode is selected, you'll see the various contact folders at the left side of the program window. For most users, there will be just one, named Personal, but if you specified a groupware server during setup, you will also be able to connect to this by clicking its entry. You can also create new Address Books—for instance, if you have a collection of addresses for work and one for personal information. Simply right-click beneath the existing Address Book, select the New Address box, and fill out the form. The type On This Computer will create a new book on your machine. At the top right is the list of contacts. Clicking any contact displays that individual's information at the bottom of the window, in the contact information area. The search bar at the top of the window, beneath the toolbar, lets you quickly search for contacts by name. The New button on the toolbar lets you create a new contact, where you can enter a wealth of data. To edit an existing entry, double-click its entry and fill in the additional details. This kind of information is useful for a variety of tasks, so it's particularly useful that Evolution's Contacts mode can be used as a data source in OpenOffice.org.

Calendars: The Calendars mode is arguably Evolution's second most useful function after e-mail. You can add events in half-hour increments and view your schedule in day, week, work week, and month views by clicking the relevant button on the toolbar (work week presents just five days in the view). After the mode is selected, you'll find the various calendars you can access at the top left of the program window. For most users, the Personal calendar will be the principal one, but you can also access shared calendars including Google Calendars here. Assuming the default day view is in operation, beneath this you'll see the monthly calendar and, in the middle of the program window, the appointment list, with half-hour entries covering the working day. By default, the current day is shown. To select a different day, simply double-click the day in the month view or click the Go To button on the toolbar and use the widget to find the date. You can switch among day, week, and month appointment views by clicking the labeled buttons on the toolbar. On the right of the window, any tasks and memos that have been created are displayed, as described next.

Memos: The best way to think of Evolution's Memos mode is as a personal notepad. After Memos mode is selected, the list of memos will appear on the right side of the screen, and the contents of the memo at the bottom. Memos can consist of virtually any amount of text, along with attachments. They're ideal for jotting notes during phone calls, for example. Again, you can use the list on the left pane of the application to create categories for memos, such as breaking things down by client, job, or interest.

Tasks: Effectively, this is a simple to-do list. After the mode is selected, your tasks will be listed on the right side of the program window. Beneath this will be details of any selected task. If you're a fan of the Getting Things Done method of task management, the left-pane Tasks list is the ideal companion because you can create lots of lists and then populate the main window with tasks to be accomplished.

Basic E-Mail Tasks

Evolution's e-mail functionality is arguably the heart of the program. Although it offers many features, it is quite simple to use. If you've ever used any other mainstream e-mail client, such as Microsoft Outlook, you have a head start.

This section describes how to accomplish several everyday tasks within the e-mail component of Evolution. When you start Evolution, the e-mail mode is selected automatically. However, if it isn't, or if you've switched to a different mode within the program, simply click the Mail button at the bottom left of the program window.

Sending and Receiving E-Mail

After Evolution has been set up correctly to work with your e-mail servers, as outlined in Chapter 8, you can simply click the Send/Receive button on the toolbar to connect to the server(s) and both send and receive e-mail.

You may need to enter your password if you didn't enter it during setup. You can select the Remember Password check box in Account Preferences (Edit ➤ Preferences) to avoid having to type your password again, but the password will then be stored on your hard disk, posing a security risk if other people have access to your PC.

■**Note** Although e-mail is normally sent as soon as you click the Send button after composing it, if the sending has been delayed for any reason (such as being offline at the time), it will be sent as soon as you click the Send/Receive button. Until that point, it will be held in the Outbox folder on the left side of the program window. You may need to choose File ➤ Work Online if you've been composing e-mails in offline mode.

Any outstanding mail is sent first, and then the receiving procedure is started. As shown in Figure 27-2, a status dialog box will tell you how many messages there are and the progress of the download. Clicking the Cancel button will stop the procedure (although some messages may already have been downloaded). When you get a new e-mail, an envelope icon blinks in the notification area in the top right of the desktop, and a small window appears to tell you that you have mail.

Figure 27-2. *You'll see a progress display whenever you click the Send/Receive button.*

E-MAIL SIGNING AND ENCRYPTION

In Chapter 9, you learned how to use the Seahorse application to set up a public-key pair. This allows you to encrypt e-mail messages destined for other people, so that only they can read the messages (provided you have their public key). The application also enables you to digitally sign your own e-mail, so recipients can be sure messages came from you (provided they have *your* public key). If you've followed the instructions to set up the key pair, and uploaded them to a key server, you now need to configure Evolution to use it. After doing this, and when you send a new e-mail message, you can select whether you wish to encrypt the e-mail and/or digitally sign it.

Remember that setting up encryption is *not* obligatory, and relatively few people in the wider world use e-mail encryption or signing.

Assuming you've already set up an account within Evolution, here's the procedure for configuring Evolution for encryption and digital signing:

1. Click Edit ➤ Preferences, ensure that the Mail Accounts icon is selected on the left side of the window, and select your mail account in the list on the right side of the window. Then click the Edit button. In the dialog box that appears, click the Security tab.

2. You now need to find your PGP key ID by using Seahorse. Click Applications ➤ Accessories ➤ Passwords and Encryption Keys. Locate your key in the list under the My Personal Keys tab, and look under the Key ID heading. You should see an eight-character hexadecimal number, like F0C1B52A. Write this down, remembering that any 0 you see is a zero, and not the letter *O*.

3. Switch back to the Evolution dialog box and type the PGP key ID you found into the PGP/GPG Key ID box. If you want every e-mail message you send to be digitally signed automatically, which is a good idea (the message itself *won't* be encrypted, so even if the recipients are not using encryption, they will still be able to read it), ensure there's a check in the Always Sign Outgoing Messages When Using This Account box. Then click OK and close the parent Preferences dialog box.

Encrypting outgoing messages, or signing them if you haven't selected to automatically do so, is easy. When composing a new message, click the Security menu entry and select either or both PGP Sign and PGP Encrypt. Remember that you'll need to have imported the recipient's public key via Seahorse if you want to encrypt a message addressed to that person, or you'll see an error. If you sign a message, upon sending it, you'll be prompted to enter the PGP passphrase you entered when you created the key pair back in Chapter 9.

If, upon sending an e-mail message, you see the error message "Failed to execute GPG: Broken pipe," it's likely you mistyped your key ID when you configured Evolution. Try again.

If you receive a message that has been encrypted using your public key, Evolution will automatically prompt you to enter your PGP passphrase to decrypt it. This is the passphrase you entered when creating your key pair back in Chapter 9.

When you receive a message from someone who uses digital signing, and you have that person's public key, the message should contain a green bar along the bottom containing the words *Valid signature*. If you see words to the effect that the signature is invalid, or if the signature is missing, you should be suspicious and independently verify the authenticity of the e-mail message.

Reading E-Mail

Simply click an e-mail message to view it in the preview pane at the bottom of the screen. Alternatively, you can double-click a message to open it in its own program window (selecting a message and pressing Enter will have the same effect).

As with most e-mail clients, any unread messages in the list appear in bold, and messages that have been read appear in ordinary type. By default, each message is marked as read after 1.5 seconds, but you can alter this value. To change it, click Edit ➤ Preferences, click the Mail Preferences icon in the Preferences dialog box, click the General tab, and then change the value under the Message Display heading. A value of 0 will cause the mail to switch to read status as soon as it's clicked, which can be useful if you want to quickly clear a lot of messages.

You can also mark many messages as read by highlighting them all, right-clicking an individual one, and selecting Mark As Read from the menu that appears. You can select multiple messages in the usual way: Shift-click to select a consecutive list, or Ctrl-click for nonconsecutive selections. The Show drop-down menu, above the e-mail list, can be used to display only unread mail, which is great if you have a lot of messages that you're not going to read and want to mark them as read or delete them.

Deleting Messages

You can delete messages by highlighting them and pressing the Delete key. Alternatively, right-click any message (or a selection of them) and select Delete. The message will then be moved to the Trash folder. To empty the Trash folder, right-click the folder and select Empty Deleted Items, as shown in Figure 27-3.

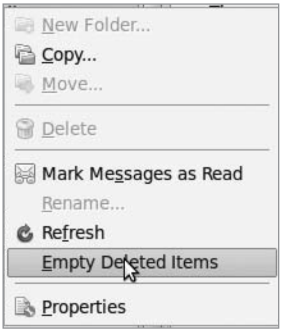

Figure 27-3. *To permanently delete messages, right-click the Trash folder and select Empty Deleted Items.*

If you move any messages from folder to folder, as described later in the "Sorting and Filtering Messages" section, a copy of the mail will end up in the Trash folder. This is because Evolution doesn't literally move messages. Instead, it copies them from the old to the new location and deletes the original. This can be a little disconcerting at first, but there's nothing to worry about. The mail message will remain wherever you moved it, and it won't disappear.

Flagging Messages

You can flag messages in a variety of ways to help remind you of their status or purpose. The simplest form of flagging is to mark a message as important: right-click the message and select Mark As Important, or click in the space beneath the Important column (this is located to the left of the From column). This will add an exclamation mark symbol alongside the message.

Alternatively, you can add several different flags by right-clicking a message and selecting Mark for Follow Up. The choices, which can be selected from the Flag drop-down list in the dialog box that appears, range from Do Not Forward to No Response Necessary and Review. This heading will then appear in the message preview at the bottom of the window whenever the mail is selected.

If you prefer a simple color-coding scheme, you can mark up a message by right-clicking it and selecting Label. Then assign a color. As you'll see, each color relates to a key word or phrase. You can edit both the colors and the key phrases by clicking Edit ➤ Preferences, clicking Mail Preferences on the left of the dialog box, and clicking the Labels tab.

IMPORTING OUTLOOK E-MAIL VIA THUNDERBIRD

Back in Chapter 4, we discussed a method of exporting e-mail from various Microsoft e-mail programs, which use proprietary formats, so that it can be imported under Ubuntu. To recap, you can install the Mozilla Thunderbird e-mail client under Windows, import your e-mail into it from Outlook or Outlook Express, and then export Thunderbird's mailbox (`.mbox`) files for *importing* within Evolution.

If you followed these instructions and now have the `.mbox` files ready for use with Evolution, it's easy to import them. Click File ➤ Import. In the Import dialog box, click the Forward button and then select Import a Single File. Click Forward again and click the Filename drop-down list. This will open a file-browsing dialog box, in which you can locate the `.mbox` file, and click Open. If you have more than one `.mbox` file, you'll need to import each one manually. The Automatic entry in the dialog box refers to the file type and will select the correct file type by file extension.

Composing a Message

Creating a new e-mail is as simple as clicking the New button at the top left of Evolution's program window. Fill in the To and Subject details as usual, and then type in the main body of the message.

To add a CC or BCC, click the To button, and select addresses from your contacts list in the dialog box that appears (selecting the CC or BCC button as appropriate). Alternatively, if you would like to have the CC and BCC fields visible and available at all times, click their entries under the View menu of the Compose a Message window.

As with most Microsoft mail programs, new e-mail can be sent either as plain text or as HTML. Plain text mode is the default. To switch to HTML, click the entry on the Format menu. The advantage of HTML mail is that you can vary the style, size, and coloring of text, so you can emphasize various words or paragraphs, as illustrated in Figure 27-4. In addition, if you click Insert ➤ Image, you can insert pictures from the hard disk. Other options on the Insert menu let you insert tables, dividing lines (click the Rule menu entry), and web links.

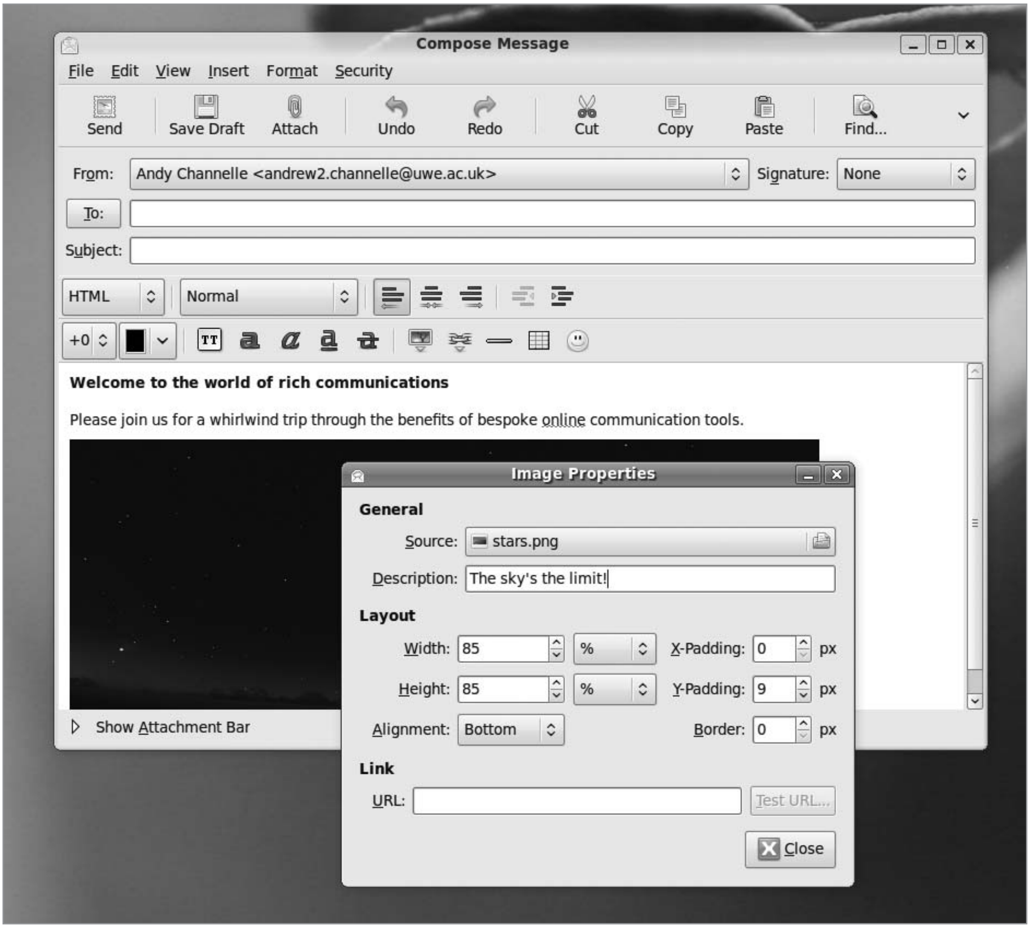

Figure 27-4. *New messages can be formatted in HTML, allowing you to format text and even add images to your messages.*

The disadvantage of HTML e-mail is that the person receiving the message will need an HTML-compatible e-mail program to be able to read it (though most common e-mail programs can handle HTML e-mail just fine). Your mail is also more likely to be tagged as spam by the recipient's server, because of the widespread abuse of HTML and images in mail by spammers.

■ Tip Many people in the Linux community frown on HTML-formatted e-mail and prefer plain text messages.

Words are automatically spell-checked in the new e-mail, and are underlined in red if the spell checker thinks they are incorrect. To correct the word, right-click it and then select the correct spelling from the list provided.

By default, if you chose the English language during the installation of Ubuntu, the Evolution spell checker will offer only an English (American) dictionary. You can switch to other English dialects (for example, British, Canadian, or Australian English) by choosing Edit ➤ Preferences in the main Evolution window, clicking the Composer Preferences icon, and then clicking the Spell Checking tab. Select an alternative dictionary or multiple dictionaries by selecting the check boxes to the left of the dictionary names.

While composing an e-mail, you can switch languages by choosing Edit ➤ Current Languages in the menu of the Compose Message window. If the language you require is not listed, this means that you need to install an additional Aspell dictionary package with the Synaptic Package Manager. These dictionary packages usually have a two-letter suffix indicating the language that they support; for example, `aspell-fr` is the French dictionary package. You'll need to quit and restart Evolution before the new language is visible.

■ **Note** The `aspell-fr` package also includes the Swiss French variation of the language.

Creating an E-Mail Signature

E-mail signatures are the blocks of text that appear automatically at the end of new e-mail messages you compose. They save you the bother of typing your name and contact details each time. To create an e-mail signature, follow these steps:

1. Click Edit ➤ Preferences. Select Composer Preferences from the left side of the dialog box and click the Signatures tab.

2. Click the Add button at the top right of the dialog box.

3. In the Edit Signature dialog box, type what you want to appear as your signature. The signature can be in either plain text or HTML (click Format ➤ HTML). Don't forget that in HTML mode, you can insert lines (Insert ➤ Rule), which can act as a natural divider at the top of your signature to separate it from the body of the e-mail, as shown in Figure 27-5.

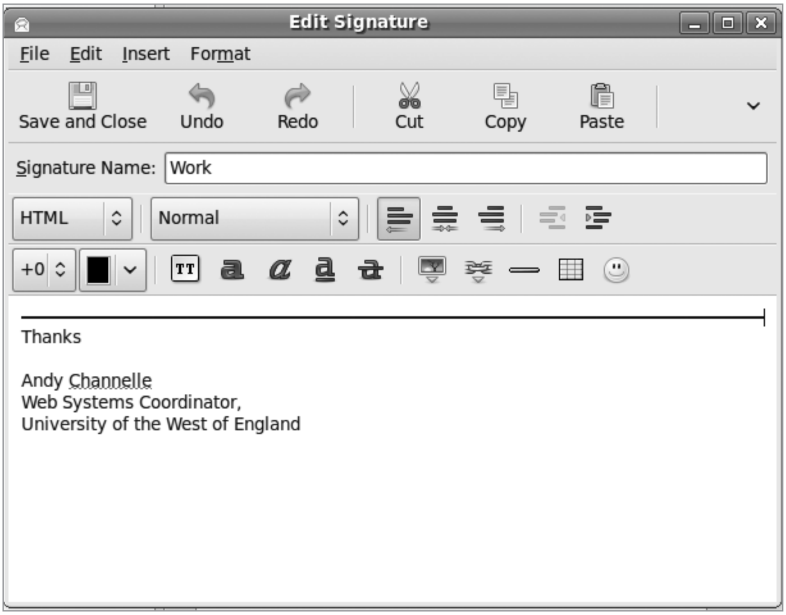

Figure 27-5. *Creating an e-mail signature saves you from having to type your contact details each time.*

4. Click the Save and Close icon at the top left.
5. Click Mail Accounts in the Preferences dialog box, and double-click your mail account in the list on the right side.
6. In the dialog box that appears, ensure that the Identity tab is selected and click the Signature drop-down list. Click the signature you just created.
7. Click OK and then Close in the Preferences dialog box. Your new signature will then automatically appear in new messages. It's possible to create multiple signatures—for instance, one for work and one for personal e-mail—and then choose the appropriate signature when writing your e-mail.

Advanced E-Mail Tasks

Evolution offers several features that can help you to organize your e-mail. You can create new folders, as well as filter, sort, and search through your messages.

Creating New Folders

If you want to better organize your e-mail, you can create your own folders, which will then appear in the list on the left side of the program window.

To create a new top-level folder, which will appear in the list alongside the standard folders (Inbox, Junk, Outbox, and so on), right-click On This Computer and select New Folder. Then make sure that On This Computer is selected in the folder view of the dialog box that appears. Type a name and click Create.

You can also create second-level folders, which will effectively be "inside" other folders and will appear indented below their parent folder within the list. For example, you might want to create a series of folders within the main Inbox folder to sort your mail from various individuals or organizations. To do this, right-click Inbox, select New Folder, and give the folder a name in the dialog box that appears, as shown in Figure 27-6. After the new folder has been created, click the chevron next to Inbox to expand the display to show your new subfolder.

Figure 27-6. *You can create your own folders to better organize your mail.*

You can then drag and drop messages into the new folders, or you can simply right-click them, select Move to Folder, and select the folder from the dialog box that appears. This can be useful if you wish to select a handful of messages by holding down the Ctrl key. All you need to do then is right-click one of them and select Move to Folder.

You can also copy messages from one location to another, thus producing two copies of the same message. Simply right-click the message, select Copy to Folder, and select the folder from the list. Alternatively, you can hold down the Ctrl key while you drag the message to the new location.

Dealing with Junk E-Mail

Evolution includes intelligent junk mail filtering. Any mail that Evolution thinks is spam or junk mail will end up in the Junk folder. When you first start using Evolution, you should check the folder regularly, because there's a chance Evolution might have made a mistake. However, this is a good thing, because by right-clicking the message and selecting Mark As Not Junk, the Evolution junk mail filter will be able to better understand what to consider as junk in your particular Inbox.

In a similar way, if you find that Evolution misses a junk e-mail, and it ends up in your Inbox, you can right-click it and select Mark As Junk. Alternatively, select it and click the Junk icon on the main toolbar.

To empty the Junk folder, select all the messages (Ctrl+A), right-click, and select Delete. Bear in mind that, as with any folder, after the messages are deleted, they will appear in the Trash, and you can restore them from there if necessary.

■ **Note** The junk mail filter used in Evolution is a third-party program called Bogofilter (`http://bogofilter.sourceforge.net`). You can switch Evolution to an alternative spam filter, which some consider more powerful, called SpamAssassin (`http://spamassassin.apache.org`). To do so, use Synaptic to install the `spamassassin` package. Restart Evolution, and then click Edit ➤ Preferences, click the Mail Preferences icon in the dialog box that appears, and click the Junk tab. Then select SpamAssassin from the Default Junk Plugin drop-down list. While on that preferences page, it's also a good idea to select the Do Not Mark Messages As Junk If Sender Is In My Address Book check box. When you are finished, click OK and then Close to return to the main Evolution program window.

Sorting and Filtering Messages

You can filter incoming messages according to practically any criteria, including who sent the message, its subject line, words within the body of the mail, its size, or even if it has attachments. Coupled with the ability to create folders, this allows you to automatically sort messages as soon as they're received.

To set up filters, click Edit ➤ Message Filters. Click the Add button and, in the Rule Name box, start by giving the new rule a descriptive name by which you'll be able to recognize it in the future. You might think this isn't important, but you may create tens, if not hundreds, of filters, so being able to identify filters will be very helpful.

As shown in Figure 27-7, the Add Rule dialog box is split into two halves: Find Items That Meet the Following Conditions and Then. As implied by the labels, if the selected conditions are met, then the selected actions will take place.

The Find Items part is used to identify the mail. You can select to filter based on almost any criteria, such as who appears in the Sender field of the message, words that appear in the Subject line, the date sent, and so on. Simply select what you require from the drop-down list directly beneath the Add Condition button. In most cases, you'll then need to specify details for the filter. For example, if you select to filter by the address of the individual sending the e-mail, you'll need to provide that e-mail address.

■ **Tip** Several If rules can be created. For example, you could create a rule to filter by the address of the sender, and then click the Add Condition button to create another rule to filter by text in the Subject line. By clicking If All Conditions Are Met in the Find Items drop-down list, the mail will be filtered only if both conditions are met. By selecting If Any Conditions Are Met from the drop-down list, the mail will be filtered if either condition is met.

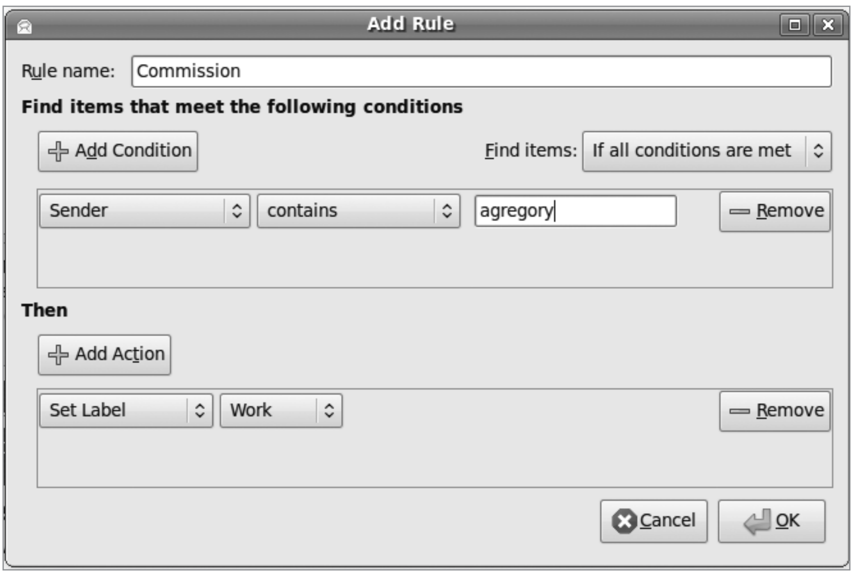

Figure 27-7. *Creating message filters lets you automatically organize your e-mail as soon as it's received.*

After you've set the Find conditions, you need to select from the Then section of the dialog box. This tells Evolution what to do with the filtered mail. The obvious course of action is to move the e-mail to a particular folder, which is the default choice, but you can also delete the e-mail, set a particular flag, beep, or even run a particular program! As with the rules for finding items, you can set more than one condition here, so you can have

Evolution beep and then delete the message, for example. When designing filters, it's good practice to finish with a Then option of Stop Processing because one message may be filtered into a folder and then have other operations performed on it.

Creating Search Folders

Evolution's search folders feature is a more powerful alternative to message filters. Using search folders, you can filter mail based on a similar set of criteria, but you can choose to include messages in the results that might be *associated* with the filtered messages. For example, if you choose to filter by a specific individual's e-mail address, you can select to have any replies you sent to that person included in the results, rather than simply messages received from her. In addition, you can apply search folders to specific e-mail folders on an ongoing basis, rather than all incoming e-mail.

It's important to note, however, that a search folder isn't a filter. The messages aren't moved into the new folders. They stay where they are in your Inbox (or any other folder they might be contained in). Despite the name, search folders are actually little more than saved searches. They just *act* like filters. However, search folders are dynamically updated—if a message is deleted from the Inbox folder, for example, it will also stop appearing in any relevant search folder.

You can create a new search folder by clicking Edit ➤ Search Folders and then clicking the Add button. As with creating message filters, clicking the drop-down box beneath the Add button will let you select filtering criteria. The choices are broadly similar to those for message filters, in that you can filter by e-mail address, size of e-mail, message body, and so on. At the bottom of the dialog box, you can choose to search specific folders (the default), all local folders, or all active remote folders (which includes any of your mail stored on a server elsewhere).

In the Include Threads drop-down box, you can select what kind of results you would like the search to return:

- None simply returns e-mail messages matching the criteria.
- All Related returns every single message that is associated with the criteria.
- Replies returns results that include replies to the messages returned via the filter.
- Replies and Parents returns results that include replies and also any initial message that you or others might have sent that inspired the message included in the filter results.
- No Reply or Parent returns results that include only initial messages sent to you.

Search folders results are listed under Search Folders on the left side of the Mail mode window.

The search folders feature is very powerful and worth spending time investigating.

TIPS FOR USING EVOLUTION E-MAIL

In many ways, Evolution is similar to e-mail programs you might have used in the past, but it also has a few of its own quirks and idiosyncratic ways of working. Here are a handful of preferences you might want to set to have Evolution behave in a more familiar way:

- **Forward e-mail inline**: If you attempt to forward a message, Evolution will attach it to a new message as a file. The person receiving the e-mail will then need to double-click the file to view the forwarded e-mail, which can be confusing. The solution is to make Evolution forward the message *inline*, which is to say that Evolution will quote it beneath the new mail message, like Microsoft e-mail programs. To do this, click Edit ➤ Preferences, click Composer Preferences on the left side of the dialog box, click the Forward Style drop-down list, and select Inline.
- **Change the plain text font**: Any messages sent to you in plain text format, rather than HTML, will appear in the message preview pane in a Courier-style font. To have messages display in a more attractive and readable typeface, click Edit ➤ Preferences, select Mail Preferences on the left side of the dialog box, and then remove the check from Use the Same Fonts As Other Applications. In the Fixed Width Font drop-down list, select an alternative font. The standard Ubuntu font is called Sans and is a good choice.
- **Always create HTML e-mail**: Evolution defaults to plain text e-mail for any new messages you create. If you want to always create HTML messages, click Edit ➤ Preferences, click Composer Preferences on the left side of the dialog box, and then put a check alongside Format Messages in HTML.
- **Empty trash on exit**: To automatically get rid of deleted messages each time you quit Evolution, click Edit ➤ Preferences, click Mail Preferences on the left side of the dialog box, and put a check alongside Empty Wastebasket Folders on Exit. Then select how often you would like this to happen from the drop-down list: every time you quit Evolution, once per day, once per week, or once per month.
- **Vertical message window**: As an alternative to positioning the message preview window beneath your messages, Outlook lets you position the message at the right of the message list, thus forming three vertical columns (folders, messages, and preview). To switch to this view under Evolution, click View ➤ Preview ➤ Vertical View.

Contacts

Evolution includes a powerful contacts manager component that can catalog information about individuals. At its most basic, the contact manager stores e-mail addresses for use within the e-mail component of Evolution, but you can enter significant additional data about each individual, including addresses, phone numbers, fax numbers, and even a photograph for easy identification. This should allow Evolution to become your sole personal information manager.

To switch to the Contacts mode, click the button at the bottom-left side of the program window. Once in the Contacts mode, you can view information in several ways. Click View ➤ Current View to choose from the following views:

Address Cards: This is the default view and shows the contacts as virtual index cards arranged alongside each other at the top of the program window. Click the scrollbar beneath the cards to move through them.

List View: This shows the contact information as a simple list, arranged vertically, with various elements of the contact's personal information listed alongside, such as phone numbers and e-mail addresses.

By Company: This organizes the data in a similar way to List view but sorted by the company the contacts work for (if such data has been entered into the contact entries).

Adding or Editing Contact Information

By far, the best way of initially building up your contacts list is to right-click e-mail addresses at the head of messages, in Mail mode, and select Add to Address Book. This will add a simple contact record consisting of the individual's name and e-mail address.

When using Microsoft mail applications, simply replying to an e-mail from an individual is enough to add that contact to your address book. Evolution is capable of this behavior too, but the feature isn't activated by default. To set this up, click Edit ➤ Preferences, click Mail Preferences on the left side of the dialog box, and click the Automatic Contacts tab. Next, put a check in the box marked Automatically Create Entries in the Address Book When Responding to Messages. From the Select Address Book for Automatic Contacts drop-down list, select Personal. In the same dialog box, you can synchronize contacts from the Pidgin instant messaging client, so that Evolution is brought up-to-date with your Pidgin contacts, and vice versa. You can then edit the contact details by double-clicking the entry in Contacts mode. This will let you enter a variety of information, as shown in Figure 27-8. To import a photo for this contact, click the top-left icon. You can use any picture here, and you don't need to worry about its size, because it will be resized automatically by Evolution (although its aspect ratio will be preserved). The imported photo will appear in the lower area of the Contacts window when you click the contact's name.

If you add a new contact and the details are substantially similar to those of another contact already on the system, the software will give you the opportunity to merge the two contacts to a single profile.

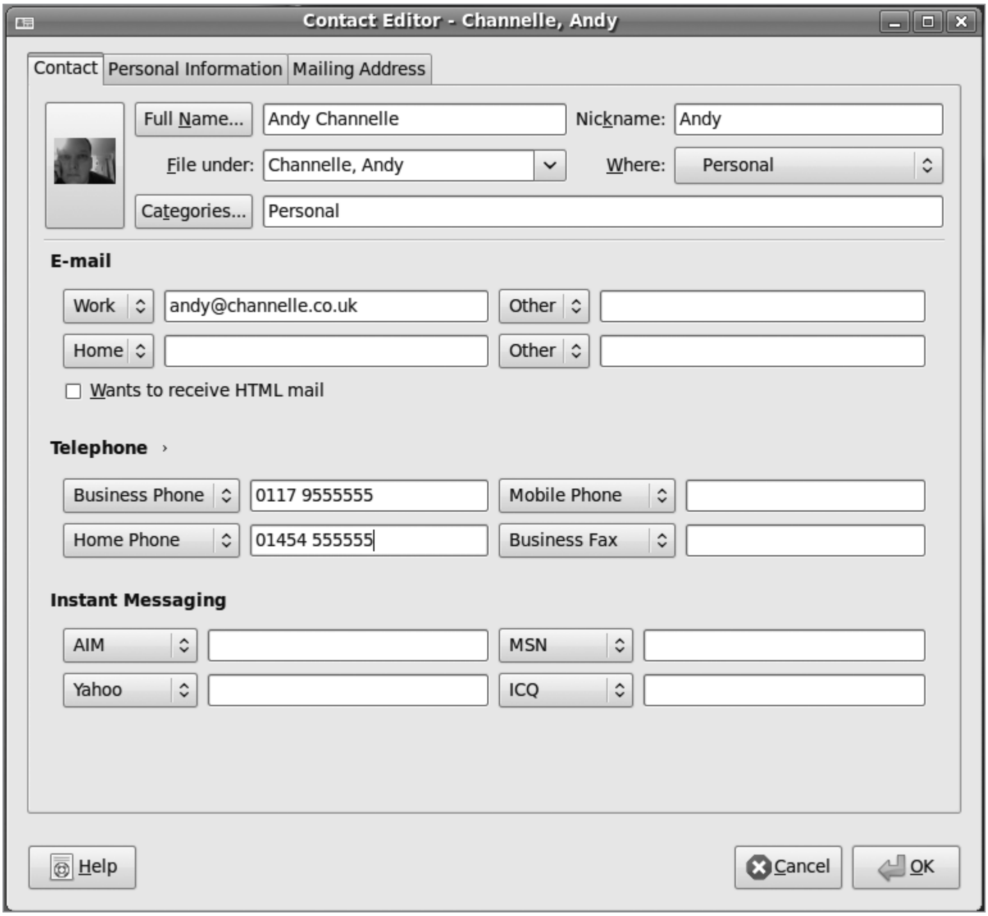

Figure 27-8. *A lot of information can be entered for each contact, and, by clicking the button at the top left, you can also add a photograph.*

Creating a Contact List

Contact lists are simply lists of e-mail addresses. After a list is created, you can right-click its entry in the contacts list, and then choose to send a message to the list or forward it to someone else as a vCard. The obvious use of contact lists is for sending e-mail messages to a particular group of people.

■ **Note** A vCard is a virtual business card. Effectively, it's a small file that contains personal information. vCards can also contain pictures and audio clips. They're understood by practically all business-level e-mail programs, including Microsoft Outlook and Apple OS X's Mail program.

To create a contact list, click the small down arrow next to the New button in Contacts mode, and select the option from the list. Give the list a name in the relevant box, and simply click and drag contacts from the main program pane onto the bottom of the Contact List Editor pane. This will automatically add their names and e-mail addresses. Alternatively, you can type their e-mail addresses manually into the field under the Members heading, and then click the Add button, which can be useful if the individual isn't in your contact list.

By selecting the Hide Addresses When Sending Mail to This List check box, you can ensure that the e-mail addresses are added to the BCC field of a new message, so people on the list don't see the others on the list.

Calendars

The Calendars mode of Evolution allows you to keep an appointments diary. Entries can be added in half-hour increments to the working day, and you can easily add events to days that are weeks, months, or even years in advance. Viewing a day's appointments is as simple as clicking its entry in the month view at the top right of the program window.

Specifying Appointment Types

You can make the following three types of diary entries:

Appointments: These are events in your diary that apply to you only. You might have a meeting with a colleague, for example, or might simply want to add a note to your diary to remind you of a particular fact.

All Day Appointments: A training day or a holiday could be entered as an all-day appointment. However, all-day events don't block your diary, and you can still add individual appointments (after all, just because your day is taken up with an event, that doesn't mean you won't need to make individual appointments during the event). All-day events appear as a light-blue bar at the top of the day's entry in your diary.

Meetings: Meetings are like appointments, but you also have the option of inviting others to attend. The invitations are sent as iCal attachments to e-mail, so users of Microsoft Outlook should be able to reply to them (provided Outlook is properly configured; see the program's documentation for details, and note that iCal is sometimes referred to by the specification number RFC 2446/2447). After receiving a meeting invitation, an individual can click to accept or decline. When Evolution receives this response, the individual's acceptance or declination will be automatically added to the diary entry.

Adding or Editing a Diary Entry

These instructions assume that the Calendars mode is set to Day view, which shows a full working day diary alongside a monthly calendar. To ensure Day view is selected, click the Day icon on the main toolbar running across the top of the screen. Day view is the default calendar view under Evolution. The other choices are Week, Month, and Work Week (which shows appointments during the week in daily columns). If you switch to another view, Evolution will always work in that view until you change back again.

To add a new diary entry, simply select the day in the monthly calendar on the left, and then select the time the appointment is to start in the day viewer. Then right-click and choose an appointment, an all-day event (this is called an all-day appointment on the New button on the toolbar), or a meeting. To edit an existing diary entry, double-click its entry in the list.

■ **Note** When you right-click in Calendars mode, you'll also see an option to add a task. Adding a task in Calendars mode automatically links it to the selected day and time. Task items due on the current day are marked in dark blue.

At its most basic, all an appointment needs in order to be entered into your diary is some text in the Summary field, as shown in Figure 27-9. By default, appointments and meetings are assumed to last for half an hour, but you can adjust this by using the arrows in the Hour and Minutes sections. For longer appointments, such as a holiday or conference that may last days or weeks, use the drop-down labeled For, select Until, and then define a finishing date or time.

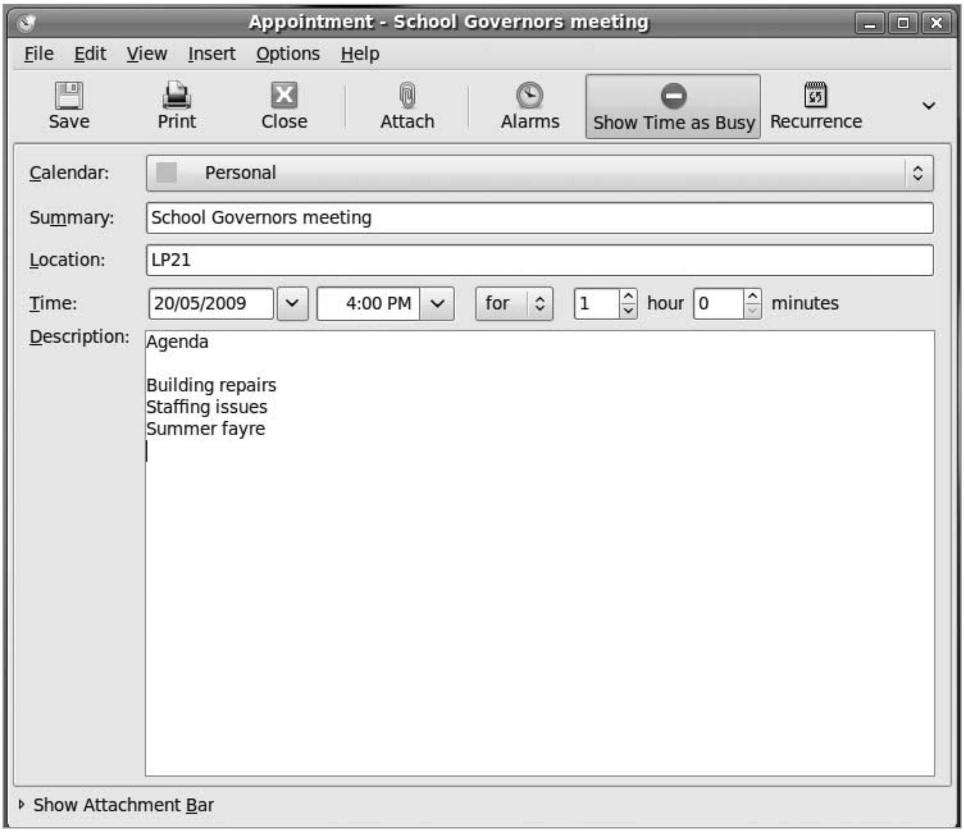

Figure 27-9. *When creating a new appointment, you can add all the details you need, but don't forget to set how long it lasts!*

By clicking the Recurrence button on the toolbar (note that not all buttons are visible in the default program width), you can set the appointment to be booked into your diary according to certain intervals. Start by putting a check in the This Appointment Recurs box, and then select a time interval. For example, selecting 1 week will mean that the appointment is booked into your diary automatically on a weekly basis. After this, select a day of the week for the recurring appointment. Following this, you must specify the number of recurrences. You can specify an ending date for the appointment or select Forever. In the calendar view at the bottom of the dialog box, you'll be able to see how this looks. Days in bold are those that have appointments.

It's also possible to set exceptions, as when the meeting might skip a week. This could be useful to work around holidays, for example. Simply click the Add button, and then type a date or click the down arrow to select the date from a calendar. Finally, you can also add attachments to an appointment—a meeting agenda, minutes, and so forth—by clicking the Attach button and locating the appropriate file.

When you're finished, click the Close button to add the details of the recurring event to the appointment.

In the case of meeting appointments, you can click the Add button to invite others to the meeting via iCal invitations, which will be sent out by e-mail as soon as you've finished creating the appointment. Simply click the Add button, and in the empty field that appears, start typing the contact name of the individual you want to invite. If the person is already in your contacts list, the name will be automatically completed, but you can also type individual e-mail addresses. By clicking the entry under the Role heading, you can alter the role of the individual. The choices are Chair, Required Participant, Optional Participant, Non-Participant (that is, somebody you want to inform about the meeting but who doesn't need to attend), and Unknown (for all other instances).

Clicking the Free/Busy button will open a new dialog box showing who can and can't attend, according to replies to the invitations sent out (obviously, this is a feature you'll be using after you initially created the appointment). On the left side of the dialog box, you will see the list of attendees and also their status: whether they've accepted, declined, or sent a busy/tentative reply (in which case, you might choose to reschedule the meeting).

Additional Calendars

For those with complicated lives, Evolution can manage multiple calendars sourced from either your local machine or from an online service such as Google Calendar. Moreover, each one can be assigned a different color so you can see how events clash (or not) at a glance. To create a new local calendar, right-click the Calendars pane (on the left) and select New. Choose On This Computer from the drop-down, provide a name for the new calendar, and choose a color. When you create a new event, specify the appropriate calendar, and the event will be highlighted in its color.

You can also add a Google calendar by following the preceding instructions but choosing Google from the drop-down. Supply your Google credentials and then choose a calendar from those available. Again you can define a color to apply to this calendar, as in Figure 27-10. The Google option is limited to viewing information added to the web service, so you can't add events by using Evolution, but this is a great way to access some of the many public calendars (such as national holidays and football match fixture lists) available on the Internet.

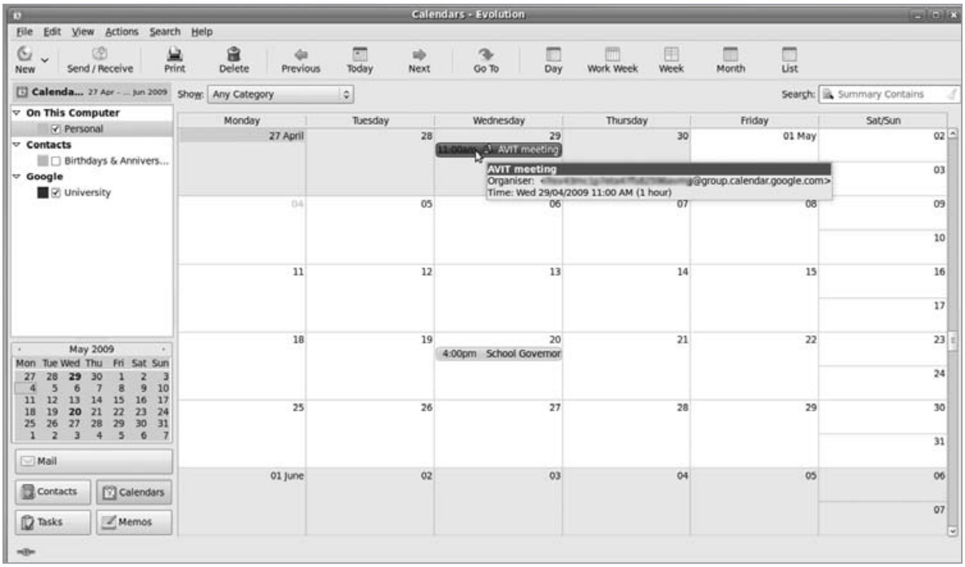

Figure 27-10. *Evolution can manage both local calendars and remote calendars from the Internet, making it ideal for creating and sharing group calendars.*

Memos and Tasks

The Memos and Tasks modes are the simplest components within Evolution. Memos mode allows you to jot down simple notes, and Tasks mode allows you to create a to-do list.

In both modes, which can be selected by clicking their buttons at the bottom left of the screen, the program window consists simply of an area where you can click to add a new memo/task, a list area, and a preview area, which will show any details of the currently selected task.

■ Note Memos created in Evolution can also be opened in Tomboy, the default GNOME desktop note-taking application.

In the case of Tasks mode, after you've made an entry, clicking the check box alongside it will mark it as completed. Completed items appear with a strike-through.

To add a new memo or task, click the bar that reads Click to Add a Memo (or Task), type a description, and then press Enter. You will be able to enter more tasks or memos in the same field.

Double-clicking a task or memo allows you to fine-tune its details. For example, you can add a due date for a task, so you'll know when the task must be completed. You can also add a description for future reference and attach files by clicking the relevant button on the toolbar. By clicking the Status Details button in the Task Details dialog box, you can also set a percentage figure for completion of the task, as well as its priority, ranging from Low to High. By adding these details, a quick scan over your tasks will give you a good idea of which jobs are overdue, which need attention, and which will stand a little procrastination.

After you've added these details, right-click the Summary bar (at the top of the main window) and select Add a Column. You can now drag and drop elements to the main window to get a better view of your tasks, as in Figure 27-11.

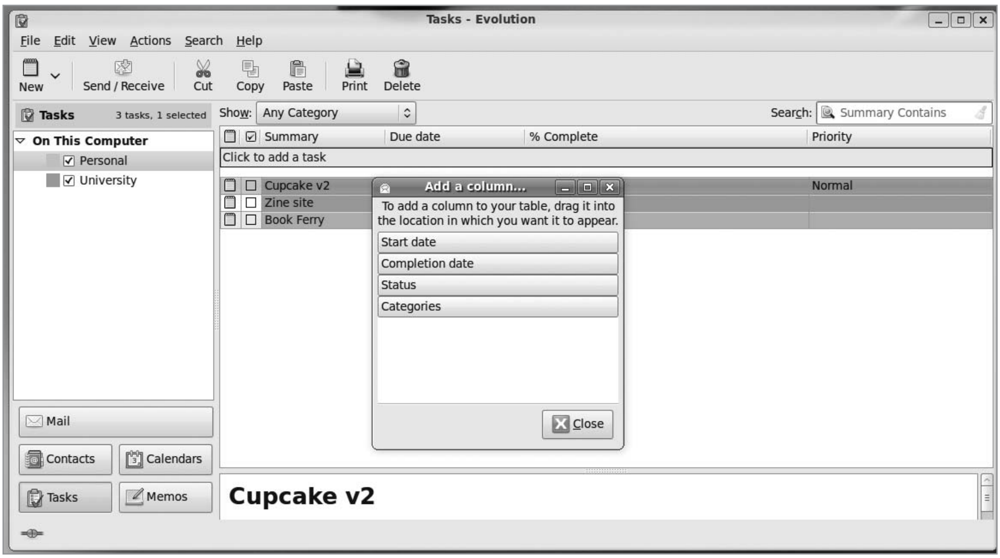

Figure 27-11. *The Tasks mode lets you catalog chores that you want to do during the day.*

Summary

This chapter has been a whistle-stop tour of Evolution's main features. You've looked at e-mail creation and organization, contacts management, working with the appointments calendar, and editing the task list and memos.

Evolution is a powerful program. Be sure to take a look at its help documentation (Help ➤ Contents) to learn more about it.

In the next part of the book, you will look at keeping your system running. As a first step, the next chapter explains how to install, remove, and otherwise manage the software installed under Ubuntu.

PART 7

Keeping Your System Running

CHAPTER 28

Installing and Removing Software

One of the fun things about running any operating system is the ability to expand it—to add in new software over time to improve your workflow or just enhance entertainment value.

Linux is blessed in this regard, because tens of thousands of software titles are available to meet almost every need. However, even if you've tracked down the ideal software title, there's just one barrier to overcome: installing it on your system.

Installing software under Ubuntu isn't the same as with Windows, and indeed you can't simply install any application you come across on the Internet, because these are most likely to be Windows versions. See Chapter 11 for more information on Linux versions of common Windows applications. Users are afforded a lot more power over what happens to their systems, but this comes at the expense of needing to take a little time to understand the terminology and techniques. That is what you'll learn in this chapter.

Software Installation Basics

Installing programs on Windows is relatively easy. If you wish to use the WinZip archive tool, for example, you can browse to the web site, download the installer `.exe` file, and install the software. Although you might not realize it, a lot of work goes into making this apparently simple task possible. After the original software has been created by the programmers, it must be made into a form that you, the end user, can deal with.

The first thing to happen is that the software is *compiled*. This is the process of turning the source code (the raw ingredients of the software) created by programmers into an actual file (or set of files) that can be used on a daily basis. On most systems, compiling source code involves a lot of number crunching. This takes time—hours, in some cases—and this is why it isn't normal practice to compile the source code every time you want to run the program.

After the program files have been compiled, there needs to be a way they can be installed on various systems and easily transported across the Internet. This is where *packaging* comes into the equation. Programs usually consist of many files. To make each program file individually available would mean that some are sure to get lost or corrupted, and the program wouldn't work. Therefore, the files are usually combined into a single archive file. In addition, third-party system files are added to ensure compatibility on all computers, and an extra program, called an *installer*, is added so that users can quickly get the files onto their systems.

All of this means that, to be able to install a program like WinZip on Windows, all you need to do is download the installer `.exe` file and run it once. No more work is necessary.

Linux is a little more involved, largely because it assumes that users would prefer to retain more control over their systems. However, most Linux distributions still embrace the paradigm of packaging software into a single, easily transported file. We will explain how software packages work in Ubuntu in a moment, but first it's necessary to understand other typical software distribution file formats used in the world of Linux.

Formats of Linux Installation Files

If you visit the web site of a particular Linux application, you may find that it's available to download in a number of different formats. The program will almost certainly be available as *source code*—the original human-readable text that the developer created. But it might also be available as a binary or a package file.

■ **Tip** Linux isn't the only operating system for which open source programs are created and used. There are open source projects for both Windows and Apple Macintosh, many of which are hosted at the `http://sourceforge.net` web site. Many other, less widely used operating systems also rely on open source software to a greater or lesser extent.

Here are the formats by which Linux software is usually distributed:

Source code: Programmers write their software in various programming languages, such as C and C++, and the code that results is known as *source code*. To make source code usable, it must be *compiled* into a *binary*. Because the cornerstone of the Linux philosophy is the sharing of source code, you'll almost always find the source code of a program available at the developer's web site. You can then download and compile this on your own system (or, if you're so inclined, study the source code to further your understanding). Although compiling source code isn't very hard to do, it's more convenient to download either a binary version of the program or a package.

Binary files: You might find that ready-made binary files are available at the developer's web site. In other words, the programmer (or a third party) has taken his or her own source code and, as a service to users of the program, compiled it so that it's ready for use as soon as it's downloaded. For example, this is how Linux versions of the Mozilla Foundation software, like Thunderbird and Firefox, are currently distributed if you download them directly from `www.mozilla.com`. Sometimes binary files come with scripts to help you install them. However, in most cases, you simply place the files in a convenient location on your hard disk and then run them from there.

■**Note** In the cases of both source code and binary files, the files usually come in a *tarball*, which is a single archive file containing other files. A tarball isn't, by definition, compressed, but usually either the `bzip2` or `gzip` tool is used to shrink the file, to ease transportation across the Internet.

Self-installing binaries: Some larger programs are made available as self-installing binary files. This comes very close to the way Windows works, because when the file is executed, a GUI-based installation wizard takes you through installation. If you download the standard version of OpenOffice.org (that is, not a version packaged for a particular system) from the official web site (`www.openoffice.org`), for example, you'll end up with a single 160MB+ file, which you then simply execute from the command line.

Package files: In many cases, you'll find that a package file of the program is available. In this case, someone has compiled the software files and put them all together in a single, easily transported file. Ubuntu package files end with `.deb` file extensions, but other Linux distributions use other package formats, such as `.rpm` (Fedora/Red Hat, SUSE Linux, and Mandriva, among others).

■**Note** As a blanket rule, an installation package created for one distribution won't be compatible with another. It's possible to use a program called `alien` under Ubuntu, which aims to convert packages between distributions and different package formats, but this should be seen as a last resort because the results may not always be satisfactory. You'll be better off simply obtaining a package specifically designed for your Linux distribution.

Package Management

Of all the preceding formats, packages are by far the most common and popular in the world of Linux. Ubuntu utilizes packages, as do nearly all other distributions. In fact, the Ubuntu installation DVD-ROM contains hundreds of packages, and its various software repositories contain many thousands.

A well-implemented package management system is able to install programs, upgrade them, and uninstall them, all with just a few keystrokes or clicks of the mouse. It vastly reduces the amount of work required to get new software onto your system and makes maintenance tasks such as upgrading software easy too.

It's important to understand what an Ubuntu package file actually is and what it contains. With Windows, an installation `.exe` file is effectively a piece of software combined with an archive of files. When you run the executable, it triggers a small program contained within it that then unpacks the contents of the file and installs them to the hard disk.

In contrast, package files used by Ubuntu merely contain the program files along with a handful of configuration scripts to ensure that the software is set up correctly. Package files are useless without the various pieces of software already installed on the system that are used to manipulate them and do the hard work of installing, removing, and querying them. This software is known as the *package management system*. In the case of Ubuntu, the package management system has two components: `dpkg` and *APT*, which we cover later in this chapter.

The use of a package management system has a number of benefits. The package management system builds its own database, so it knows exactly what programs are installed at any one time. Therefore, you can simply query the database rather than search the applications menu or hard disk. The package system also keeps track of version numbers. This gives the user much more control over the software on the system, and it makes updating easy.

The use of a package management system also means that if a program starts to act strangely, its configuration files can simply be refreshed by using the package manager. There's no need to uninstall and reinstall the software, as is so often the case with Windows programs. The clean way in which a package manager uninstalls software makes it very easy to try out, and remove, lots of different software without worrying about the stability of your computer.

Dependency Management

One of the key features offered by any package management system is *dependency management*. Put simply, the package manager ensures that if you install a piece of software, any additional software it relies on to work properly is already present on the system. It the software isn't present, the package manager must either resolve the situation automatically or ask you what to do.

Sometimes the software you want to install might depend on other programs on your system, such as applications that simply add a graphical front end to shell applications, but more often, the dependencies take the form of system libraries. It helps if you realize that not all packages contain software that you, as a user, will make direct use of. Some packages contain nothing but library files—shared pieces of code that are equivalent to `.dll` files under Windows. The key library on an Ubuntu system is the GNU C Library, without which the Linux kernel couldn't function, which is provided by the `libc6` package.

But practically every program has its own needs when it comes to library files, and these requirements must be handled by the package manager.

■**Note** One reason Windows installation files are often so large is that they typically come with all the system files they need, in case they're not already present on the system. This does not make dependency problems disappear, however. Third-party applications installers sometimes overwrite existing libraries with versions that are incompatible with the rest of the system.

Dependency management doesn't just mean adding in packages that a piece of software needs. It might also mean *removing* packages already present on your system. This might need to happen if they're incompatible with new software you want to install, something that's referred to as *package conflict*. In addition, sometimes you might want to remove a package that other packages rely on, a situation known as *reverse dependency*. In such a case, the package manager must either stop you from removing that software, to avoid breaking the software that depends on it, or remove the reverse-dependency packages too. In most cases, the package manager will ask you what you wish to do.

DEPENDENCY HELL

If you try to install certain software packages, you will very likely find that they depend on other packages, such as software libraries. These must be either already present on the system or installed at the same time for the software to work correctly. In most cases, the Synaptic Package Manager takes care of all this.

Dependency hell, which is far less common than it once was, comes about when chains of dependencies arise, which is to say, when a program you install or remove involves the installation or removal of several other, apparently unrelated pieces of software. For example, let's say you decide to manually install a program called `Oscar`. You download it and type the command to install it, but you are then told that this depends on another program called `BigBird`, which isn't installed. Fine, you think, I'll just download and add `BigBird` to the same installation command. But it then transpires that `BigBird` has its own dependency of `Snuffleupagus`. You download and add that too. Alas! `Snuffleupagus` has its own dependency of `MrHooper`.

This can carry on for some time, and this is why you should use the Synaptic Package Manager to install and remove software and try to stay within the standard Ubuntu repositories (see the following section). In the preceding example, Synaptic would add in all the dependencies automatically and download and install them at the same time.

Dependency chains like this are a by-product of any package management system. The solution is often simple—just don't remove the software package. After all, hard disks are extremely large nowadays, and space is rarely an issue, so there's little reason to not have software packages you no longer need hanging around.

Software Repositories

As mentioned previously, `dpkg` and APT take care of package management within Ubuntu. These tools are taken from the Debian distribution of Linux, on which Ubuntu is based.

Debian Package, or `dpkg`, is the most basic part of the system. It's used to install and uninstall software, and it can also be used to query any individual software packages. It's like the manager in a warehouse who is tasked with knowing exactly what boxes have been stored where. The manager doesn't know where the boxes come from, and he doesn't know anything about packages outside his warehouse. He just manages the boxes that are delivered to him and that are stored in his warehouse.

`dpkg` is aware of dependency issues and will refuse to fully install a package if the others it needs aren't already installed or supplied at the same time. But it doesn't have the means to fix the situation automatically. This is akin to the warehouse manager's inability to order more boxes if he needs them. That's not his job. He'll just tell you if boxes delivered to him are missing some of their components.

Because of this, there's an additional layer of software that sits on top of `dpkg` called the Advanced Packaging Tool, or APT. APT is very sophisticated. Its job is to handle dependency management. Try to install some software using APT, and any dependency issues will be worked out for you.

APT can do this because it's designed to work with *software repositories*. Users can search and install packages from these collections of software. More often than not, these software repositories are online, but that's not always the case. The DVD supplied with this book contains the base installation software repository, for example.

■ **Note** As you might already have guessed, the Synaptic Package Manager is simply a GUI front end for the APT system. You can see this clearly when you're installing or removing a package. In the Apply Changes dialog box that appears after software has downloaded, click Terminal, and you'll see the output of various APT commands.

It's important to note that APT relies on the `dpkg` system to take care of the actual installation. Effectively, `dpkg` and APT are two sides of the same coin.

As you might have realized, the package management system means that Linux software installation/removal is a fundamentally different proposition than handling software under Windows or Mac OS X. If you want to install new software, the first place to look is the Ubuntu software repositories. The online repositories contain most of the popular software available for Linux right now, all packaged for installation under Ubuntu.

It's comparatively rare for an Ubuntu user to visit a web site and download a package file for installation, as is often the case for Windows users. The only time this normally happens is if you can't find what you're looking for in the official repositories. Staying within the standard repositories will make problems less likely.

Tip Software repositories don't have to be "official," or sanctioned by Ubuntu, to be used under Ubuntu. Sometimes you might opt to add repositories that contain particular software, such as multimedia repositories. This may be necessary because multimedia formats are often licensed under terms that Ubuntu doesn't agree with, so it declines to offer this software from its official repositories.

Out of the box, Ubuntu comes with a couple of software repositories already configured. These allow you to download new software and also update the system online. Ubuntu software repositories are subdivided into various categories and components.

SOFTWARE VERSIONS

Because most Linux software is open source, a curious thing happens when it comes to software versions. Rather than there being just one "official" version of a program, such as with most Windows software (where you must download the official version of the file), many individuals and organizations take the source code, compile it, and make their own package files available for others to use.

For example, virtually all the software installed with Ubuntu has been compiled by Ubuntu developers. This means it can be quite different from what's "officially" available at the programmer's web site. In some cases, the source code is tweaked to fix notorious bugs or apply a different look and feel to the software, so it integrates with the distribution. Often the configuration files are changed so that the software works properly under Ubuntu, such as integrating with other software packages.

The programmer behind the software doesn't mind when such things happen, because this way of working is part and parcel of open source software. In fact, the programmer is likely to encourage such tweaking.

Because of this, the first place to look if you want any additional software is not the developer's web site but the Ubuntu software repositories. If the package is available in the Ubuntu main distribution, you'll get an officially sanctioned Ubuntu release that will fit in with the rest of your system and won't require much, if any, additional work to get it up and running.

Categories of Repositories

Regardless of whether they're online or on a CD/DVD, Ubuntu repositories are strictly categorized according to the type of software they contain:

Main Distribution: This repository contains the packages that are required to install Ubuntu. This repository usually takes its name from the code name for the release and is activated by default. For Ubuntu 9.04, the main distribution repository is called `jaunty`, after the code name for the 9.04 release (Jaunty Jackalope). In the previous release, the main distribution repository was called `intrepid`, and the next version (Karmic Koala) will have the `karmic` repository. (For more details on Ubuntu code names, see `https://wiki.ubuntu.com/DevelopmentCodeNames`.)

Security Updates: Sometimes security flaws are so serious that they need to be fixed immediately, within as little as 24 hours of being discovered. If so, the packages concerned will be placed on this server. The Security Updates server isn't about new versions or functionality. It's about fixing security holes rapidly. This repository is also activated by default and is named after the main release title. In the case of 9.04, this means the Security Updates repository is called `jaunty-security`.

Recommended Updates: This repository contains newer versions of the packages in the Main Distribution repository. Like Security Updates, this category also offers bug fixes, but these fixes aren't urgent and are often more substantial than quick patches to fix a critical bug. It is named after the main release title. In the case of 9.04, it is called `jaunty-updates`.

Proposed Updates: This is a special category by which testing releases of updates are made available. There's no reason to use this category unless you want to test packages and help fix bugs (for more information, see `https://wiki.ubuntu.com/HelpingWithBugs`). This category is not activated by default. It is named after the main release title, so in the case of 9.04 is named `jaunty-proposed`.

Unsupported (Backport) Updates: The Backports server allows access to software that's intended to go into the next version of Ubuntu but has been packaged for the current version. This software might not have been tested thoroughly and so is suitable only for neophiliacs or those who absolutely need the latest version (perhaps because of a vital new feature it offers). This category is not activated by default. As before, its name is derived from the main release, so in the case of 9.04 is called `jaunty-backports`.

Repository Components

In addition to the categories listed in the previous section, the Ubuntu repositories are further split into *components* (effectively subsections) according to how essential the software is to a basic Ubuntu installation or the license that the software uses. Here are the components under which software is typically filed within a repository (although you should note that a third-party repository might have its own names for repository components, and they might vary from this list):

Main: This section contains nearly all the software that's featured in a basic Ubuntu installation. As such, it's all free software, and every package is supported by Canonical, the company that oversees the Ubuntu project. That means that updates are frequently provided to fix security holes or simply to keep up with latest releases.

■ **Note** *Free software* refers to software that's licensed by using one of the schemes recognized by the Free Software Foundation as being free. The most common example is the GNU Public License (GPL). It doesn't mean that the software is free of charge, although that's nearly always the case.

Restricted: Although Ubuntu is mostly free software, it must include some drivers released only in binary form (that is, proprietary) and that, therefore, have license agreements that are not compatible with the goals of free software. That's what you'll find in this section. Some hardware simply won't work fully without software from the Restricted section.

Universe: This section might be referred to as "the rest," because it contains the majority of free software available at the present time. Much of it is borrowed from the massive Debian software repository, although the packages are sometimes tweaked to work correctly under Ubuntu before being made available (some people who create Debian packages also create the Ubuntu equivalents). Unlike Main and Restricted, the Universe section is not officially supported by the Ubuntu project, which means there's no guarantee that security flaws will be fixed. Nor is there any guarantee of updates, although most packages are usually updated regularly.

Multiverse: As with the Restricted section, here you'll find software that's released under a software license incompatible with either the letter or spirit of free software. However, unlike the software in the Restricted section, none of the software in Multiverse is considered essential to a default Ubuntu installation.

Source Code: This section contains source code packages. Unless you're a software developer or are thinking of becoming one, this section won't be of much interest.

Partner: This repository contains software offered by vendors who have partnered with Canonical, the company that sponsors the development of Ubuntu. This software is usually commercial and proprietary (that is, not open source). The precise list of software packages offered differs from release to release, but past examples have included virus scanners, media players, and commercial server software.

Now that we've covered the basics of Linux software installation, it's time to talk about the tools used to manage software. First we'll look at graphical applications that can be used to manage software, and then we'll look at the command-line tools you can use.

DECODING PACKAGE FILENAMES

Although the filenames of packages might seem like cryptic mumbo-jumbo, they actually tell you a great deal about the file. Let's take a look at the package file of the Eye of GNOME image viewer to explain this:

```
eog_2.21.92-0ubuntu1_i386.deb
```

The first element of the filename is the name of the program. In this case, Eye of GNOME has been abbreviated to `eog`. Abbreviations like this are quite common, because they decrease the length of the filename. But it's important to note that they will be consistent. For as long as Eye of GNOME is supported as a package under Ubuntu, its package filename will always begin with `eog`.

Following the name of the package is the version number of the program in question: `2.21.92-0`. This is almost always the version number that will appear if you click Help ➤ About when the program is running and is the version number decided on by the developer who created the software.

After the version number is the word `ubuntu`, which indicates that this is a package that has been created specifically for the Ubuntu distribution of Linux. Then you see the build version number of the package: `1`. This is Ubuntu's own version number, indicating how many times the package has been built (created) by the Ubuntu team. Sometimes it's necessary to release an updated build of the same version of a program in order to correct an error that was accidentally introduced in the preceding build version. Sometimes the program is patched by the Ubuntu team to support a new function.

After Ubuntu's build version number is the platform on which the package will run. In this case, `i386` indicates that the package will run on all x86-based processors, from 80386 upward (the 486, Pentium, Pentium II, AMD processors, and so on). Sometimes you might see `i686`, which means that the package has been optimized for Pentium Pro chips and above (Pentium II, III, IV, and AMD's Athlon range of chips). If the package is created for 64-bit desktop processors, `amd64` will appear there.

Optimized versions of packages for particular processors are used only when they might bring a performance boost. For example, there are `i686` versions of the Linux kernel and the `libc6` library. Even ordinary programs, like OpenOffice.org, can be optimized for their architectures, but the majority of packages that are used under Ubuntu have the `i386` designation.

The Synaptic Package Manager in Depth

The Synaptic Package Manager is effectively a graphical front end for the APT system. You can use it to search for and install software. To start this program, click System ➤ Administration ➤ Synaptic Package Manager.

Searching for Software

Before searching for software, it's always a good idea to refresh the package database. This database describes the software contained in the repositories, and it is held on your hard disk. Just click the Reload button on the Synaptic Package Manager toolbar to grab the latest package lists from the various repositories you're subscribed to (that are in your `sources.list` file). Reloading can take a few minutes on a slow connection, but it ensures that you have access to the latest software within the repositories.

You can search for software in three ways:

Ultra-quick: For a fuss-free instant search, click any entry in the list of packages and then simply start typing. This will match what you type against the package names and sort the list dynamically as you type. This does not let you search through descriptions for keywords, however.

Quick: By typing your search term into the Quick Search field on the main toolbar, you can search through package names and descriptions.

In-depth: For an in-depth search, which lets you search all the information contained within packages, click the Search button on the toolbar. By default, this searches through both package names and the descriptions, but by clicking the Look In drop-down list, you can select to search by other information, such as the version number. You can type either the specific program name or a keyword that may be within the description. For example, if you are looking for graphics drivers for your Nvidia card but you don't know the name of the package that contains them, you can type *nvidia*.

■ **Tip** You don't need to type whole words in the search field. You can type part of a word or, more commonly, the word in a shortened or alternate form. For example, if you're looking for an e-mail client, it might be more fruitful to simply type *mail client* or even just *mail*. This will then return results containing *e-mail*, *mail*, *mailing*, and so on.

By clicking the Settings ➤ Filters button, you can enhance your search results by creating a filter that will remove packages from results that don't meet your requirements. You can filter by criteria such as whether the software is already installed, whether it's new in the repository, and much more. It's advisable to click the New button to create your own filter before starting, as shown in Figure 28-1, rather than editing one that's already there. After a filter has been created, you can apply a filter to search results by clicking the Custom Filters button at the bottom left of the main program window, and then clicking the name of your filter in the list.

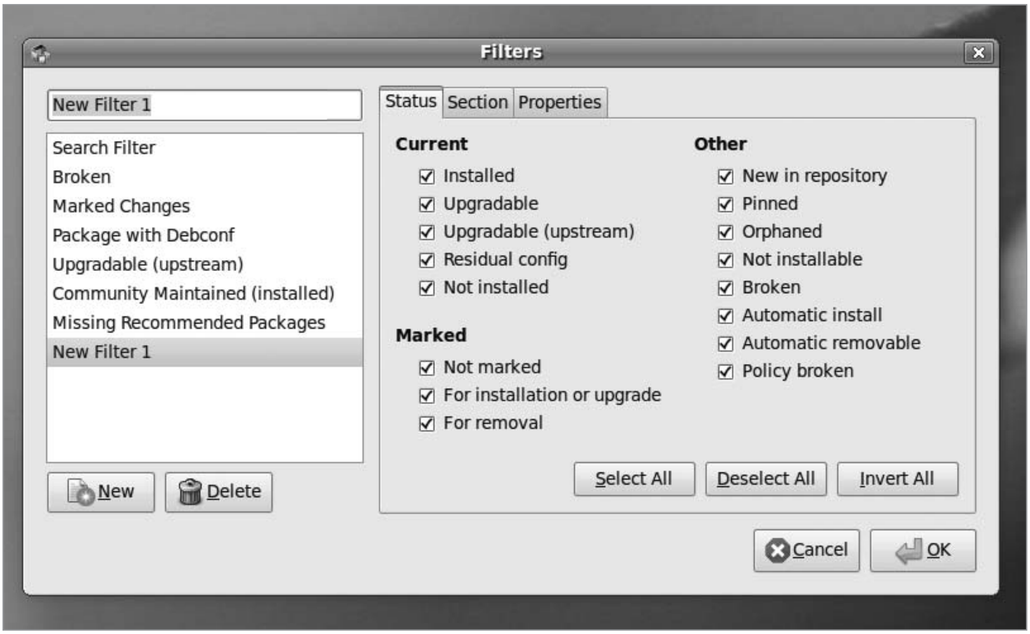

Figure 28-1. *Filters can be used to trim the list of search results according to certain criteria.*

One use of filtering is to remove the check alongside Installed so that you can remove from the search list any packages that might be already on your system.

Note Filtering can help reduce the number of search results if you use a generic search term, but don't forget to deactivate filtering when you're finished. To do so, click All at the top of the filters list.

In the search results, any packages with the Ubuntu symbol next to them are supported packages, which is to say, they're from the Main or Restricted software repositories, as opposed to Universe, Multiverse, or a third-party repository. Therefore, future updates are likely to be offered.

If the check box is green, that means the package is already installed. A star next to the check box means the package is new. You can view the complete range of Synaptic icons by clicking Help ➤ Icon Legend.

By clicking the Get Screenshot button at the top of the description panel, you can view a thumbnail screenshot of the application if one is available. This can help identify whether the software will fulfill your needs. Clicking the thumbnail when it appears will cause a full-resolution rendition of the screenshot to be downloaded.

Be aware that not all applications presently have screenshots. Some—such as system software or command-line programs that lack a user interface—will never have screenshots because, quite simply, there is nothing to see.

Installing Software

When you click the check box next to a piece of software in the search results and select Mark for Installation, the program will be queued for installation, which will take place as soon as you click the Apply button on the toolbar. If the program has any uninstalled dependencies, you'll also see a dialog box asking you to confirm installing those as well. If you agree, these will be automatically added to the list of packages to be installed.

Additionally, if you right-click the file and select Mark Suggested for Installation or Mark Recommended for Installation, you'll see a list of programs that, although not essential to the running of the program in question, will enhance its features to some degree. For example, if you choose to install the VLC media player program, it's also suggested that you install `mozilla-plugin-vlc`, so that VLC can be used as a plug-in for playing media files in Firefox. You don't have to install these recommended programs; the software will run fine without them. But it can often be rewarding if you do so.

Note If the software in the recommended and suggested lists is grayed out, that means it's already installed. It's also possible that the package doesn't have any recommended/suggested packages.

After making your selection and clicking the Apply button on the toolbar (bear in mind that you can install more than one piece of software at once), you'll see the Summary dialog box, as shown in Figure 28-2. Here you're once again asked to confirm what needs to be installed. If any software needs to be removed in order to handle dependency issues, you'll be told about this too. Additionally, under the Summary heading, you'll be shown the total size of the files that will be downloaded, as well as the space required on your hard disk.

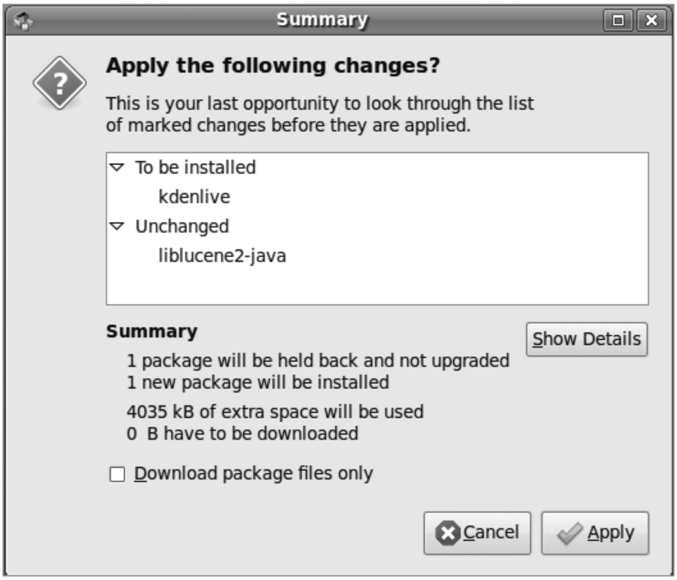

Figure 28-2. *Before any software is installed by the Synaptic Package Manager, you'll be told what it is and asked to confirm the choice.*

At the very bottom of the Summary dialog box, you'll see a check box marked Download Package Files Only. As it suggests, this will download but not install the packages. If you then select the package for installation again in the future, you won't need to download it, and installation will be almost instantaneous (unless a newer version of the package has been released—in which case, the newer version will be downloaded and installed).

If you see an Unchanged heading in the Summary dialog box, this means that there are several system updates available that you haven't selected for installation. To install the system updates, click Cancel and then click the Mark All Upgrades button on the toolbar. Then click Apply again. You will then see two separate headings in the Summary dialog box: one listing the upgrades and one listing the new packages you've selected to install.

Note Of course, you can opt to ignore the fact that updates are available and simply go ahead with installation. Installing updates as soon as possible is advised but not enforced.

METAPACKAGES

Software such as the GNOME desktop actually consists of a number of programs and system libraries, rather than one single piece of software. Therefore, you might be wondering how, as just one example, you might install the KDE desktop under Ubuntu 9.04. Is it necessary to install each component's package manually?

In theory, dependency management should be able to help, and you should be able to select one key part of the KDE desktop system, such as the Konqueror file browser, and have the Synaptic Package Manager take care of the rest. After all, Konqueror will be dependent on other KDE packages.

Alas, this rarely works in reality. Installing Konqueror in this way will indeed install much of the KDE desktop suite, but not everything. Konqueror isn't reliant on Kate, for example, which is the default text editor under KDE. And although the packages will be installed, there's no guarantee that they'll be configured to work correctly as a desktop environment.

Metapackages provide the solution. These are packages that contain configuration files to ensure that the full range of software is installed and configured correctly, and they also have extensive lists of dependencies that include the complete set of packages for the software in question. (The metapackage for KDE is `kdebase`, but if you want the full Kubuntu experience, you should install the `kubuntu-desktop` metapackage.)

Alongside desktop suites, other examples of Ubuntu metapackages include the OpenOffice.org office suite, where the metapackage ensures that all the components of the suite can be easily installed, and the X.org graphical subsystem. To see what metapackages are available, simply search for *metapackage* by using the Synaptic Package Manager.

Removing Software

To remove a piece of software, search for it by name, click the check box alongside it, and then select Mark for Removal. This will remove the software but leave behind any configuration files it created. This means you can install it again in the future, and it will function as it did before removal. However, you can also select Mark for Complete Removal, which will remove the configuration files.

As with installing software, the Synaptic Package Manager will attempt to manage dependencies when you remove software, but in this case, it will enforce the removal of any software that explicitly relies on that software.

Often the solution is simply not to remove the software package. After all, modern hard disks have huge capacities, and it's unlikely the package will take up much room.

USING ADD/REMOVE APPLICATIONS

You can use another graphical package manager, accessed by choosing Applications ➤ Add/Remove Applications from the Ubuntu desktop, to easily install or uninstall programs without worrying about package dependencies. Add/Remove Applications is intended to be easy to use compared to Synaptic, which takes a more thorough approach.

The top right of the Add/Remove Applications window shows a list of application items. Each item has a check box that denotes whether the listed application is installed, with a brief description and a popularity rating. By selecting an item, you can view more information about the application at the bottom right of the window. Selecting an item to install or uninstall is as easy as marking or unmarking the item's check box.

To find the software you are looking for, you can filter the items in the list by selecting a software category in the left column. The category choices are All, Accessories, Education, Games, Graphics, Internet, Office, Other, Programming, Sound & Video, System Tools, and Universal Access. You can also filter the software list by using the Show drop-down list or by entering a query in the Search box. The software type choices are All Available Applications, All Open Source Applications, Canonical-Maintained Applications (that is, those supported with updates), Third-Party Applications (that is, those from the Partner repository), and Installed Applications Only. If you're not sure which packages to try first, you can click the Popularity tab to rank items from five stars to one star.

Once you are satisfied with your choices, click Apply Changes to proceed. You'll see a confirmation dialog box, listing the items to be installed or uninstalled. Click the Apply button to confirm the changes, and you will be prompted for your password. After you've entered your password, the installation or uninstallation process will commence. The system will notify you when the process has been completed.

Manually Installing Using Gdebi

Gdebi Package Installer is a simple program designed to facilitate the installation of single packages that you've sourced yourself (that is, that you may have acquired from elsewhere on the Internet). Like Synaptic, it is able to automatically take care of dependencies by adding them into the total installation tally.

Gdebi runs automatically when you double-click a package file on your hard disk (a file with a `.deb` file extension). It is also offered as the default choice to open package files when you click on a package link within the web browser.

After Gdebi's simple program window appears, there is only one course of action: to click the Install Package button. This will install the software and—if necessary, or possible—automatically download and install the software packages. You'll be told if any dependencies are required, and clicking the Details button will display a list of them.

If the dependency packages are not available in the repositories, the Install Package button will be inactive, and the missing dependencies listed. In theory you must now source the missing dependencies manually, but it is very likely that, if they are not available in the repositories, the package in question just isn't intended for either the version of Ubuntu you're using, or even for Ubuntu itself (it might be a package designed for a different derivative of Debian, for example, or even Debian itself).

When Gdebi first runs, you might see a dialog box indicating that the package "is available in a software channel." This means that the software you are intending to install is available in Ubuntu's repositories. If so, it might be better for you to install it from there instead, because then you will receive automated updates, as well as a version of the software that's guaranteed to be tweaked so it works fully within Ubuntu's infrastructure.

Package Management from the Command Prompt

Synaptic is one of the best examples of package management programs around, and there's little reason to shun it and choose to install packages from the command line. However, you may find occasions to use `dpkg` or the APT tools. For example, if you're already working at the command line, this method is quicker than starting up the Synaptic Package Manager.

Using the APT Tools

If you wish to fully utilize software repositories at the command line, you'll need to use the APT tools `apt-get` and `apt-cache`. These use `dpkg` in the background (see the following section) to install and remove packages, but they also feature intelligence to handle dependency management and so will help you maintain a more stable system. `dpkg` and Gdebi are the only options if you want to install a package file you've downloaded. It's worth remembering that if you're installing desktop applications, the worst that could happen if something went wrong is that the software won't run correctly. However, if you're taking system or library files from nonstandard sources, there is significant opportunity for messing up lots of things!

Note If, while using `dpkg` or APT, you get an error message along the lines of "Can't get a lock," make sure that the Synaptic Package Manager or Update Manager program isn't open. Only one piece of software can access the package database at any one time.

Installing and Removing Packages

The most basic APT command is `apt-get`. You can use this command to install or remove packages contained within the repositories as follows:

```
sudo apt-get install packagename
sudo apt-get autoremove packagename
```

You should specify the program name without the version number. You can specify two or more programs to be installed and/or removed at the same time. Just separate the package names with a space:

```
apt-get install package1 package2 package3
```

■Note On rare occasions, there are several different versions of the same software in the repository (for example, both Firefox versions 2 and 3 are available). In such cases, version numbers are sometimes used. But this isn't something you should worry about.

To install the `links` web browser, for example, you just need to type the following command:

```
sudo apt-get install links
```

Figure 28-3 shows the results. As you can see, `apt-get` will check dependencies, download the software, and then install it. It's a much better way of working compared with `dpkg`.

Uninstalling software presents a similar situation. For example, suppose you tried to remove the Evolution e-mail client, like so:

```
sudo apt-get autoremove evolution
```

`apt-get` would also mark for removal `evolution-exchange`, `evolution-indicator`, and `evolution-plugins`, three packages that depend on the e-mail client. But before doing anything, it will tell you what it is about to do and ask you to confirm it.

■Note In fact, there are two command options for removing software when using `apt-get`: `remove` and `autoremove`. The difference is that the latter will also uninstall any redundant packages that were installed along with the original program (programs that were dependencies *back when the program was installed*). Because of this, it's always best to use autoremove to uninstall software. It will keep your system tidier and help conserve disk space by removing unneeded software.

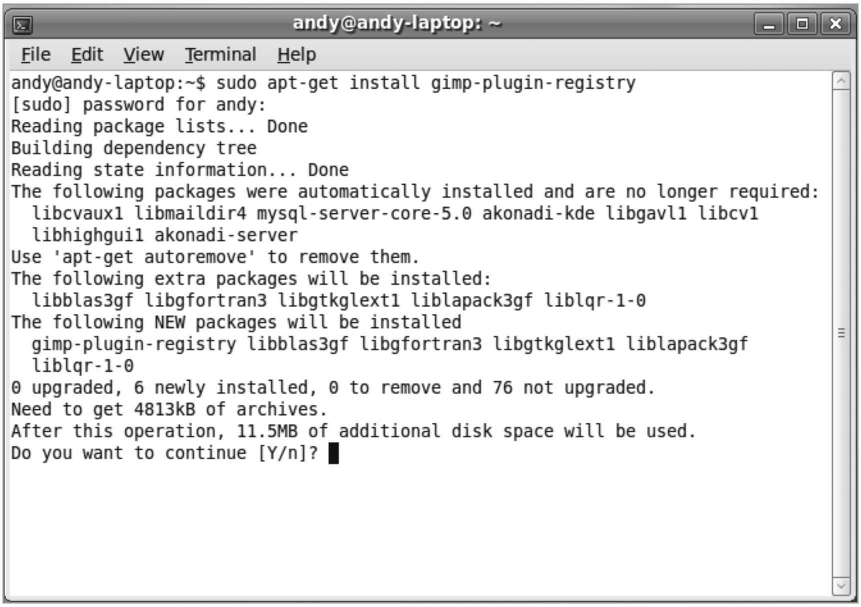

Figure 28-3. *You can use `apt-get` to install, remove, and update packages at the command line.*

Similarly, if you tried to install the Epiphany web browser, like so:

```
sudo apt-get install epiphany-browser
```

you would be informed that several additional packages need to be installed: `epiphany-browser-data`, `epiphany-extensions`, `epiphany-gecko`, `libosp5`, and `w3c-dtd-xhtml`. These will be automatically added to the list of packages that are to be installed.

As with the Synaptic Package Manager, `apt-get` will also list suggested packages that will complement the software you wish to install but aren't vital (note that "recommended" packages aren't listed). However, if you wish to install any of the suggested packages, you'll need to do that later, in a separate `apt-get` command.

Tip An alternative to the command-line APT tools is `aptitude`. This can be used like APT tools such as `apt-get`, but can also take into account suggested and recommended packages. For more information, see its man page.

Querying Packages and Repositories

To search the repository databases for particular software packages, use the `apt-cache` command:

```
apt-cache search packagename
```

Both descriptions and package names are searched. The list of results will show the package name on the left and a description on the right. Sometimes the results can scroll off the screen, so it's useful to pipe the output into `less`:

```
apt-cache search packagename | less
```

You can also find out about dependencies and suggested packages by using `apt-cache`. Once again, it's a good idea to pipe the output into `less`, because the dependency list may run off the screen:

```
apt-cache depends packagename | less
```

You can read the program description for a package file by typing the following (see Figure 28-4 for an example):

```
apt-cache show packagename | less
```

None of these commands makes a distinction between installed and uninstalled packages—you're accessing the details held in the repository database.

Before searching for packages, it's a good idea to make sure you have the latest package lists in the database (the equivalent of clicking the Reload button in the Synaptic Package Manager). To refresh the repository data, use this command:

```
sudo apt-get update
```

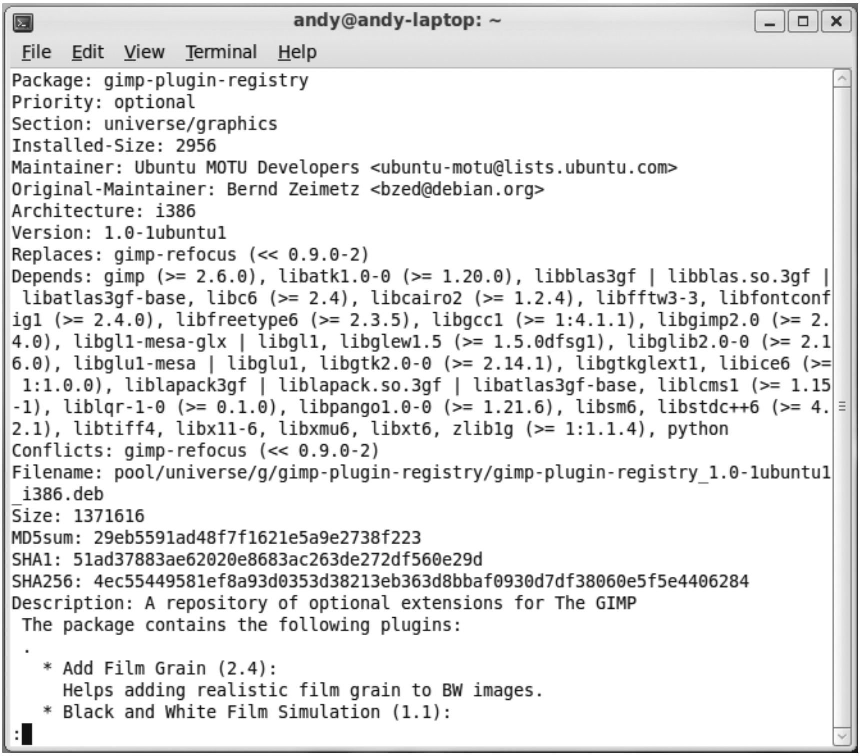

Figure 28-4. *You can query any package by using* `apt-cache show` *to learn more about it.*

Updating the System

`apt-get` can also perform various types of system updates. To update all the packages on your system to the latest versions contained within the repositories, type the following:

```
sudo apt-get upgrade
```

This is the command-line equivalent of using the Update Manager function of the Ubuntu desktop.

To upgrade the system to the latest version of Ubuntu (if there is one), type this:

```
sudo apt-get dist-upgrade
```

Updating your system can take a long time, depending on the number and size of files to be downloaded. In addition, each package will need to configure itself during installation, and this can also take a long time.

Using dpkg

The most basic package-manipulation command is dpkg. dpkg allows you to perform a lot of package-related tasks, such as building packages from scratch. Here we'll look at simple package installation, removal, and query functions.

■**Note** dpkg requires superuser powers to install or remove software, so the command must be preceded with sudo. If you simply wish to query the package database, dpkg can be run without superuser powers. The same is true of the APT tools discussed later in this chapter.

Installing Packages

dpkg is useful when you've already downloaded a specific .deb package and would like to install it. Here is the command:

```
sudo dpkg -i packagename.i386.deb
```

You must specify the entire filename, rather than just the name of the program.

■**Note** Be careful when downloading .deb package files. Not all of them are guaranteed to be 100 percent compatible with Ubuntu, because the .deb package format is used within a variety of distros, such as Debian and Xandros. Your first choice should be to download packages that are specifically created for your installed version of Ubuntu. These will probably have the word ubuntu in their filenames. If these are not available, you should try downloading those created for Debian. Package files created for other distros might work but should be tried only as a last resort.

---

dpkg is quick and dirty, and although it will warn you about any dependency issues, it will still go ahead and install the package. After installation, it will run the package's configuration scripts. But if there are missing dependencies, dpkg won't be able to configure the program to work on your system, because it probably won't be in a usable state, as shown in the example in Figure 28-5.

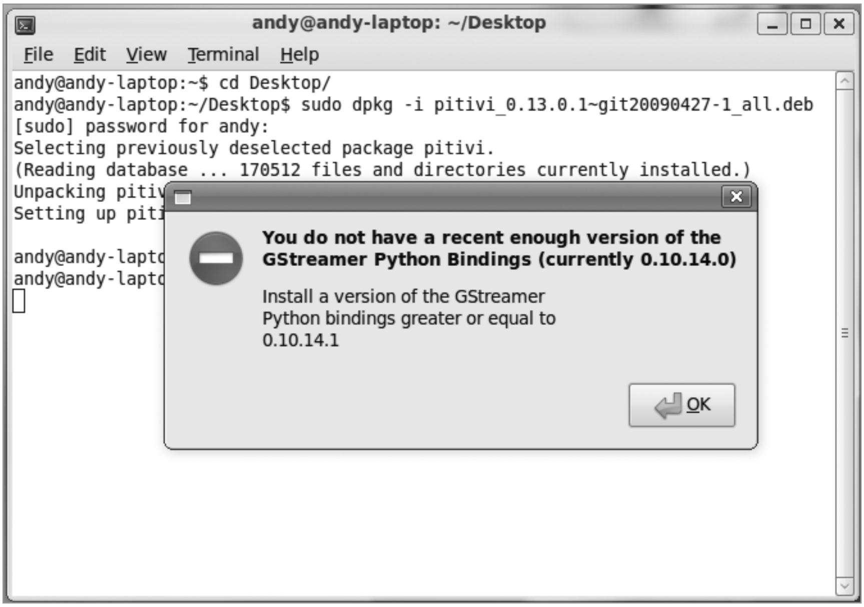

Figure 28-5. *`dpkg` will warn about missing dependencies but will still install the package. You may become aware of problems only when you try to run the software.*

If this situation arises, it's up to you to install the dependencies that `dpkg` lists. (Several packages can be specified with the `dpkg` command, in any order; `dpkg` will sort them out itself.)

Of course, some of these will have their own dependencies, which will also need to be installed. This cascade situation is known as *dependency hell,* as discussed earlier in the chapter, and is the main reason why the APT system was invented. As you'll see in the next section, APT effortlessly handles dependency issues.

If the dependencies aren't met after a `dpkg` installation, whenever you run the Synaptic Package Manager or attempt to use the APT tools, you'll be told of "broken" packages or unmet dependencies. APT will refuse to install any other software until the problem is fixed. Synaptic Package Manager will attempt to fix the problem automatically—the missing packages will be selected for installation and will be installed alongside any software you choose. At the console, you can type `sudo apt-get -f install`. This will install all of the missing dependencies on the system.

■ **Tip** Within the Synaptic Package Manager, you can click the Custom Filters button at the bottom left and then click the Broken entry in the filter list in order to see any packages that have unmet dependencies.

Uninstalling Packages

To remove a package, type the following:

```
sudo dpkg -r packagename
```

Note that you simply need to type the name of the program, without its version number or the `.i386.deb` file extensions.

In this case, `dpkg` is slightly better behaved than when installing software. If there are any reverse dependencies (other packages that depend on the one you're trying to remove), you'll be stopped in your tracks with a couple of error messages. You'll need to resolve the reverse dependencies first; of course, they might also have their own reverse dependencies. Welcome back to dependency hell!

■ **Note** The `dpkg -r` command will remove the package but leave behind its configuration files. This is handy if you install the software again in the future. In order to remove the configuration files in addition to the software, type `sudo dpkg -P` *packagename*.

Querying Packages

`dpkg` includes a couple of query facilities that display details about packages. You can find out if a package is installed by typing this:

```
dpkg -l packagename
```

If you want to find out every bit of information about an installed package, including what dependencies it has, use the following command:

```
dpkg -s packagename | less
```

This example pipes the output of `dpkg` into `less` so you can read it more easily, because it's likely to fill several terminal window screens.

You can also use `dpkg` to query an installation file you've just downloaded:

```
dpkg -I packagename.i386.deb | less
```

All said, `dpkg` is an often undervalued tool that's capable of some handy low-level package management tasks. Take a look at its man page to learn more.

Using Gdebi

The same Gdebi program mentioned previously also has a command-line front end that can be used to install packages. The advantage of using Gdebi over the similar `dpkg` program is that Gdebi can source any missing dependencies that the package requires. However, once again, the same proviso applies: the dependency packages have to be available within the software repositories that your computer is signed up to. If they aren't, Gdebi will stop with an error message.

Using Gdebi at the command line is simple: the following will install `packagename.deb`:

```
sudo gdebi packagename.deb
```

If the dependency packages cannot be sourced, the message "This package is uninstallable" will be displayed. Assuming the dependency packages are available, you'll be shown a list of the packages that are needed, and also the long description contained within the package you are intending to install. After you have confirmed that you want installation to continue by pressing Y, the packages will be downloaded and everything installed automatically.

Managing Software Repositories

It's unlikely that, in general use, you'll need to add, remove, or otherwise manipulate the list of software repositories, above and beyond what we described in Chapter 18, when you enabled the Skype repository.

The list of repositories is held within the `/etc/apt/sources.list` file and also in the `/etc/apt/sources.list.d/` directory. You can administer this either by using the Software Sources program, through Synaptic's Settings ➤ Repositories dialog box or by directly editing it. Although it's not a complicated file to understand, we don't advise making manual edits; in most cases, the Software Sources program will do all you need. However, we explain both approaches in the following sections.

Using Software Sources

The Software Sources program can be found on the System ➤ Administration menu. Although you can use it to add and remove third-party repositories, it's designed to let you tweak settings relating to the official repositories, which are set up by default.

The program contains five tabs, which offer the following functionality:

Ubuntu Software: This tab lets you choose the repository components. You can choose to activate the Main (Canonical-supported open source software), Universe, Multiverse, Restricted, and Source Code components. Additionally, you can choose whether Ubuntu connects to a regional repository server (that is, one in or near your country) or the main Ubuntu server. Simply select the one you want from the Download From drop-down list, or try the Select Best Server button for automatic configuration. Connecting to a regional server is likely to result in faster service. If you're outside the United States, you can also opt to connect to the Server for United States.

Third-Party Software: This tab lets you add your own selection of repositories. These can be online or on a CD/DVD-ROM. When you click Add, you'll be asked to supply the APT line, which should be the line as it would appear in the `/etc/apt/sources.list` file, discussed in the next section. However, after a line has been added, you can double-click it in the list to see a more user-friendly dialog box, which splits the category and component fields into separate text boxes. Two entries are already present in the list but deactivated, and they relate to the Partner category within the main repository (both binary and source code releases).

Updates: This tab lets you select the types of updates you would like to download. Effectively, it lets you choose a repository category, as discussed earlier when the nature of Ubuntu's software repositories were outlined. You can choose to connect to Proposed Updates and Backported Updates, in addition to Security Updates and Recommended Updates, as shown in Figure 28-6. You can also set when to check for updates, and whether you want to be informed of all new releases of Ubuntu or just the Long-Term Support releases every few years. Additionally, you can select to automatically install security updates without being prompted first. This is not a bad idea, considering many are considered vital for the safety of your system.

Figure 28-6. *The Updates tab lets you choose which repository categories you wish to use.*

Authentication: Package files within repositories are usually digitally signed by their creators. This is a way of proving that they haven't been tampered with. Your computer can check the digital signature, but it needs a copy of the signing key for the relevant repository. If the key is missing, you'll be warned within the Synaptic Package Manager that the package can't be authenticated when you try to install it (although it's still possible to install the package after this). Two signing keys are added to Ubuntu by default—one for the installation DVD-ROM and one for the online archive—but you can add more, such as those for third-party repositories that you've added manually. The Authentication tab lets you do this. Using a web browser, download the key file from the server (right-click the file and select Save As), and then click the Import Key File button. In the Open dialog box, select the file and click OK. The key will then be instantly imported.

Statistics: Here you can opt into an attempt by the Ubuntu developers to monitor which packages are most popular. This will help shape future releases of Ubuntu and also improve the rank of the applications you choose in the Add/Remove Applications program. Simply put a check in the Submit Statistical Information box if you would like to participate.

Adding/Removing a Repository at the Command Line

The `/etc/apt/sources.list` file is at the heart of the APT system and contains details of all the package repositories you're subscribed to, as well as the individual categories within each repository.

You can edit the file within `vim` by opening a terminal window (Applications ➤ Accessories ➤ Terminal) and typing the following:

```
sudo vim /etc/apt/sources.list
```

The `sources.list` file usually contains two types of entries: those beginning with `deb`, which indicate a standard repository containing binary files, and those beginning with `deb-src`, which indicates a source file repository. `deb-src` entries are largely for developers.

Here's an example line from `sources.list` on a test system:

```
deb http://us.archive.ubuntu.com/ubuntu/ jaunty main restricted
```

As you can see, the first component of the line is the address of the server. Then the repository category is listed: `jaunty`. If the server offered updates, this might read `jaunty-security` or `jaunty-updates`. Following this, the repository components are listed: `main` and `restricted`.

A hash symbol (`#`) at the beginning of a line in `sources.list` means that it's ignored. This can be useful for disabling a repository in a situation where you don't necessarily want to remove it from the file. In addition, as you can see within the file, some explanatory comments from Ubuntu developers are inserted into the file and are preceded by a hash symbol, so that APT doesn't attempt to interpret them.

Adding a new repository is easy. For example, to add the Skype repository, in order to download the Skype VoIP software, switch to insert mode within `vim` (by typing `i`) and then type the following:

```
# added by Keir, 4 June 09
deb http://download.skype.com/linux/repos/debian/ stable non-free
```

As you can see, we've added a comment to identify who added the line and when.

You'll notice something interesting about the actual `deb` line. The Skype server's repository category and components aren't like the others in the `sources.list` file. The category is `stable`, and the component is `non-free`. In this case, the Skype server uses the Debian method of naming repository categories and components, which is different from Ubuntu's way.

After you've added a new repository, don't forget to refresh your local list of packages. If you don't do this, APT won't be aware of the software contained in the new repository. Refresh the list by typing the following at the command prompt:

```
sudo apt-get update
```

This should also be done after you remove or disable a repository within `sources.list`. If you see an error message during the update such as "Some index files failed to download," APT was unable to contact a repository. This probably means the line you added either is incorrect or contains a typo. In the case of the latter, the error should give you some indication of which line is not added properly. Take another look.

Installing from Source

Back in the old days of Unix, the only way to install many software packages was from source code, a process known as *compiling*. This was because most people edited the source code themselves, or at least liked to have the option of doing so. Nowadays, innovations such as the Debian package management system make compiling all but redundant for the average user. But knowing how to compile a program from source is still a good Linux skill to have. In some cases, it's your only option for installing certain programs, because you may not be able to find a packaged binary or because the packagers have not yet created binary versions of their latest cutting-edge release.

Program compilation is usually handled at the command prompt. It's not the kind of thing you would do via a GUI program.

Installing the Compiler Tools

Before you can compile from source, you need to install several items of software: the `make` program, which oversees the process of creating a new program, and the GNU Compiler Collection (GCC), which does the hard work of turning the source code into a binary. In addition, if the software relies on certain library files, you'll need to install development (`dev`) versions of them, as well as the libraries themselves if they're not already installed. For example, if you're compiling a program to run under the GNOME desktop, you'll need development versions of the GTK2+ libraries.

Under Ubuntu, it's possible to install all the program-compilation tools you need by installing the `build-essential` metapackage. You can use the Synaptic Package Manager or the following `apt-get` command at the command prompt:

```
sudo apt-get build-essential
```

Unpacking the Source Tarball and Solving Dependencies

Let's take a look at installing a program from source. Dillo is a stripped-down web browser that's designed for speed and small file size. It's a fun little program that's good to have around in the unlikely event of your main browser developing a glitch that you can't fix. The Dillo home page is `www.dillo.org`, so head over there and choose to download the latest version of the source code. Choose the last release that isn't the 2.0 release—when I visited the web site, this was 0.8.6. The 2.0 release was still in beta testing at the time of writing, and it also has some library needs not yet available in Jaunty.

■**Note** Okay, you got us. If you use `apt-cache` or the Synaptic Package Manager to look through the repositories, you'll see that Dillo is available as a ready-to-install package. But Ubuntu's package repositories are so comprehensive that, frankly, we couldn't find anything to demonstrate program compilation that wasn't already in there!

The first thing to do is to unpack and uncompress the tarball (if you wish to learn more about the `tar` command, see Chapter 31):

```
tar jxf dillo-0.8.6.tar.bz2
```

Of course, you should replace the filename with that of the version you downloaded.

Next, you'll need to switch into the source code directory and take a look at the `README` file. This will tell you what dependencies Dillo has and also any caveats you may need to take into account in order to compile Dillo on a Linux system:

```
cd dillo-0.8.6
less README
```

■**Note** Unlike binary packages, source code is rarely designed with one specific Linux distribution in mind–or even with Linux in mind! For example, Dillo is able to compile on all types of Unix, including Linux, Solaris, BSD, and others. With a little work, it might even be possible to compile it under Windows!

First, you see that Dillo needs the `glib` libraries. This is a given on nearly all Linux systems, but in order to compile, Dillo will need the `dev` version of `glib`, which isn't part of the default Ubuntu installation.

Next, you read that it also needs the GTK+ 1.2 libraries. These are present on the majority of GNOME-based Linux desktop systems, but once again, the `dev` versions will need to be installed.

Beneath that in Dillo's list of requirements is support for JPEG and PNG image formats, which are definitely installed on the average Linux system, and the Wget download tool, which is also included with most versions of Linux (although it's a good idea to use the Synaptic Package Manager or `apt-cache search` to check that it's installed).

After finding out about dependencies, you should scroll down the `README` to look for any notes about compiling under Linux. It turns out there might be some issues with older 2.4 versions of the Linux kernel, but Ubuntu uses 2.6, so this isn't an issue.

So, in short, before you can compile Dillo, you need to install `dev` versions of the `glib` and GTK+ 1.2 libraries. You can install these via the Synaptic Package Manager or `apt-get`. It will help cut down the search results if you realize that system library packages under Ubuntu are usually prefaced with `lib`. So, search for the `dev` versions of `libgtk` and `libglib`. Doing so on our test system returned three likely packages: `libglib1.2-dev`, `libglib2.0-dev`, and `libgtk1.2-dev`. There are two `libglib` entries, because our system has both `glib2` and the older `glib1.2`. To ensure compatibility, we decided to install `dev` versions of both. Because you're working at the command prompt, install the packages via `apt-get`:

```
sudo apt-get install libglib1.2-dev libglib2.0-dev libgtk1.2-dev
```

As soon as we typed this, it turned out that `libgtk1.2-dev` came with a host of dependencies in the form of X server `dev` libraries. The reasoning is that if the GTK+ `dev` library files are needed, these other libraries are often needed, too. Whatever the case, there's no harm in installing them.

Compiling

Now comes the exciting process of compiling the program! This is done via three commands, issued in sequence with an Enter following each one:

```
./configure
make
sudo make install
```

The first command starts the `configure` script, created by the Dillo programmer, which checks your system to ensure that it meets Dillo's requirements. In other words, it checks to make sure the `glib` and GTK+ libraries are present. It also checks to make sure you have the correct software that's required to actually compile a program, such as GCC and `make`.

It's when the `configure` script is running that something is most likely to go wrong. In that case, more often than not, the error message will tell you that you're missing a dependency, which you must then resolve.

■ **Note** Some `configure` scripts are very thorough and check for components that the program you're trying to install might not even need because, for example, they may just be alternative packages for doing the same job. Because of this, you shouldn't worry if, as the text scrolls past, you see that various components are missing. Unless `configure` complains about it when it has finished, it's not a problem.

The next command, `make`, takes care of the actual program compilation. When you run this, the screen will fill with what might look like gibberish, but this is merely the output of the GNU compiler. It provides a lot of valuable information to those who know about such things, but you can largely ignore it. However, you should keep your eyes peeled for any error messages. It's possible that the `configure` script did not check your system thoroughly enough, and you might be missing an important system component—in which case, `make` will halt.

■ **Note** We saw an error message at the end of the `make` session when compiling Dillo. We were able to follow up with the `sudo make install` command, which also reported error messages. However, we found that Dillo worked fine! The moral of the story is that software compilation is something of a black art, with error messages designed for programmers, and not all error messages are fatal.

Alternatively, the program simply might not be able to compile on your system without some tweaking to the `Makefile` (the file that `make` uses). If such a situation arises, the best plan is to visit the web site of the developer of the software and see whether there's a forum you can post to. Alternatively, check if the developer has an e-mail address you can contact to ask for help.

Eventually, the compilation will stop with a number of exit messages. Then the final command must be run: `make install`. This needs to be run with superuser powers, because its job is to copy the binary files you've just created to the relevant system directories. In addition, any documentation that comes with the program is also copied to the relevant location on your system.

After the three commands have completed, you should be able to run the program by typing its name at the command prompt. If you've been playing along at home and have compiled Dillo, you can run it by typing `dillo`. Figure 28-7 shows Dillo running under Ubuntu.

Note You'll probably need to add your own icon for Dillo to the desktop or Applications menu (see Chapter 10). Source packages are usually designed to be installed on any version of Unix running a variety of desktop managers. In the past, it was difficult for the developer to know where to create desktop shortcuts, but now organizations like freedesktop.org (`http://freedesktop.org`) are standardizing the process.

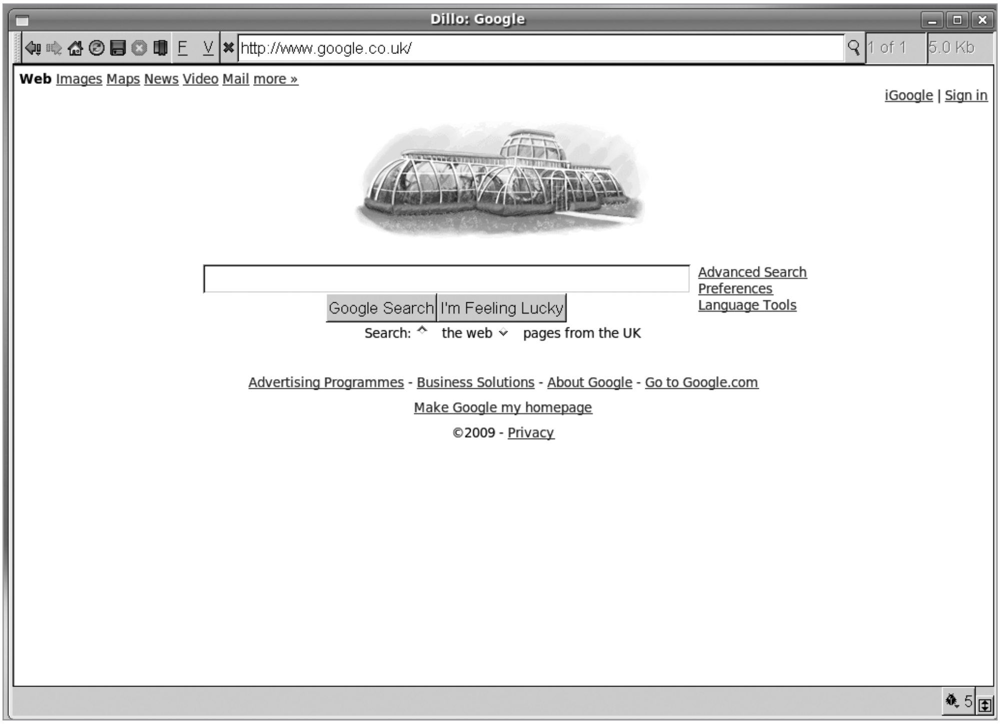

Figure 28-7. *Dillo in action—a certain satisfaction comes from compiling a program from source code.*

Summary

This chapter described how to install software under Ubuntu. You've looked at how this differs from Windows software installation, and how the Debian package management system is designed to make life easier.

You learned how to use the Synaptic Package Manager to install software under the GUI, and how to use the `dpkg` and APT tools to install software at the command-line prompt. Finally, you looked at how programs can be compiled from their source code, which is a fundamental process for all versions of Linux.

In the next chapter, you'll look at how to administer the user accounts on the Ubuntu system.

CHAPTER 29

Managing Users

Linux was designed from the ground up to be a multiuser system. When powerful Linux machines are deployed in huge data centers, they are capable of serving hundreds, if not thousands, of users at the same time. In a more domestic setting, such as when Ubuntu is installed on a desktop PC, *multiuser* means that several family members can have their own login on the PC. They'll get their own desktop environment that is separate from that of the other users and their own file storage area away from the eyes of everyone else (except the root user).

And even if you're the only person using your PC, you can still take advantage of Ubuntu's multiuser capabilities. Consider creating user accounts for various aspects of your life—perhaps one for work and one for time spent browsing the Web. Each user account can be tailored to a specific need.

In this chapter, you'll learn how to administer multiple user accounts.

Understanding User and Group Accounts

The concept of users and file ownership was explained in Chapter 14, but let's take a moment to recap and elaborate on some important points.

Users and Groups

Each person who wishes to log in to Ubuntu must have a user account. This will define what that user can and cannot do on the system, with specific reference to files and folders. Because Ubuntu is effectively one large file system, with even hardware devices seen as individual files (see Chapter 14), this means that user permissions lie at the heart of controlling the entire system. They can limit which user has access to which hardware and software, and therefore control access to various PC functions.

Each user also belongs to a group. Groups have the same style of permissions as individual users. File or folder access can be denied or granted to a user, depending on that person's group membership.

Note As in real life, a group can have many members and can be based around various interests. In a business environment, this might mean that a group is created for members of the accounting department and the human resources department, for example. By changing the permissions on files created by the group members, each group can have files that only the group members can access (although, as always, anyone with superuser powers can access all files).

On a default Ubuntu system with just a handful of users, or probably just a single user, the group concept might seem somewhat redundant. However, the concept of groups is fundamental to the way Ubuntu works and cannot be avoided. Even if you don't use groups, Ubuntu still requires your user account to be part of one.

In addition to actual human users, the Ubuntu system has its own set of user and group accounts. Various programs that access hardware resources or particular sets of files are part of these groups. Setting up system users and groups in this way makes the system more secure and easier to administer.

Root User

On most Linux systems, the root user has power over the entire system. Root can examine any file and configure any piece of hardware. Root typically belongs to its own unique group, also called `root`.

Ubuntu is different from most Linux distributions in that the root account isn't used by default. Instead, certain users—including the one set up during installation—can "borrow" root-like, or superuser, powers by simply typing their login password. This is done by preceding commands with `sudo` or `gksu` at the command-line prompt or as needed when using GUI programs that affect system settings. For some programs, including System ➤ Administration ➤ Users and Groups, you need to click an Unlock button to gain superuser powers. Until you unlock the Users and Groups program, most of the buttons are grayed out and unusable.

If you wish, you can activate the root user account on your system for administration purposes. To activate the root account, use the following command in a terminal window (see Chapter 13 for details on issuing commands in a terminal window):

```
sudo passwd root
```

After typing your own login password, you'll be invited to define a password for the root user. Because of its power, the root user can cause a lot of accidental damage, so by default Ubuntu prevents you from logging in as root. Instead, you can switch to being the root user temporarily from an ordinary user account by typing the following in a terminal window:

```
su
```

You will be prompted for the root password, and then given root powers for as long as you need. When you've finished, type `exit`, and you'll be returned to your ordinary user account.

■ **Tip** You can tell when you're logged in as the root user because the command prompt will end with a hash symbol (#). When logged in as an ordinary user, it ends with a dollar sign ($). The hash symbol should be seen as a warning that you now have unrestricted control over the system, so be careful what you type, and double-check everything before hitting Enter!

As an alternative to setting the root password, you can simply type the following whenever you want to switch to the root user account:

```
sudo su
```

You'll be prompted for your login password, in exactly the same way as if you had just preceded another command with `sudo`. After this, you'll have the powers of the root user. To quit the root user account, type `exit`.

If you enable the root password in the name of security, it might be a sensible precaution to then disable `sudo`, thus preventing nonadmin users from playing with things they shouldn't. To do this, you'll need to edit the file `/etc/sudoers`. There will be a line (shown in Figure 29-1) that reads:

```
%admin  ALL=(ALL) ALL
```

Comment this out with a # sign and save the file. This, of course, will all need to be done using root privileges, so use `sudo gedit` to launch the text editor and then navigate and open the file. Also make sure you've set up the root password, as shown earlier, before you do this.

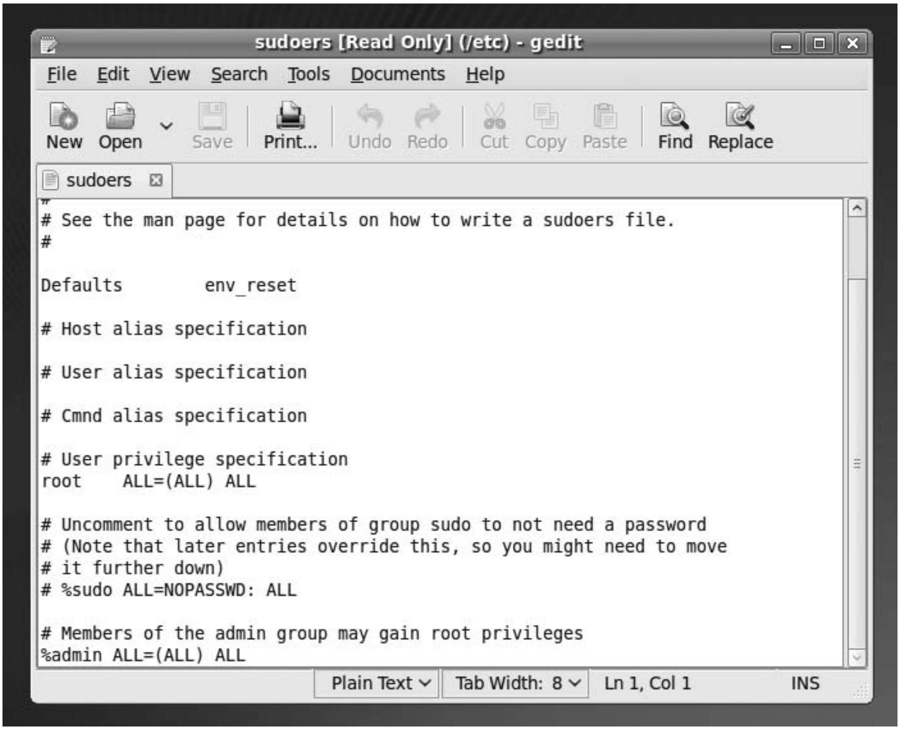

Figure 29-1. *Be very cautious when editing these files.*

UIDs and GIDs

Although we talk of user and group names, these are provided only for the benefit of humans. Internally, Ubuntu uses a numerical system to identify users and groups. These are referred to as user IDs (UIDs) and group IDs (GIDs), respectively.

Under Ubuntu, all the GID and UID numbers below 1,000 are reserved for the system. This means that the first nonroot user account created during installation will probably be given a UID of `1000`. In addition, any new groups created after installation are numbered from 1,000. On one test system, the default user of `keir` had a UID of `1000` and a GID of `1000`. The second user we added was given a UID of `1001`.

■Note UID and GID information isn't important during everyday use, and most commands used to administer users, groups, and file permissions understand the human-readable names. However, knowing about UIDs and GIDs can prove useful when you're undertaking more-complicated system administration, such as setting up a restricted system for children or scripting.

Adding and Deleting Users and Groups

The easiest and quickest way to add a new user or group is to use the Users and Groups tool under the System ➤ Administration menu. Of course, you can also perform these tasks through the command line.

Adding and Deleting Users via the GUI

To add a new user, choose System ➤ Administration ➤ Users and Groups. Click the Unlock button. In the authentication window, supply your password and click Authenticate. Next, click Add User. You'll see the New User Account dialog box, as shown in Figure 29-2.

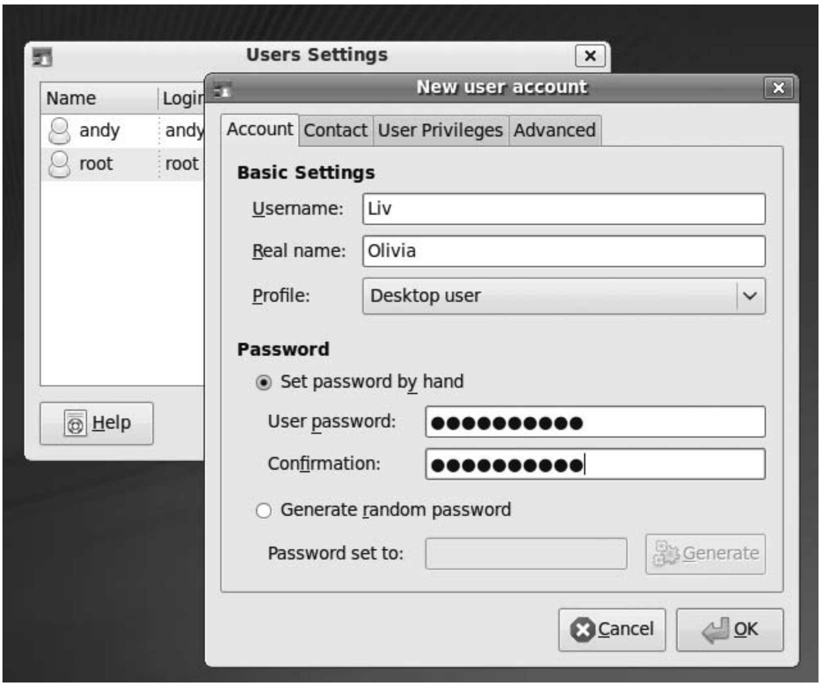

Figure 29-2. *Adding new users and groups is easy with the Users and Groups program.*

Fill out the fields on the Account tab, and optionally the Contact, User Privileges, and Advanced tabs, as follows:

Account: As during initial installation (see Chapter 5), you're invited to enter a username as well as a real name. The username is how the user is identified to the system, while the real name is how the user will be identified to other users. Beneath this, you can select the profile you want the user to have—Administrator, Desktop User, or Unprivileged. Users with the Administrator profile can use `sudo` or `gksu` to administer the system. Although Desktop Users can't use these commands, they do have access to most other system resources. The Unprivileged profile removes access to virtually all resources, including external storage devices. Effectively, this is a lockdown account, although such users are still allowed to go online, provided the system has been preconfigured for online access. For most users, the Desktop User profile is a good choice. An initial password for the user is required. You can enter it in the text box (and confirm it below) or let the system generate a random password from letters and numbers, but this may be harder for the user to remember.

Contact: Here you can enter contact information for the user. This is not obligatory.

User Privileges: The settings on this tab offer much more control over what a user can and cannot do on the system. Here you can prevent users from using certain hardware, such as the 3D capabilities of graphics cards, or modems. You can also control whether the user is able to administer the system. Simply put a check alongside any relevant boxes.

Advanced: Here you can alter additional settings, if you wish, relating to the technical setup of the account on the system. If you're not sure about these parameters, it's best to leave the default settings alone. You might like to change the main group for the user. By default, the user will belong to a newly created group based on the user's own username. For example, if you add the user `john`, he will be added to the group `john`. This private group approach enforces a more stringent policy regarding personal file access. Alternatively, you could create a single group and assign several users to that group for file-sharing purposes. We'll discuss adding and removing groups in the next section.

■ **Caution** Many groups are listed in the Main Group drop-down list. Nearly all of these relate to the way the Linux operating system works and can be ignored. You should never, ever delete any of these groups or add a new user to one of them. This may make the system unstable and/or insecure.

Deleting a user is simply a matter of highlighting the username in the list within the main Users and Groups window and clicking the Delete button. Note that the user's `/home` directory won't be deleted. You must do this manually with superuser powers, and it's best accomplished from the command-line prompt (you can use standard file-manipulation commands, such as `rm`; see Chapter 13 for an introduction to basic file-manipulation shell commands).

Creating and Deleting Groups via the GUI

Adding a group is simply a matter of clicking the Manage Groups button in the Users and Groups program window (System ➤ Administration ➤ Users and Groups). Don't forget to click the Unlock button, if you haven't already done so. After clicking the Add Group button, you'll be prompted to give the group a name. The GID will be filled in for you automatically, but you could choose a different number if you have good reason to do so. (Remember to use a number above 1,000, to keep in line with the way Ubuntu operates.)

It isn't essential that you add users to the group then and there, but a list of users is provided at the bottom of the dialog box. Put a check alongside any user to grant that user access to your group.

■ **Note** Bear in mind that users can be members of more than one group, although all users have a main group that they belong to, from which the GID is assigned to files they create.

As with user accounts, deleting a group is simply a matter of highlighting it in the list and clicking the Delete button. You should ensure that the group no longer has any members before doing this, because Ubuntu won't prevent you from removing a group that has members (although it will warn you that this is a bad thing to do).

■ **Note** Ubuntu appears to offer protection against the havoc caused by deleting a group that is the main group of users on your system. When we deleted an entry that was the main group of a different user and then logged in as that user, the group was automatically re-created! You shouldn't rely on this kind of protection, however, and should always check before deleting a group.

Adding and Deleting Users and Groups at the Command Line

You can create new users at the command-line shell by using the `useradd` command. This command must be run with superuser powers, which is to say that it must be prefaced with the `sudo` command.

The command to add a user is typically used in the following way:

```
sudo useradd -m <username>
```

The `-m` command option tells the command to create a `/home` directory for the user. Used on its own, `useradd` merely updates system files with the new user's details and nothing else. There are several other useful command options, which can be discovered by a quick browse of the command's man page. An important note is that your new user can't log in to the new user account until a password is assigned, as discussed in the next section.

Creating a new user this way will automatically create a new group, which will have a title that's exactly the same as the username you just created, and add this user to it.

Adding a new group is just as easy as adding a new user, and the command is similar:

```
sudo groupadd <groupname>
```

To specify a different main group when creating a new user, use the `-g` switch:

```
sudo useradd -m -g <groupname> <username>
```

For example, the following command creates a user called `raymond` and adds him to the main group `users`:

```
sudo useradd -m -g users raymond
```

Note that the specified group will need to be created first; it won't be created automatically by the `useradd` command. Although it's easy to do, creating users and groups at the command line is not advised, because there are a handful of annoying issues. One issue is that the new user is assigned the Bourne (sh) shell environment, rather than BASH, as is the default under Ubuntu. This can be overcome by the user simply typing `bash` at the command line after he has logged in.

Note For a permanent change to the user's shell, edit the `/etc/passwd` file. You'll need administrator powers to do this. Look for the line that begins with the name of the new user, probably at the end of the file, and change the end of the line to read `/bin/bash`, rather than `/bin/sh`. Be *extremely careful* editing this file! It's a central file without which your system could not operate. Ensure that you make only the edit described here and, of course, make a backup of the file that you can restore should things go wrong.

But there's another, more annoying issue relating to groups when you're creating a user account at the command line. Most users are members not only of their own group, but also of several system groups. These groups relate to various hardware and software functions. For example, membership of the `cdrom` group may be required if the user wants to be able to use the CD or DVD-ROM drive.

Strictly speaking, you should add new users to these groups if they're to make full use of the system. These groups are described as *supplementary groups*, as opposed to the main group that is assigned to files the user creates.

Use the `id` command to display user and group information. On our test system, typing the following:

```
id keir
```

revealed the following groups:

```
uid=1000(keir) gid=1000(keir)
groups=4(adm),20(dialout),24(cdrom),46(plugdev),106(lpadmin),120(admin),121
(sambashare),1000(keir)
```

All those after the main group, `1000(keir)`, are supplementary groups. For a list of what they do, see Table 29-1.

Table 29-1. *System Groups Within Ubuntu*

Group	Definition
`adm`	Used for system logging
`dialout`	Required for use of serial port devices, such as older modems
`cdrom`	Allows the user to access the CD/DVD-ROM
`plugdev`	Allows the user access to removable storage, such as card readers, digital cameras, and so on
`lpadmin`	Allows the user to administer the printer
`admin`	Gives the user system administration abilities (superuser powers)
`sambashare`	Facilitates sharing files with others across the network

As you might have guessed, to manually add a user under Ubuntu, you must not only create a group and then add the user to it, but you must also add that user to the required selection of supplementary groups. Some might be considered mandatory for effective use of the computer, such as `plugdev`, while others are optional, depending on how much freedom you want to afford the new user.

You can add a new user to supplementary groups by using the `-G` (an uppercase *G*) switch with the `useradd` command. Here's how to add a new user called `raymond` to the system so that he is able to make full use of the system (having first created a group called `raymond`):

```
sudo useradd -m -g raymond -G adm,dialout,cdrom, plugdev, lpadmin,admin,\
sambashare raymond
```

Additionally, creating a new user by using `useradd` won't automatically apply a password to the account. Ubuntu can't work accounts unless they have a password, so until one is applied, the new account will be locked. A user with administrative powers can assign a password by using the `passwd` command, as discussed in the next section.

Deleting a user is mercifully simple compared to this! Use the `userdel` command, as follows:

```
sudo userdel <username>
```

This command alone won't remove the user's `/home` directory, however. To accomplish this task, add the `-r` switch to delete the user and the user's `/home` directory, like so:

```
sudo userdel -r <username>
```

Similarly, to delete a group, use the `groupdel` command:

```
sudo groupdel <groupname>
```

Note that you won't be able to remove a group if it's an existing user's main group.

Adding and Changing Passwords

On a default Ubuntu installation, ordinary users are able to change their own password in a terminal window. The command for any user to change her own password is simple:

```
passwd
```

The user will be asked to confirm her current password, and then to enter the new password twice, to make sure that it has been typed correctly.

Alternatively, by adopting superuser powers, a user can change the password of another account:

```
sudo passwd <username>
```

This is necessary after you create a new user account on the command line with `useradd`, because the new user isn't given a password automatically. For obvious security reasons, Ubuntu won't allow blank passwords.

You can enter just about anything as a password, but you should bear in mind some common-sense rules. Ideally, passwords should be at least eight characters long and contain letters, numbers, and even punctuation symbols. You might also want to include both uppercase and lowercase letters, because that makes passwords harder to guess.

A number of command-line options can be specified with the passwd command when it is invoked with superuser powers. For example, the -l option will lock the specified account so that it can't be accessed (the -u option will unlock it).

Tip You can temporarily switch into any user account by typing su <username>. When you've finished, simply type exit to return to your own account. Remember that typing su without a username will give you root powers, so be careful.

Summary

In this chapter, you looked at the principles behind user and group accounts under Ubuntu. You examined how user and group accounts can be created, edited, and deleted by using the GUI, as well as on the command line. You also looked at how passwords can be manipulated by individual users and by an administrator with superuser powers.

In the next chapter, you'll look at how the Ubuntu system can be optimized. You'll also learn about several interesting and important system tools.

CHAPTER 30

Optimizing Your System

Ubuntu should prove to be as responsive in day-to-day operation as Windows, if not more so. But if you run into any performance issues, or if you simply want to get the most out of your system, this chapter is for you. The chapter doesn't cover essential knowledge, so you can skip it if you're satisfied with how your system runs. More often than not, it discusses hacks—clever methods of making things work in a nonstandard fashion. But as your experience of Ubuntu might have already taught you, such hacks are the lifeblood of Linux. One of the strengths of Linux is the ability to delve under the hood and change absolutely any aspect of the way it works.

Speeding Up Booting

Since Ubuntu 6.10 (Edgy Eft), Ubuntu has been using a boot routine called Upstart that effectively optimizes itself. You can learn more about Upstart at `http://upstart.ubuntu.com`. However, you can still tweak performance by enabling startup scripts to run in parallel instead of one after the other. This works well for multithreaded, multicore processors, like Intel's Core 2 Duo and AMD's Athlon 64 X2. It won't make the computer start instantly, but it will save a few seconds each time you boot.

To configure running startup scripts in parallel, you need to edit the `/etc/init.d/rc` file. You can load this file into the Gedit text editor by typing the following in a terminal window:

```
gksu gedit /etc/init.d/rc
```

Look for the line that begins with `CONCURRENCY` near the top of the file, as shown in Figure 30-1, and change the value from `none` to `shell`. Save the file and reboot the computer. If you see no improvement in boot speed, you can change this value back to `CONCURRENCY=none` if you wish.

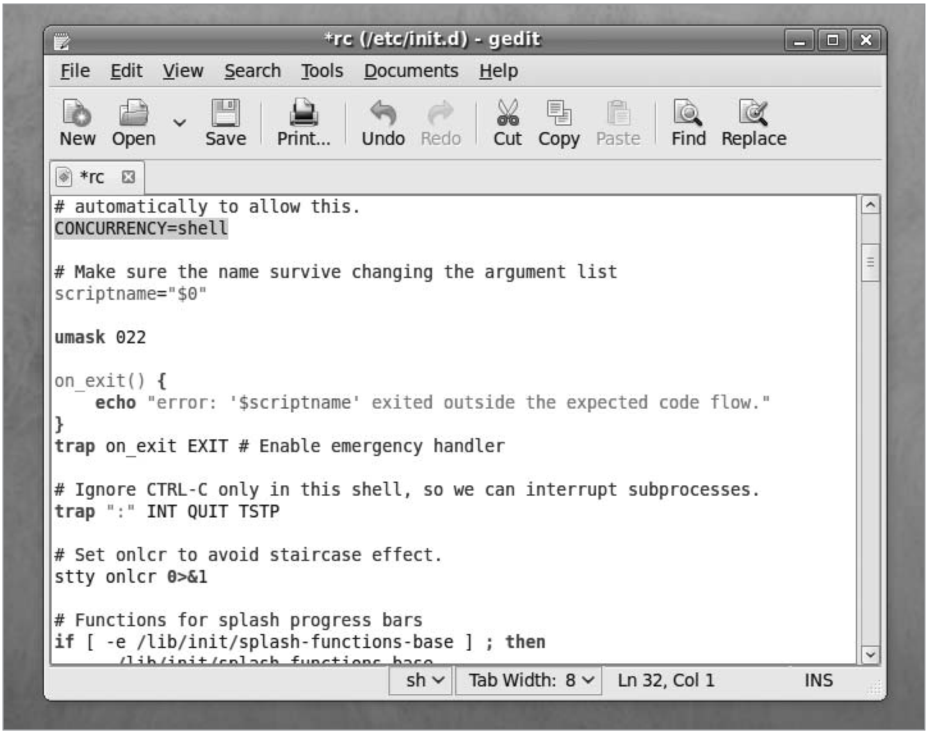

Figure 30-1. *Parallel execution of scripts in the boot process can be enabled by editing the* `/etc/init.d/rc` *file.*

Reducing the Boot Menu Delay

Getting rid of the GRUB boot menu delay can save some waiting around in the early stages of the boot process. The delay can be reduced to 1 second or even eradicated completely. Of course, in such a case, you won't be able to choose which operating system you want to load if you're dual-booting with Windows. Even if Ubuntu is the only operating system on your computer, without the boot menu delay, you won't have the chance to boot into recovery mode or a previously installed Linux kernel from the GRUB menu. So you need to consider whether this is a worthwhile time-saving measure.

The boot menu delay is stated in the `/boot/grub/menu.lst` file. You can load this into the Gedit text editor by typing the following in a terminal window:

```
gksu gedit /boot/grub/menu.lst
```

Look for the line that begins with `timeout`, as shown in Figure 30-2, and change the value to whatever you wish. The units are counted in seconds, so a value of `3` equates to 3 seconds. A value of `0` (zero) will mean the boot menu won't appear at all, which is not recommended, for the reasons just mentioned. Generally speaking, a delay of 1 second

(1) gives you just enough time to press a key at the appropriate time. This will cancel the countdown, meaning the boot menu will stay on your screen until you select an option.

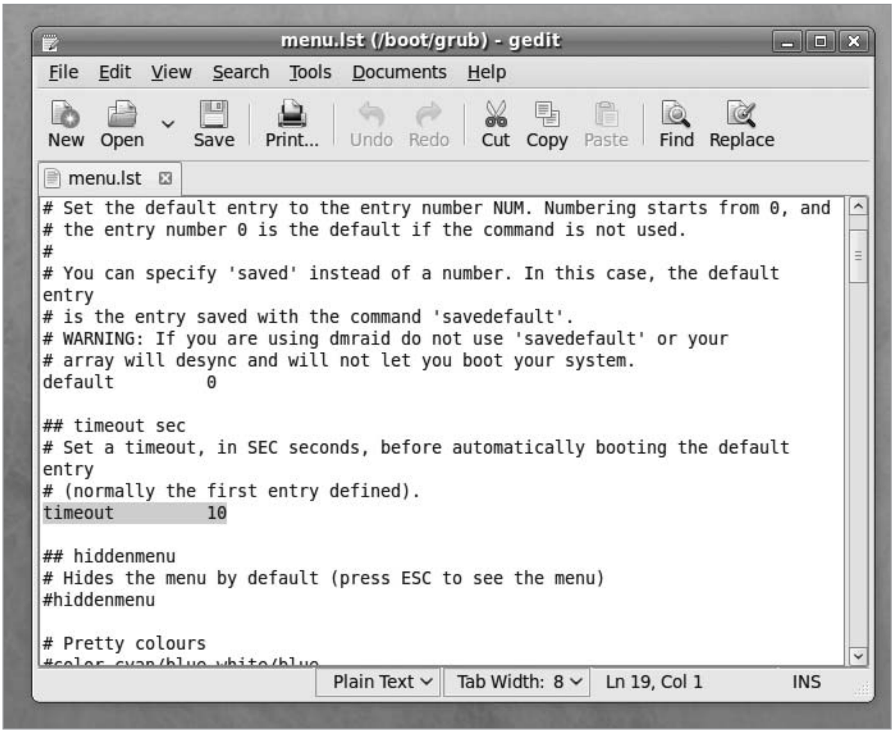

Figure 30-2. *You can stop the GRUB menu from hanging around for so long by changing the* `timeout` *value in its configuration file.*

Note When you've finished, save the file and quit Gedit.

Managing GNOME Sessions

Under Windows, you might be used to controlling which programs start up at the same time as the desktop, by adding or deleting entries in the Start menu's Startup program group. When running Ubuntu, you can control which system applets are started automatically, as well as your personal choice of desktop applications.

To control which programs start up with the GNOME desktop, use the Startup Applications Preferences dialog box (`gnome-session-properties`). To run the program, click System ➤ Preferences ➤ Startup Applications.

Clicking the Startup Programs tab shows the programs that start when GNOME does, as shown in Figure 30-3. You can disable a startup program in the list by unchecking the check box beside it.

Figure 30-3. *In the Startup Applications Preferences dialog box, you can control which programs start when GNOME does.*

You should see most or all of the following entries, though our test system (in Figure 30-3) has some additional elements added by other applications and services.

AT-SPI Registry Wrapper: This enables Ubuntu's screen reader (accessibility) software to function correctly. If you do not use the screen reader, this option can be disabled.

Bluetooth Manager: This program is responsible for the Bluetooth applet that can be used to send and receive files, browse other Bluetooth devices, set up Bluetooth services, and manage Bluetooth service settings. You can disable this applet if your system is not Bluetooth-enabled or if you just don't want to use Bluetooth at all.

Check for New Hardware Drivers: This tool scans your hardware devices and checks whether new third-party proprietary drivers can be used with them. If a new driver is compatible, this tool provides a facility to download, install, and configure the driver in your computer. If your hardware devices are working perfectly without third-party drivers, or you're uncomfortable using proprietary software, it is safe to disable this program. Otherwise, keep the tool enabled so you can receive driver bug fixes and updates.

Evolution Alarm Notifier: As its name suggests, this utility ties into Evolution's calendar function in order to notify you of events, such as an appointment that you don't want to forget. If you don't use Evolution or don't use its calendar function, this applet can be disabled.

GNOME Keyring Daemon: This makes available to other software the GNOME keyring service, by which passwords are securely cached (such as the password for your wireless connection). It should not be disabled.

GNOME Login Sound: As you might have guessed, this sounds the Ubuntu welcome music that you hear whenever the GNOME desktop appears. It can be disabled without causing any problems.

GNOME Settings Daemon: This program configures the GNOME desktop according to your personal settings, such as the GUI style. As such, it is an essential background service and should not be disabled.

GNOME Settings Daemon Helper: This is an ancillary of the preceding option and should not be disabled.

GNOME Splash Screen: This displays a small progress window during GNOME startup, showing which services are being activated. However, Ubuntu does not utilize a startup splash screen, so this can be disabled.

Network Manager: This applet manages your Wi-Fi, Ethernet, and VPN connections. This is useful for laptop users who connect to several Wi-Fi networks on the go, as discussed in Chapter 8. You should not disable this program.

Power Manager: This program controls all aspects of GNOME's power management, including the useful hibernate feature that can save the contents of the system's RAM to provide quicker startup. If your computer is a notebook, this tool should be considered essential. If you have a desktop PC and are looking to save power by using hibernate, suspend, or screen blanking after a period of inactivity, you won't want to disable Power Manager. Disabling it will remove the Suspend and Hibernate options from the System ➤ Quit dialog box.

Print Queue Applet: This applet provides an interface for you to cancel or repeat printer jobs. It is also responsible for automatically setting up a printer for use when you plug in a printer. You can disable this applet if you will never print from your computer.

Remote Desktop: This background service allows other computers to connect to your computer, after an invitation has been issued (see Chapter 33). If you have no intention of remotely accessing your computer, this service can be disabled.

Seahorse Daemon: This is a background component necessary for Seahorse, the application that generates and stores encryption keys (see Chapter 9). If you do not encrypt files and/or e-mails, this service can be disabled.

Tracker and Tracker Applet: These two entries appear in the list if you have the Tracker service activated. Tracker is the background process that indexes the contents and metadata of your `/home` directory for fast searching. Tracker Applet is the tool for searching your data and customizing Tracker settings. By default, indexing is disabled unless you enable the indexing options in the Tracker Preferences window (System ➤ Preferences ➤ Search and Indexing). You should leave indexing disabled if using it slows down your computer; however, the benefits of obtaining fast results when searching your data are undeniable.

Update Notifier: This is the Update Manager tool. You shouldn't disable this applet, because it performs the essential task of checking whether any system updates are available. It runs in the background after it is started and hardly impacts startup time at all. However, if you absolutely must prune valuable milliseconds from startup, you can disable it. You can then check for updates manually, whenever you desire, by clicking System ➤ Administration ➤ Update Manager.

User Folders Update: This tool pops up during the start of your session if you have recently changed the default language (System ➤ Administration ➤ Language Support) of your desktop. The tool gives you an option to translate the folder names Desktop, Templates, Public, Documents, Music, Pictures, and Videos in your `/home` directory to the new default language. You can disable this tool if you don't change your language settings.

Visual Assistance: This utility runs assistive technologies such as the Orca screen reader, magnifier, and Braille application if these tools were enabled in the Assistive Technologies Preferences window (System ➤ Preferences ➤ Assistive Technologies). See Chapter 10 for a discussion of these tools. If you are not using assistive technologies, you can disable this applet.

The Options tab contains a single item labeled Automatically Remember Running Applications When Logging Out, and this is designed to get you back exactly where you started next time you launch the computer. The system has been problematic in previous versions of Ubuntu, but the developers appear to have sorted things out because it works well in Jaunty. The exception is Wine-based Windows applications. These didn't seem to automatically start on our test system, but everything else, including KDE applications, worked fine.

Tip The Startup Programs tab of the Startup Applications Preferences dialog box contains an Add button, which lets you add any program you like to the GNOME startup. You could add Evolution, for example, so that it starts automatically whenever you log in. But it's easier to add currently running applications by using the option on the Options tab.

STOP WAITING FOR AN ADDRESS

If you use an Ethernet or Wi-Fi connection to access your network, you might find that Ubuntu spends a few seconds during each boot acquiring an Internet address. This will be characterized by a long pause while nothing seems to be happening. Therefore, one way to provide an instant speed boost is to give your computer a static IP address. Chapter 8 explains how to configure your network interface.

However, to assign a static address, you'll need to find out what IP address range your router (or other DHCP server) uses. This can be discovered by looking at the router's configuration software. Sometimes this is accessed via a web browser. Look for the section of the web interface headed DHCP Configuration or something similar.

Normally, IPv4 local area network addresses are in the 192.168.*x.x* range, where *x.x* can be any series of numbers from 0.0 to 255.255. For instance, you may find that your router uses the 192.168.1.2-255 range. In this case, assigning a static IP address that will work with the router is simply a matter of choosing an IP address in this range. However, this router may hand out addresses sequentially from 2 upward, so it's best to choose an address it's unlikely to reach, even if you happen to have many computers connected to the network. Starting at 50 is a good idea, so you could assign the address 192.168.1.50.

Don't forget that when defining static IP addresses, you'll need to manually supply the gateway, subnet, and DNS addresses. In the example, the gateway would be 192.168.1.1 (the address of the LAN interface on the router), and the subnet would be 255.255.255.0. The DNS address on a small home network will probably be the same as the gateway address, because the router will usually be set to forward DNS requests by default. This isn't always the case, though, so be sure to check.

BUILD YOUR OWN READAHEAD PROFILE

Ubuntu includes a feature called readahead, which is able to order the list of files to be loaded during bootup by their locations on the hard disk. A default readahead list is installed on a standard Ubuntu installation. This is created on a generic PC, but you can build your own version of the list, customized for your own computer.

Here are the steps to create your own readahead list:

1. Reboot Ubuntu, and at the boot menu, highlight the Ubuntu entry and press E. If Ubuntu is the only operating system on your computer (that is, your computer doesn't dual-boot with Windows), you might need to press Esc to see the boot menu when prompted.

2. Highlight the second line, beginning with the word `kernel`, and press E again.

3. Using the right-arrow key, move the cursor to the end of the line. Insert a space, type `profile`, and press Enter. The following is how the entire line read on our test PC; yours may be slightly different (note that the beginning of the line was cropped off because of the resolution of the screen):

```
< quiet splash profile
```

4. Press B to boot the computer. This boot will take longer than usual, because the boot profile is being rebuilt. When the computer has booted up, and all disk activity has stopped (which might take a minute or two after the desktop has appeared), reboot your computer. You should find that bootup is faster.

Prelinking

A lot of Ubuntu software relies on other pieces of code to work. These are sometimes referred to as *libraries*, which is a good indicator of their purpose: to provide functions that programs can check in and out whenever they need them, as if they were borrowing books from a library.

Whenever a program starts, it must look for these other libraries and load them into memory so they're ready for use. This can take some time, particularly with larger and more-complicated programs. Because of this, the concept of *prelinking* was invented. By a series of complicated tricks, the `prelink` program makes each bit of software you might run aware of the libraries it needs, so that memory can be better allocated.

Prelinking claims to boost program startup times by up to 50 percent or more, but the problem is that it's a *hack*—a programming trick designed to make your system work in a nonstandard way. Because of this, some programs are incompatible with prelinking. In fact, some might simply refuse to work unless prelinking is deactivated. At the time of this writing, such programs are in the minority. However, keep in mind that prelinking can be easily reversed if necessary. Alternatively, you might want to weigh whether it's worth setting up prelinking in the first place.

Configuring Prelinking

If you decide to go ahead with prelinking, you'll need to download the relevant software from the Ubuntu software repositories. Open the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager), click the Search button, and type `prelink` into the search box. Mark `prelink` for installation and then click Apply.

Before you can run a prelinking sweep of your system, you need to enable it in one of its configuration files. To do this, type the following in a terminal window:

```
gksu gedit /etc/default/prelink
```

Change the line that reads `PRELINKING=unknown` to `PRELINKING=yes`. Then save the file and quit Gedit.

To run a prelinking scan of your system, simply issue this command:

```
sudo prelink -a
```

This will prelink practically all the binary files on your system and may take some time to complete. You may also see some error output, but you don't need to pay attention to it.

Prelinking was automatically added as a daily `cron` job when you installed it (see Chapter 32 for a description of `cron`), so any new programs you add will be automatically prelinked.

Deactivating Prelinking

If you find that prelinking makes a particular application malfunction or simply stop working, you can try undoing prelinking. To do this, find out where the main binary for the program resides, and issue the `prelink` command with the `--undo` command option. For example, to remove prelinking from the Gedit text editor program, you could type the following:

```
whereis gedit
```

This command will show that the `gedit` binary is found at the location `/usr/bin/gedit` in the file system. Next, attempt to undo prelinking on the binary:

```
sudo prelink --undo /usr/bin/gedit
```

However, this may not work, because some programs might rely on additional binaries on the system. Therefore, the solution might be to undo prelinking for the entire system, which you can do by typing the following:

```
sudo prelink -ua
```

After this, you should remove the `prelink` package, via the Synaptic Package Manager, to stop it from running again in the future (or manually remove its `cron` entry, as explained in Chapter 32).

OPTIMIZING THE KERNEL

You can download the Linux kernel source code and compile your own version of it. This gives you total control over the kernel configuration, so you can leave out parts you don't want in order to free memory. You can also set certain optimization settings, such as creating a version of the kernel specifically built for your model of CPU.

Although compiling a kernel is a simple procedure, you'll need to answer many complex questions and have an in-depth knowledge of the way Linux works.

In addition, compiling your own kernel brings with it several issues. The first is that it may not work with any binary modules that you have installed, such as graphics cards or wireless drivers. You can opt to update these yourself, but this adds to the complexity.

The second problem is that Ubuntu is built around precompiled kernels. Several software packages expect to work with the precompiled kernel, and in addition, Ubuntu may occasionally download an updated prepackaged kernel automatically as part of the system update feature and override the one you've created. If there are any security problems with the kernel version you compiled, you'll need to recompile a new kernel from scratch (or patch the one you have). This means you'll have to keep an eye on the security news sites and take action when necessary.

Your customized kernel may also fail to automatically detect newly supported hardware, meaning you'll have to acquire and load the drivers manually.

That said, compiling a kernel is an excellent way of learning how Linux works, and if it all goes well, the sense of achievement is enormous.

Some people choose to download the kernel source code from the official Linux kernel site, `www.kernel.org`. However, it makes more sense to download the official Ubuntu release, because this will be tailored for the way your system works. Using the Synaptic Package Manager, simply search for `linux-source`.

You can find several guides to compiling your own kernel online, but we recommend the following posting on the Ubuntu forums web site, which looks at compiling a kernel under Ubuntu: `https://help.ubuntu.com/community/Kernel/Compile`.

Freeing Up Disk Space

After using Ubuntu for some time, you might find that the disk begins to get full. You can keep an eye on disk usage by clicking System ➤ Administration ➤ System Monitor and looking under the File Systems tab or using the following command in a terminal window:

```
df -h
```

Either method will show the free space in terms of megabytes or gigabytes for each partition, also expressed as a percentage figure. If the disk does start to get full, you can take steps to make more space available.

■ **Note** You can also find information about any connected disk by right-clicking it in Nautilus and selecting Properties.

Emptying the /tmp Folder

An easy way to regain disk space is to empty the `/tmp` folder. Like its counterpart in the Windows operating system, this is the folder in which temporary data is stored. Some applications clean up after themselves, but others don't, leaving behind many megabytes of detritus.

Because the `/tmp` folder is accessed practically every second the system is up and running, to empty it safely, it's necessary to switch to run level 1. This ensures that few other programs are running and avoids the risk of deleting data that is in use. First, switch to the text console by pressing Ctrl+Alt+F1. Then enter these commands to switch to run level 1:

```
sudo killall gdm
sudo telinit 1
```

A recovery menu will appear. Select the Drop to Root Shell Prompt option. Then enter the following to empty the `/tmp` folder and reboot:

```
rm -rf /tmp/*
reboot
```

Tip On a similar theme, don't forget to empty the desktop Trash. This can hold many megabytes of old data. If you see an error message about permissions when emptying the Trash, you can do so manually from a terminal window. Simply type `sudo rm -rf ~/..local/share/Trash/{files,info}/` to get the job done.

Emptying the Cache of Package Files

You might also choose to clear out the Advanced Packaging Tool (APT) cache of old `.deb` package files. On a system that has been very frequently updated, this can free many megabytes (possibly gigabytes) of space.

You can empty the cache by typing the following command in a terminal window:

```
sudo apt-get clean
```

Note The files concerned are held in the following directory: `/var/cache/apt/archives/`. Alternatively, you can use the `apt-get autoclean` command; this simply removes any package files that are no longer available on the main repository server (that is, those that are out-of-date) but leaves any that you might need in the future. Using this command is considered a much safer way to remove unwanted package files.

If you want to restore any packages later, simply locate them in the Synaptic Package Manager list, click the check box, and click Mark for Reinstallation. This will cause the package to be downloaded, installed, and configured.

Removing Unused Software

If you still need disk space, consider uninstalling unused programs. As you've learned, you can manage software through the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager).

To remove a package, click its check box and select Mark for Removal. However, it's not a good idea to simply scroll down the list and remove anything that seems dispensable. Because of the way Linux works, many seemingly insignificant packages are actually vital to the running of the system. Instead, it's a better idea to look for programs on the Applications menu, and then return to the Synaptic Package Manager to remove them by searching for their names.

As always, removing software can create dependency problems, so you might find yourself limited in what software you can actually remove.

Tip If you want to remove all the desktop games, simply search for `gnome-games` and `gnome-games-data` in the Synaptic Package Manager, and mark them for removal.

It's also worth periodically issuing the `sudo apt-get autoremove` command, which will remove any unused dependency packages on the system. Theoretically, these will always be removed provided `apt-get autoremove` is used when specifying packages to uninstall (see Chapter 28), but the way Ubuntu is updated might mean that a handful of unused dependencies hang around after they're no longer needed.

If you find you're adding and removing lots of software, you might find an application such as BleachBit (`http://bleachbit.sourceforge.net/`) quite useful. This can remove clutter that takes up space and could contain private information that would be best cleared away. You can download BleachBit through the Synaptic Package Manager, and it will appear under the Applications ➤ System Tools menu. You can run the software either as a normal user (which makes it harder to mess things up), as in Figure 30-4, or as root. To use it, simply scroll down the list and select the parts you'd like to remove (for instance, the cookies from Firefox), and then click the Delete button. Clicking the Preview button will give you a good idea of what is going to be removed and the amount of space it's likely to save.

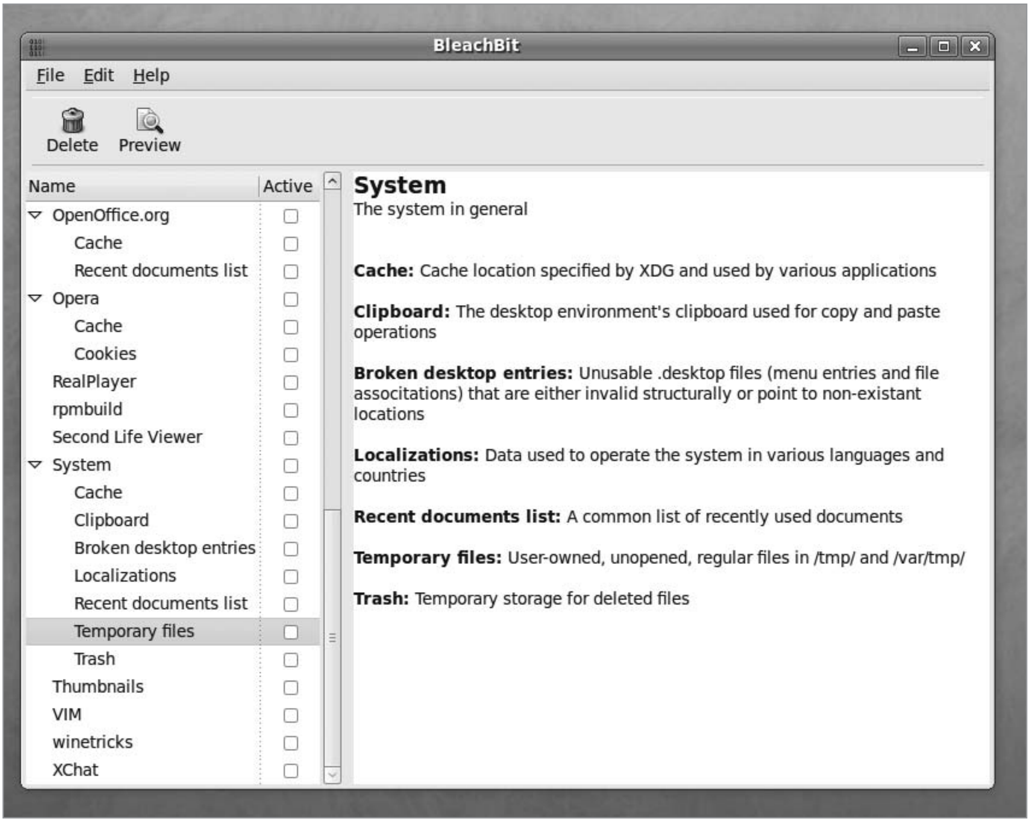

Figure 30-4. *BleachBit is a useful addition to your system administration toolkit.*

Summary

In this chapter, you looked at streamlining your installation of Ubuntu. This involves speeding up the boot procedure by running boot scripts in parallel, and decreasing the boot menu delay, along with a handful of other tricks. You also looked at optimizing your hard disk settings to allow for greater speed when loading and saving files.

Additionally, we discussed prelinking programs so that they load faster, recompiling the kernel so that it's optimized for your system, and freeing disk space by various means.

In the next chapter, you'll learn how to perform backups to safeguard your data.

CHAPTER 31

Backing Up Data

Every computer user knows that backing up data is vital. This is usually because every computer user has lost data at some point, perhaps because of a corrupted file or an accidental deletion.

Some of the people behind Unix were highly aware of such occurrences, and built in several advanced and useful backup tools. These have been mirrored within Linux, with the result that creating and maintaining backups is easy.

In this chapter, you'll first look at what data should be backed up and then explore two ways to make backups: via the Simple Backup utility and the command line.

What Data Should You Back Up?

Data on your system can be classified into three broad types: program data, configuration data, and personal data. It's traditionally reasoned that backing up all types of data is inefficient, because it would mean backing up many gigabytes of information regularly. Because of this, you usually want to back up the latter two types of data: configuration and personal. The theory is that if your PC is hit by a hard-disk-wrecking disaster, you can easily reinstall the operating system from the CD or DVD. Restoring your system from backup is then simply a matter of ensuring that the configuration files are back in place, so your applications work as you would like them to, and making sure that your personal data is once again made accessible.

Practically all the personal configuration data for programs you use every day, as well as your personal data, is stored in your `/home` directory (although the configuration files for software used systemwide are usually stored in the `/etc` directory). If you take a look in your `/home` directory, you might think that previous sentence is incorrect. On a freshly installed system, the directory appears largely empty, apart from a handful of directories for music, photos, and so on. However, most, if not all, of the configuration files are hidden; their directory and filenames are preceded with a period (`.`), which means that Linux doesn't display them during a standard directory listing.

To view hidden files and folders in the Nautilus file manager, choose View ➤ Show Hidden Files. This can be quite an eye-opener when you see the masses of data you didn't even realize were there, as shown in the example in Figure 31-1. To view hidden files at the shell prompt, simply use the -a command option with the ls command:

```
ls -a
```

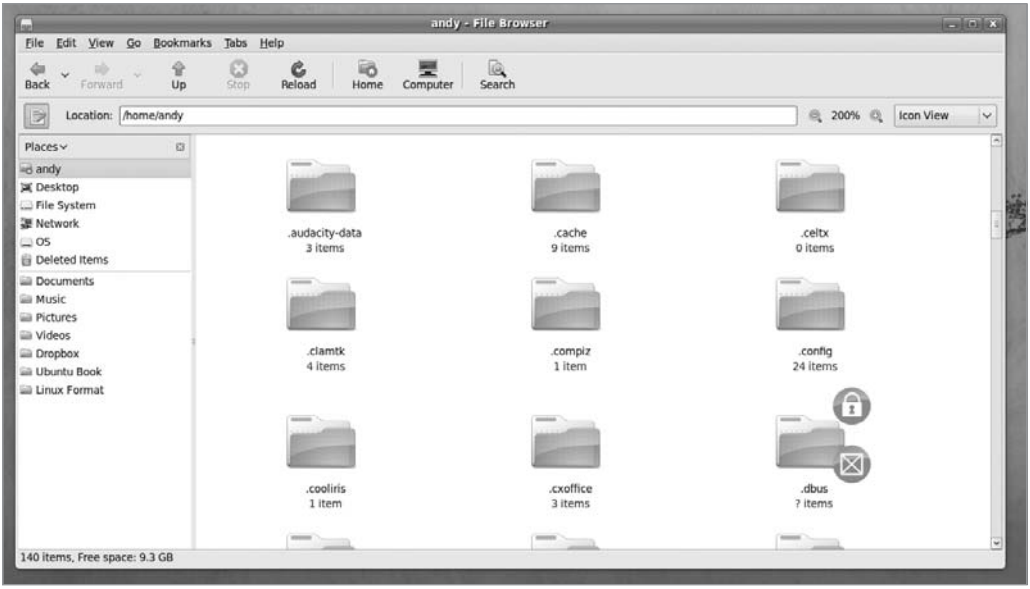

Figure 31-1. *Most of the configuration files for programs are hidden—literally—in your* `/home` *directory.*

The configuration files held in your /home directory relate solely to your user account. Any other users will have their own configuration files, entirely independent of yours. In this way, all users can have their own configuration settings for various applications, which can be backed up independently.

Under Ubuntu, you can back up both configuration data and personal files by using Simple Backup, which can be downloaded from the Ubuntu software repositories.

Keep in mind that there's little point in making backups if you leave the resultant archive files on your hard disk. For full backup protection, the archives should be stored elsewhere, such as on an external hard disk, network mount, or CD/DVD-ROM. Consider using GNOME's CD/DVD Creator (click Go ➤ CD/DVD Creator on the menu of any open Nautilus window, or click Places ➤ CD/DVD Creator from the desktop).

Using Simple Backup

Simple Backup is a series of programs that enable quick and easy backup and restoration of personal data, as well as system configuration files. Its output, which takes the form of backup directories containing an archive of the files, plus configuration data, can be written to your hard disk (or a network mount attached to it), or to a remote Internet location, such as an FTP server.

Simple Backup was created courtesy of the Google Summer of Code sponsorship scheme and was designed with the help of Ubuntu developers. To install Simple Backup, open Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager), and then search for `sbackup`. Click its entry in the list of results, mark it for installation, and click Apply. You'll then find entries for the backup and restoration components of Simple Backup on the System ➤ Administration menu.

Backing Up Data via Simple Backup

To configure a backup, choose System ➤ Administration ➤ Simple Backup Config. You'll see the Backup Properties dialog box, as shown in Figure 31-2. Using this dialog box, you can choose the files that Simple Backup backs up, as well as when it does so. After you've made your changes, click the Save button. This should be done before making a backup. If scheduled backups are set, it's sufficient to save the changes and quit the program. The backup jobs will take place automatically, in the background, at the set times.

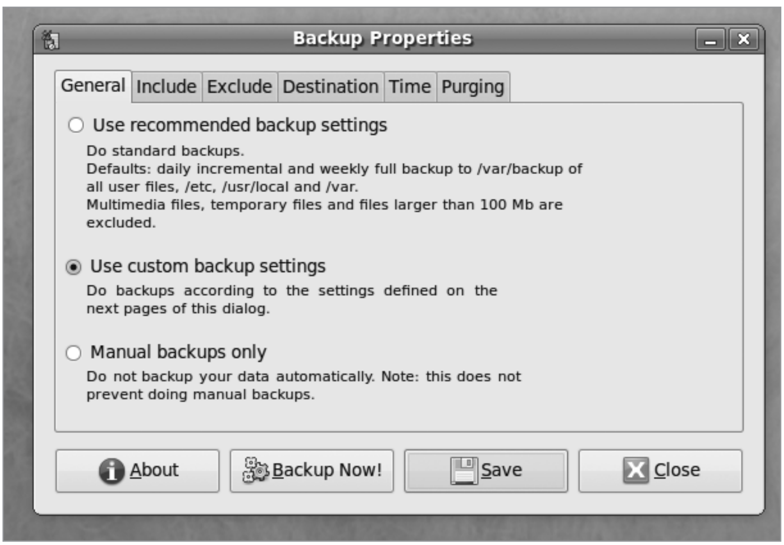

Figure 31-2. *Simple Backup can work automatically or with custom settings you specify.*

As listed on the General tab of the Backup Properties dialog box, Simple Backup can operate in three modes:

Use Recommended Backup Settings: This is by far the best choice for fuss-free operation. Simple Backup will perform a daily backup of your `/home` directory, as well as the vital system data held in `/etc`, `/usr/local`, and `/var`. However, it will deliberately exclude any multimedia files (because of their large size), along with any temporary files and files of any type that exceed 100MB (again for size reasons). By default, the backup directory created is placed in `/var/backup`.

Use Custom Backup Settings: This is effectively the same as the recommended backup, and includes the same list of file inclusions and exceptions, but you are able to edit the settings manually. For example, you might choose to include MP3 files, rather than excluding them. The custom backup option lets you alter where the eventual backup directory is saved and the time when the backup is made.

Manual Backups Only: This effectively deactivates Simple Backup, so that it no longer periodically backs up files. However, you can still click the Backup Now! button to manually perform a backup according to the settings on the other tabs of the Backup Properties dialog box.

■ **Note** Simple Backup doesn't create a new backup each time it runs, because that would take too long. The first time it runs, a full backup is taken, but those created afterward are *incremental backups*, and only files that are new or that have changed are backed up. The backup directory created during the first run is given the file extension `.ful`, while the backup directories created after this have the extension `.inc`. As you might expect, if the original `.ful` backup directory can't be found, a new full backup will be created.

Including Files and Folders in the Backup Job

Assuming that you've chosen a custom backup, and therefore are able to alter the backup settings, clicking the Include tab in the Backup Properties dialog box enables you to specifically define directories and files that you wish to include in the backup. Simply click the Add File or Add Directory button, and then browse to the relevant location (to add a directory, you'll need to click to open it before clicking the Open button).

Bear in mind that adding a directory does so recursively, which means that any directories contained within that directory are also backed up. For this reason, you don't need to specifically add your `/home/<username>` directory, because the entire `/home` directory is included in the backup by default. This means the backup will also include all other users' directories within `/home` too.

Excluding Files and Folders from the Backup Job

You have a wide range of choices when it comes to excluding files and folders from the list. Directories can be excluded based on their location. Files can be excluded based on location, type, or size.

Clicking the Exclude tab in the Backup Properties dialog box reveals a set of side tabs on the left side of the program window, which enable you to exclude items from the backup as follows:

Paths: To exclude a specific file or folder, click this side tab. As with including files, click the Add File or Add Directory button, and then browse to the relevant location.

File Types: To exclude certain types of files, click this side tab, as shown in Figure 31-3. After clicking the Add button, you'll see that you can choose from a brief list of standard file types or filter by file extension (such as `mp3` for MP3 files or `zip` for compressed Zip files). If you want to back up your multimedia files, remove the corresponding file type entries from this list.

Regex: If you're competent at using regular expressions, as outlined in Chapter 15, you can use them to specify extremely precise rules by clicking this side tab.

Max Size: Any files larger than the stated size on this tab aren't backed up. By removing the check next to the Do Not Backup line, you can deactivate this feature (although that could lead to massive backup files, which would take a long time to generate).

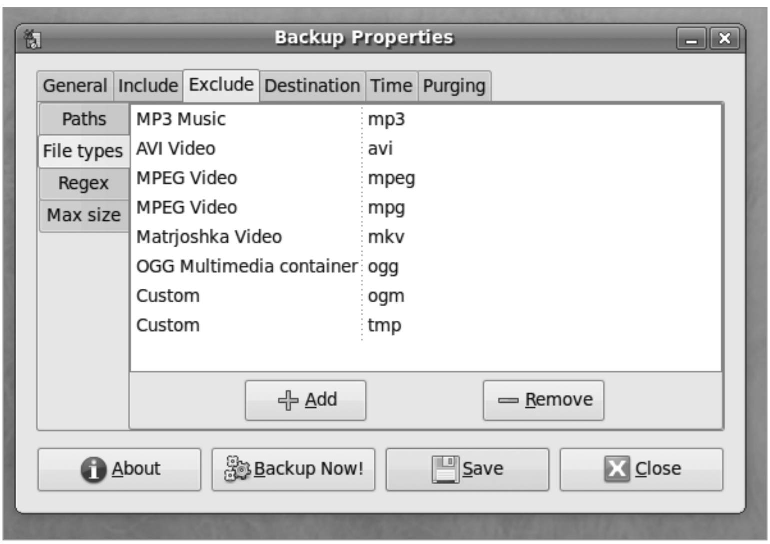

Figure 31-3. *Excluding certain types of large files will lead to far smaller backup files.*

Changing the Backup Directory Destination

By default, the backup directory created by Simple Backup is stored in the `/var/backup` directory. By clicking the Destination tab in the Backup Properties dialog box, you can choose to save it in a different location on your hard disk. Of course, if you have a network mount, you can also opt to save it there. In most cases, we advise that you use `/var/backup` to store the newly created backup files, and copy the files to their permanent destinations later. You might even choose to do this periodically and automatically. By following the instructions in Chapter 32, which explain how to schedule tasks, you could set up a `cron` job to automatically copy the files to a network mount or removable storage device.

■Note Remember that Simple Backup creates incremental backups, so you should copy *all* the backup directories and files within `/var/backup` to the external storage device, rather than just the latest one.

You can even transfer the backup directory across the Internet via SSH file transfer or the less secure FTP standard. To do so, simply enter the protocol, username, password, and URL in the following format:

```
sftp://username:password@mysite.com/remotedirectory
```

It's important to precede the address with the protocol you intend to use: `sftp://` for SSH or `ftp://` for FTP.

Changing the Time Period Between Backups

Clicking the Time tab in the Backup Properties dialog box lets you set the frequency of the backup. You can opt to back up hourly, daily, weekly, or monthly. You can also set the exact time of the backup if necessary. For example, you could set a backup to take place every week on a Tuesday at 12.30 p.m. Simply select the interval period from the Do Backups drop-down list, and then select from the Day of Month, Day of Week, Hour, and Minute lists, as necessary. Simple Backup uses the system scheduler, `cron` (discussed in more detail in Chapter 32). The use of `cron` means that Simple Backup doesn't need to be running all the time for the backup to take place. Simple Backup is started and stopped automatically in the background as needed.

You can also elect to perform a full backup after a certain number of days have passed (up to 1,000). A full backup means that Simple Backup creates a new complete backup, rather than incremental ones.

Purging Old Backup Files

By clicking the Purging tab in the Backup Properties dialog box, you can opt to automatically delete old backup directories. This can save on storage space. Purging can be done either by specifying a cutoff date, so that any backup archive older than the specified number of days is deleted, or it can be done logarithmically. This means that the program keeps just one backup out of the many that might be created in a week, month, and so on. All others are deleted. For obvious reasons, you should use the purging option with care!

Restoring Data via Simple Backup

If the worst happens and you need to restore any number of files from the backup, you can click System ➤ Administration ➤ Simple Backup Restore.

The first step is to select the location of the backup directories. If the backups aren't contained in `/var/backup`, click Use Custom, and either type the path into the field or click the file browser button and locate the backup directories. Then click the Available Backups drop-down list to choose a backup directory from which to restore. The directory names contain the dates and times the backups were made, and it makes sense to choose the latest (unless you want to revert to an older version).

After the backup has been selected, the files that the backup archive contains will be displayed. Each directory will have a small triangle to its left, which you can click to expand the directory and show its contents.

After you've found the file(s) or directories you want to restore, highlight them and then click the Restore button. But beware, because this will rewrite the files and directories to their original locations—files or directories already there with matching filenames will be overwritten!

If you want to restore the files to a different location, click the Restore As button and then choose a folder. Simple Backup stores its information in a standard `.tar.gz` file within the selected directory when you back up. This means it's possible, if necessary, to manually access the information in the backup.

Caution Restored files and directories are owned by root. This is because Simple Backup runs with superuser powers. Therefore, one of the first things you'll have to do is use the `chown` command, preceded by `sudo`, to change the ownership and group of the file to what they were originally. See Chapter 14 for more details about file ownership and how the `chown` command works.

Making Backups from the Command Line

Although Simple Backup allows the uninitiated to make quick backups, the `tar` program is preferred by Linux old-timers. This creates `.tar` files and is one of the original carryovers from Unix; tar stands for Tape ARchive and refers to backing up data to a magnetic tape backup device. Although tar files are designed for backup, they've also become a standard method of transferring files across the Internet, particularly with regard to source files or other installation programs.

A tar file is simply a collection of files bundled into one. By default, the tar file isn't compressed, although additional software can be used to compress it. tar files aren't very sophisticated compared to modern archive file formats. They're not encrypted, for example, but this can also be one of their advantages.

■ **Note** Linux comes with a couple more backup commands, which you might choose to use. They are `cpio` and `pax`. Both aim to improve on `tar` in various ways, but neither is broadly supported at the moment. `cpio` is installed by default under Ubuntu, and `pax` can be found via the Synaptic Package Manager. Examine their man pages for more details.

Creating tar Files

Perhaps unsurprisingly, tar files are created at the console by using the `tar` command. Usually, all that's needed is to specify a source directory and a filename, which can be done like so:

```
tar -cf mybackup.tar /home/keir/
```

This will create a backup called `mybackup.tar` based on the contents of the `/home/keir` directory. The `tar` command is automatically recursive, so in this example it will delve into all subdirectories beneath `/home/keir`. The `-c` command option tells `tar` you're going to create an archive, and the `-f` option indicates that the filename for the archive will immediately follow. If you don't use the `-f` option, `tar` will send its output to standard output, which means that it will display the contents of the archive on the screen.

If you typed in a command like the preceding example, you would see this message:

```
Removing leading '/' from member names.
```

This means that the folders and files added to the archive will all have the initial forward slash removed from their paths. So, rather than store a file in the archive as this:

```
/home/keir/Mail/file1
```

the file will be stored as follows:

```
home/keir/Mail/file1
```

The difference between the two forms concerns us when the files are extracted from the archive. If the files had the initial slash, `tar` would restore this particular file to `/home/keir/Mail/file1`. If there were already a file of that name in that location, it would be overwritten. With the leading slash removed, `tar` will create a new directory wherever you choose to restore the archive. In this example, it will create a new directory called `home`, and then a directory called `keir` within that, and so on.

Because of the potential of accidentally overwriting data by specifying absolute paths in this way, a better way of backing up a directory is simply to change into its parent and specify it without a full path:

```
cd /home/
tar -cf mybackup.tar keir
```

When this particular archive is restored, it will simply create a new folder called `keir` wherever it's restored.

■ **Note** If you're more of a graphical person, it's easy to open Nautilus, select a range of files or folders, and right-click to access the Create Archive option. You can select the `.tar` option within this to create the correct archive format.

Compressing tar Archives

You can also compress the archive from within `tar`, although it actually calls in outside help from either `bzip2` or `gzip`, depending on which you specify. In theory, `bzip2` should achieve a better compression ratio than `gzip`, while `gzip` may be faster, but the difference isn't always significant.

To create a tar archive compressed using `bzip2`, the following should do the trick:

```
tar -cjf mybackup.tar.bz2 keir
```

This will create a compressed backup from the directory `keir`. The `-j` command option passes the output from `tar` to the `bzip2` program, although this is done in the background. Notice the change in the backup filename extension to indicate that this is a `bzip2` compressed archive.

The following command will create an archive compressed with the older `gzip` compression:

```
tar -czf mybackup.tar.gz keir
```

This uses the `-z` command option to pass the output to `gzip`. This time, the filename shows it's a `gzip` compressed archive, so you can correctly identify it in the future.

Extracting Files from a tar Archive

Extracting files when using `tar` is as easy as creating them:

```
tar -xf mybackup.tar
```

The `-x` option tells `tar` to extract the files from the `mybackup.tar` archive.

Extracting compressed archives is simply a matter of adding the `-j` or `-z` option to the `-x` option:

```
tar -xjf mybackup.tar.bz2
```

■ **Note** Technically speaking, `tar` doesn't require the preceding hyphen before its command options. However, it's a good idea to use the hyphen anyway, so you won't forget to use it with other commands in the future.

Viewing tar Archive Information

To view the contents of a tar archive without actually restoring the files, use the `-t` option:

```
tar -tf mybackup.tar |less
```

This example adds a pipe into `less` at the end, because the listing of files probably will be large and scroll off the screen. Just add the `-j` or `-z` option if the tar archive is also compressed.

In addition, you can add the `-v` (for verbose) option to all stages of making, extracting, and viewing an archive to see more information (chiefly the files that are being archived or extracted).

Typing -vv provides even more information:

```
tar -cvvf mybackup.tar keir
```

This will create an archive and also show a complete directory listing as the files and folders are added, including permissions.

Saving the File to a CD-R/RW

After the tar file has been created, the problem of where to store it arises. As we mentioned earlier, storing backup data on the same hard disk as the data it was created to back up is foolish, because any problem that might affect the hard disk might also affect the archive. You could end up losing both sets of data!

If the archive is less than 700MB, it should be possible to store it on a CD-R or CD-RW. To do this from the command line, first the file must be turned into an ISO image, and then it must be burned.

■ **Note** Remember that Ubuntu has a very capable CD/DVD burning tool called Brasero that can save the hassle of working at the command-line prompt. To access it, click Applications ➤ Sound & Video ➤ Brasero. Note that although it's listed as a multimedia application, it is in fact capable of burning all types of data discs. To get started, just click the Data Project button. Then simply drag the backup file(s) onto the program window and click the Burn button at the bottom right.

To turn a backup archive into an ISO image, use the `genisoimage` command:

```
genisoimage -o backup.iso mybackup.tar.bz2
```

You can then burn the ISO image to a CD by using the `wodim` command. Before using this command, you must determine which device name your CD writer uses.

Typically, the device name `/dev/cdrw` is already associated with a CD drive capable of writing discs. This name is just a link to the actual location of the drive. You can run the Device Manager (see Chapter 8 for more information about the Device Manager) and locate your CD writer in the hardware list to find its precise device name. In the example in Figure 31-4, the precise device name of the CD writer is `/dev/sr0`. Therefore, either `/dev/cdrw` or `/dev/sr0` will do the trick, as long as there is only one CD drive in the machine. If you have more than one CD drive, you should use the precise device name to specify the correct CD writer.

Specify this device name by using the `dev=` command option. You must also set the speed at which the burn is to take place by using the `speed=` option. This is the writing speed of the drive, which is usually mentioned in the drive's documentation. Put together, to burn the backup image, enter a command in this format:

```
wodim dev=<device name> speed=<speed of your drive> mybackup.iso
```

On a test system, this took the following form:

```
wodim dev=/dev/sr0 speed=24 mybackup.iso
```

You'll need to eject and then reinsert the newly burned disc before you can examine its contents.

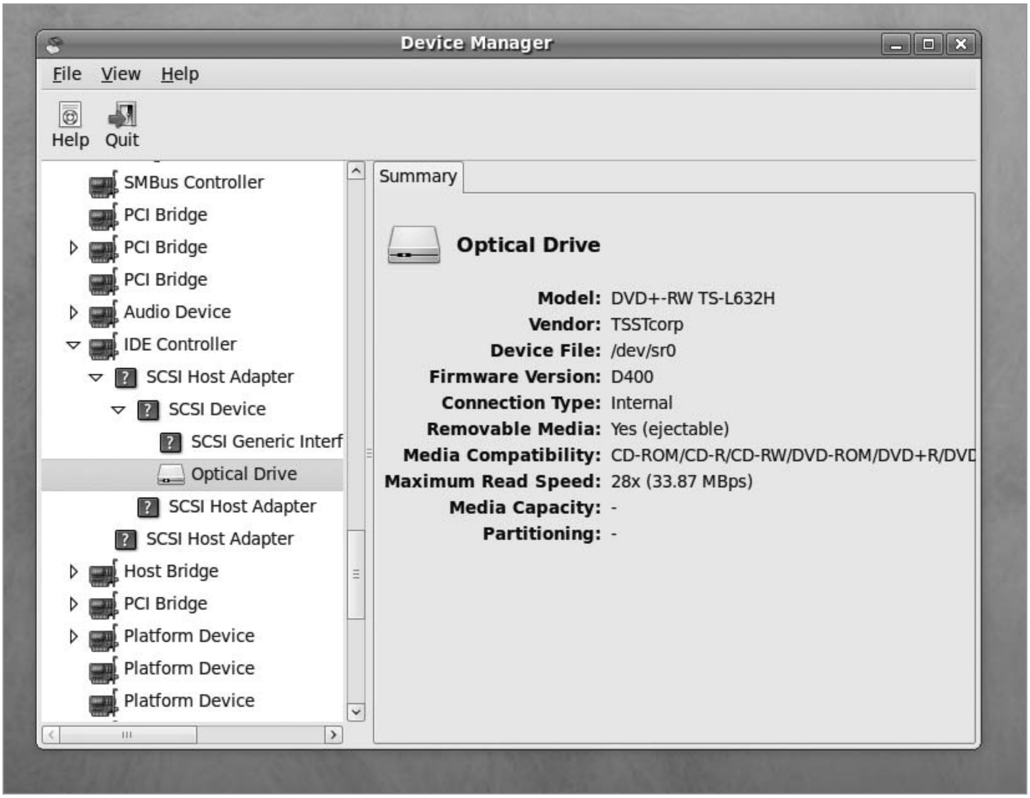

Figure 31-4. *Use the Device Manager to find the precise device name of your CD writer.*

Saving the File to a DVD

If the backup file is larger than 700MB, you might want to burn the backup file to DVD, using a DVD-R/RW drive. You can use the `growisofs` command for this. You don't need to create an ISO file for this command, because one is created automatically in the background. Instead, you simply specify the file(s) you want to back up.

Apart from this difference, `growisofs` works along the same lines as `wodim`, and the following command should do the trick:

```
growisofs -Z /dev/dvdrw -R -J mybackup.tar.bz2
```

Typically, the device name for the DVD writer is linked from `/dev/dvdrw`, but you can use the Device Manager to get the precise device name.

If the DVD disc has any space left, you can simply add your next backup to the disc, alongside the older file. To do this, use the `-M` command option instead of `-Z`:

```
growisofs -M /dev/dvdrw -R -J mybackup2.tar.bz2
```

In both cases, you'll need to eject the DVD and then reinsert it in order to read its contents.

■ **Note** Remember that you can use the `man` command to learn about any commands, including those detailed here. In the case of `wodim` and `growisofs` in particular, this is worthwhile, because they are very powerful pieces of software.

Summary

In this chapter, you looked at making backups. First, you saw where in the Linux file system your personal files and other vital data are stored. Then you looked at how the Simple Backup tool can be used to back up system configuration and personal data. You next learned how to use `tar`, `bzip2`, and `gzip` at the command line to back up any kind of data. Finally, you learned how to burn CDs and DVDs of your backup files at the command line.

In the next chapter, you'll look at how tasks can be scheduled to occur at various times under Ubuntu.

CHAPTER 32

Scheduling Tasks

In this book, you've learned about various tasks you can perform to keep Ubuntu running smoothly. Although some of these tasks require human intervention, many—such as backing up your important files or clearing the clutter from the `/tmp` folder to ensure that you always have enough free disk space—can be automated relatively easily by using the methods in this chapter. This will give you more time to do other stuff and will also ensure that those vital tasks are carried out regularly and without fail. They can be run either periodically or as one-time tasks.

Scheduling with cron

Under Linux, the traditional way of scheduling tasks, such as creating an archived file of a particular folder, is via the `cron` daemon. This works on behalf of the user to automate individual jobs and is also used by the system to run its own maintenance tasks. The `cron` command is useful for scheduling heavy loads at a time when you know the system will be underused.

For `cron` to run system tasks, it reads a file called `/etc/crontab`. Traditionally, `cron` starts soon after bootup and sits in the background while you work, checking every minute to see whether a task is due. As soon as one comes up, `cron` commences the task and then returns to a waiting status.

Creating a Scheduled Task

Users have their own `crontab` file, which is stored by username in the `/var/spool/cron/crontabs/` directory. This directory is owned by root, and normal users can't view each other's `crontab`. The user's `crontab` file is updated in a text editor, but a special command, which we'll go over next, is needed to do it. (This command saves you from having to remember to run the `crontab` command after editing the file.)

Adding a scheduled task is done via a terminal window (Applications ➤ Accessories ➤ Terminal). Entering the following command will cause your personal `crontab` file to be loaded into the GNU `nano` text editor, ready for editing:

```
crontab -e
```

If this is the first time you've edited your `crontab` file, you'll be invited to choose which text editor you want to use to edit the `crontab` file. The options are `ed` (a primitive text editor beloved of Unix old-hands), `vim.tiny` (effectively this is vi, as discussed in Chapter 15), or `nano`. Unless you're experienced with ed or vi, `nano` is the best option, and you can select it by typing the number alongside it in the list and hitting Enter.

After the file appears, you'll see a comment line at the top. Comments in configuration files are nearly always preceded by hash symbols (`#`); the hash tells Ubuntu to ignore that line. This particular comment outlines the syntax for adding an entry to the file. You can delete the comment line if you want.

Adding a new entry is relatively easy and typically looks something like this:

```
01 12 15 * * tar -cjf /home/keir/mybackup.tar.bz2 /home/keir
```

Let's examine that line (as shown in Figure 32-1) piece by piece. The first part—the numbers and asterisks—refers to when the task should be run. From left to right, the fields refer to the following:

- Minutes, from 0 to 59
- Hours, in 24-hour time, so from 0 to 23
- Day of the month, from 1 to 31 (assuming the month has that many days)
- Months, from 1 to 12
- Day of the week, either from 0 to 6 (0 is Sunday), or specified as a three-letter abbreviation (`mon`, `tue`, `wed`, and so on)

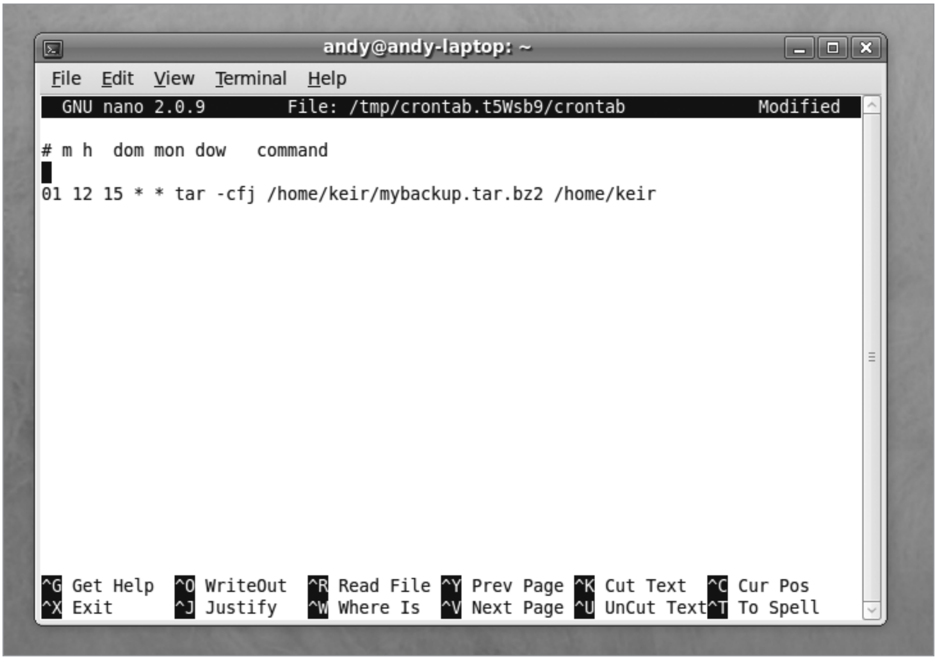

Figure 32-1. *Editing `crontab` lets you schedule tasks by using the `nano` text editor.*

In the example, the task is set to run at the first minute at the 12th hour (midday) on the 15th day of the month. But what do the asterisks stand for? They're wildcards telling `cron` that every possible value applies. Because an asterisk appears in the month field, this task will be run every month. Because an asterisk appears in the day field too, the task could run on any day of the week.

You might have noticed a logical contradiction here. How can you specify a day if you also specify a date in the month? Wouldn't this seriously limit the chances of the task ever running? Yes, it would. If you were to specify `sat`, for example, and put `15` in the date field, the task would run on the 15th of the month only if that happened to be a Saturday. This is why the two fields are rarely used in the same `crontab` entry, and an asterisk appears in one if the other is being used.

After the time and date fields comes the command itself: `tar`. As you learned in the previous chapter, this `tar` command can be used to back up your personal data (in this example, as long as your username is `keir`).

The `cron` daemon isn't clever enough to interpret symbols such as the tilde (`~`) as a way of referring to your `/home` directory. For this reason, it's best to be very thorough when defining a `cron` job, and always use absolute paths.

Let's take a look at another example:

```
50 23 * * 0-3 tar -cjf /home/keir/mybackup.tar.bz2 /home/keir
```

The first field says that this task will run at the 50th minute of the 23rd hour (that is, 10 minutes before midnight). The day and month fields have asterisks, so this indicates that the task could run on any day and every month. However, the day field contains `0-3`. This says that the task should run only on days 0 through 3, or Sunday through Wednesday.

You can have as many `cron` entries as you like; simply give each a separate line. You don't need to put them in date or time order. You can just add them as and when you see fit.

When you're finished, save the file by pressing Ctrl+O and quit GNU `nano` by pressing Ctrl+X. You'll be prompted to save the file to the `/tmp` directory, which is fine. The `cron` file will be copied into the correct location as soon as `nano` quits, and you should see the following output in the terminal:

```
crontab: installing new crontab
```

Scheduling with anacron

If `cron` has an Achilles' heel, it is that it expects your computer to be up and running all the time. If you schedule a task for around midnight, as in one of the previous examples, and your computer isn't switched on at that time, the task simply won't run.

`anacron` was created to fix this problem (see Figure 32-2). It also can run scheduled tasks, but unlike `cron`, it doesn't rely on exact times or dates. Instead, it works on the principle of time periods. For example, tasks can be set to run every day. In fact, tasks can be set to run every *x* number of days, regardless of whether that's every two days or every hundred thousand. It also doesn't matter if the computer is shut down and rebooted during that time; the task will be run only once in the specified time period. In addition, tasks can be specifically set to run at the beginning of each month, regardless of the length in days of each month.

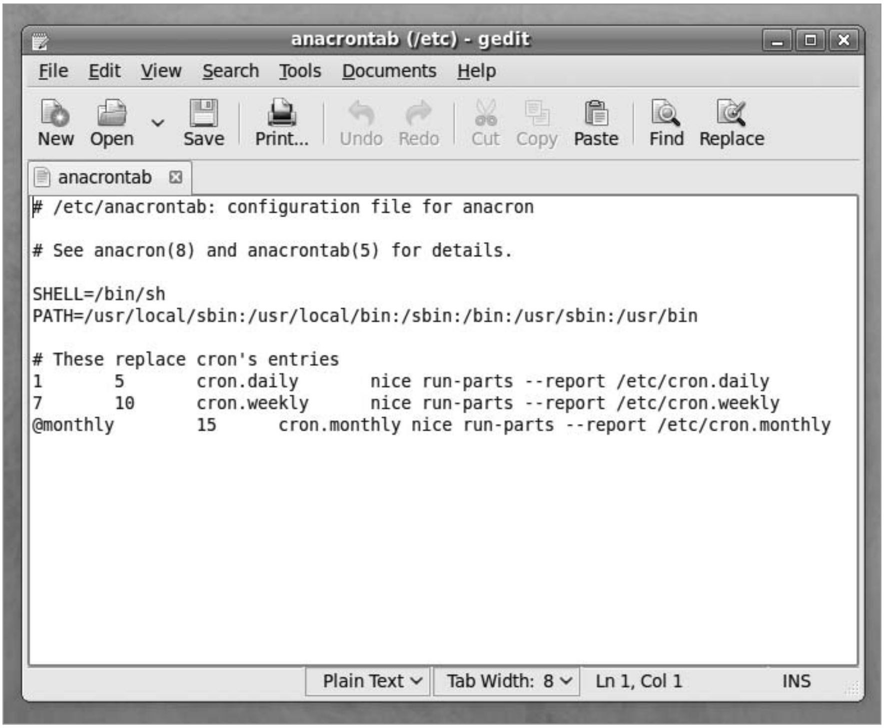

Figure 32-2. *`anacron` is used to run tasks periodically, such as every couple of days.*

`anacron` is primarily designed to be used for system maintenance, and the `/etc/anacrontab` file holds the details of the tasks. Unlike with `crontab`, each user doesn't have his own `anacrontab` file. However, there's no reason why you can't add your own commands to the main `anacrontab` file. This file can be modified in any text editor, and you don't need to use a special command (as with `crontab`), although you'll need to adopt superuser (root) powers.

■ **Note** The `/etc/anacrontab` file runs scripts contained in the directories `/etc/cron.daily`, `/etc/cron.weekly`, and so on, depending on when the tasks are meant to run (every day, week, or month). The average user never needs to bother with systemwide `anacron` jobs. Programs create their own entries as and when necessary.

Each line in anacrontab takes the following form:

```
days     delay     name of task     command
```

The days field holds the number of days in between the running of the task. To set the task to run every day, you would enter 1. To make the task run every nine days, you would add 9. To set it to run monthly, you would type @monthly.

The delay field tells anacron how long to wait before running the task, specified in minutes. It is necessary because anacron is run at boot time by default. If it were to run all the scheduled tasks simultaneously, the machine could grind to a halt under the load. A delay of 5 minutes is usually adequate, although if some tasks are already scheduled to run on the same day before that task, you should allow enough time for them to finish.

The name of the task field is for your personal reference and shouldn't contain either slashes or spaces. (Hint: Separate words by using underscores or periods.)

The command field is, as with crontab, the shell command that should be run.

■**Note** anacron is run as the root user, so if you do add your own entry to anacrontab, any files it creates will be owned by root too. If you use anacron to create a backup of your /home directory, for example, the resultant backup file will be owned by root, and you'll need to use the chown command to change its ownership so you can access it. See Chapter 14 for more information about the chown command.

Let's look at an example of an anacrontab entry:

```
1     15     backup_job     tar -cjf /home/keir/mybackup.tar.bz2 /home/keir
```

This will run the specified tar command every day (because 1 is in the days field), and with a delay of 15 minutes after anacron is first run.

anacron is run automatically every time you boot, but you can also run it manually by simply typing it at the command prompt (with superuser powers):

```
sudo anacron
```

Using at to Schedule One-Off Tasks

What if you quickly want to schedule a one-time-only task? For this, you can use the at command.

Adding a job with `at` is easy, largely because the `at` command accepts a wide variety of time formats. For example, typing the following at the command prompt will run a job at lunchtime tomorrow:

```
at noon tomorrow
```

It really is as simple as that!

Alternatively, you can specify a time, a date, and even a year:

```
at 13:00 jun 25 2009
```

This will run the job at 1 p.m. on June 25, 2009. The various time and date formats are explained in the `at` command's man page.

After you have entered the `at` command containing the date, you'll be presented with a mock shell prompt. Here you can type the commands you want to run. Many shell commands can be entered, one after the other; just press Enter between them. Then press Ctrl+D to signal that you're finished editing. At this point, `at` will confirm the time and write the task into its list.

■ **Note** You might see a warning that "Commands will be executed using /bin/sh." Theoretically, this means that some extremely clever commands that rely on specific BASH functionality won't work. However, it is extremely unlikely you will use such commands.

You can view the list at any time by typing `atq`. This will show a list of numbered jobs. You can remove any job by typing `atrm`, followed by its `atq` job number. For example, the following will remove the job numbered `9` in the `atq` list:

```
atrm 9
```

Summary

In this brief chapter, you looked at how you can schedule tasks under Ubuntu, which essentially means making programs run at certain times. You examined the `cron` and `anacron` daemons, which can schedule tasks to run at specific times or periodically, and you also examined the `at` command, which can schedule one-off tasks.

In the final chapter of this book, you will look at how you can access your Ubuntu computer remotely—theoretically, from any Internet-equipped location in the world.

CHAPTER 33

Accessing Computers Remotely

One area where Linux particularly excels is in its support for networking, including across the Internet. If you wish to learn about how networks operate on a fundamental level, Linux is an ideal choice, because it puts you in direct contact with the technology.

The widespread integration and support for networking extends to several useful system tools, which let you access Linux across any kind of network, including the Internet. In fact, it's even possible to access a Linux machine running on a different continent, just as if you were sitting in front of it!

This chapter presents the many ways you can access your Ubuntu computer remotely. In addition, you will look at ways that you can use Ubuntu to access almost any other computer, including Windows PCs.

Using Secure Shell

The history of Unix has always featured computers connecting to other computers in some fashion, whether they were dumb terminals connecting to a mainframe computer, or Unix machines acting as nodes on the fledgling Internet. Because of this, a wide variety of techniques and protocols were invented to allow computers to communicate and log in to each other across networks. However, although these still work fine over the modern Internet, we're now faced with threats to the privacy of data. In theory, any data transmitted across the Internet can be picked up by individuals at certain key stages along the route. If the data isn't protected in any way, it can be easily intercepted and read.

To counter such an occurrence, the `ssh` suite of programs was created. Although these programs started as open source, they gradually became proprietary. Therefore, several newer open source versions were created, including the one used on the majority of Linux distributions (including Ubuntu): OpenSSH.

The goal of `ssh` is to create a secure connection between two computers. You can then do just about any task, including initiating a shell session so you can use the remote computer as if you were sitting in front of it, or copying files to and from the remote machine. `ssh` uses various techniques at both ends of the connection to encrypt not only the data passing between the two machines, but also the username and password.

Note This chapter refers to remote and local machines. The *remote* machine is the computer you're connecting to across the network or Internet. The *local* machine is the one you're sitting in front of. These two terms are widely used within documentation describing networking.

Logging In to a Remote Computer

The most basic type of `ssh` connection is a remote login. This will give you a command prompt on the remote computer, as if you had just sat down in front of it and logged in to a text console.

But before you can log in to any machine via `ssh`, you'll need to be sure the remote computer is able to accept `ssh` connections. This means that it needs to be running the `ssh` server program (referred to as a *service* or *daemon*), and also that its firewall has an open port for incoming connections.

The two major components of OpenSSH are the client and server. Some distributions install both packages and run the server component all the time. However, only the client component of OpenSSH is installed under Ubuntu by default. To install the server component, and therefore access your Ubuntu system remotely, you'll need to open the Synaptic Package Manager (System ➤ Administration ➤ Synaptic Package Manager) and search for `openssh-server`. Click to install it. Configuration will be automatic, although if you're using the Ubuntu firewall (see Chapter 9), you will need to configure an incoming rule to open port 22, the standard port for `ssh` connections.

Tip If you use Firestarter, as described in Chapter 9, you can simply select the default incoming `ssh` rule. There's no need to manually specify a port number.

Initiating an `ssh` session with a remote machine is usually achieved by typing something similar to the following at a command prompt on the local machine:

```
ssh <username>@<IP address>
```

In other words, you specify the username you want to log in as, as well as the IP address of the remote machine. If there's a fully qualified domain name (FQDN) for the system you want to access, you could specify that instead of the IP address.

Note An FQDN is the hostname of a system plus its Internet address, such as `mycomputer.example.com`. Unless you have had this function specifically set up for you by a system administrator, you'll probably have to connect via its IP address. However, if you rent a web server, you might be able to `ssh` into it by using the domain name of the server.

You'll be prompted for your password, which, obviously, is the password for the account you're trying to log in to on the remote computer.

When you log in for the first time, you'll see the following message:

```
The authenticity of the host <host IP address> can't be established
```

Figure 33-1 shows an example. This means that the remote computer's encryption key hasn't yet been added to your PC's store file. However, after you agree to the initial login, the encryption key will be added, and it will be used in the future to confirm that the remote computer you're connecting to is authentic.

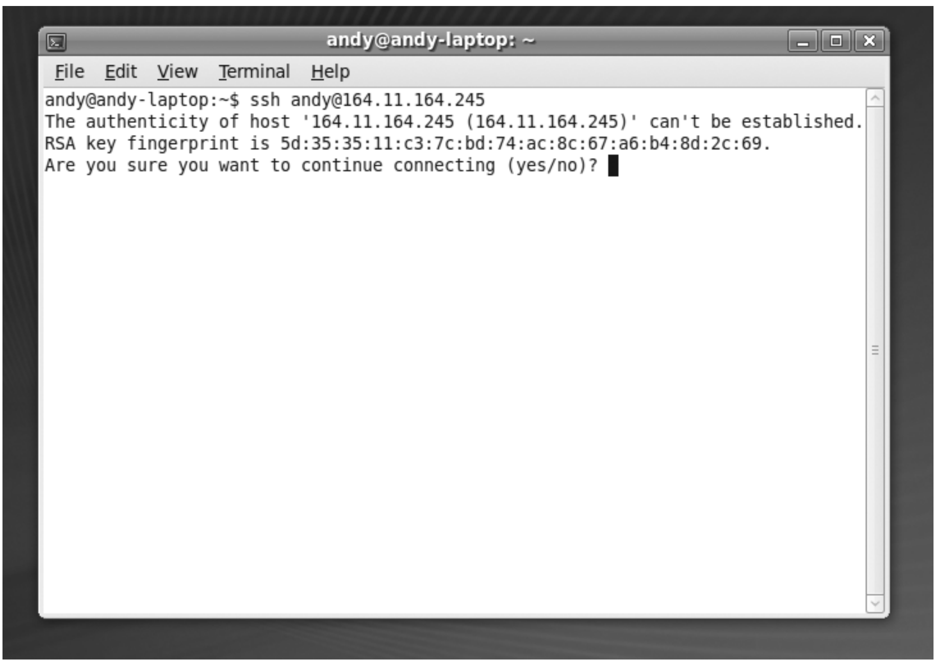

Figure 33-1. *When logging in via* `ssh` *for the first time, you'll need to confirm acceptance of the encryption key.*

■ **Note** There's a fine line between security concern and paranoia. Connecting to a remote machine for the first time and accepting its `ssh` key is considered insecure by some people, because you cannot be 100 percent sure that the remote machine is the one you want to connect to. It might have been swapped for a different machine by crackers. In addition, the key might be intercepted on its journey to you. Because of this, those who are highly security conscious can use the `ssh-keygen` program or Seahorse (see Chapter 9) to create a key on the remote machine first, and then import it to the local machine before logging in. See the `ssh-keygen` man page or `www.openssh.com` for more details.

After confirming that you want to make the connection, you'll be invited to enter the password for the user account under which you initiated the `ssh` connection. After this is done, you should find yourself with a shell login on the remote computer. You can run the same commands as usual and perform identical tasks.

The machine you're logged in to will show no symptoms of being used remotely. This isn't like the movies, where what you type on your local machine is somehow mirrored on the remote machine for all to see. However, obviously, if a user of the remote machine were to view her network connections using something similar to the `netstat` command, then she would see another computer attached via `ssh`.

To end an `ssh` session, simply type `exit`. This will return you to the command prompt on your own machine. You can also press Ctrl+D to log out.

■ **Tip** There's a version of the `ssh` client that runs on a variety of non-Linux operating systems, making it possible to log in to your Ubuntu machine from a Windows computer. The program is called PuTTY and can be downloaded from `www.chiark.greenend.org.uk/~sgtatham/putty/` and many mirrors of this site around the world.

MANAGING REMOTE SESSIONS

Whenever you open any kind of shell to enter commands and run programs, you might have noticed that any commands you start running last only as long as the shell window is open. When the shell window is closed, any task running within it ends too. This is because the shell is seen as the "owner" of the process, and when the owner dies, any processes it started also die.

When using `ssh` to start a remote shell session, this also applies. Whenever you log out, any tasks you were running are ended. This can be annoying if, for example, you've started a lengthy download on the remote machine. Effectively, you must remain logged in via `ssh` until the download has finished.

To get around this, you can use the handy `screen` program. This isn't specifically designed to be an aid to remote logins, but there's no reason why it cannot be used in such a situation.

The `screen` program effectively starts shell sessions that stick around, even if the shell window is closed or the `ssh` connection is ended or lost. After logging in to the remote computer via `ssh`, you can start a `screen` session by simply typing the program name at the prompt: `screen`. After choosing a color scheme when prompted, which can help remind you that you're running a screen session, there won't be any indication that you're running a `screen` session. There's no taskbar at the bottom of the terminal window, for example. `screen` works completely in the background.

Let's consider what happens when you detach and then reattach to a `screen` session. To detach from the `screen` session, press Ctrl+A and then Ctrl+D. You'll then be returned to the standard shell and, in fact, you could now disconnect from your `ssh` session as usual. However, the `screen` session will still be running in the background on the remote computer. To prove this, you could log back in and then type this: `screen -r`. This will resume your `screen` session, and you should be able to pick up quite literally where you left off; any output from previous commands will be displayed.

To quit a `screen` session, you can either type `exit` from within it or press Ctrl+A and then the backslash key (\).

The `screen` program is very powerful. To learn more about it, read its man page. To see a list of its keyboard commands, press Ctrl+A, and then type a question mark (`?`) while `screen` is running.

Transferring Files Between Remote Computers

The `ssh` utility brings with it two basic ways of transferring files between machines: `scp` and `sftp`. `scp` is fine for smaller file transfers, but if you want to copy a lot of files, `sftp` is probably a better choice.

Using scp

Strictly speaking, `scp` is merely a program that copies files from one computer to another in a secure fashion by using the underlying `ssh` protocol. You don't have to be logged in to another computer via `ssh` to use it. For example, if you were merely browsing your own computer and wanted to transfer a file to a remote computer, you could type the `scp` command in the following form:

```
scp myfile <username>@<IP address>:/home/username/
```

The `IP address` is the IP address of the computer to which you want to send the file. In other words, you must first specify the local file you want to copy across, and then provide the login details for the remote computer in the same format as with an `ssh` login. Then, after a colon, you specify the path on the *remote* computer where you would like the file to be copied.

Note If it helps, consider the latter part of the `scp` command after the filename as one large address: first you provide your username, then the computer address, and then the path.

Using the command when you *are* logged in to another computer via `ssh` works in exactly the same way. Let's consider an example.

Assume there are two computers: A and B. You have a user account on each one. So sitting at the keyboard of A, you establish an `ssh` connection with B by typing the following:

```
ssh <username>@computer_B
```

This lets you log in to B as if you were sitting in front of it. You spot a file called `spreadsheet.xls` that you want to copy to your local machine (A). You therefore issue the following command:

```
scp spreadsheet.xls <username>@computer_A:/home/username/
```

This will copy the file from computer B to computer A and place it in the `/home/` *`username`*`/` directory.

Tip With `scp`, you can copy entire directories too. Simply add the `-r` command option, like so: `scp -r mydirectory <username>@<IP address>:/path/`.

Using sftp

To copy a lot of files to or from a remote computer, the `sftp` program is the best solution. If you've ever used a shell-based FTP program, you'll feel right at home, because `sftp` isn't very different.

You can initiate an `sftp` session by using this command format:

```
sftp <username>@<IP address>
```

The same rules as when you're logging in with `ssh` apply, both in terms of formatting the login command and also confirming the encryption key if this is the first time you've logged in.

The `sftp` commands are fairly basic. For example, to copy a file from the remote machine, simply type this:

```
get <filename>
```

This will copy the file into the directory you were in on the local machine before you started the `sftp` session.

By specifying a path after the filename, the file will be copied to the specified local directory, as in this example:

```
get spreadsheet.xls /home/keir/downloaded_files/
```

Sending files from the local machine to the remote machine is just as easy:

```
put <filename>
```

By specifying a path after the filename, you can ensure that the file is saved to a particular remote path.

One useful thing to remember is that any command preceded by an exclamation point (`!`, called a *bang* in Linux-speak) is executed on the local machine as a shell command. So, if you wanted to remove a file on the local machine, you could type this:

```
!rm -rf <filename>
```

Simply typing a bang symbol on its own starts a shell session on the local machine, so you can perform even more tasks. When you're finished, type `exit` to return to the `sftp` program.

For a list of popular `sftp` commands, see Table 33-1.

Table 33-1. *Common sftp Commands*

Command	Function
`cd`	Change the remote directory
`lcd`	Change the local directory
`get`	Download the specified file
`mget`	Download multiple specified files
`ls`	List the remote directory
`lls`	List the local directory
`mkdir`	Create a directory on the remote machine
`lmkdir`	Create a directory on the local machine
`put`	Upload the specified file to the remote machine
`mput`	Upload multiple specified files to the remote machine
`pwd`	Print the current remote directory
`rmdir`	Delete the remote directory

Continued

Table 33-1. *Continued*

Command	Function
`rm`	Delete the remote file
`exit`	Quit `sftp`
`!command`	Execute the specified command on the local machine
`!`	Start a temporary local shell session (type `exit` to return to `sftp`)
`help`	Show a list of commands

Accessing GUI Applications Remotely

So far, we've looked at connecting to a remote machine by using command-line tools. But Ubuntu is based around the graphical desktop, so is there any way of running, say, a Nautilus file browser window so you can manipulate files on the remote machine? Yes!

The graphical subsystem of Linux, X, is designed to work across a network. In fact, if you run Linux on your desktop PC, X *still* works via a loopback network within your machine (meaning that network commands are sent out but addressed to the very same machine on which they originated). Because of this, it's possible to make programs on a remote machine run on a local machine's X server. The actual work of running the application is handled by the *remote* machine, but the work of displaying the graphics is handled by the *local* machine.

Caution X connections across a network can be a little slow and certainly not as snappy as running the same application on the local machine. This lag can become irritating after a while.

Running X Applications on a Remote Computer

Unfortunately, X server communications aren't typically encrypted, so if one machine were to simply connect to an X server over a network (or even the Internet), the data transfer would be unencrypted and open to eavesdroppers.

But `ssh` once again comes to the rescue. You can configure `ssh` so that X applications on the remote computer can be run on the local machine, with the data sent through the `ssh` connection. Log in to the remote machine by using `ssh`, but also specify the `-X` flag:

```
ssh -X <username>@<IP address>
```

When you're logged in, you can simply start any application by typing its name as usual. The only difference is that the program will appear on the screen of the local machine, rather than on the remote machine, as shown in Figure 33-2.

Using X across the Internet or even a local network isn't very fast, and you can expect delays when you open menus or if the screen must frequently redraw. However, it can prove very useful.

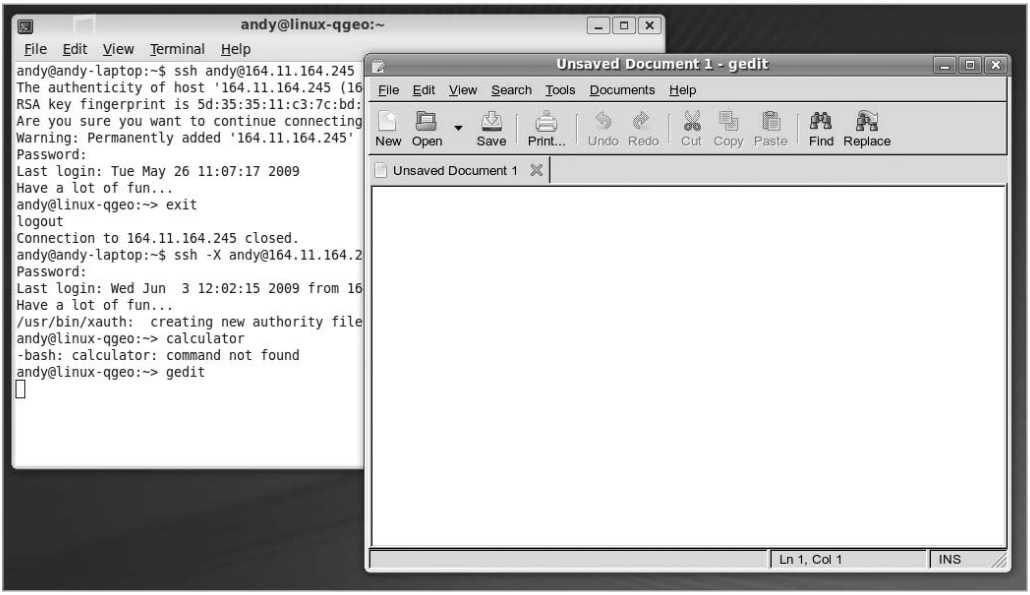

Figure 33-2. *Although the Gedit window appears on the local computer's display, the application is actually running on the remote machine.*

Accessing Ubuntu via Remote Desktop

A less secure but more convenient way to access your Ubuntu PC's desktop applications across a network is to use Ubuntu's Remote Desktop feature. The advantage of this method is that the entire desktop of the remote computer appears in a window on the local computer's desktop.

Remote Desktop uses the Virtual Network Computing (VNC) software to share the desktop. *Sharing* is the key word because, effectively, anyone who connects will take control of the main desktop. They will control the mouse and keyboard input.

However, there are a couple of important differences compared to accessing X across an `ssh` connection:

- Although the password is sent encrypted, the rest of the VNC data transfers aren't. Complete encryption is possible by using special versions of VNC, or via an OpenSSH tunnel, but this can be difficult to set up on the Windows end of the connection.
- The remote desktop isn't blanked, so anyone standing in front of the computer will be able to see what you're doing. This could present a security/privacy risk.

If you're prepared to put up with these caveats, then allowing Remote Desktop access on a computer is easy. Here's the procedure:

1. Click System ➤ Preferences and then click Remote Desktop. In the Sharing section of the dialog box, put a check alongside Allow Other Users to View Your Desktop and ensure that there's a check in the box alongside Allow Other Users to Control Your Desktop, as shown in Figure 33-3. In the Security section, you can choose whether the user can confirm each connection and whether you want to set a password. Both options add to the security of your system, although the confirmation option will mean that someone will have to be at the computer to authorize an incoming connection.

Figure 33-3. *Ubuntu's Remote Desktop feature lets you share your desktop but isn't as secure as making an X server connection across SSH.*

■**Note** Ignore the information in the dialog box about how users can view your desktop. Instead, you should find out your computer's IP address and use that.

---

2. On the computer from which you want to connect to the remote desktop, click Applications ➤ Internet ➤ Remote Desktop Viewer.
3. With any luck, you'll see the remote computer listed in the panel on the left of the program window. Just select it and double-click. If it isn't listed, click the Connect button. In the Host field, enter the IP address of the computer you wish to connect to. Under the Connection Options heading within the dialog box, you can select to run the session full-screen (which is to say, let the remote desktop entirely take over the local computer's screen); opt to create a connection whereby you only view the remote desktop, rather than control it; and opt to scale the remote desktop, so it shrinks to fit within the program window. After you've made your choices, click Connect.
4. You'll be prompted to enter the password, if one is applicable, and you should then see the remote computer's desktop in a window.

After you've finished with the Remote Desktop session, press Ctrl+Alt to release the cursor and simply close the window's tab, or click the Close button to terminate the connection.

Connecting to Remote Windows Computers

The Terminal Server Client program (Applications ➤ Internet ➤ Terminal Server Client) allows you to connect to a variety of remote desktop server programs and, in particular, Windows Vista, XP, or 2000 computers via the Remote Desktop Protocol (RDP). Unfortunately, Windows XP Home and earlier versions of Windows don't support RDP connections, which means that they aren't able to run an RDP server and allow other computers to access their desktops. Windows Vista Basic and Vista Premium also suffer from this limitation. However, there is a way to access the desktop of these computers remotely by using some add-in software.

Connecting to Windows Vista

Before initiating the connection, you should ensure that the Windows Vista computer is set for incoming remote connections, if you haven't already. First, make sure that your Vista account has a password—Terminal Server Client won't be able to connect otherwise. Next, ensure that Vista's remote desktop feature is activated. Click the Start button, right-click Computer, and click Properties. In the window that appears, click the Remote Settings link on the left side. In the dialog box that appears, click Allow Connections from Computers Running Any Version of Remote Desktop (Less Secure), and then click Apply.

■ **Note** These instructions assume that you intend to connect using a Windows Vista administrator username and password. If not, you'll need to click the Select Users button and add the user accounts you wish to use.

Back on the Ubuntu computer, click Applications ➤ Internet ➤ Terminal Server Client. When the program is running, in the Computer field, type either the IP address of the machine or its FQDN. You don't need to type the username, password, or any other details. Click Connect, and a new window should appear, in which you should see a login prompt. You should then log in to Windows, using your username and password.

Connecting to Windows XP Professional, 2000, and NT

Here we use an XP Professional machine as an example, but the instructions are also valid for Windows 2000 and NT.

First, make sure the Windows XP computer is configured to allow incoming RDP connections. To configure it, right-click My Computer and select Properties. In the System Properties dialog box, click the Remote tab, and make sure Allow Users to Connect Remotely to This Computer is selected, as shown in Figure 33-4. The Windows computer to which you want to connect may also need to be updated with the latest service packs, particularly in the case of a Windows 2000 computer.

To connect, use the Terminal Server Client program, which is on the Applications ➤ Internet menu. When it's running, in the Computer field, type either the IP address of the machine or its FQDN (if applicable). You don't need to type the username, password, or any other details. Click Connect, and a new window should appear, in which you should see an XP login prompt. You should then log in to Windows, using your username and password.

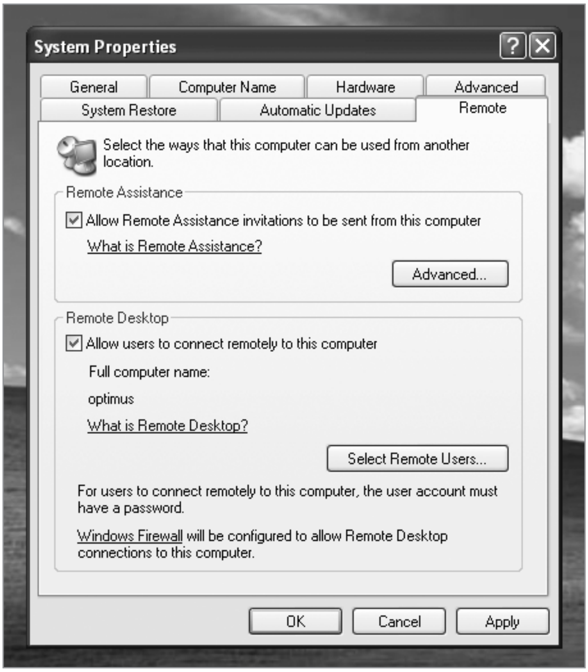

Figure 33-4. *You need to enable the option under Remote Desktop to access Windows XP Professional machines using RDP and the Terminal Server Client program.*

Caution If you haven't set a password for your user account on the Windows machine, you won't be able to log in. This is a quirk of the Windows XP RDP system. The solution is simple: use the User Accounts applet within the Windows Control Panel to assign yourself a password.

Connecting to Other Computers

You can download a VNC server for just about any operating system. Windows and Linux are supported, as is Mac OS X. In fact, a VNC server will run on any Windows computer, from 95 upward. After it's installed, you can then use the Terminal Server Client program within Ubuntu to connect to that computer's remote desktop.

■ **Note** Any computer that's running the VNC Viewer program can access a computer running a VNC server (including the one set up by Ubuntu's Remote Desktop feature). Various VNC Viewer programs are available for Linux, Windows, Mac OS X, and other operating systems, including the likes of PocketPC. Just search the Web by using *VNC Viewer* as a search string to find viewer programs.

Of course, you'll have the same insecurities and lack of desktop blanking that plague VNC connections to an Ubuntu desktop, as described previously. But if you're prepared to accept this, you'll be pleased to hear that setting up the VNC server on the Windows machine is easy. TightVNC, available from `www.tightvnc.com`, is one of the best variations of VNC around. You should download the self-installing package for Windows. During installation, you'll be asked whether you want to register TightVNC as a system service. Click the check box alongside this option. This will activate the VNC server every time the computer starts.

After the program is installed, the server configuration program will appear. You should change the password by overtyping the default in the Password field.

Connecting to the remote Windows machine is also a piece of cake. On the Ubuntu system, open Remote Desktop Viewer (Applications ➤ Internet ➤ Remote Desktop Viewer) and click the Connect button. Type the remote computer's IP address into the Host field and then click Connect. There's no need to fill in any of the other details. You'll be prompted for the remote computer's VNC server password and, after you enter this, the remote desktop will appear in a window. Figure 33-5 shows an example of connecting to a Windows XP computer.

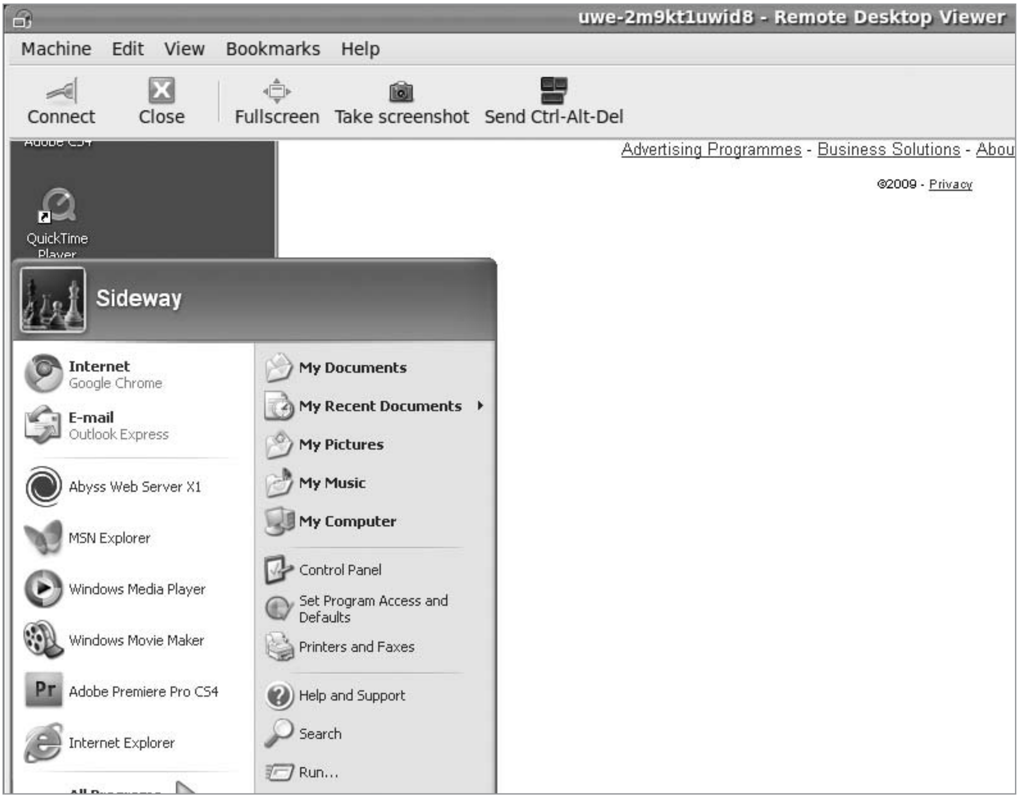

Figure 33-5. *By installing a VNC server, you can connect to just about any remote operating system, including Windows XP (as here).*

Summary

In this chapter, you looked at how you can access your Ubuntu computer remotely across the Internet. You examined how you can access the computer as if you were sitting in front of it, using the `ssh` program. This allows you to start a command-line prompt and even run GUI programs from the remote computer.

In addition, we discussed how the `screen` program can be used to keep sessions alive across various logins, and how you can transfer files by using the `sftp` and `scp` programs. Then you looked at how to use the Remote Desktop Viewer and Terminal Server Client tools to access the desktop of remote Windows computers.

PART 8

Appendixes

APPENDIX A

Glossary of Linux Terms

This appendix provides brief explanations of common terms used in the Linux and Unix environments. These include technical terms, as well as conventions used within the Linux community. Because of space limitations, this glossary is somewhat selective but still should prove a lasting reference as well as a helpful guide for those new to Linux.

Cross-referenced terms are highlighted in italics.

Symbols

.

In the context of file management at the *command-line prompt*, this symbol refers to the current directory.

..

In the context of file management at the *command-line prompt*, this symbol refers to the parent directory of that currently being browsed.

/

In the context of file management at the *command-line prompt*, the forward slash refers to the *root* of the file system; it also separates directories in a path listing.

~

In the context of file management at the *command-line prompt*, the tilde refers to a *user*'s home directory.

|

The pipe symbol is used at the *command-line prompt* to *pipe* output from one *command* to another.

>

When used at the *command-line prompt*, the right angle bracket indicates that output should *redirect* into a file.

<

When used at the *command-line prompt*, the left angle bracket indicates that a *command* should accept input from a file (see *redirect).*

#

When it appears at the *command-line prompt*, this symbol usually indicates that the *user* is currently logged in as *root*.

$

When it appears at the *command-line prompt*, the dollar sign usually indicates that the *user* is currently logged in as an ordinary user. (Note that some versions of *Linux*/*Unix* use `%` or `>` instead of `$`.)

?

The question mark is a wildcard character indicating that any character can be substituted in its place; this symbol is typically relevant only at the *command-line prompt*.

*

The asterisk is a wildcard character indicating that zero or more characters can appear in its place; this symbol is typically relevant only at the *command-line prompt*.

*nix

Popular but unofficial way of describing the family tree that comprises *Unix* and its various clones, such as *Linux* and *Minix*.

A

administrator

A *user* on the system with ultimate power to configure the system. Usually under standard *Linux* installations, this is another word for either the *root user* or one who has adopted that user's powers temporarily.

AIX

IBM's *proprietary* form of *Unix* that runs on the company's proprietary hardware, as well as *commodity* hardware based around AMD and Intel processors. Nowadays, IBM is slowly deprecating AIX in favor of *Linux*.

alias

Method of creating a *user*-defined *command* that, when typed, causes another command to be run or a *string* to be expanded.

Apache

Popular *open source* web *server* software that runs on *Unix*, *Linux*, and other operating system platforms. Considered responsible in part for the rise in popularity of Linux in the late 1990s.

applet

Small program that, in the context of the *Ubuntu* desktop, runs as part of a larger program and offers functions that complement the main program. The *GNOME* desktop incorporates several applets, and—technically speaking—all features or elements of the panels are applets, including even the main menus.

APT

Advanced Packaging Tool; the underlying system by which software is managed and installed on *Ubuntu* and *Debian Linux* systems. *Shell* commands beginning with `apt`, such as `apt-get`, are used to install new software from various repositories. Under Ubuntu, the Synaptic Package Manager program provides a *GUI* method of using APT.

archive

Any file containing a collection of smaller files, compressed or otherwise (see also *tar*).

B

BASH

Bourne Again SHell. The most common *shell* interpreter used under *Linux* and offered as the default on many Linux systems. Based on the older Bourne sh software.

binary executable

Another way of referring to a program that has been compiled so that it can be used day to day. See also *compilation*.

block device

How the *Linux kernel* communicates with a *device* that sends and receives blocks of data; usually a hard disk or removable storage device. See also *character device*.

BSD Unix

Berkeley Software Distribution Unix; form of *Unix* partially based on the original Unix *source code* but also incorporating recent developments. BSD is *open source* and *free* for all to use and share, with practically no restrictions. There are various forms of BSD Unix, such as FreeBSD, NetBSD, and OpenBSD. BSD doesn't use the *Linux kernel* but runs many of the same programs. Some of the programs offered within the Linux operating system come from BSD.

bzip2

Form of file compression. Together with the older and less-efficient *gzip,* it is a popular form of file compression under *Linux* and the equivalent to Zip compression under Windows. Files employing bzip compression are usually given a `.bz2` file extension (*tar* files are usually given the double file extension `.tar.bz2`, or occasionally just `.tbz`). See also *tar*.

C

C

Programming language in which much of the *Linux kernel* is written, as were later versions of *Unix* before it. C was created by some of the same people who created Unix, and its development mirrors that of Unix.

C++

Object-oriented programming language; originally designed to be an enhancement to *C*, but now seen as a popular alternative.

C#

Modern programming language, which uses similar syntax to *C*, created by Microsoft and re-created on *Linux* via the Mono project.

character device

How Linux refers to a *device* that sends/receives data asynchronously. For various technical reasons, this typically refers to the *terminal* display. See also *block device*.

checksum

Mathematical process that can be applied to a file or other data to create a unique number relative to the contents of that file. If the file is modified, the checksum will change, usually indicating that the file in question has failed to download correctly or has been modified in some way. The most common type of checksum program used under *Linux* and *Unix* is md5sum.

client

Shorthand referring to a computer (or software) that connects to a *server*.

closed source

The reverse of *open source*, in which the *source code* is not available for others to see, share, or modify. See also *proprietary*.

code

See *source code*.

command

Input typed at the *shell* that performs a specific task, usually related to administration of the system and/or the manipulation of files.

command-line prompt

See *shell*.

commodity

In the context of hardware, describes PC hardware usually based around Intel or AMD processors that can be bought off the shelf and used to create sophisticated computer systems (as opposed to buying specially designed hardware). One reason for *Linux*'s success is its ability to use commodity hardware.

community

The general term for the millions of *Linux users* worldwide, regardless of what they use Linux for or their individual backgrounds. By using Linux, you automatically become part of the community.

compilation

The practice of creating a binary file from *source code*, usually achieved using the `./configure`, `make`, `make install` series of *commands* and *scripts*.

config file

Configuration file; any file that contains the list of settings for a program. Sometimes it's necessary to edit config files by hand by using programs such as *vi* or *Emacs,* but often the program itself will write its config file according to the settings you choose.

copyleft

The legal principle of protecting the right to share a creative work, such as a computer program, using a legally binding license. Copyleft also ensures that future iterations of the work are covered in the same way.

cracker

Someone who breaks into computer systems to steal data or cause damage. The term is not necessarily linked to *Linux* or *Unix* but was created by the *community* to combat the widespread use of *hacker* in this sense. The word *hacker* has traditionally defined someone who merely administers, programs, and generally enjoys computers.

cron

Background *service* that schedules tasks to occur at certain times. It relies on the `crontab` file.

CUPS

Common Unix Printing System; set of programs that work in the background to handle printing under *Unix* and *Linux*.

curses

Library that lets software present a semigraphical interface at the *shell*, complete with menu systems and simple mouse control (if configured). The version of curses used under *Linux* and *Unix* is called ncurses.

CVS

Concurrent Versions System; application that allows the latest version of software packages to be distributed over the Internet to developers and other interested parties. Nowadays Git or Subversion are preferred instead and work along similar lines.

D

daemon

See *service*.

Debian

Community organization that produces *distributions* of *free software* operating systems, including *Linux*. Because it is a nonprofit organization run by passionate free software advocates, it is considered the most ethically sound of all Linux outfits. Many distributions, including *Ubuntu*, use Debian as the basis for their software because of its claimed reliability, relative simplicity, and certain sophisticated features, such as the *APT* software management system.

dependency

A way of referring to system files or other software that a program requires in order to run. If the dependencies are not present during program installation, a program might refuse to install.

device

Linux shorthand describing something on your system that provides a function for the *user* or that the system requires in order to run. This usually refers to hardware, but it can also describe a virtual device that is created to provide access to a particular Linux function.

directory

What Windows refers to as a folder; areas on a hard disk in which files can be stored and organized.

distribution

A collection of software making up the *Linux* operating system; also known as a *distro*. The software is usually compiled by either a company or organization. A distribution is designed to be easy to install, administer, and use by virtue of it being an integrated whole. Examples include *Ubuntu*, SUSE *Linux*, *Red Hat*, and *Debian*.

distro

Shorthand for *distribution*.

documentation

Another way of describing written guides or instructions; can refer to online sources of help as well as actual printed documentation.

dpkg

Debian package management system; *shell command* that can be used to administer software under *Ubuntu* and *Debian*. However, the *APT* system, which uses `dpkg`, is the preferred method of installing software.

E

Edubuntu

Official spin-off of the main *Ubuntu* project that features educational software along with a child-friendly user interface and classroom administration software. Unlike other spin-off projects, such as *Xubuntu* and *Kubuntu*, Edubuntu features the same *GNOME* interface as the main Ubuntu release, and much of the same software.

Emacs

Seminal text editor and pseudo-*shell* beloved by *Unix* aficionados; can be used for programming tasks, simple word processing, and much more. This editor has cultural significance as one of the core pieces of software offered by the *GNU Project*. Emacs was originally developed principally by *Richard Stallman*. See also *vi*.

environment

Shorthand referring to a *user*'s unique *Linux* configuration, such as *variables* that tell the *shell* where programs are located.

F

FAT32

File Allocation Table 32-bits; file system offered by Windows 98, Me, 2000, and XP. *Linux* can both read and write to FAT32 file systems. More recently, a proposed extension has been announced for larger disks: FAT64. See also *NTFS* and *VFAT*.

Firefox

Web browser program used under *Ubuntu* and produced by the *Mozilla Foundation*.

FLOSS

Free, libre, or open source software; used within the *community* to describe all software or technology that, broadly speaking, adheres to the ethical approach of *open source* software and/or *free software*, as well as its legal guidelines.

FOSS

Free or *open source* software; alternative term for *FLOSS*.

free

When used to describe software or associated areas of technology, *free* indicates that the project abides by the ethical (if not legal) guidelines laid down by the *GNU Project*. It doesn't necessarily indicate that the software is free in a monetary sense; its meaning is quite different from freeware.

Free software

Software in which the *source code*—the original listing created by the programmer—is available for all to see, share, study, and adapt to their own needs. This differs from the concept of *open source,* because the right of others to further modify the code is guaranteed via the *GNU Public License* (GPL) software license (or a compatible license). For various reasons, in some instances free software does not include the source code (although the software can still be legally decompiled), but this is rare.

Free Software Foundation

Nonprofit organization founded by *Richard Stallman* to effectively sponsor the creation of the *GNU* operating system, and further the aims and goals of *free software* (including the legal documents, such as the *GPL*). It is considered the home of the free software ideal and GNU itself. Sometimes abbreviated as FSF.

G

GCC

GNU Compiler Collection; programs used when creating *binary executable* files from *source code*. Formerly called GNU C Compiler.

GID

Group ID; numbering system used by the operating system to refer to a *group*.

GIMP

GNU Image Manipulation Program; high-powered image-editing program that runs under *Linux, Unix,* Windows, and other operating systems. Often preceded by the definite article: The GIMP.

GNOME

A *GUI*-based desktop *environment* used by *Ubuntu* as well as several other *distributions*. It uses the GTK+ libraries. The name was originally created as an acronym standing for GNU Network Object Model Environment, but now the term is considered a word and not an acronym. See also *KDE*.

GNU

GNU's Not Unix; seminal operating system project initiated by *Richard Stallman* in 1983 and intended to form a *free software* clone of *Unix*. See *GNU Project*.

GNU/Linux

Another name for the operating system referred to as *Linux*. The name GNU/Linux gives credit to the vast quantity of *GNU Project* software that is added to the *Linux kernel* within a *distro* to make a complete operating system. As such, GNU/Linux is the preferred term of many *free software* advocates.

GNU Project

Organization created by *Richard Stallman* in order to further the aims of *free software* and create the body of software that makes up the *GNU* operating system.

GNU Public License

Software license principally created by *Richard Stallman* in order to protect software *source code* against *proprietary* interests and ensure that it will always be shared. It does this by insisting that any source code covered by the GNU Public License (GPL) must remain licensed under the GPL, even after it has been modified or added to by others. The *Linux kernel*, as well as much of the software that runs on it, uses the GPL. There are several versions of the GNU Public License that refine its requirements and limitations (notably versions 2 and 3), and several variations designed for other uses; key examples include the Lesser GPL (*LGPL*), which relinquishes some requirements of the GPL and is usually used with *library* software, and the GNU Free Documentation License that, as its name suggests, is usually used to license technical literature, such as manuals.

GPL

See *GNU Public License*.

grep

Global regular expression print; powerful *shell command* that lets you search a file or other form of input by using *regular expressions*. Because of the ubiquity of the grep program, many *Linux* and *Unix* users refer to searching as *grepping*. To *grep a file* is to search through it for a *string*.

group

Collection of *users* under one heading (group name) to facilitate system administration.

GRUB

GRand Unified Bootloader; boot manager program that offers a menu from which you can choose which operating system you wish to boot. It's needed to load the *kernel* program and thereby initiate the *Linux* boot procedure.

GUI

Graphical user interface; describes the software that provides a graphical system to display data and let you control your PC (usually via a mouse).

guru

One who is experienced and knowledgeable about *Linux*/*Unix* and is willing to share his or her knowledge with others. In a perfect world, every *newbie* would have his or her own guru.

gzip

One of the two preferred forms of file compression used under *Linux*. Files employing gzip compression usually have a `.gz` file extension. See also *bzip2*.

H

hack

Ingenious and/or extremely efficient solution to a problem, particularly within the programming world.

hacker

Term used within the *community* to describe anyone who enjoys computers and possesses some skill therein, either in a professional capacity or as a hobby. A positive and highly valued term, the word is distinct from connotations of maliciously breaking into computers propagated by the media. See also *cracker*.

host

Shorthand referring to any computer that acts as a *server* to another computer. See also *client*.

HP-UX

Hewlett-Packard's *proprietary* form of *Unix* designed to work on its own hardware platform.

Hurd

Kernel developed by the *GNU Project* and originally intended to form the centerpiece of the *GNU* operating system. However, with the arrival of the *Linux kernel*, its necessity was lessened, and it is now arguably a minor project. It's not associated with the Linux kernel in any way.

I

info

Source of *documentation* accessible from the *shell*; an alternative to the more established *man page* system. Also known as Texinfo.

init

With most versions of *Linux*, init is the program that is automatically run after the *kernel* has finished loading, and therefore early in the boot procedure. It's responsible for effectively starting the operating system. Under *Ubuntu*, a system called *Upstart* is used instead, but it is 100 percent backward-compatible with the way init works, to the extent that those not knowing Upstart was in use would not realize the difference.

init.d

Collection of startup *scripts* that make up the components of a *run level*. Under *Ubuntu*, these are found at `/etc/init.d`. *Symbolic links* to selected `init.d` scripts are contained in folders within `/etc/init.d` that are named after *run level* numbers, such as `rc0.d`, `rc1.d`, `rc2.d`, and so on.

initrd

Initial RAM disk; system used by the *Linux kernel* to load *modules* that are essential for the kernel to be able to boot, such as disk controllers.

inode

Part of the usually invisible file system structure that describes a file, such as its ownership permissions or file size.

ipchains

Now-deprecated component of version 2.2 of the *Linux kernel* that allows the creation of network security setups, such as firewalls or port-forwarding arrangements. Note that some *distros* still prefer to use ipchains. See also *iptables*.

iptables

Component of versions 2.4 and 2.6 of the *Linux kernel* that allows powerful network security setups via the configuration of netfilter. Chiefly used in the creation of firewalls, but can be used for more elementary arrangements such as network address translation (NAT) routers. *Ubuntu* offers a far more user-friendly command-line tool called `ufw` that aids configuration of iptables.

J

job

How the *BASH shell* refers to a running program in order to facilitate administration by the *user*.

journaling

File system technology in which integrity is maintained via the logging of disk writes.

K

KDE

K Desktop Environment; *GUI* and set of additional programs used on various *distros,* such as Mandriva and a variation of *Ubuntu* called *Kubuntu*.

kernel

Essential but ordinarily invisible set of programs that run the computer's hardware and provide a platform on which to run software. In the *Linux* operating system, the kernel is also called Linux, after its creator, *Linus Torvalds*.

kernel panic

Error message that appears when the *kernel* program in *Linux* cannot continue to work. In other words, a polite way of indicating a crash or, more often, a problem arising from *user* misconfiguration. This is most often seen when booting up after making incorrect changes to the system.

kludge

Community slang describing an inelegant way of making something work, usually not in a way that is generally accepted as being correct. Pronounced *kloodge*.

Kubuntu

Version of *Ubuntu* that substitutes the *GNOME* desktop *environment* for *KDE*.

L

LAMP

Acronym describing a series of programs that work together to provide a complete *Linux*-based web-hosting *environment*. Stands for *Linux*, *Apache*, *MySQL*, and PHP, Python, or Perl (the last three in the list are scripting languages; see *script*).

LGPL

Lesser GPL; version of the *GNU Public License* (GPL) in which some use restrictions are slackened at the expense of various freedoms laid down by the main GPL. The LGPL is mostly used for *library* files.

library

General term referring to *code* that programs need to run and that, once in memory, is frequently accessed by many programs (leading to the phrase "shared library"). The most common and vital library is glibc (GNU C Library), created by the *GNU Project* and the fundamental building block without which *Linux* could not operate. *GNOME* relies on the GTK+ libraries, among others.

link

File system method of assigning additional filenames to a block of data that represents a file; also known as a "hard link." See also *symbolic link*.

Linux

(1) A *kernel* program created by *Linus Torvalds* in 1991 to provide an inexpensive operating system for his computer, along with other components.
(2) The entire operating system discussed in this book, although many argue (perhaps quite rightly) that this is inaccurate, and use the term *GNU/Linux* instead, to give credit to the inclusion of many components of the *GNU* operating system.

Linux Foundation

A nonprofit organization that aims to further the adoption of the *Linux* operating system, and as such is sponsored by many corporations that utilize the Linux operating system as part of their business, such as IBM and Novell. It is considered the spiritual home of Linux, if such a distinction can be made, and employs *Linus Torvalds*, the originator and leader of the Linux *kernel* project.

local

Shorthand referring to the *user*'s PC or a device directly attached to it (as opposed to *remote*).

localhost

Network name used internally by *Linux* and software to refer to the *local* computer, distinct from the network.

M

man page

Concise technical *documentation* accessible from the *shell* that describes a *command* and how it should be used.

Minix

Created by Andrew Tanenbaum, this operating system is a rough clone of *Unix*. It was the operating system that *Linus Torvalds* had in mind when devising *Linux,* and which acted as an early development platform for him.

module

Program *code* that can be inserted or removed from the *kernel* in order to support particular pieces of hardware or provide certain kernel functions. Drivers under Windows perform the same function.

mount

To add a file system so that it is integrated (and therefore accessible) within the main file system; applies to external file systems, such as those available across networks, as well as those on the *local* PC, such as the hard disk or CD/DVD-ROMs.

Mozilla Foundation

Organization founded by Netscape to create *open source* Internet software, such as web browsers and e-mail clients; originally based on the Netscape *source code*. At the time of this writing, it produces the *Firefox* and Camino web browsers, the Thunderbird e-mail and Usenet client, the Bugzilla bug-tracking software, as well as other programs. The underlying web-browsing engine software used by many Mozilla Foundation products is known as Gecko.

MySQL

Popular and powerful *open source* database application. See also *LAMP*.

N

newbie

Term used to describe anyone who is new to *Linux* and therefore still learning the basics. It's not a derogatory term! See also *guru*.

NFS

Network File System; reliable and established method of sharing files, printers, and other resources across a network of *Unix*-based operating systems. See also *Samba*.

NTFS

NT File System; file system offered by Windows NT, 2000, XP, and Vista. It is usually fully accessible under *Linux*, although some distributions do not allow writing to NTFS *partitions*. See also *FAT32*.

O

open source

(1) Method and philosophy of developing software whereby the *source code*—the original listing created by the programmer—is available for all to see. Note that open source is not the same as *free software*; describing software as open source doesn't imply that the code can be shared or used by others (although this is often the case). (2) A community of *users* or any project that adheres to open source values and/or practices.

OpenOffice.org

Open source office suite project created with the continuing input of Sun Microsystems and based on *code* Sun contributed to the open source *community*. Its commercial release is in the form of StarOffice (although StarOffice has several *proprietary* components added).

P

partition

Subdivision of a hard disk into which a file system can be installed.

PID

Process ID; the numbering system used to refer to a *process*.

pipe

Method of passing the output from one *command* to another for further processing. Piping is achieved within the *shell* by typing the | symbol.

POSIX

Portable Operating System Interface; various technical standards that define how *Unix*-like operating systems should operate and to which the *Linux* operating system attempts to adhere.

PPP

Point-to-Point Protocol; networking technology that allows data transfer across serial connections such as telephone lines. In other words, it's the technology that lets you connect to your Internet service provider by using a modem.

process

The way the system refers to the individual programs (or components of programs) running in memory.

proprietary

Effectively, software for which a software license must be acquired, usually for a fee. This usually means that the *source code* is kept secret, but it can also indicate that the source code is available to view but not to incorporate into your own projects or share with others.

R

Red Hat

Well-known company that produces *distributions* of *Linux*.

redirect

Used to send the output of a *command* into a particular file. This also works the other way around: the contents of a particular file can be directed into a command. Redirection is achieved within the *shell* by using the left and right angle brackets (`<` and `>`), respectively.

regex

See *regular expression*.

regular expression

Powerful and complex method of describing a search *string*, usually when searching with tools such as *grep* (although regular expressions are also used when programming). Regular expressions use various symbols as substitutes for characters or to indicate patterns.

remote

Indicates a computer or *service* that is available across a network, including but not limited to computers on the Internet (as opposed to *local*).

root

(1) The bottom of the *Linux* file system directory structure, usually indicated by a forward slash (`/`).

(2) The `/root` directory in the bottom of the file system, which is effectively the root user's personal directory.

(3) The hard disk *partition* on which operating system files are installed, sufficient to boot Linux; under *Ubuntu* the root partition contains all operating system and user data files.

(4) The *user* on some versions of *Unix* or Linux who has control over all aspects of hardware, software, and the file system.

(5) Used to describe a user who temporarily takes on the powers of the root user (via the *`sudo`* command, for example).

RPM

Red Hat Package Manager; system used to install and administer programs under *Red Hat*, *SUSE Linux,* and some other *distributions*. The equivalent of *APT*.

RTFM

Read the <expletive> manual/*man page*; exclamation frequently used online when a *newbie* asks for help without having undertaken basic research.

run level

Describes the current operational mode of *Linux* (typically, the *services* that are running). Run level 1 is single-user mode (a stripped-down system with minimal running services); run levels 2 through 5 provide a *GUI*; run level 6 is reboot mode (switching to it will cause the computer to terminate its processes and then reboot); run level 0 is shutdown (switching to it will cause the PC to shut down). Under *Ubuntu* and most derivatives of *Debian*, run level 2 is the default.

S

Samba

Program that re-creates under *Unix* or *Linux* the Microsoft *SMB*-based system of sharing files, printers, and other computer resources across a network. It allows Linux to become a file or printer *server* for Linux and Windows computers, and also allows a Linux *client* to access a Windows-based *server*.

scalable

Term describing the ability of a single computer program to meet diverse needs, regardless of the scale of the potential uses. The *Linux kernel* is described as being scalable because it can run supercomputers as well as handheld computers and home entertainment devices.

script

Form of computer program consisting of a series of *commands* in a text file. Most *shells* allow some form of scripting, and entire programming languages such as Perl are based around scripts. In the context of the *Linux* operating system, shell scripts are usually created to perform trivial tasks or ones that frequently interact with the *user*. Shell scripts have the advantage that they can be frequently and easily modified. The Linux boot process relies on several complex scripts to configure essential system functions such as networking and the *GUI*. See also *init* and *Upstart*.

server

(1) Type of computer designed to share data with other computers over a network.

(2) Software that runs on a computer and is designed to share data with other programs on the same PC or with other PCs across a network.

service

Background program that provides vital functions for the day-to-day running of *Linux*; also known as a *daemon*. Services are usually started when the computer boots up and as such are constituent parts of a *run level*.

shell

Broadly speaking, any program that creates an operating *environment* in which you can control your computer. The *GNOME* desktop can be seen as a shell, for example. However, it's more commonly understood within *Unix* and *Linux* circles as a program that lets you control the system by using *command*s entered at the keyboard. In this context, the most common type of shell in use on Linux is *BASH*.

Shuttleworth, Mark

Entrepreneurial South African businessman who, as a long-term *Debian hacker*, devised and financially supports *Ubuntu* via his company, Canonical Ltd.

SMB

Server Message Block; network technology for sharing files, printers, and other resources. See also *Samba*.

Solaris

Form of *Unix* sold by Sun Microsystems; runs on *proprietary* hardware systems as well as on *commodity* systems based on Intel and AMD processors. Available in an entirely *open source* rendition called OpenSolaris.

source code

The original program listing created by a programmer. Most programs that you download are precompiled—already turned into *binary executables* ready for general use—unless you specifically choose to download and compile the source code of a program yourself.

SSH

Secure SHell; program that lets you access a *Linux*/*Unix* computer across the Internet. SSH encrypts data sent and received across the *link*.

SSL

Secure Sockets Layer; form of network data transfer designed to encrypt information for security purposes. It's used online for certain web sites and also within *Linux* for certain types of secure data exchange.

Stallman, Richard M.

Legendary *hacker* who founded the *GNU Project* and created the concept of *copyleft*, as well as the software license that incorporates it: the *GNU Public License* (GPL). See also *Linus Torvalds*.

standard error

Linux and *Unix* shorthand for the error output provided by a *command*.

standard input

Linux and *Unix* shorthand for the *device* usually used to provide input to the *shell*. For the majority of desktop PC *users*, this refers to the keyboard.

standard output

Linux and *Unix* shorthand for the *device* usually used to display output from a *command*. For the majority of desktop PC *users*, this refers to the screen.

string

A word, phrase, or sentence consisting of letters, numbers, or other characters that is used within a program and is often supplied by the *user*.

sudo

Program that runs under *Unix* and *Linux* by which ordinary *users* are temporarily afforded *administrator* rights. *Ubuntu* relies on sudo as the exclusive way for users to administer the system. The equivalent command to start *GUI* applications under Ubuntu is `gksu`.

SVG

Scalable Vector Graphics; vector graphics technology. SVG is actually an XML markup language designed to create 2D graphics, increasingly used for *Linux* desktop icons and web graphics.

swap

Area of the hard disk that the *Linux kernel* uses as a temporary memory storage area. Desktop or *server* Linux differs from Windows in that it usually requires a separate hard disk *partition* in which to store the swap file.

symbolic link

Type of file akin to a Windows shortcut. Accessing a symbolic link file routes the *user* to an actual file. See also *link*.

sysadmin

Systems administrator; a way of describing the person employed within a company to oversee the computer systems. In such an *environment*, the sysadmin usually is the *root* user of the various computers.

System V

Variant of *Unix* used as a foundation for modern forms of *proprietary* Unix.

T

tainted

Describes a *kernel* that is using *proprietary modules* in addition to *open source* modules. Can also refer to insecure software.

tar

Tape ARchive; software able to combine several files into one larger file in order to back them up to a tape drive or simply transfer them across the Internet. Such files are usually indicated by a `.tar` file extension. Note that a tar file isn't necessarily compressed; the *bzip2* and *gzip* utilities must be used if this is desired.

TCP/IP

Transmission Control Protocol/Internet Protocol; standard protocol stack used by most modern operating systems to control and communicate across networks and also across the Internet (as opposed to NetBEUI, commonly available on older versions of Windows, and IPX/SPX, used on Novell's NetWare operating system).

terminal

Another word for *shell*.

TeX

Method and set of programs for typesetting complex documents. Invented prior to word processors and desktop publishing software, and now considered a specialized tool for laying out scientific texts. An updated version of the program called LaTeX is also available.

Torvalds, Linus

Finnish programmer who, in 1991, created the initial versions of the *Linux kernel*. Since then, he has utilized an international network of volunteers and staff employed by various companies who help produce the kernel. Torvalds himself contributes to and oversees the efforts and is employed by the *Linux Foundation*.

tty

TeleTYpewriter; shorthand referring to underlying *Linux* virtual *devices* that allow programs and *users* to access the *kernel* and thereby run programs.

Tux

The name of the penguin character that is the *Linux* mascot. The original Tux graphic was drawn by Larry Ewing.

U

Ubuntu

Linux distribution with several unique characteristics. Ubuntu is designed primarily for desktop use (although other versions are available, including some for *server* hardware and for handheld computers). It is intended for use by individuals in any location in the world, so it has strong multiple-language support. It's run by the *Ubuntu Foundation*, which is financially backed by *Mark Shuttleworth*. Each release is guaranteed to be supported for 18 months, or three years in the case of long-term support (LTS) releases (five years in the case of server releases).

Ubuntu Foundation

Organization set up by *Mark Shuttleworth* and his company, Canonical, Ltd., to provide an official home for the *Ubuntu* distribution of *Linux*.

UID

User ID; numbering system used by the operating system to refer to a *user*.

Unix

Seminal operating system created as a research project in 1969 by Kenneth Thompson and Dennis Ritchie at Bell Labs (later AT&T). Because it was initially possible to purchase the *source code* for a fee, subsequent revisions were enhanced by a variety of organizations and went on to run many mainframe and minicomputer systems throughout the 1980s, 1990s, and up to the present. Nowadays, Unix is fragmented and exists in a variety of versions. Perhaps most popular is its *open source* rendition, *BSD Unix,* which has seen many developments since the source code was first released. This means that BSD Unix no longer exists but has instead diversified into a number of separate projects. *Proprietary* versions are also available, including *Solaris*, *HP-UX*, and *AIX*.

Upstart

Replacement for *init*, the software that effectively boots *Ubuntu* into a useable state whenever the computer is switched on or rebooted. However, Upstart goes beyond the design goals of init, and can stop and start various *services* (and also monitor them) on the fly while the system is up and running.

user

The way the operating system refers to anyone who accesses its resources. A user must first have a user account set up, effectively giving that user his or her own private space on the system. In addition to actual human users, an average *Linux* system has many other user accounts created to let programs and *services* go about their business. These are usually not seen by human users.

V

variable

A changeable value that stores a certain data type (such as a number, date, or *string*), remembering it for future reference by the system or *script* it is defined by. Variables defined by and for the *Linux kernel* are vital to it.

verbose

Command option that will cause it to return more-detailed output (or, in some cases, to return actual output if the command is otherwise “quiet”); usually specified by adding the `-v` command option.

VFAT

Virtual File Allocation Table; technical name of Microsoft’s FAT file system offered under Windows and also on removable storage devices such as flash memory cards.

vi

Arcane text editor and pseudo-*shell* beloved by *Unix* aficionados that can be used for creation of text files or programs. Traditionally, Unix *users* either love or hate vi; some prefer *Emacs*. Nowadays new and improved versions of vi are available, such as vim, used under *Ubuntu*.

W

Wine

Short for Wine Is Not an Emulator; software that re-creates the Windows application programming interface (API) layer within *Linux* and lets *users* run Windows programs.

workspace

X terminology referring to a *GUI* desktop.

X

X

Short for X Window; software that controls the display and input devices, thereby providing a software foundation on top of which desktop managers like *GNOME* are able to run.

X11

Version 11 of the *X* software, currently in use on most desktop *Linux* systems.

XFree86 Project

Organization that creates *X* software. At one time, every *distribution* of *Linux* used XFree86 software, but most now use similar software from the *X.org* organization.

xinetd

The *service* responsible for starting various network servers on the computer.

XMMS

Audio player program.

X.org

Organization that produces the *X* Window software and, in particular, a set of programs called *X11*. X11 is used on most modern distributions of *Linux*. It is backed by a number of *Unix* and Linux industry leaders.

xterm

Simple program that allows you to run a *shell* under *X*. This program has the advantage of being available on most *Linux* systems that offer a *GUI*.

Xubuntu

Version of *Ubuntu* that utilizes the XFCE4 desktop *environment* instead of *GNOME*.

APPENDIX B

BASH Command Index

This appendix provides a whistle-stop tour of commands that can be used at the BASH shell. This is a highly selective listing, intended to provide a guide to commands that see day-to-day use on average desktop systems. In a similar fashion, although some command options are listed, they're strictly limited to those that receive regular deployment.

The description of each command is deliberately simple. Note that the quantity of space given to a command is not an indication of its importance or usefulness. To this end, each command listed with an asterisk after its name offers far more than its brief description indicates. In such cases, we strongly advise that you refer to the command's man page for more information.

Various conventions are used in the list:

- You should substitute your own details wherever italicized words appear.
- Commands that can and might be run by ordinary users are preceded with a dollar sign (`$`).
- Commands that require root privileges (the use of `sudo`) are preceded with a hash symbol (`#`).

Commands that present dangers to the system through misuse are clearly marked. Such commands should not be used without research into the command's usage and function.

Table B-1. *Common BASH Commands*

Command	Description	Typical Command Options	Examples of Use
`$ alias`	Create or display command aliases		`alias` *`list`*`=ls`
`$ alsamixer`	Alter audio volume levels		`alsamixer`
`$ apropos`	Search man pages for specified words/phrases		`apropos "`*`word or phrase`*`"`
`$ apt-cache`	Search, query, and otherwise manipulate the APT database cache (see `apt-get`)	`search`: Search for specified package (regexes may be used; see Chapter 15) `showpkg`: Show information about specified package `depends`: Show package dependencies of specified package, and show other packages that can meet that dependency	`apt-cache search` *`packagename`*
`# apt-get`	Multifunction tool used to install, remove, and otherwise administer software packages, according to the APT database	`install`: Search for and install specified package from repositories (as specified in `/etc/apt/sources.list`) `update`: Update or build package database by contacting package repositories `upgrade`: Attempt to upgrade all current installed packages with new versions `dist-upgrade`: Attempt to upgrade all currently installed packages, automatically and aggressively resolving package conflicts; often used to upgrade entire distro to new version `remove`: Opposite of `install`; removes packages `clean`: Remove any old package installation files that are stored on hard disk `-f`: Attempt to fix broken package dependencies (used with `install` or `remove`) `force-yes`: Override any errors and thereby bypass `apt-get`'s protective measures. Dangerous option—use with care!	`apt-get install` *`packagename`*
`$ bzip2`	Compress specified file (replaces original file with compressed file and gives it `.bz2` file extension)	`-d`: Decompress specified file `-k`: Don't delete original file `-t`: Test; do a dry run without writing any data	`bzip2` *`myfile`*
`$ bzip2 recover`	Attempt recovery of specified damaged `.bz2` file		`bzip2recover` *`myfile.tar.bz2`*
`$ cal`	Display calendar for current month (or specified month/year)		`cal` *`4 2005`*
`$ cat`	Display a file onscreen or combine and display two files together		`cat` *`myfile`*

Command	Description	Typical Command Options	Examples of Use
`$ cd`	Change to specified directory		`cd /usr/bin`
`$ cdparanoia *`	Convert CD audio tracks to hard disk files	`-B`: Batch mode; convert all tracks to individual files `-S`: Set CD read speed (2, 4, 8, 12, and so on; values relate to CD-drive spin speed; used to avoid read errors)	`cdparanoia -S 8 -B`
`# wodim *`	Burn audio or CD-R/RW data discs (the latter usually based on an ISO image; see `mkisofs`)	`-dev=`: Specify the drive's device number (can be discovered by running `wodim` with the `scanbus` option) `scanbus`: Scan to see which CD-R/RW drives are present and return device numbers `-speed=`: Specify the write speed (2, 4, 6, 8, and so on) `-v`: Verbose output; obligatory for feedback on `wodim`'s progress	`wodim dev=0,0,0 -speed=16 -v myfile.iso`
`# cfdisk *`	Dangerous! Menu-based disk-partitioning program		`cfdisk /dev/hda`
`# chgrp`	Change group ownership of a file/directory	`-R`: Recursive; apply changes to subdirectories	`chgrp mygroup myfile`
`$ chmod`	Change permissions of a file/directory (where `a` = all, `u` = user, `g` = group, and `r` = read, `w` = write, `x` = executable)	`-R`: Recursive; apply to subdirectories `reference=`: Copy permissions from specified file	`chmod a+rw myfile`
`$ chown`	Change file ownership to specified username	`-R`: Recursive; apply to subdirectories	`chown username myfile1`
`# chroot`	Change the root of the file system to the specified path		`chroot /home/mydirectory`
`# chvt`	Switch to the specified virtual terminal (equivalent of holding down Ctrl+Alt and pressing F1–F6)		`chvt 3`
`$ clear`	Clear terminal screen and place cursor at top		`clear`
`$ cp`	Copy files	`-r`: Recursive; copy subdirectories and the files therein `-s`: Create symbolic link instead of copying	`cp myfile1 directory/`
`$ crontab`	Edit or display the user's `crontab` file (scheduled tasks)	`-e`: Edit the `crontab` file (create/amend) `-l`: List `crontab` entries `-r`: Delete the `crontab` file `-u`: Specify a user and edit their `crontab` file	`crontab -e`
`$ date`	Display the date and time		`date`

Continued

Table B-1. *Continued*

Command	Description	Typical Command Options	Examples of Use
$ df	Display free disk space within file system	-h: Human readable; display sizes in KB, MB, GB, and TB, as appropriate -l: Restrict to local file systems, as opposed to network mounts	df -h
$ diff	Display differences between specified files	-a: Consider all files text files (don't halt when asked to compare binary files) -i: Ignore lowercase and uppercase differences	diff *myfile1 myfile2*
$ diff3	Display differences between three specified files		diff3 *myfile1 myfile2 myfile3*
$ dig	Look up IP address of specified domain		dig *mysite.com*
$ dmesg	Display kernel message log		dmesg
# dosfsck *	Check and repair MS-DOS–based file hard disk partition (see also fsck)	-a: Repair without asking user for confirmation -r: Repair file system, asking user for confirmation when two or more repair methods are possible -v: Verbose; display more information	dosfsck -rv */dev/hda4*
# dpkg	Install, remove, and otherwise administer local installation packages (on your hard disk); see also apt-get	-i: Install specified package -r: Remove (uninstall) specified package -I: Show info about specified package ignore-depends=*packagename.deb*: Don't halt on package dependency issues (dangerous!)	dpkg –i *packagename.deb*
# dpkg-reconfigure	Reconfigure an already installed package		dpkg-reconfigure *packagename*
$ du	Show sizes of files and folders in kilobytes	-h: Human readable; produce output in MB, GB, and TB -s: Summary; display totals only for directories rather than for individual files	du -h */home/myuser*
$ eject	Eject a removable storage disk	-t: Close an already open tray	eject */media/dvd-rom*
$ ex *	Start a simple text-editor program used principally within shell scripts		ex *myfile.txt*
$ exit	Log out of shell (end session)		exit
$ fdformat	Low-level format a floppy disk (this won't create a file system; see also mkfs)		fdformat */dev/fd0*
# fdisk *	Dangerous! Hard disk partitioning program	-l: List partition table	fdisk */dev/hda*
$ fg	Bring job running in background to foreground		fg *1*

Command	Description	Typical Command Options	Examples of Use
`$ file`	Display information about specified file, such as its type		`file myfile`
`$ find *`	Find files by searching directories (starting in current directory)	`-maxdepth`: Specify the number of subdirectory levels to delve into, starting from 1 (current directory) `-name`: Specify name of file to search for `-type`: Specify file types to be returned; `-type d` returns directories, and `-type f` returns only files	`find -name "myfile"`
`$ free`	Display information about memory usage	`-m`: Show figures in MB `-t`: Total the columns at bottom of table	`free -m`
`# fsck *`	Check file system for errors (usually run from rescue disc)		`fsck /dev/hda1`
`$ ftp *`	FTP program for uploading/downloading to remote sites		`ftp ftp.mysite.com`
`$ fuser`	Show which processes are using a particular file or file system	`-v`: Verbose; detailed output	`fuser -v myfile`
`$ genisoimage *`	Create ISO image file from specified directory (usually for burning to disc with `wodim`)	`-o`: Options; this must appear after command to indicate that command options follow `-apple`: Use Mac OS extensions to make disc readable on Apple computers `-f`: Follow symbolic links and source actual files `-J`: Use Joliet extensions (make ISO compatible with Windows) `-R`: Use Rock Ridge extensions (preferred Linux CD-ROM file system) `-v`: Verbose; display more information (`-vv` for even more info)	`mkisofs -o isoimage.iso -R -J -v mydirectory`
`$ grep *`	Search specified file for specified text string (or word)	`-i`: Ignore uppercase and lowercase differences `-r`: Recursive; delve into subdirectories (if applicable) `-s`: Suppress error messages about inaccessible files and other problems	`grep "phrase I want to find" myfile.txt`
`# groupadd`	Create new group		`groupadd mygroup`
`# groupdel`	Delete specified group		`groupdel mygroup`
`$ groups`	Display groups the specified user belongs to		`groups myuser`
`$ gzip`	Compress files and replace original file with compressed version	`-d`: Decompress specified file `-v`: Verbose; display degree of compression	`gzip myfile`
`# halt`	Initiate shutdown procedure, ending all processes and unmounting all disks	`-p`: Power off system at end of shutdown procedure	`halt -p`

Continued

Table B-1. *Continued*

Command	Description	Typical Command Options	Examples of Use
# hdparm *	Dangerous! Tweak or view hard disk settings		hdparm */dev/hda*
$ head	Print topmost lines of text files (default is first 10 lines)	-n: Specify number of lines (such as -n 5)	head *myfile.txt*
$ help	Display list of common BASH commands		help
$ history	Display history file (a list of recently used commands)		history
$ host	Query DNS server based on specified domain name or IP address	-d: Verbose; return more information -r: Force name server to return its cached information rather than query other authoritative servers	host *82.211.81.166*
$ hostname	Display localhost-style name of computer		hostname
$ id	Display username and group info of specified user (or current user if none specified)		id *myuser*
# ifconfig *	Display or configure settings of a network interface (assign an IP address or a subnet mask, and activate/deactivate it)	down: Disable interface (used at end of command chain) netmask: Specify a subnet mask up: Enable interface (used at end of command chain)	ifconfig *eth0* *192.168.0.10* netmask *255.255.0.0* up
$ info *	Display info page for specified command		info *command*
# init	Change current run level		init *1*
$ jobs	Display list of jobs running in background		jobs
$ kill	Kill specified process		kill *1433*
$ killall	Kill process(es) that have specified name(s)	-i: Confirm before killing process -v: Verbose; report if and when successful	killall *processnumber*
$ last	Display details of recent logins, reboots, and shutdowns		last
$ ldd	Display system files (libraries) required by specified program		ldd */usr/bin/program*
$ less	Interactively scroll through a text file	-q: Quiet; disable beeps when end of file is reached or other error encountered -i: Ignore case; make all searches case insensitive unless uppercase letters are used	less *myfile.txt*
$ ln	Create links to specified files, such as symbolic links	-s: Create symbolic link (default is hard link)	ln -s *myfile1* *myfile2*
$ lpr	Print file (send it to the printer spool/queue)	-V: Verbose; print information about progress of print job	lpr *myfile.txt*

Command	Description	Typical Command Options	Examples of Use
$ lpstat	Display print queue		lpstat
$ ls	List directory	-a: List all files, including hidden files -d: List only directory names rather than their contents -h: Human readable; print figures in KB, MB, GB, and TB -l: Long list; include all details, such as file permissions -m: Show as comma-separated list	ls -h *mydirectory*
# lsmod	Display currently loaded kernel modules		lsmod
$ lsof	Display any files currently in use	-u: Limit results to files used by specified user	lsof -u *username*
$ man	Display specified command's manual		man *command*
$ md5sum	Display MD5 checksum (normally used to confirm a file's integrity after download)		md5sum *myfile*
# mkfs *	Dangerous! Create specified file system on specified device (such as a floppy disk)	-t: Specify type of file system	mkfs -t *vfat* */dev/fd0*
# modinfo	Display information about kernel module		modinfo *modulename*
# modprobe	Insert specified module into the kernel, as well as any others it relies on	-k: Set module's autoclean flag so it will be removed from memory after inactivity -r: Remove specified module as well as any it relies on to operate	modprobe *modulename*
$ more	Interactively scroll through text file (similar to less)		more *myfile.txt*
# mount *	Mount specified file system at specified location	-o: Specify command options, such as rw to allow read/write access; various types of file systems have unique commands	mount */dev/hda4* */mnt*
$ mv	Move (or rename) specified files and/or directories	-b: Back up files before moving -v: Display details of actions carried out	mv *myfile* *mydirectory/*
$ netstat *	Show current network connections		netstat -a
$ nice	Run specified command with specified priority	-n: Specify priority, ranging from the highest priority of –20, to 19, which is the lowest priority	nice -n *19*
$ nohup	Run specified command and continue to run it, even if user logs out		nohup *command*
$ passwd	Change user's password		passwd

Continued

Table B-1. *Continued*

Command	Description	Typical Command Options	Examples of Use
`$ ping`	Check network connectivity between local machine and specified address	`-w`: Exit after specified number of seconds (such as `-w 5`)	`ping` *`mydomain.com`*
`$ printenv`	Display all environment variables for current user		`printenv`
`$ ps *`	Display currently running processes	`a`: List all processes (note that command options don't require preceding dash) `f`: Display ownership of processes by using tree-style graphics `u`: Limit results to processes running for and started by current user `x`: Include processes in results not started by user but running with the user ID	`ps aux`
`$ pwd`	Display current directory		`pwd`
`# reboot`	Reboot computer		`reboot`
`$ renice`	Change a process's priority while it's running (see `nice`)		`renice` *`19 10704`*
`$ rm`	Delete single or multiple files and/or directories	`-r`: Recursive; delete specified directories and any subdirectories `-f`: Force; don't prompt for confirmation before deleting (use with care!)	`rm -rf` *`mydirectory`*
`# rmmod`	Delete module from kernel		`rmmod` *`modulename`*
`# route *`	Add and create (or view) entries in routing table (see `ifconfig`)		`route add default gw` *`192.168.1.1`*
`$ runlevel`	Display current run level		`runlevel`
`$ screen *`	Program that runs pseudo shell that is kept alive regardless of current user login	`-ls`: Display list of currently running screen sessions `-R`: Reattach to already running screen session or start new one if none available	`screen`
`$ sftp *`	Secure Shell FTP; like FTP but running over an `ssh` connection (see `ssh`)		`sftp` *`username@192.168.1.14`*
`$ shred`	Overwrite data in a file with gibberish, thereby making it irrecoverable	`-u`: Delete file in addition to overwriting `-v`: Verbose; show details of procedure `-f`: Force permissions to allow writing if necessary	`shred -fv` *`myfile`*
`$ sleep`	Pause input for the specified period of time (where `s` = seconds, `m` = minutes, `h` = hours, `d` = days)		`sleep` *`10m`*
`$ smbclient *`	FTP-style program with which you can log in to an SMB-based (Windows) file share		`smbclient` *`//192.168.1.1/`*

Command	Description	Typical Command Options	Examples of Use
`$ sort`	Sort entries in the specified text file (default is ASCII sort)		`sort` *`myfile.txt`* `-o` *`sorted.txt`*
`$ ssh *`	Log in to remote computer by using secure shell		`ssh` *`username@192.168.1.15`*
`$ startx`	Start GUI session (if GUI isn't already running)		`startx`
`$ su`	Temporarily log in as specified user; log in as root if no user specified (provided root account is activated)	`-`: Adopt user's environment variables, such as `$PATH`	`su`
`$ sudo`	Execute specified command with root privileges		`sudo` *`command`*
`$ tac`	Display specified text file but in reverse (from last to first line)		`tac` *`myfile.txt`*
`$ tail`	Display final lines of specified text file	`-n`: Specify number of lines to display (such as `-n4`)	`tail` *`myfile.txt`*
`$ tar *`	Combine specified files and/or directories into one larger file, or extract from such a file	`-c`: Create new archive `-j`: Use `bzip2` in order to compress (or decompress) files `-f`: Specifies filename (must be last in chain of command options) `-r`: Add files to existing archive `-x`: Extract files from existing archive `-z`: Use `gzip` to compress (or decompress) files	`tar -zcf` *`myfile.tar.gz mydirectory`*
`$ tee`	Display piped output and also save it to specified file		`ls -lh| tee` *`listing.txt`*
`$ top *`	Program that both displays and lets the user manipulate processes		`top`
`$ touch`	Give specified file current time and date stamp; if it doesn't exist, create a zero-byte file with that name		`touch` *`myfile`*
`$ tracepath`	Discover and display network path to another host		`tracepath` *`192.168.1.20`*
`$ umask`	Set default permissions assigned to newly created files		`umask u=rwx,g=r,o=`
`# umount`	Unmount a file system		`umount` *`/media/cdrom`*
`# useradd`	Add new user	`-m`: Create home directory for user	`useradd -m` *`username`*
`# userdel`	Delete all mention of user in system configuration files (effectively deleting the user, although files owned by the user might remain)	`-r`: Remove user's `/home` directory	`userdel -r` *`username`*

Continued

Table B-1. *Continued*

Command	Description	Typical Command Options	Examples of Use
`$ unalias`	Remove specified `alias`	`-a`: Remove all aliases (use with care!)	`unalias` *`command`*
`$ uname`	Display technical information about current system	`-a`: Display all basic information	`uname -a`
`$ unzip`	Unzip a Windows-compatible Zip file	`-l`: Display archive content but don't actually unzip	`unzip` *`myfile.zip`*
`$ uptime`	Display uptime for system, as well as CPU load average and logged-in users		`uptime`
`$ vim *`	Text editor program		`vim`
`$ wc`	Count the number of words in a file		`wc` *`myfile.txt`*
`$ whatis`	Display one-line summary of specified command		`whatis` *`command`*
`$ whereis`	Display information on where a binary command is located, along with its source code and man page (if applicable)	`-b`: Return information only about binary programs	`whereis -b` *`command`*
`$ xhost`	Configure which users/systems can run programs on the X server	`+`: When followed by a username and/or system name, gives the user/system permission to run programs on the X server; when used on its own, lets *any* user/system use the X server `-`: Opposite of `+`	`xhost +`
`$ xinit`	Start elementary GUI session (when not already running a GUI)		`xinit`
`$ zip`	Create Windows-compatible compressed Zip files	`-r`: Recursive; includes all subdirectories and files therein `-u`: Updates Zip with specified file `-P`: Encrypts Zip with specified password `-v`: Verbose; display more information `-#`: Set compression level (from 0, which is no compression, to 9, which is highest)	`zip -r` *`myfile.zip mydirectory`*
`$ zipgrep`	Searches inside Zip files for specified text string		`zipgrep "`*`search phrase`*`"` *`myfile.zip`*

APPENDIX C

Getting Further Help

So you've read through this book and have a good working knowledge of Linux. Ubuntu is running exactly as you want it to, and things are going okay. But then you hit a brick wall. Perhaps you want to perform a task but simply don't know how. Or maybe you know roughly what you need to do but don't know the specifics. Although this book tries to be as comprehensive as possible, it can't cover every eventuality.

You need to find some help, but where do you turn? Fortunately, many sources of information are available to those who are willing to help themselves. Linux contains its own series of help files in the form of man and info pages, and these are good places to start. In addition, some programs come with their own documentation. If neither of these sources provides the help you need, you can head online and take advantage of the massive Linux community around the world.

Read the Manual!

Before asking for help online, it's important that you first attempt to solve your problems by using Linux's built-in documentation. If you go online and ask a question so simple that it can be answered with a little elementary research, you might find people reply with *RTFM*. This stands for *Read the <expletive> manual*. In other words, do some basic research, and then come back if you're still stuck.

It's not that people online don't want to help. It's that they don't like people who are too lazy to help themselves and expect others to do the hard work for them. Although not all Linux people you encounter will take such a hard line, doing a little homework first can provide answers to a lot of questions, removing the need to ask others. This is particularly true when it comes to the fundamentals.

Documentation typically comes in three formats: man pages, info pages, and `README` files.

Man Pages

Man pages are the oldest form of Unix documentation. In the old days, after an individual had created a piece of software, he would write a brief but concise man page in order to give others a clue as to how to operate it. The programmer would come up with a few screens of documentation that could be called up from the command prompt. This documentation would outline what the software did and list all the ways in which it could be used.

Nowadays, depending on the software package, man pages are sometimes created by technical writers, but the concept of providing essential information still applies. Man pages under Linux provide all the information you need about how to use a particular command or piece of software.

Sounds great, doesn't it? Alas, there's a problem: man pages are written by software engineers *for* software engineers. They expect you to already understand the technology being discussed. This is illustrated very well by the man page for `wodim`, software that can be used to burn CD images to disc. You can view this man page by typing `man wodim` at the command prompt.

The first line of the man page states, "Wodim is used to record data or audio compact discs on an Orange Book CD-recorder or to write DVD media on a DVD-recorder."

Most of that is clear, but what do they mean by *Orange Book*? They don't explain. (If you're curious, head over to `http://searchstorage.techtarget.com/sDefinition/0,,sid5_gci503648,00.html`.)

Further down in the man page, you see, "Wodim is completely based on SCSI commands . . . Even ATAPI drives are just SCSI drives that inherently use the ATA packet interface as [a] SCSI command transport layer."

What's SCSI, or ATAPI for that matter? Again, the man page doesn't explain. (They're methods of interfacing with storage devices attached to your computer.)

But why should man pages explain as they go along? Their function is to describe how to use a piece of software, not to provide a beginner's introduction to technology. If they did that, a single man page could run to hundreds of pages.

In other words, man pages are not for complete beginners. This isn't always the case and, because Linux sees widespread usage nowadays, man pages are sometimes created with less knowledgeable users in mind. But even so, the format is inherently limited: man pages provide concise guides to using software. Luckily, there are some tips you can bear in mind to get the most from a man page. But before you can use those tips, you need to know how to read a man page.

How to Read a Man Page

To read a man page, you simply precede the command name with `man`. For example, to read the man page of `wodim`, a piece of software used to write ISO images to CD-R/RW discs, type the following command:

```
man wodim
```

This opens a simple text viewer with the man page displayed. You can use the cursor keys to move up and down line by line, or you can use the Page Up and Page Down keys (these are sometimes labeled Pg Up and Pg Down) to move page by page. You can search by hitting the forward slash key (`/`). This will highlight all instances of the word you type. You can search for other examples of the word in the document by pressing the N key (pressing Shift+N will search backward). The average man page will include many headings, but the following are the most common:

Name: This is the name of the command. There will also be a one-sentence summary of the command.

Synopsis: This lists the command along with its various command options (sometimes known as *arguments* or *flags*). Effectively, it shows how the command can be used. It looks complicated, but the rules are simple. First is the command itself. This is in bold, which indicates it is mandatory. This rule applies to anything else in bold: it must be included when the command is used. Anything contained within square brackets (`[ ]`) is optional, and this is usually where you will find the command options listed. A pipe symbol (`|`) separates any command options that are exclusive, which means that only one of them can be used. For example, if you see `[apple|orange|pear]`, only one of `apple`, `orange`, or `pear` can be specified. Usually at the end of the Synopsis listing will be the main argument, typically the file(s) that the command is to work on and/or generate.

Description: This is a concise overview of the command's purpose.

Options: This explains what the various command options do, as first listed in the Synopsis section. Bearing in mind that command options tell the software how to work, this is often the most useful part of the man page.

Files: This lists any additional files that the command might require or use, such as configuration files.

Notes: If this section is present (and often it isn't), it sometimes attempts to further illuminate aspects of the command or the technology the command is designed to control. Unfortunately, Notes sections can be just as arcane as the rest of the man page.

See Also: This refers to the man pages of other commands that are linked to the command in question. If a number appears in brackets, this means the reference is to a specific section within the man page. To access this section, type `man <section no> command`.

Although there are guidelines for the headings that should appear in man pages, as well as their formatting, the fact is that you may encounter other headings, or you may find nearly all of them omitted. Some man pages are the result of hours, if not days, of effort; others are written in 10 minutes. Their quality can vary tremendously.

Tips for Working with Man Pages

The trick to quickly understanding a man page is decoding the Synopsis section. If you find it helps, split the nonobligatory command options from the mandatory parts. For example, `wodim`'s man page says that you *must* specify the `dev=` option (it's in bold), so at the very least, the command is going to require this:

```
wodim dev=X <filename>
```

Then you should skip to the Options section and work out which options are relevant to your requirements. While you're there, you'll also need to figure out what the `dev=` command option requires.

Although the command options contained in square brackets in the Synopsis section are, in theory, nonobligatory, the command might not work satisfactorily without some of them. For example, with `wodim`, we use the `-speed` command option, which sets the burn speed, and also the `-v` option, which provides verbose output (otherwise, the command runs silently and won't display any information onscreen, including error messages!).

Another handy tip in decoding man pages is understanding what standard input and standard output are. In very simple terms, standard input (stdin) is the method by which a command gets input—the keyboard on most Linux setups. Standard output (stdout) is where the output of a command is sent, which is the screen on most Linux setups. (See Chapter 15 for more details about standard input and standard output.)

Often a man page will state that the output of a command will be sent to standard output. In other words, unless you specify otherwise, its output will appear onscreen. Therefore, it's necessary to specify a file to which the data will be sent, either by redirecting the output (see Chapter 17), or by using a command option to specify a file. For example, the `genisoimage` command can be used to create ISO images from a collection of files for subsequent burning to CD. But unless the `-o` option is used to specify a filename, `genisoimage`'s output will simply be sent to standard output—it will appear on the screen.

Finally, here's the best tip of all for using man pages: don't forget that `man` has its own man page. Simply type `man man`.

Info Pages

Man pages date from the days of relatively primitive computers. Back then, most computers could only display page after page of text and allow the user to scroll through it. In addition, memory and disk space were scarce, which is why some man pages are incredibly concise— fewer words take up less memory!

The *Texinfo* system is a valiant attempt by the GNU Project to overcome the shortfalls of man pages. Often this is referred to as *info*, because that's the command used to summon Texinfo pages (normally, you type `info command`).

For starters, info pages are more verbose than the equivalent man pages, and that gives the author more space to explain the command or software. This doesn't necessarily mean that info pages are easier to understand, but there's a better chance of that being the case.

Second, info pages contain hyperlinks, just like web pages. If you move the cursor over a hyperlinked word, which is usually indicated by an asterisk (*), you can proceed to a related page. In a similar sense, pages are linked together so that you can move back and forth from topic to topic.

The bad news is that the man page system is far more popular and established than Texinfo. A programmer who creates a new application, for example, will not likely bother with an info page but will almost certainly produce a man page.

In fact, in many cases, typing `info command` will simply bring up the man page, except in the software used to browse info pages.

However, nearly all the GNU tools are documented by using info pages, either in their own pages or as part of the `coreutils` pages. For example, to read about the `cp` command and how to use it, you can type this:

```
info coreutils cp
```

To browse through all sections of the `coreutils` pages, type this:

```
info coreutils
```

Because man pages are so established, everyone expects to find one for every utility. So most utilities that have info pages will also have man pages. But in such a case, the man page will state near the end that the main documentation for the utility is contained in an info page, and you may find it more fruitful to use that instead.

Navigating through info pages is achieved via the keyboard and is something of an art. But, as you might expect, there's a user-friendly guide to using info: just type `info info`. Remember that words preceded with an asterisk are hyperlinks, and you can jump from link to link by using the Tab key.

README Files and Other Documentation

Some programs come with their own documentation. This is designed to give users the information they need to get started with the program (as opposed to the man page, which is a concise and complete guide to the software). Alternatively, program documentation sometimes gives a brief outline of the program's features.

The files are usually simple text, so they can be read in any text editor or word processor, and are typically called `README`. Under Ubuntu, these documents are usually stored in a program-specific directory within `/usr/share/doc` (although a small minority of programs use `/usr/doc`).

Not all programs are friendly enough to provide such documentation, but even so, you'll still find a directory for the software in /usr/share/doc. This is because the software might also come with a getting started guide written by the Ubuntu package maintainer. Such guides detail specifics of using the software under Ubuntu, such as where configuration files are located or how the program interoperates with other software on the system. Sometimes this documentation is written by a Debian package maintainer because nearly all Ubuntu software has its origins in the Debian project (www.debian.org).

In addition, the directory will probably contain copyright information, explaining the software license used by the software, as well as a CHANGELOG, which is a text file listing features that have been added to each release of the software. The directory might contain some other files too, detailing where to send information about bugs, for example.

Viewing the README documentation is easy. For example, for the sudo command, you could type this:

```
cd /usr/share/doc/sudo
less README
```

Sometimes the README documentation is in a compressed tarball, in which case it will have either a .tar.gz or a .tar.bz2 file extension. However, less is clever enough to realize this and extract the document for reading.

Getting Help Online

If you can't figure out the answer by referring to the documentation, there's little choice other than to look online. Linux benefits from a massive community of users, all of whom are usually willing to help each other.

The best way of getting help is to visit a forum. There you can post messages for others to reply to. Alternatively, you might choose to sign up for a mailing list. This is a way of sending e-mail to several hundreds, if not thousands, of people at once. Any individual can then reply. Mailing lists often have the benefit of allowing personal attention and interaction, but this comes at the expense of each subscriber receiving a whole lot of mail.

Forums

The official Ubuntu project forums are located at www.ubuntuforums.org. You'll find forums for just about every need, from security to beginner's issues, but by far, the most popular is the one devoted to the current release of Ubuntu. Look in the General Help forum if your question isn't specifically related to one of the other technology areas listed.

Before you can post, you need to register by providing an e-mail address. This is designed to keep down the quantity of unwanted junk postings to the forum.

You might think it fine to post a new question immediately after registering, but don't forget the simple rules mentioned at the beginning of this appendix: if you don't do elementary research first and try to solve your own problem, you may elicit a hostile response from the other posters, especially if your question is one that comes up time and time again and has been answered several times.

So, first use the comprehensive search facility provided with the forums. For example, if you're looking for advice on getting a Foomatic D1000 scanner working, use this as a search term and see what comes up. The chances are that you won't be the first person who has run into problems with that piece of hardware, and someone else may have already posted a solution.

Often you'll need to read the full thread to find an answer. Someone may start by asking the same question as you but, with the help and guidance of the forum members, might find a solution, which is then posted several messages later.

In addition, some individuals write their own HOWTO guides when they figure out how to do something. These are normally contained in the Tutorials & Tips forum, under the Other Community Discussions heading.

If you're unable to find a solution by searching, consider posting your own question. Keep your question simple, clear, and concise, because no one likes reading through acres of text. If possible, provide as many details about your system as you can. You will almost certainly want to provide the version number of the Linux kernel you're using, for example. You can find this version number by typing the following in a GNOME Terminal window:

```
uname -sr
```

In addition, any other details you can provide may prove handy. You definitely should mention the version of Ubuntu you're using, which is Jaunty Jackalope (often referred to simply as *Jaunty*). If you're asking about hardware, give its entire model name and/or number. Don't just ask for help with a Foomatic scanner. Ask for help with a Foomatic D1000 scanner, model number ADK1033, Revision 2. If you're asking about a piece of software, provide its version number (click Help ➤ About).

Sometimes in their replies, other forum members may ask you to post further details or to provide log files. If you don't understand the question, simply ask the poster to give you more details and, if necessary, instructions on what to do. Just be polite. Explain that you're a newbie. If you think the question is extremely obvious, say so—apologize for asking what may be a stupid question, but explain that you've tried hard to answer it yourself but have failed. Don't forget that the Ubuntu forums include the Absolute Beginner Talk forum, where fundamental questions are asked all the time.

Mailing Lists

Using the forum's search function also has the advantage of searching the archives of the mailing lists.

Mailing lists have a number of advantages and disadvantages. The advantages are that a mailing list provides an excellent way to learn about Ubuntu. All you have to do is read through the e-mail messages you receive in order to partake of a constant information drip-feed. In addition, some mailing lists are designed to make public announcements, so you'll find it easy to learn about the latest happenings in the Ubuntu community.

Mailing lists also have a terrific sense of community. They offer a neat way of getting to know other Ubuntu users and talking to them. E-mails often drift off-topic into humor and general discussion.

The disadvantages of mailing lists are that you can easily receive in excess of 200 messages a day, depending on which mailing list you join (although you can also opt to receive period digests of recent messages; these arrive in the form of a single daily, weekly, or monthly e-mail). Even if you have a moderately fast Internet connection, that quantity of messages can take a long time to download. In addition, you'll need to sort out any personal or business e-mail from the enormous quantity of mailing list traffic (although the mailing list messages usually have the list title in square brackets in the subject field; you can therefore create a mail rule that sorts the mail according to this).

You can learn more about the Ubuntu mailing lists at `https://lists.ubuntu.com`.

Other Official Sites

The Official Ubuntu Documentation is an ongoing community effort to create simple and effective instructions on the use of Ubuntu. In truth, there is nothing presently on the site that isn't already described in this book, so its usefulness for you is limited, but it might be ideal to send the link to a friend or relative who's new to Ubuntu. In addition, you might want to take a look at the Ubuntu wiki: `https://wiki.ubuntu.com`. Once again, this is largely community generated. It contains a whole world of fascinating information about Ubuntu but can be somewhat difficult to navigate and tends to be aimed at higher-level Ubuntu users, such as developers. However, it's an excellent place to learn "off-the-wall" Ubuntu knowledge, such as how to get Ubuntu working with particular hardware.

Third-Party Sites

Of course, the Ubuntu project doesn't have a monopoly on sites that discuss Ubuntu. Several third-party web sites are worth at least an occasional visit, and other forum web sites are devoted to Linux.

One we visit on a regular basis is the Ubuntu Geek blog: `www.ubuntugeek.com`. Written by a team of dedicated Ubuntu experts, this blog is packed full of tips for all levels of

Ubuntu users. In addition, we like to visit `http://linuxhelp.blogspot.com`, which is a similar blog written by a Linux user who uses Ubuntu and likes to share tips and techniques.

Perhaps the king of third-party Ubuntu sites is Ubuntu Guide: `http://ubuntuguide.org`. This contains brief instructions on how to do a variety of common tasks under Ubuntu, such as installing certain types of software or administering particular hardware. It covers a lot of the same ground as this book, but is still worth investigating if you wish to browse through some excellent tips and advice.

Finally, one of the best Linux forums and general advice sites can be found at `www.linuxquestions.org`. This has a forum dedicated specifically to Ubuntu but also contains hundreds more devoted to just about every aspect of Linux, including forums for beginners.

APPENDIX D

Exploring the DVD-ROM and Other Ubuntu Versions

The DVD-ROM supplied with this book contains the main Ubuntu 9.04 release (Jaunty Jackalope), along with sister versions of Ubuntu that use different desktop environments, including Kubuntu, Xubuntu, and Edubuntu. Additionally, we have included the older 8.04.02 Long-Term Support (LTS) release, and the alternate installer version of Ubuntu, which can be useful if your PC hardware is incompatible with the main Ubuntu installation routine.

This appendix provides details about the many and varied Ubuntu derivations, along with instructions on how to utilize them.

Version Numbers, Code Names, and Support

Each version of Ubuntu has a version number and a code name. The version number is simply the year of release, followed by the month. The release made in April 2008 has the version number 8.04, for example.

The code name is how Ubuntu is referred to informally, especially among community members, and is set by Mark Shuttleworth, the creator of Ubuntu. Code names tend to involve animals and are usually humorous. The 6.06 version of Ubuntu was code-named Dapper Drake, for example. The 8.04 release was code-named Hardy Heron. People often just use the first word of the code name, especially on Internet forums. For example, the 8.04 release is often referred to as *Hardy*.

This book was written using version 9.04 as a base. This version was released in April 2009. It was the most recent version at the time of this writing.

Each successive version of Ubuntu brings improvements, such as newer versions of software packages. However, not all versions of Ubuntu are created equal when it comes to online updates, as provided by the Update Manager program. All versions of Ubuntu come with free software updates for a set period, usually 18 months, after which users are expected to upgrade (for free) to the most recent version at that time.

However, the 6.06 release from three years ago and the 8.04 release also have the epithet LTS, which stands for *Long-Term Support*. The freely available software updates for 8.04 will last until 2011, some three years after the initial release. Support for the 6.06 release expired in early 2009. LTS releases are made approximately every two years.

Note If you use the Ubuntu 8.04 or 6.06 release on a server system, support will last for five years.

The intention behind the Long-Term Support releases is that they should be used by those who want a proven and stable Linux operating system, and don't care about newer features in the latest releases of Ubuntu. For example, in a corporate environment, some of the new features provided in more recent versions of Ubuntu might require additional staff training, so an unchanging release may prove appealing.

UPDATING TO A NEWER VERSION OF UBUNTU

Ubuntu works to a six-month release cycle, and this means a new version of Ubuntu comes out every half year. By the time you read this, a new release of Ubuntu may be available, and you might choose to update to it.

You can update to a newer version of Ubuntu in two ways: by burning the ISO image to a CD or by upgrading online.

You can download the ISO image of the latest release from `www.ubuntu.com/getubuntu/download` and burn it to CD. Then insert the CD when Ubuntu is up and running. You'll be asked whether you want to upgrade to the latest version using the Synaptic Package Manager. This process is automated. Of course, you can then use the same CD to install Ubuntu afresh on any other computer.

To upgrade online, open a terminal window (Applications ➤ Accessories ➤ Terminal) and type the following two lines, pressing Enter after each one:

```
sudo apt-get update
sudo apt-get dist-upgrade
```

This will download all the packages for the latest release of Ubuntu, if one is available, and attempt to update your system. Updating in this way involves less downloading, because your computer will get only the packages it needs, although it's still likely that several hundred megabytes will need to be downloaded.

Often when a newer version of Ubuntu becomes available, you may find a pop-up window appearing, asking whether you want to upgrade. In this case, upgrading is as simple as agreeing to the prompts and using Update Manager to complete the procedure. You will have to reboot when the upgrade has finished.

Other Versions of Ubuntu

In addition to the main Ubuntu releases, several Ubuntu derivations are available. You might refer to these as *spin-off projects*. They are created by taking the main Ubuntu release as a base and then adding software, usually in the form of an alternative desktop environment. Some support alternative hardware platforms but are otherwise identical to the main release.

Some spin-off projects are officially sponsored, which is to say they are developed as part of the wider Ubuntu project, and development work on them is paid for by Canonical, the corporate sponsor of Ubuntu. However, others are strictly community projects, developed largely by enthusiasts. Some of their software packages might be found in the Universe software repositories, however. This section describes how to install the Ubuntu derivatives that are included on the DVD-ROM disc supplied with this book. It then provides some details about the Kubuntu, Xubuntu, and Edubuntu versions. Table D-1 lists the major Ubuntu projects at this time.

Table D-1. *Versions of Ubuntu*

Ubuntu Derivation	Description	Officially Supported?
Kubuntu	Same as the main Ubuntu release, except that it uses the KDE desktop (`www.kde.org`). This is included as an ISO image on the DVD-ROM that comes with this book (`kubuntu-kde-9.04-desktop-i386.iso`).	Yes
Xubuntu	Same as the main Ubuntu release, except that it uses the Xfce Desktop Environment (`www.xfce.org`). This is included as an ISO image on the DVD-ROM that comes with this book (`xubuntu-9.04-desktop-i386.iso`).	Yes
Edubuntu	Same as the main Ubuntu release but with a child-friendly interface along with the addition of some educational software. This is included as an ISO image on the DVD-ROM that comes with this book (`edubuntu-9.04-addon-i386.iso`).	Yes
Ubuntu alternate installer	Same as the standard release of Ubuntu but employs a text-mode installer that can help bypass some graphical problems. This is included as an ISO image on the DVD-ROM that comes with this book (`ubuntu-9.04-alternate-i386.iso`).	Yes
Ubuntu x86-64	Same as the main Ubuntu release but compiled for computers with 64-bit processors[a]	Yes
Ubuntu PowerPC	Same as the main Ubuntu release but compiled for computers with PowerPC processors, such as G3, G4, or G5 chips, typically found in older Apple Macintosh computers. To download the ISO image, visit `http://cdimage.ubuntu.com/ports/releases/9.04/release/`.[b]	No

Continued

Table D-1. *Continued*

Ubuntu Derivation	Description	Officially Supported?
Mythbuntu	Version of Ubuntu designed for computers containing TV/video processing cards. It is built around the MythTV digital video recording software, and features the Xfce Desktop Environment. For more details, and to download the project ISO image, visit `www.mythbuntu.org`.	No
Gobuntu	Almost identical to the main release of Ubuntu, although this release features only software that strictly follows the letter and spirit of the GNU Public License and the GNU philosophy. To this end, proprietary hardware drivers are not included. For more details, see `www.ubuntu.com/products/whatisubuntu/gobuntu`.	Yes [c]
Ubuntu Server	A release of Ubuntu designed for server computers. To this end, it includes software for easy installation of the Apache web server, for example, or the Samba file server software. It does not feature a graphical user interface, although it shares the same repositories as the main release, so a GUI can be added in later. For more details, see `www.ubuntu.com/products/whatisubuntu/serveredition`.	Yes
Mobile Internet Device (MID)	A special version of Ubuntu designed for handheld or ultra-portable devices. To this end, it features special graphical interface software that works well on lower-resolution screens. For more details, see `www.ubuntu.com/products/mobile`.	Yes
JeOS	Experimental release of virtualized server appliances, a specialist area of industrial-grade computing. For more information, see `www.ubuntu.com/products/whatisubuntu/serveredition/jeos`.	Yes
Ubuntu Studio	A version of the standard Ubuntu release that includes multimedia editing tools. For more information, see `http://ubuntustudio.org`.	No

[a] *As the filename suggests, this release will work only on 64-bit chips that support the AMD64 or EM64T/Intel 64 extensions. Intel's Itanium (IA-64) chips are no longer supported in any capacity, although a community-supported 8.04 release for Itanium chips can be downloaded from `http://cdimage.ubuntu.com/ports/releases/8.04/release/`.*

[b] *The PowerPC release of Ubuntu is not officially supported. Updates are provided by its community of users.*

[c] *At the time of writing, Gobuntu is in limbo and will probably be merged into the similar Free Software Foundation's gNewSense project: `http://gnewsense.org`.*

Installation of Other Versions

Several of the Ubuntu derivatives are included in the DVD-ROM disc supplied with this book, as follows:

- Kubuntu
- Xubuntu
- Edubuntu
- Alternate installer disc

They are included on the disc in the form of *ISO images*. These are single files that contain the entire contents of the bootable installation CDs. They're designed to be burned to blank CD-R or CD-RW discs, and the user then installs from the disc. The ISO images are contained in the `Ubuntu alternatives` folder. If you want to install Kubuntu, Edubuntu, or Xubuntu, you have two options:

- Start afresh, by burning a CD from the ISO image and installing from it. To learn how to do this on most major operating systems, see the "Creating Bootable CDs from ISO Images" section later in this appendix. See Table D-1 for the filename of the ISO image for each version.
- Upgrade from an existing installation of Ubuntu by using the Synaptic Package Manager.

To install each version alongside the current desktop, you'll need to search for and install a particular metapackage by using the Synaptic Package Manager (see Chapter 28 for details on using the Synaptic Package Manager):

- For the main Kubuntu release, install the `kubuntu-desktop` package. During installation of Kubuntu, you will be prompted for which login manager you wish to use. It's a good idea to stick with `gdm` (GNOME Display Manager), which is the default choice.
- For Edubuntu, choose to install the `edubuntu-desktop` package. There are two versions of Edubuntu: the default based on the GNOME desktop and another based on the Kubuntu desktop. You can choose either from the list of results in the Synaptic Package Manager.
- For Xubuntu, install `xubuntu-desktop`. This is a metapackage that ensures all the Xfce desktop components are installed alongside the current desktop environment.

Kubuntu

The standard Ubuntu release, as supplied with this book, relies on the GNOME Desktop Project for its graphical interface (see `www.gnome.org`). Many other desktop projects exist in the wider Linux world, but perhaps the only one that ranks alongside GNOME in terms of popularity is the K Desktop Environment project (`www.kde.org`), usually referred to as KDE (see Figure D-1). Kubuntu is simply a version of Ubuntu that eschews GNOME in favor of KDE.

Kubuntu (`www.kubuntu.org`) retains the same philosophy as Ubuntu, in both its humanitarian aims of being available to all, as well as its more pragmatic aspects, such as always including the latest versions of applications. It also shares many technical features, such as the use of `sudo` to invoke superuser powers.

■ **Note** Rather than use `gksu` to invoke `sudo` powers for graphical applications, Kubuntu uses `kdesu`. It's used in the same way, however.

The main difference is the software bundled with this variant. When it comes to e-mail, KDE's KMail program is used instead of Evolution, for example, and Konqueror is used for web browsing instead of Firefox (although, of course, Evolution and Firefox can easily be installed via the Synaptic Package Manager after Kubuntu has been installed). Additionally, the Dolphin file manager is used instead of Nautilus. The system configuration software is radically different too, with several KDE tools used instead of the GNOME software described in this book. However, most work in a broadly similar way.

After the Kubuntu components have been installed, as described in the previous section, you can opt to boot into Kubuntu by clicking the Options button on the login screen and clicking the Select Session entry. Then select the KDE entry and click the Change Session button. You'll be asked whether you want to always boot into KDE, or just this time. If you select to always boot into KDE but decide to boot into GNOME subsequently, repeat these steps and select GNOME from the list.

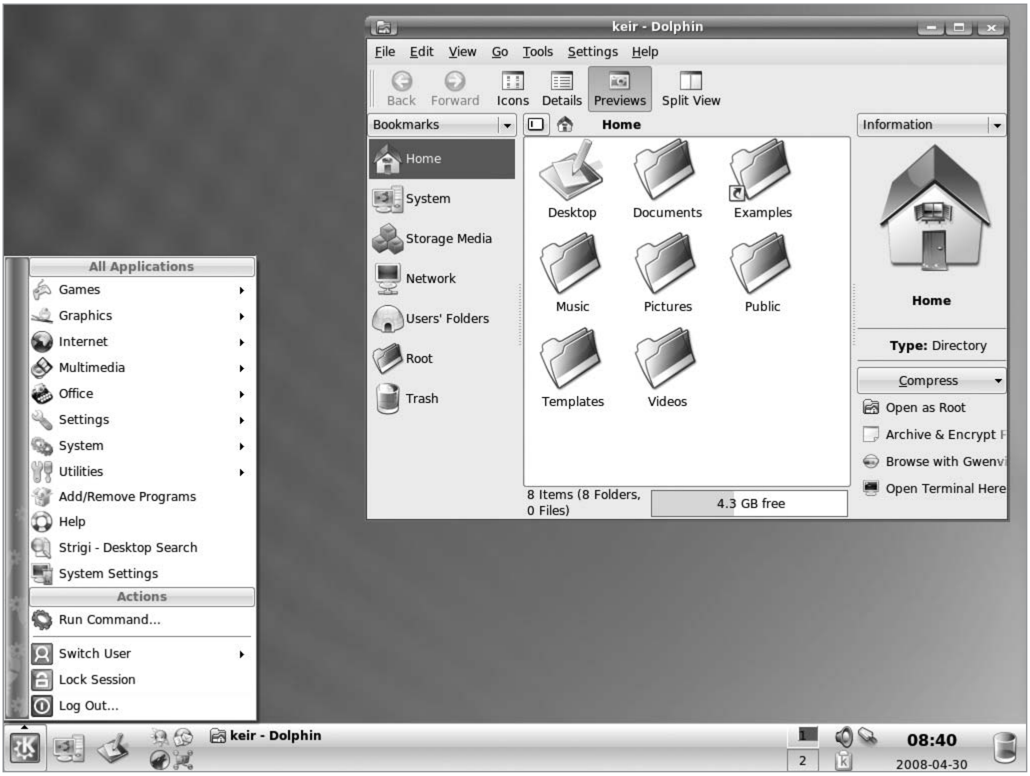

Figure D-1. *Kubuntu 9.04*

Edubuntu

The Ubuntu philosophy is to make an operating system accessible to everyone, no matter who they are or where they live in the world. Of course, young people are included in this vision, and Edubuntu (`www.edubuntu.org`) is a version of Ubuntu specifically geared toward their needs. This rendition of the standard Ubuntu release has been bolstered by many educational software titles as well as classroom management software, which makes administrating many classroom computers easier for teachers.

In addition, Edubuntu has a friendlier and simpler interface that's designed to appeal to youngsters, although it still utilizes the same desktop environment as the main Ubuntu release. Actually, two versions are available: one that uses the same GNOME desktop as the main release, as shown in Figure D-2, and another that is built on the KDE desktop of Kubuntu.

Edubuntu also features software from the Linux Terminal Server Project (`www.ltsp.org`). This brings the potential for computers without a hard disk to boot Edubuntu from a central server. The intention is to give older computers (unfortunately, the type typically found in educational environments) a new lease on life, even if they're too underpowered to run modern software. Additionally, the terminal server can be used to administer the computers, which is clearly beneficial in a teaching environment. For information on how to set up a Linux Terminal Server Project system, see `https://help.ubuntu.com/community/LTSPServerSetup`.

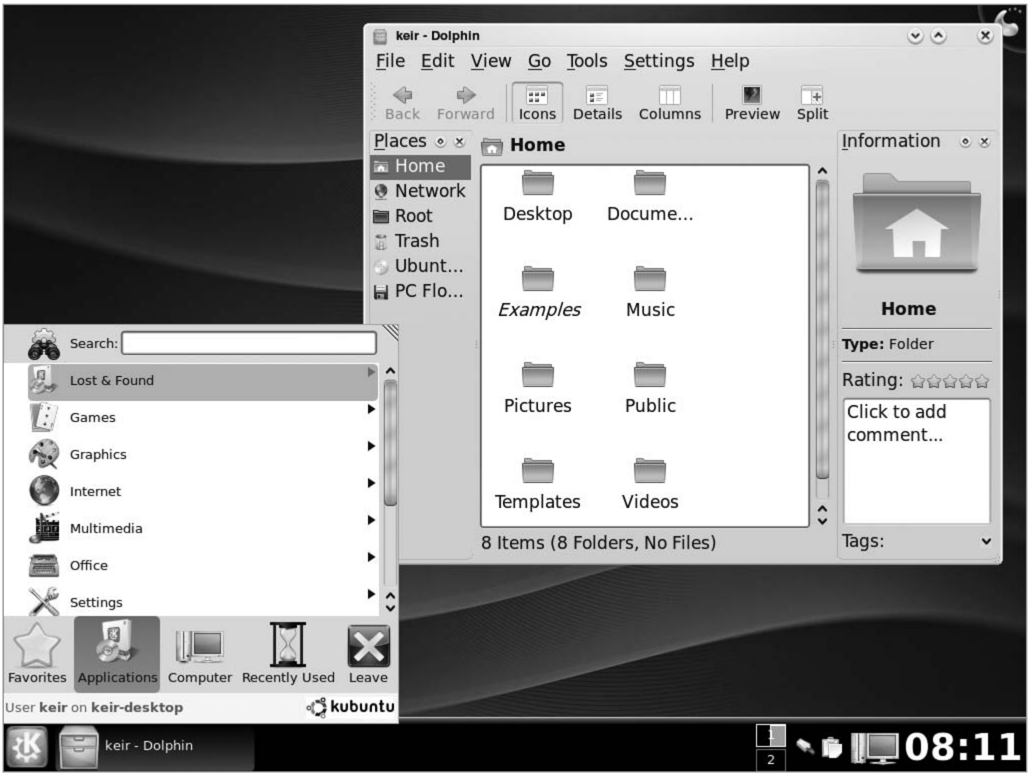

Figure D-2. *Edubuntu 9.04 (GNOME desktop version)*

However, the standard installation of Edubuntu is just like any other Ubuntu configuration, and the software is designed to be installed directly on the hard disk of computers. The following are the chief education titles provided with Edubuntu:

- KDE-Edu programs (`http://edu.kde.org`) include games involving mathematics, languages, science, and other miscellaneous topics. Teachers might also appreciate the inclusion of KEduca, a program designed to create form-based tests and exams.
- GCompris (`http://gcompris.net`) is for children of kindergarten age and introduces them to computer use as well as elementary math and reading skills.
- Tux Paint (`www.tuxpaint.org`) is a user-friendly drawing package full of sound effects and colorful graphics.

The main benefit of Edubuntu for educational establishments is that it's both free of charge and comes with the same kind of update support as Ubuntu. This provides a consistent experience for students and teachers alike.

Because Edubuntu is built on the Ubuntu base, there is no way to "switch between" Edubuntu and Ubuntu. Effectively, Edubuntu is a reconfiguration of Ubuntu with the addition of some educational software and a more kid-friendly theme. To return to a standard Ubuntu setup and deactivate the Edubuntu theme, simply select the Human entry within the Appearances Preferences dialog box. See Chapter 10 for more details on how to switch themes.

Xubuntu

While GNOME and KDE dominate the desktop interface landscape of Linux and are used in the main Ubuntu and Kubuntu releases, respectively, other projects take a different approach to the graphical desktop. The Xfce Desktop Environment (`www.xfce.org`) is one of these. It's a streamlined desktop that retains the good looks of GNOME but is much smaller in terms of memory footprint. This means that a system running Xfce is faster than an equivalent GNOME system. It also means that Xfce can be used on many older computers that don't have the powerful hardware we take for granted nowadays and would struggle with the latest GNOME and KDE releases of Ubuntu.

Because a key component of the Ubuntu Foundation's philosophy is to create an operating system that can be used by everyone, regardless of where they are in the world, a version of Ubuntu that can run on older hardware makes a lot of sense. It's unlikely that less-developed countries will have access to the latest expensive computer hardware, for example.

As you might expect, Xubuntu (`www.xubuntu.org`) is simply a version of Ubuntu that replaces the GNOME desktop with the Xfce desktop, as shown in Figure D-3. Some key components are still present, such as the Firefox web browser. Other Ubuntu components are swapped for Xfce replacements; for example, the Nautilus file browser is replaced with Thunar.

Despite Xfce's claim to be lightweight, it still offers a high degree of usability and shouldn't be seen as a second-best choice for stripped-down hardware. It's certainly worth trying out if you long for a less cluttered desktop experience. It also uses many modern GUI aspects we take for granted, such as theming (see Chapter 10) and font antialiasing.

To use the Xfce desktop after it's installed, click the Options button on the login screen and then click the Select Session entry. Next, select Xfce from the list and click the Change Session button. To boot to the standard Ubuntu desktop after this, simply repeat the steps and select GNOME from the list.

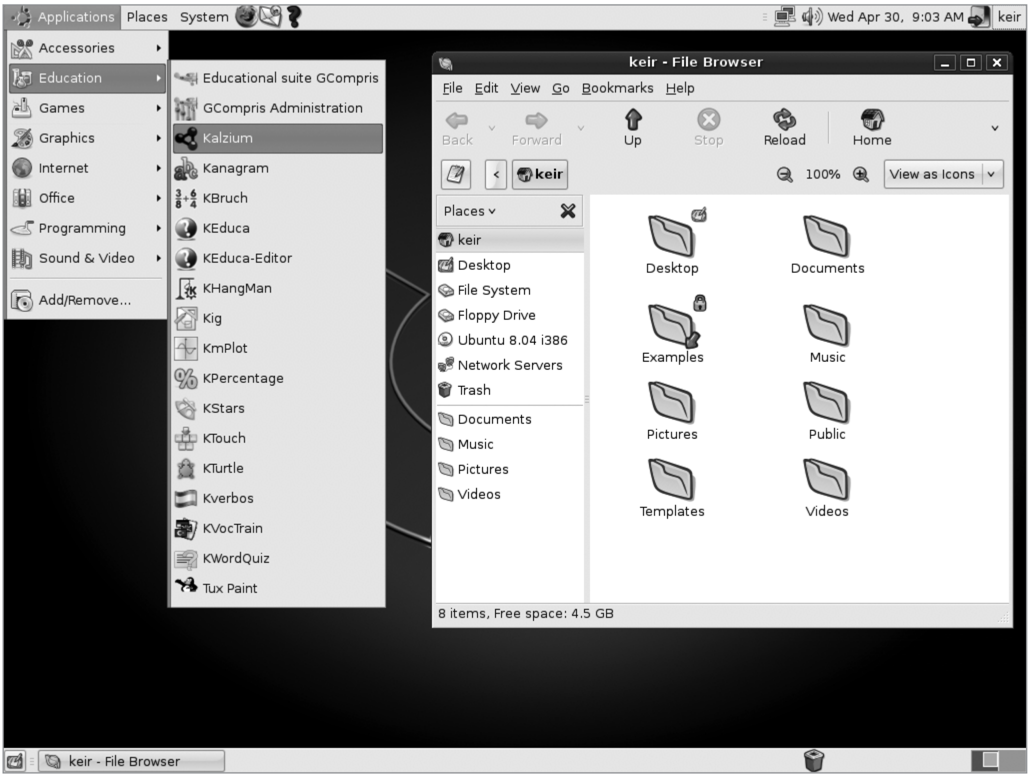

Figure D-3. *Xubuntu 9.04*

Creating Bootable CDs from ISO Images

The Ubuntu derivatives can be found in the `Ubuntu alternatives` folder on the DVD-ROM disc attached to this book. It should be obvious from the individual filenames what each ISO file contains, but you can also consult Table D-1.

ISO images are designed to be burned to blank CD-R or CD-RW discs that you boot from in order to install the operating system, just as you booted from the DVD-ROM to install Ubuntu. Alternatively, you can use an ISO image to install the operating system on virtual machines.

Of course, to burn ISO images to CD, you'll need a CD or DVD drive capable of burning discs. These have been available for many years and are standard features on nearly all desktop and notebook computers. You'll also need a blank CD-R or CD-RW disc and perhaps one or two spares in case your first attempt doesn't work. If you opt to use CD-RW discs, these should be blanked prior to use. This can be done with most CD-burning software.

A few rules should be followed whenever burning ISO images:

- Copy the ISO image to your computer's hard disk. Don't try to burn an ISO image directly from a DVD/CD or a network share. The burning software requires quick access to the ISO file, and this isn't possible when it's not on your hard disk.
- Always burn at the slowest speed possible, even if your CD/DVD burner is capable of much faster speeds. For some reason, ISO images burned quickly onto discs often fail to work. Even worse, sometimes the discs appear to work until it becomes apparent that one particular file is corrupted and the installation halts.
- It's not a good idea to use your computer for heavy tasks while burning ISO images. You should refrain from game playing or video editing, although light computer use should be fine (that is, word processing, web browsing, and so on).

The instructions in the following sections describe how to burn ISO images to CDs when using Ubuntu, Windows, and Mac OS X.

DECODING ISO FILENAMES

ISO filenames for Linux distributions can be a little hard to understand, so here's a quick guide. Let's take the Xubuntu 9.04 ISO filename as a guide. Here it is:

```
xubuntu-9.04-desktop-i386.iso
```

This filename consists of four main parts:

- The first part is the name of the distribution. In this case, it's `xubuntu`, but this could read `edubuntu` or just `ubuntu`, for example.
- The second part is the version number of the distribution—9.04.
- The third part is the platform for which the distribution is designed. In this case, this version of Xubuntu is designed for the `desktop`, but this could read `server` or `alternate`, to indicate an alternate install disc.
- The final part, before the `.iso` file extension, is a description of the computer architecture for which the distribution is made. `i386` means the distribution will run on all 32-bit PCs (which is to say, every computer made since around 1990). You might also see `amd64` here, which means the distribution is designed to work on 64-bit processors, such as recent Intel Pentium 4 and AMD Athlon 64–based computers. If you see `PowerPC` here, it means the distribution is designed to run on PowerPC-based computers, primarily older Apple Macintoshes.

Burning CDs Using Ubuntu

Here are the steps for burning CDs from ISO images when using Ubuntu:

1. Copy the ISO image to the desktop.
2. Right-click the image on the desktop and select Write to Disc from the menu that appears.
3. A new dialog box appears. In the Write Speed drop-down list, select the lowest value possible (if you don't see a Write Speed drop-down list, click the Properties button). If you have more than one CD/DVD writer drive installed on your computer, ensure that the correct model is selected from the Write Disc To list.
4. Insert a blank CD-R or CD-RW.
5. Click the Write button to create the CD.

Burning CDs Using Windows Vista/XP

Unlike Ubuntu and Mac OS X, Windows Vista and XP don't contain any built-in ISO burning software. For the purpose of burning ISO images, we recommend that you download and install the freeware ISO Recorder tool from `http://isorecorder.alexfeinman.com/isorecorder.htm`. Versions are available for both Windows XP and Vista. The following are the steps for burning CDs from ISO images when using the Windows XP version of ISO Recorder:

1. Copy the ISO file to your desktop.
2. Insert a blank CD-R or CD-RW disc into your drive.
3. Right-click the `.iso` file on the desktop, select Open With, and then select ISO Recorder from the list.
4. The ISO Recorder program window opens. Click the Properties button.
5. Click and drag the recording speed slider so that the middle number under the slider is 1 (or to the lowest possible number if 1 isn't available). Click OK in the Properties dialog box.
6. Click the Next button in the main ISO Recorder program window. This will start the burning procedure, which might take some time, during which you should avoid using your PC.

Burning CDs Using Mac OS X

Here are the steps for burning CDs from ISO images when using a Mac OS X system:

1. Copy the ISO file to the desktop.
2. Insert a blank CD-R or CD-RW disc.
3. In Finder, click Applications ➤ Utilities ➤ Disk Utility.
4. When the program starts, click Images ➤ Burn.
5. Navigate to the ISO file on the desktop, and then click the Burn button in the dialog box that appears.

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