

CHRISTOPHER NEGUS

UBUNTU[®] LINUX[®]

TOOLBOX

2nd
Edition

1000+
Commands
for Ubuntu and
Debian[®] Power Users

WILEY

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Introduction

The huge, enthusiastic Ubuntu community has swept up thousands and thousands of new Ubuntu Linux users. If you are one of them, you will probably soon find yourself wanting to dig beneath the surface of Ubuntu's applications and graphical tools. You'll want to become a power user.

Becoming a power user with any Linux system means being able to work from the command line. Few graphical interfaces will provide you with the options and flexibility you get with commands that address the same features.

Ubuntu Linux Toolbox provides you with more than 1000 specific command lines to help you dig deeply into Linux. Whether you are a systems administrator or desktop user, the book will show you the commands to create file systems, troubleshoot networks, lock down security, and dig out almost anything you care to know about your Linux system.

This book's focus for your Linux command-line journey is Ubuntu, the community-based Linux distribution sponsored by Canonical Ltd., and the Debian GNU/Linux system on which it is based. Tapping into the skills required to run those systems can help you to work with your own Linux systems as well as learn what you need to do as a Linux professional.

Ubuntu Takes Linux by Storm

Since its inaugural release in 2004, Ubuntu (www.ubuntu.com) has become the most popular and arguably, best loved of the Linux distributions. From its name, which translates to *humanity towards others*, to its focus on support for many languages and special needs, Ubuntu has reflected its ideals of spreading free software beyond the standard Linux target markets of geeks and corporate servers.

The Ubuntu project does everything it can to help ease new users into using its Linux-based Ubuntu operating system. Ubuntu live CDs let a new user try out Ubuntu before installing it. If the user likes Ubuntu, a single click can start an Ubuntu install to hard disk. And because Ubuntu is based on Debian GNU/Linux, Ubuntu has made massive amounts of software from the Debian software repositories available free to Ubuntu users.

Although it's true that Ubuntu focuses on ease-of-use desktop systems, that doesn't mean Ubuntu has no commercial Linux value. In fact, Canonical offers paid enterprise-quality support through its Landscape initiative (www.ubuntu.com/management). Canonical also offers a range of free and paid support options for individuals and small businesses (www.ubuntu.com/support). In other words, there are professional opportunities for those who learn to operate Ubuntu.

Who Should Read This Book

This book is for anyone who wants to access the power of a Linux system as a systems administrator or user. You may be a Linux enthusiast, a Linux professional, or possibly a computer professional who is increasingly finding the Windows systems in your data center supplanted by Linux boxes.

The bottom line is that you want to find quick and efficient ways of getting Ubuntu and other Debian-based systems working at peak performance. Those systems may be a few desktop systems that work, a file and print server at your school, or a home web server that you're doing just for fun.

In the best case, you should already have some experience with Linux. However, if you are

computer professional with skills managing other types of operating systems, such as Windows, you can easily adapt your knowledge to use the specific commands I cover in the book.

What This Book Covers

This is not a beginner's Linux book. Before you jump in, it would be best if you have a basic working knowledge of what Linux is, how the shell works, and what processes, filesystems, and network interfaces are. The book will then supplement that knowledge with information you need to do the following activities:

- **Get software**—Ubuntu offers the Ubuntu Software Center GUI tool for getting software. With tools such as `apt-get`, you'll learn the best ways to search for, download, install, update, and otherwise manage software from the command line.
- **Use the shell**—Find neat techniques and tips for using the shell.
- **Play with multimedia**—Play and stream multimedia content from your computer. You can also modify audio and image files, and then convert the content of those files to different formats. For video, you can play a variety of video formats, including commercial movies.
- **Work with files**—Use, manipulate, convert, and secure a wide range of file types in Linux.
- **Administer file systems**—Access, format, partition, and monitor your file storage hardware (hard disks, CD/DVD drives, floppy disks, USB flash drives, and so on). Then create, format, and check the file systems that exist on those hardware devices. You can even create encrypted file systems to protect your data.
- **Back up and restore data**—Use simple commands to gather, archive, and compress your files into efficient backup archives. Then store those archives locally or on remote computers.
- **Work with processes**—List running processes in a variety of ways, such as by CPU use, processor use, or process ID. Then change running processes to have them run in the background or foreground. Send signals to processes to have them re-read configuration files, stop and resume processing, or stop completely (abort).
- **Manage the system**—Run commands to check system resources, such as memory usage, runlevels, boot loaders, and kernel modules.
- **Monitor networks**—Bring wired and wireless network connections up and down. Check routing, DNS, and host information. Keep an eye on network traffic.
- **Get network resources**—Connect to Linux and Windows remote file systems using FTP, NFS, and Samba facilities. Use shell-based commands to browse the web.
- **Do remote administration**—Access and administer other computers using remote login (`ssh`, `telnet`, and so on), and `screen`. Learn about remote administration interfaces, such as Webmin, SWAT, and CUPS.
- **Lock down security**—Set up firewalls and system logging to secure your Linux systems.
- **Set up a virtualization host**—Configure your Ubuntu system as a host KVM system, then install and manage virtual machines on that host.
- **Get reference information**—Use the appendixes at the end of this book to get more information about the shell (such as metacharacters and shell variables) and the state of the system (from `/proc`).

Hopefully, if I have done it right, it will be easier to use this book than to Google for the command lines or GUI tools you need.

After you have mastered many of the features described in this book, you'll have gained the following advantages:

- **Hundreds of commands**—By compressing a lot of information into a small space, you will have access to hundreds of useful commands, in over 1000 command lines, in a handy form to carry with you.
- **Critical Linux information**—This book lists connections to the most critical information on the web for succeeding with Linux in general and Ubuntu in particular.
- **Transferable knowledge**—Most of the same commands and options you use in Ubuntu will work exactly the same way on other Debian-based Linux systems. Different Linux distributions, on the other hand, offer different graphical administration tools. And even within a particular distribution, graphical tools change more often than commands do.
- **Quick problem solving**—By the time others have started up a desktop and launched a graphical administration tool, you will have already run a half dozen commands and solved the problem.
- **Enduring value**—Many of the commands described in this book were used in early Unix systems. So you are gaining tools that reflect the experience of thousands of computer experts for more than 40 years.

Because the full documentation for commands used in Linux consists of thousands of man pages, info text, and help messages, you will surely want to reach beyond the pages of this book from time to time. Luckily, Ubuntu and other Linux systems include helpful information installed on the system itself. Chapter 1 contains descriptions of how to access that information that is probably already installed on your Ubuntu system.

How This Book Is Structured

This book is neither a pure reference book (with alphabetically listed components) nor a guide (with step-by-step procedures for doing tasks). Instead, the book is organized by topics and aimed including as many useful commands and options as I could fit.

Chapter 1 starts by giving you a basic understanding of what Ubuntu is and how it relates to other Linux systems, such as various Debian-based distributions. Then it describes some of the various resources available to support your experience with this book (such as man pages, info material, and help text). Chapter 2 provides a quick overview of installation and then describes useful commands such as `apt-get` for getting and managing your Ubuntu software.

Commands that a regular user may find useful in Linux are described in Chapters 3, 4, 5, and 6. Chapter 3 describes tools for using the shell, Chapter 4 covers commands for working with files, and Chapter 5 describes how to manipulate text. Chapter 6 tells how to work with music, image, and video files.

Starting with Chapter 7, you get into topics relating to system administration. Creating and checking filesystems are covered in Chapter 7, while commands for doing data backups are described in Chapter 8. Chapter 9 describes how to manipulate running processes, and Chapter 10 describes administrative tools for managing basic components, such as hardware modules, CPU use, and memory use.

Chapter 11 is devoted to managing network resources by describing how to set up and work with wired and wireless network interfaces. Chapter 12 covers text-based commands for web browsing, file transfer, file sharing, chats, and e-mail. Tools for doing remote system administration are included in Chapter 13.

Chapter 14 tells you how to lock down security using features such as firewalls and logging. Chapter 15 describes how you can configure Ubuntu as a KVM virtualization host, then use GUI and command-line tools to install virtual machines and manage them from your Ubuntu KVM host.

After that, three appendixes provide reference information for text editing, shell features (metacharacters and variables), and system settings (from the `/proc` file system).

What You Need to Use This Book

Although I hope you enjoy the beauty of my prose, this is not meant to be a book you curl up with in front of a nice fire with a glass of wine. I expect you will be sitting in front of a computer screen trying to connect to a network, fix a file system, or add a user. The wine is optional.

In other words, the book is meant to be a companion as you work on an Ubuntu or Debian operating system. If you don't already have an Ubuntu or Debian system installed, refer to Chapter 2 for information on getting and installing those systems.

All the commands in this book have been tested against Ubuntu on `x86` or `x86_64` architectures. However, because many of these commands have been around for a long time (some dating back over 30 years to the original UNIX days), most will work exactly as described here on Debian systems regardless of CPU architecture.

Many of the commands described in this book will work on other Linux and Unix systems as well.

Because this book focuses on Ubuntu, descriptions will differ from other Linux systems more prominently in the areas of packaging, installation, the boot process, and GUI administration tools.

To give this book the longest useful life, I have focused on the latest Ubuntu Long Term Support (LTS) release: Ubuntu 12.04. Support for that release is offered until 2019.

Conventions

To help you get the most from the text and keep track of what's happening, I've used a number of conventions throughout the book. In particular, I've created styles for showing commands that allowed me to fit as many command lines as possible in the book.

With command examples, computer output (shell prompts and messages) is shown in regular monospace text, computer input (the stuff you type) is shown in bold monospace text, and a short description (if included) appears in italics. Here is an example:

```
$ ls *jpg           List all JPEG files in the current directory
hat.jpg
dog.jpg
...
```

To save space, output is sometimes truncated (or skipped altogether). Three dots (...) are used to indicate that additional output was cut. If a command is particularly long, backslashes will appear at the end of each line to indicate that input is continuing to the next line. Here is an example:

```
# oggenc NewSong.wav -o NewSong.ogg \
-a Bernstein -G Classical \
-d 06/15/1972 -t "Simple Song" \
-l "Bernsteins Mass" \
-c info="From Kennedy Center"
```

In the example just shown, you can literally type the backslashes to have all that information included in the single command. Or, you can simply put all the information on a single line, excluding the backslashes.

Although a regular user can run many commands in Ubuntu, to run some commands, the user must have root privilege. Because Ubuntu is installed without a root password, you are expected to use the `sudo` command from an Ubuntu user session to run administrative commands. Here's an example:

```
chris@host1:/tmp$ sudo useradd -m joe
```

For clarity, and to save space, I typically show a regular user prompt as simply a dollar sign (\$):

```
$           Indicates a regular user prompt
```

On occasion, you will also see a pound sign prompt (#), indicating that you probably need to run the command with root privilege. So, if you see a # prompt you can either type the `sudo` command in front of the command line or gain root privilege using one of the ways described in Chapter 3.

Notes and warnings appear as follows:

Note Warnings, notes, and tips are offset and placed in italic like this.

As for styles in the text:

- I *italicize* new terms and important words with italics when we introduce them.
- I show keyboard combinations like this: Ctrl+a. If the command requires you to type an uppercase

letter, the combination will show this: Ctrl+Shift+a.

- ~~I show file names, URLs, and code within the text like so: persistence.properties.~~

One final technique I use is to highlight text that describes what an upcoming command is meant to do. For example, I may say something like, “use the following command to ***display the contents of file.***” Highlighting descriptions in this way is done to provide quick visual cues to the readers, so you can easily scan the page for that command you just knew had to be there.

Starting with Ubuntu Linux

IN THIS CHAPTER

- Introducing Ubuntu Linux
- Finding Ubuntu resources
- Learning quick and powerful commands
- Referencing useful utilities
- Working as Linux gurus do

Whether you make extensive use of Ubuntu Linux at work every day, or just putter around with it once in a while, a book that presents efficient and comprehensive ways to maintain, monitor, secure, and enhance Ubuntu can be an invaluable resource.

Ubuntu Linux Toolbox, Second Edition is that resource.

Ubuntu Linux Toolbox, Second Edition is aimed primarily at power users and system administrators. To give you what you need, I will show you how to quickly find and install software for Ubuntu, as well as how to update, maintain, and monitor the health and security of your system. In short, I will show you the most efficient ways of using Ubuntu by working with some of the powerful tools that are at your fingertips.

The goal of this book is to pack as much useful information as possible into a small package that you can carry around with you. To that end, I describe:

- **Commands**—Tons of command line examples demonstrate clever and useful ways to navigate the often daunting command line.
- **GUI tools**—Quick tips for using graphical interface tools to administer and configure your Ubuntu system.
- **Software repositories**—Methods for downloading and installing the software, which is customized for your Ubuntu system.
- **Online resources**—Where to find useful and helpful information about Ubuntu, such as mailing lists that you can subscribe to, IRC channels, and other online resources.
- **Local documentation**—Tools for working with the man pages, the standard Linux and UNIX reference volumes, as well as specific documentation for the software you install.

Because this book is for people already familiar with Linux, there won't be a lot of screenshots, icons, and menus. What you get instead is the quickest path to using your Ubuntu system to its fullest extent. Primarily, that means unlocking the mysteries of the command line to do things you can only dream about doing from the desktop.

What you learn in this book will help you become more adept at working with your Ubuntu or Debian system, as well as Linux in general. If this sounds useful to you, please read on.

Ubuntu, Debian, and Linux

Ubuntu is an operating system based on Debian GNU/Linux (www.debian.org). Debian has been around since the early 1990s, and because of its maturity, is regarded as a leading Linux distribution in terms of stability and security. Debian is also known for its strict adherence to free software (www.debian.org/intro/free). It is on this foundation that Ubuntu has been formed.

Debian has given rise to not only Ubuntu, but many other Linux distributions (www.debian.org/misc/children-distros). Some are derived directly from Debian, while others are Ubuntu derivatives:

- **Xubuntu**—An Xfce-based desktop system based on Ubuntu
- **Kubuntu**—A KDE-based desktop system based on Ubuntu
- **Edubuntu**—An Ubuntu derivative focused on schools
- **Linux Mint**—An easy-to-use desktop system with both Ubuntu and Debian roots
- **Knoppix**—A KDE desktop-oriented live CD based on Debian
- **Kanotix**—A Debian-based live CD
- **Damn Small Linux**—A tiny (50MB) live CD based on Knoppix
- **Mepis**—A desktop live CD based on Ubuntu and Debian

Xubuntu, Kubuntu, and Edubuntu are the same Debian-based Ubuntu distribution under the hood. The only difference in these is the default desktop they run, or the collection of applications bundled with them. For example, Kubuntu features the KDE desktop and Adept package manager, which are not installed on Ubuntu by default. Edubuntu is geared toward educational applications, many of which are not installed by default on the other Ubuntu distros.

Because Debian and Ubuntu are open source systems with most parts built on the GNU General Public License (www.gnu.org/copyleft/gpl.html), anyone is free to take the GPL-based source code, any part of the GPL'd system, and modify, strip down, build upon, extend, embed, reverse-engineer, and freely distribute those changes or modifications. Generally, the only requirement is that you abide by the terms of the GPL, which basically states that any changes you make to existing GPL works must be made available for others to utilize in the same way (see www.debian.org/social_contract for other licenses Debian recognizes).

In the end, you have not only a superior system with a free, online, worldwide support base, but a product that is constantly evolving and that is driven by people with a passion for what they do. Many other Linux distributions offer these same advantages; however, Ubuntu has certainly pulled out front in terms of popularity among desktop and first-time Linux users.

Understanding Ubuntu Releases

Every six months or so, a new release of Ubuntu comes out. You can choose which release you want to use from the Ubuntu Releases page (<http://releases.ubuntu.com>).

Short release cycles allow Ubuntu to always offer the latest open source software available. The downside of short release cycles, however, is that many businesses prefer stability over the latest bells and whistles. Traditionally, that is why business applications are more often run on Red Hat Enterprise Linux, which has a much longer major release cycle.

To deal with that issue, Canonical began offering releases of Ubuntu that were specified as Long Term Support (LTS) releases. For LTS releases, Canonical makes extra efforts at stability and offers longer support cycles. See the Ubuntu Wiki LTS page (<https://wiki.ubuntu.com/LTS>) for a description of the support cycles offered with long term releases.

To have the longest possible useful life, this book is focused on the Ubuntu 12.04 LTS (Precise Pangolin) release. To use the same version of software used in this book, go to the Precise Pangolin download page (<http://releases.ubuntu.com/precise/>) and choose server install media that is appropriate for your computer (x86 or 64-bit).

If you don't have the exact same version of Ubuntu, don't worry. Most of the commands in this book are ones you can rely on to not change much over time. They will form a foundation for your command line use that will help you to get up-to-speed quicker on new features as they are released.

Note Ever wonder where Ubuntu (Edgy Eft) and Debian (Woody) get those odd naming conventions from? Find out at <https://wiki.ubuntu.com/DevelopmentCodeNames> or www.debian.org/doc/manuals/project-history/ch-releases.en.html.

Ubuntu Compared to Other Linux Distributions

If you log into the command line of both an Ubuntu system and a Red Hat Enterprise Linux or Fedora system, very little will look different. There are common directories and utilities between the two, and the functionality is fundamentally the same. So what makes Ubuntu different from other Linux distributions? Consider the following:

- **Ubuntu Unity desktop**—Taking its own direction, Ubuntu features its own Unity desktop, rather than use GNOME, KDE, or other common Linux desktop interfaces. Though based on GNOME, Unity seeks to simplify the user interface to make it more useful on smaller screens, such as those used on netbook computers.

A major plan for Unity is to change the underlying display management system from the X Window system (used in most Linux and UNIX desktop systems) to the OpenGL-based Wayland project. With Wayland, Ubuntu seeks to improve the user experience with smoother graphics and other effects. Popular X-based applications would then be run in compatibility mode.

- **Mobile and entertainment devices**—While Ubuntu has made some inroads into the enterprise computing arena, a more natural transition for Ubuntu from the desktop has been to specialty devices. The Canonical Group (www.canonical.com), which runs the Ubuntu project, announced an Ubuntu phone (www.ubuntu.com/devices/phone). There is also an Ubuntu TV project (www.ubuntu.com/devices/tv).
- **Simplified installation**—The complexity of booting and installing Ubuntu has been narrowed down to a handful of mouse clicks, making many of the install decisions automatic based on assumptions as to what the average user may need and want. A simpler installation process made it possible for people to leverage the stability of Debian packages without needing to make sophisticated decisions about disk partitioning and package selection.
- **Software management**—Another major difference among Linux distributions is in software management tools. The aim of the utilities and packaging systems is the same for Debian as for other Linux distributions; however, the operation and implementations are significantly different. Ubuntu and most other Debian-based systems use the APT (Advanced Package Tool) family of utilities for managing software. You use APT to install, remove, query, and update Debian (deb) packages. Red Hat uses an RPM packaging system to handle the same tasks with its RPM packages.
- **Cloud computing**—Canonical is making several different plays into the cloud. Instead of running

Ubuntu on a local computer, you could create an Ubuntu instance in an Amazon cloud using CloudInit (<https://help.ubuntu.com/community/CloudInit>). As for setting up your own cloud infrastructure, like other Linux distributions, Canonical is supporting the OpenStack project (www.openstack.org).

- **Administration with `sudo`**—One unique characteristic of an Ubuntu system is the intentional practice of locking the root user account, and instead implementing the use of `sudo` (www.gratisoft.us/sudo/intro.html), which allows you to run a command with root permissions, for system administration tasks (see Chapter 3 for details on the `sudo` command).

The root login on a Linux system has privileges that allow unrestrained access to nearly every component of the system. It would be trivial to remove an entire filesystem as the root user, so Ubuntu tries to limit use of this account to only times when it is prudent. Most Linux distributions require the user to log in or `su` to root to perform administration tasks; however, a user on an Ubuntu system does this through `sudo` using his or her own login password, and not a separate one for the root user. Each `sudo` command run is also logged, making it easier to track who makes changes (rather than just knowing that someone with the root password did it).

Ubuntu has unique features that have their advantages and disadvantages, but they are far from limiting. Ubuntu has the tools in place to allow you to customize, modify, experiment, and hack to your heart's content if that is what you want to do. Otherwise, the idea is to be an easily maintainable, secure system with a clear and concise application set that is neither limiting nor overwhelming. This makes Ubuntu a very fluid system so you can jump right in and become familiar with it very quickly.

Finding Ubuntu Resources

The Ubuntu community has a vast pool of knowledge you can draw from in the form of online resources. The following is a list of links to some of the most popular and useful venues:

- <http://ubuntuforums.org>—In this searchable web forum and moderated social network is a diverse and talented community of Ubuntu users and support staff. Here, people share their success and setbacks with one another as well as offering assistance and guidance. Chances are good that if you're having difficulty with something in Ubuntu, someone has already run into the same problem and found a solution.
- www.ubuntu.com/support—This site offers paid support from Canonical Ltd., the company behind Ubuntu. If you don't want to spend time searching through the forums, or waiting for responses, Canonical Ltd. is one avenue for telephone, e-mail, and web support, costing around \$20 a month. Ubuntu training aimed at companies and corporate users is also available.
- <https://help.ubuntu.com>—This site contains the official, up-to-date, online documentation for each Ubuntu release. As newer Ubuntu releases come out, you can come here to find out what's new.
- <http://screencasts.ubuntu.com>—View recorded desktop sessions on how to do different things with Ubuntu, from setting up a printer, to setting up Samba file sharing, to installing updates to keep your Ubuntu system in top shape. Ubuntu users are encouraged to join the Ubuntu Screencasts Launchpad Team (<https://launchpad.net/~ubuntu-screencasts>) to contribute.
- <https://lists.ubuntu.com/mailman/listinfo/ubuntu-users>—Join the Ubuntu-users mailing list and interact with Ubuntu users over e-mail to discuss and solve problems that come up with everything from implementing mysql databases to setting up problematic network devices. An archive of past threads can be viewed at <https://lists.ubuntu.com/archives/ubuntu-users>.

- <https://wiki.ubuntu.com/IRCResourcePage>—If you are interested in live IRC chat support, you can visit the Ubuntu IRC resource page to find guidelines, clients, and chat servers, which are an available source of support, free at any time. It is advisable to visit the Ubuntu Code of Conduct page (www.ubuntu.com/project/about-ubuntu/conduct) if you have not taken part in IRC chat before.

If you plan on buying hardware to use with your Ubuntu or other Linux system, these sites may be helpful in determining where to spend your money:

- www.linux-usb.org—This website aims to maintain a working knowledge of USB devices known to be Linux-friendly. There is a search utility where you can plug in the name or model of a manufacturer and get an instant status report on the usability of that device with Linux.
- www.linuxfoundation.org/collaborate/workgroups/openprinting—The CUPS (<http://cups.org>) printing system is the standard printing system used on most Linux systems these days. If your printer model is not listed when you attempt to add a new printer to your Ubuntu system, you may need to search this site for an updated PPD file to add to your CUPS system.
- www.sane-project.org—Scanner Access Now Easy (SANE) is a site devoted to the topic of document scanning on Linux. If you are looking for a scanner or multifunction printer, check here to see how well the vendors stack up in terms of Linux support.
- <http://tldp.org>—The Linux Documentation Project is a culmination of Guides, How-To articles, and FAQs covering everything from how to make coffee with Linux to setting up QoS and Traffic Control.

Certainly, this is not a complete list, but these are good places to look first. You can also try searching for Linux-related support on a hardware vendor's website prior to making your purchase. If they intend their hardware to work with Linux, they may have drivers or instructions available. And don't forget the wealth of information you can find by searching for Linux on your favorite search engine.

Finally, look for a local Linux User's Group (LUG) in your area. A LUG is a local community of people keenly interested in Linux and its implementations. You will find people with a wide range of experience, from system administrators to casual Linux users, to distro maintainers, to CEOs of companies. LUGs generally meet on a regular basis for group discussions and hold presentations to demonstrate ways they've found to implement Linux and other related technology.

Some LUGs sponsor local events like install fests (http://en.wikipedia.org/wiki/Install_fest) or other Linux advocacy-type events. Chances are good that if you ask a question at a LUG meeting, someone (but more likely several) will have an answer. A search engine should help you locate a LUG in your area if you decide to pursue this. Most LUGs have websites or mailing lists that can be easily found online.

Ubuntu Software

Most Ubuntu software can be found on the Ubuntu package website (<http://packages.ubuntu.com>). The standard tools—Synaptic, APT, and Update Manager—are the most common ways of installing software on your Ubuntu system. (Chapter 2 provides details on finding and installing software.)

As a mature Linux operating system, over time Ubuntu has had many, many open source software packages ported to work on it. There are even software packages offered with Ubuntu that include non-free components (binary-only or software encumbered by software patents or other restrictions).

The bottom line is that you should look in the official Ubuntu repositories first for the software you want before venturing out to third-party software repositories. That said, some day you may want to experiment and look for software that is not available in the Ubuntu packages. Most packages will have an MD5sum or GPG key you can use to verify that downloaded software hasn't been tampered with (www.debian-administration.org/articles/375). You can also run into compatibility issues with non-standard software, making upgrades a difficult task. The key to experimenting with non-standard software is to test it out in ways that do not alter your system. The following list includes some websites you can check out to see what other software is out there.

Warning You should be careful about how you go about mixing the software on your Ubuntu system with software from non-Ubuntu sources. Carefully check the authenticity of anything you download.

- <http://freecode.com/>—Boasts the web's largest collection of UNIX and cross-platform software, themes, eye-candy, and Palm-OS software. It also sports a discussion board for each software entry to facilitate discussions and feedback. These guys have been around for a very long time, although formerly, the site was known as freshmeat.net.
- <http://sourceforge.net>—When open source developers get together to start a new project, many have their project hosted at SourceForge. SourceForge offers web space as well as tools for managing projects, resources, communications, and code. If you are looking for software, certainly try some searching here.

Focusing on Linux Commands

These days, many important tasks in Linux can be done from both graphical interfaces and from the command line. However, the command line has always been, and still remains, the interface of choice for Linux power users.

Graphical user interfaces (GUIs) are meant to be intuitive. With some computer experience, you can probably figure out, for example, how to add a user, change the time and date, and configure a printer from a GUI. For situations such as these, I'll mention which graphical tool you could use for the job. For the following situations, however, you will probably need to rely on the command line:

- **Almost any time something goes wrong**—Ask a question at an online forum to solve some Linux problem you are having, and the help you get will almost always come in the form of commands to run. Also, command line tools typically offer much more feedback if there is a problem configuring a device or accessing files and directories.
- **Remote systems administration**—If you are administering a remote server, you may not have graphical tools available. Although remote GUI access (using X applications or VNC) and web-based administration tools may be available, they usually run more slowly than what you can do from the command line.
- **Features not supported by GUI**—GUI administration tools tend to present the most basic ways of performing a task. More complex operations often require options that are only available from the command line.
- **Scripted tasks**—GUIs are nice if you want to add one user. But what if you want to add a hundred users or gather complex sets of performance data from your system. By running commands together in what are referred to as shell scripts, you can create complex and recursive tasks that

you can then repeat later by simply running the script again.

- ~~**GUI is broken or not installed**~~—If no graphical interface is available, or if the installed GUI isn't working properly, you may be forced to work from the command line. Broken GUIs can happen for lots of reasons, such as when you use a third-party, binary-only driver from NVIDIA, and a kernel upgrade makes the driver incompatible.

The bottom line is that to unlock the full power of your Linux system, you must be able to use shell commands. Thousands of commands are available for Linux to monitor and manage every aspect of your Linux system.

But whether you are a Linux guru or novice, one challenge looms large. How do you remember the most critical commands and options you need, when a command shell might only show you this:

```
$
```

Ubuntu Linux Toolbox, Second Edition is not just another command reference or rehash of man pages. Instead, this book presents commands in Ubuntu Linux by the way you use them. In other words, instead of listing commands alphabetically, I group commands for working with filesystems, connecting to networks, and managing processes in their own sections, so you can access commands by what you want to do, not only by how they're named.

Likewise, I won't just give you a listing of every option available for every command. Instead, I show you working examples of the most important and useful options to use with each command. Then, I show you quick ways to find more options, if you need them, from man pages, the info facility, and help options.

Finding Commands

Some of the commands in this book may not be installed by default on your Ubuntu distro, but will certainly be available through APT or other sources. If the bash shell cannot find a command that you've typed in Ubuntu, there are several reasons why that might happen:

- The command may not exist at all.
- You may have mistyped the command name (“fat-fingered” it).
- The command is not in any of the directories the shell has been instructed to look in (PATH variable).
- The command, or Ubuntu package containing the command, is simply not installed.

The command shell will respond in different ways, depending on the reason the command isn't found. If the command is not installed, is not in your PATH, and isn't available in any known software package, you see a simple `command not found` message:

```
$ sillycommand  
sillycommand: command not found
```

If the command is one that is in a known package that is simply not installed, the shell will tell you what to type to install that package. For example, here's what happens when you try to run the `kate` editor when it isn't installed:

```
$ kate  
The program 'kate' is currently not installed. Install it by typing:  
sudo apt-get install kate
```

If the command you type is not found, but the name is close to one or more available commands, the

shell tries to guess what you mean and suggest packages to install to get the command. Here is what you see if you type `cate` instead of `kate`:

```
$ cate
No command 'cate' found, did you mean:
Command 'kate' from package 'kate' (universe)
Command 'cat' from package 'coreutils' (main)
Command 'date' from package 'coreutils' (main)
Command 'late' from package 'late' (universe)
Command 'cfte' from package 'fte' (universe)
Command 'cake' from package 'cakephp-scripts' (universe)
Command 'yate' from package 'yate' (universe)
Command 'catg' from package 'nauty' (multiverse)
cate: command not found
```

If you find a command listed in the output of `apt-cache search` or suspect that the command you want is not installed, you can install it from the Internet by running the command:

```
$ sudo apt-get install packagename
```

where *packagename* is the name of the package you want to install.

The following list shows some shell commands you can run on any Linux distribution to check whether the command you typed is on the system.

Note You may see an ellipsis (. . .) used in code output to note where non-essential information has been omitted for the sake of brevity.

- Show the current **PATH**:

```
$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:
```

- Find the first occurrence of the **mount** command in the **PATH**:

```
$ which mount
/bin/mount
```

- Search the **/usr** filesystem for a filename or directory named **umount**:

```
$ find /usr -name umount
/usr/lib/klibc/bin/umount
```

- Show where the first binary and man page are for the **mount** command:

```
$ whereis mount
mount: /bin/mount /usr/share/man/man8/mount.8.gz
```

- Use the **locate** command to search its list of (configurable) directories for **mount**:

```
$ locate mount
...
/usr/bin/fdmountd
```

- Search the man page descriptions for instances of a keyword—in this example, **umount**:

```
$ apropos umount
...
umount (8)          - unmount file systems
```

- View section 8 of the man page for **umount** (type **q** to quit):

```
$ man 8 umount
Reformatting umount(8), please wait...
```

The following list shows similar commands specific to Ubuntu and Debian systems:

- Search the cached list of packages that may contain a command or description of **umount**:

```
$ apt-cache search umount
gnome-mount - wrapper for (un)mounting and ejecting storage devices
```

- Search the list of installed packages for the filename `umount`, revealing the package it is in:

```
$ dpkg-query -S umount
...
initscripts: /etc/init.d/umountnfs.sh
--
```

- List all the files contained in the `initscripts` package:

```
$ dpkg -L initscripts
...
/bin/mountpoint
--
```

- Refresh the list of cached packages:

```
$ sudo apt-get update
Password:
Get:1 http://security.ubuntu.com feisty-security Release.gpg [191B]
...
--
```

Reference Information in Ubuntu

Original Linux and UNIX documentation was all done on manual pages, generally referred to as **man pages**. A slightly more sophisticated documentation effort came a bit later with the GNU `info` facility. Within each command itself, help messages are almost always available.

This reference information is component oriented. There are separate man pages for nearly every command installed on the system. Man pages also document devices, file formats, system, development, and many other components of a Linux system. Documentation more closely aligned to who software packages is typically stored in a subdirectory of the `/usr/share/doc` directory.

Ubuntu compresses much of this documentation so it needs to be uncompressed before it can be read. You can use the `gzip` program to do this, but instruct `gzip` to only print the contents of the file and not decompress the files to disk. Here's the command to unzip the change log for the `mount` command and list its content to the screen:

```
$ gzip -dc /usr/share/doc/mount/changelog.Debian.gz | lessutil-linux \
(2.20.1-5.1ubuntu2) quantal; urgency=low
```

```
...
```

The man pages, info facility, and `/usr/share/doc` directories are all available on most Linux systems.

Using help Messages

Nearly all commands on a Linux system print some form of brief usage information if asked to. Frequently, the way to ask for this usage info is by way of the `-h` or `--help` argument to the command and nothing more. The following command shows how to ask the `ls` command to print its usage information:

```
$ ls --help
Usage: ls [OPTION]... [FILE]...
List information about the FILES (the current directory by default).
```

```
...
```

Because there is so much information printed by the `--help` flag, you can again use a pager to limit the output to one screen at a time:

```
$ ls --help | less
```

```
...
```

Note If you have used UNIX systems, the `more` command is probably the first pager command that you used. Although the `more` command is available with Linux, Linux systems favor the newer `less` command, which is whimsically named and ironically more functional than the `more` command. It allows you to page backwards in the output as well as forwards, allows the use of the arrow keys to scroll, and understands `vi` editor keystrokes for navigating and searching through text.

The preceding examples show you how to output the `ls` command help to the screen. You can also format the help output with the use of the `card` command, which will print directly to the default printer, or can be saved to a Postscript file to be viewed later with something like the `evince` utility or converted into a PDF file with the `ps2pdf` utility.

Using man Pages

You can use the `apropos` command to search the man page database for any keyword or group characters. The output will show man page sections that contain the word you supply to `apropos`.

```
$ apropos crontab
```

```
/etc/anacrontab (5) [anacrontab] - configuration file for anacron
anacrontab (5) - configuration file for anacron
crontab (1) - maintain crontab files for individual users (V3)
crontab (5) - tables for driving cron
```

The `apropos` output here shows the section and man page where the word `crontab` was found. Sections of man pages group together man pages by topic. Man pages in section 1 are *Executable programs or shell commands*. Man pages in section 5 fall under the topic of *File formats and conventions*. The man page sections will be the same on all Linux systems, but may vary a bit on other UNIX-type systems. You should be able to view the man page for `man` to find out which sections are represented on the system you're on:

```
$ man man
```

```
Reformatting man(1), please wait...
```

```
...
```

The following list shows the section numbers of the manual followed by the types of pages they contain:

- **1**—Executable programs or shell commands
- **2**—System calls (functions provided by the kernel)
- **3**—Library calls (functions within program libraries)
- **4**—Special files (usually found in `/dev`)
- **5**—File formats and conventions such as `/etc/passwd`
- **6**—Games
- **7**—Miscellaneous (including macro packages and conventions), such as `man(7)`, `groff(7)`
- **8**—System administration commands (usually only for root)
- **9**—Kernel routines (Non standard)

Given this information, you can see the crontab word you searched for has an entry in section 5 (*Executable programs or shell commands*) as well as section 5 (*File formats and conventions*). You can view the man pages from those sections by passing the section number as an argument to the man command.

```
$ man 5 crontab
Reformatting crontab(5), please wait...
CRONTAB(5)                                CRONTAB(5)
```

```
NAME
  crontab - tables for driving cron
```

```
DESCRIPTION
  A crontab file contains instructions to the cron(8) daemon of
  the general form: ``run this command at this time on this date''.
  ...
```

If you omit the section number, man will return the man page from the first section it finds. In the next example, man returns section 1 of the crontab man pages:

```
$ man crontab
Reformatting crontab(1), please wait...
CRONTAB(1)                                CRONTAB(1)
```

```
NAME
  crontab - maintain crontab files for individual users (V3)
  ...
```

In addition to section numbers, the man command takes several arguments to perform different tasks. Here are some examples:

- Shows all man page sections, in succession, for crontab:

```
$ man -a crontab
```

- Shows the section 5 man page for crontab:

```
$ man 5 crontab
```

- Uses the pager program more for paging through the crontab man page:

```
$ man -P more crontab
```

- Equivalent to the whatis command:

```
$ man -f crontab
```

- Equivalent to the apropos command:

```
$ man -k crontab
```

The whatis command is another man page searching utility. It is different from apropos in that it only prints man page descriptions that match the keyword you type in. Running the apropos command for the route command returns three different man pages where a reference to the word route was found:

```
$ apropos route
NETLINK_ROUTE (7)    - Linux IPv4 routing socket
route (8)            - show / manipulate the IP routing table
traceroute6 (8)     - traces path to a network host
```

In running whatis for the route command, only the section 8 man page for the route command was returned:

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